

# ***Dairy Farm Management***

## Guideline



**NATIONAL  
DAIRY  
DEVELOPMENT  
BOARD**



## Foreword

India's dairy sector is sustained by millions of smallholder farmers, for whom dairying is an important source of livelihood and household security. The continued progress of the sector depends not only on improving animal productivity, but also on strengthening farmers' capacity to manage their animals and farm resources in a scientific and economically sustainable manner. Over the years, the National Dairy Development Board has made sustained efforts to promote scientific dairy husbandry practices, contributing significantly to creating awareness among dairy farmers on animal health, breeding, nutrition and management. As dairy farming becomes increasingly knowledge and management intensive, there is a need to complement this awareness with a more structured approach to day-to-day farm management, enabling farmers to monitor performance, identify problems early and take timely, informed decisions.

The Small Holder Dairy Farm Management Guideline has been developed with this objective. Building on the fundamental principles of good dairy husbandry, it presents dairy farming as an integrated production system and provides practical, science-based guidance on key aspects of herd and farm management, including monitoring production, reproductive and health indicators; improving reproductive efficiency; strengthening preventive health care; enhancing feeding and animal management; and making effective use of the adaptability and resilience of indigenous cattle and buffalo.

An important feature of this guideline is its emphasis on measuring and managing performance, helping farmers and field functionaries identify areas needing improvement and take timely corrective action. It also addresses the economic dimension of dairying through practical approaches for estimating the cost of milk production and maintaining essential farm records, recognising that sustainable dairying requires both biological efficiency and sound economic management.

I hope that this Guideline will serve as a useful reference for dairy farmers, veterinarians, extension personnel, farm advisors and other stakeholders, and contribute to improving the productivity, profitability and resilience of smallholder dairy systems. I also hope it will encourage a progressive shift from reactive practices to planned, preventive and evidence-based farm management. The National Dairy Development Board remains committed to empowering dairy farmers through appropriate technologies, knowledge resources and institutional interventions. I sincerely hope that this guideline will prove to be a valuable resource in strengthening dairy farm management practices across the country.



Dr. Meenesh Shah  
Chairman  
National Dairy Development Board





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## Abbreviations

|            |   |                                                        |
|------------|---|--------------------------------------------------------|
| ADG        | — | Average Daily Gain                                     |
| AFC        | — | Age at First Calving                                   |
| AI         | — | Artificial Insemination                                |
| AM-PM Rule | — | Morning-Evening Rule for Artificial Insemination       |
| BCS        | — | Body Condition Score                                   |
| BEP        | — | Break-even Point                                       |
| BQ         | — | Black Quarter                                          |
| CI         | — | Calving Interval                                       |
| CMT        | — | California Mastitis Test                               |
| CR         | — | Conception Rate                                        |
| DCAB       | — | Dietary Cation-Anion Balance                           |
| DM         | — | Dry Matter                                             |
| DMI        | — | Dry Matter Intake                                      |
| DP         | — | Dry Period                                             |
| FC         | — | Fixed Cost                                             |
| FMD        | — | Foot and Mouth Disease                                 |
| HF         | — | Holstein Friesian                                      |
| HGM        | — | High Genetic Merit                                     |
| HS         | — | Haemorrhagic Septicaemia                               |
| IBR        | — | Infectious Bovine Rhinotracheitis                      |
| INAPH      | — | Information Network for Animal Productivity and Health |
| LSD        | — | Lumpy Skin Disease                                     |
| NDF        | — | Neutral Detergent Fibre                                |
| NEB        | — | Negative Energy Balance                                |
| NRR        | — | Non-Return Rate                                        |
| QTL        | — | Quantitative Trait Loci                                |
| RBP        | — | Ration Balancing Program                               |
| ROI        | — | Return on Investment                                   |
| SCC        | — | Somatic Cell Count                                     |
| SCM        | — | Sub Clinical Mastitis                                  |
| SP         | — | Service Period                                         |
| TAI        | — | Timed Artificial Insemination                          |
| TC         | — | Total Cost                                             |
| TMR        | — | Total Mixed Ration                                     |
| VC         | — | Variable Cost                                          |

# Introduction

Dairy farming plays a pivotal role in rural livelihoods, food security, and the agricultural economy. As consumer demand for milk and dairy products continues to grow, there is an increasing need to adopt sustainable and scientifically-informed practices that ensure animal health, farm profitability, and environmental responsibility. This manual has been developed as a comprehensive, user-friendly guide for farmers, veterinarians, extension personnel, and other stakeholders involved in the dairy sector.

By focusing on key indicators of herd performance, reproductive efficiency, health management, and cost control, the manual offers a holistic framework to enhance productivity and profitability. It addresses critical aspects such as heat detection, new-born calf care, disease prevention, and treatment protocols, while also emphasizing the importance of indigenous breeds' adaptability and natural disease resistance. Additionally, it provides actionable insights into managing milk quality, controlling production costs, and maintaining accurate records for informed decision-making.

The goal of this manual is to empower dairy farmers with scientifically grounded, practical knowledge that supports sustainable, resilient, and economically viable dairy operations. Through the adoption of these best practices, farmers can improve animal welfare, optimize resource use, and contribute to the broader objectives of food security and rural development.

By integrating scientific principles with practical approaches, this manual aims to serve as a reference and decision-support tool for improving dairy farm outcomes. Whether starting a new dairy unit or improving an existing one, users will find actionable insights throughout this manual to support profitable, resilient, and responsible dairy farming.



# Key indicators for a sustainable dairy farm

## Production traits

- Birth weight
- Average daily body weight gain (ADG)
- Heifer body weight
- Pregnancy weight gain
- Lactation yield
- Lactation length
- Milk fat%
- Dry period (DP)
- Wet Average
- Herd Average

## Reproduction traits

- Age at puberty
- Age at first calving (AFC)
- Calving interval (CI)
- Service period (SP)
- Conception rate (CR)
- Abnormality in Pregnancy
- Artificial insemination (AI) with high genetic merit bull (HGM) semen/sexed semen

## Health management

- Calf mortality
- Incidence of mastitis
- Incidence of metabolic diseases
- Body condition score (BCS)
- Removal of diseased animal from the herd

# Production traits

- i. **Birth weight:** Birth weight varies with breed, sex, dam nutrition, and gestation length. As a general guideline, a healthy calf typically weighs about 6–8% of the dam's mature body weight. In practice, birth weights are usually around 20–30 kg in indigenous cattle, 25–35 kg in crossbred cattle, 35–45 kg in Holstein–Friesian calves, and 30–40 kg in buffalo calves.
- ii. **Average daily gain (ADG):** Under good management, pre-weaning calves should ideally gain about 0.5–0.8 kg/day in indigenous cattle and buffalo breeds and 0.7–1.0 kg/day in well-managed crossbred and exotic calves.
- iii. **Heifer body weight:** Heifers should reach about 55–60% of expected mature body weight before first breeding to support good fertility and future milk yield. Indigenous cattle 180–220 kg; Jersey crossbreds 250–300 kg; Holstein-Friesian crossbreds 300–350 kg; buffaloes 300–350 kg.
- iv. **Pregnancy weight gain:** In mature cows, body weight increases during gestation due to growth of the foetus, uterus, fluids, udder, and some maternal tissue. Most pregnancy related weight gain occurs in the last trimester, especially in the final 30–45 days. Total gain per pregnancy is generally higher in first parity cows than in older cows.
- v. **Lactation yield:** Lactation yield (305-day standard) varies with breed, genetics, nutrition and management. Under Indian conditions, typical 305-day yields are: indigenous cattle 1,000–1,500 kg; crossbred cattle 2,500–4,500 kg; Holstein-Friesian crossbreds 4,500–7,500 kg; Jersey crossbreds 3,000–5,500 kg; buffaloes 1,800–3,500 kg.
- vi. **Lactation period:** The lactation period is the time after calving when a cow produces milk, and the optimal period is 305 days.
- vii. **Milk fat %:** Varies as per breed, feed, management etc.
  - a. Indigenous (Zebu) cattle: 4.5-5.5%
  - b. HF: 3-4%
  - c. Jersey: 3.5-4.5%
- viii. **Dry Period (DP):** is the time between when milk production stops and subsequent calving. Ideally it should be around 60 days.
- ix. **Ratio of in-milk to dry animal:** Ideally it should be around 70:30
- x. **Wet average=**  $\text{Per day per lactating animal yield} = \frac{\text{Total milk yield per day}}{\text{Total no. of lactating animals}}$
- xi. **Herd average=**  $\text{Per day per animal yield} = \frac{\text{Total milk yield per day}}{\text{Total no. of animals in the farm}}$ 

Growth and production traits are influenced by genetics, nutrition, health status, climate, housing, and overall farm management. Therefore, these values should be used as practical guidelines rather than fixed standards.

## Reproduction traits

- i. **Age at puberty:** the age when first ovulation occurs and the animal experience oestrus, or heat period.  
a. Zebu cattle: 25 months      b. HF: 15-18 months      c. Jersey: 15-18 months
- ii. **Age at first calving (AFC):** It is the time it takes for a female calf to reach puberty and reproduce for the first time. Varies with respect to breed of animal.  

Under good management, target age at first calving is 24–30 months for crossbred cows and 30–36 months for indigenous cattle and buffaloes, while ensuring adequate body growth at calving.
- iii. **Calving Interval (CI):** Time period between two successful calving = 14 months in cattle (roughly estimated as one calf per year), in buffalo - 18 months
- iv. **Service Period (SP):** Number of days from calving until successful conception. The optimum service period for cattle is 60-90 days; buffaloes 90-150 days.
- v. **Conception Rate (CR):** Percentage of inseminated females that become pregnant to a given insemination. A practical target is about 40–60% pregnancy per insemination, which corresponds to an average of 1.5–2.0 services per conception, with most animals conceiving within third successive insemination.
- vi. **Abnormality in pregnancy:** Abortion, stillbirth, and dystocia (difficult calving) are considered abnormal pregnancy events.
- vii. **Artificial Insemination (AI) with High Genetic Merit (HGM) semen:** AI using semen from high genetic merit bulls helps produce progeny with higher milk yield potential.



Doorstep artificial insemination services using a portable frozen semen carrier

# Indicators for optimum reproductive efficiency

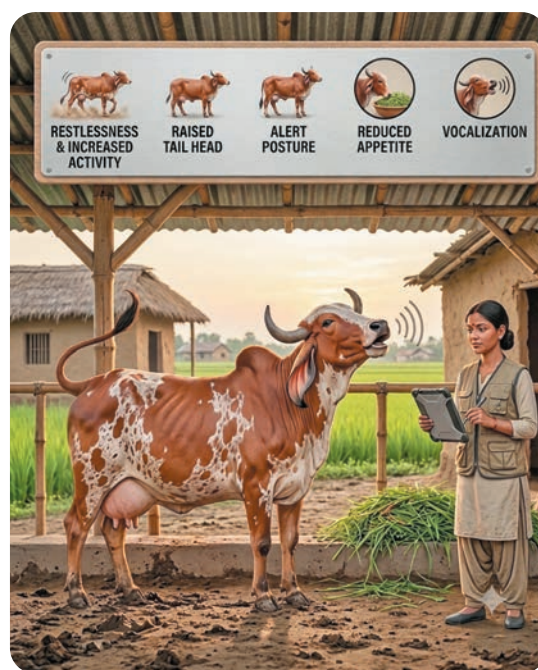
- I. The proportion of in-milk cows to dry cows in a herd should ideally be around 70:30, depending on herd structure, calving pattern, seasonality, and production system.
- II. About 80% of dairy cows should exhibit their first postpartum oestrus within 60 days after calving; in buffaloes, postpartum cyclicity is often around 90 days or more depending on management.
- III. The combined incidence of repeat breeding, anoestrus, and silent heat should ideally remain below 10% of breeding females under proper nutrition, health care and reproductive management.
- IV. At least 80% of breeding-age heifers should exhibit regular oestrous cycles and be fit for breeding under good nutritional and health management.
- V. The combined incidence of abortion and stillbirth should ideally remain below 3% through effective reproductive health management, biosecurity and disease prevention.
- VI. **Services per conception:** 1.3–1.7 (excellent), 1.8–2.0 (acceptable), >2.0 (needs investigation of heat detection, semen quality, AI technique or fertility problems)
- vii. Wet average is the average milk yield of animals that are currently giving milk, whereas herd average is the average milk yield of all animals in the herd. A larger difference between the two indicates a higher proportion of dry animals, while a smaller difference indicates that more animals in the herd are producing milk.
- viii. **Postpartum oestrus and conception:** Under good nutritional, reproductive, and health management, dairy cows should exhibit their first postpartum oestrus within 30–60 days after calving (buffaloes: 45–90 days). The objective is to achieve successful conception within 60–90 days postpartum in dairy cows and 90–150 days postpartum in buffaloes, thereby maintaining an optimum calving interval and improving lifetime productivity.
- ix. **Calving Interval (CI):** The calving interval is the number of days between two successive calving. In dairy cattle: An ideal calving interval is 365–380 days (12–12.5 months). Under practical herd management, a calving interval of up to 400 days is generally considered acceptable. A calving interval exceeding 420 days indicates reduced reproductive efficiency and should be investigated for nutritional, reproductive, health, or management-related problems.  
  
In buffaloes: An ideal calving interval is 395–425 days (13–14 months). Under good herd management, a calving interval of up to 450 days (15 months) may be considered acceptable. A calving interval exceeding 450 days indicates suboptimal reproductive performance and requires evaluation of nutrition, heat detection, breeding efficiency, health, and overall herd management.
- x. **Non-return rate (NRR):** It is the percentage of animals that don't return to heat after insemination within a specific time period. Ideally 70% animals must not come to heat within 60 days after insemination. Non-return rate is only an indirect indicator of pregnancy and should always be confirmed by pregnancy diagnosis (per-rectal examination or ultrasonography) performed by a qualified veterinarian.

# Signs of heat and proper time of insemination

## Signs of heat

Standing to allow other animals to mount is the most reliable behavioural sign of oestrus (standing heat) and should be used as the primary guide for determining the time of insemination. Other common signs of heat include

- Mounting other animals
- Restlessness and increased walking activity
- Frequent bellowing
- Chin resting on the back of other animals
- Sniffing and licking the vulva of other animals
- Frequent urination
- Raising or lifting the tail
- Swollen, moist vulva with reddening of the vulvar mucosa
- Clear, stringy, transparent mucus discharge from the vulva, which is a useful supporting sign of heat
- Reduced feed intake and a temporary decline in milk yield
- In buffaloes, heat signs are often less obvious than in cattle; therefore, careful observation during the early morning and late evening is particularly important



*Signs of heat in cows*

## Proper time of insemination

- Artificial insemination (AI) should ideally be done about 12 hours after the onset of standing heat (traditional 'AM-PM' rule) so that viable sperm are present in the reproductive tract before ovulation. If heat is seen in the evening, inseminate in the following morning. If heat persists in the following morning, another AI may be required on the same evening. A repeat insemination should not be done routinely just because some heat signs persist; the need for a second AI should be decided by a trained inseminator after assessing standing oestrus and reproductive findings.
- If the animal does not become pregnant, it will come into heat after 18-21 days.
- After 21 days of insemination the animal should be observed for symptoms of heat, especially during early morning and late evening hours.

## Reproductive technologies for improved fertility

Modern reproductive management technologies, including oestrus synchronization, ovulation-based artificial insemination (AI), and Timed Artificial Insemination (TAI), are used to improve reproductive efficiency, breeding management, and conception rates, particularly in organized dairy herds. These technologies should be implemented under the guidance of a qualified veterinarian.

# Health management

## Care of newborn calf

- i. It is better to manage and take care of newly born calf and raise it to become a lactating cow rather than purchasing a calf from an unknown source.
- ii. Before birth: care of pregnant cows should be proper with respect to feeding, housing and management in general. Specific care during last 3 months of pregnancy directly helps for better nourishment of calf. Negligence during this period may adversely affect the growth of the calf.
- iii. At the time of birth: Animals with normal calf presentation usually deliver within 30 minutes to one hour after the water bag bursts. Both the fore limbs and head of the calf are seen in normal delivery. Observe carefully, in case of any difficulty in parturition take the support and advice from veterinarian.
- iv. After birth: Check/facilitate for respiration.  
Clean the nostrils and mouth immediately after birth to remove mucus that may obstruct breathing, then place the calf in sternal recumbency (sitting upright on its chest with the forelimbs tucked under the body and the head and neck extended) so that both lungs can expand properly. Vigorously dry and rub the calf, especially over the chest and ribs, using a clean towel to stimulate respiration and blood circulation; a clean blade of straw or a finger gently touched inside the nostril can also trigger a sneeze or gasp and help initiate breathing. If the calf is not breathing adequately but still has a heartbeat, a trained person may provide gentle mouth-to-nostril breaths or use a calf resuscitator, taking care not to over-inflate the lungs and using appropriate hygiene precautions. If breathing does not improve promptly, seek immediate veterinary assistance, as advanced resuscitation and supportive treatment may be required. The first seven days of life are highly critical, so the calf should be monitored closely for breathing difficulty, dullness, poor suckling, diarrhoea or fever and veterinary help obtained without delay when abnormalities are noted.
- v. After initial drying, the calf's body can be further stimulated by gently massaging it with a handful of clean straw rolled into a ball, especially over the chest and ribs, to promote circulation and help maintain body temperature.
- vi. The strength of calf for standing must be checked. Usually the calf should stand within 15-20 minutes after birth.



*Cow licking newborn calf*

vii. Licking of cow: Allow the cow to lick the calf clean which promotes circulation within the calf's body and prepares the calf to stand up and walk. If the cow fails to do it, it can be stimulated to lick by sprinkling handful of bran or salt over the body of the calf. When the cows do not lick or in cold climate, dry the calf with a dry cloth or gunny bag.

viii. Cutting of umbilical cord: The umbilical cord should be tied with a clean thread about 2.5-3cm away from the body and cut 1.5 cm below the ligature. Tincture iodine (~3.5% and above) must be applied with minimum contact time of at least 30 seconds. Repeat navel dipping after 12 hours. A poorly maintained navel is the gateway to serious infections.



*Umbilical disinfection*

ix. Colostrum feeding/suckling: A new born calf should be given 2 litres of colostrum within the first 2 hours of birth and 1-2 litres (based on weight) within 12 hours of birth. Colostrum provides nutrition and adequate immunity. Hand-feeding new-born calves ensures the amount of colostrum an individual calf receives. Colostrum contains large amount of gamma globulins which are the antibodies produced by the cow against antigens (bacteria/virus/protozoa etc) encountered during her life. Absorption of antibodies provides the calf with an umbrella of passive immunity. Colostrum contains higher amount of Vitamin A and minerals essential to combat disease. Colostrum can be fed up to 1/10th of the body weight. When the calf is unable to suckle, hand feeding of colostrum using a bottle should be done.

x. New born calf should void meconium (first stool) within 4-6 hours of first colostrum feeding and the first faeces is tarry in colour. If first stool is not expelled with this period feed half tea spoon full of castor oil. Other congenital problems like atresia ani or atresia recti (absence of anus or rectum) may be checked.

xi. Deworming: De-worming should be done within 10-14 days of age and subsequently on a monthly basis up to the 6th month.

xii. Weaning of calf: As per the farm's practice weaning may be carried out. If early weaning is practiced, it should be adopted on the first day itself. In early weaning, calf is not allowed to suckle the cow. Calf can be provided with milk replacer. The cow is completely



*Colostrum feeding in newborn calves*

milked and required quantity of colostrum, whole milk or skimmed milk is fed to the calf. Weaning is problematic where strong maternal instinct is seen, example: *Bos indicus* and buffaloes. In case early weaning is not feasible, weaning may be done at 3-4 months.

- xiii. Calf starter: Provide calf starter from 2-8 weeks for better growth and early maturity. Example of calf starter is provided below

| Sl No | Component                  | Percentage |
|-------|----------------------------|------------|
| 1     | Maize                      | 52         |
| 2     | Oat                        | 20         |
| 3     | Soyabean meal              | 20         |
| 4     | Molasses                   | 5          |
| 5     | Salt                       | 0.5        |
| 6     | Minerals (Macro and Micro) | 1.5        |
| 7     | Vitamin                    | 1.0        |

- xiv. Managing calf diarrhoea: Calves are prone to calf diarrhoea due to various reasons such as drinking excess milk, infection etc. Because of diarrhoea there is loss of water and electrolytes leading to death of calves. In case of calf diarrhoea feed 2-4 litres of electrolyte solution when the calf is able to drink. Refer the table below for preparation of electrolyte solution

| Sl no | Component          | Quantity                  |
|-------|--------------------|---------------------------|
| 1     | Glucose            | 25 gm [5 teaspoons (tsp)] |
| 2     | Sodium bicarbonate | 5 gm [1 tsp]              |
| 3     | Common salt        | 5 gm [1 tsp]              |
| 4     | Water              | 1 litre                   |

The electrolyte solution provided should be over and above the normal feeding. Consult a veterinarian at the earliest to determine the cause of diarrhoea and to provide appropriate treatment.

- xv. Identification: Permanent marking must be planned for easy identification; ear tagging is a suitable alternative. Tagging should be completed within 1-2 week of age.
- xvi. Vaccination: No vaccine should be administered before 3 months of age since passive immunity from colostrum would be present. FMD vaccine is given at the age of 4-6 months and it is to be repeated at every six-month interval. Calfhood vaccination against brucellosis is to be given only to female calves at the age of 4-8 months.

- xvii. **Castration:** Castration is the removal or permanent inactivation of the testes in a male animal to prevent reproduction. The Burdizzo (bloodless or closed) method is generally performed in young calves, preferably before 3 months of age. Surgical (open) castration is also preferably done at an early age, but it may be performed in older animals when necessary under appropriate veterinary supervision, with adequate pain management and hygiene.
- xviii. **Removal of Extra Teats:** Extra teats, if present, should be removed surgically, preferably at 2–3 months of age, under veterinary supervision.
- xix. **Dehorning/Disbudding:** Horn buds should be removed at an early age, preferably before 2–3 months, using chemical, mechanical, or hot-iron methods. The procedure should be performed under veterinary supervision using appropriate pain management.
- xx. **Body Weight Recording:** Record the calf's birth weight soon after birth. Birth weight varies with breed and management but generally ranges from 5–7% of the mature body weight. During the first six months, body weight may be recorded at 7, 14, 21, 30, 60, 90, 120, 150, and 180 days, where regular monitoring is feasible, to assess growth and nutritional status.
- xxi. **Minimising calf mortality:** Mortality in calves can be significantly reduced by properly managing
  - a. Calf diarrhoea
  - b. Calf pneumonia
  - c. Joint ill/ Navel ill



*Newborn calf suckling*

## Monitoring colostrum quality



*Assessment of colostrum quality using a Brix refractometer*

Before feeding colostrum, ideally colostrum quality should be measured using a Brix refractometer to know the levels of colostral antibodies.

- Colostrum with a Brix value  $\geq 22\%$  should be used (to ensure that the concentration of IgG is at least 50 g/L)
- Colostrum with a Brix value of  $< 18\%$  should be discarded
- If colostrum has a Brix value of  $\geq 18\%$  but  $< 22\%$ , supplementation should be considered
- Supplementation should be done in consultation with consulting veterinarian. Frequently used options for supplementing colostrum are:
  - a. Colostrum from another dam: If available, colostrum from another healthy dam with a Brix value greater than 22% can be used to supplement the calf's feeding. This ensures the calf receives enough antibodies for proper immunity development.
  - b. Commercial colostrum products: Several commercially available colostrum replacers or supplements exist. These products are typically derived from bovine colostrum and concentrated to provide a high level of antibodies.

| SL No | Body weight of calf | Recommended IgG (in gram) |
|-------|---------------------|---------------------------|
| 1     | $\geq 35$ kg        | 300                       |
| 2     | $< 35$ Kg           | 225                       |

| SL No | Time                          | Equivalent IgG (in gram) | Volume of colostrum required (Brix value $\geq 22\%$ ) |
|-------|-------------------------------|--------------------------|--------------------------------------------------------|
| 1     | Within 2 hours of birth       | 150-200                  | 3-4 litre                                              |
| 2     | 6-12 hour after first feeding | 75-100                   | 1.5- 2 litre                                           |

**Good Practice:** The first 2 hours after birth represent the “golden window” for passive transfer of maternal antibodies. Early feeding of clean, high-quality colostrum is one of the most effective measures for improving calf survival, reducing disease and enhancing future productivity.

## Incidence and management of mastitis

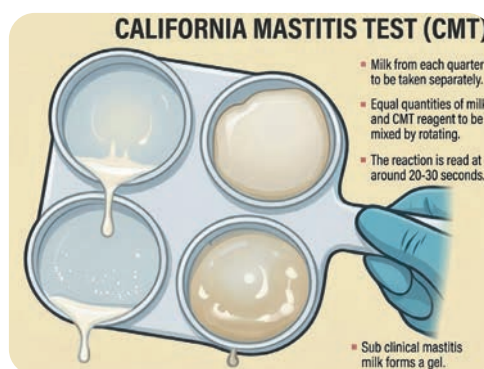
- Pure exotic breeds like HF, Jersey have the highest susceptibility to mastitis followed by crossbreds as the milk production is high.
- Indigenous breeds are less susceptible as the milk production is less.
- Buffaloes are the least susceptible to mastitis.

### Sub clinical mastitis (SCM):

- SCM causes about 70% of the loss due to mastitis.
- For detection of subclinical mastitis California mastitis test (CMT) should be done periodically (at least once per week)

### California mastitis test (CMT):

- Where facilities are available, monitor individual cow somatic cell count (SCC) and bulk tank milk SCC routinely as standard indicators of udder health and subclinical mastitis.
- Milk from each quarter to be taken separately. Equal quantities of milk and CMT reagent to be mixed by rotating. The reaction is read at around 20-30 seconds. Sub clinical mastitis milk forms a gel.
- SCM positive animals should always be milked at the end.
- Newly purchased animals should always be tested for mastitis/sub clinical mastitis before being added to the herd.



California Mastitis Test (CMT) scoring

### Clinical mastitis:

- It is the severe inflammation of the udder in which visible changes are observed in udder or milk or in both.
- It is mostly caused by bacteria.
- Other agents can also cause mastitis like fungi, virus or algae.
- Before milking, clean the udder well with clean water and wipe dry with clean towel.
- Repeated use of unclean towel may itself predispose to mastitis.
- Carry out teat dipping or spray immediately after milking.
- Prevent the animal from sitting for at least 30-45 minutes after milking.
- Mastitis positive animals should always be milked at the end.

### Chronic mastitis:

- It is the persistent infection of the udder.
- Neglected subclinical mastitis leads to chronic mastitis.
- Separate the affected cow from rest of the herd.
- Consider removing such animals from the herd.

## Management of mastitis in a dairy farm

- i. Record the milk from all the lactating animals on daily basis. Grade the animals as per their milk yield, low yielder (say 5 litre or less milk per day), medium yielder (5-10 litres of milk per day), high yielder (15 litres and above). Animals with higher milk yield to be monitored more rigorously. Observe the teat orifice, teat, udder size and milk, any abnormality requires more attention.
- ii. For detection of sub clinical mastitis CMT can be conducted. Initially conduct CMT on a daily basis. Subsequently, this frequency in the farm can be modified based on incidence of mastitis such as high incidence (CMT-everyday), Medium incidence (CMT-alternate day), low incidence (CMT-weekly)
- iii. Send CMT positive samples/Clinical mastitis milk samples for bacteria culture and antibiotic sensitivity test.
- iv. Ideally some of the CMT positive samples should be tested on monthly basis to know the prevalent microbes in the farm and drug resistance pattern. This data is very helpful in deciding the treatment regimen. For recurrent cases or chronic infections, milk samples should be submitted for culture and antimicrobial sensitivity testing to guide treatment decisions and to determine whether the animal should be retained or removed from the herd.
- v. Before milking, clean the udder well with clean water and wipe dry with clean towel. Avoid repeated use of unclean towel.
- vi. Once started, complete the milking as soon as possible but not exceeding 8 minutes.
- vii. Allow calves to suckle after milking to remove the residual milk that is retained in the udder.
- viii. Carry out teat dipping or spray immediately after milking. This is the most critical step in mastitis prevention.
- ix. Prevent the animal from sitting for at least 30-45 minutes after milking by providing some feed/ fodder.
- x. Keep the floor clean, dry and without holes.
- xi. Mastitis positive animals should always be milked at the end.
- xii. Cows that suffer from chronic or recurrent form of mastitis may be removed from the herd if they don't respond to treatment.
- xiii. Routine evaluation of milking machine performance including vacuum pressure, pulsation, liner condition, air leakage and hygiene is essential for preventing teat-end damage and minimizing mastitis risk.



## Treatment of mastitis

- i. Send milk sample to laboratory for bacteria culture and antibiotic sensitivity test (ABST) before initiation of treatment.
- ii. CMT positive animals can be given 10 grams of trisodium citrate orally for 10 days. At the end of 10th day CMT test can be done to check for the status. Any time during testing if the animal is again found to be CMT positive then another round of trisodium citrate can be given. Animal found CMT positive even after two trisodium citrate oral regimens may be treated in consultation with the veterinarian.
- iii. Mastitis can be treated by topical application of ethnoveterinary medicine, homoeopathy, parenteral antibiotic, intra-mammary applications. Seek advice from veterinarian for treatment of mastitis. Use systemic or intramammary antibiotics only under veterinary prescription, preferably guided by culture and sensitivity results and always follow the recommended milk withdrawal period.
- iv. Dry cow therapy: Dry cow therapy is an essential management practice in dairy farming aimed at treating cows during their non-lactating period, known as the dry period. The main goals of dry cow therapy are to cure existing infections in the udder and to prevent new infections from developing during this dry period. Animals frequently found positive in CMT or chronically infected animals can be given dry cow therapy in consultation with the veterinarian.



**Water based Preparation**

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**Oil based Preparation**



*Post-milking teat dipping*

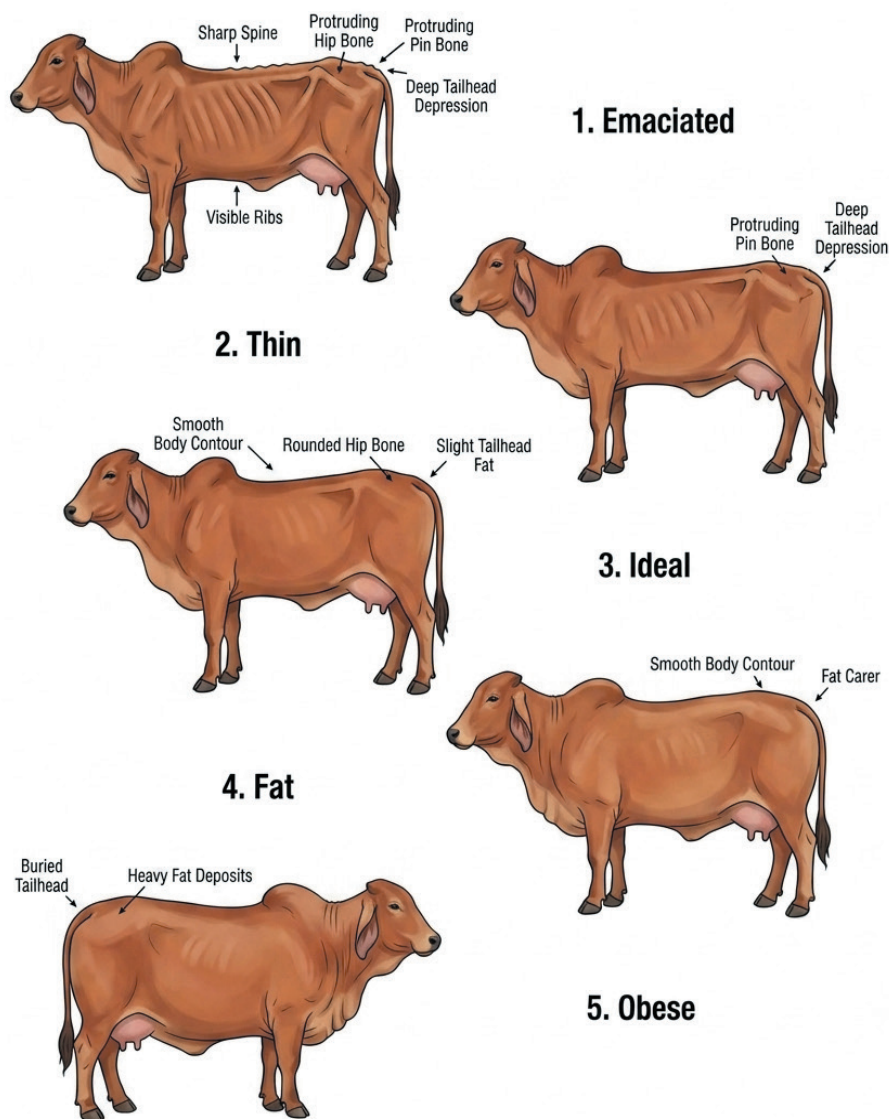
## Incidence of metabolic diseases

- Metabolic diseases occur when dairy animals cannot meet their increased requirement for energy and minerals, especially around calving and early lactation.

| Sl. No | Striking clinical sign                                                                                                                                                                                                | Condition                       | Reason                                                      | Control and preventive measure (s)                                                                                                                                                                                                       |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Animal unable to stand up within 72 hours of calving, recumbent and neck turned to one side, sub normal body temperature                                                                                              | Milk fever                      | Low calcium                                                 | Calcium therapy in consultation with veterinarian. When there is history of milk fever in earlier lactations, oral calcium supplementation can be given just before calving and continued further in consultation with the veterinarian. |
| 2      | Animal throws up head, falls down, paddling convulsion                                                                                                                                                                | Hypomagnesemia                  | Low magnesium                                               | Magnesium therapy in consultation with the veterinarian.                                                                                                                                                                                 |
| 3      | Decrease in feed intake, drop in milk production, nervous dysfunction, such as abnormal gait, bellowing, aggression, pica, and abnormal licking, low blood glucose level, seen usually in first 2 months of lactation | Ketosis                         | Energy deficit                                              | Treatment is aimed to restore lack of glucose. Proper feeding of the animal based on the stage of lactation. Treatment should be done in consultation with the veterinarian.                                                             |
| 4      | Recent calving, haemoglobinuria, (red/ coffee coloured urine), anaemia                                                                                                                                                | Post parturient haemoglobinuria | Phosphorus and copper deficiency                            | Other causes of haemoglobinuria to be ruled out. Phosphorous supplementation in consultation with veterinarian.                                                                                                                          |
| 5      | Fatty animal, lower milk yield, incidences of milk fever, ketosis, mastitis, retained fetal membrane. Blood tests show elevated levels of nonesterified fatty acids (NEFA) and increased ketones.                     | Fatty liver syndrome            | Excessive negative energy balance at the start of lactation | Maintain the ideal body condition score between 3-3.5 during calving by proper feeding. Consultation with the veterinarian.                                                                                                              |
| 6      | Accumulation of excess fluid in udder and sometimes in the belly around calving time                                                                                                                                  | Udder oedema                    | Lymphatic fluid builds up in the udder, causing swelling    | Rule out clinical mastitis, if the udder is not painful or hot. Consult with veterinarian if the oedema interferes with milking.                                                                                                         |

## Body condition score

- Body condition scoring is used to assess the animal's fat reserves, health status, nutritional status, and reproductive readiness.
- In dairy cattle, BCS is commonly measured on a 1–5 scale.
- A score of 1 indicates a very thin/emaciated cow, whereas 5 indicates an obese cow.
- In lactating cows, the target BCS depends on stage of lactation; around 3.0 is generally appropriate for mid-lactation, while cows should not become too thin in early lactation or too fat at calving.
- Cows with a BCS of 5 are at increased risk of metabolic and reproductive problems.



Body condition scoring (BCS) chart for dairy cattle



## Removal of animal from the herd

Removal from the herd (culling) is a crucial management practice in dairy farming, involving the removal of cows from the herd for various reasons, such as health, production, or reproductive issues. The decision to cull an animal is influenced by multiple factors aimed at maintaining herd health, productivity, and economic efficiency. Here are some common culling criteria in dairy farming:

### 1. Health and disease

Animals suffering from chronic diseases like Johne's disease, tuberculosis, brucellosis etc, should be removed from the herd to maintain overall herd health. Animals with chronic or recurrent mastitis, especially those not responding to treatment, may be removed to prevent the spread of infection and maintain milk quality. Animals with persistent lameness or severe foot and leg issues may be removed.

### 2. Reproductive efficiency

Animals that fail to conceive after multiple breeding attempts or have prolonged calving intervals may be culled due to their impact on herd reproductive performance. Animals with a history of dystocia (difficult calving) or other calving-related issues (eg. uterine prolapse) may be removed from the herd to prevent future complications. Animals that take longer time than expected to show oestrus after calving and show signs of silent oestrus may be considered for removal from the herd.

### 3. Age and productive life span

Animals that have reached the end of their productive lifespan, based on their overall health and lifetime milk production, may be moved to a Gosadan/Panjrapole or, maintained at the farmers' homestead if she/he has the wherewithal to keep unproductive animals.

### 4. Genetic improvement

If an animal's offspring consistently underperform in terms of health, production, or reproduction, the cow may be removed to improve herd genetics.

### 5. Economic considerations

The economic viability of treating an animal versus removing from the herd is an important factor. High veterinary costs for chronic conditions may justify removing from the herd.

### 6. Behavioural issues

Animals displaying aggressive behaviour that endangers other cows or farm workers may be removed to ensure safety. Animals those are difficult-to-handle, particularly during milking or veterinary procedures, may be removed for easier herd management.

**Common infectious diseases of bovines\***

| SL No | Striking clinical sign                                                                      | Disease                                 | Control and preventive measure                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Availability of vaccines in India |
|-------|---------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 1.    | Fever, vesicle in foot and mouth (tongue, dental pad, lips and gums), foamy/ropy salivation | Foot and mouth Disease (FMD)            | Inform the veterinarian/authority. Separate the infected animals from healthy animals. Destroy the feed and fodder that has come in contact with secretion and excretion of diseased animal. The equipment and farm premises should be disinfected with 4% sodium carbonate solution. Preventive vaccination of cattle and buffaloes in the farm. Since more than one species of animal can be infected, preventive vaccination should be extended to sheep, goat and pigs.      | Yes                               |
| 2.    | Rhinitis, nasal discharge, pustular vulva, abortion                                         | Infectious bovine Rhinotracheitis (IBR) | Only IBR negative animals to be introduced into the herd. Purchase new animals when IBR test result is negative. Vaccination may be practiced.                                                                                                                                                                                                                                                                                                                                   | Yes                               |
| 3.    | History of dog bite, drooling of saliva, aggression or paralysis, constant bellowing        | Rabies                                  | Disease is always fatal once symptoms are seen. Control measures should be taken immediately after the suspected dog bite. Avoid direct contact with saliva or bite wound. Wear gloves and gum boot while handling such cases. Wash the bite wound in running water for 5-10 minutes. Clean the wound with bath soap. Post bite vaccination to be carried out in consultation with veterinarian. Domestic dogs and cats can be protected from the disease by annual vaccination. | Yes                               |
| 4.    | Fever, stiffness, sudden drop in milk yield.                                                | Ephemeral fever                         | Fly and mosquito control in the farm. Prevent biting of flies and mosquitoes.                                                                                                                                                                                                                                                                                                                                                                                                    | No                                |
| 5.    | Cutaneous nodules (2-5 cm), enlarged lymphnode.                                             | Lumpy skin disease (LSD)                | Tick, fly and mosquito control in the farm. Prevent biting of tick, flies and mosquitoes. Annual vaccination in endemic areas.                                                                                                                                                                                                                                                                                                                                                   | Yes                               |
| 6.    | Swelling of throat/neck region, salivation, fever, respiratory sound.                       | Haemorrhagic septicaemia (HS)           | Segregate the sick animal from healthy ones and don't give contaminated feed, fodder and water to healthy animals. Annual vaccination in endemic areas.                                                                                                                                                                                                                                                                                                                          | Yes                               |
| 7.    | High fever, muscle swelling, crackling sound because of gas accumulation.                   | Black quarter (BQ)                      | Sprinkle lime over carcass at the time of burial. Annual vaccination in endemic areas.                                                                                                                                                                                                                                                                                                                                                                                           | Yes                               |

| Common infectious diseases of bovines* |                                                                              |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |
|----------------------------------------|------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| SL No                                  | Striking clinical sign                                                       | Disease                 | Control and preventive measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Availability of vaccines in India |
| 8.                                     | Abortion after 5th month of pregnancy, retention of placenta, joint swelling | Brucellosis             | Avoid direct contact with aborted materials and discharges of cow. Wear gloves and gum boot for handling the aborted foetus, placenta, contaminated bedding, feed etc. The aborted materials should be buried (at least 4 feet deep) and sprinkle lime over it. Disinfect the shed with 1-2%NaOH or 5% sodium hypochlorite after taking out the aborted materials. Disinfect the lochial discharge from the cow daily till it ceases (around 10-15 days). Vaccinate female calves between 4-8 months of age once. | Yes                               |
| 9.                                     | Sudden death, bleeding from nose, mouth, anus                                | Anthrax                 | Annual vaccination of animals in endemic areas. Never open a carcass of an animal suspected to have died from Anthrax.                                                                                                                                                                                                                                                                                                                                                                                            | Yes                               |
| 10.                                    | Long lasting diarrhoea, stunted growth                                       | JD                      | Only JD negative animals to be introduced into the herd. JD positive animals should be culled immediately to prevent the infection spreading to healthy animals. Carry out regular testing of herd at 6-month interval.                                                                                                                                                                                                                                                                                           | No                                |
| 11.                                    | Weakness, coughing, weight loss                                              | TB                      | Only TB negative animals to be introduced into the herd. TB positive animals should be culled immediately to prevent the infection spreading to healthy animals. Carry out regular testing of herd at 6- month interval.                                                                                                                                                                                                                                                                                          | No                                |
| 12.                                    | Swelling of inter digital space, foul smell discharge, lameness              | Foot rot                | Remove the sources of injury and keep the feet clean & dry, also use footbath.                                                                                                                                                                                                                                                                                                                                                                                                                                    | No                                |
| 13.                                    | Fever, swollen lymph node, nervous sign, tick infestation                    | Theileriosis            | Tick control in the farm. Annual vaccination of exotic and cross bred animals.                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes                               |
| 14.                                    | Fever, red/coffee coloured urine, nervous sign, tick infestation             | Babesiosis              | Tick control in the farm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | No                                |
| 15.                                    | Nervous sign, tilting of head and circling                                   | Trypanosomiasis (Surra) | Biting flies transmit the disease. Control biting flies in the shed and surrounding area.                                                                                                                                                                                                                                                                                                                                                                                                                         | No                                |

\*Includes important viral, bacterial and protozoal diseases relevant to Indian dairy herds.

## Vaccination for bovines

The schedule given below, is a general guideline; disease prevalence and government vaccination programmes vary between states, so always follow the latest recommendations of the State Animal Husbandry Department and the attending veterinarian.

| Sl no | Disease                       | Age at first dose                            | Booster dose             | Subsequent dose(s)                                                  |
|-------|-------------------------------|----------------------------------------------|--------------------------|---------------------------------------------------------------------|
| 1     | Foot and mouth disease (FMD)  | 4 months and above                           | 1 month after first dose | Six monthly                                                         |
| 2     | Haemorrhagic septicaemia (HS) | 6 months and above                           | -                        | Annually in endemic area                                            |
| 3     | Black quarter (BQ)            | 6 months and above                           | -                        | Annually in endemic area                                            |
| 4     | Brucellosis                   | 4-8 months of age<br>(Only in female calves) | -                        | Once in a life time                                                 |
| 5     | Theileriosis                  | 3 months of age or above                     |                          | Once in a life time. Only required for crossbred and exotic cattle. |
| 6     | Anthrax                       | 4 months and above                           |                          | Annually in endemic areas                                           |
| 7     | IBR                           | 3 months and above                           | 1 month after first dose | Six monthly                                                         |
| 8     | Rabies                        | Immediately after suspected bite             | 4th day                  | 7,14,28, and 90 (optional) days after first dose.                   |
| 9     | Lumpy Skin Diseases (LSD)     | 4 months and above                           | -                        | Annually                                                            |

Animals should be dewormed two weeks before the vaccination for better vaccine response.

Use only licensed vaccines and follow the manufacturer's instructions for storage, handling, and administration. Vaccination is most effective when supported by good biosecurity, hygiene, balanced nutrition and appropriate parasite control.



Vaccination camp



## Advantages of vaccination

1. Vaccines help prevent many infectious diseases that can affect dairy animals, thus ensures the health and longevity of dairy animals.
2. Vaccinating a significant portion of the dairy herd helps to establish herd immunity, reducing the overall prevalence of diseases within the herd.
3. Vaccination helps to maintain optimal health and reproductive health (example: Brucellosis) thereby supporting consistent and higher milk production levels.
4. Preventing diseases through vaccination reduces the need for expensive veterinary treatments, medications, and labour costs associated with treating sick animals. This leads to significant cost savings for dairy farmers.
5. Vaccinated dairy animals are less likely to suffer from painful and debilitating diseases, leading to improved overall welfare and better quality of life for the animals.
6. Vaccination programmes are essential for the eradication of certain diseases.
7. Vaccination helps control zoonotic disease (example: Brucellosis), protecting the health of farm workers and consumers.
8. Vaccination contributes to the production of safe and high-quality milk by preventing diseases in dairy animals. This is crucial for public health and for maintaining consumer confidence in dairy products.

## Reasons for vaccine failure

- i. Poor immune response in weak and immunocompromised animals.
- ii. Ideally over 80% of animal should be vaccinated to have adequate herd immunity; when only few animals are vaccinated the purpose is not fulfilled.
- iii. Lack of maintenance of adequate cold chain as indicated by the vaccine manufacturer.
- iv. Repeated freezing and thawing of vaccine.
- v. Ineffective vaccine due to poor antigenic match, poor formulation, or low potency.

## Deworming for bovines

After colostrum feeding, calves should be dewormed at 7–14 days of age in cattle calves and 3–7 days in buffalo calves. Piperazine-group drugs may be used initially and repeated after 7–15 days as advised by a veterinarian. Subsequent deworming should be based on faecal examination, parasite burden, age, seasonal risk and clinical signs such as diarrhoea, pot-belly, poor growth, debility or anaemia.

Calves may be dewormed monthly up to 6 months, while adult cattle should undergo strategic deworming 1–2 times annually, preferably before and/or after the rainy season. Where possible, faecal egg counts and veterinary advice should guide deworming and selection or change of deworming compounds.

## Advantages of deworming

1. Deworming helps to eliminate internal parasites such as roundworms, flukes, and tapeworms that can cause a variety of health issues, discomfort, mortality in dairy animals. This leads to healthier animals with improved vitality and reduced disease susceptibility.
2. Young dairy animals, such as calves and heifers, are particularly vulnerable to the parasitic infestations. Regular deworming supports their growth and development, ensuring they reach their full genetic potential.
3. By regularly deworming all animals in the herd, the overall parasitic load in the herd is reduced. This helps protect even those animals that might be more susceptible to infections, such as young calves.
4. Parasites can interfere with nutrient absorption in the digestive tract, leading to poor feed efficiency. Parasitic infections can significantly reduce milk production due to the stress and nutrient depletion in the affected animals. Deworming helps maintain optimal health and body condition, thereby resulting in better growth, maintenance, and milk production.
5. Deworming helps improve reproductive performance, ensuring better calving rates and healthier offspring.
6. Regular deworming helps to prevent the health complications associated with parasitic burdens, thereby reducing the need for costly veterinary treatments and interventions. This leads to significant cost savings for dairy farmers.



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the video on YouTube

## Common deworming drugs, doses and precautions

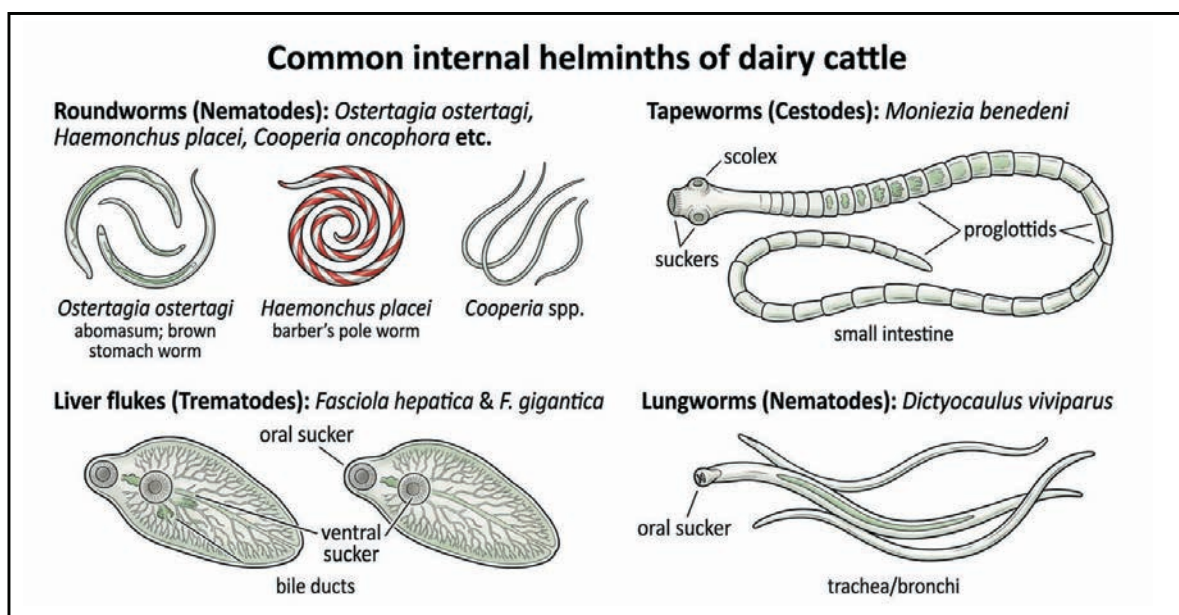
| Sl. No. | Target parasite(s)                                | Common anthelmintic | Typical dose  | Route                                    | Important remarks                                                                                                                    |
|---------|---------------------------------------------------|---------------------|---------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Gastrointestinal nematodes                        | Piperazine          | 200–300 mg/kg | Oral                                     | Mainly used in young calves; limited spectrum.                                                                                       |
| 2       | Gastrointestinal nematodes                        | Albendazole         | 5–10 mg/kg    | Oral                                     | Avoid during the first trimester of pregnancy; effective against many adult nematodes and some cestodes.                             |
| 3       | Adult liver flukes (Fasciola spp.)                | Albendazole         | 10–15 mg/kg   | Oral                                     | Effective mainly against adult liver flukes; use under veterinary guidance.                                                          |
| 4       | Gastrointestinal nematodes and cestodes           | Fenbendazole        | 5–10 mg/kg    | Oral                                     | Broad-spectrum anthelmintic; generally considered safe during pregnancy when used according to the product label.                    |
| 5       | Gastrointestinal nematodes                        | Levamisole          | 7.5 mg/kg     | Oral or injectable, as per product label | Use according to the product label; also acts as an immune stimulant.                                                                |
| 6       | Gastrointestinal nematodes and some cestodes      | Oxfendazole         | 4.5–5 mg/kg   | Oral                                     | Follow product label; use with caution during early pregnancy where applicable.                                                      |
| 7       | Liver flukes (Fasciola spp.) and amphistomes      | Oxyclozanide        | 10–15 mg/kg   | Oral                                     | Effective against adult flukes and amphistomes.                                                                                      |
| 8       | Adult liver flukes (Fasciola spp.)                | Rafoxanide          | 7.5 mg/kg     | Oral                                     | Use under veterinary guidance; effective mainly against adult liver flukes.                                                          |
| 9       | Immature and adult liver flukes (Fasciola spp.)   | Triclabendazole     | 12 mg/kg      | Oral                                     | Highly effective against both immature and adult liver flukes                                                                        |
| 10      | Gastrointestinal nematodes and external parasites | Ivermectin          | 200 µg/kg     | Subcutaneous injection or pour-on        | Follow product label and observe milk withdrawal periods; cattle injection products are commonly 1 mL/50 kg body weight by SC route. |



Animal deworming camp

## Reasons for failure of deworming

- i. Use of lower than the recommended dose (under-dosing).
- ii. When drug is administered without proper animal examination and faecal sample examination.
- iii. Carrying out deworming in stressed animals (stress due to transit; extreme weather condition etc.)
- iv. When deworming is carried out in only a few animals in the herd.
- v. Repeated use of the same drug class without monitoring efficacy, which can favour development of anthelmintic resistance in parasites.



## Common causes of abortion in dairy animals

| Sl no | Cause of abortion        | Distinguishing feature                                                                                                                                                                                                                                                                   |
|-------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | Infectious diseases      | <ul style="list-style-type: none"> <li>Often accompanied by fever, weakness, and other signs of illness in the animal.</li> <li>Common infectious causes include Brucellosis, Bovine Viral Diarrhea (BVD), <i>Campylobacter</i>, Trichomonosis</li> </ul>                                |
| 2.    | Uterine infection        | <ul style="list-style-type: none"> <li>Infections of the uterus such as metritis can lead to abortion.</li> <li>Animals may exhibit signs of uterine inflammation, including vaginal discharge, fever and discomfort.</li> </ul>                                                         |
| 3.    | Nutritional deficiencies | <ul style="list-style-type: none"> <li>Inadequate intake of essential nutrients such as Vitamin A, Vitamin E, selenium, or copper etc.</li> </ul>                                                                                                                                        |
| 4.    | Toxic Plants/chemicals   | <ul style="list-style-type: none"> <li>Exposure to toxic plants or chemicals (e.g., pesticides, lead) can lead to abortion.</li> <li>Symptoms may include sudden illness, gastrointestinal distress, or neurological signs in affected animals.</li> </ul>                               |
| 5.    | Trauma/injury            | <ul style="list-style-type: none"> <li>Physical trauma or injury to the pregnant animal can lead to abortion.</li> <li>This can occur due to accidents, aggressive behaviour from other animals, or improper handling.</li> </ul>                                                        |
| 6.    | Genetic abnormalities    | <ul style="list-style-type: none"> <li>Genetic defects or abnormalities in the foetus can result in abortion at any stage of gestation.</li> <li>These may be spontaneous or inherited from one or both parents.</li> </ul>                                                              |
| 7.    | Metabolic disorders      | <ul style="list-style-type: none"> <li>Metabolic disorders such as ketosis or hypocalcemia can increase the risk of abortion, especially as the cow approaches parturition.</li> <li>Signs may include lethargy, poor appetite, and neurologic abnormalities.</li> </ul>                 |
| 8.    | Heat stress              | <ul style="list-style-type: none"> <li>Excessive heat can cause heat stress in pregnant animals, leading to abortion, especially during the hottest months of the year.</li> <li>Signs of heat stress include panting, increased respiration rate, and decreased feed intake.</li> </ul> |

## Common infectious causes of bovine abortion

| SL No | Infectious agent          | Type of agent | Specific time of abortion (if any)                                                                    | Control and preventive measure(s)                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------|---------------------------|---------------|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | <i>Trichomonas spp.</i>   | Protozoa      | 2 <sup>nd</sup> -4 <sup>th</sup> month of gestation                                                   | Bulls are the main source of infection. Test and cull bulls positive for trichomonosis. Bulls should be tested periodically for trichomonosis (yearly once). Avoid natural service by the bull. Encourage artificial insemination.                                                                                                                                                                                                           |
| 2.    | <i>Neospora caninum</i>   | Protozoa      | Typically mid-gestation (5-6 months), but can occur at any stage                                      | Prevent canine fecal contamination of feed, removal of persistently infected cows, avoid keeping offspring of seropositive dams as replacements.                                                                                                                                                                                                                                                                                             |
| 3.    | <i>Campylobacter spp.</i> | Bacteria      | 4 <sup>th</sup> -5 <sup>th</sup> month of gestation.                                                  | Bulls are the main source of infection. Bulls should be tested periodically for <i>Campylobacter</i> (yearly once). Avoid natural service by the bull. Encourage artificial insemination.                                                                                                                                                                                                                                                    |
| 4.    | <i>Brucella spp.</i>      | Bacteria      | 6 <sup>th</sup> - 9 <sup>th</sup> month of gestation. Retention of foetal membrane is often observed. | Avoid direct contact with aborted materials and discharges of cow. Wear gloves and gum boot for handling the aborted foetus, placenta, contaminated bedding, feed etc. The aborted materials should be buried (at least 4 feet deep) and sprinkle lime over it. Disinfect the shed with 1-2%NaOH or 5% sodium hypochlorite after the aborted material. Disinfect the lochial discharge from the cow daily till it ceases (around 10-15 days) |
| 5.    | <i>Chlamydia spp.</i>     | Bacteria      | Variable, but often mid to late gestation                                                             | Biosecurity, isolation of aborting animals, proper disposal of aborted materials, minimizing stress                                                                                                                                                                                                                                                                                                                                          |
| 6.    | <i>Coxiella burnetii</i>  | Bacteria      | Most often late gestation, but can be variable                                                        | Isolation of aborting animals, proper disposal of aborted materials, control of ticks, biosecurity, minimize dust, PPE for handlers                                                                                                                                                                                                                                                                                                          |
| 7.    | <i>Leptospira spp.</i>    | Bacteria      | Usually last trimester (third trimester), 2-6 weeks after infection                                   | Vaccination, rodent control, prevent access to contaminated water, isolate affected animals, biosecurity                                                                                                                                                                                                                                                                                                                                     |

## Abortion management

Abortion is the loss of the foetus before completion of the normal gestation period. It may result from infectious diseases, nutritional deficiencies, hormonal imbalance, toxins, trauma, stress, or other management-related factors. Because abortion may indicate a contagious disease and can also pose a risk to human health, prompt investigation is essential.

### Immediate actions

Immediately isolate the aborting animal and prevent other animals from coming in contact with the aborted foetus, placenta, or contaminated bedding. Inform the veterinarian promptly for examination, sample collection, diagnosis, and control measures. Wear gloves and gumboots when handling aborted material, submit the foetus and placenta to a diagnostic laboratory as advised by the veterinarian, and dispose of the contaminated materials safely. After removing all organic matter, thoroughly clean and disinfect the affected area with an approved disinfectant, such as sodium hypochlorite, following the manufacturer's instructions for dilution and contact time.

### Prevention

Reduce the risk of abortion by following the recommended vaccination schedule, providing balanced nutrition with adequate minerals and vitamins, and maintaining clean calving areas. Purchase animals only from reliable sources with a known disease-free or tested-negative health status, quarantine newly introduced animals before mixing them with the main herd. Minimise stress, overcrowding, rough handling, and transportation during late pregnancy. Maintain accurate breeding, pregnancy, calving, and abortion records.

### Good practice

Report any abortion associated with fever, retained placenta, or abnormal vaginal discharge, to a veterinarian immediately. Early diagnosis and timely intervention help control disease spread, protect public health, and minimise economic losses



*Disinfection of the animal shed*

## Causes of drop-in milk production in dairy animals along with possible remedies

| SL No | Probable cause                    | Remedy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Nutritional imbalance             | <ul style="list-style-type: none"> <li>• Provide concentrate feed according to the breed, body weight, milk yield, and stage of pregnancy of the animal (cattle or buffalo). For maintenance, feed 0.5 kg concentrate per 100 kg body weight, irrespective of breed. In addition, feed 400 g concentrate per litre of milk produced by cows and 500 g per litre of milk produced by buffaloes. Pregnant animals require an additional 0.5 kg concentrate daily during the second trimester (3<sup>rd</sup>–6<sup>th</sup> month of gestation) and 1.0 kg daily during the third trimester (6<sup>th</sup>–9<sup>th</sup> month of gestation).</li> <li>• Ensure adequate nutrition, including proper levels of protein, energy, vitamins, and minerals.</li> <li>• Provide access to high-quality green fodder, forage, balanced feed and clean water.</li> <li>• Carry out ration balancing.</li> <li>• Ensure proper body condition score during every stage of lactation, pregnancy and drying off.</li> </ul> |
| 2     | Health issues                     | <ul style="list-style-type: none"> <li>• Consult a veterinarian to diagnose and treat specific health issues affecting milk production, such as mastitis (sub clinical/clinical mastitis), worm infestation, metabolic disorders etc.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 3     | Age of cow and stage of lactation | <ul style="list-style-type: none"> <li>• Milk production decreases as the cow becomes older.</li> <li>• The lactation period can broadly be divided into three phases Early lactation (0-100 days): Milk production increases rapidly. Mid lactation (100-200 days): In this phase there is sustained milk production Late lactation (200-305 days): Milk yield continues to decline</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 4     | Genetic factors                   | <ul style="list-style-type: none"> <li>• Milk yield in dairy cows is influenced by breed-specific potential. Different breeds have been developed and optimized for various traits, including milk production, fat content, SNF and adaptability to different environments.</li> <li>• Implement genetic improvement programs, such as artificial insemination (AI) or embryo transfer, to introduce superior genetics into the herd. Monitor and record milk yield in progeny.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5     | Environmental stress              | <ul style="list-style-type: none"> <li>• Provide a comfortable and well-ventilated housing environment to minimize stress.</li> <li>• Implement cooling systems such as fans, misters, or sprinklers during hot weather (Micro climate modification)</li> <li>• Minimize stressors such as overcrowding, excessive handling, or abrupt changes in routine.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## Drop in milk fat: causes and possible remedies

Milk fat content naturally varies with the animal's breed, diet, health, season, stage of lactation, milking interval, and individual characteristics. A decline in milk fat percentage may occur when the diet does not contain enough effective fibre, such as good-quality green fodder, dry fodder, or properly processed roughage. It may also be associated with nutritional imbalance, excessive concentrate or rapidly fermentable carbohydrate intake, excess dietary unsaturated fat, disturbances in rumen fermentation, heat stress, disease, or other management-related factors.

The appropriate corrective measure depends on the underlying cause. Improving feed intake, maintaining a balanced ration, supporting normal rumen function, following proper milking practices, and maintaining good animal health may help maintain or restore milk fat percentage when it has declined because of a correctable problem.

| SL No | Probable cause                                     | Remedy                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Nutritional imbalance and inadequate dietary fibre | <ul style="list-style-type: none"> <li>• Provide enough good-quality green and dry fodder to meet the animal's fibre requirement.</li> <li>• Maintain an appropriate forage-to-concentrate ratio.</li> <li>• Provide a balanced ration with adequate energy, protein, fibre, minerals, and vitamins.</li> <li>• Avoid sudden ration changes and excessive feeding of rapidly fermentable carbohydrates.</li> </ul> |
| 2     | Excess dietary fat, particularly unsaturated fat   | <ul style="list-style-type: none"> <li>• Avoid excessive use of vegetable oils, oilseeds, or other feeds rich in unsaturated fatty acids. •Keep total dietary fat within the recommended level</li> </ul>                                                                                                                                                                                                          |
| 3     | Stage of lactation and high milk yield             | <ul style="list-style-type: none"> <li>• Milk fat may be lower during early lactation and periods and when milk production is high. •Adjust feeding and management according to milk yield and stage of lactation</li> </ul>                                                                                                                                                                                       |
| 4     | Poor body condition or negative energy balance     | <ul style="list-style-type: none"> <li>• Monitor the animal's body condition and feed intake throughout lactation.</li> <li>• Provide adequate feed according to its nutritional requirements, especially during early lactation, and prevent excessive loss of body condition after calving.</li> </ul>                                                                                                           |
| 5     | Heat stress                                        | <ul style="list-style-type: none"> <li>• Provide shade, good ventilation, and sufficient clean drinking water.</li> <li>• Feed animals during cooler periods and minimize overcrowding.</li> <li>• Monitor feed intake, milk yield, and fat content during hot weather.</li> </ul>                                                                                                                                 |
| 6     | Disease or poor health                             | <ul style="list-style-type: none"> <li>• If milk fat content declines unexpectedly, examine the animals for mastitis or other health conditions and seek veterinary advice for diagnosis and treatment.</li> <li>• Maintain good farm hygiene and follow the recommended vaccination, deworming, and herd health programmes.</li> </ul>                                                                            |
| 7     | Milking interval or incomplete milking             | <ul style="list-style-type: none"> <li>• Maintain regular milking intervals and ensure complete milk removal using proper milking practices, as milk fat percentage is generally higher in the later portion of milking.</li> <li>• If unusual variation in milk fat percentage is observed, check for incomplete milking and review the milking process.</li> </ul>                                               |

## Drop in milk solids-not-fat (SNF): causes & possible remedies

SNF content in milk is influenced by breed and genetic characteristics, nutrition and feeding management, health status, season and environmental conditions, stage of lactation, parity, milking interval, and individual variation among animals. A decline in SNF may be associated with inadequate or imbalanced nutrition, negative energy balance, reduced feed intake, heat stress, disease, or other management-related factors. Milk composition naturally changes with the stage of lactation and level of milk production. Therefore, the appropriate corrective measure depends on the underlying cause. Measures that improve feed intake, animal health, and overall management may help maintain or restore SNF when it has declined because of a correctable problem. However, when an animal is receiving an adequate and well-balanced diet and is in good health, SNF generally cannot be increased beyond its genetic and physiological potential.

| SL No | Probable cause                                             | Remedy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Nutritional imbalance                                      | <ul style="list-style-type: none"> <li>• Provide a balanced ration containing adequate energy, protein, fibre, minerals, and vitamins.</li> <li>• Provide good-quality green fodder, dry fodder, and suitable concentrates.</li> <li>• Provide protein supplements, only when required and in appropriate amounts.</li> <li>• Undertake ration balancing with the help of a qualified animal nutritionist.</li> <li>• Avoid sudden changes in the ration and excessive concentrate feeding.</li> </ul> |
| 2     | Negative energy balance, especially during early lactation | <ul style="list-style-type: none"> <li>• Provide adequate energy-dense feed according to milk yield and stage of lactation.</li> <li>• Give particular nutritional attention to recently calved and high-yielding animals.</li> <li>• Monitor body condition, feed intake, milk yield, and SNF regularly.</li> </ul>                                                                                                                                                                                   |
| 3     | Stage of lactation and high milk yield                     | <ul style="list-style-type: none"> <li>• Monitor SNF and interpret changes in relation to the stage of lactation and milk yield.</li> <li>• Adjust feeding and management according to the stage of lactation rather than relying on supplements alone to increase SNF.</li> <li>• Compare SNF results with previous records of the same animal and with animals at a similar stage of lactation.</li> </ul>                                                                                           |
| 4     | Heat stress                                                | <ul style="list-style-type: none"> <li>• Provide shade, good ventilation, and sufficient clean drinking water.</li> <li>• Feed animals during cooler periods and minimize overcrowding.</li> <li>• Monitor feed intake, milk yield, and SNF during hot weather.</li> </ul>                                                                                                                                                                                                                             |
| 5     | Disease or poor health                                     | <ul style="list-style-type: none"> <li>• If SNF declines unexpectedly, examine the animals for mastitis or other health problems and seek veterinary advice for diagnosis and treatment.</li> <li>• Maintain good farm hygiene and follow the recommended vaccination, deworming, and herd health programmes.</li> </ul>                                                                                                                                                                               |

## Farm biosecurity and disease surveillance

Farm biosecurity refers to the measures taken to prevent the introduction and spread of infectious diseases within and between dairy farms. Effective biosecurity improves animal health, productivity, milk quality, and farm profitability, while also helping protect public health.

### Key biosecurity measures

Buy animals only from trusted farms with a known disease-free or tested-negative health status. Keep all newly purchased animals separate (quarantined) for at least 30 days before introducing them into the main herd, under veterinary guidance. If the disease status is uncertain, extend the quarantine period as advised by the veterinarian.

Restrict unnecessary visitors and vehicles from entering the farm. Provide facilities for hand washing, boot cleaning, and foot disinfection before entry into animal areas.

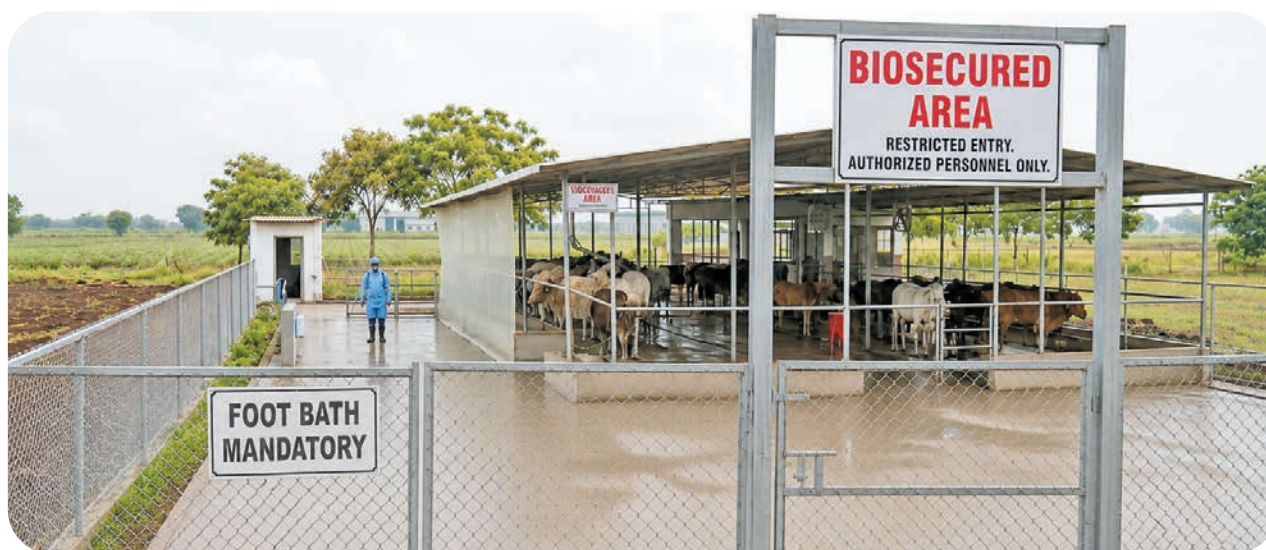
Isolate sick animals immediately and, whenever possible, use separate equipment, utensils, and attendants to reduce disease spread.

Maintain clean sheds, feed mangers, water troughs, and calving pens. Remove manure regularly and dispose of carcasses safely according to local veterinary and environmental guidelines.

Protect feed, fodder, and water from contamination by rodents, birds, insects, and other animals.

### Disease surveillance and record keeping

Animals should be observed regularly for signs of illness such as fever, loss of appetite, reduced milk yield, diarrhoea, coughing, lameness, abortion, nervous signs, or sudden death. Health and treatment records should be maintained, and unusual disease outbreaks, sudden deaths, or suspected notifiable diseases should be reported immediately to the nearest veterinarian or veterinary authority. Early detection and prompt reporting help reduce disease spread and economic loss.



*Dairy farm biosecurity measures*

# Hoof management

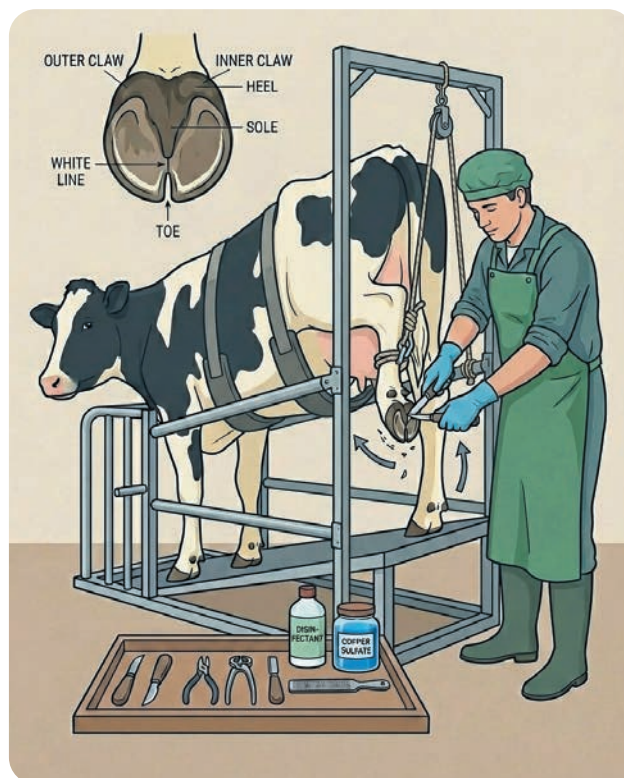
## Introduction

Maintaining healthy hooves is essential as it directly affects mobility, productivity, and overall animal welfare. Poor hoof management can result in lameness, leading to substantial financial losses due to reduced milk production, slower weight gain, and higher veterinary expenses. In contemporary farming practices, where animals are often confined to stalls and tethered for extended periods, the importance of proper hoof care is amplified.

## Anatomy of the bovine hoof

The bovine hoof is a complex structure consisting of four digits two primary weight-bearing claws (medial and lateral) and two smaller, non-weight-bearing dewclaws. Understanding its anatomical components is essential for proper care:

- **Hoof Wall:** The outermost hard structure providing support and protection
- **Sole:** The softer, concave surface that bears weight and absorbs shock
- **Heel:** The rear, shock-absorbing portion crucial for balance
- **Coronary Band:** The area where new hoof growth occurs
- **White Line:** The junction between the hoof wall and sole, vulnerable to infections
- **Flexor Tuberosity:** A pressure-sensitive area requiring protection during trimming



*Hoof trimming in a cow*

## Importance of hoof management

### 1. Enhanced mobility and comfort

Healthy hooves enable efficient movement and reduce the risk of injuries and lameness. Unevenly grown hooves cause disproportionate weight distribution, creating stress and pain that can lead to permanently deformed feet and legs.

### 2. Improved productivity

Lameness significantly impacts productivity by reducing feed intake and lowering milk production in dairy cows while slowing weight gain in beef cattle. Additionally, hoof problems can increase the incidence of secondary issues like mastitis and metritis due to bacterial proliferation in lesions.

### 3. Disease prevention

Proper hoof management helps prevent bacterial and fungal infections, particularly important in intensive farming systems where animals have limited movement.

### 4. Economic benefits

Preventative hoof care reduces treatment costs, production losses, and culling rates, making it a crucial investment in farm profitability.

## Common hoof disorders and prevention

### 1. Laminitis

- Cause: Inflammation of sensitive tissues, often linked to nutritional imbalances
- Symptoms: Swelling, heat, reluctance to walk
- Prevention: Balanced diet, reducing high-energy feeds, proper trimming

### 2. Foot Rot

- Cause: Bacterial infection (*Fusobacterium necrophorum*)
- Prevention: Clean, dry flooring, regular foot baths, proper nutrition

### 3. Digital dermatitis (hairy heel warts)

- Cause: Contagious bacterial infection
- Prevention: Routine foot baths, maintaining hygiene, minimizing wet conditions

### 4. White line disease and sole ulcers

- Cause: Excessive pressure and poor weight distribution
- Prevention: Regular trimming, soft bedding, balanced nutrition

## Best practices for hoof care

### 1. Systematic trimming protocol

- Trim the medial hoof first for even weight distribution
- Match the lateral hoof to the medial side
- Balance heels for even weight bearing
- Model the toe to prevent sole ulcers
- Address any existing lesions
- Implement preventive trimming twice yearly

### 2. Environmental management

- Maintain dry, clean barn floors with proper drainage
- Provide appropriate flooring in cattle sheds
- Avoid gravel in open areas
- Ensure adequate space for free movement
- Design proper stall dimensions and ventilation

### **3. Foot bath**

- Implement regular foot baths 2-3 times weekly in high-risk environments
- Monitor solution effectiveness and refresh as needed

### **4. Nutritional management**

- Provide balanced diets rich in biotin, zinc, and methionine
- Avoid excessive carbohydrates to prevent laminitis
- Monitor feed concentrates to prevent sub-acute ruminal acidosis

### **5. Monitoring and early intervention**

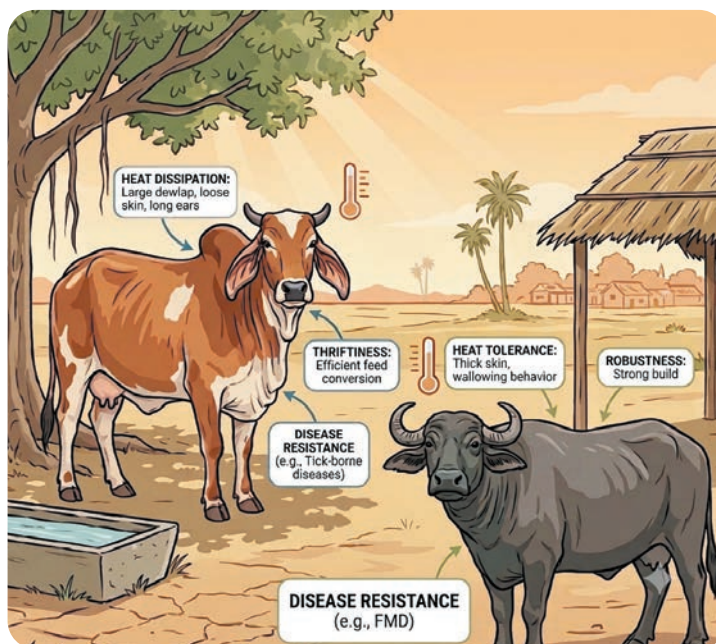
- Conduct daily observations for signs of lameness
- Implement prompt isolation and treatment of affected animals
- Keep detailed records of hoof health issues and treatments

### **Conclusion**

Effective hoof management in bovines requires a comprehensive approach combining regular trimming, proper nutrition, environmental management, and preventive care. The increasing trend toward intensive farming systems makes this even more critical. By implementing these management strategies, farmers can significantly reduce lameness incidence, improve animal welfare, and maintain optimal herd productivity.

# Adaptability and disease resistance in indigenous cattle and buffalo

Indigenous livestock breeds are fundamental to sustainable livestock production, particularly in diverse and often challenging environments. In India, indigenous cattle (*Bos indicus*) and buffaloes (*Bubalus bubalis*) have co-evolved with local conditions over centuries, developing exceptional adaptability and natural resistance to diseases prevalent in their habitats. This innate resilience makes them crucial for maintaining livelihoods and ensuring food security in regions with harsh climates and limited resources.



*Key adaptive traits of indigenous cattle and buffalo*

## Adaptation to challenging environments

Indigenous breeds possess remarkable adaptability to environmental stresses. They have evolved traits that allow them to thrive where exotic breeds often struggle.

### Key adaptability traits:

- **Drought tolerance:** Indigenous breeds, including those from India, are well-known for their capacity to flourish in drought-prone areas by efficiently utilizing scarce forage and water resources.
- **Heat tolerance:** They have developed specific mechanisms, such as efficient water retention and thermoregulation, to endure high temperatures. Indigenous cows are adapted to thrive in temperatures up to 40.5°C. Their sleek coats, loose skin, functional sweat glands, and low metabolic rate contribute to superior heat dissipation compared to *Bos taurus* breeds.
- **Hardiness:** These breeds are typically hardy and require fewer inputs like supplementary feed or intensive management compared to exotic breeds, making them highly suitable for low-input farming systems. They can tolerate harsh environmental conditions and even poor husbandry practices without significant impacts on their production.
- **Water efficiency:** In arid or water-scarce regions, indigenous breeds may have evolved to conserve water more effectively.

- **Seasonal breeding:** Many exhibit breeding behaviours tied to seasonal changes, optimizing reproductive success in their specific habitats.
- **Reduced stress:** Indigenous breeds are often less stressed by environmental or climate changes, which contributes to their overall resilience and potentially supports immune function.

Examples of adaptable indigenous breeds include Tharparkar and Ongole cattle known for drought tolerance, heat resistance, and disease resistance.

### Natural disease resistance

A significant advantage of indigenous breeds is their natural disease resistance, a trait developed through long-term exposure to local pathogens and subsequent natural selection. This intrinsic resistance reduces the need for extensive veterinary interventions and lowers mortality rates in areas where certain diseases are endemic, especially when compared to exotic breeds. The higher survival rates of indigenous cows compared to crossbred or exotic cattle under Indian field conditions underscore this point.

## Disease resistance in indigenous cows (*Bos indicus*)

Indian indigenous cattle, such as Gir, Sahiwal, Vechur, Kankrej, Ongole, Tharparkar etc. show notable resistance to a wide range of infectious, parasitic, and viral diseases common in India's challenging agro-climatic conditions.

### Resistance to specific diseases in indigenous cows:

- **Tick-borne diseases:** Indigenous cows exhibit significantly higher resistance or tolerance to tick-borne pathogens like *Theileria annulata*, *Babesia spp.*, and *Anaplasma marginale*. While crossbred cattle often suffer severe clinical symptoms from *Theileria annulata*, indigenous breeds tend to experience milder effects and have higher survival rates. Similarly, pure *Bos indicus* cattle are highly resistant to *Babesia bovis* infection, with experimental studies showing 0% needing treatment compared to 80% of pure *Bos taurus* steers. Breeds like Vechur and Kasaragod Dwarf in Kerala demonstrate high natural resistance to tick infestation, with little to no tick burden. Field surveys confirm lower tick prevalence in indigenous cattle compared to Holstein-Friesian crosses.
- **Mastitis:** The incidence of clinical and subclinical mastitis is significantly lower in indigenous cows than in crossbreeds and exotic breeds. This is linked to factors such as lower milk yield, different udder morphology, and robust innate immune responses in the mammary tissue.
- **Foot-and-Mouth Disease (FMD):** Indigenous cattle are reported to have greater resistance than crossbred cattle. They may show milder clinical signs during outbreaks or mount stronger antibody responses to vaccination compared to exotic breeds. However, all cattle breeds are susceptible to FMD virus, and control relies heavily on vaccination. Certain field surveys have reported a comparatively higher prevalence in indigenous cattle; however, these observations are more likely attributable to epidemiological factors such as exposure risk and management practices.

- **Brucellosis:** Resistance is linked to the Nramp1 gene. Some studies suggest Indian native breeds demonstrate better resistance than crossbreds.
- **Other diseases:** Indigenous cows also show resistance to Johne's disease, Tuberculosis, *Mycoplasma*, *Leptospirosis*, Pneumonia, Rotavirus infection in calves and post parturient diseases.

## Disease resistance in indigenous buffaloes (*Bubalus bubalis*)

Indian buffalo breeds, including Murrah, Surti, Hool etc. are recognized for their robust resistance to systemic diseases and parasitic infestations.

### Resistance to specific diseases in indigenous buffaloes:

- **Systemic infections:** Buffaloes are generally more resistant to systemic infectious diseases than cattle, with fewer cases of febrile reactions or contagious diseases like FMD observed in field studies.
- **Tick-borne diseases:** Native buffaloes, like indigenous cattle, show greater tolerance or resistance to tick-borne pathogens such as *Theileria annulata*. Infections in buffaloes often run milder. Buffaloes also have higher resistance to tick infestations and lower parasitemia in Babesiosis and Theileriosis.
- **Lumpy skin disease (LSD):** Experimental studies indicate that buffaloes are less susceptible to Lumpy Skin Disease virus (LSDV) than cattle, showing limited clinical signs and lower viral loads.
- **Foot and mouth disease (FMD):** Despite potential susceptibility to certain strains, buffaloes show lower rates of systemic infections compared to cattle.
- **Brucellosis:** Buffaloes show resilience against brucellosis. The Nramp1BB genotype in water buffalo confers high resistance to *Brucella abortus*, even in heavily infected herds.
- **Other diseases:** Indian buffaloes also show resilience against tuberculosis and salmonellosis. Regional breeds like the Hool Buffalo are noted for resistance to blood protozoan diseases, gastrointestinal parasites, and systemic infections under harsh conditions. Field data suggest buffaloes generally sustain fewer internal parasite infections than cattle in the same environment. Buffalopox outbreaks can also affect both buffaloes and cows.

## Mechanisms of resistance

The superior disease resistance of indigenous cattle and buffalo is a complex interplay of physical, physiological, immune, and genetic factors shaped by natural selection.

### Physical and physiological mechanisms:

- **Skin and secretions:** Indigenous cows possess dense sweat and sebaceous glands that produce oily secretions acting as a natural repellent to insects and mosquitoes, reducing the risk of vector-borne diseases. They also have thicker, more mobile hides covered with short, non-medullated hair and well-developed panniculus muscle, which serve as physical barriers.
- **Thermoregulation:** Their ability to regulate body temperature and resist heat stress, as discussed earlier, reduces stress-induced immunosuppression and contributes to overall health and disease resistance. Water buffalo wallow and seek shade, behaviours that cool them down and can also limit ectoparasites.
- **Grazing behaviour:** Indigenous breeds are well-adapted to local forage, efficiently utilizing available plant species.

### Immune mechanisms:

- **Innate immunity:** Indigenous cattle have higher baseline levels of blood globulins (IgM/IgG) and acute-phase proteins, which enhance rapid pathogen clearance. Their immune response includes heightened phagocytic activity of macrophages and upregulated genes related to phagocytosis and inflammation during infection. Indigenous breeds, particularly Zebu, tend to have more skin-resident T cells ready to respond to tick saliva and mount stronger inflammatory responses to tick secretions compared to taurine breeds.
- **Maternal immunity:** Calves of indigenous breeds may benefit from robust maternal antibodies received via colostrum, providing early-life protection against common local pathogens due to the dam's continuous exposure.

### Genetic mechanisms:

- **Immune-related genes:** Comparative genomic studies highlight genetic differences, including immune-related gene expansions (e.g., MHC class I/II, defensin genes) in *Bos indicus*, enhancing pathogen recognition. Variants in innate immune genes (e.g., Toll-like receptors - TLRs, NOD-like receptors - NLRs, JAK-STAT pathways) indicate adaptive evolution of defense mechanisms.
- **Specific gene associations:** Resistance traits have been associated with specific gene markers and alleles. For example, the Nramp1 gene is linked to brucellosis resistance. Certain BoLA-DRB3 alleles and IFN- $\gamma$  genotypes correlate with tolerance to *Theileria* and *Babesia* and better FMD vaccine response. Polymorphisms in TLR genes (TLR2, TLR4) have been linked to mastitis resistance.
- **Genomic insights:** Whole-genome comparisons reveal structural variants in innate immunity genes and quantitative trait loci (QTLs) on specific chromosomes (e.g., Chr1, X) associated with health and milk traits in Zebu breeds compared to taurine breeds.

- While the precise genetic basis for all resistances is not fully documented, ongoing research continues to clarify these mechanisms.

### **Comparative advantage and significance**

Evidence consistently shows that indigenous cattle and buffalo breeds have a comparative advantage over exotic and crossbred animals in surviving and maintaining productivity in challenging Indian conditions. Their ability to resist endemic diseases and environmental stresses makes them invaluable assets for sustainable dairy and draught purposes, supporting the livelihoods of millions of rural households. They represent a vital genetic resource for enhancing livestock resilience to climate change and improving breeds globally.

### **Breeding and management implications**

Recognizing the natural resistance of indigenous breeds provides a sustainable approach to disease management. Breeding programmes that emphasize disease resistance traits can help reduce economic losses, improve animal welfare, and decrease reliance on antimicrobials. Selective breeding for genetic resistance is considered a promising strategy. Genomic tools and marker-assisted selection are being utilized to identify and incorporate desirable resistance genes into breeding programs. However, it is important to note that no breed is completely immune to all diseases. Conservation of indigenous germplasm is also essential to maintain genetic diversity and resistance traits.

### **Conclusion**

Indigenous cattle and buffalo breeds in India have evolved over generations to thrive in the country's varied climates and farming conditions. Their natural tolerance to heat, drought, and local diseases, combined with low input requirements, makes them highly suited for sustainable livestock systems. These animals offer built-in resilience through strong genetic traits, effective immunity, and physical hardiness; however, they are not immune to infectious diseases and still require the same standards of vaccination, biosecurity, nutrition, disease surveillance, and veterinary care as crossbred and exotic animals. By conserving these breeds and promoting selective breeding to enhance their natural strengths, farmers can improve animal health, lower costs, and support environmentally sound, economically viable, and long-term sustainable farming practices.

# Feeding management

## 1. Checklist for good feeding management

Effective feeding management in dairy farms may be assessed through the following key indicators:

- Are the animals consuming adequate dry matter to support their milk production and physiological needs?
- Are animals provided with feed tailored to their specific stage of lactation, reproduction, or age?
- Do the animals maintain an ideal Body Condition Score (BCS) appropriate to their physiological stage (e.g., lactation, dry period, late pregnancy)?
- Do the animals exhibit healthy rumen function, such as regular cud-chewing, normal dung consistency, and absence of bloat or acidosis?
- Are mineral mixtures, and essential vitamins provided regularly as part of the feeding program?
- Are the animals returning to oestrus in a timely manner after calving?
- Are the days open and calving intervals within acceptable limits?
- Is the farm using ration balancing tools or services to formulate nutritionally balanced diets?
- Does the farm maintain a consistent supply of quality fodder throughout the year, including preserved forage such as silage or hay during lean seasons?
- Is the feed conversion efficiency (milk produced per unit of feed consumed) satisfactory?
- Is the feed cost per liter of milk produced remains within economically viable limits?
- Is feed wastage minimal, with negligible leftover after feeding?
- Does the farm maintain systematic records of feed intake, milk yield, body weight, and other relevant parameters?
- Are milk fat and SNF levels maintained within the normal range?

### LIFE STAGE MANAGEMENT



#### YOUNG CALF (Milk Feeding)

- Colostrum, milk replacer, calf starter



#### HEIFER (Growing Stage)

- Moderate feed for growth, not excessive fat deposition



#### ADVANCED PREGNANT (Pre-calving)

- Targeted nutrition for fetal growth



#### LACTATING COW (High Production)

- Optimal ration for milk yield



#### DRY COW

- Ration for body reserve restoration

*Nutritional management of dairy cattle at different life stages*

## 2. Feed animals in groups

Efficient feeding management is critical to the success of dairy farm operations, as feed constitutes approximately 60–70% of the total cost of milk production. Ensuring balanced ration in accordance with the physiological stages and production levels of animals is essential for maintaining the economic sustainability of the farm.

To facilitate efficient feeding strategies, animals should be systematically grouped based on their parity stage of lactation and level of productivity. Among lactating cows, further categorization into early, mid and late lactation stages is advisable. This approach enables precise ration formulation and optimal nutrient delivery. The suggested grouping is as follows:

- **Advanced pregnant cows:** Need a nutrient-dense diet rich in energy and protein, with appropriate Dietary Cation Anion Difference (DCAD) to support foetal development and prepare for lactation.
- **Lactating cows:** Require a high-energy and high-protein diet supplemented with good-quality forage to support milk production.
- **Dry Cows:** Should be provided with a diet lower in energy but sufficient in essential minerals, with particular attention to maintaining the calcium-to-phosphorus (Ca:P) balance.
- **Calves:** Must be fed colostrum within the first 2–3 days of life, followed by milk or milk replacer, and gradually introduced to calf starter feed to support rumen development.
- **Heifers:** Should receive moderate nutrition to ensure optimal growth without excessive fat deposition.

## 3. Feeding animals as per the stages of lactation

### 3.1 Feeding management of far-off dry cows (60 days before calving):

Proper feeding at this stage will ensure optimal birth weight of the calves, higher dry matter intake, reduced incidences of metabolic disorders, higher milk yield and timely conception post calving etc. The following guidelines are recommended:

- Provide high-quality concentrate mixtures that supply the necessary nutrients in small quantities to meet the increased nutritional demands of the pregnant dam.
- Offer 2–3 kg of good quality concentrate feed (pregnancy feed) daily, while maintaining an appropriate Dietary Cation-Anion Difference (DCAD) to support metabolic health.
- Incorporate bypass fat into the ration to minimize the risk of Negative Energy Balance (NEB) after calving.
- Implement individual feeding practices during the final stage of pregnancy to monitor and ensure proper nutrient intake for each animal.

### 3.2 Nutritional management of transition cows (21 days pre- to 21 days post-calving)

- Ensure an optimal roughage-to-concentrate ratio to promote efficient rumen fermentation and support the synthesis of microbial protein.
- During the last 2–3 weeks of gestation, provide rations that are low in fibre and rich in soluble carbohydrates to enhance nutrient absorption post-calving and facilitate the proper development of rumen papillae.
- The ration should be strategically supplemented with higher levels of Vitamin E, Selenium, Yeast, Probiotics, and anionic salts.
- Avoid calcium supplementation during the final two weeks of pregnancy to help prevent hypocalcemia and related complications post-calving.

### 3.3 Feeding management during early lactation (first 100 days post-calving)

To effectively manage negative energy balance and prevent excessive body weight loss (which should not exceed 0.5 kg/day) during early lactation, the following nutritional strategies are recommended:

- Provide a balanced ration, ensuring an optimal fat-to-protein ratio, to support metabolic health and milk synthesis.
- Maintain a concentrate-to-roughage ratio of 50:50 to ensure uniform intake and improved nutrient utilization.
- Incorporate high-quality concentrate feeds with increased levels of grains (as a source of bypass starch) and high-quality protein to meet elevated energy and amino acid requirements.
- Of the total green fodder offered, one-third should comprise leguminous fodder and two-thirds cereal grasses, to provide a balanced mix of nutrients and improve digestibility.
- Optimize dietary fibre intake by minimizing indigestible fibre while ensuring adequate physically effective fibre to support rumen health and chewing activity.
- Supplement the diet with bypass fat (100 - 150 g/d) to mitigate negative energy balance and support peak milk production.
- Provide mineral mixture in recommended quantities (about 100-200 g based on milk yield and fat content) to support milk production and maintain metabolic and skeletal health.
- Introduce dietary buffers to high yielding animals, such as sodium bicarbonate (50–75 g/day), to stabilize rumen pH and prevent acidosis.
- Adopt a strategy of challenge feeding to stimulate and sustain milk production in accordance with the animal's genetic potential.

### 3.4 Feeding management during mid-lactation (100 to 200 days post-calving)

During mid-lactation, milk yield begins to stabilize, and the animal's body reserves are typically replenished. Nutritional management should focus on maintaining milk production while optimizing feed costs. The following recommendations are advised:

- The forage component of the ration may be gradually increased, while reducing the concentrate proportion, maintaining a roughage-to-concentrate ratio of 60:40.

- The grain portion in the concentrate mix can be partially replaced with good-quality bran, to maintain energy supply at lower cost.
- Bypass fat supplementation may be discontinued, as energy requirements decline compared to early lactation.

### **3.5 Feeding management during late lactation (200 to 305 days post-calving)**

During late lactation, milk yield progressively declines. The focus during this stage is on cost-effective feeding while preventing over-conditioning and associated calving complications. Recommended feeding practices include:

- Optimize the cost of feeding by avoiding excess nutrient supply that could lead to unnecessary fat deposition and potential reproductive issues.
- Increase the forage content of the ration up to 70%, reducing the concentrate proportion to 30%, to match the declining nutrient requirements.
- Rations may be formulated using economical and locally available feed ingredients to reduce the cost of milk production, without compromising the basic nutritional needs of the animal.

### **3.6 Feeding management of calves**

- Administer colostrum within 30 minutes to 1 hour after birth, as timely feeding is critical for passive immunity transfer.
- Feed a minimum of 10% of the calf's body weight in colostrum during the first 24 hours, divided into 2–3 feedings.
- Continue feeding whole milk or milk replacer at approximately 10% of body weight per day, divided into three to four feedings.
- Maintain strict hygiene in feeding equipment and housing to prevent the incidence of diarrhoea and other infections.
- Provide access to clean, potable water ad libitum starting from day 3 of life.
- Introduce a calf starter (containing approximately 22% crude protein and low fibre) from the first week to promote early rumen development. By six months of age, calves should consume at least 1.5 kg of starter feed per day.
- Gradually introduce high-quality forage or hay alongside the calf starter to encourage fibre intake and proper rumen function.

### **3.7 Feeding management of heifers**

- Offer good-quality dry forage (such as hay or pasture grasses) along with concentrate mixtures containing 20% crude protein.
- Provide 1.5 to 2.0 kg of concentrate per day, adjusted based on the animal's body weight, growth rate, and body condition.
- Aim for a daily weight gain of 500 to 700 grams to ensure timely attainment of breeding weight and maturity.
- Ensure the diet includes adequate levels of essential vitamins (A, D, and E) and essential minerals such as calcium (Ca), phosphorus (P), copper (Cu), zinc (Zn), manganese (Mn), and selenium (Se).

- Prevent over-conditioning, as excessive fat accumulation during the growing phase may adversely affect future productive and reproductive performance.

#### **4. Forage management**

Efficient forage management is fundamental to ensuring the year-round availability of high-quality roughage, which is critical for maintaining the productivity, health, and overall well-being of dairy animals. As forage constitutes a significant portion of the total ration, it has a direct influence on milk yield, reproductive efficiency, and the overall economics. The following guidelines are recommended for effective forage production and utilization at the farm level:

- Prepare a seasonal forage calendar to ensure a continuous and balanced supply of green fodder throughout the year.
- Adopt a cropping system that combines annual and perennial fodder crops. Incorporate leguminous fodders such as cowpea, guar, ricebran, berseem and lucerne to enhance the protein content of the diet and improve soil fertility.
- Conserve excess green fodder during the peak production season in the form of silage or hay to meet feed requirements during lean periods.
- Use the appropriate fodder such as maize, oats and sorghum for silage making. Ensure proper compaction and airtight sealing in silage pits or bags to maintain nutritive value and prevent spoilage.
- Store hay in a clean, dry, and well-ventilated environment to preserve quality and prevent fungal growth.
- Chaff fodder to increase palatability, improve intake, and minimize wastage.
- Combine green and dry forage in the animal ration to optimize fiber intake and maintain appropriate dry matter levels.
- Introduce leguminous fodder gradually into the diet to avoid digestive issues such as bloating.
- Maintain systematic records of fodder crop types, area under cultivation, yield, and seasonal availability to facilitate effective planning and informed decision-making.

##### **4.1 Tips for preparation of quality silage**

- Select suitable varieties of cereal fodder crops such as maize, sorghum and oats for silage purposes.
- Harvest the crop at the right stage between the milk and dough stages when dry matter content in foliage is 35%.
- Cut the crop 10 cm above the ground and leave it to wilt for half a day to decrease moisture.
- Chop the harvested fodder with a proper chaff cutter to 1-2 cm size.
- Compaction of chopped fodder should be done swiftly, manually or by tractors, in thin layers to remove air pockets.
- Use additives (Lactobacillus/ jaggery/ organic acids) as per requirement.

- After the filling and compaction, seal the silo properly.
- Leave the compacted fodder in a well-covered silo for 45 days.
- As & when required, open the silo from one side for feeding purpose and check the aroma, colour and pH of silage.
- Good quality silage is golden yellow in colour, fruity aroma and 3.5-4.2 pH.

## **5. Feeding schedule and feeding methods:**

- To maintain an appropriate roughage-to-concentrate ratio, ensure uniform feed intake, reduce feed wastage, and improve overall feed utilization, it is advisable to provide the ration in the form of Total Mixed ration (TMR).
- TMR formulations should be tailored according to the stage of lactation to meet the specific nutritional requirements of the animals.
- For lactating animals, a base TMR formulation should be prepared for each production group. In cases where individual animals produce milk beyond the group's average yield, additional concentrate should be supplemented at the time of milking at the rate of 400 grams per litre of extra milk produced.
- Special attention should be given to balancing key minerals such as calcium, phosphorus, and trace elements including zinc (Zn), copper (Cu), and Manganese (Mn).
- Supplementation with vitamins A, D, and E may be required depending on the quality of the basal feed and forage.
- Feed adjustments should be made gradually based on changes in milk yield, stage of lactation, and body condition score. Sudden changes in feed composition or feeding schedule must be avoided.
- Feeding should be carried out at fixed times daily, preferably two to three times a day, to maintain consistency.
- Provide clean and unlimited drinking water. A lactating cow may need 50–100 liters/day depending on season and production.

## **6. Feeding management strategies during heat stress conditions**

During periods of heat stress, dry matter intake (DMI) in dairy animals can decline sharply by 20–30%, while energy requirements concurrently increase by approximately 30%. This necessitates the adoption of specialized feeding strategies to maintain animal productivity and health during the summer months. The following recommendations are suggested:

- Offer the bulk of feed during the cooler parts of the day (early morning and late evening) to encourage feed intake.
- Provide smaller and more frequent meals to minimize feed spoilage and enhance digestibility.
- Ensure continuous access to clean, cool drinking water, as water consumption may increase by 50–100% during hot weather.

- Reduce the Neutral Detergent Fibre (NDF) level in the ration and incorporate forages with higher NDF digestibility.
- Increase the inclusion of protein meals rich in rumen degradable protein to support microbial activity and nutrient absorption.
- Enhance the energy density of the ration by supplementing with bypass fat to compensate for reduced DMI.
- Slightly increase the DCAD value of the ration (to 35–45 mEq per 100 g of DM) to mitigate potassium losses during heat stress.
- Add buffers and potassium carbonate at a rate of 0.25% of total DMI to support rumen function and acid–base balance.
- Consider incorporating specialized supplements (e.g., Pashu Sheetvardhak developed by NDDB) to support thermal tolerance and maintain performance.

## 7. Monitoring Body Condition Score (BCS) of animals

Animals should maintain an optimal BCS that aligns with their specific physiological stage, indicating adequate and balanced intake of nutrients. As an example, the recommended BCS for crossbred cows across different physiological stages is as follows:

| Physiological Stage         | Ideal BCS | Reference Range |
|-----------------------------|-----------|-----------------|
| Calving                     | 3.25–3.5  | 3.0–3.75        |
| Peak Lactation (60–90 days) | 2.5–3.0   | 2.5–3.25        |
| Mid Lactation               | 2.75–3.25 | 2.5–3.5         |
| Late Lactation              | 3.0–3.5   | 2.75–3.75       |
| Dry Period (Far-off)        | 3.25–3.5  | 3.0–3.75        |
| Close-up (Pre-calving)      | 3.25–3.5  | 3.0–3.75        |

## 8. Other important considerations for effective feeding management

- Avoid feeding mould-infested or spoiled feed and fodder, as it may contain mycotoxins (e.g., Aflatoxin) that can adversely affect animal health. Always use fresh and high-quality feed ingredients.
- Maintain hygiene by cleaning feed troughs and waterers regularly to prevent contamination and disease transmission.
- Store feed in a cool, dry, and rodent-proof environment to preserve its quality and prevent spoilage.
- Utilize locally available and cost-effective feed resources to optimize feed costs without compromising nutritional value.
- Refrain from overfeeding expensive concentrates unless economically justified by corresponding improvements in milk yield or productivity.
- Where available, make use of feed analysis and ration balancing software to ensure nutritionally balanced and cost-effective feeding.
- Adjust feeding strategies seasonally: increase water availability and manage energy density appropriately during summer and winter months.

# Heat stress management

Heat stress occurs when dairy animals are unable to dissipate excess body heat, resulting in reduced feed intake, lower milk yield, poor reproductive performance, and increased susceptibility to disease. Common signs include rapid breathing or panting, excessive salivation, crowding around water sources or shaded areas, prolonged standing, reduced feed intake, and a decline in milk production.

To minimise heat stress, provide adequate shade, good ventilation, and continuous access to clean, cool drinking water. Where feasible, use fans, sprinklers, or foggers to improve cooling, and combine shade with good airflow for better heat dissipation. Feed animals during the cooler hours of the day, avoid unnecessary handling and transport during hot weather, and provide a balanced ration with adequate energy and fibre. Monitor animals regularly during hot weather and seek veterinary advice if signs of severe heat stress are observed.



*Cooling management during heat stress*

# Estimating per litre milk cost: a practical approach

## Introduction

Understanding the cost of milk production per litre is fundamental for dairy farm management, profitability analysis, and strategic decision-making. Accurate calculation of this cost enables dairy farmers to set appropriate milk prices, evaluate their operational efficiency and make informed choices about investments and improvements.

## Components of milk production cost

Milk production cost is generally broken into two main components:

- Variable Cost (VC): Costs that vary with the level of output (e.g., feed, fodder, hired labour, veterinary care, electricity and water etc.).
- Fixed Cost (FC): Costs that do not vary with production (e.g., depreciation on animals and buildings, interest on capital and equipment etc).
- Total Cost (TC) = Variable Cost + Fixed Cost
- Per Litre Cost: The total cost divided by the total litres of milk produced in a given period.

## Factors affecting cost per litre

- Feed & fodder costs: Constitute over 60–70% of total cost. Seasonal availability of fodder affects feed costs
- Labour: Both family and hired labour. In most Indian dairy farms, family labour constitutes a significant share, especially women.
- Animal maintenance: Veterinary and breeding expenses, medicines, insurance, and depreciation of animals.
- Utilities and overheads: Water, electricity, repairs and maintenance of sheds and equipment.
- Depreciation: On cattle sheds, fodder storage structures and equipment.
- Interest and Opportunity Costs: On working and fixed capital, including imputed costs for family-owned resources.

### Example for milk cost calculation

Suppose a small dairy farmer has 2 milch cows. During one month, the farmer records the following expenses:

| Item                                        | Amount (₹/month) |
|---------------------------------------------|------------------|
| Feed and fodder                             | 3,000            |
| Labour (family/hired)                       | 2,000            |
| Veterinary care and medicines               | 500              |
| Utilities (water, electricity)              | 300              |
| Miscellaneous (repairs, maintenance)        | 200              |
| Depreciation on animals, shed and equipment | 500              |
| <b>Total monthly cost</b>                   | <b>6,500</b>     |

If the two cows together produce 8 litres of milk per day, then the total milk produced in 30 days is:

Total milk produced = 8 litres/day × 30 days = 240 litres

#### Cost per litre

Cost per litre = Total monthly cost ÷ Total milk produced

= 6,500 ÷ 240 = ₹27.08 per litre.

### Additional metrics for farm advisory

- Fodder Cost/Litre: Helps identify feed efficiency.
- Break-even Point (BEP): The minimum quantity of milk that must be produced and sold at a given price to cover all costs, resulting in neither profit nor loss.
- Feed-to-Variable Cost Ratio: Indicates feed efficiency.
- Return on Investment (ROI): Assesses profitability of expansion or new investment.

### Recommendations for reducing milk cost per litre

- Adopt Ration Balancing Programs (RBP): Improves feed efficiency and animal health.
- Improve milk yield: Through genetic improvement and better animal management.
- Reduce fodder cost: By cultivating green fodder or adopting community fodder farms.
- Reduce veterinary costs: Through preventive health care and better disease surveillance.
- Labour optimization: Training and efficient allocation of family and hired labour.
- Infrastructure investment: Proper cattle sheds and storage to minimize losses and improve animal comfort.
- Record keeping: Maintaining detailed financial and production records to identify cost-saving opportunities

Calculating milk cost per litre is essential for effective farm management. It supports accurate pricing, informed investment, and cost control. Farm advisors should focus on cost tracking, improving yields and optimizing feed plans to enhance efficiency and profitability.

# Record keeping in a dairy farm

Record keeping is an integral part of routine farm operation. It serves as a fundamental management tool that assists farmers in monitoring various aspects of their operation, including herd health, productivity, reproduction, feed efficiency, and financial performance. Accurate records are essential for economic analysis and play a crucial role in decision-making. They enhance farm efficiency, enable timely interventions, and contribute to sustainable profitability.

## Purpose and importance of record keeping

Maintaining detailed and accurate records provides numerous benefits to a dairy farm. Key purposes include:

- **Evaluation of animals:** Records provide the basis for evaluating individual animals.
- **Selection and removal:** They help in the systematic selection of productive animals and removal of less desirable ones.
- **Breeding programme:** Records aid in establishing a systematic breeding programme for herd improvement.
- **Progeny testing:** They are helpful in progeny testing of bulls.
- **Economic feeding:** Records support economic feeding of animals.
- **Registration:** Record keeping is a necessity for registration in a central herd book.
- **Pedigree and history:** Help in preparing pedigree and history records of animals.
- **Health management:** The health condition of animals can be monitored, enabling early detection of disease, vaccination tracking, and treatment follow-up.
- **Animal pricing:** Aids in fixing proper prices for animals meant for purchase and sale.
- **Herd supervision and management:** Contributes to better supervision and management of the herd.
- **Economic analysis:** Helps in ascertaining the income and expenditure of the dairy farm.
- **Cost of milk production:** Helps in determining the cost of milk production.
- **Comparing efficiency:** Useful for comparing the efficiency of labour and the herd with other farms.



*Individual animal records and herd performance monitoring*

- **Performance comparison:** Enables comparison of results across different years to determine the degree of profits each year.
- **Farm investment details:** Helps determine details of farm investment, receipts, expenses, and net income.
- **Resource management:** Furnishes information regarding quantities of roughages and concentrates fed, milk production amounts, and production methods to improve efficiency.
- **Regulatory compliance:** Aids in meeting legal, quality assurance, and traceability requirements.
- **Insurance and compensation:** Documented losses support insurance claims.
- **Audits and certification:** Required for various farm audits and certification programs.

### Types of records maintained

The kinds of records maintained depend on the scope and nature of the farm. Generally, farm records are categorized into technical records (performance of animals) and business records (purchase, disposal, accounts).

More specifically, records on a dairy farm typically include:

- **Animal Identification records:** Unique ID, breed, sex, birthdate, sire/dam details, purchase/sale details. These are part of the Cattle section records which include a daily report register, history and pedigree sheet, and livestock register.
- **Reproduction and breeding records:** Heat detection dates, service dates, bull/semen used, pregnancy diagnosis results, calving dates, calving outcome, calving interval, services per conception. These are part of Breeding and calving registers, Bull assignment registers, and pregnancy records. The purpose of a breeding and calving register is to determine services per conception, compare conception methods (AI vs. natural), determine breeding efficiency, and aid in culling animals with poor breeding efficiency.
- **Milk production records:** Daily yield per animal, morning/evening yields, fat/SNF percentage, milk quality tests, drying-off dates, lactation length, cumulative yield. This includes milk record registers and milk summary records. Lactation records aim to determine peak yields, persistency, milk days, dry days, and average daily yield, evaluate performance, and help in selection/culling.
- **Health and treatment records:** Vaccinations, disease occurrence/diagnosis, treatment details (drug, dose, withdrawal), veterinarian notes, recovery status, mortality/removal reasons. This corresponds to health registers.
- **Feeding and nutrition records:** Daily ration, feed types/quantity, nutritional content, feed purchase details (cost, source), feed conversion ratio. These include registers for receipt of cattle feeds, Registers for feed consumption, feed order books, and concentrate feeding schedules.
- **Calf rearing records:** Birth weight, growth milestones, colostrum intake, weaning date, vaccinations/deworming, morbidity/mortality. This includes Calf feeding registers.
- **Labour and personnel records:** Number of workers, daily roster, wages, training, work incidents. This includes labour sheets, muster rolls and attendance and pay records.

- **Financial records:** Milk sales, animal sales/purchases, expenses (feed, medicine, equipment), labour/overhead costs, loan details, profit/loss statement, cash flow. These are considered general records like ledger, cash book, purchase book, bill payable book, store stock book and inventory register.
- **Farm section records:** Includes machinery and implement books, tractor registers, field registers, and fodder cultivation records.

### Formats for record keeping

Record keeping can be managed using various formats:

- **Manual record books:** Simple registers or logbooks, sometimes color-coded for different categories. These are common on smallholder farms.
- **Printed templates and charts:** Pre-designed herd cards, wall charts, milk yield charts, or breeding calendars, useful for visual tracking.
- **Computerized systems:** Using software like Excel sheets with automated formulas or database software like MS Access.
- **Farm management software and Apps:** Dedicated software or mobile applications designed for dairy farming (e.g., INAPH, BoviSoft, SmartCow) offering features like auto-reminders, dashboards, and cloud storage. These are suitable for medium to large farms.



Recording of milk yield

## Commonly used record formats

As discussed, here are sample formats for key records, suitable for manual registers, Excel sheets, or adaptation for digital systems:

### 1. Animal Identification record format

- o Sr. No.
- o Animal ID
- o Name/Tag
- o Species (Cow/Buffalo)
- o Breed
- o Sex
- o DOB (Date of Birth)
- o Sire ID
- o Dam ID
- o Date of Purchase
- o Source
- o Remarks

### 2. Breeding and reproduction record format

- o Animal ID
- o Heat Date
- o Service Date
- o Bull/Semen ID
- o Method (AI/Natural)
- o PD Date (Pregnancy Diagnosis Date)
- o PD Result
- o Calving Date
- o Calf Sex
- o Calf Alive?
- o Remarks

### 3. Milk production record format

- o Date
- o Animal ID
- o Morning Yield (L)
- o Evening Yield (L)

- o Total (L)
- o Fat (%)
- o SNF (%)
- o Remarks

### 4. Health and treatment record format

- o Animal ID
- o Date
- o Disease
- o Symptoms
- o Diagnosis
- o Drug/Treatment
- o Dosage
- o Vet Name
- o Withdrawal Period (days)
- o Recovery Status
- o Remarks

### 5. Vaccination and deworming record format

- o Animal ID
- o Date
- o Vaccine/Dewormer
- o Disease Prevented
- o Dose
- o Manufacturer
- o Next Due Date
- o Administered By

### 6. Feeding and nutrition record format

- o Date
- o Animal Group
- o Feed Type
- o Quantity Fed (kg)

- o No. of Animals (in group)
- o Total Feed (kg)
- o Feed Cost (₹/kg)
- o Total Cost (₹)
- o Remarks

#### **7. Calf rearing record format**

- o Calf ID
- o Date of Birth
- o Dam ID
- o Birth Weight (kg)
- o Colostrum Given (Yes/No)
- o Weaning Date
- o Vaccination Done
- o Growth Notes
- o Mortality Date (if any)

#### **8. Labor and wages record format**

- o Date
- o Employee Name
- o Job Assigned
- o Working Hours
- o Daily Wage (₹)
- o Overtime(₹)
- o Total Wage (₹)
- o Remarks

#### **9. Financial record format**

##### **A. Income record**

- o Date

- o Source
- o Description
- o Quantity
- o Rate (₹)
- o Total Income (₹)
- o Buyer/Party
- o Payment Mode
- o Remarks

##### **B. Expenditure record**

- o Date
- o Item Purchased
- o Description
- o Quantity
- o Unit Cost (₹)
- o Total Cost (₹)
- o Vendor
- o Payment Mode
- o Remarks

#### **10. Summary performance sheet (monthly)**

- o Month
- o Avg. Milk per Cow/Day (L)
- o Total Income (₹)
- o Total Feed Cost (₹)
- o Labor Cost (₹)
- o Vet/Health Cost (₹)
- o Net Profit (₹)



## Best practices in record keeping

To ensure effective record keeping:

- **Consistency:** Record every event on the same day it occurs.
- **Accuracy:** Enter precise quantities, dates, and names; avoid assumptions.
- **Simplicity:** Use easy-to-understand formats suited to the literacy level of workers.
- **Security:** Keep backups (digital or physical) and protect records against damage.
- **Review and analysis:** Regularly review farm records and use the information to improve feeding, management, and culling decisions.
- **Training:** Teach workers and family members how and why to record data.

## Challenges in record keeping

Common challenges, particularly noted in the Indian context, include:

- Low literacy or digital skills among farmers.
- Lack of standardized formats.
- Poor access to mobile/computer tools in remote areas.
- Limited use of records for decision-making.
- Selling milk to multiple buyers may discourage farmers from maintaining detailed milk yield records.

Practical solutions include training farmers and field staff, offering incentives for regular digital record-keeping, and promoting easy-to-use tools like pictorial or voice-based mobile apps. Using software in local languages also helps ensure better understanding and wider adoption at the grassroots level.

## Conclusion

Good record keeping is a game-changer for any dairy farm. It shifts management from guesswork to informed decision-making. Accurate records help farmers track herd health, improve breeding, control diseases, and plan for long-term profits. While notebooks and registers still work on small farms, moving towards mobile-based digital tools brings added value over time. Simple apps can make it easier to store, access, and analyse data. When records are kept regularly and used wisely, they become a powerful tool for better herd performance, stronger biosecurity, and more sustainable farm management.

## Additional information and resources

For more information on dairy farming, readers are encouraged to visit the Dairy Knowledge Portal (<https://www.dairyknowledge.in>), which provides regularly updated manuals, technical publications, posters, videos, and other educational resources on dairy animal health, nutrition, breeding, farm management, and allied topics. Some important technical publications, posters, and awareness videos with direct links are provided below for ready reference.

### Technical publications



Handbook of good dairy husbandry practices



Understanding your bovine (cow comfort manual)



Ethnoveterinary formulations for important ailments in bovine

### Technical posters



Antimicrobial resistance (AMR)



Brucellosis – farmer



Brucellosis – veterinarian



Hoof management



Tick control



Microplastics



Mycotoxin



Mastitis





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