FEED THE FUTURE INNOVATION LAB FOR LIVESTOCK SYSTEMS TRAINING MANUAL

Good Management of Cows and Buffaloes to Prevent and Treat Mastitis

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FEED THE FUTURE INNOVATION LAB
FOR LIVESTOCK SYSTEMS

Training Manual

Good Management of Cows and Buffaloes to Prevent and Treat Mastitis

JANUARY 2018
Foreword

Mastitis (or infection of the udder) is a problematic disease for many farmers raising cows and buffaloes. Milk animals suffering from this disease have reduced milk yield, which results in an economic loss for farmers. One of the main causes of mastitis is the lack of knowledge of dairy farmers on how to prevent and control the disease. Even if farmers are aware, they may not follow the standard management practices to prevent the disease, thus mastitis is considered a management disease.

As part of the Feed the Future Innovation Lab for Livestock Systems and in collaboration with Department of Livestock and Himalayan College of Agricultural Sciences and Technology, Heifer International launched a one-year project in December 2016 to reduce mastitis in the Bardiya, Surkhet and Dang districts of Nepal. The project targeted 400 dairy farm households and it had three objectives: 1) to understand the prevalence of the disease in these districts, 2) to understand the control mechanisms of mastitis, and 3) to disseminate the technologies developed to control and prevent mastitis.

Dairy farmers that want to prevent and control mastitis should learn about the good management practices to follow. This training manual discusses the symptoms of mastitis, the various causes of mastitis, the economic impacts of mastitis, and its negative impacts on animal and human health. This manual also outlines good management practices farmers can use to prevent and control mastitis. We hope that others can use this to conduct workshops on mastitis prevention and control.

We welcome any feedback you may have on the contents of this manual.

Heifer International Nepal
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<td>NARC</td>
<td>National Agricultural Research Council</td>
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<tr>
<td>RF</td>
<td>Right Front</td>
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1. Introduction

The livestock sector is an important contributor to Nepal’s agricultural production (26.8% of agricultural sector GDP) and overall economy (contributing 11% of Nepal's total GDP). Within the livestock sector, dairy production is particularly important and comprises more than half of Nepal's economic production in the livestock sector (62.6%). Buffaloes produce 70% of Nepal's milk while cows produce the remaining 30%. Milk products such as whole milk, curd, ghee, buttermilk and cream have important religious and cultural significance in Nepal. However, despite increases in the number of crossbred and higher yielding cattle and buffaloes, the demand for milk products exceeds the current supply by 30kgs per person per year. In addition to the religious and cultural importance of milk products in Nepal, dairy production also provides means of livelihood for 500,000 households. However, livestock diseases can reduce livestock productivity and mastitis is one of the main diseases responsible for reduced milk yield in Nepal.

2. Mastitis

Mastitis is an infection that causes inflammation of the teats and udder in dairy animals. In severe cases, mastitis can lead to agalactia (lack of milk secretion) or even a systemic infection, which can result in the death of the animal. Certain types of viruses, bacteria, and fungi can cause mastitis, and it is contracted either through contact with an infected animal or from the environment. Often, mastitis can be prevented through standard hygiene and husbandry practices. Due to its effect on milk production, quality, and the overall health of the animal, mastitis can have significant economic impacts on dairy farmers. In general, mastitis occurs in early lactating animals; however, it has been observed even in first calving animals. Research in Nepal suggests that 13.6% to 60% of dairy animals may be infected with sub-clinical mastitis. The health of dairy animals and the quality of their milk has implications for human health as well, thus it is important for dairy farmers to apply Good Management Practices (GMP) and Good Health Practices (GHP) to prevent cases of mastitis in their animals.

Mastitis occurs when the mammary glands of the dairy animal become infected with viruses, bacteria or mycotic organisms such as Streptococci, Staphylococci, or gram negative rod organisms. There are many factors that can increase the likelihood of a dairy animal becoming infected, such as: unhygienic milking practices, keeping the animal in unhygienic conditions (i.e. in a shed without sufficient ventilation), and the presence of wounds or ulcers on the teats or udders. It is important to note that high-yielding cross-bred dairy animals may be more susceptible to mastitis. Additionally, various diseases such as Foot and Mouth Disease (FMD), Hemorrhagic Septicemia (HS), or internal/external parasites can increase the likelihood of a mastitis infection.

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1 Annual progress report 2072/73, Livestock Development Ministry
3. Types of Mastitis

**Symptoms of Mastitis**

Mastitis can be categorized into two types, clinical and sub-clinical. Mastitis may be present in a single teat or in all four teats. Clinical mastitis is characterized by the following symptoms:

- Milk that is thin and watery, yellowish, and/or blood-tinged is a symptom. As the infection develops, the milk may become thick (like yogurt) due to pus.
- Inflammation of the mammary gland along with redness is a sign. It may also be hot to the touch and the animal may react in pain.
- Thickness and fibrosis of the mammary gland with little milk is a symptom. If left untreated, milk yield will cease completely.
- A 20-30% reduction in milk yield is often a sign of mastitis.

In contrast, the symptoms of sub-clinical mastitis may not be visible, but the milk yield will gradually decrease. Only by testing milk samples can sub-clinical mastitis be detected. If left untreated, sub-clinical mastitis may develop into clinical mastitis. Unlike clinical mastitis, sub-clinical mastitis is not characterized by any external symptoms (i.e. inflammation of the mammary glands), but a 70-80% reduction in milk yield can occur in cases of sub-clinical mastitis.

**Diagnosis of Mastitis**

Mastitis can be diagnosed by physical examination or by laboratory tests. When a physical examination for mastitis is conducted, the examiner looks for the presence of inflammation in the mammary glands (hot and reddish condition on palpation) and changes to the milk, such as watery milk or the presence of granular flakes or blood in milk. In addition, the examiner will evaluate the animal’s overall condition and disease history.

Laboratory testing for mastitis can be done in several different ways, but in general it is preferable to test milk samples before treating the animal so that the correct diagnosis can be made. Milk samples can be tested for mastitis using the California Mastitis Test (CMT), a somatic cell count, or a milk conductivity test.
4. Using the California Mastitis Test (CMT) to Diagnose Mastitis

**Preparation of CMT Reagent**

Chemicals needed to prepare the CMT reagent:
- Sodium hydroxide (15gm)
- Tipol (5 ml)
- Bromothymol blue (0.1 gm)
- Distilled water (1000 ml)

**Reagent Preparation Procedure**

1. Measure 1 liter of distilled water.
2. Place sodium hydroxide into a pestle and add distilled water to mix thoroughly using a mortar.
3. Pour the solution into a conical flask; wash the pestle and mortar with the remaining distilled water and then pour into the flask gently.
4. Add tipol in the made solution and stir thoroughly.
5. At the end, add bromothymol blue, which acts as an indicator.
6. Keep the made solution in a clean bottle with a label (date of preparation, name of solution and person preparing it). Store in a dark and cool place.

**Materials required for CMT**

- CMT reagent
- CMT paddle
- Milk sample
- Mask
- Gloves

**Procedure for California Mastitis Test (CMT)**

1. Collection of milk samples from all the four quarters in sterile vials, test tubes or Bijou bottles.
2. Discard (fore strip) 2/3 streams of milk from the quarter.
3. In a four section plastic paddle or in four petri dishes indicating RF (Right Front), RH (Right Hind), LF (Left Front) and LH (Left Hind).
4. Add 3 ml of milk to each sample according the respective label (i.e. RF, RH etc.).
5. Add 3ml of CMT reagent (see above for instructions) to all the milk samples.
6. Gently stir or shake the paddles/petri dishes for thorough mixing.
7. Observe if there are changes in the milk sample. If the milk sample is positive, the mixture will become thick and mucous-like. If the milk sample is negative, there will not be any changes.
5. Mastitis Prevention

Good Management Practices (GMP) can prevent the occurrence of mastitis in dairy animals, which can reduce the amount and quality of milk from dairy animals. Application of GMPs, especially sanitation and hygiene in animal sheds, can reduce the occurrence of mastitis and can help farmers attain higher milk production and quality.

If a mastitis infection occurs, the following steps can be taken to treat the infection:

1. Treat the infected teats and udder with warm water. Empty any milk, blood or pus from the udder.
2. If the teat canals are blocked, use a teat siphon to drain out the milk.
3. Topically apply Mastilep or Masticare ointment twice daily to teats and udders.
4. If the mastitis does not improve, consult animal health technicians or veterinarians for milk sample testing. After testing, antibiotics may be prescribed to treat the infection.

To prevent mastitis from occurring there are several steps dairy farmers can take:

1. Ensure the dairy animals are kept in a clean and healthy environment.
2. Before milking, wash the udder and teats with soap then rinse udder and teats with warm water and dry with a clean cloth.
3. The milking person should maintain good personal hygiene by trimming nails and washing hands with soap prior to milking.
4. Milking utensils must be clean and disinfected prior to milking.
5. Sick animals should be kept away from healthy animals. Additionally, sick animals should be milked last to prevent contamination of hands or milking utensils.
6. Standard milking procedures should be followed and milking should be completed from quarters.
7. Ensure that the bedding is soft. Rubber mats can be used to soften concrete floors.
8. After milking, dip each teat with antiseptic solution (povidine iodine) to prevent infections.
9. Dry cow therapy should be practiced by applying antibiotics ointments to all teats.
10. If animals are suffering from other diseases than mastitis, provide appropriate examination and treatment as necessary.
6. Shed Management

In dairy husbandry, shed management plays a vital role in animal health and production. Incorrect shed management practices, such as: lack of sanitation in the shed, lack of separate places for fodder/concentrate and dung, a wet floor, or lack of ventilation can increase the likelihood of mastitis.

The following steps can be taken to ensure the dairy animal sheds are managed properly:

- The shed should be constructed so that there is plenty of sunlight. The shed should also be well-ventilated so that there is plenty of air movement, which reduces foul smells. Sheds with inadequate ventilation and a damp floor greatly increase the chance that the animals contract respiratory diseases like Pneumonia.
- Sheds should have a manger for feed and fodder.
- Cracks or crevices in the walls or floor of the shed may make the shed unhygienic and the dairy animals within it more prone to infection. Similarly, spider nets or dust in the roof or on the walls may contaminate the milk while milking. Hence, the walls and roof of the shed should be cleaned regularly.
- The floor of the shed should be slightly sloped for easy cleaning. Floors with holes and cracks are more difficult to keep clean.
- Dung should be removed and collected in a pit for compost manure. The compost pit should be kept at least 3 meters away from the shed to maintain the cleanliness of the shed. If no space is available 3 meters away from the shed, another area away from shed may be used.
- Apply bio-security practices to prevent the infection of animals and the contamination of the shed (see below).

![Figure 2 Shed design and bio-security practices](image-url)
7. Bio-security

Bio-security is the prevention of infection in animals or the contamination of the shed. Strict maintenance of bio-security can prevent the spread of disease in livestock and minimize the negative impacts of zoonotic diseases on public health.

Bio-security measures include:

- When a new animal is brought to the farm, only healthy and vaccinated animals should be introduced to it.
- New animals should be kept in isolation at least for a week before they are integrated with other animals. Keeping the new animal in isolation allows time for observation to ensure that the animal is not diseased and will not contaminate the other animals.
- Animals not sold in the market should not be mixed in the group/herd.
- While working in a shed, an apron should be worn at all times. If an apron is not available, clean clothes may be used instead. Additionally, while working in the shed, masks should be worn to cover nose and mouth and a pair of boots should be worn to protect the feet.
- Priority and importance should be given to personal hygiene and hands should always be washed with soap before and after working in the shed.
- The area around the shed should be dusted regularly with calcium oxide.
- When animals become sick, lab tests should be done to diagnose the issue and the appropriate treatment should be applied.
- Sick animals should be kept isolated as far away from healthy animals as possible.
- When milking, milk the healthy animals first and milk the sick animals last.
- Unauthorized persons should not be allowed to enter the shed.

**Personal Hygiene of the Milking Person**

The cleanliness and hygiene of the person milking the dairy animals has an important role in producing clean, uncontaminated, and healthy milk. For example, if a person who has tuberculosis milks a healthy animal, they may contaminate the milk with T.B. bacteria by sneezing or coughing the air surrounding the milk.

For the better personal hygiene of the person milking, the following criteria should be considered:

- The fingernails of the person milking may cause cuts in the teats and udder and may contaminate the milk if dust and dirt is present under the nails. Thus, it is important that the person milking trims their fingernails regularly. Additionally, watches or bangles should be removed before milking as they may carry bacteria that can contaminate the milk or infect the teats and udder.
- Before milking, hands should be washed with soap and water and then dried with a clean cloth.
- People with illnesses such as Tuberculosis or whooping cough should not milk the animals.
Hygiene of the Diary Animals

To ensure the production of clean and healthy milk, proper hygiene of the animals should be practiced in addition to personal hygiene. Be aware that milk and milk products from sick animals may not be safe for consumption. To ensure that the milk produced is safe for consumption, routine health check-ups of the dairy animals should be performed. Additionally, the external body of the animals should be washed and cleaned regularly to prevent disease. Also, prior to milking, the dairy animals should be cleaned with a brush to remove any dirt, dust or dung from the hind portion of the animal.

To ensure proper hygiene of the dairy animal the following steps should be taken:

1. Before milking, the udder and teats should be thoroughly cleaned.
2. To clean the udder a pinch of potash (KMNO4) should be added to the cleaning water for better results.
3. After cleaning the udder with the potash water, the udder should be dried with a clean cloth.
4. If there are dairy animals suffering from mastitis, they should be cleaned after the healthy animal have been cleaned.
5. Milk from sick animals suffering from diseases like tuberculosis, brucellosis, or mastitis should not be mixed with the milk from healthy animals to avoid the contamination of safe milk with unsafe milk, as these diseases can be transmitted to humans.
Sanitation of the Milking Utensils

Utensils used for milking need to be properly washed and cleaned. Utensils used for milking, or that come into contact with the milk at any point between milking and sale or consumption can contaminate or reduce the quality of the milk if they are unclean.

To ensure that the quality of the milk is not degraded the utensils used must be cleaned using the following steps:

1. The milking utensils should be made either from stainless steel or aluminum.
2. Milking, milk storage, or other necessary utensils should be rinsed with clean water and then washed in hot water with soap. Utensils should be scrubbed in the hot water with the soap to ensure that they have been cleaned thoroughly.
3. After scrubbing the utensils with hot water and soap, the utensils should be rinsed again with clean water and then placed in sunlight upside down for drying.
4. On the way to the milk collection and chilling center, the milk storage container must be air tight so that contamination and spillage can be avoided.

In addition, to keep the milk safe and hygienic and to prevent the curdling of milk, farmers should consider implementing the following steps:

a. Milk from animals treated with antibiotic should be separated from that of healthy animals.

b. After milking, milk should be strained through a clean cloth into the clean storage containers.

c. Never store milk in a plastic utensil.
d. There should be a set time to collect milk in the morning and evening.

e. Never mix milk collected in the morning with that collected in the evening, or vice versa.

f. Boil the milk collected in the evening in slow heat and store in cool place.

g. After milking, milk should be transported to dairy cooperatives, milk collection centers, or milk chilling center as soon as possible. If this cannot happen, the milk should be boiled and kept in cold water.
Teat dipping technology

One of the most effective technologies for preventing mastitis is teat dipping, which is recommended by the Animal Health Research Division of the National Agricultural Research Council (NARC) of Nepal. With regular teat dipping, the occurrence of mastitis can be reduced by 50-80%.

Required materials

- Cup/glass
- Povidine iodine solution
- Glycerin solution
- Clean rod or spoon for stirring

Mixing process

In a clean wide-mouthed cup with an airtight cap, pour 9 parts of povidine iodine and 1 part of glycerin into the cup and then mix together thoroughly with the help of a rod or spoon. Thus, a solution of povidine iodine and glycerin is prepared with a ratio of 9 to 1. For example, to prepare 100 ml of solution, mix together 90 ml of povidine iodine and 10 ml of glycerin for the right concentration.

Application process

After milking the animals both in the morning and evening, all the four teats should be dipped for half a minute in the prepared povidine-glycerin solution. After each milking, the teat dipping process must be applied throughout the milking period of the animals.

Figure 7 Dipping teat in povidine iodine (Photo credit: ILRI)
**How Mastitis is Controlled by the Teat Dipping Process**

In cows and buffaloes, the teat cistern remains open for about an hour after milking. During that time, microorganisms may enter the udder through the opened cistern and cause mastitis. The teat dipping process using povidine-glycerin solution helps to prevent microorganisms from entering the udder through the open teat cistern and kill microorganisms on the teats, thus, mastitis can be prevented with regular teat dipping.

For the control of mastitis following steps should be taken:

- Regular milk tests should be carried out to monitor for sub-clinical mastitis.
- If mastitis is present, consult a veterinarian immediately for treatments.
- Milk in the udder and teats should be drained completely when milking.
- Sheds and surroundings must always be clean and hygienic.
- Milk animals should be clean and healthy.
- The person milking must always consider their personal health, hygiene, and sanitation.
- Utensils and materials for milking must always be clean and hygienic.
- The gap between two or more milking sessions should be of same interval and as far apart as possible.
- Safeguard the teats and udder from extreme cold or heat.
- In cows and buffaloes, avoid giving extra feeds and milk promoters for at least one week after calving.
- After the completion of milking, dairy animals should not sit for at least one hour. To prevent sitting feed and fodders such as hay, rice straw, silage and concentrate feed can be given to distract the animals.

**Dry Cow Therapy**

When the dairy animals cease to give milk (become dry), medication should be applied to the teats to avoid mastitis in the next calving. The process of treatment is known as Dry Cow Therapy (DCT). Instead of stopping milking abruptly, the best practice is to stop milking gradually, which is more beneficial for the animals. To reduce milk production, gradually reduce the feed/fodder intake with respect to the normal consumption level. There are also ointments available to prevent mastitis, which block the teat cistern in the dry period so that the chances of getting mastitis are minimal.
9 - Collection and Transport of Milk Samples

To test for mastitis, the appropriate procedure for the collection of milk samples should be followed. To find out the cause of mastitis and which drugs are most effective for treatment, laboratory tests play an important role. Make sure that the samples are collected properly and are identifiable (labeled) when sending to a laboratory for testing.

**Reasons for milk sample collection:**

1. To know scientific diagnosis, monitoring and surveillance of the disease (mastitis)
2. To know the exact etiology of mastitis
3. To initiate timely treatment and control measures for mastitis
4. To prevent loss of production in dairy animals

When collecting milk samples for laboratory testing, make sure that the materials and equipment used in collecting milk samples are sterile. If metal tools are not sterile, they can be sterilized by boiling them in hot water. Also, make sure that the teats and udder of the sampled animal are cleaned and washed prior to sample collection. The technician collecting milk samples should wash his/her hands with soap and water prior to sample collection or use disposable gloves during sampling. It is preferable to use glass vials or bottles for sample collection. To avoid contaminating the sampling contain, only open the lid of the sample collection vials just before collection. Additionally, the lid of the sample collection vial must not be placed on the floor during the collection process. If there is no place other than the floor to put the vial lid during sampling, place on a clean surface facing upwards. When collecting the milk samples, discard the first few streaks of the milk before filling the collection vial, which should be angled at 45 degrees during sample collection. Before antibiotics are administered to treat mastitis, the milk samples need to be examined at a laboratory to determine the cause of the infection. When sending milk samples to the lab, make sure that collection vials or bottles are properly labeled (i.e. date, time, location, animal etc.) and keep the samples in cold storage after collection and during transport, if possible.
10 - Negative Impacts of Mastitis on Animal and Human Health

Not only does mastitis have negative impacts on milk production in cows and buffaloes, but it can also have negative impacts on animal and human health.

**Animal Health**

In cows and buffaloes with mastitis, the inflammation of the mammary glands causes them to be painful, red, hot to the touch, and sometimes causes fever (pyrexia). Animals with these symptoms will have a drastic reduction in milk production. Additionally, the infection may compromise the immune system of the animal, making it more susceptible to other diseases. Since mastitis can be caused by viruses, bacteria or fungi lab testing is necessary to identify the cause of the infection and the proper treatment procedure. Haphazard or inappropriate use of antibiotics to treat mastitis can lead to antibiotic resistance, which is a common problem in Nepal.

**Human Health**

Milk is a nutritionally complete food. Milk contains protein for body growth and development, minerals for bone growth, vitamins for a healthy life, and also sugar (lactose) and fat for energy. However, milk can be susceptible to contamination by harmful microorganisms. If the milk is contaminated with harmful microorganisms, the quality of the milk may deteriorate significantly and make the milk unsuitable for human consumption. Thus, the contamination of milk or milk products with harmful microorganisms can make an otherwise beneficial product harmful.

When the harmful bacteria that cause mastitis such as *E. coli*, *Staphylococcus*, *Streptococcus* contaminate milk or milk products, the consumption of those contaminated products by humans can lead to illness. The consumption of unpasteurized milk can cause zoonotic diseases such as Tuberculosis, Brucellosis, or gastroenteritis, which can be prevented by boiling, as it kills most pathogens, making the product safe for consumption. The use of antibiotics without the proper identification of the cause of infection can lead to antibiotic resistance in animals; dairy farmers should have basic knowledge of antibiotic residual effect and antibiotic withdrawal period so that milk intended for human consumption is safe and healthy.
## Appendix

### Suggested Training Agenda

#### Day 1

<table>
<thead>
<tr>
<th>Session</th>
<th>Time</th>
<th>Topics Covered</th>
</tr>
</thead>
</table>
| 1       | 10:00 - 10:30 | • Inauguration, welcome and highlight of the training  
           |          | • Introduction of participants  
           |          | • Pre-test                                                                   |
| 2       | 10:30 - 11:30 | • Status of cows and buffaloes husbandry in Nepal  
           |          | • Control and prevention of mastitis through proper management                  |
|         | 11:30 - 11:45 | Tea break                                                                      |
| 3       | 11:45 - 12:45 | • Types and symptoms of mastitis                                              |
| 4       | 12:45 - 1:45  | • Diagnosis and prevention of mastitis                                         |
|         | 1:45 - 2:30   | Lunch break                                                                    |
| 5       | 2:30 - 3:30   | • Treatment of mastitis  
           |          | • Biosecurity and proper management of the shed                                |

#### Day 2

<table>
<thead>
<tr>
<th>Session</th>
<th>Time</th>
<th>Topics Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10:00 - 10:30</td>
<td>• Overview</td>
</tr>
<tr>
<td>2</td>
<td>10:30 - 11:30</td>
<td>• Control and prevention of mastitis (Hygiene of milking person, dairy animals and utensils)</td>
</tr>
<tr>
<td></td>
<td>11:30 - 11:45</td>
<td>Tea break</td>
</tr>
<tr>
<td>3</td>
<td>11:45 - 12:45</td>
<td>• Control and prevention of mastitis (teat dipping and teat application technology)</td>
</tr>
</tbody>
</table>
| 4       | 12:45 - 1:45  | • Collection and dispatch of milk samples  
           |          | • Negative impact of mastitis in humans and animal health                     |
|         | 1:45 - 2:30   | Lunch break                                                                   |
| 5       | 2:30 - 3:30   | • Post-test and closure                                                       |
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Heifer’s mission is to work with communities to end hunger and poverty and care for the earth.