SMALL SCALE DAIRY FARMING MILK PROCESSING AND MARKETING MANUAL

TRAINING AID
FOR FARMERS, RURAL WOMEN AND YOUTH

SASAKAWA AFRICA ASSOCIATION
Tables

Table 1: Unit of competencies, training outcomes and required time

Table 2: Sample type and amount of inputs

Table 3: Preparation of urea molasses mixture

Table 4: Alternative formulas to prepare molasses urea block

Table 5: Preparation of urea molasses block

Table 6: Daily feed requirements (of a 450 kg's cow)

Table 7: Stages and signs of heat

Table 8: The type and amount of feed requirement for a cross-bred calf on different ages

Table 9: Content of calf starter mix from various feed sources

Table 10: Biweekly milk yield record format

Table 11: MONTHLY MILK YIELD RECORD OF A COW FOR VARIOUS LACTATION PERIOD

Table 12: CALVING AND SERVICES RECORD AND MONITORING FORM

Table 13: RECORD FORMAT FOR CONDITION OF ANIMALS PURCHASED FOR THE DAIRY FARM

Table 14: RECORD FORMAT FOR REGISTERING ANIMALS SOLD DUE TO VARIOUS REASONS

Table 15: Vaccination and treatment record and monitoring format for individual animals
## Contents

SMALL SCALE DAIRY FARMING MILK PROCESSING AND MARKETING MANUAL ........ 1

MODULE/MANUAL INTRODUCTION .................................................................... 1

MODULE ONE: Conduct feasibility study to establish small scale dairy farm and milk processing unit .......................................................... 10

MODULE TWO: Prepare a design to build the shed and milk processing unit ...... 17

MODULE THREE: Build the shelter and milk processing unit .......................... 31

MODULE FOUR: Select dairy cows and heifers ................................................. 35

MODULE FIVE: Develop and produce forage feeds ........................................... 40

MODULE SIX: Prepare good quality hay ......................................................... 46

MODULE SEVEN: Prepare silage ................................................................. 51

MODULE EIGHT: Produce improved by-product feed by treating molasses and urea ......................................................................................... 61

MODULE NINE: Prepare balanced ration for dairy cows and calves .......... 69

MODULE TEN: Feed the milking dairy animals ............................................ 77

MODULE ELEVEN: Follow up the pregnant cow/heifer and assist delivery ........... 87

MODULE TWELVE: Follow up pregnant cow/heifer and assist delivery .......... 96

MODULE THIRTEEN: Follow-up the new born calves starting from delivery .... 110

MODULE FOURTEEN: Milk the cows .......................................................... 130

MODULE FIFTEEN: Look after and protect the health of the animals .......... 146

MODULE SIXTEEN: Protect the environment using liquid and dry waste ....... 178

MODULE SEVENTEEN: Process the milk .................................................... 183

MODULE EIGHTEEN: Sell the raw milk the processed and the byproduct .......... 201

MODULE NINETEEN: Record information .................................................... 207
Figures

Figure 1: Layout for dairy shelter/barn to be construction by the side of a resident house wall ................................................................. 26
Figure 2: Dairy barn design for five cattle with roof cover against the sun .......... 27
Figure 3: Dairy shelter/barn layout for five cattle under zero grazing system.......... 27
Figure 4: An alternative diagram-a zero-grazing unit ......................................................... 28
Figure 5: Feed and water troughs design .............................................................. 33
Figure 6: Manual hay balling ............................................................................. 49
Figure 7: Important points for silage making ................................................................. 52
Figure 8: The Processes involving silage making ................................................................. 53
Figure 9: Small scale silage preparation ................................................................. 55
Figure 10: A design layout for pi (trench) silo ................................................................. 55
Figure 11: Dry matter contents of different feed types ......................................................... 71
Figure 12: Proper position for milking ........................................................................ 137
Figure 13: Step by step method of hand milking ................................................................. 140
Figure 14: Cow with milk fever ............................................................................. 167
Figure 15: Cattle Mange (Psoroptus) ........................................................................ 173
Figure 16: Damalina bovis, female - cattle ked ................................................................. 173
Figure 17: Tick Amblioma ......................................................................................... 174
Figure 18: Manual Cream Separator ........................................................................ 191
Figure 19: Milk Churner - ILRI Type ................................................................. 192
Small Scale Dairy Farming is a good income generation livelihood option for farmers living in urban and rural areas. Further to generating good income Small Scale Dairy Farming allows urban and rural farmers to utilize locally available resources like crop residues (hay-from teff, wheat, barley, etc), forage types and industrial by-products (noug cake, cottonseed cake, sunflower cake, linseed cake, wheat bran, wheat shorts, wheat middling, wheat screenings and barley screenings).

After securing the seed money to procure dairy animals, farmers usually observed to lack the stamina and gut to start the Dairy Farming business due to lack of technical knowledge. This manual is designed primarily to encourage farmers to start dairy farming business by incorporating important technical information on how to select and breed better yielding dairy animals; how to produce, collect, prepare and feed sufficient animal feed within their locality; how to produce milk by products and market it; and in general the manual guides how to create proper skill and awareness on how to increase income (business skill), improve knowledge, skills and management capacities.

In addition, the manual is prepared to support farmers to conduct feasibility study and assess and address the challenges of dairy farming under their own agro-ecological setting. Therefore, the manual is designed to answer questions like “What do farmers have to do?”, “How do farmers improve their dairy farming knowledge and skills?”, and the like. Furthermore, s the trainings organized under the FTC’s are meant to train adult and experienced farmers. In line to that, the manual equips technical skills and knowledge to those who dare to start the dairy farming business, and what is more, support farmers and give insight into how to look for alternative options.

The manual also serves as a teaching aid primarily for those who plan to keep from one to three (and for capable farmers up to five) dairy cattle. Furthermore, it incorporates information to support those who are interested to start with more than five dairy cattle either individually or in group such as small and micro enterprises, farmers training centres, etc.

The Manual is based on functional adult literacy suitable for adult farmers, rural women and youth and each unit of competency (Major Title) has the following structural flow:

- Duration.
- General/brief description on the competencies of the Module.
SMALL SCALE DAIRY FARMING MILK PROCESSING AND MARKETING MANUAL

- Learning outcomes.
- Description of learning activity (operations guide).
- Information sheet.
- Written Test.
- Practical activities procedure.

Following this, the training manual has the following unit of competencies:

1. Conduct feasibility study on establishing a Small Scale Dairy Farming and Milk Processing Unit.
2. Prepare the design to build the barn/shed and Milk Processing Unit.
3. Build the shelter/barn/shed and Milk Processing Unit.
4. Select Dairy type animals.
5. Develop and produce forage feeds.
6. Prepare good quality hay.
7. Prepare silage.
8. Produce good quality feed by treating crop by-products with molasses and urea.
10. Feed the dairy animals (cows and calves).
11. Follow and control the breeding of animals by choosing the right feeding scheme.
12. Closely follow up and pay attention to pregnant cows and assist in times of delivery.
13. Give proper follow up to new born calves starting from the time of birth.
14. Milk the cows.
15. Protect the health of the animals.
16. Protect the environment by proper use of drainage and farm dirt.
17. Process the milk.
18. Sale (Market) the raw and processed milk and milk-by-product.
19. Record Information.
Table 1: Unit of competencies, training out comes and required time

<table>
<thead>
<tr>
<th>Competencies of the units</th>
<th>Detailed activities of each of the unit competencies</th>
<th>Required time</th>
</tr>
</thead>
</table>
| 1. Conduct feasibility study on establishing a small scale dairy farming and milk processing unit. | - Distinguish the types of modern dairy farms.  
- Collect information to conduct the feasibility study.  
- Come to a decision by summarizing the information gathered. | 16 hours |
| 2. Prepare the design to build the barn/shed and milk processing unit. | - Select the site where to construct the dairy farm.  
- Decide on the type and number of shelters needed as well as the rooms and layout of the rooms.  
- Prepare appropriate shelter design. | 16 hours |
| 3. Build the shelter/barn/shed and milk processing unit | - Based on the shelter design prepared in the previous session, list down and prepare the inputs (materials) required to build the dairy farm shelter.  
- Based on the design prepare control means whether or not the job is done.  
- Follow through the construction of feeding manger and water trough. | 24 hours |
| 4. Select Dairy type animals | - Identify the parameters that a good dairy animal should have.  
- Select animals that are fit for dairy farming.  
- Transport the selected cattle.  
- Control and follow up whether the cattle receive proper health care at arrival  
- Put on identification marks for the cattle. | 12 hours |
| 5. Develop and produce forage feeds | - Identify and prepare utility goods and materials to develop forage feeds.  
- Prepare the land intended for forage development  
- Decide on the type of forage to cultivate and prepare the seed accordingly | 8 hours |
<table>
<thead>
<tr>
<th>Competencies of the units</th>
<th>Detailed activities of each of the unit competencies</th>
<th>Required time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Seed the selected forage seed and cultivate it.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Properly utilize the cultivated forage (allow grazing or feed on with cut-and-carry method).</td>
<td></td>
</tr>
<tr>
<td>6. Prepare good quality hay</td>
<td>• Identify and prepare utility goods and materials</td>
<td>8 hours</td>
</tr>
<tr>
<td></td>
<td>• Decide on when to collect the hay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cut and properly wilt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Gather and properly store the hay.</td>
<td></td>
</tr>
<tr>
<td>7. Prepare silage</td>
<td>• Identify and prepare utility goods and materials to prepare silage</td>
<td>8 hours</td>
</tr>
<tr>
<td></td>
<td>• Prepare silage pit (enough for small scale farmer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Prepare the grass and forage needed to make the silage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Make the silage</td>
<td></td>
</tr>
<tr>
<td>8. Produce good quality feed by treating crop by-products with molasses and urea</td>
<td>• Identify and prepare utility goods and materials for the treatment of crop by-products</td>
<td>8 hours</td>
</tr>
<tr>
<td></td>
<td>• Prepare all the necessary inputs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Treat the crop by-product in different ways and make it ready as a good quality feed.</td>
<td></td>
</tr>
<tr>
<td>9. Prepare balanced ration for dairy cows and calves</td>
<td>• Identify and prepare various feed types</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>• Identify and prepare utility goods and materials for ration preparation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Prepare the needed feed ration and store it properly.</td>
<td></td>
</tr>
<tr>
<td>10. Feed the dairy animals (cows and calves)</td>
<td>• Select various feed types to prepare balanced ration and store it properly.</td>
<td>8 hours</td>
</tr>
<tr>
<td></td>
<td>• Decide on an appropriate feeding scheme.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provide/feed enough feed and potable water every. day.</td>
<td></td>
</tr>
<tr>
<td>11. Choosing</td>
<td>• Decide on the breeding scheme.</td>
<td>8 ours</td>
</tr>
<tr>
<td>Competencies of the units</td>
<td>Detailed activities of each of the unit competencies</td>
<td>Required time</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------</td>
<td>---------------</td>
</tr>
</tbody>
</table>
| breeding schemes, and follow and control breeding animals | - Identify whether cows/heifers are in heat.  
- Breed those cows/heifers in heat. | |
| 12. Closely follow up and pay attention to pregnant cows and assist in times of delivery | - Specially follow up pregnant cows/heifers.  
- Know what to do in times of delivery.  
- Follow up and control whether the new born calf has received the proper treatment or not.  
- Make sure that the placenta has dropped down. | 8 hours |
| 13. Give proper follow up to new born calves starting from the time of birth | - Decide on the type of raising calves.  
- Make sure that the new born calf has got colostrums at list for a week.  
- Next feed the calf only whole milk and milk replacing feed types for the next four months.  
- After the fourth month to stop feeding milk to the calf start feeding roughage slowly.  
- Identify major calf diseases and protect the calves’ health accordingly. | 8 hours |
| 14. Milk the cows | - Identify and prepare utility goods and materials for milking  
- Prepare the milking cow.  
- Milk the milk from the cows [Undertake the milking]  
- Do the after milking task properly. | 24 hours |
| 15. Protect the health of the animals (follow | - Understand the difference between healthy and sick animals as well as the bad effect and cost of diseases  
- Monitor, follow up & control the health of dairy animals. | 16 hours |
<table>
<thead>
<tr>
<th>Competencies of the units</th>
<th>Detailed activities of each of the unit competencies</th>
<th>Required time</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Identify sick animals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Knows what to do when animals get sick.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Look after sick animals by isolating them into the isolation room.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Record the type of treatment given to sick animals, follow up the treatment of sick animals according to the veterinarians order.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Know disease prevention measures in terms of day to day husbandry, hygiene and sanitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Regular vaccination against major preventable dairy cattle diseases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Protect the cattle from internal and external parasites and other pests by regular medication.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Protect the environment by proper use of drainage and farm dirt</td>
<td>• Identify and prepare materials and equipments to keep cleanliness and help to use drainage</td>
<td>8 hours</td>
</tr>
<tr>
<td></td>
<td>• Collect cattle dung, slurry and urine in one place without being dispersed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Utilize the collected dung and slurry.</td>
<td></td>
</tr>
<tr>
<td>17. Process the milk</td>
<td>• Prepare a separate room for milk processing</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>• Identify and collect materials for milk processing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Refrigerate the milk</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Separate the milk cream</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Churn the milk to make butter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Learn how to handle and use milk products such as cheese</td>
<td></td>
</tr>
<tr>
<td>Competencies of the units</td>
<td>Detailed activities of each of the unit competencies</td>
<td>Required time</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------------</td>
<td>---------------</td>
</tr>
</tbody>
</table>
| 18. Sale (market) the raw and processed milk and milk-by-product | • Study the milk and milk by-product market  
• Sale your product by fix your selling price after deciding on the amount of profit to earn  
• Scan and identify who are engaged in keeping dairy animals, milk and market the milk in your area  
• Identify and learn who are involved in collecting whole milk, process the milk and market the milk by-product in your area  
• Search for organizations and institutes that support the dairy farming business. | 8 ours |
| 19. Record Information | • Record your products:  
- Record daily the amount of milk produced  
- Record the amount of milk given to calves  
- Record the amount of spoiled milk  
- Record the amount of milk by products produced  
• Prepare health record book – (for prevention and treatment)  
• Keep the reproduction Record for each cattle  
• Record expenses and income | 10 hours |

Total 246 hrs (32 days)
Estimated training time requirement-246 hours (32 days)

Manual Users

This manual is intended to anyone already involved or who like to start new dairy farming which includes individuals or group of farmers, rural women, rural youth, and investors etc.

Training Methodology

Based on adult education methodologies, this manual employs the following training methodologies: brainstorming, interactive talk, illustrative talk, group discussion, panel discussion, role play exercise, workshop method, classroom practical, field practical demonstration (engagement), practice in participatory evaluation of training and exercise (individual skills assessment) as well as if available by video show with videos prepared purposely to undertake training on dairy cattle reproduction such as individual case studies, etc.

Assessment Methodology

To assess the skills and knowledge transfer, the proposed training assessment methodologies in this manual include oral questions, practical guidelines, discussions, home work, monitoring and assessment on practical activities, written test, interviews on major unit of competencies, etc.

Further Note on the training Process

In all possible circumstances, this training manual is designed to focus on practical activities. Above and beyond this, trainees are expected to take it more to practical level. Therefore, more than 70% of the training time is allocated for practical activities. In addition, taking into consideration the extent to which adults can learn, it is important that the trainer shall support the training process in easy ways and if possible use visual aids.

To give the training using this manual, an expert should have sufficient knowledge, skills and experience in the field of dairy cattle reproduction and milk by-product processing and marketing. Before the start of the training, based on the local context, the facilitator need to decide the type of training to organize and prepare the required inputs including trainee’s working clothes as well as materials and equipment required. On the other hand, it is advised that the trainer shall have general knowledge about the trainees their culture, life style and their environs. It is important to remember The knowledge of the trainees’ culture and life style is key factor to the effectiveness of the training. Furthermore, the teaching-learning process should gear to the principles of adult education. The training venue should
be convenient for the trainees and thus need to be given due consideration to the special needs of women trainees. While arranging the training venue and conducting the training, it is important to consider avoiding any hazardous circumstances and prepare relevant safety equipment and clothes as well as keeping personal hygiene and clean surrounding should not be forgotten.

The training manual guides the facilitator and the trainees what to prepare before the training and how to proceed with practical activities during the training session for each topic, thus, it is important to read the manual before each session.
MODULE ONE: CONDUCT FEASIBILITY STUDY TO ON ESTABLISH SMALL SCALE DAIRY FARM AND MILK PROCESSING UNIT

Duration: 16 hours

1. General Description of Competencies of the Module

The Module focuses on running small scale dairy farming and milk processing business which will be profitable. In line to that, the Module highlights the knowledge, skill, attitude required to run the business. In addition to that, it looks into the features of dairy farming, and on assessment that should be made on the area where the business is locality.

2. Learning Outcomes

At the end of this Module the trainee will be able to:

- Distinguish the features of modern dairy farms.
- Collect information to conduct the feasibility study.
- Come to a decision by summarizing the information gathered.

3. Description of Learning Activities (operations guide)

Read and remember the information under the following Sheets:

- Information sheet 1 - Distinguish the features of modern dairy farms.
- Information sheet 2 - Collect information to conduct the feasibility study.
- Information Sheet 3 - Decide and summarize the information gathered.

- Answer the questions given under Self Check Exercise.
- Evaluate your answers by your trainer.
- If the evaluation done by your trainer is satisfactory, proceed to the next module; otherwise do the above procedures again.
- The rest of the trainings will have similar procedures throughout the Modules.
4. Information Sheet

<table>
<thead>
<tr>
<th>Information Sheet 1</th>
<th>Distinguish the features of modern dairy farms</th>
</tr>
</thead>
</table>

What does dairy cattle production mean?

A cow produces milk to feed/raise her calf. However, human beings also exploit the surplus milk for consumption.

In line to this, dairy cattle production means selecting and reproducing cows and heifers to get milk and make them ready for market or processing by products (such as butter, cheese) for profit. Dairy cattle reproduction also looks into how calves raise, replace aged cows for the purpose of consumption, and then earn income by selling the surplus.

Based on the different agro-ecological settings, the following are types of dairy farming:

1. **Traditional dairy farming**

   In our country, in different regions, it is customary to keep farm animals in traditional manner, despite the fact that Ethiopia is the first in livestock population in Africa and 10th in the world. We can categorize traditional livestock keeping into two:

   1.1. In Pastoral and agro-pastoral areas:

   In the different Regional States of Ethiopia, there are seven known pastoral and agro-pastoral areas. These are: Afar, Somali, Gambella, Southern Nations and nationalities and people Regional State (Hammer, Mursi, etc) Oromiya (Kereyu and Borena).

   The traditional livestock production under these pastoral and agro-pastoral areas is primarily characterized by keeping large number of animals over an extensive rangeland (pasture) with calculated movement routes for pasture and water. Agro-ecologically these areas are known for rain shortage and low lying areas. These pastoralists reproduce primarily cattle, camel, sheep, and goat for milk, meat, and transport (pack). Pastoralists feed on milk and meat and whenever the need arises they sell selected livestock and surplus milk to meet their purchase requirements like grain, cloths, etc. In addition to economic value livestock in pastoral areas play important traditional and cultural roles.
1.2. **In mixed crop-livestock farming areas**

In many highland and midland areas of Ethiopia, smallholder farmers practice mixed crop-livestock agriculture. These means that farmers use animal power to plough the land to cultivate crop as well as get milk, meat, skin and hide, and earn cash by marketing livestock. This traditional livestock reproduction is intertwined with deep rooted cultural elements involving a synergy between crop and livestock.

The above two traditional livestock reproduction methods are known to be not market oriented. This means that farmers do not calculate their inputs to raise and breed their livestock and simply market without profit analysis.

Pastoralists traditionally approach in keeping and reproduce livestock is explained by the following features:

- Keeping livestock without proper selection.
- Usually practice grazing rather than cultivating, cutting and feeding forage and grass.
- Do not regularly feed unless there is left over.
- Livestock watering is time consuming as it takes long distance to water points.
- Poor animal health care provisions characterized by erratic treatment when animals succumb to illness and rare preventive vaccination coverage on regular basis. Even when animals get ill traditional herbal medicine comes to the front.
- Livestock are considered as bank deposit to generate income when the need arises as individuals prefer to count more number of heads rather than sell their livestock.

Because of the reasons given above, many of the small dairy farms are not market oriented.

2. **Market oriented dairy farming**

The following are the major features of market oriented dairy farming:

- Keep and reproduce suitable dairy breeds known for better milk yield.
• Availability of good quality pasture, forage and concentrate feed with sufficient potable water throughout the year.
• Application of skill and knowledge on good animal husbandry.
• Availability of reliable condition for the control of animal diseases and parasites.
• Availability of reliable market for milk.
• Presence of favourable government policy for smallholder dairy farmers.

**Information Sheet 2**

**Conduct feasibility study**

Consider the following points for your feasibility assessment: From the discussion made above, you have already known about market oriented dairy cattle reproduction. Therefore, now it is time for you to conduct assessment before launching your business. The assessment is to know whether or not the dairy farming would be profitable in your local context.

- Is there sufficient availability of animal feed? (grass, forage, concentrate as well as potable water)
- Where do you get improved dairy cattle breed? May be 50% cross bred cows/heifers?
- Is there suitable milk market? Do other people operate dairy farming business in your locality? Or where do communities buy milk?
- Is there an animal health care service in the area?
- Is there road access to the selected site?
- Is there power supply to the selected site to build the dairy barn?

**Additional Information:** Conduct sound feasibility study for better decision making. Please read the separate manual entitled “Planning and Management of Agricultural Income Generating Activities”

**Information Sheet 3**

Make a decision by summarizing the information gathered
Based on the information collected above, make sure that there is enough input and market for your dairy business.

1. Identify the list of inputs and supply required:
   1.1. Is there seed capital to start the dairy cattle farming?
   1.2. Is there a place for the dairy cattle breeding?
   1.3. Is there construction material and supply to build the dairy cattle shelter/barn?
   1.4. Is there supply of dairy cattle?
   1.5. Is there animal feed supply?
      - Grass and forage feed supply.
      - Concentrate feed supply.
   1.6. Is there animal health service?
   1.7. Do you have the experience on animal husbandry?
   1.8. Are there governmental and private organizations that can give support services?

2. Identify milk and milk by-products market assessment points.
   2.1. Availability of sufficient milk users.
   2.2. Sufficient and sustainable milk production potential.
   2.3. Potential to deliver/transport the milk to customers.

NB: You can only move to the next practical exercise if you do satisfactorily.

5. Assessment Methodology (written test)

<table>
<thead>
<tr>
<th>Module 1: Self Check 1</th>
<th>Written Test</th>
</tr>
</thead>
</table>
| Answers the following questions | - What does traditional dairy cattle reproduction mean?  
- What does market oriented dairy cattle farming mean? What are the special characteristics of market oriented dairy cattle farming? |

Allow trainees to answer the points stated under the feasibility study part either individually or in a group based on their local context.

If the trainee didn’t answer all the questions, he/she should revise the Information Sheet. This will apply to all assignments/tests.
Trainee's name: __________________________________________

Submit your answers to your trainer for evaluation:

6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Operation Sheet 1</th>
<th>Practical Demonstration (collect information on milk market)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• About the milk market place: Is there any separate shelter?</td>
</tr>
<tr>
<td></td>
<td>• For people coming to sell milk:</td>
</tr>
<tr>
<td></td>
<td>- Where are the dairy cows located, urban or rural?</td>
</tr>
<tr>
<td></td>
<td>- Are the breeding cows local or improved exotic or a combination of the two?</td>
</tr>
<tr>
<td></td>
<td>- Do they deliver milk to the house of customers?</td>
</tr>
<tr>
<td></td>
<td>• What is the price of milk per litre (locally used unit of measurement)? What is the trend in milk price? When does the milk price fluctuate?</td>
</tr>
<tr>
<td></td>
<td>• How many people come to sell milk per day to this milk market?</td>
</tr>
<tr>
<td></td>
<td>• How many litres of milk does one person bring to the market?</td>
</tr>
<tr>
<td></td>
<td>• How many days per week/month do you get milk in the market?</td>
</tr>
<tr>
<td></td>
<td>• What are the major challenges in marketing milk in the locality?</td>
</tr>
<tr>
<td></td>
<td>• What is the main challenge, lack of sufficient milk or lack of milk buyer?</td>
</tr>
<tr>
<td></td>
<td>• Prepare summary for the collected information.</td>
</tr>
<tr>
<td></td>
<td>Additional points:</td>
</tr>
<tr>
<td></td>
<td>• Discuss with your trainer what it takes to collect information about construction of dairy cattle shelter/buildings.</td>
</tr>
</tbody>
</table>

Go to the milk market in your locality; interview buyers and sellers to collect data/information.
- In consultation with construction experts in your area collect construction equipment and materials. This will help to know whether or not you are on the right track. Show your design to construction experts and get feedback.
MODULE TWO: PREPARE A DESIGN TO BUILD THE SHED AND MILK PROCESSING UNIT

Duration: 16 hours

1. General Description of Competencies of the Module

The Module explains the parameters of site selection for the construction of a dairy shelter, and the kind and purpose of sheds required for dairy farm and milk processing unit. In addition, the Module deals with the preparation of a design for shelters needed to run the business.

2. Learning Outcomes

At the end of this Module the trainee will be able to:

- Select suitable site to construct the dairy farm.
- Decide on the type and number of shelters needed, as well as the rooms and their layouts.
- Prepare appropriate shelter design.

3. Description of Learning Activity (operations guide)

- Read and realize the information under Information Sheet 1
- If you scored satisfactory mark in the evaluation given by your trainer, proceed to Information Sheet 2; otherwise do the above procedures (Sheet 1) again.
- Submit your self-check answers to your trainer for evaluation. If you scored satisfactory mark in the evaluation, proceed to the next Module

4. Information Sheet

<table>
<thead>
<tr>
<th>Module 2: Information Sheet 1</th>
<th>Select the site to construct the dairy farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Parameters for dairy farm site selection</td>
<td>When establishing a new dairy farm facility, choose the most favourable site and pay attention to the topography of the land whenever and wherever possible. While selecting the site the following parameters should be considered:</td>
</tr>
</tbody>
</table>
- Availability of sufficient grazing land within and nearby your locality.
- Identify whether there are dairy breeds in the area to start the business.
- Above all, analyze the prospective site with respect to soil conditions, drainage, mains water and electricity supply, and good accessibility for trucks.
- Make sure that there is availability of sufficient and continuous potable water for the dairy cattle as well as for other sanitary purposes.
- Make sure that there is reliable market in the nearby area to purchase concentrate feed and other utility goods as well as to sell milk, milk by-products and culled cattle with reasonable price.
- Look whether there is suitable road to transport materials, visit markets and contact individuals and organizations.
- The site should not be very close to residential areas, but not far away from your locality.
- Identify and select sites that are close to other similar breeding cooperatives. This will help you to easily contact and share experiences with them; what is more you will get easy access to the service of animal health centres, among others.
- Look for availability of sufficient grazing and construction area for future expansion.
- If you can, your site should be:
  - Well drained.
  - On high ground.
  - Nearer to trees and wind breaks or where you can grow trees.
  - Far from areas known for recurrent draughts, cattle diseases, and strong wind.
  - Area with road infrastructure:
    - To access feed and water.
    - To market your products.

**Information Sheet 2**

Decide on the type and number of shelters needed, prepare a layout design for the shelter and compartments.

Preparation of a shelter design for dairy cattle is a requirement. Accordingly, the design of a layout for a dairy shelter include the following shelter types:
1. Barn for day and night times; on average for livestock of various ages, the floor requirement is:

- Bull 2.0 X 1.2 m²
- Heifer - 1.5 X 1.0 m²
- Cow - 1.75 X 1.1 m²
- Calf - 1.0 X 1.0 m²

1.1. Shade from the sun

A simple roof constructed over the feed trough and the area where the cows stand and eat will provide shade and encourage daytime feeding in bright weather, while protecting the feed from water damage in rainy periods.

A shade structure allowing 2.5–3 square meters per animal will give the minimum desirable protection for cattle, whether for one animal belonging to a smallholder or many animals in a commercial herd. A 3 meter by 7 meter roof will provide adequate shade for up to eight cows. The roof should be a minimum of 3 meters high to allow air circulation.

1.2. The standing area

The standing is the area allowed for cows and heifers.

The main aspects to be considered are the floor area, type of floor and slope, partitioning and tethering arrangements.

1.3. Floor area

- The floor on the standing allowed for each cow/heifer depends on the size of the animal. The principle is to provide adequate space for the animal to lie down in comfort and to get up without obstruction. At the same time the urine and dung should drop away from the animal, preferably into the gutter (dung channel).
- Your animal should be able to lie down and get up easily.
- Heifers need a smaller area and you can angle the gutter.

1.4. Type of floor and slope: Consider the following to build the floor:

- Rammed earth and gravel
  - You can make the floor of rammed earth and gravel.
  - Make the slope 1 in 30 (3 %) towards the gutter.
  - This floor is low cost but:
Note: you must keep it flat (and sloping) to prevent pools of mud and urine.

There are also difficulties in collecting all the urine for fertilizer or compost making because part of it will be absorbed into the floor.

This can be partially overcome by having sufficient bedding; for example, saw dust, straw or left over roughage around the hind quarters of the animals.

- Large pieces of rubble with the flat surface facing up

The rubble is laid on and bound together with a mixture of cement and sand (see 1:3).

It is difficult to collect urine for compost manure because it soaks into the floor.

You can help soak up urine by putting bedding (such as saw-dust, straw, and left-over roughage) around the back of the animal.

- Rubble and cement

You can make the floor of rubble and cement.

Make sure the site is sloping at least 1 in 60 (1.5%) towards the gutter.

- 7.5 cm layer of concrete

Cement, sand and gravel are mixed in a suitable ratio, for example 1:3:3. Mix 1 part of cement with 3 parts of sand and a little water.

The slope can be reduced to about 1.5% or 1 in 60 when large rubble on cement or concrete is used.

Check the slope is still at least 1 in 60.

2. Partitioning

Partitions (dividers) between two adult animals are usually placed about 1.10 m apart and may extend only a distance of about 100.0 cm from the head of the standing to allow free access to the animal for milking etc. They may consist of two rafters (roof beam), placed about 30.0 cm apart with the top one at a height of about 75.0 cm., fitted to two wooden posts, one at the head of standing and the other about 100.0 cm from it; or a 40.0 mm. diameter galvanized pipe fitted to a wooden or galvanized post at the head end, and bend about 100 cm away so that the other end can be buried in the standing.

You need partitioning to:
Separate your calves from your adult cattle.

Stop your animals moving around and dropping dung and urine on the standing; cleaning is difficult.

Stop one animal trampling on another animal’s udder; this may cause injury (and mastitis).

For adult animals, place wooden partitions about 1.10 m apart with a length of 1.00 m, so you can easily get to your cow for milking. You can also use 40 mm diameter galvanized piping. Bend at 1.00 m and bury the bottom in the standing.

Barbed wire should never be used on partitions. Nails, or pointed or sharp edges of the material used should not be allowed to protrude because these can injure the animals.

3. Tethering: A rope or chain attached to an animal and attached to something at the other end, restricting the animal’s movement.

The simplest tethering arrangement is to tie the animal by its neck to a wooden post erected on the floor, using plastic rope. However, to prevent injuries to the animals and also to restrict its movements various improvements have been made.

The stay for tying each animal may be an iron ring fixed to the floor close to the manger halfway between two partitions. Alternatively, two rings may be fixed for each animal, one close to each partition, so that the animal is more restricted to the centre of the standing.

4. Wall height: On average the wall height of a dairy barn is 3 metres. For appropriate level of air circulation, there should be enough space left between the wall and the roof, the amount of space varying based on the local weather and climate. However, precaution shall be exercised so that this space left between the wall and the roof shall not subject the dairy animals to dangerous level of draught/breeze wind (current of air in enclosed space).

5. Feeding manger and drinking trough: The following are the dimensions needed for feeding manger and water troughs for various livestock:

- For bull or cow:
  - Width 0.6 m
  - Depth 0.4 m
  - Height 0.5 m

- For heifer or calf:
  - Width 0.4 m
6. **Gutter** (also called drain or dung channel): A drainage gutter can be made to drain slurry away from the cows and between two separate barns so that spaces shall remain dry. Even when the floor is of rammed earth and gravel, it is best to have the gutter made in rubble and cement or brick and cement. If the sides of the gutter are not strong, they will continuously erode into the gutter and proper maintenance of the floor of the standing will be impossible. By having the gutter finished smooth with cement and sand, cleaning will be convenient and the dung and urine can easily be led into a urine pit or a biogas digester outside the shed.

7. **Milk collection room**: To protect the milk from strong sunshine and heat, it is better if the milk room shall be constructed in such a way that the longer side of the room to face east and west. The size of the room can vary depending on the amount of milk to be collected.

8. **Concentrate feed store**: The following area requirement is set to store various types of concentrate animal feed:
   - One quintal of grain feed = 0.2 m³
   - One quintal of oil seed cake = 1.6 m³
   - One quintal of Flower by-products = 0.5 m³

   Therefore, based on the amount of annual feed requirement the size of the store shall be determined from the figures given above.

9. **Hay shed**: To protect hay from being spoiled by rain and sun, the hay shed shall be constructed based on the following parameters:
   - For one quintal of belled hay = 0.7 m³ (excluding mound (pile-up) additions)
   - For one quintal non-belled hay = 1.6 m³ (excluding mound (pile-up) additions)
   - For one quintal straw (non-belled) = 3.0 m³ (excluding mound (pile-up) additions)
   - Single belled hay is equivalent to 18-20 kg’s on average.

10. **Water supply strategy**: Based on the dairy farmers’ capacity and conveniences as well as based on the quality of locally available potable water sources, water from the following sources can be used: pipe, well, etc.
SMALL SCALE DAIRY FARMING MILK PROCESSING AND MARKETING MANUAL

rivers, rain harvest and spring. Therefore, based on the locally available water sources, appropriate water drinking trough shall be constructed.

11. Delivery room: The construction of a delivery room is a requirement to separate pregnant cows that are left with 2 to 5 days to deliver and to keep them during the time of delivery. Every delivery room shall have 3x4 m² dimension.

12. Isolation room: To keep new coming dairy animals for 24 hours until their health status is checked as well as to keep sick animals separately until they finish treatment an isolation room shall be constructed far away from the main barn.

13. Milk Parlour: To keep every milking cow during milking time, a space that amounts to 1/3rd of the number of cows shall be constructed partitioned by tree log. For example, 5 partitions are required for 15 milking cows. To milk cows in a standing position, the milk parlour shall have:
   • The lowest height is 1.5 while the biggest level is 1.7 m
   • The lowest width is 1.05 m while the biggest level is 1.2 m

If the milk parlour is to be constructed in two lines and facing tail to tail, there shall be a passage alley with 1.5 to 1.8 m width while there should be 0.75 m passage in front of the feeding trough. Building the wall 0.5 to 1 m the roof level with wire mesh will allow sufficient air flow. However, where there is space limitation, cows can be milked in barn where they have been tethered.

14. Treatment and insemination crush: The space in the treatment and insemination crush should allow standing animals one after the other in a line but will not accommodate animals to come side to side. This crush will be having 50-53 centimetres width at its lowest point (close to the ground) with outward slanting resulting in 70 centimetres while having a total height of 1.5 metres above the ground.

15. Design calf box

15.1. The importance of calf box

Among major points in looking after a calf the construction of a calf box is one. Calf box will protect cold breeze, strong sunshine, wind, torrential rain.
As far as the capacity of the farmer can allow, a calf shall be attended separately in a calf box until it reaches 90 kg's.

15.2. Materials required to construct a calf box

The type and amount of materials required for a calf box construction depend on the capacity of the dairy farmer, the size of the dairy farm, availability of construction materials, as well as the climate of the locality. A dairy farmer that follow the principle of attending calves indoors, shall construct feeding and water troughs as well as standing area.

Materials required to construct a calf box:

- Cement: if the floor is to be build from concrete.
- Corrugated Iron: if the wall and roof of calf box is to be build from corrugated iron.
- Grass: if the calf box is to be constructed from thatched grass roof.
- Sand: if the floor is to be build from concrete.
- Stone: for construction of floor water level.
- Nail: to connect the roof and wall support tree logs.

15.3. Types of calf box construction

There are two types of calf box constructions based on the local climate:

Three side wall: having three side wall and the fourth wall open; four side wall having walls all around.

15.4. Calf feeding and drinking utensils

In a calf box, it is important to build feeding and watering troughs which can be made from carpentry, cement and corrugated iron. The dimensions required to build feeding and drinking troughs for one calf/heifer are as follows:- calves, heifers and bullocks.

- Height = 0.4-0.5 metre.
- Width = 0.4 metre.
- Depth = 0.15 metres.
- Length = 0.2 metres.

15.5. Provide beddings for the calf box

- If the calves of milk cow are expected to grow properly for a better
yield, the calf box shall be provided with a bedding to comfort the calves.
  - To do so the bedding can be from grass or straw that will give worth to the animals while preventing the cold emanating from the floor and at the same time comforting the animals.
  - In addition, it is useful if the floor shall be coarse if it is made from concrete.
  - Based on local availability and convenience, the bedding can be from straw, hay (grass) or saw dust.

Note: Based on the prevailing wind direction, design the layout and build the hay shade and the concentrate feed store, against the wind (in a direction that is opposite to the prevailing wind direction).

| Information Sheet 3 | Based on the information generated, prepare shelter design |

Shelter/barn for small number of dairy cows

Zero grazing is appropriate and advised for small scale farmers having small size land and wishing to use its small land for crop production as well as building shelter for its livestock. On the next page Figure 1 shows the design for the construction of dairy barn for 3 animals with floor, width and length requirement for zero grazing. Based on the figures given, it is possible to expand the barn to accommodate up to 10 animals. But if the barn should accommodate more than 10 animals there needs to be two milking parlour and spacious feed store is a requirement.

It is possible to use treated poles made from selected tree species that resist decomposition. Spaces between two separate shelters shall be paved. Shelter for dairy cows can be build in two ways:

A) Tethering/zero grazing: Under this system, each cow, heifer and calf will be tied in one fixed place and feed and water will be provided there. For this tethering system Figure 1 below gives a draft layout plan. In these figures, when the shed is constructed making use of an existing wall, it automatically gets bounded by a complete wall on one side. Consideration should be given to the possibility of selecting a wall which would also serve as a wind barrier where strong winds are present. It is usual to have the feeder towards the wall end of the standing as more space is required at the hind end of the animal for milking, AI etc. When an existing wall is used as one side of the
shed, the lean-to roof (with a single slope) is the most convenient arrangement. When a separate shed is constructed away from other structures, a roof sloping in either direction from the centre would be best. Look at Figure 2, 3 and 4.

B) In a compound with free stall: Keeping animals in a compound and not tethering/free stall where each cow wonders freely and feeds on and drink on a common feeding and watering trough on one corner of the compound. When needed, the animals may rest under shed build for the same. During the night the animals will be tied under the same shed. To demonstrate this, please look at figure 3.

Look for animal production experts in the Agriculture and Rural Development Office, or other relevant institution. Show your design to experts in the field to get a feedback.

Please note that the designs given as a sample are meant to be for zero grazing based on cut and carry system.

Figure 1: Layout for dairy shelter/barn to be construction by the side of a resident house wall
Figure 2: Dairy shelter/barn layout for five cattle under zero grazing system

Figure 3: Dairy barn design for five cattle with roof cover against the sun
Summary: important points to consider for the preparation of a layout/design for the construction of a dairy farm shelter/barn:

Lighter and suitable dairy barn/shelter should be constructed.

- At the level of smallholder farmers to accommodate from one to five dairy cattle the preparation of shelter shall be based on available capacity. However, the preparation of all dairy shelters should take in to consideration the following points:

  - **Should have roof cover:** Make innovative use of locally available resources including tree sheds, side wall of resident house, making thatched roof (from grasses in our area), etc.

  - **Should have wind break:** By observing the prevailing wind direction, the diary shelter shall protect the cattle from draft wind. Wind breaks can be fences,
walls, trees, as well as other natural rocks and slopes.

- **Should have drainable floor**: Care shall be exercised so that the floor shall not lodge urine and dung. Otherwise such a floor has the potential to cause foot rot. To cover the floor it is possible to use gravel, sand, and if possible cover the floor surface with a flat, uniform stone (paved floor). The point in making the floor drainable is that the floor shall facilitate easy cleaning of the urine and dung (as well as slurry) and shall be easy to collect the dung for use.

- **Suitable feeding manager**: The feeding manager that you prepare can be from locally available resources but it shall be made considering that it has to have 30 centimetre higher level than the ground and also shall prevent spread (spoilage) of the feed. It is important to take into consideration the points indicated below under the sub title feeding manager.

- **Water reservoir**: There shall be one reservoir the size of which may depend on the type of available water source.

- **Slurry collection pit**: To collect slurry and other sewerage, a pit shall be made from concrete as well as the floor draining towards this pit.

On the other hand, while preparing the construction of shelter for five or more cattle, points to consider include comfort of the cattle, convenience for operational activities, e.g. feeding, watering, milking and maintenance of a hygienic environment has to be provided for in designing the arrangements within the shed and in the actual construction.

Therefore, the construction of a shelter/barn for more than five cattle should have:

- Comfortable and sufficient floor for standing and lying down.
- Gutter (also called drain or dung channel).
- Feeding Manger and water troughs.
- Passage ways for the convenience to the operator.

### Module 2: Self-check Assessment point

<table>
<thead>
<tr>
<th>Assessment point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Manual for Farmers, Rural Women and Youth</td>
</tr>
</tbody>
</table>

Trainee’s name: ____________________________________________

Based on the learning points discussed above, answer the following questions in writing.
Assume you got two improved dairy breed cattle. Based on the parameters given below explain in detail how you will keep them.

- Explain the details of the holding area.
  - Explain the type of floor recommended.
- Explain the protection against sunshine/rain and wind.
- Explain the requirements to build a shelter.
- Explain how you will provide feed and water.

6. Practical Activities Procedure

<table>
<thead>
<tr>
<th>Module 2:</th>
<th>Practical demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>(prepare a design for dairy cattle shelter/barn)</td>
</tr>
<tr>
<td>Sheet 1</td>
<td></td>
</tr>
</tbody>
</table>

By explaining briefly the types of requirements for a dairy cattle shelter/barn, prepare a shelter layout by indicating the required facilities for 10 cattle.
MODULE THREE: BUILD THE SHELTER AND MILK PROCESSING UNIT

Duration: 24 hours

1. General Description of Competencies of the Module

Based on the shelter design prepared in the previous session, this Module deals with issues on how the trainer constructs, and follow up a dairy cattle shelter/barn. This means, the focuses is on the capacity to coordinate the construction of a dairy cattle shelter/barn. This includes the skill and capacity to build the shed, seeking expert advice from afar, addressing challenges, and improve management efficiencies. The related responsibility/tasks discussed here also consist of environmental protection issues, decision making on material selection, team work and issues concerned with succeeding in a challenging environment.

2. Learning Outcomes

At the end of this Module, the trainee will be able to:

- Identify and prepare the inputs (materials) required to build the dairy farm shelter.
- Follow up and control proper construction of the dairy barn/shelter based on the shelter design prepared.
- Follow through the construction of feeding manger and water trough.
- Prepare a dairy barn/shelter construction plan.
- Coordinate the construction work and report to the concerned body.

3. Description of Learning activities (operations guide)

- Read and understand what is given under Information Sheet 1.
- Answer the questions given in Self check 1.
- Submit your answers to your trainer for evaluation.
- If the evaluation done by your trainer is satisfactory, proceed to the next module; otherwise do the above procedures again.
- Do the tasks given under Practical Procedures Section.
Module 3:
Information Sheet 1

Based on the shelter design, list out and collect the inputs (materials) required to build the dairy farm shelter.

Based on the design (layout), list out the inputs (materials) required to build the dairy farm barn. To assist you with a tip, read the following information:

1. Inputs for roof making: Corrugated iron sheet, grass (savannah for making thatched roof), other locally available resources.
2. Inputs for wall making: Poles (logs), mud, hollow blocks, etc.
3. Inputs for floor making: Sand and gravel, compactor, etc.

Prepare the type and amount of input based on the sample given in the Table 2.

Table 2: Sample type and amount of inputs

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of Inputs</th>
<th>Measurement</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Corrugated iron sheet</td>
<td>2 meter by 80 centimetres</td>
<td>10</td>
<td>ETB 120</td>
<td>ETB 1200</td>
</tr>
<tr>
<td>2</td>
<td>Cement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Nail</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Inputs for Feeding manger and water troughs: Sand, cement, barrel, flat ply wood, etc.; sample feeding manger is given below. Based on the layout given, exercise the construction of a feeding manger either from wood or cement.
Perspective view of timber feed trough

Masonry walls in the trough

Concrete trough with a step in front of the trough

Timber trough

Figure 5: Alternative Feed and Water Troughs Design

Figure 5: Feeding trough made from half split barrel
5. Written Test

<table>
<thead>
<tr>
<th>Module 3</th>
<th>Assessment point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>Explain in writing what a modern dairy farm should have.</td>
</tr>
</tbody>
</table>

Trainee’s name: _______________________

Evaluate yourself based on the feedback you get from your trainer on question 1.

6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 3</th>
<th>List of operational activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical work 1</td>
<td>Give home work to trainees so that they will design a layout for a small scale dairy farm shelter in an area where the trainees are familiar with and in a place selected for the same purpose. For the details of the parameters for the barn, see Module 2.</td>
</tr>
</tbody>
</table>
| Practical work 2 | Based on the design prepared in Module two, list out the inputs required to construct a dairy cattle shelter:  
  
  - Discuss your design/layout with construction experts (masons and carpenters) in your locality.  
  - Based on the discussion identify and write down the required amount of construction materials (inputs).  
  
  Submit your project to your trainer for evaluation. |
| Practical work 3 | • Make the feeding trough as depicted in Figure 3 and submit to your trainer.  
  • Compare your home work with what is explained in the Information Sheet. |
MODULE FOUR: SELECT DAIRY COWS AND HEIFERS

Duration: 12 hours

1. General Description of Competencies of the Module

   It is quite decisive to identify dairy breeds of cattle rather than keeping what is available. The knowledge of dairy cattle parameters is a key factor for the selection of better dairy cattle. Therefore, this Module discusses the knowledge, skills and proper attitude to select the right type of dairy cows and heifers.

2. Learning Outcomes

   At the end of this Module trainees will be able to:

   ▶ Identify the parameters for better dairy animal, select animals that fit the dairy farming, and buy accordingly.

   ▶ Select the type of transport system for the selected and purchased cattle without serious constraints.

   ▶ Control and follow up the cattle health at arrival.

   ▶ Put on identification marks for the cattle.

3. Description of Learning Activities (operations guide)

   • Read the information given under the Information Sheet and listen attentively the explanation of the trainer.

   • Next, answer the question given under Written Test or Self Check.

   • Submit your answers to the trainer, for evaluation.

   • If the evaluation done by your trainer is satisfactory, proceed to Information Sheet 2;; otherwise do the above procedures again.

   • Follow the same procedure until you reach the practical activities section where you have to accomplish the tasks given based on the instructions provided.
Identifying the right dairy breeds is quite essential. In Ethiopia, indigenous dairy cattle breeds are known for their sturdiness to withstand hardships and disease; however, they are low in milk yield. Even in a single dairy cattle breed, using modern approach, productivity varies from cow to cow, unless cross breed is applied. To select better product yielding animal, consider the following parameters

1. **Identify by their conformation (shape):** Dairy type cattle have longer shape; wider on their sides but smaller towards their front; slim on their neck but wider from behind to have wedge shaped appearance, and correctly proportional and grossly visible udder and teat size. Briefly, dairy cattle should have a posture of slimmer on the front while wider from behind while having bigger and healthy under and teat.

2. **Select based on pedigree and level of productivity:** It means that selecting dairy cattle based on the information obtained from dams, sires, sisters, brothers and offspring’s or any higher level of blood related animals. Selection can be based on analyzing the reproduction record (dam, sir, half and full sisters) or based on reproductive traits (milk yield and other behavioural traits) of the animal to be selected. Before commencing the dairy cattle breeding it is important to identify if there are suitable dairy cattle in the surrounding area based on the objective of the dairy farm to be established, management and financial capacity.

3. **Select based on health status:** Investigation by visual observation and in consultation with health experts as well as analysis of health records and direct information collected from relevant personnel.

4. **Consider behaviour:** Avoid animals with bad behaviours such as head and leg kicking and those that avoid their calf to suckle.

5. **Foundation stock type and number:** Prior to commencing the dairy farm decide the type and number of cattle. Afterwards it is required to list out the increasing number of produced cattle every year based on age, milk yield, etc; then work out the required amount of feed, shelter, medicine, vaccination and other expenses before the start of the operation. Know that cross bred heifers can get bull service starting from 18-24 months or on average from 230 - 250 kg’s live body weight and deliver a calf after 9 months of pregnancy. For indigenous cows, it will take 2.5 to 3 years to reach the required level of weight, and take 9 months pregnancy time to deliver. Estimating this time helps to make the necessary plan like preparation of a delivery room, feed and
health provisions as well as to prepare the required man power (care takers) and financial requirements.

In Ethiopia dairy cattle types can be categorized into two — indigenous and improved/exotic.

<table>
<thead>
<tr>
<th>Module 4: Information Sheet 2</th>
<th>Suitable and improved dairy cattle types in Ethiopia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5 and 6 depict improved dairy cattle breeds that are available in Ethiopia.

Figure 6: Holstein Frisian dairy cattle breed  
Figure 5: Jersey dairy cattle breed

What to look for when buying cows

a) Health

- A healthy cow is usually alert and looks a bit restless, have shining coat, feeds and drinks, etc.
- Avoid rough looking cows. Udders should be soft and pliable. Cows with hard or lumpy udders have probably had mastitis. All four quarters should be balanced in size.
- Try milking the cow by hand and check the first few squirts of milk for blood clots. Clots can indicate mastitis.
b) Temperament

- The cow should be quiet to handle, not prone to climbing through fences. If you intend milking the cow in the paddock, it needs to be very docile and preferably have had some experience as a house cow.
- A young cow on its second calf is a good choice. The cow must have been broken in but will not have many of the problems associated with older cows. Check that it is free of bad habits and easy to milk.

c) Milk production

- Check with the farmer that the cow can produce enough milk for the family.

What you should look while buying a calf

Calves to be purchased for rearing as house cows might have been weaned from their mothers and thus inspect to ensure they do not show the following faults:

- Wet/infected naval cord.
- Swollen joints/lameness.
- Discharge from eyes/nose.
- Sign of scour (diarrhea).
- Distressed breathing.
- Physical abnormalities.

When transporting calves to your property, keep them warm and dry. It is important to keep calves in a dry, warm area for at least the first 2 to 3 weeks of their life.

5. Written Test

<table>
<thead>
<tr>
<th>Module 4</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>What type of body gait/posture and shape should a dairy cow have?</td>
</tr>
</tbody>
</table>

Trainee’s name ______________________________

Evaluate your answers by your trainer
6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 4</th>
<th>List of practical activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Explain the similarities in shape among the dairy cows given above; for example discuss on the following points:</td>
</tr>
<tr>
<td></td>
<td>• The shape of their neck.</td>
</tr>
<tr>
<td></td>
<td>• Shoulders' shape.</td>
</tr>
<tr>
<td></td>
<td>• Nature of their udder.</td>
</tr>
<tr>
<td></td>
<td>• Shape of their hip as compared to the shape of their neck.</td>
</tr>
<tr>
<td></td>
<td>Diagrammatically, place the shape given below properly. Understand/analyze the similarity. The shape of a dairy cow looks like a wedge that is held horizontally.</td>
</tr>
</tbody>
</table>

![Diagram of dairy cow shape](image)
MODULE FIVE: DEVELOP AND PRODUCE FORAGE FEEDS

Duration: 8 hours

1. General Description of Competencies of the Module

This Module deals with the strategy of selecting and cultivating good quality forage. Particularly, it attempts to answer questions related to why cattle require good quality forage; the various reasons why cows cannot give good yield feeding on certain types of quality forage. In line to this, the Module introduces the strategy of preparing better quality feed that can be used for business oriented dairy farm.

2. Learning Outcomes

At the end of this Module, the trainee will be able to:

- Identify and prepare utility goods and materials.
- Prepare the land intended for forage development.
- Decide on the type of forage to cultivate and prepare seed accordingly.
- Seed the selected forage seed and cultivate it.
- Properly utilize the cultivated forage; allow grazing or feed on with cut-and-carry method.

3. Description of Learning activities (operations guide)

- Read the information given under the Information sheet, and listen attentively the explanation of the trainer.
- Next, answer the question given under Written Test or Self Check.
- Submit your answers to your trainer for evaluation.
- If your evaluation is satisfactory, proceed to the Information Sheet 2; otherwise do the above procedures again.
- Follow the same procedure until you reach the practical activities section where you have to accomplish the tasks given based on the instructions provided.

4. Information Sheet
**Module 5: Identify and cultivate the forage feed suitable to dairy cattle**

**Introduction:** Forage crops are plants which, when grown as a crop, produce high yields of plant material, high in nutrients suitable for livestock requirements for maintenance and production. Natural pasture is forage that doesn’t grow as a crop, so it is termed as forage, and not forage crop. Forage crops produce much higher yields than natural forages; because they produce high yields, can be fed to cattle as green forage during rainy seasons as well as conserved forage for the long dry seasons.

To summarize, the advantage of producing forages for animals, among others, is to:

- Provide higher quality feed than the natural pasture can supply.
- Increase overall carrying capacity of grazing systems.
- Fill gaps in the feeds supply over the long dry season.
- Provide a specialist crop for both feeding in the rains and for conserving.
- Provide nutrients for the animals which are much cheaper than those found in commercial stock feeds.

a) In general forage feeds are divided into two types: Basal forage feed and Supplementary forage feed types.

A) Basal forage feed types

Also known as basal feeds, these are fibrous plants known as forages and include grass, hay, straw and stovers (stems and leaves of tall cereals such as maize and sorghum). They provide most of the energy and bulk an animal needs and will make up most of the diet. Most contain only low or medium levels of protein. Forage forms up to 30-70% of the diet, depending on level of productivity. Using a feed trough helps to make forage accessible without wastage.

Grass type feeds lie under basal forage feed types. It is important to use all grass types at an earlier age when the grasses are fresh and green as they are readily consumed by cattle. Therefore, grasses shall be cut before the flowering stage. It is known that to use grasses after maturity has no use as the grasses lose their nutrient value (lignite). Good quality forage feed types have higher amounts of carbohydrates and protein.
The major types of basal forage feed types are:

- Rhodes grass.
- Elephant grass.
- Setaria grass.

**B) Supplementary forage feed types [Legumes]**

These are feeds with a higher concentration of energy or protein or both, i.e. more nutrients per volume or weight of feed compared to forages. Certain forages (such as legumes), commercial dairy concentrates and cereal by-products are high in protein. They are fed in relatively small amounts together with the bulk feeds and are most often fed to productive animals such as lactating or pregnant cows. Protein feed should not exceed 30% of total feed since proteins cannot be stored in the body and will be in addition, extra energy is (which would otherwise be used for milk production) is used to remove the extra protein (nitrogen) from the body in form of urea in the urine.

Legumes: They can fix nitrogen from the surrounding air to the soil. Therefore, sawing legumes with grasses can improve the protein content of the grass as the fertility of the soil improves.

If these legumes get older, they could produce toxic substances that are dangerous to animals. Therefore, feeding the legumes at the right time is advisable.

- If animals are allowed to graze or feed large amount on legumes directly, bloat may result and consequently may die.
- After legumes are cut, before feeding to animals, welting under the sun is a requirement. The following are the major legume types: Desmodium, Leuceana, Cow pea, Alfa Alfa/ Lucerne and Lab lab.

**Information Sheet 2:** To improve the nutrient content of forage feed types for dairy cattle, the following options are available:

a) Cultivate (saw) improved forage feed types.

b) Improve pasture and grazing lands by sawing (cultivating) with leguminous forage types.

c) Cultivate (saw) improved grass types to supplement cattle feed during the dry period.

d) Cultivate natural grass or improved pasture for hay making.
Information Sheet 3

Select forage types that are suitable to your locality

In our country there are plenty of forage types. However, since only a small proportion of the forage types are known to fit for a specific climate, for example, the amount of rain fall, altitude (above sea level), and soil types. The trainees are advised to consult development agents or agricultural experts working in their area to select which forage types can be cultivated in their respective areas.

To select forage feeds that can be cultivated consider the following points:

- Fast growth rate and shorter maturity period as well as the ability of the forage crop type to absorb nutrients faster.
- Fast regeneration rate in the field and remain viable (green) in wet and dry seasons.
- In addition, low labour, time and capital requirement for cultivating the plant.

Selecting the right forage type therefore depends on the nature of the local climate as well as the trainees’ capacity. Among the many grass, legume and forage crops available it is possible to cultivate a mixture of grass and legumes based on what is convenience.

Again trainees are advised to consult development agents and agricultural experts in their area to select the most suitable forage types to cultivate in their project area.

5. Written Test

Answer the following questions to evaluate yourself

<table>
<thead>
<tr>
<th>Module 5</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>How many categories of forage feed types are there?</td>
</tr>
<tr>
<td>Question 2</td>
<td>List down the values of forage feed types in addition to soil conservation.</td>
</tr>
</tbody>
</table>

Trainee’s name: _____________________________________________

Let your trainer evaluate your answers. Note: Attempt all questions.
6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 5</th>
<th>Descriptions of tasks to accomplish</th>
</tr>
</thead>
</table>
| To cultivate forage feed, do the tasks given in the column at the right. | 1. First identify and prepare utility goods and materials; then list down and gather farm tools for soil preparation.  
2. Prepare the land intended for forage development.  
   a. Undertake soil preparation for sawing either by hand tools or oxen plough  
   b. For those that need seedlings transplantation prepare soil bed according to the instruction in the manuals.  
   c. Make sure that the soil bed is free from weeds-  
3. Decide on the type of forage to cultivate and prepare the seed accordingly.  
   a). Points to consider while selecting good quality forage types are:  
      - Fast growth and maturity rate.  
      - Capital requirement for the whole cultivation.  
      - Knowledge and skills needed to seed, grow and cultivate it.  
   b) Among the forage seeds available in your area, select the most suitable ones (you can consider Desmodium, Alfaalfa, Leucinia, Cow pea, Lab lab, etc).  
4. Seed the selected forage seed and cultivate it.  
   - Check the quality of the seed.  
   - Usually the seeding season is the start of the rainy season, and therefore, you need to accomplish the seeding accordingly.  
   - Apply fertilizer or manure.  
   - Control weed.  
5. Properly utilize the cultivated forage: - allow grazing or feed on with cut-and-carry method.  
   - Look whether it has reached the right age to cut it (to feed) |
- Prepare cutting tools (like sickles, axe and machete).
- Cut the required amount per day.
- Keep the harvested forage under the sun for a while so that it can wilt and feed the animals on the right feeding place or store it properly.
MODULE SIX: PREPARE GOOD QUALITY HAY

Duration: 8 hours

1. General Description of Competencies of the Module

This Module looks into the preparation of excess animal feed in the form of grass, forage and crop residues into hay, particularly during the short and long rainy seasons, which is mainly used for dry seasons.

2. Learning Outcomes

At the end of this Module trainees will be able to:

- Identify and prepare utility goods and materials for hay preparation.
- Decide on when to collect the forage to make hay.
- Cut and properly wilt the forage to make hay.
- Gather and properly store the hay.

3. Description of Learning Activities (operations guide)

- Read the information given under the Information Sheet and listen attentively the explanation given by the trainer.
- Next answer the question given under Written Test or Self Check.
- Submit your answers to your trainer for evaluation.
- If your evaluation by the trainer is satisfactory, proceed to the Information Sheet 2; otherwise do the above procedures again.
- Follow the same procedure until you reach the practical activities section where you have to accomplish the tasks given based on the instructions provided.

4. Information Sheet

<table>
<thead>
<tr>
<th>Module 6: Hay preparation for cattle feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Sheet 1 (methods of conserving green feeds for dry seasons with feed scarcity)</td>
</tr>
</tbody>
</table>

Hay is prepared by cutting forage while it is green (having moisture content of 80-85%) and drying it by the sun and wind (before shedding off their flower or at the start of flowering stage). Since there is relatively excess amount of grass, forage and crop residues during the short and long rainy seasons, it is possible to prepare the
excess animal feed in the form of grass, forage and crop residues into hay or silage for use in the dry season. Details about the preservation of hay is as follows:

- To preserve cut green fodder from rotting and decomposing and drying it by sun and wind.
- Once the moisture (water) content is reduced from 80% in the fresh material to less than 20%, you speak of hay.
- It is much better to cut the fodder fresh and preserve it, than to leave it to dry on the stem. In that case it becomes very old and fibrous and loses almost all its feeding value.
- Well prepared hay remains leafy, clean, soft, palatable and nutritious.
- Plant residues like stovers and straw are also dry like hay.

By deciding the daily, monthly and yearly (annual) required amount of hay, straw and crop residues and calculate the required space based on the following figures:

- 0.7 M² space for one quintal of belled hay-without the piled up amount.
- 3.0 M² space for one quintal non-belled straw & crop residues-without the piled up amount.
- 1.6 M² space for one quintal of non-belled hay - without the piled up amount.

The following are plant (forage and grass) types to make hay:

<table>
<thead>
<tr>
<th>Grass Types</th>
<th>Forage Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Sinar</td>
<td>- Gaya</td>
</tr>
<tr>
<td>- Rhodes</td>
<td>- Alfa Alfa</td>
</tr>
<tr>
<td>- Phalaris</td>
<td>- Desmodium</td>
</tr>
<tr>
<td>- Elephant grass</td>
<td>- Savannah Grass</td>
</tr>
</tbody>
</table>

Preparation of green forage (containing between 65% and 80 % water) for storage:

- During tedding, green forage is cut and dried as quickly as possible until it has less than 15-20 % water.
- Drying can be done naturally by exposure to the sun on the ground aerating the forage regularly by turning it over. After cutting the hay crop, turn over often to help wilt all parts of the crop.
- Sun-drying requires 2 or 3 days without rain.
The hay must then be kept in appropriate conditions (covered area). If, when harvesting, the grass has matured and has already dried standing, it is not hay but straw.

The hay then shall be stored either after it is belled or as it is non-belled. It shall be stored half metres above the ground level on a wooden bed made for the same.

The hay should be stored in a shelter with protection against the sun and rainfall.

Otherwise if the hay is belled, load the hay to form a cone. Keep the surface area small in a form that looks like an umbrella which is easier to cover it by plastic.

**Advantage and disadvantage of hay for dairy animals**

**Advantages of hay:**
- Hay can be used during seasonal lack of forage.
- Cost needed to make hay is small.
- Hay contains carbohydrates and protein nutrients required by animals.
- Hay plays a role in filling the gut and facilitating digestion and absorption.

**Disadvantages of hay:**
- Hay is liable to fire hazard.
- Hay can get wet and decompose.
- As compared to grazing hay making requires more manpower and machineries.

**Baling hay**

Baling the hay allows more material to be stored in a given space. A good estimate of the amount stored makes feed budgeting easier. Baling can be manual or mechanized, manual baling being more economical for small-scale dairy farmers. Manual hay baling is done using a baling box with dimensions 85 cm long x 55 cm wide x 45 cm deep, open on both ends (Figure 6). If the hay is well pressed, the box will produce an average bale of 20 kg.
Summary harvesting and curing

- Harvest the fodder for haymaking when the crop has attained 50% flowering. At this stage protein and digestibility are at maximum, after which they decline with age.

- The fodder should be harvested after 2 to 3 days of dry weather so that drying will be possible.

- Where possible, drying should be done under shade so that the dried fodder retains its green colour, which is an indicator of quality.

- Turn the fodder using a farm fork to ensure even drying.

- Check the dryness by trying to break the stem. If it bends too much without breaking, there is still too much water.

- Legumes and grasses can be mixed to make better-quality hay, e.g. Rhodes grass + lucerne.
5. Written Test

<table>
<thead>
<tr>
<th>Module 6</th>
<th>Assessment points</th>
</tr>
</thead>
</table>
| Question 1 | 1. Explain the right time of cutting green forage.  
2. Explain how you can prepare starting from cultivating green grass and forage. |
| Question 2 | What is the advantage of cutting the green grass and forage before the flowering time? |

Trainee's name: ____________________________

6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 6</th>
<th>List of practical activities</th>
</tr>
</thead>
</table>
| Practical procedures 1: Selecting one forage crop/plant; then answer the following questions | 1. Prepare materials/equipment that will help you to prepare hay for the selected forage crop type.  
2. Cut and dry properly; wilt the cut forage to lose water.  
3. Store properly the sun dried hay.  
   - Store the hay in a shade prepared for the same purpose.  
   - Take care by keeping it dry (avoid wetting). |
| • Identify, gather flowering and older grass and forage feeds; and show to your trainer.  
• From what you know in your area identify, gather the grass and forage feed types for making hay; and show to your trainer. |
 MODULE SEVEN: PREPARE SILAGE 

Duration: 8 hours

1. General Description of Competencies of the Module

This module deals with the strategy of preserving forage resources to prepare silage, in its wet state while having its nutrients for the dry season. It also points out that the importance of ensuring continuous regular feed for livestock.

2. Learning Outcomes

At the end of the training, trainees will be able to:

- Identify and prepare utility goods and materials to prepare silage.
- Prepare silage pit (enough for small scale farmer).
- Prepare the grass and forage needed to make the silage.
- Make the silage.

3. Description of Learning Activities (operations guide)

- Read the information given under the Information sheet and/or follow carefully to the explanation of the trainer.
- Next answer the question given under written test or Self Check.
- Evaluate your answers by your trainer.
- If your evaluation by the trainer is satisfactory, proceed to the Information Sheet 2; otherwise if your evaluation is not satisfactory read and attempt to answer the questions again, until you get satisfactory evaluation.
- Follow the same procedure, until you reach the practical activities section where you have to accomplish the tasks given based on the instructions provided.

4. Information Sheet

<table>
<thead>
<tr>
<th>Module 7: Information Sheet 1</th>
<th>Silage preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silage is cut plant material sealed in a silo without air and water.</td>
<td></td>
</tr>
<tr>
<td>• To solve green feed shortage during dry season one way out is to store green forage by making silage. Silage can be made from fresh green</td>
<td></td>
</tr>
</tbody>
</table>
pasture or crops such as maize grown in abundance during the rainy season.

- Preparation of a silage involves the following steps:
  o First of all preparing a pit of suitable size.
  o Then the forage shall be chopped.
  o And then the chopped forage shall be piled in the pit.
  o Pressing the chopped forage down to push air out.
  o Then it shall be covered with plastic material to prevent entry of air from above and
  o Finally the pit shall be covered with soil.
- Over time, the material ferments and is preserved in the process. On opening, the material will smell of ammonia. It should be used within a day or two of opening.
- Bacteria found in air and on the forage to be buried create acids and preserve the forage fresh, without decomposition and while it is green. For some forage types without sugar, it is a requirement to add sugary substances (E.g. Molasses) to facilitate this fermentation process.
- For the silage to mature it needs some period of time without opening it.
- If it is fully protected from air and water the silage can be stored for longer period of time.
- The following figure shows the processes involved in silage making.

![Diagram showing processes in silage making](image)

The Forage Q&A (made by All Japan Agricultural Cooperative Federation)

**FIGURE 7: IMPORTANT POINTS FOR SILAGE MAKING**
Advantages of silage:

- Feeding good silage increases your milk production, as good silage is up to 85% feed value of the original crop.
- Fresh and green forage in dry season.
- Cattle feed on silage at a higher volume and digestion is fast. In addition, silage has better nutritive value than hay.
- Silage preserves the nutrients required by milk production for many years.
- Silage cannot get fire easily.
- Silage helps cows to come to heat as it is reach in vitamin A.
- Nutrients found in grass silage are double in amount than that one found in hay.
- Silage preparation is not affected by weather.
- The space requirement of silage making is smaller than that required by hay making,
- Silage will reduce the cost of purchase for balanced ration.

Disadvantages of silage:

- More equipment requirement for silage making.
- Silage making requires higher level of precaution, experience and knowledge.
Forage species used for silage making:
- maize and sorghum stem - Alfa Alfa
- Rhodes - Clover
- Phalaris - Desmodium
- Panicum - Lab Lab
- Sinar - Setaria

Facilitate fermentation in silage making

For silage to ferment and produce acid use forage species with higher content of carbohydrate/energy/

- Add 0.5-1 percentage lime stone to facilitate fermentation and thereby increase acid production,
- Add sodium bisulphate to create higher level of evaporation and sour taste.

To prepare good quality forage it is important to consider the following quality control issues:

- Determine the water content of the silage to 55-65 percent.
- Chop down the forage into 1.5 - 2.5 cm so that good compaction can be achieved by removing the air trapped among the chopped forage particle. In other words the forage crop shall be chopped to the length of a match box. It is easy to compact and remove the air.
- Cut the crop at the right time to get the best feed value. Here are some examples:
  
<table>
<thead>
<tr>
<th>Forage crop type</th>
<th>Cutting time</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Lucerne</td>
<td>- full bud</td>
</tr>
<tr>
<td>- Elephant grass</td>
<td>- before 1.5 m high</td>
</tr>
<tr>
<td>- Other grasses</td>
<td>- just before flowering</td>
</tr>
<tr>
<td>- Grass/shrub</td>
<td>- end of the rainy season</td>
</tr>
<tr>
<td>- Oats</td>
<td>- beginning of the</td>
</tr>
<tr>
<td>&quot;dough&quot; stage</td>
<td>- 50-55 days after silking</td>
</tr>
<tr>
<td>- Maize</td>
<td></td>
</tr>
</tbody>
</table>

- Add Molasses and leafy forage to facilitate fermentation:
  - Mix 1 part of molasses with 2 parts of water.
  - Put the mixture in a large sprinkling can.
  - Add 35 litre of the mixture for every 1 m³ of crop (less for short,
leafy grass, more for legume crops.

- Measure the amounts of crop by marking a pole along the silo wall. After adding each layer of crop, sprinkle on the molasses mixture.

- **Add Salt:** Salt helps the silage process in the same way as wilting. Add 1-2% of salt to the crop (less if the crop is dry, more if it is not so dry).

- **Keeping out soil -** Do not put any crops with soil or other dirty material into the silo. This will slow down or spoil the silage process.

- **Compacting:** Compact the crop all the time as you fill the silo. This will remove the air. Compact the crop by continuous treading.

- **Fill your silo in one day and seal quickly.** This will improve and speed up the silage process.

- **Add urea to maize silage to increase the protein content by 12%**.

**Burying (compacting) process:**

- Burying the silage can be accomplished in the following four ways: 1) Pit 2) Trench/canal 3) on a roof top 4) Plastic bag.

- A place far from the dairy barn and having good drainage and no staying of rain water (especially close attention is required when building a semi-underground silo or a trench silo).
The moisture content of the forage for silage making shall not exceed 70% otherwise put the forage under the direct sunlight so that it can wilt.

The dry matter content of the forage for silage making shall be more than 30-35%.

To taste the water content squeeze a hand full of forage by two hands and if there is no water dropping down it is then ready for burial.

While burying the forage shall be well compacted so that no air shall be trapped in.

To keep the quality of forage very good, forages like maize shall be harvested to make silage during flowering stage.

To facilitate the silage fermentation process add to the forage substances like chopped sugar cane, molasses, and formic acid.

Types of pits for silage burying

In general pits for silage making can be divided into two:

1. Above the ground level-standing pits.
2. Underground-horizontal pits.

Average space requirement:

- Length-10 metres.
- Width-4 metres.
- Depth-2 metres.

For smallholder farmers Upright silo with plastic cover is preferable. The plastic sheeting follows the inner side of the silo wall 1-1.5 m. The following are the steps to make silage:

- First dig from 0.5-1 metre dip and 2 Meter wide canal.
- Before adding on the chopped forage, you have to cover one side of the pit with plastic cover.
- Put hay on the floor.
- While filling on the chopped forage add on salt/molasses on regular intervals step by step until the hip reaches 1 metre height.
And, then compact it by rolling over a barrel of water, allowing people to jump over it.

Next cover it with a plastic sheet. If there is no plastic sheet use thick layer of grass hay (as in making thatched roof).

Finally cover the whole thing by a layer soil.

The pit shall be filled and covered within a maximum of two days otherwise it will be difficult to make it free from air.

**Opening the silage pit:**

- The odour coming out when opening a silage pit could tell the quality of the silage. The silage should be fresh and have an acid odour. In addition to measure the quality of the silage one can measure the pH.

- The pit shall be opened on the short side of the pit so that after withdrawing the required amount it shall be sealed again.

- Based on body weight 6 – 15 Kg’s of silage can be fed to one cattle.

- It is advised that silage shall not be given to a milking cow during or just before milking since the silage could spoil the odour of the milk.

**Summary**

Silage is high-moisture fodder preserved through fermentation in the absence of air. These are fodders that would deteriorate in quality if allowed to dry. Silage can be made from grasses, fodder sorghum, green oats, green maize or Napier grass. An ideal crop for silage making should.

- Contain an adequate level of fermentable sugars in the form of water-soluble carbohydrates.

- Have the dry matter content in the fresh crop of above 20%.

- Possess a physical structure that will allow it to compact readily in the silo after harvesting.

- Crops not fulfilling these requirements may require pre-treatment such as:
  - Field wilting, to reduce moisture.
  - Fine chopping to a length of 2–2.5 cm to allow compaction.
  - Use of additives, to increase soluble carbohydrates.

Dry matter yield of common fodders used for silage making is 4–12 t/acre for Napier grass, 6.8-8.8 t/acre for sorghum E6518 and 9.6 t/acre for maize.
Harvesting stages

- Napier grass should be harvested when it is about 1 m high and its protein content is about 10%.
- Maize and sorghum should be harvested at dough stage, that is, when the grain is milky. At this stage, maize and sorghum grains have enough water-soluble sugars so it is not necessary to add molasses when ensiling.
- However, when ensiling Napier grass, it is necessary to add molasses to increase the sugar content.
- To improve silage quality, poultry waste and legumes like lucerne and desmodium may be mixed with the material being ensiled to increase the level of crude protein. However, since protein has a buffering effect that increases the amount of acid required to lower pH, poultry waste and legumes should be incorporated within limits. Poultry litter should not exceed 5% and legumes should not exceed 25% of the total material ensiled.

Types of silos

A silo is an airtight place or receptacle for preserving green feed for future feeding on the farm. Silos can be either underground or above ground, the qualification being that the silo must allow compaction and be airtight. Five types are described here: tube, pit, above-ground, trench and tower.

- Silage can be made in large plastic sacks or tubes. The plastic must have no holes to ensure no air enters. This is popularly referred to as tube silage.
- Silage can also be made in pits that are dug vertically into the ground and then filled and compacted with the silage material.
- An above-ground silo is made on slightly sloping ground. The material is compacted and covered with a polythene sheet and a layer of soil is added at the top. When finished, it should be dome shaped so that it does not allow water to settle at the top but rather collect at the sides and drain away down the slope.
- The trench silo is an adaptation of the pit silo, which has long been in use. It is much cheaper to construct than a pit silo. Construction is done on sloping land. A trench is dug and then filled with silage material. This method is ideal for large-scale farms where tractors are used. Drainage from rain is also controlled to avoid spoiling the silage.
Tower silos are cylindrical and made above-ground. They are 10 m or more in height and 3 m or more in diameter. Tower silos containing silage are usually unloaded from the top of the pile. An advantage of tower silos is that the silage tends to pack well due to its own weight, except for the top few meters.

5. Written Test

<table>
<thead>
<tr>
<th>Module 7</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>What does silage mean?</td>
</tr>
<tr>
<td>Question 2</td>
<td>Explain in writing the step by step process of silage making (including all required inputs).</td>
</tr>
</tbody>
</table>

Trainees' name: _______________________
Submit your answer to your trainer for evaluation.

6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 7</th>
<th>Description of the task</th>
</tr>
</thead>
</table>
| Following the steps given in the next column, prepare silage and submit to your trainer for evaluation. | 1. List down the materials and equipment needed to make silage.  
2. To prepare silage pit under smallholder farmer level what steps are required?  
3. How do you prepare forage to make silage?  
4. What are the steps to prepare silage?  |

Reference points:

1. Answer for the first practical task:  
   - Hand tools/Materials for digging the pit-fork, spade, and other hand tools to dig a pit  
   - Machete-large heavy knife with a broad blade used as a weapon or as a tool for cutting through vegetation i.e. to chop down the forage.  
   - Plastic sheet - to cover the pit (the size depends on the size of the pit)  
   - Lime stone, sodium bisulphate, etc.  

2. Answer for the second practical task:  
   - Determine the size of the pit based on our capacity.  
   - Dig a pit by the determined size  

3. Answer for the third practical task:  
   - Cut the grass and forage at or before the flowering
stage
- Wilt the forage by keeping it under the direct sunshine
- Chop down the forage into smaller pieces (a size of match stick)

4. Answer to the first practical task:
- First cover the pit by the plastic sheet.
- Put the chopped forage on the plastic sheet and put on lime stone; sodium bisulphate and then compact step by step after an addition of a small layer until the pit is full.
- Cover the compacted forage by replacing the plastic sheet from the sides over on the top.
- Compact again to push out air trapped in the chopped forage.
- Bury the plastic sheet over by replacing on soil (burying).
MODULE EIGHT: PRODUCE IMPROVED BY-PRODUCT FEED BY TREATING MOLASSES AND UREA

Duration: 8 hours

1. General Description of Competencies of the Module

This module deals with the preparation of improved feeds. Particularly it focuses on how the feed could be prepared using locally available inputs. This helps to improve the nutritive values of hay and crop residues (like straw) by adding on molasses and urea and thereby increase edibility by livestock is described.

2. Learning Outcomes

At the end of this Module the trainee will be able to:

- Identify and prepare utility goods and materials for the treatment of crop by-products.
- Prepare all the necessary inputs.
- Treat the crop by-product in different ways and make it ready as a good quality feed.

3. Description of Learning Activities (operations guide)

- Read the information given under the Information Sheet and listen attentively the explanation given by the trainer.
- Next answer the question given under Written Test or Self Check.
- Submit your answers to the trainer for evaluation.
- If your evaluation by the trainer is satisfactory, proceed to the Information Sheet 2; otherwise do the above procedures again.
- Follow the same procedure until you reach the practical activities section where you have to accomplish the tasks given based on the instructions provided.

4. Information Sheet

<table>
<thead>
<tr>
<th>Module 8: Treating animal feeds using molasses and urea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information sheet</td>
</tr>
<tr>
<td>1. Improving the nutritional value of crop residues</td>
</tr>
<tr>
<td>In our country where there are more crop productions, crop residues are major</td>
</tr>
</tbody>
</table>

Training Manual for Farmers, Rural Women and Youth
animal feed types. It is possible to improve the nutritive values of these crop residues and increase edibility by treating it with urea fertilizer. To improve the nutritive values and increase edibility of these crop residues, it is important to follow the procedures given below:

1.1. Procedures of tasks to follow:

- Prepare two holding vessel (width 1 m, depth 0.5 m and length 2 m) to keep the urea treated crop residue. These vessels can hold up to 150 kg's of crop residues.
- While it is in the holding vessels to protect the urea treated crop residue from being spoiled by soil, keep it air tight, cover the walls of the vessels by plastic sheet or sacks or if these are not available use layers of grasses.
- After loading the vessels with treated crop residues, cover the top with the same material to be air tight, add over the top soil or other material with heavier weight.
  - Crop residues that can be treated by urea are straw, wheat straw, barley straw, oat straw as well as maize and sorghum residues. Before treating maize and sorghum residues it is important to chop them down into small pieces to obtain good result.
  - Prepare the urea mixture (follow the formula given in Table 3).

Table 3: Preparation of urea molasses mixture

<table>
<thead>
<tr>
<th>Crop Residues in Water in</th>
<th>Urea</th>
<th>Molasses in</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>4</td>
<td>--</td>
</tr>
<tr>
<td>150</td>
<td>150</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>150</td>
<td>150</td>
<td>6</td>
<td>--</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>8</td>
<td>--</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
<td>12</td>
<td>--</td>
</tr>
</tbody>
</table>

- Mix very well in one vessel, the urea, water and molasses mixture as it is given above.
- If there is no balance to measure the ingredients, measured stones can
be used over a strong stick. Mark the centre of the stick and then tie with a rope over a posted log. Then use one end of the horizontal stick to place the measured stone while the other end to hang the crop residue in a sack and watch as it comes levelled (balanced) with the other end. For correct measurement pay attention to the length of the stick that hangs the measured stone which shall be equal to the length of the stick that hangs the sack of the crop residue. If there are better ways of measurement try to use your convenient one.

- Use plastic sheet or other materials that cannot absorb moisture to mix the urea mixture and the crop residue. Based on what is ready to mix the contents, sprinkle the measured urea mixture over the measured amount of crop residue. Mix it thoroughly.

- Put the thoroughly mixed crop residue in to the holding vessels. Compact the crop residue placed in to the holding vessels to push out air. For proper compaction and thorough mixing, always use small amounts at a time. For further understanding please refer Methods of improving crop residues extension manual No 10, prepared by Smallholder Dairy Development project.

- After placing the urea treated crop residues into the holding vessels, you have to wait for 7 days before starting to feed to their animals. Therefore, when finishing the urea treated crop residue in one of the holding vessels, start to use the next one while preparing a new one in the empty holding vessel.

1.2. Utility goods and materials for the treatment of crop by-residues by urea:

- Wood/plank (flat timber) to prepare casting and moulds, floor to the casting and moulds, plastic sheet or flattened plastic sacks to cover the sides and the top, or if these are not available, grasses used to make thatched roof.

- Balance and measuring unit to measure crop residues, water, molasses and urea.

- Vessel to mix molasses and urea.

- Plastic sheet to mix the urea mixture with the crop residue.

- Flat corrugated iron or other similar material.

- Crop residue.
2. Urea-molasses block

Urea molasses block is cattle feed prepared primarily from the mixture of molasses, urea, wheat bran/husk, oil cakes, salts and cement and can be fed to cattle with feed types known to have low nutrient value. This kind of urea molasses block when fed with crop residues can have the following values:

- Improve the nutritional value and increase edibility of animal feeds, especially that of crop residues
- Improve the fermentation capacity of rumen bacteria by providing nitrogen and energy requirement,
- Improves digestibility and assimilation/absorption of animal feeds,
- In general, Molasses Urea Block can be used as an alternative feed type in times of drought where there is shortage of feeds.

3. Utilities needed to prepare molasses urea block

- Mixing trough/barrel/tub/etc
- Small buckets to serve as moulds, bowl, or wooden boxes that can hold from 3-5 litres of liquid.
- Strong sticks for stirring purposes, metallic pot, plastic sheet or other materials that cannot absorb moisture.

### Major Inputs

<table>
<thead>
<tr>
<th>Urea</th>
<th>Molasses</th>
<th>Wheat bran</th>
</tr>
</thead>
</table>

4. Preparation procedures

Depending on various locations, it is possible to prepare molasses urea block with various input formulas. Three alternative formulas are given in Table 4.
Table 4: Alternative formulas to prepare molasses urea block

<table>
<thead>
<tr>
<th>Types of inputs</th>
<th>Percentage of required inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Block 1 percentage</td>
</tr>
<tr>
<td>Molasses</td>
<td>50</td>
</tr>
<tr>
<td>Urea</td>
<td>10</td>
</tr>
<tr>
<td>Salt</td>
<td>5</td>
</tr>
<tr>
<td>Cement</td>
<td>10</td>
</tr>
<tr>
<td>Oil cakes</td>
<td>--</td>
</tr>
<tr>
<td>Wheat Bran</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

From the alternatives given above, preparation procedures for Block 1 is given as an example:

• First put 10% urea with 50% molasses in to the mixing vessel and mix until the urea dissolves in the molasses.

• Next put in a separate vessel/container such as bucket 10% cement, 5% salt with 4% of the total water requirement and stir it very well so that the cement shall be coarse; the water is needed only to mix the cement (only 4% water is required in all block making alternatives). Since the water evaporates in the process of drying the block and couldn’t remain part of the block, water is not list among the inputs required to make blocks.

• Mix the properly mixed cement and salt mixture with the urea-molasses mix.

• Finally, add 25% wheat bran, straw or grounded bran in to the mix and mix thoroughly.

• Next after doing the above stated tasks, put and compact thoroughly the prepared mix in to casting moulds with flat plastic sheet on the floor.

• To gain good strength put the filled casting moulds under the sun after keeping it for 12 hours.

• Feed the block to the cattle with other feed types, when the block gain appropriate strength so that it will not crack easily and at a strength level on which cattle can feed on it.
5. Drying and storage

Remove the blocks from the moulds after 24 hours and place on racks to dry. Leave the blocks to dry for at least 5 days depending upon the weather condition.

Based on the above descriptions of block making, you can prepare your own block sizes. To do so look for the different formulas given below:

Table 5: Preparation of urea molasses block

<table>
<thead>
<tr>
<th>Types of inputs</th>
<th>Percentage input (%)</th>
<th>Inputs for 10 kg block</th>
<th>Inputs for 15 kg Block</th>
<th>Inputs for 30 kg block</th>
<th>Inputs for 50 kg block</th>
<th>Inputs for 100 kg block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molasses</td>
<td>50</td>
<td>5</td>
<td>7.5</td>
<td>15</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Urea</td>
<td>10</td>
<td>1</td>
<td>1.5</td>
<td>3</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Salt</td>
<td>5</td>
<td>0.5</td>
<td>0.75</td>
<td>1.5</td>
<td>2.5</td>
<td>5</td>
</tr>
<tr>
<td>Cement</td>
<td>10</td>
<td>1</td>
<td>1.5</td>
<td>3</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Bran</td>
<td>25</td>
<td>2.5</td>
<td>3.75</td>
<td>7.5</td>
<td>12.5</td>
<td>25</td>
</tr>
<tr>
<td>Water</td>
<td>4</td>
<td>0.4</td>
<td>0.6 litre</td>
<td>1.2 litre</td>
<td>2 litre</td>
<td>4 litre</td>
</tr>
</tbody>
</table>

For the sake of easy of making, it is better if a onetime preparation mix is 10-100 kg's. Otherwise the size of the blocks is determined by the size of the casting moulds. This means that you can prepare 30 kg's of mixture at one time, and can make 10 blocks using 3 litres capacity of casting moulds each. Based on this
background, you can decide on the amount of mixture needed to make the required size and numbers of blocks.

Precautionary procedures

Take the following precautionary measures while preparing molasses urea block:

- Do not exceed the stated amount of urea on any size of block as urea has toxic nature.
- Thorough stirring is required while preparing mixtures, especially so take care not to make coarse mixture during cement mixing.
- The amount of water needed to mix the cement shall not exceed the stated amount in the mix content.
- Keep the block in a dry place as it can grow mould and could be spoiled if it gets wet.

6. Feeding

If it is for the first time, blocks should be introduced to animals slowly and should be fed after animals have consumed adequate forage. To smoothly introduce the balanced ration, give the balanced ration step by step starting with small amount and increasing the amount step by step while reducing the feed type the cattle is accustomed to. The same holds true to molasses urea treated blocks. It is important that the block shall be kept clean from dust, free from water, urine and dung and shall be placed in the feeding trough so that the cattle can access it whenever they want it. For cattle that are new to the block, try to introduce it by covering the block with bran-flour, so that they can feed on it.

5. Written Test

Answer the following questions in writing

<table>
<thead>
<tr>
<th>Module 8</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>What is the value of treating grass hay with urea and molasses?</td>
</tr>
<tr>
<td>Question 2</td>
<td>What are the negative effects of urea and molasses on cattle?</td>
</tr>
</tbody>
</table>

Trainees’ name: ____________________________

Submit your answers to your trainer for evaluation.
### Module 8: Description of tasks

<table>
<thead>
<tr>
<th>Description of tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>List down the required inputs and the procedures to treat hay and crop residues with urea molasses</strong></td>
</tr>
<tr>
<td>1. If you have crop residues (like straw), identify the materials and equipments needed to treat it with urea molasses.</td>
</tr>
<tr>
<td>2. Write down the required inputs in detail.</td>
</tr>
<tr>
<td>3. Treat and make the crop residues ready as an animal feed in different ways. Or think about what it takes to prepare urea molasses treated crop residue, using wheat, barley, teff straw etc, treat it with molasses urea. Submit your answers to your trainer for evaluation.</td>
</tr>
</tbody>
</table>

### References:

1. **Answer for the first task:**
   - Casting moulds.
   - Mixing bucket, washing tub or other wider vessel/container.

2. **Answer for the second task:**
   - Molasses.
   - Urea fertilizer.
   - Fibrous feeds like bran, etc.
   - Table salt.
   - Cement or substances to help stick together all the inputs.

3. **Answer for the third task:**
   - Prepare all the required inputs.
   - Mixing.
   - Cast moulding, and
   - Drying and storage.
MODULE NINE: PREPARE BALANCED RATION FOR DAIRY COWS AND CALVES

Duration: 24 hours

1. General Description of Competencies of the Module

   This Module explains the required skills, knowledge and proper attitude of the trainee, on how to prepare balanced ration from available feed sources.

2. Learning Outcomes

   At the end of this Module, trainees will be able to:

   - Identify and prepare various feed types for the preparation of balanced feed ration.
   - Identify and prepare utility goods and materials for ration preparation.
   - Prepare the needed feed ration and store it properly.

3. Description of Learning Activities (operations guide)

   - Read the information given under the Information Sheet and listen attentively the explanation of the trainer.
   - Next answer the question given under written test or Self Check.
   - Submit your answers to the trainer for evaluation.
   - If your evaluation by the trainer is satisfactory, proceed to the Information Sheet 2; otherwise do the above procedures again. Follow the same procedure until you reach the practical activities section where you have to accomplish the tasks given based on the instructions provided.

4. Information Sheet

<table>
<thead>
<tr>
<th>Module 9: Information Sheet 1</th>
<th>The standard amount of daily feed requirement of a cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following two feed formula show an example for the amount of feed a cow needs per day to maintain her life and be productive.</td>
<td></td>
</tr>
<tr>
<td>Formula One</td>
<td></td>
</tr>
<tr>
<td>For example, the maintenance ration and ration for the production of 8 litres of milk yield should include about:</td>
<td></td>
</tr>
</tbody>
</table>
- 22% concentrates (about 4 kg/day).
- 48% treated straw (about 9 kg/day).
- 30% grass (about 6 kg/day).

Alternatively, five feeding strategies are presented as follows:

a. Feeding 6 kg/d of immature grass plus 6 kg/d of formulated concentrate.

b. Increasing ration protein content by substituting some of the grass with lacunae leaves.

c. Increasing ration protein content by substituting some of the concentrate with soybean meal.

d. Reducing cost by substituting some of the concentrate with rice bran.

e. Reducing cost by substituting some of the concentrate with brewer’s grain.

**Formula Two**

**Table 6: Daily feed requirements (of a 450 kg’s cow)**

<table>
<thead>
<tr>
<th>Feed type</th>
<th>Daily requirement (kg)</th>
<th>Cost/kg</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Roughage</td>
<td>8.0</td>
<td>4.5</td>
<td>36.0</td>
</tr>
<tr>
<td>2. Concentrate</td>
<td>5.0</td>
<td>4.0</td>
<td>20.0</td>
</tr>
<tr>
<td>3. Mineral mixture</td>
<td>2.0</td>
<td>10.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Total daily feed cost per cow</td>
<td>15.0</td>
<td>A - 6.2</td>
<td>76.0</td>
</tr>
</tbody>
</table>

**Note:** To understand how these daily feed requirements are formulated, read thoroughly the information given below:

**What is dry matter intake**

**Introduction:** The components of animal feeds

The important components of feed for animals include:

- Energy (especially carbohydrates and fats but also other components).
- Protein.
Minerals and vitamins.

Water.

Different feeds contain different amounts of water. Fresh green pasture can contain over 80% water and dry hay can contain less than 10% water. For nutritional calculations, you need to separate the water from the other components. You have to consider only the other components, the dry matter. We talk about dry matter intake.

Dry matter is the part of the feed which remains when you remove all the water. It is the part which contains all of the energy, protein, minerals and vitamins. It also contains fibre which does not get utilised as a nutrient.

- Green fresh pasture contains about 75-85% water and 15-25% dry matter.
- Maize silage contains about 60-65% water and 35-40% dry matter.
- Dry hay or stored crop residues contain 10-15% water and 85-90% dry matter

**Figure 11: Dry matter contents of different feed types**

You can see that if an animal eats 10 kg of fresh green pasture, it will only consume about 1.5-2.5 kg of dry matter. However, if the animal eats 10 kg of dry hay or crop residues, it will consume 8.5-9.0 kg of dry matter.

**Dry Matter Intake Requirements**

- An adult dairy cow will eat dry matter equal to about 2-3% of its own body weight each day.
• This is about 12-18 kg of dry matter each day for a large cow.
• This means that if the cow eats only green pasture, it would need to eat about 50-90 kg of feed per day to get that amount of dry matter. In practice, a cow will not consume that much pasture in one day.
• If the cow eats only dry hay, it would need to eat about 14-20 kg of feed to get the same amount of dry matter. Remember though that hay made from grass that is cut too late, after it has already turned brown, will have very low nutritive value. It will be mostly fibre and will have very low energy content.

**Useful Rules of Thumb**

• The heavier the animal, the higher its maintenance requirements, and the higher the intake required for production.
• An efficient milking cow needs a daily dry matter intake equivalent to at least 3% of its body weight. For instance, a 600 kg cow needs at least 600 kg x 3% = 18 kg DM/day.
• Higher producing cows will eat more than 4% of their body weight as dry matter. For instance, a high-producing (>30 L/day) 600 kg cow could eat 600 kg x 4% = 24 kg DM/day.

**Importance of Dry Matter Intake**

• Cows have a minimum requirement for protein and energy to maintain normal body functions—known as their ‘maintenance’ requirement—which is approximately 2% of their body weight.
• Maximising dry matter intake provides more nutrients to rumen microbes, which in turn provide more nutrients to the cow for milk production and composition, growth, reproduction and body condition.
• Every day, an efficient milking cow needs a DM intake equivalent to at least 3% of their body weight.

**Minerals and Vitamins**

• Ruminants (sheep, goats and cattle) are different from other animals. They can produce many of the vitamins that other animals must get from their feed. It is not usually necessary to give ruminants any supplementary vitamins.
Sometimes a dairy animal needs an extra boost of minerals. These can be supplied in a mineral block. The block is solid and the cow licks it to get a little at a time. Too much minerals can kill the animal. Never allow a cow to consume a large portion of the block at one time.

Note: Heifers should start to feed on high amount of feed in 10 months. This will support the heifer to be productive so that the heifer could be able to yield more volume of milk. A heifer grown on this basis will be healthier as she can easily be able to stand a lot of stress and pressure and could give much more milk on sustainable basis.

Module 9: Information Sheet 2

What is a balanced ration? Prepare balanced ration for milking cow and calves

Balanced ration

- Ration formulation skills form the basis of any profitable dairy enterprise, whether they are used in a series of complex calculations or have been intuitively developed through years of experience. This skill involves selecting and sourcing a range of feeds to provide sufficient feed nutrients to optimise young stock growth and long-term cow performance.

- Balanced rations for cattle are made up of five basic types of feed. When combined in the right amounts, these feeds can supply all the nutrients needed to keep cattle healthy and productive. The five types of feed are:
  - Forages - Carbohydrates (Bulk and Supplementary forages for energy and protein).
  - Concentrates - protein or energy or both.
  - Mineral supplements.
  - Vitamins.
  - Water.

- Proper feeding is essential to ensure that dairy cattle: Stay alive; remain healthy; are in good body condition; have enough energy to move; produce enough milk for the calf and extra for home consumption/sales (to earn money); grow when and/or if young; become pregnant and give birth to healthy calves.

- Dairy cattle must eat different types of feed to supply the various nutrients they need.
Therefore dairy cattle must eat a *balanced* diet. Cattle diets are usually called *rations*.

During formulation of dairy cow rations, the daily requirements for all the above nutrients must be taken into consideration. The available feed resources should then be mixed to meet the cow's nutrient requirements, which are dependent on bodyweight, milk yield, reproductive (pregnancy) requirements and growth.

A balanced ration will consist of combined feed ingredients which will be consumed in amounts needed to supply the daily nutrient requirements of the cow, both in correct proportion and amount. A ration will be balanced when all the required nutrients are present in feed eaten by the cow during a 24 hr period.

The challenge of a farmer is to put together a balanced ration for their cattle from the different feeds that are readily available.

Balanced ration is obtained primarily from commercial suppliers. However from different industrial by products and concentrates balanced ration can be formulated at home. Balanced ration can be prepared using different formulas. For Example, by using the following raw feed materials, one quintal of balanced ration can be prepared:

- Wheat bran/ husk 45 kg's
- Coarsely grinded maize or other cereals 16 kg's
- Oil seed cake 35 kg's
- Mineral supplements 2 kg's
- Salt 2 kg's
- **Total** 100 kg's

- One improved dairy breed can give 2-2.5 litres of milk from 1 Kg's of balanced ration.
- Balanced ration should have 16-17% crude protein.
- It is possible to use pigeon pea in place of oil seed cakes.
- A milking cow can give 2 kg's of milk for each kg's of balanced ration while pregnant cows need 1.5 kg's of balanced ration every day in dry season.
Formulating a ration for milking cows requires a series of calculations to determine the energy, protein and fibre requirements, based on a series of descriptors of the cows' current live weight, stage of pregnancy, changes in live weight, milk composition and target milk yield. The next step is to select the most appropriate available feeds to supply the nutrients at the lowest cost. This exercise can be facilitated by a computer program, and can lead to the highest milk income at less feed costs.

Least cost rations using locally available resources will be formulated. Based on the chemical composition of available feed resources (a pre-requisite to this is the preparation of inventories of feed resources that are available in the proximity of the farm location. Consult Development Agents or agricultural experts in your area) and in accordance with the nutrient requirement of the animal, the feed ration will be computed on the least cost ration within the given constraints. These constraints could include non-availability or limited availability of green fodder and/or concentrate (cereals) cattle feed, affordability of milk producers to purchase specific feed ingredients from the market, roughage to concentrate ratio, stage of lactation and type of feed offered, etc.

- There is no fixed fodder requirement for the animals but a rule of thumb says that an animal needs daily fodder equal to 3% of its body weight.
- Dry matter (DM) intake of the animal is very important for feed formulation. Concentrates and forages contribute to the dry matter in a ration. The ratio of these two is very important, as high levels of concentrates will lower ruminal pH, resulting in a depression in milk fat and predisposing the animal to some metabolic disorders.
- Accordingly a cow that weighs:
  - 500 kg’s can consume 15 kg’s of DM per day.
  - 400 kg’s cow can consume 12 kg’s of DM per day.

General assumptions for the percent dry matter are as follows:

- Grain = 89% dry matter.
- Dry hay = 90% dry matter.
- Grain Silage = 25-35% dry matter.

• Hay/balled = 35-60% dry matter.
• Grass has 20% DM while concentrates have 90% DM.

Example: Conversion of DM into animal feed as it is.

Feed source kg's, as-fed x Dry Matter, % = Kg's, dry matter

- Hay 2.25 x 90/100 = 2.025
- Grain 4.95 x 89/100 = 4.40

Total = 6.425

Therefore, total Kg’s DMI from feed sources other than pasture = 6.425.

5. Written Test

Module 9 List of assessment points

Question 1 Is it enough to feed only grass and forage feeds to dairy cattle? Why? Explain the reasons.

Question 2 What are the side effects of feeding dairy cattle on concentrates/cereals as much as they can? Why? Explain the reasons.

Question 3 What is the percentage of grass and forage out of the total cattle feed ration? Explain the reasons.

6. Practical Activities Procedure

Module 9 Description of practical tasks

Practical task 1 List three grasses and forage feed types for cattle among those found in your area?

List three concentrate/cereals feed types among those found in your area?

Prepare a balanced ration based on animal feed types that you mentioned above.
MODULE TEN: FEED THE MILKING DAIRY ANIMALS

Duration: 8 hours

1. General Description of Competencies of the Module

This module explains the importance of good quality feed for the purpose of improving the time needed. The discussion focusing on feeding milking animals is made in terms of heifers’ first service/heat, good calves (off-springs), increase milk yield and productivity for a longer reproductive period.

2. Learning Outcomes

At the end of this Module the trainee will be able to:

- Select various feed types to prepare balanced ration and store it properly.
- Decide on an appropriate feeding scheme.
- Feed dairy animals enough feed and potable water every day.

3. Description of Learning activities (operations guide)

- Read and understand points in the Information Sheet.
- Information Sheet 1-Identifying suitable animal feed types.
- Information Sheet 2-Do the contents of daily balanced ration.
- Using practical procedures, prepare silage.
- Next do exercises under Written Test (trainee’s assessment methodology).

4. Information Sheet

<table>
<thead>
<tr>
<th>Module 10: Information</th>
<th>Feed dairy cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>The two types of animal feeds are:</td>
<td></td>
</tr>
<tr>
<td>- Grasses and forage feed types.</td>
<td></td>
</tr>
<tr>
<td>- Concentrate feed types.</td>
<td></td>
</tr>
<tr>
<td>1. Grass and forage feed types includes the following:</td>
<td></td>
</tr>
<tr>
<td>- Grass: Green, or cut and stored as hay as well as silage.</td>
<td></td>
</tr>
<tr>
<td>- Crop residues, for example:</td>
<td></td>
</tr>
<tr>
<td>o Straw and bran of teff, barley, and wheat.</td>
<td></td>
</tr>
<tr>
<td>o Stem and leaves of maize and sorghum.</td>
<td></td>
</tr>
</tbody>
</table>
In addition, forage crops developed for the purpose of animal feed (for instance among green forage animal feeds Alfa-Alfa, Lacunae, Sesbania, Desmodium and Lab-lab are the major ones). The protein content of these forage crops is double in amount as compared to the protein found in grass species. Therefore, forage crops are very much important.

Next you will look into how you have to feed these forage crops to dairy cattle.

1.1. Zero-grazing system

Zero-grazing system is a feeding system in which dairy cattle remain tethered in the barn/shed and are provided with green grass and forage after it is cut from the grazing field, carried to the barn and chopped down into small pieces.

Advantages of cut and carry (zero) grazing

- Increase the productivity of the grazing field.
- Proper use of the forage.
- As the cattle stay under shade they will not be subject to unnecessary whether change.
- The amount of feeding space requirement of a dairy cow is smaller as compared to other grazing systems.
- Reduces the cost incurred for fencing to partition the grazing field and costs for making water troughs.
- As the cut forage wilts, it reduces the chance of occurrence of bloat.
- Milk yield is almost stable (has less day to day milk yield variation.

Disadvantages of zero-grazing system

- It requires the cost of cutting, carrying and feeding.
- It requires the cost of manpower and water to clean the barn which easily gets dirty as the cattle are fed in the barn.
- It reduces the physical exercise of the cattle.

1.2. Grazing system

A. Feeding by grazing

Natural Pasture: Includes forage plants grown naturally due to favourable environmental conditions but doesn’t include improved exotic forage
plants.

Improved man-made pasture: Includes sawing and developing selected high value grass and forage crops.

Advantages of direct grazing

- Do not require much manpower /reduces the cost of manpower/.
- Do not require cost of machinery to cut and transport.
- It is not time consuming.

Disadvantages of direct grazing

- Results in denuded grazing land as well as soil erosion.
- Helps the multiplication of important feed plants and depletion of forage plants.
- Reduces the burden of livestock on the grazing land.

B. During grazing

As soon as the rain starts, plants start to sprout (grow). Even if they have higher amounts of protein and water, these young plants cause diarrhoea when livestock feed on them. The protein will be wasted together with the watery diarrhoea. The protein as well cause higher level of fermentation with accumulation of higher volume of air resulting bloat and finally may result in death. On the other hand, the nutritional value of feed plants reduces too much after flowering and seed making. Therefore, feeding forage plants at the middle of their growing age helps to get appropriate nutritional value. Furthermore, draining swampy grazing land helps to avoid trampling of forage crops and facilitates their growth as well. In addition, it protects livestock from water born diseases.

C. Improving the soil fertility of grazing land

To improve the soil fertility of grazing lands as well as to enhance better growth and secure better nutritional content of the forage crops, use the following two methods:

- Man-made fertilizer: Add 200 kg's of urea per hectare.

  Instruction:

  - Use 1/3rd /67 kg's/ at the start of short (belg) rainy season.
- And then use 2/3rd /133 kg’s/ at the start of long (kiremit) rainy season.

- Manure: Add manure on the sparse (bare) land before the plants cover the grazing land since they start to grow as they get rain water. Then the manure will dry due to the heat from the sunshine so that when it gets rain it holds water and decomposes to come down to the roots of the plants which will improve the water holding capacity of the soil as well as enhance growth of the forage plants.

Management and use of grazing Lands:

A. Limit the carrying capacity of the grazing land

Based on the quality and productivity level of the grazing land it requires to decide on the carrying capacity (number of livestock to graze on). If the grazing land is over grazed, it may result in bare land with soil erosion. Livestock grazing on this land will be emaciated as they do not get good quality forage in sufficient amount. Under grazing is also not advised. Therefore, it is important to allow sufficient number of livestock to graze.

B. Grazing systems

Identify the grazing system based on the size of the grazing land, number of livestock, manpower availability, financial capacity, and other factors and allow one of the following grazing systems.

i. Free grazing system

Without dividing the grazing land by fence and season and allowing grazing through following the livestock is called free grazing.

Free grazing has the following advantages as compared to zero-grazing and alternative grazing systems:

• Do not require much manpower to cut and transport.
• Saves the time required to cut, transport and feed.
• Allows livestock for physical exercise.
• Reduces the cost of machinery to cut and transport.
• Reduces the cost of fencing and water troughs.

Free grazing has the following disadvantages
- As livestock trample over feed plants and over graze them free grazing results in bare land.
- As compared to zero grazing, it is difficult to control bloating in the rainy season.
- It gives the chance for the spread of organisms that causes livestock diseases.

**ii. Rotational (alternative) grazing system**

Is a grazing system by dividing the grazing land based on the land size, forage type as well as deciding on how many livestock can sufficiently feed on one division and to which category of livestock should priority be given, and allowing grazing by making partition on rotational/alternative basis.

Advantages of alternative grazing system over free grazing system:

- Availability of animal feed either in dry or wet season.
- Allows timely use of the plant either by cutting or grazing.
- Allows identification and elimination of unwanted plants.
- Allows control of external parasites on the grazing land.
- Increases the carrying capacity of the grazing land.

Disadvantages of as compared to free grazing system:

- Demands the provision of sufficient water troughs as well as costs for additional fences

**iii. Strip grazing system**

As part of rotational grazing system allowing grazing for limited number of hours by creating strips and moving it using electric fences in a confined feeding paddock.

Advantages of strip grazing:

- Enhances the growth of pasture plants.
- Allows control of external parasites like ticks.
- Increases the carrying capacity of the grazing land.

Disadvantages of strip grazing:

- Requires higher amount of cost for electric wires as well as for
To provide dairy cattle with required type of feed, in Information Sheet 1 you have seen how to feed grasses and forage feed types. Now you will see how to feed concentrate feed types.

2. **Concentrate Feed:** It includes the following:
   - Various types of cereal products and by-products. An example is leftover from maize, sorghum, barley, wheat, etc products as well as by-products.
   - Industrial by-products: Agro-industrial by-products, for example:
     - Dry grain by-products (wheat/barley bran, shorts, middling, Screenings).
     - Wet grain by-products (brewer's grains).
     - Pulps (e.g. beet, citrus).
     - Cakes/meal (for example noug, cottonseed, sunflower, groundnut, linseed, soy meal, rapeseed meal).
     - Others like molasses, pollard as well as dairy feed ration prepared in commercial ration formulation plants.

3. **Prepare Feeding Strategy:** Feed supplementary balanced ration to dairy cattle.

   The need for supplementary dairy feed is because dairy cattle cannot maintain their body weight as well as produce milk only by feeding on hay, straw and grass.

   **a) Sources of supplementary balanced ration:**
   - Source of carbohydrate/energy raw materials: Maize, barely, barley bran, brewery's malt, wheat and wheat bran, wheat husk.
   - Source of protein raw materials: Animal by-products, oil pressing by-products, in general known as oil-seed cakes or oil cakes.
   - Sources of vitamins: Alfa-Alfa and fish oil.
   - Sources of minerals: Grinded bone, grinded lime stone, salt, grinded bone and meat.
b) Balance between feed ration and hay feeding- amount distribution

If dairy cows feed only on hay they produce small amount of milk since they cannot get enough nutrients. Like this if dairy cows are allowed to feed only on ration problems will result on their digestive organs and impair their health. Among these, rumen bloat, constipation may result. Furthermore, the fat content of the milk will be lower. Therefore, the amount of hay shall be 40 - 50% as compared to the balanced ration.

c) Combination of dairy feed- balanced ration

A cow shall feed on equal to 2.5 kg's dry matter per day for every 100 kg's of her live weight (example, if the cow weighs 500 kg's; it means that the cow shall feed on 12.5 kg's of dry matter per day).

- Every kilogram of balanced ration given to one improved exotic or hybrid cow will make her produce 2.5 litres of milk.
- Pregnant cows require 30% balanced ration and 70% hay mix.
- Pregnant cows require half, 1.5, 2 and 2.5 kilograms of supplementary balanced ration per day when they have 6, 5, 3 and 2 months to go to delivery, respectively.

d) Dairy cattle water consumption

Factors that determine the water consumption of dairy cattle:

- The physical weight of dairy cattle.
- Weather.
- Amount of milk production.

Therefore:

- For every litre of milk a cow needs to drink 3-5 litres of water.
- Cattle living in hot weather need more amount of water than those living in cold weather.

Heavy and spent cows need 37-45 litres of water per day while at the last months of pregnancy a cow may drink up to 70 litres per day.
**Information Sheet 1: Identify suitable feed sources.**

Identify and list down animal feed types which can be used to feed dairy cattle in the locality where trainees live in. List down according to the categories given below:

- **Grass and forage feed types:** Grasses in grazing lands, hay, forage crops that can be cultivated, list like this and identify and evaluate also quality and availability with seasonal variation
- **Concentrate feed types:** Oil-seed cakes, brewery's malt, and keep on listing like this and also identify and evaluate quality and costs (affordability) as well as continuous availability throughout the year.

**Information Sheet 2: Contents of daily balanced feed**

Discuss with trainees to prepare daily feed ration based on the information provided earlier. In addition, by considering the lists of available animal feeds (in the trainee’s locality as an example), direct the trainees to formulate a daily feed ration as if they have one cross-bred cow, based on the formula given below.

**Daily feed ration for a 250 Kg’s of cow**

For good reproduction and sufficient milk yield a cow has to feed on minimum amount of 16-18 kg’s of various and balanced feed ration. Out of these daily feed amount:

- Grass and forage, 12-13.5 kg’s grass and forage plants = \((16 - 18) \times \frac{3}{4}\)th
- Concentrate, 4-4.5 kg’s of bran, husk, brewery’s malt, molasses, etc = \((16 - 18) \times \frac{1}{4}\)th :
- \(\frac{1}{2}\) (half) kilo minerals (salt, mineral lick block, locally known as Bole or Horra.
- Add sufficient amount of water, for one cattle 150 litres of water.

**Note:** One milking cow needs to feed on 0.45 kg’s of balanced feed for every litre of milk yield.
5. Written Test

Module 10

List of assessment points

The live weight of a cross-bred cow is 300 kg's. The cow yields 15 litres of milk per day:

- In general, how many kg of feed should the cow feed on daily?
- From the total daily amount of feed provided to the cow how many percentages shall be grass and forage? And how many percentages should concentrates be?
- How many litres of water does the cow need per day?

Trainees name: ____________________________

Submit your answers to your trainer for evaluation.

6. Practical Activity Procedures

Module 10

List of practical tasks

Prepare balanced ration based on the information given in the column at right. If you have questions consult your trainer.

1. Select, prepare and store balanced ration.

   A. What does balanced ration include? Based on points mentioned below, select what is available in your area?
      - Grass and forage (hay, forage crops, silage, pasture, etc).
      - Concentrate feed types (bran, husk, coarsely grounded cereals, etc).
      - Minerals (salt, mineral blocks, mineral soil types like Bole/Horra, etc).
      - Urea molasses treated hay, bran, husk, etc.

   B. Estimate and the amount of feed to be provided per day per cow

   C. Prepare balanced feed formula out of the daily feed types to be provided per day.
      i. Percentage of grass and forage.
      ii. Percentage of concentrates.
iii. Percentages of mineral mix.

2. Prepare feeding strategy to provide and feed the daily feed amount, two or three times a day.

3. In a fixed time per day allow sufficient water as much as they can (ad libitum - as much as the animal chooses to drink).
MODULE ELEVEN: FOLLOWUP THE PREGNANT COW/HEIFER AND ASSIST DELIVERY

Duration: 8 hours

1. General Description of Competencies of the Module

This Module focuses on issues of identifying dairy cattle reproductive cycle and the application of breeding strategy of heifers and cows. It also deals with on how the trainee would be able to acquire the knowledge, skills and relevant attitude on how to identify and manage the entire breeding process.

2. Learning Outcomes

At the end of this Module trainees will be able to:

- Decide on suitable breeding scheme by understanding the types of cattle breeding systems.
- Identify whether cows/heifers are in heat or not.
- Breed those cows/heifers in heat.

3. Description of Learning Activities (operations guide)

- Initiate discussion with trainees about what the kind of animal breeding methods in their immediate environment and discuss their experience accordingly
- Next read and understand the information provided in Information Sheet 1.
- Answer the questions and accomplish the practical tasks provided under Practical Procedures
- Next answer the questions provided under the Trainees' Assessment (Written Test) part.

4. Information sheet

<table>
<thead>
<tr>
<th>Module 11: Information Sheet 1</th>
<th>Methods of breeding dairy cattle</th>
</tr>
</thead>
</table>
1. Decide on the strategy that you would like to apply on your dairy cattle. | a) Types of breeding dairy cattle |
   a) Types of breeding dairy cattle | 1. Cross breeding of different dairy breeds |
     1. Cross breeding of different dairy breeds | In Amhara Regional State, farmers at Fogera, cross-breed indigenous |

Training Manual for Farmers, Rural Women and Youth
cattle with exotic/improved Holstein Friesian cattle. Cross-breeding results in better reproductive traits and other highly required cattle behaviours that may not occur in other dairy cattle breeds. The disadvantages of cross-breeding among others, are that cross-bred cattle need more amount of feed than indigenous breeds, require better management skills (skilled manpower), and reduce resistance capacity against disease and hardship.

II. Cross-breeding of related dairy cattle

This technique of breeding takes place among blood related dairy cattle. The advantage of breeding related dairy cattle is that it sustains the original traits (behaviours) of dairy cattle. This means, the breed herd will remain being similar in colour, physical appearance, yield (product), etc.

On the other hand the drawback of this breeding technique is the fact that it strengthens weak behaviours, and what is more during culling a number of the cattle could be avoided which results in diminishing cattle population, with the long term impact of affecting capital accumulation.

b) Methods of dairy cattle breeding (breeding strategy)

Breeding methods: Breeding can be achieved through natural service or artificial insemination, and irrespective of the method, the objective is to achieve increased chances of conception.

I. Natural service: This is where the bull serves the cows/heifers in heat. Natural mating can be done in two ways:

- **Free/pasture mating:** This method of mating is practiced by farmers who own bulls which run full time with the cows. One bull can serve 20-25 cows.

  Its advantage is that it doesn’t require heat detection, while lack of accurate records and possibility of transmission of reproductive diseases (brucellosis) is its limitation.

  **Hand mating:** The bull is enclosed in its pen and the cows are brought in when they show signs of heat. Most small-scale farmers practice this method since bulls are owned by few farmers and others bring their cows for service at an agreed fee. The advantage is that it is easy to keep accurate records while the disadvantage is it requires farmers to detect heat.
Increasing the chances of conception through natural service:

- Take the cow to the bull as soon as you detected it is in heat and leave it for at least twelve hours.
- Young inexperienced heifers should be mated with old experienced bulls.
- Young inexperienced bulls should be given to old experienced cows.
- The bull should be kept fit and in good health particularly the legs and feet.

The advantages are:

- The bull can easily identify the cow/heifer in heat and serve in time.
- Using a bull is profitable in areas where there is no AI service coverage.
- Reduces the chance of cows/heifers coming to heat without service.
- Helps the cow/heifer to come to heat.
- The cow has an opportunity to be served more than once; this increase the chance of conception.
- The semen is fresh and of good quality since there is no handling.
- Where the farmer does not own a bull, cost of service is lower compared to A.I.

Natural service has the following disadvantages:

- To avoid the in breeding of one family of dairy herd, replacing the bull every three years necessitate additional cost to the smallholder dairy farmer.
- Cows/heifers may show repeated heat if the breeding bull by chance has sterile semen. As a result the number of calves and milk yield reduces.
- Rearing a bull is not economical especially to a small holder farmer
- There is risk of injury to the cow/heifer in the process of mating.
- There is risk of spreading breeding diseases.
- There is risk of inbreeding if the bull is not changed frequently.
- There is no opportunity of selecting the type of bull the owner wants.

II. Artificial Insemination

Artificial insemination popularly referred to as AI is the process of using bull semen to serve the cow/heifer in heat by human hand. AI is one of the breeding methods that contributes to the development of the dairy sector
with worldwide coverage since many years. The process of artificial insemination starts with a healthy bull, that is disease free and producing ample quantities of high quality semen. The fertility of the cow is also important, the competency of the inseminator and a clean environment. Farmers are encouraged to use semen from proven bulls which is obtained from AI centres and registered service providers.

Benefits of Artificial Insemination

- Semen from one bull has got the chance to serve many more cows/heifers.
- It is cost effective since the farmer does not have to rear a bull and thus saves cost.
- Avoids the problems associated with accidental use of sterile bulls.
- Avoids the risk of physical injury from pressure by big bulls over smaller cows during mating.
- Prevention of venereal diseases; when handled properly, there is no chance of spread of breeding diseases.
- Indefinite preservation of genetic materials of low cost enabling wide testing and selection of bulls.
- Enhances genetic progress as best bulls are used widely nationally and internationally.
- Small scale farmers through AI can access good bulls cheaply.
- One is able to select the bull of interest.
- It is easy to control inbreeding.
- AI is the best method of improving the genetic make-up of local breeds because it enables semen from the very best bulls to be widely available.

Disadvantages of AI

- It requires very accurate heat detection and proper timing of insemination for greater chances of conception.
- The inseminator must be trained on the technique.
- It requires high investment in equipment.
- In remote areas semen transportation cost is expensive.

2. Breed dairy cows/heifers

A) Identify the first heat of heifers
i. Age and weight at first heat

Even if the age of dairy heifers to reach first heat is known to have variations, on average cross-bred heifers reach first heat from 18-24 months old and 230-250 Kg's live weight. On the other hand for indigenous dairy breeds, it took them 2.5 to 3 years to reach to first heat even if they are known to mature at 2 years old age.

ii. Heat signs

Heat detection: This is an extremely important exercise as a missed heat translates into a wasted 21 days while efficient heat detection makes it possible to serve the animal at the right time. The average heat interval is 21 days with a range of 18 to 24 days. Duration of heat is 24 to 36 hours in exotic and crossbred cows. Several methods are used to detect heat. The most commonly used by farmers are behavioural signs and physical changes.

Signs of heat in cows/heifers

The stages and list of signs of heat are given in Table 7 below. Normally, farmer will not see all signs of heat at the same time. Some signs of heat may be absent or too weak to be observed. The standing heat period normally lasts 18-20 hours, but may be several hours shorter or longer.

Table 7: Stages and signs of heat

<table>
<thead>
<tr>
<th>Early heat</th>
<th>Standing heat</th>
<th>After heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Increased nervousness/restlessness.</td>
<td>• Standing to be mounted.</td>
<td>• Dried mucus on the tail.</td>
</tr>
<tr>
<td>• Mounting other cows.</td>
<td>• Sharp decline in milk production.</td>
<td>• Roughened tail head</td>
</tr>
<tr>
<td>• Swollen vulva.</td>
<td>• Tail bent away from the vulva.</td>
<td>• The animal refuses to be mounted.</td>
</tr>
<tr>
<td>• Licking other cows.</td>
<td>• The animal may stop eating.</td>
<td>• Streaks of saliva or signs of leaking on her flanks.</td>
</tr>
<tr>
<td>• Sniffing other cows and being sniffed.</td>
<td>• The lips of the vulva become red and swollen.</td>
<td></td>
</tr>
<tr>
<td>• Reduced feed intake and isolation from the herd.</td>
<td>• A thin, clear discharge from the vulva opening can be seen, sometimes sticking to the tail and skin surroundings.</td>
<td></td>
</tr>
</tbody>
</table>

Early signs: Watch the cow closely

Best signs: Take the cow for service

Late signs: Keep record
(a) **Standing to be mounted:** The positive sign of heat is standing to be mounted. The cow in heat stands to be mounted and does not move away.

(b) **Licking:** Both cows may be in heat.

(c) **Mounting head to head:** The cow mounting is in heat.
Signs of young bull coming to services:

- Shows erection.
- Mount other animals.
- Sniffs the vagina of cows/heifers in heat.

iii. Factors affecting heifers and bulls to come to maturity - first heat or service

- By breed and from individual to individual: Exotic breeds come to heat sooner as they grow fast.
- Proper care during pregnancy for foetal growth: If pregnant cows do not receive proper care, they could be subject to various diseases giving birth to emaciated calf with retarded growth. As a result the calf could come to heat late.
- Management of calf/heifer: If the feeding and health management of calves is poor, they will not grow well and the coming to first heat will delay.
- Environmental Factor: Very hot and cold environment is not suitable to dairy cattle and calves growing in these environmental conditions will delay to come to first heat.

iv. Management of heifers and bulls when they come to first heat and service

- Keep young bulls and heifers on average weight; not very fat (obese or not very emaciated). If they are very heavy, there may be delay or reduction in sperm/egg production. On the contrary, if they get undernourished, there will be reduced nutrition required to produce viable sperm and even if the young bull is capable of serving the cow/heifer it may not result in fertile foetus.
- Heifers shall not feed on high carbohydrate/energy feed staff because fat can accumulate in their body parts showing fattened animal behaviour that can potentially inhibit them to come to heat.

3. Identify whether cows/heifers do come to the reproductive cycle

a) A non-pregnant cow with a normal oestrus cycle will release an egg and show heat about every 21 days (variation: 18-24 days). If not served and conceived the cow/heifer will keep repeating this cycle.

b) About every 21 days non-pregnant cows are ready for breeding. They show
signs of heat. The heat period lasts about 18-20 hours.

c) Reasons for silent heat and false heat:-

- If not fed on sufficient and balanced feed ration cows lose weight; as a result heat signs may not come at the right time
- Due to health related problems, cows/heifers may not show heat signs
- Due to breed differences
- If the placenta is fully or partially retained, it may suppress the heat signs

d) Repeated breeders

Cows may come to heat repeatedly due to health problems. If this happens, show your cow to your animal health worker or veterinarian.

e) The right service time (for breeding/mating/insemination)

The right time of service is when the cow is in 'standing heat'. It stands for mounting by bull or another cow. The normal working routine to follow is:

- If the farmer observes heat early in the morning, inseminate in the afternoon of the same day.
- If the farmer observes heat in the afternoon, inseminate early next morning.

Note:

- Look carefully for signs of heat.
- Inform the AI technician quickly, within 3-5 hours of observing heat.

The best possibility for getting a cow pregnant is when insemination is done in the last half of the standing heat period or within 6-8 hours after the end of the standing heat period.

Note: The heat period is short; thus be ready to observe:

- Early morning before milking
- Afternoon before milking
- Before going to bed.

You may not see some heat signs at all. Look out for the typical discharge and for standing heat. Inseminate the cow towards the end of the heat period or at latest within 6-12 hours of the end of the heat period.
f) Be careful about feeding pregnant heifer and provision of special feed requirement

Since pregnant heifers did not finish their growth and their uterus is not well matured, over feeding may result in heavy weight gain of the foetus/calf which can cause delivery problems.

5. Written Test

Answer the following question in writing. Alternatively the questions can be posed verbally or in the form of group discussion, as this would help to assess trainees' (participants) knowledge and skill.

<table>
<thead>
<tr>
<th>Module 11</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>In what time interval does a non-pregnant heifers/cow’s reproduction cycle repeat itself?</td>
</tr>
<tr>
<td>Question 2</td>
<td>List down the signs of heat of a cow/heifer?</td>
</tr>
<tr>
<td>Question 3</td>
<td>After how many hours of showing heat sign a cow/heifer should get bull/AI service?</td>
</tr>
</tbody>
</table>
| Question 4 | From the list of breeding cattle given below, which one do you choose? Why?  
• Bull service, or  
• Artificial Insemination. |
| Question 5 | How do you detect whether a cow/heifer is in heat? |
| Question 7 | 3-4 months after bull/AI service, how do you confirm whether the cow/heifer has conceived or not (how do you diagnose whether your cow is pregnant or not)? |

Trainees' name: ________________________________

Submit your answers to your trainer for evaluation.
MODULE TWELVE: FOLLOW UP PREGNANT COW/HEIFER AND ASSIST DELIVERY

Duration: 8 hours

1. General Description of Competencies of the Module

The Module deals with the kind of care that trainees have to take when the cow/heifer get pregnant, approaches delivery and at the time of delivery. Furthermore, after delivery the kind of care to be provided to both the dam/cow and the newborn calf is discussed in this Module.

2. Learning Outcomes

At the end of this Module, trainees will be able to:

- Specially follow up pregnant cows/heifers.
- Know what to do in times of delivery.
- Follow up and control whether the new born calf has received the proper treatment or not
- Make sure that the placenta has dropped down.

3. Description of Learning Activities (operations guide)

- Read and be aware of the information provided here under:
  - Information Sheet 1: Identifying whether or not serviced cows/heifers get conceived.
  - Information Sheet 2: The steps and the preparation you have to make when pregnant cow/heifer approaches delivery time, and during delivery.
  - Information Sheet 3: What kind of care you take after the calf is delivered.
  - Information Sheet 4: What you should do during delivery, assisting delivery/calving.
  - Information Sheet 5: What kind of care you take after the calf is delivered; for the new born and the dam (cow/heifer) as well?
4. Information Sheet

<table>
<thead>
<tr>
<th>Module 12: Information Sheet 1</th>
<th>Identifying whether serviced cows/heifers got conceived</th>
</tr>
</thead>
</table>

I. Pregnancy diagnosis and identification of stages of pregnancy

1. Confirm whether the cow/heifer comes to heat again or not. Following whether a cow/heifer has conceived or not is important because:
   - If the cow/heifer repeats coming to heat it results in loss of yield.
   - If the cow conceives (become pregnant), changes her feeding nature.

Pregnancy Period

The length of pregnancy depends on:

- Breed
- Your animal (age, number of calving, calf sex, twin/single calves).
  - In terms of the sex difference of the conceived calf, male foetus lasts longer than female.
  - Stages of the cow’s reproductive years vary, since after repeated calving, the pregnancy period gets longer.
II. Signs of pregnancy at the beginning and end of term

**Signs of first term pregnancy**

- A healthy cow/heifer if comes to heat 60 days after service, it shows pregnancy.
- As compared to non pregnant times, pregnant cow/heifer starts to move slowly soon after pregnancy.
- Calf grows slowly at first and is about this size at 7 months (about one third of birth weight).
- Figure 9 is your calf just before birth. This is the correct position; legs forward with head on the legs for easy birth.

<table>
<thead>
<tr>
<th>Module 12: Information Sheet 2</th>
<th>Attend and provide especial care for pregnant cows/heifers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnant cow need to get especial feed, sufficient clean water and health care service for maintenance of her body condition, for milk production as well as for the foetal growth. Pregnant heifers shall be provided with additional feed for their growth further to the amount provided to other older cows.</td>
<td></td>
</tr>
</tbody>
</table>

**Feed pregnant cows**

In general pay due attention to pregnant cows especially after the seventh month of gestation (two months to go to delivery) in provision of better management of husbandry, feeding and health care.

a. **Feeding in the first term of pregnancy**

The nutrient requirement of the first term of pregnancy is more than pregnancy maintenance ration and less than that of the last term feeding ration. In this first term pregnancy period, in addition to pregnancy maintenance ration they need additional good quality feed (rich in nutrients) for the growth of the foetus.

b. **Importance of feeding at the last month of gestation**

When the pregnancy period is about to end as the amount of nutrient...
requirement depends on the size of the foetus the quality and quantity of their feed requirement increases. In the last trimester (3 – 4 months) of the pregnancy period, this nutrient requirement will be for the following purposes:

- Maintenance of their weight.
- For proper foetal growth and to deliver healthy calf.
- For the mammary gland and udder to have proper growth and for more milk yield after calving.
- On the contrary over feeding is not important. Therefore, you have to take maximum care when you feed pregnant cows.

c. Drying off pregnant cows/heifers
For a cow/heifer to be productive and give satisfactory milk yield, on average she has to rest (should not be milked) for the last two months of pregnancy. Even if it is known that fat will accumulate in her body parts during this non-milking period, care must be exercised so that excess fat may not obstruct the delivery process. Therefore, the main purposes of the dry period are given as follows:

- Reserving sufficient time for the cow’s body to recover and time to rebuild the mammary tissue
- When the calf is born, the dam can be able to produce sufficient colostrums to feed the new born calf.
- To assist the cow to nurture strong and healthier foetus and give birth to strong and healthier calf.
- To enable her (the cow or heifer) give more milk yield when milking is started.

Follow the following steps to dry off your pregnant cow, step by step dry off your cow 2 months before expected calving.

- Beginning of the 6th month of gestation, do not finish the milk in the udder while milking.
- Middle of the 6th month of gestation, milk less frequently.
- End of the 6th month of gestation, stop milking altogether.

Rations:- Increase the rations 1 month before expected calving. If your cow is in good condition give daily:

- Clean water (freely).
- Good quality grass (freely).
- Enough concentrates and minerals.
If your cow is in poor condition, consult your extension worker about feeding.

d. Precautions while feeding pregnant cows

Pregnant cow should receive balanced ration rich in carbohydrates /Energy, Protein, vitamins and minerals. If the feed and feeding doesn’t continue like this, the following conditions may prevail:

• The cow loses weight and become emaciated.
• During calving/delivery, the cow will become weaker to strain.
• After calving, the cow will not give much milk as she used to give.
• As the new born calf haven’t received the required nutrients in sufficient amount, the calf will be emaciated, stunned, have bowed leg and will be susceptible to diseases.

As underfeeding results in poor consequences, overfeeding also causes problems. The following are among the major problems of overfeeding:

• The foetus will be gigantic (big).
• The over weigh gain of the cow and the resultant fat accumulation narrows the birth canal by pressing her pelvic body parts from the right and left side.

The combination of these two factors could result in difficult birth (dystocia) which otherwise could have been safe and normal delivery. In worst case the cow may die out of birth complication.

Preparation before calving

• Calculate the approximate calving date from the AI/mating date.
• Pregnancy in cows lasts 274-291 days.

How do you prepare for calving?

• You know that your dairy cow gives birth about 9 months after successful AI or natural breeding.
• Consult your breeding calendar and your extension worker.

When and Why should pregnant cows be separated from the herd and looked after carefully?
The reason why pregnant cows should be kept in the barn are as follows:

- The fact that the pregnant cow will be tired to travel long distance to and from pasture/grazing area.
- To keep her close and provide her with green grass and balanced ration.
- If she is left mixed in the herd she may be attacked by others resulting in abortion, physical injury.
- To avoid disturbance and chaise that could disturb her.
- To secure her calving in a place free from dirt, dry, bedded and with sufficient air circulation.
- If she could not calve by herself to assist her in times of difficult delivery.

Prepare the calving site in the following manner:

- Always separate the calving site from the rest of the herd.
- Use a protected outside area or a calving box.
- Make the calving box at least 180 cm x 180 cm.
- Clean and disinfect it before use.
- Provide sufficient bedding where possible.
- Make sure the cow/heifer to deliver is:
  - Safe, and
  - Quiet.
- If outside, the site should be:
  - Dry.
  - Fenced.
  - Roofed, for example in rainy weather or places with no shade.
- If inside the barn, prepare a 1.8 x 1.8 m calving box outside of which are:
  - Gutter.
  - Feeder.
  - Water.
- Move dairy cows to the calving site at 270 days pregnancy. Before moving your cow to the box:
  - Clean everything.
  - Disinfect everything.
Add plenty of straw bedding (if available).
Add sand or sawdust if the floor is slippery.

Move your dairy cow to the box about 1 week before calving; about 270 days of pregnancy.

Note: Consult your breeding calendar or extension worker for further instruction.

Washing: - Wash your cow with soap and water daily to prepare for calving.

Equipment: Prepare the following equipment and store in a clean place one week before expected calving date:
- Clean bucket for water.
- Soap (bar or powder).
- Disinfectants such as alcohol and iodine (1 litre each); normally from your health care kit.
- Small bottle of tincture of iodine (make sure the iodine is not adulterated).
- A 2 m strong, clean plastic rope 1 cm thick (or an obstetrical chain).
- A 1 m strong, clean stick.
- Protective clothes.
- Sufficient water for cleaning.

Signs of approaching calving: The most important signs of approaching calving are:
- The udder grows quickly in the last weeks of pregnancy and begins secreting close to calving.
- The vulva may show swelling and discharge of mucus.
- The hip areas on each side of the tail root relaxed.

What are the signs of calving?
- 1-2 weeks before calving, the udder becomes bigger as liquid collects.
- 1-3 days before calving, the area on each side of the tail relaxes. You can feel the looseness and see the curve, as your cow is preparing for birth. Furthermore, your cow may:
  - Raise her tail.
  - Arches her back.
  - Eat less.
- Near to calving, the vulva swells and begins to discharge mucus.
- At parturition, the cow becomes restless and tries to separate if in a group. She also starts to strain intermittently. Duration of straining increases and intervals between straining shorten as the parturition process continues, with a short pause after the rupture of the water bag. Just before calving

- Your cow becomes restless and tries to separate from the herd.
- Your cow begins to strain (labour) from time to time.
- As calving progresses, she strains harder and more often.

Make sure:

- The cow/heifer is quiet
- No one disturbs cow/heifer or the cow/heifer may hold back her calf.

What do you see and then do during calving?

Normal birth - Watch carefully but do nothing if everything is normal. Next, on what you should do during the time of delivery, read the information given under Information Sheet 4

<table>
<thead>
<tr>
<th>Module 12:</th>
<th>Information Sheet 4</th>
<th>What do you do during delivery?</th>
<th>(assisting calving)</th>
</tr>
</thead>
</table>

Normal delivery

The most important thing to remember during calving:

- **Observe the cow**, but leave her alone if the calving proceeds normally.
  - First, the water bag appears in the vulva opening.
  - It breaks by itself later, so **do not break it**!
- Normally, the head and two front legs appear in the vulva opening.
- Never try to hurry your cow; you may hurt her and your calf.
- You see the water bag in the vulva opening. Never break the bag, it breaks by itself.
- The straining **stops** for a short time. Then the straining begins again, you see the two front legs, and then the head.
- **Normally**, your cow continues labour for 2-6 hours while the rest of your calf comes out.
In most cases the rest of the calf is then soon delivered. If, however, the birth stops at this point you may assist in pulling out the calf. Clean the cow well (vulva surroundings) with water and soap.

Otherwise call the veterinarian if:

- Your animal starts labour but you do not see the water bag:
  - For cows, in 6 hours.
  - For heifers, in 12 hours.
    - You see the water bag break but no part of your calf after 2-3 hours.
    - You see part of your calf but no more of the calf comes out after 30 minutes.
    - You see the head and only one front leg.
    - Do not try to turn the calf or pull the other leg out, you may hurt your cow and your calf.

Assist delivery: What kind of help should you give to your calving cow/heifer?

You may help your cow if, the head, two front legs (and maybe the front part of the body) come out but no more of the calf comes out with labour.

Clean and disinfect:

- Your hands and arms and make sure your finger nails are short.
- The area around the vulva.
- The rope or chains.
- The stick or torsion bars.
- Place a clean rope or chain around each leg of the calf at a point higher than the pastern joints.
- Pull by using a strong, clean stick as a torsion bar.
- Pulling should be out and down. Never up!
- Pull at the time the cow strains and not during the intervals between straining.
- Not more than two persons should pull. If excess force is used, the uterus will also come out with the calf or it may tear.
- Carefully tie each end of the chain or rope above the hoof joints of the calf.
- Put the stick or torsion bars through the loop of the rope or chain.
Pull:
  o Only when your cow strains.
  o Only towards your cow's udder.
  o Only with one other person.

Never pull:
  o Straight or upwards.
  o With more than one other person.

If no progress is seen, call the veterinarian. The veterinarian should also be called when:
  o The cow has shown restlessness/labour for 3-6 hours (heifer: 12 hours), but no water bag or calf appears;
  o The water bag breaks, but the calf does not appear after 2-3 hours;
  o Part of the calf appears, but there is no progress in birth for about half an hour.

If pulling correctly does not help:
  o Your cow may have twins.
  o The calf may be too big or deformed.

And in this case, you must call the vet.

<table>
<thead>
<tr>
<th>Module 12: Information Sheet 5</th>
<th>Care after calving (How do you care after the calf and the dam-cow/heifer-delivered?)</th>
</tr>
</thead>
</table>

After calving you should care for your calf and your cow.

Caring for your calf:

- Do not cut the navel cord. Your calf receives blood from the placenta.
- Remove liquid from the lungs by: By holding your calf by the hind-legs and swinging or shaking.
- Remove mucus from the mouth and nostrils. If the birth was difficult, hang the calf, head down, over a divider or likewise to let fluid run out of the lungs.

If your calf is not breathing:

- Start missing respiration by tickling the nostrils with a clean straw, by rubbing the chest area thoroughly with some straw or grass or even a piece of rough cloth or by using artificial respiration, alternately pressing...
and relaxing slowly the calf’s shoulder and front leg.

- Hanging your calf over a board and rubbing firmly. Rub from the stomach to the chest to the throat.
- Put your calf down. Put your hand in the back of your calf’s mouth and wipe out the mucus.
- Use two fingers to milk (wipe) out mucus from your calf’s nose.
- Gently rub the chest with some straw or rough cloth.

Dry the calf (or allow the cow to clean it by licking) as follows:

- Hold your calf’s front leg and shoulder and alternately press and relax.
- Slap your calf on the ribs or on the rump.
- Give your calf fresh air and let your cow lick the calf dry as soon as possible.
- If your cow cannot lick the calf, use straw to rub the calf dry.
- Dip the navel cord in tincture of iodine (do not cut the cord!). Apply an antiseptic dressing three times a day during the first 3 days. This helps healing. Give at least 1 litre of colostrums within 2 hours after birth, and another 2 litres within 6 hours (or encourage the calf to drink colostrums as soon as possible, within the first hour). If suckling is practised, encourage the calf to suckle at least four times during the first 24 hours (and remove surplus colostrums by hand milking). Suckling stimulates uterine activity and helps in expulsion of after birth.

  - Dip the navel cord in tincture of iodine.
  - Do not cut the cord.
  - Check daily for navel infections at least 2 weeks after calving.
  - Allow your calf to get colostrums by suckling.

Make sure your calf gets:

- at least 1 litre of colostrums within 2 hours of birth
- 2 more litres of colostrums within 6 hours of birth.

For 2-3 days after calving the milk (colostrums) contains:

- High amounts of proteins
- Antibodies which protect calves from disease.

You cannot use colostrums for dairy products because it coagulates when heated. So do not deliver milk to the dairy for 4-5 days after calving.
Move your calf to a separate calf box.
Place the calf in a clean, draught-free box with a lot of dry bedding.

Caring for your cow:

- Make sure the cow stands up within an hour after calving.
- Keeping the calf in front may encourage her to get up.
- Carry your calf or use a wheel-barrow.
- Do not drag your calf along the floor.
- Make sure the calf box:
  - is clean
  - is dry
  - is free from draughts
  - Has lots of dry bedding.

- Caring for your cow: Keep your cow in a place which is:
  - Clean
  - Dry
  - Warm and free from draughts.

- Make your cow stand up within 1 hour after calving, even if she does not want to.
- The cow should deliver the afterbirth within 24 hours after calving. If there is no afterbirth within 24 hours call a veterinarian for examination.
- Your cow should deliver the placenta within 12 hours after calving.
- If there is no placenta after 24 hours, call the vet.
- A reddish discharge from the vulva is normal for 2 weeks after calving.
- After 2 weeks, the discharge should become clear and then stop.
- For the 1st week after calving, feed your cow mainly foods which are:
  - Light.
  - Bulky.
  - Slightly laxative.

For instance bran and molasses with little silage or grain would do the purpose.

- After the 1st week, slowly increase the amounts of grain and silage in your cow's diet.
- Make sure that the new born calf is breathing:
  - Turn it upside down, the nose and mouth facing the ground and pat the sides of the chest.
  - Artificial respiration.
- Make sure that the placenta is detached.
- Disinfect the placenta; use sterile sharp edged.
- Make sure that the newborn calf is ready to suckle.

5. Written Test

Answer the following questions in writing.

<table>
<thead>
<tr>
<th>Module 12</th>
<th>List of assessment questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>What signs does your pregnant cow/heifer show when she approaches delivery/calving?</td>
</tr>
<tr>
<td>Question 2</td>
<td>What preparation do you do when pregnant cow/heifer approaches delivery time?</td>
</tr>
<tr>
<td>Question 3</td>
<td>What do you do after the calf is delivered?</td>
</tr>
</tbody>
</table>

Trainees' name: ________________________________

Note: You have to attempt all questions. Check your answers against the notes provided in information Sheet 1 up to 4.

6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 12</th>
<th>List of practical tasks/procedures</th>
</tr>
</thead>
</table>
| Based on the information given in the Information Sheet is, describe and list | 1. Learn what you are going to do during times of delivery/calving.
  i. For your pregnant cow/heifer that approaches the end of 9 months, list down and collect equipment/materials that help to assist delivery/calving. |
<table>
<thead>
<tr>
<th>down what you have to do when your cow/heifer approaches delivery/calving!</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii. Prepare separate calving box or room. List down what you do for the calving box or room (clean and wash well with chemical disinfectants and prepare bedding).</td>
</tr>
<tr>
<td>iii. Describe the signs that a pregnant cow/heifer will exhibit when approaching calving/delivery time.</td>
</tr>
<tr>
<td>iv. Describe the kind of care needed when a pregnant cow/heifer starts straining.</td>
</tr>
</tbody>
</table>

2. Describe the kind of care needed immediately after the calf is born.

   i. Know what you have to do around the mouth and nose of the calf.

   ii. Know what you have to do to the umbilical cord.

3. Make sure that the placenta is detached and dropped down.

   i. After how many hours should the placenta drop down?

   ii. If the placenta does not drop out after 10-12 hours of delivery, what should you do?
MODULE THIRTEEN: FOLLOW-UP THE NEW BORN CALVES STARTING FROM DELIVERY

Duration: 8 Hours

1. General Description of Competencies of the Module

Immediately after birth, calves should receive especial husbandry and management. Without such management, the future productive capacity of the calves will be lower. This Module, therefore, looks into the right husbandry management required from the trainee, explained by proper awareness/knowledge, skills and attitude, which ultimately would serve him/her raise calves for better productive adult dairy cattle.

2. Learning Outcomes

At the end of this Module, the trainee will be able to:

- Decide on the type of methods of raising calves.
- Make sure that the new born calf has got colostrums at list for a week.
- Feed the calf only on whole milk and milk replacing feed types for the next four months.
- Stop feeding milk to the calf and step by step start feeding roughage slowly after the calf is fourth month old.
- Identify major calf diseases and protect the calves’ health accordingly.

3. Description of Learning Activities (operations guide)

- Read and discuss the information provided under the following sheets:
  - Information Sheet 1: Decide on which method to raise your calf.
  - Information Sheet 2: Feeding calves’ milk and milk replacers.
  - Information Sheet 3: What are the main health problems and disease management in terms of calves?
  - Information Sheet 4: Other tasks while rearing calves:
    - How can you keep records of growth?
    - How can you dehorn your calf?
    - What is important in calves’ housing?
4. Information Sheet

<table>
<thead>
<tr>
<th>Module 13: Information Sheet</th>
<th>Decide on the method you apply to raise your calf</th>
</tr>
</thead>
</table>

1. New born calf should receive the following husbandry services:
   - Immediately after birth wipe out the mouth and nostril area with clean cloth.
   - If the calf has breathing problem, hold up the hind legs and put your calf down and then shake the calf for a while.
   - Put your hand in the back of your calf's mouth and wipe out the mucus. Trickle the nostrils so that the calf could sneeze so that accumulated dirt can get out.
   - Leave about 5 cm of the umbilicus and dip it in iodine tincture to prevent infection.
   - Dry the body of the calf with clean towel.
   - In the first week of the birth of the calf manage the calf in individually separated, clean and bedded with clean grass with feeding and water trough.
   - Give identification tag or number from 3-5 days of the birth of the calf.
   - The calf should get colostrums immediately after birth. The maximum delay to feed colostrums to the calf should not exceed 4 hours of the birth of the calf. For the next four days the calf shall be provided with colostrums.

2. Decide on how to manage your calf.
   2.1. **Advantages and disadvantages of managing calves indoors**

   **Advantages of indoor calf rearing:**
Feeding calves in a clean grass bedded indoor places prevents the calves from heavy rain, cold air and strong sunshine. As a result the calves grow fast and heifers show heat faster.

Calves will not be affected by internal and external parasites.

Disadvantages of indoor calf management:
- Requires capital to build calf box.
- Needs close supervision.

2.2. Advantages and disadvantages of managing calves outdoors:
- Advantages: It requires lesser capital.
- Disadvantages:
  - Calves will be regarded as the calf do not get balanced ration, colostrums, as well as the calf do not get protection from rain, cold and strong sunshine and as a result heifers come to heat late. In addition, calves raised in outdoors will be shorter and their milk yield is also low.
  - While out in search of pasture, as calves get soiled with dung and mud, they will be subject to disease causing agents and can easily be attacked with internal and external parasites.

2.3. Advantages and disadvantages of managing calves half indoors and half outdoors
- Under this system, calves stay indoors during the night while allowing calves to freely graze. This system reduces the cost of compartmentalizing the calf pen.
- Calves usually are found to be stunted and health wise also affected by internal and external parasites.
- As compared to indoor system, it requires lower cost of feeding.
- As compared to outdoor system, disease occurrence is lower and calves show relative better growth rate.

<table>
<thead>
<tr>
<th>Module 13: Information Sheet 2</th>
<th>Feeding calves milk and milk replacers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why do you need to feed calves separately?</td>
<td></td>
</tr>
</tbody>
</table>

Training Manual for Farmers, Rural Women and Youth
At birth the calf resembles a non-ruminant because the "fore" stomachs are not developed. Thus the calf requires milk or milk replacers and calf starters in its early days of life. During this early period, milk gets directed into the abomasum, without passing through the "fore" stomachs, by a special mechanism.

As the calf grows, it starts to nibble grass (or hay offered to it) and the "fore" stomachs become functional rapidly. Thereafter, the food taken by the animal first enters the rumen. Here the digestive process starts (before reaching the abomasum).

Calf feeding management should also be directed at addressing nutrient requirements and encouraging rumen development.

Calf feeding methods: After the first week during which the calf is left with the dam, several methods can be used for feeding depending on ease and convenience. The following are some calf feeding methods:

A. Single suckling

The calf is separated with the mother but during milking it is brought to suckle. The amount of milk the calf consumes is difficult to quantify. Some farmers will allow the calf to suckle one quarter. This method is rarely used in commercial dairies. The disadvantage is that if the calf is not present, then the cow may not let down all the milk. This method is the best in terms of hygiene as the calf gets clean milk at body temperature.

1. B. Foster mother or multiple suckling

In farms where several cows give birth at the same time, one cow can be assigned to a number of calves depending on milk production. The calves suckle in turns ensuring that each calf only suckles the designated quarter. This method is not practical in small scale farms.

a) Nipple suckling

A plastic nipple is attached to a clean bottle filled with milk and the calf is trained on how to suckle. An alternative is to attach a nipple on a short plastic hose pipe and insert the same into a bucket. The calf is then trained on how to suckle.

b) Bottle feeding

The milk is placed in a clean bottle and the calf is fed directly from the bottle. This method is tedious and slow if many calves are to be fed. There is a high
c) Bucket feeding

This is the most commonly used method and milk is placed into a bucket and the calf is trained to drink (place finger in the milk and as calf suckles your finger it takes in milk). Stainless steel buckets, where available, should be used for hygienic reasons as plastic buckets are difficult to clean. Whatever method is used, clean equipment should be used at all times. Sick calves should always be fed last to minimize cross contamination. Attempts should be made to feed milk at body temperature especially during the cold season.

How do you feed your calves? Feeding the right rations: Usually feeding calves is categorized into three:

- From birth to weaning.
- During weaning.
- After weaning.

How do you feed your calves from birth to weaning?

Week 1: After birth, your calf needs colostrums for at least 4 days for the following reasons:

- For nutrients.
- For protection against disease.
- For passing faeces the first day.

If you do not separate your calf and dam:

- Let your calf suckle freely in day 1, the first suckling is within 3 hours after birth.
- Let your calf suckle 3 times per day in days 2-4.

Each feeding time is about:
The advantages of suckling are:

- The milk is at the temperature of the udder.
- The stomach does not overfill.
- Your calf does not get scours through fast drinking.
- The milk is clean.
- You use no labour.
- Zebu breeds sometimes do not let down milk without the calf.

There are some advantages in separating your calf and dam at birth:

- Less noise and disturbance.
- You can easily teach feeding to calves that didn’t suckle.
- You can keep records of consumption.
- Nipple feeding is a good way to feed your calves.
- Buckets hang at the right height.
- Rubber nipples fit over tubes which lead into colostrums in the bucket.
- You can also use bucket feeding but nipple feeding is better:
  - it is like suckling.
  - Digestion is better.

If you use bucket feeding, you must teach your calf how to feed:

- Hold your calf’s head near the colostrums.
- Put two fingers in your calf’s mouth.
- Lower his head into the colostrums.
- When your calf tastes the colostrums remove your fingers and let him drink alone.
- Repeat until your calf can drink alone.
Remember in nipple or bucket feeding:

- Feed colostrums at the temperature of the udder and at the same time each day, this avoids fast drinking, indigestion and scours.
- Give your calf plenty of clean water.
- Feed your calves the right amount:
  - Day 1-2: 0.75-1 l (3-4 x/day).
  - Day 3: 1-1.5 l (3 x/day).
  - Day 4-7: 2-3 l (2 x/day).
- Do not overfeed your calves.
- Clean and disinfect all equipment after each feeding.

Weeks 2-7:

- Each day, your calf needs:
  - 6 litre of whole milk.
  - Concentrates (fed freely) (up to 1/2 kg/day).
  - Hay (not more than concentrates).
  - Water (fed freely).
- For weeks 2-7 you need a total amount of:
  - 250 kg of whole milk.
  - 11 kg of concentrates.
  - 5 kg of hay.
  - A calf needs at least 1/7 of his body weight in water each day.
- Concentrates contain about 20 % protein. One possible mixture is:
  - 50 % cotton seed cake
  - 50 % maize bran.
- You should use good hay and chop it into small pieces to help digestion.
  Begin feeding hay to your calves as young as 2 weeks. It helps:
  - Develop the rumen.
  - Provide vitamins.
  - Prevent anaemia and rickets.
- You can easily make calf feeders from local materials (like bamboo, used tyre, log, etc) and place them in the exercise yard. Make sure your calves get enough water. In hot climates, each calf may need more than 10 litres per day.
- Secure water buckets with a holder so your calves can drink all the water they want.

- Instead of whole milk, you can feed your calf milk replacer. One type you can make is sour milk:
  - Add 20 g of citric acid to 10 litre of milk 24 hours before feeding.
  - Keep 1/2 litre of the sour milk; you can use this instead of citric acid to make the next feed. Sour milk:
    - keeps longer, you can make enough for 3 days feed and save labour
    - Is better for your calf’s digestion.

**Note:** Add a vitamin premix if you use skim milk.

- You can also use milk replacer powder. It contains skim milk, fish and soya proteins and vegetable fat. Follow the directions for mixing with water and make sure everything is clean.

- Hang a mineral lick so that your calves can get the minerals and vitamins they need.

**Week 8-16:**

- From week 8, you can begin to wean your calf off milk:
  - reduce the amount of milk week by week
    - week 8 : 6 kg/day
    - week 9 : 6 kg/day
    - week 10 : 4 kg/day
    - week 11 : 2 kg/day
    - week 12 : 0 kg/day

- At the same time, increase the amount of:
  - Concentrates Hay/day:
    - week 8 800 g 300 g.
    - week 9 1,000 g 350 g.
    - week 10 1,200 g 400 g.
    - week 11 1,400 g 500 g.
    - week 12 1,500 g 600 g.
After week 12, ration concentrates at 1.5 kg/day and give hay freely.

- For weeks 1-16, you need a total amount of:
  - 140 kg of milk.
  - 42 kg of concentrates.
  - 15 kg of hay.
  - Water freely.

Week 17-25:

- Feed your heifers hay and water freely with a mineral lick and 1-2 kg/day of low-protein concentrates such as:
  - 25 % cotton seed cake.
  - 75 % maize bran.

Table 8: The type and amount of feed requirement for a cross-bred calf on different ages

<table>
<thead>
<tr>
<th>S. N°</th>
<th>Age on weeks</th>
<th>Litre of milk per day</th>
<th>Kg of balanced ration per day</th>
<th>Hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>5</td>
<td>Hand full</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>5</td>
<td>Hand full</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>6</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>6</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>2</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>13-40</td>
<td>0</td>
<td>1.5</td>
<td></td>
</tr>
</tbody>
</table>

The amount of hay or other grass and forage mixtures increases as the calves grow.

1. What are milk replacers for your calves? Calf feeds that can replace milk are:
   - Mixed factory products together with hay and water.
   - If the dam die and there is no cow with colostrums, a step by step preparation of artificial colostrums is given below:
     - Mix an egg with 280 Millilitres of water.
Add one tea spoon full of castor bean oil to 280 Millilitres of Lukewarm water.

And mix the egg and water mix with the castor bean oil mix.

Allow the calf to feed three times a day for four days.

Here in after allow the calf to feed only on milk.

Feed your calf dry calf feed types

1. When do calves stop feeding on milk?

   It is better to decide on the weight of a calf than its age when it comes to stop feeding milk.
   - Therefore, for heavier weight breeds cows that weighs 500 Kg’s, stop feeding milk (separate) the calf on 70 Kg’s of body weight.
   - Similarly, for smaller weight dairy cow breeds with 350 Kg’s live weight, stop feeding on milk when the calf is about 45 Kg’s.

2. Feeding calves on dry feed:

   When the calf is three weeks olds, start providing the calf with clean and fresh forage first with smaller amounts and then step by step increasing the amount per day.

   The step by step increase in amount of dry feed in addition to milk for your calf is as follows:
   - 2nd -5th weeks, feed one handful.
   - 5th -6th week old age, half kg dry feed.
   - 7th -11th week old age, 1 kg of dry feed.
   - Starting from the 12th week up to the time the calf should stop feeding on milk increase on the dry calf feed up to one and half \((1\frac{1}{2})\) Kg’s.

   The above feeding scheme works only if the amount of milk feeding is provided based on the increase in the calves age. However, if the calf has stopped feeding on milk and provided only with dry calf feed type and water, the calf shall be fed on more amount of dry calf feed types.

3. Conditions of dry feeding your calf, after ending feeding on milk:

   - Feed from 1-2 kg’s of balanced calf ration every day.
   - In case of indoor feeding system, provide sufficient (ad libitum - as
much as the calf feeds on) hay, grass and forage.

- Provide sufficient (Ad libitum as much as the calf can drink) amount of clean potable water.

### 4. Methods of training calves to feed on dry feed staffs:

- Training your calf to feed on dry feed staffs shall be started when the calf is 2-3 weeks old.

- Therefore, when calves start to feed on dry feed staffs for the first time, you can do so in the following method:
  - Put the dry balanced calf feed staff in to the milk bucket.
  - Add on some milk and.
  - Allow the calf to lick on step by step in small amounts.
  - On another method, hold on your hand small amounts of the dry calf feed and bring it close to the calf’s mouth and tongue so that the calf can lick it in step by step amounts.

### 5. The amount of dry feed requirement for calves in different ages:

Training and feed on per day per calf, the following is balanced calf ration with high nutrient quality amounts:

- From 2\textsuperscript{nd} - 3\textsuperscript{rd} weeks = 30 – 50 grams (a hand full).
- From 4\textsuperscript{th} - 6\textsuperscript{th} weeks = ½ Kg.
- From 7\textsuperscript{th} - 11\textsuperscript{th} Weeks = 1 Kg.
- From 11\textsuperscript{th} weeks onward = 1.5-2 Kg.
- In addition to the balanced ration, feed the calves on grass hay cut while green or welting green grass for 2 days as much as the calf feeds. This will secure proper calf growth.

In general, make sure that the amount of balanced ration, grass and forage feeds are sufficient. Therefore, after three months old, the calf shall put on 400 grams of weight per day.

### 6. Kinds of training your calf on dry feed staffs and quality

Among possible sources of starter dry calf feed types, some of them are the following: coarsely grinded maize, ground nut (peanut) cake, grinded fish, wheat bran, rice bran, coarsely grounded barely, and various minerals. Out of this list you can prepare calf starter feed based on the following formula given in the table below:
The primary concern in rearing the newborn calf is to ensure it remains healthy. Healthy calves have smooth and shiny coat, bright eyes, have rapid walking style and are alert. If there the calf dropped down his/her neck, with rough coat and have mucous on the nostrils; have soiled hind quarter and other signs of health problems show that the calf has health problems.

As mentioned before, colostrums are very important in preventing sickness in the first three months of life. The calf should be left with its mother for 48 hours so it starts drinking as soon as possible and as therefore gets as much colostrums as possible. In general the most important calf diseases are mentioned below:

a) Scouring or calf-diarrhoea

This is the most common disease among calves.

Symptoms of scours are:
- The dung is liquid and has a whitish colour.
- The calf appears dull and drinks slowly or refuses to drink at all.
- The dung has a strong smell.
Causes:
- Unhygienic housing; dirty calf pen or dirty bedding.
- Dirty buckets if they are used for milk feeding.
- Overfeeding of the calf with milk.
- Too little colostrums fed so that resistance of the calf is low.

Treatment:

If you suspect scouring, the calf should not be given milk. Boiled water should be given instead to prevent drying out (dehydration). It is good to add 1 teaspoon of salt and 1 teaspoon of baking-soda to the water. If no improvement is seen after one day, seek veterinary assistance.

If your calf has diarrhoea, act quickly!

- Day 1:
  - Add 9 g of sodium chloride to 1 litre of water and feed.
  - Give no other dry or liquid feed.
  - Give 3 times/day
- Day 2:
  - Mix 1.7 litre of milk with 2.6 litre of water and divide into 3 parts.
  - Give 3 times/day.
- Day 3
  - Mix 2.6 l of milk with 1.7 l of water and divide into 3 parts.
  - Give 3 times/day and continue each day until your calf is normal.

Note: In cases of severe diarrhoea, give an anti-diarrhoea agent. Consult your vet and follow directions carefully.

b) Pneumonia

Calves are most susceptible in the period just after weaning until 5-6 months of age.

Symptoms of pneumonia are:
- Coughing.
• High fever.
• Mucous from the nose and watery eyes.

Causes:
• Viruses and bacteria may be involved.
• Draught increases the risk of infection by pneumonia, especially when combined with humid conditions and lack of shelter during the rainy season.

Treatment:
• Colostrums will give the calf resistance.
• A clean, draught-free pen will prevent most cases of pneumonia.

c) Internal parasites

Symptoms:
• The calf’s condition deteriorates.
• The calf’s coat is dull, not shining.
• The dung is more liquid.

Causes:
• Worms.

Treatment:
• Regular de-worming is needed, especially at the start of the rainy season. Start de-worming the calf from 6 months onwards.
• Most animals build up a natural resistance from 2 years of age onwards.

d) External Parasites (ticks)

Symptoms:
• The skin is covered with ticks.
• The calf’s condition deteriorates.
• Anaemia occurs after a while.

Causes:
• Ticks can be brought in by cats, dogs or other animals.

Treatment:
• dip or spray acaricides-consult your animal health professionals (veterinarians)
e) Signs to watch for in healthy calves

- Dry navel.
- Ability to walk unassisted.
- Alert ears and clear eyes.
- Good body condition.
- No signs of diarrhoea.
- Resuming a normal standing posture after standing and stretching.

f) Signs to watch for in the calves' environment

- Cleanliness of calving area (for example, frequency with which bedding is changed).
- Clean, sanitized, dry, and well-ventilated housing facilities and pens.
- Availability of fresh, clean water and feed.
- If pastured, appropriate fencing, access to water, supplemental feed, and shade/shelter.

In general, diseases of calves can be caused by the following causative agents:-

A. Non-infectious diseases

- Your calf may lack some nutrients and show signs such as:
  - Rough coat.
  - Change of coat colour.
  - Loss of hair.
  - Enlarged joints.
- Make sure your calf gets:
  - Enough minerals, vitamins and concentrates.
  - Exercise, fresh air and sunshine.
- Your feeding routine may be poor:
  - Different time each day.
  - Not enough water.
- Your calf will show signs such as:
  - Lying down.
• Diarrhoea.
  • In serious cases, your calf may vomit.

- Set up a good feeding routine by:
  • Feeding at the same time each day.
  • Feeding more often if your calf is eating too fast.
  • Making sure everything is clean.

B. Bacterial and virus diseases, look out for signs of:
- Navel infections.
- Fever.
- Diarrhoea with blood or mucus.
- Coughing and breathing difficulty.

C. Parasites, look out for signs of:
- Digestive trouble.
- Poor growth.
- Diarrhoea.
- Rough coat.

What are you going to do if your calves get sick?

Isolate the sick calf in a pen away from the others. Bring a sample of faeces to the vet for analysis. Consult your vet about treatment with disinfectants, anti-diarrhoea agents or antibiotics and follow directions carefully.

- Follow his directions about treatment carefully. This will include a schedule for:
  - Deworming.
  - Vaccinations.

- Check your feeding routines:
  - Colostrums feeding.
  - Enough vitamins and minerals.
  - Hygiene.

- Check your housing and grazing routines:
  - Good temperature and ventilation.
- No overcrowding.
- Good hygiene.
- No feeding from ground or near wet areas.
- Moving pastures and no overcrowding.
- Free from insects.

  o Give the right medicine at the right time.

**What are the main ways to prevent health problems?**

  o Good feeding of pregnant cows and hygiene during calving.
  o Early feeding with colostrums and enough hay, concentrates, vitamins and minerals as your calves grow.
  o Clean, dry housing with good ventilation:
  o Separate sick calves.
  o Do not mix calves of different ages.
    - Medicines, injections and sprays given at the right time in consultation with your vet.

<table>
<thead>
<tr>
<th>Module 13:</th>
<th>Information Sheet 4</th>
<th>Other tasks while rearing calves</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How can you keep records of growth?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• When you separate your calf from the dam, tag the ear.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Weigh your calf at birth and each month after birth; keep a record of weight gain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Growth should be at least 500 g/day.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• If you cannot weigh your calf, measure the breast circumference:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**How can you dehorn your calf?**

• Clip hair away from the horn bud.
• Wipe the bud clean with spirit or a cleansing solution.
• Dip a wooden handled brush into collodion (ask your vet for an available chemical to do the same).
• Apply a small amount to the horn bud and rub in.
• Do not touch the surrounding skin.
- After the collodion is dry apply again without rubbing.

What is important in housing?

- Good temperature and ventilation with no drafts.
- Separate calf pens to:
  - Reduce disease and parasites.
  - Allow calf to eat his whole ration.
  - Allow you to control feeding.
- If you cannot have a separate calf pen:
  - Tie your calf in the cow shed.
  - Separate your calf from the dam.
- Make sure the floor slopes to keep the calf's area dry.

Your calf needs more space at 8 weeks, than at 4 weeks. The width of the pen should be more than the calf's shoulder height. You have little space on your farm. Design individual calf pens, so you can change them into group pens or take them to pieces and store them leaving only the corner posts. Pole holders hold runners for use as a group pen. Add dividers for individual pens. The group pen leads to an open area for exercise. The extended roof provides shade and shelter. Fence the exercise area. You can use ropes from local materials (sisals, plastic ropes, etc) for tying; however staples and nails are dangerous.

Use ropes in the same way for individual pens.

These calf pens have only 1 bucket. They are suitable for feeding calves in the first month:

- For milk feeding
- For concentrate feeding.

After weaning, the pen should have 2 buckets:

- One for water (fed freely)
- One for concentrates (fed freely).

- Do not mix water and concentrates. The mixture becomes sour and causes digestive problems.
- If you have no bedding, make a slatted floor to give your calf a dry resting place.
- Slats should be at right angles to the long side.
- This shape allows droppings to pass easily.
- Slat to slat distance can be from 20-25 mm.

5. Written Test

<table>
<thead>
<tr>
<th>Module 13</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>Explain the pattern of growth of a calf without having colostrums?</td>
</tr>
</tbody>
</table>
| Question 2 | What is your decision for feeding your calf in Week 1:
- Why do you allow your calf to suckle?
- Separating calf and dam, then which way are you going to feed your calf? Why?
  - Nipple feeding. |
| Question 3 | Under what kind of husbandry should a calf grow to make better yielding dairy cow? |
| Question 4 | When should a calf stop feeding on milk and milk replacers and start feeding on forage? |
| Question 5 | What do you know about calf rearing?
- What does it include growing a calf?
  - How do you decide about the system of growing your calf?
  - Write down the list of important calf diseases?
  - What do you have to prepare to feed your calf on milk and milk replacer?
  - How do you introduce your calf to forage and grass? |
| Question 6 | For how long should you keep to ensuring your calf has colostrums? |
Trainees name: __________________________________________

Submit your answers to your trainer for evaluation.

6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 13</th>
<th>List of practical procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>What steps should you follow in supporting the growth of your newborn calf?</td>
<td>1. Prepare artificial milk replacer as it is given in Information Sheet 1.</td>
</tr>
<tr>
<td></td>
<td>2. Based on the Information Sheet 2, prepare 10 kg of balanced ration for your calf.</td>
</tr>
</tbody>
</table>
MODULE FOURTEEN: MILK THE COWS

Duration: 24 hours

1. General Description of Competencies of the Module

This Module focuses on the skills that are required for milking and looking after dairy cows. In addition, the skills of how to milk cows quickly and cleanly without stressing the cow and spoiling the milk are also the themes of the Module.

2. Learning Outcomes

After completing this module, the trainee will be able to:

- Identify and prepare utility goods and materials for milking.
- Prepare the cow for milking.
- Milk the cows.
- Do the after milking task properly.

3. Description of Learning Activities (operations guide)

- Read carefully the points provided under Information Sheet.
  - Information Sheet 1-What should you know about milking?
  - Information Sheet 2-How do you prepare yourself for milking?
  - Information Sheet 3-How do you milk your cow?
- Answer the questions given under the Written Test, and then evaluate your answers by your trainer.
- Do the final Written Test
- Submit your answers to your trainer for evaluation.
- If the evaluation done by your trainer is satisfactory, proceed to the next module; otherwise do the Information Sheet and the Written Test again.
4. Information Sheet

<table>
<thead>
<tr>
<th>Module 14: Information Sheet</th>
<th>What should you know about milking?</th>
</tr>
</thead>
</table>

**Introduction: Milking**

Milking means drawing out the milk accumulated in the udder and teat of the cow. Under all milking methods, either by hand or machine milking, milking skill is the ability to completely or partially empty the milk from the cow’s udder in a limited period of time on regular time interval. Before starting to milk your cow, try to answer the following questions:-

How do you prepare for milking? You should know how to prepare:

- Your milk shed.
- Your equipment.
- Your cow.
- Yourself.

How do you milk your cow? You should know how to:

- Check your milk.
- Milk correctly.

What do you do with your milk? You should know how to:

- Store your milk.
- Deliver your milk.

How do you care for utensils? You should know how to:

- Wash utensils.
- Store and dry utensils.

What is important in milking your cow? To produce high quality milk:

- Milk your cow correctly
- Keep everything clean.

Incorrect milking and poor hygiene give you low quality milk.

If you are sick do not milk your cow. You could pass your disease onto others.
Organize work well and make sure everything is present at the milking shed before milking starts. This has many benefits:

- The milker will not waste time searching for items after milking has started. Time saving.
- Milking can be carried out immediately after washing the udder. Make maximum use of the cow’s let-down reflexes, which are present 5-7 minutes after washing. Milking is then easy, takes a short time, and no residual milk remains in the udder.
- Milk should be brought straight to the churn and strained after milking. Do not leave milk in an open pail exposed to dirt and dust. This affects the milk quality.

One udder cloth for each cow greatly reduces the risk of spreading mastitis from one cow to another. Never put an udder cloth from a cow’s udder back in the bucket of water with the clean cloths. Use a basket or some other container for the dirty cloths.

Use the milking pail only for milk. If it is used for washing udder cloths, carrying concentrates or other purposes, the pail may well contaminate the milk during the next milking, with harmful particles left in the pail.

i) The environment-Prepare your milking shed (Parlour):

- A milking shed (parlour) which can be permanent or movable should be constructed. It should be located away from any smells.
- The floor of shed should be clean and dry and if possible have a cement floor for ease of cleaning.
- The shed should be cleaned after every milking and animals kept off outside milking time.
- Therefore, before every milking.
  - Clean the milking shed.
  - Sweep the floor.
  - Wash the floor and walls with a disinfectant.

ii) Prepare your cow:

It is important that you have to milk your cow gently and slowly while
creating no stress and no harm to the cow. If milking is hectic and with inhumane handling of the cow, it may result in harmful injury to the teat so that disease causing organisms could get entry and cause disease as well as it will reduce the amount of milk to be collected. Therefore, during milking the cow should be handled with care. Therefore, how to handle your cow during milking is described below: Keep the surrounding quite

- Do not scare your cows or distress them by shouting, beating or kicking. A scared or hurt dairy cow will not let down milk.
- A relaxed cow lets down milk easier.

iii) Provide feed to your milking cow based on her milk yield

- Give your cow a little concentrate while you milk her. This helps her to stay calm.
- Do not feed hay or silage while milking. The dust may contaminate the milk.

iv) Washing your cow

Always wash your cow before milking. Regular washing of your cow before you start milking will make your cow comfortable and this is known to facilitate the milk let down. Follow the steps given below to wash your cow:

- 1st - Do not wet wash the other body parts of the cow. Only brush dirt and loose hair from the side and back leg of the cow.
- 2nd - Wet wash the teats and lower udder with a clean cloth and clean water. If teats are not wet washed, the milker's hands will rub off dirt during milking.
- After washing the udder, wring the cloth and wipe all water off the udder with the wringed cloth. Since if water is left on the udder, dirty drops may fall into the milk during milking.
- After washing and wiping off the udder, do not put the used cloth back in the bucket with the clean cloths. The dirty cloth will spread dirt and bacteria to the clean cloths and diseases will spread from one cow to another.
- 3rd - Add 10 cc or millilitre of 12 % chlorine bleach to one litre of water which will disinfect the udder but does not taint the milk. Or use Savalon as per the instruction.
o Wring (squeeze) the cloth.

o Wipe off the teats and udder with the same wringed cloth.

o Throw the used udder cloth in a basket, not back in the bucket.

Note:

- Washing stimulates the cow’s udder and the cow produces a hormone called oxytocin. The blood stream carries oxytocin from the brain, where it is produced, to the udder.

- In the udder, oxytocin causes cells surrounding to contract. These cells expel the milk towards the teats, from where it can be milked out. This is the cow’s reflex for let-down of milk. The production of oxytocin and subsequent active let-down of milk lasts only 5-7 minutes. Therefore, start milking immediately after washing. Aim to empty the udder within 7 minutes. If milking takes longer it will be hard to empty the udder, and milk will remain in the udder.

- Do not interrupt milking before the udder is empty. The cow’s let-down reflexes will cease by the time you start milking again, making the milking hard and unpleasant for both the cow and the milker.

v) Prepare your equipment

Milking equipment:

- Use seamless aluminium or stainless steel cans for milking and storing milk. Plastic container is difficult to clean.

- Clean utensils immediately after milking or after emptying milk: rinse with cold water, scrub with a brush using hot water with detergent then rinse with cold water.

- Place upside down on a rack and dry in the sun.

- Store utensils in a safe, clean and well ventilated room.

- Make sure your equipment is clean. Bacteria multiply quickly in dirty equipment.

Make sure everything you need for the milking is ready before you start milking:

o One udder cloth for each cow in a bucket of clean water.

o A stool for the milker.

o A basket to throw the udder cloths in after use.
vi) Preparing yourself (as a milker)

- Make sure you and your clothes are clean. Finish all cleaning and sweep before milking.
- Wash your hands before milking.
- Make sure your fingernails are short. Long fingernails may hurt your cows. Therefore, maintain short nails and hair (for ladies, cover the head when milking)
- Wash hands and make sure clothes are clean before milking.
- The milker/you should be healthy and clean.
- Never smoke during milking time.
- Milk quickly and completely without interruptions.

vii) Milk on a regular time every day

If you milk your cow twice a day and on a fixed time per day (or regular basis) with 12 hours apart, your milk yield is going to be better.

Frequency of milking: Cows milked 3 times produce 10-25% more milk than those milked twice. Cows milked 4 times produced 5-15% more milk than those milked thrice. Though there is increased milk yield with more than twice a day milking, there is extra labour and materials which has to be considered. More than twice a day milking is only recommended if economical (the extra milk pays for the extra cost of milking), for high yielding cows and for mastitis cases.

viii) Use regular milker

Dairy cows have the capacity to identify milkers and attendants that are very close to them. Therefore, cows feel good and cool towards a regular milker who treats the cow very well rather than those new milkers. The
cows will also release all the milk they have. Therefore, change of milker and milking routine will lower milk yield.

ix) The milker's behaviour

As it is stated earlier treating cows slowly and gently without causing pain and stress will make them feel safe and these results in more milk release.

1. Massaging the udder
   - Massage the back part of the udder and then the front part and the teats.
   - This helps the let down of milk.

2. Take your position as a milker
   - Sit down on a low stool beside the udder, with the milking pail between your knees.
   - Sit close to the cow.
   - Use both hands for milking.
   - Your knee will stop the cow from kicking over the pail.
   - Usually, you do not need to tie the tail or the back legs of the cow.

3. Milking
   - Check your milk; it is important and the first step in milking
     - Milk out the first milk from all four teats into a strip cup. Check the milk in the strip cup to see if it contains lumps or odd colours. If the milk looks abnormal, the cow might have mastitis.
     - Never let the fresh milk squirt on the ground. This could pass on disease if your cow is sick.
   - Moisten your hand
     - If you find it hard to milk with dry hands, you can use cream to moisten your hands.
     - Never dip your fingers in the milk to moisten your hands.
     - Never use spit to moisten your hands.
Never use water to moisten your hands during milking.

**Start milking**
- Begin milking, soon after washing.
- Squeeze milk out of the teats using your full hands around the teats. Do not try to pull the milk out.

**FIGURE 12: PROPER POSITION FOR MILKING**

A) Support the teat and wait until it is full

B) Squeeze your hand to withdraw milk

Do not pull down

- First, close the canal between the teat and the udder, using two fingers.
- Squeeze the milk out by closing the rest of the fingers firmly round the teat.
- Do not pull the teats. This can harm the inside of the teats, and they are easily infected. Strip milking can lead to mastitis.
- A rhythmic squeezing of the teats with the full hands maintains a strong let-down reflex. Repeat the same procedure sequentially, the teat is refilled from the udder and the milk can be squeezed out again.
The two hands of the milker alternate, when one hand is squeezing, the other one loosens the grip for refilling.

Do not strip milk or strongly pull the teats with two fingers. This strains the soft tissue inside the teats and irritations here very easily lead to infections *mastitis*.

**Important:** After you begin milking, do not stop until the udder is empty.

During milking, you must maintain hygiene.

Do not wet milk, which includes wetting hands with milk, water or spit, to ease the milking. It is very unhygienic, and may contaminate the milk severely.

If dry milking is difficult, use a cream with no smell or taste to moisten hands.

Keep cream clean in a closed container. Machine milking does not pose many difficulties. However, if not put to machine milking during the first lactation, it might cause several problems. Owing to teat shapes and intra-mammary pressure both teat cups and vacuum are slightly modified.

The first milk from the teats (the foremilk) usually contains a high number of bacteria. Do not mix the foremilk with the rest of the milk. Strip the foremilk in a cup, with a black plate inside (a strip cup). Examine the milk on the black plate; you can easily see lumps or abnormal colours caused by mastitis.

**Note:**

- Milk easily takes taste from the environment. If milk is left standing in an open bucket, dirt and dust particles can fall in and it can absorb smells or tastes from fodder, manure, pesticides or other substances in the environment.
- Make sure to bring the milk to the churn and strain it immediately after milking. Keep the churn in a well ventilated place out of the direct sun.
There are always bacteria in milk. In warm milk, the bacteria multiply rapidly, and will produce acids or other products which make the milk go bad. In cold milk, there are few bacteria.

Cool fresh milk quickly after milking to prevent spoilage and resulting low prices. Immediately after milking bring the milk to the collection centre where it is cooled down to a temperature where bacteria do very little damage to milk quality.

Exercise 1: Summary of practical procedures of milking

Milking

Milking is the most important activity in a dairy farm. Milk can be extracted either by hand or by machine. Hand milking is an art, which is improved with practice.

Steps:
The cow is brought to the milking parlour as calmly as possible. Frightening the animal at this stage has a negative effect on milk let down due to release of adrenaline (hormone) which has a negative effect on milk letdown. In line to this, consider the following steps:

i) Feed the cow its production ration (this is optional depending on the feeding system); this calms the animal and stimulates milk letdown.

ii) Restrain animal; tie hind legs above hock joint in the form of a figure 8. A loose knot should be used to safeguard both animal and man (applicable only for hand milking).

iii) Wash hands with soap and clean water before milking. Dry hands with towel.

iv) Test for mastitis using a strip cup — strip first few rays of milk into strip cup from each quarter and observe for any abnormalities. If mastitis is detected, the cow should be milked last.

v) Wash udder with warm clean water with disinfectant using a clean towel. Warm water also stimulates milk let down. Dry udder using a dry towel.

vi) Apply milking jelly—prevents cracking of teats and eases milking (for hand milking only)

vii) Milk quickly and completely by squeezing the teat, do not pull. Milking each cow should take 7-10 minutes at most.
viii) Use clean containers for milking.
ix) After milking: Strip the animal-getting last drops of milk from udder to avoid incomplete milking (can lead to mastitis).
x) After milking dip the teats in a teat dip (disinfectant to ensure that bacteria do not gain entry through the teat sphincter which is usually loose immediately after milking).

![Figure 13: Step by step method of hand milking](image)

4. Handling the milk

The following guidelines should be followed to avoid milk spoilage:

- Filter milk immediately after milking: Use a white filter cloth or strainer. Disinfect, wash and dry the cloth/strainer after use.
- Always handle milk in clean, preferably metal, containers.
- When transferring milk between containers, pour the milk instead of scooping since scooping may introduce spoilage bacteria.
- Do not store milk at high temperatures.
- Do not handle milk if you are sick. Seek medical treatment and resume work only when the doctor says you are fit to do so.
• Store milk in a cool clean place preferably lockable room set aside for milk only. If storing overnight, keep the milk in cold/ chilled water.
• Deliver milk to the market as soon as possible preferably in the cool morning or evening.

5. Milk storage
• Store the milk without chemicals in a lockable cool and clean place.
• Do not mix warm (morning) milk with cool (evening) milk; deliver to the collection centre separately or cool the warm milk before mixing.

6. Milk preservation
Milk is highly perishable hence it should be preserved to ensure it is safe for human consumption at the home and that it reaches the processor and/or final consumer in good condition. The success of any preservation method is highly dependent on hygiene conditions under which the milk was produced. Hence milk produced from a healthy cow, milked by a healthy milker using clean equipment will be clean and more likely to keep long. Milk can be preserved using the following simple methods:

Cooling
Cooling milk slows down the growth and activity of germs and hence prevents spoilage. Milk can be cooled through:
• Keeping under a shade.
• Dipping the containers with milk in a cold water bath, flowing stream of cooling tank.
• Keeping the milk in a refrigerator.
• Using a charcoal cooler.
• Using cooling rings: if cool (10°C or less) running water is available, you can pass it through a perforated ring so that it flows over the cans.
• Using an electrical cooling tank.

When cooling milk, loosen the lids of the cans to allow the air to escape, and make sure no water gets into the milk. Cover the cooling tank with a lid to protect the milk from insects and dust.

7. Make sure that your milk is clean
Dirt and hair fall from the cow into the milking pail during hand milking and
cause contamination. The strainer separates particles and hair from the milk, but bacteria and dirt left in the milk, reduce the quality and taste of the milk. A quick brush-off from the cow's side and leg reduces this risk. Do not wet wash because dirty water may run from the cow's body into the milk.

When your cow is empty, bring the milk to the churn and strain it with a clean filter. If the milk contains dirt, find out what it is:

- Hair?
- Skin?
- Faeces?
- Insects?

Find out where it comes from and keep it out of the milk.

- Keep lids on milk buckets.
- Handle your milk gently.
- Rough handling causes fats to oxidize or split up. This leads to tallowy or rancid tastes in your milk.
- Keep your milk in the shade.
- After milking, take the milk to the collection centre as quickly as you can. Remember to protect your milk from the sun during transport.

Note:

Most bacteria in milk come from milking utensils which are not cleaned properly. Milk residues on utensils provide good living conditions for bacteria, which contaminate the fresh milk during the next milking. To produce good quality milk with a low number of bacteria, wash all milking utensils thoroughly and follow routines:

- Rinse all milking utensils in cold water. This removes all loose particles and rinses out all water-soluble parts of the milk (i.e. protein). If you rinse immediately after milking, you clean out over 90% of all milk residue. If the milk residues dry on the utensils, it is much harder to wash them clean.
- Wash the utensils in hot water with a recommended dairy detergent using a brush. High temperatures help milk fats dissolve and help cleaning in general. Detergents soften the water, prevent milk stone forming and keep dirt in solution so that it does not attach to the surfaces.
• After washing with detergent, rinse the utensils thoroughly in clean water again.

• After washing, disinfect the utensils, by dipping them in a solution of disinfectant and water. Leave the utensils to dry after dipping in disinfectant solution. If local water is clean, rinse the utensils in clean water just before next milking.

8. How do you care for utensils?

Washing: Follow the steps given below to clean your milking utensils

• Rinse all milking utensils in cold water.

• Wash the milking utensils in hot water with detergent. Use a hand brush to scrub clean.

• After washing with detergent rinse with plenty of clean water again.

• Mix disinfectant with water, and rinse all the milking utensils in the solution.

• Always follow the instructions and keep chemicals in a safe place.

• Note: Wash and disinfect all strip cups, udder cloths and baskets.

• Leave milking utensils to dry on racks in a well-ventilated, clean and tidy place. Racks should:
  o Allow water to drain out from buckets and churns.
  o Allow air to circulate so that the insides dry quickly.
  o Be made in any available material, which is easy to clean.

Bacteria do not live on a clean, disinfected and dry surface, but if the insides remain wet, bacteria infest the utensils, and again reduce milk quality. Leave dry utensils on the racks. Fix racks in an area with little activity, dirt and dust or in a storeroom, which is clean, well ventilated, and contains no chemicals like pesticides.

9. Storing and drying of milking utensils

• When you wash the milking utensils dry them in a clean and tidy place.
  You should dry utensils in fresh air, preferably in sunlight.

• Make drying racks for milk utensils from suitable materials.
10. Written Test

<table>
<thead>
<tr>
<th>Module 14</th>
<th>List of assessment questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>How should you do to prepare your cow for milking?</td>
</tr>
<tr>
<td>Question 2</td>
<td>How do you milk your cow? Explain in detail how you withdraw milk from the udder and teat of your cow.</td>
</tr>
<tr>
<td>Question 3</td>
<td>How do keep your cow’s udder and teat clean?</td>
</tr>
<tr>
<td>Question 4</td>
<td>How do you prepare yourself to milk your cow?</td>
</tr>
<tr>
<td>Question 5</td>
<td>You have to sit properly to milk your cow. How and where should you sit?</td>
</tr>
<tr>
<td>Question 6</td>
<td>How do you keep your milk clean?</td>
</tr>
<tr>
<td>Question 7</td>
<td>How do you clean your milking utensils?</td>
</tr>
</tbody>
</table>

Trainee’s name: __________________________

Submit your answers to your trainer for evaluation.

11. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 14</th>
<th>Description of procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take a cow (or find one) and demonstrate the step to show how you milk the cow.</td>
<td>References: To help you demonstrate how you prepare and milk your cow follow the outline of procedures given below:</td>
</tr>
<tr>
<td></td>
<td>1. Preparing for milking:</td>
</tr>
<tr>
<td></td>
<td>• Prepare your milking shed; sweep and wash before milking.</td>
</tr>
<tr>
<td></td>
<td>• Prepare your cow:</td>
</tr>
<tr>
<td></td>
<td>o Relax and feed her.</td>
</tr>
<tr>
<td></td>
<td>o Brush, wash and disinfect her.</td>
</tr>
<tr>
<td></td>
<td>o Dry and massage her.</td>
</tr>
<tr>
<td></td>
<td>• Prepare your equipment-Clean and disinfect.</td>
</tr>
<tr>
<td></td>
<td>• Prepare yourself:</td>
</tr>
<tr>
<td></td>
<td>o Clean clothes and hands.</td>
</tr>
<tr>
<td></td>
<td>o Cut fingernails.</td>
</tr>
<tr>
<td></td>
<td>2. Milking:</td>
</tr>
<tr>
<td></td>
<td>• Check milk for lumps or odd colours.</td>
</tr>
<tr>
<td></td>
<td>• Sit in right position.</td>
</tr>
</tbody>
</table>
3. Handling of milk:

- Strain milk.
- Cover milk and handle gently.
- Keep milk cool and deliver quickly.

4. Caring for utensils:

- Rinse, wash, rinse and disinfect.
- Dry and store in fresh air or sunlight.

- Squeeze teats with full hands, do not pull.
- Use cream to moisten hands if necessary.
- Never moisten hands with milk, spit or water.
MODULE FIFTEEN: LOOK AFTER AND PROTECT THE HEALTH OF THE ANIMALS

Duration: 16 hours

1. General Description of Competencies of the Module

This Module looks into how trainees able to assess the health of the dairy cattle, identify their health irregularities, and how the trainees handle the overall health issues of the dairy cattle. The Module also deals with the kind of annual vaccinations required, and the means of regular follow up and monitoring strategy for the dairy.

2. Learning Outcomes

At the end of this Module the trainee will be able to:

- Identify the difference between healthy and sick animals, and impacts and cost of dairy diseases.

- Monitor, follow up and control the health of dairy animals, particularly by:
  - Identifying sick animals.
  - Being aware on what to do when animals get sick.
  - Looking after sick animals by isolating them into the isolation room.
  - Recording the type of treatment given to sick animals, follow up the treatment of sick animals according to the veterinarians order.

- Recognize disease prevention measures in terms of day to day husbandry, hygiene and sanitation, in terms of:
  - Regular vaccination against major preventable dairy cattle diseases.
  - Protecting the cattle from internal and external parasites and other pests through regular medication.

3. Description of Learning Activities (operations guide)

- Read and the information provided under the Information Sheet.
  - Information Sheet 1-Introduction; what is a disease? What is its effect?
  - Information Sheet 2-Health monitoring and measures after observing irregularities.
  - Information Sheet 3-Disease prevention and health control.
4. Information Sheet

Module 15: Information Sheet 1

Introduction: What is disease? What is its effect?

Introduction:

- Disease is broadly defined as an alteration (or a disturbance) in the structure or function of any organ or part of the body. Diseases reduce the productivity of animals and may even result in their death. Thus there will be losses from the farming enterprise.

- Disease is a change in your animal which can causes:
  - Lower production.
  - Death.
  - You to lose money.

What are the major types of disease? There are different types of disease. Some come from microorganisms:

- Bacteria.
- Virus.

Some come from parasites:

- Outside.
- Inside your animals.

Some diseases come from:

- Body problems.
- Food problems.
- Injuries.

How can disease make you lose money?

- When your animal get sick, it has lower:
  - Weight gain.
SMALL SCALE DAIRY FARMING MILK PROCESSING AND MARKETING MANUAL

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milk yield. Reproduction.</td>
</tr>
<tr>
<td></td>
<td>Your sick animal can pass the disease on to other animals.</td>
</tr>
<tr>
<td></td>
<td>You and your family can be infected with the diseases.</td>
</tr>
<tr>
<td></td>
<td>You must pay for treatment.</td>
</tr>
<tr>
<td></td>
<td>Your animal may die.</td>
</tr>
<tr>
<td></td>
<td>If your animal gets better, it may still have lower production.</td>
</tr>
</tbody>
</table>

It is common to consider diseases based on how they are caused. Infectious diseases caused by micro-organisms (e.g. bacteria and viruses) and parasitic diseases caused by various types of worms and insects receive much attention because of the possible transmission from animals to man, from one animal to another in a herd or even from animals in one herd to those in others. However, diseases resulting from metabolic, anomalous and traumatic conditions also deserve prompt attention to minimize losses.

Some of the serious diseases affecting dairy cattle are:

- **Bacteria**: Anthrax, black quarter, brucellosis, haemorrhagic septicaemia, john’s disease, mastitis, tuberculosis.
- **Viral**: Foot and mouth disease, rinderpest.
- **Parasitic**: These are of several types:
  - Ectoparasites such as lice, ticks and mites.
  - Endoparasites for example worms in alimentary tract and lungs and protozoan parasites in blood.
- **Metabolic**: Bloat, Ketosis (acetonemia), milk fever, and poisoning.
- **Anomalous**: Dystokia, prolapsed uterus/vagina, retained placenta.
- **Traumatic**: Various types of external and internal injuries (some of which may become infected with microorganisms or invaded by maggots subsequently).
Module 15: Health monitoring and measures after observing irregularities

1. Health control-regular observation

Regular observation of cattle at ease is a must, both for health control and for being able to tell whether a cow is in heat. During observation of the animal, check the following points:

- **Behaviour**: Does it react normally to its environment or is it acting strangely?
- **Attitude**: Does it carry its head, ears, body and tail as usual? And gait; is there any change in the way it moves about?
- **Condition**: Is the animal in good condition, and is it well muscled?
- Does it eat, drink and ruminate properly? After eating, cattle older than six months will be seen chewing the cud. After sometime they swallow the ball of food, which you can see as it slides down the neck into the stomach. If you continue to watch carefully, you will see after sometime that another ball of food is going in the opposite direction towards the head. The cow "burps" and starts chewing the new ball that came from the rumen part of the stomach. You say the cow is ruminating. You can measure the rumen’s activity by pressing lightly with your fist on the upper part of the left flank. The movement of the rumen expanding can be felt. Be careful not to confuse it with the breathing of the animal and beware of kicks.
- Does it urinate and defecate as usual? If a cow is being milked, the milk yield should be watched (any sudden drop in milk yield is a sign of discomfort).
- Does anything else abnormal catch your eye?

2. The sign of sick animals

What are the signs of sick animals? When your dairy animals get sick look for the following signs:

Sick cows/heifers/calves:

- Do not feed (loss of appetite) or drink.
- Loss body weight.
- Isolate themselves from the rest of the herd.
• Changes behaviours—restlessness, depression, etc.
• Have rough hair coat (have erect hair).
• Have higher or lower body temperature.
• Sometimes have tear drops.
• Changes of consistency on their faeces (watery or dry dung).
• Colour change of their faeces (dung).

Note: Animals have ‘signs’ (an objective observation), not ‘symptoms’ (complaint by human patient).

3. Isolate and take special care of sick animals

After observing the above signs of sick animals, what do you do? First of all you have to separate the sick animal from the rest of the herd and you have to call your veterinarian (Animal Health Assistant). Do the activities given under the two subtopics below:-

First of all isolate the sick animal

• It is strongly recommended to isolate unhealthy animals from the remainder of the herd.
• Beware of all body excretions and secretions (such as dung, urine, milk, blood and aborted material).
• They may contain the infectious agent and transmit the disease to other animals. Some diseases (such as tuberculosis, brucellosis and rabies) may even cause problems for humans.
• Therefore, make sure you take proper hygiene measures (cleanliness and disinfection).
• Sick animals need special care. Provide them with shade and protection against wind, fresh clean water and good quality feed.

Call for veterinary assistance

• If you find something unusual about your animal(s), you should call for veterinary assistance. This can be a veterinarian, a veterinary assistant or an animal health auxiliary.
• You may live far from veterinary assistance. If this is the case, it could be worthwhile collecting some more useful information to tell the veterinarian when you call for him. It will help him estimate
how urgent your case is. To obtain this extra information, you may do a general examination of your animal. Another option would be to ask your veterinarian if he can train somebody in your village or neighbourhood as an animal health auxiliary. Animal health auxiliaries are taught how to prevent, recognize and treat the most common diseases in their area.

4. General examination

Once again, always be careful with sick animals and be sure to respect the rules of hygiene. Abstain from further examination yourself if you have noticed strange behaviour. The following are some of the most important health signs that you have to regularly follow up:-

A. Breathing frequency.

The normal breathing frequency of:

- Adult cattle = 10-30 breaths/minute.
- A calf = 30-50 breaths/minute.

To count the number of breaths a minute, watch the right flank of the animal move out (inspiration, or breathing in) and in (expiration, or breathing out) for one minute: (1 breath = 1 inspiration + 1 expiration).

B. Pulse or heartbeat.

The normal pulse rate of:

- Adult cattle=50-80 pulse beats/minute.
- 2 months-1 year = 80-110 pulse beats/minute.
- 2 days-2 months=100-130 pulse beats/minute.

C. Temperature

The normal temperature of:

- Adult cattle=38-39°C.
- Calf (up to 1 year) = 38,5-40,5°C.
- A newly born calf =38 - 40°C.

Temperature is not necessarily a sign of fever. For instance, in adult cattle the digestion of food produces warmth that can result in a rise in body temperature. If temperature is due to fever, it is usually accompanied by shivers, faster breathing and pulse rate, the body tends to retain water and the animal might have diarrhoea. Often the ears and the legs of the animal are
cold to touch while the body is too warm.

- If you have a thermometer, you can check the temperature of the animal by inserting it into the anus for a minute. In calves, insert the thermometer one third of its length, in cattle two thirds.
  - Be careful not to lose it (keep holding it), and
  - Do not break it (do not use with restless animals), because it contains mercury which is toxic.
- If you don’t have a thermometer:
  - You may compare the warmth of the animal you suspect of fever by putting your hand on its back and comparing it with the backs of other animals that are healthy. Of course, this is just an indication.
  - Look also for the muzzle area. Normally it is wet and shining. But if there is fever (increased body temperature), the muzzle area will be dry and show cracks. You can simply compare it with other healthy animals and appreciate the difference.

D. Coat, skin, hooves and horns

A healthy animal has a shining, smooth and even coat, no skin wounds, shiny horns and hooves.

E. Mucous membranes

Just as the skin covers the outside of a body, the mucous membranes cover most of the inside: they can be seen on the inside of the mouth and the nose, under the eyelids, the inside of the vulva lips of a cow, and so on.

Check the colour of the membranes by lifting and gently turning them inside out, one by one. They should be pink (except when there is colouring of the skin continuing inside the mouth and the nose).

Look for bleeding and sores. They should not be present.

F. Lymph nodes

Lymph nodes or glands belong to the system which protects the body from disease. Lymph nodes grow in size in reaction to disease located near to them.
There are several lymph nodes that can be examined, but only the two which are the easiest to find will be described here. They are:

- **Pre-scapular lymph nodes**: locate by standing next to the shoulder of the animal and sticking your fingers halfway to two thirds down the shoulder blade under the front side of the blade. The fingers are then pointing backwards. Move your fingers over the skin until they are pointing forwards. You should feel the gland slip under your fingers.

- **Sub-iliac lymph nodes**: Can be found by making the same movement at the rear leg, except that instead of sticking your fingers under the shoulder blade, you stick them in front of the rear leg, two thirds of the way down the hip bone. Beware of kicking. Get used to the normal size of the lymph nodes by practising on healthy animals.

Your vet might teach you how to feel for other lymph nodes.

5. **Disposal of a dead animal**

If an animal is found dead, the meat should not be sold or eaten. Neither should you leave the body somewhere to rot. Preferably, it should be burnt. Otherwise it can be buried deep (3 to 4 metres) under the ground. If a diseased animal is killed in agony on farm (just before natural death), it is also not recommended that you sell or eat the meat. The body should be disposed of as described above. In practice this advice does not seem to be respected.

If you decide to slaughter a sick animal because you think it will not recover, the best is to ask for veterinary advice. Unless the disease is highly contagious, slaughtering should be done in recognized slaughterhouses. If you slaughter on farm, veterinary personnel should be present to help select the edible parts from those that should be destroyed. Beware of diseases dangerous to man, such as anthrax. In suspected cases of anthrax, do not open the body (the blood is highly contagious), and burn or bury the animal.

6. **The importance of a health record**

- A health record of an animal is a piece of paper on which you write down all dates and facts relevant to the health of each dairy cattle (Cows, Heifers, Calves, and Bulls - if there is one).

- It will remind you when to repeat a vaccination, and help you remember exactly how a disease preceded in an animal, as well as the
way the animal responded to treatment.

- The information might be needed years later, and the health record will help recall the details.
- Also it will help a new veterinarian, who might not know your farm very well yet, to give you correct advice.

7. Causes of ill health

Loss of health can have many causes, such as:

- Infectious agents (internal and external parasites such as worms & ticks, protozoa, bacteria, rickettsia, viruses and fungi).
- Nutritional deficiencies (in energy and/or proteins, minerals or vitamins) and metabolic disturbances (due to imbalances in feeding rations).
- Genetics (the animal may be born with an abnormality or acquire it).
- Accidents.
- A combination of some or many of these.

Module 15:
Information Sheet 3

Disease prevention and health control

Taking good care of your dairy cattle does not only mean treating an animal when it is sick. It also means helping the animal to avoid becoming ill. It is very important to realize that, even though treatment may eliminate the cause of the disease efficiently, the disease has already hurt the body. The effects of the disease may take longer to heal (if they do at all) than the time needed to eliminate the disease itself. Consequently, production losses may continue to be suffered after the animal has seemingly recovered. Examples of such production losses are retarded growth in calves and reduced milk production of cows after illness.

General disease prevention and protection procedures

The best is to discuss disease prevention measures with your district veterinary officer. He will give you advice that applies to your situation. The following paragraphs contain background information that can be of help to you in your discussion with him/her. Most diseases can be prevented by the same measures that enhance production! Understand and follow up the following General preventive measures:

- Hygiene-cleaning and disinfecting: Remember disinfection is useless
without cleaning thoroughly beforehand. Therefore, after thorough cleaning use chemicals and disinfectants regularly. Consult your veterinarian or development agent for choosing the right chemicals and disinfectants.

- **Water**: Always ensure free access to clean and fresh water.
- **Husbandry**: Good feed and regular feeding.
- **Shelter** for protection against bad weather (rain, wind and cold or intensive sunshine).
- **Regular light exercise**: Make sure that the barn/shelter gets sufficient light uniformly.
- **Peaceful environment** (avoid unrest and stress).
- **Isolation and quarantine**: Another precaution to be taken is quarantine. This means isolating sick animals (during their illness) and newcomers (for about six weeks) from the rest of the herd. This measure is often hard to implement, but helps to avoid the spread of contagious diseases to other animals.
- **Other diseases** require other specific measures. These can be either:
  - Vaccination or preventive measures
    - **Vaccinations**.

When an animal is vaccinated against a specific disease, the body of the animal will react to it, but the animal does not develop the disease. However, the animal’s body has then been prepared to withstand an attack by this specific disease in its real form. Sometimes a vaccination against a disease will protect the animal all its life against this disease, but most vaccinations have to be repeated after a certain amount of time to ensure protection.

**Note**: Vaccinations are not available for all diseases.

- **Preventive treatment**.

Sometimes you know a certain disease always occurs at the same time of the year. In some cases it can be useful to treat animals with medicine before you actually see the sickness in them. This will prevent them from becoming weak and avoid production losses. For example, preventive treatment against worms can be given before and after the rainy season.
There are large numbers of diseases and conditions that can affect dairy cattle. Some of the most major dairy cattle diseases are discussed below:

1) **Foot and Mouth Disease (FMD)**

- FMD is a dangerous disease. It spreads very quickly from one animal to another and from one area to another.
- Your cow usually suffers from the disease for 2-3 weeks. Only a few cows die from FMD but you lose money from:
  - Low weight gain.
  - Low milk yield.
  - Mastitis.
  - Un-thriftiness even after the cow has recovered from FMD.

**What causes FMD?**

- FMD virus causes the disease.
- FMD virus can live for a long time outside the body and still be infective.

**What animals get FMD?**

- All animals with cloven hooves, such as cattle, pigs, sheep, goats, buffalo, deer, elephants, or even people.
- FMD does not affect horses.

**What are the signs of FMD?** Within 1-15 days after getting FMD (usually 2-6 days):

A. Drooling; long ropes of stringy saliva hang from the mouth.
B. Low appetite; your cow takes only liquid food or stops eating.
C. Blisters; blisters appear:
   - On the nose and in the mouth.
   - On the teats.
   - Between the claws.
D. The blisters break and can become bleeding ulcers. They usually heal in 1-2 weeks.
E. Fever and lameness; the virus causes:
• Shivering and high fever.
• Lameness from blisters/ulcers.

F. Low milk production; cows with FMD produce little milk.

How do your animals get FMD?

• Direct contact-Liquid from the blisters contains the virus.
• Indirect contact-Vehicles, equipment and you may carry the virus from one animal to another.
• Milk and meat can carry the virus from one animal to another. Pasteurization does not always kill the virus.
• Pigs may eat meat with FMD virus. They pass on large amounts of the virus which can infect your cows.
• In AI, semen with the virus can pass on FMD but this is unusual.
• The wind can carry the virus from one cow with FMD to another.
• Animals which:
  o Have the virus inside but do not yet show signs of FMD
  o Have recovered from FMD can pass on the FMD virus.

How can you treat animals with FMD? You cannot cure FMD. You can only:

• Clean and disinfect the ulcers and open wounds
• Give antibiotics to stop further bacterial infection.

How do you know if your animals have FMD?

Other diseases also cause ulcers in the mouth. Your vet can identify FMD by laboratory tests.

How can you prevent and control FMD?

• Vaccination: The extension worker can vaccinate your animals. This usually protects your animals for about 6 months but there are many types of FMD virus, and not all may be covered by the vaccine. Your animals may still get FMD after vaccination.

• Isolation: If any of your animals show signs of FMD:
  o Isolate those animals from your herd.
  o Isolate your herd from other herds.
• Never move an animal, bedding grass or equipment from an infected herd.
• Try to keep people, vehicles etc away from infected herds.
• Disinfect anything - vehicles, equipment, clothes, you – which contacts an infected place or infected animals.
• You can use:
  o Sodium hydroxide.
  o Sodium carbonate.
  o Acetic acid as disinfectants.
Follow the directions on the labels and ask your extension worker for advice.
  o Burn or bury dead animals and bedding and disinfect everything on your farm.
  o Consult your extension worker about what you can and cannot do. You may have to slaughter infected animals.

2) **Black-quarter (Black-leg)** is caused by *Clostridium chauvoei* and is an acute infectious disease of cattle and sheep. The disease is common in young cattle between 2-3 years because they are most susceptible.

**Signs:** It is characterized by:
- Fever.
- Depression.
- Painful oedematous swelling on the neck, chest, hip, acute lameness, and
- Death in 24 hours.

**Control of black-quarter**
- Vaccinate cattle and sheep in high risk areas.
- Vaccinate calves between 2-6 months old.
- Treat sick and susceptible cattle with penicillin.

3) **Anthrax:** It is an acute infectious disease of all warm blooded animals including man. It is caused by a large bacillus called Bacillus anthracis, which is capable of forming spores on exposure to air. The spores can survive for many years in the soil. The disease is found worldwide, but is more common in tropical countries. The bacteria can enter the body through a wound or may be inhaled or ingested.
What animals does anthrax attack?

- Anthrax attacks man, all domestic animals and many wild animals.

Signs include:

- In many cases, an infected cow is found dead suddenly, usually with a bloody discharge from the nose and anus, but without any previous signs of illness.
- In other cases, the characteristic features are sudden onset, high fever, swollen throat, difficult breathing, staggering gait, extreme weakness and rapid death.
- If an animal dies suddenly without any previous signs of disease (or after showing signs indicated above), anthrax should be suspected.

Control of anthrax

- Anthrax is a dangerous disease and is controlled by the following means:
  - As anthrax is a notifiable disease, you should immediately report to the government veterinarian such deaths or suspected cases.
  - Rapid diagnosis by examination of smears.
  - Disposal of carcass by efficient and safe means such as burning or burial.
  - Supervision of carcass until it is disposed off, with efficient methods of sterilization or using disinfectants on blood or discharges.
  - Annual vaccination and control of movement of unvaccinated animals.
  - Milk from infected animals should not be consumed.

Precautionary measures:

- No post mortem examination should be attempted.
- Carcasses of animals which have died or are suspected to have died of anthrax should be buried at least 1.8 m deep, covered with quick lime and the area fenced off.
- All infected material, soil and bedding etc should be burnt.
- All susceptible animals should be kept away from infected areas and vaccinated. Vaccination should be repeated annually at least for three years after the last case.
4) **Bovine babesiosis** (red water disease, piroplasmosis, tick fever).
   - This is a parasitic disease which often attacks temperate breeds of cattle and may kill them in 2-3 days.

   **Signs** of the disease include:
   - High temperature, loss of appetite and dull, staring coat - anaemic mucous membranes turning yellow.
   - Red urine and diarrhea.

   Call your vet. He/she will take a blood smear for diagnosis. Your animal can recover if treated early.

5) **Anaplasmosis** (gall sickness) is a parasitic disease which can cause death if untreated.

   **Signs** include:
   - High temperature.
   - Dark yellow urine.

   Call your vet. He will take a blood smear for diagnosis. Animals can usually recover if treated early.

   Animals sometimes get the disease again and need further treatment.

6) **Tuberculosis** is a bacterial disease which attacks all animals and man. It is very important in cattle, pigs and camels.

   **Signs** include:
   - Coughing.
   - Lesions in mouth and throat.
   - Weight loss and possible death.

   You must call the vet for diagnosis and you should not try to treat your animals.

   You can control tuberculosis by:
   - Having your herd tested every 6-12 months.
   - Slaughtering any animals with tuberculosis.

7) **Brucellosis** is a bacterial disease which is dangerous for your animals and you. A bacterium, *brucella abortus*, causes the disease. This bacterium can live for a long time in the animal and in the surroundings.

   **Which animals get Brucellosis?** Brucellosis attacks: Cattle, Goats, Sheep, Dogs, Horses, People and other animals.
What are the signs of Brucellosis?

The signs include:

- **Cows**: Abortions and still born calves - Cows with Brucellosis have abortions or still born calves, usually in the last 4 months of pregnancy. After abortion, there are bacteria in:
  - The discharge from the uterus
  - The milk
  - The foetus
  - The placenta.

- **Bulls**: They will have inflamed reproductive organs. Inflammation of the male reproductive organ. Bulls with Brucellosis have inflamed testicles. The semen can contain bacteria.

How can your animals get Brucellosis?

- If injured skin coming into contact with the virus.
- At service-mating. Semen with bacteria can pass on Brucellosis in A.I. and sometimes in natural mating.
- By contact with the bacteria. Eating food and drink with the virus. The bacteria live in:
  - The discharge from the uterus.
  - The placenta.
  - The aborted foetus.
  - The milk; colostrums from cows with Brucellosis can give the disease to calves from cows which do not have Brucellosis.
- Bacteria live for some time outside the body. Vehicles, equipment and you can easily carry the bacteria from one animal to another.
- The period from contact with the bacteria to signs of the disease can be 1 week up to 3 or 4 months.
- Pregnant cows and heifers get Brucellosis more easily than no pregnant animals.

How can you treat animals with Brucellosis? You cannot treat Brucellosis.

How can you prevent and control Brucellosis? You can control Brucellosis by:
Slaughtering infected animals.
Disinfecting everything.
Testing all other animals in your herd regularly.

Note:
If your cow has Brucellosis, it continues to release the disease even after it looks healthy again.
Vaccination of female calves helps prevent Brucellosis but they may still get the disease with a lot of contact with the bacteria.
Always test new animals before mixing them with your herd.

8) Mastitis
Mastitis is Inflammation of the mammary glands. The udder consists of 4 glands. Mastitis may infect 1, 2, 3 or all 4 glands. There are two types of mastitis:

A) Acute Mastitis: The cow shows general poor condition:
- High fever.
- Low food intake.
The udder is hot-swollen, as well as hard and painful. Milk in the strip cup is abnormal:
  - Watery and thin.
  - Flecks and clots.
  - Yellow or brownish colour.

B) Chronic Mastitis: The cow in general is in satisfactory condition.
But you know your cow has mastitis if you check your milk carefully. There are 3 types of chronic mastitis:
- Chronic hidden mastitis; your cow and milk appear satisfactory. But:
  - You get less milk.
  - Your milk is poor quality.
- Chronic Mild Mastitis; your cow appears satisfactory. But:
  - The glands are slightly hard, swollen, and painful.
  - The milk is slightly abnormal, watery, discoloured.
- Chronic Mastitis with Gland Shrinkage; without treatment, scar
tissue replaces gland tissue. The gland becomes hard, shrinks and cannot produce milk any more.

**Why is mastitis serious?**

- Mastitis costs you money. You must pay for veterinary fees and medicines.
- You get less money from the collection centre if your milk is low quality (from an udder with mastitis).
- If your milk contains antibiotics from mastitis treatment, the centre will reject your milk and pay you no money.
- Any kind of mastitis leads to lower milk production and therefore you get less money.

**How do you know if your cow has mastitis?**

- Cow - Check for fever and low food intake.
- Udder - Check if glands are swollen, hard, red, hot, and painful.
- Strip Test-Before each milking:
  - Milk a few streams of milk into the strip cup (a small black container) from one teat only.
  - Spread the milk on the plate of the strip cup.
  - Check carefully.
  - Clean the strip cup and then check milk from the next teat.

**How can you treat mastitis?**

In any case of mastitis, call the veterinarian. He may take a sample of milk for testing.

- Inject antibiotics into the teat.
- Sometimes also inject antibiotics into the muscle or blood stream if the cow shows poor general condition.

**How can you prevent mastitis?**

- Hygiene; before milking:
  - Always wash your dairy cows if they get dirty.
  - Clean anywhere your animals are likely to lie down.
  - Always:
Clean your hands thoroughly before milking.
Rinse in disinfectant after washing.

Milk 2 or 3 streams of foremilk from each quarter into a strip cup; examine carefully.

- After wallowing:
  - Wash the teats in clean (or sanitised) running water.
  - Dry the teats and udder with a disposable paper towel or clean, dry cloth.
  - Use only one cloth per cow - If you cannot use only one cloth per cow, use only clean hands.

During milking; plan the order in which you milk your cows.
- First, milk cows which do not have mastitis.
- Secondly, milk cows with suspected mastitis.
- Finally milk cows with mastitis.

Make sure milking is complete, especially when you do not let your calf suckle.

9) Pasteurellosis

This highly contagious pneumonia is present in Africa. The causal organism is mycoplasma mycoides mycoides small colony type. Susceptible cattle become infected by:

- Inhaling droplets disseminated by coughing in affected cattle.
- Feeding on feed contaminated by nasal droplets.

Signs: In acute cases, signs include:
- Fever up to 41.5°C.
- Anorexia – the animal stops feeding (or lower appetite).
- Painful and difficult breathing.
- The animal often stands by itself in the shade, its head lowered and extended, its back slightly arched, and its elbows turned out.

Chronically affected cattle usually exhibit signs of varying intensity for 3-4 wk, after which the lesions gradually resolve and the animals appear to recover. Subclinical cases occur and may be important as carriers.
10) Trypanosomiasis

This disease is caused by protozoa (blood parasite) of the genus Trypanosoma affects all domestic animals. Cattle, sheep, goats, horses and camels are infected as well as humans (sleeping sickness). The disease is transmitted by Tsetse fly or domestic animals are mainly affected by tsetse-transmitted trypanosomes in the geographic areas where tsetse-transmitted trypanosomiasis occurs.

The primary clinical signs are:

- The animal cry; tears drop.
- Intermittent fever.
- Hair erects.
- Anaemia.
- Weight loss.
- Diarrhoea.

11) Metabolic Diseases: bloat, ketosis (Acetonaemia), milk fever, and poisoning

- They are also known as:
  - Production diseases, and
  - Metabolic diseases.

- The cause is largely related to unbalanced production or management factors, the disease occurs due to imbalance between the cow’s yield and feed intake:
  - As your cow produces more, your cow’s demand for a specific nutrient increases.
  - The cow’s feed is deficient under certain conditions or management is poor. E.g.
    - No dry period.
    - No balanced ratio.

- The difference between production-related metabolic diseases and nutritional deficiencies is often subtle.
  - Nutritional deficiencies are long-term, steady state conditions that can be corrected through dietary supplementation.
Metabolic diseases are generally acute states that dramatically respond to the systemic administration of the deficient nutrient or metabolite, although affected animals may require subsequent dietary supplementation to avoid recurrence.

11.1. Bloat

- Normally in Cattle:
  - Rumen produces gases:
    - Cattle eructate (belch); pass out the gas through regular belching.

- Bloat; cattle can’t belch
  - When bloat occurs, gases cannot escape and they continue to build up causing severe distension of the abdomen, compression of the heart and lungs, and eventually death.
  - Bloat is the abnormal accumulation of gas in the rumen. There are three categories of bloat:
    - Frothy bloat which occurs when diets that lead to the formation of a stable froth or foam in the rumen are fed.
    - Free gas bloat caused by diets that lead to excessive gas production.
    - Free gas bloat caused by failure to eructate rumen gases leading to accumulation (such as oesophageal obstruction).

- Signs of bloat include:
  - Animal stops grazing and is reluctant to walk.
  - Distension and swelling of left side of body between last rib and hip bone.
  - The animal strains to urinate and defecate.
  - Rapid breathing; mouth may be open with tongue protruding.
  - Staggering; stamping of feet.
  - Frequent passing of small amounts of dung and urine.
• Treatment:
  o Passing tube.
  o Abdominal wall puncture.
  o Drugs.

Note:

• You must act quickly or your animal may die. Put a handful of laundry detergent powder into the animal’s mouth or give 500 ml of mineral oil (for example epeanut or linseed oil) or 100 ml of turpentine to an adult animal as a drench.
• If your animal cannot swallow, you may have to use a stomach tube.
• In areas where bloat is common, keep a trocar and cannula ready for use.
• In an emergency you may have to pierce the rumen with a sharp pointed knife to prevent death; many traditional healers know how to pierce the swollen abdomen.
• After relieving bloat, you can prevent it developing again by:
  o Walking your animal.
  o Keeping the front part of your animal higher than the rear.
  o Putting a stick across the mouth to let gas escape.

11.2. Milk fever - Parturient paresis in cows (Hypocalcaemia)

• Milk fever is an acute to per acute, afebrile (no fever), flaccid paralysis of mature dairy cows
• Milk Fever occurs most commonly at or within 72 hours after parturition.
• The disease may be seen in cows of any age but is most common in high-producing dairy cows >5 yr old.
The cause of the disease is low calcium level in the blood.

Signs include:

- Cows are unable to stand but can maintain sternal recumbence.
- Anorexia (loss of appetite) cows do not feed.
- Cows often place their heads into their flanks/abdomen or, if the head is extended, an S-shaped curve to the neck may be noted.
- Dry muzzle, subnormal body temperature and cold extremities, such as cold ear, lower temperature on the ears.
- Head to side; arching of the neck towards the one side of the abdomen.
- Unable to pass faeces and urine.
- Bulging of the abdomen (bloat).
- Depression, muscle tremors, grinding teeth, muscular paralysis.
- The cow may injure her body parts.
- Possible death.

11.3. Pregnancy toxaemia [fatty liver or fat cow syndrome]

- Occur in late pregnancy (the last three months of gestation) when the demand of the foetus for carbohydrates increases and the cow cannot meet this demand.

- Occurrence of the disease is exacerbated by the following conditions:
  - Big foetus or many foetuses in a cow.
  - Feeding feed staffs with low level of carbohydrates.
  - When the cow is unable to feed (like sour mouth, lacerated tongue).
  - Health problems that result in increased carbohydrate demand.

Signs

- In-appetence; low level of feed intake.
- Low volume of dung.
- Licking the nostril.
- Depression.
- Weight loss.
弱点。
- 睡眠。
- 向后扭脖子。

11.4. Ketosis or Acetonemia

- Ketosis is a common disease of dairy cows in early lactation.
- Ketosis is most common in high yielding cows
- Occurs when the blood glucose level is lower but higher amount of keton

Signs include:
- Weight loss.
- Reduced feed intake (inappetence); partial anorexia and depression.
- Reduced milk production, lethargy, and an ‘empty’ appearing abdomen.
- Afebrile(no fever) and may be slightly dehydrated.
- Offensive smell from the mouth and nose.
- Signs of nervous dysfunctions such as pica, abnormal licking, incoordination (inability to control muscles) and abnormal gait, bellowing, and aggression are occasionally seen.

12) Nutritional Deficiency Diseases

12.1. Protein deficiency

A deficiency of protein commonly accompanies a deficiency of energy. Protein Deficiency occurs when the feed is without enough protein. However, the effects of the protein deficiency, at least in the early stages, are usually not as severe as those of energy:

- In young animals: Insufficient protein intake results in reduced appetite lowered feed intake, inferior growth rate, lack of muscle development, and a prolonged time to reach maturity.

- In mature animals: Insufficient protein intake results in loss of weight and decreased milk production.
  - Signs of protein deficiency include underweight and weak animals.
  - In growing animals symptoms of protein deficiency include:
12.2. Mineral deficiency

- Swelling under the throat and brisket area.
- Bigger size abdomen.

**Definition:** Any of the inorganic elements, as calcium, iron, magnesium, potassium, or sodium, those are essential to the functioning of the dairy cattle body and are obtained from foods.

- Dairy cattle require minerals in their diet for optimal productivity in small amounts but every day.
- These minerals are derived from the feed and fodder.
- The input of minerals through feed and water must balance their output through faeces, urine and milk to maintain the animal’s health.
- If the output exceeds input, the animals meet out their normal requirements by mobilization from its body reserves for a shorter period.
- But continuous imbalances develop into productivity related problems.

- Minerals most likely to be deficient in livestock rations are:
  - Calcium deficiency: Bone structure, cell performance, muscle contraction, bone deformity, joint swelling etc.
  - Phosphorous deficiency results in:
    - Bone cracking.
    - Pica; chewing bones, rocks, boards.
    - Decreased reproduction and growth (low milk yield and growth rate).
  - Magnesium deficiency results in grass tetany, osteoporosis (bone texture loss).
  - Sodium deficiency-retarded growth, weight loss, loss of appetite, low milk yield, lower body temperature, etc.
13) Parasites

- Parasites cause major losses of production in dairy cattle. There are two main groups:
  - Parasites which live inside the animal, for instance worms and flukes (internal parasites);
  - Parasites which live on the outside of the animal, for instance ticks and mange mites (external parasites).
- Under most farm conditions animals come into contact with parasites. As a result most animals have parasites.
- Animals that grow up normally will get some resistance to parasites so the problem is biggest in young animals. However, certain parasites, such as the liver-fluke, may be a problem even in older, well-fed animals.
- Animals can usually live with some parasites without any clear signs of disease. However, the presence of parasites decreases production (weight gain, milk yield, calvings). This means economic losses for the farmers.
- To keep the number of parasites as low as possible the farmer has to:
  - Manage his animals well (good hygiene, satisfactory nutrition, pasture rotation);
  - Treat animals against parasites at fixed intervals.
- This will not kill all parasites present but will reduce the harm to the animals.
- The variety of parasite species that can damage animals is enormous.
- However, depending on climate, environment, animals and management practices, some kinds of parasites will normally "out-number" the others in the various cattle areas.
- For the field worker it is practical to consider the many kinds of parasites in groups, and in this text the following grouping has been made:

13.1. **Internal parasites** – are also known as Endoparasites, such as worms in alimentary tract and lungs and protozoan parasites in blood. Many different kinds of Roundworms, Hookworms, Lungworms, Tapeworms, Flukes, and Coccidia live as parasites in the stomach and intestines of cattle. Size, shape and effect on the animal vary.

a. **Liver flukes (fasciola hepatica)** are flat and leaf shaped, 2-3 cm long and about 1 cm wide. They are grey-brown in colour.
The signs of disease vary with the age and condition of the animal and the density of flukes present. Very often the signs are confused with signs of low nutrition or wrong management.

**Signs** include:
- Poor appetite and resulting loss of weight and production.
- Rough hair coat.
- Pot-belly.

Diarrhoea or constipation may also be present. If animals are attacked by many flukes, more severe signs of disease, and in some cases even sudden deaths, may be seen. This, however, only happens rarely.

b. **Lungworms**

Lungworms are white threadlike worms. They are about 1 mm thick and 6-8 mm long.

**Signs** of disease include:
- Coughing.
- Difficulty in breathing.
- Reduced food intake.
- Reduced milk yield.

c. **Rumen flukes (paramphistomum)**

- It is a kind of fluke, rumen flukes, often live in the stomachs of ruminants. They are pear shaped, up to 1.5 cm long and have a bright red colour.

d. **Tapeworms**

- Tapeworms are long, flat worms divided into segments. A large number of different tapeworms exist. Adult worms live in the intestines of human beings and animals.
- One kind, moniezia-tapeworms live in the intestines of cattle. Normally they do not cause signs of disease. If animals, especially young stock, are not well-fed, they may show bad condition and digestive problems. In this case a number of drugs are available for treatment. Other kinds of tapeworms are of greater importance to people.
e. The Beef-tapeworm (*taenia saginata*)

- The adult tapeworm lives in the intestines of people. However, before eggs can develop into adult worms they have to pass through cattle as part of their life cycle.

13.2. External parasites: Include blood and nymph sucking ticks, mites, manges, lice and flea.

a. Mange mites

There are different kinds of mange mites which can cause disease (mange). All are about 0.5 mm or less in size.

The typical signs of external parasites are:

- Loss of hair.
- Formation of scabs and crusts.
- Thick and folded skin.
- Itching.

Animals which are not in good condition will show more serious signs of disease than healthy, well-fed animals.

b. Lice

Lice are wingless, flattened insects, usually 2-4 mm long. The claws of the legs are adapted for clinging to hairs or feathers. There are many kinds of biting or chewing lice (order Mallophaga) and sucking lice (order Anoplura) that are obligate ectoparasites of domestic animals.

Lice live within the microenvironment provided by the skin and its hair or feathers, and are transmitted primarily by contact between hosts.

Signs:

- Itching and dermal irritation with resultant scratching.
rubbing, and biting of infested areas.
A generally unthrifty appearance, rough coat, and lowered production in farm animals are common.

c. Ticks
It is easy to see ticks on animals. Common places to find ticks are on the head, ears, and the base of the tail, the udder and the dewlap. Several hundred ticks on one animal are not uncommon, but sometimes only a few are present.

Ticks can cause different kinds of disease in animals:
  o Tick-borne diseases (disease transmission).
  o Loss of condition; emaciation.
  o Anaemia.
  o Inflammation and damage to the skin.

Transmission of diseases
  • Some parasites cause serious damage by transmitting diseases from one animal to another. This is especially true for ticks which act as transmitters of the protozoan blood diseases Babesiosis, Theileriosis and Anaplasmosis. Therefore, tick-borne diseases are diseases which are spread by ticks. They are similar to malaria in man. (Malaria is a blood parasite which is spread by mosquitoes).
  • These diseases cause great losses of animals in many areas of the world and are the reason for the continuous efforts made to reduce the severity of tick infestations in affected areas, particularly in the tropics.

13.3. Control of parasites

A) Control and treatment of internal parasites
  • There are many drugs which can be used against internal parasites. If worm infestation is suspected you should treat all animals with broad-spectrum dewormers (anthelmintics). For advice on which type of dewormer to use and the method of administration, you should
consult your local veterinarian.

- Drugs which are given through the mouth and by injection are available.
- All animals in the herd should be treated - including those which show no signs of disease.
- In order to avoid disease, treatment against worms should be given at regular intervals. To avoid severe disease, animals should be treated against worms regularly. How often deworming should take place depends on the area in which the animals are on pasture.
- Some other precautions can be taken by the farmer to avoid disease or make the parasite burden less serious:
  - If possible pastures should be rotated.
  - Animals with severe signs of disease should be isolated from the rest of the herd.
  - Animals should not be fed from the ground.
  - Overstocking should be avoided.
- Treatment of liver flukes There are many drugs which have effect on both adult and young flukes. In each case, advice should be given by the local veterinarian or extension officer about choice of drug.
  - Regular treatment, normally twice a year, should also be given to avoid disease.
  - Keep animals away from wet areas with snails which transmit flukes.
  - Drain wet areas with many snails.
  - Keep sick animals by themselves.
  - Give the right medicine at the right time.
  - Consult your extension worker or veterinarian.

B) Control and treatment of external parasites

- Dairy cattle can be treated with chemicals which kill external parasites in general. These chemicals are called acaracides/insecticides. Some are applied through dipping, some are applied through spraying, and some are applied by pour-on. In all cases, it is important to follow the instructions on the product label.
• The local veterinarian/extension officer should advise you on drugs which can be used for treatment. Treatment is usually undertaken by dipping or washing.
• Buildings and equipment should also be cleaned and disinfected, when animals are treated.
• To avoid disease, sick animals should be kept isolated from healthy animals. Clean animals and clean and dry surroundings also help to avoid disease.

The way to avoid tick-borne diseases is to avoid ticks on the cattle. Dairy cows should not be grazed in the field where the ticks live, but should be confined in their barn where feed can be brought to them. That way the ticks do not infest the cattle.

5. Written Test

Writing down the answer to the following questions

<table>
<thead>
<tr>
<th>Module 15</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Question 1</strong></td>
<td>Based on your own experiences, what are the diseases of dairy cattle that you know? How do you treat sick animals?</td>
</tr>
<tr>
<td><strong>Question 2</strong></td>
<td>Which dairy cattle diseases do you think are threatening in your area? Write down the major dairy cattle diseases.</td>
</tr>
<tr>
<td><strong>Question 3</strong></td>
<td>What do you regularly do to prevent the occurrence of <em>mastitis</em> on your milking cow?</td>
</tr>
<tr>
<td><strong>Question 4</strong></td>
<td>What are the dairy cattle diseases that are preventable by vaccination?</td>
</tr>
<tr>
<td><strong>Question 5</strong></td>
<td>Before calling your veterinarian, what do you do for your sick animal?</td>
</tr>
</tbody>
</table>

Trainee’s name: __________________________________________

Submit your answers to your trainer for evaluation.
6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module 15</th>
<th>List of practical procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Go to the animal health post/clinic in your locality and ask about:</td>
</tr>
<tr>
<td></td>
<td>• Common animal diseases in the area.</td>
</tr>
<tr>
<td></td>
<td>• Basic animal health equipment, drugs and disinfectant chemicals.</td>
</tr>
</tbody>
</table>
MODULE SIXTEEN: PROTECT THE ENVIRONMENT USING LIQUID AND DRY WASTE

Duration: 8 hours

1. General Description of Competencies of the Module

This Module is about planning and implementing dry and liquid waste from dairy animals (Dairy Farms). In addition, the Module also explains how to take care of dairy cattle sewerage and farm waste without polluting the environment and making use of the liquid and dry waste.

2. Learning Outcomes

At the end of this Module the trainee will be able to:

- Identify and prepare materials and equipments to keep cleanliness and help to use drainage.
- Collect cattle dung, slurry and urine in one place without being dispersed.
- Utilize the collected dung and slurry.

3. Description of Learning Activities (operations guide)

- Read the information given under the Information Sheet and listen attentively the explanation of the trainer.
- Next answer the question given under Written Test or Self Check.
- Evaluate your answers to the trainer.
- If the evaluation done by your trainer is satisfactory, proceed to Information sheet 2; otherwise do the above procedures again.
- Follow the same procedure until you reach the practical activities section where you have to accomplish the tasks given based on the instructions provided.

4. Information Sheet

<table>
<thead>
<tr>
<th>Module 16: Information Sheet</th>
<th>Dairy cattle dung and slurry management and disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste associated with dairy cattle production/operations includes:</td>
<td></td>
</tr>
<tr>
<td>- Manure.</td>
<td></td>
</tr>
</tbody>
</table>

Training Manual for Farmers, Rural Women and Youth
Animal wastes can adversely affect water, air, and animal resources in a variety of ways. Nutrients can kill fish and create algae blooms in surface water. In ground water, nitrates can make well water unfit for human consumption, particularly for infants. In addition, organic matter can cause dissolved oxygen problems in surface water, while bacteria and other microorganisms can contaminate wells and create health problems in recreational waters.

To reduce deposition of waste or to prevent waste from accumulating in feeding, watering, and shade areas, there shall be a waste management and disposal scheme/plan.

Dairy waste is used as bedding for livestock, marketed as compost, and used as an energy source, but the most common form of utilization is through land application.

Dairy waste can be used:

- To make compost and be distributed over the crop farm land to improve soil fertility.
- To make biogas for alternative energy production.

As it is depicted in the pictures above, it is a good measure to collect all dairy farm waste into one pool. After it is collected in one place, you can manage how to make use of it.

After it is collected in one place, for the best use of dairy farm waste consult your development agent and other agricultural experts.

Careful management of dairy cattle dung and slurry is important for the following reasons:
To make use of the dairy cattle dung, slurry and urine to improve soil fertilizer quality and to enhance soil fertility.

Protect the health of the dairy cattle through keeping standard of hygiene.

Avoid air and water pollution as well as to keep clean the environment around the dairy farm.

The method of disposal for dairy cattle dung, slurry, urine and other wastes depends on the kind of waste coming from the dairy operations:

- If it is dry waste in dry season you can pile it over one place after spreading to dry.
- If it is liquid you have to collect it into a pit.

Kinds of waste from dairy cattle production.

- **Dry slurry and dung** is when it contains more than 25% dry matter content. This happens when urine is separately collected. In this condition, the dry slurry and dung can be piled up to 1.5 to 2 metres height.
- **Thick liquid slurry** has less than 20% dry matter content.

**Summary:** Tasks to undertake for a proper disposal of wastes from dairy farmers are the following:

A. Identify and collect hand tools to help you for a proper disposal of dairy cattle wastes. E.g. broom, rack, spade, brush, and other cleaning materials. Look at the picture

B. Identify and collect cleaning and disinfection chemicals (for example alcohol, savalon, bar or powder soap

C. Prepare a waste disposal management plan to prevent environmental pollution from your dairy cattle production. Do the following to help you prepare a waste disposal plan:-

- List down the options to dispose of your dairy farm waste and choose the one that fits into your context.
  - You may say dry or liquid disposal but give your reasons.
  - Discuss and identify waste types that can create environmental
problems with development agents or agricultural experts in your locality.

D. From the results of your consultation, choose one and prepare an implementation plan – Read the information sheet provided in this Module and consolidate your choice. Based on the information provided you understand that there are two ways to dispose off wastes from dairy farms. These two methods of waste disposal are summarized below:

- Prepare Bio-gas plant. This depends on:
  - As per the number of dairy cattle and thereof the amount of dung (slurry) collected per day.
  - Ambient temperature of your area.
  - Proper knowledge and experience on bio-gas plant construction and operation.

  Therefore, consult your development agents (Agricultural Experts) to collect information to help you decide on this matter.

- Prepare compost pit. This involves the preparation of natural fertilizer in a pit. There are green forages to be added on the slurry and dung in the pit. Consult development agents for further information.

- Prepare the dung as firewood: This is usually accustomed near residential areas but now you have to think how to adopt it in your modern dairy farm.

E. After deciding on your choice, identify and collect needed materials and equipment.

F. Remember: In all waste disposal methods.

- Dung, slurry and urine shall be collected without spoiling the local stream, river or water points by considering the watershed towards which your area drains. The place of waste collection shall be in a higher position to the water sources.
- Use the collected waste as per your waste management plan.

5. Written Test
6. Practical Activity Procedures

Write down the answers to the following questions

<table>
<thead>
<tr>
<th>Module 16</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>What are the environmental impacts on dairy farm wastes?</td>
</tr>
<tr>
<td>Question 2</td>
<td>What are the uses of dairy farm wastes?</td>
</tr>
<tr>
<td>Question 3</td>
<td>Explain the value of collecting disposal of dry and liquid dairy cattle wastes in one place.</td>
</tr>
</tbody>
</table>
| Question 4 | Comment on the picture given below.  
 a) Is this the correct way of dairy farm disposal?  
 b) What is the environmental impact of this disposal?  
 c) Had it been your farm what issues would you raise to handle this waste? |

Trainee's name: ____________________________

Submit your answers to your trainer for evaluation.
MODULE SEVENTEEN: PROCESS THE MILK

Duration: 24 hours

1. General Description Competencies of the Module

This Module deals with the knowledge, skills and proper attitudes about milk processing tasks in dairy business.

2. Learning Outcomes

At the end of this Module, trainees will be able to:

- Prepare a separate room for milk processing.
- Identify and collect materials for milk processing.
- Recognise the importance of cooling (refrigerating) the milk.
- Separate the milk cream.
- Churn the milk to make butter.
- Handle and manage raw milk (yogurt, fermented milk), cottage cheese, whey, butter and ghee (heated butter) as major marketable milk products.

3. Description of Learning Activities (operations guide)

- Read the points given in the following information Sheet carefully.
  - Information Sheet 1-Milk Composition: What are the constituents of milk?
  - Information Sheet 2-Quality Milk: What should you know about milk quality?
  - Information Sheet 3-Milk Preservation: What should you know about milk preservation?
  - Information Sheet 4-Milk Processing: What should you know about milk processing?
- Answer the questions given under Written Test.
- Accomplish the tasks given under the practical procedures section.
- Show your answers to your trainer.
- If the evaluation done by your trainer is satisfactory, proceed to the next module; otherwise do the above procedures again.
Milk Composition: What should you know about milk composition?

What does milk look like?

- Fresh milk is a liquid.
- It has a yellowish white colour and pleasant, sweetish smell.
- If you make milk cold, it will freeze at a slightly lower temperature than water.
- Milk is slightly heavier than water.

Constituents of Milk

In general, milk consists of water, fat, protein, lactose, minerals, vitamins and enzymes. The composition of milk depends on the kind of mammal, feeding (type and quantity of fodder), cycle of lactation and number of lactations.

What does milk contain? Whole milk from cows contain approximately:

- 87% water.
- 4% butter fat.
- 9% solids not-fat.

Milk contains the following constituents:

a. Fats: There are many small fat globules in milk, such as:
   - Fat globules.
   - Skim milk.

   If you leave milk to stand, yellowish fat or cream (3.5-5%) rises to the top of bluish-white skim milk. Percentages of milk fat are:
   - Cream (3.5-5%).
   - Skim milk (95-96.5%).

Proteins: Normal milk contains 3.4-4% proteins which help to build up our bodies. There are two main types of protein in milk: caseins and whey proteins. When you sour milk or add rennet (enzyme), the whey is liquid and casein precipitates (curdles). Milk products contain different amounts of protein:
• Cream 2-3%.
• Cheese 20-40%.

c. Enzymes: Start chemical changes; one substance in milk changes to other substances.

- Some enzymes come from the udder. Pasteurization usually destroys them.
- Other enzymes come from bacteria, for instance on dirty equipment, and change the milk to have a bad taste and smell. Pasteurization does not always destroy them. Milk products made from this milk are poor quality. Therefore, keep good quality milk free from bacteria.

d. Lactose: It is a milk sugar and milk contains 4.6-4.7%. It gives milk a slightly sweet taste and is soluble in water. Lactose is a carbohydrate and gives our body energy. Lactose changes into lactic acid with helps from lactic acid bacteria and produces the fresh sour taste in sour milk, yoghurt, cheese and other products. After strong heating, the lactose gives the milk a brownish colour and a caramel taste.

e. Vitamins: Milk contains many vitamins. If our body lacks vitamins we get disease. Some vitamins are soluble in cream (A, D, E, and K). Other vitamins are soluble in skim milk (B, C) i.e. they are water soluble. A lot of vitamin A gives the milk fat a rich yellowish colour because of carotene. Leaving milk in strong light reduces the amount of vitamins B2 and C.

f. Minerals: When the dry matter in the milk burns, ash remains. The ash contains minerals which make up about 1% of the milk. Milk is rich in some minerals. For instance calcium and phosphate for bones and teeth, but poor in others for example iron; calves need a supplement to prevent anaemia.

g. Bacteria: All milk contains bacteria.

- Some bacteria cause useful changes e.g. in making cheese, yoghurt & other milk products.
- Other bacteria cause harmful changes such as bad flavours or smells and bad keeping quality.
- There are more bacteria:
- On dirty udders, hands and containers.
- In diseased udders at warm temperatures.
  - Bacteria reproduce quickly. Try to slow the reproduction of bacteria by keeping your milk: Cool and clean.

<table>
<thead>
<tr>
<th>Module 17: Information Sheet 2</th>
<th>Quality milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>(What should you know about milk quality?)</td>
<td></td>
</tr>
</tbody>
</table>

**Why should you produce high quality milk?**

**High quality milk:**
- Earns you money.
- Is better for you.
- Keeps longer.

**How can you produce high quality milk? Make sure:**
- You and your cows are healthy.
- Everything is clean.
- You keep your milk cool and deliver quickly.

**What affects the quality of your milk?**
- The number of bacteria in your milk.
- The health of your cows.
- The quality of your feed.
- The purity of your milk.

**Why should you produce high quality milk?**
- Customers test your milk at the collecting centre – high quality milk gets a good price.
- High quality milk has many nutrient and few bacteria.
- So it tastes good and makes you strong and healthy and keeps.
- Milk with many bacteria tastes bad and does not keep.

**How can you produce high quality milk? Make sure:**
- Your cows are healthy.
- You are clean your cow is clean everything at the milking place is clean.
- You keep your milk cool.
You get your milk to your customers or collecting centre in the shortest time possible.

What affects the quality of your milk? All milk contain some bacteria:

- Milk with few bacteria is of high quality.
- Milk with many bacteria is of low quality. You get more money for high quality milk.
- If your milk is of low quality and contains many bacteria, you get less money and your customers or the milk collection centre may reject your milk.
- Some bacteria produce acids and turn the milk sour.
- Some bacteria produce gas and spoil your milk.
- Most bacteria breakdown your milk and reduce the nutrient value.
- Some bacteria can make you ill or even kill you.

Where do the bacteria come from?

1. **Your cattle**
   - Healthy udders produce a few bacteria, but only a few. They do not harm your milk.
   - Diseased udders produce many bacteria, which can harm your milk and you.
   - Bacteria come from dirt and faeces on the hind legs, udder and teats.

2. **From people**:
   - Sneezing and coughing.
   - Dirty hands and clothes.
   - Inflamed wounds.

3. **Milking utensil; bacteria come from**:
   - Dirty pails.
   - Dirty strainers.
   - Dirty churns.
   - Dirty udder cloths.

4. **Environment**
   - Dirty walls and floors.
5. Dust carries bacteria from:
   - The surroundings
   - The manure heap
   - Residues
   - The soil

5. Dirty water contains lots of bacteria.

How can you keep the number of bacteria in your milk low?

1. During milking - Keep milk clean by:
   - Milking in a clean cow shed.
   - Using clean milking utensils.
   - Using clean milking practices.

2. During storage:
   - Bacteria multiply quickly in a warm place.
   - Keep the collected milk in cans in a shady and cool place. Dip the cans in cold water before and after milking.

3. During transport: Get your milk to your customers or the collecting centres as soon as possible after milking.

4. Health
   - High quality milk comes from healthy cows. If your cow is sick, consult your extension worker.
   - If your cow has mastitis, do not deliver your milk. The collecting centre will reject it.
   - If your cow had antibiotic injections, do not deliver your milk until you consult your veterinarian or extension worker.

5. Feeding: Do not feed silage and wet crop residues at the milking place. Smells from this and other feed may pass to your milk.

6. If your milk has bad taste or smell, you may have to improve:
   - Cleaning.
   - Handling.
   - Storing of milking utensils.

7. Temperature
   - Bacteria multiply in warm milk. Your milk has a bad smell and taste and spoils quickly.
8. **Purity: How do you make sure your milk is pure?**
   - Never add water or anything else to your milk.
   - Make sure you use detergents and disinfectants to clean your milking equipment.
   - Follow instructions carefully and consult your extension worker.
   - Keep insecticides, pesticides and other chemicals away from the milking shed and the water supply.


10. **Milking: Apply the proper hand milking practice.**
   - Prepare:
     - Yourself.
     - Your equipment, and
     - Your cow well before milking.

---

### Module 17: Milk preservation

**Information Sheet 3**

**Milk preservation**

(What should you know about milk preservation?)

It is important to make sure that your milk is:

- Clean.
- Cool.
- Delivered quickly.

**What is important in preserving milk?**

- All of the ways of preserving milk depend upon the initial hygienic quality of your milk.
- Make sure everything is clean and you cattle are healthy.
- Don’t mix warm (morning) milk with cool (evening) milk. Keep it separate for the collecting centre or cool warm milk before mixing.

Whatever method of preservation you use, plan with farmers near you and your collecting centre to deliver the milk in the shortest time possible.
Why you cool milk?

Keeping your milk cool reduces damage. If everything is clean and you and your cow are healthy, your milk will be:

- Fresh.
- Good quality.
- Quite stable.

When you store or transport your milk many things can damage it:

- Chemicals.
- Bacteria.
- Bad handling.

Note:

- If your milk is warm, there will be more damage from chemicals, bacteria and bad handling.
- Temperatures between 15-40 °c are bad for milk.
- There is high enzyme activity and bacteria multiply quickly.
- Keeping your milk cool reduces damage.
- About 4 °c is the best temperature to keep milk.

If you can deliver your milk within one to two hours to your customers and the milk collecting centre has good cooling facilities, cooling your milk at home is not essential.

How long can you keep your milk? This depends on the temperature and hygiene.

How do you cool your milk?

- You can keep your milk in the shade or in a dark, well ventilated place.
- You can put your milk cans in a well. If you use the water for drinking, be careful it does not become dirty.
- Make sure the tops are tight or cover with cloth so that water from the well does not get into your milk.
- You can use cooling tanks.
- If you have a good supply of water, put your cans into a cooling tank. The temperature of your milk is 3-5 C above the temperature of the water (after some time in the water).
Why heat treats and processes your milk?

- Heat treatment kills bacteria and your milk keeps longer.
- Processed products like cheese keep longer too.

Can you use chemicals to preserve your milk? Yes, but you must ask your extension worker or milk collecting centre for advice.

Milk transportation

After milking, maintain good milk quality by:

- Keeping your milk clean and cool.
- Handling your milk gently.
- Transporting your milk quickly.

For questions about transporting your milk, read the next Module.

### Module 17: Information Sheet 4

**Milk processing**

**Why process your milk?**

For quick local consumption, you can preserve your milk by processing it into products such as:

- Cheese.
- Curd.
- Pasteurized milk.
- Yoghurt.

#### I. Prepare a Milk Processing room

- It is preferable if the floor is cement since it is easily cleaned
- Make the all cemented to the height of 1 and half metres
- Make sure that the room shall have sufficient windows for proper ventilation

#### II. Raw Materials

- Milk or cream.
- Sour buttermilk or starter.
- Fine salt.
III. Equipment:
- A heater.
- A container for the milk or cream.
- A thermometer to measure temperature.
- Milk churn: Improved milk churner – ILRI Type Figure 16.
- Manual cream separator – Figure 15.
- A sieve or coarse cloth.
- A skimmer.
- A bowl.
- A working table.
- Wooden spoons.
- Greaseproof paper for wrapping the butter.

Note: Consult your development agents where to get these equipment.

IV. Churn the cream or milk to get butter

You can make butter from Milk or Cream: 1 litre of cream makes about 300 - 400 g butter

The following are the reasons why we need to process milk:
- When there is lack of customer, changing the surplus milk to milk by-products for longer period of storage,
- If the selling prices of milk by-products is better than the value of selling milk,
- If there is no milk market in the near vicinity of the dairy cattle farm, and when there is a need to collect more milk volume and processing it may be required for ease of transporting it to far away market places.

The procedures of making butter from milk cream is presented as follows:
1. Cream Separation - First separate milk cream from skimmed milk by using cream separator
2. Treatment of the milk cream for cultured butter making

Before starting the churning process:
Heat the milk cream for 15 minutes at about 85 – 90 °C.

Cool it quickly to 18 °C in running water.

Use a thermometer to measure the temperature accurately.

Ripening: Then ripen.

For each 1 litre of milk or cream:

- Add 50 cc of (3 desert spoons) of sour butter milk or mesophilic starter.

- Stir this into the milk or cream.

Cover container and leave for 24 hours at 18 C.

3. Churning:

And then put the pasteurized cream in to the milk churner and churn it (either manually or automatically). There are different forms of churning:

A. Small scale churn

- You can churn milk or cream:
  - by shaking in a sealed bottle
  - by rotating in a milk can but it can be difficult to remove the butter by whipping in a bowl:
  - bowl with cream or milk
  - rotating whippers
  - by plunging in a container
  - tub or can
  - lid with hole

- plunger, moves up and down

- Wooden disc with holes.

This is a small household glass churn:

- Screw lid.
- Glass container.
- Rotating wipers.
- Rinse the churn with clean water. This prevents sticking.
- Half fill with sour milk or sour cream.
- Churn with a regular movement until:
- The pieces of butter are as big as peas.
- The buttermilk looks watery.
  - Do not let the pieces of butter become one large lump.
  - If there are no pieces of butter after 30 minutes:
    - change the temperature by adding clean cool or warm water
    - Churn again.
  - For cream do not add more than 25% water.
  - Churning may take from 15 to 60 minutes.
  - Carefully remove the pieces of butter from the lid and side with clean, cold water.
  - The water with butter will float on top of the buttermilk.
  - Do not use too much water.
  - Pour off the buttermilk through a coarse sieve.

B. Large-scale churning
  - You can work this churn by hand or use an electric motor.
  - It holds 30-50 litre of milk or cream.
  - Half fill the churn with milk or cream. Churn for 5 minutes (the speed depends on the shape, size and construction of the drum).
  - Stop the churn and release the gases.
  - Churn again for 35-45 minutes or until the butter pieces are about 2 cm in diameter.
  - Pour off the buttermilk through the valve into plastic pails.
  - Add the same amount of water as buttermilk you remove.
  - Churn at 10-15 rpm for 5 minutes.
  - Pour off the water.
  - Churn at 10-15 rpm for about 10-20 minutes.
  - Check the water content and if correct remove the butter from the churn.

4. Wash the butter again
   Wash the butter to remove the buttermilk; the more buttermilk you
remove, the better your butter.

Either wash the butter in the churn:

- Half fill the churn with clean cold water
- Churn for at least 10 minutes
- Use a skimmer to remove the pieces of butter floating on the water

Or wash the butter in a sieve:

- Sieve the butter and buttermilk
- Put the buttermilk on one side
- Turn the butter over while washing with clean cold water.

Do not let the butter become a large lump.

If you wash your butter carefully you can:

- Lower the water content.
- Keep it longer.

Do not over wash. Your butter will have:

- Less solids-not-fat.
- A poor smell.

5. Salting-Add salt to the butter

Add salt to your butter according to taste:

- Lightly work about 10 g of salt into every 1 kg of butter.
- Leave overnight.
- Work again the next day.

The reason why salt is added to the butter is to prevent bacterial multiplication so that to store the butter for longer period of time.

6. Storage-Rap the butter and store it in vessels/container

- Store butter in a cool place:
  - In a pot or,
  - Wrapped in grease proof paper or aluminium foil.
  - Sprinkle a little salt on the surface of butter in a pot to prevent fungus.
V. Cheese Making

A. What is cheese?

- Cheese is the solid part of milk; curds separated by chemical reaction from the liquid part of milk-whey.
- Coagulation: Milk contains two different groups of proteins. These are:
  - The casein complex (75-80 % of total protein).
  - The whey proteins (20-25 % of total protein).
- It is the case in that coagulates when making cheese.
- You can make the curds separate from the whey by adding acid, bacteria culture and/or rennet (starter).
- This causes the milk protein, casein, to curdle.
- Acid or starter culture produces a soft curd which breaks up easily. Rennet produces a firm and elastic curd.

B. What do you need to make cheese?

- You need good quality milk with few bacteria.
- Cheese made from milk with high bacteria content has a bad flavour.
- Use milk from healthy cows.
- Do not use milk from cows with mastitis or other diseases.
- Do not use milk which contains antibiotics.
- Do not use colostrums. It turns into curd on heating and the curd is too soft.

C. Points to Remember while making cheese

- Make sure you clean and sterilize your milking utensils. Pasteurization does not destroy all bacteria from dirty utensils.
- Rinse your utensils thoroughly in clean water. Cleaning agents and disinfectants in cheese milk kill lactic acid bacteria which are necessary for cheese.
- Do not use poor quality silage. This contains some bacteria which pasteurization does not destroy. These bacteria produce butyric acid which gives cheese a bad taste and shape.
o You can test the quality of your cheese milk by: tasting and smelling 
o Bad tastes and smells go to your cheese: - boiling sour milk or milk with colostrums precipitates.

D. Additives to cheese milk

i) You add rennet to milk to coagulate it.

o Prepare your own Rennet. You can:
  - Buy rennet or,
  - Make it yourself.

You can make rennet from the 4th stomach of un-weaned calves or pigs which contain the enzyme chymosin.

o Buy readymade: You can also get rennet with enzymes which coagulate milk. Always:
  - buy or make small amounts of rennet
  - Store in a dark, cool place, a refrigerator if possible.
  - Do not keep for more than 3 months.

ii) Starter (lactic acid bacteria)

The starter produces acid has the following advantage:

- Helps when you remove the water from the curd.
- Helps the rennet coagulate the cheese milk quickly.
- Makes the cheese soft, rubbery, hard or brittle.
- Gives the cheese flavour.
- Prevents the growth of harmful bacteria.
- Breaks down proteins to help ripening.

E. How much cheese do you get from milk? 10 litre of milk makes:

- 1 kg of semi-hard cheese, or
- 2 kg of soft cheese (it contains more whey).

F. Cheese can be prepared from milk cream, whey or yoghurt as follows:

a) Making cheese from milk, milk cream separated by product (whey).

In Ethiopia, cheese is usually prepared from whey. However, it can
be prepared from clean milk, yoghurt and from the by product of cream separation. On average 9 litres of whey or by product of cream separation is needed to make 1 Kg’s of cheese.

b) Heat milk or milk by products (whey).
   ○ Heat the whey or skimmed milk at 50 °C until rounded up coarse features appear.
   ○ And then cool it for about an hour.

c) Add additives-sweeteners as follows:
   ○ Add 10 gm salt to make 1 Kg of cheese – to stop bacterial growth so that the cheese will not grow fungus and have no bad odour.
   ○ Thoroughly mix it to dissolve the salt and for uniform distribution.

d) Filter out the whey as follows:
   To separate the cheese from the whey you can use sieve or cloths. Tie the cloth over the mouth of a vessel/container & pour on the cheese and whey mix.
   Collect the cheese over the cloth or sieve.

e) Pack the cheese and store it:
   After separating the cheese form the whey, add some salt and put it into clean bowl to store it. This will help to keep the shelf life of the cheese longer.
   Therefore, cheese can be stored fresh, i.e.,
   ○ For 2 days in a room with 30 °C.
   ○ For 7 days in a room with 4 °C.

G. Summary of Procedures: For processing milk the input requirement and procedures of tasks are summarized as follows:

1. Raw milk is poured into the cheese vat through a cloth. The temperature should be > 32 °C
2. 1.25 % yoghurt starter is added and the milk is thoroughly stirred. Leave to stand for 30 minutes.
3. Add rennet according to instructions from supplier. Stir milk to ensure equal distribution of rennet. Leave untouched until a shiny firm coagulum has formed (35-45 minutes).
4. Cut the curd into equal sized cubes of 1 to 1.5 cm. Cut horizontally first, then twice vertically, if cubes are too big cut again vertically.

5. Start heating with low fire and leave to stand for 15 minutes.

6. Start stirring gently and put on full fire. Gradually intensify stirring. Keep on stirring and heating until the temperature is 47 C. Stop heating and keep on stirring for about 30 minutes.

7. Stop stirring. The cheese grains will then sediment on the bottom of the vat. Remove with a clean bucket as much whey as possible. Pour the whey through a sieve into a milk churn or another container. Push cheese grains away from the outlet, insert a sieve in front of the hole and remove remaining whey through outlet.

8. The cheese grains will stick together within 5 minutes after removal of the whey. Cut the lot into pieces of approx. 25 x 25 cm and turn them. Put lid on the vat.

9. Cut, turn and pile the cheese every 30 minutes for 1 1/2 hours of until pH has reached 5.1-5.3. The cheese should be like boiled chicken meat.

10. Cut the cheese into ribbons of approx. 25 x 8 cm. Weigh out 2.2 kg, put them into a basin with holes in the bottom of the side.

11. Insert basin into another basin containing water at 82 - 85 C. Leave the cheese there for 10 minutes.

12. Take basin with cheese out, knead and stretch the cheese vigorously while it is hot. Add salt (one spoonful per 2 kg) and knead again.

13. Insert cheese in hot water for short time (1-2 minutes) take it out, shape it and fill it in the mould.

14. Put mould with cheese into ice-water.

15. Cool the cheese in the ice-water until it becomes firm, about 1 hour.

16. Let the surface of the cheese dry before packing.

17. Put the packed cheese in the freezer or refrigerator.
## 5. Written Test

<table>
<thead>
<tr>
<th>Module 17</th>
<th>Lists of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>Why do you have to cool milk immediately after milking?</td>
</tr>
<tr>
<td>Question 2</td>
<td>What do you do to preserve milk from being spoiled and keep it for longer time?</td>
</tr>
<tr>
<td>Question 3</td>
<td>Given that you have whole milk at hand, explain the procedures in detail how to make milk by products such as butter, cheese, etc.</td>
</tr>
<tr>
<td>Question 4</td>
<td>To get 1 kg of butter, how many litres of milk is needed?</td>
</tr>
</tbody>
</table>

Trainee's name: ________________________________

Submit your answers to your trainer for evaluation.

### 6. Practical Activity Procedures

<table>
<thead>
<tr>
<th>Module</th>
<th>Practical procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 1</td>
<td>As per the figure given in the <em>information Sheet</em> make improved butter churner and show to your trainer for evaluation.</td>
</tr>
<tr>
<td>Task 2: Buy 10 litres of milk and process it as per the chart given in the next column</td>
<td>![Diagram of butter churner process]</td>
</tr>
</tbody>
</table>

*Training Manual for Farmers, Rural Women and Youth*

Duration: 8 hours

1. General Description of Competencies of the Module

This Module introduces the trainee to marketing milk and milk by-products in the context of the dairy cattle production. This includes, to whom to sell where to sell, how to set selling price and how to promote the products. Accordingly, the trainee will get the required knowledge, skills and proper attitude about marketing milk and milk by products. In addition, the module looks into the importance of searching for similar businesses in cattle dairy sector either individually or in group. Furthermore, the Module highlights the value of cooperation and building team spirits among and within groups to run dairy business.

2. Learning Outcomes

At the end of this Module trainees will be able to:

- Conduct study on milk and milk by-product market.
- Calculate profit, and set selling price.
- Assess and identify those engaged in keeping dairy animals, produce and sell whole milk and by-products in his/her locality.
- Look for organizations and cooperation that support the dairy farming business.

3. Description of Learning Activities (operations guide)

- Read carefully the information provided under the Information Sheet
- Answer the questions given under Written Test
- Accomplish the tasks given under the Practical Procedures Section
- Submit your answers to your trainer for evaluation.
- If the evaluation done by your trainer is satisfactory, proceed to the next module; otherwise do the above procedures again.
4. Information Sheet

<table>
<thead>
<tr>
<th>Module 18: Information Sheet</th>
<th>Marketing milk and milk by-products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing whole milk is the marketing of whole milk as it is milked without processing. Marketing whole milk involves the following processes:</td>
<td></td>
</tr>
<tr>
<td>- After you finished milking your cow:</td>
<td></td>
</tr>
<tr>
<td>- Keep the milk in a cool place for about 2 - 3 hours.</td>
<td></td>
</tr>
<tr>
<td>- The milk creams will floatation.</td>
<td></td>
</tr>
<tr>
<td>- Collect the cream by using sieve and you can use it.</td>
<td></td>
</tr>
<tr>
<td>- After collecting the cream, put the milk in a well cleaned small containers for distribution. While pouring the milk in half, one and two litres of vessels take care of the following points:</td>
<td></td>
</tr>
<tr>
<td>- Make sure that the milk jog that you use to draw the milk from the milk collection jar shall be boiled for at least 10 minutes.</td>
<td></td>
</tr>
<tr>
<td>- After boiling make sure that the milk vessels were kept under direct sunlight &amp; are dry.</td>
<td></td>
</tr>
<tr>
<td>What is important in milk transport?</td>
<td></td>
</tr>
<tr>
<td>1. Take care of your milk in all the following steps; keep your milk clean.</td>
<td></td>
</tr>
<tr>
<td>- During milking.</td>
<td></td>
</tr>
<tr>
<td>- During storage.</td>
<td></td>
</tr>
<tr>
<td>- And during transportation.</td>
<td></td>
</tr>
<tr>
<td>2. Keep your milk cool.</td>
<td></td>
</tr>
<tr>
<td>3. Handle your milk gently.</td>
<td></td>
</tr>
<tr>
<td>4. Transport your milk in the shortest time possible but at low cost.</td>
<td></td>
</tr>
<tr>
<td>How can we collect milk efficiently?</td>
<td></td>
</tr>
<tr>
<td>- Establish your dairy project nearer to farmers' cooperatives etc so that your product arrives at the market keeping its quality, with low cost and in time. The system is also efficient in terms of managing man power and transportation.</td>
<td></td>
</tr>
<tr>
<td>- If your milk is not cool or preserved, it must arrive at the dairy within 4-6 hours.</td>
<td></td>
</tr>
</tbody>
</table>
• Protect your milk from light and temperature. Keep it cool.
• Keep everything clean and sanitize your equipment.
• Always use clean, disinfected filters when you strain milk. Never carry animals or dry things along the milk.

What kind of milk containers should you use?
• For small qualities of milk, you should use cans.
• Bulk tanks use pumps. They are extensive and need maintenance to avoid spoilage of milk.
• Choose your cans carefully.
• Materials for cans should be non corrosive such as stainless steel, aluminium or plastic.
• They should not give any flavour to the milk. Do not use containers which have contained pesticides or other chemicals.
• They should be light but strong and with a smooth surface (easy to clean).
• Consult your extension worker about the best type of container to use.
• You may construct a box with insulating foam inside (polystyrene) to avoid temperature increase during transport.

How can you avoid problem during transport?
• Do not:
  o Shake up your milk.
  o Freeze it.
  o Expose it to rapid change in temperature (especially 15-30 °C).
Otherwise, the fat globules may break down and your milk may get rancid flavour.
• Do not:
  o Use containers made of copper or iron.
  o Leave your milk in direct light or sun light. Your milk may get metallic or sunlight flavour.

Do not allow bacteria to develop quickly. Keep your milk cool and clean and send it to your customers or the collecting centre quickly.

Identify stakeholders in the milk production and processing business:
• Search for institutions that are interested in the dairy farming business in
your area to get support and improve your dairy business.

- Identify what kind of support you can get from the local administration and private organizations.

- From experiences elsewhere, the following can be those institutes that can potentially support the milk production and processing business:
  1. Agriculture and Rural Development Coordination offices: This is found in all regional states at the level of regional zonal, and woreda. The office delivers the following services:
     b. Artificial Inseminations.
     c. Professional services in the field of animal breeding and husbandry.
  2. Cooperatives Promotion Office.
  4. Non Governmental organizations:
     a. Market promotion.
     b. Inputs provisions.
     c. Professional/expert advices.
  5. Financial Services Providing Organizations; to look for credit.
  6. Organizations that provide livestock market information.

5. Written Test

<table>
<thead>
<tr>
<th>Module 18</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>What is the advantage of teaming up with other milk marketing agents?</td>
</tr>
<tr>
<td>Question 2</td>
<td>Explain the precautions that you have to take while taking your milk to the market</td>
</tr>
</tbody>
</table>

Trainee's name: ____________________________

Submit your answers to your trainer for evaluation.
6. Practical Activities Procedure

<table>
<thead>
<tr>
<th>Module 18</th>
<th>Description of practical tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer the questions by assuming you are to market your milk.</td>
<td>• Look for and assess local market for your milk and by-products:</td>
</tr>
<tr>
<td></td>
<td>o Price of milk.</td>
</tr>
<tr>
<td></td>
<td>o Where and how is the milk produced?</td>
</tr>
<tr>
<td></td>
<td>o Who are the milk customers?</td>
</tr>
<tr>
<td></td>
<td>o How could you promote your milk product?</td>
</tr>
<tr>
<td></td>
<td>• Taking into consideration the following 3 points that are required to produce, your milk calculate your milk price</td>
</tr>
<tr>
<td></td>
<td>o Inputs: These are tangible things that are “put in” for the business to operate.</td>
</tr>
<tr>
<td></td>
<td>o Operational activities - These are the various tasks or activities that must be carried out for the business to produce results.</td>
</tr>
<tr>
<td></td>
<td>o Marketing activities: These are the tasks related to linking the business products to the consumers or customers.</td>
</tr>
<tr>
<td></td>
<td>• Milk can be marketed in two ways. These are given below:</td>
</tr>
<tr>
<td></td>
<td>o Whole milk, and</td>
</tr>
<tr>
<td></td>
<td>o Processed milk by-products.</td>
</tr>
<tr>
<td></td>
<td>Explain the strategy you prefer to market your milk product.</td>
</tr>
<tr>
<td></td>
<td>• In your area which of the following are known for marketing milk and milk by products?</td>
</tr>
<tr>
<td></td>
<td>o Small holder farmers.</td>
</tr>
<tr>
<td></td>
<td>o Small petty traders, who usually buy milk from producers.</td>
</tr>
<tr>
<td></td>
<td>o Hotels, cafeteria, and other retailers.</td>
</tr>
<tr>
<td></td>
<td>o Small and big dairy farms.</td>
</tr>
<tr>
<td></td>
<td>o Small and big milk processing plants.</td>
</tr>
<tr>
<td></td>
<td>To identify the above listed milk marketing agents, you have to undertake market assessment. Milk and milk by-products market</td>
</tr>
</tbody>
</table>
assessment includes the following: (trainees should attempt all answer the questions)

- Who needs whole milk? Who needs butter?
- What is the amount of their requirement?
- Where is it needed?
- Does this require means of transport?
MODULE NINETEEN: RECORD INFORMATION

Duration: 10 hours

1. General Description of Competencies of the Module

Proper recording and management of information are elements in running dairy cattle production. Therefore, the different information and data that require record are dealt in this Module. In addition to that, charts and tables that would facilitate the task of recording are also incorporated with adequate explanation.

2. Learning Outcomes

At the end of this Module trainees will be able to:

- Record milk and other by-products, such as:
  - Daily amount of milk produced.
  - The amount of milk given to calves.
  - The amount of spoiled milk.
  - The amount of milk by products produced.
- Prepare health record book (for prevention and treatment).
  - Prevention such as vaccination.
  - Medication.
- Keep the reproduction record for each cattle such as calving, service, etc
- Record expenses and income.

3. Description of Learning Activities (operations guide)

- Read and carefully the information provided under the Information Sheet
- Print the different formats given under the Information Sheet for group discussion.
- Answer the questions given under written test.
- Accomplish the tasks given under the Practical Procedures Section.
- Submit your answers to your trainer for evaluation.
- If the evaluation done by your trainer is satisfactory, proceed to the next module; otherwise do the above procedures again.
1. Importance of record Keeping and contents recorded

Record keeping is an important activity in any dairy or other enterprises. You should therefore ensure that all farm activities are recorded promptly. Records are decisive among others, for the following reasons:

- Management decisions.
- Financial accounting.
- Identifying problems.
- Planning for the future.
- To determining whether targets are met not.

2. Information to be recorded

For a successful operation of a dairy enterprise, the following records should be kept:

- Pedigree and numbers of each animal kept on the farm.
- Dates of heat periods, breeding, pregnancy checks, bulls used for mating,
- Performance records and growth rates.
- Ancestry or genetic records include maternal and paternal records
- Breeding records sire, date of breeding, pregnancy confirmation, date of calving, and particulars of calf.
- Veterinary records; disease type, date and treatment
- Production amount of milk (daily, weekly or monthly), butter fat, drying date.
- Feed records; amount of concentrate fed for pasture grazed animals or the total amount fed for zero grazed animals.
- Financial records; all financial transactions.

3. Good records should have the following characteristics:

- Easy to update.

<table>
<thead>
<tr>
<th>Module 19: Information Sheet</th>
<th>Record keeping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record keeping</td>
<td></td>
</tr>
<tr>
<td>Importance of record Keeping and contents recorded</td>
<td></td>
</tr>
</tbody>
</table>
4. Methods of keeping records

Records can be kept by filling in special forms or recording in specially designed ledger books. The advantage of using forms is that records are entered in a predetermined and systematic way, but the main drawback is that they are easily lost or misplaced. Ledger books are handy in the office but not easy to carry around.

Whatever method you choose to use, the records must be entered daily. From forms, ledger books and other books of accounts, if possible, the data may be entered into a computer for further analysis and reporting.

5. Types of dairy farm records

The following are the major types of dairy farm records that you can keep:

5.1. Milk yield and utilization record

- Record the milk yield from each milking cow on:
  - Daily basis.
  - Weekly basis.
  - Monthly basis, and
  - One lactation period basis. By adding all the daily yields for one animal, you get the lactation yield. This helps you decide on culling and selecting calves.

- Record the amount of milk given to calves as well as other purposes.
- Record the milk selling prices.

Exercise: Why do you have to record milk yield?

Hints that could help you decide on the exercise

To improve feeding; are you feeding the right balanced ration

To select better breeding cattle (selecting animals) such as calves from animals with high yields because they should have high yields when they grow.

To cull out poor performing cattle.
Name of dairy farm:
Month: Year:

**TABLE 10: BIWEEKLY MILK YIELD RECORD FORMAT**

<table>
<thead>
<tr>
<th>Ear tag number</th>
<th>Birth date</th>
<th>Amount of milk yield</th>
<th>Ear tag number of the cow:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>The first week of the</td>
<td>Ear tag number of her father:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>month</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Morning</td>
<td>Night</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Morning</td>
<td>Night</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Ear tag number of the cow:**  
**Ear tag number of her father:**  
**Birth date of the cow:**  
**Ear tag number of her mother:**

**TABLE 11: MONTHLY MILK YIELD RECORD OF A COW FOR VARIOUS LACTATION PERIOD**

<table>
<thead>
<tr>
<th>Month</th>
<th>Amount of milk yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lactation period 1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

5.2. **Feed and utilization records.** This should include:
- Animal identity.
- File number.
- Daily provided amount of hay, green forage, balanced ration and silage.
- Date of recording including the year.
- Write also if there is shortage of feed.
- Record also where you purchase the feed type and how much you paid.

5.3. **Calving and services records**

Calving and services record can help to manage and decide whether a cow is...
productive or not based on her calving rate and calving interval. Or to keep the cow or cull it based on her reproductive performance.

This record format should include the elements as given in Table 3.

**TABLE 12: CALVING AND SERVICES RECORD AND MONITORING FORM**

<table>
<thead>
<tr>
<th>Lactation period</th>
<th>Services/mati...</th>
<th>Details of the calf</th>
<th>ID Number of the calf</th>
<th>Weight of the calf (in kg's)</th>
<th>Calf Sex</th>
<th>Problems encountered during delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.4. Animal purchase and sale Records: This should include the following points:

- From where the animals were purchased (organization, individual supplier); the date and year of purchase; price, blood level, sex, age, length and weight at purchase, and reason for purchase.

- Animal sales; to whom it is sold, selling date, and year, price, blood level, sex, length and weight at selling time and the reason for selling.

**TABLE 13: RECORD FORMAT FOR CONDITION OF ANIMALS PURCHASED FOR THE DAIRY FARM**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Identification name or number</th>
<th>Breed</th>
<th>Blood level</th>
<th>Sex</th>
<th>Age</th>
<th>Purchase Date</th>
<th>Year</th>
<th>Purchase place</th>
<th>Purchase price</th>
<th>Weight at purchase</th>
<th>Reason for purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 14: RECORD FORMAT FOR REGISTERING ANIMALS SOLD DUE TO VARIOUS REASONS

<table>
<thead>
<tr>
<th>S. No</th>
<th>Animal identity</th>
<th>Breed</th>
<th>Blood level</th>
<th>Sex</th>
<th>Age</th>
<th>Selling Date</th>
<th>Selling Year</th>
<th>Selling place</th>
<th>Selling price</th>
<th>Weight at selling time</th>
<th>Reasons for sell</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.5. Vaccination and treatment records: This should include:

- Internal and external parasites; date of disease occurrence; sign and symptoms; date of diagnosis; period of treatment; result of diagnosis; and if it happened due to familial problems it shall be recorded so.
- The type and amount of treatment given.
- Also the amount of pesticide/insecticide used to treat external parasites, sprayed or dipped.
- The type of vaccinations given to various age groups.
- The price of treatment and vaccination.

Animal identity: ___________________________  Father's name/identity number: ___________________________

Birth date: ___________________________  Mother's name/identity number: ___________________________

### TABLE 15: VACCINATION AND TREATMENT RECORD AND MONITORING FORMAT FOR INDIVIDUAL ANIMALS

<table>
<thead>
<tr>
<th>S. No</th>
<th>Type of vaccination given</th>
<th>Price of vaccine</th>
<th>S. N°.</th>
<th>Date</th>
<th>Type of treatment given</th>
<th>Drug price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remark: ___________________________
Summary: Read and remember the following information that should be recorded in a dairy farm:

1. Production Record: Milk is the product of your dairy farm. Record your milk yield and milk production on daily basis as well as for each milking time per day. To do so prepare Table or Format to record:
   - Daily milk yield.
   - The amount of milk given to calves.
   - Amount of milk spoiled.
   - Amount of milk transferred for milk processing—for butter, cheese making.

2. Health Record
   - Prepare to record format or table the type of vaccinations given once or twice a year.
   - Prepare recording format or table to register the type of treatment given for sick animals throughout the year.

3. Reproduction Record: Prepare reproduction record Table or Format for individual cattle that includes:
   - Calving.
   - Service/AI or mating/.

4. Expense and income record: Prepare expense and income record format/table

5. Written Test
Write down the answer for the following questions and then discuss it in a small group

<table>
<thead>
<tr>
<th>Module 19</th>
<th>List of assessment points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>Explain in detail the importance of recording information.</td>
</tr>
<tr>
<td>Question 2</td>
<td>What are the advantages recording milk production?</td>
</tr>
<tr>
<td>Question 3</td>
<td>Explain the kind of information to be recorded in a dairy farm.</td>
</tr>
</tbody>
</table>

Trainee’s name: _____________________________
Submit your answers your trainer for evaluation.