

Training Manual for Smallholder Dairy Producers

Prepared under the
Assam Agribusiness & Rural Transformation Project (APART)
ARIAS Society, Khanapara, Guwahati-22

For
Dairy Development, Assam

By
International Livestock Research Institute (ILRI)





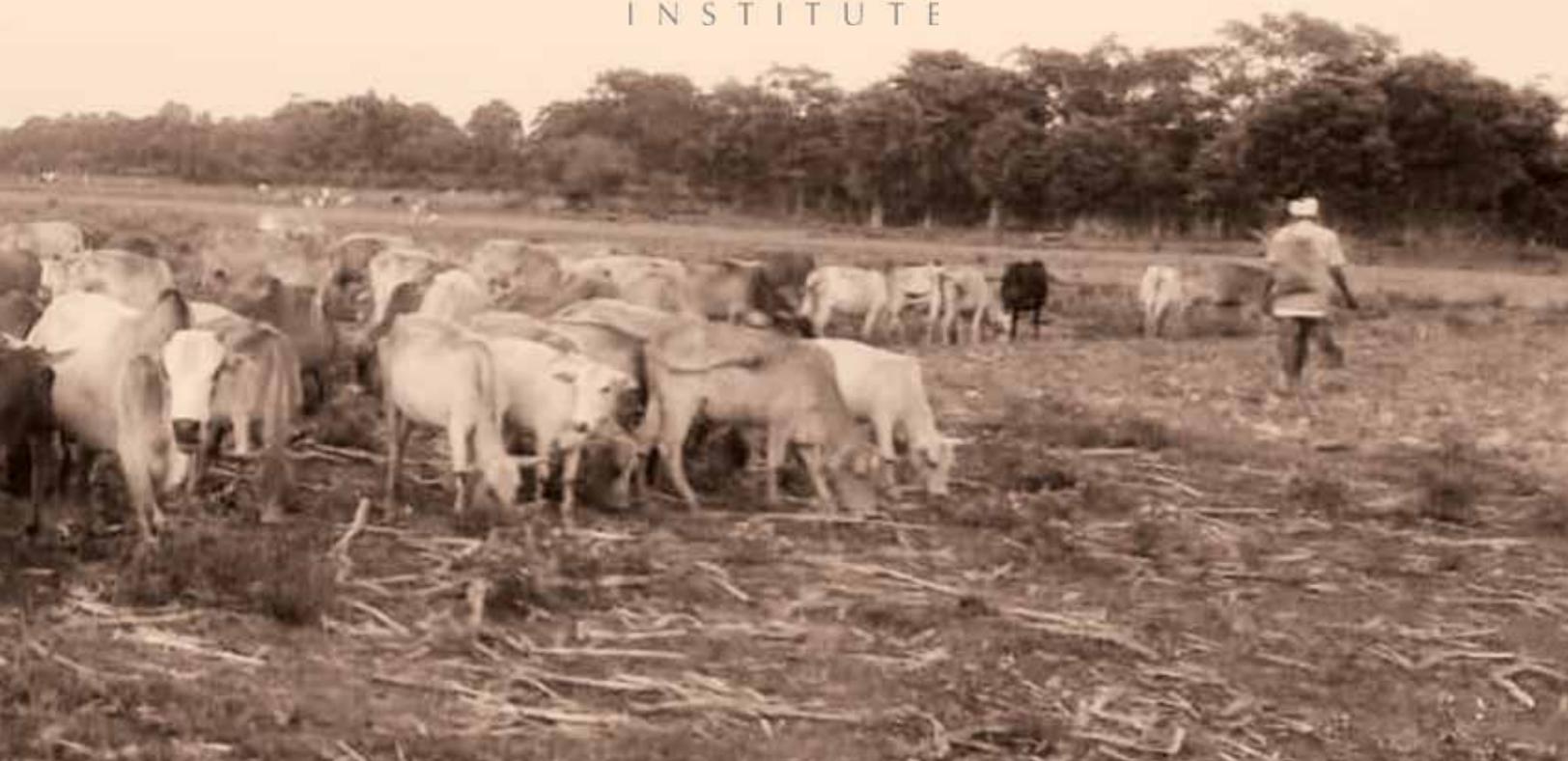
Training Manual for Smallholder Dairy Producers

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By
International Livestock Research Institute (ILRI)

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Foreword

Assam is largely deficit in milk production. Assam's per capita availability of milk is only 70 gm/day in contrast to the national average of 337 gm/day. To gear up the state's milk production and to generate more income and employment among the farming community, the Animal Husbandry & Veterinary Department (AHVD), Govt. of Assam is taking several initiatives including the World Bank aided Assam Agribusiness and Rural Transformation Project (APART) under which capacity building of dairy farmers on increasing productivity, production efficiency and quality and safety of milk have been emphasized. Towards this, it has become imperative on the part of the smallholder dairy producers to gain knowledge and capacity to bring changes in their production practices for optimum utilization of resources and reducing the negative externalities of milk production on human health (e.g. zoonotic diseases) and environment.

This training manual has been very comprehensive covering all important aspects required for a market led development of milk. The manual has included topics of local relevance that include different breeds and breeding systems, housing and manure management of dairy farms, day to day management of different categories of dairy animals, nutrition for improved productivity, reproductive health management, common diseases of dairy animals, clean and hygienic practices for milk production, storage and handling of milk, reducing milk borne hazard, welfare of animals and environment and improving dairy entrepreneurship. I am sure that training would immensely contribute in improving farm management practices, reducing diseases incidence, improving farm hygiene, improving milk quality and safety and improving milk production and productivity. This manual would meet a long standing requirement of the department for a customized training course for dairy producers which can be used across the projects and districts.

I truly commend the hard work put by International Livestock Research Institute (ILRI) and the concerned officials of AHVD, Directorate of Dairy Development (DDD) and ARIAS society in conceptualizing the dairy producers' manual and bringing the same to its present form. The publication of this manual is timely and need based. Given that the manual has been written in short and simple language with addition of several photographs, illustration, demonstration, exercise, videos etc. I am highly confident that users of this manual will greatly be benefitted.

(Rajesh Prasad)

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Preface

Assam is a milk deficit state which is largely because of dominance of nondescript indigenous breed producing small volume of milk per day. The deficit calls for the opportunities for more investment on dairy farming in the state and urges the need for transforming the current low input low output milk production system to more market oriented system. In addition to increasing production, improving milk quality and safety is also important to reduce the milk borne diseases and to ensure better health of the milk consuming population. To produce safer milk, the key requirement is to improve clean and hygiene practices in the farm and to reduce prevalence of diseases of dairy animals in addition to improving other areas of management practices. This transformational change needs to begin with more access to information, knowledge and capacity of the farming community. Realising the fact, the Dairy Development, Assam of the Animal Husbandry and Veterinary Department (AHVD), Govt. of Assam has taken up a special initiative under the World Bank aided Assam Agribusiness and Rural Transformation Project (APART) to bring about changes in the practices adopted by the smallholder dairy farmers.

The International Livestock Research Institute (ILRI), the knowledge partner of AHVD under the APART project, has done a commendable job by developing a customized training manual for the smallholder dairy farmers of the state in consultation with the concerned officials of AHVD and Directorate of Dairy Development (DDD), Govt. of Assam

I am sure this manual will bring a noticeable change in the skill and attitude of the smallholder dairy farmers of the state for a higher production of hygienic milk to meet the requirement of the consumers of the state and also make them earn more income from this practice. I appreciate sincere efforts of ILRI, the concerned officials of AHVD and DDD, Assam and ARIAS Society for developing the training manual for the smallholder dairy farmers in its present form.


25/09/19

Commissioner & Secretary
A.H. & Veterinary Department, Govt. of Assam

Acknowledgment

We sincerely thank and acknowledge the guidance and support that we received from the Agriculture production Commissioner (APC) to the Govt. of Assam; Commissioner and Secretary to the Govt. of Assam, Animal Husbandry and Veterinary Department; State Project Director, ARIAS Society; Director, Nodal Officer (APART) and other officials of DDA and AHVD and concerned officials of the ARIAS Society without which this training module would not have been possible to complete.

Our sincere thanks also goes to all of the District Dairy Officers (DDO), Veterinary Officers (VOs), Food Safety Officers and other concerned officials who gave important feedback during content development and content finalization of this training module.

We also express our sincere gratitude to the dairy producers who immensely helped us by supplying the necessary information during Training Need Assessment (TNA) surveys in the sample districts and supported in collecting images of specific dairy farming activities needed to incorporate in the manual.

At last but not the least we express our sincere thanks to all the ILRI's colleagues who drafted the earlier version of this training manual based on which this comprehensive revised version has been developed to meet the current need of the farming communities.

Team Leader and Resident Consultant, APART-ILRI
International Livestock Research Institute (ILRI)

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Abbreviation

AHVD	: Animal Husbandry and Veterinary Department
AI	: Artificial Insemination
APART	: Assam Agribusiness and Rural Transformation Project
ARIAS	: Assam Rural Infrastructure & Agricultural Services
BQ	: Black Quarter
CLR	: Corrected Lactometer Reading
CMT	: California Mastitis Test
DDA	: Dairy Development Assam
DDO	: District Dairy Officers
DVO	: District Veterinary Officer
FMD	: Foot and Mouth Disease
GNC	: Ground Nut Cake
HF	: Holstein Friesian
HS	: Hemorrhagic Septicemia
ILRI	: International Livestock Research Institute
MOC	: Mustard Oil Cake
SNF	: Solids Not Fat
TNA	: Training Need Assessment
TDN	: Total Digestible Nutrient
TOC	: Til Oil Cake
ToT	: Training of Trainers
UMMB	: Urea Molasses Mineral Block
VO	: Veterinary Officer

Proposed training schedule

Day	Session	Topic	Time
1 st Day	Registration		10:30 am -11:00 am
	Session 1	Introduction to the training, its importance, relevance and expected outcome.	11:00 am -11:45 pm
		Pre-training evaluation	11.45 am -12.00 pm
	Session 2	Breeds and breeding of dairy animals	12:00 pm - 2:00 pm
2 nd Day	Session 3	Management of different categories of dairy animals	11.00 am-12.30 pm
	Session 4	Housing and manure management of dairy farms	12:31 pm – 2.00 pm
3 rd Day	Session 5	Better nutrition for improved productivity	11:00 am -12:30 pm
	Session 6	Reproductive health management and common diseases of dairy animals	12:31 pm - 2:00 pm
4 th Day	Session 7	Clean and hygiene practices for milk production, storage and handling	11:00 am -12:30 pm
	Session 8	Human health risk posed by dairy animals/milk and risk reduction measures	12.30 pm-2.00 pm
5 th Day	Session 9	Entrepreneurship development in dairy farming	11:00 am -12.00 pm
	Session 10	Welfare of animals and environment	12:00 pm-1:00 pm
		Post training evaluation	1:00 pm - 1:30 pm
		Formation of Hygienic Milk Monitoring Committee	1.30 pm -2.00 pm

Note: The suggested training schedule is only indicative, facilitator may modify the schedule as deemed fit locally. high tea may be provide at the end of the 2nd session on each day.

Duration of the training: 5 days; Total time: 15 hours

SESSION 1: Introduction to the Training, Its Importance, Relevance and Expected Outcome

Introduction to the training

The training facilitator will introduce the training by following the sequence as stated below-

Welcome address: Facilitator will welcome the participants and explain the objectives of the training.

Self-introduction: Facilitator will ask the participants to state their name, address, primary occupation, years of experience on dairy farming, etc..

Expectation from the training: Facilitator will ask the participants to explain their expectations from the training. Facilitator will write down the key points in a flipchart/white board/black board in order to revisit the same at the end of the training (whether the training has met those expectations or not).

Pre-training status evaluation: Facilitator will distribute the pre-training status evaluation form among the participants. Facilitator will ask them to put tick marks in appropriate boxes (Agree/Disagree/Don't know). After the evaluation, he/she will collect the forms and use the same at the end of the training to compare the differences before and after the training.

Ground rules: Facilitator will ask the participants what general behaviour (e.g. switching off the mobile during training, coming to the training on time, leaving the training after completion, no involvement on side discussion during the time of training delivery etc.) he expects to experience in order to run the training smoothly and effectively, he/she will list all suggestions in a flip chart and post the flipcharts where it is visible throughout the training.

Content: Importance of the dairy farmer, changing consumers' behaviour and relevance of the training and benefits of the training

Training materials

- Laptop, LCD projector and screen
- White board and marker (multiple color)
- Flip chart
- Pre-training status evaluation form
- Manual and handouts

1.1 Importance of a dairy farmer

A milk producer-

- Supports nutritional security to milk and milk product consumers;
- Generates income and employment for self;
- Directly/indirectly supports livelihood of self and other value chain actors (input suppliers, service providers, milk traders, sweet makers, Cottage processor, etc.);
- Helps in economic empowerment of the womenfolk for their dominant role in milk production activities;
- Contributes in State's total income (GDP);

1.2 Objective of the training

- To increase productivity (milk production/day);
- To increase income and employment of dairy farmers;
- To improve milk quality and safety;
- To increase welfare of animals and environment;
- To increase entrepreneurship in dairy farming;

1.3 Changing consumers' behaviour and relevance of training

- With increase in income, urbanization and population growth, the demand for milk and milk products are constantly increasing.
- Consumers are increasingly becoming cautious about the food that they eat and ready to pay premium price for better quality.
- Various food safety regulations (like FSSAI) are constantly reminding them to buy food items from sources that ensure better clean and hygiene and comply with safety norms.
- If consumers cannot trust on quality they would look for better options resulting fall in demand and price.
- Big processing houses outside the state may exploit the opportunity in their favour by introducing milk produced by their farmers making the milk business more competitive. This may make smallholder farmers difficult to survive in the business.
- Training and certification, and adoption of clean milk production practices may potentially raise the demand for milk of smallholder producers by establishing consumers' increased trust on the quality of milk sold by them. Traders may also prefer those trained producers who are supplying clean and hygienic milk to them.

1.4 How does the training benefit you?

The training would help in gaining knowledge on

- Characteristics of various good dairy breeds available in Assam, method of selection of good dairy animals and advantages and disadvantages of different methods of mating and record keeping;
- Types of housing system and proper method of constructing of cattle shed;
- Nutritional requirements of dairy animals, different types of feed, feed composition, feed requirement, feed processing and preservation, etc.;
- Most prevalent diseases of cattle, mode of transmission, symptoms and control options;
- Different types of germs, their mode of transmission, ways of causing disease, important zoonotic diseases, milk safety through reducing antimicrobial residue, pesticide residue, adulterants, etc.;
- Good practices of milk handling, transportation and storage;
- Bio-security provisions, better farm hygiene, disposal of farm waste, manure management, etc.;
- Wellbeing of animals by welfare activities;
- Development of entrepreneurship skill.

Summary

- A dairy farmer plays an important role in the society through supplying milk to a large milk consuming population.
- The changing consumers' preference and behaviour and their awareness towards food safety invite better quality and safer milk for consumption.
- Increased demand for milk in the market calls for increased productivity and market efficiency of production system.
- The training will benefit the farmers by improving knowledge and skill on various aspects like breeding, feeding, housing, management, disease control and entrepreneurship development.

SESSION 2: Breeds and Breeding of Dairy Animals

Session objectives

- To make participants understand about the available cattle breeds and their characteristics
- To enable them explain the characteristics of good dairy animal and give cattle buying tips
- To guide the participants on selection of dairy animals for breeding purpose
- To enable the participants explain about the available system of breeding and mating methods as possible ways of improving breeding herds
- To explain the reproductive system of cattle and importance of record keeping.

Training Methods to be followed

- Participatory discussion
- Distributing manuals and relevant handouts
- Experience sharing
- Group discussion

Training materials

- Laptop, LCD projector and screen
- Whiteboard and markers (multiple color)
- Manual and handouts
- Photos and illustrations

2.1 Dairy breeds: Characteristics of different dairy breeds of the state

Good dairy breed is important for higher productivity of milk. In Assam about 94% of dairy animals are of local variety (non-descript) that produce only around 1 liter of milk/day. Among the exotic breeds (breeds of foreign origin producing higher milk), Jersey and Holstein Friesian (HF) and their crosses with local breed are the most common. Some Indian breeds like Red Sindhi and Sahiwal are also reared by a small section of farmers in some parts of the state.

Table 1: Most common exotic breeds of cattle available in Assam

Photo	Name of Breed	Characteristics
	Jersey: This breed is originally from England	<ul style="list-style-type: none">• Body colour: slightly red or brown or a mix of both• Body size: long sized head and long hair at the end of the tail• Body weight: pure breed cow ranges from 400-500 kgs.• Average milk yield: about 20 litres per day• Adaptability: well acclimatized in Assam's condition• Feed requirement: Requires lesser amount of feed and care than Holstein-Friesian

	<p>Holstein Friesian (HF): This breed is originally from Holland</p>	<ul style="list-style-type: none"> • Body colour: mainly black with white patches or white body colour with black patches • Body weight: about 680-770 kg • Milk yield: about 25-30 litres per day in Indian condition • Feeding: needs better care and feeding than Jersey • Milk fat: lower than the Jersey breed
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Table 2: Indian breeds of dairy cattle available in Assam

Photo	Name of Breed	Characteristics
	Red Sindhi	<ul style="list-style-type: none"> • Body colour: mainly deep red • Body shape: wide forehead with ears hanging down • Body weight: mature cow ranges from 300-350 kgs • Horn shape: curved horns • Milk yield: about 4-6 liters per day
	Sahiwal	<ul style="list-style-type: none"> • Body colour: ranges from reddish brown to more prominent red with white shades on neck, underline and hind limbs. • Body weight: about 400-500 kgs. • Milk yield: about 5 -7 liters per day • Dewlap: large

2.2 Characteristics of a good dairy animal

For selection of good dairy animals following points should be taken into consideration

Udder

- Teat: of average size, squarely placed and points should be straight down. teats are uniform and cylindrical in shape
- Udder vein: prominent and tortuous

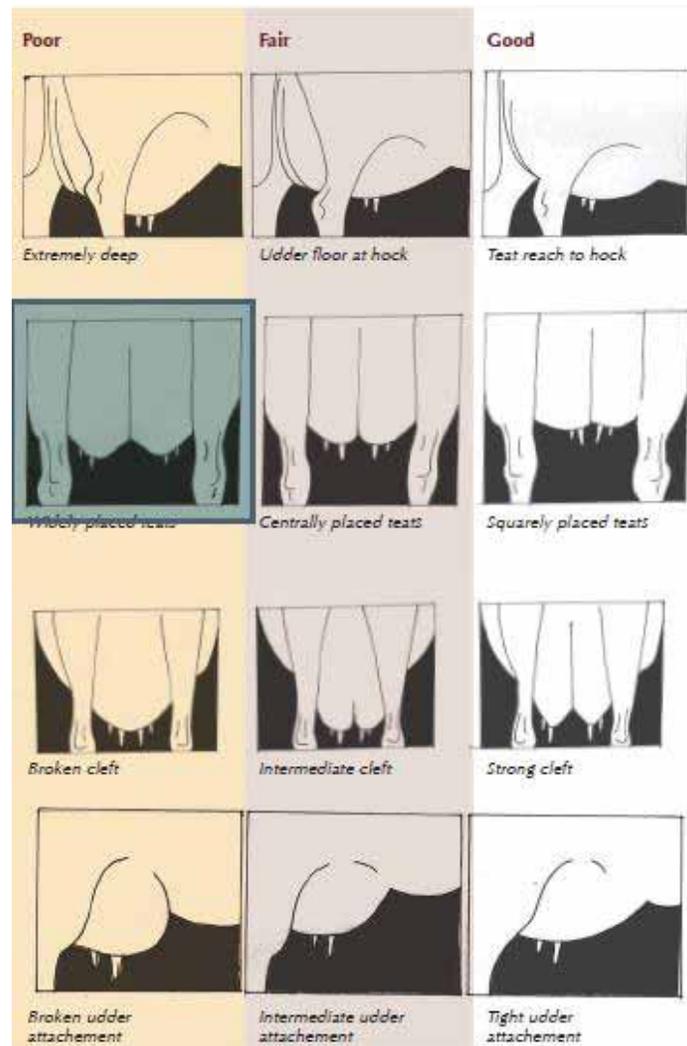


Non-pendulous udder with prominent and tortuous udder vein

- **Quarter:** free from lump or injury and all are uniform in size, non pendulous and firmly attached



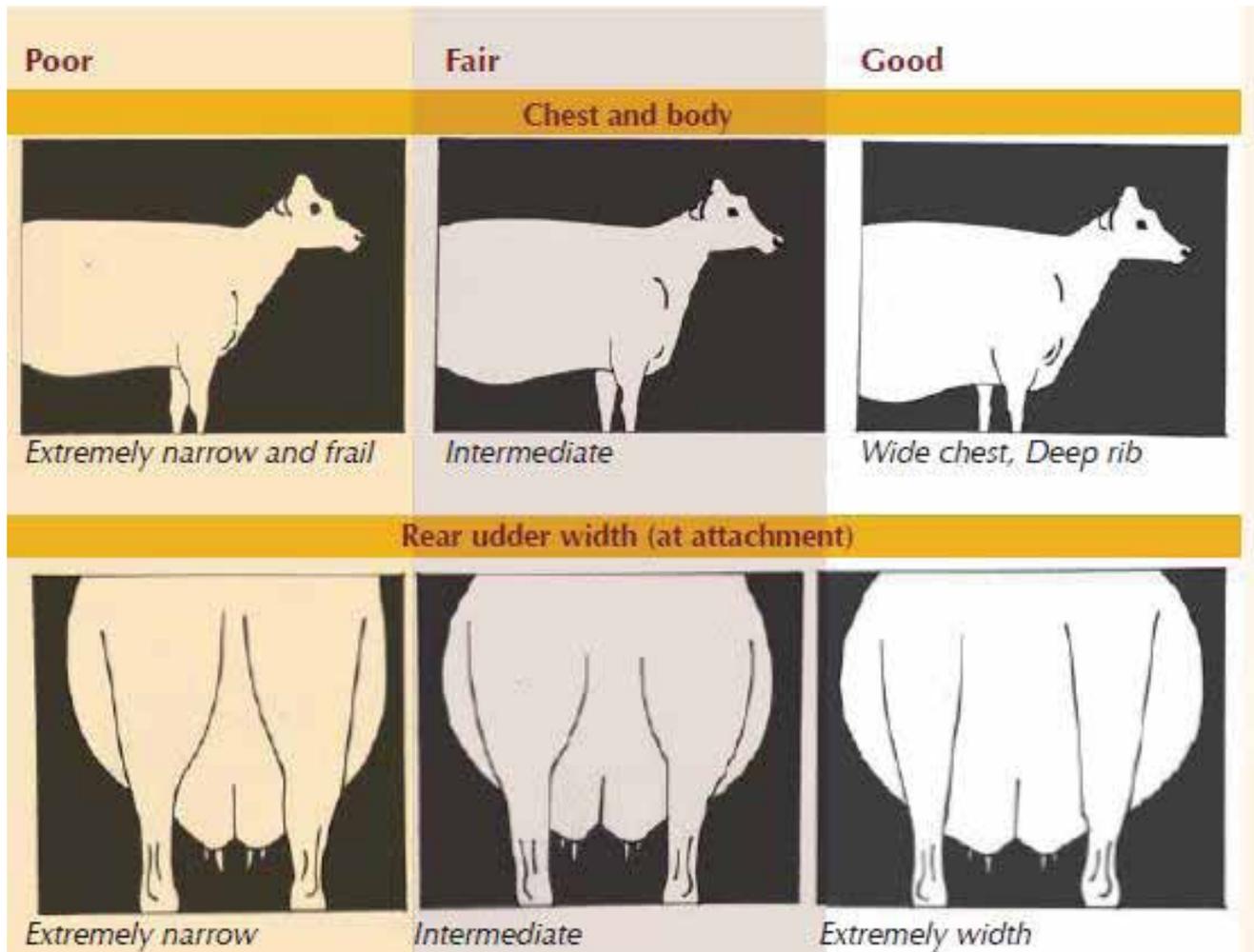
All the four quarters are uniform in size



Different parameters for a perfect udder

Overall body shape

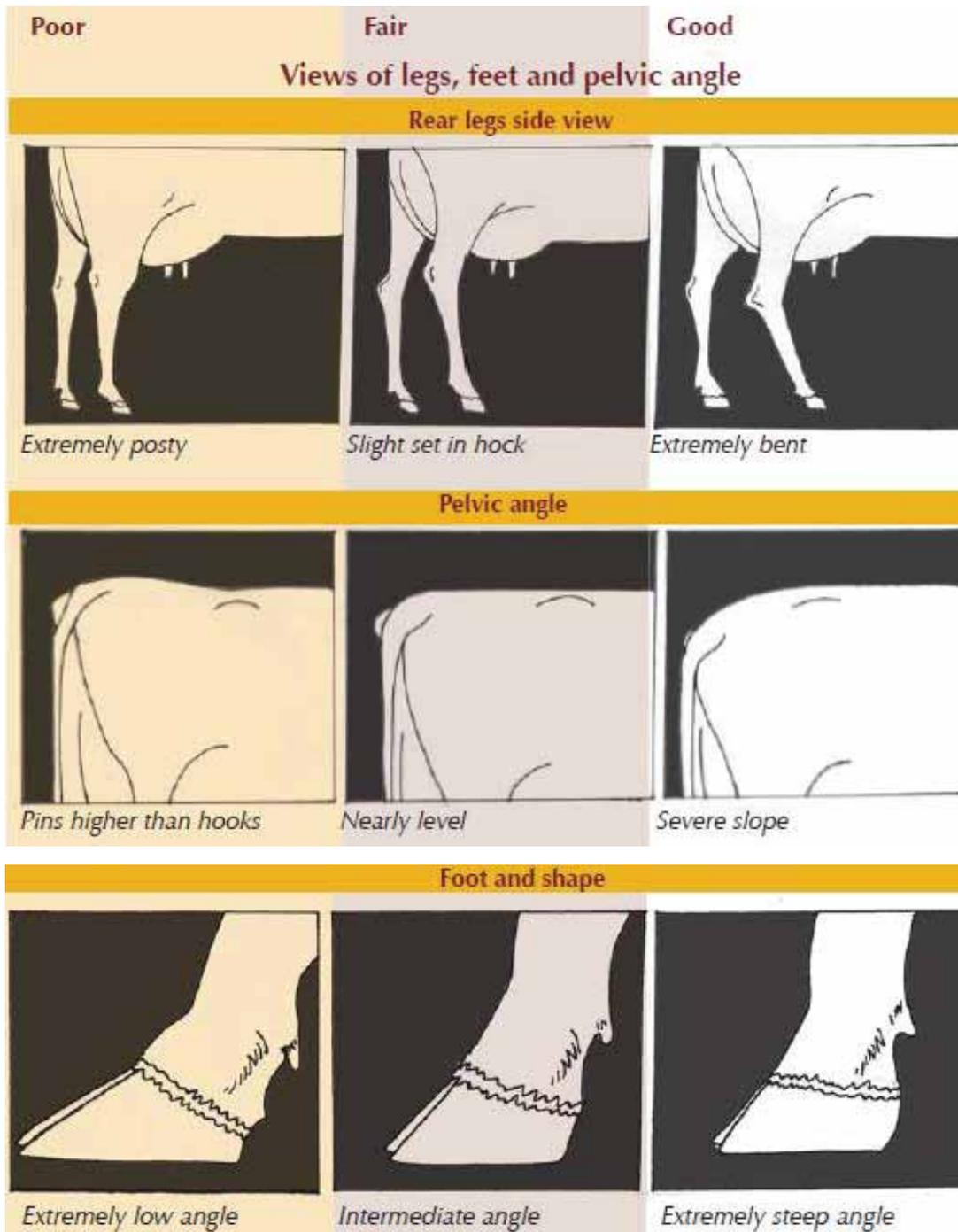
- Deep long body with wide chest
- Top line should be straight from the side and wide from the rear
- Overall body should be triangular in shape from neck to back
- Neck should be long
- Skin should be soft, shiny and pliable



Body configuration parameters

Legs and feet

- **Hind legs:** should be straight and wide apart when seen from behind;
- **Front legs:** should be straight;
- **Hock joints:** should be free from swelling and erosion;
- **Hooves:** should not be elongated and inter digital space should neither be wide apart nor overriding;



Well positioned leg, foot and hoof.

Cattle buying tips

- Observe the presence of characteristics of good dairy animals in the cow.
- Observe the cow during milking and feeding. It should ideally be good milk yielder and good eater.
- Prefer to buy from a farm which is
 - Clean and hygienic,
 - Properly managed,
 - Keep proper records,

- Climatic and management conditions at source should be similar to that of your farm,
- Routinely vaccinated and dewormed,
- Take good care in providing adequate feed and water.
- Collect the history of the cattle
 - Name/number of the cattle,
 - Age and stage of lactation,
 - No. of lactation,
 - Milk yield during last one week and on the day of purchase (try to physically verify),
 - Feeding and other habits (e.g. docile) of the animal including bad habits,
 - Disease history,
 - Deworming and vaccination

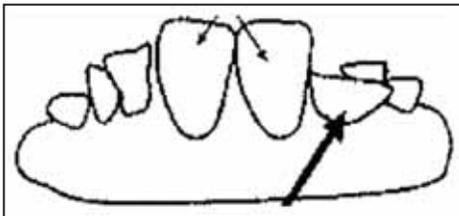
Try to visit the farm for about 2 to 3 times to observe the milk production, work schedule, habit of the animal and build rapport with it. If there is chance that the sellers may potentially misguide, then try to gather information from few in the neighbourhood are well-acquainted with the farm.

2.3 Determination of age

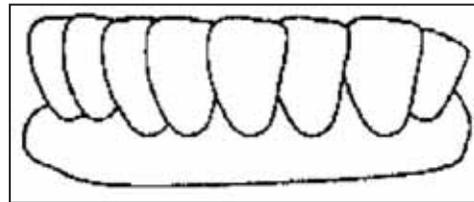
It is very important to determine the age of the animal that is going to be purchased as the information provided by the seller may not always be reliable.

2.3.1 Determination of age by dentition

By the end of one month of age, all the eight temporary incisors appear of a calf.



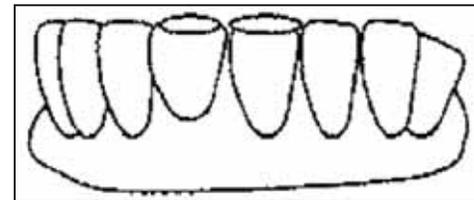
Dentition at 30 days??



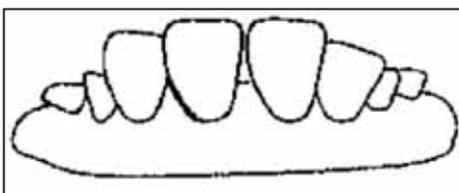
Dentition by 4-5 years



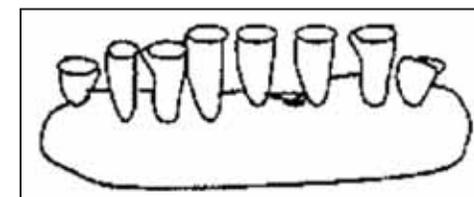
Dentition after 30 months



Dentition by 6th year



Dentition at 3 years



Dentition by 10th year

Source: NDDB, India

- The central pair of temporary incisors are replaced by permanent ones which attains full growth by 2 years (indicated by thin arrows).
- The third permanent incisor erupts at around 30 months of age (indicated by thick arrow)
- The fourth permanent incisor erupts after 30 months of age
- By the 4-5 years the animal has a full set of permanent incisors.
(In buffaloes by 5-6 years)



Dentition of a 3 year old cattle with 2 pairs of fully developed incisors



Dentition of cattle aged around 4-5 years with 4 pairs of permanent incisors

Source: NDDB, India

- By the sixth year, the central incisor shows wear and leveled top
- The wearing progresses steadily after the sixth year and by the tenth year, all the incisors show significant wear and space in between them.

2.3.2 Determination of age by horn rings

This is not a good indicator and gives only a very rough idea. The first horn ring appears at around 10- 12 months of age. One ring is added approximately in a year. But at the fifth year, the first three rings may not be visible and after 8 years, none may be visible.

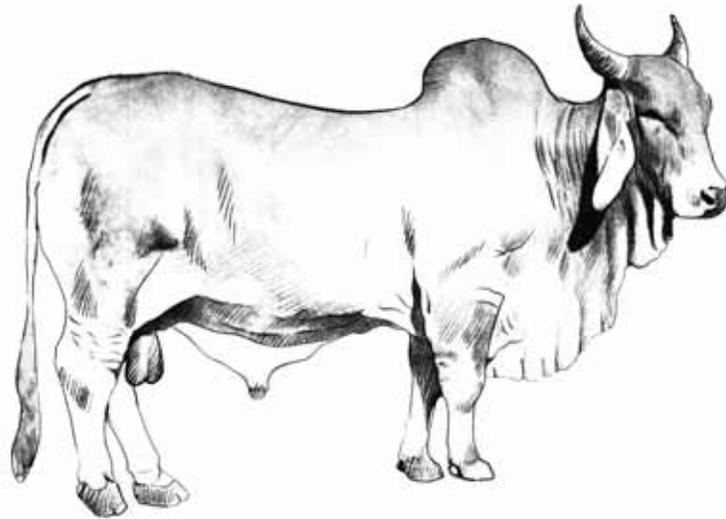
2.4 Method of selection of dairy animals for breeding purposes

Good quality offspring (calves/ young animals) is important to produce more milk in future. This could be achieved by mating between good quality male and female animals. To get a good offspring it is essential to select the best available male and female animals based on certain characteristics that are stated below:

2.4.1 Selection of male animals (bull)

- The selected animal's body structure should preferably be aligned to its breed characteristics;
- Legs and feet of the selected animals should be strong and straight;
- The selected animals should be healthy and free from any physical deformities;

- It should be free from diseases;
- It should be free from external parasites;
- It should be a good eater;
- Both the testicles should be well developed of equal size and well placed on both sides;
- The penis should be of normal shape and size and there should not be any pus or blood around the penile area;



A bull with well-developed testicles of equal size

2.4.2 Selection of female animals

- The selected animal's body structure should preferably be aligned to its breed characteristics.
- History of milk yield of the cows in its previous lactation (if heifer, of its mother's) and lactation length should be checked. Only the cows with the history of higher milk yield and normal lactation length should be selected.
- History of mothering ability and calf survivability should be good.



A cow with a shiny body coat

- History of reproductive problems of cows (e.g. repeat breeding, retention of placenta, abortion, still birth) should reportedly not be present.
- The cow should be docile and should let down the milk easily.
- Legs and feet of the selected animals should be strong.
- Should be healthy and free from any physical deformities.
- Should be free from any infectious/contagious or other diseases.
- Should be free from external parasites.

2.5 Possible ways to improve breeding herds

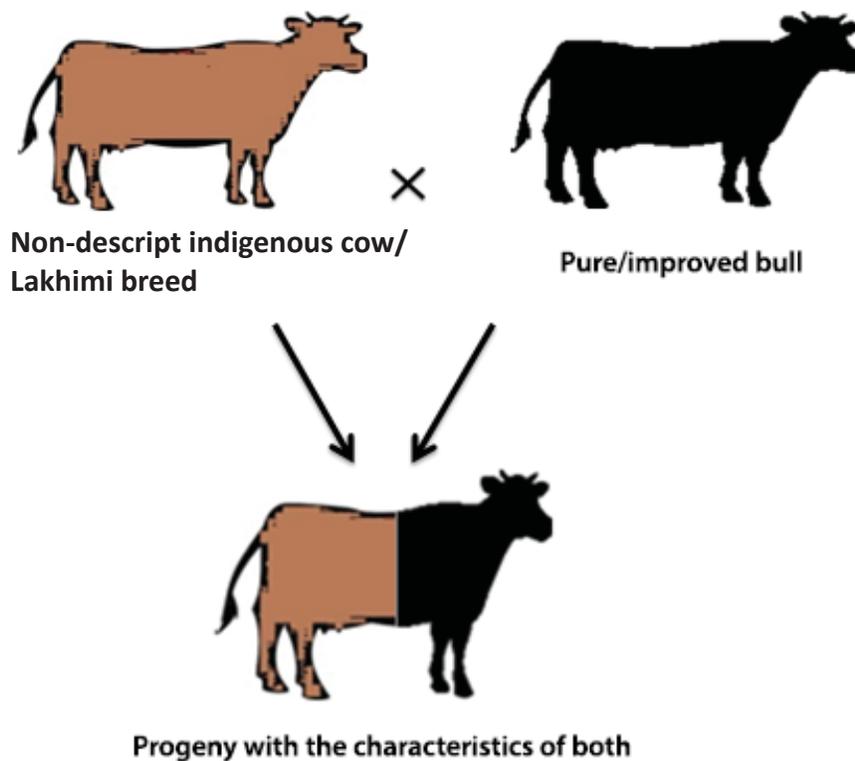
2.5.1 Inbreeding

In this type of breeding, male and female animals of one family of the same breed are mated repeatedly to preserve the distinct breed characteristics. Doing inbreeding for several generations may lead to reduction of performance of the progeny called inbreeding depression.

- In village condition, this mostly occurs when a community bull is repeatedly used for Suggest to avoid this practice.
- Try to select best quality male from unrelated families to breed the cows.

2.5.2 Crossbreeding

Crossbreeding is the most common method of breeding followed to get an offspring with better productive and reproductive traits of two different breeds. In this system of breeding female of one breed (more particularly of indigenous breed) is mated with the selected male of an another breed (e.g. Jersey or HF crossed with indigenous cattle).



Advantage of crossbreeding

- Off spring inherits desired qualities of both the parents and gives higher milk yield compared to the indigenous breed;
- A cross of Jersey and Indigenous cow can produce 4-6 liters of milk per day instead of about 1 liter by non-descript alone;
- Cross bred animals are more adaptable to local climatic condition than their exotic parents;
- Cross bred animals suffer from lesser diseases than their exotic parents;

Disadvantage of crossbreeding

- Local breeds may disappear gradually in future.
- Necessitates the knowledge of breeding between two breeds of animals.
- Sometime it becomes difficult to comply with the breeding norms laid down in the state cattle breeding policy.

General considerations regarding crossbreeding

- Calving difficulties may arise when a heavy large breed male is crossed with smaller breed female.
- Selection of breeds should be done based on performance and adaptation to local climatic condition in the area.

Selective breeding: To get better quality offspring (calves/ young ones) of a breed the best quality male and female animal of the breed should be selected for mating.

2.6 Mating system

There are two types of mating. These are-

-Natural mating

-Artificial insemination

2.6.1 Natural mating

Mating of a female animal by a male animal naturally.

Advantages

- Conception rate is better in case of natural mating than in artificial insemination;
- Heat detection and timing of insemination is not considered as a major factor for mating;
- Small holder dairy farmers in rural areas can easily use community bull where they do not get access to artificial insemination services;
- Commercial farmers can breed their female animals by rearing bull at their own farm.

Disadvantages

- Difficult and costly to maintain a good bull for mating;
- Difficult to get a bull of desired breed for mating/ crossing;
- More chances of transmission of sexually transmitted diseases;
- There are more chances of getting the animals injured during mounting;
- Natural mating may lead to inbreeding depression if same male and female animals are mated repeatedly;



Natural mating of cow and bull

2.6.2 Artificial Insemination

It is a method of breeding by artificial means through collection of semen from a bull and depositing the same at the reproductive tract of a female animal.

Advantages

- Can breed female animal with the desired breed of male animal to increase productivity and performance of the progeny;
- Eliminate the chances of physical contact of the animals and thereby, reducing the chances of transmission of infectious/ contagious diseases;
- Eliminate the chances of inbreeding depression;
- No chances of physical injury.

Disadvantages

- There may be lesser conception rate if the cows are not inseminated in proper time of the heat period or if the semen quality is not good.
- Dystocia (difficulty in the process of delivery) may develop if indigenous cow is inseminated with the semen from bull of exotic (heavy) breed.
- There is involvement of cost for insemination.

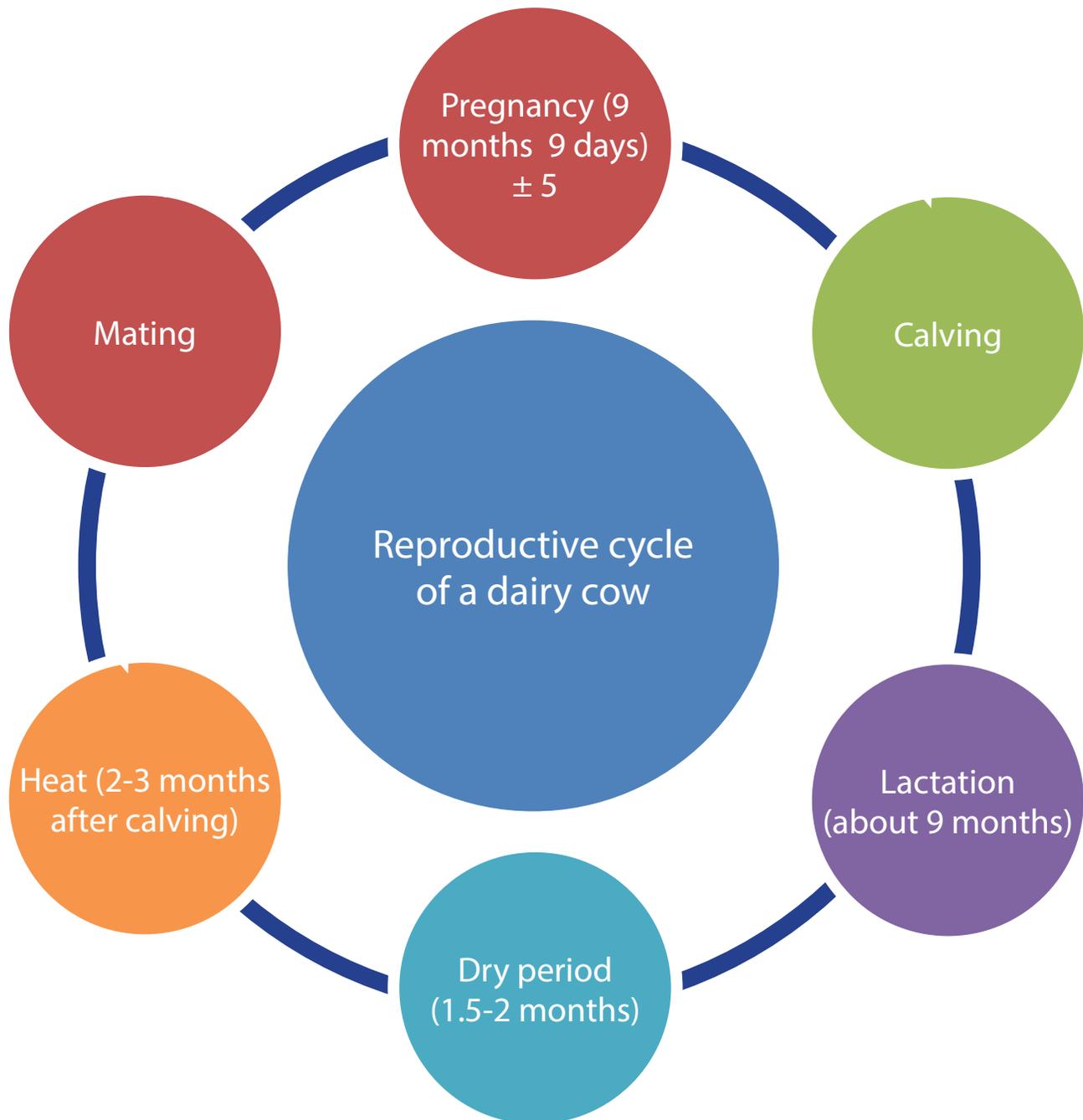


Artificial Insemination in cow

2.7 Reproductive system

Reproductive system talks about the process involved in producing a new off-spring. It is a key parameter determining the level of production and profitability in a dairy herd. A number of reproductive diseases occur during and after calving. It is important to determine when the animal is in heat, and to know the common reproductive disorders and the ways to manage them.

Reproductive cycle of a dairy cow



Reproductive cycle of cattle

- The age of puberty in a well fed dairy cow is 8-16 months and in bull is around 9-10 months.
- Inter-calving period (one calf to the other) about 14-16 months

Table 3: Cattle Gestation Table based on 283 Days Gestation Period

Generally younger cows and smaller breeds may calve up to 10 days earlier and older cows and larger breeds may calve up to 10 days later.

Date of Service	Calf Due										
1-Jan	10-Oct	1-Feb	10-Nov	1-Mar	8-Dec	1-Apr	8-Jan	1-May	7-Feb	1-Jun	10-Mar
2-Jan	11-Oct	2-Feb	11-Nov	2-Mar	9-Dec	2-Apr	9-Jan	2-May	8-Feb	2-Jun	11-Mar
3-Jan	12-Oct	3-Feb	12-Nov	3-Mar	10-Dec	3-Apr	10-Jan	3-May	9-Feb	3-Jun	12-Mar
4-Jan	13-Oct	4-Feb	13-Nov	4-Mar	11-Dec	4-Apr	11-Jan	4-May	10-Feb	4-Jun	13-Mar
5-Jan	14-Oct	5-Feb	14-Nov	5-Mar	12-Dec	5-Apr	12-Jan	5-May	11-Feb	5-Jun	14-Mar
6-Jan	15-Oct	6-Feb	15-Nov	6-Mar	13-Dec	6-Apr	13-Jan	6-May	12-Feb	6-Jun	15-Mar
7-Jan	16-Oct	7-Feb	16-Nov	7-Mar	14-Dec	7-Apr	14-Jan	7-May	13-Feb	7-Jun	16-Mar
8-Jan	17-Oct	8-Feb	17-Nov	8-Mar	15-Dec	8-Apr	15-Jan	8-May	14-Feb	8-Jun	17-Mar
9-Jan	18-Oct	9-Feb	18-Nov	9-Mar	16-Dec	9-Apr	16-Jan	9-May	15-Feb	9-Jun	18-Mar
10-Jan	19-Oct	10-Feb	19-Nov	10-Mar	17-Dec	10-Apr	17-Jan	10-May	16-Feb	10-Jun	19-Mar
11-Jan	20-Oct	11-Feb	20-Nov	11-Mar	18-Dec	11-Apr	18-Jan	11-May	17-Feb	11-Jun	20-Mar
12-Jan	21-Oct	12-Feb	21-Nov	12-Mar	19-Dec	12-Apr	19-Jan	12-May	18-Feb	12-Jun	21-Mar
13-Jan	22-Oct	13-Feb	22-Nov	13-Mar	20-Dec	13-Apr	20-Jan	13-May	19-Feb	13-Jun	22-Mar
14-Jan	23-Oct	14-Feb	23-Nov	14-Mar	21-Dec	14-Apr	21-Jan	14-May	20-Feb	14-Jun	23-Mar
15-Jan	24-Oct	15-Feb	24-Nov	15-Mar	22-Dec	15-Apr	22-Jan	15-May	21-Feb	15-Jun	24-Mar
16-Jan	25-Oct	16-Feb	25-Nov	16-Mar	23-Dec	16-Apr	23-Jan	16-May	22-Feb	16-Jun	25-Mar
17-Jan	26-Oct	17-Feb	26-Nov	17-Mar	24-Dec	17-Apr	24-Jan	17-May	23-Feb	17-Jun	26-Mar
18-Jan	27-Oct	18-Feb	27-Nov	18-Mar	25-Dec	18-Apr	25-Jan	18-May	24-Feb	18-Jun	27-Mar
19-Jan	28-Oct	19-Feb	28-Nov	19-Mar	26-Dec	19-Apr	26-Jan	19-May	25-Feb	19-Jun	28-Mar
20-Jan	29-Oct	20-Feb	29-Nov	20-Mar	27-Dec	20-Apr	27-Jan	20-May	26-Feb	20-Jun	29-Mar
21-Jan	30-Oct	21-Feb	30-Nov	21-Mar	28-Dec	21-Apr	28-Jan	21-May	27-Feb	21-Jun	30-Mar
22-Jan	31-Oct	22-Feb	1-Dec	22-Mar	29-Dec	22-Apr	29-Jan	22-May	28-Feb	22-Jun	31-Mar
23-Jan	1-Nov	23-Feb	2-Dec	23-Mar	30-Dec	23-Apr	30-Jan	23-May	1-Mar	23-Jun	1-Apr
24-Jan	2-Nov	24-Feb	3-Dec	24-Mar	31-Dec	24-Apr	31-Jan	24-May	2-Mar	24-Jun	2-Apr
25-Jan	3-Nov	25-Feb	4-Dec	25-Mar	1-Jan	25-Apr	1-Feb	25-May	3-Mar	25-Jun	3-Apr
26-Jan	4-Nov	26-Feb	5-Dec	26-Mar	2-Jan	26-Apr	2-Feb	26-May	4-Mar	26-Jun	4-Apr
27-Jan	5-Nov	27-Feb	6-Dec	27-Mar	3-Jan	27-Apr	3-Feb	27-May	5-Mar	27-Jun	5-Apr
28-Jan	6-Nov	28-Feb	7-Dec	28-Mar	4-Jan	28-Apr	4-Feb	28-May	6-Mar	28-Jun	6-Apr
29-Jan	7-Nov			29-Mar	5-Jan	29-Apr	5-Feb	29-May	7-Mar	29-Jun	7-Apr
30-Jan	8-Nov			30-Mar	6-Jan	30-Apr	6-Feb	30-May	8-Mar	30-Jun	8-Apr
31-Jan	9-Nov			31-Mar	7-Jan			31-May	9-Mar		
1-Jul	9-Apr	1-Aug	10-May	1-Sep	10-Jun	1-Oct	10-Jul	1-Nov	10-Aug	1-Dec	9-Sep
2-Jul	10-Apr	2-Aug	11-May	2-Sep	11-Jun	2-Oct	11-Jul	2-Nov	11-Aug	2-Dec	10-Sep
3-Jul	11-Apr	3-Aug	12-May	3-Sep	12-Jun	3-Oct	12-Jul	3-Nov	12-Aug	3-Dec	11-Sep
4-Jul	12-Apr	4-Aug	13-May	4-Sep	13-Jun	4-Oct	13-Jul	4-Nov	13-Aug	4-Dec	12-Sep
5-Jul	13-Apr	5-Aug	14-May	5-Sep	14-Jun	5-Oct	14-Jul	5-Nov	14-Aug	5-Dec	13-Sep
6-Jul	14-Apr	6-Aug	15-May	6-Sep	15-Jun	6-Oct	15-Jul	6-Nov	15-Aug	6-Dec	14-Sep
7-Jul	15-Apr	7-Aug	16-May	7-Sep	16-Jun	7-Oct	16-Jul	7-Nov	16-Aug	7-Dec	15-Sep
8-Jul	16-Apr	8-Aug	17-May	8-Sep	17-Jun	8-Oct	17-Jul	8-Nov	17-Aug	8-Dec	16-Sep

9-Jul	17-Apr	9-Aug	18-May	9-Sep	18-Jun	9-Oct	18-Jul	9-Nov	18-Aug	9-Dec	17-Sep
10-Jul	18-Apr	10-Aug	19-May	10-Sep	19-Jun	10-Oct	19-Jul	10-Nov	19-Aug	10-Dec	18-Sep
11-Jul	19-Apr	11-Aug	20-May	11-Sep	20-Jun	11-Oct	20-Jul	11-Nov	20-Aug	11-Dec	19-Sep
12-Jul	20-Apr	12-Aug	21-May	12-Sep	21-Jun	12-Oct	21-Jul	12-Nov	21-Aug	12-Dec	20-Sep
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14-Jul	22-Apr	14-Aug	23-May	14-Sep	23-Jun	14-Oct	23-Jul	14-Nov	23-Aug	14-Dec	22-Sep
15-Jul	23-Apr	15-Aug	24-May	15-Sep	24-Jun	15-Oct	24-Jul	15-Nov	24-Aug	15-Dec	23-Sep
16-Jul	24-Apr	16-Aug	25-May	16-Sep	25-Jun	16-Oct	25-Jul	16-Nov	25-Aug	16-Dec	24-Sep
17-Jul	25-Apr	17-Aug	26-May	17-Sep	26-Jun	17-Oct	26-Jul	17-Nov	26-Aug	17-Dec	25-Sep
18-Jul	26-Apr	18-Aug	27-May	18-Sep	27-Jun	18-Oct	27-Jul	18-Nov	27-Aug	18-Dec	26-Sep
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21-Jul	29-Apr	21-Aug	30-May	21-Sep	30-Jun	21-Oct	30-Jul	21-Nov	30-Aug	21-Dec	29-Sep
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29-Jul	7-May	29-Aug	7-Jun	29-Sep	8-Jul	29-Oct	7-Aug	29-Nov	7-Sep	29-Dec	7-Oct
30-Jul	8-May	30-Aug	8-Jun	30-Sep	9-Jul	30-Oct	8-Aug	30-Nov	8-Sep	30-Dec	8-Oct
31-Jul	9-May	31-Aug	9-Jun			31-Oct	9-Aug			31-Dec	9-Oct

Source: www.progressivelivestock.co.nz

Signs of heat

The best time to look for signs of heat in the cow is either early morning or in the evening. Take care not to disturb the animals but just watch the animals for the signs.

Signs of heat in dairy cows

- Swelling in the genital organ of cow;
- Shows restlessness;
- In milking animals, milk production suddenly drops;
- Jelly like mucus can be found on the floor and/or in the dung;
- Female in heat shows tendency to allow bull to mount.

Key message of session 2

- Farmers may buy dairy animals of his/her choice but he should also consider the characteristics of a good dairy animal and cattle buying tips as guiding principle
- The laid down parameters of selection of animal (bull, female animal) should be followed when reared for breeding purposes.
- The farmers should explore the best possible way of improving breeding herds by making trade offs for advantages and disadvantages.
- The farmers should observe that his/her animal is behaving as per the reproductive cycle and consult the local veterinary officer for any deviation. For successful breeding one should be able to closely observe the heat.

SESSION 3: Management of Different Categories of Dairy Animals

Session objectives

- To make participants understand about the care and management of calves, heifer, lactating animal, dry and pregnant animal etc.
- To make the participants aware about the methods of milking
- To make them aware the daily work schedule and keeping of different farm records.

Training Methods to be followed

- Participatory discussion
- Distributing relevant handouts
- Experience sharing
- Group discussion

Training materials

- Laptop, LCD projector and screen
- Whiteboard and markers (multiple color)
- Manual and handouts
- Flip chart
- Photos and illustrations

3.1 Care and management of calf

Proper feeding and management practices must be adopted for calves so that they develop well. The feeding and care of the calf start before its birth. The pregnant cow should be dried off 6-8 weeks prior to expected calving date and should be fed well, otherwise the calves born would not be so healthy as expected.

3.1.1 Early management of calves

- Remove/clean any mucous from nostrils and mouth of new born immediately after birth.
- Normally the cow licks the calf immediately after birth. This act facilitates drying off the calf and helps in stimulating breathing and circulation.
- If the cow do not lick the calf, rub and dry the calf with a dry cloth. The umbilical cord should be tied with a thread about 2-5 cm away from the body and cut 1 cm below the ligature and apply antiseptic solution such as Jincture Iodine, etc.
- Remove the wet bedding from the pen to keep it clean and dry.
- Weigh the calf at birth should be recorded.
- Wash the cow's udder and teats with lukewarm water, preferably with some mild antiseptic solution.
- Allow the calf to suckle colostrum (milk produced in 2-3 days at the beginning of lactation).
- The calf should be standing up within one hour. If not, help the calf stand up.

3.1.2 Feeding of calves

- Don't milk out and consume the colostrum (milk produced in 2-3 days at the beginning of lactation). Allow the calf to consume colostrum. Colostrum increases the immunity of the calf to fight against diseases.

- Whole milk should be given after 3 days.
- Over feeding of milk may lead to development of 'Calf Scours'.
- Milk replacer ration can be given to replace mother's milk. This will make the farm more economic. Calf's health would also not suffer.
- Start feeding calf starter ration after one month of age.
- Provide good quality green fodder and hay from fourth month onwards.

3.1.3 Other management practices of calves

- Identification of the calf should be done by ear tagging.
- First deworming should be done at the age of 21 days with suitable anthelmintic drug (e.g. piperazine citrate/adequate) to eradicate Ascaris worms which may be transmitted vertically from the mother.
- Precaution should be taken in the first month to prevent occurrence of pneumonia, diarrhea (calf scous) and worms.
- Start vaccination against various diseases from the third month onwards.
- House the calves under warm and clean condition to avoid above occurrences.
- If any extra teat is present in female calf as an addition to four, it should be surgically removed with the help of a veterinarian at 1-2 months of age.
- Keep the body clean and dry to avoid fungal infection.
- Provide mineral-blocks for licking/mineral mixture to prevent mineral deficiency.

3.2 Care and management of heifer

A cow shall give the maximum productive and reproductive performance only when provided with proper care and management at her heifer stage. The following care and management practices are recommended for a heifer.

- Feed the heifer sufficiently for her normal growth. There is relatively more protein requirement during the early stage.
- A heifer is expected to come into heat within 8-16 months age depending on breed.
- The size of a heifer is more important than the age at breeding time.
- Small heifers are more likely to have difficulty in calving.
- Heifer should be well grown and in good flesh at calving time to get most profitable level of milk production.
- Move the heifer to a separate shed about 6-8 weeks before the expected date of calving.
- Maintain proper hygiene and take necessary preventive steps against common diseases to ensure her good health.
- Take extra care during calving of a heifer because it is her first calving and she may have difficulty in it.

3.3 Care and management of lactating cows

The milch animal would give optimum milk production only when she is properly fed and necessary care is taken and good management practices are followed.

- Always treat the cows gently and with kindness. Never frighten or cause excitement because this may lead to a sharp drop in milk yield.

- With proper feeding and care, a cow generally shows heat symptoms within 20-30 days after calving. However, cows are inseminated after about 3 months to get the full lactation yield.
- Maintain regularity in feeding. Concentrate mixture is to be fed before or during milking while roughages are fed after milking.
- Provide sufficient clean drinking water to drink at frequent intervals. If sufficient water is not given, a high yielder also cannot produce milk to its potential.
- Always maintain the time of milking to bring natural stimulation to yield milk. The milk man should be the same always. It gives more comfortability to the animal.
- Full hand milking should be done and not with thumb and index finger i.e. fisting. Rapid, continuous and dry hand milking should be practiced without undue jerking of teats.
- Never use oil to make the teats slippery.
- It should be practiced to milk the cow without having been suckled by the calf. This will help weaning the calves early and increased the milk production for human consumption.
- The cows should be cleaned before milking. Daily brushing will remove loose hair and dirt from the coat and will help in clean milk production. Grooming also keeps the animal coat silky and the hide pliable.
- Check for common diseases regularly and take necessary action, if detected any.
- Check for mastitis at periodic interval by CMT test. Any sub-clinical mastitis can lead to heavy loss in production.
- Common vices such as- Kicking, licking, suckling etc. should be looked for and be detected, if any, and preventive measures to be taken.
- Provide at least 2 months dry period between two calvings. If the dry period is not sufficient, the milk yield in subsequent lactation will be reduced.
- Carry out periodic vaccination against the common and prevailing diseases and also guard against insects and pests.
- Number every animal and record it.

3.4 Care and management of pregnant cows

Adequate health care and nutritional management during pregnancy will ensure-

- Proper growth and development of the foetus in mother's womb will result in birth of a healthy calf.
- Optimum development of the udder resulting in a higher milk yield and also a longer lactation period.
- Development of optimal immunity to win over diseases like-mastitis, post partum uterine infection, etc.
- Lesser chances of retained placenta.
- Never take a cow in the last trimester of pregnancy far away for grazing and avoid uneven paths.
- Drying off of a lactating cow should be done within a period of 15 days after the 7th month of gestation.
- Provide enough space to the pregnant cows for standing and sitting comfortably.
- Feed good quality roughage and give concentrate supplementation as per requirement.
- Provide adequate and suitable ration enriched with calcium and energy booster to the pregnant cow to reduce the possibility of occurrence of diseases like milk fever and ketosis at the time of calving. This will also ensure maximum milk yield.

- Provide adequate water (about 80-100 lit) round the clock to pregnant cows with 80-100 liters of clean and potable drinking water daily.
- Vaccinate against Foot and Mouth Disease (FMD), Hemorrhagic Septicemia (HS) and other diseases periodically.
- Carry out de-worming for external and internal parasites routinely.
- As the cow/heifer is approaching parturition, she becomes uneasy and separates herself from the herd.
- Signs of nearing to calving include enlargement of the udder and belly, and discharge from the vulva.
- Move the animal to a separate shed 4-5 days prior to calving and the shed should be clean and dry. Bedding materials like paddy straw should be spread on the ground.

3.5 Care and management of dry cows

Drying off: It is the process of making the lactating cow stop giving milk 60 days prior to expected date of calving. The transfer of maternal immunity from the cow's blood to the milk start about one month before calving and reaches its peak just before parturition.

If dry period is not sufficiently maintained, the milk would be devoid of maternal immunity and the new born calf would be vulnerable to various diseases.

Drying off is essential to –

- Increase the subsequent lactation length and milk yield,
- Recoup strain of previous parturition and previous lactation,
- Provide enough nutritional level for reaching peak yield,
- Withstand stress of next pregnancy,
- Avoid metabolic diseases like milk fever,
- Build reserve of nutrients for maintaining good level of milk yield in lactation,
- Keep good health of cow and the unborn calf.

Proper care and management of dry cow is going to pay for itself in subsequent lactation. It is done in the following ways-

- A course of intra mammary antibiotics helps resolve sub clinical mastitis and prevents new infections from occurring over the dry period.
- There are different types of dry cow intra mammary infusions available in the market which acts on different group of organisms. Consult nearby veterinarian for guidance.
- Teal sealant is one kind of plug that can be inserted into the teat canal post intra mammary infusion. By using it, the teat can be sealed at drying-off.
- After the antibiotic infusion is completed, re-sterilize the teat end. Then infuse the sealant, but do not massage, as the product should not be pushed further into the udder. Again, finish with the post-dip/wipe.
- The dry period is the choice of time for vaccination. There is less quantum of stress on the cow during this period leading to maximum immunogenic response.
- Provide adequate floor space for the cow to lie down comfortably (75 to 100 square feet per cow).
- Farms with a larger herd should arrange for a separate calving pen with adequate space and proper ventilation and with water access and a non-slippery walking surface.

- There should be proper bedding materials on the floor and it should be cleaned daily.
- Don't overcrowd dry cows.
- Dry cows consume 40 to 80 percent more energy than normally required. Deficit of energy supplement in the feed leads to risk of metabolic diseases like ketosis, milk fever, etc. and other health issues.
- Give sufficient amount of good quality green fodder with 1-2 kg concentrate during dry period. The ration should have high level of energy with moderately lower levels of protein (12 to 14 percent).
- Mix 50 gms of mineral mixtures with concentrate feed daily.
- Strictly avoid feeding mouldy feed.
- Give adequate amount of paddy straw to maintain ruminal movement at optimum.

3.6 Methods of milking

There are two methods of milking

Hand milking and machine milking

3.6.1 Hand milking

The different methods of hand milking are –

- Stripping;
- Fisting (Knuckling);
- Full hand milking;
- Full hand milking followed by stripping ;

The best milking method is “full hand milking followed by stripping”.

Procedure

- Wash the hands properly with soap;
- Wash the udder with mild antiseptic solution and gently wipe it off with a soft and clean cloth;
- Gently massage the teats;
- Start milking;

Stripping: Hold the teat firmly between the thumb and fore finger and draw it down the length of the

Different steps in Milking



Step - 1
Hand washing



Step - 2
Udder washing followed by
drying with a clean cloth



Step - 3
Teat massaging



Step - 4



Step - 5



Step - 6



Step - 7



Step - 8



Step - 9

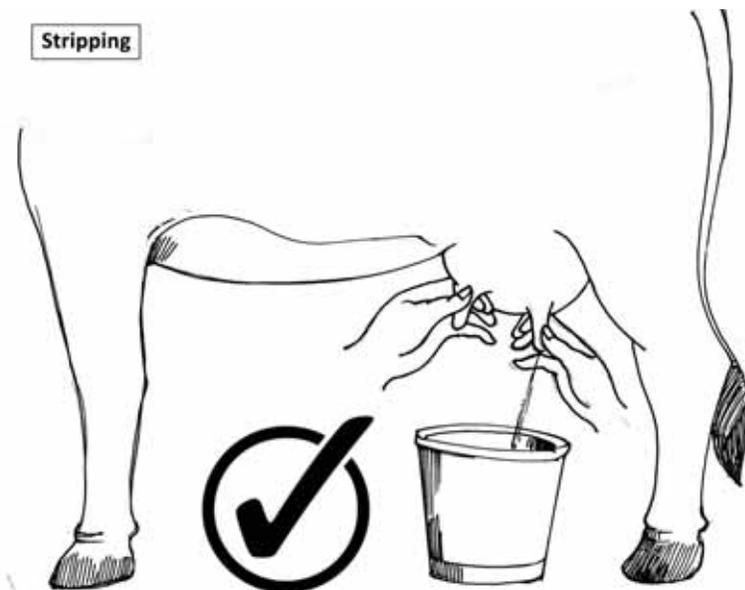
Step - 4 to Step - 9 (Full hand milking)
Followed by Step - 10



Step - 10
Stripping

teat and press it at the same time. It will cause the milk to flow down in a stream

Fisting/Knuckling: In this method, the thumb is bent against the teat and rest is just like stripping. This



Stripping method of milking

method should always be avoided to prevent injuries of the teat.



Fisting method of milking (not recommended)

Full hand milking: Grasp the teat with all the five fingers in a sequence starting from the index finger to the little finger and press it against the palm. It will cause the milk to flow down in a stream.



Full hand method of milking

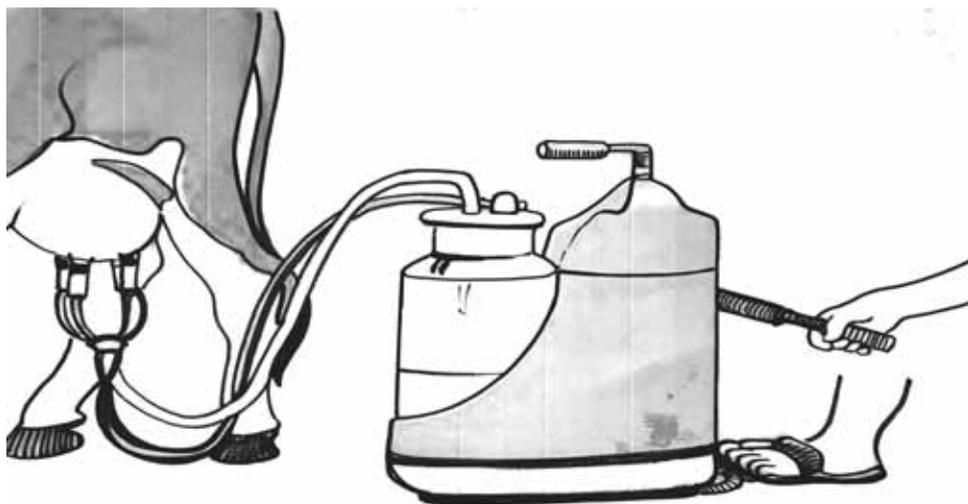
3.6.2 Machine milking

There are two methods of machine milking-

Hand milking machine and automatic milking machine

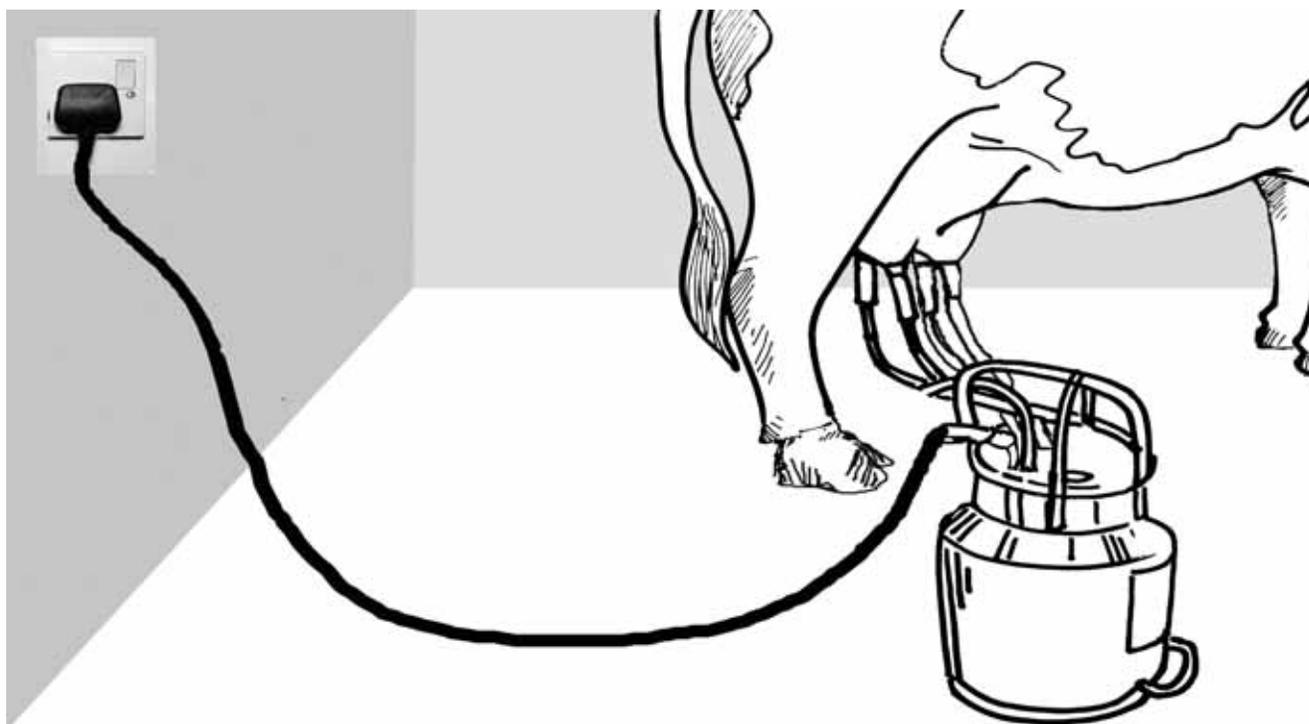
Hand milking Machine

- It is a low cost milking machine presently available in the market.
- Because of cheaper price, the small dairy farmers are interested to buy it.
- In machine milking the peak yield is achieved early and remains longer than hand milking leading to a total yield more than hand milking.



Milking using a hand milking Machine

Automatic milking machine: It opens the teat canal by using a partial vacuum and massaging the teat.



Milking using an automatic milking Machine

Advantage of machine milking

- Cows are milked quickly;
- Milking is done without causing any injury to the udder and painlessly;
- Easy to operate;
- Very hygienic;
- Udder is evacuated completely;

3.7 Daily work schedule

Table 4: Tentative timing of farm operations (regular and occasional)

Time	Farm operation (regular)	Farm operation (occasional)
4-30 am to 5-30 am	<ul style="list-style-type: none"> • Observe the animals • Clean the cow shed briefly • Prepare the feed for cows • Provide one third of the required daily feed and adequate water 	-
5-30 am to 06-00 am	<ul style="list-style-type: none"> • Milk the cows 	.-
06-00 am to 07-00 am	<ul style="list-style-type: none"> • Aggregation of milk and delivery 	-
07-00 am to 08-30 am	<ul style="list-style-type: none"> • Clean the cow thoroughly using disinfecting agents • Clean the thoroughly and dry them • Provide green fodder 	

08-30 am to 09-00 am	<ul style="list-style-type: none"> • Observe the behaviour of the animals • Segregate the diseased cow (if any) • Identify the cows in heat (if any) 	Clean the surrounding of the cow shed Deworming
09-00 am to 11-00 am	<ul style="list-style-type: none"> • Collect or buy green fodder and feed 	Treatment of sick animal/ AI/ vaccination of cows, heifers and calves, ear tagging, etc
11-00 am to 12-30 noon	<ul style="list-style-type: none"> • Provide one third of the required daily feed, green forage and adequate water 	Make entries in the farm record Do the necessary management in the pasture garden
03-00 pm to 04-00 pm	<ul style="list-style-type: none"> • Clean the cow shed • Milk the cows 	-
04-00 pm to 05-00 pm	<ul style="list-style-type: none"> • Aggregation of milk and delivery • Clean the utensils 	-
5-30 pm to 06-30 pm	<ul style="list-style-type: none"> • Provide one third of the required daily feed, green forage and adequate water 	-
07-00 pm to 07-30 pm	<ul style="list-style-type: none"> • Make entries in the financial record 	-
08-30 pm to 9-00 pm	<ul style="list-style-type: none"> • Clean the cow shed 	-

Note: There may be variation in the schedule depending on – location of the farm, distance of the farm from market/aggregator and season.

3.8 Record keeping

Record keeping is important in a dairy farm to track the details of animals and their productive and reproductive performances, health conditions of the farm animals, input availability and requirement of labour and cost & revenue generation to finally assess the economics. Record keeping helps a farm to assess its performance, efficiency, constraints and limitation and to frame a future improvement plan. To make record keeping more meaningful, every animal in the farm should be assigned with an identification mark, more particularly ear tagging. Ear tagging is also important for insuring animals under any insurance company.

Different types of records that a farm should maintain to review the performance and financial health of the farm

Breeding record

Identification number/ Name of cow	Breed of cow	Age of cow	No. of lactation	Date of insemination	Breed of bull/ semen used	Expected date of calving	Sex of calf	expected date of next heat

Health record

Identification number/ Name of cow	Breed of cow	Age of cow	Disease suffered with date	Major symptoms	Treatment given	Vaccination			Deworming		
						Date	Name of disease against which vaccine given	Next date	Date	worms against deworming done	Next date

Feed and feeding record

Date of purchase	Source	Category of cattle	No. of cattle	Total quantity of feed (kg) purchased/in stock	Quantity of feed used (kg)	Balance in stock (kg)	Remarks
		Cow					
		Heifer					
		Calf					

Milk marketing records:

Date	Milk production	Milk sold to customer	Volume (in lit)	Total amount (in Rs)	Amount received in cash (Rs)	Amount due (Rs)	Expenses incurred on the day	Total balance in hand	Remarks
20/04/2020	100	Hari	30	120	80	40	40	260	
		Jadu	30	120	120	0			
		Madhu	40	160	100	60			

Group discussion: Care and management of different category animals

Instruction for the Resource Person:

Constitute four groups among the participants. Ask each group to discuss about the key learning of care and management of heifers, pregnant, dry and lactating cows separately for each group and identify which practice/s will be more useful in their context. One or two participants from each group will present the key key discussion points in the form of best practices suitable to their local condition and which they intend to follow after the training.

Key message of session 3

1. Feed the different category of dairy animals adequately with required proportion of nutrients
2. Provide plenty of clean drinking water to dairy animals
3. Take care to maintain minimum 60 days of dry period
4. Deworm and vaccinate the dairy animals
5. Maintain proper hygiene in the dairy farm

SESSION 4: Housing and Manure Management of Dairy Farms

Session objectives

- To make participants understand the proper location for dairy farms
- To make them understand on the types of housing systems, their advantages and disadvantages
- To make them understand the proper method of constructing different parts of cattle shed
- To make them understand about the bio-security provisions and farm waste management.

Training Methods to be followed

- Participatory discussion
- Distributing relevant handouts
- Experience sharing
- Group discussion

Training materials

- Laptop, LCD projector and screen
- Whiteboard and markers (multiple color)
- Manual and handouts
- Flip chart
- Photos and illustrations

Design and construction of cattle shed should be based on local climatic condition, herd size and financial condition of the farmers. Good cattle shed should ensure the following:

- Comfortable stay of dairy animals;
- Protection from adverse climatic condition;
- Easy to clean, free from off smelling;
- Durability;

4.1 Location of dairy farms

The following points should be considered for selection of location/site for dairy farms.

- The farm area should be free from water logging. Sufficient exposure to sunlight;
- Sufficient trees in surroundings for fresh air;
- Should have access to all weather road;
- Should have sufficient water supply;
- Should have access to electricity;
- Surroundings should be less noisy and less polluted;
- There should be sufficient land for fodder cultivation in the farm premises according to number of animals reared.

4.2 Types of rearing

Rearing for dairy animals is done mainly in three ways:

- Open ranging e.g. farming system prevailing in riverine (char) areas;
- Semi-intensive system / partly stall fed. e.g. housing system may prevail in rural areas of Assam;
- Intensive system/fully stall fed. e.g. housing system adopted by commercial dairy famers;

4.2.1 Open ranging

Under this system, cows are allowed to graze throughout the day and night in the open field/riverine areas except during milking. This housing system is mostly used by the people residing in the riverine/char areas.



Open ranging system of cattle rearing

Advantage

- No cost of housing, feeding, watering;
- No cost of labour;
- No cost of breeding;

Disadvantage

- Less productivity;
- More chances of transmission of various diseases;
- Prone to natural calamities such as –flood and extreme weather condition;
- Difficult to go for cross breeding;
- Not easily accessible to health coverage and other veterinary services;

4.2.2 Semi- intensive system/partly stall fed

Under this system, cows are allowed to graze throughout the day in the field and at night they are sheltered in a shed. Here, they are offered with water and feed in the evening. This housing system is mostly used for rearing the indigenous dairy animals.



Cows grazing in the field under semi-intensive system

Advantage

- Cost of construction is significantly lower than Intensive type;
- Lesser cost of feeding;
- Lesser cost of labour;
- Cross breeding/AI is easier than open ranging;
- Allows free movement of the animals during the day.

Disadvantage

- Needs open/community grazing area (VGR/PGR);
- Higher chances of transmission of diseases because of close interaction with other animals (both domestic and wild) during daytime;
- Higher chances of parasitic infestations;
- Exposed to adverse weather condition during daytime;

4.2.3 Intensive/fully Stall fed system

Under this system, cows are housed throughout the day and night inside a stall and are provided all required feed and water inside the stall. Animals are not allowed to graze in the open fields at any part of the day.



Intensive system of cattle shed with double row

Advantage

- Well protected from adverse weather condition;
- Easy to maintain better hygiene and cleanliness;
- Breeding/AI is easier;
- Health coverage is easier than other two systems;
- Record keeping is easier.

Disadvantage

- higher construction of shed;
- Higher cost of feeding;
- Higher cost of labour;
- Requirement of electricity, water, access to all weather road, farm input services and veterinary services.

Arrangement of rows under Intensive system

Under intensive system, animals could be placed in single or double rows (in the same shed). Double row is followed when more animals are kept in the farm. It reduces the length of the shed.



Intensive system cattle shed with single row

If animals are kept in two rows, they could be arranged in two different patterns: **Head to head** and **tail to tail**

Head to head: head of one animal faces the head of another placed in the other side of the row. Drain is constructed along the wall of the shed and feeding and water trough is constructed along the central line.



Cattle housed in two rows with head to head arrangement

Tail to tail: Tail of one animal faces the tail of another placed in other side of the row. Feeding and water troughs are constructed along the wall on either side of the shed and drain is constructed along the central passage.



Cattle housed in tail to tail arrangement

4.3 Guidelines for construction of cattle shed

4.3.1 Floor

- The floor should be laid on a compact foundation and should not be damp;
- The constructed floor surface should be non-slippery with a rough finish but it should not be too uneven which may make the animal uncomfortable;
- The floor should have gentle slope towards the drain;
- Drainage system should be well planned to flush out water, cow dung, urine etc. to the manure pit;
- Protective floor coverings (e.g. rubber matting or other non-slip surfaces) can be used on walkways to reduce carpal hygroma and hoof abrasions that lead to secondary hoof infections;
- The length of water troughs should be shorter than feeding trough as unlike feed, water is not drunk at the same time by all animals;
- Low front feeding trough is more comfortable for cattle but high front trough prevents feed wastage;
- Floor space requirement of different categories of cattle and buffalo are presented in the table below;
- Ideally floor space should be adequate for each animal to stand, move and sleep comfortably. Floor space depends on the size of the cows.

Table 5: Floor space requirements of dairy animals as per Bureau of Indian Standards (BIS)

Type of animal	Floor space/ animal				Feeding space/ animal		Water space/ animal	
	Covered area		Open area		in cm	in inch	in cm	in inch
	in sq mtr	in sq ft	in sq mtr	in sq ft				
Young calves (< 8 weeks)	1	10.76	2	21.52	40- 50	16-20	10-15	4-6
Older calves (> 8 weeks)	2	21.52	4	86.08	40-50	16-20	10-15	4-6
Heifers	2	21.52	4-5	43-54	45-60	18-24	30-45	12-18
Adult cows	3.5	37.66	7	263.62	60-75	24-30	45-60	18-24
Adult Buffaloes	4	43.04	8	344.32	60-75	24-30	60-75	24-30
Bulls	12	129.12	120	1291	60-75	24-30	60-75	24-30

Source: <https://www.dairyfarmguide.com/space-requirements-of-dairy-0133.html>

4.3.2 Walls

- There may or may not be wall around the sheds. Most of the smallholder farms do not construct a wall around the shed. During winter, curtain is used to protect the animals from cold;
- If wall is constructed, the wall surrounding the shed should be about 3-4 ft high (above the plinth) depending on the size of the animals. Remaining may be covered with wire netting for adequate ventilation;
- The inside of the walls should be plastered so that it does not allow dust to accumulate and does not cause injury.

4.3.3 Roof

- A height of 8 feet at the sides and 10 feet at the ridge is sufficient to give the necessary air space to the cows. Roof should be light and does not need heavy supporting structure;
- Roof of the shed may be of asbestos sheet or corrugated iron sheet;
- Thatch (kher) may be used as roofing material which give a cooler environment but its durability is less;
- Thatched roof house may harbor insects, flies, cobwebs and are highly prone to fire hazards;
- The pillars/ posts should be of iron/concrete/wooden. Bamboo post should not be used as it is not durable;
- There should be provision of electric light and fan in the shed.



Roof of the cowshed made of corrugated tin sheets



Cow shed with non slippery floor

4.3.4 Central passage

- The central passage should be of 5-6 feet wide including place for drainage if the animals are kept in tail to tail system and 4-5 feet if the animals are kept in head to head system.

4.3.5 Isolation/quarantine shed

- Animals that suffer from any disease should be separated immediately and should put in a small separate shed used to house diseased cows called quarantine shed;
- Quarantine shed (room) should be away from the main farm house;
- The shed should also be used to house newly purchased animals (after thoroughly cleaning) before mixing them with the existing animals;
- Quarantine shed should have separate drainage system.

4.3.6 Sheds for young stock

- Calves should never be accommodated with adults in the cow shed. Smallholders can keep the calves in one corner of the cow shed;
- The calf shed must have provision for daylight ventilation and proper drainage;
- Damp and ill-drained floors cause respiratory trouble in calves to which they are susceptible;
- Shed for the young calves should be quite close to the cow shed. Each calf shed should have an open paddock or exercise yard;
- An overall covered space required for a calf is 20-40 sq. ft. depending on age up to one year.

4.3.7 Plan and layout

- Cattle shed should be planned based on number of animals to be housed, availability of construction materials, cost of construction and facilities to be provided for feeding, watering etc.,
- Earlier open area was mandatory but in present day commercial farms, farmers hardly keep any open space.

4.3.8 Foot bath

- The foot bath is a small tank of 2 ft. width x 5 ft. long with about 0.5 ft depth constructed just in front of the cattle shed;
- This should be filled with potassium permanganate solution so that visitors/ farm workers can deep their feet in to it before entering the farm.



Foot bath filled with potassium permanganate solution

4.4 Bio-security provision

To prevent transmission of diseases from outside the farm to the farm or vice versa, movement of people should be restricted. No outsider, including trader, should be allowed to go inside the farm/ near the farm as they can transmit germs from one farm to the other. Maintenance of proper bio-security by smallholder is difficult but still they can try to do the followings:

- Try to put a boundary fencing (may be of bamboo) around the shed and a gate;
- Do not allow any outsider to go near the farm without a specific reason which justify that he should go;
- Suggest him to clean his feet and legs before and after entering the farms;
- Suggest him to wear a chappal /footwear meant for visitors in the farm;
- Suggest him to deep his feet in the foot bath;
- Do not allow to take farm utensils from one farm to the other;
- Do not allow any trader to take his bicycle/ motor cycle to near the farm.

4.5 Farm waste management

Proper management of waste helps keep the farm environment clean and cows to remain in good health. Converting waste to fertilizer, vermin-composting or gas may lead to productive utilization of wastes by saving money and generating income

The main wastes from the dairy farm are-

- Cow dung;
- Cow urine;
- Feed and fodder waste like straw etc. not consumed by the cattle;
- Empty syringes, drug containers etc. used during treatment of cattle;
- Fetal membranes, and occasionally aborted foetuses.

Cow dung and urine are the major waste in terms of volume. Buildup of cow dung and urine near the shed is bad for cattle health. Cow dung is a major source of germs that cause milk to spoil and people and animals to become sick. It is also potential breeding place of the flies.

The following are the few ways by which farm waste can be managed.

4.5.1 Cow dung and cow urine as organic fertilizer

- Use in the farm yard kitchen garden;
- Apply to field for crops and fodder;
- Sell to other farmers.

The dung needs to be collected away from the shed in an open chamber to facilitate its sun drying. Urine can be used for making bio pesticides. For this the cow shed should be designed such that the urine automatically flows down to containers.

4.5.2 Vermicompost (Kechu Sar)

- Vermicompost is a high quality bio fertilizer.
- Cow dung is one of the major ingredients for along with dry and green biomass and earthworms.
- Vermi-compost can be done in bed method or pit method.
- You can make Vermicompost yourself or you can sell your cow dung to people engaged in this business.

Intela Method of vermicompost

- Vermicomposting is done in a tank made up of plastic or concrete in which small pieces of dried straw and leaves are placed followed by addition of cow dung
- Earthworm is released into the mixture of biomass and cowdung and cover the mixture with dry straw or gunny bags.
- Sprinkle water on a regular basis to maintain moisture.
- Protect the compost from rainwater and direct sunshine.
- It may take about six months to produce vermicompost.



A



B

Vermicompost production unit: A-large scale, B- small scale



Vermicompost ready for marketing

4.5.3 Producing Biogas (Gobar Gas)

Biogas is produced from cow dung through a bio-chemical process in which certain types of bacteria convert the biological wastes into useful and combustible gas. It can produce heat and energy when burnt. Bio gas mainly comprises of hydro-carbons, Methane gas being the main constituent. It is called Bio gas because it originates through a biological process.

- Gobar gas is an environment friendly source of fuel;
- As an alternative source of energy it can replace firewood/gas cylinders/ electricity in the household as well as the farm and reduce expenses;
- In general, average cattle yields about 10 kg dung per day. To run a 3 cubic meter capacity plant, 4 cattles are required and 3 cattles are sufficient to run with capacity of 2 cubic meter;
- The cost of biogas plant varies from place to place and size of the plant. Average cost of 2 cubic;
- There are several implementing agencies for biogas programme such as- State nodal departments and agencies, Khadi and Village Industries Commission, etc.



A small scale Bio gas plant

Experience sharing: Housing system for animal

Instruction for the Resource Person: At the beginning of the session, ask participants to explain advantages and disadvantage of good housing and another one on poor housing.

Group discussion: housing system

Instruction for the Resource Persons: Divide the participants into three groups and ask each group to choose any one of the topics given and discuss among themselves to consider for making future piggery development plan in their local situation. One from each group will present the salient points on selected topic emerged out of their discussion to rest of the participants. Correct them if they commit any mistake. (The whole exercise is expected to be completed within 20-25 minutes)

Topics

- Ideal location of dairy farms;
- Types of housing most suitable for them;
- Bio-security provision that they should follow;
- Farm waste management (as source of organic fertilizer, vermin compost, biogas and fuel) that they should do.

Key messages of session 4

- Before constructing a cattle shed, the farmers should consider comfort of the dairy animal, protection from adverse climatic condition, easy cleaning and free from off smelling and durability of the shed.
- There are three types of housing for dairy animals and each has its own advantages and disadvantages.
- The farmers should follow the guidelines for construction of cattle shed as laid down for floor space, walls, roof, central passage etc. as per comfortable stay.
- If possible farmers should consider for construction of a quarantine shed with separate drainage system.
- Relatively large commercial farms must keep foot bath filled with potassium permanganate solution.
- In making a housing plan for dairy animals, the required bio-security provision should be kept in mind.
- Farmer should consider for farm waste management through using as organic fertilizer, vermin compost, bio-gas production and/or cow dung cake as fuel.

SESSION 5: Better Nutrition for Improved Productivity

Session objectives

- To make the participant farmers know about the nutrition requirements of cattle.
- To enable them explain the types of feed used for feeding of dairy animals.
- To make them understand about ration balancing and the concentrate ration required by dairy cows.
- To make the participants know about the proper feeding requirements of dairy calves.
- To make them know about the water requirements of dairy cattle.
- To enable them explain on the importance of feeding mineral mixture and know about area specific mineral mixture.
- To make them know about fodder cultivation, preservation of fodder
- To know about the proper method of enrichment of dry fodder

Training Methods to be followed

- Participatory discussion
- Distributing relevant handouts
- Field visit

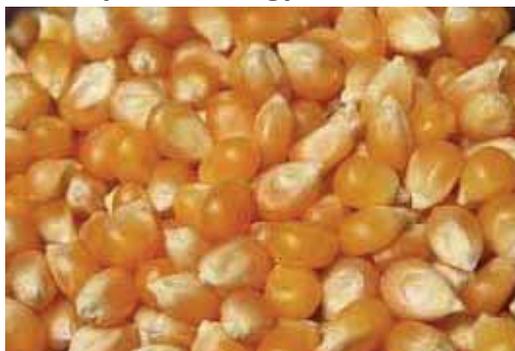
Training materials

- Laptop, LCD projector and screen
- White board and markers (multiple color)
- Manual and handouts
- Flip charts
- Photos and illustrations
- 1 kg rice polish/broken rice/wheat bran/maize (as energy source)
- 0.25 kg of mustard oil cake, ground nut cake, fish meal (as protein source)
- 100 gram of mineral/vitamin compound and salt mix
- One container for preparation of home made ration.

5.1 Nutrient requirement of cattle and their sources

Nutrient	Function	Source
Protein 	Protein is essential for growth of animals and production of milk	<ul style="list-style-type: none"> • Important sources of protein are oil cakes that include groundnut cake, til oil cake, sunflower cake, soybean meal, meat meal, fish meal etc. • Green fodder crops like berseem, Lucerne, pigeon pea (arhar), lentils etc. • Urea (mainly mixed with dry fodder
Mustard oil cake		

Carbohydrate/ energy



Maize grain



wheat bran

Carbohydrate or energy is required for normal body functioning, day-to day activities, milk production, body temperature maintenance etc.

- Maize grain, wheat bran, rice polish, broken rice, sorghum, barley, etc.
- Fodder crops like maize, barely, sorghum, cow pea, etc

Minerals



Small quantity of minerals are required for normal body functioning, growth of dairy animals and milk production

- Mineral mixtures are commercially available in the market
- All green fodders contain minerals

Vitamins



Mineral mixture with vitamins

Small amount of vitamins are required for normal body functioning, utilization of nutrients, growth of dairy animals and milk production

- Vitamin mixtures are commercially available in the market
- Green fodders contain vitamins

<p>Fiber</p>  <p>Lucerne; a kind of green fodder is a rich source of fiber</p>	<p>It is required to fill the stomach (rumen) of dairy animals, normal functioning of stomach (rumen), reduce formation of gas in the stomach and for easy digestion.</p>	<ul style="list-style-type: none"> Fibres are available in all green and dry fodders
<p>Common Salt</p>	<p>It is used in feed to maintain healthy appetite, increase feed intake, carrier of some other essential minerals</p>	<p>Commercially available in the market</p>
<p>Water</p>  <p>Cow drinking water from its muzzle keeping the nostrils above water</p>	<ul style="list-style-type: none"> Water is required to maintain the body fluid and body temperature. Daily water intake may vary from 5-100 litres per day depending on age, body size (weight), stage of production and the environmental temperature. Water helps in absorption of feed and supports in digestion consumption of water is important for milk production (Milk is 87% water; therefore, milk production is partly a function of water intake). 	

5.2 Types of feed used for feeding of dairy animals

Generally, two types of feed are fed to the dairy animals – concentrate feed and fodder.

Again, fodder is of two types- Green fodder and dry fodder

5.2.1 Concentrates

- Different sources of protein, carbohydrate, minerals, vitamins and salt are added in required quantity to produce a concentrate mixture of feed that can meet the nutrient requirement of dairy animals.
- Concentrate feed contains all required nutrients in right quantity. Therefore, it is always much better than feeding only rice bran or chapar which are commonly used by farmers for feeding of dairy animals.

- Better to offer 0.1 kg concentrate than offering 2 kg rice bran or chapar.
- Concentrate can also be prepared at home by mixing different types ingredients (source of energy, protein, minerals, vitamins, salt, etc.)
- Good quality kitchen waste and crop residue can be a complement to concentrates, but should not contain animal products.
- High quality fodder can reduce the requirement of concentrate but both concentrate and dry and green fodders are essential for dairy animals.



concentrate feed (pellet form)

5.2.2 Home-made concentrates

Small dairy farmers can prepare concentrate by themselves by adding different ingredients in proper ratio which may make the concentrate feed cheaper.

Requirement of ingredients

- Energy source: rice polish, broken rice, wheat bran, maize, etc.
- Protein source: mustard oil cake (MOC), groundnut Cake (GNC), til oil cake (TOC) soybean meal, etc.
- Mineral/vitamin mixture and salt: Available in veterinary clinics and feed supply stores.

Method of preparation

- As a thumb rule three buckets of energy source (3/ 4th) and 1 bucket of protein source (1/4th) should be mixed thoroughly to prepare a mix ration for adult animals.
- To do this mixture add one tenth of a bucket (5% of the total) of mineral/vitamin compound and salt mix thoroughly.

5.3 Ration balancing

Ration balancing is done by use of a software that helps in calculating the nutrient requirement of a dairy animal and designing a customized feed based on availability of feed ingredients locally. The software can be used on desktops, laptops, tablets as well as phones. Balanced ration could be prepared by farmers considering the animal's profile, i.e. cattle or buffalo, age, milk production, milk fat, and feeding regime etc. Milk producers are advised to adjust the quantity of locally available feed ingredients offered to their animals along with area specific mineral mixture.

5.4 Concentrate ration for dairy cows

Concentrate feeding of cattle is directly related to the age, body weight, milk yield and condition of the animal. For cattle not milking and not pregnant, feed is needed only for maintenance; for pregnant cattle additional nutrition is needed for development of the calf in the last 2 months, while for lactating cows additional feed is needed for milk production.

The concentrate ration requirement of average dairy cattle and buffalo is presented in the table.

Table 6: Feed requirement of different category of dairy animals

Particulars	Cow (400 kg body wt.)	Buffalo (500 kg body wt.)
For maintenance	1.5 – 2.0 kg	2.0 – 2.5 kg
For milk production	400 grams/litre	500 grams/litre
For pregnancy	2.0 kg (last two months)	2.0 – 2.5 kg (last two months)

Source: NDDB

Feeding dairy calves

- The calf must get colostrum (milk produced in first two days that is high in nutrient and have qualities of disease resistance) within the first 4 hours of life and it should continue till 2 days.
- Introduce calf starter ration from 4th day onwards and gradually increase the amount with a decrease in the amount of milk consumed.
- Mother's milk can be withdrawn from the feeding schedule after 4th months of age provided calf starter ration is offered.
- Under industrial farming condition, mother's milk can be withdrawn from the feeding schedule after 1st month of age.
- It will cut down the cost of feeding (milk is costlier than calf starter ration) and will ensure proper growth and development of the calf.
- To avoid poor/diminished letting down of milk after the calf is removed, the following procedure is to be followed-
 - Simulate the suckling effect by massaging the teats with a piece of soft cloth dipped in luke warm water.
 - Keep the calf near the cow, this will induce a reflex for letting down of milk within a short span of time.
 - Don't change the timing of milking and the milker as well. Provide green fodder from in small amount till completion of 3rd month only to initiate the ruminal function. Start regular feeding of green fodder/dry fodder from the 4th month onwards in full required amount.

Table 7: Feeding requirement of dairy calves

Period	Colostrum/ milk (kg/day/calf)	Calf starter (kg/day)	Good quality hay* (kg/day)	Green fodder* (kg/day)
0-2 days	1.5-2.0	--	--	--
3-4 days	1.5-2.0	--	--	--
4-14 days	1.0-1.5	0.10	0.10	--
3 rd week	0.5-1.0	0.20	0.15	0.75
4 th week	0.5	0.25	0.20	1.25
5 th week		0.40	0.30	2.0
6 th week		0.50	0.40	2.5
7 th week		0.60	0.60	3.0
8 th week		0.70	0.80	3.5
9 th week		0.80	0.90	4.0
10 th -11 th week		1.00	0.90	5.0
12 th week		1.20	1.00	5.0
13 th -16 th week		1.50	1.20	6.0
17 th -20 th week		--	1.75	1.50
21 st -26 th week	--	2.00	2.0	8.0

Note: *Requirement of hay and green fodder may vary from breed to breed & body weight of calf.

Source: NDDB India

5.5 Fodder

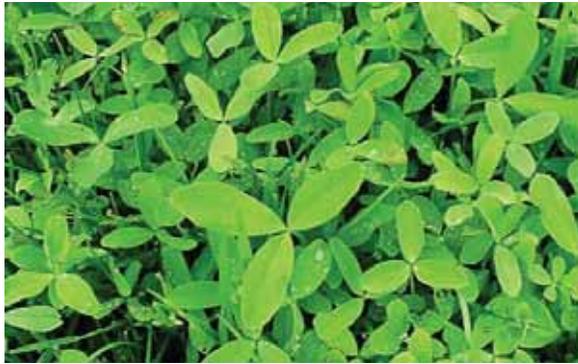
5.5.1 Green fodder

There are two types of green fodder-

- Non-leguminous fodder- e.g. napier grass, para-grass, guinea grass, fodder maize, oat, pearl millet (bajra) , finger millet (ragi), etc.,
- Leguminous fodder- e.g. lucerne, lechara bean, cowpea, clover, etc.

Table 8: Different types of fodders for feeding of dairy animals

Type	Image	Name of fodder with details
Non-leguminous		Guinea grass: Good source of energy
		Napier Grass: Good source of energy
		Maize plant: Good source of energy
Leguminous		Cowpea plant: Rich source of nitrogen i.e. protein

Leguminous		Lucerne: <ul style="list-style-type: none"> • Rich source of fiber; • Rich source of protein
		Berseem: Rich source of protein
Perennial Fodder		Subabul tree: A perennial fodder plant and excellent source of protein

5.5.2 Principles of feeding green grass

- Green grasses with legumes provide carbohydrates, protein, vitamins, minerals and trace elements.
- Dry fodder at the rate of 5 kgs and green fodder @20 kgs/day should be fed to dairy animals.
- Green fodder should be harvested at pre flowering stage.
- Surplus green fodder should be conserved in the form of 'hay' or 'silage'
- Conserved fodder becomes useful during summers or when green fodder is scarce.
- Fodder must be stored dry to avoid moulds. Mouldy feeds may contain fungus that can cause aflatoxicosis.
- Should ensure that the feed/fodder does not



Chaff cutting of green fodder

contain chemical residues (e.g., pesticide), toxins or other contaminants that pose a risk to animal health or the safety or quality of milk or meat derived from these animals.

- Only use approved chemicals for treatment of feeds or components of animal feeds and observe withholding periods.
- Silage and other fermented crops should be kept under sealed conditions.

5.5.3 Fodder cultivation

- To make dairy farming profitable, cultivation of fodder is essential.
- For best results, a combination of cereals and legume crops should be cultivated.
- Cereal crops like maize, sorghum, oats are rich in energy while lucerne, berseem, cowpea, subabul are the legumes rich in protein and minerals.
- Grasses like hybrid napier, guinea grass and para grass contributes to higher milk yield.
- For best results supply of green fodder comprising about 2/3rd of cereals and 1/3rd of legumes is recommended.
- Animals with medium level of milk production (3-4 lit/day) can be maintained without supplementation of concentrates when good quality fodder is provided.
- There are number of perennial fodder tree species (e.g. Subabul, lucerne etc.) and leaves of which can be used for feeding cattle.
- Each fodder crop has definite stage of harvest which should always be born in mind (see table 10)
- For best results, crop selection should be made taking into consideration the climate, soil, moisture condition and seasonality of other feed ingredients.



A good fodder plot

Table 9: some important varieties of fodder available in Assam and their cultivation details

Name	Planting time	Soil type	Harvesting time	No. of harvests/year
Hybrid napier	March-October	Sandy loam	After 30 days	6-8
Para-grass	March-August	Loamy	After 30-35 days	4-5
Guinea grass	March-July	Polosuwa loamy	After 40-45 days	5-6
Maize	April-August	Sandy loam	After 70-80 days	1
Lechara bean	March-August	Sandy	After 60-70 days	2
Oat	October-November	Sandy loam	After 70-75 days	2-3

A simple estimate for cultivation of Hybrid Napier grass in one katha of land

- 1 katha=2880 sq ft
- Gap between two saplings/stem cuttings =6.25 sq ft (2.5 ft X 2.5 ft)
- Number of saplings/stem cuttings required/katha=2880/6.25= 460
- After 1st cutting, it takes 50-60 days, say 60 days to grow up for the next cutting (one basketful of cow dung and one tea spoonful of urea to be applied after cutting to each grass and to be watered adequately)
- So, if cutting done in rotational manner, number of grass to be reaped per day is, $460/60=7.66$, say 7 numbers, in the 2nd day , another 7 numbers and so on upto 60 days when the 1st batch would be ready for 2nd cutting.
- If yield is 5 kg per grass, daily fodder yield will be 35 kg
- If daily requirement is assumed to be 15-20 kg/cow/day, 35 kg can be fed to 2 cows.
- For plantation also, the same rotational system to be followed.

5.5.4 Dry fodder

- Dry fodder includes rice straw, wheat straw, maize straw, etc;
- Dry fodder has very low protein but this can be improved by adding urea;
- Molasses (gur mithai) should be included in a urea diet to constitute urea molasses block;
- Chopping (cutting) dry fodder increases digestibility;

Why dry fodder is essential in feeding of dairy cattle?

- It provides fibre which is very essential for digestion;
- In addition to green fodder and concentrate, dry fodder is given to fulfil the voluminous rumen and to maintain the motility of the rumen i.e. the fourth stomach of the cow;
- It helps in microbial digestion in the rumen;



Paddy straw after threshing of paddy makes good dry fodder

5.6 Water requirements

Cow should be offered sufficient clean drinking water round the year. Frequency and volume of water offering to cows in summer should be more than winter.

- Lactating cows should be offered water according to their milk yield as mentioned in the table 10.
- A high yielding cow cannot produce milk of its capacity without having sufficient water even if it is fed with sufficient feed and forages.

Table 10: Water requirement of dairy animals

Dairy cattle type	Milk production (lit /day)	Daily water requirement (lit/day)
Dairy calves (1-4 months)	-	5-13
Dairy heifers (5-24 months)	-	14-36
Lactating cow	Upto 14	68-83
Lactating cow	15-23	87-102
Dry cows	-	35-50

5.7 Area specific mineral mixture

Minerals should be fed with adequate amount of good quality mineral mixture based on level of deficiency of mineral mixture. It is advised to feed 100-200 gms. mineral mixture to dairy animals/day depending upon level of milk production in lactating animals, 50 gms daily for growing and non-producing animals and 25 gms daily for calves.

Benefits of feeding mineral mixture

- Improves growth rate of calves resulting early sexual maturity;
- Reduce repeat breeding, infertility, proper maintenance of estrus cycle and therefore increasing reproductive health of dairy animals;
- Reduce inter-calving period leading to more productive life of animals;
- Improves efficiency of feed utilization;
- Improves milk production and SNF content of the milk;
- Better immune response resulting better resistance against diseases.

5.8 Urea molasses mineral block (UMMB)

Urea molasses mineral block is prepared by mixing urea, molasses, mineral mixture and other ingredients in a suitable proportion. It is a readily available source of energy, protein and minerals for the dairy animal. Supplementing an animal with UMMB would provide adequate quantity of these nutrients and slow ingestion of urea leads to efficient microbial protein production and improved digestibility.

- Resourceful farmers may try to use UMMB, if available,
- If UMMB is not available farmers can feed mineral mixture as stated above.

5.9 Few points to be considered when feeding dairy animals

- In normal production cycle dry-period (when cow does not yield milk) is the last two months before the cow delivers the next calf.
- The cow should be in good health condition at calving.
- At the beginning of the lactation the cow depends on her body reserves as well as her diet to produce milk. Therefore, cow needs to be fed extra with concentrate after calving.
- If body reserves are inadequate at the time of calving the cow will have a much lower peak lactation yield. This will result in much lower total yield.
- Also she will take longer time to come into heat.
- Peak yield occurs at around 2 months after calving.
- Too much concentrate will affect the rumen environment. This will lead to loss of appetite, weight

loss and a drop in milk yield. Adequate green and dry fodder should be fed to maintain the rumen environment.

- Advance planning is required for supply of feed and water round the year. Preservation of feed, fodder and water is required for scarcity period.

5.10 Use of chaff cutter for chopping dry and green fodder

It is a mechanical device for cutting straw or hay into small pieces before being mixed together with other forage and fed to cattle.

- This helps in animal's digestion process;
- Prevents animals from rejecting any part of their feed.

Chaff cutters are of two types: Hand operated and Electrical

Electrical one is little more costly than hand operated one. Every commercial farm should have a chaff cutter. Couple of smallholders can also join hands to have one chaff cutter among them if their houses are conjunctive.



Power operated chaff cutter



Hand operated chaff cutter

5.11 Preservation of fodder

Preservation of fodder is done by making hay or silage.

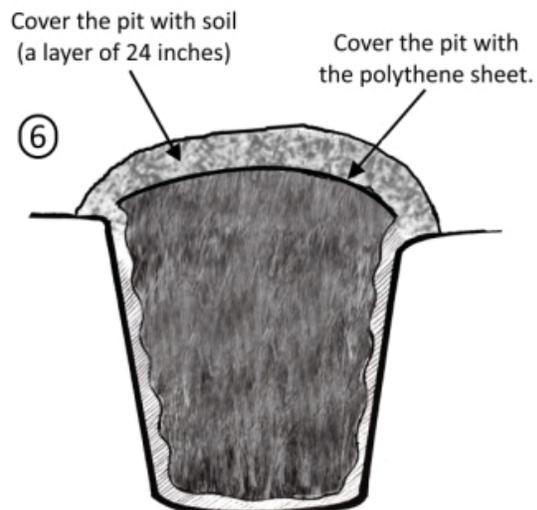
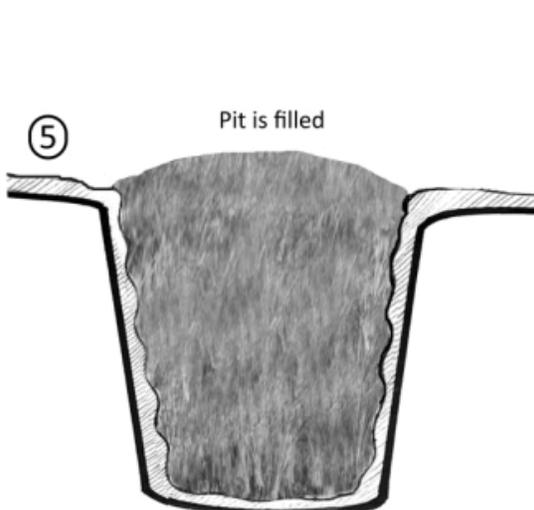
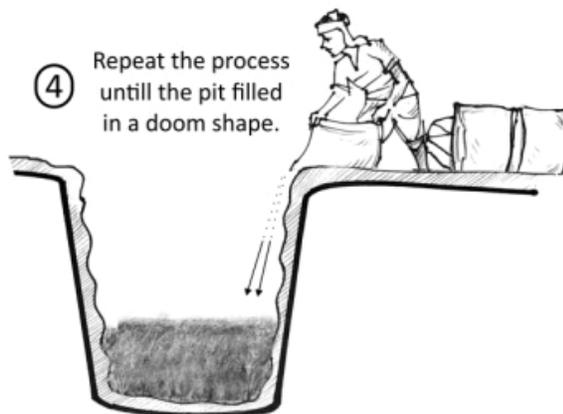
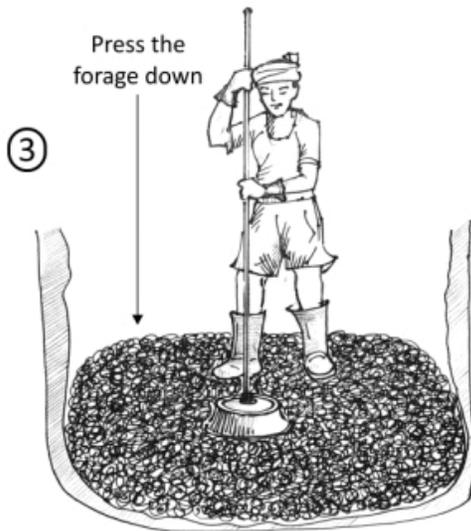
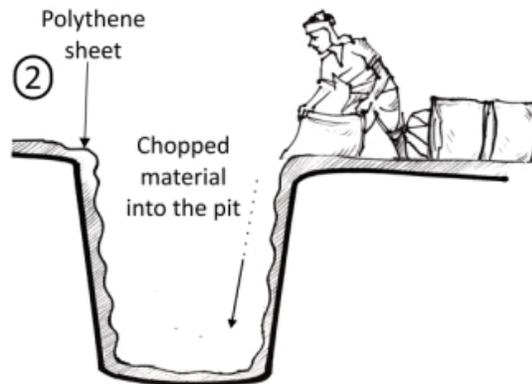
Hay: It refers to cereals, grasses or legumes that are harvested at flowering stage, dried and stored. Legume, non-legume & mixed hay are the major three types.

Silage: It is the green succulent roughage preserved under controlled fermentation by compacting green chops in air and watertight receptacles.

5.11.1 Process of silage making

- Best quality silage can be prepared from cereal fodder crops like Maize, Sorghum, Pearl millet etc. which are rich in carbohydrates/sugars;
- Green fodder should be harvested at flowering stage of the crop, containing moisture content around 65 to 70 per cent. After harvesting, fodder is chaffed to 1 to 2 inch size for filling in silo pit;
- Silage storage structure (Silo pit) is to be constructed prior to initiating silage making. Surface silo is an ideal storage structure and to be constructed on raised ground to minimize inflow of water;

Different steps in silage preparation



Different steps in silage making

- Size of the silo pit depends on the quantity of fodder to be ensiled. Silo pit with area of one cubic meter (1 metre length x 1 meter width x 1 meter height) is sufficient for ensiling 500 to 600 Kilograms of chaffed fodder.
- The chaffed fodder is filled in tightly pressed layer of 10 cm each.
- Pressing of fodder can be done manually in small silo and through tractors on big size silo.
- After complete filling of silo pit, silage heap should be well sealed at the top with polythene sheet and 5 inches thick moist soil layer.
- Use of additives should be avoided in silage making. However, if fodder is not harvested at proper stage, suitable additives (molasses/common salt/ urea/formic acid) can be used during fodder filling.
- After 45 days silage is ready for animal feeding. When green fodder is in deficit, silo pit can be opened from one side to take out the silage as per daily need of animals. It may be covered properly with polythene sheet after taking out of silage daily.
- Silage is a substitute of green fodder. However, initially for 3 – 4 days, its feeding is limited @ 5 to 10 kg/animal/per day to adjust the animals on silage feeding.

5.11.2 Hay making

- Hay is a sun dried green fodder, containing moisture below 15 per cent.
- The best quality hay is prepared from thin stem cultivated fodder crops like Lucerne, Oats and Sweet Sudan Grass during hot and dry summer months from April to May. Some perennial pasture grasses like Guinea grass, Rhodes grass, are also suitable for hay making.
- To get best quality hay, these crops are cut at 50% flowering stage. After cutting, green foliage is evenly spread on dry surface in thin layers of 5 cm thick for sun drying.
- Every morning after 10 A.M. fodder is inverted manually /mechanically for quick and evenly drying. After 4 to 5 days, when moisture reaches to less than 15 per cent in the forages, hay is collected and bundles are made for storage.
- While drying, care should be taken that hay retain the leaves and green colour, as it is an indicator of good quality hay.
- These bundles of hay should be stored in moisture and dust free places like bunkers/godowns to maintain quality for longer period. Hay can be fed @ 5 kg per animal per day with or without chaffing.

5.12 Enrichment of dry fodder

Straw treatment method

- At a time at least 1 ton straw should be treated. We need 40 kg urea and 400 litres of water for the treatment of 1 ton straw;
- Dissolve 4 kg urea in 40 litres of water;
- Spread 100 kg straw on the floor to form 3-4 inch thick layer;
- Sprinkle 40 litres of prepared urea solution on the straw using gardener's sprinkler. Then press the straw with feet by walking on it;
- Spread another 100 kg of dry straw on top of this compressed straw, and prepare another 40 litres of urea solution (dissolving 4 kg urea in 40 litres of water) again. Sprinkle the prepared urea solution over the second layer of straw and repeat the compaction by walking on the layer of treated straw. Likewise, repeat the procedure 10 times by spreading 10 layers of straw, sprinkling it with 4 % urea solution and then pressing with feet.

- Cover the treated straw heap with a new plastic sheet and spread some quantity mud at the point where it touches the ground to prevent the formed ammonia gas to escape;
- In case plastic sheet is not available, cover the treated heap with dry straw. Then after putting some soil, cover the same with wet clay /or cow dung layer to make it airtight.



Enrichment of straw with urea

5.13 Precaution in feeding of urea treated straws

- Never feed urea or urea solution directly to the animal. Urea as such is fatal to animals.
- While treating the straw, keep the urea solution away from the reach of animals and children.
- Cemented floor is more appropriate for treatment of straw.
- If the floor is kuccha, use a plastic sheet on the floor before spreading the first layer of straw.
- It is convenient to undertake straw treatment in a closed room or in the corner location. Treated straw should be opened after 21 days in summer and 28 days in winter.
- Before feeding, the straw should be spread in open air to allow the ammonia gas to escape.
- Start with feeding small quantities of treated straw. Slowly the animal gets habituated and starts relishing it.

Field visit

Instruction for the Resource Person: Ask the training facilitator to (i) identify a farming household with cultivation of green fodder crops preferably near the training venue and make a visit to his /her fodder plot taking the participants. Explain them on the different green fodder crops that may be grown, method of cultivation, method of feeding and potential benefits of the same to the farmers; (ii) ask the training facilitator to bring concentrate and feed ingredients to the training venue and show the participants preparation of home-made concentrate ration.

Key message of session 5

- Feed should be given to dairy animals as per requirements of different proportion of nutrients, water and salt.
- A resource poor smallholder farmer may provide the home-made concentrate by preparing compounds of energy and protein source, mineral/vitamin and salt mix.
- Balanced ration can be prepared through use of specially designed software considering the animals' profile and fed accordingly.
- The feed requirement may vary according to the category of animal (dry, lactating, pregnant etc.) and farmers should give to the animal in required proportion of feed only.
- There are specified principles of feeding green and dry fodder and farmers, while feeding, should stick to that.
- Farmers may prepare Urea Molasses Mineral Block (UMMB) by mixing urea, molasses, mineral mixture and other ingredients in suitable proportion and feed to the animals.
- For easy digestibility of dry and green fodder, chaff cutter can be used by the farmers.
- The farmers shall also try to prepare silage from different fodder crops as per the methods indicated.

SESSION 6: Reproductive Health Management and Common Diseases of Dairy Animals

Session objectives

- To explain common reproductive diseases of dairy animals and their preventive measures.
- To explain common diseases (mastitis, FMD, HS, BQ etc.) of dairy animals and their preventive measures.
- To make the participants know the vaccination schedule of cattle.

Training Methods to be followed

- Participatory discussion
- Distributing manuals and relevant handouts
- Experience sharing

Training materials

- Laptop, LCD projector and screen
- Whiteboard and markers (multiple color)
- Manuals and handouts
- Photos and illustrations

Reproductive diseases are the kind of diseases that affect the reproductive organs and breeding ability of cattle. Symptoms of reproductive diseases include poor fertility rates, still births, discharge, etc. The major reproductive diseases are:

- Anoestrus in cattle;
- Repeat breeding;
- Retention of placenta;
- Abortion;
- Dystocia.

6.1 Anoestrus in cattle

Anoestrus in cattle means that the cow fails to come into heat for quite some time.

Reasons for anoestrus

- Inadequate feeding of required nutrients (e.g. proteins, minerals, vitamins, etc.);
- Hormonal deficiency;
- Problems/ disorder in reproductive tract.

Prevention/control

- Provide feed with required nutrients more particularly minerals;
- Consult a veterinary doctor for treatment.

6.2 Repeat breeding

A repeat breeder is a cow that has no clinical abnormalities, may or may not have a normal cycle but has failed to conceive after at least two successive inseminations.

Reasons for repeat breeding

- Cows may repeat if it is not inseminated at right time using right method with quality semen;
- Infection in uterus is one of the major reasons for repeat breeding;
- Underweight animals show poor rates of conception;
- Incorrect insemination in relation to stage of heat may result into repeat breeding;
- If animals are not inseminated at accurate time with good quality semen, the animal cannot conceive.

Prevention/control

- Inform veterinarian/ inseminator at right time for insemination;
- Cows showing foul smelling thick mucus discharge should not be inseminated and should be checked for any uterine infections by a veterinarian;
- Do not feed mould infested grains and green fodder and soiled wheat straw to dairy cows;
- Balanced ration must be fed to the cows to solve the problem of malnutrition. Mineral mixture supplementation should be an integral part of diet;
- Artificial insemination must be done by trained personnel at an appropriate time, with quality semen;
- The bull used for breeding the cow must be of good quality and free from any physical deformity/genital diseases;
- Consult a veterinary doctor for treatment.

6.3 Retention of placenta

Retained placenta is a condition where a part of the placenta can be seen hanging from the vulva after a cow gives birth. The placenta should be expelled within 12 hours of giving birth.

Reasons for retained placenta

- Reduced uterine contraction (insufficient force to expel it out) is primarily responsible for retention of placenta.
- Retained placenta is most commonly associated with dystocia, abortion, milk fever (metabolic disease) and other diseases.



Retention of placenta

Prevention/control

- Maximize dry fodder intake;
- Supply correct nutrients particularly minerals;
- Provide a clean and dry environment;
- Consult a veterinarian for treatment.

6.4 Abortion

Abortion means that a cow gave birth to calf before the actual time of calving. The calf is either born dead or dies within 24hrs.

Reasons of abortion: the reason of abortion can be both infectious and non-infectious.



Aborted fetus in cattle

Table 11: Infectious and non-infectious causes of abortion

Non-infectious causes	Infectious causes
<ul style="list-style-type: none">• Environmental causes e.g.: high temperature leading to heat stress.• Genetic defects• Physical injury or accident• A cow might eat something that causes abortion. (mycotoxins)	<p>A no. of contagious diseases occurring in cattle cause abortion. The names of some of the diseases are listed below:</p> <ul style="list-style-type: none">• FMD• Brucellosis• Vibriosis• Leptospirosis• Bovine viral diarrhea

Prevention/control

- Proper hygienic measures in the cow's environment and feed storage;
- Keep the pregnant cow in a cool environment and provide sufficient water to drink;
- Keep the pregnant cow carefully (away from other animals, must be fed separately);
- Adequate vaccination against infectious diseases causing abortion;
- Isolation of aborting cows and immediate removal of aborted materials;
- For treatment and vaccination consult a veterinary practitioner.

6.5 Dystocia (difficulty in giving birth)

Dystocia refers to abnormal or difficult birth.

Causes

- The size of the fetus is too large for the cow;
- Abnormal position of the fetus in the birth canal of the cow;
- Hip joint dislocation.

Prevention and care

- The cows/heifers in the gestation period must be well fed;
- Small cows must not be inseminated with the semen of a bull that belongs to a heavy breed;
- Farmers should be encouraged to leave cattle undisturbed for few hours after the appearance of a mucus string at the genital region, especially in heifers;
- However, if abdominal contractions occur more frequently and the cow is not able to give birth, immediately call a veterinary doctor;
- Dislocated hip joint must be reduced i.e. corrected.

6.6 Common diseases of dairy animals

6.6.1 Common infectious diseases of dairy animals

Infectious diseases are those which are caused by infectious agents (germs) such as –bacteria, virus, fungi or parasites. These diseases can be transmitted from one individual to other via different routes/medium.

6.6.2 How germs spread in dairy farms (medium of transmission)

Germs spread by following means

- Physical contact of one animal with other,
- Through animal excreta and discharges,
- Through farm utensils,
- Through water and air,
- Through animal handlers,
- Through improper drainage system,
- Through flies, mosquitoes, dirty cloths,
- Through birds and stray animals.

6.7 Some of the infectious diseases caused by germs

- Mastitis,
- Foot and mouth disease (FMD),
- Brucellosis,
- Haemorrhagic Septicaemia (HS),
- Black quarter (Johor baat).

6.7.1 Mastitis

Mastitis is an inflammation of the mammary glands in the udder caused by infection with disease-causing germs.

Symptoms

- Udder gets red, swollen and hard;
- If you touch the udder the cow may show signs of pain;
- Milk becomes watery or stringy and may have clots;
- Sometimes blood and pus comes out of the teats;
- In severe cases, teats may get blocked.



Swollen and hard udder of a cow suffering from mastitis



Consequences of mastitis: Sloughing off of the mammary gland

To prevent mastitis

- Make sure the teat is clean and dry before milking;
- Use full hand milking;
- After milking dip the teat in antiseptic solution;
- Don't allow the cow to sit for 5-10 minutes after milking so that the teats close properly;
- Don't use oil to the teats before milking;
- Make sure the cow shed is clean and dry;
- Keep the cow clean and groomed and trim long hair.



Full hand milking



Stripping method of hand milking



Mustard oil used during milking (a bad practice)

Control measures

- Take guidance of a Veterinary Doctor;
- Keep milking the cow frequently (4-6 times a day) to remove the bad milk;
- Use salt or magnesium sulphate in warm water to massage the teats and udder and for foamentation;
- Use California Mastitis Test (CMT) Kit for detection of Sub Clinical Mastitis.

6.7.2 Foot and Mouth Disease (FMD)

FMD is a disease where ulcerations occur on the hoofs and around the mouth of the cattle. This is a highly contagious disease. Cattle get infected by contact with infected animals or by contact with feed, water or other such things the affected animal has touched.

Symptoms

- Sudden high fever and unable to eat;
- Blisters and ulcers in mouth and increased salivation;
- Erosion of the tongue;
- Blisters and ulcers on feet especially above and between claws;
- Limping while walking;
- Sudden death in calves;
- "Smacking" sound of the lips.

Precautionary measures

- Regular vaccination is a key preventive measure;
- Keep sick animals away from healthy animals.



Increased salivation and blisters and erosions on mouth of a cow in FMD



Foot lesions in FMD

Control measures

- Take guidance of a veterinarian;
- Keep the shed clean and dry. Do not tie the cattle in dirty places like muddy water;
- Use potassium permanganate (Potash) solution; clean the affected places twice or thrice daily;
- Use of fly repellent cream/spray.

6.7.3 Brucellosis

Brucellosis is a highly contagious disease of dairy animals. People may also get infected with Brucellosis if they come in contact with the diseased animals or the animal products contaminated with germs.

Symptoms

- Abortion occurs in the cow mainly during the last trimester of pregnancy;
- Animals may have fluid filled swelling at the knee;
- Bulls have swollen testicles.

Prevention and Control measures

- Vaccinate the animals;
- Isolate the cow that aborts the foetus and get it checked immediately by the veterinarian;
- Dispose the aborted material by burying and do not touch the aborted material with bare hands. Always wear plastic gloves. Take bath immediately after disposal;
- The place of abortion should be disinfected properly with chemicals like phenol etc.;
- Consult a veterinary doctor for treatment.



Fluid filled swelling at the knee in Brucellosis of cattle



Abortion in cow caused by Brucellosis

6.7.4 Haemorrhagic Septicaemia (HS)

Haemorrhagic septicaemia is an infection characterized by high fever and highly fatal blood infection. This disease usually occurs during monsoon season.

Symptoms

- Sudden high temperature;
- Salivation and a clear discharge from the nose;
- A swelling starts under the jaw and spreads to the neck and sometimes brisket;
- Some have distressed and noisy breathing;
- The tongue gets dry and tends to come out.

Precautionary /control measures

- Vaccinate one month before the start of the wet season;
- Keep sick animals away from healthy animals;
- Take immediate guidance of a Veterinary Doctor.

6.7.5 Black quarter (Johor baat)

Black quarter is a highly fatal disease of cattle characterised by swelling of the heavy muscles (especially in the leg).

Symptoms

- High fever and the animal looks very tired and weak;
- The animal is lame and there is swelling in the back leg;
- You can feel bubbles under the skin and hear crepitating sound when you press the swollen area.

Prevention and control

- Vaccinate every year;
- Take immediate guidance of a Veterinary Doctor.



A calf affected with black quarter

Table 12: Vaccination schedule of the dairy animals

S. No.	Name of the disease	Age at first dose	Booster dose	Subsequent dose
1.	FMD (Foot and mouth disease)	4 months and above	1 month after first dose	Six monthly
2.	HS (Haemorrhagic septicaemia)	6 months and above	No booster required	Annually
3.	BQ (Black quarter)	6 months and above	No booster required	Annually
4.	Brucellosis	4-8 months of age	No booster required	Once in a life time

Source: NDDB

6.8 Common metabolic diseases of dairy animals

Among the several metabolic diseases of cattle, the following two are the most common and harmful ones-

- Milk fever
- Ketosis

6.8.1 Milk fever

This disease is usually seen in high yielding cattle due to low calcium in the blood. Generally, this disease occurs two to three days after the cow gives birth or sometimes, on the day of calving.

Symptoms

- The body temperature of the cattle comes down, nose and mouth are dry;
- The cow might start shivering;
- The cow lacks desire to take feed and water;
- The cow cannot get up and tends to keep its head on the flank initially and then lies by side on the ground;
- The neck of the cow takes a typical S shaped appearance.

Precautionary and Control measures

- Feed the animal with calcium and phosphorous containing feed from one month before delivery;
- Feed more green fodder to pregnant cow towards the last quarter of pregnancy;
- On observing the symptoms of the diseases, consult the Veterinary doctor immediately.



A cow suffering from Milk fever

6.8.2 Ketosis

This disease is usually seen in high yielding cattle due to low carbohydrate level in the blood. Generally, this disease occurs to cows either after two to three days of giving birth or may be after 4-6 weeks of parturition

Symptoms

- The cow lacks desire to take feed and water;
- Reduced milk production;
- Reluctant to move;
- Variable rumen movement (sometimes higher and sometimes lower);
- Nervous symptoms like- twitching of the eye, abnormal licking, in coordination and staggering gait, bellowing and aggression;
- Sometimes the symptoms may be confused with those of rabies.

Precautionary and Control measures

- Feed the animal with carbohydrate containing feed from one month before delivery;
- Feed more green fodder to pregnant cow towards the last quarter of pregnancy;
- Feed supplement containing carbohydrates should be fed routinely;
- On observing the symptoms of the diseases, consult the Veterinary doctor immediately.

Experience sharing

Instruction for the Resource Person: Identify 5 farmers who can share their experience of seeing and managing 5 different diseases of dairy animals. Let them explain the symptom of the disease, and what they have done to manage these. Allow other participants to interact with them.

Key message of session 6

- The farmer should observe the dairy animals daily in the morning hours for any abnormality in behaviour, feeding habit, organs, discharges, etc.
- If any abnormality is observed, he should call the local veterinarian.
- Separate the animal from the herd if diagnosed by doctor as infectious/ communicable disease (quarantine).
- Regularly inform the local veterinarian for periodic vaccination.
- Clean the farmstead with suitable disinfectant at regular intervals and, as and when required.
- Prevention is better than cure. Taking preventive measures can reduce the chance of occurrence of many diseases and keeping the dairy animals in good health.

SESSION 7: Clean and Hygiene Practices for Milk Production, Storage and Handling

Session objectives

- To make the participants know about proper method of cleaning the farms and have understanding on various sources of dirt.
- To enable them explain the proper method of cleaning of equipments, utensils and cloths used in milk handling.
- To know about the importance of personal health and hygiene.
- To make the participants know about the proper method of handling, milking, cooling and storage of milk.

Training Methods to be followed

- Participatory discussion
- Distributing manuals and relevant handouts
- Experience sharing
- Physical observation
- Role play

Training materials

- Laptop, LCD projector and screen
- Whiteboard and markers (multiple color)
- Manuals and handouts
- Photos and illustrations
- Flip chart
- Two metal containers (one with relatively bigger mouth with easy to clean compared to the one with smaller mouth)
- Cleaning agents of containers and a scrubber

7.1 Cleaning of farms

A dirty cowshed invites a lot of infections and diseases that affect cows, reduce milk production and deteriorate the quality of milk. Infections in farms and various disease conditions can be prevented if the following essential features of adequate sanitation are adopted:

- Floor, drains, feeding and watering troughs and foot bath should be thoroughly cleaned every day with disinfectants like potassium permanganate, bleaching powder, etc.
- All dirt on walls, roof/ceiling, iron pipes and grills should be cleaned thoroughly with water containing a reliable disinfectant (0.5 kg of lime in 4 lit of water and disinfectant) at periodic interval.
- Proper disposal of manure, feed wastes and other excreta everyday away from the farm. Proper drainage is required to do the same.
- There should be a manure pit to dispose the farm waste and to reutilize the same as manure for backyard gardening.
- Water tank should be cleaned thoroughly at periodic interval with bleaching powder, potassium permanganate, etc.
- Surroundings of the cattle shed should be cleaned and disinfected at a regular interval with lime, phenol, etc. The site must be free from any garbage.
- Dead animal should be disposed off properly by deep burying it away from the human habitation.

- Diseased animals should be separated from healthy ones and should be kept in a quarantine shed (separate shed/room) to prevent spread of infection, and also to keep the diseased animals under observation.
- Feeding and watering utensils used for diseased animals should be separate from the healthy one.
- Visitors should not be allowed to enter the quarantine shed for no important reason. Hands and feet should be cleaned thoroughly with soap and water after every time diseased animal is handled.
- Curative treatment should be given to the suspected animals. Diseased animals should be mixed with healthy animals only after one week of recovery.
- The contaminated premises and utensils are to be cleaned thoroughly using hot water and disinfectant.
- It's ideal if the dairy farmers can construct a shed/room where milking of cows is carried out. The shed should thoroughly be cleaned after every milking and should be kept clean & dry.

7.2 Common disinfectant and their level of concentrations, method of use and surface for use

Table 13: Common disinfectants and their level of concentrations, method of use and surface for use

Name	Concentration	Method of use	Surface for use	Remarks
Washing soda	3% solution in boiling water	Splashing(wet the surface with the solution), rinsing utensils	Utensils and floors	Little disinfection power but effective cleansing agent.
Lime	½ kg lime per 4 lit of water as white wash+ 5% phenol.	Sprinkling, dusting of powder of lime alone.	Floors, walls and grounds	Use freshly prepared solution.
Potassium permanganate	1:10,000 solution in water.	Splashing	Floors, gutters, and troughs	Disinfection action is due to oxidizing power
Phenol	2-5% solution in water	Splashing	Metallic objects and clothing	Goods disinfectant
Bleaching powder (calcium hypochlorite)	30% available chlorine	Dusting	Floors, gutters, passages	Protect it from sunlight
Boric acid	5-6% solution	Splashing	Skin, floors, walls equipments, wounds etc.	-

Source: Principles & Practices of Animal Health & Hygiene by Dr. Neeraj (1998)

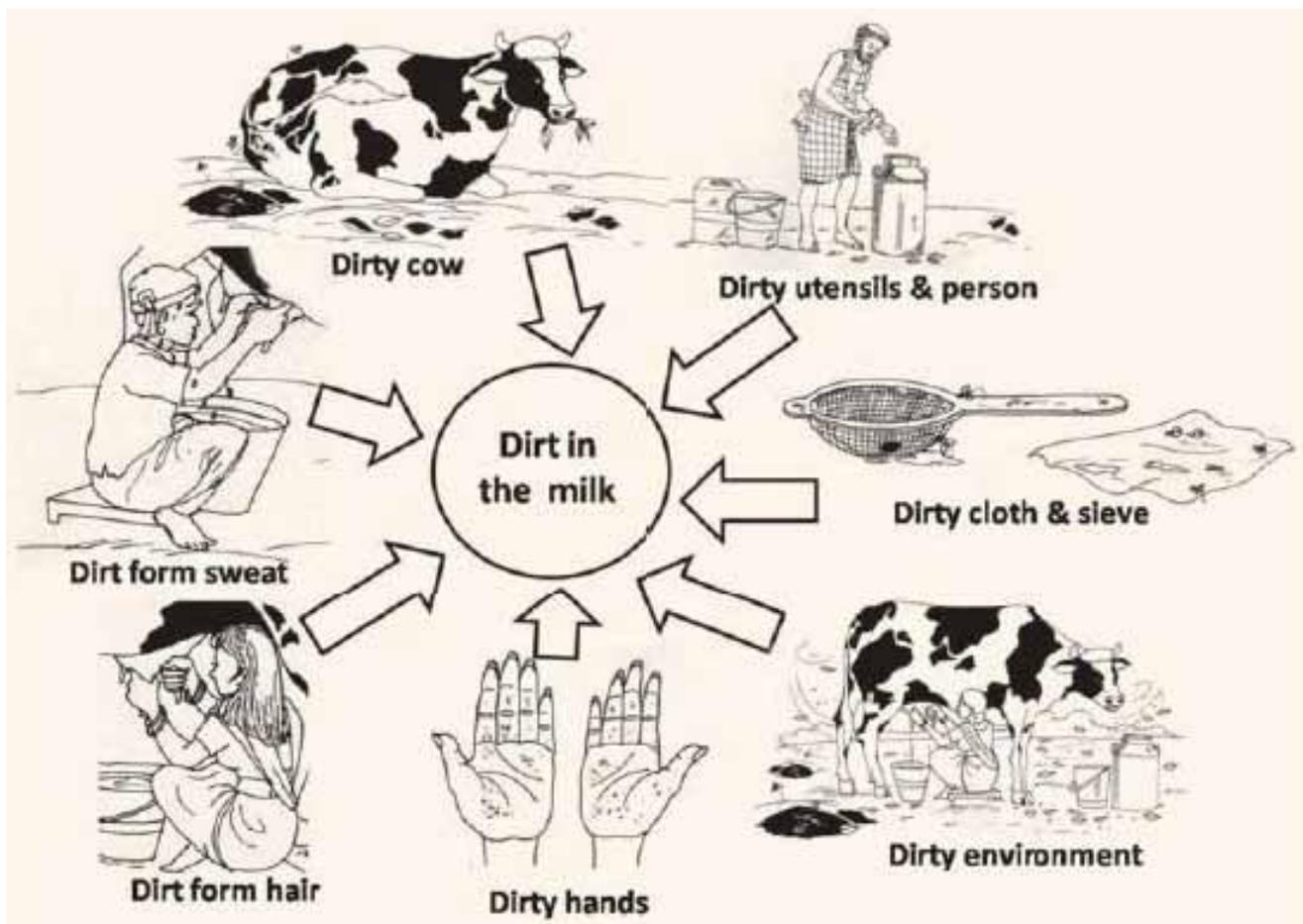
7.3 Special sanitation programme of farms (when dairy animals in a herd suffer from disease)

- Separate diseased animals from healthy ones (quarantine) to prevent spread of infection and to keep diseased animals under observation.

- Give curative treatment to diseased animals. Curative treatment should be given until the animals are fully recovered.
- Fully recovered animals should only be introduced with the old stock after one week of recovery.
- Thoroughly clean the contaminated premises and utensils using hot water and disinfectant. Cattle shed and surrounding may be disinfected with lime, phenol, formalin etc.
- Fresh lime can be sprinkled on the floor and walls for disinfecting them. Whitewash can be more effective disinfectant when phenol is mixed up to 5%. Lime can also be used for cleaning feed and water troughs.
- Farm utensils may be scalded with boiling water adding washing soda.
- Phenol can be used for disinfecting metallic objects, clothing, etc.
- Skin disinfectants like iodine, iodophore, potassium permanganate, hydrogen peroxide, etc. may be used for cleaning the visible wounds of the diseased animal. Potassium permanganate is used extensively for wound dressing and foot bath.
- The dead animals, aborted materials, placenta etc. should not be thrown away in the open field but should be buried deep enough to prevent digging out by dogs/Jackals, etc.
- Bedding materials, gunny bags (bosta), curtains, etc. used for diseased animals should be burnt out.

7.4 Cleaning of equipments/utensils and clothes used in milk handling

Dirt in milk can come from different sources including dirty utensils, clothes, environment, cow and milk handlers as stated in the illustration below:



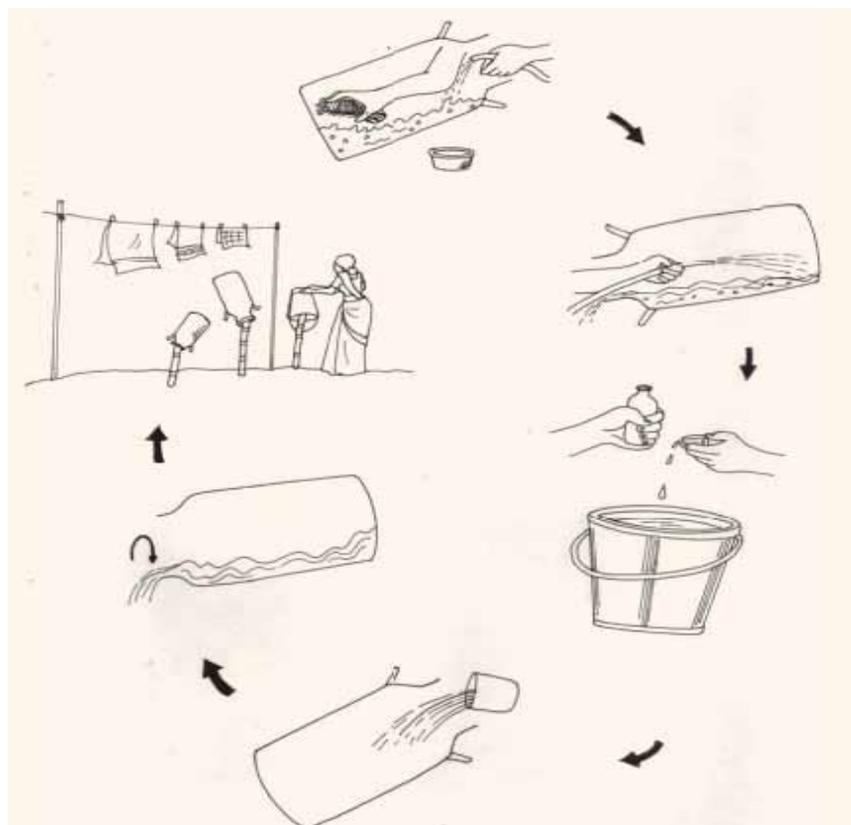
Different sources of germs/dirt in milk

The equipments/ utensils used in the farm must be kept clean and dry to avoid contamination. Dirty equipments and utensils lead to the introduction of germs into the milk. Infections/germs from milk equipments, utensils, clothes can be prevented if the following sanitation measures are adopted.

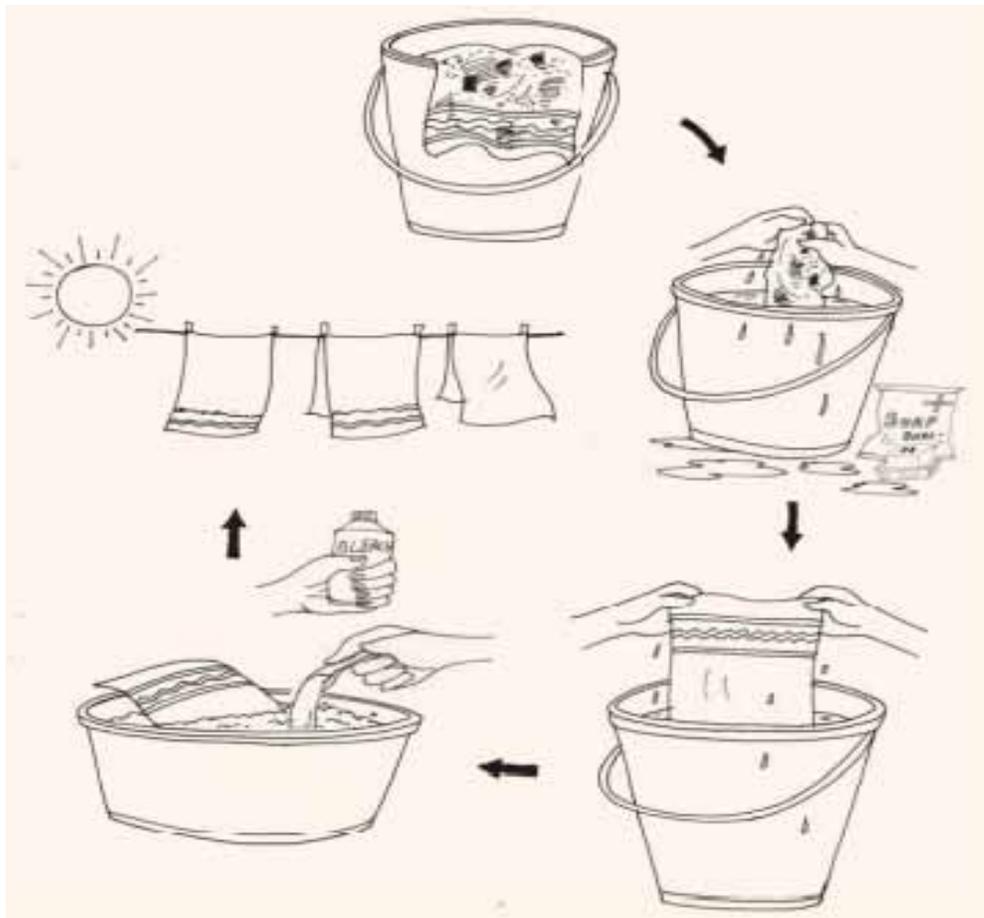
Following procedure should be followed to clean the equipment, utensils and clothes used for straining of the milk

Table 14: Procedure for cleaning of milk containers/utensils and clothes used in milk handling

Procedure for cleaning of milk containers/utensils	Procedure to clean clothes that are used for washing, drying teats and for straining milk
<ul style="list-style-type: none"> • Rinse the container/utensil immediately after use. • Thoroughly scrub the container with warm water and detergent or soap. • Rinse the container in clean water. • Dip-rinse the container by putting into boiling water for at least one minute to kill germs. • Then turn the container upside-down so it can drain and air dry on a clean rack or bench in the sun. • Once it is perfectly dry, store in a clean, cool place with the cover on. 	<ul style="list-style-type: none"> • First wash cloths with soap and water. • Then rinse in clean water. • Then leave in disinfectant solution for five minutes. • Then dry in the sun until completely dry. • Then store in a clean, dry place.



Procedure for cleaning A). Milk containers or utensils



Procedure for cleaning B). Clothes used in milk handling

7.5 Personal health and hygiene

It is also possible for a farmer to contaminate milk with bacteria if they are not healthy and clean during the milking process. This is especially true if you practice hand milking. Make sure that anyone involved in milking cows is healthy and clean.

- Make sure that anyone involved in handling milk is healthy and clean.
- If someone is sick or dirty, there is a possibility that he/she will contaminate the milk with disease-causing germs.
- If you are sick, seek treatment and do not resume work until the doctor says you are fit to do so.
- Always wash hands with soap and dry them with a towel before and after milking.
- Do not handle the animals if you are sick and get yourself treated first.
- Always try to wear protective clothes like mask, gloves, and gumboots while handling the animals
- Never touch sick animals, their discharges and aborted materials with bare hands. Always wear gloves and mask when attending a sick animal.
- Trim the nails in every week to keep it shorter and shave moustache at regular interval.
- People with long hair should cover their heads or at least tie up the hair
- Never smoke during milking time.

Don'ts during milking (Personal hygiene)



Have long nails



Smoking



Sneezing or coughing



Have long beards



Have long and untidy hair



Scratching



No finger deeping



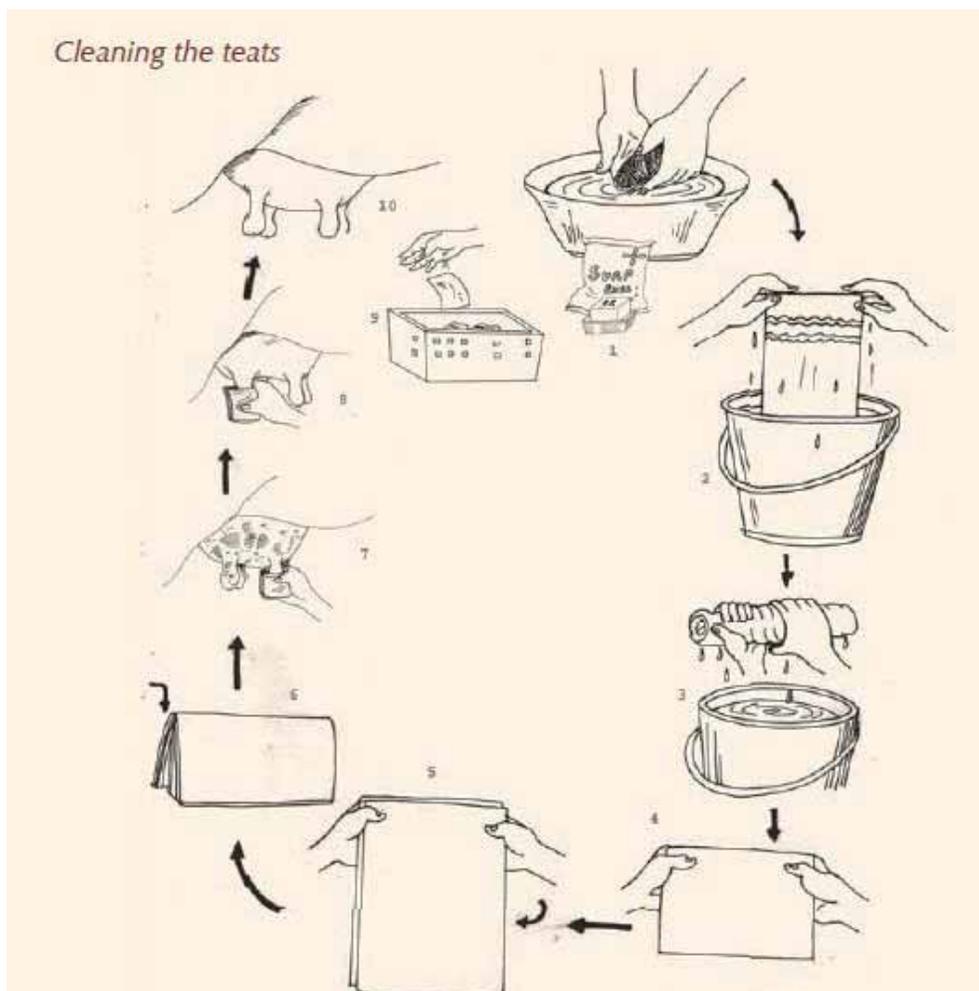
Use long handled measuring scoop

7.6 Milking, handling, storage and preservation of milk

7.6.1 Milking

It is important to milk the cows in such a way that maximum milk comes out from the udder hygienically without causing any injury or unnecessary pain and without adding any organism to the milk. In milking dairy cows following practices should be adopted

- A high standard of cleanliness should be maintained at all times in milking areas to decrease soiling of the udder and to protect udder health.
- The milker should wear clean clothes, wash his/her hands and arms thoroughly with soap before and after milking and sneezing/coughing is done keeping the milk away from him/her while milking.
- Wash and dry dirty teats before milking. Only milk from the animals whose teats are clean and dry.
- After milking teats could be disinfected by disinfectant solution/teat dipping.
- Do not use oil or other lubricants at the teat or in the hand before milking.
- Use full hand milking to reduce pain to teats.
- In large dairy farms, farmers may go for machine milking.
- Check the udder and teats for any abnormalities which may indicate clinical mastitis.
- Milk animals using the same technique at the same time preferably, by the same person at every day.
- Diseased animals should be milked at the last in a separate bucket.
- Discard milk abnormal in sight and smell so that it does not pose disease risk to people, animals and the environment.



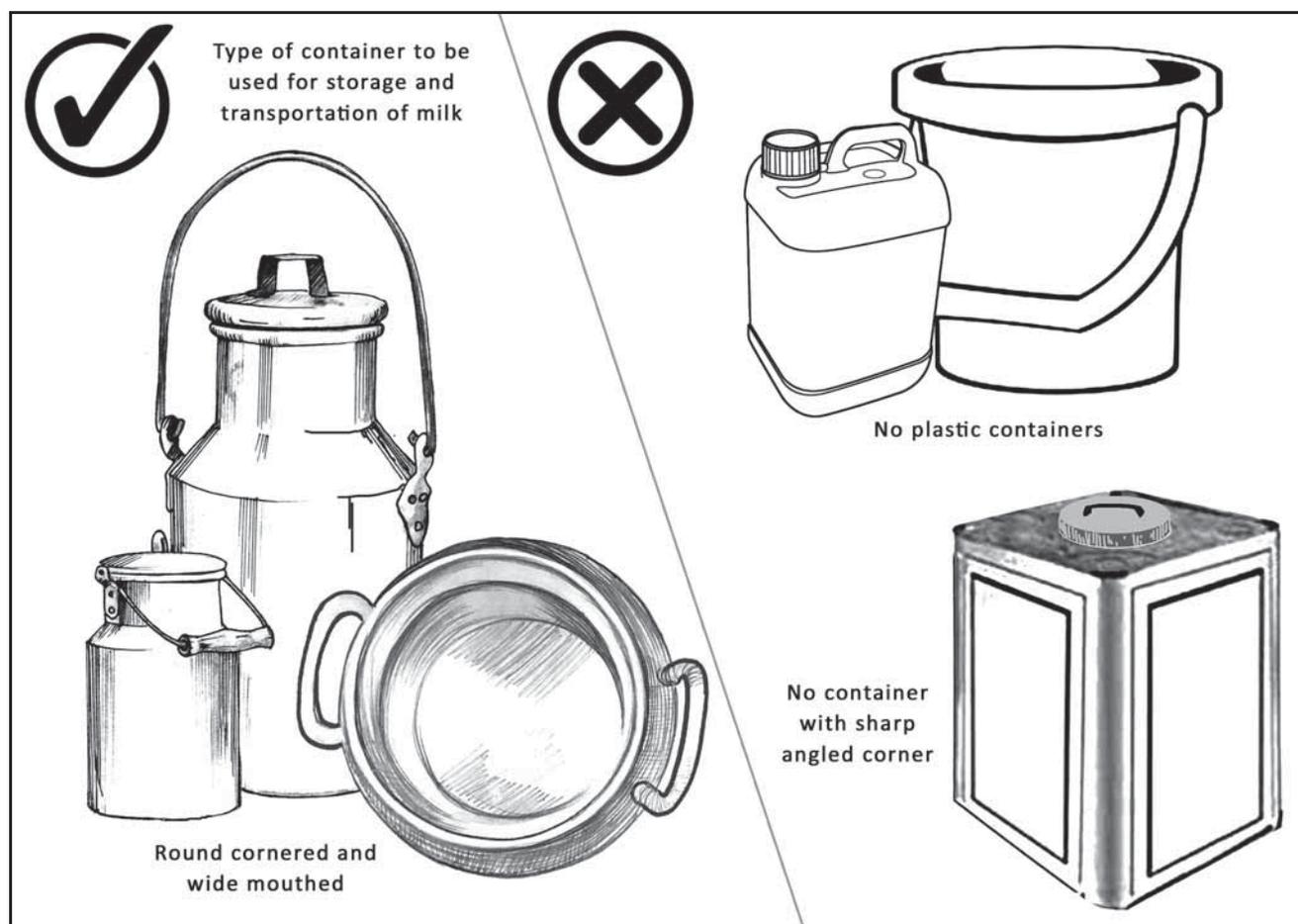
Cleaning and drying of teats before milking

Milk is highly perishable good. Even if you keep yourself and your cows clean and healthy and follow proper milking procedures, there remains a high risk of spoilage during handling and storage. To ensure

that milk is delivered to the consumers in good condition, you should follow these guidelines:

7.6.2 Handling

- Aluminum or stainless steel cans should be used for storing milk.
- Do not use plastic containers as they are difficult to clean and increase the risk of contamination after getting exposed to sun heat.
- Always handle milk in clean containers.
- When transferring milk from one container to the other, pour the milk directly from one container into the other instead of scooping it with a cup or bucket. Scooping greatly increases the chance of contamination and spoilage.
- Use long handle measuring litter/ scoop for taking out required volume of milk from milk can.
- Do not allow your fingers/ nails to touch the milk.



Different containers used for storage and transportation of milk

7.6.3 Cooling and storage

Some general guidelines for storing milk include-

- Strain milk immediately after milking and prior to storage. Use a clean filter cloth or strainer. Wash and dry the cloth/strainer immediately after use.
- Store milk in a cool, clean room.
- There shall not be any off smelling in the storage area.
- Do not store milk at room temperatures for longer. Milk gets sour after 4-6 hours of milking depending on environmental temperature.
- If storing overnight is required, keep the milk in refrigerator. Dairy plants store the milk overnight in chilling plants
- Do not mix warm (morning) milk with cool (evening) milk. Ideally, cool and warm milk should be delivered to the collection center in separate containers. If this is not possible, cool the warm milk by placing the container in cold water before mixing.
- Deliver milk to the market as soon as possible, preferably during the cooler hours of morning or evening.
- During summer, milk cans could be wrapped with wet clothes
- Keep containers in shade.



Straining of milk after milking



SESSION 8: Human Health Risk Posed by Dairy Animals/Milk and Risk Reduction Measures

Session objectives

- To make the participant-farmers know about human health risk associated with dairy animals.
- To explain about milk safety.
- To make the participants know about various methods to check milk quality.
- To know about various myths associated with dairy farmers.

Training Methods to be followed

- Participatory discussion
- Distributing manuals and relevant handouts
- Physical demonstration

Training materials

- Laptop, LCD projector and screen
- Whiteboard and markers (multiple color)
- Manuals and handouts
- Flip charts
- Photos and illustrations
- Starch to add in milk
- A litre of pure fresh raw milk in a milk container
- Lactometer, cylinder, Thermometre, A spoon and a candle for heating milk
- A syringe and alcohol solution, a small tube/glass cup

8.1 What is human health risk?

It is the probability of causing any adverse effect on human body by any physical, biological or chemical agents.

8.2 Human health risk associated with dairy animals

There is a major risk to human health caused by germs present in milk, dairy animals and environment. One of the major risks is the zoonotic diseases that transmit from animal to human or human to animal. Poor quality of milk is another important risk that causes food borne diseases. Quality milk depends on good farming practices as well as proper handling, transportation and storage of milk. Quality assurance plan should start at farm level. If dairy animals contain lot of germs, parasites, antimicrobial residues, etc. and if these transmit to milk; traders/processors or other milk value chain actors cannot eliminate the risk.

8.3 Disease causing agents: Germs and parasites

8.3.1 What are germs?

Germs are tiny living creatures and are present everywhere, more particularly in dirt, feces, other body excreta, farm wastes, etc. They are too small to be seen with the naked eye but can be seen with a microscope. Germs also come from the skin of animals and people, from discharges of animals and people, from the soil and untreated water and flies and other pests. You may have heard of 'bacteria' or 'viruses' – these are types of germs.

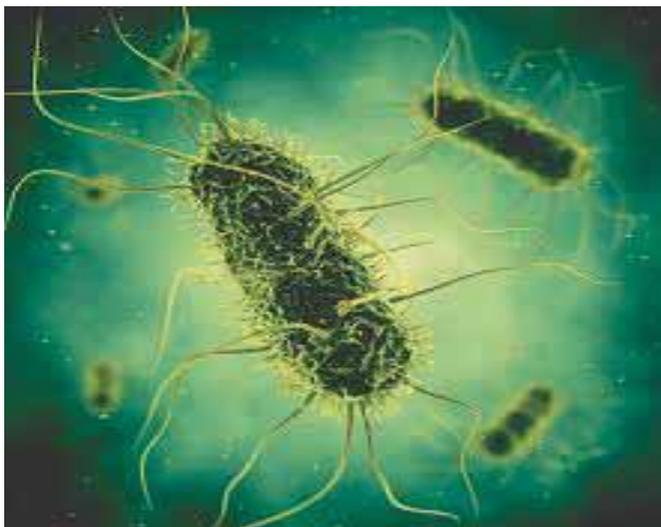
Some germs are always present in the body but, when they exceed the normal acceptable number they cause disease to the dairy animal. Milk produced from the diseased animal will have higher microbial count and consumption of such milk may cause disease to human beings. Additionally, germs from diseased cattle/buffalo may transmit to other such animals through direct/indirect contact between the animals or through their excreta.

Milk is very rich in nutrients for both human and to germs as well. Because of this, the germs grow faster in milk under warm environmental temperature and cause spoilage very quickly.

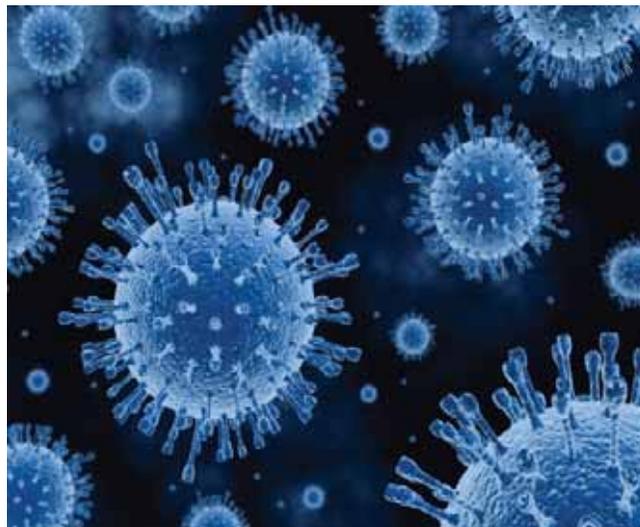
- Two types of germs are commonly available: bacteria and virus. Both causes diseases in human and animals
- Disease caused by bacteria can be cured by use of medicine (antibiotic).
- Disease caused by virus cannot be cured by use of medicine. Needs to prevent the disease by use of vaccine that helps the animal to increase its inner strength (immunity) to fight against the germs and to prevent occurrence of disease.
- Germs are transmitted from environment to animal, animal to animal, animal to human, human to animal and so on.
- Germs are mainly transmitted from the diseased animals by different means including faeces, urine, skin contact, sneezing, coughing, ocular discharge, meat, milk, aborted materials, air, water, etc.

How germs spread in dairy farms (medium of transmission)

Germs spread by following means



Photograph of bacteria



Photograph of virus

- Physical contact of one animal with other,
- Through animal excreta and discharges,
- Through farm utensils,
- Through water and air,
- Through animal handlers,
- Through improper drainage system,
- Through flies, mosquitoes, dirty cloths,

- Through birds and stray animals.

8.3.2 What are parasites?

In addition to bacteria and virus, there is another type of disease causing agent called parasites. It could be internal or external parasite and can be observed through naked eyes.

- External parasites (lice, tick, mite, etc.) are found on the body of the animals and can be seen through naked eyes.
- Internal parasites (worms) are found inside the body of the cattle/buffalo and many of those can be seen through naked eyes.
- If eggs/worms are passed to human body through consumption of milk from affected animal, it can cause disease to human being.
- Generally the dairy animals coming from well managed farm contain lesser number of germs

Risk reduction measures from parasitic infestation

- Animal sheds should be cleaned regularly with antiseptic/disinfectant solution.
- Should not be fed with green forages collected from damp place without boiling/wilting in sun.
- Cattle/buffalo feces should be examined at regular interval to know the presence of parasitic infestation in animals
- All dairy animals should be fed with broad spectrum deworming drugs at six months interval.

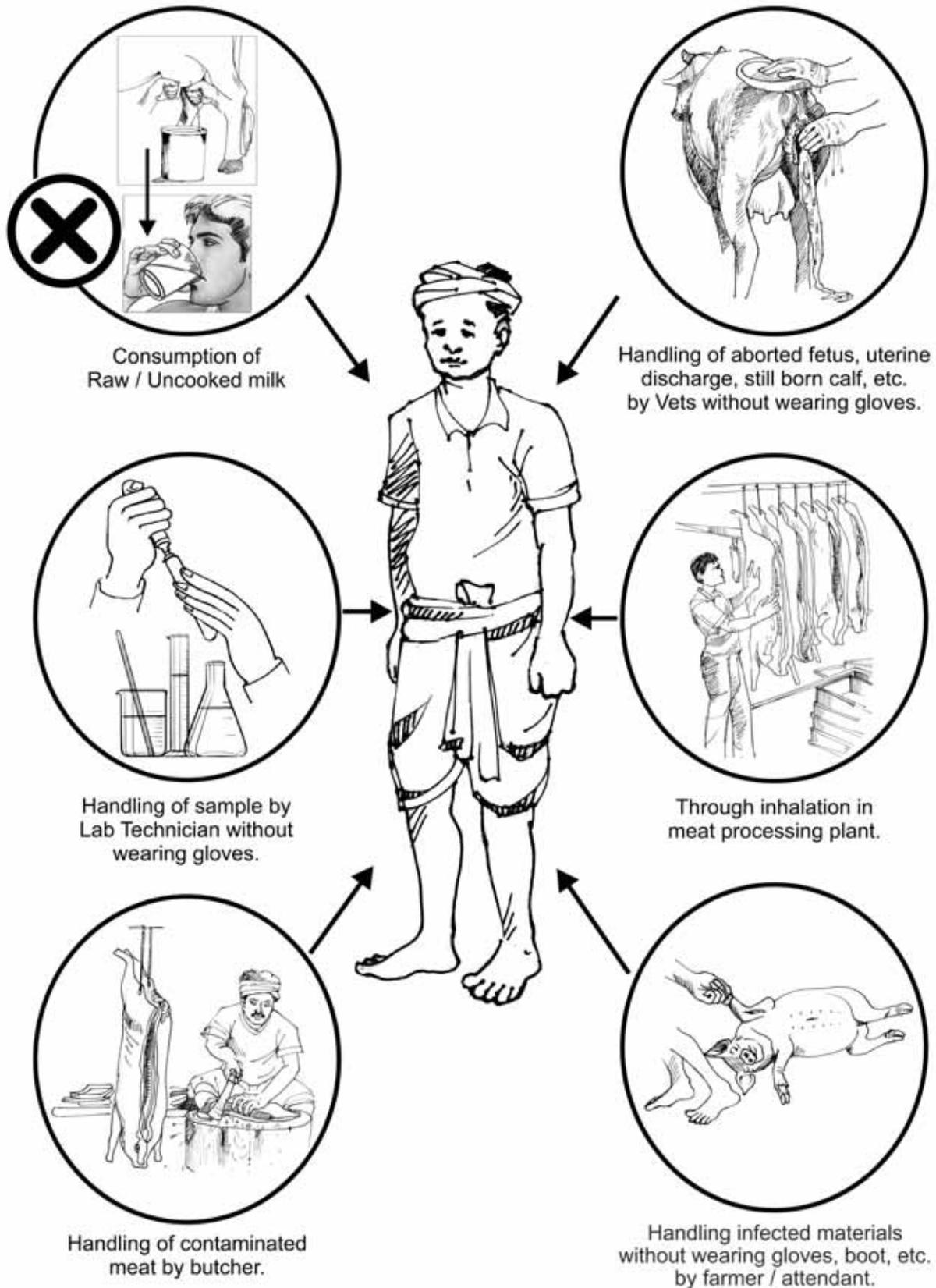
8.4 Zoonotic diseases

Some of the diseases caused by germs in animals and that can get transmitted to humans through contact with diseased animals/animal excreta or through consumption of milk (more particularly, if these are not properly boiled)/meat or their products (if prepared from raw milk).

Some of the important zoonotic diseases of dairy animals are:

- Brucellosis
- Tuberculosis
- Leptospirosis
- Q-fever

Routes of Transmission of BRUCELLA ORGANISM



These diseases while affected human shows wide range of symptoms based on organs affected. Human doctors also find it difficult to diagnose and treat these diseases because of ignorance towards these diseases (as these are not well covered in human health science courses).

8.5 Risk reduction practices of zoonotic diseases

- Diseased animals and their excreta, tissues, blood, aborted materials, etc. should not be touched with bare hands. These should be disposed by burying at places away from the farm and buried deep enough so that Jackals or dogs cannot dig out.
- Should always use mask, hand gloves and other such personal protective clothing.
- Should wash hands and feet with soap-water and should take bath after handling any such infected materials.

8.6 Human health risk associated with milk

In addition to zoonotic diseases human health may also get affected if they consume poor quality milk having disease causing germs. Milk from the clean udder of a healthy cow contains fewer germs. However, if even a small amount of germs get into milk after milking because of poor hygiene and sanitation, they can grow rapidly and spoil the milk. Additionally, these germs get into human through consumption of milk and can cause various diseases. There are other human health risks as well that include toxins (including aflatoxins) produced by bacteria, fungus (e.g. aflatoxins) or residues of pesticides, antimicrobials, etc.

8.7 What is good quality safe milk?

- Does not contain any physical contaminant,
- Is yellowish white, with no odor,
- Does not contain germs beyond an acceptable limit,
- Does not contain any residues (antibiotic residues, pesticide residues, etc.) beyond an acceptable limit,
- Does not contain any toxic or poisonous substance (aflatoxins, phytotoxins, etc.).

No physical contaminant: physical contaminants are dirt, dust, piece of grass, cow hairs, etc. Presence of physical contaminant in the milk means that the milk is not handled carefully and there is a lack proper hygiene.

- To avoid the physical contaminants, you should always cover the milk containers with a clean cloth or keep the lid containers closed;
- Trim the long hairs of the cow more particularly of the tail on regular intervals;
- Always tie your hairs up or cover your head while milking the animal;
- Strain the milk with a clean cloth;
- Take utmost care for personal hygiene;
- Maintain proper sanitation and hygiene in the farm.

Milk having a normal color and is free of bad smell: normal color of cow milk is yellowish white and it should not have sour or foul smell. Change in color and smell is an indication that your animal is diseased or is not healthy (e.g. in case of animals with the incidence of mastitis).

- The milk should be discarded if it has a foul smell or smells slightly sour;
- The milk is not fit to use if the color is not normal yellowish white (Reddish-blood or yellow-pus);
- Don't use the milk from the animal that is sick and is not fully recovered.

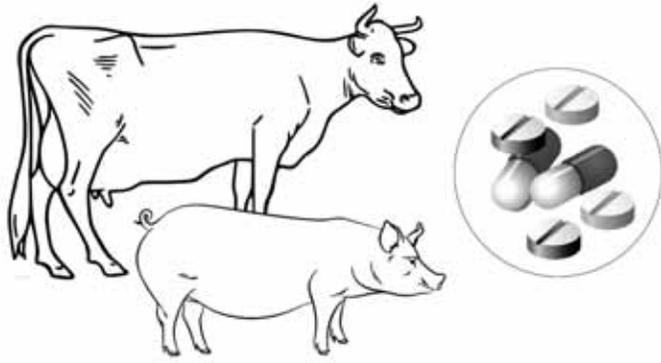
No germs beyond an acceptable limit: Germs are tiny, living creatures. Germs are everywhere: they are too small to see with the naked eye. Some germs are always present in the milk but they should not exceed the acceptable level.

- Germs exceeding the acceptable limit lead to diseases and spoil the milk;
- This can be avoided by using clean equipments and utensils;
- Proper handling and storage of the milk;
- Personal health and hygiene,
- Reducing the occurrence of diseases by proper treatment and vaccination,
- Avoid keeping the milk under normal temperature for a long duration.

Antibiotic residues: antibiotics are given to the animals to treat infectious diseases and are also, used as growth promoters for the feed that is given to the animals. The particles of these antibiotics slowly come out through milk. Humans get the antibiotic particles through consumption of this milk. The germs present in the human body get exposed to these antibiotic particles present in milk and when they fall sick, these antibiotics might not work and fail to treat the disease.

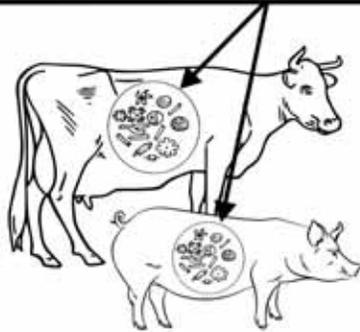
- Never try to treat animals on your own.
- Veterinary practitioner should always be consulted for treating the animals. Please note that all the diseases don't require the treatment by antibiotics.
- The course of antibiotics (5 days) should always be completed.
- Do not consume or sell the milk till two days after the completion of antibiotic course (withdrawal period).

Antibiotic residue:
How it contribute to development
of antibiotic resistant bacteria



ANTIBIOTICS

- I. Low doses of antibiotics are put into feed for better growth of the pig & treatment of diseases.
- II. Animal products are sold within the withdrawal period and antibiotics are passed to humans when consumed.
- III. Overuse / Misuse of antibiotics by farmers.



ANTIBIOTIC - RESISTANT BACTERIA
develop in the intestine
of the animal.



- Bacteria from animal's intestine enters -
- I. Meat during slaughtering and processing.
 - II. Milk during production



Bacteria are carried through animal waste & then by air to crops.

Humans consume the contaminated meat, milk and food products and the antibiotic resistant bacteria and gets totally sick.

Pesticide residues: pesticide is a chemical substance used for destroying insects or other organisms harmful to cultivated crops. When the animals take plants or feed sprayed with pesticides, the particles of the pesticide come in the milk they produce.

- Pesticides cause a wide range of toxic effects in human beings. So, the milk containing particles of pesticide are harmful for you as well as your consumers.
- Avoid using chemical pesticides on the farm. A number of organic pesticides can be used instead of the chemical pesticides.
- Avoid giving your animal the feed sourced from an area where pesticides are used in cultivation of feed and fodder.

Aflatoxins: Milk gets contaminated with aflatoxins due to the consumption of mouldy feed or fodder. These toxins can pose health hazards to the milk consumers.

- The feed and fodder given to the animals must be stored in a clean and dry place.
- The stored feed must not come in contact with water.
- The storage area must have proper ventilation.

8.8 Adulteration of milk

Milk adulteration means addition of any external material like water, milk powder etc. to milk which alters its natural quality. It might give you short term benefits but adulterating the milk may affect the health of the consumers.

- The common milk adulterants that are used are water, urea, starch, milk powder etc.
- Milk adulterants can pose serious health hazards and highly reduce the quality of the milk.
- Health hazards associated are acidity, indigestion, ulcers and cancers.
- Adulterants decrease the nutritive value of the milk.
- Consumers do not get the original flavor and taste of the milk and will lose trust on the quality of your produce. This lowers the demand and price.

Milk quality can be checked by the food safety officers at any time and if found guilty of adulteration, farmers/ traders can be penalized under the act of law.

- The punishment might be in terms of fine or imprisonment (few month to life imprisonment depending upon the severity of offence)

8.9 How to check milk quality

You can perform the following simple tests that do not need any special equipment and are easy to perform to test the quality of milk:

8.9.1 Fat testing

Fat % in milk can be assessed by (i) Gerber Method (ii) Digital Milk Analyzer (DMA).

(i) Gerber Method

Equipment and materials

- Sulphuric acid (density 1.807 – 1.812 g/ml at 270C, colourless);
- Amyl alcohol;
- Butyrometers: 6%, 8% and 10% scales depending on fat content;
- Stoppers and shaker stands for butyrometers made from a suitable grade of rubber or plastics;
- 10 ml Acid pipette for sulphuric acid (with rubber suction device);
- 10 ml pipette for milk;
- 1 ml pipette for amyl alcohol;
- Centrifuge, electric or hand driven;
- Water bath at 65 + 20C.

Procedure

- Use the 10 ml acid pipette to transfer 10 ml of sulphuric acid into the butyrometer,
- Fill the 10.75 ml pipette with milk and deliver the sample into butyrometer,
- Add 1 ml of amyl alcohol using the 1 ml pipette and close,
- Shake the butyrometer in the shaker stand until no white particles are seen and invert it for a few times,
- Put the butyrometer in the water bath for 5 minutes;
- Take it out and dry with a cloth, put it in the centrifuge, placing two butyrometers diametrically opposite, centrifuge at maximum speed for 4 minutes;
- Transfer the butyrometers, stoppers downwards into water bath for 3-10 minutes;
- Bring lower end of fat column on to a main graduation mark by slightly withdrawing stopper.
 - The colour of the fat should be straw yellow;
 - The ends of the fat column should be clear and sharply defined;
 - The fat column should be free from specks and sediment;
 - The water just below the fat column should be perfectly clear;
 - The fat should be within the graduation.

Interpretation

Note down the upper and lower scale readings corresponding to the lowest point of fat meniscus and surface of separation of fat and acid. The difference between the two readings gives the percentage by mass of fat in milk. The reading has to be done quickly before the milk cools. The butyrometers should be emptied into a special container for the very corrosive acid-milk liquid, and the butyrometers should be washed in warm water and dried before the next use. Fat testing is often carried out on composite or random samples in order to reduce time and costs involved in testing.

(ii) By using a digital milk analyzer

In this case, the milk sample should be put in a container that fits into the lactometer and to be placed in the machine as shown in the figure below. The lactometer will give instant results for SNF, fat percentage and water content.



A digital milk analyzer

8.9.2 Solids Not Fat (SNF) testing

SNF can be assessed by measuring the specific gravity (i) By using a lactometer. (ii) By using a Digital Milk Analyzer

(i) By using a lactometer.

Materials required

Lactometer

Cylinder

Dairy thermometer

Procedure

- Mix the sample of milk well. Pour it into a dry cylinder which enables the lactometer to float without touching the sides,
- Put the lactometer into the cylinder. Take the reading from the lactometer as soon as it becomes stationary,
- Note the corrected lactometer reading (CLR).

Calculation

Specific gravity = $1 + \text{CLR}/1000$

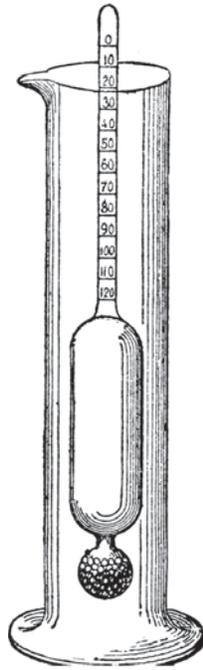
For cow milk, Lactometer reading is taken at 21°C.

The SNF is calculated using the formula.

$\% \text{ SNF} = \text{CLR}/4 + 0.21 \times F + 0.14$

CLR means Corrected Lactometer Reading at 21°C

F = % of Fat in milk



A lactometer

(ii) By using a Digital Milk Analyzer

8.9.3 Sight and Smell (Organoleptic) test

This involves checking the milk for smell, appearance and colour. The test allows the segregation of poor quality milk. The tester should have a good sense of sight and smell.

Procedure

- Open the cover of the milk container,
- Immediately smell the milk and establish the nature and intensity of smell, if any,
- Observe the colour of milk,
- Check for any foreign bodies or physical dirt,
- Do not stick your hand or finger into the milk as this will contaminate milk,
- Don't taste the milk. Please observe that tasting raw milk is not a good practice since raw milk can contain dangerous bacteria.

Interpretation

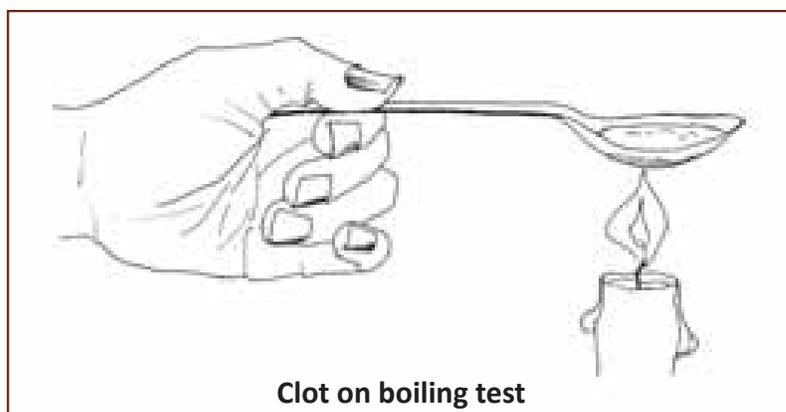
- The milk should be discarded if it has a foul smell or smells slightly sour,
- The milk is not fit to use if the color is not normal yellowish white. (Reddish-blood or yellow-pus). Milk should be discarded if it contains any foreign bodies or dirt.

8.9.4 Clot on boiling test

It allows for detection of milk that has been kept for too long without cooling and has developed high acidity. Milk with high acidity is not fit for consumption.

Procedure

- Boil a small amount of milk for a few seconds in a clean spoon or other suitable container,
- Observe immediately for clotting.



Interpretation

- The milk will be rejected if there is visible clotting, coagulation or precipitation.

8.9.5 Strip cup test

Use of the strip cup is the best way to detect mastitis. A strip cup is a shallow black cup around 10 cm in diameter. It must be black on the inside to show up the presence of mastitis.

Procedure

- At the start of milking squeeze the milk 2 to 3 times into a strip cup,
- In stripping you squeeze the base of the teat between thumb and forefinger and draw down in one smooth movement squeezing out the milk,
- Observe the milk for abnormalities,
- Clean and dry the strip cup before using on the next cow.

Interpretation for mastitis

- Watery or stringy milk is a sign of mastitis.
- Clots or flakes in the milk are signs of mastitis.
- The mastitis milk might have abnormal smell or colour.



A strip cup

8.9.6 California mastitis test(CMT)

It is a simple test to detect sub-clinical mastitis in cow by using the CMT kit.



CMT kit

Procedure

- A four-well plastic paddle is used, one well being for each quarter of the cow to be tested,
- Foremilk is discarded, and then a little milk drawn into each well. An equal volume of CMT reagent is added, and gently agitated,
- The reaction is scored on a scale of 0 (mixture remains unchanged) to 3 (almost-solid gel forms), with a score of 2 or 3 being considered a positive result.



Testing of milk for detection of sub-clinical mastitis in cow by using the CMT kit.

8.9.7 Rapid test kit for milk testing

There are certain commercially available rapid test kits that are used for conducting milk tests as stated below:

- Urea test
- Ammonia fertilizer test
- Pond water test
- Starch and flours test
- Sugar test
- Glucose test
- Salt test
- Hydrogen peroxide test



The advantage of these rapid tests is, there is no requirement of several reagents, utensils, equipments and glassware. Only requirement is test tube. Small volume of milk should be poured at a test tube and few ml of reagent/s supplied by the manufacturer should be added to it as per the norms prescribed by them.



Changes in colour of milk will indicate the positivity or negativity of the test results.

8.10 Common myths associated with dairy farmers

Table 15: Common myths associated with milk

Myth	Truth
<ul style="list-style-type: none"> If milk and dairy products look and smell good, then they are safe. 	Many diseases are spread by germs which are too small to see. These can make you sick or kill you, even if the food looks perfectly good.
<ul style="list-style-type: none"> If you boil milk well it is completely safe 	Boiling will kill the germs responsible for some diseases. But, some germs shed poison i.e. and boiling will not remove these. Also, boiling will not destroy harmful chemicals in milk. Boiling or cooking will always make food safer but it will not remove all things that can cause disease.
<ul style="list-style-type: none"> The faeces of cattle is harmless 	Cow dung is the number one cause of diarrhea. 1 gram of cow feces can contain many lakh germs. For Hindu's, cattle faeces and urine is a purifying agent, but even though it is spiritually purifying it can contain germs.
<ul style="list-style-type: none"> Milk quality can be tested by dipping hand and seeing the thickness on finger nails. 	Milk quality cannot be judged like this and same can introduce germs from one's hand making it unsafe to consume and lessening the keeping quality.
<ul style="list-style-type: none"> Fat content depicts the quality of milk exclusively 	Milk quality has many different aspects: these include fat content, solids non-fat, absence of adulterants, good texture, good taste, good smell and freedom from germs.

Physical demonstration: Basic milk quality tests

Instruction for the resource persons: With the help of few participants perform the following basic quality tests to demonstrate.

Prepare beforehand some samples of milk

- Pure fresh raw milk
- Milk which is starting to go sour
- Milk with 5% added water
- Milk with 20% added water: milk with 50% added water; milk with starch added
- Milk with dirt

Basic milk quality tests

1. SNF test/Lactometer test, 2. Sight and smell test, 3. Clot on boiling test, 4. Alcohol test

Have the participants conduct the tests

Key message of session 8

- The farmers should possess the basic knowledge on the disease causing agents (germs and parasites), mode of their transmission, disinfection, sanitation etc.
- The farmer should understand the human health risk associated with milk and take measure to keep the milk clean and germs-free.
- To do away with antibiotic and pesticide residues, and Aflatoxins, adequate care should be taken by following instruction of veterinary practitioners and managing feeding habits.
- Keep milk away from adulteration as it may give short term benefits only, but in the long run he will loose many customers. The farmers should learn the rapid milk testing methods so that he/she can prove his milk quality by conducting these tests before his/her customers.

SESSION 9: Entrepreneurship Development in Dairy Farming

Session objectives

- To enable participants make the strategic farm improvement plan for entrepreneurship.
- To provide knowledge for improving personnel business and behavioural skill of dairy entrepreneur.

Training Methods to be followed

- Participatory discussion
- Distributing manuals and relevant handouts
- Field visit

Training materials

- Laptop, LCD projector and screen
- Whiteboard and markers (multiple color)
- Manuals and handouts

9.1 Who is a livestock entrepreneur?

- An individual/group of individuals who start a new profit making animal based enterprise;
- An individual who can take risk and can lead the enterprise;
- An individual/ group who enjoys most of his profit/revenues generated out of the farm;

9.2 How an entrepreneur can plan for an improved dairy farm

An entrepreneur needs to determine the size of the farm by exercising the following

- Assessing own financial resources and capacity,
- Assessing the capacity to avail credit,
- Working out the economically viable size of the farm,
- Working out the total expenses required,
- Working out the estimated production in a year,
- Assessing the market demand and price,
- Working out the expected revenue to be generated,
- Assessing the availability of farm inputs.

To determine the infrastructure requirements-

- Identify a suitable site for starting the farm;
- Decide the type of housing to be followed (conventional scientific/modern scientific, etc.);
- Decide the type of materials/structures to be used for housing (concrete, wooden, bamboo, etc.);
- Working out the total infrastructure requirements (water, electricity, drainage, approach road, etc.);
- Decide the farm waste disposal/use options (biogas plant, farm manure, vermincomposting, etc.);
- Working out nutritional content of the concentrate feed available in the locality and decide on improvement/procurement options as per the breed type held in the farm. Decide on building up the suitable infrastructure as per the feeding regimes;

- Decide market infrastructure and equipments required, if any;
- Prepare the design and layout;
- Make a cost estimation of the total infrastructure to be created.

To determine the operationalization of the farm

- To work out the number of dairy animals to be introduced in phased manner;
- To identify the possible sources of high yielding dairy animals (breed, milk yield, price, transportation cost);
- To identify the possible sources of concentrate feed/feed ingredients (price, quality, ease of transportation, etc.);
- To make arrangement for procurement and storage of quality feed/feed ingredients at competitive price;
- To make arrangement for procurement of non-conventional feed stuffs and silage making including storage of them;
- To make arrangement for procurement, storage and administration of vaccines and dewormings;
- To make arrangements for need based veterinary services with an experienced local veterinarians;
- To work out the labour requirements and their skill development plan (numbers, trainings, exposure visit plan);
- To recruit preferably experienced labourers/supervisor/farm manager;
- To regularly assess the comparative market demand and price of farm produce (milk/live animals/farm manure) and choose profitable market option;
- To make arrangement for keeping different farm records and books of accounts for proper farm planning (preparing formats of record keeping).

To operationalize the access to institutional services plan

- To do the needful to get access to credit from Banks;
- To do the needful to get insurance services from reputed insurance companies;
- To establish network with all concerned (bank/insurance company/input suppliers/farmer producer organization etc.);
- To establish network with the AHVD to get access to benefits offered by department under different govt. supported schemes.

For successful implementation, following points should be considered

- The entrepreneur should be ready to devote time and energy for management of the farm. One should not solely depend on others' labour for management of the farm.
- Initially, the size of the farm should be within manageable limits from all aspects. It may even be necessary to start first with the help of the family members/1-2 hired labourers.
- In the case of limited capital in hand, improvement of infrastructure like land development, boundary fencing, farm building, etc. should be taken up in a phased manner.
- Under similar circumstances, initially farmers should consider investing sufficiently on productive components like piglets, feed, health care and management, and subsequently he/she can improve the infrastructure from the revenue generated out of the farm.

- In the same way, only good quality piglets have to be purchased and fed adequately to ensure more production and more profit. The health care measures must not equally be ignored.
- Consultation with a veterinarian or experienced person to learn about the suitable breed, housing system, etc. is helpful.
- Before purchasing cattle or buffao, different farms (from which they can be purchased) may be visited in the area to assess performance and history of different cattle/buffalo herds. Ideally, dairy animals should be procured from same the agro-climatic condition.
- The cattle/buffalo should be vaccinated with good quality vaccine against prevailing diseases like FMD, Brucellosis, etc.
- De-worming drugs have to be administered periodically.
- Cleanliness of the farm must be maintained.
- Fodder crops (Napier/Oats grass) suitable for the climatic condition of the state may be cultivated.
- Producers should look for milk market options available with them and choose the one/s that is/are remunerative and sustainable.
- Loan, if any, must be repaid timely to build reputation with the bank.

9.3 Personal business and behaviour skill of a dairy entrepreneur

In order to promote the farming business of a dairy entrepreneur, he should inculcate certain good business and behavioural skills as follows:

- **Active listening skill:** A dairy entrepreneur should possess the skills to listen actively while dealing with his customers and input suppliers (including labour). He should also be able to read body language as well as verbal communication. He should try to respond according to the opinion of persons with whom he is dealing with.
- **Keep emotions in control:** Sometimes conflict may arise with the input suppliers and customers. So, a dairy entrepreneur should have the ability to keep his emotions under control even under difficult circumstances.
- **Clear and effective communication:** A dairy entrepreneur should communicate to his clients the way they understand the most. The customers and traders may be a simple person with lesser business tricks. A dairy entrepreneur, while negotiating with them, should try to communicate slowly and clearly without expression of any excitement, anger and emotions.
- **Collaboration and teamwork:** For effective business management of a dairy entrepreneur, he will need support from many others. To strengthen his association with others he should take all concerned into confidence, communicate transparently, keep commitment, discuss issues on time, give due share/credit for their contribution and appreciate the contribution that others have made in making things happen.
- **Problem solving skills:** A dairy entrepreneur may confront variety of problems in the field while delivering the services. He should try to inculcate good practices that may potentially diffuse the tensions. He should avoid stating/behaving the way that may escalate the situation. He is the best person to judge the situation and behave according to need.
- **Decision making ability:** When a dairy entrepreneur faces a business client with particular problem, he should have the ability to correctly assess the situation and make a decision which is appropriate under the given circumstance and act accordingly. If required he may discuss with other business associates or any other concerned person prior to making the decision.

- Maintaining good relationship: A dairy entrepreneur should always try to maintain friendly working relationship with all concerned for making his business even better and rewarding.

9.4 Formation of Dairy Cooperative Society (DCS)

Dairy producers in rural areas who do not get direct access to market, farm inputs and services may form a DCS to collectively do the job of selling and procuring inputs. Amul brand of milk of Gujarat is a very good example of successful three tier dairy cooperative system in India. The Anand Model (Anand, Gujarat) of cooperative system has three tiers system which is followed throughout the country:

- At village level, dairy farmers form the DCS;
- At district level several, DCSs form the Milk Union;
- At state level, several Milk Unions form the Milk Federation.

Amul brand of milk is produced by the Kaira District Milk Union.

Under the ambit of the Cooperative Society Act-2007, provisions have been laid down for formation of DCS so that the dairy farmers/producers can come to a common platform and can be benefited in a better way.

- About 30 farmers or more in an area can come together to form a DCS.
- For formation of DCS there is a standard process under Cooperative Society Act-2007.
- Every DCS must need to be registered under the Cooperative Act. The group of farmers need to apply in standard format for formation of DCS to the Registering Authority i.e. Dairy Development Department.
- After formation, DCS need to follow certain procedures like having yearly governing body meeting, auditing accounts by external auditor etc.
- DCS enjoy legal entity and therefore, it is not like the Self Help Group (SHG) or other such groups which can be formed and dissolved at the farmers' will.
- DCS members deliver the milk at the milk collection center of the society. From the collection center, milk is generally collected by dairy plants for processing.
- Farmers are paid based on Fat and SNF content of each litre of milk delivered. After delivery of milk farmers generally get a receipt stating what volume of milk delivered, what is the Fat & SNF content and what is the price of the delivered milk.
- Every collection center of DCSs must have milk testing facilities, generally provided by government under different schemes.
- Payments are made either weekly or fourth nightly or monthly. Many dairy plants directly transfer the money directly to farmer's bank account.
- Every DCS should have an office where the records are kept.
- Successful DCSs are eligible to get assistance from the government from time to time as per their schematic provision.
- Interested farmers are suggested to meet local officer of the Dairy Development Department for further details.

Case study

Instruction for the resource person: Ask the training facilitator to identify a successful dairy farmer in the area . Take the participants to his/her farm. Let the participants directly interact with the farmers about his/her experience (both good and bad) in managing the farm and in milk business. The participants should note down the key learning.

Key messages of session 9

- A dairy farmer with a goal to become entrepreneur should know about his/her position (financial and physical capacity), market demand of his product and source of farm inputs.
- He should be able to determine the requirements of his infrastructure
- He should be able make the operational plan of his business as well as access to institutional services plan.
- He should be able to make necessary changes of his personnel business and behaviour skill to become a dairy entrepreneur.

Session 10: Welfare of Animals and Care for Environment

Session objectives

- To make the participants understand ways for mitigation of environmental stress arising due to rearing of dairy animals
- To make the methods understand the importance and practices of animal welfare (more particularly of dairy animals).

Training Methods to be followed

- Participatory discussion
- Distributing manuals and relevant handouts
- Group discussion

Training materials

- Laptop, LCD projector and screen
- Whiteboard and markers (multiple color)
- Manuals and handouts
- Post-training evaluation form
- Photos and illustrations

10.1 Care for environment

While we plan for dairy farming, we should also think of environment in order to reduce the effect of dairy development on environment. Consumers are also increasingly becoming more concerned about the environment and they prefer to take food/animal products produced in environment friendly production system. Dairy farmer should play a constructive role in protecting environment by reducing effect on air, water, land and natural resources. In promoting dairy following points should be taken into consideration for environmental protection:

- Properly use farm manure as bio fertilizer for cultivation instead of using chemical fertilizer.
- Do not allow farm waste to get into the water stream/ drains that may pollute the water reservoir which have concern towards biodiversity/environmental aesthetic value or an important source of drinking water for human being and livestock.
- Provide feeds and fodder that are easily digestible. This would result lesser greenhouse gas emissions, lesser feed requirement and increase productivity.
- Judicious use of grazing in community land and cultivation of more fodder crops.
- Take care so that livestock/farm waste does not pollute water courses, ponds, lakes, reservoirs, wells, boreholes, underground water;
- Reduce, reuse or recycle farm waste as appropriate. Re-using and/or recycling are also good dairy farming practices (RRR).
- Reduce use/ wastage of water and energy by improved housing and management.
- Reduce off smelling/ bad odour in farm premises by adopting improved clean and hygiene practices and proper drainage in order to reduce environmental pollution.
- Dispose off dead animals, aborted materials, biological waste, etc. by burring to prevent spread of infection.
- Storage facilities for oil, silage liquor, soiled water and other polluting substances must be located in a safe place and precautions must be taken to ensure that accidents do not result in the pollution of local water supplies.

- Avoid disposing of agricultural or veterinary chemicals where there is potential for them to enter the local environment.
- Use agricultural and veterinary chemicals and fertilizers appropriately to avoid contamination of the local environment.
- Ensure the safe disposal of expired and defective antimicrobials and chemical containers.
- Apply integrated pest management practices where appropriate.

10.2 Animal welfare

Animal welfare is primarily concerned with the well-being of the animal. In general, consumers perceive high animal welfare standards as an indicator that food is safe, healthy and of high quality.

Animal welfare organizations mainly talk about ‘five freedoms’ in regards to animal welfare. These include:

- Ensure animals are free from thirst, hunger and malnutrition.
- Ensure animals are free from discomfort.
- Ensure animals are free from pain, injury and disease.
- Ensure animals are free from fear.
- Ensure animals can engage in relatively normal patterns of animal behaviour.

Ensure animals are free from thirst, hunger and malnutrition

- Provide sufficient feed and clean drinking water for all animals everyday as per their nutrient requirement at different stages of their life;
- Protect animals from toxic plants and other harmful substances;
- Do not feed animals with mouldy feeds.
- Store chemicals securely to avoid contamination of pastures, and observe with holding periods for pasture and forage treatments;



Animals are properly fed

Ensure animals are free from discomfort

- The farm house should protect the animals from all adverse climatic conditions;
- Design and construct the buildings such a way that animals feel maximum comfortable and do not suffer from any injury;
- Adequate floor space and clean bedding should be allowed to the animals for their comfortable stay;



Rubber matting on the floor

- Provide adequate feeding and watering space to reduce aggressive competitive behaviours;
- Try to house same age group animals in the same area;
- Protect animals from adverse weather conditions (hot, cold, rains, etc.) and the consequences thereof;
- Have plans to protect dairy animals against emergencies (for example back-up power supplies) and natural disasters (for example fire, drought, flood, earthquake, etc.);
- All animal housing should be adequately ventilated allowing sufficient supply of fresh air to remove humidity;
- Use protective floor coverings (e.g., rubber matting or other non-slip surfaces) on walkways to reduce carpal hygroma and hoof abrasions that lead to secondary hoof infections;
- Proper care should be taken for comfortable transportation, feeding, watering and loading and unloading of animals.

Ensure animals are free from pain, injury and disease

- Check animals regularly to detect injury and/or disease. All the injured/diseased animals should be treated.
- Do not use procedures and processes that cause unnecessary pain.
- People carrying out veterinary related tasks should be able to demonstrate competency to treat an animals or to do dehorning, castration, injection etc.
- Animals should not be allowed to walk for long distance, more particularly during hot hours of the day.
- Animals should not be allowed to work which is not possible from its part to do.
- Avoid poor milking practices as they may injure animals.



Maternity/calving pen for near and post parturient cows with adequate bedding material

Ensure animals are free from fear

- Animals should be handled with care so that they are not afraid;
- Only experienced and competent persons should be allowed to handle;
- Animals should not be beaten up;
- Avoid producing loud noise near the farm/animal;
- Use facilities and equipment that are suitable for animal handling;
- Do not unnecessarily disturb animals at odd time;
- Ensure animals can engage in relatively normal patterns of animal behaviour;
- Do not create a housing and management environment in which animals find it difficult to express its normal behaviour;
- During regular inspection(s) of animals, check for any abnormal behaviour;
- Ensure each animal has adequate space to express its behaviour.

Group discussion

Instruction for the resource person: Ask the participants to divide in two groups and let them discuss on the need of taking care of environment and welfare of animals. At the end of discussion one from each group will present the key outcome of the discussion.

Key message of session 10

- While running a dairy farm, there is production and generation of different types of wastes having negative effect on environment. There may be emission of foul smelling gases, green house gases, pollution and contamination of water sources.
- The farmer should not allow contaminating the source of water by the waste generated in the farm.
- The farmer should bury the dead animals or other biological waste and the left over medicine, vaccine vials, etc.
- Never keep the pigs under starvation, in unhygienic condition, under stressful condition, in panic, left untreated, unnecessary beating, etc.
- Never handle/restrain in a harsh way which may lead to stress and injury.

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Performance Indicator: Training of Smallholder Dairy Farmers

SI No.	Performance Indicator	Expected performance		Achieved Performance		Remarks
		Cross bred	Indigenous	Cross bred	Indigenous	
1	Age of attaining puberty (i.e. first heat)	10-14 months	20-24 months			
2	Time required to come into heat post partum (days)	20-30 days	2-3 months			
3	Age at first calving	20-24 months	30 -34 months			
4	Length of Inter-calving period	14 months	18 months			
5	Number of AI required per conception	2	2			
6	Milk yield per day (average)	6 ltr	1 ltr			
7	Length of lactation period	300 days	210 days			
8	Total lactational yield	1800 ltr	210 ltr			
9	Milk fat %	3.5-4.5 %	4-5 %			
10	SNF %	9 %	8.54 %			
11	Occurrence of still birth/ abortion	15% reduced	15% reduced			
12	Occurrence of repeat breeding	20% reduced than before training	20%			
13	Occurrence of mastitis	30% reduced than before training	30%			
14	Increased in income	20% increased	20%			
15	Vaccination of animals	Yes	Yes			
16	Deworming of animals	Yes	Yes			
17	Adoption of AI practice for breeding	20% increase	20% increase			

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