PREFACE

The dairy extension manual has been prepared, primarily for Development Agents and field staff who are in direct day to day contact with dairy farmers. It covers many of the practical issues which confront extension staff and gives guidelines upon which appropriate advice can be given.

In agriculture, and particularly in dealing with livestock, each situation must be evaluated within the context in which it arises. There is no textbook in dairy farming which gives all the answers: the extension agent must draw upon his own knowledge and experience in the first instance coupled with the practical observations of the farmer in deciding what action to take. This manual is designed to augment his knowledge: experience will only come as that knowledge is applied to each new situation.

This manual may be regarded as the first edition. As the dairy industry expands and develops, and as new technology is introduced and traditional techniques are reviewed the manual will be revised to meet the changing needs of the extension service. In time it is envisaged that it will become a standard reference manual for the dairy extension service.

I am very grateful therefore to the staff of the Dairy Rehabilitation and Development Project for their technical inputs to the manual, to FARM (Africa) for providing the services of the editor Mr. Jim Miley, and to Agri-Service Ethiopia for printing it.

Gizaw Nigussie
Vice Minister
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SECTION 1

INTRODUCTION

1.1 BACKGROUND

Livestock farming is common in all areas of Ethiopia, from the intensively cultivated highlands to the sparsely populated lowlands. Dairying forms an important part of traditional livestock production. Over 95% of total milk production in Ethiopia is accounted for by smallholder farmers.

In most cases, however, milk is regarded as a by-product of other livestock enterprises. In the highlands cattle are kept primarily for use as draught oxen. Cows are used mainly for breeding replacement draught oxen so milk production is of secondary importance.

Performance levels are generally very poor. Most cows on smallholder farms calve only every second year. Milk yields are often as low as 300 litres per annum with much of the milk being consumed by the calf.

There are a small number of cooperatives who specialise in dairying as well as the State Dairy farms. However, milk production is still well below the demand for milk and milk products.

1.2 CONSTRAINTS TO DAIRY DEVELOPMENT

There are a number of constraints to the development of a strong dairy sector in Ethiopian agriculture. The lack of suitable breeding stock poses a major constraint. Local breeds need to be crossed with exotic high-yielding breeds to increase yields.

An improved Artificial Insemination service and the provision of high quality exotic breeding stock is needed to upgrade the indigenous stock.

Feeding is another major problem in small-scale dairy farming. Cows are often not allowed to graze for long enough, and forage quality is generally very poor. Calves are usually not weaned until they are 8-12 months old and are fed almost completely on fresh milk. Calves are sometimes fed up to 350 liters of milk before weaning. This is a waste of milk. 250 liters is
adequate to produce a good calf. A successful dairy development programme requires a change in feeding practices for cows and calves.

Lack of finance, animal health problems and poor road access are some of the other constraints to the development of dairying.

1.3 DAIRY DEVELOPMENT

The medium to high altitude areas have been identified as most suitable for intensive dairy development. Moderately cultivated areas between 1500 m and 2700 m are ideal for dairy production provided there is enough land available to develop a forage programme.

The more intensively cultivated areas at these altitudes are also suitable for dairy development although land availability may sometimes be a problem. Good road access and proximity to markets are also crucial for successful dairy development. It is important to get the milk and milk products to the market as quickly as possible because they have a very limited shelf life.

Dairy development must form part of an integrated programme involving forage improvement, animal health improvement and the development of local infrastructure.
1.4 THE MANUAL

This manual is written for Development Agents and extension workers involved with dairy development. The manual includes details of the technical and management information necessary for operating a dairy programme. The manual is divided into sections. Users of this manual should refer directly to the section in which they are interested by using the table of contents.

Section 2 deals with breeding for dairy production. The theoretical background on reproduction and oestrus is discussed, as well as practical hints on heat detection, and cow and bull selection. The section also includes some notes on Artificial Insemination and crossbreeding for high performance.

Section 3 deals in detail with feeding. Feed quality is discussed in terms of digestibility and protein content. Practical hints are given on forage and concentrate feeding for cows and replacement stock.

Section 4 gives details on the management and feeding of the calf from birth to maturity. The section gives details of calving and calving difficulties and the importance of colostrum feeding in the early days of life. Rumen development and weaning are also discussed as well as post-weaning management.

Section 5 on milk and milking includes details on the composition of milk, the lactation cycle and milking procedures. Milk handling and storage are also dealt with.

Section 6 discusses dairy herd health. The three most important dairy disease problems are discussed in detail, and a summary of other diseases is included.

Section 7 covers dairy housing, cow handling and fencing.

Section 8 is on routine tasks on the dairy farm.

Section 9 gives a summary of the most important records and reports necessary for a dairy farm or cooperative.

Finally, practical information which is useful in day-to-day field activities is given in the Annexes at the end of the manual. A dairy calendar is also included.
SECTION 2
BREEDING

2.1 DAIRY BREEDS

There are many breeds of cattle used for milk production in Ethiopia. For intensive dairy production the following five breeds are suitable when crossed with exotic breeds.

Berca
Fogera
Borana
Horro
Arsi

These local breeds have a low yield potential unless they are crossed with exotic breeds. Yields from unimproved local cows are generally less than 500 liters per lactation. With cross-breeding yields may be increased to 3000 liters per lactation.

Friesian and Jersey are the most common exotic breeds for upgrading local dairy stock. Details on crossbreeding are given later in this section.

Before going into the details of a crossbreeding programme it is necessary to summarise the basic principles of reproduction and breeding.

2.2 REPRODUCTIVE SYSTEM OF COW

Fig. 2.1 Reproductive organs of the cow.
The cow's ovaries produce ovules or eggs about every 21 days, provided the cow is not pregnant. Oestrus (heat period) lasts one or two days. The cow is attracted to the bull at this time. Ovulation occurs at the end of the heat period. If the cow is mated with a bull within 18 to 24 hours of oestrus, the egg should be fertilized.

The fertilized egg eventually develops into a calf which is born approximately 281 days after service. For example a cow served on Meskerem 1 should calve on Sene 12.

2.3 REPRODUCTIVE SYSTEM OF BULL

Sperm are produced in the testes of the bull and transported through the vas deferens or ducts to the ampula or sperm store.

Seminal vesicles provide the fluid in which sperm are transported. From there semen (sperm plus fluid) passes through the urethra to the penis and into the cow's vagina. Sperm production begins when the bull is 8 months old. The bull should be segregated from the heifers at this stage, but he will not be used for serving until at least 16 months old.
2.4 OESTRUS CYCLE

The non-pregnant cow, provided she is healthy, produces eggs on average every 21 days. However, this period can vary between 16 and 26 days.

The young heifer may start to produce ovules at nine or ten months of age. The onset of ovulation may be delayed, however, if the heifer is undernourished or in poor health. Under Ethiopian conditions the onset of ovulation is often delayed until 15 or 18 months of age.

The oestrus cycle is governed by hormones (mainly oestrogen) in the cow. However, the ambient temperature and nutrition also play an important part in the oestrus cycle.

Under natural conditions most cows will come on heat towards the end of the main rains. The onset of heat is linked to an improved plane of nutrition. Service should be timed so that the cow will calve 3 or 4 weeks after the main rains start. This will ensure that adequate supplies of forage are available at the time of peak milk production.

Summary
- Gestation period in cow 275 to 287 days, average 281.
- Oestrus cycle 16-26 days, average 21.
- Oestrus in heifers begins at 9-10 months.
- Sperm production in bull begins at 8 months.

2.5 HEAT DETECTION

Accurate heat detection in the dairy cow is essential. There are a number of signs of heat as shown in the diagrams. The one foolproof sign is when the cow stands to be mounted by another cow and does not move away.

The other signs of heat are not always as reliable as this method. They may be a good indication that the cow is coming into heat.
On many small farms there may only be one cow with no other bovine animal running with the cow. In other cases the cow may be tethered and not in contact with other animals. In these situations heat detection may be difficult, but there are a number of signs as follows:

- the cow is restless and noisy.
- the cow loses her appetite.
- the vulva is swollen.
- there may be a clear mucus discharge.
- the milk yield may be reduced.
- the cow may be slow to let down milk.

Fig. 2.3 A - Conclusive signs of heat.
   B to F - Secondary signs of heat.
The most important lesson in heat detection is to observe the cow at regular intervals.

As well as at milking times, the herd should be observed for at least 10 minutes another 3 times per day.

Early in the morning and late in the evening are the best times for accurate heat detection. The cows are likely to be calm and undisturbed at these times. Heat may occur during the night so early morning and late evening observance is absolutely crucial. If nutrition is poor, heat may only last a few hours and may be undetected. Good nutrition based on high quality forage is essential.

2.6 CALVING INTERVAL

The calving interval for a cow is the time, in days, between one calving and the next.

The calving interval is a simple measure of the fertility of the dairy cow or herd. The calving interval can be divided into three separate stages as shown in the diagram.

Fig. 2.4 The three stages of the calving interval.
First heat usually occurs about 45 days after calving. Mating is recommended at the second heat period, which occurs 60 to 85 days after calving.

The ideal situation is where conception takes place at the first service. Thus, with 85 days from calving to conception, the cow produces approximately one calf every year. In other words the calving interval is 365 days. (In practice it is more likely that the calving intervals of up to 500 days occur on some farms. This is totally unacceptable.)

400 days should be the minimum target to aim for. In other words the cow should be successfully served within 120 days or 4 months after calving. A longer calving interval will reduce the profitability of the farm because:

- there will be fewer calves per year.
- there will be less milk produced per year.
- the cost per unit of milk produced will increase as the cows must still be fed even when they are not producing milk.

If the calving interval is more than 365 days there are a number of possible causes.

(i) Poor nutrition:

Badly fed cows are more difficult to get in calf, so good feeding in the weeks before - and after - calving is essential.

(ii) Deficiencies:

Mineral deficiencies, or imbalances, especially phosphorous, can cause fertility problems. Feeding poor quality forage may cause mineral deficiencies.

(iii) Heat detection:

One of the most common reasons for a long calving interval is poor heat detection. (See section 2.5)

(iv) Barren cow:

Some cows may become infertile and fail to become pregnant. These should be culled after failing to conceive on the fourth or fifth service provided there is no other identifiable reason for failure to conceive.
2.7 COW AND HEIFER SELECTION:

Cows:

A good dairy cow is one which:

- calves each year.
- produces a good milk yield.
- becomes productive at an early age.
- is healthy and disease free.
- produces calves and milk for at least six and preferably 10 or more years.

Rearing of replacement breeding stock is a major weakness on many dairy farms in Ethiopia. Farmers should produce their own heifers from the existing herd. It is important to make the right selection.

Heifers:

The choice must be based on the performance of the mother or dam.

The calves of cows with good yields should be chosen. Cows with fertility problems should be culled and their calves sold or fattened but not kept for dairy production.

Heifers should be mated at 18-24 months of age provided they are of the correct weight and well nourished.

Cross-bred heifers should be between 270 and 300 kg at their first service. If crossing with some of the smaller breeds, such as the Arsi, the weight at first service may be lower, at 230 kg to 250 kg. Weighing is not possible in most cases, so a rough but useful guide is the heart girth measurement.

(Heifers should be mated at approx 2/3 of their expected mature weight)
A measuring tape is placed around the heifer behind the front legs as shown and the weight can be estimated by using the graph below. For example an animal with a girth measurement of 1300 mm will weigh 190 kg (See graph). A table showing the relationship between girth measurements and weights is given in Annexe 1.

Heifers should be selected for mating on the basis of weight rather than age.

As a general rule serve cross-bred heifers when they weigh more than 270 kg or when the girth measurement is approximately 150 cm. Except for crosses with the smaller breeds such as Arsi and Horo which can be mated at 230 kg. Under traditional management heifers do not reach this weight until they are over 3 years old. Under good management a well fed heifer will be ready for service at 18 months.
2.8 BULL SELECTION AND MANAGEMENT

Bull Selection

Many farmers and extension workers forget that the bull is half of the breeding herd. It is important therefore, that, as much, or even more attention is given to bull selection as to cow and heifer selection. A good bull must be well conformed with a good head and a strong neck. He must have a good scrotum and well developed, evenly balanced testicles.

Local bulls can often be of poor quality.

The DA should keep simple records of bulls in his locality and assess the performance of the progeny of the bull over a number of years. If a bull is found to be producing consistently poor offspring over a number of years, the DA should advise farmers to use another bull.

Bull management

Most farmers do not own their own bull. However the DA needs to know the basics of bull management, as some farmers in his area will be bull owners. PC’s or SC’s may also keep a bull.

The following are some simple guidelines on bull management.

1) The bull must be well nourished at all times, but especially in the peak mating season. However, the bull should not be too fat.

2) Young bulls under 16 months old should not be used for serving cows. After that age the bull should be introduced gradually to work. He should only be used to serve cows on a regular basis after 2 to 3 years of age.
The ratio of bulls to cows should be in the range from 1:30 to 1:50.

3) Many contagious diseases can be transmitted by the bull through sexual contact. Hygiene is vitally important to control the spread of disease. Do not work the bull if he is known to have a contagious disease or is known to have been in contact with an infected cow.

A routine precaution is the disinfection of the bull’s penis before and after mating with each cow.

4) Bulls with 75% or more exotic blood must be fitted with a nose ring, especially if they are kept isolated as they may become aggressive and difficult to manage.

5) With larger dairy herds it may be possible for the farmer or cooperative to own their own bull. In such cases the bull should be allowed to run with the herd but care must be taken to avoid contact with other cows because of the risk of disease.

2.9 ARTIFICIAL INSEMINATION

Artificial insemination is only used in a limited number of areas in Ethiopia. AI involves the collection of semen from proven bulls, diluting it and freezing it in liquid nitrogen. The semen may then be stored and transported when necessary to the cow to be serviced.

For a successful AI programme a number of conditions are necessary.

i) An efficient transport and communications system.

ii) A skilled inseminator

iii) Good cow handling facilities.

iv) Accurate heat detection.

v) Inseminating at the right time.
Accurate heat detection is vital for successful artificial insemination. The best time to inseminate is 12 to 24 hours after the onset of heat. If heat is detected in the morning the cow should be inseminated in the afternoon and if heat is detected in the evening, insemination should take place the following morning.

The duration of heat is often shorter in local zebu breeds than in exotic breeds. This makes successful AI more difficult.

The insemination should be carried out by a skilled operator. It is important that the cow is kept restrained in a crush to ensure success. The semen must be deposited at the mouth of the cervix as shown in the diagram.

The margin of error is only 1 or 2cm. so accurate insemination is very important.

Warning:

AI is a quick method of cross breeding with good quality bulls. However, unless facilities and management are absolutely correct, success rates will be low, and serving with a bull may be preferable.
2.10 CROSS BREEDING

Crossing local zebu breeds with exotic breeds is a quick method of increasing milk production in Ethiopia.

Milk yields can be substantially increased following crossing with Friesians or Jerseys.

Friesians are the most common breed for crossing. It is recommended that the maximum percentage of Friesan blood on most cooperative dairy farms is 62.5%. However, if the management conditions on the farm are correct, the level of exotic blood may be increased to 75% or more.

A herd with 50% to 68.75% exotic blood may be obtained in the third generation under the following breeding strategy.

**Step** | **Generation** | **Breeding**
---|---|---
1 | (Parental) | Pure Exotic Sire X Local Dam
   |       | F1
   |       | 50% Exotic
2 | F1 Sire
   | or
   | 62.5% Exotic Sire X F1 Dam
   | or
   | 75% Exotic Sire
   |       | F2
   |       | 50% Exotic to 62.5% Exotic
3 | F1 Sire
   | or
   | 62.5% Exotic Sire X F2 Dam
   | or
   | 75% Exotic Sire
   |       | F3
   |       | 50% Exotic to 68.75% Exotic
There are other variations to this breeding strategy which will result in an F3 generation with similar exotic blood levels. This criss-crossing programme is a practical system of upgrading local breeds in easy stages. It is recommended that a bull sharing scheme is introduced where there are a number of Producer Cooperatives in the same area.

For good breeding management, accurate records must be kept by all cooperatives.
SECTION 3

FEEDING COWS AND HEIFERS

3.1 THE DIGESTIVE SYSTEM

Before discussing the feeding of the cow it is necessary to get a basic understanding of how the cow's digestive system works.

The cow is a ruminant or four-stomached animal. The rumen is the largest of the four stomach compartments. Together with the reticulum it ferments and breaks down the food into a liquid mass. Ruminants have the ability to manufacture or synthesize amino acids in their digestive tract. Chains of amino acids make up protein which is essential for milk production and growth.

Carbohydrates and simple plant sugars are broken down easily by bacteria in the rumen. The more fibrous cellulose and hemi-cellulose parts of the forage take longer to be broken down.

The food then passes on to the omasum where excess water is removed. Further digestion and absorption takes place in the abomasum and small intestine. A summary of the sites of absorption of the various end-products of digestion and the relationship with the milk constituents is given in Annexe 2.
Digestion is a continuous process so regular feeding is important.

3.2 FEEDING VALUE

Feed which is high in energy has a superior feeding value. If the amino acids in the feed protein are the same as or closely resemble, the amino acids required by the animal, the feeding value of the feed is much higher. For example, the protein feeds of animal origin have a higher value than those of plant origin.

High energy protein concentrates and by-products such as molasses and oil meals have a higher feeding value than forage. Good quality forage can provide an adequate diet for maintainence and a milk yield of up to 8 litres per day from upgraded cows. The net digestibility of dry forages can be increased when fed together with 25% of fresh green material.

3.3 DRY MATTER INTAKE

The amount of feed which a cow can consume is a vital part of feeding. The dry matter of forage varies from about 20% for young green pasture, to over 80% for mature dried out pasture.

A general rule for feeding dairy cows is that:

**Dry matter intake is approximately 2 to 2/2% of bodyweight for a mature cow in the tropics.**

Thus a 450 kg cow will consume 9 to 11 kg. of dry matter per day.

Dry matter intake is also linked to digestibility. Usually dry matter intake is higher for feed of high digestibility.

Dry matter intake will be lower for the dry cow and higher for pregnant and lactating cows. Dry matter intake is usually lower in hotter areas as the cows may suffer from heat stress.
3.4 DIGESTIBILITY

There are many sophisticated methods of calculating the digestibility of forage. For the extension worker, however, all that is needed is an understanding of when a forage is at its most digestible. The following points are a useful guide for the extension worker.

- Young, grass/legume green pastures are highly digestible.

- Mature and dried out pastures are not very digestible. They usually have a high fibre and cellulose content so the animal must use a lot of energy to break down the feed.

During the wet season there should be enough green forage available for feeding. Grasses should be supplemented with legumes and particularly tree legumes. Forage may be fed by grazing or by cut and carry management if sufficient labour is available.

It is in the dry season that feed digestibility can become a major problem. Even if the cow is getting sufficient intake of dry matter she can be undernourished if the feed has a low digestibility.

Forage at this stage will have a low digestibility. It is therefore important to supplement forage feeding with drought resistant green legumes or with well conserved hay. Tree legumes or undersown legumes are ideal for supplementing the diet of the cow in the dry season. Up to 40% of the feed can be in the form of legumes.

Hay should be cut before the grass flowers. This will yield a highly digestible feed that is ideal for feeding in the dry season.

In general, if the digestibility of forage is low milk production will be very poor and the animal will lose weight and condition.

3.5 PROTEIN

Protein is essential for growth and milk production. A balanced diet should have 12 to 13% crude protein. Tropical grasses are generally low in crude protein. This is particularly so in mature pastures where the protein content can be lower than 7% which is considered to be the minimum protein requirement for milking cows and young growing animals.
Legumes, on the other hand, have a much higher protein content. A useful guide for a balanced diet is as follows:

At least one-third of the cow’s feed should come from grass-legume based pastures.

![Legumes](image)

**Fig. 3.3 At least one third of the cows feed should come from grass-legume based pastures.**

### 3.6 WHAT TO FEED?

For high milk yields and maximum production the dairy cow should be fed a mixture of good quality forage and concentrates or industrial by-products. However, in many cases in Ethiopia concentrates may not be available or may be too expensive to purchase.

#### 1. Forage

Forage will be the main feed for dairy cows on all farms. Extension workers should refer to the Ministry of Agriculture Forage Manual for a complete guide on forage production and use. A few summary points are made here.

- Existing pastures in most areas are unproductive and need to be improved.
- For intensive dairying new permanent pastures with grass/legume mixtures may need to be established.
- Legumes are essential for high quality dairy forage.
- Legumes may be included in pastures, undersown, or grown as tree legumes.
- Good quality hay should be conserved for use in the dry season.

See Annexe 3 for details on hay requirements and estimation of weights of haystacks.

Conservation allows the forage surplus in the wet season to be used to make up the deficit in the dry season. The deficit in the dry season may also be made up by growing drought resistant herbaceous or tree legumes or by supplementary feeding.
Permanent grass/legume pastures are a suitable source of forage on smallholder dairy farms. It involves establishing perennial mixed pastures on prepared seedbeds.

Permanent grass/legume pastures have four important advantages.

i) It produces a high yielding, high quality forage.
ii) The legumes improve or maintain soil fertility.
iii) It allows a high stocking rate.
iv) It improves crop yields by means of rotation.

A well prepared moist seedbed is essential for permanent pasture establishment. Permanent pastures require good management. The pastures are costly to establish in the first year but the returns are good so the cost is justified.

Nitrogen based fertilisers are not required because of the use of legumes. Weeding is necessary until the pasture species have a chance to become established.
The pastures may be used for cut and carry management, for grazing or for conservation. If management is good, yields from grass/legume pastures can be very high.

In general, a cross-bred cow has the potential to produce 8 litres of milk per day from ‘good’ quality grass/legume pasture.

Mixtures of the following species are suitable for grass/legume pastures.

In the higher altitude areas a mixture of Phalaris, Tall Fescue and Cocksfoot with Trifolium species gives a good grass/legume pasture.

In the medium altitude areas Rhodes grass may be mixed with Green leaf Desmodium, Siratro or Alfalfa. Panicum mixed with either Siratro or Stylosanthes spp. are also suitable mixtures.

2) Fodder crops

Fodder cropping involves the growing of high yielding, high quality short-term crops for intensive livestock feeding.

Fodder crops are a useful method of feeding dairy cows. The main crops of interest are:

- Oats and vetch
- Alfalfa
- Fodder beet
- Napier grass or Elephant grass.

Fodder crops are ideal for feeding at the end of the wet season and in the dry season when other forage is scarce. The fodder crops may also be conserved and fed as required in times of shortage. Fodder crops are ideal for supplementing dry feeds such as hay or crop residues. Fodder crops have a high labour requirement and seed and fertiliser costs may be high. However, there is generally a good yield of high quality forage so the investment is very worthwhile. Fodder crops are relatively easy to grow and they are acceptable to the farmer and already well proven in many areas.
Good management and husbandry practices are necessary for successful fodder crop production. Where land is limited, as in some arable areas, care should be taken when planning the cropping programme, because the replacement of food or cash crops with fodder crops may not be desirable.

3) Crop residues

Crop residues are already widely used for feeding cows in all areas of Ethiopia.

The crop residues are fed during the dry season when other forage is scarce. The most common crop residues are:

- teff straw
- barley straw
- wheat straw
- maize stalks
- sorghum stalks
- sweet potato leaves
- ensete leaves

Crop residues are useful for providing roughage for the cows. However, they are low in protein, and digestibility may also be low.

Crop residues must be supplemented with other feed to give a complete diet. Legumes are the ideal supplement as they have a high protein content.

The following legumes are suitable:

**Tree legumes**

- Leucaena
- Sesbania
- Tree lucerne
- Gliricidia

**Herbaceous legumes**

- Alfalfa
- Desmodium
- Stylosanthes
- Lablab
- Siratro
When conserving crop residues layers of green legumes should be included in the stacks. This will increase the feeding value of the crop residues and make feeding in the dry season easier.

Development Agents should refer to their MOA ‘Forage Manual’ for more details on legumes.

The ideal way to produce legumes is by undersowing in an arable crop. Once the main crop is harvested the legume can be grazed with the crop residue, or cut and carried for feeding to the cows. It can also be mixed with the conserved crop residue.

4) By-products/Concentrates

If concentrates are available and if the farmer can afford to buy them, they are an important part of the dairy diet. The level of usage of concentrates will depend on local prices and availability. The following industrial by-products/concentrates are available in some areas of Ethiopia.

- meat and bone meal
- molasses
- bagasse
- noug cake
- brewers grain
- oil cake
- wheat bran

There are three types of dairy animal to which concentrates should be fed if possible.

i) In-calf heifers:

In-calf heifers have very high nutritional requirements. They need food for their own growth as well as for the growing foetus.

Feed in-calf heifers 2 kg concentrates per day for two to three months before calving.
ii) “Steaming-up” cows

‘Steaming-up’ involves feeding animals intensively over a short period. Cows will usually be on a maintainence diet during late lactation and early pregnancy. They need to be fed well or ‘steamed-up’ in the two months before calving so that they will produce a healthy calf and produce good milk yields after calving.

Feed pregnant cows 2-3 kg concentrates per day (depending on cow condition) for one to two months before calving.

iii) Lactating cows

Lactating cows should be fed concentrates, when they are available, to improve milk yields provided it is economic to do so. Cows should reach peak milk yields 4 - 6 weeks after calving. Best results from concentrate feeding will, therefore, be achieved in the first 10-12 weeks of lactation. Concentrate feeding is also very beneficial in the dry season when forage is scarce.

Good quality pasture or forage should enable an upgraded cross-bred cow to produce 8 litres of milk per day in early lactation if the sufficient time is permitted for grazing. Milk yields may be greatly increased with concentrate feeding.

A general guide for feeding concentrates to lactating cows is:
Feed 1 kg concentrates per day for every extra 2 litres of milk above 8 litres, if cows are on good grass/legume pasture.

For medium quality pasture, feed concentrates above 4 litres of milk; and for poor quality pasture feed concentrates for all milk produced.

![Fig. 3.5 Feeding for milk production.](image)
An upgraded cow should yield 8 litres of milk on good quality grass/legume pasture.
5) Minerals and Vitamins

Minerals and vitamins have an important function in maintaining the health of the cow and calf. They also have a significant effect on the composition of the milk.

There are two major groups of minerals; the major elements and the minor or trace elements. The major elements include calcium, phosphorous, sodium, potassium, magnesium and chlorine. There are a large number of trace elements, including iron, copper, molybdenum and many others.

Calcium and phosphorous are required for milk production. Green forage and meat and bone meal contain sufficient levels of calcium and phosphorous for normal dietary requirements. Calcium and phosphorous should be fed in the ratio of approximately 55% : 45%.

1.1 to 1.32 g of calcium and 1.1 g of phosphorous are required for every one kilogram of milk produced.

Calcium and phosphorous is stored in the body in late lactation and in the dry period. The cow then mobilises these stores in early lactation when it is not possible to get an adequate supply from the normal diet.

Sodium is another important element for dairy cows. Sodium deficiencies result in loss of appetite, loss in weight, a rough coat, and a drop in milk production. The diet may be supplemented by adding salt to the diet. For every kg of milk produced 0.6 g of sodium (or 1.42 g of sodium chloride) is required. Sodium requirements can be supplied by adding salt to the feed or providing salt licks for the animals.

Vitamins are required by the lactating animal to allow the normal functioning of the body and for milk production. Vitamins are also essential to ensure that the composition of the milk is correct.

Vitamins are either synthesised in the rumen of the animal or provided in the feed.

Vitamins A and K are supplied in green feed. The B vitamins are mainly synthesised in the rumen.

A good supply of green feed as part of a balanced diet will ensure an adequate supply of vitamins for dairy animals.
3.7 WATER

Extension agents should always remember that adequate quantities of clean water are vital for good milk production. Nearly 90% of the composition of milk is water so if water is not available the cow’s milk yield will decrease.

A successful dairy production programme can only take place where there is a good supply of water. If cows have to walk a long distance for water the milk yields will be reduced.

The following are approximate water requirements for animals in the dairy herd.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Water requirement 1/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steer (450 kg) - exotic</td>
<td>35 – 40</td>
</tr>
<tr>
<td>- zebu</td>
<td>27</td>
</tr>
<tr>
<td>Dry cow (450 kg) - cross bred</td>
<td>35</td>
</tr>
<tr>
<td>Lactating cow - cross bred</td>
<td>35 + 3 litres water</td>
</tr>
<tr>
<td></td>
<td>per litre milk</td>
</tr>
</tbody>
</table>

In general, a high yielding lactating cow requires a minimum of 60 litres of clean water per day.

Water with a high salt content is unsuitable for dairy cattle although some indigenous breeds in the lowlands may be adapted to drinking salty water.

Clean, fresh water should be available for cows at all times.
SECTION 4

FROM CALF TO COW

4.1 CALVING

Calving is a natural process for the cow. In most cases assistance from the farmer is not needed and should be avoided. Many farmers interfere with the calving process when there is no need to do so.

It is important for the farmer and the extension worker to know and understand everything about calving. The following step-by-step guide to calving is useful.

4.2 KNOW WHEN THE COW IS DUE TO CALVE

A cow will carry her calf for 281 days or about 9 months on average. It is easy to calculate when the cow is expected to calve provided an accurate record of when the cow was served is kept. A general rule is that a cow will calve 9 months and 9 days after she was served.

Sometimes, the cow will calve early so she should be watched carefully for at least 10 days before the expected calving date. For example, a cow served on Meskerem 1 is likely to calve on or shortly after Sene1.

![Fig. 4.1 Pregnancy cycle.](image-url)

Observe cow closely from this time

Conception

10 days

Calving

Normal pregnancy 281 days
4.3 SIGNS OF CALVING

i) The cow’s udder gets larger and may become firm and full one or two weeks before calving.

ii) The abdomen increases in size, especially on the right side.

iii) Soft hollows appear between the pin bones and the tail.

As calving gets closer the following signs appear.

iv) The cow may stand apart from the rest of the herd.

v) The cow becomes restless.

vi) Mucus or blood may begin to flow from the vulva.

vii) The cow’s tail may be held high and the back will be arched.

In the last hours before calving the following signs occur.

viii) The water bladder appears.

ix) The feet of the calf should appear shortly after the appearance of the water bladder.
4.4 NORMAL CALVING

In a normal calving the front legs of the calf emerge first, followed by the head and body. Assistance may be needed in some cases if the calf is very large.

4.5 DIFFICULT CALVINGS

There are a number of ways in which a difficult calving can occur.

1) Hind feet first

If the calf’s feet appear upside down it is likely that the hind feet are coming out first. The cow may be able to deliver the calf herself but assistance is sometimes needed.

Wait until the feet have emerged from the cow’s vulva before pulling. The calf should be pulled at intervals to coincide with the natural pushing by the cow.

It is important to get the calf out quickly once the whole of the calf’s hindquarter is out.

The calf may get ’stuck’ at the front shoulders and suffocate unless speedy action is taken.

2) Breech presentation
   (hindquarters first)

If a breech presentation is suspected expert assistance should be sought without delay. It is dangerous to attempt to correct a breech calving yourself.
3) Other abnormal presentations

The calf may be presented for birth in a number of other positions as shown in the diagrams.

Fig. 4.7 Other abnormal calvings.

4.6. ASSISTANCE AT CALVING

The cow should be given adequate time to calve ‘naturally’ before any interference from the farmer. It may be dangerous to try to assist too early. Labour may last for 12 hours or more so patience is needed. However, if a cow is left without help for too long she may become exhausted. If assistance is required the following procedures should be observed.

1) Internal examination

If the cow has made no visible progress within two or three hours of presenting the water bladder an internal examination should be made. Before making an internal examination:

- wash your arms and hands thoroughly.
- wash the cows vulva
- trim your fingernails; they may damage the cow’s uterus.
When making the internal examination:

- insert your hand slowly and gently

- feel the position of the limbs and decide whether the calf’s front legs or hind legs are coming first.

- When manipulating limbs make sure to protect the uterus with your hand as shown in Fig 4.8.

2) Using ropes

It may be necessary to attach ropes to the calf’s feet to assist in pulling.

- Tie a loop on the end of the rope and tie around the calf’s fetlock.
- Use two ropes, one for each leg and mark the ropes to identify right and left legs.
- Do not pull too hard - pull gently and evenly.
- Make sure the calf is coming out in the proper position; sometimes the head may be turned back or twisted to the side.
4.7 IMMEDIATELY AFTER BIRTH

1) The Calf

Handle the calf carefully immediately after it is born.

- Clean the mucus from the nose and mouth of the calf with your finger.
- Check the calf’s heart beat.
- If the calf is not breathing hold by the hind legs and swing it to and fro gently or pour water over the calf’s nostril, to make it sneeze.
- Keep the calf’s head lower than its hindquarters.
- Allow the cow to lick the calf as soon as possible.
- If the cow refuses to lick the calf, rub the calf with hay, straw or sacking

Fig. 4.10 Swing calf carefully by the hind legs to assist breathing.

2) The cow

- Check the cow for damage or bleeding immediately after calving.
- Provide clean water and fodder for the cow at all times.
- Burn or bury the afterbirth as soon as it is delivered. If the afterbirth does not emerge after one day consult the veterinarian.
- In some cases the cow may eat the afterbirth; this is not dangerous but it is not recommended.
- If the cow fails to stand up within two hours of calving call the veterinarian.
4.8 THE FIRST WEEK OF LIFE FOR THE CALF

Many calves die at birth. Many more die within the first week of life. With a few simple precautions many of these deaths can be avoided.

1) Colostrum:

Colostrum is the first milk produced by the cow after calving. Colostrum is different from ordinary milk because...

- It has a very high level of antibodies to prevent disease.
- It is very nutritious.
- It is rich in vitamins, especially vitamins A and D.
- It is a laxative and easy for the calf to digest.

Older animals produce their own antibodies in their blood to fight disease. Calves, however, must obtain all of their antibodies from the cow’s colostrum. The cow should be on the farm for at least eight weeks before calving in order to have built up sufficient antibodies to pass on to the calf. The calf absorbs the antibodies through the gut during the first six hours of life. After six hours the calf’s ability to absorb the antibodies decreases but antibodies will continue to be absorbed for up to two days. It is vital therefore that the calf gets colostrum immediately after birth.

The calf should continue to receive colostrum for at least three days after birth.

If the calf has not got sufficient colostrum during the first hours after birth the chances of infection or death are greatly increased.

2) Hygiene

To avoid infection it is important to maintain good hygiene standards with the newborn calf. The following steps are essential.

- Disinfect the calf’s navel immediately after birth with iodine.
- If the navel cord is not broken it should be pulled apart; do not cut with a knife.
- If the calf is housed, the house should be draught free and dry.
- The calf shed should be cleaned thoroughly before the calf is born.
- The cow’s udder must be kept clean to avoid infecting the calf.
3) Suckling

The best way to ensure a healthy calf is to allow the calf to suckle the cow for at least 2 days and if possible one week. This will enable the calf to get a little colostrum or milk at a time. This is important to avoid digestive upsets and scour.

4.9 FROM 7 DAYS TO WEANING

1) Milk Feeding

There are two systems of feeding calves in dairy herds; limited suckling and bucket feeding.

i) Bucket Feeding

The main advantage with bucket feeding is that a measured quantity of milk can be fed to the calf each day. This prevents the calf from drinking more milk than it needs.

It is sometimes difficult to train the calf to drink from the bucket so it is important to start early. The following are the main guidelines for bucket feeding.

- Start bucket feeding when the calf is two or three days old.
- Feed a little and often...
  ...1/10 of bodyweight for first 2 weeks, 3 times per day.
  ...1/15 (7%) of bodyweight for next 3 weeks, twice per day.
  ...1/20 (5%) of bodyweight from then until weaning, twice per day.
- Feed a total of 250 litres of milk over 12 weeks.
- Feed the calf at the same time every day.
- The calf should be fed as soon as possible after milking.
- The feeding bucket should be thoroughly cleaned before and after each feeding.
- If the calf does not drink from the bucket try a shallow bowl instead.

Fig. 4.11 Teaching the calf to drink from a bucket.
The first few days of bucket feeding are the most important. It is important to make sure that the calf is getting enough milk at this time. If the calf refuses to drink, back the calf into a corner and place two fingers in the calf’s mouth and allow it to suckle. Then lower your hand slowly into the milk so that the calf sucks milk between your fingers. Slowly remove your hand. This procedure may have to be repeated for 4 or 5 feedings. Always make sure that your hands are clean.

**ii) Limited Suckling:**

Limited suckling involves allowing the calf to suckle the cow for a limited period each day. The best method is to allow the calf to suckle for a short time before and a longer period after each milking. The time for suckling before milking should be strictly controlled.

A typical limited suckling procedure is:
1. 1 to 2 minutes before each milking and 30 minutes after milking.

It is also possible to rear calves successfully with suckling for 30 minutes after milking only. However, suckling before milking often results in better milk 'let down' by the cow and a higher milk yield.

Limited suckling of dairy cows has a number of advantages.
- Calf growth is usually better than with bucket feeding.
- Calf mortality is lower.
- Total milk yield from the cow is increased compared to bucket feeding.
- The risk of mastitis is less.

Limited suckling may pose problems in certain cases, however.
- Unless management is very strict the calf may suckle too much and the quantity of milk for sale may be reduced.
- Some cows have very strong attachments with their calves. Their milk yield may be reduced substantially after weaning as a result.
- Good handling facilities are required to keep the cow separated from the calf.
- More labour is required than with bucket feeding.
- Return to oestrus may be delayed, resulting in a longer calving interval.
2) Feeding roughage to calves

For the first few weeks of life a calf can only digest milk. The milk bypasses the rumen and goes directly to the true stomach.

After about two weeks the rumen of the calf begins to become active. At this stage non-milk feeds can be introduced into the calf’s diet.

On most farms and cooperatives concentrates will not be available so forage is the only feed available for calves. Good quality forage is nutritious and helps to develop the rumen of the calf.

Good quality leafy hay should be made available to the calf. The hay should contain a mixture of grasses and legumes and should be fed in small quantities. The hay should be mould free as moulds can cause severe digestive problems for young calves. The best food for young calves is clean, fresh grass/legume pastures between 10cm and 15cm high. A small clean paddock should be provided near the cow shed. Even if the calves are housed a loafing area should be provided near the shed.

Clean water should also be made available to the calves at all times from 2 weeks of age onwards.
4.10 WEANING

Weaning should take place at 3 months of age, by which time the calf should weigh 60-80 kg. The calf should have access to high quality forage at the time of weaning, and if possible, to concentrates.

**Do not wean until the calf is at least 60 kg and looks healthy.**

The calf should grow at the rate of 400g per day for the first 3 months. The growing calf has a high protein requirement so up to 50% of the forage feed should be legumes. Fresh legumes should be wilted for one or two days before feeding.

With bucket feeding, the earlier weaning takes place the better. With the calves weaned, the farmer will have more milk available for sale.

With limited suckling weaning is not always so easy. The total milk yield of the cow usually falls when the calf is weaned. Some cows in the limited suckling system may refuse to 'let down' their milk when the calf is weaned.

The extension worker and farmer must decide on the best approach to take in each individual case.

In some cases it may be necessary to allow the calf to continue to suckle for a very short time before each milking, say, half a minute. In other cases the mere presence of the calf, even if it is not allowed to suckle, will assist milk let down. The end result is often a better milk yield and a better calf.

Whether weaning from bucket feeding or from suckling there are two important rules to keep.

1) Make sure that the calf is eating enough feed for good growth before weaning.

2) If the calf is not eating enough feed or if the feed supply is poor, weaning should be postponed.
Many calves suffer setbacks after weaning and some never recover fully. Forage, in most cases, will be the only feed available. The calf's rumen may not be large enough to take in an adequate quantity of bulky forage.

If the forage is not high quality, the digestibility will be low and the calf will not gain weight.

A good proportion of green forage legumes in the diet is essential at weaning. Forage legumes are high in protein and are easily digestible by the young calf.

Concentrates should be fed to young calves provided they are available at a reasonable price. A useful guide is to wean cross-breed calves at 12 weeks at which time they should be eating a minimum of 0.75 kg of concentrates per day, plus forage.

It is advisable to begin to feed concentrates (if available) at 2 - 3 weeks of age by placing a small quantity (30-50 gms) in the bottom of the bucket after milking. (Make sure there are no lumps of noug cake.) From 4 - 5 weeks give free access to concentrate, putting out a small quantity of fresh conc. each day. Increase the amount as the calf's appetite increases. After weaning, feed at 1 to 2 kg per head per day, depending on the quality of forage available. Forage should also be available at all times.

4.11 FROM WEANING TO MATURITY

There are six possible uses for a calf. Three of these relate to the male calf and two to females. The six uses are as follows.

1) Veal
2) Steer beef
3) Draught oxen
4) Breeding bull
5) Breeding cow
6) Beef cow

On most farms the male animals will be reared for draught oxen and the females will be reared for replacing cull cows. If land is scarce male calves may sometimes be sold shortly after birth or at weaning. Animals may, of course, be sold at any stage of growth. The same principles apply for feeding replacement stock and male animals on the dairy farm as for feeding cows and heifers.
The general rule is that cross-bred animals should have a daily dry matter intake equal to 2-2 1/2 % of bodyweight. Forage will usually be the only feed available on most farms. Concentrates may be used in intensive fattening programmes if they are available cheaply.

A summary of the various options for rearing male cross-bred calves in the dairy herd is given in Fig. 4.14.

The target weights are given for each stage of growth. These weights, however, may vary according to the breed type.

The quality and quantity of feed and the level of management on the farm will also influence the level of performance.

In most cases the male calf will be reared as a draught oxen but rearing as a bull or for steer beef are other options as shown in Fig. 4.14.

When they reach the end of their working life draught oxen are usually fattened and sold for beef.

Fig. 4.14 Options for use of male calves.

POSSIBLE USES AND TARGET WEIGHTS FOR MALE CROSS-BRED CALF

<table>
<thead>
<tr>
<th>Stage</th>
<th>Possible Uses</th>
<th>Target Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 to 4 months</td>
<td>Weaner</td>
<td>73kg</td>
</tr>
<tr>
<td></td>
<td>Dehorn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sell</td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td>Young Bull</td>
<td>200kg</td>
</tr>
<tr>
<td></td>
<td>Sell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Young Steer</td>
<td>200kg</td>
</tr>
<tr>
<td></td>
<td>Sell</td>
<td></td>
</tr>
<tr>
<td>2 years</td>
<td>Immature Bull</td>
<td>300kg</td>
</tr>
<tr>
<td></td>
<td>Sell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mature Bull</td>
<td>400 - 500kg</td>
</tr>
<tr>
<td></td>
<td>Sell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mature Steer</td>
<td>400 - 450kg</td>
</tr>
<tr>
<td></td>
<td>Sell</td>
<td></td>
</tr>
</tbody>
</table>

For draught oxen, immature steer, and mature steer, the options are:

- Keep for work
- Sell

For mature bull, the options are:

- Keep for breeding
- Sell
SECTION 5

MILK AND MILKING

5.1 WHAT IS MILK?

Milk is a highly nutritious food for both animals and humans. Children and calves can survive on a pure milk diet for a considerable length of time.

Milk is high in protein, fat and minerals. The composition of milk, however, varies for different breeds of dairy cows. The following is the average content for three common breeds.

Table 5.1

<table>
<thead>
<tr>
<th>Constituents of milk for different breeds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Water (Zebu) 84.4  Friesan (87.5) Jersey (85.3)</td>
</tr>
<tr>
<td>Fat 6.0  3.5  5.3</td>
</tr>
<tr>
<td>Lactose 4.9  4.9  4.9</td>
</tr>
<tr>
<td>Other protein 3.9  3.4  3.8</td>
</tr>
<tr>
<td>Minerals 0.8  0.7  0.7</td>
</tr>
</tbody>
</table>

5.2 THE UDDER

The udder is the milk factory of the cow. Milk is produced continually in the udder and stored there until milking.

The udder is divided into four quarters which are not connected internally.

Fig. 5.1 Cross-section of udder showing individual quarters.
Each quarter is made up of spongy tissue with a space called the udder cistern near the base.

![Image of udder cistern](image)

The alveolus or milk cell is the basic unit of milk production. It is made up of a collection of cells surrounding a space. The milk is secreted into this space and stored until milking.

**5.3 THE LACTATION CYCLE**

The cow produces milk after pregnancy and calving. If feeding is adequate the cow may continue to produce milk until the next calving.

However, it is better to “dry off” the cow for about two months before calving. It is essential for the cow to be allowed to ‘rest’ before she produces another calf.

![Image of lactation cycle](image)

Fig. 5.4 The optimum lactation cycle.
If a cow produces one calf per year a lactation period of 305 days is best. This is known as the standard lactation.

A cow under good management should produce at least 2000 litres of milk per year. On a standard lactation curve that's about 10 litres per day at peak lactation with yields dropping off towards the end of the lactation cycle. However under cooperatives management yields fluctuate according to feed supplies, so in order to obtain 2000 litres in 305 days peak yields may have to be in the order of 12 - 15 litres per day.

Such milk yields may be achieved on a mainly forage diet with a minimum of concentrate feeding.

If cows are not dried off, milk production in the following year will be reduced. It is also difficult for the cow to produce a good healthy calf while still producing milk.

5.4 MILKING

1) Milk ‘let-down’

Milk is ‘let-down’ by the cow in the following way.

1) The udder (A) is massaged by hand or by allowing the calf to suckle and the nervous system (B) is stimulated.

2) A message is sent from the udder to the brain (C) through the nervous system (B).

3) The pituatary gland (D) at the base of the brain releases a hormone, oxytocin.

4) The oxytocin is carried to the udder through the bloodstream (E).

5) Oxytocin causes the muscles in the udder to contract (F) and the milk is “let-down”.

Fig. 5.5 Milk ‘let-down’ mechanism.
'Let-down' usually occurs when the cows' udder is massaged. Washing the udder before milking is the usual stimulus for 'let-down' so it is important to milk the cow directly after washing the udder. Feeding the cows at milking time is another stimulus for 'let-down'.

Some cows 'let-down' their milk as soon as they are brought to the milking shed. In a limited suckling system the calf will stimulate 'let-down'. 'Let down' lasts for about 10 minutes. It is important to complete milking before 'let down' ends. Most cows will not 'let down' their milk if excited or frightened. It is important that the milker does not frighten or excite the cows because then adrenalin is produced by the cow which counters the effect of oxytocin and inhibits 'let down'.

**Frightened cows will not 'let-down' their milk.**

2) **Hygiene**

Cleanliness and care for the udder is very important in milking. The following points are essential for clean milk production.

- The milkman/woman must wash their hands before milking Fig. 5.6
- Wash the cows' udder thoroughly with a clean cloth and
  - clean water Fig. 5.7
- Wash the entire cow twice per week.
- Clean the milking area after each milking.
- Clean the milking utensils after each milking.
- Keep finger nails trimmed.
- Avoid blowing nose or handling other materials while milking.

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*Fig. 5.6 Always wash hands before milking.*

*Fig. 5.7 The cow's udder must be thoroughly cleaned.*
3) Handmilking

Once the cow's udder has been washed milking should begin immediately.

The first draw of milk from each teat has a very high bacterial count. It should be thrown away.

Milk the first draw of milk from each teat into a strip cup, examine it, and throw it away.

Fig 5.8 Use the strip cup every time. Examine the milk for small clots which would indicate mastitis, then discard.

Fig. 5.9 Correct milking technique.

The method of milking should be gentle but firm.

i) Grasp the base of the teat between the thumb and forefinger.

ii) Then close the other three fingers around the teat.

iii) Squeeze the teat gently and the milk flows out.

Do not pull the teat as this can cause mastitis.
4) Milk handling and storage

The cow, the milker and the milking utensils are the most common sources of contamination of milk with bacteria.

The milking utensils are a common source of bacterial infection. After milking the milking bucket, strip, cup and any other utensils should be washed thoroughly and placed upside down on a rack to dry in the sun.

![Rack for drying milking utensils.](image)

Fig. 5.10 Rack for drying milking utensils.

After milking, the milk may often be stored on the farm for 24 hours or more. This is the time when bacteria in the milk can multiply, particularly if the temperature of the milk remains high.

The milk should be stored in a cool place. Traditionally earthenware jars are used for milk storage. These jars are good for keeping the milk cool but have the disadvantage that they may be difficult to wash.

![Traditional storage jars may be unhygienic.](image)

Fig. 5.11 Traditional storage jars may be unhygienic.
Cooling the milk below 15° C slows down bacterial growth and increases the storage life of the milk. In some highland areas the farm may be located near a river or stream. Standing the vessel with the milk in the stream in a shady place is an easy method of cooling and storing milk. It costs nothing.

Fig. 5.12 Cooling milk in a shaded stream.

Special pits for cooling the milk may be constructed in the milk house. The depth of the pit should be about 3/4 of the height of the milk can or churn. The can is placed in the pit and the pit filled with water. This keeps the milk cool.

Milk may also be cooled by placing sacking around the milk can and pouring water at regular intervals over the sacking. The can should be placed in a cool shady place.

Mixing morning and evening milk is not recommended. The evening milk will have a higher bacterial count due to overnight storage and will lower the quality of the morning milk if mixed with it.

Store morning and evening milk in separate containers.
DAIRY HERD HEALTH

Many animal diseases on dairy farms are similar to those on mixed livestock farms. The Development Agent should refer to the separate Animal Health manual for guidelines on an integrated approach to animal health.

However, there are certain diseases which are a particular problem for dairy farmers.

6.1 CALF SCOUR

The most common disease of calves is scouring. It accounts for the greatest proportion of calf deaths.

**Signs:**

A calf with scour will show the following symptoms:
- the eyes will appear dull and sunken.
- the calf will be listless.
- the calf’s temperature may be abnormally high.
- the calf will suffer from diarrhoea which may be yellow or chalky-white.

**Causes:**

Calf scour can be caused in three ways.

i) Infection

Infection from micro organisms is common and is the most serious cause of calf scour. The infection usually enters through the mouth but may also enter through the naval cord.

If the faeces are chalky-white with a very offensive smell the scour is usually caused by infection. This is commonly known as ‘white scour.’
ii) Nutritive

Calves which drink too much milk at one time may suffer from scour. With very young calves the milk will collect in the rumen, curdle and result in scouring. Feeding cold milk or milk that is not fresh can also result in scouring.

iii) Mechanical

Some calves drink their milk too rapidly and scour as a result. Calves may also have ‘hair balls’ in their stomachs. This arises from sucking other calves and often results in scouring and sometimes in death.

Fig. 6.1 "Hair balls" may result from sucking or licking.

Treatment

The simple treatment for calf scour is as follows:

i) Isolate the calf from the rest of the herd immediately.

ii) Stop milk feeding.

iii) Feed with clean, boiled water for 24 hours. A total of 2 to 3 litres should be given in 4 feeds. The water should be given at body temperature.

iv) For the second and third days feed half the normal milk ration with water. Sugar or glucose should be added for energy if available.

v) If the signs of scour have disappeared, the calf can be returned to its normal diet on the fourth day.

vi) If scour signs persist or if the calf does not show much improvement veterinary assistance should be sought if possible.
Prevention

Good husbandry and management practices are the key to preventing calf scour.

- Make sure that the calf receives a sufficient supply of colostrum in the first few days of life.
- For the first two weeks of life feed the calf little and often - three times a day is the minimum.
- The calf house should be clean, well ventilated and draught free. If possible, calves should be penned individually for the first few weeks.
- If bucket feeding, the milk should be fresh and warm.
- Infected calves must be isolated and sheds where infected calves have been housed should be thoroughly disinfected.

Proper hygiene and feeding practices will, in most cases, avoid calf scour.

6.2 MASTITIS

Mastitis is an inflammation of the cow's udder caused mainly by bacteria such as streptococci or staphylococci. The bacteria enter the udder through the teat orifice.

Mastitis results in a sharp reduction in milk yield.

Mastitis, if untreated, can result in the loss of the infected quarter or even death.

Signs:

There are a number of symptoms of mastitis.

- thick or clotted milk.
- reduced milk yield.
- swollen or inflamed udder or quarter.
- painful udder when touched.
- the cow loses appetite.
- with severe infection the cow's hindquarter may be stiff.
Causes:
Mastitis is caused mainly by infection with bacteria. The infection is usually caused by poor management practices such as:

- incomplete milking of the udder.
- unwashed and dirty udders and teats.
- dirty milking area.
- milker with dirty hands.
- untreated cracks and sores on teats.

Fig. 6.2 An acute case of mastitis (right).

Treatment:
In order to obtain a successful cure mastitis must be treated early. The following procedure for treatment should be followed.

i) Empty the quarter completely of all milk. Use a strip cup and discard the infected milk in a safe place.

ii) If there is a severe infection it may be difficult to empty the quarter because of clotting of the milk. Massaging the quarter with a cloth soaked in warm water will make it easier to strip the quarter. It may be necessary to hold the warm cloth against the udder as a poultice to soften the quarter and reduce the swelling. It may be necessary in some cases to use a teat cannula to empty the quarter.

Fig. 6.3 Reduce the swelling with a hot poultice or cloth.
iii) Repeat the above procedure at least three times per day.

iv) Once the quarter is completely empty, a suitable antibiotic should be injected into the teat. The intramammary antibiotic may be either in a plastic syringe or a flexible tube.

v) When all of the antibiotic has been injected into the teat, the teat should be massaged gently upwards while holding the tip of the teat between thumb and forefinger as shown in the diagram.

Fig. 6.4 Correct method of intramammary antibiotic treatment.
Prevention

Mastitis problems can be reduced by observing a few simple rules on milking practices and hygiene measures.

- Wash hands before milking
- Wash the cows’s udder thoroughly.
- Always use clean milking utensils.
- Keep the milking area clean.
- Squeeze the teat when handmilking; do not pull.
- Milk the first draw of milk into a strip cup, this will ensure early detection of mastitis.
- Milk out the udder completely.
- Treat cuts and sores on teats and udder with a suitable antiseptic.

6.3 PARASITES

1) Internal:

Most animals have a certain amount of internal parasites. Severe worm infestation, however, causes a severe drop in milk production and growth. Adult animals develop some resistance to worms but calves suffer badly from worm infestation.

Symptoms

There are many symptoms of worms in livestock including:
- failure to thrive
- weakness
- loss of appetite
- diarrhoea
- coughing and increased breathing rate.
- hair standing, or dry staring coat.

Causes:

Roundworms and liver fluke are the main internal parasites of importance. The animals become infected with the parasites from infected pastures. The worm eggs can remain in the pasture from year to year.

High stocking rates will usually lead to higher parasite levels. Wet and waterlogged areas lead to parasite problems, particularly fluke.
Fig. 6.5 Liver fluke life cycle

Fig. 6.6 Roundworm life cycle
Treatment:

Use of antihelmintics is the only effective worm treatment. Service cooperatives stock suitable worm treatments and the manufacturers dosing rates should be observed. Refer to Section 7 for details on drenching and administration of bodus.

Treatment for internal parasites, however, often occurs after the animal has suffered severe setbacks in growth. Parasite control is much more effective.

Control:

There are three elements in a parasite control programme:
- proper rotational grazing
- good calf-shed hygiene.
- routine treatment.

On small peasant holdings it may be difficult to operate a good rotational grazing system. However, where possible the following rules should be observed for parasite control:

- Allow calves and young stock to graze pastures first.
- Calves or young stock should not be grazed on the same pasture two years in a row.
- Calves should graze pasture grazed by sheep in the previous year or on an area which was used for forage conservation in the previous year.
- Calves and young dairy stock should be kept away from wet and waterlogged pastures.
- The calf shed should be cleaned and disinfected once per month to prevent the build up of parasites.
- All animals should be treated at 2-3 months of age and again at 6-9 months to fit in with the regular treatment programme on the farm.
- Routine treatment should be carried out at the beginning of the rains and again at the end of the rains.
2) External parasites

External or ectoparasites are a major problem in Ethiopia. Ticks, flies, fleas and lice infect dairy cattle with dangerous and often fatal diseases.

Regular spraying or dipping are the only reliable methods of external parasite control. Dip baths, however, are expensive to construct and manage, and are scarce in Ethiopia. Dipping is not practical in most areas, so spraying for ectoparasites is more appropriate, because it can be done regularly and at a low cost.

Spraying:

For treating small numbers of animals for ticks and lice, handspraying is appropriate. Any standard knapsack sprayer can be use for spraying cattle. The pressure setting on the sprayer should be high to ensure good penetration.

Fig. 6.7 Spray all parts of the animal
Spraying is an effective form of parasite control but it must be carried out at least twice per month and preferably once per week to be effective. Acaricide should be applied more frequently in the rainy season and also where tick concentration is high, and where tick borne diseases are a problem. All parts of the animal should be sprayed as shown in the diagram. The manufacturers recommendations on mixing, spraying rates, and frequency of application should be followed.

Hand washing may also be used for ectoparasite control. The same procedure should be followed as for spraying.

COMMON DISEASES OF DAIRY CATTLE

A complete list of the major animal diseases are given in the MoA Animal Health extension manual. The list includes symptoms, treatment and control measures for many diseases, including those affecting dairy animals.

DAs should refer to that list for a complete guide on treatment and control measures. The simple checklist in Annexe 4 of this manual provides an easy method of recognizing some of the more common diseases in dairy cattle.

Important information on the temperature, pulse and respiration rates for cattle is given in Annexe 5.
SECTION 7

HOUSING, HANDLING AND FENCING.

7.1 RESTRAINING ANIMALS

Animals on the dairy farm must be handled very often. It is therefore important to have an effective means of restraining the cows and other animals. Activities such as spraying, drug administration, and Al (artificial insemination) require that the animal is kept very steady. A three pole crush is a simple, cheap, and very effective method of restraining large animals. The animal's head is tied with a halter, and the rope is attached to the pole at the apex of the crush. The two poles at the rear prevent the animal from moving from side to side. Three pole crushes are ideal for individual farmers.

Other more permanent crushes may also be constructed, such as that shown in fig. 7.2. The crush may be built with a movable head yoke to make handling easier. A crush such as this may be made from local materials at a reasonable cost. This kind of crush is useful where larger numbers of animals are being handled, such as in Producer Cooperatives.

With either type of crush the farmer can restrain the animal even further by holding the nose with the head held high. Another method is to grasp the base of the tail and hold it in a vertical position.
Calves may be easily restrained by holding the head and tail as shown in fig. 7.3. Calves may also be restrained lying down.

7.2 HOUSING

Producer Cooperatives will require accommodation for up to 30 cows. The design and layout of the housing may vary considerably. A range of building materials may also be used.

Whatever the size or design of the cow shed, there are a number of general guidelines for building.

- The shed should be built with the open side of the shed faced away from the direction of the prevailing winds.

- The site should be well drained (preferably on a slope), sheltered and in a central location near the grazing area.

- The shed must be close to a reliable water source.

- The shed should not occupy good quality land which could be used for cultivation.

- The roof may be flat or pitched, [double or single pitch]. In areas where winds are strong double pitched roofs must be used. Single pitch roofs are suitable in other areas.

- The shed should be well ventilated but draught free. Air inlets should be sited above the level of the animals. The correct design of dairy housing to ensure good ventilation is shown in fig 7.4 and 7.5.
There are two main types of dairy housing: loose housing and tie barns. Loose housing is recommended for most areas of Ethiopia.

1) Loose Housing with Yards

Loose sheds are usually provided with an open paddock so that the cows can lie indoors or outdoors depending on conditions. Stalls may be provided for each cow in the shed. Loose houses with stalls require less space per animal than those without stalls.

The cows are usually free to move around but in some cases tie-up stalls may be used and fresh forage or hay is carried to the stalls. If tie-up stalls are used, they must be fitted with a feed trough or hay rack. Cows may also be milked in the stalls of a loose house. It is important, therefore, to keep the stalls clean at all times.

![Fig. 7.6 Side view of cow stall with feed trough.

Fig. 7.6 shows a side view of a typical cow stall. A step should be made at the rear of the stall with a dung channel provided. The floor is sloped towards the back and the drains towards the side. The effluent can be channeled out in such a way that it can be used to fertilize a small plot for intensive forage production near the cow shed.

The loose house should have three walls with one open side. This allows good ventilation and allows extensions to be easily made if necessary.
2) Tie Barns

Tie barns are four-sided buildings with a door and windows. Provision must also be made for good ventilation. The cows are usually tied by neck chains in rows on a platform. A manger or feed trough is provided along the length of the barn. The cows remain outdoors during the day and are taken indoors for milking and to spend the night.

For good ventilation double pitch roofs must have a split in the middle.

If a single pitch roof is used there must be adequate ventilation at the top of the wall. Closed tie up barns have the advantage that they are easier to keep clean and are more hygienic. However, in warmer, humid areas the barns may be damp and ventilation may be a problem, particularly during the rainy season. They are also more expensive than loose houses.

The floor space requirements per animal for each type of housing is given in Annexe 6. The Annexe also includes information on floor slope and concrete mixing specifications as well as details on trough and manger space requirements.

Many calves die at birth. Many more die within the first week of life. With a few simple precautions many of these deaths can be avoided.
In general, a feeding manger should be long enough to allow all of the animals to feed at the same time. Water troughs, however, need only be long enough to allow 10% of the animals to drink at one time. On some farms there are existing buildings which can easily be converted to suitable dairy housing. When converting existing sheds or houses ventilation is the most important factor to take into account. The ridge on a double pitch roof can usually be opened to improve ventilation. (see Fig. 7.4). The open ridge should be covered to protect against rain. Holes may be bored in the walls of the building above the level of the animals to improve ventilation in buildings with flat roofs.

3) Milking stalls

In intensive dairy operations it may be best to build multi-purpose tie-up stalls for the cows. The tie-up stalls may be either in a loose house or closed barn. The stall may be used for milking as well as for feeding and overnight housing. On smaller farms it may be necessary to build special milking stalls if no other housing is provided. The milking stall design should be the same whether it is part of a loose house, a barn or an independent stall. The stall should be long enough to accommodate the cow and a feeding trough. The milking stall should be approximately 215cm long including a feed trough of 60cm wide, and 110cm wide, depending upon the size of the cows.

The milking stall should have a smooth concrete floor so that cleaning will be easy.

Fig. 7.8 Milking stall
4) Calving sheds

Separate sheds (or a section of the milking barn) should be provided for pregnant and calving cows. The calving pen should be 3m X 4m with a manger and trough provided. It should be easily cleaned and disinfected. Fresh bedding should be provided for each calving. The shed should be disinfected with lime. Similar sheds or pens may be provided for isolating sick animals.

5) Calf housing

It is important to provide good quality calf housing on the dairy farm. The calves may be housed in a section of the building where the cows are kept or in a separate shed.

The dimensions and design of the calf house is the same regardless of where it is located. The calf house may be open-fronted or closed. The important thing is that it must be well ventilated but draught free. The floor should be made of concrete with a slope of 1 in 40 to 1 in 60 to provide good drainage. A drain should be constructed at the rear of the calf pen to carry away the effluent.

The pens should be large enough to accommodate one or two calves. A pen measuring 125cm by 150cm (total area 1.875 m) is adequate for two young calves. After one to two months an area of 1.25 to 1.5 m per calf is required. The pens should be 120cm high.

The calf pen must contain a small water trough which should be kept filled with clean fresh water. A bucket hanger should also be provided. Fresh bedding must be provided for the calves at all times.

6) Feed stores

Feed stores may also be necessary on the dairy farm. The store should be near the milking shed but may be of simple design and construction. The important thing is that the feed store is completely waterproof. It should also be designed so that vermin will find it difficult to enter. Concentrates, by-products and other bulky material may be stored in the feed store. A separate store must be provided for medicines, acaricides and other materials.
Hay is usually stored outdoors. A simple stack which is thatched is weatherproof. If the stack is built around a eucalyptus pole, the animals can feed directly from the stack and the pole will prevent it from collapsing.

The cubic capacity for different forage feeds is as follows.

<table>
<thead>
<tr>
<th>Feed</th>
<th>m³ per quintal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay (loose)</td>
<td>1.0 - 1.5</td>
</tr>
<tr>
<td>Straw (loose)</td>
<td>2.0</td>
</tr>
<tr>
<td>Straw (baled)</td>
<td>1.1</td>
</tr>
<tr>
<td>Fodder beet</td>
<td>0.2</td>
</tr>
</tbody>
</table>

A cow eats about 9-11 kg of hay per day and young stock 4-6 kg per day. This, however, is only an approximate guide, and does not make allowances for hay quality and for wastage.

Annexe 4 gives details of how to estimate the cubic capacity of round and rectangular haystacks. Once the cubic capacity is known the weight can be calculated from the above table.

7) Milk house

A small milk house is also needed to store the milk, and the milking utensils. The shed should contain a rack with hooks or pegs on the wall. The milk house should be cool with good ventilation. Fine mesh wire should be placed on the windows to keep out flies. The milk house should have a smooth floor so that cleaning is easy. A concrete pit should be constructed in the milk house for cooling the milk. The pit should be threequarters the depth of the milk can. A shed measuring 3m x 2m is adequate for a herd with an output of under 100 litres per day.

7.3 FENCING

There are three main types of fencing that are suitable for smallholder dairy farms and cooperatives.

Traditional Fences constructed from local materials are very common. They are cheap and easy to construct. Wooden rails, poles or boards are all suitable for fencing. Boards are recommended as they result in the saving of timber but they are more expensive because of the sawing costs.
Traditional fences can be of a very simple design. Care should be taken to treat the timber to avoid termite damage in areas where termites are a problem. Used motor oil is ideal for treating timber.

![Traditional wooden fence](image)

Fig. 7.9 Traditional wooden fence

Growing fences are a very effective form of stock control. Thorny shrubs and bushes provide ideal fences and some are also useful as browse or fodder for the livestock.

Establishment is easy, using cuttings which sprout in the rainy season. The following species are suitable for fences.

**Higher Altitudes**

- Gliricidia spp
- Erythrina spp

**Medium and low altitudes**

- Cactus
- Acacia spp
- Erythrina spp
- Sisal

Tree legumes such as leucaena, sesbania, and tree lucerne may also be incorporated into fences. The thorny bushes provide protection for tree legumes which can then be used for livestock feeding.
Barbed wire fencing may also be suitable for larger dairy farms and cooperatives. Barbed wire is an expensive but very effective method of fencing. Posts should be placed 5m apart. The posts should be 1.5m above ground with 0.5m to 0.75m underground. Five rows of wire are adequate. Strainers must be placed at intervals of at least 200m. Plain wire may be used for internal fencing.
SECTION 8

ROUTINE TASKS ON THE DAIRY FARM

8.1 CASTRATION

Male animals are castrated for the following reasons:

- to prevent pregnancy in immature females.
- to prevent in-breeding with mature females.
- castrated males are less aggressive than uncastrated males.
- castrated animals produce better quality meat.

Castration involves severing or crushing the spermatic cords so that sperm can no longer be produced.

Traditionally castration has been carried out when the animal is one or even two years old. This is bad animal husbandry except in the case of draught oxen which are not castrated until 1 - 2 years in order to allow them to develop their strength.

Calves should be castrated as early as possible. Only healthy calves should be castrated.

There are three possible methods of castration.

1) Burdizzo castration

The bloodless castrator or burdizzo is safe for use on animals of all ages. However, it is better to castrate with the burdizzo before 2 or 3 months of age, or at weaning at the latest.
The procedure for burdizzo castration is as follows:

- Make sure the calf is firmly held or restrained.
- Grasp each testicle and manipulate it to the bottom of the scrotal sac.
- Hold one spermatic chord against the side of the sac with thumb and forefinger.
- Place the jaws of the burdizzo 3/4 way up the scrotum or about 2 cm above the testicle. Keep the jaws below the rudimentary teats.
- Hold the chord with fingers just below the jaws of the burdizzo.
- Check that chord is in correct position in the jaws and close the jaws firmly.
- The crushing of the chord will be felt through the handle of the burdizzo.
- Repeat the above procedure until four crushes are made as shown.
- The crush marks should never be joined across the scrotum. A distance of 2cm should be left between the crushes.
- Clean the jaws of the burdizzo with disinfectant before further use.
- Watch the calf closely during the following 2 or 3 days for signs of ill health.
- Check one month later to ensure that the testicles have disappeared.

Fig. 8.2 Diagram of scrotum showing correct crushing position.
2) Knife Castration

For castration with a knife the following equipment is required:

- sharp scalpel
- cotton wool or sterile cloth
- disinfected hot water in bowl or bucket.
- antiseptic powder

The procedure for knife castration is as follows:

- Restrain or hold the calf firmly.
- Clean the scrotum with antiseptic solution.
- Grasp testicles and move to bottom of scrotal sac.
- Cut across the bottom of scrotum with scalpel.
- Pull each testicle away from the cut and twist the cord.
- Pull away the testicles, do not cut.
- Do not touch the wound with your fingers.
- Dust the wound with antiseptic powder.
- Clean the scalpel and store.
- Inspect the calf often during the following days for signs of infection or bleeding.
- Contact a veterinary surgeon if infection occurs. Castration by knife should only be carried out by experienced personnel.
3) Rubber ring

Rubber ring castration is only suitable for calves up to 3 weeks old. The following materials are required.

- elastrator (Fig. 8.4)
- rubber rings.

Procedure

- Restrain the calf.
- Load the ring on the elastrator.
- Move the ring up over scrotum Fig. 8.5
- Check that both testicles are in the scrotum below the ring.
- Release the ring and withdraw the elastrator.
- Check the calf over the next three weeks for signs of infection or ill health.

Fig. 8.4 Elastrator in closed and open positions.

Fig. 8.5 Applying rubber ring to scrotum with elastrator.
8.2 TREATMENT FOR INTERNAL PARASITES

Treatment is necessary to control internal parasites in dairy cattle, especially in young stock. Roundworms, and liver fluke are the most common internal parasites to be treated. The same treatment may be effective for the range of parasites. Treatment may be administered either as a drench (liquid form) or as a bolus (tablet).

The following materials are required for drenching:
- long necked drenching bottle or drenching gun Fig. 8.6.
- the drenching chemical (purchased from service cooperative).
- a measuring jug.

Drenching is carried out as follows
- Restrain the animal
- Measure the correct amount of medicine into the drenching bottle or drenching gun (first calibrate the drenching gun)
- Place hand over animal’s mouth and open the mouth by inserting fingers in the side of the mouth, or as in Fig 8.7.
Open the mouth just enough to allow the neck of the bottle or drenching gun to enter.
- Do not hold the animal's tongue.
- Place the neck of the bottle in the corner of the animal's mouth above the tongue.
- The animal will then swallow the medicine.
- Hold the mouth closed for a few seconds after dosing to ensure the medicine has been swallowed.

Balling
A bolus is best administered by a balling gun, which places the bolus at the back of the tongue. Ensure the bolus is firmly inserted into the head of the gun and raise the head of the animal until the muzzle is extended in a straight line with the neck. Insert the balling gun over the centre of the animal's tongue until the end is over the back of the tongue (approx. 25-30 cm), eject the bolus into the mouth, and make sure it is swallowed before releasing the head.

DONT try to insert the balling gun if the animal is struggling.
DONT hold the head too high as this may prevent the animal from swallowing.

If there is no balling gun, the head may be raised to drop bolus onto the rear of the tongue, then lower head to permit the animal to swallow it.
8.3 INJECTING

Great care is needed when injecting animals. The Development Agent should be aware of the correct method of injection. Usually the Animal Health Assistant or Animal Health Technician will be responsible for carrying out injections.

1) Preparing for injecting

Cleanliness is vital when using a syringe. The syringe and needle should be sterilised before and after each time it is used.
- Check that the medicine is not out of date.
- Check the correct injection rate.
- Fill the syringe with the required amount of medicine and expel any air from the syringe.

2) Types of injection

i) Subcutaneous:

Subcutaneous injection or injecting under the skin is a common form of injection.

The skin is pulled into a ‘tent’ shape. The needle is jabbed into the skin but be careful to avoid damaging the deeper tissue.

The syringe is then attached to the needle and the plunger pressed home slowly.
After withdrawing the needle massage the skin to help disperse the medicine. There are two common sites for subcutaneous injection. Fig 8.10

ii) Intramuscular

There are three suitable sites for injecting into the animal’s muscle. Fig 8.10

- in front of the shoulder blade.
- behind and below the shoulder blade.
- in the rump or buttocks.

In general, do not inject more than 20 ml. into any one injection site.
In thin animals care must be taken to avoid the bone.

Procedure:
- Tap the area with the back of the fist to prepare the animal.
- Aim the needle at the target and then bring it down sharply to insert it into the muscle.
- Attach the syringe to the needle and slowly depress the plunger.
- Withdraw the needle and massage the muscle.

iii) Intravenous injection

Injections into the vein are necessary for the treatment of certain illnesses. However, intravenous injections are a very specialised operation and should only be carried out by a veterinarian or a trained AHA or AHT. Details of intravenous injection procedures are given in the ‘Animal Health Extension Manual’ of the MOA.
8.4 DEHORNING

Dehorning or disbudding cattle has a number of advantages.

i) It reduces the risk of bruising especially among housed animals.

ii) Dehorned cattle are usually quieter and less aggressive.

iii) Dehorned cattle are easier to handle.

iv) Dehorned cattle need less space at feeding troughs and in yards.

The best time to dehorn cattle is when they are calves.

1) Caustic soda

When the calf is a week or two old dehorning is easily carried out by rubbing the horn with caustic soda. A ring of vaseline should be placed around the horn bud to prevent the caustic soda from burning the adjoining skin. The calf’s eyes must also be protected. The horn bud should be rubbed with a caustic stick until near bleeding. Avoid damaging the skin around the horn end.

Store the caustic stick in a safe place.

2) Dehorning with hot iron

Dehorning with a hot iron should be carried out when the calf is 3 or 4 weeks old. A purpose-made cylindrical iron is needed with a hollow tip.

The calf should first be injected with a suitable anaesthetic in the occipital groove. Fig 8.11

Fig. 8.11 Injecting anaesthetic before dehorning
The following dehorning procedure should then be followed. Fig. 8.12

i) Check with a needle to ensure that the area around the horn tip is numb.

ii) Check that the dehorning iron is red hot.

iii) Trim the hair around the horn bud.

iv) Make sure the calf is properly restrained.

v) Apply the iron at right angles to the horn bud.

vi) Rotate the iron continuously until the bud loosens.

vii) Dislodge the end by digging the rim of the iron under the loosened end and scoop it out.

viii) Hold the iron over the horn cavity at an angle for two or three seconds to cauterise the wound.

ix) Reheat the iron and repeat procedure for the other horn.

Fig. 8.12 | Dehorning with a hot iron.
3) Dehorning older animals

There are a number of methods of dehorning older animals although it should be stressed again that dehorning animals as calves is best.

Older animals may be dehorned by using a cutting wire, a saw or a guillotine shears.

With older animals a large cavity will be left, so infection occurs easily.

Procedure:

i) Restrain the animal properly.
ii) Inject with a suitable anaesthetic.
iii) Saw with wire or snip with the shears.
iv) The horn will spurt blood for a short time but bleeding should stop quickly. The wound should be cauterised or tied up.
v) Apply antiseptic powder to the wound.
vi) Check the animal continually for 24 hours for bleeding.
vii) If bleeding continues seek expert help.
viii) Watch out for infection until the wound has healed after 2 or 3 weeks.

Dehorning of mature animals is best carried out by veterinary staff.

Dehorning adult cattle of more than a year old is difficult, painful, time-consuming and dangerous.

Dehorning during heavy rain or when blowflies are active should also be avoided.
SECTION 9

RECORD KEEPING AND REPORTING

9.1 INTRODUCTION

It is important that accurate records are kept on a dairy farm or cooperative. Records are an important tool in monitoring progress and in identifying problems in the dairying operation. Records must be simple and easy to understand in order to be effective. All dates should be in the Ethiopian calendar.

Accurate records are necessary for the following reasons:

- to monitor yields and performance on the dairy farm.
- to identify management problems.
- to plan a breeding programme.
- to monitor disease problems.

The system of record keeping may vary depending on the size of the dairy herd and the area in question. However, regardless of what system or format is used, the same principles must apply. This section gives details on the main items that must be included in any record keeping system. The record system should have a minimum of three documents; the day book, the cow record and the monthly report.

9.2 THE DAY BOOK

All important events on the dairy farm are recorded in the day book.

A hard back notebook is all that is required. The farmer or cooperative worker can establish his/her own system of making entries in the day book. All entries should be identified clearly by using the ear tag number of the cow and the date of recording.

The day book must contain basic information on all aspects of the dairy farm and herd. The following information is essential.
1) Milk production

An accurate record of the milk yield of each cow is vital for good dairy management. The yield should be measured every day by the farmer or cooperative representative. The Development Agent should visit the farm at least once per month at milking time to observe the milk yield. The DA should then check the Day Book to ensure that the correct yields are being entered.

The yield is recorded in kilograms using a spring scale. If no scale is available the yield may be recorded in litres. Litres are approximately equal to kilograms.

![Fig. 9.1 Weighing the milk at a cooperative.](image)

2) Milk Sales and Utilisation

An accurate record should be kept of all milk sold off the farm. The price received for the milk must also be recorded. A separate page of the day book should be used to record one month's milk sales. This makes it easy to total the sales and revenue received at the end of the month. A special sheet may be supplied by the MoA for recording milk sales. If such a sheet is available there is no need to use the day book as well.

A record must also be kept of spillages and sour milk. Milk consumed by the household or fed to calves should also be recorded. If a limited suckling system is used it may be difficult to estimate the quantity consumed by the calf.
3) Feed records

If by-products or concentrates are being fed to the dairy herd records must be kept. The amount fed per day should be entered in the day book. A monthly stock check must also be kept with details on opening stock, purchases, and closing stock.

4) Health Records

All major health events must be entered in the day book. Details of unusual symptoms must be recorded. The following health events must be recorded accurately:
- deaths and abortions.
- serious illnesses, and treatment given.
- vaccinations.
- drenching.
- spraying.
- mastitis outbreaks, and treatments.

5) Reproduction Records

Heat and service records are essential for good breeding management. The service records should include details of the identity of the bull. Notes should be made of the expected calving date and the date on which pregnancy diagnosis is required.

The calving date should be recorded and any difficulties at calving should be noted. The sex of the calf, its condition at birth, its weight and ear tag number must also be recorded.

6) Sales and Purchases

All sales and purchases must be recorded in the day book. Feed, veterinary supplies, equipment and building materials must all be noted. Livestock sales and purchases must also be recorded. The quantity, unit price and total price must be quoted in all cases.

A simple account of stock may also be kept in the day book. The day book may also be used for keeping a simple ledger to record the main items of income and expenditure each month. The ledger can be a useful indicator of the profit level on the farm.
9.3 THE DAIRY COW RECORD

The dairy cow record or cow card provides a summary of all of the important information on, and events in, the life of the cow.

Every cow on the farm or cooperative should have an individual cow card. This card should accompany the cow if she is sold. If the cow dies a copy of the card should be retained as it may be useful when assessing the breeding potential of the cow’s offspring. Two copies of the cow card should be kept, one by the farmer or cooperative representative and the other by the Development Agent. The Development Agent should make sure that the card is kept up to date. There are a number of important features in the cow card.

1) Identification

Each card must include accurate details of the identity of the cow, the cooperative, the woreda and awraja. The identity of the cow’s parents should also be noted, if known. The date of birth of the cow should be included and the level of exotic blood recorded.

2) Heat and Service Records

All service dates must be recorded on the cow card. The bull identity must be recorded also. Abnormal heats should be noted too as they may give a clue to reproductive problems. Normal heats will be recorded in the day book.

3) Calving Records

Calving records may also be obtained from the day book. The age at first calving and the weight, if known, should be recorded. Details of calving date, the calf’s ear tag number and it’s condition at birth should also be included.

The calving interval should be given in days.

4) Milk Records

The cow card should give a summary of all the relevant details of the cow’s milk production. Space should be provided for up to 15 months per lactation and for a total of eight lactations.
The total milk yield of the cow per month should be entered. The information may be obtained from the day book. If yields are recorded just once per month the total yield for the month is calculated by multiplying the yield on the recorded day by the number of days the cow was milked during the month.

The dates for the start and finish of lactation should be entered as well as the total lactation length in days.

Fig. 9.2 The Development Agent must attend the farm at milking time once per month.

5) Health and Vaccination Records

The dates on which the cow has been vaccinated must be entered on the cow card together with the type of vaccine used.

Major health events such as abortion or serious illnesses should also be recorded. Minor illnesses need not be included.

6 Notes

There should be a provision on the cow card for miscellaneous events that may occur during the life of the cow. Such events may not be appropriate for recording elsewhere.
9.4 THE MONTHLY REPORT

A monthly report is necessary to enable continuous evaluation of the dairy enterprise. It is useful for the farm or cooperative itself as well as for the Ministry of Agriculture. The report allows the MoA Zonal and Head offices to compare the performance of dairy cooperatives.

Three copies of each monthly report are required; one for the farmer or cooperative representative, one for the Development Agent and one for MOA headquarters.

Each report should correspond to a calendar month, with the short month of Pagume being included in the previous month.

All of the information for the monthly report may be obtained from the cow card. The report should be completed by the Development Agent. The following is a summary of the information that should be included in the report.

1) Identity of farm or cooperative, woreda, awraja and DA's name.
2) Monthly milk production details.
3) Number of days each cow was milked during the month.
4) Quantity of milk sales.
5) Revenue from milk sales.
6) Service and calving records.
7) Death and disease records.
8) Livestock sales and purchases.
9) Other sales and purchases.
## ANNEX 1

### RELATIONSHIP OF WEIGHT TO HEART GIRTH MEASUREMENT

<table>
<thead>
<tr>
<th>Heart Girth Measurement Cm</th>
<th>Estimated Weight Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>26</td>
</tr>
<tr>
<td>70</td>
<td>32</td>
</tr>
<tr>
<td>75</td>
<td>40</td>
</tr>
<tr>
<td>80</td>
<td>48</td>
</tr>
<tr>
<td>85</td>
<td>56</td>
</tr>
<tr>
<td>90</td>
<td>66</td>
</tr>
<tr>
<td>95</td>
<td>77</td>
</tr>
<tr>
<td>100</td>
<td>89</td>
</tr>
<tr>
<td>105</td>
<td>103</td>
</tr>
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<td>110</td>
<td>115</td>
</tr>
<tr>
<td>115</td>
<td>130</td>
</tr>
<tr>
<td>120</td>
<td>142</td>
</tr>
<tr>
<td>125</td>
<td>158</td>
</tr>
<tr>
<td>130</td>
<td>182</td>
</tr>
<tr>
<td>135</td>
<td>200</td>
</tr>
<tr>
<td>140</td>
<td>223</td>
</tr>
<tr>
<td>145</td>
<td>245</td>
</tr>
<tr>
<td>150</td>
<td>275</td>
</tr>
<tr>
<td>155</td>
<td>300*</td>
</tr>
<tr>
<td>160</td>
<td>330*</td>
</tr>
<tr>
<td>165</td>
<td>355*</td>
</tr>
<tr>
<td>170</td>
<td>390*</td>
</tr>
<tr>
<td>175</td>
<td>420*</td>
</tr>
<tr>
<td>180</td>
<td>450*</td>
</tr>
<tr>
<td>185</td>
<td>485*</td>
</tr>
<tr>
<td>190</td>
<td>520*</td>
</tr>
<tr>
<td>195</td>
<td>560*</td>
</tr>
<tr>
<td>200</td>
<td>605*</td>
</tr>
</tbody>
</table>

* indicates approximate weight (rounded figures)
## ANNEX 2

### RELATIONSHIP BETWEEN MILK CONSTITUENTS, END-PRODUCTS OF DIGESTION AND SITE OF ABSORPTION IN THE DIGESTIVE TRACT

<table>
<thead>
<tr>
<th>Milk Constituent</th>
<th>Main Precursor in blood</th>
<th>End-product of digestion</th>
<th>Site of absorption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactose</td>
<td>Glucose</td>
<td>1) Propionic and lactic acid</td>
<td>Rumen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Glucose and amino acids</td>
<td>Small intestine</td>
</tr>
<tr>
<td>Protein</td>
<td>Amino acids</td>
<td>1) Propionic and lactic acid</td>
<td>Rumen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Glucose, amino acids</td>
<td>Small intestine</td>
</tr>
<tr>
<td>Fat</td>
<td>Acetate</td>
<td>1) Acetic and butyric acid</td>
<td>Rumen</td>
</tr>
<tr>
<td></td>
<td>B-hydroxybutyrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Triglycerides</td>
<td>2) Long-chain fatty acids</td>
<td>Small intestine</td>
</tr>
<tr>
<td></td>
<td>Glucose</td>
<td>3) Propionic and lactic acid</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4) Glucose and amino acids</td>
<td>Small intestine</td>
</tr>
</tbody>
</table>
ANNEX 3

HAY REQUIREMENTS AND HAYSTACK WEIGHT ESTIMATION

3.1 HAY REQUIREMENTS

Intake depends on hay quality and whether or not hay is the only constituent in the diet. As a guideline - excluding wastage - requirement is:

<table>
<thead>
<tr>
<th>Animal</th>
<th>kg hay per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>cow</td>
<td>7 - 13</td>
</tr>
<tr>
<td>Heifer</td>
<td>5 - 9</td>
</tr>
<tr>
<td>Young dairy stock</td>
<td>2 - 3</td>
</tr>
</tbody>
</table>

3.2 HAY QUANTITY ESTIMATION

A) Rectangular stacks
Cubic capacity \([A \times B \times C) (A \times B \times 1/2D)]\ m^3

B) Round stacks
Cubic capacity \((A \times A \times B \times 0.6)\ m^3

Then convert m^3 to tonnes using the following table.

<table>
<thead>
<tr>
<th>Condition of Stack</th>
<th>Round stack m^3 per Quintal</th>
<th>Rectangular Stack m^3 per Quintal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not well settled (loose)</td>
<td>1.2 - 1.6</td>
<td>1.0 - 1.2</td>
</tr>
<tr>
<td>Fairly well settled</td>
<td>0.9 - 1.0</td>
<td>0.8 - 0.9</td>
</tr>
<tr>
<td>Very well settled (firm)</td>
<td>0.6 - 0.7</td>
<td></td>
</tr>
</tbody>
</table>
DAIRY DISEASE DIAGNOSIS

Symptoms

1 Abnormal heat periods
2 Apetite...Depraved
3 Apetite...Loss of, in calves
   " ... in cows
4 Bloodstained urine
5 Clots or pus in milk
6 Constipation
7 Coughing loss of condition
8 Diarrhoea
9 Discharges from vulva
   - clear slime
   - pus and smelly slime
   - white discharge

Possible Disease/Condition
- cystic ovaries
- uterine infection
- IBR (Infectious Bovine Rhinotracheitis)
- mineral deficiencies
- scour
- virus pneumonia
- joint ill
- other infections
- mastitis
- pneumonia
- displaced abomasum
- redwater or kidney inflammation
- mastitis
- excess fibre in diet
- acetonaemia
- other fever conditions
- severe worm infestation
- worms
- improper feeding
- scour (calves)
- Johne’s disease
- normal heat
- retained afterbirth or possible abortion
- chronic vaginal or uterine infection
- IBR
DAIRY HOUSING SPECIFICATIONS

6.1 FLOOR SPACE REQUIREMENTS PER ANIMAL.
\( \text{m}^2 \) per animal, inc feed passages, etc.

<table>
<thead>
<tr>
<th>Type of Animal</th>
<th>Barn</th>
<th>Loose house</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow</td>
<td>3.5</td>
<td>5-7</td>
</tr>
<tr>
<td>Down - calvers</td>
<td>12.0</td>
<td>12.0*</td>
</tr>
<tr>
<td>Young calves</td>
<td>1.0</td>
<td>1.25 - 1.5</td>
</tr>
<tr>
<td>Older calves</td>
<td>2.0</td>
<td>3-4</td>
</tr>
</tbody>
</table>

(* Calving pen 4m x 3m.)

6.2 TROUGH AND MANGER SPACE REQUIREMENTS

<table>
<thead>
<tr>
<th>Space per Animal (cm)</th>
<th>Width (cm)</th>
<th>Manger/ Trough Height from floor (cm)</th>
<th>Depth (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult cattle</td>
<td>60 - 75</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Calves</td>
<td>40 - 50</td>
<td>40</td>
<td>20</td>
</tr>
</tbody>
</table>

6.3 FLOOR CONSTRUCTION

Floors may be constructed from concrete, stone or packed earth.
Floor depth: 45 - 70cm, depending on material used.
Floor slope: 1 in 40 to 1 in 60 towards drains
6.4 CONCRETE MIXES

Amount of material for 10 m² of concrete

<table>
<thead>
<tr>
<th>Thickness of Concrete(cm)</th>
<th>Concrete (M³)</th>
<th>Sacks of Cement</th>
<th>Sand (M³)</th>
<th>Gravel (M³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1.0</td>
<td>8</td>
<td>0.5</td>
<td>0.7</td>
</tr>
<tr>
<td>15</td>
<td>1.5</td>
<td>12</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>20</td>
<td>2.0</td>
<td>20</td>
<td>2.0</td>
<td>1.4</td>
</tr>
<tr>
<td>25</td>
<td>2.5</td>
<td>20</td>
<td>2.0</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Concrete floors should be finished with 8-12cm thick layer of 1:1:1 or 1:2:3 mix.

ANNEXE 7

CONVERSION TABLES

<table>
<thead>
<tr>
<th>TO CONVERT</th>
<th>TO</th>
<th>MULTIPLY BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metres</td>
<td>Centimetres</td>
<td>100.00</td>
</tr>
<tr>
<td>Metres</td>
<td>Millimetres</td>
<td>1,000.00</td>
</tr>
<tr>
<td>Kilometres</td>
<td>Metres</td>
<td>1,000.00</td>
</tr>
<tr>
<td>Square metres</td>
<td>Square centimetres</td>
<td>10,000.00</td>
</tr>
<tr>
<td>Square kilometres</td>
<td>Square metres</td>
<td>1,000,000.00</td>
</tr>
<tr>
<td>Hectares</td>
<td>Hectares</td>
<td>100.00</td>
</tr>
<tr>
<td>Square kilometres</td>
<td>Hectares</td>
<td>40.00</td>
</tr>
<tr>
<td>Gasha</td>
<td>Gasha</td>
<td>2.50</td>
</tr>
<tr>
<td>Square kilometres</td>
<td>Gram</td>
<td>1,000.00</td>
</tr>
<tr>
<td>Kilogram</td>
<td>Kilogram</td>
<td>100.00</td>
</tr>
<tr>
<td>Quintal</td>
<td>Quintal</td>
<td>10.00</td>
</tr>
<tr>
<td>Tonne</td>
<td>Kilogram</td>
<td>1,000.00</td>
</tr>
<tr>
<td>Tonne</td>
<td>Kilogram</td>
<td>1.00</td>
</tr>
<tr>
<td>Litre of water</td>
<td>Cubic centimetres</td>
<td>1,000.00</td>
</tr>
<tr>
<td>Litre</td>
<td>Litres</td>
<td>1,000.00</td>
</tr>
<tr>
<td>Cubic metres</td>
<td></td>
<td></td>
</tr>
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</table>

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