MINISTRY OF AGRICULTURE
LIVESTOCK AND FISHERIES
STATE DEPARTMENT OF LIVESTOCK

CALF AND YOUNG STOCK REARING

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Acknowledgements

Executive Summary

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1.1 Introduction

The calf is the foundation of the future dairy herd which signifies the importance of proper calf rearing. Selection of replacements for culled cows can only be effective if good replacement heifers are available and in enough numbers to allow for a more rigid selection. Good replacement stock depends on semen selection from proven sires (bull) used in dams of good genetic merit. Proper calf rearing should be economical to allow enough milk to be taken for home consumption and for sale. In many farms, calf rearing is often over looked. In most cases the calves become unhealthy and have a low growth rate. Sometimes they may even die. A good calf-rearing system can easily improve this situation.

1.1.1 Objectives

Good calf-rearing will lead to:

- Reduced mortality rate in the calves
- Strong and healthy cows with a well developed body. Such claves will grow into cows that are able to consume plenty of fodder and to produce much milk.
- Calves that grow to be cows which produce their first calves at an age of 2 – 2.5 years.

1.1.2 Management of the Cow in Calf

Rearing of the calf has to start at conception. Ensure that the cow is in good condition at the time of service. Good care should be taken of the cow in calf. The growth of the calf in the uterus is slow at the beginning of the pregnancy period but increase towards the end. During the last two months of the pregnancy the unborn calf grows very fast. The cow should be dried off at this time. This will enable the cow to get into good condition for the next lactation. The cow should be offered plenty of good quality fodder during the dry period. Depending on the cow's condition, 1-2 kg of dairy meal should be offered during the last 8-6 weeks of gestation.The cow should have access to minerals at all times, except three weeks before calving. To avoid milk fever, minerals should be removed from the mineral box for two weeks. Adlib mineral feeding should resume one week before calving.

1.1.3 The Birth of the Calf

Normally a cow will calf down about 280 days after the last insemination or service.
When calving is imminent the following signs can be seen:

- Swelling of the udder about one week before calving
- Swelling of the vagina
- Thick mucus will appear from the vagina about three days before calving
- Relaxation of the ligaments on both sides of the tail. When this happens the cow will calve within 24 hours. The ligaments will be completely relaxed at the time of calving.

When you are sure that the cow will calve down soon, take her to clean place preferably outside the zero grazing unit. The hindquarters should be washed with a disinfectant. After the cow shows the first signs of labour it will take about three hours before the front hooves of the calf become visible. Under normal circumstances, the calf is born an hour or so after the appearance of the front hooves.

If the birth takes too long you can help the cow by pulling the calf but do not start before the eyes of the calf have appeared. Never pull with more than two people together and then do so only when the cow is pressing herself.

Always pull in the direction of the udder of the cow. In cases of difficulty ask for veterinary assistance. Immediately after the birth the navel of the calf should be disinfected with iodine or any other suitable disinfectant. The after-birth (placenta) should come off within 12 hours after calving. If this does not happen contact the veterinary staff immediately.

1.1.4 Feeding of the Calf

Feeding management should also be directed at addressing nutrient requirements and encouraging rumen development for fast and healthy growth of the calf within the acceptable time span.

While designing a calf feeding program, the aim should be to reduce mortality (death) rate while maintaining a growth rate of about 400-500g/day. The growth rate will vary with breeds, for the bigger breeds the aim should be to wean calves at 3 months at approximately 80kg body weight.

1.1.5 Calf Feeding Programs

While developing a calf feeding program the following factors should be considered.

1. The calf has low immunity at birth and therefore must be given colostrum. The colostrum has antibodies that protect the calf against diseases the mother has been exposed to and their absorption is highest within 12 hrs after birth and very low after 24 hr. As such the calf must suckle colostrum immediately after birth and if necessary it should be given using a nipple bottle. The calf depends on the colostrum antibodies for about 2 weeks when it develops its own immunity. If new animals are introduced into the herd just before calving, it may be necessary to vaccinate them against the common diseases so that they can develop antibodies and pass then on to their new born.

2. The newborn calf is dependent on milk for nutrition and growth in its early life as the rumen is not functional. The suckling reflex forms a fold (groove) which serves as a pipe for delivering milk straight from the oesophagus to abomasum in young calves (bypassing fore- stomachs). Therefore, young calves should only be fed on liquid diets as the groove will not allow solids to pass.

3. Calves secrete high amounts of lactase enzyme (breaks down lactose in milk to glucose and galactose to supply energy). The other carbohydrate digesting enzymes are low and therefore, milk which has a high lactose level should be fed to the calves. During formulation of milk replacers, the energy source should be milk lactose. Calves have no sucrase enzyme, and should not be fed on sucrose (ordinary sugar).

4. Since the rumen is not functional, the calf cannot synthesize the B vitamins and they must be supplied in the diet. The diet of the newborn calf should contain milk proteins since enzymes to break down complex proteins do not develop until 7-10 days after birth.

5. Introduce calf to solid feed. As calf is introduced to solid feed, the rumen starts developing and the calf can be weaned as soon as it can consume enough dry feed (1.5% of body weight). It should be noted that dry feed should be introduced early, as solid feed is required for rumen development. Grain based diets promote faster growth of rumen papillae (which promotes rumen function) compared to roughages.

Calf Feeding Methods

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

1. Single suckling

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

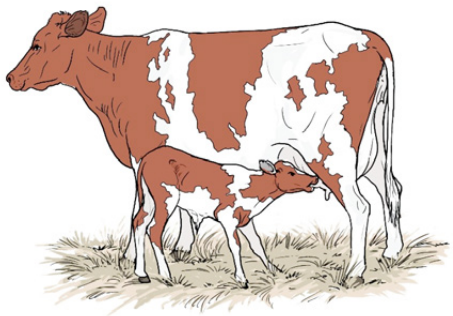

Figure 1: A calf suckling

2. Foster mother or multiple suckling

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

3. Nipple suckling

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

4. Bottle feeding

The milk is placed in a clean bottle and the calf is fed directly from the bottle. This method is tedious and slow if many calves are to be fed. There is a high likelihood of milk going to the lungs via trachea.

5. Bucket feeding:

This is the most commonly used method and milk is placed into a bucket and the calf is trained to drink (place finger in the milk and as calf suckles your finger it takes in milk).

Stainless steel buckets, where available, should be used for hygienic reasons as plastic buckets are difficult to clean.

Whatever method is used, clean equipment should be used at all times. Sick calves should always be fed last to minimize cross contamination. Attempts should be made to feed milk at body temperature especially during the cold season.

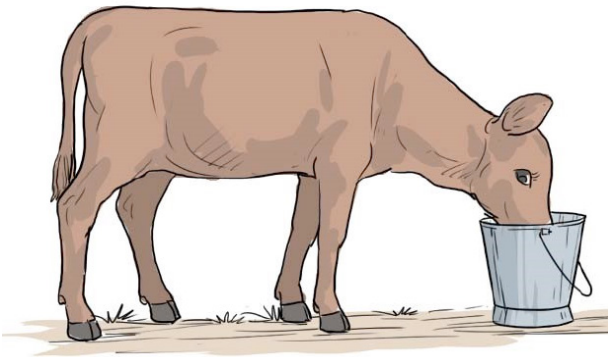

Figure 2: A calf bucket feeding

Table 1: Differences between bucket feeding and natural suckling

Advantages of suckling	**Advantages of bucket feeding**
Milk is at the correct temperature	Calf experiences less noise and disturbance
Calf is unlikely to get scours (diarrhoea)	Easier to teach the calf how to feed
Milk is clean	Records can be kept of the amount of milk fed
No investment needed for feeding equipment	Easier to control the amounts of milk/feed given to the calf
No labour required to feed the calf	Possible to record and monitor the cow's milk production
For zebu cows, the calf suckling stimulates milk let down; without the calf being present the cow cannot be milked.	For a zebu cow that has been accustomed to the bucket feeding system, if the calf dies, then the cow will not have a problem with milk let down.

The calf can now be fed twice per day. The amount of milk to be fed depends on the size of the calf, its breed and the general body condition. There exist many feeding schedules that can be used to the point of weaning. There is the early weaning regime and the late weaning regime: In the early weaning regime the calf is weaned after 2 months and the milk intake is supplemented with a high protein content supplement. In the late weaning regime, the calf is weaned after four months. The calf may not need concentrate supplementation when using this schedule. Each regime has its own advantages and disadvantages. It is possible to have an intermediate regime.

1.1.6 Colostrum feeding

During the first three days after calving the cow produces a special kind of milk. This milk is called colostrums. The feeding of colostrums is very important to give the calf a food start because:

- Colostrum contains anti-bodies. These protect the calf against diseases.
- Colostrum contains vitamins and minerals
- Colostrum assists the calf in producing the first dung

The calf should receive as much colostrums as possible during the first 3 days of life. The first colostrums should be given immediately after birth. The colostrums can be bucket fed or the calves can such directly from the dam. If bucket fed, it should be given several times in a day. Give one litre at a time and repeat 4-5 times a day.

1.1.7 Artificial Colostrum

Colostrum serves two functions in new born calves, as a source of antibodies and also a rich source of nutrients (has high amount of energy and protein compared to milk). Artificial colostrum does not supply the antibodies but is a good source of nutrients for new born calf, e.g. composition of artificial colostrum: one egg (protein source) + half litre fresh warm water + half litre whole milk (source of lactose and milk protein) + one teaspoonful castor oil (energy) + one teaspoonful of cod liver oil (energy).

NB: The practice with some farmers is to store the excess colostrum in a clean can to ferment with or without addition of lala starter culture. Additional of a culture (commercial lala) ensures fermented milk with a homogenous and smooth body. When feeding, warm the fermented milk in a water bath. The calf can be taught to drink from a bucket by putting your finger in the mouth of the calf and at the same time bending the head of the calf into the bucket containing colostrums.

1.1.8 Milk Feeding

From the fourth day onwards, the milk of the cow will become normal.
Milk can be fed to calves by suckling or by separating the calf from the mother and feeding from a bucket.

Following is an example of the intermediate regime.

Milk Feeding Schedule

Feeding of some chopped young fodder should start in the second week. Also early weaner pellets should be given.

Table 2: Milk Feeding Schedule

Age in weeks	**Milk per day**		**Early weanerpellets**
	Litres	Treetop bot-tles	Kgs. Per day
Week 1	Colostrum		-
Day 1-3	4	6	Handful
Day 4-7	4	6	0.5
Week 2	5	7	0.5
3	5	7	0.75
4	5	7	0.75
5	5	7	0.75
6	5	7	0.75
7	5	7	0.75
8	5	7	0.75
9	5	7	1.0
10	4	6	1.0
11	4	6	1.0
12	3	4	1.0
13	3	4	1.0
14	2	3	1.0
15	2	3	1.0

In case no early weaner pellets are available other concentrates like dairy meal should be fed instead. Fresh water should always be available. If the above feeding schedule is followed, the calf receives in total 415 litres of milk and 70 Kgs of early weaner pellets. The costs of this schedule depend on the prevailing milk price. In areas with high milk price, the rearing of a calf is expensive; the farmer therefore has to make decision which calves to rear, or either to use cows' milk or milk replacers.

Milk replacers

These are commercial products manufactured to resemble milk and are mostly used when there is no milk to feed the calf e.g where a cow is sick or died during calving. They are also used when demand and price of milk is high. Preserved colostrum should be used as much as possible before a farmer decides to use milk replacer. Milk replacers are always of lower quality than whole milk and should only be fed if they are cheaper.

Pre-starter

A pre-starter is a high quality calf feed, which should be low in fibre and is almost similar to milk replacer and is usually fed during the second and third week. It is fed in a dry pelleted form or as a meal. It should be used early to stimulate calves to eat dry feed to enhance rumen development. It is estimated that it takes rumen growth about three weeks after the calf starts eating a handful of dry feed, thus the earlier they start the better.

Calf starter

The starter contains slightly higher fibre content compared with the pre-starter. At this stage the calf is consuming little milk and is in transition to becoming a ruminant.

Roughage

Calves should be offered only high quality forages early in life and supplemented with concentrates (calf starter). If hay is used, it should be of high quality, fine texture, mixed with legumes and fed ad lib. If they are on pasture, it would be best to always graze calves ahead of adults to control parasites. Some of the common roughages offered to calves are sweet potato vines and freshly harvested and wilted Lucerne.

Water

Calves should be offered fresh water in addition to milk. Lack of drinking water slows down digestion and development of the rumen, and hence the longer it takes before calves can be safely weaned. Between three weeks and weaning, calves' water consumption usually increases and should be available all the time.

Table 3: Example of a feeding schedule for calves

Age of calf (days)	Milk kg/day	Total Milk (kg)	Calf starter (kg/d)	Roughage
1 to 7	Colostrum			
8 to 21	5	70	Handful	
22 to 42	6	126	0.5	Yes
43 to 56	5	70	0.5	Yes
57 to 63	4	28	1	Yes
64 to 77	3	42	1	Yes
78 to 84	2	14	1.5	Yes
Wean the calf				
Total		**350**	**55**	

This programme should result in growth rate of approximately 400-500 grams per day.

Important points to remember when milk feeding

- Hygiene and cleanliness of the buckets used in the feeding is very important in order to avoid scours in the calf. The bucket should be washed directly after feeding. First rinse the bucket with clean water. Then wash with a detergent and hot water. Finally rinse the bucket again with clean water and leave it upside down to dry in the sun.
- Feed the calf directly after milking the cow. The milk has then the right temperature and is fresh.
- The calf should drink its milk quickly. If not, the calf may not be healthy.
- Good quality fodder like young napier grass, sweet potato vines or good hay should be provided from the second week onwards.
- The quantity of milk mentioned in the feeding schedule might be too much at the time for small calves. In that case, give the milk 3 times per day. Feeding too much milk at once is often a cause of scours.

Table 4: Four phases of the calf feeding program

Phase	Feed
Colostrum phase (1 - 4 days)	Colostrum
Pre-ruminant phase (5 days to 20 - 30 days)	Milk
Transition stage (Liquids & dry feeds)	Milk replacer and calf starter
Post-weaning stage (dry feeds)	Calf starter

The aim should be to switch young calves to cheaper feeds as early as possible so that more milk can be available for sale. However, the diet must be able to promote health and growth.

1.1.9. Weaning

Weaning is the withdrawal of milk or milk replacer and the calf becomes fully dependant on other feeds. Traditionally, most dairy calves are weaned based on age, 12 weeks being the most common. Early weaning is possible if more milk is fed and calves introduced to pre-starter and starter early in life. To minimise stress, weaning should be done gradually. The twice a day milk feeding should be reduced to once a day then to once every other day to allow the calf's digestive system to adjust to the new diet.

Criteria that have been used to determine weaning time include when calf attains twice the birth weight, when the calf can consume 1.5% of its bodyweight of dry feed and age of calf. Early weaning (5 to <8 weeks) may be adopted to reduce the milk feeding period and labour required for calf rearing. This will require a specific feeding program using low levels of milk and high energy, high protein concentrates, preferably pelleted to stimulate rumen development. Liquid milk or milk replacer is reduced from 3 weeks of age to encourage the calf to consume and maximize intake of dry feeds.

1.1.10 Feeding after Weaning

When the milk feeding schedule is followed as explained before, the calf will be almost 4 months at weaning. During the next two months, besides plenty of good quality fodder, one bag young stock pencils should be fed. This should start at a rate of 1.5 Kg per day and be reduced to 1 Kg per day when the calf is about 6 months old. After 6 months, good quality fodder only can cater for the growth of animal. However, if the fodder is of poor quality like overgrown napier or maize stover supplementation with dairy meal should continue. Minerals should be present at all times.

1.1.11 Calf Housing

Immediately after birth, the calf is separated from its mother and placed in a calf pen.
A calf pen is the most ideal place to house the calf because:

- It is hygienic and very much reduces the risk of warm infestation.
- The pen provides protection for the calf against rain and cold
- A suckling calf will not need a calf pen until it is separated from the mother.

Where the farmer is practicing zero or semi-zerograzing, permanent calf-pen should be part of the zerograzing unit. Where the farmer is practicing grazing the mobile calf pen should be moved every day to a clean area. The pen in the zerograzing unit should have a raised movable raised floor, which is slatted. (see drawing and photograph in the farm structures mannual) the slats should have a one inch spacing between them. The urine and the dung is pushed through the slats and rained away. The calf is therefore kept clean and dry thereby greatly reducing the risk of pneumonia, diarrhea and worm infestation. The floor can be removed now and then to be cleaned. The calf pen should have provision for a feed through and for a water bucket. No bedding should be used.

1.1.12 Disease control in Calves

It helps to know what a healthy calf looks like.

Features of a healthy calf

- A healthy calf has a bright and shiny coat and is alert active with strong body condition.
- There should be no mucus from the nose and the eyes should not be watery.
- A healthy calf is free of coughing and high fever.
- The coat should be flossy and shiny and should not be standing.
- A healthy calf shows signs of hunger and will take milk quickly when it is given.

Preventing disease is better more economical and easier than treatment. Ensuring that the calf gets enough colostrum is one of the first steps in disease control. Keeping the calf in a clean environment and feeding clean and adequate milk at the correct temperature is a means to keep the calf healthy.

1.1.13 Common Calf diseases

1.1.14 Calf Scours

Scours or calf diarrhea is one of the most common diseases among calves.

Symptoms of scours are:

- The dung is liquid and has a whitish colour.
- The calf appears dull and drinks slowly or refuses to drink at all
- The dung has a strong smell

Causes of an infection include:

- Unhygienic housing: dirty calf pen or dirty bedding.
- Dirty buck buckets used for milk feeding
- Overfeeding of calf with milk
- Too little colostrums fed so that the resistance of the calf is too low

Treatment

As soon as the calf is suspected of scouring no milk should be fed. Boiled water should be given instead to prevent drying out. It is good practice to add one teaspoon of salt and one teaspoon of baking powder to the water. If there is no improvement seen after a day, seek veterinary assistance.

1.1.15 Pneumonia

The symptoms are:

- Coughing
- High fever
- Mucus from the nose and watery eyes
- The calf appears dull

The risk of infection can be increased considerably by:

- Exposure to draught
- Poor ventilation of the place where the calf is kept
- Presence of bacteria viruses and micro-organisms

Prevention

Feeding enough colostrums will give the calf resistance.
A fresh, draught-free calf pen will prevent most cases of pneumonia.

1.1.16 Internal Parasites

Although calves housed in a calf pen with a slatted floor are less exposed to infestation with internal parasites, control still will be necessary especially after weaning when the chance of an infestation with worms and flukes increases.

Symptoms

- Calf appears dull
- Standing and lusterless coat
- The calf is thin with the head looking proportionally big
- Parasites can be observed in the dung

Causes of internal parasite infestation

- Dirty environment
- As a result of ingesting parasite eggs
- Lack of proper whole-herd parasite control methods
- Allowing calves to graze in contaminated fields

Prevention and Treatment

- Regular deworming is needed. Start deworming the calf at an age of 2 months. Repeat this every 3 months
- Follow the recommended deworming methods and dosage
- Keep the calf in a clean environment

1.1.17 External Parasites

External parasites like ticks lice, may transmit diseases. The ticks may be brought in by the fodder or dogs may carry them near to the calf pen. The calves should be treated every week to prevent tickborne diseases. Spray or wash the calf with an acaricide solution from 2 weeks of age. Also pye grease can also be applied. After the calf is weaned and leaves the calf pen it can be taken to the dip.

1.1.18 Vaccinations

The calf should be vaccinated against the following diseases:

- Foot and mouth diseases can be done from 4 months of age and should be repeated every 6 months.
- Blanthrax (black quarter and Anthrax) at an age of 6 months
- Brucellosis heifer calves only at the age of 9 months.

1.2. Routine Calf Management Practices

1.2.1 Dehorning

Animals may be dehorned to avoid them damaging one another. If considered necessary, animals should be dehorned while young (two months old) when the horn buttons are soft and easy to cut. Animals with no horns require less space at the feeding troughs and will not damage the hides of others. However, if an adult animal is dehorned, the wound may take a long time to heal and may become infected. Dehorning also requires a degree of skill. Dehorning methods involve a disbudding iron or dehorning wire.

Dehorning by disbudding

As soon as the horns of a calf can be felt at about 1 – months of age, the veterinary staff should be contacted to disbud the calf using the hot disbudding iron.

Dehorning using a dehorning wire

This is used on already overgrown horns

1.2.2 Castration

Castration is the destruction or removal of the testicles. It is carried out on male animals that are not wanted for breeding. The best time to castrate an animal is when it is very young because the operation is more successful and the wounds heal fast (at 3 months of age). Castration can be done using a burdizzo (specialized castration tool), rubber ring, sharp knife or scalpel.

1.2.3 Teat Clipping

Extra teats should be removed at 3months of age to make the udder uniform.

1.2.4 Identification

Identification of calves should be done immediately after birth to allow efficient and proper recording. As a way of identifying animals on the farm various methods are employed which include ear tagging, ear notching and tattooing, branding and use of rumen bolus (Ceramic capsule containing an electronic chip) the micro chip is encoded with a unique number which is unalterable and which can only be read by a hand held reading equipment.

1.2.5 Hoof Trimming

It is done on hooves that are over grown by use of a hoof trimmer

1.2.6 Basic rules towards good Calf rearing

1. Proper feeding of the cow in calf is the start of good calf rearing.
2. Feed colostrums ad lib to get a good strong and healthy calf.
3. Keep the calf pen clean to avoid diseases like scouring.
4. Keep the calf on a calf-pen with a slated floor to avoid internal parasite infestation.
5. Feed the calf in clean utensils
6. Feed sufficient milk as advised in the feeding schedule
7. Make sure that fresh water and good quality fodder is available to the calf at all times.
8. Deworm and vaccinate at the right time.
9. Spray or wash your calf every week against ticks.
10. Debud the calf as soon as the horns can be felt

Chapter 2: Heifer Rearing

2.1 Introduction

Raising dairy heifers begins with choice of a bull likely to produce animals with high genetic potential for milk. A well managed dairy farm should have as many calves born every year as there are cows in the herd. Most farmers sell males calves at an early age while the females are reared as dairy replacement heifers for the herd or as heifers for sale. Raising a high number of replacement heifers allows a dairy farmer to:

i) Obtain the best replacement heifers through strict selection criteria from wide selection.
ii) Expand the dairy herd at low cost (without buying heifers or cows)
iii) Sell excess heifers to earn income.

Heifers represent the future of the herd. At the same time, they are non-productive animals incurring expenditure in terms of feed, labour and veterinary services without immediate returns. Raising heifers is a financial investment that begins to bring dividends after the first calving; therefore the goal should be to make ensure proper growth rate at minimum costs to be inseminated on time in order to realize full lactation potential later in life.

2.1.1 Feeding Heifers

Heifer raising is the second largest expenditure in a farm after the milking herd, with feed costs takes the largest share. The aim should be to rear heifers to reach the desired body weight early so that they initiate puberty, establish pregnancy, and calve easily. The way a heifer is fed is very important as it can greatly affect fertility (age at which the heifer is ready for mating or insemination) and the chance of getting in calf. Feeding also affects milk production and the number of calves produced. A well fed, healthy heifer that was also well fed as a calf should be ready for its first service (mating/insemination) from the 18th month.

When feeding heifers, the farmer should aim to:

i) Reduce interval between weaning and first lactation. This will increase number of calvings per lifetime (more of lactations) and lead to faster genetic improvement.
ii) Minimise mortality.
iii) Achieve a growth rate of 0.5-0.7 kg/d.
iv) Achieve first calving at 22 to 24 months of age
v) Feeding management must ensure that heifers reach target live weights for breeding at 14-16 months of age.

Combining both adequate development and early age at calving has several advantages:

i) It decreases the risk of calving difficulty.
ii) It improves lifetime milk production (days in lactation and milk production per day in lactation).
iii) It reduces rearing costs (feed, labour, etc.);
iv) It decreases total number of heifers needed to maintain herd size.

In most farms, heifers are normally the most neglected group in terms of feeding resulting in delayed calving. When heifers are fed as a group, the main problem becomes that the heifers are normally of different ages and thus aggressiveness varies. When concentrate is fed to the group, the young and weak consume less compared to others.

While designing a feeding program for heifers, the following should be considered:

i) Puberty (thus calving) is related to size (feeding) rather than age. The consequences of poor feeding are manifested in delayed calving resulting in delayed milk production.
ii) Feeding heifers too much energy leads to deposition of fat in mammary gland tissue displacing secretory tissue resulting in reduced milk yield. The key period in mammary gland development is between 3 and 9 months of age. During this period, mammary tissue is growing 3.5 times faster than body tissue. Heifers fed high-concentrate rations develop less milk secretory tissue in the mammary gland than heifers raised on recommended rations. iii) Underfeeding heifers results in small bodied heifers which experience dystocia (difficult calving).
iv) Heifers calving at 24 months have a higher lactational milk yield compared to calving at an older age.
v) Size of animal is related to milk yield. For twins of same genetic makeup, the heavier one produces extra milk in a lactation.

Heifers that are less than one year old have high nutrient requirements but cannot eat as much as an adult cow (see Table). Feeding forage alone will not provide the ideal amount of nutrients and will result in a slow growth rate. Supplementation with concentrate should be at 1% of body weight. Generally the amount of concentrate given to heifers should be 1 to 4 kg depending on age (size) of the heifer and forage quality. Mineral salt supplement is recommended on a free-choice basis.

From 3–6 months of age, the amount of forage in the ration should be increased from 40% to 80%, and during this period the protein content of the diet should be gradually reduced from 16% to 12%. Try to ensure the animals have free access to water. If this is not possible, aim to let them drink 1 litre for every 10 kg of body weight (a 300 kg heifer should receive approximately 30 litres of water per day). Usually less water is needed if the animals are eating fresh forage.

Table 5: Feed requirements for a heifer

Daily allowance: offered in 2–3 meals		
Age	Good quality concentrate	Good quality hay or forage
Weaning–6 months	1.5 reducing to 1 kg	Free access
6–18 months	None	Free access

2.1.2 Growth rate (weight) versus age

Both under- and over-feeding heifers are undesirable during heifer rearing. Overfeeding may result in obesity, low conception rate, difficult calving and low milk production while underfeeding will result in low conception rate, poor fetal growth, difficult calving and low first lactation milk yield. It is therefore important to monitor performance of heifers, particularly the body weight change and height at withers. Growth should be such that increase in weight is accompanied by a proportionate change in height. Growth charts allow a farmer to compare the height and weight of heifers to a standard curve that represents the average for the particular breed. This tool enables the farmer to monitor heifer performance to determine whether feeding and other management practices are adequate.

Body weight and height at withers are three important measurements used to evaluate heifer growth. The weight is estimated with a weigh band and height by graduated piece of timber as shown in the picture below. Once the measurements are taken, they are then fitted into a growth chart which is breed specific (eg below). If the body weight falls below the band (expected), then the heifer not getting enough nutrients (energy) and vise-versa. Short heifers are an indication of low protein in the diet.

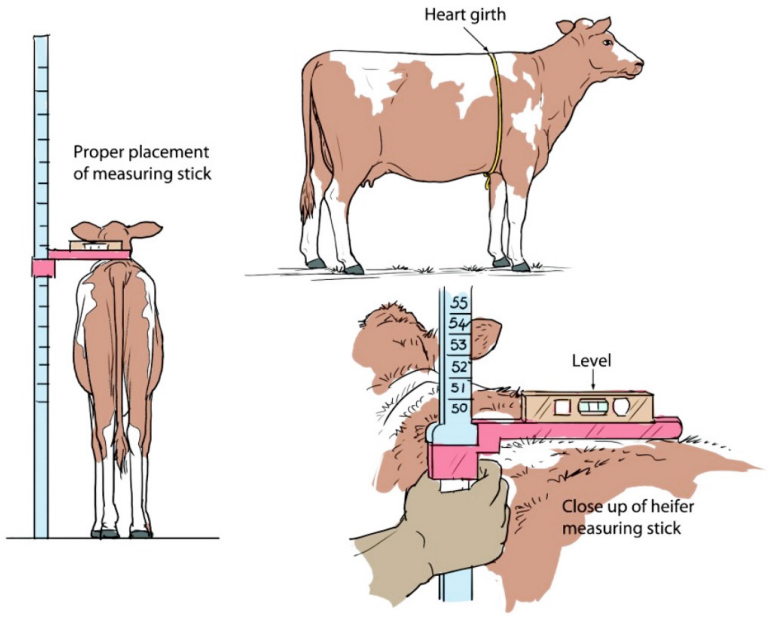

Figure 3:Three important measurements for evaluation of heifer growth

Figure 4: Heifer growth chart

2.1.3 Breeding

Regardless of age, puberty is reached when a heifer weighs approximately 40% of her mature body weight. Breeding however, is recommended when a heifer has reached 60% of her expected mature body weight. This is normally achieved when the heifer is 14 to 16 months old. Smaller breeds may be bred one or two months earlier than large breeds because they mature faster. Heifers in good condition and gaining weight at breeding time generally show more definite signs of estrus and have improved conception rates over heifers in poor condition and/or losing weight. Over-conditioned or fat heifers have been reported to require more services per conception than heifers of normal size and weight. The table below gives a guide on when to breed heifers:

Table 6: Recommended age and size for breeding and calving for different dairy breeds

Breeding			Calving		
Breed	**Age in Months**	**Size in Kg**	**Height in cm**	**Age in Months**	**Size in kg**
Jersey	12-14	230-275	112	21-23	350-375
Guernsey	14-16	290-320	120	23-25	375-400
Ayrshire	14-16	320-350	120	23-25	420-450
Friesian	14-16	320-350	125	23-25	420-450

NB: There is a tremendous increase in weight during the 9 month. This is due to heifer growth and foetal weight

2.1.4 Steaming up

Once heifers are pregnant, feeding should be adequate to ensure proper development to avoid calving problems and poor first-lactation yield. Pregnant heifers may be maintained on good quality forage alone but concentrates should be given if the forage is of low quality. During the last two months of pregnancy, the feeding regime can affect milk production during the first lactation. The exact amount of concentrates to feed before calving will depend on forage quality, size, and condition of the heifer. A rule of thumb the heifer should be fed concentrate at 1 percent of body weight starting about 6 weeks before calving with a ration balanced in protein, minerals, and vitamins.

Feeding concentrates allows the rumen bacteria to get used to digesting high levels of concentrate, which is very important during early lactation. If practical, concentrates should be fed in a milking parlour as this accustoms the heifer to the milking parlour. Well managed heifers will have a minimum of problems at calving, but ease of calving can be affected by plane of nutrition in two ways:

i) An effect on calf size, and
ii) An effect on fatness of the dam

Fat heifers have higher rates of difficult calving because of small pelvic openings and usually a larger-than-normal sized calf at birth. Underfed or poorly grown heifers also will require more assistance at calving and have a higher death rate at calving than normal sized heifers.

2.1.5 Housing

When considering housing for heifers, the following factors need to be considered:

- Convenience of feeding: Feeding from outside the house is desirable as it minimizes stress and risk of injuries.
- Cleanliness of the sleeping area: It should be easy to remove bedding or clean the sleeping area.
- Convenience of moving and restraining animals: Heifers go through management practices such as vaccination, dehorning, deworming, weighing, artificial insemination and they require restraint. The housing facility should meet the animal's requirements but also make it easy to handle them.

From weaning to five months, the young heifers may be housed in small groups of four to five. However, the house should be sheltered, clean, have dry bedding, good ventilation and easy access to water and feed. For zero-grazing systems, the heifers may be housed in the same unit with the mature cows, but in a separate cubical fitted with feed and water trough. If they are to be housed in a separate unit, a free stall may be used but it should include outside lots for exercise and feeding.

From the sixth month, heifers may can be kept in paddocks in the pastures but watched regularly. Shelter and fenced area must be constructed to ease animal handling and restraint but the degree of protection needed will depend on weather conditions. Facilities for feeding supplemental feeds and minerals must also be provided.

2.1.6 Health management

Raising healthy heifers is important in all dairy production systems as health affects growth rate, fertility and hence age at first calving and milk production. Losses are also incurred in form of veterinary costs and death limiting the opportunity for selection of high quality animals and or sales. Most of the common diseases affecting calves are also important in heifer rearing and have been dealt with in the previous chapter.

Notes

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