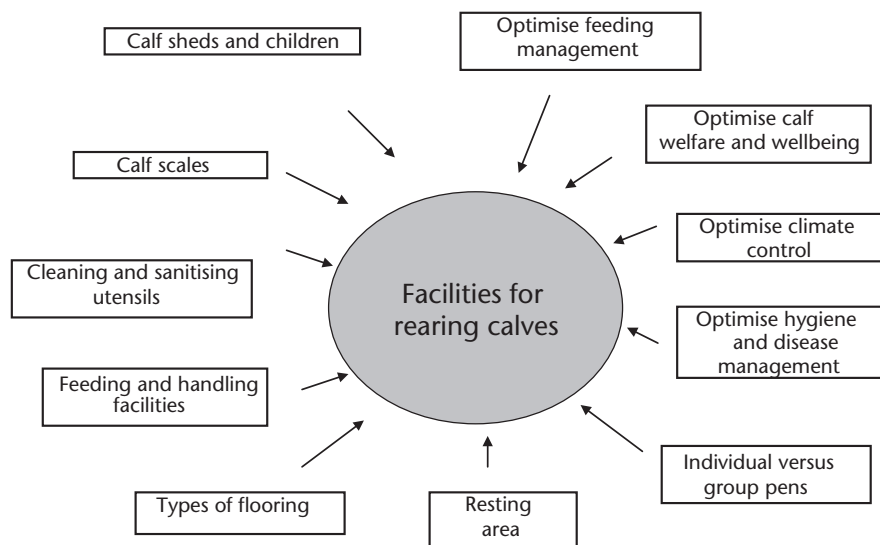


# Facilities for calf and heifer rearing in the tropics

This chapter discusses the housing of young stock and other facilities required in a well-designed calf shed.

## The main points in this chapter

- Close attention should be given to the design, construction and maintenance of facilities for calves and heifers.
- Considerations are to optimise feeding management, stock welfare and wellbeing, climate control, hygiene and disease management.
- Stock should always be provided with adequate feed and water.
- Herd management practices should always minimise stress, injury and disease.
- Staff should be adequately trained or experienced in good animal care.
- Calves can be housed in individual pens, providing 1–2 m<sup>2</sup> of floor space with a well-drained floor.
- Containing each calf in a raised metal cage provides the best housing because they are isolated from each other, live in a well-ventilated and clean pen, are easier to feed and water and allow for much easier individual surveillance.
- Group pens allow for easier feeding, although no more than six calves per pen, making it easier to regularly observe the animals with one or two glances per pen.
- Healthy calves can tolerate quite cool conditions as long as they are protected from draughts and provided with a dry floor on which to lie.
- There are many types of flooring in calf pens and there is little difference in calf performance provided they can rest in a clean and dry location.
- Routine cleaning and sanitising of all feeding equipment is essential to maintain good calf health. The WATCH principle should be used when cleaning utensils and they should be allowed to dry completely before reuse.
- With the potential of many diseases being passed on from calves to humans, it is important to supervise children closely in the calf shed and ensure they wash their hands and faces before eating.



**Figure 7.1.** The key factors to consider when planning calf- and heifer-rearing facilities

This chapter discusses the housing of calves and heifers to ensure their wellbeing and acceptable performance during the milk-rearing and growing-out phase until they enter the milking herd.

Close attention should be given to the design, construction and maintenance of facilities for calves and heifers (see Figure 7.1) to optimise their performance in the herd with regard to:

- stock welfare and wellbeing
- feeding management
- climatic control
- hygiene and disease management.

## 7.1 Stock welfare

Throughout the world, public perceptions of farm animal welfare issues have the potential to markedly affect the sustainability of livestock industries, with national and international pressures likely to have increasing roles in determining how animals are managed. Because farm animal welfare is largely part of good animal and farm management, paying close attention to their day-to-day management should also ensure acceptable welfare.

### 7.1.1 The five basic freedoms of livestock

The welfare of cattle can be summarised in the ‘five basic freedoms’ as follows:

1. Freedom from hunger and thirst, through ready access to fresh water and a diet to maintain full health and vigour.



Calf crates allow for individual management and monitoring of newborn calves.

2. Freedom from discomfort, through provision of appropriate shelter and comfortable resting areas.
3. Freedom from pain, by prevention and, when sick, rapid diagnosis and treatment.
4. Freedom to express normal behaviour by providing adequate space, proper facilities and the company of other animals.
5. Freedom from fear and distress by ensuring conditions and treatment that avoid suffering.

All management and housing systems should be designed, constructed, maintained and managed to assist with these five freedoms.

### 7.1.2 The six basic elements of stock welfare

Specific to dairy herd management, calf and heifer welfare can be broken down to six basic elements: facilities and equipment; provision of feed and water; herd management; humane killing; staff competency; and preparation, selection, sale and transport of stock.

#### 1. Facilities and equipment

These should be well designed, maintained and operated to ensure a high level of animal welfare, minimal stress or chance of injury. This includes:

- protection from extremes of weather
- provision of sufficient space with minimal possibility of injury



A well-constructed and managed calf-rearing facility.

- flooring designed to minimise slipping, falling and lameness
- facilities for water, feeding and restraint appropriately designed and maintained
- laneways, tracks and gateways designed to minimise stress and injuries
- equipment for euthanasia in good working order.

## **2. Provision of food and water**

Food and water should be provided with consideration of environment, age and body condition that ensures stock health, wellbeing and productivity. That is:

- Stock should have access to food and water of an appropriate quality and amount.
- Stock should be fed rations formulated and balanced to provide the necessary nutrients for their desired level of performance.
- Short- and long-term plans should be in place to manage food and water shortages and drought.
- Practices should be in place to reduce the potential risk of toxicity or contamination during feed storage.

## **3. Herd management**

Dairy calves and heifers should be routinely managed and handled to minimise stress, injuries and disease and promote good health and welfare. Such procedures should ensure that:

- Reproductive practices should be carried out competently to ensure good animal welfare and reproductive outcomes.
- Other routine husbandry procedures such as disbudding, castration and calving induction (if required), are carried out to minimise pain and unnecessary suffering.
- Systems to manage disease and other animal health disorders should optimise the planning, prevention and monitoring of the health of the dairy herd.
- Disease, injury, illness and stress should be identified and treated promptly with suitable expert advice sought as required.
- Animals should be inspected regularly to monitor their health and welfare.

#### **4. Humane killing**

Weak, ill or injured calves and heifers should be identified and treated appropriately or humanely destroyed using approved methods.

- Stock requiring humane destruction are identified and promptly euthanased.
- Competent staff are available to carry out humane euthanasia, using approved methods.

#### **5. Staff competency**

All staff responsible for managing and handling stock should be competent in their tasks and aware of their responsibility for good animal care.

- Staff carrying out routine husbandry, surgical procedures, reproductive procedures, administering health treatments and handling and transport of cattle are appropriately trained or experienced.
- All staff handling stock can identify signs of illness, abnormal behaviour or stress and ensure appropriate action is taken.
- There is a competent person either available on site or that can be contacted to handle emergencies and humane destruction when necessary.
- Staff behave in a manner to minimise fearfulness in cattle.

Stockmanship, plus the training and supervision necessary to achieve required standards, are the key factors in the handling and care of livestock. A management system may be acceptable in principle, but without competent, diligent stockmanship, the welfare of animals cannot be adequately safeguarded.

#### **6. Preparation, selection, sale and transport of stock**

Stock should be selected and appropriately prepared for transport to ensure they are fit for the intended journey.

- Preparation for sale and transport includes appropriate actions for feed and water curfews, identification and handling to minimise stress.
- Stock are selected for transport with consideration of age, class and condition to ensure they are fit for the intended journey.
- Any weak, ill or injured stock are not transported until deemed fit by a competent operator.
- Stock should be handled with care during loading and unloading.

### 7.1.3 Other general principles of stock welfare

Whether housed in cubicles, straw yards or cow sheds, in order to maximise performance and ensure satisfactory standards of welfare, the accommodation must provide for stocks' basic needs. As an absolute minimum, the housing must provide a comfortable, clean, well-drained and dry lying area together with shelter from adverse weather. It must allow the animal to move freely around without risk of injury.

Dairy stock at pasture choose to lie down for 12–14 hr each day, so a similar target should be achieved with stock in sheds. If they spend less time lying down, they are likely to spend more time standing in loafing or feeding areas, which can adversely affect hoof health.

Most farmers believe that animal welfare is just good cattle husbandry. The major welfare issues facing dairy farming include:

- housing and stock comfort
- castration of bull calves
- disbudding or dehorning
- branding
- transportation
- slaughter.

Lameness can be a major problem, both from the point of animal welfare and farmer profits. Farmers frequently recognise only 40–50% of lameness problems and these are often well advanced, making them difficult to treat. The calf or heifer's environment, both social and physical, and her ability to cope with it ultimately determine how bad lameness can become.

Early separation of calves from their dams is another welfare issue that is practised for animal health reasons, to decrease exposure to pathogens from the calving area. To improve the likelihood of calves receiving sufficient quality colostrum in their first 12 hr of life, they should be assisted to suckle their dam or the colostrum can be administered using a teat or stomach tube.

It is important to maintain animals in good body condition, house them in social groups in clean environments with adequate space to move around and rest comfortably, maintain feed, medication and production records and compassionately handle animals undergoing management practices, such as dehorning or castrating, and those that are injured or ill.

It should be remembered that, when working with calves in their first few days of life, they are newborn and have no understanding of what we want them to do. All handling should be done in a quiet and gentle manner and calves should not be carried by the legs, thrown, kicked, beaten, dragged along by their head or prodded with sharp instruments. At no time should dogs, sticks or electric prodders be used on calves of this age. If transported in a vehicle or trailer, they should not be overcrowded and be provided with at least 0.2 m<sup>2</sup>/calf.

Most Western countries have strict codes of animal welfare covering transport, housing, handling and feeding. Farmers purchasing dairy stock from such countries may be expected to abide by the principles of that country's animal welfare codes. This is particularly the case with young stock.

### 7.1.4 Problems of confinement

Dairy stock imported from Western countries have almost invariably been reared under grazing conditions, hence have never been exposed to a continual shed environment, as is common on most small holder farms (Moran 2005). Compared with grazing, confinement creates specific problems such as:

- restricting opportunity to seek comfort; for example, if only provided with cement floors
- creating problems of high humidity, which can be more detrimental than high temperature
- limiting opportunity for exercise, hence the need for routine hoof trimming
- increasing exposure to infectious diseases
- other health issues, such as mastitis and uterine infections when hygiene is poor during milking and calving
- creating problems of heat detection for artificial insemination
- requiring greater efforts in sanitation
- magnifying problems of social dominance
- increasing capital investment.

## 7.2 Housing calves

The way calves are housed depends mainly on the climate. The colder the climate, the more attention should be given to housing, although calves are more sensitive to draughts than to the actual cold. Calves can be housed in single or group pens. Calf sheds need not be expensive structures, but they should be built in ways that allow for easy cleaning and maintenance of hygienic conditions.

Calf housing should be directed more towards protection against severe extremes rather than from normal seasonal variations in which the calves' hair coat and natural instinct provide protection. Good ventilation is essential to minimise potential problems with pneumonia.

### 7.2.1 Selecting the site and shed layout

A good calf house is one that meets the demands of both animals and operator at reasonable cost (Moran 2002). Calves obviously need protection from rain, draughts (in winter) and direct sunlight (particularly during summer), as well as a clean, dry floor on which to lie. The operator needs a building that is comfortable and convenient to work in, particularly for routine daily tasks such as feeding and cleaning. The operator should also be able to clearly observe all calves at all times (during day and night) and be able to single-handedly catch, restrain and administer treatment to any animal requiring attention.

#### Siting the shed

Consider the area chosen to rear the calves. The history of the area should be investigated and fully known. For example, if calves will spend considerable time outside the shed, that area could have been grazed by older stock and pose a high risk of disease for calves due to faecal contamination. Similarly, multipurpose sheds may have been used to store



chemicals, other farm products or machinery, putting the calves at risk of poisoning or residue contamination.

If possible, a good plan is to maximise the time when the shed is empty between batches. All bedding should be removed and rails, gates and feeders should be cleaned to remove faecal material. Steam cleaners are very effective for this purpose. Disinfecting gates, pens and shed walls with a broad-spectrum disinfectant can also be beneficial. However, using products to sterilise dirt, such as lime, have minimal impact on pathogens in the soil and can be an irritant to staff and calves exposed to them; there seems little scientific justification for their use. The longer the calf-rearing area is free of calves and bedding, the less disease causing organisms will be present: even a 1 or 2 week period can significantly reduce the concentrations of disease organisms.

Sunshine provides a number of benefits to calves because it warms calves in winter and dries out and disinfects their bedding. It also stimulates vitamin D production (which is important in utilisation of milk). The shelter is considered adequate if it is comfortable for a person to sit dressed only in light clothing.

The building and fittings should be designed to allow for easy cleaning and disinfecting between batches of calves. Any sharp pipes, broken gates or sharp edges in calf pens should be eliminated to prevent calves from scratching and cutting their skin. The shed should provide adequate space for storage of feed, hospital pens for sick calves, a desk for record keeping and a washing-up area (with hot water) for milk-feeding utensils. Protection against vermin and birds, and possibly even flies, is important. The siting of the feed store and the location of doors and passages are important because these will influence the total distance covered each day. Therefore the shed should be designed to enable tasks to be carried out quickly and without unnecessary repetitive movements.

### **Ventilation**

Good air quality is critical for good calf health. High levels of disease-causing organisms and pollutants such as ammonia and other noxious gases can lead to high levels of disease. High temperatures and humidity can increase the ability of disease-causing organisms to survive in the air.

Where cold stress can adversely affect calf wellbeing, the shed must be designed and positioned to be draught free at calf height, but still allow regular air movement above to remove pollutants. Improved ventilation can be achieved in sheds with their back to the prevailing weather by creating an opening of 60 cm at the very top of the wall. This is necessary in open-faced sheds that are 9 m or more deep. Sheds that are not purpose designed can pose some problems. Ideally, calves should have a near solid side on the prevailing weather aspect of the shed, allowing for ventilation gaps. Slatted floors can provide excessive draughts and should be modified with shade cloth and bedding to prevent this occurring in areas with cold winters. Many sheds have no windows or air vents and these should be modified to provide better ventilation and improved animal health and welfare outcomes.

A quarantine area for newly introduced calves could be incorporated, but this should be specifically designed for thorough cleaning and disinfecting, with sufficient pens to



rest each one for at least 2 weeks before occupancy by a new calf. Pressure hoses should be used for cleaning, while a steam cleaner may reduce the need for disinfecting pens. There is less chance of disease build up by using galvanised iron, rather than wooden, pens and fittings because dried faeces are easier to remove from iron fittings. Poorly cleaned wooden pens can provide an ideal medium for bacteria to survive.

Rather than wean calves directly onto pasture, it is best to house them for several more weeks to ensure effective rumen development. Ideally, weaned calves should remain in their milk feeding pens for at least a few days after weaning so they can get used to their new feeding regime before having to adjust to any new pen and pen-mates. If the concentrate mix fed during milk rearing is different to that fed after weaning, both should be on offer (separately or mixed together) for the few days after weaning. If outside grazing areas are available, weaned calves and older heifers could be grazed, as long as they can be provided with troughs for supplementary feeding and shelter when required.

A good management practice is to divide replacement heifers into the following four age groups:

- >1 month-old milk-fed calves
- 1–5-month-old milk-fed and weaned calves
- 5–22-month-old weaned heifers and yearlings
- 22 months and older pregnant heifers.

### 7.2.2 Individual pens

It is easier to observe calves, and there is less risk of disease transfer, when they are individually penned. Ideally, the pens should be moveable and be enclosed with three draught-proof walls. Each pen should have 1–2 m<sup>2</sup> of floor space with a well-drained floor and, if desired, clean bedding each day. An individual pen 1.5 m × 0.8 m is the minimum required up to 4 weeks of age, while a pen 1.8 m × 1.0 m will suffice for an 8-week-old calf.

There should be containers for milk, water, concentrates and roughage. Calves should be confined to these pens until weaning, after which they could be allowed outside during the day. The walls should be impervious to prevent nose-to-nose contact and contamination by dung and urine. They should be constructed of material that allows thorough cleaning and disinfection between calves, such as sheet metal or plywood.

Alternatively, calves can be tethered in a 60 cm wide pen, which is open at the back. Dung and urine usually pass to the rear rather than to the walls of the pen, the next pen or the feed and water buckets. The walls can be constructed of cheaper material and less bedding is required. However, the bedding at the rear will require more frequent replacement and the pens should be raised 20 cm above the ground to keep them drier.

Some farms rear calves in individual hutches, which are usually placed outside, side by side, with each one enclosed on three sides. The design aims to provide ample ventilation without exposing calves to direct draughts. The main advantage of hutches is the improved natural ventilation and reduced chance of disease transmission from calf to calf. Even in very cold weather, calves in outdoor hutches eat more feed, grow faster and have less animal health problems than those inside warm barns. Furthermore, calf

hutches can be moved to new areas with each batch of calves to reduce any disease build up. However, their role in calf rearing in the humid tropics would be limited by reduced access for feeding during lengthy periods of rain and the accumulation of mud when located on bare ground.

### 7.2.3 Calf cages

Containing each calf in a raised metal cage provides the best housing because they are isolated from each other, live in a well-ventilated and clean pen, are easier to feed and water (because the rearer does not have to bend down to feed them) and, of most importance, allow for much easier individual surveillance. Calves should live in cages for up to 3 weeks of age, after which they can be moved to individual pens.

Each cage should be 110 cm long, 75 cm wide and 105 cm high (including the legs). The rear of the cage is a removable gate to put the calf into, or remove it from, the cage. The floor can be made from wood or plastic, with the floor lattice perpendicular to the length of the cage. The space between floor boards should be 1.5–2 cm. The cage should stand on legs and be 30 cm above floor level. To avoid injuries, there should be no sharp edges inside the cage. The metal bars should be about 15 cm apart: any narrower can lead to injuries if calves get their legs stuck between the metal bars.

Three buckets should be attached to the front of each cage. For teat-fed calves, one is for water, one is for concentrates and one is for hay. For bucket-fed calves, the concentrate one should be cleaned out each day and used for milk feeding. If desired, straw can be placed on the cage floor for calf comfort.

Physical contact with other calves should be avoided, but calves need to see each other. Cages should be at least 50 cm apart and placed in a well-ventilated but not draughty place.

### 7.2.4 Group pens

It is more difficult to observe individual calves in group pens, but feeding them is easier. Slow-learning calves in group pens will often learn to drink from a bucket or nibble on concentrates more quickly than they would if in individual pens or cages. The floor should be well drained and can consist of wooden slats or deep litter where they might lie down. Troughs for water, milk, concentrate and roughages are required in each pen. Calves can be fed via teats or taught to drink from a bucket or trough. Self-sucking or sucking other calves' udders or navels can be a problem, but this is less likely with teat-fed calves.

When housing calves in groups, the optimum group size is six calves or fewer, with sufficient floor space (at least 1 m<sup>2</sup>/calf), making it easier to regularly check the animals with one or two glances at each pen. Ideally, calves should not be moved from one group to another. Sick calves should be moved to hospital pens and, once recovered, to a new group. New calves should never be introduced into existing groups to replace dead calves.

With a 35 cm/calf pen frontage and 1.5 m<sup>2</sup>/calf total area, group pens should be 3–4 m deep. In fully enclosed sheds, the stocking density is generally limited by the air volume per calf, rather than the floor space. The recommended cubic capacity is 6.5–7 m<sup>3</sup> per calf, with a ceiling height of at least 2.7 m.

### 7.2.5 Isolation pens

There should be some ‘hospital pens’ for isolating sick calves and heifers. This should be easy to clean and sterilise and have solid partitions to minimise contact between stock. It is convenient to store equipment in a specific veterinary drug box close by these pens for treating health problems, taking blood samples, and so on. There should be one treatment stall per 20 calf pens or cages.

## 7.3 Physical comfort of calves

The ideal temperature and humidity for calves is 17°C and 65% relative humidity. However, a normal healthy calf, eating well, is remarkably cold tolerant and is hardly affected by air temperatures below freezing point, provided it is dry and not exposed to draughts. On the other hand, sick calves, particularly emaciated ones with poor appetites, are very susceptible to cold. In regions with cold winters, the hospital pens should be in a warmer part of the calf shed and should be able to be heated, if required.

Calves lying on dry concrete lose more heat than those lying on wooden slats or damp straw. The warmest bedding is deep dry straw, wood chips or rice hulls. Draughts coming up through wooden slats or metal-grating floors should be eliminated during winter. These draughts can be easily detected using a lighted candle or match. On the other hand, draughts on hot summer days improve comfort by decreasing heat loads on shedded calves. Heat stress can also be reduced through constructing sheds with insulated roofs and well-ventilated walls, and by feeding calves in the cool of the evening.

Once air temperatures exceed 26°C, calves are outside their comfort zone. The degree of heat stress can be gauged by the calf’s respiration rate. If it is more than 60 breaths/min, the calf is showing signs of stress. If it approaches 100 breaths/min, artificial cooling is required. This can be achieved by spraying with a garden hose or sprinkler system and fan, as with other stock in the herd. In hot, humid tropical regions, well-constructed cow sheds, with high roofs, open sides, sprinklers and fans will also be the best housing for replacement stock.

Plentiful supplies of fresh drinking water are essential for calves to cope with hot weather. Because stock can double their water intake once temperatures approach 30°C (compared with 15°C), water containers should be checked and refilled more frequently.

With regards cold stress, the lower comfort zone temperature is 13°C for calves from birth to 3 weeks of age and 1°C for dairy calves from 3 weeks old to weaning. Consider providing specific facilities for re-warming sick young calves, such as heat lamps or warm blankets, ensuring that attention is given to ventilation and sanitation following use of such a warming box. Calf coats can improve insulation of sick calves, while facilities to heat milk or drinking water can also provide additional methods to warm sick calves.

## 7.4 Types of flooring

The floor of calf pens is the surface on which animals stand, walk, lie down and pass excreta. It must – depending on the needs – be either solid, non-slippery and well

drained, or comfortably soft, warm and dry and easy to clean by machinery. No single material meets all these specifications. Of most importance, it must provide calves with secure footing.

Wooden slats (50 mm × 25 mm with 20 mm gaps) placed 150–200 mm above a concrete sloping floor are ideal for calves. This arrangement allows the urine and dung to pass through the grating onto the concrete below where it can be easily removed by hosing without unduly wetting the calves. The grating should be made in sections small and light enough to be removed from the calf shed for thorough cleaning and disinfecting to prevent any build up of disease.

Wire mesh suitable for calf shed flooring is also available. Designed specifically for pig pen floors, it incorporates a mesh opening of 12.5 mm × 150 mm. It is welded onto a metal frame and should be positioned about 150–200 mm above the concrete floor.

During the milk-rearing phase, calves lie down for 17–19 hr every day. A deep litter of rice hulls or wood chips 40–50 cm thick over a concrete floor is probably the best bedding material. With occasional topping up and removal of excess dung, rice hulls can stay clean and dry for up to 4 months in summer. In winter, they will need replacing more frequently. Access could be provided for a tractor with a front-end loader or scraper to clean pens between batches. Tractor traffic must then be considered when planning concrete floor thickness. A damp-proof membrane should always be included in concrete floors. Sand does not make good bedding for calves because it does not provide any insulation and can accumulate in the stomach of calves that may consume it. The use of straw as a bedding should be avoided when such straw is also supplied as a feed source.

Alternative flooring could include concrete in the feeding area and a rice hull, wood chip or sawdust deep litter at the back of each pen. Dry straw is excellent, but is very labour intensive. When given a choice, calves seem to prefer sawdust and rice hulls to straw and wooden slats, and they least prefer metal gratings. Despite these preferences, there is little difference in performance of calves raised on either straw bedding or wooden slats.

Effluent disposal from pens is most important. A minimum fall of 1 in 20 will ensure that free liquid drains away. Drainage channels should run under the feed and water buckets at the pen fronts and drain both pens and passages.

## 7.5 Feeding and handling facilities

Feeding space requirements for individually fed calves (whether individually or group penned) is 35 cm/calf. This may limit the shape of group pens with bucket feeding to allow for sufficient frontage to the feeding passage. When feeding concentrates from a trough or bulk feed bin, allow 10 cm/calf. Troughs are more versatile, but less protected from birds and vermin. Hoppers must be robust and provide an even flow of feed without blocking or bridging. They should also be kept clear of the built up manure. A 10-week-old calf is able to reach into a trough 70 cm above the ground. If restricting or controlling concentrate intakes, 20–30 cm feeding space/calf is required. Group-fed weaned heifers also require 30–35 cm/head feeding space.

Large volumes of milk replacer can be mixed with warm water in stainless steel tanks using electrically powered rotors. In large calf-rearing sheds, it can be pumped or gravity

fed to buckets using a petrol bowser dispenser. Feed scales are essential to ensure accurate weighing of powder. Whole milk can be pumped directly from the milking parlour to buckets or even to feeding drums located in nearby paddocks. If transition milk is being preserved, a milk line could be used to take it directly from the milking parlour to the preserving tank. Hot water is essential for cleaning feeding utensils.

Portable milk tanks with a delivery hose could be used when rearing calves in outdoor hutches. Whatever the method, regular flushing of hoses with water and thorough cleaning of milk dispensers and buckets is important. Concentrates can be automatically handled and dispensed using large silos and conveyors of the auger, chain or endless belt-type, such as those used for supplementing dairy cows during milking. Straw can be chopped then fed out in troughs or more easily handled unchopped using hay racks.

Water can be supplied through troughs or bowls, with one communal trough per two pens or one water bowl for up to 20 calves. Under normal conditions calves can drink up to 15 L/day, and 25 L/day on hot summer days. Drinkers must be guarded against pollution by faeces (both from calves and birds) and damage by rubbing. Water bowls and troughs should be of the low pressure type, because cattle tend to play with water. They should be sited away from the resting area so that spillage may drain away freely. If using buckets to individually feed the water, the water should be changed, and not just refilled, every day. In very cold weather, there can be benefits from feeding young calves with warm water. Ideally, different buckets should be used to feed milk and water; if using the same bucket, it should be washed thoroughly after milk feeding. It is worthwhile having extra buckets for water that can be rotated around the pens so all the water buckets can be scrubbed and thoroughly dried every week or so.

Nipple drinkers are a common feature in pig and poultry sheds and have been used successfully with young calves. The principle of these drinkers is that, when thirsty, calves simply push a metal nipple in the water line to extract the drinking water. They are cheaper to install and keep clean, but slow-learning calves may need to be taught how to operate them.

Stock-handling facilities should incorporate a calf race, head bail and calf scales, and lead to a loading ramp. A race for adult cattle can be modified for calves by adding a partition to make it narrower. This should be at least 1 m high and should reduce the width of the main race to 40–45 cm. In group pens, self-closing yokes at the feed face allow for easy restraining of calves for closer inspection or veterinary attention.

Passages between pens should be wide enough to allow buckets to be carried in both hands (1.2 m), be easy to clean and self-draining, have a non-slip surface, and allow easy access to the calf pens.

One very important item for any calf shed is a centrally located white board plus erasable marker pens. Managers can list jobs for staff, or details of any calves requiring particular attention. To assist in feeding and health management, every pen should be clearly numbered to remove ambiguity when recording feed intakes, calves requiring attention, and so on. There should be adequate lighting for any night-time activities and a lockable cupboard for veterinary medicine and even a small refrigerator for storing vaccines and other drugs.

### 7.5.1 Calf scales

Weighing scales are an essential component of good cattle-handling equipment. They are important for monitoring the growth of calves during rearing and ensure feeding management is sufficient for growing heifers to achieve target weights. Chest girths tapes and wither height sticks can also be used to assess calf and heifer development.

Cattle scales also allow dairy farmers to monitor changes in cows' weights throughout lactation. This will ensure that cows are being fed and managed properly to take advantage of their ability to utilise body reserves for milk in early lactation then replace it later in lactation. Changes in body condition score are a guide to this, but weight changes are the ultimate measurement. Scales can also be used to check the weight of bags of concentrate feed ingredients or bales of hay or silage, to assist in supplementary feeding programs.

### 7.5.2 Office and staff facilities

Maintaining good farm records is much easier in a farm office. An area in the calf shed could be dedicated to keeping records. It must have a desk and good lighting. It must be a quiet place in which to set up the office files (preferably in a filing cabinet) and computer and office supplies. The 'how and when' of keeping farm records depends on the person recording them. Computers are very convenient, but require money to purchase and skills to operate efficiently. Record keeping should be given as high a priority as other farming activities.

Suitable chairs and tables should be included for business meetings with service providers and other farm-related visitors. Farm staff should also be provided with space to eat and relax when off duty. This could include a shower and toilet, food preparation area, and storage for their work clothes.

## 7.6 Cleaning and sanitising feeding equipment

As SHD farmers are more frequently being penalised for poor-quality milk, they have become more aware of the principles of cleaning and sanitising of their milking equipment in the cow shed. But what about their milk feeding equipment in the calf shed? How often do farmers clean and sanitise it? Much of this equipment may be stored in conditions for ideal bacterial growth: namely moist, with no direct sunlight and with poor air exchange. Feeding milk out of dirty buckets and teats is a common way to spread scouring pathogens from one calf to another. Ideally, all feeding equipment should be cleaned and sterilised between feeds.

Cleaning removes residual milk from surfaces, while sanitising (or sterilising) removes bacteria from cleaned surfaces. The principles of good cleaning and sanitising can be summarised as WATCH, namely:

- **Water:** good water quality is important.
- **Action:** such as mechanical action with a scrubbing brush.
- **Time:** leave equipment long enough for the chemicals to work.

- **Chemicals:** match the chemicals for the job, detergents for cleaning and sanitisers for sterilising.
- **Heat:** chemical activity doubles every 10°C over 50°C.

The recommended cleaning and sanitising procedure for calf feeding equipment (Heinrichs 2002) should include the following:

1. Rinse equipment in lukewarm water (40–43°C) to remove leftover milk, manure and dirt. Organic material reduces the effectiveness of detergents. Do not use very hot water initially because this causes the milk proteins to bond to the equipment, especially plastics, instead of being washed away.
2. Wash equipment in hot water (60–82°C) using a chlorinated alkaline detergent. Soak the equipment for 5 min and then scrub all surfaces with a brush. Soap helps to loosen fat and dirt while chlorine kills bacteria. Hot water is essential to clean the equipment thoroughly. If the water temperature falls below 49°C, fat and soluble proteins come out of solution and stick to the equipment. Scrubbing loosens and removes minerals and organic soils from the equipment.
3. Rinse the equipment in warm to hot water (43–65°C) containing an acid sanitiser for 2–3 min. Hot water is needed to activate the acid, which rinses away soap and lowers pH on equipment surfaces for 12–14 hr. The low pH prevents bacterial growth.
4. Place equipment upside down on a rack to drain and dry. It should be dried completely before the next use to prevent bacterial growth. Using a rack allows air to circulate inside buckets or bottles.
5. If calf scours are a persistent problem or equipment remains wet between feedings, a pre-feeding sanitising step may be helpful. Allow the equipment to soak in sanitiser solution for 2–5 min before use. A possible sanitiser is 70 mL of chlorine bleach mixed with 3.8 L of water.

Other key points include:

- Always read and follow label directions.
- These procedures are also appropriate for cleaning animal health equipment, such as obstetric chains used with difficult calf births, drenching guns or hand milking equipment.
- Cracked or scratched plastic containers are very difficult to clean properly. Therefore replace buckets, bottles or oesophageal feeders if the scratching becomes excessive.
- Brushes designed for bottles or teats will make it easier to cleaning them properly.
- Clean feeding equipment immediately after use to prevent residues from drying.
- Isolate the milk feeding equipment used for sick calves and wash it separately to prevent it from contaminating other equipment.
- All individual buckets for milk feeding should be cleaned thoroughly after every feeding. Using individual buckets prevents calves sharing pathogens during feeding, but they cannot prevent bacteria growing on left over milk or saliva.

Some of the traps when cleaning and sanitising milk feeding equipment include:



- **Inadequate rinsing.** Detergents do not work efficiently in dirty wash water. If the wash water is too cloudy, then there should be better rinsing beforehand.
- **Using extra detergent following inadequate rinsing.** This does not work and can damage plastic equipment and human skin. It also increases the costs and adds to the chemicals contaminating the environment.
- **Wash water is not hot enough.** Detergents have to break through milk films, lift the milk components from the surfaces and break them into small enough particles to stay suspended in the wash water. This does not happen efficiently when the wash water falls below 50°C.
- **Water is too hard for detergents to work well.** If the detergents will not soap up, the fresh water may contain too many dissolved chemicals, so a water conditioner or softener may be needed. This can 'pay for itself' because less detergent will be needed.

### 7.6.1 Detergents and disinfectants

Detergents and disinfectants should be selected based on the job they must perform. Their effectiveness depends on their concentration, water temperature and contact time. Although increasing any of these also increases their performance, any deviations from the recommendations can reduce their effectiveness.

When cleaning both housing and feeding equipment, the important contaminants are organic matter and minerals. Detergents for cleaning feeding equipment are similar to those used to wash milking equipment by hand. Alkaline detergents remove both mineral and organic matter, although hard water may interfere with cleaning. A detergent compatible with the quality of water should be selected and the label's directions for concentration, temperature and contact time followed closely. Chlorinated alkaline detergents are most commonly used in developed dairy industries. Chlorine loosens protein, while alkali substances dissolve fat, protein and carbohydrates. Acid cleaners remove mineral deposits.

In general, disinfectants should be broad spectrum, non-irritating, non-toxic, non-corrosive and inexpensive. Other considerations include their effectiveness against specific pathogens, safety of use, residual activity and the surface to be disinfected (skin, metal, plastic, rubber, wood, etc.).

The effectiveness of disinfectants depends on several factors. First, the surface must be clean. Disinfectants can be inactivated by protein (or other organic material), the wrong pH and soaps. Next, they must be applied at the proper concentration and temperature and be allowed adequate contact time. The degree of contamination affects the concentration and contact time required.

As with all farm chemicals, precautions must be taken when handling cleaning and sanitising materials:

- Make sure that containers of chemicals have tight-fitting lids and spouts to prevent fumes and spills. Clearly label the containers, including the manufacturer's directions for use.
- Store the containers in a locked room to prevent children and unauthorised people for entering. The room should be cool and well lit.

- Use acid-resistant gloves, eye protection, face shields and protective footwear when mixing chemicals. Mix only in ventilated areas.
- Slowly add chemicals to cold water (never hot) and never add water to chemicals.
- Never mix chlorine compounds with other chemicals because this can produce deadly chlorine gas.
- Display details of the cleaning directions for each piece of equipment for temperature, amount of water, amount of chemical and contact time in clearly visible locations.
- Display emergency numbers (poison control and hospital) near telephones.
- Place an eye wash station near the chemical mixing area; if chemicals get into the eyes, flush with water for 15 min and see a doctor.
- Do likewise if chemicals touch the skin, and remove contaminated clothing.
- Rinse empty containers and dispose of them according to any local regulations.

### 7.6.2 Using household bleach as a sanitiser

Bleach is a weak solution of sodium hypochlorite and can be used as a sanitiser to sterilise clean milk handling equipment. When purchased for household use, the label often includes a 'shelf life' or length of time when it remains stable. It is important to store bleach away from light and in a cool place. However, it is only likely to be effective for several months.

The bactericidal effect (that is its ability to kill bacteria) of bleach is increased by:

- time: the longer the exposure, the better it kills
- concentration: the stronger the solution, the better it kills
- temperature: the hotter the solution, the better it kills.

So, its effectiveness in sterilising clean equipment is best when using a strong, hot solution and with as long an exposure as practical.

## 7.7 Calf sheds and children

Unfortunately, with ever-increasing stories about accidents and deaths on farms, many of which involve children, the owners and managers of calf-rearing operations must become more aware of the dangers for children in calf sheds. With increasing surveillance to comply with Occupational Health and Safety requirements, staff need to be protected from work-related accidents.

When purchasing chemicals for veterinary or cleaning/sanitising purposes (whether specifically for calf rearing or for other farm uses), ask for the associated material safety data sheets and store them in a secure, but easily accessible, place. These sheets will provide you and your doctor with information essential to treat any accidental spillages or swallowings, with the latter more likely by children. Keep all chemicals out of reach of children, and preferably in a locked cabinet. Place a first aid kit in the calf shed, in a nearby office or in the staff room and make all staff aware of its presence.

It goes without saying that all children, particularly those that live in towns or cities, love calves. When children visit the calf shed, keep an eye on them, either yourself or ask

one of your staff to do so. Even small calves can become unsettled and injure a small child if they are unable to move out of the way.

Milk-fed calves, being monogastrics, carry many of the same diseases as humans. These diseases are called zoonoses. The most important ones include:

- *Salmonella*, *E. coli* and *Cryptosporidia*
- ringworm, mange and other skin diseases
- leptospirosis, which is more of a problem with adult cows
- Q fever.

In past years, doctors located in dairying regions of the US and Australia have noted a close association between outbreaks of specific pathogens causing calf scours and its occurrence in very young children. When children visit the calf shed, extra precautions should be taken with their personal hygiene. They should be made to wash their hands and face carefully prior to eating. Ideally, they should change their footwear and even clothes. If they frequently visit the calf shed, for example to assist with feeding the calves, they should have a pair of boots specifically for use in the calf shed. Elderly people, with a reduced immune system, could also be more susceptible to zoonoses.