14

Mating and calving management of dairy heifers

This chapter discusses the optimum management of dairy heifers during mating and their first calving.

The main points in this chapter

- The key decisions when mating dairy heifers are: what age and weight should they be and what type of mating (natural or artificial) should be used?
- Mating heifers at too low live weights will lead to reduced fertility and more calving difficulties. Mating pure or crossbred Friesians weighing less than 260 kg will lead to more calving difficulties, as will mating Zebu dairy-type or Jersey heifers at less than 200 kg.
- 'Catch up' feeding after mating often results in heavier calves at birth, over-conditioned heifers and more calving problems, with little improvement in milk yield during the first lactation.
- A herd of 100 cows generally requires the rearing of 20 to 30 heifer replacements each year. Bulls (or semen) must be selected on 'ease of calving' to reduce potential calving difficulties.
- Natural mating of heifers is easier than artificial insemination (AI) and running heifers with a bull for 9 weeks can lead to good pregnancy rates, provided the heifers are actually cycling.
- AI will provide greater scope for selection and genetic improvement in the dairy herd, but it requires a higher level of skill in heat detection and insemination. Natural mating is often required after AI to further increase conception rates.
- Heat detection aids can be used, such as tail paint, pressure-sensitive heat mount detectors, vasectomised bulls or hormone-treated steers. Heat synchronisation also reduces the time required for heat detection.
- Sexed semen can produce 90% heifer calves in a well-managed breeding program. However, in addition to its considerably higher cost, conception rates are lower than with conventional semen (40% versus 50% with virgin heifers).

- It is important that calving heifers are provided with a good, clean calving area to minimise injuries to the uterus and reduce infections in newborn calves.
- The newborn calves should be permanently identified, their navel cords disinfected with iodine and they should be assisted to suckle their dams or be provided with adequate good-quality colostrum.

This chapter covers two key areas of post-weaning dairy heifer management: namely mating and calving down the first calf. Figure 14.1 provides a visual summary.

14.1 Mating replacement heifers

When deciding on the most appropriate mating management for their replacement heifers, farmers need to ask a series of questions, such as:

- What age should heifers be at mating?
- How big or heavy should heifers be at mating?
- What type of mating, natural or artificial, should be used?

A normal pregnancy takes 282 days from conception to calving. If heifers are to calve at 24 months of age, they should be mated at 15 months. The only time when heifers should calve older than 24 months is when their growth has been restricted and they are not sufficiently developed to mate at 15 months.

Most changes in skeletal size occur before puberty. The onset of puberty – that is, the commencement of cycling – is related to live weight rather than age. A delay in puberty

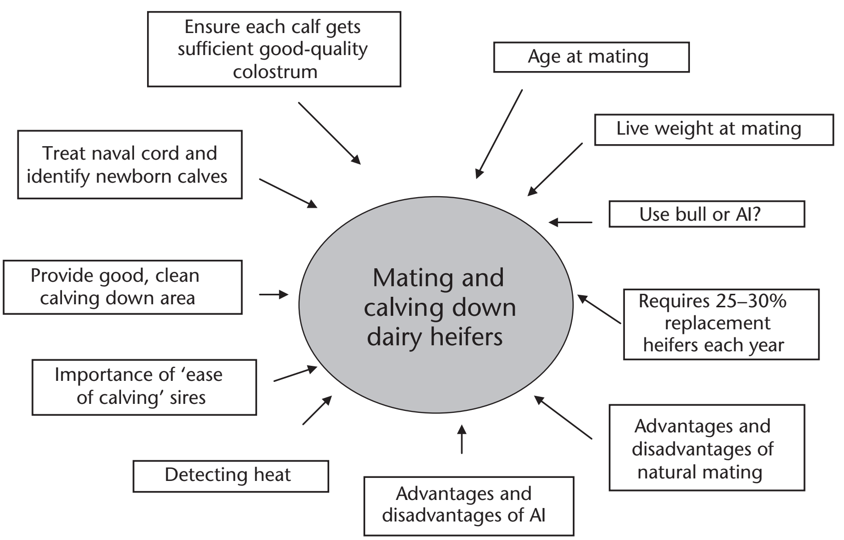

Figure 14.1. The key factors to consider when planning mating and calving down of dairy heifers

means an increased chance of a delayed first conception, which can disrupt future calving patterns.

All heifers should reach minimum live weight before mating, because lighter animals have lower conception rates and more calving difficulties. Mating pure or crossbred Friesians weighing less than 260 kg will lead to more calving difficulties, as will mating Zebu dairy-type or Jersey heifers at less than 200 kg. 'Catch up' feeding after mating often results in heavier calves at birth, over-conditioned heifers and more calving problems, with little improvement in milk yield during the first lactation.

Data from tropical breeds are limited, but it is likely that the normal variation in the gestation period is between 275 and 287 days, as in temperate zones. The normal variation for heats, 18 to 24 days, is also similar to temperate regions. There is, however, a major difference in the duration of the heat. In temperate zones, it averages 18 hr, ranging from 6 to 30 hr. In both temperate and tropical breeds in the tropics, the average is much shorter and this short period often occurs at night, when 'silent' heats are more common. This complicates breeding management, with often low fertility unless special managerial measures are employed. This is particularly so for grade Friesian dairy herds.

AI should be used only when the support infrastructure is available and herd management is good. Even with AI, a back up bull should be available to breed heifers that miss the normal AI program. Heat detection may be improved with vasectomised bulls or using heat mount detectors, located on the back of cows, that burst when she allows another animal to mount her.

Dairy cows usually come into heat 30 to 60 days after calving. A percentage of heifers and cows are always sterile and in temperate zone this varies from 3% to 5% in cows up to 10 yr of age; the incidence is higher in older cows. Culling for sterility is essential, while short heat periods and silent heats can be reduced by aggressive culling. Once the cows conceive, 2–3% may lose their calf due to abortions.

Batch calving, or calving down cows at particular times of the year can lead to easier feeding, such as in the early wet season when forage supplies and quality are at their best, or be part of breeding management, such as not trying to mate cows in the hottest season. However, because most small holders are seeking a regular milk income, ideally they should be calving cows down throughout the year.

Heifers should be gaining weight for at least 60 days before mating, be in good body condition and be seen to be cycling. Heifers in poor condition and losing or only maintaining weight will have reduced fertility.

Calving difficulties (or dystocia) are common concerns with heifers and the major causes are:

- using a sire which produces too large a calf for the size of the dam
- poor feeding management both before and after mating
- problems with presentation of the calf at birth
- heifer- or cow-related problems with the anatomy of the birth canal.

With heifers, the first and second problems are the most common causes of dystocia, whereas with older cows, it is the third and fourth problems.

14.2 Natural mating

Natural mating is using bulls to service the heifers. The choice of bull depends on many factors, such as:

- the heifer's age
- the heifer's size or live weight
- the heifer's stage of development
- farmer's requirement for extra heifer replacements to increase herd size or achieve desired culling rates
- availability and cost of bulls.

Using beef sires over replacement heifers is a common practice on many dairy farms. The argument in favour of using beef bulls has been that small poorly developed dairy heifers are not big enough at 15 months to be serviced by dairy bulls (except in the case of Friesian heifers, other than by Jersey bulls). Problems can occur with physical damage when small heifers are mated with large bulls, because calving difficulties frequently occur with large calves being born to small heifers. However, heifers that have achieved minimum target live weight are generally capable of being successfully mated and calved to the larger dairy breeds. With the recent influx of large-framed overseas genetics into what were previously considered small and safe, easy calving beef breeds, such as Angus, many producers now experience calving difficulties through mating their smaller heifers with these beef bulls. If newborn 'bobby calf' prices are low, the value of a beef cross calf is minimal compared with the potential cost of a dystocia and the resultant loss of milk production.

The advantages of natural mating over AI include:

- There is no cost of semen or equipment needed for semen storage and insemination.
- Natural mating requires less labour with a lower level of skill than AI.
- If the bull is run with the herd for periods less than 9 weeks, good pregnancy rates can be achieved, because the submission rate is extremely high provided the heifers are actually cycling.
- No heat detection is required.

Some of the disadvantages of natural mating are:

- The genetic gain with natural mating is less than with AI.
- Capital invested in bulls could be used for other productive investments.
- Feed eaten by bulls could be used to feed cows to produce milk.
- Bulls require more secure fencing.
- Bulls are more likely to damage fences and other equipment.
- Running bulls with heifers on agistment may not be acceptable to the land owner or they might restrict the selection of the desired bull for agisted heifers.
- There is a risk of severe mating failure through infertile or lame bulls or bulls with low libido.
- Natural mating introduces the risk of venereal disease, such as vibriosis.

- Natural mating also increases the risk of disease introduction to otherwise closed herds, such as Johne's disease.
- There is an increased risk of injury to people when managing bulls.

14.2.1 Bull management for natural mating

Despite attention to achieving heavier mating live weight and the publication of calving ease values for AI bulls, many farmers still find that Friesian heifers mated to Friesian bulls leads to too many difficult calvings, compared with AI or natural mating with Jerseys. They may still prefer to use Jerseys for mating their Friesian heifers, either for ease of calving and/or to produce herd replacements. This can be a practical option because herd recording data show that Jersey × Friesian cows can be very competitive in milk production, and may have superior feed efficiency, after taking into account their lower live weights.

Sufficient bulls should be run with each heifer group. Too few bulls is a common problem, resulting in low pregnancy rates. The recommended rate is one bull for every 30 empty heifers plus one spare bull. The number can be reduced as more heifers become pregnant. For example, after a single AI, about 50% of the heifers are likely to be pregnant and only half the bulls will be needed compared with natural mating alone. However, if the heifers have been synchronised, their first heat during natural mating will be compressed so that twice as many will be on heat per day, and more bulls should be used for this first cycle.

To ensure good results with natural mating, bulls should be physically examined for reproductive abnormalities and observed to ensure they can mount, serve and ejaculate normally. They should be vaccinated for vibriosis. Their feet need to be inspected 6 weeks before mating and trimmed if they are overgrown. Lame or overweight bulls will not be able to serve their full quota of heifers, thus should be avoided, replaced or augmented with other fit bulls. The health of bulls should also be tested prior to introduction to the herd, or at least with Johnes disease, be accompanied with a vendor's declaration of a disease-free status.

Any heifer not in calf after a 3-month mating period should be culled because she is likely to have permanent low fertility: a trait worth culling to avoid.

14.3 Artificial insemination

Farmers can achieve the greatest genetic gain in their herd by mating maiden heifers with AI, using semen from 'proven' dairy bulls selected for milk, fat and protein, and a rating for ease of calving. These advantages arise from:

- production benefits from their progeny
- reducing the generation interval
- increasing the number of calves of higher genetic merit available as herd replacements.

Other advantages of AI over natural mating include:

- reducing the number of bulls required on the farm
- having a shorter mating program, particularly if using oestrus synchronisation, thus resulting in a shorter calving period and less time spent on calf rearing
- reducing the risk of disease introduction from purchased bulls
- reducing the risk of reproductive failure through bull infertility, injury or low libido
- increased handling of heifers for AI can improve their temperament after calving.

The disadvantages of AI include:

- added costs for semen purchase and storage
- added cost of heat synchronisation, if used
- increased requirement for skilled labour for heat detection and insemination
- heifers have shorter cycles than mature cows, making heat detection more difficult
- submission and conception rates can be lower, although less variable
- heifer groups often calve over a slightly longer calving period
- if heifers are away on agistment, AI programs are less convenient
- natural mating is often required after AI to ensure adequate conceptions.

It can take up to six straws of semen to generate one replacement heifer in the herd, so for a 50 milking cow herd with 25% replacement rate each year, this requires a total of 75 straws. This is based on the following assumptions:

- 50% conception rate per straw
- 10% loss of cow prior to calving (that is, pregnant cow that either dies or is culled)
- 50% female calves
- 5% loss of heifers pre-weaning
- 5% loss of heifers prior to joining
- 90% heifer conception rate to natural mating
- 3% loss prior to calving
- 3% loss within 30 days post-calving.

The traditional management system of naturally mating with terminal sires leads to a 5 yr interval between the birth of replacement heifers to the entry of their progeny into the milking herd. If heifers are mated to AI at 15 months, their first calves will enter the herd when they are 4 yr old.

A herd of 100 cows requires 20 to 30 heifer replacements each year. If beef bulls are used on heifers, these replacements must be bred from nearly all the early cycling cows, allowing little chance of selecting the better cows from which to breed future replacements. Using AI over the heifers also provides greater scope for selection and genetic improvement of the herd.

Ease of calving depends on the condition of the dam and calf factors such as gestation length, calf weight and presentation at birth. A bull rated highly for calving ease can still produce calves that have the potential to grow into large-framed cows, even though they have lower birth weights. When using AI, it is important to select easy calving sires. These should have 'calving ease' values of 2–3%; that is, only 2–3% of the calves born to that sire in mature cows will present calving difficulties. It is important to note that ‘calving ease’ values are determined from mature cows, meaning that they may underestimate difficult calvings in heifers.

14.3.1 Managing artificial insemination

Heat detection

Heifer heats are much less obvious and of shorter duration than those of older cows. An 8-hr heat is not uncommon, so successful heat detection in an AI program requires the input of time from the herd manager.

The incidence of cows showing signs of heat vary throughout the day. Recent US studies with dairy cows (Anon 2010) found that 22% of the cows showed heat between 0600 and 1200 hr, 10% between 1200 and 1800 hr, 25% between 1800 and 2400 hr while the highest incidence, 43% of the cows, showed heat between 2400 and 0600 hr the next day.

Heifers must be observed for at least 20 min, three times each day, to detect heat. Because most producers cannot allocate this much time to AI of their heifers, they often use aids or drugs to assist with heat detection.

Heat-detection aids

These include tail paint, pressure sensitive heat mount detectors (KAMAR®) and vasectomised bulls or hormone-treated steers with chin ball markers. Recent technology is also now available, either using electronic pressure-sensitive pads to monitor heat detection (Heat Watch®) or pedometers to measure the number of steps taken over 24 hr. No single heat detection system can be recommended for every herd because factors vary between herds and most systems can work well. The choice of heat-detection aids depends on many management factors and whatever the system chosen, it will have to be managed well to ensure good results.

Tail paint is applied in a strip about 20 cm long and 10 cm wide, centred on the highest point of the tailhead where it will be disturbed when the heifer is mounted. A heifer is classified as on heat when the tail paint is disturbed. Any exterior house paint can be used and bright colours are easy to see. A different colour paint should be used after insemination to help detect heifers that have not conceived, so they can be mated again using AI or conceive later to a natural mating.

There are many different ways to use tail paint and most will work if carefully managed. One system that works well is to apply fresh tail paint every 3 days and observe heifers very carefully in the paddock or in a race twice per day, then inseminate any with tail paint that is not clean and shiny, but was clean and shiny at the last observation.

KAMAR® heat detectors are glued onto the highest point of the tailhead. When rubbed firmly, following mounting from another animal, a capsule of dye breaks, indicating that this heifer is probably on heat. Both KAMAR® heat detectors and tail paint can give ‘false readings’, and so should only be used as aids to heat detection. Other signs of heat should be observed at the same time to confirm oestrus, or poor pregnancy rates may result.

Heat synchronisation

Heat synchronisation reduces the time required for heat detection. A group of synchronised heifers can be managed more easily and precisely because they are all at the same stage of pregnancy. Synchronisation also concentrates the resulting calving over a shorter period, reducing the time needed to oversee calving. AI-bred calves from synchronised heifers are born closer together, reducing management problems during calf rearing. Optimum results will only be achieved under ideal conditions, such as during fine weather, with access to good yards and handling facilities and when heifers are in good body condition. If conditions are not ideal, it may be advisable to use natural mating rather than AI.

In seasonal calving herds, a heifer synchronisation program can advance the average calving date by up to 10 days. This is partially offset by reduced submission rates. If heifers are mated, say, 10 days before the cows, then their earlier calving date will give them ten extra days prior to the start of the next mating. This is important for first calving heifers because they take longer to recover from the stresses of calving and commence cycling.

Cost is the main disadvantage of synchronisation. Careful planning of the synchronisation and AI are needed, while additional skilled labour is required to successfully manage the concentrated mating and calving periods. It is advisable for 'do it yourself' inseminators to employ a trained (A class) inseminator for their synchronisation programs, unless they have been able to refresh their technique and practice on some cull cows just prior to the program.

As a general principle, inseminations should be when heat is detected. Fixed time inseminations, also known as 'blanket insemination' (that is, without heat detection), give variable results, and should only be considered if conditions are ideal. Some groups of heifers achieve more than 70% pregnancy to AI in a single, synchronised cycle, while other groups may only achieve 20% pregnancy. Low AI conception rates can be compensated for by natural mating after insemination to get most heifers to calve in the desired calving period. Some farmers are willing to accept variable AI conception rates because there is less work involved when heat detection is not used.

Near-term calving induction has been used successfully following synchronised AI programs, with heifers induced to calve 7–10 days before full term. They generally calve about 36 hr later, ensuring smaller calves with less calving difficulty. This enables any required assistance to be given promptly. It also reduces night-time calvings and can eliminate weekend calvings.

14.3.2 Examples of heat synchronisation

Heifers can be synchronised in many ways to compress the normal 21-day cycle. Generally speaking, the shorter the cycle achieved, the more costly the synchronisation treatment. Some examples of synchronisation methods with approximate drug costs (in Australian dollars) and spread from first to last AI are:

1. Heat detection and insemination for five days followed by a prostaglandin injection, and a further five days of heat detection and insemination. A bull is usually run with the heifer group for a further six weeks. This is a low cost option that reduces the heat detection and insemination period from 21 to 10 days and still gives each heifer

one opportunity for AI. It is also the most time consuming synchronisation option. The prostaglandin costs about A$4 per heifer. This will typically result in 60% of the heifers calving to AI.

2. Using a progesterone implant, such as a CIDR (controlled internal drug release) device. These intravaginal implants are inserted for 7 days with a dose of oestradiol at the start. A prostaglandin injection is given at the time of implant removal. This is followed by 4 days of heat detection and insemination, with an oestradiol injection 2 days after the device is removed. Again, a bull is usually run with the group for a further 6 weeks. This compresses the heat detection into 4 days from the normal 21-day cycle but costs about A$20 per heifer, with about 60% of the heifers calving to AI.
3. Using an intravaginal progesterone implant for 7 days with a dose of GnRH at the start. A prostaglandin injection is used at the removal of the device and a second GnRH dose 2 days after removal. All heifers with detected heat are inseminated, then, after 56 days, all other heifers (previously not detected on heat) are blanket inseminated. A bull is then introduced for 6 weeks. This removes the need for heat detection completely but costs more than A$20 per heifer. The results vary widely, with blanket insemination, but a long-term average of about 50% of heifers pregnant to AI can be expected over a number of years.

The programs require multiple yardings, so heifers must be quiet and used to being handled. Hygiene, correct semen handling and good AI technique are also critical. Many of these drugs can only be supplied by veterinarians, whose responsibility is to prescribe the program and drugs used.

Some treated heifers may produce an unpleasant discharge at CIDR removal, although this is unlikely to adversely affect fertility. A few heifers may also suffer damage from CIDRs due to pressure on the vaginal wall. The biggest single cause of failure in synchronisation programs is low mating live weight, hence non-cycling heifers.

14.3.3 Sexed semen

Sexed semen is a relatively new commercial innovation in advanced reproductive technology, but it is still being evaluated for its long-term benefits, particularly on farms where breeding management is sub-optimal. This semen has a very high proportion of female sperm cells, which can result in up to 90% heifer calves when used in a well-managed breeding program. Another of its advantages is a reduction in calving difficulties when used to mate virgin heifers (Millar 2010), because of the lower birth weight of heifer calves. Some Asian countries are producing their own sexed semen using less advanced techniques and only achieving 70% heifer calves.

However, its biggest disadvantage is a lower conception rate than with conventional semen. If 50% conception is expected using AI with virgin heifers, a similar group of heifers mated with sexed semen would be expected to result in 40% conception. So, in addition to its considerable higher cost (A$60 per straw versus, say, A$20 per straw in Australia in May 2010), there will be fewer conceptions than with conventional semen. Accurate heat detection is critical when using sexed semen and it is vital that animals be inseminated in standing heat. Proper semen handling and AI technique is also critical. One other disadvantage is the limited range of bulls from which sexed semen is available.

In fact, with any imported, exotic semen one must query whether the bulls from which the semen is collected are the most suitable for the tropical SHD production systems for which they are purchased. The interaction between genotype and environment is discussed in my previous books (Moran 2005, 2012).

14.3.4 Targets for heifer mating programs

The Dairy Calf and Heifer Association in the US published a series of targets for heifer mating programs for Friesians (DCHA 2010), which can be used as guidelines for tropical dairy systems. These are:

- Begin mating at 13–15 months of age with heifers weighing 375–410 kg, with hip height of at least 127 cm and wither height of at least 122 cm.
- Strive to achieve 70% first service conception, or 7–12% less with sexed semen.
- Inseminate at least 80% of the heifers within the first 21 days of mating.
- 85% of the heifers should be pregnant within three heat cycles.
- Test all heifers to confirm pregnancies (some animals – typically 3% – will abort after pregnancy testing).

14.4 Calving down replacement heifers

Dystocia or calving difficulties can contribute to death loss at calving. Selecting light weight bulls is the best management strategy to reduce the incidence of dystocia. Measuring the pelvic area of yearling heifers prior to breeding them is a good way to check whether heifers can handle calving. Heifer development programs should aim for heifers to reach 65% of their mature weight at breeding and 85% at time of first calving.

It is a misconception that reducing the feeding levels prior to calving will reduce dystocia. This will reduce calf birth weight, but not dystocia. It may, in fact, reduce calf survival and increase calf scours. Animals should not be too fat or too thin at calving, to avoid calving difficulties, metabolic disorders and potential subsequent culling.

Parturition is the term used for giving birth to the young calf. The calf can be expected 9 months and 9 days (40 weeks) after conception. The udder will start to swell 2–3 weeks before calving. Within 12–24 hr of parturition, the heifer requires a comfortable clean place where she can lie down easily. She should be cleaned before entering this area to avoid introducing unnecessary contamination. Farmers should also practice good hygiene by washing their hands and the rectal/vaginal area of the cows.

A good calving area is important for:

- the heifer, to avoid injuries and infections of the uterus and to stay there 24–48 hr post-calving
- the calf, to avoid infections of the navel passed on from other stock that either are, or have been, in the shed

- the farmer, to have enough space to assist with the calving. It should be at least 3 × 4 m in size.

The calving area should be:

- isolated from other stock
- have good light, ventilation and protection against any winter draughts
- be easy to clean and disinfect
- provide easy access to fresh, cool and clean water
- covered with a generous layer of straw, to minimise the heifer's problems with slipping
- ideally, not be used for any other purpose, particularly as a hospital pen.

14.4.1 The actual birth process

Cows undergo a series of physical changes that indicate the start of calving. Several weeks or days before parturition, the udder fills with colostrum, the vulva becomes swollen and the pelvic ligaments relax, causing a sunken appearance around the tailhead. Mucus discharged from the vulva is no longer thick or opaque, but becomes flowing and clear, similar to the mucus observed during oestrus. The actual birth process progresses through three continuous stages: 1. preparation for delivery; 2. expulsion of the foetus; and 3. expulsion of the foetal membranes. The events of each stage are described in Table 14.1.

14.4.2 Monitoring the actual birth process

It is important to observe calving cows and heifers every 2 hr and to monitor the degree of difficulty and the assistance required during calving. This can be done using a calving score based on the benchmarks in Table 14.2.

In many cases, extended labour as well as lack of adequate lubrication in the birth canal increase the likelihood of calving problems. It is important to:

- observe the calving heifer (or cow) for labour signs
- examine the dam that is not making normal progress once in labour
- intervene soon enough to reduce the help required later for a successful birth. However, it is important to give the calving heifer sufficient time (up to 2 hr) before intervening.

14.4.3 Assisting the birth process

Assistance to calving heifers and cows should be provided when any of the following occur:

- When heifers have not calved within 5–6 hr after the first sign of abdominal straining.
- When cows have not calved within 3–4 hr after the first sign of abdominal straining.
- When calving has not occurred within 3–4 hr after the membranes have ruptured.
- If delivery has commenced, the calf's legs or head are just visible externally and it is obvious that the calf's presentation is abnormal.

Table 14.1. Events of a normal delivery

Stage	Events	Duration	Action
1	Relaxation and dilation of cervix	Cows: 3–6 hr Heifers: 3–24 hr	Observe frequently from a distance
	Contractions last 15–30 seconds, 15 min apart		
	Cow acts restless, seeks solitude, may look at flanks, stamp feet, raise tail or arch back		Examine animal if no progress after 5–8 hr
	Weak straining		
	Ends when foetal membranes become visible		
2	Begins when water bag breaks	Cows: 0.5–1 hr Heifers: 1–4 hr	Continue observations every 30 min
	Legs and head push through cervix into vagina		
	Cow acts restless, stands and lies down		Examine animal if no progress after 1 hr
	Strong straining		
	Contractions last 10–15 seconds, every 2–3 min		
	When feet enter vagina, second membrane breaks, releasing thick lubricating fluid		Examine heifer if no progress after 2 hr
	Cow rests after head and shoulders delivered Remains of body passes quickly		Examine for malpresentation, such as breech delivery
			Examine if cow showing any signs of calving paralysis or distress
3	Continued contractions	Cows: 2–8 hr Heifers: 2–8 hr	Considered retained placenta if not passed within 12 hr
	Rapid decrease in size of uterus (involution)		Do not attempt to remove placenta manually
	Attachment between uterus and placenta relaxes and placenta separates		Do not insert uterine bolus as it may prolong passage
	Ends with passage of foetal membranes (after birth)		

Table 14.2. Benchmarks for calving scores

Calving score	Birth process
0	No hand touches the calf
1	Hand touches the calf but no rope is used
2	Rope is used: gentle pull
3	Rope is used: hard pull
4	Caesarean section, requiring anaesthetising the heifer for a full operation

- If delivery has commenced, the calf's legs or head are just visible externally and the calf is not delivered within 30 min.

If you think that a cow may have calved (for example, she may have placenta hanging from the vulva) but you have not found the calf, it is best to perform a vaginal examination to ensure that she has in fact calved.

When assisting a calving cow, cleanliness is essential to prevent the introduction of infection. Use plenty of warm water containing disinfectant to clean the back end of the cow and thoroughly wash your arms with clean, fresh warm water containing disinfectant. Lubricate your arms with obstetrical lubricant, always using plenty of lubrication to stop the calving passage from drying out.

Investigate the presentation of the calf in a systematic manner and be gentle. Check that the cervix is dilated by inserting your lubricated arm into the vagina. If you feel a band, or there is a ridge between the uterus and the vagina, then do not attempt to pull the calf. If two hind limbs can be felt, check that the hocks and the calf's tail can be positively identified. If the calf's head cannot be felt, do not assume that the legs are the hind legs, they may be the front legs and the calf's head may be twisted back. Traction is often necessary to deliver an oversized calf and in cases where active straining has stopped. Great force should not be used when traction is applied and never use vehicles to apply traction.

Do not attempt to deliver the calf unless it is:

- upright with both forelegs first and head lying over its knees
- upright, backwards with two hind legs and tail presented.

If the head and legs are not in the normal positions, they can often be gently moved into place. Never pull the calf until it is positioned correctly.

If the calf is coming forwards, traction should be applied at three points using:

- a cord or calving chain with a running noose applied to each foreleg above the fetlock
- a third cord with a running noose placed behind both ears and between the jaws (or eye hooks, as in this case) – but do not put a noose on the lower jaw because the jaw will break.

The direction of pull is critical and the calf is delivered in an arc. Once the head and feet are through the vulva, the pull should be directed towards the cow's hocks. If the calf's hips become stuck in the pelvis, do not pull, but rotate the calf's hips 14 degrees from the vertical then pull in a direction towards the cow's hocks. Always check to make sure that there is not a second (or third) calf in the uterus.

Hygiene, antibiotics and oxytocin will reduce the risk of uterine infection following an assisted calving.

Call the veterinarian if you cannot:

- work out what is wrong
- correct the position of the calf within 5–10 min
- pull the calf with three people.

Table 14.3. Calf mortality by dystocia category

Calving difficulty	Percentage of calvings		Calf mortality within 48 hour (%)	
	Heifers	Cows	Heifers	Cows
Unassisted	45	79	8	6
Easy pull	30	15	10	8
Hard pull	14	3	35	24
Calf jack	7	1	55	66
Veterinarian	4	1	48	65

Prolonged assistance can severely damage the birth canal and result in the death of the cow and/or calf. A safe delivery increases the cow's chances of breeding next season and increases the chance of a live calf.

Farmers should aim to have less than 7% of their cows and less than 10% of their heifers calve down with severe assistance (scores of 3 or 4). The chances of these calves dying is over six times greater than for calves requiring no or little assistance (scores 0 and 1). The major causes for dystocia in heifers are either selecting a sire that produces heavy calves or poor feeding management during pregnancy.

Table 14.3 presents a survey of calf mortalities related to different degrees of calving difficulties undertaken in the US over 20 yr ago (Heinrichs and Swartz 1990). The categories for calving difficulties do not correspond directly to those described in Table 14.2. This clearly shows a greater likelihood of calving difficulties in heifers than in cows and the associated very high calf mortalities (50–60%) among these calves.

In the US, 2% of calves are born dead. The live birth rate should also be monitored. Live birth rate is defined as the percentage of calves that are alive and survive for at least 24 hr. Targets are 97% for cows and 92% for heifers.

The long-term impacts of calving difficulties can be quite dramatic for both the cow and the calf. Calving heifers receiving assistance take longer for their first service in the future, experience more services per conception, and hence have a longer calving interval (by up to 28 days), compared with heifers not requiring assistance. In addition, calves experiencing calving difficulties produce less milk in their first lactation.

14.4.4 Caring for the newborn calf

Every time a heifer calves down, she contaminates the calving area with 15–20 L of amniotic fluids (that surround the developing calf foetus) mixed with faeces. Dry bedding on a concrete floor can provide an effective physical barrier between the newborn calf and the pathogens. Immediately after calving, the calf should be provided with clean bedding where the dam may lick the calf. It is important to minimise the possibility of pathogens entering the calf via the two major routes: the mouth and the navel.

It is essential to make sure the calf is breathing by clearing the nose and mouth. If breathing is slow to occur and sticking straw up the nose does not initiate breathing, cold water could be poured over the calf's head, especially into its ear canal, and its nose could

Calves should be removed from their dams after being cleaned.

be tickled. It could even be held upside down. The calf should be placed in a 'dog sitting' position to encourage inhaling through the lungs. The navel cord should be disinfected with 7% iodine and checked for infection (pain or swelling); this should be repeated 24 hr later. Death rates of calves without navel disinfection are 10–15% higher than those that have been disinfected. Teat dip should not be used to disinfect calf navels because it contains less iodine and does not contain alcohol, which dries the navel.

If desired, the calf could be assisted to suckle from its mother soon after birth to ensure it drinks some colostrum, which provides protection against various infections. Assisting suckling should at least allow the calf to be offered a relatively clean teat. If there is no natural suckling, the heifer should be hand milked with the first feeding of colostrum given using a bottle and teat or a stomach feeder.

The longer the calf spends with her dam, the greater the chance of exposure to pathogens, and therefore contamination. But how long is too long? The dam should be allowed to lick the newborn calf because this also stimulates breathing and blood circulation. Once the calf stands and is ready to walk, its chances of picking up bacteria from the dam's hair coat, dirty teats or from falling into manure greatly increase. Therefore it is best to help the calf find a clean teat for its first drink and then separate it from its dam. This may seem rather cruel, but producing a clean and healthy calf should be the primary objective from every calving.

The three golden rules to ensure newborn heifer calves get a healthy start to life are:

1. Get her up.
2. Get her dry; this may be better achieved with a dry towel and vigorous rubbing to get a dry fluffy coat, rather than depending on the dam to lick her dry.
3. Get her fed.

Calves should be suitably identified (permanently) soon after birth, with only healthy calves kept for rearing. When the cow has twins, there can be problems with possible fertility if the calves are of different genders. The heifer calf, called a freemartin, may not be fertile, so cannot be used as a dairy herd replacement.

Calves resulting from difficult births require close attention over their first few weeks of life. These calves have higher sickness and death rates. They should be individually identified, say, with coloured string around their necks or a mark on their head, and watched more carefully for early signs of scours or pneumonia.

By 30 min after birth, the gums and nose should have changed to pink (from bluish-grey at birth). Note any abnormalities such as:

- swelling of the head and tongue
- dopey behaviour
- cloudy or bloody eyes
- head held back, arched back or puffy abdomen
- blood from any opening
- laboured breathing
- broken ribs.

Monitor these calves closely. By one hour after birth, the calf should be able to stand and have a normal body temperature (near 38.6°C). When the calf is born, its body temperature is 39.4–40.0°C. It drops to about 38.3°C within 30 min, but should stabilise by 1 hr. It is important that the calf is placed in its permanent calf housing by this time to allow it to adjust in that environment. If the calf's temperature is less than 37.8°C, it should be provided with an artificial heat source, such as a heat lamp or blanket, to be warmed.

In summary, for a normal delivery, a newborn calf should exhibit the following signs:

- the calf tries to lift its head within minutes
- it rolls up on its sternum within 5 min
- it attempts to stand within 15 min
- it is standing within 1 hr
- its temperature, while higher at birth, stabilises to 38.3–38.9°C by one hour after birth
- it suckles within 2 hr
- its respiration rate is 50–75 breaths/min
- its heart rate is 100–150 beats/min.

If most calves do not exhibit these signs, chances are that the deliveries are not normal and farmers may have to intervene.

14.4.5 Cold stress and the newborn calf

There can be areas within the tropics, such as in the highlands, where cold stress can adversely affect calf health and performance. Cold stress is called hypothermia.

Wet and cold calves are more prone to hypothermia. Rectal temperature is the most accurate method of determining if a calf is suffering from cold stress. Mild hypothermia occurs when body temperature drops below 37.8°C. Severe hypothermia occurs when it drops below 34.4°C. To combat the cold, calves shiver to increase heat production and they shunt blood from their body extremities to the body core. At 34.4°C, vital organs are cold and impaired brain function results. As core temperatures drop below 30.0°C, signs of life are hard to detect. In extremes, respiration and heart rate drop, animals lose consciousness and die.

Calves can be artificially warmed in various ways: using a warm water bath, warm air or heat lamps and warm blankets. Air movement, such as from a fan, is important to ensure thorough warming of the calf. 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.

14.4.6 The 10-point plan for managing the birth process

Davis and Drackley (1998) presented a 10-point plan to manage the birth process as follows:

1. Develop a plan for calving assistance with the veterinarian and all animal caretakers, so everyone knows when to intervene and call in the veterinarian.
2. Provide a sanitary, dry, comfortable calving area with appropriate bedding as necessary. Sanitise the pens after each birth.
3. Monitor all the cows due to calve frequently and regularly and provide assistance promptly if necessary.
4. Ensure the newborn calf's airways are free from mucus and foetal membranes and that breathing is initiated.
5. Dry the calf if the cow is not allowed to do so.
6. Feed ample amounts of good-quality colostrum as soon as possible within the first hour after birth. Do not rely on sucking to achieve the desired intake: use a nipple bottle or stomach tube, if necessary.
7. Clearly identify the calf then separate it from the cow within 12 hr after birth; separate it immediately after birth if concerned about infectious transmissions such as Johne's disease.
8. Dip or coat the navel with 7% tincture of iodine.
9. Maintain strict cleaning and sanitation of all birthing equipment and feeding utensils.
10. Work with the veterinarian to establish and implement an effective vaccination program during gestation and for the newborn calf.

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