



Rearing Healthy Calves

2nd edition

Delivering
for Dairy

Acknowledgments

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Disclaimer

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Foreword

The Australian dairy industry has a strong commitment to producing high quality products that are both nutritious and safe, and dairy farmers across Australia are constantly adapting, innovating and investing to ensure they are continually improving their practices. The comfort and care of our calves is an important responsibility and enables dairy farmers to provide safe, high quality dairy produce to our consumers.

The way we care for all calves on dairy farms can have major and long lasting effects: not just at the farm level, but throughout the industry, where issues such as animal welfare, animal diseases and food safety can have significant consequences.

The first edition of Rearing Healthy Calves was published in 2011. The publication encompassed the latest science and innovations available at the time and has proven extremely popular with farmers and calf rearers. Around 12,000 copies of the original publication have been circulated.

This new edition of Rearing Healthy Calves has updated information based on new science and developments in calf husbandry and animal nutrition. It is designed to integrate with other Dairy Australia calf rearing resources, such as our calf housing case studies, fact sheets and online videos.

Rearing Healthy Calves 2nd Edition provides a practical guide to all aspects of calf management on Australian dairy farms. It includes contributions from a wide range of experts including farmers, animal scientists and veterinarians to identify best practices in calf rearing to ensure their health and well-being.

Dairy farmers make decisions every day that can affect the health and welfare of their calves. This manual combines clear and concise explanations with practical examples to help you see a range of approaches in action.

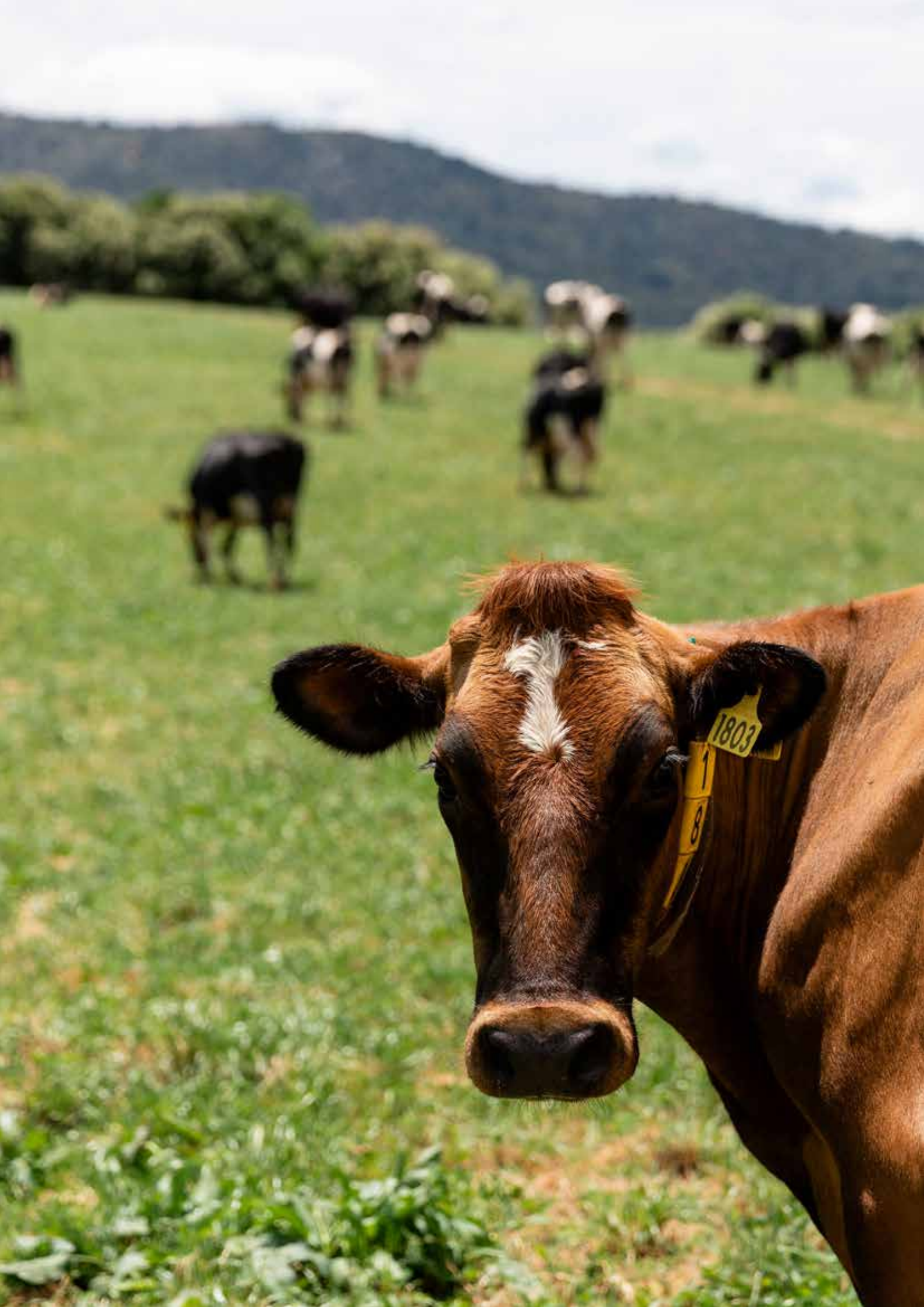
It is our hope that this 2nd Edition of Rearing Healthy Calves will help farmers and calf rearers build on the skills and knowledge contained in the original publication and implement the innovative new practices contained in this edition.



A handwritten signature in black ink, appearing to read 'D Nation'.

David Nation
Managing Director
Dairy Australia





Pre-calving care

A healthy calf starts with a healthy cow

- Select sires for 'ease of calving'.
- Ensure heifers are at target weight before mating and continue to meet their growth targets.
- Time cow vaccinations to ensure antibody levels are high in the dry period.
- Manage transition period to minimise metabolic disease.
- Prepare calving environment – it must be clean, well drained and sheltered.

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Pre-calving impacts on calf health and welfare

Making good pre-calving decisions will protect the health and welfare of the calf about to be born.

Sire selection

Using sires selected for calving ease is important to avoid calving difficulties, particularly in heifers or small framed cows. The breed of the dam can also affect calving ease.

Vaccination program

Colostrum begins to form in the udder 5 weeks before the birth of the calf. The amount of antibodies in a cow's system in the dry period has a direct effect on the amount of antibodies that end up in the colostrum. A correctly timed vaccination program that is specific to your farm is essential to maximise colostrum quality.

Decisions made pre-calving affect the cow and the calf.

Transition ration

The ideal ration provides essential nutrients to avoid negative energy balance and manages dietary cation and anion (DCAD) balance. This sets the cow up for a low stress calving period and the lactation beyond. Cows that develop metabolic disorders like milk fever, ketosis or other nutritional deficiencies experience more calving problems and put their calves at risk too.

Pre-calving care

Manage cows and the calving environment carefully – both impact on the health and welfare of newborn calves.

Get it right to benefit from the following:

- fewer calving problems and less sick cows
- better quality colostrum
- thriving calves and reduced death rates
- minimise the risk of spreading bovine Johne's disease (BJD).

Heat stress

Cows that are heat stressed in late pregnancy are more likely to have health problems around calving and produce less milk in their next lactation. Their calves may be born weaker, have poorer transfer of passive immunity and grow more slowly. The effect of heat stress before birth may also reduce the lifetime milk production of the unborn heifer.

Calving environment

A clean and dry environment minimises the risk of disease to the newborn calf and the dam.

Cow problem – calf impact

Cow issues having ill effects on the calf:

Problem for cow	Impact on calf
Metabolic disorders	<ul style="list-style-type: none">• Stunt the calf's growth and development before birth.• Increase likelihood of calving difficulties and risk of physical trauma to calves during birth – this may make them non-viable or create long term health issues.
Calving difficulties	<ul style="list-style-type: none">• Significant immediate and flow-on effects to cow and calf health.• Can contribute to stillborn calves plus a proportion of deaths within the 48 hours following birth.• Traumatized calves may have physical problems like swollen tongues or limb injuries.• Metabolic effects include oxygen deprivation and acidosis.• Often associated with failure of transfer of passive immunity.
Poor body condition	<ul style="list-style-type: none">• Potentially reduces the calf's growth and development and can also contribute to calving difficulties due to weakness of the dam during the birth process.
Poor vaccination history	<ul style="list-style-type: none">• Affects the quality of the colostrum a cow produces in the weeks before calving.• A cow with low immunity produces colostrum that has lower levels of antibodies and less potential to transfer adequate immunity to her calf.
Heat stress	<ul style="list-style-type: none">• Unborn calves of cows experiencing heat stress during late pregnancy are pre-programmed for sub-optimal health and performance. They are more likely to die or be culled between birth and the end of their first lactation, they are less fertile at first mating and produce less milk in their first lactation. This is due to long lasting changes in body metabolism and gene expression.

Care starts with breeding decisions

For any cow, complications during calving can have serious consequences. Some breeds of bulls present a higher risk of calving problems than others.

Risk	Breed of bull
Low	• Jersey
Medium	• Holstein-Friesian, Murray Grey, Angus, Hereford, Red Angus, Red Poll
High	• Limousin, Charolais, Simmental, Belgian Blue

Before mating heifers

Heavier, well framed heifers need less calving assistance and their calves benefit too. Well grown heifers also:

- have better fertility
- produce more milk in their first and subsequent lactations
- stay in the herd longer
- cope better with herd competition.

The simple message is 'don't mate till the right weight'.

Develop target weights for heifers rather than using age.

Setting your own target weights

Any target weight set for heifers should be realistic and based on planned average live weight of the mature herd.

Research has shown that the heifer liveweight at first calving should be over 85% of mature liveweight. If mature cows average 600kg, the ideal heifer is at least 510kg at the time of first calving.

Once a desirable target weight has been selected it is possible to develop a typical growth curve that will assist in setting target weights at different ages, based on achieving at least 85% of mature liveweight at first calving. The Heifers on Target calculators allow you to check if your heifers are likely to reach their target weights and create an individualised target weight chart for your herd.

Go to the Dairy Australia website for more information on heifer rearing and target weights dairyaustralia.com.au/animals/calf-rearing.



InCalf says:

“Top farmers achieve milk production in first calvers of at least 83% of the milk production of the mature cows. If your figure is less than 77%, review calf and heifer management practices as this may indicate the heifers were underweight at calving.

The InCalf Fertility Focus report automatically calculates the ratio of first calver milk production compared with mature cows (average litres/day). This is the easiest way to make this comparison. Alternatively, you can use your herd recording reports to compare 305-day yields.

Every time you vaccinate or drench your heifers, check if they are due to be weighed – it may be convenient to do both jobs at once.”

Visit the Dairy Australia website for information on heifer rearing and target weights dairyaustralia.com.au/animals/calf-rearing.

Choose sires for calving ease

Heifers are particularly vulnerable to calving problems because they are still growing. There is a higher risk that the calf will be too large to pass easily through the birth canal.

The birth canal of heifers is required to stretch for the first time, so significant trauma and tearing of these tissues can result. This may have detrimental effects on milk production and subsequent fertility.

Paralysis of the hind legs due to prolonged pressure of the calf on internal nerves is also a significant cause of early culling of heifers.

Correct sire selection can go some way to minimising heifer calving problems.

Choose sires for calving ease, it is better for the cow and the calf.

Consider the use of sex sorted semen in heifers to increase the proportion of heifer calves. Holstein heifer calves are generally smaller and have easier calvings compared to Holstein bull calves.

When selecting sires, consider the overall profitability of the bull and how each bull ranks for ease of calving. Profit-based indices and calving ease ABV (Australian

Breeding Values) for bulls from Australia and around the world are available from the Good Bulls Guide and Good Bulls app.

In some dairy herds, a long standing risk management strategy has been to join Holstein heifers to Jersey bulls. If pure bred Holsteins are preferred it is particularly important to use bulls from the Good Bulls Guide with calving ease breeding values in the top 10% of bulls i.e. ABV Calving Ease above 103.

The Calving Ease ABV refers to the ease by which the bull's progeny are born – not the ease by which his daughters calve.

The Calving Ease ABV is expressed as the percentage of normal or easier calvings in mature cows relative to the average of 100.

- A Calving Ease ABV more than 100 means more normal or easier calvings than average.
- A Calving Ease ABV less than 100 means less normal or easier calvings than average.

The best bulls in the breed for Calving Ease will have an ABV of at least 103.

For more information about the Good Bulls Guide and Good Bulls app visit datagene.com.au/GoodBulls.



Cow immunisation and colostrum

Most farmers know that colostrum provides calves with protection against infectious diseases but many are not aware that it is possible to increase the amount of antibodies in a cow's colostrum. This is achieved by careful management of the herd's vaccination program.

Always read vaccine directions carefully. The best time to administer vaccines is when the label says to!

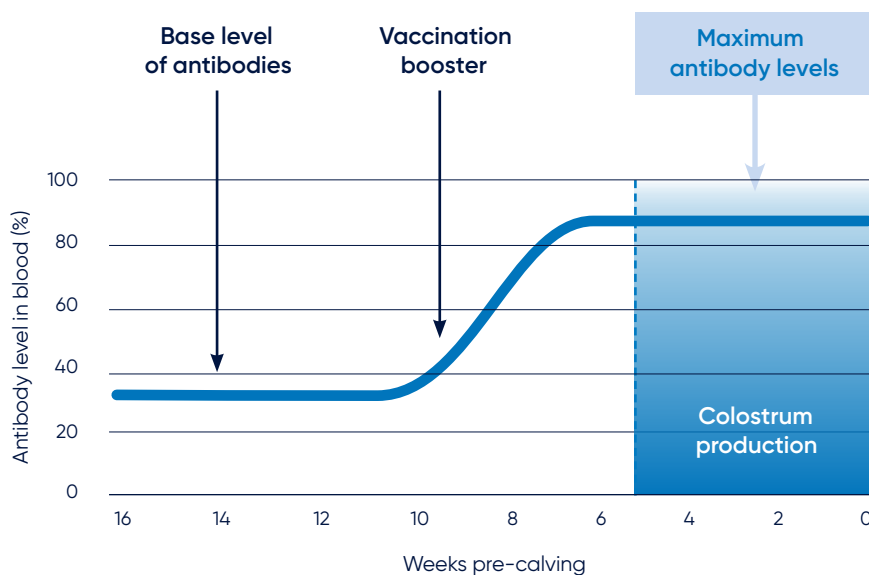
Antibodies are present in the cow's blood due to exposure to various disease 'bugs' and as a result of any vaccinations they have received. During the dry period antibodies are actively concentrated in the udder, ready to form the colostrum, which starts to be produced around 5 weeks before calving.

Accurate and timely pregnancy testing is an essential part of a successful calf rearing system. Specified dry-off dates help ensure that all cows have an adequate dry period, allowing enough time for colostrum production.

Timing cow vaccinations to ensure that peak antibody levels in the blood are available for colostrum production is a good strategy. This is particularly important for diseases that affect newborn calves, such as:

- **E.coli scours** – mainly occurs in calves less than 10 days old
- **Salmonellosis** – can occur in calves of all ages
- **Rotavirus** – mainly occurs in calves at 4–16 days of age
- **Coronavirus** – affects calves in second and third weeks of life.

Immunity for diseases of older calves such as those caused by Clostridial sp. (i.e. pulpy kidney, blackleg, tetanus, etc.) is also aided by the correct timing of vaccination. For further information on vaccinations refer to Reference section (page 133).



Cow transition nutrition

The transition period is defined as the four weeks before and four weeks after calving. Cows in the transition period need careful attention to ensure that they are in optimal health for calving and lactation. Drying off the cow in optimum body condition of 4.5–5.5 (scale 1–8) promotes the production of high quality colostrum and helps ensure a trouble-free birth.

Some specific management practices are necessary in the transition period to minimise metabolic diseases.

During the transition period in the 5–6 weeks prior to calving major changes are occurring within the cow:

- The foetus is growing at a rapid rate.
- The udder starts making colostrum.
- The cow's appetite is decreasing as the increasing size of the foetus reduces the room available for the rumen to fill.
- Additional hormonal and lactational changes also suppress cow appetite and immune function.

During the last 3–4 weeks of pregnancy, failure to provide the correct balance of nutrients such as energy, calcium, magnesium and phosphorus can result in sick cows. This may affect their ease of calving and the quality and quantity of their colostrum. Ultimately, the health and survival of their calf is at risk.

Getting transition nutrition right is important for the health and welfare of the cow and the calf.

Seek professional nutritional advice to ensure you understand the most cost effective and practical steps to get the transition cow ration balanced correctly.

Keep in mind the following:

- Avoid negative energy and protein balance – don't underfeed.
- Manage dietary cation and anion (DCAD) balance.
- Use energy dense feeds like concentrates.
- Provide the right amount of calcium, magnesium and phosphorus.

For more information visit dairyaustralia.com.au.



Calving environments

Clean, observable, drained and sheltered

If you provide a clean, observable, drained and sheltered calving environment for the cow, your calves will be better off from the word go.

Handling the numbers

High stocking rates often mean that calving areas can become highly contaminated with manure, particularly if conditions are wet and you have lots of calves arriving at the same time.

Prior to the start of calving, organise several different calving areas. This can be as simple as dividing paddocks with tapes to create calving areas that can be used for shorter periods.

Avoid high stocking of the calving area.

Protect pre-calving cows from heat stress

High temperatures and/or humidity are not good for dry cows, particularly those close to calving. Cows may begin to be affected by temperatures as low as 25°C. Heat stress during the dry period may reduce development of the udder, resulting in lower milk

production for the subsequent lactation and reduced dry matter intake, leading to weight loss. Heat stress can also affect the unborn calf. During periods of hot weather, it is important that dry cows have sufficient shelter and continuous access to water. Calving areas can be adapted to provide protection from the heat where required by the addition of shade cloth, fans and sprinklers.

Further information on managing heat stress in your herd can be found at dairyaustralia.com.au/farm-business/infrastructure/shade-and-cooling

Research has shown that heat stress during the last 6 weeks of pregnancy reduces the ability of the calf to acquire passive immunity from colostrum once it is born. This is thought to be due to impaired ability of the gut to absorb antibodies. Calves affected by heat stress before birth also tend to have lower birth weights and lower weights at weaning.

Environment	Consider
Clean	<ul style="list-style-type: none"> Exposing newborn calves to mud and manure significantly increases the likelihood of diseases such as Johne's disease and scours. Think about how you will keep the area clean to minimise the build up of disease causing 'bugs'.
Observable	<ul style="list-style-type: none"> Choose a location where it is easy to keep an eye on calving cows and monitor cleanliness.
Well drained	<ul style="list-style-type: none"> It has been said that disease bugs don't jump, they swim! Anything you can do to keep the area dry will help reduce the disease risk. Make sure dairy yard effluent doesn't drain into calving areas.
Sheltered	<ul style="list-style-type: none"> Exposure to harsh climatic conditions compromises the welfare of the calf. Shelter from radiant heat and cold winds should be provided.

Calving paddocks

When choosing a calving paddock, common sense applies:

- Calving paddocks should not be in the grazing rotation.
- Lock up for an extended period before calving commences to minimise manure contamination.
- Do not use the calving paddock for the introduction of new or agisted stock, as they could carry disease.

- If possible avoid areas close to the dairy and yards to minimise the risk of effluent run off – select higher ground.
- Make sure the paddock is large enough to calve all cows in clean conditions.
- Identify a 'back up' paddock if conditions are too wet.



For example

1 Calving paddock

Close by, well drained and sheltered on two sides.

2 Dairy

Easy access for extracting colostrum from freshly calved cows.

3 Calving pad

Converted old dairy – undercover with lights and crush.

4 Calf shed

Calves are transferred to pens for temporary identification and colostrum.

Once permanently identified, calves join a group with automatic milk feeders.

5 Calf paddock

Calf shed has adjoining outside area.

Older calves are kept in separate paddock separated by a laneway so there is no exposure to adult cattle or their effluent.

Calving pads

Calving pads are often purpose built and if well located, can be convenient for observation and provide quick access to facilities if the need for assistance arises.

Calving pads allow for greater control over key aspects of the calving environment like drainage and protection from the weather.

Keep in mind the following:

- Calving pads should not be used to hold sick cows or as a holding area for other stock.
- Position to minimise contamination from adult cow effluent – ensure sub-surface drainage is well designed.
- Choose bedding that will maximise cow comfort and replace or replenish bedding regularly.
- Clean pads regularly.

Be prepared to make changes and repairs to the calving area during the calving period. Adequate supplies of bedding should be kept on hand to allow regular top dressing of the pad, if necessary.



For example

On this farm cows about to calve are managed in the following way:

1 Paddocks for cow

'Close, but not that close'.

Cows due in 7–10 days are brought to paddocks near the sheds for easy observation and to facilitate appropriate transition nutrition.

2 Covered shed/feed pad

Cows due in 1–2 days are moved here.

3 Trough

Easy access to water.

4 Sand pile

Sand is used for floors in both sheds. Floors are scraped regularly.

'Bugs' are less able to stick to sand, so good for disease control.

5 Loafing area

Cows can wander in and out of shed – note that this area drains away from the calving shed.

6 Feed alley

At the start of the season the concrete that runs the length of the shed is scraped and hay/silage is fed out. Good tractor access along the laneway.

7 Calving shed

Cows about to calve are moved to calving shed.

Shed has water troughs along one wall and a small crush at the end.

Summary of recommendations



Care taken pre-calving is repaid with healthier newborn calves.

Making good decisions at mating time and in the pre-calving period minimises the risks to the health and welfare of calving cows and their calves.

- 1 Select sires with high Australian Breeding Values for calving ease – this can minimise the risk of calving difficulties.
- 2 Don't mate till the right weight! Heifers do better at calving if they are well grown out.
- 3 Time cow vaccinations to ensure antibody levels are high in the dry period so that the colostrum they produce will be of higher quality.
- 4 Pay particular attention to cow nutrition in the transition period – the cow's body condition and diet in the 4 weeks before calving are critical.
- 5 Calving environments need to be clean, easily observable, well drained and sheltered.
- 6 At any one time, keep numbers on the calving area to a minimum – this reduces the risk of disease.
- 7 Protect dry cows from excessive heat to safeguard their health and production and get calves off to a good start.





Clean, comfortable environment

Rear calves in clean and comfortable conditions:

- Ensure you have the facilities for current and future needs.
- Calves should be provided with protection from wind, rain and heat.
- Make sure dairy effluent does not enter the rearing environment.
- Disinfect rails, partitions, walls and gates in calf pens.
- Make sure clothes and boots are clean to minimise spread of disease.
- Plan procedures to minimise the need to enter calf pens.



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Designing the calf rearing environment

When designing a calf rearing area or assessing your existing facilities, it is important to remember:

- Most calves are housed when their immune systems are still immature so they are very vulnerable to disease.
- Calves that are housed in poorly designed, poorly maintained or dirty, overcrowded environments have an increased rate of disease.

The following design elements all need to be considered to ensure calf health and comfort:

Space – have you allowed enough room for times of peak demand?

Shelter – are all calves protected from wind, rain and hot sun?

Ease of access – can you manage all necessary stock handling, feeding and cleaning activities?

Sick calves – do you have a quarantine area or isolation pen?

Orientation – is the shed open to sunlight and protected from the prevailing wind?

Ventilation – is air circulation adequate to ensure fresh air and help dry bedding while managing draughts at calf level?

Drainage – is the calf rearing area protected from dairy effluent and calf waste?

Bedding – does it provide good insulation? Is it risky if calves nibble on bedding material?

Feeding space – is there enough space for all calves to access the feeder, especially in restricted milk feeding systems?

Ease of cleaning – what cleaning regime will be used for hard surfaces in pens etc?

Maintenance of bedding – how will it be refreshed or replaced?

Water – will all calves have ready access to fresh drinking water? Is there a good supply of water for cleaning the calf rearing area and equipment?

Clean, comfortable calf rearing environment

Calves should be reared in clean and comfortable conditions to ensure:

- less diseases like Johne's disease, scours and pneumonia
- reduced death rates
- increased growth rates.

A calf rearing environment that provides clean and comfortable conditions limits the risk of disease.

Building a new calf housing facility?

It pays to do some research before designing your calf housing facility. Use the two fact sheets, 'Comparison of calf housing systems' and 'Designing a calf housing system' to help you work through the important decisions involved.

These are available for download from the Dairy Australia website along with a series of 6 calf housing case studies. These case studies showcase a range of practical solutions and include farmer interviews, video tours, detailed plans and photographs.

Space requirements and layout

How much space is needed?

Whatever approach you adopt to housing your calves, make sure you are able to respond to changing circumstances on the farm.

Group housing

When considering pen size or numbers of calves to allocate per pen, keep in mind that each newborn calf should have at least 1.5–2.0m² of space. Establish groups of similar sized calves and avoid moving calves between groups.

As calves grow it is recommended to increase space available (to 2.5m² or greater), particularly if they do not have access to paddocks or yards. This allows the calves to rest undisturbed in a clean dry area, significantly improving calf comfort, reducing their stress levels and the risk of disease. The more room they have the healthier and happier they will be.

Restricting the number of calves per pen will improve disease control and reduce competition. Try to keep the age range of calves within a group to less than 2 weeks.

An all-in, all-out approach is the best way to move calves between pens as it creates an opportunity for cleaning, disinfection and resting of pens between groups.

Individual housing

If rearing calves in individual pens, ensure they have at least 2.0m² of space. Calves in individual pens should be able to see other calves at all times – you may not like to see your neighbours everyday but calves do!



For example

On this farm, each calf pen has an additional area outside the shed to the south, which is accessed through a sliding door when the weather is suitable. Inside, lights are used to encourage feeding. This makes checking the calves an easy task when it is dark outside.

Make sure your space estimates are realistic.

- **Review the predicted calving pattern** – when will you have the most calves?
- **Factor in the average time calves are held in the calf rearing environment** – will there be any bottlenecks?
- **Identify alternative housing areas for potential periods of overcrowding** – where else can you house calves in comfort?

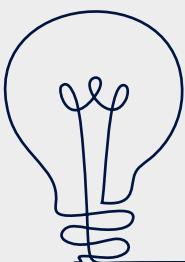


Build in space for cleaning access and stock handling

Remember that young calves have poor herding instincts so moving calves takes time and patience. Design pens for easy access and stock movements.

If possible, keep design of pens and laneways flexible so they can be easily modified. Moveable partitions are also a good idea.

The pens should be completely cleaned out and disinfected between batches of calves, so allow access points for the necessary equipment.



Factor in spare space

Maximising the time the shed or pen is empty between batches of calves will reduce the risk of disease.

In warm conditions, even an empty period of 1–2 weeks can result in significant reductions in disease causing organisms (pathogens), particularly if sunlight hits the area.

If you can, be generous in terms of the space you allocate to calf housing. This gives you the flexibility to rest areas.

It may be better to have several smaller sheds rather than one large shed. This may allow more air space and resting time between groups. It also gives you the ability to segregate different classes of calves e.g. sick calves, replacement heifers, sale calves.

The longer the calf rearing area is free of calves and bedding, the fewer pathogens will be present next time around. Maximise the periods the calf rearing areas are empty to minimise disease.



Consider quarantine areas

Separating sick calves from healthy calves is a good idea – it will reduce the risk of transferring disease to other calves and help you to manage antibiotic residues in treated calves.

Areas should be set aside for the isolation and treatment of sick animals as well as for calves requiring special attention, however, there are some issues to consider:

- Sick calves may be left with their immediate group if they do not have direct contact with calves in neighbouring pens.
- Any movement of a sick calf may spread the disease further through the shed.

A footbath and boot scrubbing facility should be provided at the entry into the quarantine area. Provide staff with easy access to handwashing facilities, disposable gloves and a separate store of clean aprons or overalls.

Comfort in the sick pen

Attention to the comfort and wellbeing of the sick calves will improve survival rates. Sick calves will often have body temperatures outside of the normal range. They will also experience higher levels of stress.

- Cold calves can be warmed by the use of covered hot water containers placed close to a calf or by calf jackets.
- Warm calves can be cooled by placing them in cool areas away from direct sunlight.

Providing a controlled temperature and ample, clean bedding can significantly improve the welfare and the survival of a sick calf.

For example

On this farm the isolation pen is in a separate shed, well away from the normal calf shed and out of the wind.

The pen is easy to construct, proving that you don't have to spend lots of money to solve a problem.

Ensure separate area for sale calves

The risk of antibiotic residues in any calves destined for sale must be minimised.

Any calf treated with antibiotics or other chemicals with a meat withholding period on the label needs to be managed very carefully. Ideally, they should be physically separated from non-treated calves.

- Having a completely separate area can help ensure that mix ups between treated and non treated calves do not occur.
- Separate areas also ensure that no physical contact or sharing of feed or equipment, such as buckets and stomach tubes, between treated and non-treated calves can occur.

Remember, sale calves that become ill must receive appropriate treatment or be humanely destroyed.

Keep the feeding and watering areas clean and dry

Feeding areas

Areas where calves are fed often become the wettest and most contaminated areas within the calf housing.

Milk feeding sites (both manual and automatic) may become very wet under foot due to spillage of milk.

Often calves will pass manure or urinate shortly after feeding.

Position calf feeding stations on flooring which can be easily cleaned and is well drained, such as cement.

If this is not possible then replenish bedding under feeders regularly to ensure it is fresh and not waterlogged. Consider providing some underground drainage in these sites.

Monitor feed troughs for urine and faecal contamination and clean as necessary.

Watering areas

Fresh, clean water must be available to all calves from day one of life.

Water can be supplied via troughs or nipple systems.

Monitor bedding under water sites for waterlogging and replenish regularly.

Design to minimise physical contact between calves

Limiting contact between sick and healthy calves is important to prevent the spread of infectious diseases. Solid partitions between pens are the best option for preventing contact between calves. However you need to also ensure that ventilation is still adequate.

Controlling antibiotic residues risks

The most common way that calves are contaminated is through consuming milk/fluid that is given via feeding equipment that has previously been contaminated with antibiotics.

Sale calves should have separate feeding equipment, buckets and group feeders that are never used for the heifer replacements.

Design your calf rearing environment to make sure contamination never happens.

If any equipment is used to dose sick calves with antibiotics it should be either thrown away or clearly marked and then only used again for this purpose. Washing out the equipment is not sufficient to remove all traces of antibiotics so there is a high risk of accidental contamination of other calves when it is next used.

You are responsible for ensuring that the drug withholding period for treated calves is met and that other calves cannot be directly or indirectly contaminated with the product.



On this farm, calves are housed individually inside in a large shed and kept in facing rows of separate pens, allowing calves to see other calves at all times.

Each pen has a divider at the front that prevents face-to-face contact between calves, minimising the risk of disease transfer.

Also, staff do not enter the pens so infection is not transferred on boots.

The metal circles support individual water and feed buckets.

Note: Calves are social animals and need to be able to see each other if housed in individual pens.

Location, orientation and ventilation

The calf shed should not be located near any tracks or traffic. While locating a calf shed close to the dairy may be convenient, it increases the risk of disease being carried in from adult cows.

Exposure to adverse weather conditions limits growth rates as the calf diverts its energy to keeping warm. The two main design issues to consider are:

- ensuring good air circulation
- avoiding ground level draughts.

The position or orientation of the shed has an impact on how air circulates inside it and ultimately, this affects the health and comfort of calves.

The calf shed opening should be protected against the prevailing weather but open to the maximum amount of sunlight.

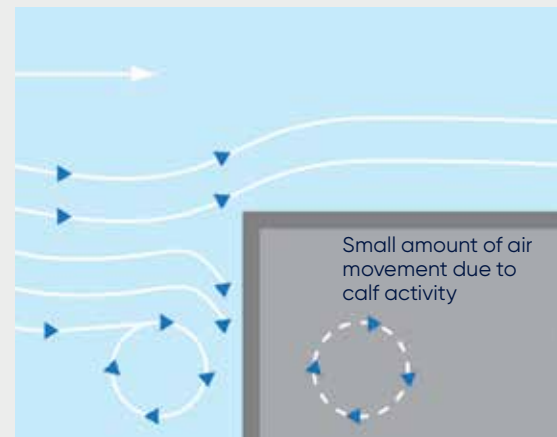
Good ventilation reduces the risk of calf illness and keeps conditions comfortable in cold and hot weather.

- Good air quality is critical as high levels of pollutants such as pathogens, ammonia and other gases can lead to airway disease in housed calves.
- High relative humidity/moisture increases the ability of pathogens to survive in the air or bedding.

The challenge with ventilation is producing an environment that is draught free at the level of the calf but with enough air movement above the calf to remove pollutants. Sheds that are not purpose designed for calves can have some ventilation problems but it may be possible to make changes to minimise the impact of the prevailing wind.

Ideally, the back of the shed should protect calves from prevailing winds and rain.

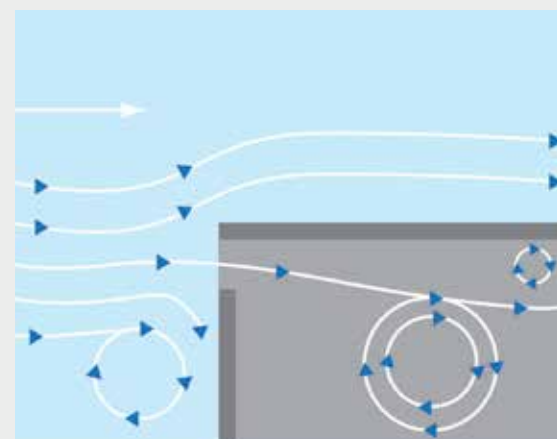
The basic shed design below may not have enough ventilation to maintain good air quality.



— strong air movements
---- weak air movements

Research has shown that improved ventilation can be achieved in this type of shed by creating an opening of 600mm at the very top of the wall.

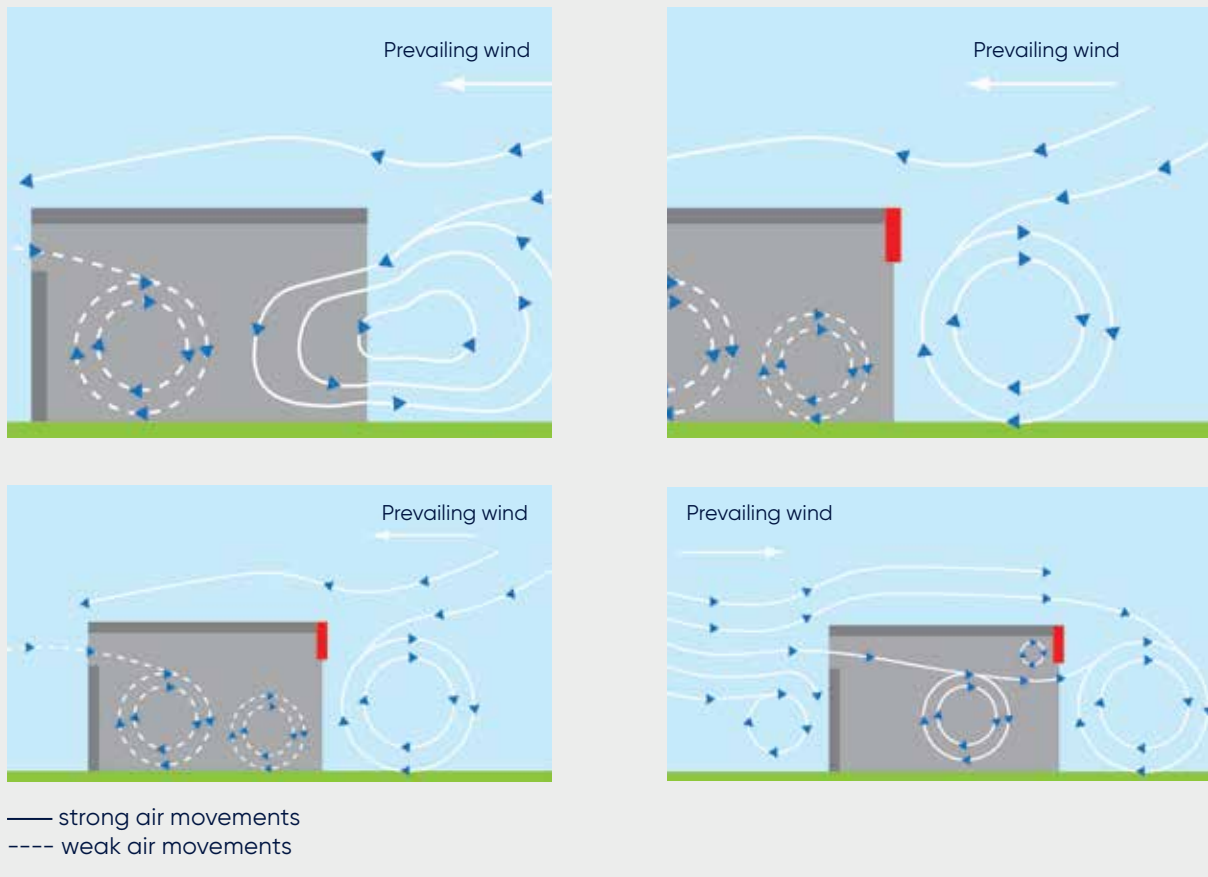
A gap high on the back wall permits good air circulation without exposing calves to direct draughts.



— strong air movements
---- weak air movements

The gap was found to be particularly important in open faced sheds which were 9 metres or more deep. Sheds that were less than 4 metres in depth did not require this opening.

Open faced sheds can benefit from adding a roof skirt to minimise wind and rain impact.



Work with the prevailing wind

No matter which direction the wind is coming from, with some careful observation and planning, it is possible to create comfortable conditions for calves.



Avoid ground level draughts

- Adding a solid front to the pen may also be beneficial if the open face is exposed to prevailing wind and rain.
- Some slatted floors can be draughty – modify them to prevent this occurring by covering with shade cloth and bedding material. Restrict air movement beneath the floor with moveable barriers.
- If raised flooring is being used, care must be exercised when cleaning underneath. High pressure hosing may spread pathogens throughout the shed.

For example

Above: shed panels have been removed to improve air circulation.

Shade cloth draped over the entrance still allows air to circulate but it blocks most of the draughts at ground level.

Not all solutions to problems need to be high-tech or expensive!



For example

Above: on this farm, all Jersey calves and any small Holstein calves are rugged to keep body heat losses to a minimum and to ensure that growth rates are steady for all calves.

Op-Shop blankets are cut down and elastic is attached at one end – this costs about 30 cents all up!

Keep calves cool in hot weather

Calves do best in environments between 12–25° Celsius. Once it gets warmer than that, they tend to eat less and start using energy to keep cool instead of for growth.

In very hot weather:

- limit any stressful activities, like moving, grouping, handling or vaccinating to when it is cooler
- make sure calves have plenty of cool, clean and fresh water. A heat-stressed calf can drink between 10–20 litres of water per day
- provide fresh feed daily to ensure calves continue to eat, even in hot weather, and feed calves before or after peak times of heat and humidity
- clean and sanitise water troughs regularly – this prevents algae, mould and bacteria growth
- keep calves well-bedded and dry
- make sure there is access to shade and fresh, clean air. Either use natural ventilation or increase air exchange with fans.



Trough space

Each calf should have an allowance of at least 35cm of trough space.

This ensures that all calves can access concentrates.

Long feeding troughs are preferred over small round tubs as they permit greater access for all, especially shy feeders and smaller calves.

If smaller tubs are used, make sure multiple feeders are available.

15 calves in this paddock share four feed troughs.



Paddock rearing

In mild climates, calves may be reared outside in paddocks but they still need shelter from extreme conditions.

You can provide either purpose built structures (permanent or transportable) or tree lines and dense vegetation as appropriate to the conditions.

Very young calves (less than one month) need access to shelter from wind, rain and sun.

Suitable vegetation/tree lines should be present to limit the impact of bad weather.

For example

This paddock has tree shelter on three sides and is protected from the wind.



Drainage

Calf rearing areas must be well drained and not contaminated with effluent run off from the dairy or adult cow grazing areas.

- Reducing the exposure of calves to effluent is a critical aspect of the dairy industry's 3-Step Calf Plan for the control of Johne's disease and a component of most milk factory quality assurance programs.
- Reducing exposure to effluent also reduces risk of other calf diseases, such as scours.

The best time to get drainage right in the calf shed is in the design phase. For example, if the shed is to have a concrete floor, then it can be grooved and sloped towards the front of the pen to improve drainage. If concrete flooring is used, ensure bedding is deep enough (>20cm) to allow for adequate footing and drainage.

Drainage of dirt floored sheds can be improved by putting down a deep layer of scoria (5–10cm particle size, depth 30–45cm), followed by a layer of shade mesh on top, followed by the desired bedding on top of the shade mesh. This three-layer system allows adequate drainage whilst preventing mixing of the bedding with the scoria underneath.

When the last calf has left the pen, the shade mesh is simply pulled from the corners towards the centre and dragged out with farm machinery. Shade-mesh should not be re-used as it has a large surface area for pathogens to grow. All used shade-mesh should be discarded.

The scoria underneath is allowed to dry and is then disinfected with a high quality disinfectant (such as Virkon-S) along with the walls of the pen. Time and UV-light are important factors to help reduce pathogens in the calf shed.

If wood chips have been used, the used bedding can be recycled on cow-tracks and areas of pugging.

New shade mesh and new bedding are put down for the next batch of calves. This system has worked very successfully on farms in south west Victoria – whilst the shade mesh is an extra cost, it saves time and money during the calf rearing period.

Ensure that bedding material is absorbent and drains well so calves are not lying in manure or urine.

Design and manage calf rearing facilities to prevent disease

Choose the area to rear your calves carefully.

- Paddocks which have been used for grazing by older stock or holding agisted or sick animals pose a high risk of disease for calves due to contamination from manure – they should not be used.
- Multipurpose sheds used to store chemicals or machinery normally pose little risk, however if there has been a spillage in the past, poisoning or residue contamination can occur.
- Paint on old timber often contains lead and can result in lead poisoning.

Consider the history of the location.

Regardless of the bedding used, adequate drainage is essential. It will help prevent accumulation of wet, soiled bedding and the follow on risk of high ammonia and humidity in the air.

Adapting old dairies

Instead of pulling down old dairies, some farmers turn them into calf facilities. While this can make sense, consider the following issues carefully.

- Paddocks around an old dairy may be contaminated with pathogens.
- The most common problem with converted dairies is lack of ventilation and light – they can be dark and dank.
- Consider Johne's disease risk and allow sufficient time for decontamination.

For example

After a new dairy was built in the centre of this farm, the yards and paddocks around the old walk-through were dedicated to the weaned calves. The old dairy is used for vaccinating and disbudding.

The rubber matting along the race protects calves and keeps them quiet and moving in the right direction.





Comfortable bedding

Providing dry, clean bedding is critical because it helps control a calf's body temperature.

Good quality bedding helps maintain body temperature by preventing heat loss. Less energy is then used for keeping warm and more can be directed to growth.

- Bedding depth should be at a minimum of 15cm at all times.
- Calves should be able to nestle deeply in bedding with their legs obscured by the bedding material.
- If a calf lies in wet bedding, it will conduct heat away from its body.

When calves nibble on what they are lying in, they can get a mouthful of disease causing bugs too!

Bedding options

There are many options for bedding and suitable materials include wood shavings, bark, rice hulls or other non-toxic organic materials.

When selecting bedding materials, don't forget to consider issues like on-going availability, price and the degree to which the material compacts over time. Another important consideration is whether calves will attempt to eat bedding material – avoid this if possible. Also avoid using dusty bedding as it can cause respiratory problems.

Options	Note
Bark chips	• Wood chips, tan bark and post peelings are absorbent bedding materials with good insulating properties and low palatability to calves.
Rice hulls	• Rice hulls are absorbent with good insulation properties. Note that the use of rice hulls is sometimes associated with high incidence of mouth ulceration and small cheek abscesses.
Straw/hay	• Using straw or hay as bedding should be avoided when it is also supplied as a fibre. Calves may consume contaminated bedding and increase their exposure to pathogens.
Wood shavings	• Fine particle sawdust will compact more and is less suitable than larger wood shavings.
Sawdust	• Treated wood/pine shavings or sawdust should not be used as these could be toxic if consumed.
Sand	• Sand does not provide any insulating properties and can accumulate in the stomach of calves if eaten. It is not recommended.

You can use the Dairy Australia bedding calculator to work out the volume of bedding you will require over the calving season.



Regularly replenish bedding

Bedding should be at least 15cm deep and should remain dry at all times. An accessible supply of bedding should be available for the whole calf rearing period.

Calf rearing areas should be designed to allow for easy access of cleaning machinery used to remove, replace or top up bedding.

'Topping up' bedding is an approach used by many farmers.

Digging up soiled bedding when calves are close by can expose them to pathogens contained in dust and particles in the air. Putting new bedding on top makes sense from a disease control perspective as it creates a physical barrier to the contaminated bedding below.

Topping up saves labour during this busy time.

For example

On this farm, calves are housed in a shed with wood chip bedding.

Calves are fed milk individually and have ad lib access to hay as a source of fibre.

Note that the hay is provided off the ground to avoid contamination.



Cleaning

Maintaining a clean environment throughout the calf rearing period can really make the difference to the disease levels and comfort that calves will experience.

- In seasonal or batch calving herds, calf sheds should be cleaned as soon as practical after the last calf leaves.
- Pathogens persist longer in the environment if organic materials such as manure, saliva and bedding are present, so all bedding and organic material should be removed.
- Pressure cleaning is recommended.
- Steam or hot water will improve disinfection.
- Calf rearing personnel should wear clean clothes and boots at all times.
- Make sure disinfection procedures are carried out carefully.

For example

On this farm, calf pens are lined with raised slats and at the end of the season, the owners make a real effort to ensure that slats are meticulously clean.

They are removed from pens and pressure hosed – rotated six times to make sure any visible dirt or manure is removed. They are then dipped in linseed oil to keep the wood in good condition and stored in a dry place till next season.

Disinfecting

Rails, gates, partitions, walls and feeders should firstly be cleaned of any obvious manure or other organic material.

- Disinfection works best if the dirt and manure are removed – pressure cleaning is suitable for this purpose.
- Hot water and soap may be necessary first steps when cleaning milk residues as they aid removal of the fat.
- Using a broad spectrum disinfectant may also be beneficial for best results.
- A minimum of 10 minutes contact time is required – 30 minutes is preferred –for effective disinfection.
- If cleaning pens when calves are in them, avoid wetting calves or creating aerosols of moisture that contain particles and pathogens.
- Calf trailers should be kept clean and disinfected each day.

Sterilising dirt is not effective

Products such as lime are thought to sterilise dirt but they have minimal impact on the number of pathogens present in the ground.

As well as being ineffective, they can be an irritant to both humans and calves exposed to them.

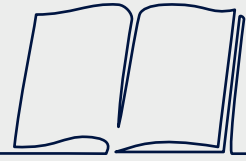
There is little scientific justification to support the use of dirt sterilisers.

Protect calves from wild dogs and foxes

Foxes and dogs can attack newborn calves and even cows.

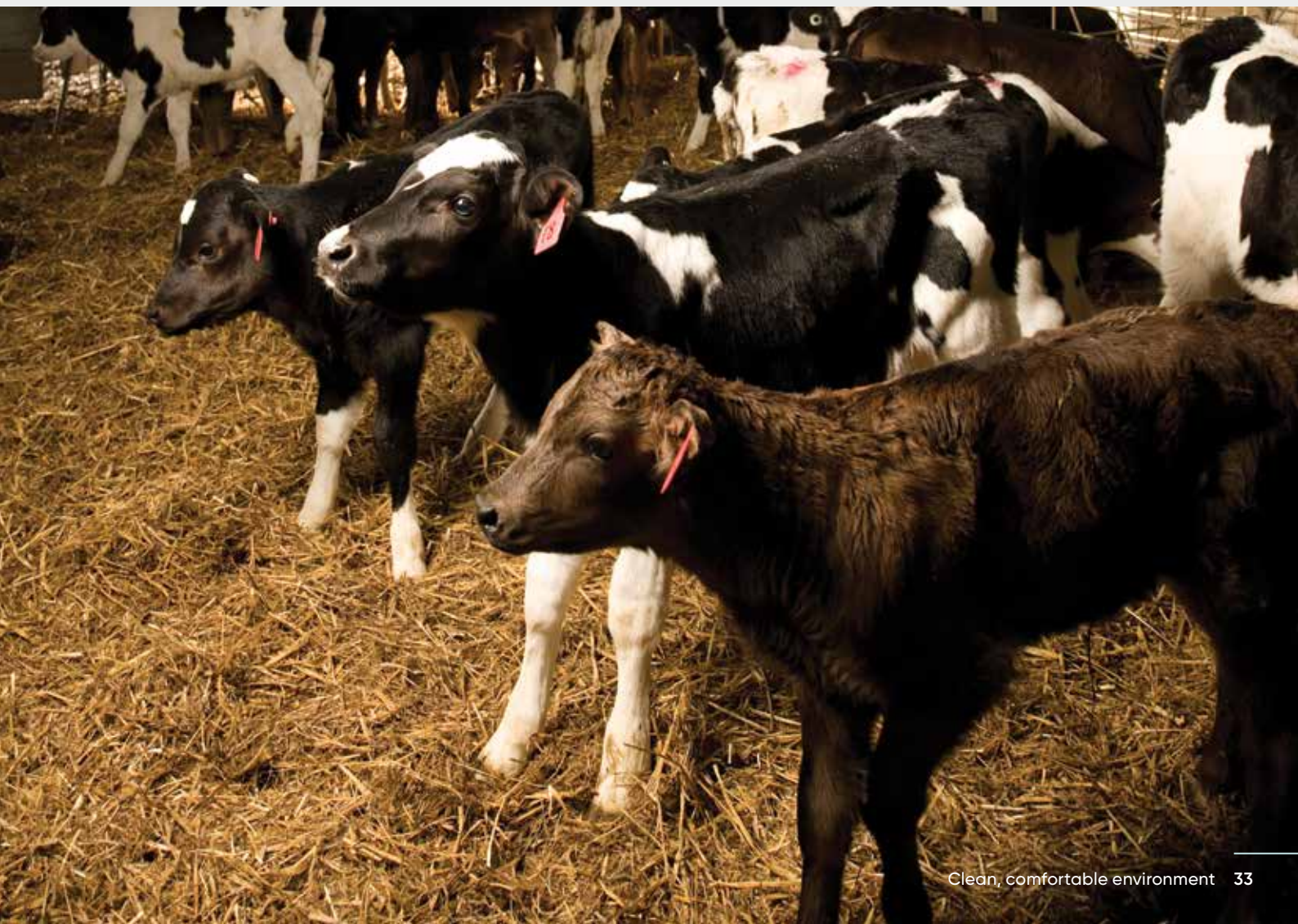
- Calf paddocks pose the greatest risk – the location and fencing should be considered to limit the likelihood of attacks.
- Calves are defenceless against attacks from predators and must be protected. Take steps to control foxes prior to, and during, the calving season.

Summary of recommendations



Calf rearing environments should be clean and comfortable to reduce the risk of disease and help calves grow well.

- 1 Check that your calf rearing facilities are suitable for your current and future needs.
- 2 Design calf rearing sheds to provide adequate protection from wind, rain and heat. Consider making adjustments to sheds to ensure good air circulation, while minimising draughts.
- 3 Keep dairy effluent away from the calf rearing environment.
- 4 Choose an absorbent and comfortable bedding material that insulates the calf from the cold.
- 5 Maintain a clean environment by topping up bedding material regularly and disinfecting rails, partitions, walls and gates in calf pens.
- 6 Make sure that calf rears do not spread disease – clothes and boots should be cleaned and disinfected as appropriate.
- 7 Plan pen layouts and procedures that minimise the need to enter calf pens.





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Identification and traceability

Keep accurate and complete records for all calves

- Record the date, sex and dam ID for every calf – herd replacements and calves you intend to sell.
- Ensure all calves are permanently identified as soon as possible after birth.
- Record any calving complications, treatments and health issues during rearing.
- Always identify any calves that receive treatments or medications.



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Identification and traceability

Records must be kept for every calf – they must be accurate and complete.

The benefits of accurate records include:

- informed management and breeding decisions
- less risk of selling calves with antibiotic residues
- confirmation of age of calves at sale
- evidence of control practices for calf diseases including Johne's disease
- ability to work out the costs of calf and heifer rearing.

The ability to confirm the identity of cattle and trace them back to their farm of origin is critical for the Australian dairy industry.

- The ability to accurately identify calves assists farmers with initial breeding decisions and on-going health and production management.
- A reliable and robust system of identification and traceability helps Australia gain access to export markets and assures customers of the food safety of dairy products – meat and milk.

It is essential to keep accurate and complete records of all calves.

Identify all calves

The bottom line is that all calves must be identified – herd replacements and those destined for sale. You must:

- provide a unique and traceable identification for each calf
- record the date, dam and sex of every calf born.

This should be done as soon after birth as possible.

Find an identification system that works for you

A method for easy identification of animals from a distance is vital for an efficient calf management system.

The general principle is that all calves should be readily identifiable to all staff at all times.

In practical terms this means staff can tell at a glance if the calf is a replacement, has received treatment or is destined for sale in the next couple of days.

- Identify calves with a permanent identity tag as soon as practical after birth. Many farms use both an NLIS tag and a farm tag.
- Use more than one method if possible in case a tag is lost.
- Make sure that all the tools for identifying calves are readily accessible from calving areas.
- All farm workers need to understand the identification system used on your farm.

Non permanent, short term identification methods may consist of necklaces or a system of coloured paint markings.

Records help colostrum management

Calves that experience difficult births or other complications are less likely to consume enough colostrum if unaided. Accurate identification of these calves can help ensure that they receive appropriate colostrum management.

Knowing the time and date of birth makes it easier to work out which calves should receive the highest quality colostrum.

Timing of colostrum consumption is important as the ability of the newborn calf to absorb antibodies in the colostrum is highest during the first four hours following birth. The calf's ability to absorb the protective constituents of colostrum steadily declines beyond this point.

For example



On this farm most cows calve in a well set up shed which is close to the house. This makes it possible to remove calves from their dams very quickly – about 10 minutes after birth. As the calf enters the shed, staff place a temporary ID necklace around the calf's neck and record this number next to the dam's ID number on the record sheets.



As a double check, they also record the pen number the newborn is assigned to. The system works even if it is late at night – there is never any doubt which calf is which.



Before calves are moved out of the 'reception pens' to join the other calves, they are permanently identified. Note – each calf has 3 forms of identification – white NLIS tag, yellow farm tag and brass ear clip.

Identify sale calves

Calves destined for sale also need early permanent identification. Delaying identification increases the risk of mix ups.

Calves must be at least 5 days old before they can be transported to calf scales, saleyards or sent to abattoirs. A documented birth date and calf identification system enables all those involved to identify calves that are eligible for transportation and provides auditable evidence should a dispute arise.

For example

On this farm, the sale calf pen is clearly identified.

This makes it easier for all staff giving veterinary treatments or chemicals that have withholding periods.

Calves in selling pens are never treated with veterinary products that have withholding periods.

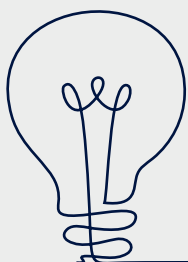




Identify all treated calves

Every year a small number of calves are detected with antibiotic residues at slaughter. These incidents can harm our markets, damage the reputation of Australia's dairy and red meat industries and lead to fines or even prosecution of the farmer. All dairy farmers have a responsibility to ensure that young calves which may have antibiotic residues are not sent off for slaughter.

Many dairy farmers do not treat sale calves with antibiotics but will treat them with electrolytes instead.



Delaying the identification of calves destined for sale increases the risk of these animals being misidentified. Lack of clear identification also increases the risk of accidentally treating sale calves with antibiotics.

Whether you treat sale calves or only herd replacements, you must:

- record each and every calf treatment
- record calf ID, date, treatment and withhold period
- clearly mark each calf so that they are easily identifiable by all staff.

Consider using additional methods of identification for treated sale calves in addition to the NLIS tags.

- A specific coloured tag and highly visible paint markings are good options.
- Ideally, treated calves should be separated from non-treated calves.

These steps will help ensure that withholding periods are adhered to and treated calves are not sold before the drug withhold period elapses.



NLIS tags

The National Livestock Identification Scheme (NLIS) is the Australian system for identifying and tracing livestock.

Animals can be tracked throughout life from their property of birth through to slaughter. Many of Australia's trading partners demand trace back systems to be in place before granting access to their markets. This allows for producer feedback on meat quality, tracing animal movements when disease problems occur or to find the source of chemical residues. This system is also an important measure for control of exotic disease outbreaks.

Each NLIS tag contains a microchip encoded with a unique radio frequency identification (RFID) number that is linked to the NLIS database and the PIC number of the property where the animal resides. Once applied to an animal, the device is designed to remain with the animal for its entire life.

It is illegal to remove an NLIS device unless it is damaged or faulty. NLIS tags are suitable for the early identification of calves. Any animal that leaves your property must have an NLIS ear tag in the right ear, including sale calves.

More and more farms are benefiting from electronic identification of stock as an aid to everyday herd management e.g. in automated calf feeding and drafting systems.

For information visit <https://www.nlis.mla.com.au/NLISDocuments/Applying%20NLIS%20devices.pdf>

To see how to apply an NLIS ear tag correctly, download the NLIS tag brochure.



Or scan the QR code below:



Summary of recommendations



Complete records and accurate identification are critical.

- 1 Record the date, sex and dam ID number for every calf born on farm.
- 2 Record any calving complications (such as any assistance offered or trauma) and health issues during rearing.
- 3 Make sure all calves are permanently identified as soon as possible after birth to minimise the risk of misidentification.
- 4 Always clearly mark calves that receive treatments – all staff should be able to spot these calves very easily. This is critical to eliminate the risk of selling calves contaminated with antibiotics.
- 5 Record the birth details of sale calves as soon as possible and make sure they have permanent identification too.
- 6 All sale calves must have an N LIS eartag applied before leaving your property.





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Colostrum management

Colostrum is essential for all calves

- All calves need colostrum to get off to a great start – heifer replacements and sale calves.
- Failure to absorb enough IgG (antibodies) from colostrum in the first 24 hours of a calf's life can make the calf more susceptible to disease and death.
- This is known as Failure of Passive Transfer (FPT) and is relatively common.
- Good management practices (the four Qs) can limit the chance of FPT.
- You can test for frequency of FPT and for the quality of your cows' colostrum.

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What is colostrum?

Colostrum is the first mammary secretion produced after calving. Unlike in humans, the placenta of the cow keeps the maternal blood supply separate from that of the developing foetus. This means that the calf is born without antibodies in its bloodstream.

Colostrum provides maternal antibodies for the newborn calf that help it fight disease. A calf that does not receive colostrum has a higher risk of illness until it develops antibodies of its own at around 6 weeks of age.

All newborn calves need colostrum – herd replacements and sale calves.

Colostrum begins forming in the udder about 5 weeks before calving and production ceases completely once the cow gives birth. It is most concentrated and of highest quality at the point of calving.

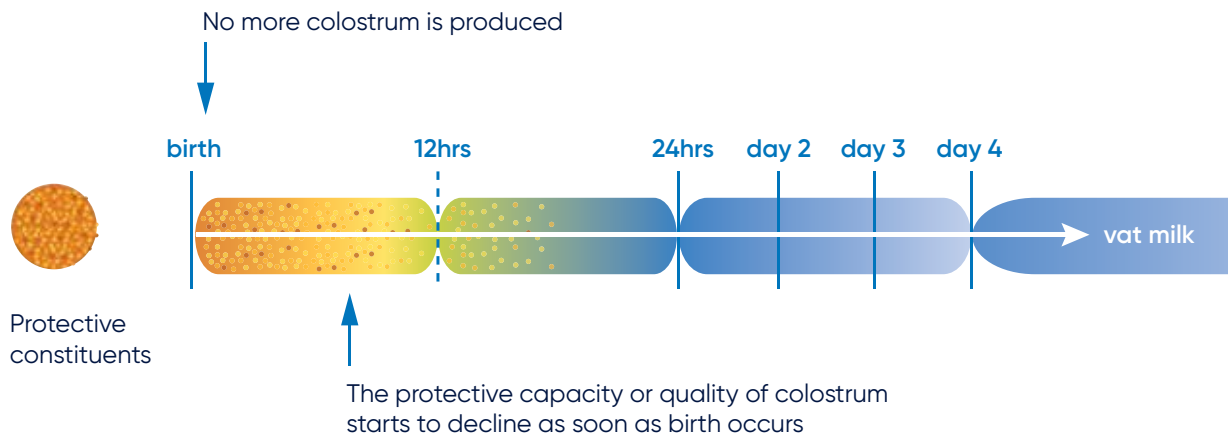
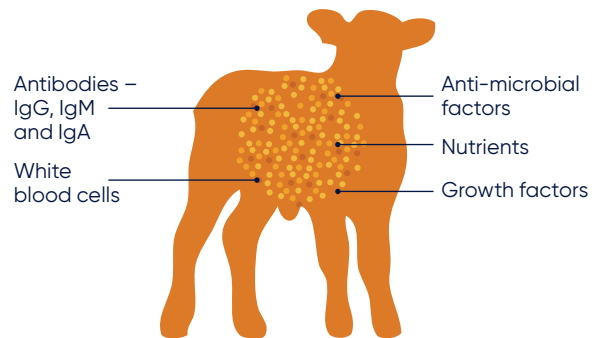
Colostrum is a unique mixture of factors derived from the cow's udder and blood that work together to provide nutrition, growth factors and immunity for the newborn calf. No wonder good calf rearing treat colostrum like 'liquid gold'.

Why is colostrum so important?

Providing the correct amount of high quality colostrum to newborn calves will help ensure:

- less scours and other diseases
- reduced death rates
- better growth rates
- improved lifetime milk production and fertility (in females).

Key constituents



Milk companies may define colostrum differently!

Milk for human consumption must have a specific composition so colostrum (from the first milking) and the transition milk (from the next 7 milkings) must be excluded from the milk vat. Some companies refer to all substances from the first 8 milkings as 'colostrum'. Only first milking colostrum will ensure passive transfer of immunity to newborn calves. Transition milk is still very nutritious and can be fed to newborn calves.

Remember

- No additional colostrum is produced by the cow from the moment the calf is born.
- The protective quality of the cow's colostrum declines after calving even if the cow is not milked or suckled.
- Colostrum collected straight after birth maintains its protective capacity if stored correctly in the fridge or freezer.

Only use 'first milking' colostrum for newborn calves.

Failure of passive transfer of immunity

The only way a newborn calf can receive antibodies (IgG) from the cow is through consuming colostrum. This is referred to as passive transfer of immunity.

Failure of passive transfer (FPT) means that calves do not have protective levels of antibodies in their blood stream 36–72 hours after birth.

Calves with FPT may remain healthy, particularly where there is a low disease challenge, but have an increased risk of disease and death prior to weaning.

Longer term issues include:

- increased veterinary costs associated with sick calves
- increased losses in the pre and post-weaning periods
- decreased rate of growth
- increased average age at first calving
- lower milk production during their early years in the milking herd.

FPT is common. It is estimated that approximately 31 per cent of pre-weaning deaths in the first 3 weeks of life could be related to this issue. A study of 100 herds in south west Victoria showed that 38 per cent of heifers had FPT and two thirds of herds had more than 25 per cent of calves with FPT.

Why do calves get failure of passive transfer?

- Feeding colostrum with inadequate levels of IgG.
- Feeding insufficient volumes of colostrum.
- Feeding colostrum too late after birth.
- Bacteria contaminating colostrum at harvest, during storage or at feeding. Coliforms (bacteria from faecal material) have the worst effect on immunoglobulin absorption.

Calves left on their dams are at high risk of FPT.

One study showed that 64% of calves left on their dams failed to consume enough colostrum compared to 11% of those fed colostrum by stomach tube. Another showed that calves left to be suckled were 2.5 times more at risk of FPT.

Relying on suckling alone to provide transfer of immunity places the health of newborn calves at risk and is not recommended.

Removing calves as soon as possible after birth and giving them a known quantity of colostrum is far more reliable than suckling.

You can test for the prevalence of FPT by blood sampling 12 healthy calves (not scouring or dehydrated), between 24 hours and seven days of age, for laboratory analysis of total protein. It is recommended that this is done both at the beginning and peak of calving when the prevalence of FPT is typically higher.

A total protein value of 55 mg/ml (or above) indicates that successful passive transfer has occurred. Australian research has shown that these calves have half the odds of being treated with antibiotics or electrolytes compared to calves with values less than 50 mg/ml. Recent overseas research indicates that values of 58–63 mg/ml may be even better to aim for – the higher, the better!

If 20 per cent or more of tested calves are below 55 mg/ml then you should review your colostrum management system.

A man with a white beard and a blue beanie is wearing a dark blue jacket and blue gloves. He is pouring a thick, yellowish liquid (colostrum) from a clear plastic jug into a white plastic bottle. The background is a blurred outdoor setting with a fence and trees.

Four Qs of colostrum management

Successful transfer of immunity via colostrum requires close attention to the following factors:

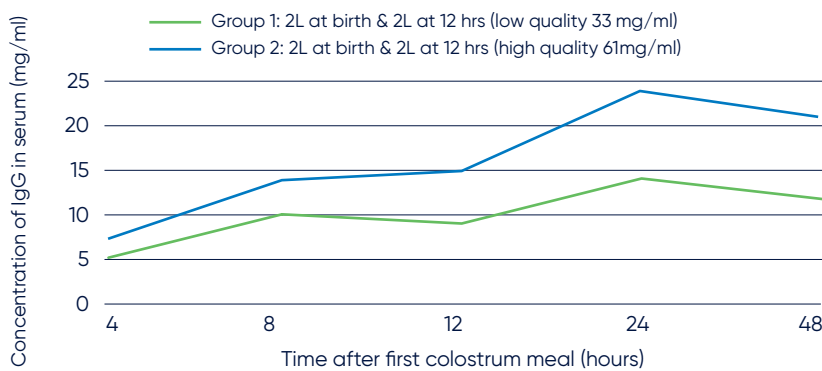
- Quality
- Quickly
- Quantity
- sQueaky clean.

Quality

High quality colostrum has an IgG (antibody) concentration of greater than 50 milligrams of IgG in each ml of colostrum.

Colostrum with a high IgG concentration is more reliable at transferring immunity to the calf.

Very high	60mg per ml
High	50mg per ml
Low	30mg per ml



These results show the benefits of using high quality colostrum.

Calves were fed the same quantities within the same timeframes. Calves fed better quality colostrum had much higher concentration of blood serum IgG.

Factors affecting the quality of colostrum – you can control some of these

Factor	Notes
Length of the dry period	• Dry periods less than 5 weeks are likely to decrease colostrum quality.
Delay in first milking after calving	• The quality of the colostrum declines the longer it is held in the udder.
Volume of colostrum at first milking	• High volumes of colostrum at first milking (i.e. more than 8.5 litres) may mean that the quality is poorer, but you should always test colostrum before discarding.
Vaccination of the dam	• Vaccinating your herd 3 to 6 weeks before planned start of calving will boost specific antibody levels in colostrum
Age of dam	• Older cows generally have better quality colostrum (due to greater exposure to disease) but some heifers produce high quality colostrum. • Always test colostrum quality before discarding.
Breed of dam	• Jerseys tend to have higher levels of IgG because of lower volume, but you still need to test the colostrum quality.
Mastitis/High cell counts in dam	• Colostrum that is stringy, flaky or bloody should not be used. • Test and check IgG levels of colostrum from cows with high cell counts as it can still be good quality.
Early calvers	• Cows that calve early (induced or naturally) generally produce colostrum with lower IgG level.

Assessing the quality of colostrum

You should routinely assess the quality of each colostrum sample you collect. Testing individual cows only takes five seconds using a Brix refractometer. It is difficult to judge IgG content of colostrum visually.

How to use a Brix refractometer

Brix refractometers are robust, pocket-sized tools that are well suited for use in the dairy environment. Inexpensive Brix refractometers can be purchased online, through some veterinary clinics or local scientific suppliers. Check that the device is measuring on the Brix scale with a range of at least 15–25%. Both optical and digital versions are available.

The Brix refractometer uses a beam of light to determine the optical density of the colostrum. The greater the protein level in the sample, the more light is bent from the light path. Values are read as a percentage.

Use a Brix refractometer to check the quality of colostrum rather than your eye.

Mix the colostrum sample well before taking a single drop for testing. Results are accurate and repeatable. A digital Brix refractometer does not need a bright light source to read the scale, and takes the guess work out of the reading by supplying an exact number.

Tip: If a reading on the scale of an optical Brix refractometer appears fuzzy, try wiping the face of the refractometer clean and then re-apply a smaller drop of colostrum. Alternatively, choose a point midway between the end and start of the blue fading.



Refractometer

A Brix score (or density) of 22% is the cut off for detecting good quality colostrum (IgG above 50 mg/ml). If the colostrum sample has a value below 20% it is of poor quality (less than 30 mg/ml). Do not feed it to calves during the first 24 hours of life. Save it for feeding to calves at days 2 and 3 of age.

Newborn calves should be given the freshest, highest quality colostrum.

Older calves can be given older and lesser quality colostrum.

Pooling colostrum from different cows

Pooling colostrum can greatly reduce the quality of colostrum – mixing high quality (high IgG/ml) with low quality colostrum creates a more dilute and lesser quality colostrum. Pooling colostrum is usually practiced to achieve a greater quantity. If high quality colostrum is harvested and fed to newborn calves then the quantity required is much less. If pooling is unavoidable then only mix like with like i.e. Brix >22% with Brix >22%. This way the quality will not be changed.

Special care calves

Research has found that calves born in weather extremes are more likely to have difficulty in standing and suckling and so are likely to have reduced IgG intake and absorption. Calves that experience a difficult birth or are born prematurely are also at risk. Identify high risk calves as soon as possible after calving and make sure that they get the highest quality colostrum.

Colostrum replacement products

Be wary of commercial colostrum replacements. They may be promoted as a viable alternative to cow's colostrum but remember nothing beats fresh, high quality colostrum. Many products promoted as colostrum substitutes, supplements and replacers have been found to have very low levels of IgG and have little value in preventing FPT.

Quickly

Time is of the essence in the transfer of immunity to the newborn calf. The clock starts ticking as soon as the calf is born because the calf's intestine can only absorb antibodies (IgG) for a short time.

- Straight after birth – the calf's intestine absorbs the large IgG molecules easily.
- Within 6 hours of birth – the intestine's ability to absorb IgG has decreased by 30–50%.
- Between 24 to 36 hours after birth no more IgG can be absorbed.

Calves should be removed from the calving area as soon as possible after birth to reduce exposure to pathogens that cause diseases like calf scours and Johne's disease.

Leaving the calf to suck colostrum from the dam is no guarantee of successful transfer of immunity.

Continuing to feed colostrum to calves beyond the initial 24 hours (after the calf gut 'closes') may also have advantages, as the IgG can still bind to pathogens in the gut and help protect the calf from infections. Colostrum is also a highly nutritious food for calves.

Poorer quality colostrum should be reserved for feeding calves over 24 hours of age.

Get good quality colostrum into all calves as soon as possible after birth.



Quantity

The quantity of colostrum each calf needs to achieve successful passive transfer depends on:

- the amount of antibodies (IgG) contained in the colostrum
- the time elapsed after the birth of the calf
- the cleanliness of the colostrum
- any special needs of the calf.

Testing quality with the refractometer takes the guess work out of how much to feed:

- **Good quality** (> = 22% Brix) – give 2 x 2 litre feeds within the first 12 hours of life
- **Poor quality** (< = 22% Brix) or if not tested – give 2 x 3 litre feeds within the first 12 hours
- An additional feed of 2 litres of good quality, fresh colostrum in the next 12 hours is beneficial.

Greater volumes and more frequent feedings can be used to increase the likelihood of transfer of immunity but if overfeeding problems are a concern, avoid feeding more than 2–3 litres in a single feed and space out feeds by at least 2 hours.

Remember

Even if your colostrum management is perfect, some calves may still get sick or die. Colostrum is only one piece of the puzzle and it will not compensate for lack of attention to other areas of calf rearing such as protection from the elements, nutrition and calf shed hygiene.

You can also use the Dairy Australia Colostrum Calculator to work out the optimum volume to feed.

Check the volume

Some stomach tube bottles only hold about 1.8 litres at best – this is not the same as 2 litres!

Giving 2 nearly full stomach tube bottles could only provide the calf with 3 litres of colostrum when 4 litres was the plan.

Keeping track of colostrum feeds

It is useful to have a recording system to ensure each calf receives the correct number of feeds of colostrum: such as a white board with ticks i.e. 2 ticks = 2 feeds or paint marker on calves i.e. 1 strip/dot = 1 feed.

Squeaky clean

Excellent hygiene is necessary to maintain colostrum quality and minimise the growth of bacteria.

Large numbers of bacteria in collected colostrum may bind to the antibodies and interfere with absorption by the calf. Bacteria present in colostrum and other pathogens may also cause disease in the newborn calf. You can minimise these issues by:

- avoiding direct contamination of colostrum during collection, storage and handling
- preventing any bacteria present from multiplying up to high levels.

Clean colostrum is defined as:

Total Plate Count (TPC) <100,000 cfu/ml
(cfu = colony forming units)

Total Coliform Count (TCC) <10,000 cfu/ml
(coliforms indicate faecal contamination)

Bacteria in colostrum can double in number every 20 minutes if left at room temperature.

High numbers of bacteria may interfere with IgG absorption across the calf's intestine in the first 24 hours of life. Feeding contaminated colostrum can contribute to FPT from the cow to the calf, putting it at greater risk of disease. The newborn calf's intestine is also very 'leaky' for the first 14 days of life so bacteria can more easily enter the body and cause disease.

Laboratory testing

A Total Plate Count (TPC) or Total Coliform Count (TCC) can be obtained for fresh or frozen colostrum by submitting samples to a laboratory via your vet practice. It is best to submit samples from a few different batches of colostrum over the calving period. As a guide, if more than 80% of samples come back with TPC exceeding 100,000 cfu/ml or TCC over 10,000 cfu/ml then you should review the cleanliness of your colostrum collection and storage practices.

Most colostrum is not squeaky clean!

A recent study of colostrum quality on northern Victorian dairy farms found that only a minority of samples met all quality standards. Only 23% of the 240 samples taken around the Rochester area met industry recommendations for total plate and coliform counts as well as Brix quality standards. These findings demonstrate that a large number of calves were at risk of receiving colostrum of poor quality, with high bacterial loads that may have interfered with the transfer of passive immunity and affected calf health.

Controlling contamination of colostrum

Cow side

- Remove the calf from dam as soon as possible after calving to limit the amount of suckling and contact with contaminated udder skin.
- Clean, disinfect and dry teats prior to harvesting colostrum.
- Do not use colostrum from cows that are sick or suspected of being positive for disease such as Johne's disease, Salmonellosis or Mycoplasma.
- Discard colostrum if you can see evidence of contamination i.e. faecal or other organic material present.
- Do not pool raw colostrum – it increases the risk of spreading bacteria.

Equipment

- Collection, storage and feeding equipment must be spotlessly clean and disinfected before use.
- Stainless steel buckets are easier to clean.
- Rubber teats must be washed and dried.



How to clean equipment containing milk

Containers

1. Rinse

Use lukewarm water. DO NOT rinse with hot water. Rinse/scrub off dirt and milk residue.

2. Wash

Use hot water (>50°C) and add detergent. Brush all surfaces to remove any milk residue. Disinfection can be added at this step. Virkon-S or bleach can be used as per label directions. To achieve disinfection the solution needs to be in contact with equipment for at least 5–10 minutes.

3. Rinse

Use warm water to thoroughly rinse containers. Can finish with an acid rinse and leave on to dry.

4. Dry

Allow the bottles and buckets to drain and dry – preferably on drying racks. Do not stack buckets inside each other. Do not sit buckets upside down on a concrete/solid floor as residues build up around the rim.

Rubber nipples should be thoroughly cleaned inside and out following the above protocol.

A firm brush will help. Discard nipples that are cracked and showing signs of aging. It is good practice to replace nipples at least annually (or sooner if required).

Storage: short term

- Store colostrum in a container with a lid to avoid further contamination.
- Refrigerate excess colostrum within an hour of collection.
- Refrigeration at 4°C will maintain bacterial quality for up to 48 hours.
- Very short-term cooling can be achieved by adding some clean plastic containers containing frozen water into the buckets holding the warm colostrum. Any plastic container used for this purpose must be thoroughly cleaned between uses.
- Colostrum should be fed to calves at 35–38°C – place container in a warm water bath (not hot water).

Potassium sorbate

Potassium sorbate (a preservative commonly used in the food and wine industry) can be added to colostrum immediately after collection to inhibit bacterial growth for at least 4 days. Refrigeration at 4°C is still essential – if potassium sorbate is added to colostrum which is then left at room temperature, bacteria will quickly multiply up.

Potassium sorbate is not helpful if colostrum is already heavily contaminated or starting to go off. Your vet can provide advice on sourcing, handling and using this product at the correct concentration.

Storage: long term

- Always test colostrum quality before storing – it is unwise to store poor quality colostrum. Record the Brix reading on the container, along with date of collection.
- Deep freezing is recommended – small freezers in the top of refrigerators do not reduce the temperature quickly enough to prevent microbial growth.
- Use thin, flat storage bag (e.g. plastic bags laid on trays) rather than plastic containers (e.g. old milk cartons) to reduce both freezing and thawing times.
- Frozen colostrum should be discarded within 12 months of collection.
- Colostrum should be thawed in a water bath at no hotter than 49°C i.e. lukewarm! Do not use a microwave as this will destroy the antibodies.
- It is a good idea to freeze some good quality colostrum towards the end of calving, ideally from vaccinated cows. This will provide a 'colostrum bank' for calves born to heifers at the beginning of the next calving season. Heifers commonly produce low volumes of colostrum and the quality may also be poorer.

Heat treatment and pasteurisation

Heat treatment of colostrum using commercial pasteurisation units on farm is a relatively new approach to improving the cleanliness of colostrum. This practice involves heating colostrum to 60°C for 30 or 60 minutes in a special pasteurising unit. This process differs from traditional milk pasteurisation, which causes damage to the antibodies in colostrum. Other pasteurisers using UV light are also available but limited information suggests that they are not as effective at reducing bacterial counts.

Although the initial setup can be expensive, pasteurisation can deliver significant benefits. Studies have shown significantly reduced TPC and TCC, without damage to colostrum IgG and when fed, resulted in higher IgG levels in calves. It is a valuable method for reducing pathogens that cause calf health problems like scours (*E.coli* and *Salmonella*), Johne's disease and *Mycoplasma bovis*. Pasteurisation of milk fed to older calves confers similar health benefits.

If using heat treatment or pasteurisation of colostrum it is recommended to regularly test the bacterial levels of the treated colostrum (by culturing), to ensure the processing system is working correctly.

How to give colostrum

Colostrum can be given to a calf via an oesophageal tube (commonly referred to as 'tubing') or a teat feeder.

Tubing (oesophageal/stomach)

Oesophageal feeding tubes (sometimes referred to as stomach tubes) are preferred by some farmers. Once the practice of 'tubing' calves is learnt it can be quickly carried out.

- Oesophageal feeders ensure rapid ingestion of a known volume of colostrum without the need to teach the calf how to suck. This is valuable when the calf is born weak or has had a difficult birth
- Care needs to be taken as poor technique may damage the oesophagus and incorrect tube placement can result in colostrum being taken into the lungs causing pneumonia or even the death of the calf.
- The operator must be trained to ensure correct placement of the tube and to regulate the rate at which the colostrum is administered.

Check the volume of the stomach tube bottle – many only hold a maximum of 1.8 litres when full.

Teat feeding

Teat feeding requires training the calf to suck on a teat before the colostrum can be given.

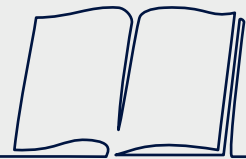
Teat feeding is preferable to tube feeding in calves over 12 hours of age. It may also be best to teat feed if you have poor quality colostrum.

Colostrum given by tube does not go directly into the true stomach but is deposited into one of the forestomachs. This can delay the absorption of the colostrum by up to 3 hours.

If fed good quality colostrum in the first 12 hours, this slightly slower absorption is of little consequence but if colostrum intake has been delayed, the best strategy is to feed colostrum via a teat.

If for some reason a calf has not received colostrum in the first 12 hours of life it may be better to teat feed it.

Summary of recommendations



Remember the four Qs

Feed newborn calves with the highest quality colostrum available – as soon as possible after birth.

- 1 **Quality** – Colostrum should be harvested as soon as possible after a cow has calved. Test colostrum quality! Use a Brix refractometer to assess the antibody concentration in the colostrum before you feed, store or discard it.
- 2 **Quickly** – Feed calves as soon as you can – remember the calf can only absorb antibodies for a short time after birth.

- 3 **Quantity** – use the Brix reading to adjust the volume – if in doubt give more rather than less.

- 4 **sQueaky clean** – Make sure the colostrum is collected hygienically into clean collection containers. If storing colostrum, refrigerate or freeze quickly and avoid pooling from different cows.



Good nutrition

A healthy start and a productive future

- All calves need access to fresh clean water from birth.
- Good results are obtained with either teat or bucket feeding.
- Feed either warm or cold milk but be consistent.
- Surplus milk is the most cost effective.
- Only use good quality milk replacers.
- Introduce small quantities of grain or concentrates from day one to drive rumen development.
- Feed good quality fibre from 3 weeks of age to help the rumen function properly.
- Monitor growth rates regularly.
- Growth rate in young calves may affect their age at first calving and first-lactation milk yield.

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Healthy now for a productive future

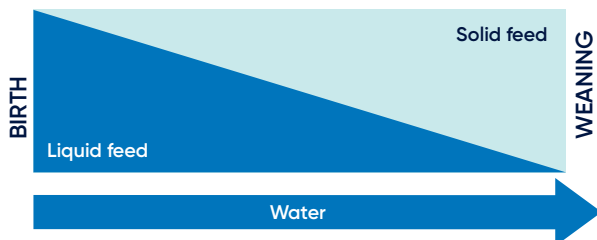
The aim of any calf rearing program is to ensure that all calves are healthy and that replacement calves are productive over the course of their lives in the herd.

The effect of good nutrition provided at the start of a calf's life has a big impact in terms of:

- 1 general health status
- 2 growth rate and weaning age
- 3 fertility and mating
- 4 production levels
- 5 longevity in the herd.

Providing calves with good quality colostrum straight after birth gets them off to a great start. The next challenge is to help the animal make a smooth transition from being a 'drinker' to an 'eater'.

Initially, milk provides the main source of nutrients for the newborn calf. As the calf ages, it obtains more and more of its nutrients from solid feed. Of course, fresh, clean water is essential throughout an animal's life and must be provided to all calves from day one.



Good nutrition

Provide consistent and correct nutrition to all calves – the benefits include

- Steady development of the rumen
- Healthier calves
- Better growth rates
- Less setbacks at weaning
- Earlier calving age
- Improved milk production in future lactations.

Healthy calf development depends on correct nutrition.

Facts about calf digestion

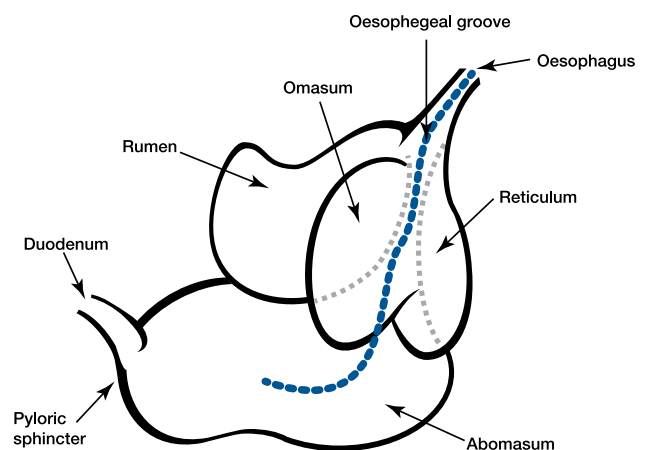
Understanding the basics about how a calf digests milk, water, grain/ concentrates, fibre and pasture allows you to work with a calf's digestive system to achieve successful weaning and future production.

The absorption of milk and water

Milk

When a calf drinks milk, the liquid travels down the oesophagus and is channelled via the oesophageal groove. This groove allows milk to bypass the rumen and enter the abomasum directly.

Once the milk enters the abomasum, it forms a clot and nutrients are slowly released into the calf's blood stream. After a while this clot moves into the intestine where it is digested further.

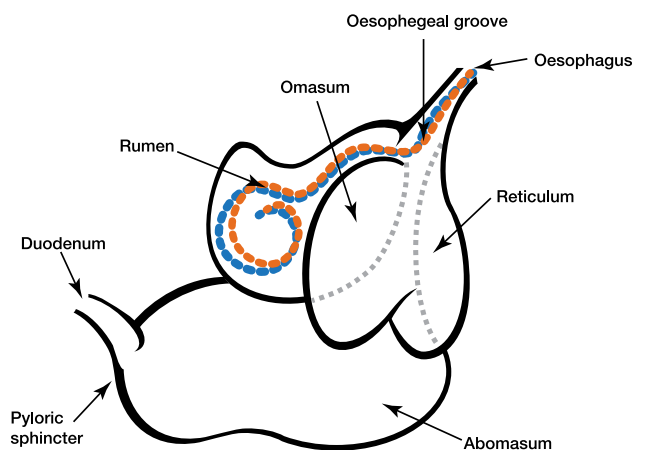


Water

The pathway that water takes is different from milk. When a calf drinks water it travels down the oesophagus but is mainly channelled towards the rumen.

Fresh water rather than the water present in milk or milk replacer is essential for a calf's health.

Later on water plays a critical role in the healthy function and development of the rumen.



Teat feeding, buckets and the oesophageal groove

Feeding milk via the teat was once believed to be more natural and better for promoting the formation of the oesophageal groove. In reality though, minimal milk enters the rumen of bucket reared calves.

The formation of the groove by the calf is probably triggered as much by sensory means, such as the calf seeing the feed arriving as it is by any chemical factor in the liquid feed.

Fresh, clean water is essential

Water is required to maintain normal body function in all animals, regardless of age. Water must be available to all calves from birth and always be fresh and clean.

- Water is an integral part of every cell in the calf's body.
- Water helps to avoid dehydration in calves that are scouring.
- Water is needed for the rumen to function.
- Water needs to be supplied separately – never rely on milk/milk replacer to supply the water requirements of calves.

All calves, sale calves included, must be provided with fresh, clean water from birth.

There is no evidence to suggest that calves will over consume water and consume less concentrates. In fact, the opposite has been shown to be the case:

- Early access to water encourages early consumption of concentrate.
- Research has shown that calves not offered water ate 31% less dry feed.
- Calves also gained 38% less weight over a 4 week period than calves that had constant access to water.

It is important to have water positioned near any concentrate feed so calves can access it easily. The water will get messy and will need to be changed regularly, rather than just topped up.



Rumen development and rumen function

It is important to distinguish between rumen development and rumen function. The ability to wean a calf is dependent on it having a developed rumen that functions well.

- Rumen development is driven by the chemical breakdown of grain and grain based concentrates.
- Fibre in the ration helps ensure rumen function is optimal.

In the past, the physical stimulus that fibrous feed, like straw, provides was thought to be the most important factor in achieving good rumen development in a calf.

This is incorrect and too much fibre will lead to reduced average daily growth rates.

If calves are to be weaned successfully without losing condition, it is essential that the rumen is properly developed.

The digestion of grain/concentrates

The difference between a poorly developed rumen and one that is well developed comes down to the size and numbers of papillae on the rumen wall.

Papillae are the small projections that grow on the wall of the rumen that absorb nutrients. The two key things to remember about papillae are:

- the more papillae there are, the greater the surface area available to absorb nutrients
- the presence of certain chemicals in the rumen promotes the development of papillae.

The two principle chemicals that contribute to papillae development are propionate and butyrate – these are both volatile fatty acids (VFAs) and are the major breakdown products of grain and grain based concentrates.

As these photographs show, the early introduction of grain or grain based concentrates stimulates the growth and development of papillae. In addition, extra energy becomes available from the feed to supplement the total energy available to the calf.

BIGGER HEIFERS ARE MORE PRODUCTIVE – IT IS A FACT!

Calves with more developed rumens grow better and produce much more milk in the long term.

Heifers that are 50kg heavier at calving can produce at least 1,041 litres more over their first 3 lactations.

Better calf growth rates translate into better grown heifers at first calving.



Diet: milk only – 6 weeks



Diet: milk and hay – 6 weeks



Diet: milk and grain – 6 weeks

Source: Penn State University, USA

The role of fibre

The role of roughage or fibre is to promote the growth of the muscular layer of the rumen and to maintain the health of the rumen lining.

- Papillae can become too long and clumped if exposed to high levels of the volatile fatty acids contained in grain.
- The abrasive effect that dietary fibre has helps maintain papillae in optimal condition.

Choose a source of fibre that is different from the bedding.

If straw is used as bedding it should not be used as a feed supplement. Calves may eat contaminated bedding and consume disease causing organisms.

From liquid to solid feed

As a calf makes the transition from absorbing nutrients from milk to dry feed, its digestive system adapts and changes.

The diagrams opposite illustrate the changes that occur.

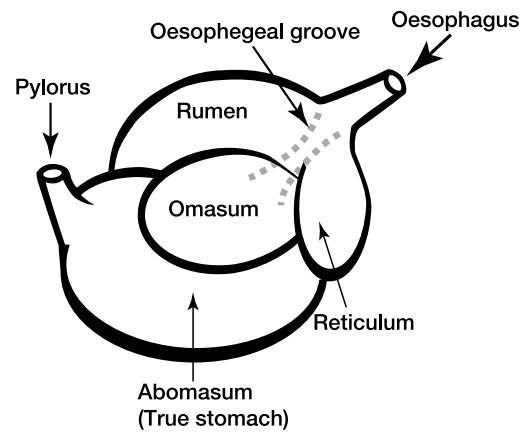
- The digestive system of a calf is geared up to process milk so the abomasum is large in comparison to other parts. At birth the abomasum makes up 65–70% of the total volume of the four stomachs of the calf.
- The rumen is designed to handle 'concentrates, grass and roughage'.

It grows as the animal eats more solid feed.

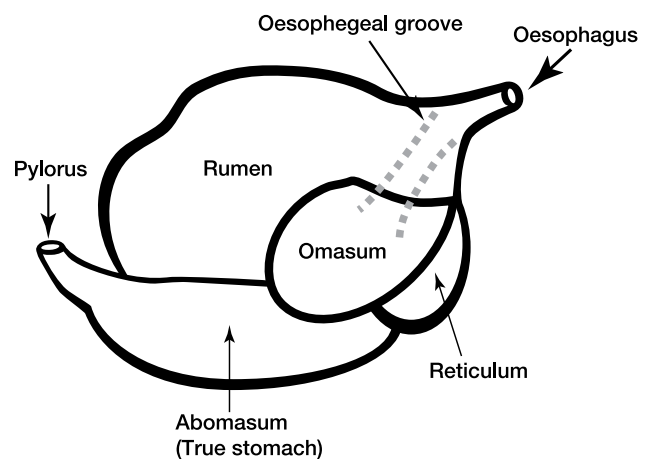
At weaning the rumen should make up 65–70% of the total volume of the stomachs.

The developing rumen

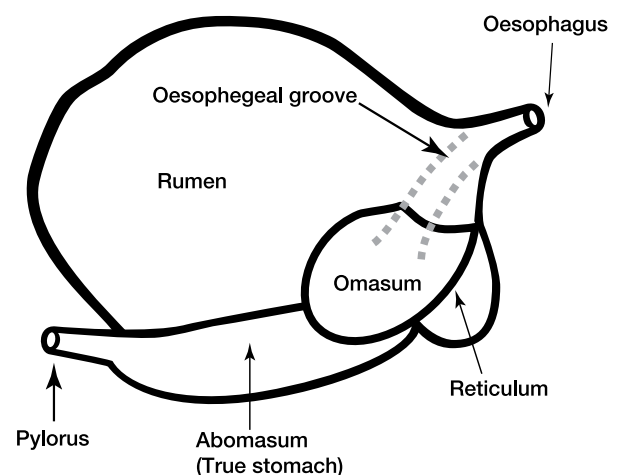
First week



Three to four months



Maturity



Source: John Moran

Managing liquid feeding

Farmers manage the feeding of milk or milk replacers in many different ways and achieve good results. While there is no single, best way to rear calves, it is important to be aware that recommendations may change based on new research and farmer experience.

Milk or milk replacer?

The abundance of surplus and waste milk in seasonal Australian dairy systems means that on many farms the use of milk replacers cannot be justified on economic grounds.

When surplus milk is not readily available or milk prices are high, calves can be reared economically on high quality, reputable milk replacers.

Milk replacers may be useful to prevent the spread of infection from the adult herd and for the control of diseases such as Johne's disease.

Consistency is the key to success with milk replacers. Always read the label and mix according to the manufacturer's directions. The digestive system of the calf takes some time to adapt to a new diet so avoid sudden changes in products or mixing rates.

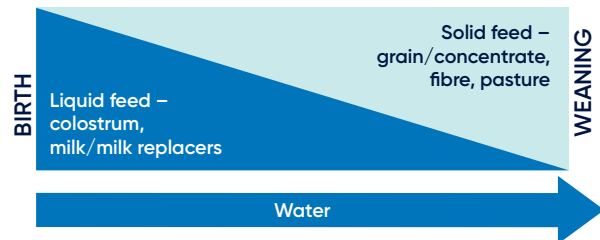
Automated calf feeding systems can achieve good results with milk replacers, as the preparation and mixing is consistent. Delivery to the calf often seems to work better than with fresh milk and cleaning up the system is easier too.

Advantages

- Consistency of product (when mixed correctly) – less risk of digestive upsets and scours
- Can be stored and handled more easily than fresh milk
- Easily fortified with additional vitamin, minerals and medicines if necessary
- A potential cost benefit over saleable whole milk
- Less risk of disease transfer from cow to calf
- Well suited to automated calf feeding systems.

Disadvantages

- Cost compared to feeding unsaleable/waste milk
- Labour required to mix
- Need space and facilities for dry storage
- Risk of spoilage by rodents.

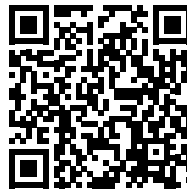


Choosing a milk replacer

Calf milk replacers can be used as either a total replacement for fresh milk or as an additive to fresh milk, producing a liquid feed higher in nutritional value, often referred to as 'fortified milk'.

To see how one farmer has used fortified milk to improve heifer growth and health watch: [youtube.com/watch?v=_RWg05hWqzs&t=17s](https://www.youtube.com/watch?v=_RWg05hWqzs&t=17s)

Or scan the QR code below:



When comparing calf milk replacers, make sure that the produce contains adequate protein and fat to meet your calf rearing objectives. Decisions about other ingredients such as vitamins, minerals and other additives are less significant.

Protein

The majority of calf milk replacers are based on downgraded skim milk powders. When digested in the calf's abomasum they form a clot, much like whole milk. High quality whey based products are also available which do not form a clot. Some of the protein in the milk replacer may come from plant sources such as wheat and soy. Newborn calves find milk-base proteins much easier to digest than proteins from plants. Unfortunately the protein sources are not always shown on the product label so choose reputable products with proven results when feeding very young calves.

The protein percentage of milk replacers can vary significantly. Calves fed on a restricted milk diet require at least 22% protein (on a dry matter basis) to support sufficient growth and development. Calves being reared on an ad-lib or high milk feeding regime require more protein to support more rapid growth, so will benefit from milk replacer with a protein percentage of at least 25% on a dry matter basis.

Fat

Fat content of milk replacers commonly ranges from 18–22% on a dry matter basis, providing less dietary fat compared to whole cows' milk. Higher fat products may be valuable for rapidly growing calves on ad-lib or high milk feeding regimes. Under very cold conditions, calves also benefit from the extra energy supplied by a higher fat diet.

Additives

Vitamins, minerals and animal health medications are commonly added to milk replacers. Ionophores such as lasalocid and monensin help control coccidiosis, and may also have growth promotant effects. The value of coccidiostats in calves less than 2–3 weeks of age is questionable and lasalocid is potentially toxic when given to calves less than 24 hours of age.

Be careful about milk fed to calves

Calves should be reared on fresh, clean milk. Wherever possible avoid feeding milk from mastitic cows or antibiotic contaminated milk.

Milk destined for calves should be collected as cleanly as possible. Milk that is contaminated with organic material and faeces is a potential disease source for calves.

Milk containing antibiotics should never be fed to sale calves.

Milk collection and feeding equipment needs to be kept scrupulously clean and well maintained (see page 55 for recommended cleaning protocols).

Milk from sick cows may contain pathogens or antibiotic residues.

Feeding milk containing antibiotics may also lead to increased risk of antimicrobial resistance.

If mastitic milk must be fed, use only for feeding older calves. Calves under 14 days of age are more vulnerable to infections due to their immature immune system.

Any waste milk should be used quickly and kept chilled to minimise the growth of bacteria.

Never feed milk from cows treated with antibiotics or other veterinary chemicals to sale calves.

Rear any calves destined for sale in an area separate from other calves, using clearly marked, separate feeding equipment that is never used for contaminated waste milk.

Milk from cows with confirmed bacterial infections such as Salmonellosis or Johne's disease should not be fed to calves under any circumstances. Calves destined for sale must never have access to antibiotic treated cows.

Milk pasteurisation

Small pasteurising units are commercially available, making it practical to treat milk on farm before feeding it to calves. Pasteurisation significantly reduces the number of pathogens in milk and has been shown to reduce disease rates in milk fed calves.

Best temperature?

- Consistency of temperature appears the most important thing to get right – avoid feeding warm one day, cool the next.
- Liquid milk has been fed at around body temperature (38°C) with good results, as has chilled milk.
- Very cool milk has the potential to lower the body temperature. The calf will then need to use energy to increase its body temperature, diverting energy away from growth and development.
- If using cool milk in cold climates the effect could be significant, however there is likely to be little impact in warmer climates.

How often?

Studies have shown that calves can be reared using a variety of feeding frequencies.

Keep in mind	
Once/ twice daily	<ul style="list-style-type: none">• Once or twice daily liquid feedings can produce the same outcomes in terms of weight gain, nutritional status and metabolic stress.• Twice daily feeding makes sense as it allows calves to be closely observed. Reluctance to drink or other signs of disease can be detected and action taken.• If necessary once daily feeding should not be implemented until calves are at least 14 days of age. Calves are at a very high risk of scours and infections in this critical first two weeks of life.
Automated systems	<ul style="list-style-type: none">• Automated systems provide set amounts of milk at intervals dictated by the calf. This mimics the natural feeding behaviour of a calf on a cow.• Properly managed, automated systems have been found to reduce nutritional or non infectious scours and the need for additional labour.

Teat or bucket?

Calves can be fed successfully via a teat or a bucket.

However, teat feeding helps to satisfy the natural desire of a calf to suck and can reduce the incidence of cross sucking (including ears, umbilicus and pizzlies in bull calves).

How much milk to feed?

Two different approaches can be taken:

- the low volume restricted intake method which aims to achieve rapid rumen development and early intake of solid feed
- the high volume method which more closely mimics the milk consumption of a calf on its mother.

Low volume approach

This approach was developed in the 1920s to improve the profitability of the calf rearing process. The goal is to induce rapid rumen development to allow earlier weaning off milk. This is the typical feeding system adopted in Australia and results in lower milk feeding costs, more milk available for sale and lower infrastructure and labour inputs.

The newborn calf receives approximately 10% bodyweight in milk daily, which generally equates to 4–5 litres per day, and roughly this same daily volume of milk is maintained throughout the pre weaning period. It provides sufficient energy from milk for normal body maintenance but only a small amount is available for tissue growth. If young calves are exposed to cold temperatures and require extra energy to maintain body temperatures then reduced growth rates will result.

Calves on this feeding system start to consume concentrates and fibre at an early age to increase their energy intake. However, it takes between 2–4 weeks before substantial intake, digestion and absorption of non-milk energy regularly occur. This means that they may lack energy and grow more slowly in the early part of life.

Apart from the animal welfare considerations, this early check in growth rate can delay maturity, meaning that heifers enter the milking herd at an older age, reducing the overall efficiency of the heifer rearing system.

The real value of this approach for improving profitability is if calves are fully weaned at an early age, such as 5–6 weeks. In Australia, calves are typically weaned at 8–12 weeks of age, so this advantage is not fully realised. Other potential advantages are a lower risk of calves developing bloat and lower risk of pathogens transmitted from feeding large volumes of milk.

High volume approach (accelerated calf rearing)

A growing body of evidence indicates that lifetime productivity gains can be made by feeding calves greater volumes of milk. Bigger heifers are generally more productive in their first and subsequent lactations, and tend to calve more easily and get back in calf

sooner. It has been estimated that 22% of the variation in first lactation milk yield can be traced back to the average daily gain of heifers. This is a far larger effect on milk production than the heifer's genetics. Birth to 12 weeks is an ideal time to manipulate average daily gain – at this stage the heifer's feed conversion efficiency is at its highest and it will have minimal negative impact on udder development.

Allowing intakes of milk or milk solids that more closely resemble this level of milk feeding (20% of bodyweight) may be necessary to see the full effect of this higher plane of nutrition feeding approach.

Milk feeding systems which approximate this level of milk intake are referred to as accelerated, enhanced or intensified rearing. The aim is to feed calves around 20% of bodyweight daily in milk or equivalent milk solids. Significantly higher average daily gains in weight are seen from day one. Growth rates above 1.0kg/day can be achieved due to the high efficiency of young calves in converting milk nutrients into body tissue.

High volume milk feeding may also reduce calf disease in the first two weeks of life. However, you won't see this benefit if milk hygiene is poor or the calf rearing environment is suboptimal.

Several methods can be used to increase milk intake in calves including:

- feeding more milk volume per feed
- increasing the number of feeds daily
- increasing solid concentration of whole milk by addition of milk powder (fortification)
- increasing solid concentration of milk replacers by mixing with less water.

Calves will eat less high energy solid feed and fibre, so rumen development may be delayed. Later and more gradual weaning off milk is recommended.

The pros and cons of feeding more milk

Pros	Cons
Increased weaning weights and improved odds of heifers reaching optimal calving weights.	Need to monitor and control individual calf milk intake.
Calves are more satisfied and exhibit more natural behaviours.	Less suitable for early weaning systems (5–6 weeks of age).
Calves may be less susceptible to disease during the pre weaning period.	Cost of feeding extra milk or milk replacer.
Epigenetic effects on body tissues may increase lifetime milk production.	Larger volumes of liquid feed to handle – good milk hygiene is vital.
Sets up heifers to reach puberty earlier, start milking earlier and have improved fertility after first calving	Some calves may have loose stools.

FAQs

Does milk just make calves grow faster?

If you are breeding heifers with superior genetics to improve your herd's performance, you must ensure that these genes are actually expressed. This depends partly on how calves are fed early in life. Evidence is accumulating that milk not only provides nutrients for growth, but also contains factors that can turn on genes that improve future production characteristics in heifers such as udder tissue development and milk production. However, to lock in the lifetime production benefits of accelerated calf rearing, you need to maintain good growth rates throughout the post weaning period to ensure heifers achieve their target live weights at calving.

Does feeding extra milk cause diarrhoea?

Larger volumes of milk fed throughout the day can be successfully delivered using automatic calf feeding systems with no noticeable increase in scours. This mirrors the situation when calves are suckled by cows. However, variations in daily feeding volumes can lead to mild digestive disturbances. If calves are fed highly contaminated milk this may expose them to a greater number of disease causing organisms and overwhelm their natural defences. High volume feeding may also provide intestinal conditions suitable for pathogens to multiply due to changes in digestion such as transit time, pH or volume of liquid contents.

Farmers sometimes observe that calves fed on high volumes of milk tend to have looser stools. Feeding greater amounts of liquid feeds may increase the water content of the calf's stools, while the dry matter component remains the same. In these cases the calf may not actually be suffering any ill effects.

Can calves grow too quickly?

Some farmers are concerned that fast growing calves may end up with udder issues due to excess fat deposition – a condition known as Fatty Udder Syndrome.

The udder has three distinct growth phases:

- Phase 1 – isometric growth where udder grows at same rate as general body growth (birth–12 weeks).
- Phase 2 – allometric where udder grows faster than general body growth (from 12 weeks–12 months).
- Phase 3 – isometric growth(12 months–24 months).

No significant detrimental effects have been seen on the udder from feeding for rapid growth during the first 8–12 weeks of life (Phase 1). This contrasts to the research investigating the impact of high growth rates from weaning to puberty (Phase 2) where the results do not provide a clear answer.

Does more milk produce healthier calves?

Current research suggests that calves that are more fully fed, particularly in the first 2 weeks of life, will exhibit less disease. This may be because calves are exhibiting less non-nutritive sucking i.e. calves are not spending as much time sucking and licking surfaces and objects where they could be potentially consuming pathogens. Research currently suggests that calves that are fully fed may also have strong immune systems and be better able to resist disease.

Is accelerated calf rearing suited for every farm?

Farms most suitable for this approach would be those with the ability to hygienically handle larger volumes of milk or milk replacer and the infrastructure to regulate individual liquid intake (i.e. individual pens or locking head bails). Farms using automated calf feeding systems are also well placed to implement such programs.

A study in SW Victoria found that calves fed 4L of fortified milk (whole milk +150gm of a 25% protein/20% fat calf milk replacer) per day had higher overall growth rates, gained significantly more weight and height by 8 weeks and were more likely to double their birth weight by 8 weeks than calves fed 4L of whole milk per day.

To see how one farmer has used fortified milk to improve heifer growth and health watch:

[youtube.com/watch?v=_RWg05hWqzs&t=17s](https://www.youtube.com/watch?v=_RWg05hWqzs&t=17s)

Or scan the QR code below:



Introducing solid feed

There is no 'silver bullet' or a single best way to provide a balanced and nutritious ration to calves. To promote steady growth and maintain health, calf rations need to be formulated so they contain:

- energy for growth and functions like breathing, walking, grazing
- protein for all basic metabolic processes and growth
- fibre for rumen function and to ensure cud chewing
- vitamins for metabolic processes, bone formation and disease resistance
- minerals for carbohydrate metabolism, cartilage and muscle function.

Introduction of fibre

If you aim to wean calves at 8–12 weeks of age then ad lib access to a fibre source such as hay or other forages is not required in the diet before 3 weeks of age. Small amounts of fibre i.e. a handful per calf per day can be introduced within the first two weeks of life. The total amount of fibre as supplied by hay should not contribute more than 10% of the diet during the pre weaning period.

Large amounts of fibre introduced too early in a calf's life can reduce average daily weight gain.

Feeds high in fibre create a fill effect, reducing overall daily energy intake. Lucerne is an example of a feed high in fibre, very palatable and attractive to calves, but if fed ad lib may limit the consumption of milk and/or concentrates.

Is pasture suitable for calves?

If calves have access to it, they will normally start to nibble on grass from a young age. While this is not a problem, it is important that farmers realise that pasture is not an ideal feed for calves until well after weaning.

Energy, protein and additives

If you are purchasing high energy feeds such as grains, meals or pellets, an awareness of its composition is important to ensure that what you are paying for is 'fit for purpose'. Will it help you achieve your growth targets?

Energy	<ul style="list-style-type: none">• Supplements for calves from birth to weaning should have adequate energy supplied from a grain base.• Values of 13–14 MJ ME/kg dry matter are acceptable.• Grain based products produce propionate and butyrate – the breakdown chemicals that encourage the growth of rumen papillae.
Protein	<ul style="list-style-type: none">• Concentrates should be a minimum of 18% crude protein (CP) on a dry matter basis.• Protein levels beyond 22% may be of little additional benefit for the extra cost
Additives	<ul style="list-style-type: none">• Some concentrates contain additives, which aid rumen function and feed conversion and may promote optimal growth rates however, they are not essential.• The addition of coccidiostats may be of value where coccidiosis is considered a risk.
Vitamin premixes	<ul style="list-style-type: none">• Prior to the development of the rumen, calves are not able to manufacture any of the B group of vitamins and so addition of these may be of some benefit.
Probiotics	<ul style="list-style-type: none">• Farmers should confirm there is a scientific benefit prior to using any commercially supplied probiotic product.

Recommendations for feeding fibre

Fibre content	<ul style="list-style-type: none">• Early calf rations should aim for adequate fibre content but not at the cost of energy.• Aim for no more than 10% hay or roughage in the pre weaning ration.• Neutral detergent fibre (NDF) is the fibre part of feed that creates the feeling of being full. Its value reflects the physical fibre level of a feed – the goal is to have NDF levels in pre weaning calf rations of between 15–25%.
Fibre length	<ul style="list-style-type: none">• Take care with pellets – finely ground particles can cause digestive upsets and promote excessive thickening of the lining of the rumen if fed alone. This type of pellet must be accompanied by a suitable source of fibre.• Calf meals and mueslis usually contain fibre of a sufficient length to promote healthy rumen function.• Optimum fibre length is 1–2cm.• Chopped hay is a source of fibre that can be added to pellets and other calf feeds like meal and muesli as required.



Monitoring intake and growth

It is important to monitor calves to make sure that they are consuming milk and supplements and are growing as expected.

Feed intake

Monitoring feed intake is a valuable tool for assessing the health of calves – decreased intake can indicate problems:

- Sick calves will often show evidence of decreased appetite early in the disease process.
- Early attention to calf illness can lessen its consequences.

Feed intake in healthy calves can be influenced by the amount of milk/milk replacer being consumed, the nature of the feed (coarse meals are preferred), size of calf and water availability/intake.

It is important to build up to an intake of at least 0.75–1 kg of solid feed per day before weaning. Studies have shown that calf concentrate intake increases rapidly from weeks 3 to 6 and then increases more slowly.

Monitor weight and height

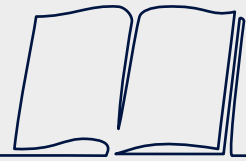
As calves grow, their muscle and fat deposits expand. Their height also increases due to skeletal growth.

- Recording weight alone may give misleading information on growth as it may not represent balanced skeletal growth and tissue deposition.
- To save on labour, weigh and measure a representative sample (between 5–10% of the rearing group).

Any monitoring should ideally address both of these aspects of growth.

Increasing evidence shows early-life factors such as pre weaning growth rate, are important in determining the future productivity of heifers when they enter the milking herd, including their milk production, fertility and longevity.

Summary of recommendations



Well grown and healthy calves become productive herd replacements. To achieve good growth rates and excellent rumen development and function, ensure that calves are fed appropriate amounts of milk or milk replacer and good quality concentrate.

- 1 Provide access to fresh clean water from birth.
- 2 Use the feeding method that suits you (teat or bucket).
- 3 Warm vs cold milk? It doesn't make a great deal of difference, but be consistent.
- 4 High volume milk or milk solid feeding can lead to significant increases in average daily gains and set up heifers to be more productive over their lifetime.
- 5 Surplus milk is the most cost effective liquid feed. If no surplus is available or milk price is high, milk replacers may become cost effective.
- 6 Only use good quality milk replacers – mix to manufacturer's directions to ensure consistent results.
- 7 Introduce small quantities of grain or grain based concentrates from day one – the breakdown chemicals drive rumen development.
- 8 Introduce small amounts of good quality fibre from 3 weeks of age to ensure healthy rumen function. Fibre should comprise no more than 10% of the pre weaning diet.
- 9 Monitor growth rates – measure the height and weight of a sample of calves.





Residue risk management

Sale calves must be residue free

- Develop treatment protocols for your farm.
- Train staff about what to do when calves get sick.
- Use electrolytes as a first option for treating scours.
- Observe withholding periods if using antibiotics – use only as directed.
- Keep sale calves separated from replacement calves.
- Record every treatment, for every calf, every time.
- Use separate labelled feeding equipment for sale calves – do not rely on washing.

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Residue risk management

If you sell calves for processing they must be free from antibiotic residues. This is important for both the dairy industry and the red meat industry. The benefits include:

- compliance with legal obligations
- continued access to the calf processing chain
- continued access to world markets.

Every year calves contaminated with antibiotics are detected at abattoirs.

- Industry data shows that most residues arise from use of oral 'sulfa' antibiotics (like Scourban™) or oxytetracycline.

Residues can be prevented by avoiding contamination of non-treated calves and using veterinary products only as directed.

The most common reason for antibiotic residues to be detected in sale calves is feeding them milk or electrolytes from a feeder, bottle or stomach tube that has previously been used to administer antibiotics.

Sale calves can be accidentally contaminated with antibiotics in a number of ways.

- Drinking from equipment previously contaminated with antibiotic residues.
- Sucking on contaminated teat feeders.
- Accidental treatment due to incorrect identification.
- Licking residues off the faces of other calves.
- Consuming waste milk containing traces of antibiotics present.

Could this happen on your farm?

Residue testing

Calves are tested routinely for antibiotic residues at domestic and export abattoirs. Calves are selected for testing at random. Meat processors do this testing as part of their food safety obligations and to ensure that the calves they receive are 'fit for purpose'.

- If any calves have a positive test, then the abattoirs will test subsequent consignments of calves from that supplier.
- Electronic calf identification along the supply chain enables rapid traceback to the farm of origin.

Washing equipment just doesn't work.

It is very difficult to remove all traces of antibiotics from feeding equipment. It doesn't matter if you use hot water, acid rinses or detergent, you still cannot be 100% sure that all antibiotics have been removed. Scratches, grooves and gaps in plastic and rubberware can retain traces of antibiotics sufficient to cause a calf residue violation.

A Dairy Australia trial found that even when calf feeders were washed and dried at least twice after antibiotics were added to them, some calves were still found with antibiotic residues at slaughter.

The message is clear, don't take the risk. Purchase additional separate feeding equipment for use only on sale calves. Ensure this equipment is labelled so everyone knows what it is for and that it is not used for the replacement heifer calves – ever!

One antibiotic contaminated calf has the potential to destroy a market

It doesn't take much antibiotic to contaminate a sale calf!

A tiny trace of antibiotic, so small you may not even be able to see it in the feeder, is all it takes. This is far less than a normal treatment dose.

Dairy Australia actively investigates the calf management practices of farms that have sold an antibiotic positive calf.

Feeding milk or electrolytes from contaminated feeding equipment is overwhelmingly the most common cause of the residue but some other risks have been identified.

Be alert and actively manage all the risks, all of the time.

Lessons from Dairy Australia's on farm antibiotic residue investigations

Most residue incidents arise from high risk practices such as sharing feeding equipment between sale and replacement calves or a failure of the normal management system e.g. when high numbers of calves are coming through the shed or mistakes are made by inexperienced workers.



Common 'sulfa' containing products

Recommended risk management practices

- **Minimise calf disease** – management, calf shed biosecurity, vaccination and treatment of calf diseases – ask your vet for advice if you are unsure what to include.
- **Training** – make sure that everyone who cares for your calves understands and follows your management plan.
- **Separate housing** – keep calves destined for sale separated from the calves you intend to rear.
- **Avoid cross contamination** – buckets, feeders, drench guns and syringes that have been in contact with antibiotics are common sources of contamination. Never share feeding equipment between sale calves and replacement calves – despite how well it is cleaned you can never be 100% sure of removing all traces of antibiotics.
- **Avoid using test buckets that collect antibiotic milk to transfer milk to sale calves** – again, they can never be assumed to be safe. Use dedicated buckets to transfer milk to sale calves that have never been in contact with milk containing antibiotics.
- **Dedicated equipment** – feed your sale calves with separate equipment that is clearly marked and used only for this purpose and ensure everyone knows the system.
- **Fluid therapy** – use electrolytes as the first option for treating sick calves. Remember most of the common causes of calf scours do not respond to antibiotics.
- **Follow directions** – use antibiotics carefully and only after discussing the treatment options with your vet. Always read the label and observe the meat withhold period.
- Don't feed sale calves with waste milk from antibiotic treated cows.
- **Manage treatments** – treat calves individually, preferably by injection to minimise cross contamination. It is risky and ineffective to mix oral antibiotics with milk.
- **Identify treated calves** – make sure any treated calves are highly visible and kept away from other calves until the drug withhold period has elapsed.
- **Keep records** – record every treatment, for every calf, every time.

Contamination scenarios

Could this happen on your farm?

On-farm investigations of incidents involving contamination of calves show mistakes made by farmers or their staff typically contribute to these incidents. The scenarios below are drawn from real investigations.

Scenario	How did contamination occur?
<p>Calf given a liquid feed before travelling. Fed using a bucket that had been used for feeding heifer calves with milk from a Trisoprim™ treated cow.</p>	<ul style="list-style-type: none"> Residues in the bucket – separate feeding equipment was not used.
<p>Sale and heifer calves kept in same pens. Heifers treated for scours with Scourban™ but not identified in any way.</p>	<ul style="list-style-type: none"> Highly likely that sale calves were also treated by mistake. Calves poorly identified and staff unaware of risks.
<p>Sale calf given milk feed via bottle previously used to give a heifer calf a combination of electrolytes and Scourban™.</p>	<ul style="list-style-type: none"> Separate feeding equipment for sale calves was not used.
<p>Scouring heifer calves are treated with Streptosulcin™ tablets which are crushed and added to milk. The same feeders are used for the sale calves.</p>	<ul style="list-style-type: none"> Residues in the feeders – separate feeding equipment was not used.
<p>Calf treated with high doses of Excenel™ for a long period because of a serious joint infection – decision made to cull.</p>	<ul style="list-style-type: none"> Drug used differently from label directions so meat withholding period is not applicable. Need veterinary advice as to what withholding period should be used.
<p>Calves treated by relief milker instead of normal calf rearer – information not passed on.</p>	<ul style="list-style-type: none"> Lack of training or poorly communicated operating procedures. Relied on verbal passing on of information instead of written records.
<p>Heifer calves fed treated milk via teat feeders. Feeders are then cleaned. Next morning sale calves are fed using same feeders.</p>	<ul style="list-style-type: none"> Residues left behind despite cleaning. Plastic feeding equipment and rubber teats that have been in contact with any antibiotics are almost impossible to decontaminate and should never be used for feeding sale calves.

Where are the contamination risks?

Calves can become contaminated with antibiotics in a number of ways.

Sometimes risks are inherent in the layout of a calf shed. Often they exist because of calf rearing practices – things that happen or don't happen.

Some risks can be minimised by changing the physical environment but often they can only be mitigated by changing the way you do things.

Assessing the risk on your farm

Where is the risk?	Management
Dam is treated with Dry Cow but calves early	<ul style="list-style-type: none"> • This may mean that the milk and meat withholding period has not been completed. • Calves must be considered to be under the same meat withholding period as their dam.
Dam is treated with antibiotics prior to calving	<ul style="list-style-type: none"> • Calves born to these cows must be considered to be under the same meat withholding period as their dam.
Calves fed milk containing antibiotics	<ul style="list-style-type: none"> • Can be from a cow injected or treated with intramammary antibiotics. • Calves consuming antibiotic milk must be managed according to the meat withholding period of the particular antibiotic – regardless of the dose consumed. • Label containers, clean thoroughly and never use these containers for feeding milk or electrolytes to sale calves.
A calf is given antibiotics to treat an illness	<ul style="list-style-type: none"> • Check the identity of the calf – if sale calves are sick, euthanase or treat and wait until the meat withholding period is completed. • Mark the calf visibly and record the treatment. • Adhere strictly to the meat withholding period.
Use of oral drugs	<ul style="list-style-type: none"> • Consider using injectable instead of oral drugs to minimise the risk of residues being left behind in equipment.
Label not checked every time	<ul style="list-style-type: none"> • Relying on memory is not good enough. • Check the label every treatment, every time.
Dose rate is wrong or changed	<ul style="list-style-type: none"> • Overdosing changes the withholding period. • The correct dose rate is based on weight so good estimates of calf weights are critical. • Check the label, check equipment – dose correctly. • If in doubt ask your vet about the appropriate withholding period.
Length of treatment is changed	<ul style="list-style-type: none"> • Changing the treatment period can affect the withholding period. • Only alter under direction from your vet.
Method of dosing is changed	<ul style="list-style-type: none"> • Changing the method of dosing from that advised on the label can alter withholding period. • Only alter under direction from your vet.
Antibiotics are not stored in their original container	<ul style="list-style-type: none"> • Risk of mistakes is high especially if they are stored unlabelled. • Never decant antibiotics to another container.

Assessing the risk on your farm

Where is the risk?	Management
Antibiotics are used too much	<ul style="list-style-type: none"> • Most calf illnesses do not require antibiotics – each time they are used, your risk of problems occurring goes up. • Electrolyte treatment is often all that is required and has no withholding period. • Only administer antibiotics on the advice of your vet.
Blanket treatment of calves	<ul style="list-style-type: none"> • Using medicated milk to treat a whole group can muck up dosage rates and withholding periods. • Treat individual calves wherever possible.
Replacements and sale calves are penned together	<ul style="list-style-type: none"> • Makes treating individual calves more difficult. Increases risk of inadvertently treating a sale calf by mistake. • If space limits physical separation, sale calves must be extremely easy to differentiate from replacements.
Pens too close together	<ul style="list-style-type: none"> • Calves can make physical contact with each other and lick off residues from oral treatments. • Separate pens or erect barriers to eliminate contact.
The same feeders and equipment are used to feed replacement and sale calves	<ul style="list-style-type: none"> • No matter how you clean it, you can never be 100% sure that all the antibiotic residues are removed. • Invest in separate, labelled feeders for sale calves which are never used to feed replacement calves.
Equipment not properly cleaned after every use	<ul style="list-style-type: none"> • Cleaning is not a substitute for the need to use separate equipment for sale calves. • Traces of antibiotics can be left in feeders, tubes and teats. • Clean thoroughly after every use. • Clean all parts thoroughly – pay particular attention to teats and valves. • Replace cracked/old equipment.
Relief staff not clear about what to do	<ul style="list-style-type: none"> • Provide written instructions and leave contact numbers so they can check. • Make sure sale calves are clearly identified.
Procedures not written down	<ul style="list-style-type: none"> • Written protocols help relief and occasional staff to know how things are done. • Laminate and display in a prominent spot.
'That little bit won't hurt' attitude	<ul style="list-style-type: none"> • Highlight to staff – it doesn't take much to contaminate a sale calf. • It doesn't take much to damage the reputation of the dairy industry.
Treated calves not highly visible	<ul style="list-style-type: none"> • If calves under a withhold period are highly visible it is harder to mistake them for an eligible sale calf.
Treatment records are incomplete or inaccurate	<ul style="list-style-type: none"> • Not worth keeping if they are not right. • Record every treatment and every withholding period, for every calf, every time.

Have a health plan in place

Develop a written plan with your vet. Include protocols on calf management and residue risk reduction.

Antibiotics should only be used under the direction of a veterinarian as they have a legal responsibility to control their use.

- By law, Prescription Animal Remedy (S4) or other restricted drugs can only be supplied by registered veterinarians.
- Vets can only supply these to their clients and for animals under their care.

A good working relationship with your veterinarian is important to learn how to administer antibiotics effectively and correctly.

Veterinary advice should be sought when antibiotic use is being considered for treatment of a sick calf. This is particularly important when more than one calf is sick.

Always know what you are giving your calves – find out, if in doubt!

Vets can provide informed directions on:

- the need for antibiotic treatment
- alternative treatments
- the dose required
- risks associated with the use of a drug
- duration of treatment and withholding periods.

They also provide information on:

- strategies to prevent disease in the first instance, like colostrum management and vaccinations
- additional supportive treatments
- methods and tests to investigate the cause of the problem
- strategies to minimise the spread of the disease
- actions that can prevent ongoing outbreaks of the disease.

Many scour treatments contain antibiotics

Residue violation investigations reveal that many farmers are unaware that some common scour treatments contain antibiotics.

Electrolyte products can be very effective but they are not prescription items. Other commonly used scour treatments do contain antibiotics and withholding periods apply.

Any antibiotic calf scour treatment prescribed by a vet must have a directions label attached. Read the label and consult your vet if further information or advice is required.

Summary of recommendations



Actively manage the risks of residue contamination. Use products as intended and avoid contaminating sale calves.

- 1 Do not share feeding equipment between heifer replacements and sale calves.
- 2 Invest in separate, labelled feeding equipment for sale calves.
- 3 Develop a health plan and protocols for your farm – ask your vet for advice.
- 4 Make sure all staff receive training about what to do when calves get sick.
- 5 Use electrolytes as a first option for treating scours. Only opt for antibiotics after discussing the options with your vet.
- 6 Use antibiotic products carefully and only as directed. Observe withholding periods.
- 7 Keep sale calves separated from replacement calves – ensure no physical contact is possible.
- 8 Make antibiotic treated calves highly visible – segregate them from other calves.
- 9 Record every treatment, for every calf, every time.





Health management

Focus on good health

- Planning for disease prevention is key to rearing calves that thrive.
- Health management starts at calving.
- Minimising exposure to infection is critical.
- Monitor calves to identify sick ones early.
- Know the causes of scours and best treatment options.
- Have clear treatment protocols.
- Ensure staff are trained in humane killing of calves.
- Have vaccination and parasite control plans.



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It all starts with calving

If the pre-calving care of your cows has been excellent, then chances are you will be rewarded with an uncomplicated delivery of a healthy calf that is ready to thrive.

The majority of cows will calve without any assistance but occasionally, some do need help. Heifers commonly require greater supervision as they have a higher risk of calving problems.

Paying attention to heifer growth rates, mating weights and selecting 'ease of calving' sires can minimise the risk and lessens the need for intervention at calving.

The three stages of calving

The process of calving can be divided into three stages, each with its own physiological characteristics but it is important to remember that every calving will be slightly different. Cows are all individuals!

Remember, assisted calvings can result in significant trauma for calves and cows. Ensure those assisting in the delivery have lots of experience and know what they are doing – otherwise, call the vet.

Watch for progress

Biological processes like calving vary from animal to animal.

Often, time estimates are given to aid understanding of the birth process but the key to success is to monitor progress not just the clock. What is most important is the ongoing appearance of more of the calf. A period of 15–30 minutes without any progress is an indicator of the need for attention and possibly, intervention. The key message is to look for evidence that the cow is progressing with the calving process.

Triggers for action:

- heifers not calved within 5–6 hours after first signs of straining
- cows not calved with 3–4 hours after first signs of straining
- calving has not occurred within 3–4 hours after membranes or bag have broken
- delivery has begun, the calf's legs or head are (just) visible and it is obvious that the calf's presentation is abnormal
- delivery has begun, the calf legs or head are (just) visible and the calf is not delivered within 30 minutes.

If you think that a cow may have calved but have not found the calf, then safely perform a vaginal examination to check that she has in fact calved.

Stage 1: Pre-calving	Stage 2: Calving	Stage 3: Post calving
The cow prepares to give birth	The calf is born	Expulsion of the afterbirth
<ul style="list-style-type: none"> • cervix begins to open and tissues are relaxing and softening • milk production begins and is let down into udder • cows are often agitated, heifers may stand and sit repeatedly • cow seeks safe and private area. 	<ul style="list-style-type: none"> • cervix and vagina should be completely dilated • membranes or hooves appear from the vulva – calf normally delivered up to 3 hours after this • blood/oxygen flow from cord ceases and this triggers the calf's breathing. 	<ul style="list-style-type: none"> • contractions of the uterus continue after the calf's birth to expel the membranes (placenta/afterbirth) • the membranes are normally delivered 30–60 min after birth • generally best practice to wait for the membranes to be delivered without intervening.

Stage 1: Pre-calving	Stage 2: Calving	Stage 3: Post calving
Watch for	Take care	Take care
<ul style="list-style-type: none"> • Monitor closely for the presence of membranes but with no evidence of a calf. • This can suggest a backwards/breech presentation or a dead calf. • May need an internal exam if cow is repeatedly lying down, or shows excessive rising and sitting behaviour. • May be a problem like a twisted uterus – if in doubt, call the vet. 	<ul style="list-style-type: none"> • Perform internal exams very carefully to avoid doing damage. • Keep things as clean as possible – wash the vulva of the cow, hands, arms and chains with an appropriate antiseptic solution or soapy water. • Use lots of lubricant. • Perform basic checks to see if calf is alive. • Only use calf pullers, pulleys or traction devices if you are skilled and experienced. • If after 15 min you have not helped the cow make progress, call the vet. 	<ul style="list-style-type: none"> • In some cases delivery of the membrane can be delayed by hours or even days. • Seek vet advice if cow has high temperature or shows signs of illness. • Some trimming of the membrane may be required to reduce the risk of it tearing from being stood on. • If you suspect some of the membrane has been retained, seek vet advice.

Monitoring problems – calving difficulties

Monitoring rates of calving difficulty can help you track improvement in your prevention strategies.

Calving difficulty – heifers	Calving difficulty – cows
<p>A = Total number of heifers which required assistance to calve</p> <p>B = Total number of heifers that have calved $(A/B) \times 100 = \% \text{ Calving difficulties in heifers}$</p>	<p>A = Total number of cows which required assistance to calve</p> <p>B = Total number of cows that have calved $(A/B) \times 100 = \% \text{ Calving difficulties in cows}$</p>
<p>Example:</p> <p>A = 15 heifers needed calving assistance</p> <p>B = 80 heifers calved $(15/80) \times 100 = 18.75 \%$</p>	<p>Example:</p> <p>A = 5 cows needed calving assistance</p> <p>B = 200 cows calved $(5/200) \times 100 = 2.5 \%$</p>
<p>Calving difficulty – heifers</p> <p>Aim for less than 15%</p>	<p>Calving difficulty – cows</p> <p>Aim for less than 6%</p>

Immediate care of the newborn calf

Keeping a close eye on calves in the first few days makes it easier to spot problems and take action early.

Pay particular attention to the following:

- **If the calving was assisted** – clean airways, stimulate breathing (e.g. pinch nose or tickle inside of nose with straw), position correctly (on sternum with legs either side up towards nose, rub with towel).
- **Navel cord** – spray with disinfectant early and stop any excessive bleeding by applying pressure.
- **Colostrum intake** – make sure all calves receive colostrum, pay particular attention to injured or sick newborn calves.
- **Clearly identify** – ensure all calves are clearly identified for traceability and treatment/health monitoring.

Over the next few days

- **Navel cord** – Continue to monitor navel cord for signs of infection i.e., swollen, painful and/or discharge.
- **Signs of dehydration** – monitor for sunken eyes or skin tenting which may indicate dehydration or serious bacterial infection.
- **Signs of ill health** – reluctance to rise or drink, signs of dehydration.

Make sure injured or weak calves get colostrum immediately after birth – they are in particular need of its benefits.

Spraying the navel cord

One of the most critical tasks to complete in the early stages of a calf's life is to disinfect its navel. This helps ensure bacteria do not enter the body via the umbilical cord and cause joint ill, navel abscesses and other internal infections. Timely disinfection is particularly important if the calving area was muddy or contained lots of manure.

Important

- Keep navel area clean.
- Dip or spray umbilical cords to disinfect with an iodine or alcohol/methylated spirits spray.
- Disinfect as soon as possible after birth and again 24 hrs later.
- If using a 5% iodine solution, make up a new batch every two days.
- Commercially available iodine solutions are readily available which are more stable and do not need to be discarded.
- DON'T use teat spray as it contains unnecessary emollients.

Technique

- Spray hair/skin at top of cord initially and move down to completely cover cord.
- Ensure cord is completely covered.
- You should be able to pinch cord with 2 fingers and get disinfectant on both.
- Navel cords should be checked regularly over the first week of life for evidence of shrinking.
- Any abnormalities in the navel area or swellings, pain or discharge should be checked by a vet.
- Calves may need antibiotic treatment if an umbilical cord infection occurs.

Colostrum for all calves

Lack of immunity can occur when not enough colostrum is taken in during the critical period just after birth. At this time, the calf's gut is able to absorb the antibodies but if a calf is too sick to drink much, then failure of passive transfer will occur and their immunity will be compromised.

- Make it a priority to feed calves individually with colostrum as soon as possible after birth – possibly by using a stomach tube.
- Give adequate quantity of high quality colostrum in the first 12 hours of life (see page 57). If the Brix quality is poor or not known give 2x3 litre feeds in the first 12 hours.
- Herds experiencing unacceptable levels of calf deaths (i.e. over 3%) should check their colostrum management system including testing for failure of passive transfer.



Reducing the impact of calf diseases

Reducing the risk of sickness in calves

Maximising the time the rearing environment is empty between batches of calves reduces disease risk.

- In seasonal or batch calving herds, clean out rearing areas as soon as the last calf leaves.
- All bedding and organic material should be removed – bugs persist longer in the environment if materials such as manure, saliva and bedding are present.
- Rails, gates, partitions, walls and feeders should be cleaned of any obvious manure or other organic material.
- Disinfection works best if the dirt and manure are removed – pressure cleaning is suitable for this purpose.
- Hot water and soap may be a necessary first step when cleaning milk residues as it aids removal of the fat.
- Use a broad spectrum disinfectant for best results.
- A minimum of 10 minutes contact time is required (30 minutes preferred) for effective disinfection.

Maximise the periods the calf rearing areas are empty. A simple but effective strategy.

Calf trailers

Trailers used to transport newborn calves often become contaminated with faecal material. They should be regularly pressure cleaned and clean bedding such as hay should be used to reduce the exposure of calves to pathogens while being transported.

Preventing Johne's disease with the 3-Step Calf Plan

Bovine Johne's disease or BJD is a chronic, incurable disease of adult cattle caused by a hardy, slow-growing bacterium called *Mycobacterium paratuberculosis*.

- Calves less than 12 months of age are very susceptible to infection.
- Generally no symptoms of Johne's disease are seen until the animals are at least four years old.
- When clinical signs do occur they include weight loss, persistent diarrhoea that is unresponsive to treatment and a drop in milk production.

If the animal is not removed from the herd it will waste away over weeks shedding billions of bacteria in its manure until it eventually becomes too weak to stand.

Dairy Australia, on behalf of the dairy industry, has developed a comprehensive approach called the 3-Step Calf Plan which is aimed at minimising the spread of Johne's disease to calves.

The plan focuses on stopping the spread of the disease by minimising calf contact with manure. Other strategies are aimed at avoiding introducing the disease to the herd in the first place and the early removal of cattle suspected of being infected with Johne's disease.

The good thing about this plan is that it also helps to minimise diseases like scours in newborn and young calves. Minimising calf contact with manure from adult cattle is critical to stop the spread of BJD and reduce the incidence of scours.

3-Step Calf Plan for the control of bovine Johne's disease (BJD)

For further information see dairyaustralia.com.au

Identifying sick calves – hearing with your eyes

While animals cannot talk they certainly have other ways of communicating with us. Sick calves do try and tell us they are unwell and require help but unfortunately we do not hear them.

Why? Because we don't use our eyes!

The behaviour and appearance of a calf clearly gives an indication of their state of health.

A sick calf is more likely to:

- sit away from the group
- lay around more
- have a fever
- not get up and move with the mob
- be less interested in feeding or drink slower
- breathe faster
- look bloated
- have a rough, dull coat
- look skinnier
- cough
- have a wet mouth or chin
- grind its teeth
- vocalise
- have droopy ears
- hold its tail up and strain
- be lame or have a swollen joint
- have a large swollen navel cord.



Taking the time to observe your calves and learn what they look like when they are healthy will help you notice when they are sick and need help.

What is in a temperature?

Taking the body temperature of a calf is a very important part of assessing its health status.

For an accurate temperature measurement you can use a digital thermometer made for humans. The thermometer needs to be inserted deeply into the rectum of the calf. Obviously this needs to be done gently to avoid damaging the sensitive rectal tissue. It is important to gently push down on the thermometer so it is resting against the rectal tissue and not just sitting within the bowel contents. Repeating the measurement increases the accuracy of the result.

Temperatures of 39.5°C or above can indicate that the calf is seriously unwell and requires a more thorough examination, possibly by a vet. Temperatures below 37.5°C can indicate a severely chilled, sick and/or dehydrated calf. Seek vet advice on how to further manage these calves.

You should take immediate action to warm cold calves using hot water containers, heat lamps or other forms of direct heat plus blankets to trap the heat in.

Calf scours

Infectious calf scours

The most common health problem seen in young calves is diarrhoea (calf scours). The pathogens that cause scours are generally spread via calves ingesting faeces directly or consuming liquid or feed contaminated with faeces.

The common infectious causes of scours in the first 14 days of life are:

- E coli K99/F5
- Rotavirus
- Coronavirus
- Salmonella sp
- Cryptosporidium parvum.

It pays to assess the demeanour, temperature and degree of dehydration of any calf with loose faeces to get a complete picture of their health status. You can also test the faeces of scouring calves to determine the organism(s) responsible using a rapid "calf-side" testing kit.

If you fail to address the weaknesses in your calf management system you may have recurrences of the problem.



In many cases more than one organism is involved. Knowing which organisms are present can be helpful when deciding on treatments and preventative measures such as vaccination.

The presence of pathogens indicates a breakdown in the calf rearing process. Calves are either being exposed to faeces or faecally-contaminated material and/or their immune systems are not strong enough to fight the disease. Attention must not only focus on treatment of the scouring calves but also on:

- **Calving and care of the new born** – see chapter 1
- **Housing, bedding and stocking rate** – see chapter 2
- **Colostrum management** – see chapter 4.

Calf scours timetable (approximate age in days):

	Calves (days old)																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23+
<i>E.coli</i>	■	■	■	■	■	■	■	■															
<i>Rotavirus</i>				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
<i>Coronavirus</i>					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
<i>Salmonella</i>						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
<i>Crypto</i>						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Other infectious organisms, such as *Coccidia*, *BVDV*, *Clostridium perfringens* and other *E.coli*, may also affect calves, often after 3–4 weeks of age.

Non infectious calf scours

Sometimes calves have loose faeces but no pathogens are found on testing. Generally these calves are quite bright and alert and the scouring is mild. The most likely causes are simple digestive upsets due to changes in milk volume and/or quality consumed, milk composition and/or milk temperature variations. Calves prefer consistent quality and temperature of milk so avoid sudden feeding changes. High volume milk feeding does not significantly contribute to the incidence of calf scours. Research has shown that calves have a large digestive capacity – calves left on their mothers have been found to drink up to 12 litres via small feeds over a day!

Treatment of scours

It is important that everyone on the farm understands how to correctly manage this common calf health problem. Early identification of the scouring calf followed by rapid, effective treatment is the key for success.

Check the front end of the calf, not just the back end!

Is every scouring calf sick and/or requiring treatment?

Remember not to just focus on how watery the calf's faeces is, but also check the calf's appearance and other signs of illness. Calves that are quiet, not drinking and inactive are at greater risk than those that have loose faeces but are still bright, alert and active.

Fresh water can be life saving

Having fresh, clean water available to calves at all times is essential. Scouring calves will feel thirsty and drink water to help combat the effects of dehydration. Scouring calves can become very dehydrated between milk feedings. All calves benefit from being able to access water whenever they feel thirsty.

Use electrolytes to correct dehydration

Many different calf electrolyte preparations are available. Electrolyte products should provide the calf with several key ingredients, plus there are a range of other additives available that may be beneficial but are not essential. Think of the key ingredients as being the cake and the others as being the icing.

Key ingredients

The most important ingredients of any calf electrolyte product are:

- Sodium
- Glucose
- Potassium
- An alkalisng agent – bicarbonate, citrate, acetate or propionate. Acetate or propionate are preferred – they stabilise the pH of the small intestine to reduce the risk of ingested pathogens like E. coli and Salmonella causing disease and are good sources of energy. Bicarbonate is very effective at combating acidosis in scouring calves but can change the pH of the small intestine. It may also interfere with the formation of the milk clot.

A period of 2 hours is usually recommended between feeding milk and electrolytes containing bicarbonate.

Other ingredients

Other additives include vitamins, minerals, binding agents, prebiotics, probiotics and flavourings. The impact of these ingredients on the overall success of treatment is generally considered to be low.

Binding agents or gels can produce better formed faeces which can be misleading as the calf may still be losing significant amounts of fluids. Close attention to the calf's appearance and overall demeanour is important to monitor its response to treatment.

Remember calves drinking large volumes of milk (or those being treated with large volumes of oral electrolytes) will tend to have more watery faeces than calves being fed smaller amounts.

Fluid therapy for scouring calves

Assessing the hydration status of the scouring calf is essential. Maintaining normal hydration, ensures sufficient blood volume is available and adequate oxygen can be supplied to the tissues in the body, limiting complications.

Three factors should be considered when deciding how much fluid to give to a scouring calf:

1 What is the normal amount of fluid this calf needs to drink each day?

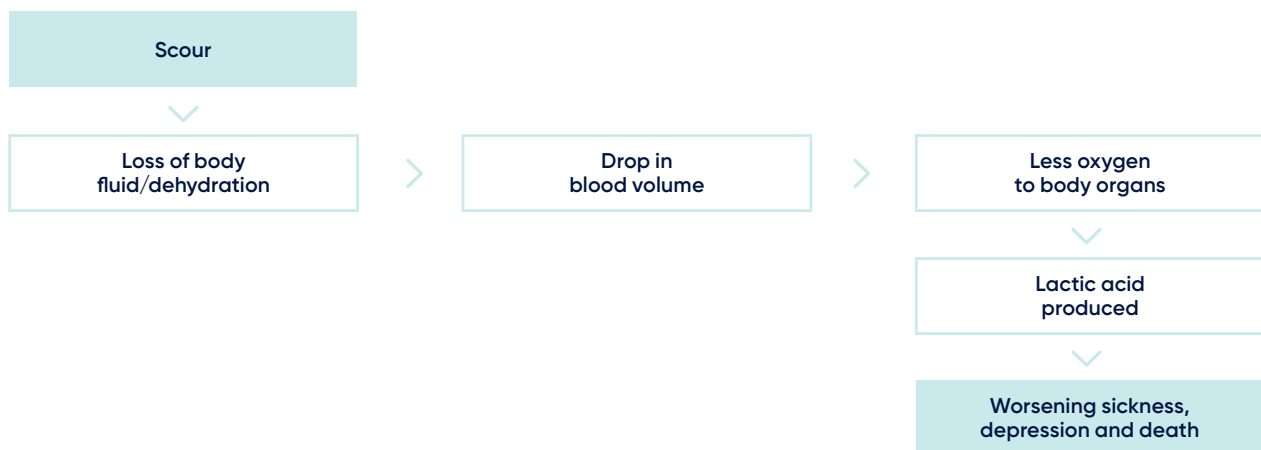
A healthy calf needs to drink about 6–7.5% of its bodyweight daily to avoid becoming dehydrated. For an average dairy calf in the first 14 days of life this is about 4–5 litres per day.

2 How dehydrated is this calf?

Accurately assessing dehydration does require some skill and experience. You need to consider how bright and alert the calf is, how strong is its suck reflex, how long does the skin stay sticking up when pinched over the neck or chest and how sunken the eyeballs appear. This will allow you to calculate how much fluid it needs to become rehydrated.

3 How much fluid is this calf continuing to lose from the ongoing scour?

As the scour continues, so does the loss of fluid. The following amounts should be considered when calculating how much oral fluid should be given.



Dehydration (%)	Behaviour	Suck reflex	Skin tent (seconds)	Eyeball sunkenness	Mouth	Approx. volume of oral electrolytes required to correct dehydration (litres)
1–5	Bright and alert, standing and moving around	Normal	1–4	Minimal	Moist	2–3
6–8	Less active, sitting down more than other calves	Usually reduced	5–10	Separation of eyeball to lower eyelid margin by 2–4mm	Sticky	3–5
9+	Lying down, reluctant to move, drink, may be unresponsive	None	11+	Obvious separation of eyeball to lower eyelid margin of 5mm or more	Sticky-dry, cold to touch	Requires intravenous fluid therapy. Call your vet

WHEN TO CALL THE VET

Calves that are over 8% dehydrated (i.e. will not stand, poor or absent suckle reflex, cold, dry mouth, severely sunken eyes) cannot be properly rehydrated with oral electrolytes. Urgent veterinary attention is critical to provide intravenous fluid treatment. If vet help is not available, then euthanasia should be considered.

Severity	Description of scour	Ongoing loss (litres/day)
Mild	Small or minimal amount, becoming doughy, resolving	< 1
Moderate	Sloppy, semi formed, sits on bedding	2
Severe	Watery, profuse, soaks into bedding	3–4

Example

A 50 kg calf which is 1–5% dehydrated with a moderate scour requires the following fluid volumes:

Maintenance	4 litres
Correct dehydration	2.5 litres
Ongoing loss	2 litres
Total	8.5 litres*

*If this calf is still drinking 4.5 litres of milk per day it requires 4 litres (8.5 minus 4.5) of oral electrolytes to meet daily needs and correct dehydration. (If drinking less milk, then more oral electrolytes needed.) Adjustments should be made on a daily basis depending on your assessment of the level of dehydration and severity of scour. It is important to remember that this is a total daily fluid intake and so it should be spread out over the day.

This is particularly important if using oral electrolytes containing bicarbonate that need to be spaced at least 2 hourly from milk feeds.

Daily fluid requirements (electrolyte and milk) of a scouring calf

Appearance of calf	Sloppy/pea soup scour	Watery scour
Bright and alert, standing and moving around. Good suck reflex	6 litres	6–8 litres
Less active, sitting down more than other calves. Poor suck reflex	6–8 litres Consider giving small feeds more often	8+ litres Consider giving small feeds more often
Lying down, reluctant to move, drink, may be unresponsive. No suck reflex	Seek veterinary attention or consider humane euthanasia	Seek veterinary attention or consider humane euthanasia

Calves need more fluids than you think!

Scouring dairy calves under 14 days of age typically require a total of 6–8 litres of fluid intake per day. An average stomach tube feeder holds only 1.8 litres at best so most calves will require 3–4 of these stomach tubings per day.

You can also use the following estimated daily fluid requirements for dairy calves up to 14 days old. The amount of oral electrolytes required each day is calculated by subtracting the amount of milk being consumed from the selected number of litres in the table.

If no milk is being consumed then just electrolytes can be used but milk should be reintroduced after 24 hours – see below.

The key to success – review each calf, each day

One day of intense treatment is usually not enough to guarantee success. Assess each treated calf daily and adjust its treatment (oral electrolytes/milk/other) daily. Of most importance is their behaviour and presence or absence of suck reflex. Remember that calves being fed large volumes of fluid will have more liquid faeces anyway so be less concerned with how the scour looks and more focused on how the calf looks.

Feeding milk to scouring calves

There are differing opinions on whether scouring calves should be fed milk or not. Milk is the only source of nutrition and energy for young calves. Removing it completely from their diet can harm the overall health of the calf.

- For mild cases of scours where the calf is still bright and alert and suckling well, milk should be continued to be fed with extra oral electrolyte solution.
- For more severe cases of scours where the calf is obviously depressed and the suck reflex is reduced it may be best to follow the rule of 'give small feeds more often' as well as the oral electrolytes.
- If a decision is made to stop the feeding of milk it should only be for a period of less than 24 hours.

Even though it is important to keep a source of nutrition for sick calves it can sometimes cause more complications.

The digestive system of a very sick calf may not be correctly functioning. Large volumes of milk particularly if fed by stomach tube repeatedly can deposit and ferment in the rumen. This may lead to the production of a chemical (D-lactate) which can make the calf even more depressed. When feeding sick calves try to encourage sucking of small amounts of milk via teats wherever possible and avoid large feeds of milk via stomach tubing.



Protecting human health

Some of the pathogens that affect calves can also make people ill so it is important for both calf rearers and visitors to the calf shed to practice good hygiene. Wash and dry your hands thoroughly after handling calves and before eating or drinking. Children should be closely supervised in the calf shed.

Remember any milk supplied to a scouring calf helps in preventing dehydration by providing fluid. If the volume of milk fed is reduced, then a greater amount of the oral electrolyte solution will need to be given to compensate for the reduced fluid daily intake.

Monitoring illness and death rates in calves

Pre-weaning illness rates	Pre-weaning calf death rates
<p>A measure of how many calves are getting sick during the period from birth to weaning.</p> <p>Monitoring this figure is key to keeping calf deaths low. Research has shown that the impact of illness in calves can be long lasting, with effects on growth, age at first calving, milk production and survivability in the herd.</p> <p>A = Total number of calves treated with either oral electrolyte, antibiotics or other medications</p> <p>B = Total number of calves reared</p> <p>Pre-weaning illness rate (%) = $A/B \times 100$</p> <p>Example:</p> <p>A = 30 calves treated with electrolytes, antibiotics or other medications</p> <p>B = 100 calves reared</p> <p>$(30/100) \times 100 = 30\%$</p> <p>Pre-weaning illness</p> <p>Aim for less than 10%</p>	<p>The pre-weaning calf death rate allows comparisons between farms and should serve as a strong call to action if above accepted industry standards or if it is rising.</p> <p>Measuring rates of pre-weaning calf deaths can be useful in determining if disease prevention regimes are working:</p> <p>A = Total number of calves that died before weaning</p> <p>B = Total number of calves born during calf rearing period (Don't count calves which died prior to birth or during birth i.e. only include calves that make it to calf shed)</p> <p>Pre-weaning calf death rate (%) = $(A/B) \times 100$</p> <p>Example:</p> <p>A = 17 calves died or were euthanased before weaning</p> <p>B = 280 calves born during calf rearing period</p> <p>$(17/280) \times 100 = 6\%$</p> <p>Pre-weaning calf death rate</p> <p>Aim for less than 3%</p>

Congenital birth defects

A congenital defect is a defect that is present at the time of birth. A decision must be made as to whether the calf is viable and will be 'fit for purpose'.

The calf should be humanely killed if it is deemed to be suffering or non-viable.

Lots of calves with defects? Seek advice from your vet.



Managing sick calves

Isolate sick calves

Ideally, you should provide areas where sick calves can be held in isolation to minimise the risk of the disease spreading.

Cross infection can occur from:

- direct contact – an infected calf transmits the disease to healthy calves
- indirect contact – exposure to material such as bedding, boots, hands, clothing or feeding equipment which has been in contact with a sick calf.

Be aware of the risks in moving sick and infectious calves:

- If illness is detected late and the sick calf is in contact with others then it is highly likely that they are already infected – quarantine the whole group from other calves.
- Move the whole group away or alternatively leave neighbouring pens empty.
- Erect solid barriers to reduce the likelihood of calf to calf contact.
- If you are moving sick calves to an isolation area, plan the process and ensure that you do all you can to minimise the risk of disease spreading to other calves. High standards of cleanliness and disinfection are required after handling sick calves as staff can transmit the disease to susceptible calves.
- It is good practice to attend to sick calves after dealing with healthy calves – i.e. feed them last as this limits the risk of spread of disease.
- Overalls, clothes and boots worn during contact with sick calves should be disinfected afterwards – don't wear the same gear next time you attend to the healthy calves.
- Use separate feeding equipment for sick calves.
- Gloves should always be worn when handling sick calves and discarded afterwards.

Any calf treated with antibiotics should be kept away from healthy, non-treated calves – this minimises the potential for misidentification. It also prevents other calves from accidentally ingesting antibiotics from the mouth, muzzle or urine of a treated calf, or sucking on feeding equipment used to administer treatments.

Sending calves with antibiotic residues to slaughter puts the whole dairy industry at risk.

The use of antibiotics

Antibiotics are drugs used to control bacterial diseases – they don't have any effect on viruses. While important for treating certain calf illnesses, the decision to use antibiotics should be carefully considered.

Avoid blanket use or medicating large groups of calves if possible. Inappropriate or overuse of antibiotics may lead to bacterial resistance, where antibiotics fail to work. This is an emerging worldwide problem that has implications not only for your farm but also for human health. The dairy industry is also very committed to ensuring that no calves sold for slaughter contain antibiotic residues (see Chapter 6). Unnecessary use of antibiotics also adds additional expense to the calf rearing operation.

The decision to use antibiotics must be made in conjunction with your veterinarian.

Your vet has the knowledge on how antibiotics are best used on your farm. As a general guide, use of antibiotics in a calf may be considered if:

- prescribed by a veterinarian for that animal or condition
- laboratory testing has determined (or there is a high suspicion) that bacteria are involved in the disease process
- the temperature of the calf is above 39.5°C – commonly seen with bacterial infections
- blood is present in the faeces – indicates that the bowel lining is damaged and bacteria could cross into the blood stream
- the calf is very depressed, weak and/or unable to stand – antibiotics may limit any additional complications.

Other medications

Depending on the problem or diagnosis, additional medications may be of benefit to the calf. Anti-inflammatory or pain relieving medications are sometimes prescribed to reduce fever and pain and help calves regain their appetite quicker. They should always be used cautiously in calves that are dehydrated as they may contribute to kidney damage. Other medications may include specific antidotes, vitamins, minerals and treatments for internal and external parasites. Never forget the value of warmth, comfort and regular attention for sick calves.



Ensure that the label directions on any medications are closely observed. Failure to do this may result in less than optimal effect and alteration in withholding periods. All medications should be stored as per label directions in a secure location. It is advisable to limit the access to medications only to staff trained to use them correctly and responsibly.

Prebiotics and probiotics

The microflora that live within our intestines is being recognised as an important contributor to our wellbeing. Just like humans, calves need to have the correct balance of bacteria and other microorganisms in their gut to assist in digestion and protect their intestinal health. Probiotics are mixtures of live bacteria and yeast which are taken orally to help populate or replenish the microflora in the intestines.

Prebiotics are typically non-digestible, fibre compounds that pass through the upper part of the gut and act as a food source for 'good' intestinal bacteria in the large intestine. Although many products containing prebiotics and/or probiotics are on the market, research has yet to demonstrate significant benefits from feeding them to calves.

Treatment protocols

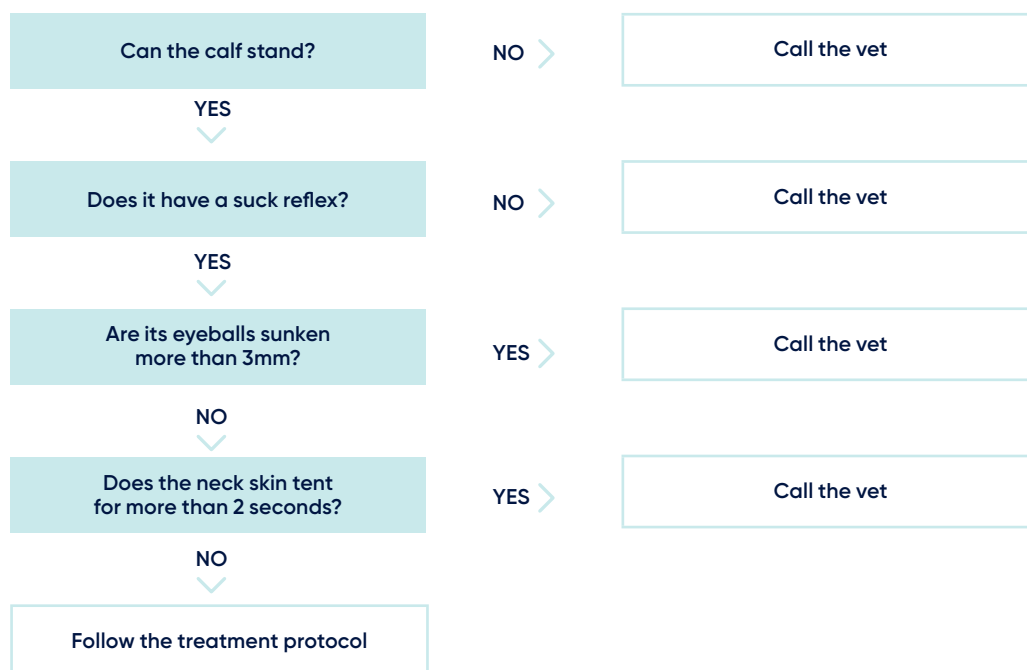
Farms may treat scouring calves differently so it is a good idea to train new staff how it is done on your farm. Having a documented protocol keeps everyone on track, especially if the usual rearers are not around.

Sample: Scouring calf treatment protocol for 'Our Dairy Farm'

Treatment protocol

- Ensure an isolation pen has fresh dry bedding and fresh clean water.
 - Move calf into isolation pen.
 - Put on calf blanket.
 - Decide on daily electrolyte protocol:
 - **sloppy faeces > one extra 2 litre feed of electrolytes**
 - **watery faeces > two extra 2 litre feeds of electrolytes**
 - **continue with 1.5 litres of milk twice daily**
 - Use 'Stop Scour', stored on third shelf in calf shed.
 - Add 200gm (2 scoops) to 2 litres of clean water.
 - Use the calf feeder bottle marked as sick calves only – rinse with warm water before use.
 - Wash calf feeder bottle thoroughly with hot water and detergent after use.
- Antibiotics are needed if:
 - **there is significant blood and mucus in the calf's faeces**
 - **the calf's temperature is above 39.5°C.**
 - Give 'Calf-treat' – 1ml per 10kg bodyweight in the leg muscle – once daily for three days.
 - Mark calf with red paint on forehead to identify it has been treated with antibiotics.
 - If unsure whether antibiotics are required then contact the farm manager on 0400 111 222.
 - Wash boots and apron, and change gloves before handling any other calves.
 - Record the following details on the computer, in the 'Farm Diary' program:
 - Calf ear tag number
 - Date
 - Clinical signs
 - Which electrolyte protocol
 - Whether antibiotics were given.

It is a good idea to develop similar protocols for managing other calf and cow health problems to ensure the best chance of a successful outcome.



Decisions about sick calves

If a calf is sick you have two choices – treat or euthanase.

Treat the sick calf

- Treat the calf and clearly identify it as treated.
- Record the treatment and any withholding period.
- You are responsible for ensuring that calves are not sold before the end of the withhold period.

Euthanase the sick calf

- Always use humane killing techniques.
- Remember, you are responsible for the proper disposal of the carcass.

If any of your calves get sick, regardless of whether they are replacements or sale calves, you must either treat them or euthanase them.



Humane killing

Humane killing (also known as euthanasia) should be considered for any calf that is found to be in pain or to be suffering. It should also be considered where calves (including sale calves) develop health problems and treatment is either not practical or not economically feasible.

If undertaking humane killing you must:

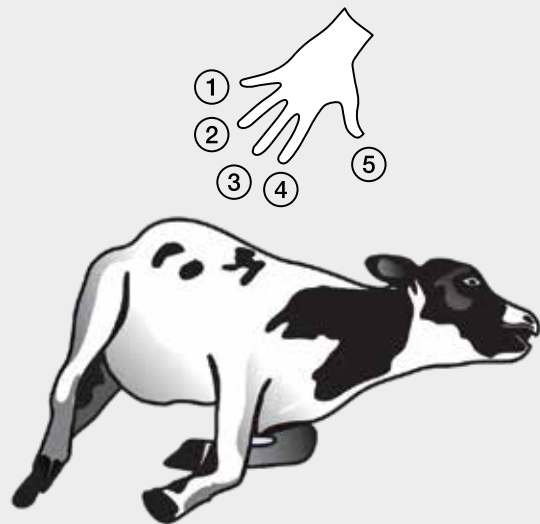
- ensure humane killing is managed by a competent operator
- ensure that immediate loss of consciousness followed by death while unconscious is the result – whichever humane killing method is used
- undertake the humane killing without delay
- confirm death in every calf, every time by observing for the presence of specific signs outlined below.

Signs of death

The following five head signs (the five finger head check) should be observed to determine whether the method used for humane killing has been effective in causing death. These are:

- 1 absence of corneal 'blink' reflex when the eyeball is touched
- 2 dilated pupils that are unresponsive to light
- 3 flaccid jaw
- 4 flaccid tongue
- 5 absence of rhythmic respiratory movements for at least five minutes.

Repeat the shot or blow if you are not confident that death has occurred. Aim between the ears again but use a different entry or striking point.



Correct technique

Every farm should have access to someone who is competent and readily available to put down a calf if necessary, and preferably has completed Dairy Australia's 'Euthanasia of Livestock' training course. Your Dairy Australia Regional Development Program can provide information on courses in your area.

Suitable equipment for euthanasing calves should be readily on hand and be maintained in good working condition.

The recommended methods involve use of either:

- **a firearm** – at least 0.22 calibre rifle
- **a captive bolt device** – does not discharge a free projectile so often more convenient and may be safer to use than a firearm.

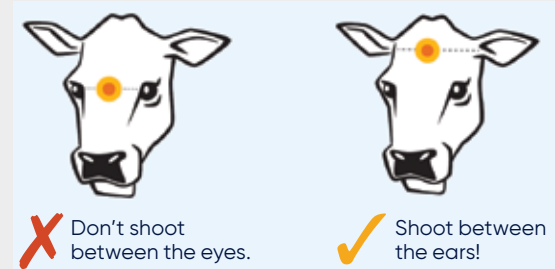
To ensure that calves are killed humanely it is very important to target the correct position on the head for the frontal shot with a captive bolt or firearm. Note the target point of entry is in the midline at the level of an imaginary line between the external ear canals (at the base of the ears). The direction of aim should be towards the centre of the neck. This is also the target for blunt trauma.

Further information: visit animalwelfarestandards.net.au for access to the full Animal Welfare Standards and Guidelines for the Land Transport of Cattle and the Australian Animal Welfare Standards and Guidelines for Cattle (including standards for humane destruction).

Take great care with firearms and captive bolts. Keep this equipment securely locked away from children.

Target position for humane killing with firearm or captive bolt

Note the target for the frontal shot with a captive bolt or firearm. Aim at a point midway between an imaginary line connecting the base of the ears in the direction of the centre of the neck.



Blunt trauma must only be used on calves less than 24 hours old when no other method is reasonably available.

Carcass disposal

It is very important that any calf carcasses be disposed of appropriately.

- The law prohibits leaving carcasses to rot or dumping them in waterways.
- It is illegal in most states to allow anyone other than a licensed knackery to remove meat from a farm.

Chemical euthanasia is a very humane method of slaughter but be extremely careful with the carcass.

Chemical euthanasia involves the administration of a drug by injection to the calf which causes a sudden and painless death.

Note that carcasses slaughtered in this way are not suitable for consumption by any species due to the ongoing presence of the drug in the tissues.

Chemical euthanasia should only be carried out by a veterinarian.

Disposal method

Knackery

- Collection sites should be confined to the farm to minimise the potential for disease spread.
- Not suitable for chemically euthanased carcasses.
- Avoid communal collection sites in public areas.

Burning

- Not a preferred method unless the animal has died from an emergency disease and must be burnt to destroy pathogens.
- Significant air pollution is created.
- High temperatures are needed and are hard to attain – tyres are not permitted.

The carcass of a chemically euthanased animal is not fit for consumption by any species – it must be buried, burnt or composted.

Burial

- Must not impact on the land, ground or surface water or the air.
- Carcasses must be buried deeply enough to prevent access by other livestock and scavengers.
- Access information from state environmental protection agencies regarding depth of hole, distance from water, exclusion of stock and scavengers.

Composting

- Advantages include the production of soil conditioner and the avoidance of digging holes.
- Disadvantages include time required and skill to do well.
- An important consideration when composting is the need to protect against scavengers.

For more information on carcass disposal

Agriculture Victoria

On-Farm Composting of Dairy Cattle Mortalities fact sheet

Dairy Australia in association with Queensland Dairyfarmers' Organisation (QDO) and Natural Heritage Trust

On-Farm composting carcasses fact sheet

Vaccination plans

Four main reasons why vaccination and parasite control programs are so important for the on-going health of calves.

- 1 **Weaning can be a stressful experience** – stress can lead to a weakened immune system.
- 2 **Exposure to pathogens and parasites** – increases dramatically at weaning as calves go out to paddocks.
- 3 **Immunity from maternal antibodies** – (contained in colostrum) declines over time.
- 4 **Calves are not able to produce significant antibodies themselves** – until week 4 and their own immunity takes time to build up.

Develop vaccination and parasite control programs as part of your animal health program – make sure to involve your vet. Also, keep good disease records as this helps monitor the effectiveness of your program.

Vaccination basics

Calves are born without immunity to disease and this is the reason that consuming sufficient high quality colostrum shortly after birth is so protective.

There is a bit of a catch, though:

- High levels of circulating maternal antibodies may interfere with the calf's response to vaccination.
- Until high levels of maternal antibodies have reduced, long lasting immunity from vaccines cannot be achieved.

This makes the timing of vaccination critical. The best time to administer vaccines to calves is when their maternal antibody levels are low enough for an active response from the calf to occur.

- It takes at least 16–28 days for the maternal antibody levels to drop by 50%.
- Vaccinations given at 6 weeks of age are generally considered temporary due to this under-developed immune response and the circulating maternal antibodies. Calves will need a booster vaccination 4–6 weeks after this temporary dose.
- Vaccines given at or near 10–12 weeks provide better responses as maternal antibodies are on average lower and the immune system is more mature and active.

Vaccine timing is about estimating when the maternal antibody levels are low enough for an active response from the calf. This can vary from calf to calf and vaccine to vaccine – always read the label. Talk to your vet about how to get the best immunity from any vaccinations given.

Protection against many diseases can be achieved with a well thought out vaccination plan.

Keep in mind

Choice of vaccine

- Some protect against multiple diseases.
- This is the case with the Clostridial diseases and leptospirosis.

Dairy versus beef vaccines

- Some products designed for cattle often assume that calves will not be handled as very young animals so the age recommended may be significantly higher (i.e. 6 months).
- If in doubt of the suitability of a product for dairy calves then seek advice from your vet.

Storage

- Always read the label. Vaccines generally require refrigerated storage and should never be frozen.

Discard at a set time

- Check the label. Vaccines have a recommended discarding time period after opening – it can vary by product.
- Try to buy only enough vaccine for the job at hand.

Administration

- Use a clean, hygienic technique to minimise risk of infections.
- Follow label directions – some vaccinations are given under the skin others are given directly into the muscle.
- Avoid vaccinating any animals in wet weather.
- In summer months, avoid vaccinating and handling young stock on hot days. It is recommended to carry out these procedures in the early morning to avoid heat-stress.
- Short length needles (<15mm) are preferred.
- Needles must be sharp.
- Wear gloves.
- Occasional swelling/abscesses may form at the injection site – this is not uncommon.
- Seek vet advice if swellings are numerous or if the calf becomes ill.



Training

Some vaccines can be dangerous. Make sure staff are trained and take care with administering and storing these products.

Advice

Your veterinarian is the best source of information about vaccine selection, timing, handling and administration.

Vaccinating for Clostridial diseases

Clostridium spp are bacteria that cause a number of calf diseases including blackleg, pulpy kidney and tetanus. These bacteria are very common in the environment and no calf should be considered immune to exposure. Many of the clostridial diseases are fatal, making effective treatment impossible.

- All calves should be vaccinated against the clostridial diseases.
- Management practices such as dehorning, extra teat removal and castration place dairy calves at a greater risk than similarly aged beef calves.

Always use products designed for dairy calves – always read the label.

Typical vaccine schedule for clostridial disease (note schedules may vary with the different products on the market):

6–8 weeks: First vaccination

12 weeks: Second vaccination

12 months: Booster vaccination

Combined clostridial and leptospirosis vaccines can be used:

- Clostridial vaccines are most commonly available as a 5 in 1 product. This protects against 5 clostridial diseases using the one vaccine.
- Leptospirosis can be protected against using a leptospirosis vaccine or a 7 in 1 vaccine (which also contains 5 clostridial antigens). Both of these vaccine types provide immunity against 2 strains of leptospirosis.

While leptospirosis is considered more of a risk to adult cows, it also poses a threat to humans. It is strongly recommended to vaccinate dairy calves against leptospirosis. The use of leptospirosis vaccines will reduce the risk of you, your family, staff, vets or A.I. technicians being exposed to this disease.

Vaccinating for other diseases

Always seek veterinary advice for the most appropriate vaccinations for your farm. Remember no vaccine is 100% protective and so wherever possible other measures should also be in place to limit the impact of the disease.

Disease

Pinkeye`

- Pinkeye (bovine keratoconjunctivitis) is an infectious eye disease associated most commonly with the bacterium *Moraxella bovis*.
- The condition is spread between calves by flies.
- Timing vaccination in relation to expected emergence of flies is critical.
- Manufacturer advice is to vaccinate with a single injection 3–6 weeks prior to the onset of each pinkeye season.

Bovine viral diarrhoea – BVD

- This viral infection of cattle is also known as Bovine Pestivirus.
- Young calves are at low risk of disease unless infected before birth.
- Currently little indication for vaccination of weaned calves.
- Seek advice from your vet prior to vaccinating for BVD as every farm will have different requirements.

Salmonellosis

- This disease is caused by a bacterium. The strain of salmonella on your farm will determine the specific vaccine used.
- The manufacturer's current recommendation is not to vaccinate calves until 8 weeks of age if they have consumed colostrum from previously vaccinated cows. If they have not received such colostrum it is recommended that they are vaccinated at any age, with a booster given 3–4 weeks later.
- The level of antibodies in colostrum is variable and vaccination is not a guarantee of complete protection from the disease. Appropriate attention to other preventative strategies including hygiene is still very important.
- Veterinary advice is essential.

Bovine Johne's disease – BJD

- Silirum® is an inactivated (killed) *Mycobacterium paratuberculosis* vaccine for use in cattle. The use of this vaccine does not prevent all new infections.
- It helps to reduce the number of bacteria shed by infected animals thus reducing spread of the disease.
- BJD vaccination should be a part of a herd BJD control program, not the entire program.
- Veterinary advice should be sought about how to best use Silirum in your herd.

Treatment and control of parasites

When calves first go out onto pasture they have high risk infection with parasites, so it is important to have a comprehensive plan for the treatment and control of internal and external parasites.

- Once a calf is weaned it becomes more difficult to control the calf rearing environment.
- Pastures used for freshly weaned calves should be free from manure and not grazed by adult cattle for 12 months to minimise exposure to parasites and Johne's disease.

Remember, permanent calf paddocks can become highly contaminated by parasites. High stocking rates of calf paddocks can lead to a rapid build up of parasites and be a significant risk factor for disease.

Wet, moist environmental conditions mean that young calves are inevitably exposed to parasites.

Pastures contaminated with adult effluent also increase the risk of infection with Johne's disease.

Do what you can to minimise contact with calf and adult cow manure – it is worth the effort.

Common calf parasites

There are a variety of internal and external parasites that can infect calves. The significance and impact each parasite can have on calves will vary with the level of infection, environmental and regional factors and individual immune status.

The following organisms should be considered in any parasite control program. Further region specific advice can be obtained from local vets or animal health professionals.

Protozoa

- Coccidiosis (*Eimeria* sp) is a common parasite affecting newly weaned calves.
- In Australia, toltrazuril is registered as a single use treatment for calves with coccidiosis and as an aid in the prevention of coccidiosis.
- Other products known as coccidiostats inhibit the lifecycle of the organism – they need to be continuously supplied to calves as part of a ration or prepared feed.

- Commonly available coccidiostats are monensin (Rumensin), lasalocid (Bovatec), decoquinate and amprolium.
- Reduce the contact of calves with manure and effluent.

Roundworm

- Majority of roundworms or nematodes are found in the gastro-intestinal tract of infected animals.
- *Dictyocaulus viviparus* or lungworm is an exception – it is found in the airways and lungs.
- Brown stomach worm *Ostertagia ostertagi* is the biggest problem, others include: *Trichostrongylus* sp, *Cooperia* sp, *Nematodirus* sp and *Haemonchus* sp.
- Wormers like macrocyclic lactone anthelmintics (i.e. ivermectin, moxidectin etc) very effective but over or inappropriate use may lead to resistance.
- Worm control strategy should incorporate faecal egg count monitoring, the use of clean pasture through paddock rotation and controlled grazing and strategic and rotational use of wormers.
- Ask your vet for advice on worming strategies.

Liver fluke

- Most common liver fluke is *Fasciola hepatica*.
- Some treatments are combined with roundworm wormers.
- Note that some products are only effective against the adult forms of the fluke while others treat the juvenile stages as well.
- Environmental management is also critical – if possible avoid wet and moist pastures known to be infected with the snail that is a necessary factor in the lifecycle of this parasite.
- Fluke can only occur when the snail is present – no snail, no fluke regardless of the wetness of paddocks.
- Fluke is mainly an issue in the irrigated dairy regions or low lying, poorly drained pasture.

Tapeworm

- Tapeworm infections are considered to be of little significance in calves.
- Most of the commonly used oral white drenches (non-macrocyclic lactone drugs like Fenbendazole) are effective in removing tapeworm.

Lice and mites

- The most common skin parasite seen on calves in Australia is the biting louse *Bovicola bovis*.
- Insecticides applied topically are normally effective.
- Products may contain synthetic pyrethroid compounds or organophosphates.
- Injectable macrocyclic lactones (i.e. ivermectin) are not effective against biting lice but do remove the less common sucking lice and other common mites.
- Pour on applications are likely to reduce the number of biting lice only if the lice come in direct contact with the active ingredient.

Ticks

- *Boophilus microplus* – in northern Australia. Control through strategic use of pasture rotation and anti-tick treatments.



Get health basics right

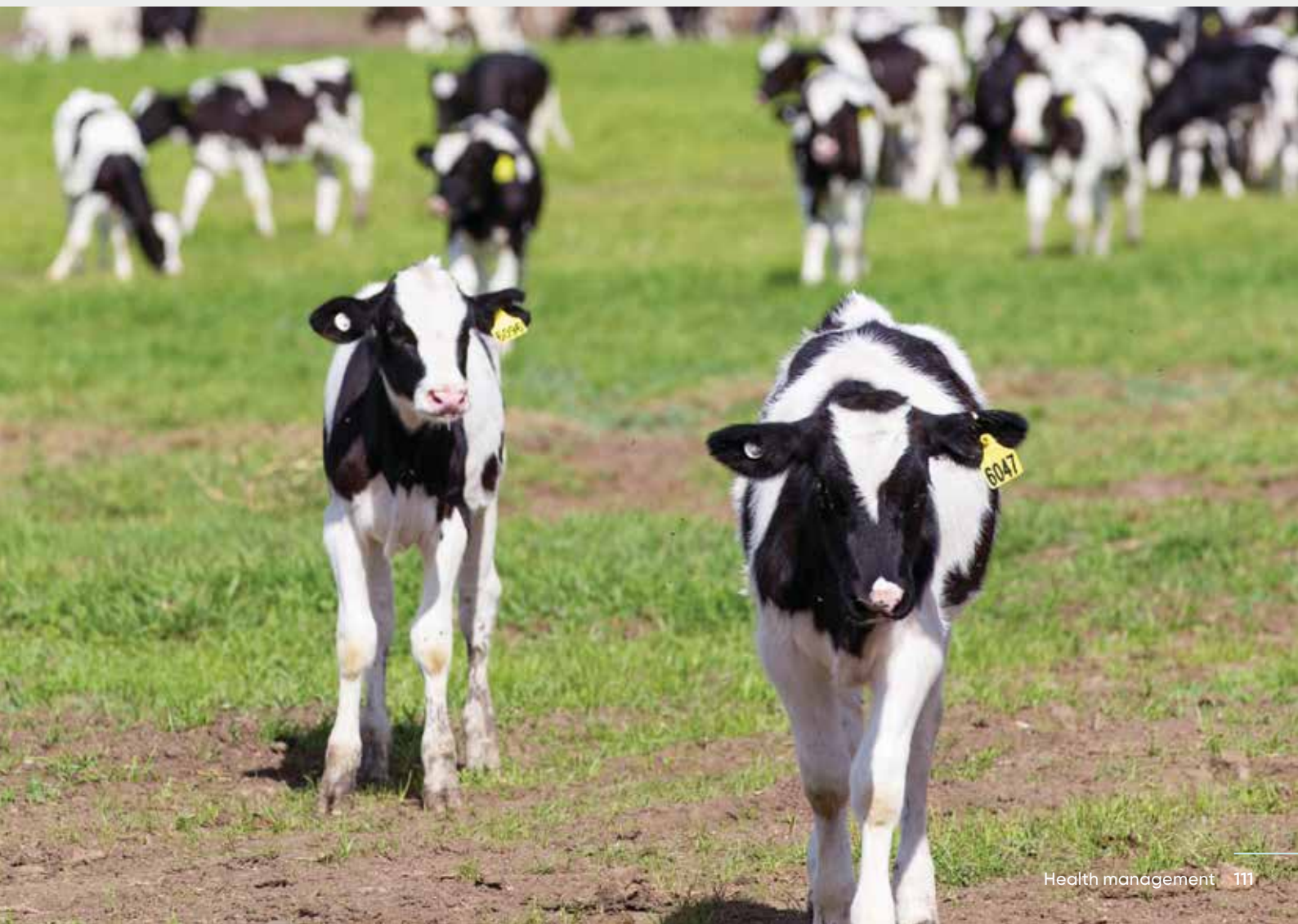
You need to get some basics right if you want herd replacement calves that thrive and sale calves that are healthy and 'fit for purpose' when they leave your farm.

Provide	Because	Note
Regular observation and quick action	<ul style="list-style-type: none"> Allows problems to be spotted early. Quick intervention gives a sick calf the best chance of survival. 	<ul style="list-style-type: none"> Observe calves at least twice a day. Train staff to know what's normal and what is abnormal. Have protocols in place so all staff know what action to take when sickness is observed.
Quality colostrum	<ul style="list-style-type: none"> Provides initial disease protection and good source of nutrients to newborn calves. Only a small window of opportunity. 	<ul style="list-style-type: none"> Quality is at its highest in the first milking. Good quality colostrum has a Brix reading greater than or equal to 22%. Aim to give all calves 2 x 2 litre feeds of good quality colostrum within the first 12 hours of life. If only poor quality colostrum is available (<22% Brix) or if not tested – give 2 x 3 litre feeds within the first 12 hours. An additional feed of 2 litres of good quality, fresh colostrum in the next 12 hours is also beneficial.
Good nutrition	<ul style="list-style-type: none"> Reduces nutritional deficits which makes calves more vulnerable to pathogens. Provides energy to maintain steady growth rates and good rumen development. 	<ul style="list-style-type: none"> All calves need access to fresh clean water from birth. Feed a minimum volume of 10% of a calf's body weight per day of milk or milk replacer. Small amounts of fibre i.e. a handful per calf per day can be introduced within the first 2 weeks of life, but significant amounts of fibre are not required before 3 weeks of age. The total amount of fibre offered should not contribute more than 10% of the diet during the pre weaning period.
Water	<ul style="list-style-type: none"> Water is essential for life. Water (not milk) is required to fill the developing rumen. 	<ul style="list-style-type: none"> Daily milk feeding may not satisfy the required daily fluid intake of a calf. Ingested milk bypasses the rumen and passes directly to the abomasum due to the action of the oesophageal groove.
Comfortable environment	<ul style="list-style-type: none"> More energy is available for growth and fending off disease if the rearing environment is dry and draught free. Energy is diverted to maintaining body temperature in cold and draughty conditions. 	<ul style="list-style-type: none"> Sheds or pens need to be protected from the prevailing wind. Bedding needs to be at least 15cm deep so calves can nestle in it with their legs covered. Get down to calf level to feel if there are any draughts or ammonia smell.
Minimal contact with manure	<ul style="list-style-type: none"> Minimising contact with manure means less opportunities for pathogens to get into a calf. 	<ul style="list-style-type: none"> Manage manure pathogen numbers by removing calf from dam as soon as possible. Before entering calf pens/paddocks, check clothes and equipment for manure. Ensure trailers used for transport are hosed/scraped out between each batch of calves. Choose a source of fibre/roughage that is different from bedding – if calves nibble on bedding, they will take in more pathogens. Thoroughly clean shed and replace bedding between batches of calves – top up bedding regularly.
Clean equipment and facilities	<ul style="list-style-type: none"> Minimises the risk of spreading disease and reduces risk of contamination with antibiotic residues. Protects against future antibiotic resistance and poor drug effectiveness. 	<ul style="list-style-type: none"> Establish cleaning and disinfection plans for facilities. Clean equipment thoroughly after every use. Use hot water and detergent to remove fat deposits contained in milk. Pay particular attention to teats and tubes – residues can get trapped and build up here. Take care in cleaning shed pens when calves are in them. High pressure hosing may wet calves and create aerosols containing pathogens.
Careful stock handling	<ul style="list-style-type: none"> Avoids injury to calf and reduces risk of spreading disease. 	<ul style="list-style-type: none"> Use a calm manner from the outset. Isolate sick calves but avoid spreading the disease in the process. Deal with sick calves after feeding the healthy calves. Clean and disinfect yourself and everything you touched when treating sick calves – hands, clothes and equipment.

Summary of recommendations



- 1 To rear calves that thrive, planning for disease prevention is the key.
- 2 At calving time, monitor cows and be ready to intervene if needed.
- 3 Minimise exposure to infection – remove calves from their dams early and keep the rearing environment clean.
- 4 Adopt a preventative disease program (vaccination and parasite control) and implement the 3-Step Calf Plan for the control of bovine Johne's disease (BJD).
- 5 Do your best to keep calves away from faeces and reduce their exposure to pathogens.
- 6 Monitor calf health regularly and act quickly if problems arise.
- 7 Handle sick calves carefully to minimise the risks of infecting healthy calves.
- 8 Develop treatment protocols for the common calf diseases and training on how to implement them – this helps busy staff and encourages consistency.
- 9 Use products as intended and avoid contaminating sale calves.
- 10 Use humane slaughter techniques when calves must be euthanased.





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Weaning management

Prepare calves well for weaning

- Ensure calves are reaching concentrate consumption targets before weaning.
- Monitor growth rates.
- Use concentrate intake and growth rates to determine the best time to wean.



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The challenge of weaning

Weaning is a challenging time for a calf for two key reasons:

- 1 The primary source of nutrients moves from liquid to solids.
- 2 Exposure to pathogens increases as the calf enters a new environment.

By the time weaning occurs, the development of the calf's rumen should be sufficient to permit good growth from a non milk-based diet. This solid nutritional status is critical as change often induces stress. Stressors may include:

- changes in housing
- competition from other calves – social stress
- husbandry practices.

When an animal is stressed, exposure to pathogens can result in higher rates of disease as stress suppresses immunity. Well fed calves cope better in these conditions.

The health and welfare of the calf is challenged at weaning – manage the process carefully.

Weaning will be more successful if calves are exposed to only one stressor at a time!

Weaning should not coincide with any other stressful event. Calves handle multiple, small periods of stress better than one big stressful event.

Good management of the weaning process ensures the on-going health and welfare of your stock. The benefits include:

- smooth transitions for calves
- minimal parasite and other disease problems
- improved growth rates and economic return from replacement heifers.

Importance of heifer growth rates

A recent Australian study clearly demonstrates the benefits of improving heifer growth rates.

It showed that growth rates before puberty had the largest influence on 100 day and 250 day performance.

For each 0.1kg of pre-pubertal daily growth there was an increase in milk yield (182 litres), protein yield (4.0kg) and fat yield (4.1kg) during the first 100 days of lactation. Similarly, an additional 0.1kg bodyweight gained per day resulted in an increase of 345 litres, 7.5kg fat and 6.1kg protein at 250-days into lactation.

Increasing post-pubertal average daily growth by 0.1 kg/day also increased the daily likelihood of insemination and conception in the first mating period after calving by 10%.

Increasing the growth rate of a heifer between mating and first calving from 0.5kg/day to 0.8kg/day will result in a 30% increase in the likelihood of insemination and the likelihood of conception in the first mating period following calving.



Nutritional challenges

The ability to wean a calf is dependent on it having a functioning rumen.

It is now known that development of the rumen is driven by chemical rather than physical stimulus.

- Volatile fatty acids from the breakdown of grain drive rumen development by encouraging the growth of small finger like projections on the wall called papillae.
- Papillae allow nutrients to be absorbed – more papillae means more surface area to absorb nutrients.
- Early introduction of grain or grain based feeds stimulate rumen papillae development.
- Commonly held beliefs that fibre roughage such as straw is essential to promote rumen development have been proven to be incorrect.

Fibre is still important and it has a physical effect on the muscular layer of the rumen wall.

- Rumen papillae often become long or clumped when exposed to high levels of grain feeding.
- Fibre found in forages helps groom the papillae via an abrasive type effect.

Good quality pasture can go some way to meeting the nutritional requirements of growing calves but supplementation with concentrates such as grains or pellets is normally required if optimal growth rates are to be met. Additional fibre is also essential.

Greater exposure to pathogens

During periods of housing, a farmer has greater control over the environment and exposure to pathogens can be limited. For example, prompt removal of newborn calves from dams limits their exposure to bacteria and viruses that cause scours.

Once a calf is having greater daily access to paddocks, exposure to pathogens is far more difficult to control. This is why vaccination and parasite control programs are so important for the on-going health of calves.

- At weaning there is an increased risk of exposure to disease.
- Immunity from maternal antibodies has declined but the calf's own immunity is developing over time.

Monitoring the burden of disease

Disease can place a heavy burden on growing calves.

The impact of disease in young heifers can include:

- reduced growth rates
- impact on future fertility
- affect future milk production
- higher death rates.

It is important to closely monitor the health of all calves.

Don't forget to check calves in distant paddocks or on agistment.

Visually assess all animals regularly for signs of ill health.

Look for

- drooling, coughing, nasal discharge, increased breathing – signs of airway disease
- scaly, peeling skin or warts indicate skin disease
- lameness, limping, non weight-bearing on limb could be footrot or an injury
- dull coat, scouring may indicate nutritional or parasite problems
- neurological signs including staggers, blindness, etc.

There are also a number of non specific signs to look for including:

- **Weight loss** – poor appetite, tucked up or hollow appearance
- **Behaviour** – lethargic, standing away from mob, frequently lying down.

Seek advice from your vet if you spot any signs of disease. The quicker you get on to these issues, the less growth rates and development will be affected.

You should have a calf health plan in place that includes parasite control and vaccination – your vet can help develop specific advice for your farm.

Approaches to weaning

Weaning is a stressful event and calves will typically have a temporary drop in average daily weight gain around this time, no matter what their age.

Approach to weaning	Note
Abrupt weaning	<ul style="list-style-type: none">• Only if rumen function is optimal and the calf is eating at least 1kg of concentrates, (or a pen of calves is averaging 1.5–2 kg consumption) daily.• Not suitable for calves on accelerated or high milk volume feeding programs (20% bodyweight milk volume per day).• More stressful and more likely to lose weight post weaning.
Gradual weaning	<ul style="list-style-type: none">• Gradual reduction of milk (typically over 10–28 days) makes for a smoother transition. May lose weight in the pre weaning period.• Requires more attention to detail and monitoring over a longer time period but is the least stressful method for calves.

Indicators: When to wean?

Weaning should only occur when adequate rumen development is present.

Farmers use calf appearance, age, weight and daily consumption of concentrate as weaning indicators. The most critical factor in deciding successful weaning is the calf's degree of rumen development. The rumen should be sufficiently developed to provide all the calf's nutritional requirements from a solid diet.

The best indicator for weaning is adequate intake of concentrate feeds.

In practice, rumen development can be gauged by the amount of concentrate a calf is consuming.

- A minimum consumption of 0.75 to 1kg of concentrate per day is generally accepted as appropriate for Holstein-Friesians. Jerseys should be eating around 0.5–0.75kg per day.
- The calf should demonstrate this level of consumption over at least 3 consecutive days.

Remember that monitoring concentrate consumption of each calf is essential if early weaning is undertaken.

For calves in a group fed system, where accurate starter consumption per calf can be a challenge, it is recommended to monitor on a group basis over three consecutive days.

As a guide, in group fed systems:

Holsteins: 1.5–2kg/day

Jerseys: 1–1.5kg/day

Examples of gradual weaning

A commonly used approach is a 50% reduction in milk intake for 10–14 days.

Reduce liquid feed allowance by 25–50% per week in the 2–4 weeks leading up to the target weaning date.

Gradual reduction can also be used to reduce the liquid feed allowance daily from peak intake (e.g. 12L) to 0L over a 14 day period.

Tips to reduce weaning stress

- Transport and/or turnout calves before or after weaning.
- Wean during good weather if possible.
- Vaccinate and disbud calves at separate times, prior to weaning.

Weaning age

Early weaning of calves has a number of economic advantages:

- reduces labour and housing capacity requirements
- reduces milk costs particularly if milk replacer is used
- reduces the cost of disease management.

Early weaning places extra pressure on the rearing system and rearers must ensure that weaning is well managed and appropriately timed for each calf.

Post weaning growth targets

The growth of calves is measured using:

- **Weight** – muscle and fat deposition.
- **Height** – skeletal growth.

Remember that bigger heifers are generally more productive over their lifetime.

Weaning age	Note
4–6 weeks	<ul style="list-style-type: none">• Early concentrate intake must be successfully achieved.• Less room for errors.• Excellent calf rearing skills required.• Labour intensive.
6–12 weeks	<ul style="list-style-type: none">• Monitoring concentrate intake is critical.• Automated calf feeding systems well suited to supply and monitor concentrate intake.
12 weeks and over	<ul style="list-style-type: none">• A common weaning age in seasonal calving herds.• Rumen development is assured due to longer time to adapt to concentrates.• Can be cost effective if surplus milk is available.• If surplus milk is not available check the cost – benefit of a lower weaning age.

A heifer 50kg heavier at calving will produce at least 1041 litres more over the first 3 lactations.

Very early weaning (4–6 weeks)

Calves that do not achieve the target concentrate intake should not be weaned. See chapter 5 for measures to promote early intake of concentrates.

Pros: reduced labour, reduced liquid feed costs, lower calf rearing facility requirements

Cons: Some calves will likely experience setbacks at weaning if concentrate intake is not closely observed.

Young calves on restricted liquid feed intake are less able to cope with infectious and environmental challenges (e.g. cold weather, outbreak of disease).

Early to moderate age weaning (6–12 weeks)

Practical steps: Automated milk feeders can be programmed to reduce milk allowance to achieve concentrate intake targets at this age.

Pros and cons: This age is a compromise between the pros and cons of the early and late weaning ages.

Older age weaning (12 weeks+)

Practical steps: (see table at left).

Pros: Target concentrate intake can be achieved easier – there is a lower requirement for intensive nutritional management and monitoring. Can easily achieve high growth rates on liquid feed before weaning.

Cons: high labour, feed, facility requirements/inputs – add to the cost of rearing.

Ideally, you should regularly monitor the weight and height of your heifers until they enter the milking herd. All calves should be monitored visually but to minimise labour, only a representative (5–10%) sample of the calves need to be weighed.

- If you look at the target weights and heights and realise your heifers are a long way from them, develop a step-by-step approach. For example, aim for 80% of recommendation in first year then 100%. This way you can get a feel for the costs and also get to see some of the benefits.
- If the majority of the mob fails to meet growth rates then review nutritional management.
- If there are only a small number of calves not achieving target weights, draft these off and provide higher levels of supplementation to improve growth rates.



Are your heifers on target?

If you can't weigh your heifers regularly here are some other useful rules of thumb for heifer performance.

- At the point of first calving heifers should be at least 85% of the bodyweight of the mature cows in the herd (around 4 years of age). If you can't weigh your cows, use the docketts from cull cow sales to estimate the typical mature cow liveweight in your herd.
- Another way to assess your heifer performance is to monitor the milk production of your first calvers. Under typical Australian conditions they should have at least 85% of the milk production of the mature cows in the herd. Production ratios of less than 80% indicate that there are significant opportunities to improve your heifer rearing.
- If you don't have access to herd milk production data by age group, check the ratio of second calvers to first calvers in your herd. You should have at least 85% of first calvers going on to calve for a second time.



For example

On this farm weaning is approached in the following way:

- The health and growth of the calves are constantly monitored as we believe there is no place for guesswork when assessing the calves.
- We use scales, weight tapes and height sticks and the results recorded.
- Our auto-feeders take some of the guess work out of weaning calves.
- As the calves rely more heavily on the calf starter ration, milk intake is gradually reduced.
- Our calves are fully weaned at 70 days–10 weeks.

Parasite control

- Young heifers are often affected by internal and external parasites.
- Refer to page 108 for more information about common parasites.
- Any condition affecting feed intake and growth can have a significant impact on later production and reproduction.
- The risk of internal and external parasites will differ depending on geographical region and season.
- Develop a plan to control parasites before they cause significant production losses or disease.
- It pays to discuss the available options with your veterinarian. Parasite resistance to veterinary chemicals is emerging and well-planned control programs are needed to limit the impact of this problem.
- Regardless of the specific products and control program used, the following is recommended:
 - Always observe the meat (and milk) withholding periods for veterinary chemicals.
 - Always check that the product is safe to use in food-producing animals. Some products are registered for use in beef cattle but not for use in dairy cattle.
 - Check that the product is safe to use in pregnant heifers, where applicable.
 - Check the minimum age and weight that an animal can be treated with a particular product.
 - Always check the route of administration – some products must be given orally, some are topical and others are injected.
 - Check for any human health implications e.g. use in pregnancy, asthma, hypersensitivity.
 - To determine the correct dose of a product, it is advisable to weigh a proportion of the mob, usually the largest 3–5 animals by eye. If static scales are not available, a weigh tape can be used instead.
 - Always dose to the heaviest in the mob.
 - Ensure the dosing gun is accurately calibrated and continuously check the delivery dose of the product.
 - Appropriate facilities designed for the safe and quiet handling of young stock will help reduce the risk of injury to animals or people.
 - Always record the animal ID, date of treatment, product used and withhold period.
 - Always wear appropriate protective equipment for the product. Some products can cause skin and eye irritation and others can be absorbed through the skin and airways.
 - Always store any unused product in an appropriate sealed container, out of reach of farm animals and unauthorised people.

Post weaning diets

The first 12 months are critical for skeletal and muscle development so heifers need a good quality diet with a high protein content.

Feed good quality concentrates (of at least 11.5MJ ME/kg DM and 17% crude protein) until calves reach 250 kg – unless they have continual access to abundant, high-quality green pasture.

Young stock will require supplements when diets are:

- based on pasture of average quality, typical of summer/autumn in many regions, or
- of limited availability, typical of winter in many regions.

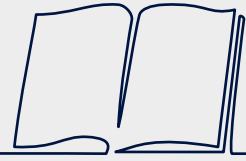
Group heifers according to their size and weight to allow differential feeding. This will help to get smaller, lighter heifers to target liveweight at mating. Avoid sudden reductions in feed, especially during mating, as this will impair the fertility of heifers.

Discuss with your nutritionist or vet whether your heifers need trace elements, vitamins and other feed additives.

Go to dairyaustralia.com.au/animals/fertility to use the Heifer Diet Calculator. This estimates the energy and protein content of the total diet, determines if requirements are satisfied and predicts heifer growth rates.

Contact your Dairy Australia Regional Development Program for information about nutrition courses available in your region.

Summary of recommendations



Prepare calves well for weaning. Weaning is a time of great challenge for the calf and so it needs to be managed carefully.

- 1 Make sure calves reach their concentrate intake consumption targets before weaning.
- 2 Monitor growth rates and concentrate intake to determine the best time to wean calves.
- 3 Weaning should be a gradual process to minimise the stress on the calf.
- 4 After weaning heifers need a high quality diet to achieve their target liveweights at mating.







Care before transport and sale

Make sure sale calves arrive healthy

- All sale calves must be fit for transport.
- Sale calves must be at least 5 days old.
- Make sure calves receive a liquid feed within 6 hours of transport.
- Provide shelter and shade prior to pick up – keep calves dry and draught free.
- All sale calves must be antibiotic free.
- Sale calves must be identified with an NLIS tag.

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National standards

The Australian Animal Welfare Standards and Guidelines – Land Transport of Livestock (2012) provide a basis for consistent legislation and enforcement across Australia.

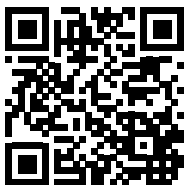
Where there is a conflict with another standard, the welfare of livestock must be the first consideration unless there is an occupational health and safety requirement.

- The standards apply to all people responsible for the preparation, care and management of livestock that are transported. These include drivers, transport companies, owners, agents and livestock handlers at farming enterprises, depots, saleyards, feedlots and livestock-processing plants.
- The chain of responsibility for livestock welfare in transport begins with the owner or their agent, and extends to the final receiver of the livestock.
- Standards are based on current scientific knowledge, recommended industry practice and community expectations.

Prepare calves for transport and sale.

Failure to comply with one or more standards is an offence and may lead to an infringement or court penalty.

For further information see animalwelfarestandards.net.au.



If the calf is unfit to transport – do not send it. If in doubt, leave it out.

Care before transport and sale

Calves that are well cared for prior to sale cope better with transportation. Other benefits include

- calves are 'fit for purpose' on arrival
- high animal welfare standards are maintained
- the reputation of the Australian dairy industry is not damaged.

Sale calves need a high standard of care

Calves destined to be sent for processing at an early age (known as bobby calves) need to be given the same standard of care as every other calf on the farm.

Good on-farm management is essential as calves that are well cared for prior to transportation will arrive at their destination in better shape. Bobby calves must:

- be fed colostrum (2–4 litres/calf) within the first 24 hours of life
- be fed daily with adequate milk or milk replacer and have free access to water at all times
- have protection from excess heat, sun, wind and rain, and be kept clean and dry with bedding. Exposed concrete, bare earth and mud floors are not acceptable.
- be handled gently at all times. Do not throw, hit, drop or drag a calf at any time.
- Bobby calves must not be moved using dogs or electric prodders.

Selecting calves that are fit for transport

Both the person selling the calf (the consignor) and the transporter share a responsibility for the selection and transport of calves that are fit for sale.

- The consignor must only supply calves that are fit for the intended journey.
- The transporter must only load, or permit to be loaded, calves that are fit for the intended journey.

Before selecting calves for transport, you need to consider both their age and their fitness for the intended journey. Bobby calves must not be consigned across Bass Strait. If an animal is not fit for the intended journey appropriate arrangements for its care, treatment or humane euthanasia must be made.



Calves less than five days old

Calves less than 5 days old must not be sold in a saleyard, sent to calf scales or consigned to an abattoir or processor.

Calves less than 5 days old travelling without their dam are only allowed to be transported directly to a calf rearing facility.

These calves must be:

- provided with thick bedding and room to lie down
- protected from cold and heat
- transported for no longer than 6 hours
- never be consigned through saleyards or calf scales.

If there is any doubt on the suitability of a calf then it should not be transported. It is always best to err on the side of caution and keep the calf until it meets all the standards. Any health issues should receive the necessary attention.

Calves less than 5 days old can only be transported directly to a calf-rearing facility.

Failure to comply with this standard is an offence and may lead to an infringement or court penalty.

Calves between five and 30 days

Select calves for sale with the following characteristics:

- minimum liveweight of 23kg
- hooves are firm and worn, not soft and bulbous
- dry and withered navel cord.

Calves of this age travelling without their dams can be sold in a sale yard or calf sale or consigned to an abattoir under the following care conditions:

Conditions	Requirement for each calf
'Fit' for transport	<ul style="list-style-type: none"> • Must be in good health, alert and able to rise from a lying position.
Comfort	<ul style="list-style-type: none"> • Must be protected from cold and heat. • Vehicles like trailers must provide protection from wind.
Liquid feed	<ul style="list-style-type: none"> • Must have been fed milk or milk replacer on the farm within 6 hours of transport unless the journey is between rearing properties and is less than 6 hours' duration.
Transport time	<ul style="list-style-type: none"> • Must not spend more than 12 hours in transport.
Arrival at sale yards, abattoir	<ul style="list-style-type: none"> • Must be delivered in less than 18 hours from last feed.
Records	<ul style="list-style-type: none"> • Must have an auditable and accessible record system. • Records must identify: <ol style="list-style-type: none"> (i) the age of the calf (ii) when the calf was last fed – i.e. within six hours of transport.

Managing sale calf care

Arrangements for selling calves vary on farms. The following quotes from farmers give you an idea of how standards are met on these farms.

'Calf buyer comes regularly at certain time. Feed bull calves with other calves and picked up shortly after.'

'I record the time of feeding on the gate sign I got from Dairy Australia – the calf buyer can check when the calves were fed and are suitable for transport.'

'Calf buyer is pretty consistent with time of pick up – if he is running late he gives us a ring and we hold off feeding the calves.'

'We like to time our feeding of bull calves so we are just finishing as the truck comes up the driveway.'

'Our daily routine is clearly documented in staff procedures – Cows are milked, breakfast is had, calves are fed, bull calves fed last, truck arrives shortly after.'



For example

On this farm, a gate sign available from Dairy Australia is used to record the time that calves were fed prior to pick-up. This record also advises the calf buyer when the calves are suitable for transport and provides a contact number in case there are any problems.

To order a bobby calf gate sign, contact your nearest Dairy Australia Regional Development Program.

Care prior to pick up – liquid feed and shelter

Calves need to be fed no more than six hours prior to transporting, so feed calves as near as possible to the time of pick up. Your records must provide evidence that this has occurred.

This is easily achieved where calves are delivered direct from farm to sale yards by farm staff, but if third party transport is used, try to determine a routine time of pick up.

Records must be audible and accessible at a later date. It may be helpful to record the time of last feeding on any NVD used for sale calves and ensure that you keep a copy of this document.

Whilst awaiting collection, calves should be provided with appropriate shelter to maximise health and welfare.

- Separate facilities should be used to aid identification and loading of calves for transport by third party transporters.
- These facilities should be constructed and maintained to provide appropriate shelter and comfort for the calves being held.
- Calves should be dry and draught free – position calves away from prevailing winds and rain.
- Clean, deep and dry bedding is essential to keep the calf warm and comfortable.
- Calves should be handled gently on to and off transport vehicles. Do not throw, hit, drop or drag a calf at any time.
- Calves must not be moved using dogs or electric prodders.

Don't forget – sale calves must be free of antibiotic residues, need NLIS tags and completed vendor declarations.

Australian Animal Welfare Standards and Guidelines – Land transport of livestock

Livestock transport begins at the loading of livestock into a container or on to a vehicle and concludes on unloading of livestock at the final destination.

There is a chain of responsibility for the welfare of livestock that begins with the owner or their agent and extends to the final receiver of the livestock.

The standards and guidelines are relevant to all those involved in the care and management of livestock that are transported, including:

- owners
- agents
- drivers, transport companies
- livestock handlers at farming enterprises, depots, saleyards, feedlots and livestock processing plants.

animalwelfarestandards.net.au

Summary of recommendations



Make sure you comply with the Land Transport standards.

- 1 Make sure all calves transported from your farm are 'fit for purpose'
- 2 All calves consigned to a saleyard, calf scales or to a processor must be at least 5 days old.
- 3 Ensure calves receive a liquid feed within 6 hours of transport and keep records available for audit.
- 4 Provide shelter prior to pick up – keep calves dry and draught free. If it is hot, shade may be required.
- 5 Remember, any calves you sell must be antibiotic free and not subject to any withholding period.
- 6 Sale calves must be identified with an NLIS tag and be accompanied by a vendor declaration
- 7 Calves must be handled gently at all times.





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Nursing a sick calf

Sick calves benefit from a number of supportive measures including:

Anti-inflammatory medication

These prescription medications relieve inflammation, fever and pain and may prove beneficial in calves displaying these symptoms. They should be used with caution in dehydrated calves due to risks of kidney damage. These medications may also have a withholding period which must be obeyed.

They should be administered as directed on the attached veterinarian's label. The dose is based on weight.

Vitamin and mineral supplements

Calves that are ill for more than a few days can suffer decreased milk or feed intake. This may limit intake of essential vitamins and minerals. Supplementation in these circumstances may be beneficial

Comfortable environment

Calves that are ill and/or dehydrated will often have body temperatures outside of the normal range.

They may also experience higher levels of stress. Supplying them with an environment of controlled temperature and good bedding can significantly improve the welfare and survivability of the sick calf. Cold calves can be warmed by the use of hot water containers placed close to a calf or calf jackets. Warm calves can be cooled by ensuring they are placed in cool areas away from direct sunlight.



Biosecurity for calf rearing areas

Farm biosecurity aims to reduce risks to a farm business by limiting the introduction and spread of animal diseases, pests and weeds. Animal health, welfare, labour and financial benefits all flow from maintaining high levels of biosecurity.

The calf rearing environment is like a small farm within the larger farm that contains the most vulnerable class of stock on the farm. Get the biosecurity right then the benefits will flow, get it wrong and pay a heavy cost.

Having a biosecurity plan for your calf rearing environment is a proactive approach to disease prevention, to help maintain a healthy environment and keep diseases out. Your vet can help analyse your situation and provide information on managing disease risks.

The three key steps to implement a biosecurity plan are:

- 1 Calculate the risks
- 2 Control the risks
- 3 Communicate your plan.

Calculate the risks

What diseases have you got lurking around and which ones are you at risk of getting? Known risks for most calf rearing environments are the common pathogens e.g. Rotavirus, Cryptosporidium, E.coli, Bovine Johne's disease, Salmonella, internal parasites such as coccidiosis, intestinal worms and pinkeye. However there are other pathogens and health risks you may not know about, so you need to plan to manage them too.

Sample biosecurity plan

Risk	Actions
Calves infected with disease when they arrive	<ol style="list-style-type: none">1 Remove calf from the calving area as soon as possible after calving.2 Ensure calf transport vehicle is clean – minimal faecal contamination.
Contaminated milk fed to calves	<ol style="list-style-type: none">1 Wash all milk feeding equipment between uses.2 Discard milk obviously contaminated with faecal/organic material.3 Control rodents.
Contaminated concentrate/hay fed to calves	<ol style="list-style-type: none">1 Monitor all hard feed for evidence of faecal contamination.2 Control rodents.
Machinery/vehicles bring disease into area	<ol style="list-style-type: none">1 Avoid bringing machinery used on other parts of the farm into the calf rearing area.2 Pressure clean any machinery/vehicles that are needed.
Disease brought in by people	<ol style="list-style-type: none">1 Do not allow unauthorized access to calf rearing environment2 Staff/vets/agents handling calves or entering environment should do so before handling older stock.3 All people having contact with calves should have clean clothes and boots on – no faecal contamination.
Disease brought in by pests	<ol style="list-style-type: none">1 Control rodents, birds and flies

Control the risks

Think about how disease could be brought into the calf rearing environment. Pathogens could arrive via an infected calf, through contaminated machinery or equipment, through contaminated people and clothing, via contaminated feed or milk or by pests such as rodents or insects. You also need to consider how these diseases move between animals. Many common pathogens are spread through contact with infected faecal material. In the case of pinkeye the infection moves from a weeping, infected eye to another calf's eye via flies.

For example

Below is a biosecurity plan developed for the farm's calf rearing environment.

Communicate your plan

All people having contact with your calf rearing environment need to know about your biosecurity plan. Your staff need to be educated on each step they must follow and have the plan available for their reference. Other visitors to the calf rearing environment such as vets, agents, herd improvement staff and calf buyers also need to be informed about your plan. You can achieve this through direct discussions and/or indirectly through signage e.g. signs restricting access to the calf rearing area to authorised personnel, or indicating the mandatory boot washing station.

Common calf diseases

Rotavirus

What causes it?

A virus.

How do calves get infected?

Infection is by ingesting virus from manure (adults and calves).

Pregnant cows are known to pass high levels of the virus around the time of calving. Once ingested, clinical signs of disease are usually seen within 24 hours but it may be up to 3 days.

How long can it last in the environment?

The virus can survive in water and soil for weeks to months (years) if temperatures are mild and there is an ongoing presence of moisture.

How is it treated?

No specific drugs are available that destroy this virus. Treatment is focused on electrolyte/fluid replacement and supportive measures. Recovered calves can become re-infected.

How do I prevent it?

- Minimise calf contact with manure from adult cattle by early removal of the calf from its dam.
- Ensure calves are not exposed to manure during transportation to calf rearing area or during the rearing period.
- Maximise immune system response by ensuring successful passive transfer of antibodies (blood IgG levels over 10 mg/L).
- Each calf should consume high quality colostrum within 12 hours of birth (see page 57 for details).

Salmonellosis

What causes it?

A family of bacteria (*Salmonella* sp.), many strains of which can cause disease in many species, including humans.

How do calves get infected?

Infection is by ingesting the bacteria which are found in manure, soil or water. It can also be found in saliva and nasal secretions of infected animals.

Heavily pregnant cows are more at risk of shedding the bacteria in their manure. These bacteria can also be present in other animal species on a farm. Vermin and birds are common carriers of infection and can spread infection.

Clinical signs appear 24–48 hours after infection. High temperatures are common. Death can sometimes occur with no signs of scour or illness. Some strains cause pneumonia and joint infections as well.

How long can it last in the environment?

It can survive in the environment for several years.

How is it treated?

Treatment relies on fluid and electrolyte replacement, the use of nonsteroidal anti-inflammatory drugs (to control fever and toxæmia) and antibiotics. Supportive measures and treatments can also aid recovery.

How do I prevent it?

- Clean up grain to reduce bird droppings contaminating calf rearing area.
- Avoid overcrowding and exposure to possible sources of infections such as contaminated water, pasture grazed by older animals and manure from other animal species.
- Minimise calf contact with manure from adult cattle by early removal of the calf from its dam. Ensure calves are not exposed to manure during transportation to calf rearing area or during the rearing period.
- Maximise immune system response by ensuring successful passive transfer of antibodies (blood IgG levels over 10mg/L. Each calf should at least consume 2 litres of good quality colostrum in the first 12 hours and another 2 litres within 24 hours of birth.

A vaccine is available in Australia. Calves receive protection from the ingestion of colostrum from vaccinated cows. The level of antibodies in colostrum is variable and vaccination is not a guarantee of complete protection from the disease. Appropriate attention to other preventative strategies is still very important.

Take care! Humans can get salmonella too!

Cryptosporidium parvum

What causes it?

A protozoan. It can also cause infection in humans. Cryptosporidiosis is very common; a recent study of dairy farms in Australia demonstrated that it was contributing to calf scours on nearly 60% of dairy farms.

How do calves get infected?

Infection is by ingesting the organism which is found in manure, soil or water. It invades the wall of the intestine and undergoes a multiplication phase.

Eggs (oocysts) are produced and either re-infect the calf or are shed into the environment. This organism can also be present in other animal species on a farm.

Clinical signs appear 2–5 days after infection. Following an infection, a calf can shed the eggs for 2 weeks or longer.

How long can it last in the environment?

The eggs can survive for months to years in water and soil in cool conditions. Unsuitable climatic conditions such as dry and warmth can significantly reduce its viability and infectivity.

How is it treated?

No specific drugs are available that destroy this protozoan. Treatment is focused on adequate fluid replacement and supportive measures.

How do I prevent it?

- Avoid overcrowding and exposure to possible sources of infections such as contaminated water, pasture grazed by older cattle or manure from other animal species.
- Minimise calf contact with manure from adult cattle by early removal of the calf from its dam. Ensure calves are not exposed to manure during transportation to calf rearing area or during the rearing period.
- Maximise immune system response by ensuring successful passive transfer of antibodies (blood IgG levels over 10mg/L). See page 57 for guidance on colostrum management.

In Australia, the drug halofuginone (Halocur[®]) is registered for the control and prevention of *Cryptosporidium parvum* infections in calves. It has shown variable results at reducing the severity of scouring in infected calves. This drug appears to be most effective at decreasing oocyst production and this effect is only seen while it is being administered.

Coronavirus

What causes it?

A virus.

How do calves get infected?

Infection is by ingesting virus from manure (adults and calves). Pregnant cows are known to pass high levels of the virus around the time of calving. Infection from inhaling the virus can also occur.

Once ingested, clinical signs of disease are usually seen within 48 hours but can be up to 6 days.

How long can it last in the environment?

The virus can survive in water and soil for weeks to months (or even years) if temperatures are mild and there is an ongoing presence of moisture. It is generally considered a bit more fragile than, and not as persistent as, Rotavirus.

How is it treated?

No specific drugs are available that destroy this virus. Treatment is focused on adequate fluid replacement and supportive measures. It commonly causes more damage to the intestinal lining than Rotavirus and so length of illness is generally longer. Recovered calves can become re-infected.

How do I prevent it?

- Minimise calf contact with manure from adult cattle by early removal of the calf from its dam.
- Ensure calves are not exposed to manure during transportation to calf rearing area or during the rearing period.
- Maximise immune system response by ensuring successful passive transfer of antibodies (blood IgG levels over 10mg/L).
- See page 57 for guidance on colostrum management.
- Maintain good calf rearing hygiene at all times.
- Vaccines are available in Australia against Coronavirus. The vaccine is given to the cows prior to calving. Calves receive protection from the ingestion of colostrum from vaccinated cows. Vaccination in conjunction with good colostrum management can minimise the impact of this disease.

Colibacillosis – E coli

What causes it?

A bacterium (E coli).

How do calves get infected?

E coli bacteria are normal inhabitants of the gut of cattle.

There are many different strains of E coli and not all cause disease. E coli (K99/F5) is the most common cause of scours in calves in Australia.

Calves are only susceptible to infection for the first 2 weeks of life but most infections are seen within the first 4 days after birth. Infection occurs by ingestion of faecal material during the early period of life.

How long can it last in the environment?

These bacteria can survive in moist environments for 3–6 months.

How is it treated?

Treatment relies on fluid and electrolyte replacement, the use of non-steroidal anti-inflammatory drugs (to control fever and toxæmia) and antibiotics.

Supportive measures and treatments can also aid recovery.

How do I prevent it?

- Minimise calf contact with manure by early removal from its dam.
- Ensure calves are not exposed to manure during transportation to calf rearing area or during the rearing period.
- Maximise immune system response by ensuring successful passive transfer of antibodies (blood IgG levels over 10mg/L).
- See page 57 for guidance on colostrum management.
- Calves receive protection from the ingestion of colostrum from vaccinated cows. The level of antibodies in colostrum is adequate and vaccination in conjunction with good colostrum management can effectively minimise the impact of this disease.

A vaccine is now available in Australia for a dam prior to calving to increase antibodies in the colostrum.

Coccidiosis

What causes it?

A protozoan.

How do calves get infected?

Infection is by ingesting the organism which is found in manure, soil or water.

The organism invades the wall of the intestine and undergoes a multiplication phase. Eggs (oocysts) are produced and either reinfect the calf or are shed into the environment.

The period from infection to clinical signs is commonly 15–20 days so this disease is unlikely to be seen in calves less than 14 days of age.

How long can it last in the environment?

The organism can survive in water and soil for weeks to months (years) if temperatures are mild and there is an ongoing presence of moisture.

Unsuitable climatic conditions such as dry and warmth can significantly reduce its viability and infectivity.

How is it treated?

Treatment options include using medications such as sulphonamides (sulpha based antibiotics) and more recently toltrazuril (Baycox®), a single dose treatment that attacks all stages of this parasite's lifecycle in the calf and prevents infection for up to 6 weeks.

How do I prevent it?

- Coccidiostats such as monesin and lasalocid can be added to feed supplements and prevent the parasite from developing inside the calf.
- Due to the period of time coccidia take to cause disease in calves, the need for these products in calves less than 2–3 weeks of age is questionable. There is certainly no value in using feeds with these supplements for calves destined for sale or slaughter at less than 2 weeks of age.
- Avoid overcrowding and minimise exposure to manure and contaminated pastures.

Non infectious, nutritional scours

What causes it?

Scouring with no identifiable infectious agent present.

How do calves get affected?

It has been the belief that feeding large amounts of milk causes scouring due to the overflow of unclotted milk into the small intestine. This is unlikely to be correct.

Calves have an enormous digestive capacity. The use of non clotting (whey based) milk replacers has to some degree discredited this overflow idea as their use has not been associated with scouring.

The actual true cause is unknown but an overly large feed may just cause a digestive upset or a simple indigestion resulting in a disruption to normal manure production.

It may also provide an environment for pathogens to proliferate, developing an infectious scour described previously. Changes in milk temperature and milk composition may also play a role.

Feeding greater amounts of liquid feeds may also increase the water content of the calf's stools, while the dry matter component remains the same. This can sometimes be misidentified as scouring.

Anecdotal evidence suggests some calves are more prone to nutritional scours than others. Varying the amount of milk available (i.e. less amounts more often) to these calves per feed can reduce their risk of scouring episodes.

With electrolyte fluid therapy, calves will generally overcome nutritional scours themselves but without it, they can develop infectious scours due to build up of causative agents in the intestine.

How is it treated?

Treatment is focused on fluid replacement and supportive measures.

Reduction in volumes of milk fed per feed and increasing feeding frequency may also be of value.

How do I prevent it?

- Feed milk at consistent temperatures
- Feed good quality milk or milk replacer – don't change milk replacer type quickly
- Identify calves that are prone to nutritional scours and regulate feeding volumes to minimise scouring episodes.

Pneumonia

How does it present?

Pneumonia is a bacterial or viral infection of the lungs. Clinical signs may include fever, coughing, increased respiratory rate, drooling and wet chin and decreased appetite.

Increased sitting or standing with head and neck extended and possibly sunken eyes may be seen in more severe cases.

How is it caused?

It is most commonly caused by bacterial invasion of lung tissue following a viral infection, commonly with abscess formation.

Accidental ingestion of liquid feeds onto lungs can be an initiating factor.

Similarly, poor ventilation resulting in high levels of irritants in the inhaled air (i.e. ammonia from urine, soiled bedding and lime) can cause inflammation of lung tissue and allow bacteria to invade. Lungworm can also precipitate pneumonia.

Viruses can also play a major role as an initial cause of lung inflammation. Stressors such as cold weather, poor nutrition and overcrowding make calves more susceptible to viral infection.

How is it treated?

Treatment with appropriate antibiotics is usually indicated. Supportive treatment with non steroidal anti-inflammatory drugs can be useful. Fluid therapy may be warranted if dehydration or toxæmia is present. Consult your vet.

How do I prevent it?

- Provide calf rearing facilities with adequate ventilation, shelter from draughts and good air quality
- Minimise ammonia levels by maintaining clean bedding
- Do not apply lime – use a disinfectant like Virkon™. Avoid overcrowding of calf pens
- Ensure high levels of staff competency in skills related to tube feeding calves their colostrum, milk or other liquids
- Keep older calves free from internal parasites, including lungworm.

Umbilical abscess

How does it present?

Common signs in addition to a painful swelling at umbilicus include fever, decreased appetite and sunken eyes in severe cases.

Pus may discharge from the umbilicus. Swelling is often hard in early stages but softens as condition progresses.

How is it caused?

Bacteria can enter an open umbilical cord shortly after birth and set up an infection. The practice of navel sucking can contribute to the problem.

How is it treated?

Treatment with appropriate antibiotics is usually indicated.

Surgical drainage may be appropriate. Consult your vet.

Supportive treatment with non steroidal anti-inflammatory drugs can be useful.

Need to differentiate from an umbilical hernia which is generally soft, non painful. Hernias can often be reduced in size by rolling calf on back and applying gentle pressure to the swelling. This is not the case for an abscess.

How do I prevent it?

- Provide and maintain a clean calving and rearing environment
- Spraying of umbilical cords with an effective disinfectant shortly after birth and repeated as necessary is considered best practice
- Regular monitoring of umbilical cords for swelling, heat or pain should be carried out
- Identify navel sucking calves and restrict behaviour
- Be careful not to confuse an umbilical abscess with an umbilical hernia.

Joint Ill

How does it present?

Signs include swollen, painful joint(s) with limping progressing to complete non-weight bearing lameness. Additional signs seen are fever, decreased appetite and sunken eyes in severe cases.

How is it caused?

Bacteria enter the blood stream and lodge in joints. Common belief is that bacteria enter the blood supply via the umbilical cord. It is now also understood that bacteria can also cross from the intestinal tract into the blood system particularly in severe or long standing causes of scouring.

How is it treated?

Treatment with appropriate antibiotics as soon as possible is usually indicated. Surgical drainage and flushing of the affected joint may be appropriate.

Supportive treatment with non steroidal anti-inflammatory drugs can be useful.

Euthanasia should be considered where severe non-weight bearing lameness is present or multiple joints are affected.

How do I prevent it?

- Spraying of umbilical cords with an effective disinfectant shortly after birth and repeated as necessary is considered best practice.
- Consider the judicious use of antibiotics in cases of severe scours where blood is present or which are chronic in nature.

Mouth or cheek abscess

How does it present?

The most common presentation is as a swelling in the cheek region. Often hard in early stages but softens as condition progresses. Pus may be present discharging from swelling.

How is it caused?

It is usually initiated by a penetrating mouth wound which becomes infected with bacteria. Often seen in conjunction with feeding grain, coarse roughage (particularly unrolled oat grain) or when using rice hulls as bedding.

How is it treated?

Antibiotics are only indicated in severe cases. Most will resolve with drainage and flushing of wound. Many burst spontaneously and no treatment is necessary.

How do I prevent it?

- Early detection and treatment is necessary to minimise severity of infection.
- Having water a long way from the concentrate feeder may mean calves don't drink enough water to wash the concentrate down. This may cause food impaction beside the gums, leading to lumps and abscesses.

Mycoplasma

What causes it?

A bacteria – *Mycoplasma bovis* (*M. bovis*).

What diseases does it cause?

M. bovis is known to cause lung infections (pneumonia), swollen joints/joint infections (arthritis) and ear infections (otitis media). In adult cattle it is also known to cause mastitis.

Calves developing a droopy ear or tilted head may indicate the presence of *M. bovis* in the herd.

How do calves get infected?

M. bovis is highly contagious and can be spread by air borne particles, respiratory secretions, nose-to-nose contact, contaminated feed, water, bedding material, feeding equipment and even via humans. Newborn calves are often contaminated in the calving environment. It is a highly infectious organism so if present, many calves will be infected.

How is it treated?

M. bovis is difficult to treat successfully with commonly used antibiotics. Best results are seen when treatment is begun early in the disease and often a long course of antibiotics is required. Your veterinarian will be able to develop the best treatment protocol for your farm.

How do I prevent it?

Maintaining high levels of biosecurity:

- When introducing new adult stock, seek thorough health histories from properties of purchase. A bulk milk PCR test is available to test herd status.
- When calves are born, ensure the calving environment is clean and remove the calf quickly.

Maintaining a clean, well ventilated calf shed – avoid overcrowding.

M. bovis related disease is quite rare in Australia, but it tends to occur on farms when animals are under some sort of stress e.g. poorly designed facilities, poor ventilation, mixing of different groups of animals, low levels of hygiene and/or nutritional stress.

Disbudding calves

Unless your calves are naturally polled (grow no horns), dehorning is a necessary husbandry procedure to improve animal welfare in the long term. It reduces the risk of bruising and hide damage, especially during yarding and transport, and makes cattle safer to handle. Dehorning also increases the value of the animal and leads to fewer aggressive behaviours within the herd.

The gene responsible for 'polled' is dominant and the gene responsible for 'horn growth' is recessive. This means that an animal that inherits either one or two copies of the dominant polled gene from its parents will not grow horns. The polled gene is unusual in dairy breeds but increasing demand for polled animals and more widespread genetic testing is increasing the selection of high genetic merit bulls that carry the polled gene.

Calves are born with horn 'buds' and the correct term for removal of these is 'disbudding'. Disbudding is usually carried out using a heated disbudding iron. At around 8 weeks of age the buds start to fuse with the underlying bone. Removal of horns after 8 weeks of age is called 'dehorning' and is usually performed using scoop dehorning devices of varying designs or embryotomy wire for larger horns. The Australian Cattle Welfare Standards mandate the use of pain relief when dehorning animals over the age of 6 months.

It is recommended that dairy calves are disbudded using hot iron cautery at 2–6 weeks of age when the procedure is quicker and less painful. Research has shown that calves and farmers both benefit from the use of pain relief at the time of disbudding. Use of a local anaesthetic means that it is safer and easier for the operator. Calves receiving effective pain relief have a smaller check in growth rate which means bigger, stronger calves that can be weaned earlier. These gains help offset the additional cost of administering the medications.

It is recommended to discuss pain relief options with your veterinarian to help reduce the pain and stress associated with disbudding.





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