Future Beef

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Second edition

Weaner management in northern beef herds

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Contents

Effective weaning – practical approaches that deliver results

Top five reasons to wean

If cow's milk is the best feed for a calf, why is it necessary to wean?

1 Manage the body condition of the breeder cow

A cow that produces 8–10L of milk a day requires almost twice as much energy as a dry cow. If energy from feed is insufficient for milk production, the additional energy comes from her own fat reserves, making her lose body condition and struggle to get back in calf.

2 Improved animal production and financial returns

Yard-weaned cattle have fewer health problems, achieve better liveweight gains and perform better in the feedlot. By establishing specific mobs/lines of cattle according to age and weight, management can be targeted to facilitate marketing and feeding strategies. This can reduce subsequent mustering and drafting costs and can help cattle to meet Meat Standards Australia (MSA) requirements.

3 Reduce the amount of supplementary feeding to breeders

At the time of weaning, breeders should already be back in calf. Weaning will then ensure the breeder's energy requirements are reduced, enhancing her ability to calve at her optimum body condition above 3.0, giving her the maximum chance of getting back in calf within three months. It's also cheaper to feed a weaner than a mature cow.

4 Educate and train young cattle by adopting best practice animal welfare outcomes

Weaners benefit from being yarded, handled by humans and familiarised with various feeders, feeds and rations. These processes expose young cattle to different environmental factors and common practices. There are significant animal welfare and workplace safety advantages from producing quiet and well-trained stock.

5 Maximise cow's milk production in the next lactation

All calves should be weaned, regardless of the cow's condition. On good quality pastures this could be at least two months prior to the birth of the next calf. This will ensure the cow's next lactation isn't compromised and some weight gain and body condition improvement is achieved.

The best options for weaning

If weaning is essential, then what is the best method to use?

Unfortunately, there is no rule that fits all situations – the main message is to apply the basic principles as outlined in the manual.

The option chosen will be determined by:

The mating system

In a controlled mating enterprise, all breeders can be mated at the same time and all calves can be weaned at once. Where continuous joining is practiced, weaner management is complicated by large variation in weights and ages at weaning.

Number of weaners being processed

The time and labour commitment to handle and educate 100 weaners is different to the requirements for 2,000 weaners.

Pre-weaning musters

In many smaller operations, calves are branded, castrated, dehorned and vaccinated prior to weaning. This is ideal if it can take place, but it is not feasible or cost effective in many large northern herds.

If the practice of weaning is understood and managed properly, producers can ensure their cattle are set up to be superior performers.

Infrastructure

Yard set up will impact weaner management, i.e. multiple permanent yards with water will require different management than portable yards with a central processing area for trucking and weaning.

Seasonal conditions and access to good hay

Many properties can routinely make their own hay while others need to import hay as it can't be made locally. In good seasons, saved pastures in allocated weaner paddocks and tailing weaners is a preferred option.

Breed and temperament

Some breeds may reach maturity more quickly than others. This will impact when calves should be weaned to manage breeder condition and weaner fertility.

Weaning 101

- ✓ Use the body condition of the breeder cow to determine the best time to wean. Aim to have the cow's body condition score (BCS) at 3/5 at calving.
- ✓ Firmly secure all yard gates and deny access to the forcing pen and race.
- ✓ Provide good quality water and grass hay (in feeders) on day one. Gradually introduce other options such as pellets or concentrates. If stock are destined for a feedlot, introduce weaner pellets while in the yards to get them familiar with eating out of troughs/feed bins.
- ✓ If possible, allow mothers to see calves in the yard for the first three days after weaning. This is not always practical, but it will reduce stress on the cows and calves.
- ✓ Vaccinate calves with 5-in-1 as soon as possible after separation, and preferably prior to animal husbandry procedures. Vaccinate for other diseases as per veterinary advice.
- ✓ Use low stress stock handling techniques and train weaners while in the yards. Once settled, tail weaners and yard up each day prior to releasing into their designated paddock. If weaners are destined for a fattening depot, truck as soon as they are settled and feeding normally, then perform most of the above duties upon arrival at the destination.
- ✓ If weaners are to be transported, provide good quality hay and clean water before trucking and on arrival at their destination. Consider weather conditions during transport and always ensure weaners are fit for their journey.
- ✓ Perform routine husbandry procedures a day or two prior to release from the yards. Avoid extreme heat or wet and boggy conditions. Use best practice castration, dehorning and branding techniques and provide appropriate pain relief. Monitor all stock for at least 24 hours post-processing.
- ✓ Prior to release into the paddock, check all fences and make sure weaners are well fed – never let hungry weaners into a paddock containing toxic weeds. Ensure weaners have found water and check stock the next day.
- ✓ If there is ample dry feed in the paddock, it may be low in protein. Consider providing a protein supplement.

Why wean?

Leaving the calf on its mother during the dry season may be beneficial for the calf, but the cow will use her body reserves to produce milk and will lose weight on a below maintenance diet. Her condition will become too poor to conceive again after calving, resulting in her producing a calf only every second year or dying.

Weaning is of direct benefit to the cow, and is a well established practice in northern Australia. The emphasis in this manual is two-fold:

1. To describe best management practices for feeding and educating weaners.
2. To enable successful weaning strategies of young, light calves under difficult conditions to reduce mortality and improve fertility in the breeders.

Main benefits of weaning

Weaning is the single most effective management tool available to manage the body condition of the breeding cow. Weaning allows:

- the cow to regain condition so she has a better opportunity to produce a calf every year
- young stock to be educated for easier management in future life.

Maintaining body condition of the cow

The nutrition available from pasture is a major constraint on cattle production across the grazing lands of northern Australia – although there are considerable differences between regions. Mitchell grass in semi-arid regions is considered more nutritious than black speargrass under higher rainfall, while light stocking in the drier regions allows cattle to select better diets.

Even during the growing season, native grasses on poor soils are often too low in protein, energy and phosphorus for optimal growth, and a cow feeding her calf may struggle to maintain her own body condition. During the long dry season, the protein and energy in the mature and dry pasture are so poor that a lactating cow will lose weight dramatically and during drought times, may not survive.

Removing the need to produce milk for her calf in the early dry season is equivalent to giving the cow a supplement of up to 3kg of grain or 4kg of fortified molasses every day.

The advantages of weaning the calf are:

- The dry cow will be able to maintain her body condition with little or no supplement. She may need some protein supplementation, but her reduced energy requirements can be met without additional energy supplement.
- Calves eat less supplement than cows, making it cheaper to feed a weaned calf than a lactating cow.
- Calves in the yards and smaller weaner paddocks are easier to feed than cows and calves in large breeder paddocks, saving labour costs.
- Less total supplement fed means less cost.

Dry cattle can gain weight rapidly as feed quality improves early in the growing season, but lactating cows often only maintain, or may even lose, condition.

» It is not easy to get a calf every year off native pastures under the highly variable climate of northern Australia

» The cow will lose condition in order to feed her calf if the nutrition is poor

Body condition score (BCS)

Body condition of the cow is assessed on a scale of 1 to 5, with a BCS of 1 being poor, BCS 3 being moderate/store and a BSC 5 being fat.

At the end of the dry season (which is often the start of calving):

- if the cow is in BCS 1–2, her ovaries may be dormant – she will probably not cycle and conceive again while lactating during the following growing season
- if the cow is in BCS 3, she should start cycling soon after calving
- if the cow is in BCS 5, she has usually not reared a calf for some time and may be a poor breeder.

BSC 5 = may have issues with fertility

BCS 3+ = better chance of conceiving within the desired time

The importance of body condition at the end of the dry season on the conception rates of lactating cows during the coming growing season is shown in **Table 1.1**.

Table 1.1: The estimated effect of body condition on subsequent pregnancy rates of lactating cows

Cow body condition at the end of the dry season		Likely pregnancy rate in the coming growing season*
BCS (1–5 scale)	Description	
1	Poor	Up to 25%
2	Backward	50%
3	Moderate (store)	70%
4	Good	85%
5	Fat	75%

(Meaker, 1984; Fordyce, pers. comm., 2016)

*This assumes good nutritional conditions during mating. Rates will be lower under poor seasonal conditions and with young cows.

Body condition drives cow fertility

To produce a calf every year, the cow must get pregnant again within 75 days of calving. To provide the best chance for conception, she must be in good condition BCS 3 or better on a scale of 1–5) when she calves.

For further information about body condition scores for beef cattle, scan or click the QR code or visit **futurebeef.com.au/body-condition-score**

Weaning rates even more important now

Profitability has always been of overriding importance in any beef business. It is driven by high weaning rates and low mortality rates in the breeder herd.

However, many extensive herds in northern Australia in past decades have had weaning rates below 60% and breeder mortalities in excess of 10%. Few cull cows were sold and nearly all heifers went into the breeder herd. Enterprises remained viable because their turn-off was based on older steers that had time to put on weight.

Productivity has improved greatly in recent decades with better management, better adapted breeds and the appropriate use of supplements. A market in the far northern region exists for younger live export steers and heifers, while the local market also requires younger animals. Weaning rates are a key variable for beef businesses to be profitable.

Higher productivity can be achieved by good weaning management and by adequate feeding of the smaller weaners.

Breeder and grazing management

To keep the cow in good condition and reduce supplementation costs, breeder and grazing management must match feed requirements to feed availability (**Figure 1.1**). Planning involves management of the breeder herd, nutritional demands and pasture.

Breeder management strategies include:

- timing mating so that the calf's highest milk requirement in its second and third month is matched to peak pasture quality
- weaning to remove the nutritional stress on the cow as pasture quality declines
- supplementing to reduce specific diet deficiencies.

Grazing management strategies include:

- adjusting stocking rates to around 20% utilisation so the cows and calves can select nutritious leaf from the bulk of the pasture
- periodically spelling breeder paddocks over the growing season to allow the good grasses to recover
- spelling weaner paddocks to accumulate good feed.

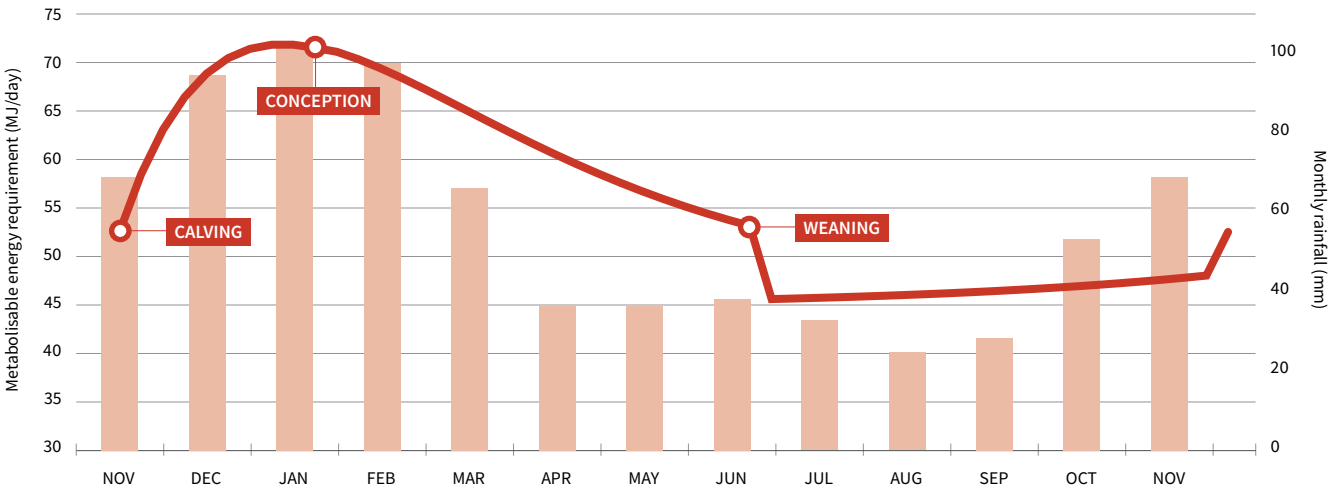
With good nutrition, most cows will cycle while lactating.

⚠ Plan for body condition

The target is a BCS of 3 or better at calving.

Planning the cycle of body weight and condition of the breeder cow throughout the year is the key to higher fertility and low mortality.

Figure 1.1: Example annual monthly rainfall pattern and total metabolisable energy requirements for lactation and gestation in a beef cow



Source: MLA, 2025

Metabolisable energy requirement Annual monthly rainfall

Note: Assumptions based on a Central Queensland location, four-year-old 500kg *Bos taurus* cow, with the calf weighing 30kg at birth.

Timing mating

On properties where controlled mating is practical, calves should be born just before the wet season, in accordance with the green date, so that peak milk demand from the growing calves coincides with peak pasture growth and quality. 'Green date' is usually defined as the number of days after 1 September to achieve a 70% chance of receiving 50mm of rain over a maximum of three days. It's based on soil temperatures and pasture responses to a specified amount of rain.

Therefore, calving is planned for late August and September in southern coastal Queensland where rainy weather may begin as early as late September. In parts of northern Australia however, calving is planned for October–November, where the monsoon storms typically arrive in mid-December.

On very large properties, however, controlled mating is not always practical if all bulls cannot be mustered with 100% certainty and if it is difficult to put out bulls during the wet.

Continuous mating can create problems. Dry cows will naturally conceive with the flush of new grass when the wet season starts. These cows will then calve in the middle of the next dry season and will lose too much condition feeding the calf before the next wet season, causing them to fail to get back into calf. Therefore, calving will gradually get out of phase with the grass season for a couple of years before synchronising again.

Instead of a calf every year, these breeders will typically produce two calves in three years at best, and will be expensive to keep alive.

Continuously mated herds can be managed by weaning small calves (100kg and over) in first and second round musters, but the best results are achieved by removing as many early weaners as possible at the first-round muster if breeders are losing weight.

Whole system

Weaning calves down to 100kg is one tool in a whole system breeding program. Other tools include selecting cows and bulls for higher fertility, culling cows that will calve out of season, and controlled mating to achieve a tighter calving period.

Timing weaning

After the grasses flower late in the growing season, the quality of pasture declines markedly and will be unable to maintain the condition of a cow producing even a few litres of milk. If weaning is delayed, the cow will lose weight and be in BCS 1–2 and therefore would be unlikely to get back into calf that year.

The calf should be weaned before the cow loses too much condition so that she can conceive at the next mating.

Early weaning

Early weaning refers to the weight (age) of the calf and not to the time of the muster.

Industry terminology is:

- **Radical weaning: under 100kg (under three months old)**
- **Early weaning: 100–150kg (three to four-months-of-age)**

Traditionally calves are weaned between four to eight months old.

» Feeding weaners requires less supplement than feeding cows. Weaning earlier would have enabled better condition of cows and weaners over the dry season

All calves over three-months-of-age can be weaned in April–May, and those over two-months-of-age at a second muster in August–September. These small weaners must be fed and managed well.

Weaning in April–May can save the cow 10–15kg liveweight per month – equivalent to about one BCS in three months.

If the first weaning round is left until later in the year when cows may already be in poor condition, it will save only about 5kg liveweight per month. This may keep the animal alive, but will do little to improve conception rates.

» A dry paddock with little grass will not be able to support a cow lactating with a calf of this size, she will lose condition and will struggle to conceive

Supplements

Non-protein nitrogen supplements (urea based) such as licks or blocks during the dry season can help maintain cow body condition but rarely increase weight and lactating cows may still lose weight. Energy supplements such as fortified molasses can overcome weight loss, but it is cheaper to supplement the weaner on its own than the cow and calf.

See Appendix 1 – feeds and feeding (page 54) for more information about weaner supplementation.

Urea-based supplements help maintain the body condition of adults and larger weaners but rarely increase weight without extra true 3protein, which is expensive

CASE STUDY

‘Pardoo Station’ manager Jeff McInnerney with weaner heifers

Eye on the market drives Pardoo’s productivity

The WA-based beef business ‘Pardoo Station’ is on track for significant productivity benefits through enhancements to its strategic breeding practices and astute market optimisation initiatives.

At a glance

Combined strategic breeding, early weight-based weaning and targeted feeding in feedlot-type systems improve growth rates, reduce mortality and meet high-value market demands. At Pardoo Station, the program is optimised by implementing:

- controlled 80-day joining and planned artificial insemination (AI) program to align calving and weaning
- yard weaning for 8–10 days with low-stress handling using dogs and horses
- segregated feeding post-weaning – high-nutrition grains for larger calves and pellets/hay for smaller weaners
- use of technology (Optiweigh) to monitor weight gain and fine-tune rations
- strong market alignment, including live export, European Union (EU) certification and integration with long-fed Wagyu supply chains.

Pardoo Station, managed by Jeff McInnerney, is located 200km north of Port Hedland and 450km south of Broome – it spans more than 200,000ha along the coastline. It’s part of the Pardoo Wagyu business aggregation – owned by Bruce Cheung – which also includes ‘Fairfield’ and ‘Leopold’ stations.

The station's pastures include Rhodes and panic grass hay which are grown under irrigation pivots. Chicory is also cultivated, and there are plans to add sorghum to the rotation. The property features a mix of sandplains and dunes, with acacia shrublands and spinifex.

Herd composition

Pardoo Station is primarily focused on breeding Wagyu and Wagyu-cross cattle, with a current headcount of 2,400 cattle grazing on the rangelands and another 2,800 head on feed, many of which are awaiting pregnancy tests after artificial insemination (AI).

After recently being awarded freehold status, Pardoo’s owners applied for a 10,000 head feedlot, where their Wagyu and Wagyu-cross cattle will be backgrounded before they are trucked to finishing feedlots.

The breeding plan includes predominantly Droughtmaster and Brahman cattle crossed with Wagyu to produce a northern Wagyu-cross breed. In the feedlot, purebred Wagyu cattle gain an average of 0.8kg per day, while first-cross cattle gain around 1.1kg/day. Liveweight is monitored using the Optiweigh system, and feed is adjusted to determine the most effective ration for weight gain.

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Breeding management

Breeding practices include AI for first-calf heifers – any identified as dry following pregnancy testing are then moved to a northern station and sold.

AI conception rates at Pardoo Station have been as low as 40% and up to 65% – overall conception rates reached 78% after covering bulls were introduced after AI. First calf heifers receive supplementation, and cows are managed to maintain a BCS of 3 to 3.5 for breeding and AI programs.

Vaccination practices include a 5-in-1 vaccine for steers, a 7-in-1 for heifers, and a botulism vaccine for all cattle. Bovi-Shield® is also part of the vaccination regimen for all purebred weaners. Tri-Solfen® is used for pain relief during procedures such as branding, dehorning and castrating. See Table 1.

Table 1: Pardoo Station's vaccination schedule

Vaccination	Class	Frequency
Longrange® Botulinum Vaccine	All cattle	Yearly
Bovi-Shield® Mh-One	All purebred weaners	At weaning
Ultravac® 7in1	All females	Yearly
Ultravac® 5in1	Steers	Yearly
Vibrovax®	Joiner heifers	Pre-joining

Weaner management

There are two rounds of mustering at Pardoo Station, one in June/July and the second in September. The station employs a controlled mating cycle with an 80-day joining period from April to June, aiming for calving in January and weaning in August.

Weaning management involves an 8–10-day yard education period which uses dogs and horses in yard and paddock education. Calves are then moved with horses to further acclimate them. Calves are weaned between 110–200kg, averaging around 135kg.

They are segregated by weight, with smaller weaners under 150kg and larger ones above 150kg.

Larger weaners are fed a mix of silage and imported grains, consisting of barley, lupins and maize. Milne weaner pellets and hay grown onsite are fed to the smaller weaners to boost nutrition. The target calf mortality rate is less than 10%.

Post-weaning, weaners stay in feedlot-type yards. The aim is to ship males at weights of 320–340kg in July and September, while F1 females are joined at 280kg in February. Dry F1 females remain on feed until reaching the target heifer weight of 300–340kg for live export. Pregnant heifers are sent to a co-operative station further north in the Kimberley after AI testing, and purebreds, if not pregnant, go south into a long-fed program.

The station targets both domestic and export markets such as the Indonesian market. Pardoo Station is European Union (EU) market certified, though they must truck cattle from WA to the east coast for long feeding as there are currently no EU-certified feedlots in WA.

Weaner steers in the yards at 'Pardoo Station'

» Rhodes grass, ready to bale

» Spinifex pasture where the cattle can graze in the rangeland

Under Jeff's management, Pardoo Station is poised for a bright future in the cattle industry with strategic breeding practices and market optimisation efforts.

Team and technology

Labour at Pardoo Station includes a crew of around 20 staff, divided into feedlot, cattle crew, pivot management and fencing contractors.

The station operates irrigation pivots, though some have yet to be restored after a cyclone in 2023.

Technology is readily used at Pardoo – in addition to the Optiweigh system for feed optimisation trials, DIT AgTech water supplementation is used on some bores.

Outlook

Future opportunities at Pardoo include continued optimisation of feed rations to enhance weight gain and expansion of market opportunities, especially focusing on the Indonesian market and new EU certifications.

Currently, the business purchases up to 400t of grain/year at a cost of around $2.9 million, which is expected to decrease to around $1 million under their new feed program.

The enterprise has an end goal of developing its feed program to include growing barley and white sorghum for silage, reducing the requirement to purchase outside grain to zero, at which time they will have internal growing costs only.

Under Jeff's management, Pardoo Station is poised for a bright future in the cattle industry with strategic breeding practices and market optimisation efforts.

Jeff offers some words of wisdom for other producers.

"Trust your experiences. I've been out of the farming game for a while, but I used to do it quite a bit and I don't hesitate to ask the experts when I don't know." ■

» Silage being loaded to feed out to weaners

The calf's stomach

The calf is not born as a ruminant; its ruminant digestive system develops as it ages.

When born, the calf has a small and non-functional rumen and so cannot digest grass. Suckled milk by-passes the rumen and proceeds directly into the abomasum for more efficient digestion through an 'oesophageal groove'.

Once the rumen develops, a ruminant has three 'pre-digestion chambers' – the reticulum, the rumen and the omasum – before the abomasum or true stomach (**Figure 2.1**). The calf can then digest grass and begins to rely on rumen microorganisms for protein.

Thus, the stage of rumen development will govern the type and quantity of feed that the calf needs.

Until the calf is weaned, milk, even in small quantities, supplies the best of the calf's diet. All calves which are removed from their mothers under six-weeks-of-age must have milk or milk replacer.

If the quantity or quality of its feed is not good enough, any nutritional deficiencies may have to be rectified with supplements.

The oesophageal groove

The oesophageal groove allows milk to pass directly from the oesophagus to the abomasum or true stomach for the most efficient digestion (**Figure 2.1**).

This groove acts like a tube formed by two lips that are raised when the calf suckles. If the oesophageal groove does not close, as can happen when the calf drinks milk directly from a bucket, the milk may leak into the rumen where it ferments. This wastes the nutrients and can cause the calf to scour.

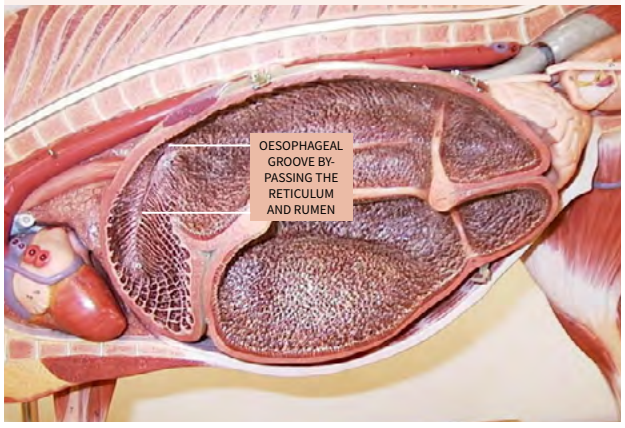
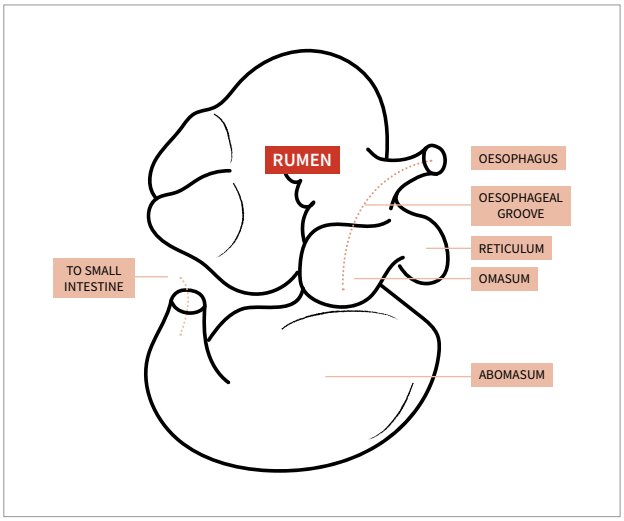
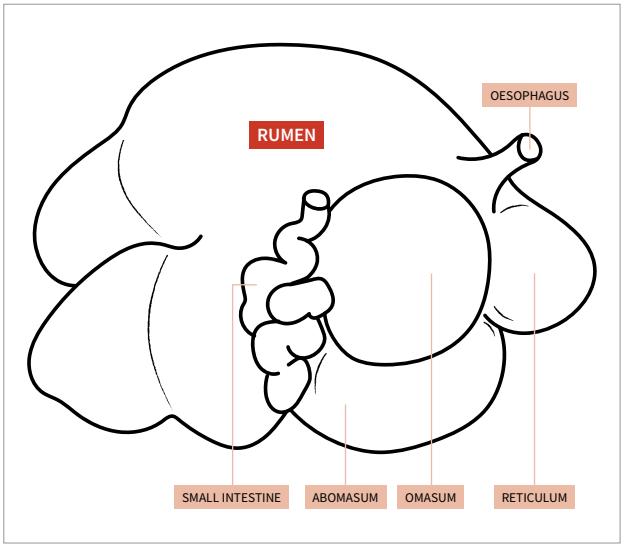


Figure 2.1: The rumen of the young calf develops as it begins to eat fibrous feed



Newborn calf rumen



10-week-old calf rumen

The rumen

The rumen and reticulum start to develop within a few weeks when the calf eats fibrous feed, with the rumen microorganisms ('bugs') being transferred from adult cattle with which it is grazing. Under normal paddock conditions, the rumen will be fully functioning by the time the calf is three-months-old.

Once the calf is weaned, its rumen will expand quickly, but the grazing weaner must then obtain all of its nutrients from a pasture-based diet high in roughage.

Change diet gradually

The mix of the various types of microorganisms in the rumen depends on what the animal is eating. In grazing cattle, the bugs are mainly those types that break down plant fibre; in cattle on grain diets, the bugs are mainly those that digest starch. Changes in diet must be made gradually so the numbers and types of bugs have time to adjust.

A rapid change from a fibre diet to one high in starch, results in the rumen contents becoming too acidic, causing digestive ailments, diarrhoea, severe metabolic disorders and even death. Acidity is buffered by the animal's production of saliva, containing bicarbonate, which is stimulated by fibre in the cud.

Nutrients

The weaner needs energy, protein, minerals and vitamins. Energy and protein are the most important nutrients for growth but must be in balance. Under the rule of limiting factors, there is little benefit in supplying large quantities of energy if there is insufficient protein in the diet for the rumen bugs to use it efficiently.

The requirements for energy, protein, minerals and vitamins can be calculated from the animal's size and its target growth rate using feeding standards.

Water

Water is vital for rumen fermentation and all body functions. Weaners should be provided with clean, good quality water.

» Weaners require good access to fresh drinking water as it is essential for rumen fermentation and health

Energy

Energy is a measure of a substance's ability to produce an action or effect; it is not a tangible compound such as starch or protein. The main sources of energy are carbohydrates (starches and sugars) and fats.

Metabolisable energy is the energy in a feed that is finally available to the animal to use for maintenance, growth, lactation and pregnancy.

The energy value of a feed is expressed as megajoules of metabolisable energy per kilogram dry matter (MJ ME/kg) while the animal's energy requirement is expressed as MJ ME/day. Some overseas standards express energy as calories.

Energy

The energy requirement of beef cattle is expressed as megajoules of metabolisable energy (MJ ME).

1 megajoule (MJ) = 1,000,000 joules

1 calorie (Cal) = 4.184 joules (J)

Protein

Protein for ruminants can come from two sources of nitrogen: true (bypass) protein from forages, grains and protein meals; and non-protein-nitrogen (NPN) from inorganic compounds such as urea. NPN can be used only by rumen microorganisms; calves under six-weeks-of-age do not have functioning rumens and cannot use NPN.

Rumen microflora need nitrogen to utilise starches and other carbohydrates for their own growth and reproduction. Protein that is used in the rumen is referred to as rumen-degraded protein (RDP) while protein that escapes breakdown in the rumen is called bypass protein or undegraded protein (UDP).

Rumen microflora eventually pass through to the stomach (abomasum) where they are digested by the animal into amino acids that are absorbed into its body. Microbial protein is the major source of protein for the ruminant animal.

Calves generally cannot get enough protein from microbial protein/rumen-degraded protein (RDP) to gain weight, and so need some undegraded protein (UDP). Normally this UDP comes from milk, but some can also come from good quality green pasture.

When calves are weaned, they can meet their UDP requirement for growth if on good quality green feed, but protein meals must be included in the ration if the pasture cannot provide sufficient UDP.

The protein value of a feed is expressed as crude protein percentage (CP%) – which may include NPN. Protein from NPN sources such as urea is expressed as equivalent protein percent (EqP%). An animal's protein requirement is expressed in grams per day (g/day).

> ⚠ **Energy and protein intake**
>
> Tables in the Appendices (pages 54–55) show the daily intake of protein and energy required for a range of growth rates on a range of feed qualities.

Minerals and vitamins

Both the weaner and its rumen microflora need minerals. The most important minerals are phosphorus for synthesising protein and bone development, sulphur as part of some protein molecules and calcium for bone growth.

Ruminants normally get their vitamins from their diet and rumen microflora. Fat-soluble vitamins, such as Vitamin A from green feed, can be stored in the body's fat and liver, but water-soluble vitamins, such as Vitamin B, are synthesised in the rumen, and cannot be stored.

Can the small weaner eat enough?

The quality and palatability of the feed will determine how much the weaner will eat – its voluntary feed intake. On low quality hay or pasture, it may not eat enough to meet the target growth rate.

» A small 100kg weaner can only eat 1.5kg of poor quality hay or grass each day. It is not enough to promote growth

Feed intake

Feed intake is expressed as the weight of feed dry matter eaten as a percentage of the animal's liveweight. Dry matter is used to take account of the varying water content of feeds.

Voluntary feed intake ranges from as low as 1% of liveweight for animals on mature dry pasture and up to 3% on a feedlot ration; it is governed by the rate that the feed is digested in the rumen.

The animal can eat more only when some of the food already in its digestive system has passed through; intake is directly proportional to the digestibility of the feed.

Therefore, a 100kg weaner in the yard will usually eat considerably less than 3kg of dry feed per day. To gain 0.5kg per day, all the feed offered must be of high quality and palatable.

The situation is similar for a small weaner grazing mature grass in the paddock. It will need a supplement to gain weight.

Pasture and grazing management for weaners

Calves are generally weaned at the start of the dry season when the grasses have seeded and pasture quality (protein and digestibility) is dropping quickly.

Pasture growth and quality on any property will depend on the soil's basic fertility and the amount and distribution of rainfall. In lower rainfall regions with a pronounced dry season, grasses tend to 'hay off', so their quality declines more slowly than in regions which experience winter rain or dews. However, by late in the dry season, the quality of all pastures at or below maintenance level, will not meet the requirements of a lactating cow.

No year is average, too much rain during the growing season may increase quantity but reduce quality – too little may do the reverse, while no rain means no growth at all. Winter rain may produce good quality herbage or spoil hayed-off pastures. This variability of seasonal rainfall, and the timing of any frost, must be taken into account when trying to match pasture supply and quality with animal demand.

As weaners need good nutrition, they should be put into paddocks with the best quality pasture. Spelling the weaner paddocks over the wet season helps improve pasture condition, ensures there is fresh feed for the weaners and reduces the potential problem of both internal and external parasites and diseases such as coccidiosis.

Weaner paddocks should not be used as dumping or holding paddocks for sale cattle, bulls or working horses.

In continuously mated herds, feed will also be needed for the second-round weaners. Weaning paddocks should not be overgrazed on the first round, and fresh paddocks should be reserved.

The digestibility of pasture varies greatly. Lush young pasture (Phase 1) may be as high as 70% digestibility, whereas old mature pasture (Phase 4) may be as low as <52%. Calves are generally weaned around April when pastures are in Phase 3 with declining nutritional value or in May–June (Phase 4) when the feed has already declined (**Figure 3.1** and **Table 3.1**).

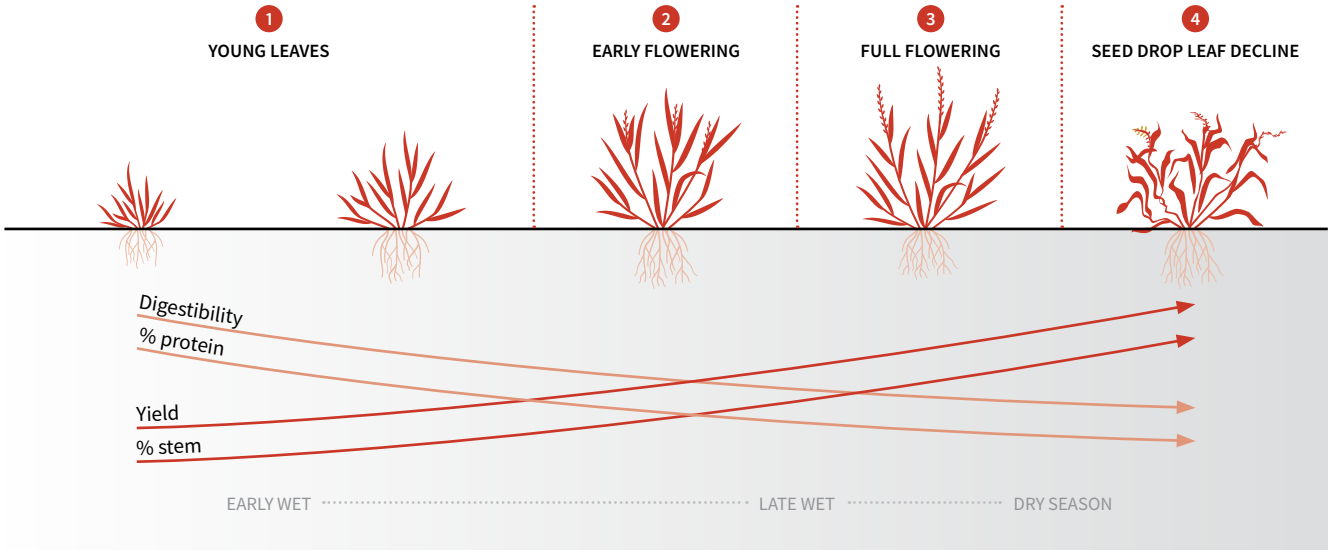
Weaners under 150kg generally need a supplement to gain weight unless the pasture is of high quality.

Table 3.1: The effect of body condition at the end of the dry season on subsequent pregnancy rates of lactating cows

Growth phase	Pasture quality	Dry matter digestibility* (%)	Energy (MJ ME/ kg DM)	Crude Protein (%)
1 Early, rapid growth	Very good	65–70	>9–11	10–18
2 Beginning to grow stem, mostly green leaf	Good	56–65	>8–9	8–10
3 Flowering and seed set, growth slows, 10–30% green leaf	Marginal	52–55	7–8	6–8
4 Seed matures and falls, no growth, no green leaf	Poor	<52	≤7	3–6

*Digestibility is based on the dry matter of the feed

Figure 3.1: Pasture growth phases



Buffel grass growth phases example

Buffel grass and native perennial grasses all go through four phases of growth. Annual grasses such as bottlewashers die at the end of Phase 3 instead of becoming dormant. In very dry years there may not be enough moisture for plants to go to seed and plants may hay off part way through Phase 3. (DEEDI, 2011)

Growth phase 1 (green pick)

Phase 1 is the crucial time to spell to promote root growth and the period when high grazing pressure can cause the greatest damage to mature tussocks and seedlings.

Phase 1 is characterised by:

- short leafy growth at start of wet season
- moderate growth rate
- high quality forage, low yield
- grazing-sensitive.

Growth phase 2 (mid-growth)

Phase 2 is crucial for spelling to promote root growth and when heavy grazing can damage mature tussocks and seedlings.

Phase 2 is characterised by:

- well developed leafy tussock phase
- high growth rate
- good quality forage, increasing yield
- moderate grazing sensitivity.

Growth phase 3 (seeding)

Phase 3 is when spelled paddocks can be grazed after seeding begins and when high grazing pressure causes less damage to mature tussocks and seedlings.

Phase 3 is characterised by:

- seedhead and stem phase
- low growth rate
- moderate forage quality, maximum yield
- low–moderate grazing sensitivity.

Growth phase 4 (hayed off)

Phase 4 is when spelled paddocks can be grazed safely, and high grazing pressure causes no damage if at least 15–20cm of residual stubble is left for the next wet season.

Phase 4 is characterised by:

- dormant phase
- little/no growth
- declining forage quality, maximum yield
- low grazing sensitivity.

Improved pastures for weaners

Fully-sown improved pastures make excellent weaning paddocks, while oversowing a legume into the native pasture can improve pasture quality and quantity, and reduce the need to feed supplements.

» Oversowing a legume such as stylo will greatly improve the feed value of a native pasture

Forage selection by animals

Pasture quality is highest early in the growing season but declines (Figure 3.1) rapidly once the grasses seed. Although overall levels of protein and energy in maturing pastures may appear low, weaners may be able to select enough green leaf within the dry mass if the stocking rate is suitably low. If there is more than 30% green leaf in the whole pasture, the animal can select a diet of almost 100% green leaf as long as the stocking rate is low at 20–25% utilisation.

Assessing pasture quality

Pasture quality is a vague term. To determine it, look at the ratio of leaf to stem, amount of green leaf, absence of fungal attack on hayed-off leaf, and presence of legumes or palatable 'herbage' growing with winter rainfall.

Leaves of grasses and palatable legumes can be plucked by hand from the dry mass of pastures, and analysed for protein and digestibility by a laboratory. These pasture samples however do not accurately represent what the animals are eating, and the value of this method of assessing the animals' diet is low in relation to the time and cost of sampling.

Assessing diet quality

The most reliable way to check the quality of the diet and fine-tune supplementation is to use Faecal Near Infrared Reflectance Spectroscopy (NIRS) testing.

This involves collecting samples of fresh cattle dung and having them analysed using NIRS. NIRS provides an indirect measure of the protein content and digestibility in the diet. Digestibility can be used to determine the diet's energy content.

Regular NIRS testing can be used to determine when animals should be given supplements of protein only or protein plus energy. Interpretation of the analyses is best discussed with a local adviser.

Forage crops for weaners

Forage crops are a valuable option for weaners where they can be grown. The most useful forage crops over winter after an autumn weaning are oats and some temperate legumes, but this will depend on the region's soil types and seasonal climate patterns (of rainfall, temperature and frost). Suitable legumes may include lucerne, butterfly pea and lablab. Stands of leucaena provide excellent forage for weaners until frosted. Stand-over high-sugar forage sorghums can be useful in autumn but may be too tall and coarse for small weaners.

» Leucaena is excellent quality forage for growing weaners but gets frosted in winter and often comes away before the grass in spring

CASE STUDY

Weaners in the yards at Boomarra Station

Weaning in the Gulf starts with managing the mother

'Boomarra Station' is located 120km north of Cloncurry in the Southern Gulf region of Queensland. The property is 108,000 hectares and has been owned by the North Australian Pastoral Company (NAPCo) since 1989. The average annual rainfall for Boomarra Station is 610mm and is summer-dominant. Fred and Carmel Shephard have managed the property since the late 1980s.

At a glance

At Boomarra Station, the focus is on managing on managing breeder body condition through timely weaning, strategic supplementation and constant pasture monitoring to deliver consistent, high-performing weaners.

- All calves are weaned at approximately seven months to give cows five months to regain BCS.
- A 'first chance paddock' is used for culling low performers.
- Wet and dry season supplementation is tailored to land type.
- Underweight weaners are given high-energy supplements to ensure growth.

The cattle

The breeder herd on Boomarra Station ranges from 6,000–7,000 head depending on seasonal conditions. NAPCo runs a Kynuna composite herd that has been developed for breeder performance and market suitability of the finished cattle.

The Kynuna composite is:

- ¼ Angus
- ¼ Tuli
- ⅜ Shorthorn
- ⅛ Brahman.

On Boomarra Station, there is also a holdover of young bulls on property for the stud operation.

The markets

Boomarra's breeding operation involves weaners being retained to a minimum of 150kg before being transported to the channel country for backgrounding. The cattle are finished at NAPCo's Wainui Feedlot at Bowenville before they are sold to three major markets:

- Woolworths direct contracts
- JBS 100-day fed market
- Five Founders, NAPCo's branded product.

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Weaners are tailed out every morning and re-penned every evening

The country

Boomarra Station is comprised of four main land types:

- bluegrass/browntop plains
- red pebbly ridges
- frontage country
- rocky spinifex hills.

Soil types include grey and brown cracking clays with sandy ridges that run into red and yellow earths on the escarpments. The pastures on the heavier soils comprise Mitchell grasses, silky browntop, various bluegrass species and Flinders grass, with many forbs species present after the wet season. The lighter soils grow Buffel grass, spinifex and bottle washer grass.

Good cows, good weaners

When deciding on a target class of animal for turn-off it is important to consider the production potential of the country, according to manager Fred Shephard.

"Designing your operation to the environment will allow your business to be the most profitable it can be," Fred said.

Boomarra Station's capacity as a breeder operation producing steers and surplus heifers to the grower properties, in addition to its production of bulls for other breeder operations further west, maximises its contribution as a cornerstone to the NAPCo production system.

A key management focus point at Boomarra Station is the BCS of the breeding herd.

"The aim is to have all calves removed from their mothers at approximately seven-months-of-age, which is not an easy feat on these extensive properties. This allows the cows five months to recover and achieve the optimal BCS before calving again.

"This creates a flow-on effect into our calving period, where our breeding herd regularly achieves 70% of calves at foot in the first eight weeks of the calving period," Fred said.

These early calves are easier to wean and manage in the production system at Boomarra Station and are set up to move through the NAPCo growing and finishing system.

The Boomarra Station joining period begins in mid-December and runs until May/June/July depending on seasonal conditions, as bulls are removed during weaning. Approximately 5% of the total females mated form a 'tail' of late calving cows which are segregated into their own paddock. This paddock consists of bluegrass species as well as Flinders grass. Dry pregnant cows go into the 'first chance paddock', which realistically is the 'last chance paddock'. In this paddock, breeders need to be pregnant and have a weaner at pregnancy diagnosis or they are culled.

"Designing your operation to the environment will allow your business to be the most profitable it can be."

Good maintenance of breeder BCS has meant a high proportion of early calves, creating an even line of weaners for backgrounding

Spacious yards on Boomarra Station with high quality hay provided during education

The Boomarra Station supplement regimen is designed to address the nutritional deficiencies the cattle face. During the wet season a mono-dicalcium phosphate (MDCP) and salt mix is fed. Fred has identified some challenges.

"Intakes of wet season phosphorus supplement have always been variable here at Boomarra Station, despite manipulating the ingredients," Fred said.

To contend with this issue, Fred offers breeders MDCP in his 25% urea dry lick as well, so that phosphorus repletion is possible throughout the year.

Dry season feeding starts around June, with intakes starting low and ramping up to 200g/head/day. In September and October, when only low-quality feed remains, supplement intakes will increase. In particularly dry years, dry season supplement will commence in May. Replacement heifers are supplemented until selection to enter the breeder herd with a 12% urea lick that contains 15% protein meal to help maintain intakes and growth. Fred is confident that in most years this supports those young females to maintain a consistent rate of weight gain to a target mating weight of between 260–300kg; a weight at which most of the composites are cycling.

Weaner management

Key tips for weaner management focus on managing the breeder herd. All decisions, from the time females are born up until when they are culled, focus on keeping them in the best possible condition so they can deliver a productive calf each year. Constant observation of the pasture is also paramount. A forage budget is performed each year to determine how much feed is available so that stocking rates can be adjusted accordingly.

"It is important to consistently monitor the pasture and the cattle to not let them begin to slip, as it is difficult to reverse. Leaving as much residual pasture as possible in the dry season means that when the season breaks, our paddocks respond rapidly to the rain to increase the breeder BCS." Fred said.

With constant observation of the pasture and the cattle, timing of key management decisions like weaning, supplementing and reducing of stock numbers become much more accurate.

"It is important to consistently monitor the pasture and the cattle to not let them begin to slip, as it is difficult to reverse."

Feeding weaners

Weaners are separated into two groups:

- Underweights (<150kg at weaning) receive a highly digestible and palatable weaner supplement. The lick comprises 60% protein meal and 30% grain. Target intakes of the 25% crude protein and 11 MJ ME/kg mix are approximately 1kg/head/day. This ensures these smaller weaners maintain a weight gain of 0.5kg/head/day, enabling them to be offloaded to the backgrounding properties within an appropriate time frame.
- Good weights (>150kg at weaning) receive a lick with 47% crude protein equivalent (8% urea, 45% protein meal and 15% grain) and 7 MJ ME/kg. Intakes are approximately 150g/head/day.

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"Animals have the pain relief at branding and are seen to be eating straight away, walking freely around the holding paddocks and have a more positive demeanour."

This process helps weaners recover more quickly from branding and ensures they are in good order for transfer to growing properties. While in the yards, weaners have access to high quality hay and clean water.

Most of the branding on Boomarra Station occurs at weaning (~five-months-of-age), apart from the 5% tail which is branded at the main muster and weaned later at a younger age and fed. Fred has noticed a significant improvement in weaner recovery after husbandry procedures with the use of meloxicam.

"Animals have the pain relief at branding and are seen to be eating straight away, walking freely around the holding paddocks and have a more positive demeanour," Fred said.

No shortcuts in education

Another focus point is the education of weaners. A systematic routine is used each year with no shortcuts. This allows Fred and Carmel to work all classes of cattle safely and efficiently. Calves are educated for 4–5 days in separate male and female groups. Fred has found that separating the sexes enables more efficient handling and education. This is because the males are sexually active and 'pester' the heifers. Separating the sexes during education reduces the risk of heifers getting in-calf to males in the paddock. Both mobs of cattle are worked through the yards each day, with one mob being worked in the yards while the other is in a holding paddock. All animals are penned overnight with access to high quality hay and water and walked back out to paddocks in the morning. Jiggers are not used on the property to ensure a calm environment is associated with yard work.

After education, weaners are put into the designated weaner paddocks which are spelled over the wet season every year. These paddocks are on some of the better country, giving the best opportunity for the weaners to grow well before they leave the property.

Since taking on the management of Boomarra Station in the late 1980s, Fred and Carmel have been supported by NAPCo to develop a plan for breeding cattle that is the best fit for the company's production systems, while at the same time, contending with the challenges of extensive Gulf grazing conditions. By focusing on finding what works and making it routine practice, they have achieved success in producing high quality weaners for the NAPCo brand. ■

Spacious yards on Boomarra Station with high quality hay provided during education

Feeding weaners

Whether fed in a paddock or yard, weaners may require additional supplements, depending on age, weight, feed quality and target growth weights.

Growth targets of weaners will be influenced by animal class, the market target, cost of supplements and the intake of supplement required to reach the target weight. Replacement heifer weaners should be fed so as to reach targeted mating weights of 340kg at two-years-of-age.

Most calves will lose some weight from stressors immediately after weaning, but soon recover with good nutrition. Feeding after this will determine performance.

Weaners' ability to achieve the desired weight will depend on the quality of the feed and supplement.

Weaners in the yards should be fed good quality hay with a high proportion of leaf to stem that is green and sweet smelling. Hay will depend on local availability and cost.

Care should be taken when purchasing hay from areas with widespread declared weeds. Weedy hay will be less nutritious – and a biosecurity risk.

> **⚠ Fodder and supplements**
>
> The best types and amounts of fodder and supplements to feed will depend on:
>
> - local availability and cost
> - economic benefit for the target market
> - animal welfare considerations.

In the paddock, give weaners access to pasture on the best country, in paddocks that have been rested over the wet season. Forage crops such as oats and sorghum can be introduced, or native pastures can be supplemented with a concentrate feed or protein supplement.

General recommendations for feeding weaners include:

- Ensure weaners have access to palatable hay so they can begin eating as soon as they come into the yards.
- Make any changes in the amount and type of feed gradually to prevent digestive upsets.
- As calves grow, they should be moved into the appropriate weight group to allow a change to the appropriate ration.
- Keep accurate records of supplements fed to determine if intakes are adequate and cost-effective.
- Good weaner paddocks should have abundant (>70%) perennial, productive and palatable (3P) pasture species, preferably with some legume. In regions with some winter rainfall, herbage provides good quality feed.
- Dry season pasture quality is frequently too poor for weaners to even maintain weight without extra protein and energy.
- Urea licks or blocks should not be allowed to run out. Weaners may gorge on the licks when replenished and could get urea poisoning.
- Weaners losing excessive weight should be segregated, have their health checked and given better quality feed.

> **⚠ Weaner weight**
>
> - Weaners under 150kg should be fed to gain weight. On poor pasture they will not get sufficient protein or energy from urea blocks or licks. They should be fed a high-energy and high-protein supplement.
> - Weaners above 150kg should at least maintain weight, and may need protein supplements to gain weight. On poor pastures, they may require a high energy and protein supplement.
> - Weaners under 200kg should not be losing more than 10–15% of their weight, or they will increase days to finish.

Figure 3.1: Weaners fed hay may lose some weight initially as their digestion adjusts but will soon recover

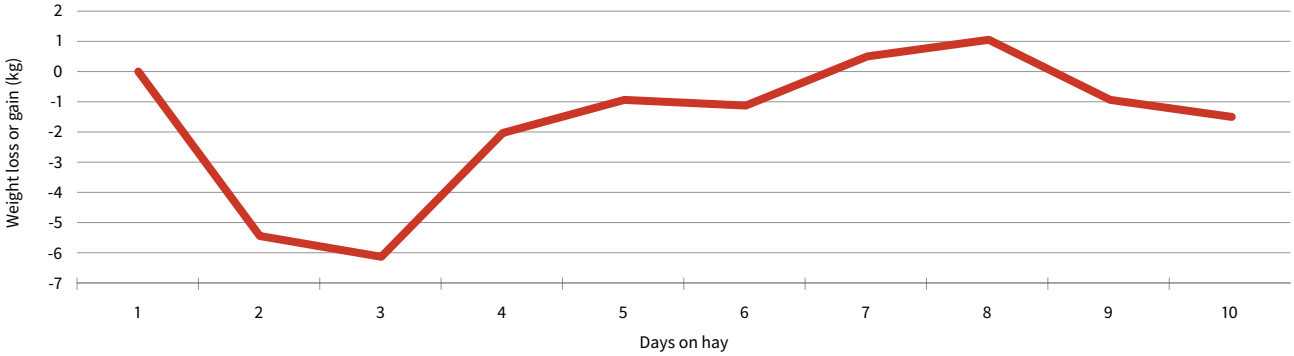
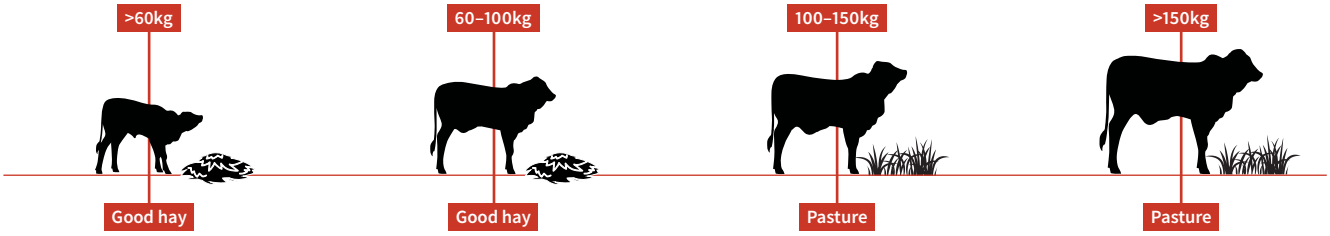


Table 4.1: Weaner supplements and intakes for various growth targets on pastures of different quality*



Weaner weight (kg)	Growth target[1] (kg/hd/day)	Pasture quality	Supplement types	Recommended daily intake
Under 60	0.4	Good hay	Milk replacer	4L twice a day
			High quality calf meals[2]	1–1.5kg/hd/day
60–100	0.25	Good hay or good to marginal pasture	Calf meals or pellets[2]	1–1.5kg/hd/day
100–150	0.2	Poor pasture	Urea loose lick	20–25g/urea/day
			Weaner meals or pellets[2], grain mixes	1–1.5kg/hd/day
		DMD <50%	Protein meals	0.5kg/hd/day
		CP <6%	MP, MUP[3,4]	1–1.5kg/hd/day
		Marginal pasture	Urea loose licks	20–25g/urea/day
		DMD 50–55%	Protein meals	0.5kg/hd/day
		CP 6–7%	Fortified molasses – MP, MUP[3,4]	1–1.5kg/hd/day
		Good pasture	None	
		DMD 55–60%		
		CP 7–8%		
150–200	0.1–0.2	Poor pasture	Urea loose licks	25–30g/urea/day
			Weaner meals or pellets, grain mixes	1.5kg/hd/day
			Protein meals	0.5kg/hd/day
			Fortified molasses – MP, MUP, M8U[3,4]	1.5–2.0kg/hd/day
	0.2	Marginal pasture	Protein supplements (dry licks, blocks and liquid supplements)[5]	Sufficient to provide 75g protein/head/day
		Good pasture	None	
	0.1	Good pasture	Urea loose licks	25–30g/urea/day
			Protein supplements (dry licks, blocks and liquid supplements)[5]	Sufficient to provide 75g protein/head/day
>200	0.2	Poor pasture	Fortified molasses – MUP, M8U[3]	1.5–2.0kg/hd/day
		Marginal pasture	Protein supplements (dry licks, blocks and liquid supplements)[5]	Sufficient to provide 75g protein/head/day
		Good Pasture	None	

*See Appendices 1 (page 54) and 2 (page 57) for more details about rations and alternative feedstuffs.

[1] On poor quality pastures, weaners may not achieve target growth rates at recommended supplement intake. [2] Proprietary mixes should be fed according to manufacturers' recommendations. [3] MP=Molasses + protein meal; MUP=Molasses + urea + protein meal; M8U=Molasses + 8% urea. [4] 100–150kg weaners may not consume the recommended level of fortified molasses. [5] Weaners may not consume sufficient supplement to supply 75g protein/head/day. Protein meal is often added to improve palatability of licks and blocks. Inclusion of a coccidiostat e.g. monensin is recommended for proprietary and homemade weaner meals or pellets, grain mixes and fortified molasses mixes.

Compensatory growth

Compensatory growth can reduce the benefit and cost efficiency of dry season supplementation.

Not all animals show compensatory growth to the same degree once the nutritional restriction is removed. The amount of compensatory gain depends on the duration of the dry season, the quality and duration of wet season feed and the age of the weaner. Very young weaners will never compensate fully if they lose weight for extended periods of time. If early turn-off is required, animals may not have time to achieve target weights, and short growing seasons may prevent animals achieving the growth required.

Heavier weaners (250kg) that received no supplements showed compensatory growth and caught up with supplemented animals after 15 months (**Figure 3.2**), whereas light weaners (under 150kg) that were not supplemented, never caught up with their supplemented peers, and would have reached target weights later.

Compensatory growth

Compensatory growth is the greater-than-expected weight gain that can occur when animals are on good feed following a period of slow growth or weight loss due to poor nutrition.

The amount of compensatory growth depends on how long and how severe the weight loss was, at what age or stage of maturity the weight loss occurred, and the quality of feed after this.

Rearing neonatal calves

A motherless calf may be humanely euthanised or taken home to be hand-reared. Orphan calves often show signs of dehydration, depression, lack of appetite or scouring. If the calf is to survive, proper care during the first 24 hours is critical.

Dehydrated calves

The calf should be rehydrated before getting any milk. Feeding a dehydrated calf with milk often results in scours and possibly death. Electrolyte mixtures are commercially available or can be mixed at home from one teaspoon table salt, 1/2 teaspoon baking soda and 125mL glucose in 1.2L of water. Electrolytes should be fed for at least 24 hours before milk is given.

Colostrum

Colostrum provides passive immunity to disease and helps build up vitamin and mineral levels. The new-born calf should get colostrum within the first 24 hours of birth – either from a mother or artificial sources. A supply of frozen colostrum can be kept in the freezer. Some milk replacers may contain colostrum. Once the calf has received colostrum, it can be fed solely on whole milk or milk replacers.

Milk replacers

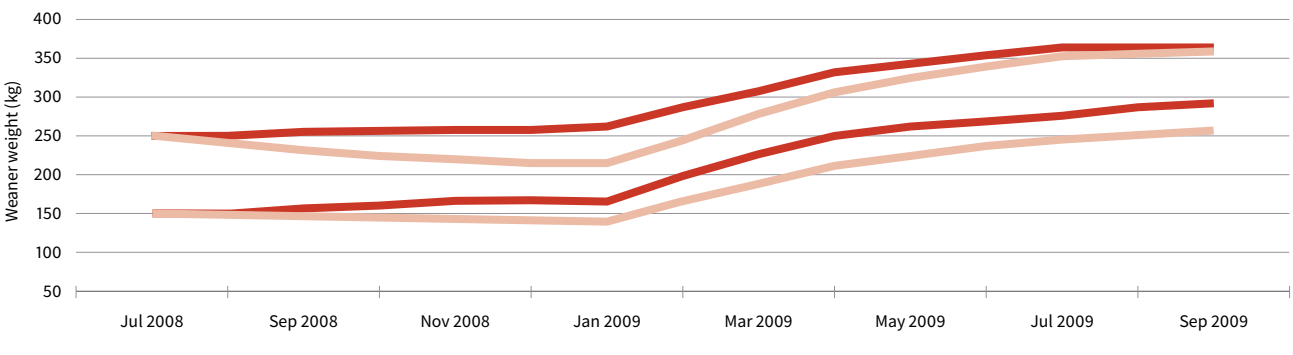
Milk replacers should contain at least 20% true protein and 10% fat and no more than 10% starch and sugars (sucrose).

Milk replacers should be reconstituted and fed as directed by the manufacturers. Milk replacers should generally be formulated at a ratio of 1kg of powder to 10L of water and fed at a daily rate of 10% of calf body weight over two to three feeds.

⚠ Animal welfare

Animal welfare considerations are becoming increasingly important. It is illegal in all states of Australia to deliberately malnourish livestock.

Figure 3.2: Weight gains of supplemented and unsupplemented light (150kg) and heavy (250kg) weaners over 15 months*



*Final differences between light and heavy weaners reflect their age. Source: MLA, 2025

Teat or bucket feeding?

Calves may be fed from a bucket or on teat feeders – both have advantages and disadvantages.

Initially, it may be easier to get calves to feed from a teat. Teat feeding helps to close the oesophageal groove for the milk to flow directly to the true stomach (abomasum) for better digestion (see page 13), it may also stimulate saliva production and maintain fluid intake in scouring calves. Teats have to be kept clean and replaced when they deteriorate.

To train a calf to drink from a bucket, back it into a corner, stand astride its neck and place two fingers moistened with milk into its mouth. Then move the hand into the milk.

Scours

Scouring can quickly lead to death. A scouring calf should be fed electrolyte solutions in addition to milk in separate feeding events. If scours continue, treatment with commercial medication may be warranted in consultation with a vet (see page 38).

Scour medication should be kept on hand as early treatment can mean the difference between cure and the loss of the calf. Isolate sick calves.

Water

Calves will begin to drink water between one and two-weeks-of-age and by six weeks, may drink 4–5L a day. Feeding milk once or twice a day does not supply enough water and fresh, cool water should be available at all times. Calves eating meal may foul the water trough, necessitating regular cleaning.

Feeding routine

- When rearing a large number of calves, it is best to draft them according to their size.
- Do not over-feed calves, especially during their first three weeks of life. As a guide, milk intake per day should be calculated at 10% of the calf's body weight; thus a 30kg calf should be fed 3L of whole milk per day.
- Start newborn and weak calves on 250mL of milk, five times a day for the first 24–48 hours and work up to 2L twice a day.
- The best milk temperature is between 35° and 38°C, but it may be fed as cold as 6°C. A consistent milk temperature is required for best results.
- Solid feed such as good-quality hay and concentrates can be introduced from one to two-weeks-of-age.
- Once-a-day feeding may begin at three-weeks-of-age if the calf is healthy and eating well. The full ration of milk should be given in the morning with plenty of cool, fresh water provided for the rest of the day. A proprietary baby calf feed should be made available.
- A 50kg calf fed milk should be consuming 1kg of baby calf feed.

Solid feed

- The calf should have access to hay and concentrates from one week to stimulate rumen activity.
- Milk or milk replacer should be fed until at least five-weeks-of-age or 70kgs body weight.
- The calf can be fed high-quality baby calf meals or pellets from two-weeks-of-age.
- By three-weeks-of-age, a calf should be able to digest small amounts of grain/meals.
- Depending on the quality of the pasture, supplementary hay and concentrates may be needed until the calf is at least 120kg liveweight.
- Calf concentrates should be palatable, coarse-textured, a minimum energy value of 12MJ ME/kg and contain protein greater than 18%.
- Producers wishing to formulate their own mix should seek advice from a nutritionist.
- Adding products containing monensin will assist rumen activity and help prevent coccidiosis. Monensin can be toxic and so should be fed according to the manufacturers' recommendations. It is not recommended for inclusion in urea-based supplements as it is difficult to evenly mix the small quantities required.
- Monensin is toxic to horses and other monogastric animals, including dogs.
- Calves need both rumen-degradable and bypass protein from a natural source such as protein meals.
- Non-protein-nitrogen sources such as urea are not suitable for young calves.
- Good grassy lucerne is best for young calves.
- If pasture is scarce or of poor quality, provide appropriate supplements.

Weaning off milk

- If the calf has been offered solids from one-week-of-age, it might be weaned off milk after five-weeks-of-age.
- Weaning should be based on concentrate consumption of at least 650g of meal a day – not on age. As some calves will reach the target consumption earlier, it is best to feed concentrates separately with more than one calf.
- Weaning can be abrupt or by reducing milk over a one-week period.
- The weaned calf will require intensive management. Poor management and poor nutrition at this early age will compromise the health and welfare of the calf.

> ⚠ **Managing calves after weaning off milk**
>
> See page 36 for more information on managing calves after weaning off milk.

CASE STUDY

Weaners in a special purpose paddock at Mt Spencer.

Intensive weaner management driving productivity gains on the Clarke-Connors Ranges

Sam and Sophie Wright, along with Sam's parents David and Raeleen, manage Mt Spencer Pastoral Company near Nebo in Central Queensland.

The country

Mt Spencer, which straddles the Clarke-Connors Ranges, is 32,000 hectares of mountainous eucalypt hills and ranges with loamy alluvial flats adjacent to the many creeks that cross the property. The pastures are dominated by native species such as forest bluegrass, black speargrass and wire grass species. The average annual liveweight gain (ALWG) here reaches 0.35kg/head/day, or 140kg/year, with peak production occurring between the green date in late January and the first frosts in June. With around 2,500 Brahman/Brahman-cross and Droughtmaster females joined annually, Mt Spencer serves as the primary breeding operation of the business.

60km west of Nebo is Dabin, a 10,000ha fattening block offering a diverse landscape: black soil alluvial, pulled brigalow and bauhinia, and patches of box forest. Buffel grass, Queensland bluegrass, desert bluegrass and Indian couch dominate the sward, contributing to a higher than average ALWG compared to Mt Spencer.

Here, cattle gain around 0.5kg/head/day, translating to an average of 180kg/year.

The markets

The Wrights market their steers for feedlots across Central Queensland, aiming for an optimal turn-off weight of 300–350kg. For cull cows, Sam has embraced a strategic approach. While they traditionally went to the local slaughter market, he now utilises their foetal ageing program to unlock new marketing opportunities. By identifying late-pregnant cows, he can market them through agents as pregnancy tested in calf (PTIC) animals, capturing additional value.

Getting the timing right

At Mt Spencer, one of the key factors influencing the success of their mating program is cow body condition at pregnancy testing. Effectively managing the duration calves are left on cows directly impacts this condition.

continued next page

At a glance

The Wrights adopted an intensive, weight-segregated weaning program with targeted nutrition and a strong focus on calf training and welfare, to protect breeder condition and drive herd fertility. The Wright's implement:

- early weaning based on foetal age and cow condition
- segregated feeding by weight group with customised rations
- long education period to reduce stress and improve handling
- measurable gains in PTIC rates and gross margins.

At Mt Spencer, one of the key factors influencing the success of their mating program is cow body condition at pregnancy testing. Effectively managing the duration calves are left on cows directly impacts this condition.

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Mt Spencer cultivates 200ha for hay and silage production

testing. Effectively managing the duration calves are left on cows directly impacts this condition. Therefore, driving breeder efficiency relies on the timing of two key events: calving and weaning.

Maiden heifers, first and second lactation females, and high-performing cows (achieving a calf every year) are grazed in more secure paddocks on Mt Spencer, where bulls are more easily managed. These females are mated between March and June, leading to calving from December to March, before the nutritional quality of the pasture declines.

First and second lactation females are weaned early (March– April) to reduce the rapid body condition loss of raising a calf while growing themselves. Foetal ageing is also used to separate females into weaning groups.

"We draft mature cows into two-month foetal age groups. December to January calves are weaned March to April, while February to March calves are weaned May to June. These are generally our two largest mobs, with 80% of our weaners off by June 30," Sam said.

Mature cows confirmed pregnant outside the desired calving window are moved to continuously mated mobs. These mobs are in larger paddocks on Mt Spencer's outskirts, where security measures against external bulls become more challenging.

Customised care

At Mt Spencer, weaning isn't a one-size-fits-all approach, recognising that calves have individual needs based on their weight. Here's how they ensure each calf thrives:

- Induction process for a healthy start:
  - » Good weaner management begins at branding – and it's not just about efficiency. The Wrights have made significant investments in their processing facilities, prioritising both their own safety and the wellbeing of their calves. Upgraded yards minimise stress and promote smoother handling, while pain relief has become a standard protocol. Every branded calf receives Tri-Solfen, while dehorned and castrated animals benefit from Meloxicam.
  - » At weaning, all weaners receive an oral drench for parasites. For further protection, they receive two 7-in-1 vaccinations alongside a botulism vaccination. This is especially crucial when using stored feed to minimise risks.
- Weight segregation and rations: For the best results, calves are separated into three groups based on weight:
  - » **60–80kg:** This smaller group receives special attention with a highly digestible, high-energy calf pellet available from a self-feeder and a fortified silage ration with Rumensin and a probiotic. They have ad lib access for rapid weight gain, targeting faster integration into the main pens. The target weight gain for this group is 0.6–0.8kg/head/day but due to their lighter weight, some calves may take longer, so feeding can last up to 90 days in this group.
  - » **80–100kg:** When weaners graduate to this weight range, they are segregated to reduce bullying of smaller weaners. Sam maintains the same feeding strategy with this group with a similar weight gain benchmark. Weaners typically stay in this group for around 60 days.
  - » **100kg+:** These larger weaners only receive the silage ration, consuming around 3% as fed of their body weight per day and gaining around 0.5kg/day. Once they reach 130kg, they get pasture access with a weaner lick and, when cost-effective, whole cotton seed.

"Our observations suggest a potential 0.2kg per day weight gain advantage post weaning on better trained weaners."

- Additional support:
  - » **Hay:** Initially, all groups have access to hay for roughage, providing essential fibre and rumen health support.
  - » **Clean water:** Fresh, clean water sources are a priority to keep calves hydrated and thriving.
  - » **Electrolytes:** Electrolytes are provided to combat stress and maintain hydration, especially during hotter months.

Training and education

The Wrights recognise that successful weaning goes beyond providing nutrition. That's why their weaning approach includes educating weaners through exposure to dogs, horses and handling facilities throughout the process, which can last up to 150 days. This ensures weaners become familiar with all the sights, sounds and interactions they'll encounter throughout their lives.

While their current education program is showing promising results, Sam remains focused on further improvement.

"This is certainly an area of focus for us. Our observations suggest a potential 0.2kg per day weight gain advantage post weaning on better trained weaners," Sam said.

This education process not only benefits the animals but also streamlines future interactions within the herd, increasing their overall value and manageability.

The impact: quantifiable success

Mt Spencer's weaning practices have translated into quantifiable results that speak volumes. Before implementing improved practices, herd reproductive performance was below an acceptable level for the Wrights. Mature cow PTIC rates averaged around 55%, maiden heifers were similar, and first lactation females struggled at only 20%. The situation today is dramatically different. Now, the mature cow benchmark sits at 75%, with maidens reaching a remarkable 90% and first lactation females climbing to 60%.

Refined weaning practices haven't just improved animal performance, they've also delivered undeniable benefits to the overall profitability of the operation.

"Feeding weaners to maximise cow BCS is a much more centralised approach. Trying to supplement 2,500 breeding females scattered across Spencer's tough topography simply wasn't efficient. By focusing on feeding weaners, we've avoided the significant costs associated with developing infrastructure for widespread cow supplementation – gravel roads, fences and trough space in vast paddocks," Sam said.

Reduced lactation stress on cows thanks to timely weaning, also leads to lower dry season feed intake. This translates into substantial savings during periods when expensive supplements are needed.

While there have been savings in some areas, there are still significant costs associated with this weaning system. These costs have been comfortably offset by an overall increase in net cattle sales. This includes more weaners produced and an increase in female sales due to a decrease in mortalities.

Table 1: A modelled (Breedcow & Dynama) comparison of gross margins between the weaning systems on Mt Spencer

Gross margin per adult equivalent	
Historical production system	Intensive weaning system
$164	$315

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A weaner pen at Mt Spencer, plenty of room for activity and trough space to reduce bullying

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Some additional insights

Transitioning to intensive weaning was challenging.

"Initially, scours were a major concern for us. Managing a large number of animals at high density with limited feedlot experience was a learning curve. Another initial hurdle was insufficient space at the feed bunk due to incomplete infrastructure. We also encountered difficulties weaning during wet weather which emphasised the importance of measures like putting gravel down, keeping pens clean, and having grass paddocks available to let weaners out," Sam said.

Sam continues to reflect on their weaning journey.

"A lot of the motivation for this work came from improving our herd recording system and building a few production benchmarks for our business. Monitoring rebreed rates year-to-year has led us to an understanding that making it our production focus provides us with a consistent cashflow to assist with budgeting/forecasting purposes," Sam said.

This data-driven approach extends to monitoring breeder BCSs at pregnancy testing. The Wrights have observed a significant improvement over time, eliminating the 'peaks and troughs' of pregnancies and weaning rates that plagued their production system in the past.

But their focus doesn't stop there. Recognising the need for a gradual improvement in fertility, they track every cow's performance. All cows that fail to rear a calf (pregnant at testing, dry at weaning) are sold. This approach aims to gradually improve fertility in an environment where culling all the empties would leave them no cattle.

"We utilise a Sapien herd recording system that allows us to review all female reproductive history crush side. We have a lot more females getting into calf whilst lactating than we did traditionally but realistically we still value females that fall in calf within four to five months of calving," Sam said.

Future opportunities

Going forward, the team are focusing on improving land condition.

"We are currently working with representatives of the Fitzroy Basin Association to improve land condition and manage lantana infestation on Denison Creek to provide a better environment for our koala populations. This work has a double benefit as it is supporting us to improve these areas so they can also be used as special purpose paddocks for our younger cattle," Sam said.

Recently, 45ha of leucaena was sown near the homestead in an attempt to support a larger number of weaners for extended periods. An additional 200ha is planned down the track.

Mt Spencer's weaning system, built on the Wrights' commitment to learning, adaptation, and resourcefulness, offers valuable insights for those grappling with similar challenges. As they continue to refine their practices, their resilient approach is paving the way for a more productive and sustainable future for their herd and the industry at large. ■

Minos silage mixer, hay grab and 90t of storage for grain and protein meal

Weaning strategies

Factors to be considered in planning and implementing weaning strategies include:

- type of country
- seasonal conditions and time of year
- ages of breeders
- mating system
- target markets.

Deciding what body weight to wean down to requires balancing the economics of the costs of infrastructure, feeding and management, against the benefits of reducing breeder mortality and time taken to get back into calf.

Type of country

Weaning calves at a younger age will help to keep the breeders in better body condition.

This applies on all classes of country but on good country, cows are generally in better condition and therefore some weight loss may be acceptable. On poor country where cows are generally lighter, managing body condition is much more important.

Seasonal conditions

Flexibility in weaning times is critical for managing poor seasonal conditions. Earlier weaning will allow the cows to maintain better body condition under drought conditions.

Don't wait – wean earlier if the rains are delayed

Breeder age

First-calf heifers and young cows will lose more weight and therefore have lower pregnancy rates than mature cows. Many producers wean these first-calf heifers and young breeders earlier when their calves are at a younger age.

Mating system

Continuous mating

In continuously-mated herds with year-round calving, having two rounds of weaning reduces the number of cows that are lactating for long periods, particularly over the dry season.

Continuous mating results in calves of mixed size at first weaning

Controlled mating

In control-mated herds with a three-month calving period, typically only one weaning is required. However some late, lighter weaners will require special management if the joining period exceeds three months.

The duration of the joining period determines the spread of weaner weights; a longer joining period usually leads to more light calves at weaning and a lower average weaning weight.

> ⚠ **Wean only the numbers and types of weaners that can be adequately managed.**

Overall weaning management

Weaning should involve a period of at least one week in the yards. Calves that are not yarded can be difficult to manage later and may suffer more stress if finished in a feedlot.

Weaning management involves planning for the muster, the yards, cow-proof fencing, stocks of hay and other supplements, the weaner paddocks and transport.

Questions that need to be asked include:

- What is the condition of the weaner paddocks, were they spelled?
- Are there adequate staff?
- Do staff understand which calves are going to be weaned from particular breeder groups?
- Are the facilities and equipment in good order – yards, gates and fences repaired, water supplies, troughs for water and supplement, hay racks in place?
- Are there sufficient stocks of good-quality hay and supplements?
- Are there stocks of current animal health products?

Yard weaning

Infrastructure

The yards should have adequate space for weaners to move freely, and with no protrusions that can cause injury or bruising. Weaners of 100–200kg need three to four square metres per head.

If the weaners are confined for extended periods, shade should be provided.

Weaners have to be held in secure, confined spaces, particularly in the first two days of weaning and in the evenings when they are more likely to take fright from strange noises or animals and try to break out of the yards. Make sure all gates are securely chained and that weaners cannot access the race or forcing yard – wiring gates will prevent accidental opening by weaners playing with chains.

Dogs should not be allowed to wander near the yards.

Plants such as button grass and pigweed that commonly grow in yards can be poisonous if consumed in large quantities – particularly if stock are hungry.

Feeding and watering facilities

Hay feeders and troughs should preferably be up off the ground for good hygiene and to reduce the risk of spread of disease such as coccidiosis. Ideally, feed troughs should not be located close to the water troughs; this reduces feed fouling the water and provides more space for the weaners to reach and eat the supplement.

Hollows and boggy areas around troughs should be built up to give small or weak animals easy access.

Trough space must be long enough for all animals to eat without bullying, and may need to be adjusted to allow for animal type, temperament, supplement intake, mob size and pen layout.

Weaners kept in the yards for up to a week while being tailed out will be quieter in the future, but the duration depends on the yard space available.

» Ensure yards and water supply are in good condition

» Hay feeders keep good-quality hay clean and reduce waste

» A rail around the molasses trough may reduce the chance of a sticky start to weaner life

» Troughs should be long enough for all weaners to eat

Weaner paddocks

Weaner paddocks should have been rested to allow growth of nutritious grasses. They must be securely fenced so the animals can be controlled and educated – electric fencing can help train weaners to respect fences.

In smaller paddocks, weaners can find watering points and supplement troughs more easily. In large paddocks, weaners should be introduced to the watering points, or they may stay in the corners and perish.

Smaller-sized and close to management weaner paddocks are easier to monitor and muster for health treatments such as booster vaccinations. The paddocks should be stocked lightly to allow weaners to select the best herbage.

» Rest the weaner paddock to accumulate a good body of grass – and check the fencing

Weaner management

Good weaner management involves:

- reducing stress for the cow and the weaner
- training the weaners
- possibly feeding weaners for the next few months.

Reducing stress

Both mother and calf are stressed when they are separated – the cows will call for their calves and try to return. To prevent cows breaking paddock fences, cows can be moved out of hearing range from their calves. Keeping calves in sturdy and secure yards is also important.

A less stressful strategy is to leave the cows close to the yards for three to four days after weaning – this strategy however can pose management challenges.

Stress at weaning time may cause problems with disease and parasites. Key factors in managing stress at weaning include:

- providing the right nutrition
- segregating weaners on size
- regular and calm handling
- monitoring every day for a couple of weeks
- treating parasites and vaccinating against relevant diseases.

Nutrition

At weaning, the calf is stressed by separation from its mother, and forced changed from a diet with milk to one based solely on forage.

Weaners need to be fed good quality hay and supplements immediately upon weaning to maintain an active rumen. A delay of more than 24 hours can result in reduced or changed rumen microflora activity, and it can take up to a week for normal rumen function to return. Each weaner must be allowed 2–3kg of good-quality hay each day.

How weaners are fed will affect how they grow over the next months, and may also affect their long-term growth, health, meat quality and reproductive performance.

Segregating on body weight

Segregating weaners into groups based on weight minimises bullying and allows all animals to get their fair share of feed.

Segregating by weight allows for cost-effective supplementation with each class being fed their appropriate nutrients (**Table 5.1**). The nutrient requirements for calves under 100kg are greater compared to a weaner of 200kg. Diets with increased nutrient density are more expensive per kg of dry matter. Ensure segregated groups are fed an appropriate diet to optimise growth and costs.

Table 5.1: Weaner management groups

Weaner weight	Supplement requirements
Under 60	Milk replacer and high-quality baby calf meals/pellets
60–100	Highly palatable calf meals or pellets
100–150	Supplements needed if pasture quality is too poor for required growth
>150	Supplements needed only if pasture quality is too poor for required growth

Segregating weaners on weight allows for more cost-effective supplementation

Pregnancy testing and foetal ageing for weaner management

Foetal ageing can be used to forecast the numbers and weights of calves at weaning the following year.

This information enables better planning by:

- evaluating when to wean, e.g. how soon a breeder group can be weaned with calves over 100kg
- identifying the weaner management groups to be handled, e.g. 100–150kg, 150–200kg, over 200kg
- estimating the numbers of weaners in each management group.

Handling weaners through the yards trains them for life

Handling

Up to weaning time, calves have had relatively little handling or contact with humans. Good handling and training in the yards for up to a week will minimise stress. Tailing weaners out in the weaner paddock will set the animals, and stock handler up for an easier life in both the paddock and the yards.

Selection for temperament within the herd is important for general herd management as well as for good presentation of sale animals.

Monitoring and checking

Weaners in the paddock should be checked for a day or two for general health and to ensure they are coming in for water and supplements.

All weaners should be checked regularly and fed supplements if they start to lose weight.

Selling weaners

If calves are going to be sold as weaners, it is generally best to sell them as soon as practical after yard weaning, or to keep them for three to four weeks to allow them to recover. Weaners sold immediately off their mothers with little handling and training generally don't perform as well in lot feeding operations.

Trucking to growing properties

Weaners should have access to good quality, palatable hay at the point of trucking and immediately after they arrive at their destination. This will reduce stress, keep their digestive systems working, and prevent engorging possibly toxic plants around the yards if present.

On many extensive properties, calves are not processed before weaning because of the cost of extra mustering and handling. If weaners are to be trucked to a 'growing' property, they should only be branded and ear-tagged with a National Livestock Identification Service (NLIS) tag. At the growing property, they are dehorned and castrated after recovering from the journey.

This strategy can help prevent setbacks due to the stress associated with castration, dehorning and trucking, and the risk of infection if they have to be plunge-dipped.

For further information about your role in responsible livestock transport, scan or click the QR code or visit **mla.com.au/transport-hub**

Weaners can be made familiar with trucking without the rush against tight schedules

Weaner health

Weaning is a time of great stress for the weaner. It is also an opportune time to check for internal and external parasites and to start good health management.

The weaner is stressed by being separated from its mother and by the loss of milk in its diet. In addition, stress and close confinement with other animals in the yard makes the calf more susceptible to infectious and non-infectious diseases.

Animal health programs can start while the weaners are confined in the yard. Recommended programs vary from region to region and depend on the climate, stocking rate, pasture quality and the local history of endemic diseases.

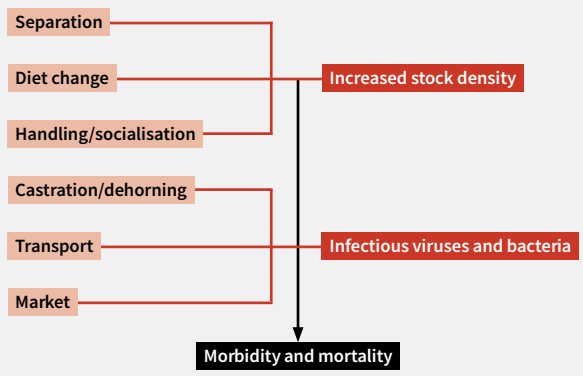
> ⚠ **Good herd health starts in the weaning yard.**

Stress management

Stress reduces the animal's immune system and is the trigger for the onset of disease.

Stress at weaning can be reduced through:

- branding, dehorning and castrating before weaning
- good nutrition
- calm stock handling
- avoiding overcrowding
- minimising poor environmental conditions such as dust, heat, lack of shade and boggy yards
- treating existing health conditions
- in the long term, by selecting for good temperament.



Animal welfare

Basic animal welfare standards must be met during weaning. Stock handlers must know how to minimise stress when working cattle to recognise early signs of distress and disease, and how to take prompt action.

Surgical procedures should not be carried out if the weaners are wet or the yards are muddy or until animals are ready to be turned out to pasture.

Pain relief

The provision of pain relief with routine husbandry practices is now an expectation. Not only do producers need to consider the use of pain relief products in their animals, but also alternative husbandry procedures and management practices. Strategies to negate the need for painful husbandry practices might include selecting for the polled gene or exploring options for marketing entire males.

Where husbandry practices are required, adopting best practice procedures is an essential first step to ensure minimal pain. Provision of good restraint ensures operator safety and allows the procedure to be conducted quickly.

Pain relief should be provided. Products available include local anaesthetics and non-steroidal anti-inflammatory drugs (NSAIDs). Most pain relief products help with some of the pain an animal experiences, but not all. Using a combination of products will provide greater pain relief. Local anaesthetics provide relief from immediate pain but are short-acting. NSAIDs provide a longer duration of pain relief but do not deal well with the immediate pain.

For further information about best practice husbandry in beef cattle, scan or click the QR code or visit **mla.com.au/beef-cattle-husbandry**

Risk assessment of diseases

Before starting a disease prevention program, check with a veterinarian which diseases pose the greatest risk to the weaners. For some diseases, there is little risk to well-managed weaners as they will build up immunity over time.

Other problems, such as worms, may become an issue during weaning therefore weaners should be carefully monitored.

Disease management

Coccidiosis

Coccidiosis or post-weaning diarrhoea (PWD) can be common in weaned calves. Coccidia are protozoa parasites that normally inhabit the intestinal tract without causing significant problems. Coccidia can reproduce rapidly when the immune system of the calf is compromised by the stress of weaning. Damage to the lining of the intestines is seen as bloody or black diarrhoea. The disease is usually self-limiting but if untreated, dehydration and death can occur.

To manage coccidiosis:

- feed good quality hay as soon as animals are weaned
- feed from troughs or hay racks to avoid contamination from dung on the ground
- reduce the stress of weaning on the calf – provide dry yards with shade and plenty of clean water
- include a coccidiostat such as monensin in the calf ration according to label instructions – care should be taken as over-dosing is toxic, and even small amounts can kill horses and dogs
- monensin use is not permitted in certified organic operations and can affect certified pasturefed and grassfed suppliers who wish to produce an antibiotic free product
- calves with severe or chronic PWD can be treated individually with a product that contains a coccidiostat, an antibiotic and anti-diarrhoeal powder
- rotate weaning yards to reduce the build-up of oocysts if larger numbers of weaners are being processed all year round.

Parasite management

External parasites

Buffalo fly

Buffalo flies irritate cattle, cause sores and can interrupt feeding but are usually not a problem in weaners.

Manage fly populations with sprays (knapsack or firefighter), insecticide ear tags or with back rubbers.

Control measures are described in the MLA's *Recommendations for integrated buffalo fly control – revised edition*. Scan or click the QR code or visit **mla.com.au/buffalo-fly-control** for more information.

Ticks

Ticks pose a serious risk to British and European breeds, and a minor risk to tropically adapted cattle.

Cattle ticks can be controlled by strategic treatment with modern pesticides that are effective against both ticks and internal parasites. Rotate the chemicals used and adopt recommended dose rates to avoid establishing tick resistance.

Pasture spelling is also a useful tool when combined with strategic chemical treatments. Weaner paddocks should be spelled for both nutrition and tick control. If tick burdens are an issue, treat all animals in a paddock that has been spelled for six months as this will ensure it is free of larval ticks.

Tick fever

Cattle ticks can transmit three serious blood-borne tick fever organisms. British and European breeds are especially susceptible, but *Bos indicus* cattle also need protection. Adult cattle of all breeds are more susceptible than weaners.

Calves born and raised in tick country acquire immunity to tick fever from their mothers and this generally lasts three to nine months. Immunity can be maintained by natural challenge. However, in many areas the cattle may not be adequately challenged, and 3-germ tick fever vaccine is given at weaning for reliable long-term protection.

As immunity after vaccination takes some weeks to develop, animals from tick-free areas should ideally be vaccinated at least 30 days before being introduced to tick-infested areas. Alternatively, they should be vaccinated on arrival and monitored for 30 days.

> ⚠ **Do not vaccinate just before trucking as the stress can trigger a vaccine-induced tick fever.**
>
> Do not assume that because the calves have been reared in tick country they are immune to tick fever. Most (80%) cases of tick fever occur in cattle that have run in tick country all their life.

Lice

Cattle lice are endemic in Australia, and weaners in poor condition are more susceptible to infestation. Lice are spread by direct contact with other infected animals, often in the cooler months, but rarely affect productivity. Rubbing due to the irritation can cause hair loss around the butt of the tail, neck and shoulders.

There are many commercial insecticides for control of cattle lice. Heat and sunlight diminish the survival rates of lice so problems are rarely seen over summer months.

Internal parasites

Nematodes

Round worms such as Barber's Pole and platyhelminthes (flat worms of fluke and tapeworm) can cause loss of condition, scours and anaemia in weaners up to 18–24-months-of-age – after which the animals become less susceptible.

These parasites are a greater problem in high-rainfall environments, following wet weather and where pastures are intensively stocked. The most common nematode in summer rainfall regions is Haemonchus (Barber's Pole). Liver fluke may be an issue but is restricted to wetter, swampy areas in south-east Queensland. The Northern Territory is currently free of fluke. Treatment is recommended only where a problem is known to exist.

Most calves will have worms, but treatment will be cost effective only when they are heavily infected. Animals with heavy worm burdens show clinical signs of anaemia, ill thrift, loss of condition, bottle jaw, rough coat and sometimes a green scour, but sub-clinical worm burdens result in lower than expected weight gains. While this can cause substantial economic loss, unwarranted treatment can be expensive.

Faecal egg counts are the best method to determine if drenching is necessary. Faecal samples should be collected from at least 10 representative animals in the mob and submitted to a laboratory for examination. The significance of the egg numbers detected will depend on the species of parasite present.

Anthelmintics can be administered as pour-ons, injectables or oral drenches. Generally, a single dose of anthelmintic and moving treated stock to a 'safe' paddock is all that is required. Animals improve immunity with age.

Ringworm

Ringworm is a fungus that attacks the hair follicles, resulting in white patches of thickened skin. It is contagious and quite common in animals in close contact. Ringworm is usually self-curing but bad cases can be treated with a fungicidal wash or spray.

Infectious diseases and vaccinations

The risk of problem diseases and their control will depend on the climate, region and production system.

Advice should be sought from the local beef advisor, stock inspector or veterinarian on managing these diseases.

Appendix 3 summarises management and vaccination against some major diseases that can be implemented at weaning, how they affect the herd, and how to test and manage for the disease. Two vaccines need to be considered in most cases: 5-in-1 vaccine is recommended in all situations and botulism vaccine is recommended in phosphorus-deficient regions and where botulism is known to be a problem.

Vaccination records

All vaccinations given to cattle should be recorded with date of vaccination, vaccine used, batch number of the vaccine and number of stock vaccinated.

A herd health program should be developed in consultation with a veterinarian. Vaccination records are a part of a herd health program and may be useful when negotiating contracts.

For further information about vaccinating beef cattle in northern Australia, scan or click the QR code or visit **mla.com.au/nth-beef-vax**

CASE STUDY

» After branding, Lakefield's weaners are turned out into small paddocks with access to trace element blocks, molasses, hay and pellets. Ten days of tailing before branding means weaners are easier to handle. Image: Chelsea Riggs

Lakefield's weaner success floats on targeted management

Since purchasing 'Lakefield Station' on the Sturt Plateau, NT, in 1999, the Riggs family has developed it into a thriving cattle operation with the help of award-winning land management and conservation strategies.

Along with their children Tahlia, Chelsea, Kirra and Hayden, Garry and Michelle Riggs have transformed what was once a bare block with only boundary fences on three sides, into a productive station running 7,500 Brahman cattle (including a small composite herd). The family developed clear management plans and ticked off their goals ahead of schedule, such as developing:

- 26 paddocks
- three sets of yards
- 68km of laneway
- 42 fenced dams with 18 on solar water-pumping infrastructure
- 14 bores (10 solar)
- 1,300ha of conservation area
- a 600-tree mango orchard.

They can now utilise most of their grazing country, with 90% of Lakefield within 3km of a watering point, and the remaining 10% within 5km.

"Moving forward, we will continue to enhance our livestock management program and improve our property with native and improved pastures, along with maintaining our environmental values and a carbon neutral environment," Garry said.

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At a glance

Matching stocking rates to carrying capacity and implemented tight breeder control, structured mustering and targeted weaner supplementation have been key to steadily lifting weaning percentages and weights.

- reduced herd size to improve land and breeder condition
- controlled mating and data-driven culling of underperformers
- three-round weaning strategy down to 80kg to relieve cows
- ad-lib molasses and tailored mineral supplementation for weaners
- strong education program in yards and paddocks.

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Matching stock to capacity

Lakefield currently runs about 2,300 breeders with an average weaning rate of 74–76%. The Riggs family recently reduced numbers by 600 head to better match carrying capacity – this resulted in significant improvements in pasture condition as well as production, with higher weaning weights and percentages. They drew on carrying capacity assessments conducted by Northern Territory Government and Charles Darwin University (CDU) scientists.

Markets

From 2014–2023, the Riggs family increased the polled rate in weaners from 60% to 92%. They have strong local demand for their polled breeders and bulls. Bulls that don't meet their criteria – which includes conformation and temperament – are directed to the live export market, along with feeder steers.

Supplementation

The Riggs family have trialled different supplementation programs to develop a strategy with the best return. Through the wet season, all cows and weaners have access to phosphorus (P) – they use Kynofos 21, which contains 21% P.

"Phosphorus has had one of the most positive impacts on production out of all of the management strategies I've tried," Garry said.

In the early dry season, cows get Beachport Liquid Minerals (BLM) White Cap until July/August, then they are switched onto a urea and phosphorus loose lick to provide them with protein in the late dry season when pasture protein levels decline. The loose lick intake target is 50g/head/day – the correct amount of supplement is distributed in lick tub tyres and diligently checked once a week to ensure consistent supplementation and to limit wastage.

Table 1: Procedures carried out at weaning for each class of weaner, after vaccinations and tailing and immediately before being turned out of the yards

Practice	Horned heifer	Polled heifer	Horned male	Keeper herd bulls
Dehorned (using hot-iron dehorners)	✓		✓	
Pain relief: Metacam	✓		✓	
Pain relief: Tri-Solfen + Stockholm Tar	✓		✓	
Earmarked	✓	✓	✓	✓
Branded	✓	✓	✓	✓
Castrated (using rings)			✓	
Management tags	Nearside ear	Nearside ear	Offside ear	Offside ear

"By investing more time out in the paddock on lick checks, we can monitor cattle and land condition more intensively," Garry said.

Feeder steers are given BLM Green Cap (added to their water) 10 days prior to trucking to reduce shrinkage during transport.

Breeder management

Cows are control mated for six months, with bulls put in on 7 January. This results in a first peak of calving in October/November and a second in January.

This controlled mating window means calves are born within a known timeframe and breeders can be managed accordingly.

Pregnancy data is recorded into a Tru Test XR5000 which stores each cow's full reproductive history.

Using this data, the Riggs family cull:

- heifers that are not pregnancy-tested-in-calf (PTIC)
- cows that are pregnancy tested empty more than once
- cows that are frequently PTIC but do not rear a weaner.

Breeders receive annual vaccinations of Bivalent botulinum vaccine and 7-in-1 at the preg-testing muster. Herd bulls receive annual Bivalent, 7-in-1 and Vibrovax vaccines.

The Riggs family aim to keep cows in a minimum BCS of 2.5–3, which results in about 65% of cows re-conceiving while lactating.

Weaning

"Around 12 years ago we were at about a 60% weaning percentage, but with careful selection for fertility we are now consistently achieving weaning percentages in the mid-70s," Garry said.

Here's a look at how the Riggs family manage their weaners.

First-round muster

First-round mustering commences the week after Easter when the first peak calves are about six months old and an average of 160kg. Only a helicopter is used for this muster, to ensure all weaners follow their mothers into the trap yards. Six breeder paddocks are mustered individually, and each mob is walked down the laneway to the yards by one person on a quad bike. Calves that weigh more than 100kg are drafted for weaning. Calves less than 100kg are tagged and branded, males are castrated using rings, and horned calves are

dehorned using hot-iron dehorners. These calves are mothered up in the paddock they came from.

Feeding, vaccinating and tailing

The first cohort of weaners are kept in the yards for up to 10 days, with access to mixed grass, cavalcade, sorghum hay, beef weaner and shipper pellets, copra meal and fresh, clean water. The average weight of first-round weaners is 155–160kg. Any animals in the lower weight range or that look like they need extra attention are drafted into a separate yard to reduce feed competition and bullying.

Weaners are given their initial vaccinations (Longrange botulism, 7-in-1 and an injectable parasite treatment) straight away. The yard period ensures these vaccines are effective before weaners are branded and turned out into the paddock.

Weaners also go through an education and training process in the yards, conducted by Michelle.

During this period, they are:

- introduced to people, horses and working dogs
- tailed in smaller yards, progressing to bigger yards and water squares
- quietly worked on foot through the pound and race, with a few 'free' runs through the crush.

Processing

After they are vaccinated and tailed, the 100kg+ weaners receive management tags and non-polls are dehorned using hot-iron dehorners. Males which won't be kept are castrated with rings. All castrated males are given Metacam pain relief.

Weaner nutrition out of the yards

Next, weaners are boxed together and turned out into fresh weaner paddocks with ad-lib access to molasses, trace element blocks, Adelaide River shipper pellets, hay in feeders and BLM Green Cap in their water. The Riggs have used molasses for five years – they buy it as concentrate and mix it in large lick tubs. They are impressed with the benefits they've seen. Weaners are then allowed into larger

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» Once educated, weaners are turned out into fresh weaner paddocks where they have ad-lib access to molasses. The molasses is bought as concentrate and mixed in large lick tubs. The Riggs have used molasses for five years and are impressed with the benefits. Image: Chelsea Riggs

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paddocks and introduced to weaner stock lick starting at 10% urea and gradually increasing to 20%.

The average daily gain of first-round weaners is 0.26kg/head/day over the dry season and 0.36kg/head/day in the wet season.

The average cost to produce a weaner at Lakefield, inclusive of feed, supplements and vaccinations is $500/head.

Second- and third-round musters

Second-round mustering begins in late July. To take the pressure off cows, the Riggs family wean down to 80kg in this muster, with the rest of the process the same as the first round.

"It's cheaper to feed weaners than to try and increase a cow's condition score while she is feeding a calf," Garry said.

The third-round muster in December, is to wean any calves that were too small in the second round, but need to be taken off before the first round the following year. Supplementation out of the yards is the same for second- and third-round weaners as it is for first-round weaners.

Overcoming challenges

The Riggs don't shy away from the challenges that come with breeding cattle in the NT and have used their learnings to improve management practices. Lakefield's average annual calf/weaner mortality from pregnancy-test to weaning is 10%, which Garry estimates is caused by 2% wild dogs, 3% birth defects (natural cause), 3% from pregnancy testing and 2% from bottle teats. Garry started using a Reproscan when pregnancy-testing to reduce losses from manual pregnancy-testing, but found it only lowered calf loss by 1%. Another challenge is bottle teats. To reduce the impact of bottle teats, affected cows

» The correct amount of supplement (g/head) is calculated and distributed in lick tubs and diligently checked once a week to ensure consistent supplementation and to limit wastage. Image: Chelsea Riggs

are taken to a smaller paddock and monitored. If needed, their calves are bottle fed for as long as necessary.

Coccidiosis is also prevalent, so any affected weaners (as well as any other ill-looking cattle) are separated from the mob and cared for with medicated feed and grassy hay, as well as being treated with a round of Tribactral and Metacam. They are kept in smaller paddocks closer to the homestead where they can be easily monitored and accessed.

In the two-year-old feeder steers, Garry says the previous annual mortality rate of ~4.5% was due to three-day sickness. To address this, the Riggs adopted the use of Allicin fly blocks which have not only reduced mortality to 3%, but appear to have increased weight gains.

Outside of animal health, challenges include controlling weeds with a railway line running through the property and wild dogs. The Riggs don't bait dogs but instead shoot or trap them and keep donkeys with their weaners to deter predators.

When the Riggs bought Lakefield 25 years ago, tough times and low beef prices followed. With a young family in tow, they persevered on a tight budget and moved forward by making their five- and 10-year plans. Now that they have completed their development plans, the station can be run with ease with only minimal staff.

"All development was centred around our Landcare objectives, with sustainability and improved economic and environmental outcomes. Moving forward, we will continue to enhance our livestock management program, property improvement with native and improved pastures, along with maintaining a high standard with our environmental values and maintaining a carbon neutral environment," Garry said. ■

Weaner training

At the time of weaning, calves have had relatively little handling.

Educating and training calves well at weaning will make them easier to work with in both the paddock and the yards throughout their lives. This will result in a reduced amount of time lost, money spent and frustration experienced on farm.

Making the weaners' first experience of the yards as pleasant as possible by steady handling and the provision of feed and water, reduces the stress of weaning. Minimising stress in the yards allows weaners to establish social order in confined spaces, increases immunity to common health conditions and de-sensitises them to noises and movements of people and vehicles. It also allows them to learn to eat new foods such as hay, pellets or supplements.

Calm handling

The first step is mustering the calves with their mothers and walking the mob calmly into the yards. Drafting and handling should also be carried out as calmly as possible, with calves to be weaned and drafted into a yard with clean water troughs and hay on offer.

Working weaners through the yards on foot three to four times over a week will familiarise them with people on the ground.

Weaners should be given 'free run' through the yards, but also taught to 'block up' at a shut gate, i.e. coming into the round yard before a gate is opened or coming to a shut gate in the race. They should not be worked in only one direction through the yards.

Stockmanship

Cattle read body language and should be shown clearly where they will move to. Handling them calmly and confidently without sudden and loud movements gives them more confidence in the handlers.

The right type of dogs – that herd or block and do not bite – will teach the mob to stay together. Do not however, allow dogs to run uncontrolled around the yard.

» Good dogs will teach the mob to stay together

» Make the first experience as pleasant as possible with good feed and water and quiet handling

» Weaners should be worked quietly from yard to yard and through the race

Tailing out

Weaners can be let out of the yards as a mob after a couple of days. They should be tailed out in a paddock and then yarded at night at least three to four times.

They should also be introduced to, and become accustomed to, all types of handling – using horses and motorbikes. There are tales of steers that have been mustered only by motorbike on one property charging stock handlers on horses at their next location.

This tailing and yarding process is not only a crucial part of the weaners' education but can also result in reduced feed costs. After a few days, weaners should walk out calmly and put their heads down and start eating. They can then progress to settling on the water in their paddock, or being left in a holding paddock for a further week as they get used to living without their mothers.

Last operations before release

Procedures such as dehorning and castration should be the last thing in the weaner training schedule but preferably would have been carried out a couple of months before weaning to reduce stress.

Doing these procedures last, before turning the weaners out onto pasture, avoids exposing them to tetanus and other germs that may exist in cattle yards and ensures they are already settled enough to go out into the paddock and continue to eat and drink as they recover.

Checking the weaner paddock

Check the weaner paddock daily for a couple of weeks after weaners are turned out to ensure they are coming to water and supplements and that none have escaped.

Time spent on weaner education will continue to pay dividends for the life of the animal in terms of time savings and increased productivity. For breeding females, this could be for the next eight or more years.

» Weaners should be handled with, and become accustomed to horses, motorbikes and other vehicles

CASE STUDY

Cattle walking through pasture. Image: Angus McKay

More than two decades of controlled mating key to weaning success

The McKay family owns and operates two properties, 'Umbearra' and 'Idracowra', situated along the border of the NT and SA, about a three-hour drive south of Alice Springs.

Property background

Angus (Gus) and Kimberley McKay and their three children manage a vast area of 8,200 square kilometres (820,000 hectares). Gus is the third generation of the McKay family on these lands.

They are custodians of diverse terrain that includes open granite range country, gum-lined creeks, mulga country, sand hill regions, river plains and flood out areas. The properties experience an average annual rainfall varying between 200–250mm.

A notable geographical feature is the rail line from Adelaide to Darwin, which extends for 130km through their property and impacts the natural water ponding in the area.

The dominant pasture species across both Idracowra and Umbearra include oaten grass, buffel grass, and kerosene grass (*Aristida contorta*) and a range of perennials including umbrella grass (*Digitaria coenicola*) and curly windmill grass (*Enteropogon acicularis*). This rich mix of native and enhanced vegetation supports the pastoral activities on the properties.

Cattle

Approximately 11,500 Red Angus-cross cattle graze across the sprawling landscapes of both properties. The McKays selected this breed for its exceptional fertility and Meat Standards Australia (MSA) scoring potential.

The average MSA index over the last twelve months for Umbearra was 59.79.

The McKays oversee a comprehensive range of cattle operations, from self-replacing breeding programs to turning off heavy steers. The cattle processed from these properties are certified organic, adhering to both the United States Department of Agriculture National Organic Program (USDA/NOP) and Australian Standards. At full capacity, the property supports 2,000 maiden heifers, 4,500 breeders, 120 bulls and 5,000 steers.

Herd numbers are strategically adjusted based on the stock class and land system, all coordinated around essential watering points.

At a glance

The McKay family has achieved high weaning rates through decades of controlled mating, organic nutrition and consistent low-stress stock handling tailored to their environment and organic certification requirements.

- Wean at higher weights (200kg) to reduce need for supplementation.
- Maintain cow and heifer BCS ≥3 with conservative stocking.
- Low-stress handling and tailored education improve temperament and performance.
- Use of organic-compliant feeds and phosphorus supplementation opens up access to premium markets.

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This is identified by the carrying capacity of the various land types across the property and the estimated pasture yield. Due to the variability of rainfall in Central Australia, a conservative approach is taken to provide sufficient ongoing feed should there be limited rainfall the following year. The McKays maintain a stable stocking strategy.

"We run conservative numbers so our stocking rate doesn't change much due to seasonal conditions," Gus said.

The McKays draw on their 60 years of family experience and expertise in managing Umbearra as well as the advice of rangeland specialists. Dr Dionne Walsh – an expert in the field who runs her own consultancy and has worked for the Northern Territory (NT) Government in research and consultancy roles around rangeland management – contributes valuable insights into their management decisions and practices. Chris Materne, Pastoral Production Officer for the NT Government, also brings his extensive experience researching pastures and carrying capacity in rangeland environments to the table when discussing the McKays' management decisions. This collaborative strategy has been crucial in optimising the efficiency of the couple's livestock management.

Markets

The McKays' cattle are predominantly marketed through abattoirs in Victoria and SA. All mature cattle are processed under an organic label, accredited by both the Australian Standards and the USDA/NOP. They aim to sell this portion of cattle at approximately 24–28-months-of-age, weighing between 600–700kg. The natural advantages of Central Australia, with its expansive natural landscapes, good pasture quality and minimal pollution and parasites, greatly facilitates the maintenance of organic farming practices. This environment ensures the McKays can easily meet stringent organic standards and receive price premiums.

The McKay family. Image: Angus McKay

The natural advantages of Central Australia, with its expansive natural landscapes, good pasture quality and minimal pollution and parasites, greatly facilitates the maintenance of organic farming practices.

Breeder herd management

The McKays use a two-month controlled mating period at Umbearra for their maiden heifers once they reach approximately 300kg at 12–15-months-of-age.

They use continuous mating after this initial phase. The heifer conception rate at Umbearra stands at an average of 86%. Any heifers identified as pregnancy tested empty (PTE) after this maiden mating are subsequently turned out with the steers. These heifers are then grown to a target weight of 500kg and are eventually transported to markets along with the heavy steers.

The McKays' weaning strategies enable them to consistently maintain a minimum BCS of three for both their heifers and cows. This careful management ensures the health and productivity of their livestock and their country, reflecting their commitment to quality and sustainability in their cattle operations.

Weaning process

The McKays' approach to cattle management involves carefully managed care of both heifers and steers from the weaning stage onward. At Umbearra, they wean from 200kg (or approximately nine-months-of-age) to allow the heifers and cows to regain their body condition before cycling again. Once in the yards, the weaners are fed organic oaten hay. Due to their organic certification, the McKays are limited to compliant supplements and therefore wean at the higher end of the weight range. This ensures weaners have enough reserves to continue growing well without additional supplementation.

The McKays spend a significant amount of time dedicated to educating the weaners in the yards and tailing them out. They adopt a low-stress stock handling practice both inside and outside the yards at Umbearra, to ensure the wellbeing of their livestock. The tailing out activities are conducted using motorbikes to allow the weaners to be efficiently moved and fed on pasture before being returned to the yards. Additionally, the weaners undergo internal yard work and education, a process that has proven to produce animals with good temperaments.

Rings are used to castrate weaner steers. Heifers and steers are branded using a gas fire brand to maintain identification and health records. Umbearra boasts a weaning rate of approximately 90% – a testament to the McKays' high standards of cattle management and strategic planning.

"We are very happy with our weaning rate – it has taken 22 years of controlled mating to achieve these results," Gus said.

Mustering

The McKays use water trapping, aeroplanes, helicopters and motorbikes for mustering. The prevalence of Indigofera, a poisonous plant that can complicate the safe use of horses in the area has led them to favour motorbikes. Gus notes that the terrain is well-suited for motorbikes, which are consistently used during the tailing out period to maintain uniformity in their handling practices.

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Red Angus cattle at Umbearra. Image: Angus McKay

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The McKays conduct two full musters annually at Umbearra, in addition to a mid-year pregnancy testing muster for the maiden heifers. The carefully managed mustering and weaning practices, along with conservative stocking rates, are key contributors to the property's high weaning rate. Females remain in good body condition, enabling a short post-partum anoestrus period and high pregnancy rate.

In addition to their usual mustering practices, the McKays have successfully integrated learnings from producer Bruce Maynard regarding stress-free stockmanship into their operations when working the cattle through the yards. This approach prioritises understanding and working with the natural behaviours of cattle to minimise stress during handling. By incorporating these principles, particularly during the critical periods of mustering and tailing out, the McKays ensure a consistent and gentle handling process is maintained. This adaptation approach not only prioritises the wellbeing of the cattle but also enhances the overall efficiency and safety of the operations, which keepings the animals calm and responsive. In turn, animals experience less stress when in the yards and more consistently and efficiently demonstrate daily weight gains.

Gus in the yards with the weaners. Image: Angus McKay

Organic certification

Like many Central Australian properties, the McKays operate Umbearra under USDA organic certification. The healthy and largely pest-free rangelands mean minimal chemical usage is required, which naturally supports organic farming practices. Approximately 50% of properties in Central Australia adopt organic operations due to these favourable conditions.

"Organic certification is pretty easy for us in our environment," Gus said.

Their primary challenge lies in securing high-quality organic hay and ensuring that urea is absent from their lick blocks. The McKays source their phosphorous lick blocks and BioChar phosphorous blocks from Ollson's Blocks as these don't contain urea so are able to pass organic certification.

Data management

The McKays follow the principle of 'what isn't measured can't be managed'. Their main data-driven areas of focus are fertility and turn-off weights. They use Gallagher crush side technology and Black Box systems to monitor cattle and carcase performance. All cattle are equipped with a National Livestock Identification System (NLIS) tag to ensure full traceability of the animals and allow for electronic data recording. Additionally, breeders are assigned management tags that identify their age, enhancing their management and tracking within the herd. This systematic approach to data collection and analysis is integral to optimising the productivity and sustainability of their livestock operations.

The McKay family's weaner management strategies at Umbearra demonstrate their commitment to maintaining high standards of both cattle health and productivity. Their approach to weaning – which involves monitoring of body condition, organic feeding practices and low-stress handling techniques – ensures the wellbeing of their livestock from an early age. These efforts not only support sustainable and efficient cattle operations but also highlight the importance of strategic weaner management in achieving long-term success in the pastoral industry. ■

The systematic approach to data collection and analysis is integral to optimising the productivity and sustainability of their livestock operations.

Longer term benefits

Growth in the dry season after weaning can affect future productivity, health, meat quality and heifer performance.

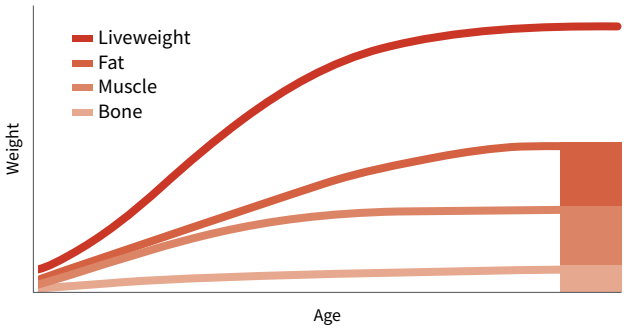
Poor weaner growth can result in:

- more cattle failing to meet market specifications, resulting in delays in turn-off
- retained heifers delayed in meeting targeted mating weights.

Weaner growth

As the weaner grows, the proportion of weight gain that is bone, muscle and fat changes. Skeletal growth is consistent throughout the first year of life – in younger animals, most of the weight gain is muscle. As the animal matures, the proportion of weight gain from muscle declines and the proportion from fat increases relative to the carcase (Figure 8.1).

Figure 8.1: Relative growth rates of body tissue



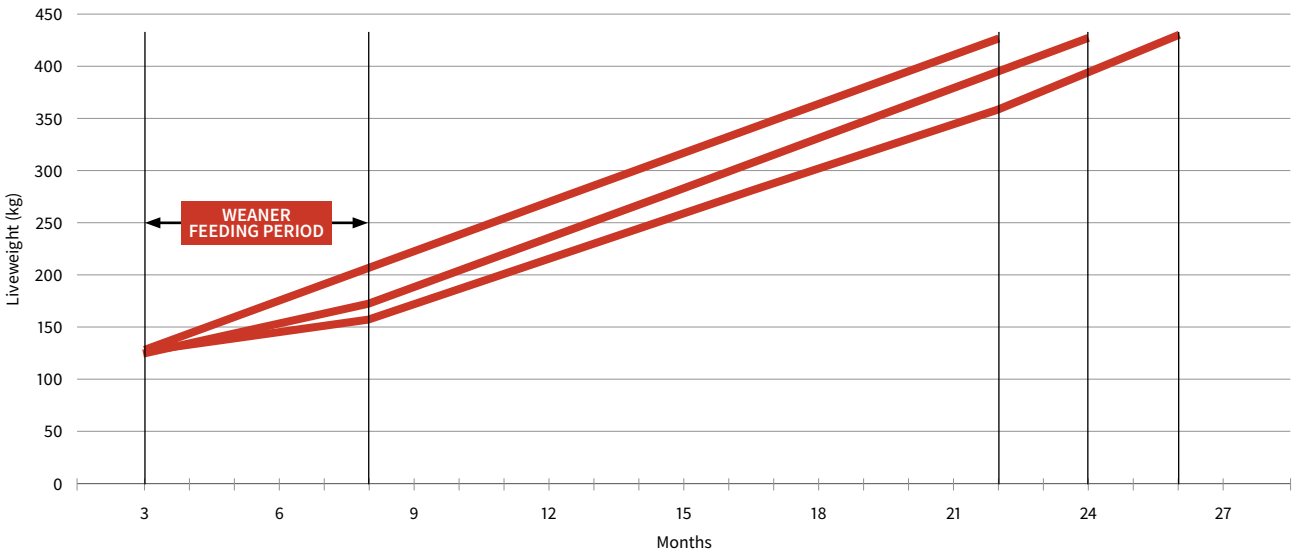
If an animal's growth is poor after being weaned, the ongoing growth pattern of the animal can be affected.

The earlier in life the growth restriction, the poorer the subsequent performance. Animals sold soon after the start of the wet season will have had less opportunity for compensatory gain.

Weaners at the same weight but with poor average daily gain will be lighter when sold or have to be held longer to achieve the same target sale weight (Figure 8.2). Meat tenderness is affected by animals losing and gaining weight and is detected through the assessment of carcase maturity by ossification, so cattle held longer may not meet dentition or ossification specifications for the desired market. Delays in turn-off mean more animals are being run on the property and the stocking rate is increased unless the breeding herd is reduced.

The effects of weaning and feeding persist when the animals go into a feedlot. Educated animals may have a greater estimated net value compared with cattle that have been weaned without best practice. The better estimated net value is calculated from better growth rate, less respiratory disease and lower health treatment costs.

Figure 8.2: Months required to reach feedlot entry weight (420kg) after different weaner growth rates



Growing replacement heifers

Of equal importance is the impact of weaner heifer growth on breeder herd performance. The age at which heifers will be joined must be considered when planning their nutritional management program (**Table 8.1**). Yearling-mated heifers have little time to reach the target mating weight. Although heifers to be mated as two-year-olds have more time, they have to go through two dry seasons before joining and are usually running on harder country. They must not lose weight during the dry season if they are to achieve target mating weights.

Table 8.1: Heifer growth rates required to achieve a minimum target mating weight of 350kg

		Average daily gain required to reach 350kg	
Weaning weight 1 May	Weight gain to reach 350kg	Yearling mating 1 Dec (214 days post-weaning)	2-year-old mating 1 Dec (580 days post-weaning)
100kg	+250kg	+1.17kg/day	+0.43kg/day
140kg	+210kg	+0.98kg/day	+0.36kg/day
180kg	+170kg	+0.79kg/day	+0.29kg/day
220kg	+130kg	+0.61kg/day	+0.22kg/day
260kg	+90kg	+0.42kg/day	+0.16kg/day

Better growth of replacement heifers allows:

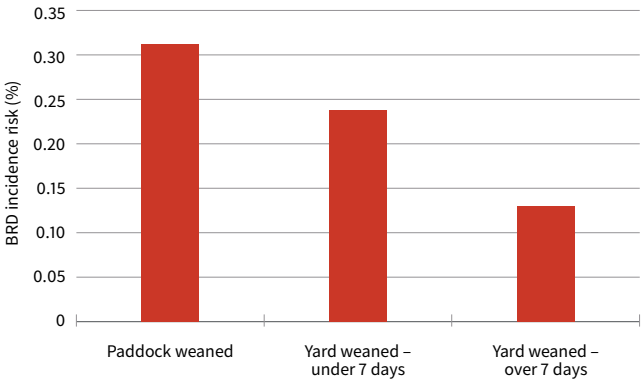
- more animals at the target weight from which to select
- greater opportunity for yearling joining
- heavier culls before and after mating.

For further information about managing heifers pre-joining to improve reproductive performance, scan or click the QR code or visit **mla.com.au/heifer-prejoining**

Weaner management and feedlot performance

Research has demonstrated benefits from good weaner management on feedlot performance. The incidence of sickness can be significantly decreased when animals are yard weaned versus those that are weaned directly into paddocks (Figure 8.3). This is because they are less stressed from being handled, they adjust more quickly to eating rations out of troughs, they have acquired immunity to viral diseases such as pesti virus and infectious bovine rhinotracheitis, and they have been adequately socialised. Socialisation or bullying of cattle in high density environments adds additional stress on stock so it is important to maintain social groupings wherever possible when placing cattle in feedlot pens.

Figure 8.3: 50-day incidence risk of bovine respiratory disease (BRD) for cattle that were paddock weaned or yard weaned for more or less than seven days*



*Data sourced from MLA funded project B.FLT.0225

In a feedlot, sickness and especially bovine respiratory disease (BRD) manifests at various levels. The losses from mortality rates, treatment costs and decreased growth rate due to sub-clinical disease all have a significant economic impact.

There are substantial weight gain advantages for yard weaned cattle as they are less susceptible to BRD, are already accustomed to concentrate feeding and are used to eating out of troughs.

Economic impacts

The economic impact of improving weaner management practices depends on current herd management, the fertility of the country and pasture quality. The exact benefit is difficult to establish because the various strategies can have many and varying results.

On low-fertility country where cow survival, weaning rates and post-weaning growth rates are a concern, improved weaner management has been shown to significantly increase business profitability.

In extensive, continuously-mated herds, the strategy of weaning those calves born late in the wet season at a younger age and lighter weight – commonly referred to as 'early weaning' – will improve overall herd performance. 'Early weaning' is now recommended as 'normal' practice in these regions.

With control-mated herds on more fertile country, calves are often weaned at older ages and heavier weights, but herd performance might still be improved if they are weaned earlier in autumn.

Weaning even earlier at lighter weights is a valuable drought management practice following a poor wet season with little prospect of carry-over winter feed.

» Early weaning can be an effective drought management practice

Early weaning

Calves that are young and small at the first muster can either be weaned early and given some supplementary feed or left with their mothers until the next muster.

This section describes the benefits and costs of early weaning and improved weaner management in general terms.

The impact

Where an early weaning strategy is implemented, the herd structure will change with fewer cows needed to produce the same number of calves, as cows will have time to regain body condition before their next calving.

Within a couple of years, the proportion of these small calves will decline – particularly at second-round musters – and calving will be aligned with seasonal grass growth.

Better branding rates

Once an early weaning strategy has been implemented, overall branding figures would be expected to rise by 5–10%. The branding rate in first-calf cows would be expected to rise from 40–50% to 50–65%.

Weaning rates will rise from better conception rates and lower calf losses from birth to weaning.

Breeder mortalities may fall from 6% to 5% from early weaning. If the cows that die are those trying to feed small calves during the dry season, it could be expected that 6% of calves would also die. If only branding figures are recorded, losses between birth and branding can only be guessed.

Increasing the number of calves weaned at the first-round muster will result in more early-pregnant cows during the next wet season. These cows should be able to improve their condition in the following early dry season and therefore will need less supplementation.

Other benefits from weaning calves that weigh less than 150kg will come two to three years after the strategy was implemented. The calving season becomes more concentrated, more calves are born in time to grow over the wet and the proportion of calves that have to be weaned early is expected to drop from around 40% to 15%. This will then reduce the costs of early weaning and with pregnant cows segregated by foetal age, can reduce the costs incurred at the second muster.

First-calf cows

Over time, better concentrated calving will allow more maiden heifers to be heavy enough to mate when they are introduced to the breeding herd. This will also result in a higher conception rate synchronised with the preferred time of year.

In an extensive breeding herd, 40% of cows are two, three or four years old, and it is the failure of many of the first-calf cows to get back into calf that lowers overall reproductive rates to around 65%. Early weaning gives these animals a chance to regain condition and start cycling again.

The extra costs

Increased costs in the first year of the new strategy will arise if additional facilities are needed to hold and feed the small weaners – extra trough space for hay, pellets and water, extra feed storage sheds, machinery and vehicles to load and distribute supplements, and extra yards to allow size-segregated weaners to be fed different rations.

Weaner feeding costs will rise in total with the higher cost of feeding high-protein rations for longer. However, these costs will fall as the number and proportion of calves that have to be weaned early will decline over the two to three years following implementation.

Worked examples

Early weaning impacting the breeder herd

An example is described with production parameters being 'best estimates' for typical northern Australian extensive properties.

In an attempt to quantify the financial benefits of early weaning on extensive properties, a financial study was based on properties with and without early weaning. The production parameters were derived from herds running in the Mitchell grass regions of northern WA, and used in herd and financial models. Costs were based on average Australian Bureau of Agricultural and Resource Economics (ABARE) data for this region. Changes in livestock performance are based on data from a weaning trial in Northern WA.

The example properties were set to run self-replacing herds of 6,400 breeding cows with 10% of the breeding herd culled each year and 80% of steers sold at about 18-months-of-age.

Changes in herd performance with early weaning included:

- Herd branding of 62% was raised to 67%.
- The proportion of calves weaned early fell from 40% to 15% after early weaning had been fully implemented.
- There was greater expense in feeding calves under 150kg compared to ‘normal’ weaners.
- Costs of feeding supplements to the breeder herd were reduced by 15%.
- Labour costs at weaning increased but the total labour costs of the property are set to reduce by 10% within three to four years.
- Extra facilities for holding and feeding early weaners were costed into the model.

When properties with and without early weaning were compared, the property implementing the early weaning strategy showed economic benefits of:

- 19% improvement in profit
- 10% improvement in gross margin per adult equivalent
- measurable increase in beef output.

Any reduction in weaner feeding costs would greatly improve profitability.

Benefits of early weaning

The likely benefits of early weaning and good weaner management on the breeder herd include:

- better overall breeder condition
- higher conception rates
- fewer mortalities
- lower cost of supplements for breeders
- more females for sale
- more concentrated calving in continuously-mated herds
- more maiden heifers heavy enough to mate.

Extra costs will include:

- more expensive supplementary feed
- more labour for tending small weaners
- increased infrastructure for yarding and feeding weaners.

Protein supplementation impact on weaners

To estimate the impact of supplementing weaners with protein over the dry season, a hypothetical herd located in the Victoria River District of the NT was modelled. The herd was continuously mated, predominantly producing high-grade *Bos indicus* steers for the live export trade, and grazed native pastures on phosphorus deficient soils. The size and structure of the herd were based on survey data from *The Australian beef report* (Holmes & McLean, 2017).

Weaners in the 'base' herd were offered a non-protein nitrogen supplement in the first dry season after weaning (180-day supplementation period) and a phosphorus (P) supplement (50g/head/day of a 10% P loose lick) in the first wet season after weaning (150-day supplementation).

Weaned heifers and steers in the treatment herd were offered 5g/kg LW/day of a protein meal-based supplement for 180 days over the dry season after weaning to gain an increase of 0.3kg/day.

Over the first dry season after weaning, weaners that were supplemented with protein (the treatment group) gained 54kg and 27kg when weaned in June and September respectively.

In contrast, the 'base' herd weaners did not gain any liveweight over the dry season. Weaners that receive no supplement at all usually lose weight over the dry season.

The whole-of-herd modelling demonstrated the protein supplement increased herd productivity. This was primarily due to two improvements.

Firstly, the reproductive performance of maiden heifers and first calf cows improved. This increased the percentage of calves weaned per cow mated and retained from 59–69.8%. By increasing the weaning percentage, there were more than 200 extra weaners per year from a smaller breeder herd (5,404 versus 6,037 mated and retained).

Secondly, increased growth rates over the dry season from protein supplementation resulted in a higher proportion of steers marketed after the first wet season. This allowed 71% of steers to be turned off before two-years-of-age, compared to 46.5% in the 'base' herd.

The economic benefit of this strategy depends on price received, the cost of the supplement, region, market strategy, and current level of performance.

No 'one recommendation' fits all situations

A sensitivity analysis at varying steer and protein prices can be conducted to make decisions as to when these strategies will be cost effective for specific circumstances.

The key management strategy is to ensure replacement heifers are selected on 'all' being pregnant at the 'right' time of the season.

Appendix 1 – feeds and feeding

Metabolisable energy requirements

Table 1: Metabolisable energy (ME) requirements (MJ/day) of cattle for maintenance and growth

ME of diet (MJ/kg DM)	Liveweight (kg)	Liveweight gain (kg/day)			
		0kg	+0.25kg	+0.50kg	+0.75kg
7	100kg	18 MJ/day	23 MJ/day	31 MJ/day	43 MJ/day
7	200kg	29 MJ/day	36 MJ/day	47 MJ/day	62 MJ/day
9	100kg	17 MJ/day	22 MJ/day	27 MJ/day	35 MJ/day
9	200kg	27 MJ/day	34 MJ/day	42 MJ/day	52 MJ/day
11	100kg	16 MJ/day	20 MJ/day	25 MJ/day	31 MJ/day
11	200kg	26 MJ/day	31 MJ/day	38 MJ/day	46 MJ/day

Protein requirements

Table 2: Rumen-degraded protein (RDP) and undegraded protein (UDP) requirements (g/day) of cattle for maintenance and growth

ME of diet (MJ/kg DM)	Liveweight (kg)	Form of protein	Liveweight gain (kg/day)			
			0kg	+0.25kg	+0.50kg	+0.75kg
7	100kg	RDP	140 MJ/day	180 MJ/day	240 MJ/day	335 MJ/day
7		UDP			15 MJ/day	
7	200kg	RDP	225 MJ/day	285 MJ/day	365 MJ/day	485 MJ/day
9	100kg	RDP	130 MJ/day	165 MJ/day	215 MJ/day	275 MJ/day
9		UDP		5 MJ/day	35 MJ/day	50 MJ/day
9	200kg	RDP	210 MJ/day	260 MJ/day	325 MJ/day	405 MJ/day
11	100kg	RDP	125 MJ/day	155 MJ/day	195 MJ/day	240 MJ/day
11		UDP		15 MJ/day	50 MJ/day	80 MJ/day
11	200kg	RDP	200 MJ/day	245 MJ/day	295 MJ/day	360 MJ/day

Note: The requirements for undegraded protein increase as the growth rate increases. They then decrease.
When enough energy is fed for high growth rates, the rumen microbes can produce enough protein to meet the animal's requirements.

Table 3: General description of protein and energy supplement mixes

Grain-based supplements supplying protein and energy	Fortified molasses-based supplements supplying protein and energy	Protein supplements
Dairy flakes Calf crumbles Weaner pellets Weaner meals Grain mixes	**Mixes with energy and non-protein-nitrogen (NPN)** Molasses + 4% urea (M4U) Molasses + 8% urea (M8U) **Mixes with energy and true protein Molasses** + 3–4% urea + 5–10% protein meal (MUP) Molasses + 10–15% protein meal (MP)	**All vegetable protein meals alone** Copra meal, cotton seed meal, palm kernal extract/ meal, soybean meal **Dry licks, blocks and liquid supplements** These supplements provide protein mainly from urea (NPN) – licks and blocks may include some protein meal, grain or molasses to improve palatability

Some sources of protein and energy

Table 4: Examples of protein and energy sources

Protein	Protein plus energy	Energy plus protein	Energy
NPN – urea, Gran-Am, sulphate of ammonia No by-pass protein with NPN	Protein meals Whole cotton seed Lupins	Grain Whole cotton seed Lupins	Molasses

Table 5: Nutrient composition of feeds used as supplements (note – as fed basis, not dry matter)

Product	Dry matter (%)	Met energy (MJ/kg)	CP (%)	Bypass protein (%)*	Ca (%)	P (%)
Cotton seed meal (solvent-extracted)	90	9.8	37	43	0.2	1.2
Canola meal (solvent-extracted)	91	9.7	34	28	0.6	0.8
Soybean meal (solvent-extracted)	90	11.0	45	35	0.2	0.8
Sunflower meal (solvent-extracted)	89	8.0	32	26	0.4	0.9
Barley	89	11.3	12	27	0.1	0.3
Corn	88	10.8	8	52	0.2	0.3
Oats	89	9.1	9	20	0.1	0.3
Sorghum	88	10.6	10	57	0.0	0.3
Wheat	89	10.7	12	22	0.1	0.3
Copra (expellor-extracted)	90	10.8	21	56	0.0	0.5
Peanut meal	90	10.8	41	16	0.1	0.7
Whole cotton seed	91	13.1	21	30	0.2	0.7
Palm kernel meal (expellor-extracted)	91	10.5	19	9	0.2	0.2
Lupin (sweet)	91	10.1	30	35	0.2	0.3
Lupin (albus)	91	10.8	36	35	0.2	0.3
Chickpeas	91	10.0	20	22	0.1	–
Mung beans	90	13.0	25	23	0.1	0.2
Faba beans	90	10.7	24	20	0.1	0.5
Linseed	90	12.1	37	40	0.5	0.9
Cotton hulls	91	5.2	4	30	0.1	0.1
Sunflower hulls	90	4.5	4	30	0.3	0.1
Molasses	75	8.7	4	-	0.9	0.1

*Percent of the crude protein; by-pass protein is included in the total crude protein. Analysis of meals may vary depending on the processing method.

Table 6: Nutrient composition of common feed additives

Additive	Phosphorus (%)	Calcium (%)	Sulphur (%)	Nitrogen (%)	Protein equivalent (%)	Sodium (%)
Urea	–	–	–	46	287	–
Gran-Am	–	–	24	20	126	–
Liquifert P (tech. grade MAP)	26	–	–	12	75	–
Sulfur (flowers of sulphur)	–	–	99.5	–	–	–
Dicalciumphosphate	17.5	23	1	–	–	–
Kynofos 21	21	18	–	–	–	–
Phosphoric acid (food grade)	26	–	–	–	–	–
Limestone	–	38	–	–	–	–
Salt	–	–	–	–	–	40
Zeolite	–	–	–	–	–	–
Bentonite	–	–	–	–	–	–

Table 7: Rations for weaners

Liveweight (kg)	Daily gain (kg/hd/day)	Nutrient requirements			Possible supplement	Amount to feed
		Protein (g/day)		Energy (MJ ME/day)		
		Rumen degraded	By-pass			
100	0.25	165	5	22	Cotton seed meal (CSM) OR Grain + protein meal mix*	1kg CSM + 1.5kg grassy lucerne hay 1kg + 1.5kg grassy lucerne hay
150	0.25	210	5	28	CSM OR Grain + protein meal mix*	2kg + 1kg grassy lucerne hay 2kg + 1kg grassy lucerne hay

*This mix is made up of two parts of barley grain and one part of CSM.

Table 8: Some typical container weights

Container	Molasses*	Urea	Cotton seed meal	Grain	Gran-AM	Salt (medium-coarse)
20L container	27	15.5	13.5	11.5	18	24
9L or 2 gallon bucket	13	8.5	7	6	8	11
5L or 1 gallon bucket	6.5	4	3	3	4.5	5
4L square ice cream container	4.5	3	2.5	2	3.5	4

*Actual weights of molasses are higher as about 10% stays in the container unless it is drained for a long time. Molasses weighs approximately 1.4kg per litre (6.5kg per gallon). These weights are a guide only; check your own measuring containers. Accurate weighing will provide the most cost-effective supplementation.

Appendix 2 – ration calculation

Calculating cost of dry matter and nutrients

Dry matter

How much dry matter in 1kg of feed?

$$\frac{Weight\ of\ feed \times \%\ DM}{100} = \frac{1kg \times 90}{100} = 0.9kg$$

How much to feed to get 1kg of dry matter?

$$\frac{Weight\ of\ DM\ required \times 100}{\%\ DM} = \frac{1kg \times 100}{90} = 1.1kg$$

Cost of 1 tonne of dry matter

$$\frac{(1\ tonne \times 100) \times cost/tonne\ as\ purchased}{\%\ DM} = \frac{1 \times 100 \times \$600}{90}$$

$$= 1.1 \times \$600 = \$660\ per\ tonne\ of\ DM$$

$ per tonne to ¢ per kg

$$\frac{Cost/tonne\ (in\ cents)}{1000} = \frac{66{,}000c}{1000} = 66c$$

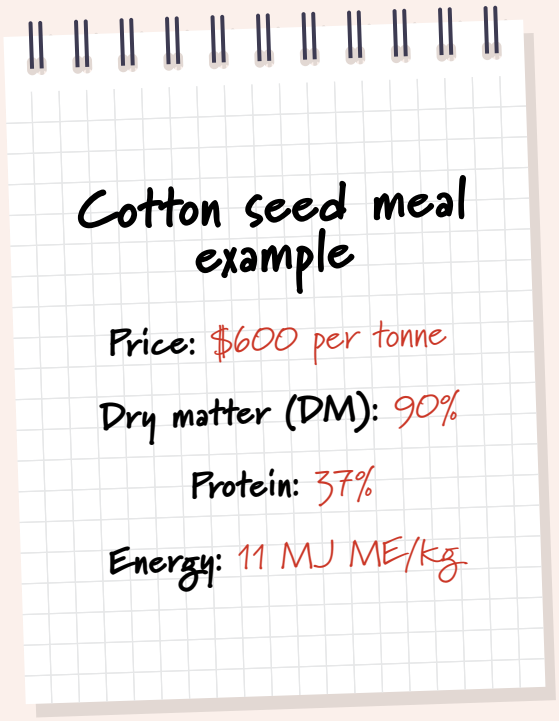
Nutrient

Cost per kg of nutrient (on dry matter basis) eg protein

$$\frac{Cost/kg\ of\ DM \times 100}{\%\ of\ nutrient} = \frac{66 \times 100}{37} = 178c/kg$$

Cost of 75g protein

$$\frac{Cost\ of\ 1kg\ of\ protein \times 75}{1000} = \frac{178 \times 75}{1000} = 13.35c$$



Cost of a ration

Table 9: Cost of ration using molasses, urea and cotton seed meal as an example

Container	Price $/tonne	%	Weight (kg)	Cost ($)
Molasses	200	87	870	174
Urea	700	3	30	21
Cotton seed meal	600	10	100	60

Note: Total cost per tonne = $255, cost per kg = 25.5¢.

Cost of supplementing

Table 10: Cost of supplementing 500 weaners as an example

Number of weaners	500	Cost of supplement	$500/tonne = $0.50/kg
Supplement period	May–October*	1kg pellets/day 150 days	$0.50/kg x 150 days = $75.00
Number of days	150*	500 weaners 150 days	500 weaners x $75.00 = $37,500.00
Supplement	Pellets for 120 days* (20% protein)	Total cost	$37,000

*These figures are assumptions for the purpose of the calculation. Use your own figures for length of feeding period and price per tonne .
**These figures are calculated. Cost of labour is not included.

Appendix 3 – major diseases affecting weaners

Table 11: Major diseases affecting weaners

Risk and cause	Signs and symptoms	Vaccination program	Management
Botulism			
The most important disease in phosphorus deficient regions: ■ potentially high mortality rates ■ infection through bone and carcase chewing ■ no treatment available	■ sudden death ■ animals go off feed and water ■ slow, progressive paralysis (inability to retract tongue), difficulty breathing, lie on brisket with hind legs stretched out	■ initial vaccination at branding or weaning four to six weeks apart followed by annual booster OR ■ one vaccination of long-acting vaccine and a booster two to three years later, as specified by manufacturer	■ supplement with phosphorus ■ where practical remove and burn carcasses and carrion, particularly where animals commonly congregate, such as near watering points.
Clostridial diseases – 5-in-1/7-in-1			
Found everywhere – spores survive in soil indefinitely. ■ Tetanus – prevalence low but usually fatal, most often seen after castration and branding ■ Blackleg – highly fatal – common on recently flooded country – young stock ■ Pulpy kidney – highly fatal disease – commonly seen after change to concentrate feeding – is a common risk for stock entering a feedlot ■ Gas gangrene – severe wound infection associated with surgical procedures ■ Black disease – associated with liver fluke infections	■ usually sudden death ■ associated with anaerobic infection i.e. puncture wounds, muscle damage	■ manufacturer's recommendation is two shots four to six weeks apart – not always possible ■ vaccinate all animals >2-months-of-age whenever possible – even if done at branding ■ ensure all animals have had at least one 5-in-1 or 7-in-1 shot at weaning	■ problem worst in some yards ■ dust control may help but vaccination is the best approach ■ vaccination is essential for stock entering a feedlot.
Vibriosis			
■ venereal disease – causes infertility, early abortion and delayed conceptions ■ widespread disease ■ highest economic loss in controlled mated herds	■ usually no clinical signs ■ poor conception rates – especially maiden heifers ■ delayed conceptions ■ repeat return to service	■ vaccination usually commences in replacement heifers only and prior to joining ■ killed vaccine – usually two shots four to six weeks apart	■ cull all empty breeders ■ join maiden bulls with maiden heifers ■ vaccinate all bulls ■ vaccinate all weaner heifers going into the breeding herd ■ vibriosis is often brought into a herd by neighbours' bulls.
Leptospirosis			
■ widespread disease throughout Australia ■ organism passed in urine – survives in melon holes and swamps – associated with wild pigs and rats	■ abortions in breeding females ■ in younger cattle, fever, inappetance, pass red urine, jaundice	■ vaccinate heifers at weaning; initially, two vaccinations four to six weeks apart with annual booster at pregnancy testing ■ killed vaccine – immunity relatively short lived	■ losses between pregnancy test and weaning indicate problem ■ diagnosis often difficult if vaccination occurring ■ workplace health and safety (WHS) considerations.

Risk and cause	Signs and symptoms	Vaccination program	Management
Pestivirus/Bovine viral diarrhoea (BVD)			
■ widespread throughout Australia ■ problems occur when carrier animals introduced to susceptible pregnant breeders	■ can cause abortion, dummy calf syndrome and infertility in breeding cattle ■ transient disease in all other classes of animals ■ immuno-suppressant disease that leads to increased respiratory disease in feedlots	■ assess risk – studs and cattle traders have the highest risk ■ vaccinate replacement heifers in high risk situations ■ vaccinate animals prior to feedlot entry	■ natural infection provides permanent immunity ■ quarantine all new cattle introductions – pregnant cows biggest risk ■ test new bulls for persistent infections to prevent spread.
Bovine ephemeral fever (Three-day sickness)			
■ endemic in far north of Australia and along coast ■ spreads south with big wet seasons ■ mostly affects younger animals ■ natural infection provides good immunity	■ temporary loss of condition ■ lameness ■ muscular stiffness ■ recumbency ■ occasional death ■ affected bulls are infertile for a minimum of six weeks, up to a lifetime	■ frozen vaccine – immunity not permanent ■ weaners seldom vaccinated except perhaps yearling replacement heifers ■ vaccinate all older steers in latter stages of finishing if no previous exposure ■ vaccinate all bulls ■ two vaccinations initially, two to four weeks apart, with an annual booster	■ bulls must be vaccinated at least two months prior to joining ■ sandflies/biting midges transmit the disease ■ disease alerts often provide early warning.
Bentonite			
■ transmitted by cattle tick ■ calves usually acquire immunity at birth which wanes by weaning	■ loss of condition ■ fever ■ weakness ■ jaundice ■ brown urine ■ death	■ live vaccine ■ best administered at weaning ■ vaccine may cause clinical signs ■ risk highest in marginal and low tick regions	■ vaccinate animals moving from clean to ticky country ■ cattle can be vaccinated prior to movement, providing that they are settled into their new paddocks and not disturbed within three days of vaccinating ■ where animals get ill from tick fever, treat with Imizol®.

Notes

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