

Weaner throughput

Key actions

- ✓ Assess the fertility and fecundity of your herd using cow condition score and heifer liveweight.
- ✓ Select cows capable of conceiving within two mating cycles.
- ✓ Select healthy fertile bulls for mating to achieve normal conception rates and a condensed calving pattern.
- ✓ Supervise calving to increase live calves born.
- ✓ After weaning cull cows needing intensive calving assistance.
- ✓ Use age, weight and condition score of calves as indicators for earlier weaning.
- ✓ Aim to wean calves when the efficiency of pasture use is greater for the calf alone than the cow–calf combination.
- ✓ Use yard weaning to lift cattle productivity.

Introduction

Why is maximising weaner throughput important?

Increasing the number of cattle sold each year has a major impact on the profitability of southern beef enterprises. Sales from a beef business include stock bred on the property, cull cows and any purchased trading stock.

There are two main components of weaner throughput:

1. The number of weaners produced and the total saleable kilograms of product from the enterprise.
2. The stocking rate (discussed in *Module 1: Setting directions*, *Module 2: Tactical stock control*, and *Module 4: Pasture utilisation*).

The cow culling policy also contributes a significant financial return for southern beef enterprises.

*Increase
throughput to
increase profit*

Fecundity (the number of live calves per breeding female) is not discussed in this module despite its potential impact on the throughput of weaners and saleable product. There are currently no commercially viable means to increase twinning in Australian commercial beef herds and, unless a high proportion of the herd has twins, the costs involved will not warrant adoption of a high-fecundity strategy.

How does this module assist you?

This module will help you:

- Increase the throughput of weaners bred on your property; and
- Manage your culling strategy for weaner heifers and mature cows.

The information in this module will help you with the management of selected animals before mating right through to the weaning stage.

Linkages to other modules

The throughput of animals is also linked with issues discussed in *Module 1: Setting directions*, *Module 2: Tactical stock control* and *Module 8: Meeting market specifications*.

Post-weaning management of progeny and the treatment of cull animals are incorporated into *Module 8: Meeting market specifications*. Genetic improvement of fertility, mothering ability and growth are discussed in *Module 5: Cattle genetics*.

The management of common reproductive diseases that infect beef herds is outlined in *Module 7: Herd health and welfare*.



Principles of maximising weaner throughput

Manage the herd to maximise fertility and weaner throughput.

Manage livestock growth by allocating high quality pasture to sale cattle.

Minimise the total consumption of pasture by the breeding herd, while still ensuring access to sufficient quality and quantity of pasture by cows and calves.

Manage weaner cattle to achieve target growth rates and good herd temperament.

Procedures for maximising weaner throughput

Procedure 1

Maximise the number of live calves per breeding female and minimise infertility in cows and bulls.



Procedure 2

Control the mating period to reduce calving spread and to maintain selected annual calving date(s).



Procedure 3

Wean as early as possible, without compromising calf growth rate.



Procedure 4

Implement a female culling and replacement policy to minimise pasture use by breeders and maintain the best herd structure.

Procedure 1

Maximise the number of live calves per breeding female

1.1 Managing cows for high fertility

Guidelines for managing cows to achieve high fertility

Use cow condition score and heifer liveweight as indicators of herd fertility

The key indicators of reproductive performance are body condition score for cows and liveweight for heifers. Birth weight can also have a direct bearing on the number of live calves born. To increase conception rates it is important to join females on a rising plane of nutrition. Condition score (or fat score) is a useful way to observe a change in the nutrition of cows, however the absolute score numbers and the relationships with fertility can differ between cattle breeds.

Guidelines for the minimum and maximum mating values for British breed heifers and cows are:

Minimum:

- Heifers – joining liveweight of 280kg, condition score 3 at 15 months of age (see Tool 6.1 for a guide to minimum joining liveweight)
- Mature cows – condition score 2.5 (see Tool 6.2)
- First calf cows – condition score 3.0

Maximum:

- Condition score 3.5

If the breeding herd is outside these recommended guidelines:

- Increase or decrease pasture available and/or pasture quality before mating to ensure condition score of cows or liveweight of weaner heifers remains within the recommended limits.
- Wean calves before cow condition score falls to 2.5.
- Supplementary feed a high quality diet to cows when condition score is below 2.0.
- Supplementary feed heifers (perhaps including the use of a rumen non-degradable protein source if pasture quality is low) to ensure they reach target weight (see Tool 6.1).
- Assess animal health status, particularly for internal parasites (worms and fluke), and treat if there is a problem as described in *Module 7: Herd health and welfare*.
- Cull weaner heifers that fail to reach target liveweight or get in calf in two mating cycles.

EBVs also have a role in breeding for herd fertility:

- Selecting sires with a high EBV for scrotal circumference results in earlier onset of puberty.
- Days to calving EBV will also help in decreasing the interval between calving and conception.
- Calving difficulties are reduced by selecting sires with a low score EBV for gestation length, and birth weight.
- If the phenotype of the herd, especially heifers, is high yielding (ie Euro type) they tend to cycle later.

Artificial insemination as a mating option

If artificial insemination (AI) is used, the correct procedures are required to ensure high conception and calving rates. Results from an AI program are optimised by managing:

- **Cow/heifer selection.** All females in an AI program must be on a rising plane of nutrition. As a guide to best results, maiden heifers are under less stress than mature cows, but mature cows are easier to get in calf than first time calvers.
- **Heat detection.** The accurate detection of standing heat and the resulting timing of insemination are critical to the success of an AI program. Clear identification of individual animals, record keeping, visual observation for signs of heat and where necessary the use of heat detection aids are all critical factors in an AI program.
- **Synchronisation of oestrus.** This saves time and labour but it will only work on cattle that are actively cycling. There are two basic types of synchronisation:
 - Prostaglandins – a hormone (administered by injection) that shortens the reproductive cycle;
 - Progesterone implants – placed under the skin behind the ear or in the vagina. The implants are usually left in place for 11 days. This postpones the onset of oestrus until two days after removal.
- **Care when handling semen.** Semen is a live biological product that must be handled correctly. It is susceptible to temperature shock and exposure to sunlight, water, blood and poor hygiene.
- **Insemination technique.** The retro/vaginal technique of insemination gives the best results.

If an AI program is being considered, carefully assess the benefits and costs of the options. Calculate the costs of the various options in terms of \$ per calf born to enable a comparison of mating systems. Attending a special AI training course is also recommended to gain the knowledge and skills to obtain the best results.

Use Tool 4.5 of *Module 4: Pasture utilisation* as the basis for determining how pasture can be successfully turned into animal products to profit the farm business. Strategies in *Module 4* enable you to more precisely manage the conversion of pasture energy and nutrients to saleable beef product while leaving pasture residue in an optimum condition for rapid regrowth. It also better matches the seasonal feed supply with beef enterprise opportunities and business objectives.

Manage fertility to maintain a calving interval <365 days

Cows with low fertility require more than two matings to conceive, making a 365-day calving interval difficult to maintain. This decreases the number of calves produced by the herd each year. When the number of calves per breeding female is below the herd genetic potential, the throughput of weaners and animals meeting market specifications is also reduced and enterprise profitability is likely to be below potential. The impacts will be greater when nutrition is marginal, and for females calving for the first time.

Select cows capable of conceiving within two mating cycles

Focus on improving fertility by feeding to ensure target liveweight for heifers and condition score for cows or risk maintaining high culling rates of infertile cows. High culling rates increase the number of replacement heifers required to maintain the herd breeding structure. This practice results in a higher proportion of quality pasture being used for maintenance of the breeding herd because of the amount of pasture needed to grow females up to first mating.

Purchase of in-calf heifers increases the risk of introducing infectious diseases and if these heifers are from an unknown genetic background, they may not be compatible with strategic business and breeding goals. Purchased heifers are also unlikely to match the planned calving period and could have higher rates of dystocia than mature cows.

What to measure and when

- Conception rates from natural mating or when an AI program is implemented;
- Condition score of cows at regular intervals according to the seasonal conditions – monitor after weaning of the last calves, from six weeks before calving, and then from calving to mating;
- Liveweight of weaner heifers every six weeks until mating.

The stock manager should also observe the breeding herd for evidence of female activity (cycling) prior to the commencement of mating.

Further information

Further information on supplementary feeding can be found on the websites of state departments of agriculture. NSW Agriculture is probably the best source for information on the use of non-degradable protein.

List of state departments of agriculture websites:

- New South Wales www.agric.nsw.gov.au
- Victoria www.dpi.vic.gov.au
- South Australia www.sardi.sa.gov.au
- Western Australia www.agric.wa.gov.au
- Tasmania www.dpiwe.tas.gov.au

1.2 Management of heifers and cows before calving

Guidelines for managing heifers and cows before calving

Careful management of female cattle in the build-up to calving pays dividends at calving time. Calf loss will be minimised and calving supervision can be kept to a minimum. Calving difficulties will be reduced by maintaining cow condition scores between 2.5 and 3.5; and minimum heifer liveweight at three, six and nine months post-conception are as specified for the various breeds and crosses in Tool 6.1.

Manage pre-calving carefully to minimise difficulties at calving

If females go outside these guidelines:

- Increase or decrease pasture available and/or pasture quality before calving to ensure condition score of cows or liveweight of weaner heifers remains within the guidelines. As a guide, manage British breed heifers to gain an average weight of 0.5 kg/day to a joining liveweight of 280kg, condition score 3 at 15 months.
- Consider supplementary feeding of a high quality diet to cows when condition score is below 2.0.
- Consider supplementary feeding of heifers, including the use of a protein source rich in rumen non-degradable protein, particularly if pasture is readily available but quality is low. This ensures weaner heifers gain weight at 0.5 kg/day to reach target weights at three, six and nine months post-conception, as defined in Tool 6.1.
- Assess animal health status, particularly for internal parasites (worms and fluke tend to be a greater problem in younger animals) and correct if there is a problem, as described in *Module 7: Herd health and welfare*.
- There is a balance required between:
 - Overfeeding (heifers in particular) in the last three months of pregnancy, as this will also increase birth weight of the calf; and
 - Underfeeding in the last month of pregnancy, as this will predispose to metabolic disorders like ketosis.

Poor nutritional management of heifers and cows before calving can lead to a number of significant problems:

- Dystocia in heifers, due to inadequate pelvic size for the foetus; and in mature cows, due to over-fatness and uterine inertia;
- Difficulties during the birth process may lead to still-born calves, inability of the mother to go back in calf, inability of the live calves to thrive, a reduced ability of resulting heifer calves to reach target weights at mating and possibly reduced mature weights as cows.
- Predisposition to various metabolic disorders, including milk fever (hypocalcaemia) and ketosis/pregnancy toxaemia, (see *Module 7: Herd health and welfare*) due to over and underfeeding of cows before calving.

Manage feed availability in the pre-calving period to avoid problems

What to measure and when

- Condition score of cows every 2 weeks from 12 weeks before calving;
- Weight and growth of heifers at three, six and nine months of pregnancy;

Use Tool 4.5 of *Module 4: Pasture utilisation* as the basis for successfully matching seasonal pasture supply to the feed requirements of heifers.

1.3 Manage bulls for high conception

Use two healthy fertile bulls per 100 cows for normal conception rates

Guidelines for managing bulls to achieve high conception

Carefully consider the number of bulls allocated to mating groups or herds. Insufficient bulls for the number of cows in a herd can lead to lower pregnancy rates and reduced throughput of animals meeting market specifications.

Bulls must be monitored closely during mating.

General guidelines for bull ratios are:

- Intensively managed southern herds – maximum 2 bulls/100 cows
- Extensive grazing, ie pastoral zone – maximum 4 bulls/100 cows
- The minimum is 2 bulls/100 cows or per herd

Single sire joining is widely practised in the southern beef industry and particular care needs to be taken to achieve high conception rates at every joining. Single bull mating reduces the risk of bull injury from fighting, but increases the potential for low calving percentages due to infertility or sudden loss of service ability. The following guidelines are suggested to reduce the risk:

- Assess all bulls every year prior to mating and only use those that pass assessment guidelines (as described in the *Bull physical soundness* box over the page).
- Join each bull to a maximum of 50 cows.
- There is no minimum, but joining sound bulls to less than 40 cows is wasteful and increases costs of bull purchases.
- Observe all herds weekly during the joining period to ensure that the bull is working and has not been injured during mating.
- Have bulls in reserve (at least 20%) to replace injured bulls as soon as they are identified and consider extending the joining period in that herd by one week (or the period between observations).

Take particular care of bulls when single sire mating

Manage bulls carefully pre-mating to achieve high conception rates

The management of bulls has a large impact on herd reproduction. Bulls with low fertility produce low conception rates. This leads to low pregnancy rates, reduces the throughput of weaners and animals meeting market specifications, and consequently reduces enterprise profitability. Additional costs may be incurred because of:

- The need to replace bulls more often; and
- The potential spread of infectious diseases that may reduce the fertility of cows and increase enterprise costs through treatment and/or eradication of the diseases.

Fertility can be significantly decreased by poor bull management

Common sources of low bull fertility and conception include:

- Bulls in poor condition two months prior to mating when the semen is produced;
- Insufficient effective bulls for the number of cows in the mating herd;
- Using too many bulls, which encourages fighting and is wasteful (but be sure to retain access to a replacement bull);
- Mixed ages of bulls in mating groups or mixing bulls shortly before or during mating, which can affect conception while dominance is being established;
- Large mating paddocks where bulls and cows become separated;
- Over-fat bulls (condition score 4 or 5) and unfit bulls due to lack of exercise. Over-fatness can interfere with the heat exchange function of the testicles resulting in infertility;
- Transporting bulls for some distance or feeding high grain supplements close to the start of mating.

Bull condition score

Body condition score is a key factor when monitoring the general health and nutritional well-being of bulls. It is also a means of assessing whether young bulls have been overfed before purchase and may fail semen and serving ability tests.

Aim to keep the condition scores of British breed bulls within the following ranges at start of mating, and then during mating:

- Minimum condition score 2.0
- Maximum condition score 3.5

Options for adjusting the condition scores of bulls include:

- Checking bull soundness at least two months before the start of mating. This allows nutritional adjustments to start with sufficient time to ensure target condition score and testicular size responses are met;
- Increasing or decreasing pasture available and or pasture quality for bulls before mating;
- Supplementary feeding with a diet containing at least 11.5 megajoules per kilogram when condition score is less than 2.0, and considering protein supplements to stimulate testicular development before mating; and
- Replacing bulls if condition score is below the suggested limit at the start of mating.

The ideal condition for a bull prior to mating is condition score 3

Bull physical soundness

Bulls that are about to be mated need to be assessed as being physically sound, not carrying reproductive infectious diseases, and having acceptable levels of libido and semen quality. Refer to the box below for bull assessment guidelines.

Assess bulls for physical soundness pre-mating

Bull assessment guidelines

Bulls must pass all physical tests specified in the Australian Association of Cattle Veterinarians' publication, 'Evaluating and Reporting Bull Fertility'. The physical attributes evaluated include:

- Front and hind feet claws and soles
- Angle of pasterns in front and hind legs
- Hind limb conformation from the side (normal, sickle hocked, post legged, swollen or puffy hocks)
- Hind limb conformation from rear (normal, bow legged, cow hocked)
- Stance and gait abnormalities
- Spine and limb defects
- Head examination from front and side for alignment, absence of swellings and normality of eyes
- Scrotal skin pliability, thickness and inflammation
- Scrotal palpations for fat, freedom of movement, head, body and tail of epididymis, shape of testes, hernias
- Prepuce, sheath and umbilicus
- Penis, including palpation through skin, protrusion of penis and examination of erect penis; there are a potentially large number of penile and prepuce abnormalities
- Infectious disease assessment as set out by the Australian Association of Cattle Veterinarians and summarised in *Module 7: Herd health and welfare*

Guidelines to minimum scrotal circumference in healthy bulls:

Age	<i>Bos taurus</i> bulls and <i>Bos indicus</i> -derived bulls	<i>Bos indicus</i> bulls
12–15 months	30cm	24cm
18 months	32cm	28cm
2 years and older	34cm	30cm

Serving ability

It is important to know the serving ability of each bull. The serving ability test is a useful procedure, but it does require a trained person to use careful application of animal husbandry skills to obtain a meaningful result. It is recommended that a local veterinarian carry out the test under approved guidelines.

A serving ability of 2 or 3 in 10 minutes is essential for high conception

Guidelines to serving ability:

- Minimum serving ability – 2 or 3 servings in 10 minutes
- Minimum time since bulls exposed to excessively hot conditions – 60 days before mating

Preparation of bulls for mating should include:

- Mating bulls of highest serving ability to heifers so that they get in calf at their first joining. Cows that calve early in their first season tend to be early calvers for the rest of their lives.
- Selecting bulls for mating that meet the specifications set out in the AACV publication, ‘Evaluating and Reporting Bull Fertility’ (see Tool 6.3);
- Ensuring access to at least one replacement bull (more in larger herds) from four weeks before mating begins;
- Planning mating groups eight weeks before joining and running bulls together before mating to allow social groupings to establish (mixing bulls either shortly before or during mating can reduce conception rate due to distraction when fighting, and possible injury to bulls);
- Vaccinating bulls with appropriate vaccine to keep the herd protected against diseases that affect fertility, as described in *Module 7: Herd health and welfare*.

Join high serving ability bulls with heifers

What to measure and when

- Ratio of bulls per 100 cows before mating each year;
- Body condition score weekly from eight weeks before mating until the end of mating;
- Physical and health check-up at eight to four weeks before and at start of mating; and weekly during mating;
- Semen examination at eight and four weeks before, and then at mating when infertility is suspected;
- Libido tests completed once at eight to four weeks before mating;
- Calving histogram prior to mating (see Tool 6.4).

1.4 Pregnancy diagnosis

Guidelines to implementing pregnancy diagnosis

Aim to conduct a pregnancy diagnosis as soon as possible after either the maximum number of days from the last day of mating has been exceeded, or calves have been weaned from the cows (except in drought when calves have been weaned earlier (see Procedure 3 for guidelines).

Schedule pregnancy diagnosis at the appropriate time for accuracy

Recommended guidelines for timing of pregnancy testing and diagnosis are:

Heifers

- Ultrasound technology:
Minimum – 22–35 days after last day of mating.
- or
- Manual palpation:
Minimum – 35–50 days after last day of mating.

Cows with calves

- 50 days after last day of mating.
- or
- At weaning, at the very latest.

Cull all non-pregnant cows and assess and record reasons for failure to conceive to aid future management decisions.

Use pregnancy diagnosis to cull all empty cows

It is important that pregnancy diagnosis is conducted at the correct time so that infertile heifers can be culled from the herd before they consume valuable high quality pasture. This feed is required by growing animals to increase the throughput of saleable product meeting market specifications.

What to measure and when

- Check for presence of a foetus (or twins) on day of pregnancy diagnosis.
- Estimate age of foetus to allow plotting of calving pattern. This will assist with labour planning for calving supervision.

1.5 Supervise heifer (and twin) calving

Guidelines to supervising heifer (and twin) calving

Calving difficulties in beef heifers can be a major source of financial loss, with calf death rate up to 10% and in some cases death of the cow. Other costs associated with calving difficulty include labour for supervision and assistance, veterinary fees and the overall reduction of the herd fertility.

As a guide assist at the birth of a calf in the following instances:

Heifers with a single calf

- Maximum of two hours after the 'waters have broken', membranes showing or the heifer is actively engaged in labour.

Cows with twin calves

Supervise calving to increase live calves born

- Maximum for first calf to be born – four hours after the ‘waters have broken’, membranes showing or the cow is actively engaged in labour;
- Maximum after birth of the first calf and before second calf – two hours.

Calve heifers between condition score 2.5 and 3.0 and have them in good physical condition at calving. If the calving of heifers (or cows with twins) is not carefully supervised, difficulties may occur during the birth process with the following consequences:

Ensure heifers are in good physical condition at calving

- The number of still-born calves may increase;
- Calves may fail to thrive;
- Cows may die or be injured;
- Foetal membranes, particularly in twin-bearing cows, may be retained, become infected and so reduce future fertility;
- Veterinary costs are likely to increase.

When a difficult calving occurs, provide assistance in the birth process to improve the chance of cow and calf survival. It is recommended that heifers or cows bearing single calves that need assistance during calving are culled after their calves have been weaned. When calving difficulties (dystocia) are a sufficiently large issue (as judged by the percentage of heifers and/or cows experiencing difficulties), or there is a high percentage of still-born calves, and/or there is considerable time required to assist heifers and cows experiencing difficulties, take action to consider:

Cows needing intensive calving assistance should be culled after weaning

- Including ‘calving ease’ as a major part of the enterprise breeding objective when selecting bulls for mating (refer to *Module 5: Cattle genetics* for information on setting breeding objectives);
- Changing the nutritional management of heifers, particularly leading up to calving as outlined above in Procedure 1.2.

If excessive time is being allocated to calving management consider the high cost of labour against the benefits of additional calves born.

Mature cows

Mature cows should not need assistance at calving as the cost of labour outweighs the benefits. Aim for cow condition scores between 2.5 and 3.5 and a minimum of 1,500kg green DM/ha in calving paddocks to minimise weight loss in cows and a satisfactory milk production for calves.

What to measure and when

- Twice-daily routine observations, then two-hourly once a cow is actively engaged in labour;
- Take particular note of the number of hours since ‘waters have broken’, membranes showing, or the cow is actively engaged in labour;
- Where calving supervision is excessive, revisit the breeding objectives and birth weight EBV of bulls and cows. Some breeds also provide EBVs for calving ease.

1.6 Managing pregnant cows after weaning until 12 weeks before calving

Guidelines to managing pregnant cows from weaning to calving

Aim to have cows with condition scores in the range of 2.5–3.5 in the period from weaning until 12 weeks before calving. If they go outside this range the options are to:

- Manage pasture available and/or pasture quality after weaning to ensure body condition score remains within the above limits (refer to *Module 4: Pasture utilisation* for guidelines);
- Use weaned cows as a management tool to utilise poor-quality pasture or to reduce pasture mass in areas destined for pasture manipulation and renovation (refer to *Module 3: Pasture growth* for guidelines).

Maintain cows in condition score 2.5–3.5 from weaning to pre-calving

An excess of high quality feed during pregnancy can cause cows to become over-fat before calving and result in greater foetal size, increasing the incidence of dystocia and metabolic disorders. Also if cows are grazed for too long on high quality feed while they have low energy requirements, they are grazing quality pasture that is better used by animals destined for sale.

What to measure and when

As a guide, make a monthly assessment of the body condition score of cows after weaning until 12 weeks before calving.

Use Tool 4.5 of *Module 4: Pasture utilisation* as the basis for successfully budgeting seasonal pasture supply between cows, heifers and sale cattle feed requirements.



Procedure 2

Control the mating period to reduce the spread of calving dates and to maintain selected annual calving date(s)

Aim for 95% cows calving in a 9-week period

Guidelines for reducing the spread of calving

Commercial beef producers who are striving for maximum efficiency should be aiming for 95% of cows to calve in a 9-week period. This procedure explores the date of removal of bulls or the duration of mating to reduce the spread of calving and to sustain the annual calving date(s). The start of mating is determined in *Module 1: Setting directions*.

The ideal calving distribution should consist of 65% of calves dropped in the first three weeks, followed by 20% and 10% in the two subsequent three-week periods respectively. With this level of reproductive efficiency you will produce an even line of calves of roughly the same age making them easier to manage and market. To achieve this, guidelines for the length of mating period are:

- Maximum – bulls run with cows for 60 days;
- Minimum – bulls run with cows for 45 days. When the bulls are not run with the cows for long enough, calving percentage is decreased.

These recommendations allow all females to have a minimum of two oestrus cycles during mating. The limits can also be applied strictly for heifers.

When the bulls are run with the cows for too long, the period of calving is also too long and results in:

- A reduced ability to maintain a 365-day calving interval;
- An unnecessary increase in the use of high quality pasture by the breeding herd and a reduced amount available for growing stock;
- Difficulty in obtaining the required mating weight at the nominated mating date for heifers that conceive later in the mating period, an increase in heifer culling and difficulty in maintaining the desired herd age structure;
- An increase in the cost of supervision of calving from heifers (and cows with twins);
- A spread in calf weights that will delay weaning date until the lightest calves reach target weight; and
- A large spread in weaning weights that can lead to problems such as calf marking and associated husbandry procedures when seasonal conditions are less favourable.

To achieve the recommended mating periods, apply these rules:

- Manage the mating so that 80% of cows conceive by the end of the second oestrus (heat) cycle.
- Remove bulls when the maximum period is reached, providing that the assessment of calving patterns indicates that a 60-day joining is sufficient for a satisfactory pregnancy rate.
- Adopt a strategy to realign the herd's calving pattern when more than 20% of the cows are conceiving on the third cycle (see the Changing calving time box below).
- Do not use the same bulls in succeeding seasons if the mating histogram shows more than 40% of cows are not conceiving at the first mating. Refer to the previous sections on cow and bull fertility if this happens.

Aim for 80% of cows conceiving by end of 2nd oestrus cycle

As a guide, if a calving date histogram of the herd (see Tool 6.4) in the previous year shows that more than 20% of cows conceived in the third cycle, the reproductive capacity and age structure of the herd will need to be realigned over several years to avoid economic penalties for the enterprise.

Take corrective action when >20% cows conceive in 3rd cycle

The recommended minimum and maximum number of mating days is based on the assumption that more than 80% of cows conceived by the second oestrus cycle in the previous year's mating. If less than 80% of cows conceived by the end of the second oestrus cycle in the previous year, initiate a program to realign the herd's calving pattern. In this case the mating period may need to be extended beyond the recommended maximum limit to ensure satisfactory throughput in the short-term.

Changing calving time

The calving pattern of cows is very repeatable and it is difficult to bring the date of calving for late-calving cows forward by more than a three-week cycle per year without risking an unacceptably high rate of empty cows.

Where it is necessary to move the calving date forward by more than six weeks (over two years) it is best to leave the current cow herd in its established calving pattern and join the replacement heifers to calve at the desired calving time and period. As the number of young breeders (calving at the desired time) builds up, the older, out-of-sequence cows can be culled. After about five years, the herd will be calving at the required time over two heat cycles with minimal risk of low conception rates.

What to measure and when

- Record the date on which each cow calved to develop the 'calving histogram' (see Tool 6.4).
- Record the number of days that bulls are with cows.

Ensure that the investment of labour to record information on calving patterns and difficulties benefits the breeding operation.

Procedure 3

Wean as early as possible, without compromising overall calf growth rate

3.1 Determine the weaning age of calves

Guidelines to determining the best calf weaning age

As a principle, the sooner calves are weaned the greater will be the potential turnoff of young cattle. Earlier weaning age is the single most important way to increase weaner throughput.

The keys to maximising the benefits of weaning age to throughput and productivity are to:

- Identify the time when the efficiency of pasture use will be greater for the calf alone than for the cow and calf together. This is normally around six months into lactation when the higher quality pasture required to maintain cows and produce a relatively small amount of milk is better consumed directly by the weaned calf.
- Implement a weaning strategy that ensures no check occurs in calf growth.

These management practices need to be in place when weaning as early as possible and without compromising the overall calf growth rate.

In southern Australia, current industry practice is to wean calves between six and nine months of age.

Weaning age and projected liveweight gains post-weaning depend on pasture availability and quality. Ideally, weaning needs to take place when pasture height and availability are best for maximum intake by the weaned calf and the pasture has a nutritional quality of more than 11.5 megajoules per kilogram of dry matter (MJ ME/kg DM) and at least 15% crude protein. When weaning in summer, use the best available dry pasture for the weaners.

In general, use the combination of age and weight of calves, and condition score of cows, as the basis for a decision to wean calves as early as possible. This is particularly important when there is a limited quantity of high quality pasture available. Determine your weaning strategy based on the following guidelines:

- Minimum age – 100 days from when the last calf was born, and weight of the lightest calves in the group is at least 100kg. Weaning calves too early can result in calf deaths, reduced ability to thrive and reduced throughput of saleable animals;
- Maximum age – 6 months old depending on the season and quality of pasture available;
- When cow condition score reaches 2.5. If weaning is too late, the loss in cow condition score can be so great that fertility is reduced at the subsequent joining.

Refer to Tool 6.5 for the relationship between weaning age and liveweights for three growth rates relative to pasture quality in British breed cattle.

Wean calves when pasture use is better for calf alone than cow-calf combination

Use high quality weaner pastures for rapid animal growth

Use calf age, weight and cow condition score as indicators to earlier weaning

If female calves destined to become replacement heifers are over-fed and become over-fat or are weaned too late, 'fatty udder' syndrome can occur, resulting in reduced milking ability when they rear their own calves. If heifers deposit fat instead of building muscle or frame size the genetic parameters need to be altered in the breeding objective for the herd.

Early weaning

Early weaning is a useful management strategy in drought. It is also a tactic of disease control that requires the separation of cows and calves, eg in a Bovine Johne's Disease management program. Early weaning may also be the best management option when the liveweight and condition score of the cow and calf could benefit from weaning, for example with first calf heifers, older age or broken mouth cows.

To make an earlier weaning strategy worthwhile in normal seasons, the additional pasture (resulting from reduced consumption by lactating cows) needs to be utilised by increasing the number of calves reared or by other avenues (such as purchased growing stock) to achieve an increased throughput of saleable product.

Early weaning is a useful drought management strategy

Pasture saved by early weaning needs to be utilised by additional growing stock

Early weaning as a management option

Early weaning is a management strategy that can be implemented to improve throughput of sale.

Many experiments have shown that beef calves can be weaned successfully at 100 days of age and from weights as low as 100kg provided they are offered high quality feed. The feed offered to early weaned calves must be of high nutritional quality and contain more than 11.5 MJ ME/kg DM and at least 15% crude protein.

Several experiments have also shown higher performance and better meat quality from early-weaned calves when compared with conventionally weaned animals. Earlier weaning of calves provides substantial benefits to the cows through reduced weight loss during lactation with higher body condition scores and significantly shorter calving intervals.

What to measure and when

- Age and weight of calves at 100 days from when the last calf was born (see Tool 6.5 for projected growth paths);
- Any harmful effect on cow health and udder damage to high milk yield cows;
- Quality and quantity of pasture available for weaned calves (at least 11.5 MJ/kg DM and 15% crude protein) – assess weekly immediately before the proposed weaning time, and then following weaning.

Note: The predicted effect on enterprise profitability from earlier weaning and better utilisation of available pasture by animals destined for sale can be determined in relation to variation in weaning age within Tool 1.1 and Tool 1.2 of *Module 1: Setting directions*.

3.2 Weaning of calves

Guidelines to yard weaning calves

Use dedicated yards to wean calves

Industry best practice has proven that yard weaning is a simple and effective procedure that has implications for lifting cattle productivity.

Weaning is an important learning phase for cattle

Cattle that are yard weaned are more familiar with stock yards, water troughs, feeding routines and people. By exploiting the fact that weaning is a critical learning time, young cattle can be well prepared for a productive future. Yard weaned groups of cattle also have the major advantage of having stronger social bonds between individuals. While training cattle during yard weaning, their individual temperament (confidence) can be assessed, and flighty (shy) cattle can be identified for removal or special treatment.

The benefits of yard weaning are fully realised if cattle later go on to feedlots. In the feedlot, a healthy and productive feeder steer has to:

- Accept confinement and go on to concentrate feed and water quickly;
- Adapt easily to the initial social/psychological and metabolic stress involved;
- Achieve high feed conversion rates and weight gain through good adaptation individually and as a feeding group;
- Have strong resistance to respiratory disease, partly as a result of social compliance and group cohesion; and
- Accept the presence of people, vehicles and horses at close quarters.

Guide to yard weaning

The following requirements must be met to implement yard weaning as a management tool:

- Well built, weaner-proof yards with solid opaque pen sides (rubber belting 1.2m wide is ideal);
- A reasonably sloped, well drained, non-bog surface;
- Pen stocking density of 4m²/head for 180–260kg calves; and 2.5m²/head for 100–170kg early-weaned calves;
- Weaners kept in the yards for 5–10 days (with the aim to have the majority back onto high quality pastures as quickly as possible);
- Cattle fed daily with high quality hay or silage (at least 11.5 MJ ME /kg DM and 15 % crude protein) – the feed does not need to be supplied in a bunk or trough and can be successfully fed through a round bale feeder;
- Good quality drinking water supplied in a trough;
- Shy feeders removed and managed as a separate group to prevent rapid and excessive weight loss;
- Routine human contact each day, for example walking quietly through the yard at least two or three times each day;
- In general, keep dogs away from the weaning yard.

Handling at weaning

Weaned calves should be encouraged to approach humans with a memory of positive associations. Grouping calves in a small area at weaning with regular handling boosts socialisation between animals and with humans, and reduces subsequent stress associated with handling and transport. Well-behaved stock will generally create fewer management and occupational health and safety problems.

Negative or insufficient positive contact between humans and calves at weaning can result in the animals remaining frightened of human activity. This can cause increased stress during handling and transport, high pH and dark-cutting meat. Insufficient contact with humans can also lead to cattle not adapting well to more intensive feeding such as in droughts or feedlots.

Positive contact between humans and weaners minimises management problems down the track

Weaner pastures

Depending on the month and seasonal conditions at weaning, the liveweight of weaner cattle may be maintained until feed conditions improve or they can be weaned onto high quality pasture for rapid growth rate. As a guide for best liveweight gain weaner pastures should be of a nutritional quality of at least 11.5 MJ ME/kg DM and 15% crude protein. If high quality pastures are not available at weaning and weight gain is desired, consider providing a feed supplement to boost the nutritional quality of the pasture, but ensure that the cost of a supplementary feeding option does not exceed the benefits.

Weaning needs to be carefully managed to avoid any check in post-weaning growth and productive performance of calves. Special attention needs to be paid to pasture quality (at least 11.5 MJ ME) and calf management to ensure that the transition to a pasture or pasture plus supplement-based diet is successful.

High quality feed produces rapid liveweight gains in weaner cattle

Careful management of weaning pays individual and industry dividends

What to measure and when

Measure the nutritional (energy and protein) content of post-weaning feed for three months after weaning. Monitor pastures at least weekly, and more often if seasonal conditions are deteriorating. (See *Module 4: Pasture utilisation* for information on the assessment of pasture quantity and quality).

Further information on yard weaning

Call 1800 155 900 to obtain a copy of the following useful publications:

- 'Yard Weaning Methods for Preparing Feeder Cattle', MLA Tip & Tool FL.03
- 'Yard wean to boost production', MLA *Prograzier*, Spring 2003 ed, p19

Procedure 4

Implement a female culling and replacement policy to maintain best herd structure

4.1 Culling heifers and cows

Guidelines for culling heifers and cows

Cull as early as possible (but at a convenient time), commonly at weaning of calves. The initial culling is based on the female being empty at pregnancy diagnosis or having calving difficulties at the previous calving. If pregnant, then cull on physical factors such as unsound feet and legs, damaged or lost teeth, aged over 10 years old (or required age structure of the breeding herd for desired rate of genetic progress), history of inability to wean a calf or of calving difficulty.

To achieve the targeted rate of genetic progress and change in herd structure, a defined culling policy is needed for older cows. But if cows are culled too young, the overall herd performance may be reduced because calves born to heifers are 15% lighter than those from mature cows.

If the animal is required during a change in the age structure or rebuilding of the herd, re-mate and manage as a group separate from the main herd. The cost of culling all infertile cows (that is, not pregnant in 45 days mating) in a program aimed at realigning calving pattern, can be too high to complete in one year. Correcting an unsatisfactory spread in calving may need to be completed over about three years (refer to *Guidelines for reducing the spread of calving* at the beginning of Procedure 2).

When infertile heifers and cows without calves are not culled, these non-pregnant animals consume pasture that can be productively used to grow stock and increase the throughput of saleable product. If retained these culls should be grown to a saleable weight for a target market.

What to measure and when

- Presence of foetuses at pregnancy diagnosis;
- Fat deposition rates to avoid fatty udder syndrome;
- If pregnant, then physical factors such as structural soundness, teeth, age, ability to wean a calf and history of calving difficulty.

4.2 Retention rate of heifers

Guidelines for the retention rate of heifers

Heifers intended as replacement breeders in the herd need to be selected for their ability to:

- Become pregnant;
- Deliver a live calf unassisted;
- Rear their calf to a satisfactory weaning weight; and
- Conceive within 45 days of start of mating after calving for the first time.

When determining the number of heifers to join, it is important to allow for culling of heifers that fail this screening test. However, if too few heifers are retained, the balance of the breeding herd (target size and desirable age structure) cannot be maintained from year to year. Another option may be to purchase pregnancy-tested in-calf cows, but the impact on the herd age structure and breeding objective would need to be carefully assessed.

When too many replacement heifers are retained, they consume more high quality pasture per calf born than older cows. Although heifers lower the average age of the herd, they are more labour-intensive at calving, and wean lighter calves. However, excess heifers can become valuable sale animals and increase the ability of a beef business to access a range of target markets.

Assess the effect on profitability of options for maintaining heifers to increase enterprise flexibility, such as selling grown heifers (see *Module 1: Setting directions*).

First, calculate the number of replacement heifers required (see Tool 6.6 for a 'rule of thumb' approach to calculating the number of replacement heifers required). If there are fewer suitable pregnant heifers than required, buy in pregnancy-tested in-calf heifers, subject to appropriate genetic and health specifications. If there are more pregnant heifers than required, sell the excess.

What to measure and when

Determine the number of heifers to be retained in the breeding herd immediately after pregnancy diagnosis of the heifers.



Select replacement heifers carefully

Calculate the number of replacement heifers required in the breeding herd

Retaining too many heifers could be a waste of high quality pasture

Toolkit 6

Tool 6.1 A guide to minimum liveweights of weaner heifers

This tool provides a guide to minimum liveweights of weaner heifers at puberty, at mating when 15 months of age, during pregnancy and at calving.

Frame score	LW at puberty	Mating LW at 15 mths	1st 3 mths of pregnancy LW	4–6 mths pregnancy LW	Calving LW at 24 mths	Mature LW at 60 mths
1 Jersey	240	260	296	319	333	400
2 British	270	300	342	369	387	470
3 Limousin, Devon	290	330	377	409	430	530
4 Simmental	310	365	419	454	478	600
5 Charolais	340	400	459	499	525	670

Subtract up to 10kg for crossbred females.

Adapted from Laster *et al.*, 1972 *JAS* 34(6), 1,031–1,036 and Patterson *et al.*, 1992 *JAS* 70(12), 4,018–4,035

Tool 6.2 Condition scoring beef cattle

John Graham, Hamilton

Source: Department of Primary Industries, Victoria Agriculture Note AG0113 – May 2003. Available online at www.dpi.vic.gov.au

The body fat reserves of beef cattle are important at critical stages of the production cycle. At the beginning of winter they influence the amount of feed required to ensure satisfactory reproductive performance. The objective of condition scoring is to obtain a simple and reliable estimate of the body fat reserves of live cattle. The condition score provides an estimate of fat reserves that is independent of size and is a more reliable descriptor than liveweight alone.

Condition scoring can aid cattle management in two ways:

- Breeding cows: assessment of body condition at critical stages of the production cycle identifies those cows in need of nutritional management to reach target condition scores.
- Fattening animals: knowing the condition of fattening cattle allows selection of those with the desired level of fat cover for target markets (see *Module 8: Meeting market specifications*).

Target condition scores for cows:

- No lower than 2.5 at calving for autumn calving
- No lower than 2.5 at the start of mating for autumn calving
- No lower than 2.0 at calving for spring calving cows

Cows can be drafted at weaning on condition score so that preferential feeding can be given to those that may not achieve their target scores by calving.

Condition scoring techniques

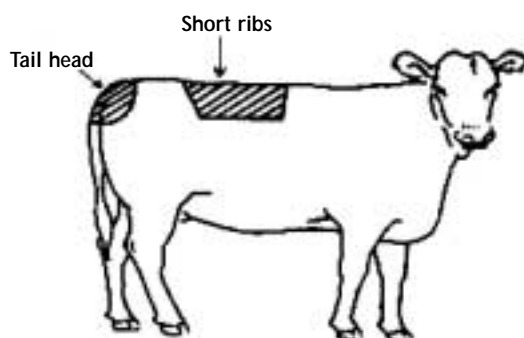
The technique is easily learned and, although subjective, has been shown to give reliable results when related to subcutaneous fat cover. The method is a 'hands-on' system, where two areas of the animal's body are palpated to assess fat cover (see *Figure 1*). The two areas are:

- The spinous processes or short ribs; and
- Around the tail head.

The short ribs

The degree of prominence of the short ribs of the individual spinous processes, is found by placing the fingers flat over the short ribs and pressing the thumb into the end of the short ribs (see *Figure 2*). A condition score is given according to the ease with which the individual short ribs can be felt with the thumb.

Figure 1: The two areas palpated to assess fat cover



The tail head

The degree of fat cover around the tail head is assessed by using the fingers and thumb and should be done at the same time as assessing the short ribs. The appropriate score is given depending on the degree to which palpable fat can be felt.

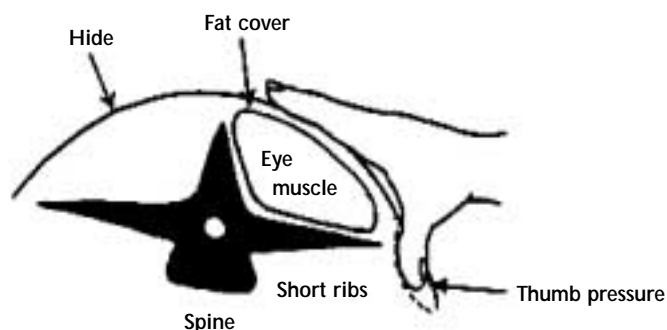


Figure 2: The degree of fat cover around the tail head and short ribs is assessed using the fingers and thumb

The scores are described as follows:

- 0 Emaciated.
- 1 The individual processes are sharp to the touch, no tail head fat. The hip, bones and ribs are prominent.
- 2 The individual processes can easily be felt, but feel rounded rather than sharp. There is some tissue cover around the tail head. Individual ribs are no longer visually obvious.
- 3 The short ribs can only be felt with firm thumb pressure. Areas either side of the tail head have fat cover which can be easily felt.
- 4 The processes cannot be felt and fat cover around the tail head is easily seen as slight mounds, soft to touch. Folds of fat are beginning to develop over ribs and thighs.
- 5 The bone structure of the animal is no longer noticeable and the tail head is almost completely buried in fatty tissue.

The score can be varied half a score depending upon the amount of tail head fat, for example if the short rib palpation (using the thumb) gives score 4 but the tail head is a typical 3, the score would then be 3.5. Scores can be directly related to fatness at the P8 site.

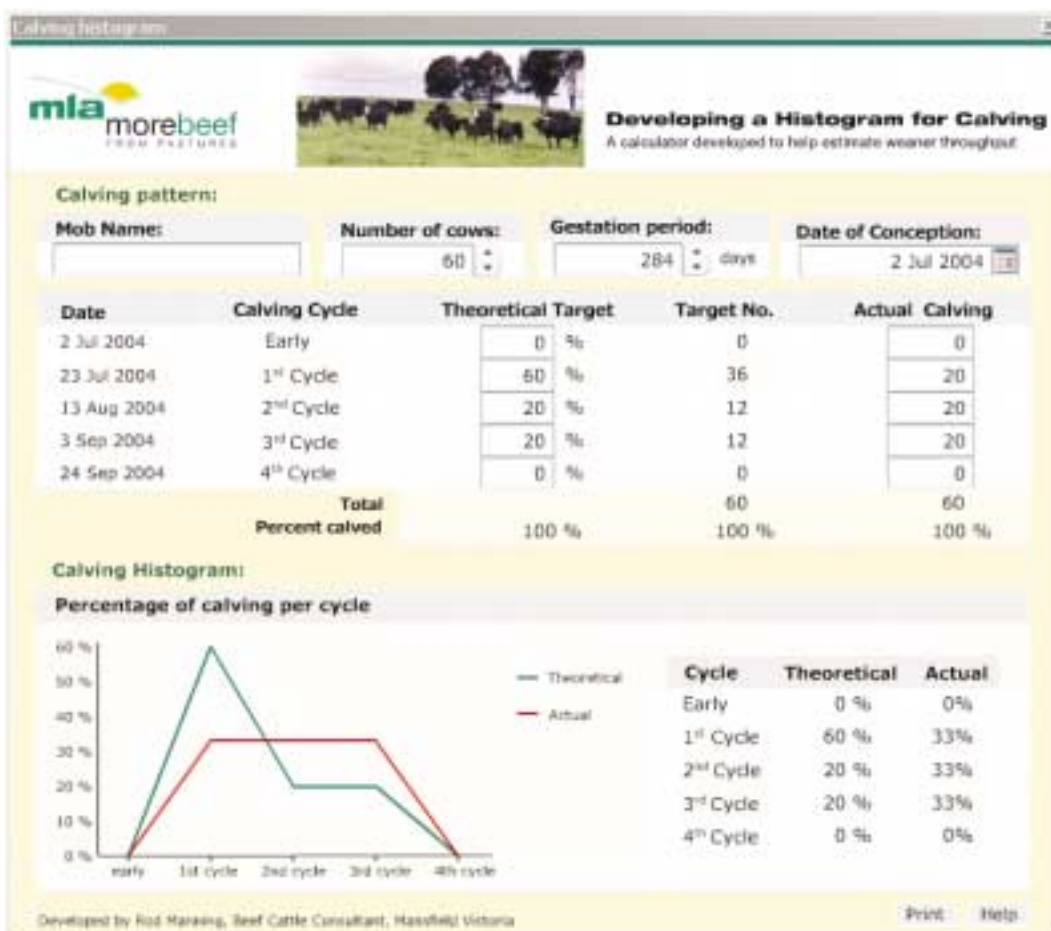
Tool 6.3 The Australian Association of Cattle Veterinarians' publication, 'Evaluating and Reporting Bull Fertility'

Copies of this publication and the associated 'Bull Reporter' can be obtained through the Australian Veterinary Association Office (07 3378 7944). Information is provided online at www.ava.com.au/content/aacv/bull.html

Tool 6.4 Calving histogram calculator

A spreadsheet calculator is provided on the accompanying CD-ROM that develops a calving histogram to identify the percentage of cows conceiving at each cycle.

(Source: Rod Manning, beef cattle consultant, Mansfield Victoria)



Tool 6.5 Weaning age and projected liveweights

The following table shows weaning and projected live weights for three target growth rates relative to pasture quality in british breed cattle.

Projected growth rate to weaning (kg/day)	Pasture quality (MJ ME/kg dry matter) ^{##}	Assumed birth weight (kg) ^{##}	Liveweight at 100 days of age (kg)	Liveweight at 150 days of age (kg)	Liveweight at 200 days of age (kg)	Liveweight at 250 days of age (kg)
1.1	12.0 (80% digestibility)	36	146*	201	256	311
0.9	10.5 (70% digestibility)	34	124	169	214	259
0.7	9.0 (60% digestibility)	31	101	136	171	206

^{##} Extrapolating from results of the high, medium and low pre-weaning pasture treatments used in the crossbreeding research project conducted by NSW Agriculture at Grafton, NSW.

* Calculated as 1.1 x 100 = 110, plus 36 = 146kg

Note: These are averaged projections over the whole pre-weaning period. There will be a range in weaning weights either side of these values, and the range will be greater in herds with extended mating seasons. As such, earlier weaning at an age of 100–120 days (and a minimum liveweight of 100kg) can be successful for calves grazed on the high quality pastures (greater than 11.5 MJ/kg DM). Earlier weaning should be managed carefully, particularly if calves are grazed on lower quality pasture to weaning. Ensure that they are heavy enough, and that there is an adequate supply of high quality feed for these calves during and after weaning.

Tool 6.6 A template for calculating the number of replacement heifers required

This is a 'best estimate' approach, assuming you are looking at **long-run averages with your herd at equilibrium**. The following instructions provide a step-by-step guide to filling in the **Replacement heifer calculator** on the following page:

- The first step is to lay out the herd age structure you want (as in column 1 over the page).
- The next step, if you want to estimate your herd structure 'on average', is to estimate the average number of breeding cows in the middle age group of breeders as your starting point – in this case, using a herd size of 1,000 breeders with nine age groups from 2.5–10.5 years old (yo), this gives 111 in the 6.5 yo group (ie $111 = 1,000/9$ – column 2).
- Then you need to estimate, or preferably use your own figures, for the losses that occur between one age group and the next (column 3). This is made up of deaths (2% used here for mature cows) and culling (eg 3% used here for the 6.5 yo group) giving losses of 5% in total for this group. Higher figures were used here for weaners, first calf cows and older cows to allow for assumed greater wastage in these age groups. Use your own figures if you have them.
- Then calculate upwards and downwards away from the middle group (ie 111 of the 6.5 yo here) to get the numbers that should be in each other age group on average (column 4). So for example for 5.5 yo we have $111 + 5\% \text{ of } 111 = 111 + 5.6 = 116.6$, rounded up to 117 here. And for the 7.5 yo group we have $111 - 6 = 105$, and so on.
- In column 5 the actual number lost between each age group is given, calculated as above, with the total equalling the number of replacement weaners needed, as is also given in column 4 of the weaner row as the number needed. All 11 yo cows are cast for age in this example. (You could also work out the estimated number of animals culled versus those that died, to project your annual sale numbers of females in each group by using the same approach, but using only the % culled in each age group.)
- Note that the total herd size of breeders at the bottom of column 4 is 1,005, not 1,000 as we originally set, which means that this rule of thumb is 0.5% out for this example due to rounding errors, but close enough for most purposes.

If you know the **current age structure of your herd**, and you want to estimate replacement numbers in the current year:

- Skip column 2 and go straight to filling in information in columns 1 and 3 for all age groups, and column 4 for breeders and yearlings.
- Then use the approach outlined above to calculate the number of replacement weaners required at the top of column 4, and the number of animals lost from the herd in column 5.
- In this case, because your herd structure is likely to be less even than in the example above, especially if it is not at equilibrium due to a drought for example, the number of weaner replacements you calculate at the top of column 4 may not equal the sum of those lost at the bottom of column 5. In this event the sum of column 5 is the figure to use.

Replacement heifer calculator

Age group of females (years of age)	Number in the middle age group	Estimated % wastage from each age group to the one below	Estimated number in each age group	Number projected to die and be culled
Column 1	Column 2	Column 3	Column 4	Column 5
Replacements				
0.5	Weaners	10	164	15
1.5	Yearlings	5	149	7
Breeders	1,000 breeders			
2.5		10	142	13
3.5		5	129	6
4.5		5	123	6
5.5		5	117	6
6.5 (middle age group)	111 (= 1,000 breeders/ 9 age groups)	5	111	6
7.5		5	105	5
8.5		8	100	8
9.5		10	92	9
10.5			83	
11	Cast for age		0	83
Totals	NA	NA	1,005 breeders + 164 weaners + 149 yearlings	164