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Selecting and managing beef heifers

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Introduction

Your heifers contain the latest genetic changes that you, the breeder, has made and should therefore have the best genetics in the herd. Hence, a great deal of emphasis must be placed on heifer management because it can affect overall profitability in a cattle breeding situation. Heifer management involves:

- sound selection
- adequate nutrition
- health management
- correct bull selection
- continuous monitoring, selection and record-keeping.

This Primefact outlines the important management phases that need to be considered during each phase of a heifer's lifespan. The five phases are:

1. Weaning to first mating
2. Pre-mating selection (as early as possible)
3. First mating to calving
4. Calving to second joining
5. Lifetime heifer performance.

Weaning to first mating

Weaning

Weaning time depends on several factors:

- **Feed availability and cow fat score.** In good years cows can continue lactation without losing condition, but in drier years it may be advisable to consider early weaning. Cow fat score is the key factor to joining success. Ask: 'Can my cows recover to the required fat score (fat score 3, i.e. 7 to 12 mm on the P8 site) by the time of joining?'
- **Type of cows.** After 6 or 7 months, milk production in British breeds (more so than in cows with *Bos indicus* or European content) declines; there is thus little benefit in leaving calves on these cows after this time.
- **Type of production.** If heifer calves destined for use as breeders are in danger of becoming too fat, especially in a vealer operation, one option is to wean them a couple of months earlier.

Critical mating weight

Heifers must achieve a critical mating weight (CMW) to ensure that the majority of them cycle and conceive when they are first joined. In British breeds this weight is usually around 280 to 300 kg, but larger-framed, later maturing types with *Bos indicus* or European content will need to be up around 300 to 320 kg. With the variety of maturity types now available within breeds, CMW must be determined for each individual herd. Alternatively, CMW may be expressed as a percentage of the average mature body weight for the herd, usually 60% to 65%. Heifers usually begin cycling at around 52% of mature body weight, so those not cycling at 65% of mature body weight are likely to be less fertile or of very late maturity.

With a 6-week joining period of heifers that have met the CMW, 85% pregnancy rates should be achievable.

Heifer nutrition is also crucial to successful heifer development. Heifers should be grown out as evenly as possible to reach their CMW and should weigh over 450 kg in fat score 3 before calving.

Table 1. Growth rates required to meet critical mating weights (CMWs) and calving weights for 2- vs 3-year-old heifers.

	Calving at:	
	2 years old	3 years old
Age at CMW of 280 kg	15mths	27 mths
Average growth rate required from birth (weight 30 kg) until mating	0.55 kg/day	0.31 kg/day
Age at heifer calving weight of 450kg+ and fat score 3	24 months	36 months
Average growth rate required from mating until calving	0.63 kg/day	0.63 kg/day

Calving heifers at 2 years of age has large economic benefits over calving at 3 years. Calving at 3 years should be considered only if growth rates and fat score targets are not achievable under normal circumstances and an expensive supplementary feeding program would be required to meet minimum fat and weight targets by age 2 years.

Health management

Good parasite control is needed in the post-weaning period, particularly in areas where parasite burdens are common. Poor parasite control may affect live weight gains and the heifers' ability to reach CMW. Response to parasite control post-weaning and additional treatments will depend on the time of year of weaning relative to local worm environmental conditions and life cycles. (See Agnote DAI 312 *Cattle worm control—the basics* for a worming program, or contact your local Livestock Officer or Rural Lands Protection Board veterinarian.)

Developing an effective vaccination program helps to avoid deaths and infectious abortions in heifers. The basis of a vaccination program should include two initial shots of clostridial (5 in 1) vaccine and an annual booster 4 to 6 weeks before calving. Always follow the directions on the label. '7 in 1' (clostridial disease vaccine combined with leptospirosis vaccine) should be used if leptospirosis is prevalent in your area.

Common causes of infectious abortions in heifers are:

- vibriosis (Campylobacteriosis) (See Primefact 451 *Vibriosis of cattle*)
- leptospirosis (See Primefact 445 *Leptospirosis in cattle herds*)
- bovine viral diarrhoea virus (pestivirus)
- ephemeral fever (3-day sickness) (See Agfact A0.9.50 *Bovine ephemeral fever: three day sickness*)
- akabane
- neospora (*Neospora caninum*), which is very common on the North Coast (See Agnote DAI-314 *Neospora caninum infection in cattle*).

Vibriosis and leptospirosis can be controlled by making sure that all heifers are vaccinated with 7 in 1 and all bulls get an annual booster shot of vibriosis vaccine.

Pestivirus, 3-day sickness and akabane are mainly issues in heifers that have not previously been exposed to the diseases. Heifers exposed to these diseases before joining will develop natural immunity. Mixing young and adult cattle before joining is a good way of developing immunity. Abortion waves or very low calf numbers are often seen when heifers that may not have been exposed to the disease are introduced to the herd, especially when introduced to coastal areas from western areas. A vaccine is available for pestivirus and 3-day sickness, and implementation of a vaccination program will ensure that losses are avoided. There is no vaccine available for akabane.

Neospora is introduced into herds via feed contaminated with dog faeces. There is no treatment or vaccine for neospora. For more information see Agfact A0.9.68 *Diseases causing reproductive losses in breeding cattle*.

Pre-mating selection (as early as possible)

Pre-mating selection should be limited to the heifers you definitely do not want to keep or to those that are excess to requirements. The major selection will be made in terms of fertility after mating.

Cull on temperament

Breeding cattle with poor temperaments should not be tolerated. They pose a risk to the handler and an extra cost to the producer in a number of ways, including increased handling times, repair and maintenance to facilities, poorer performance when on feed, and increased risk of dark-cutting. The Beef Cooperative Research Centre has found significant genetic relationships between temperament (flight time) and beef tenderness, growth rates and feed conversion in tropically adapted cattle breeds.

Temperament can be assessed by a subjective crush or yard score or objectively by flight time. Most reports indicate that even the subjective, restrained scores of temperament are moderately

The first major selection will be based on pregnancy testing results. Photo: Brian Cumming

heritable. Hence cattle of poor or excitable temperament should be culled as soon as possible.

Cull on structure

The overall structural soundness of the heifer should be assessed. To ensure fertility and longevity a heifer needs to be able to walk and join with the bull (good fetlock and leg structure) and be able to consume food (avoiding overshot or undershot jaws).

Producers may have different opinions on the importance of some structural characteristics and difference levels of tolerance towards them. It is up to the individual as to what they are willing to tolerate. More information (diagrams and photos of animal structure) can be found in the NSW DPI online publication *Bull soundness—structure*.

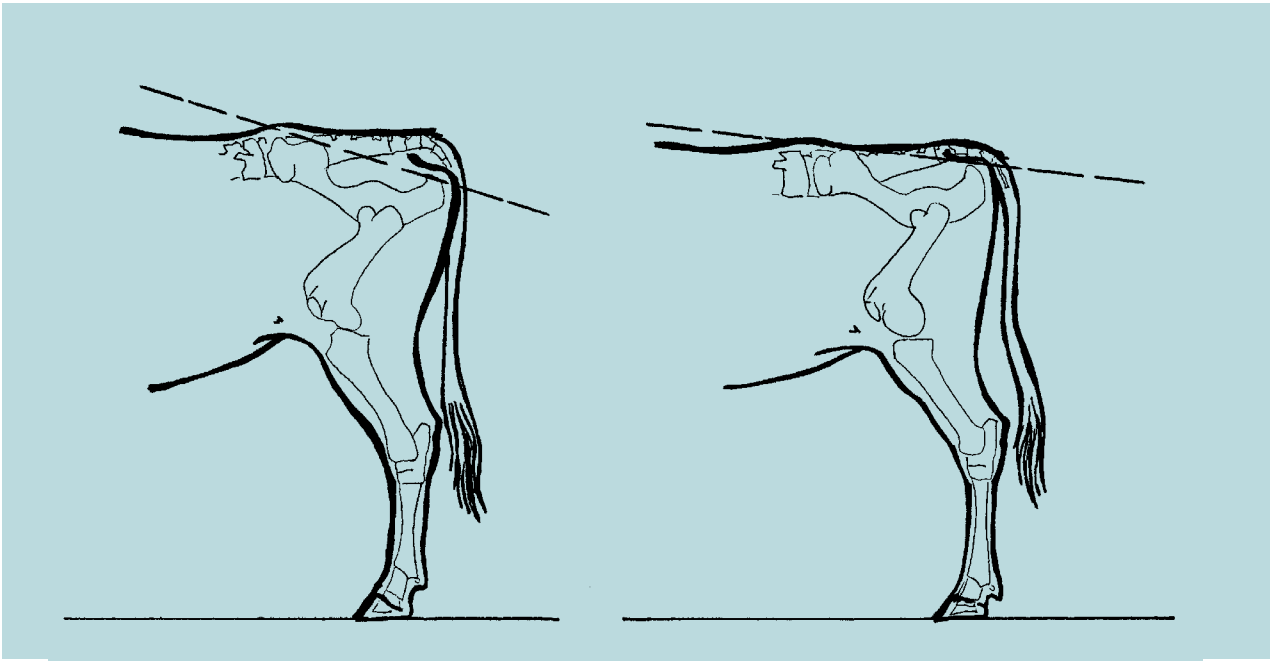
When assessing heifers for structural soundness it is important to consider the angle from the hipbone to the pin bone and the width between pin bones. Rump angle and rump width (Figures 1 and 2) have been shown to affect pelvic shape, and pelvic shape is correlated with calving ease (direct and maternal); animals with high and narrow pin bones are more likely to have a difficult calving. It is possible to measure pelvic area, but the usefulness of this measurement is questionable in heifer selection.

First mating to calving

Bull selection: birth weight and scrotal size

(See the NSW DPI online publication *Bull soundness—reproduction* and Agnote DAI-303 *Calving ease EBVs.*)

Figure 1. Rump angle



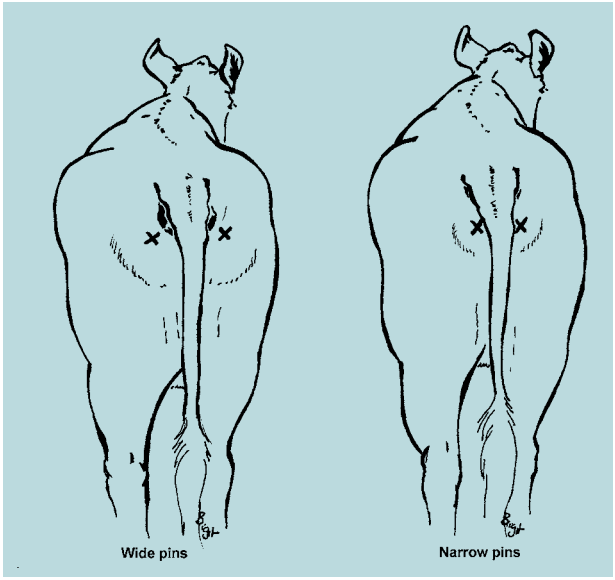


Figure 2. Rump width

The main concern with selecting a bull to go over heifers is the effect of the bull on the calf's birth weight and size, and subsequent calving difficulties. The bull's impact on the fertility of his daughters is also important.

Increased calving difficulties occur when there is disproportion between sire and dam in terms of frame size and birth weight. Useful aids to selecting easy calving bulls are BREEDPLAN Estimated Breeding Values (EBVs) for calving ease, the bull's own birth weight, and the use of 'littermate' bulls (see below). As birth weight is a moderately heritable characteristic, bulls that had below-average birth weights will probably sire lighter calves than will bulls that had above-average birth weights. If BREEDPLAN EBVs are available, bulls with positive EBVs for calving ease (maternal) and calving ease (direct) should be selected to mate with heifers. Calving ease EBVs take into account birth weight and all the other factors that effect calving ease.

In some large Australian herds, heifers are joined with 'littermate' bulls. These are bulls from the same calf drop as the heifers. This practice ensures that the bulls used are genetically compatible with the heifers for birth weight and frame size. Ideally, the littermate bulls selected should be of below-average, or average, birth weight. It may not be wise to join a bull of one breed to a heifer of another, especially in the case of *Bos indicus* bulls over British breed heifers. This can increase the level of calving difficulty because of the effect of hybrid vigour on calf size. The fertility of a bull's progeny has been shown to have a direct link with scrotal size. Bulls with larger testicles will sire daughters that are also more fertile.

Joining period and joining time (before the main herd is joined)

Heifers should have a shortened joining period of approximately 6 weeks (compared with 9 weeks for cows) or less. This ensures that only highly fertile heifers are kept in the herd.

Joining heifers 3 weeks before the rest of the herd gives more time to supervise the heifers when they calve. It also allows the heifers extra time to recover after the calving and begin cycling again for mating with the rest of the cow herd at the next joining.

Parasite control and weight gains

Heifers are particularly vulnerable to severe worm infestations. Heifers should be drenched before calving, particularly if worms are a problem in your district and especially in wet seasons, in drought, or in autumn calving situations. After calving, heifers can be moved onto crop or pasture that has been rested or previously grazed by sheep or older dry cows. This will ensure that there are relatively few worm larvae on the pasture for calves or first calf heifers to pick up when they start grazing. Heifers need good nutrition to grow and develop. They are prone to metabolic disorders because of the increased pressure of gestation and growth.

In addition, weight gain and fat score at calving play significant roles in the first-calf heifer's return to oestrus and hence fertility. Heifers should weigh over 450 kg and be in fat score 3 before calving to give them every chance to cycle in time for mating (see the effect of lactation and anoestrus on first-calf heifers—Tables 2 and 3). To meet this target an average daily weight gain of 0.63 kg/day is needed (see Table 1). It is good practice to manage heifer nutrition carefully during the first and second trimesters of pregnancy to reduce the chance of calving difficulties due to excess calf growth in the uterus.

Cull on fertility: pregnancy testing

Fertility is paramount and can be continually assessed throughout a cow's breeding life. Pregnancy testing can be carried out 5 to 8 weeks after the bulls have been removed from the herd. This allows early culling of non-productive (pregnancy-tested empty) females.

It is also possible to age the foetuses of pregnant heifers so as to better plan the management of these heifers. If you know the foetal age, then there may be opportunities to sell later calving heifers to other cattle breeders as pregnancy tested in calf (PTIC) heifers.

Calving to second joining

Supervision of calving

Supervision of calving of first-calf heifers is essential to maximise live calf numbers. A good record-keeping system should be in place so that mating dates and the expected starting date of calving is known. (This assumes that you have a restricted mating period, which has many advantages). Calving can start at least 2 weeks earlier than the calculated date!

Heifers should be checked at least twice daily for signs of impending calving, and once calving starts progress should be checked hourly for indications of dystocia (calving difficulties). If the waters have broken, and there is no further progress in 1 or 2 hours, help with calving is likely to be necessary. Calving difficulty is a major economic cost to the beef producer, for a number of reasons. First, calving difficulty increases calf death. On average, research has shown that 16 per cent of calves that require help die within 24 hours of calving, compared with 4 per cent of unassisted calves. Overall, current research has shown that 50 to 60 per cent of calf losses are due to dystocia. Dystocia also leads to increased heifer mortality and delay in the return of heifers to oestrus, reduces conception rates, and has a negative effect on milk production. In addition, there is the increased cost of labour and veterinary treatment.

There are several things that affect heifers' calving ease. The most important ones are:

- **Calf genetics.** The most important aspect is the size of the calf relative to pelvic size and shape. Hybrid vigour will increase calf size.
- **Selection of bulls.** Calving ease EBVs, birth weight EBVs, bull structure (especially shoulders), and frame size all affect calving ease, as does the use of bulls of genetically dissimilar breeding from the heifers.
- **Environmental factors.** The condition score of the heifer and the nutrition of the heifer at conception and in the first and last trimesters of pregnancy affect calf weight.
- **Calving span.** Research has shown that heifers calving early in the calving period experience less dystocia than heifers calving later, because of their shorter gestation periods and probably smaller calf size. Selecting heifers that conceive early in an extended mating period (greater than 6 weeks) will reduce dystocia.

Heifers should be checked for signs of impending calving at least twice daily. Photo: Brian Cumming

Table 2. Time after calving for cows versus heifers to show return to oestrus cycling

Days after calving	% showing oestrus cycling	
	First-calf heifers	Mature cows
40	15	30
50	24	53
60	47	72
70	62	82
80	68	89
90	79	94

Post-calving nutrition and joining

First-calf heifers must be well fed after calving. Monitoring of heifer fat score is important in deciding on the need to supplementary feed or wean calves early. Drafting off freshly calved young cows each week and drifting them into a better paddock will allow close monitoring and feeding when necessary. The difficulty in consistently achieving high pregnancy rates in heifers rearing their first calves has long been recognised. At least 30 per cent of the first-calf heifers, given a restricted mating during lactation, may fail to conceive. In many cases producers extend the mating span to solve the problem. This does increase pregnancy rates, but allows less fertile females into the herd. Heifers rearing their first calves will take longer to resume normal fertile cycles than will older cows (see Table 2).

Lactation in first-calf heifers at low live weights has a marked effect on pregnancy rates and may have an increased effect with increasing *Bos indicus* content (Table 3).

Heifers calving in fat score 3 before the main herd have the ability to cycle on time with the rest of the herd.

Forty-eight-hour weaning (taking calves off cows for 48 hours) also helps to increase conception rates

Table 3. Lactation reduces fertility, particularly at low live weights. The effect may be increased with increasing Bos indicus content.

	Weight (kg)	% pregnancy rate	
		Lactating	Non-lactating
Hereford	325	75	92
	326–350	88	100
	351	100	67
Droughtmaster	280–359	15	86
	360–399	36	79
	400	50	91
	440	–	69

in first-calf heifers, particularly in the case of *Bos indicus* breeds. This is a useful tool to bring cows and first-calf heifers into oestrus sooner than they would otherwise normally cycle.

Post-calving selection

Cull on carcase traits, ability to a raise calf and environmental adaptation. Cows and heifers need enough muscle to produce well-muscled steer progeny. It has been a long-held belief that heifers must look feminine to produce a calf. However, it is possible to select for fertility and muscularity at the same time. If you stick to a minimum acceptable level of fertility and milking ability you can breed heifers with a high level of muscling. This has been sown by current research by NSW DPI into the selection for muscle in breeding cattle.

It is impossible to tell by visual means which heifers will get in calf and then successfully rear those calves to weaning. Always keep about 20 per cent more heifers than required and let the bull sort out which ones are feminine or not. It is important to match the maturity pattern of your females to your environment and target market. Late-maturing cows have a large mature size and weight. Larger cows require more feed to maintain weight and fertility. This becomes particularly evident if feed becomes limiting. However, cows should not be too small, as their calves will also be small and may not meet market weights or may be too fat at turnoff age. If a producer were aiming for the long-feed Japanese B3 market, then animals of mid- to late maturity pattern may be more suitable for this market. However, if extremely late maturing bulls are used the producer runs the risk of increased levels of dystocia.

Producers should also cull heifers for milk production ability. The true indication of a cow's milk production is calf growth up until weaning. A heifer that is genetically a poor milker will likely be a poor milker for the rest of her life. It is important to compare only heifers' calves with other heifers' calves, not with calves out of cows, as cows generally milk better than heifers. A breeding female that gets in calf every year and raises to weaning a calf that is of adequate weight

Heifers showing different muscle scores. The heifer on the left is muscle score B. The one on the right is muscle score D. Photo: Bill McKiernan

in comparison with the group (i.e. not below the average weaning weight) is likely to be well suited to her environmental conditions.

Lifetime heifer performance

Maintaining good herd management

Once a heifer has joined the main cow herd, her lifetime performance will depend on good herd management. Below is a checklist of the critical areas of good herd management:

- ✓ Matching calving time to the best available feed
- ✓ Restricted joining: 6 weeks for heifers, 8 to 9 weeks for cows
- ✓ Calving pattern: 70 per cent of calves born in the first 3 weeks
- ✓ Maintenance of fat scores at critical times: 2.5 to 3 at calving and joining for heifers, cows and bulls
- ✓ Pregnancy testing 5 to 8 weeks after bull removal, plus foetal aging if possible
- ✓ Management of weaning time to maintain fat scores
- ✓ Critical mating weights for heifers
- ✓ Good health program and on-farm quarantine protocols, including vaccination and drenching programs
- ✓ Ongoing selection on fertility, temperament and structure
- ✓ Bull management (see Primefact 249 *Checking your bull is ready for joining*)
- ✓ Use of both visual and genetic indicators in bull selection.

Record-keeping

Good record-keeping will help with selection. If a cow fails to conceive or has problems calving, then there is a good chance she will repeat this later in her life. The ability to keep track of female performance will make the job of continuous fertility selection easier.

Conclusion

There are two final points to remember:

1. Overall, the selection process must be a balanced approach concentrating on a number of criteria. The fertility, productivity, functionality and structure of replacement heifers must all be considered when selecting replacement females.
2. Weight and good nutrition are the critical factors in ensuring good heifer pregnancy rates and reducing calving difficulties.

Further reading

Primefact 249 *Checking your bull is ready for joining*

Primefact 620 *Developing an effective breeding plan for your beef business*

Primefact 621 *Market specifications for beef cattle*

Primefact 622 *Live beef cattle assessment*

Primefact 623 *Cattle breed types*

Primefact 624 *Beef cattle breeding systems*

Primefact 625 *Using EBVs and $ Index Values in beef breeding*

Primefact 627 *Economic advantages of better management of your beef breeding herd*

Further information

For further information contact your local NSW Department of Primary Industries Livestock Officer (Beef Products).

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