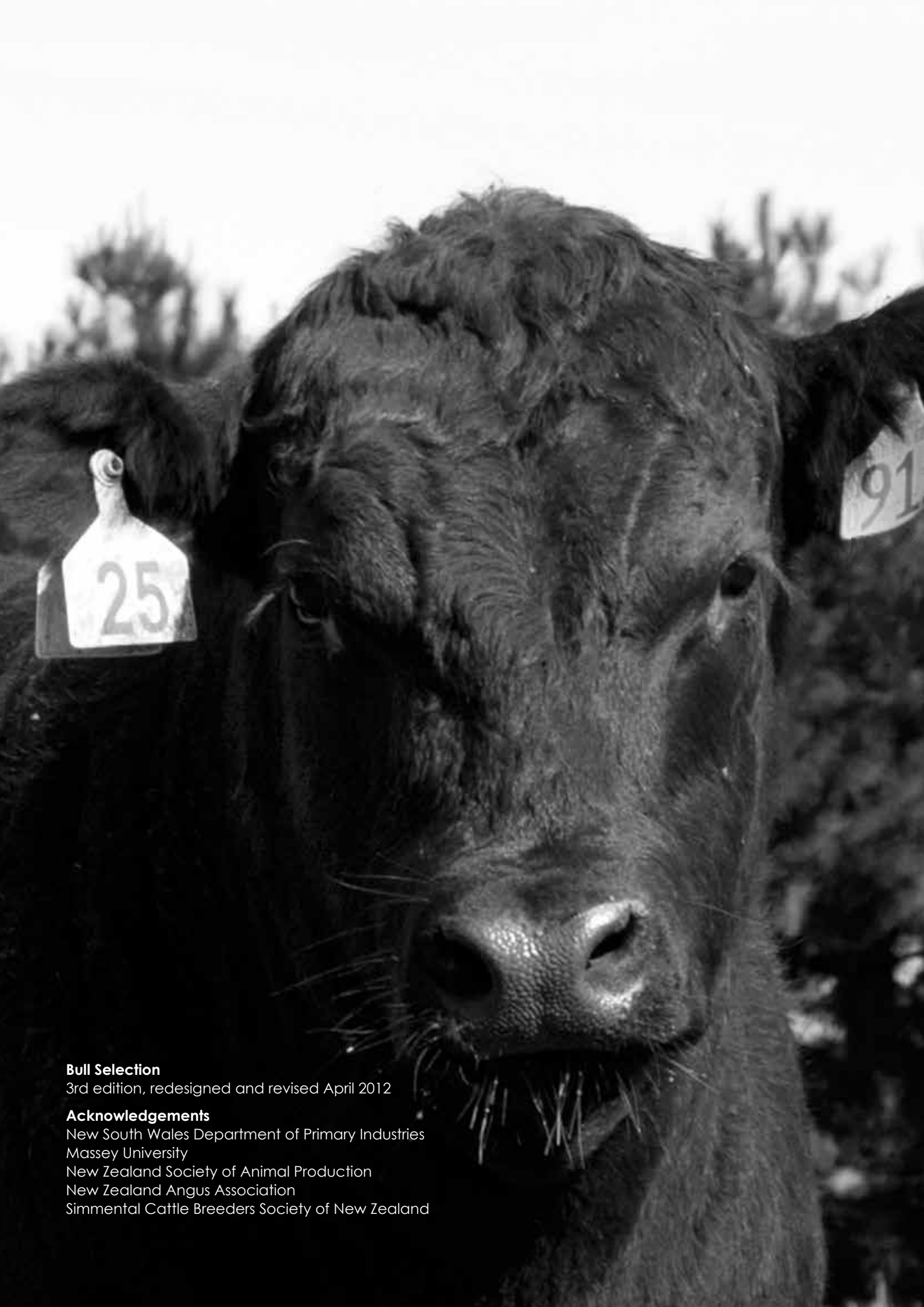




# BULL SELECTION





**Bull Selection**

3rd edition, redesigned and revised April 2012

**Acknowledgements**

New South Wales Department of Primary Industries  
Massey University  
New Zealand Society of Animal Production  
New Zealand Angus Association  
Simmental Cattle Breeders Society of New Zealand



## **Section 1 Setting objectives** **04**

The most important character of the breeding cow which can be measured and will respond to selection is the weight of calf she produces each year. The most important character of the slaughter animal which can be measured and which will respond to selection is growth rate, together with some emphasis on carcass merit.

---

## **Section 2 Where your breeder goes, you go** **08**

Set clear objectives for your herd and identify a bull breeder with similar objectives. Can this breeder show you evidence they have a progressive selection programme underway?

---

## **Section 3 Selecting a bull** **10**

Fertility is the single most important economic trait to consider in a breeding herd. It is crucial to thoroughly check physical factors which influence fertility at purchase and well before mating begins – namely, the bull's semen production and delivery mechanisms, and structural soundness issues relating to bull mobility and cow serving capability. This section also looks at the link between scrotal size and female fertility, and gives guidelines on scrotal size.

---

## **Section 4 Selecting a bull using the genetic package** **18**

Use estimated breeding values (EBVs) to help you compare an animal's performance – particularly for growth rate and milk production. Group EBVs are the best indication a bull buyer can get on the future breeding potential of a bull.

---

## **Section 5 How much can you pay for a high estimated breeding value bull?** **26**

Small per head differences in the weight of offspring, through the use of superior EBV sires, result in large annual contributions to profit throughout an animal's life.

---

## **Section 6 Explaining the different estimated breeding values** **28**

Understanding accuracies.

---

## **Section 7 Bringing your new bull home** **34**

Bulls are a large investment for breeding herds. They have a major effect on herd fertility and profitability. It is well worth your while to take the time to make sure they adjust to their new environment, are fit, free from disease and actively working.

---

## **Section 8 Yearling bulls – tapping their immense potential** **37**

The use of yearling bulls allows the introduction of superior genetic material into herds a year earlier than normal, resulting in faster genetic improvement.

---

## **Section 9 Bull buying exercises** **40**

Examples of how to select bulls for different breeding objectives.

---

# INTRODUCTION

Beef + Lamb New Zealand aims to help farmers make more profit from beef. This can be achieved in a number of ways, including improved management and breeding practices. One of the most significant gains in a breeding programme is through the purchase of superior genetics.

In the absence of any performance recording within the cow herd, the bull contributes approximately 80% of the measurable genetic gain.

The selection process should begin with the establishment of breeding objectives which have a high relative economic value. Appropriate bulls should be targeted to meet these objectives.

The most critical decision in maximising genetic progress is to identify the breeder who breeds cattle which most closely satisfy your breeding objectives. The amount of genetic progress you will make in your herd largely depends on the genetic progress being made by the breeder you buy your bulls from.





Once you've selected your breeder and been presented with a group of bulls, you should make a thorough physical inspection, looking at factors which influence physical and reproductive soundness. It does not matter how impressive a bull's performance figures are, if he is not sound in all respects he will significantly depress profitability through poor mating performance (in-calf rate). It is only at this stage that the bull's 'figures' should be considered, keeping in mind your target market.

These are just some of the steps that should be taken in the selection process. This booklet considers these in much more detail and, as such, provides a very comprehensive and useful bull selection guide.

Breedplan is used in this publication as an example of one performance recording service provider, however, there are other service providers operating within our beef industry.





# SECTION 1

## SETTING OBJECTIVES



Before preparing a plan for beef cattle improvement, you need to know which characters contribute to production and profitability, and what emphasis to place on them when you select breeding stock.

The relative importance of different characters may vary from farm to farm according to whether it's a breeding or finishing operation. The characters contributing to profitability may also vary over a period of time according to changes in market requirements.

Selection objectives appropriate to market requirements are discussed below in two sections: one relates to the productivity of the breeding cow, the other to post-weaning performance. When the same bull is used to sire replacement females as well as surplus stock for slaughter, you must be mindful of both requirements. Where circumstances allow, emphasis may be placed on specialised dam lines selected for efficient weaner production and specialised sire lines selected for rapid growth and carcass excellence.

Greatest genetic progress will result from using a limited number of objectives; you can then concentrate your attention on important productive traits that will respond to selection.

Maternal characters, which are measured directly on the cow in the bull breeder's herd, are passed on through the bull you buy to your herd. Overall, up to 80% of genetic gain is achieved through the bulls because a bull is mated to 30-50 cows per year, and bulls can be selected more intensively (you need fewer of them).

## Summary

- The maternal influence, as measured by weight of calf weaned per cow joined, is the most important consideration for the cow herd. Weight of calf weaned embraces calving date, calf weight and cow milk production.
- You should also consider some measure of efficiency which recognises cow size, body condition score and associated feed costs.
- Growth rate and carcass yield remain the two most important characters of the slaughter animal. Growth rate can be easily measured and will respond to selection. Selection should therefore be directed towards growth rate and yield of saleable meat. Less selection effort should be directed to carcass quality, depending on breed and breeding objectives.

## Productivity of the breeding cow

Breeding cow efficiency depends on the weight of weaned calves a cow produces in her lifetime, relative to the total amount of feed she eats throughout her life, plus the feed her calves eat until they are weaned. However, under pasture feeding conditions it is not possible to measure efficiency in this way, because you can't easily measure the amount of grass eaten by an individual animal.

The combined feed requirement of a cow for one year and of her calf up to weaning is similar to that of the calf from weaning to slaughter. This emphasises the importance of efficient weaner production.

Though it is not normally possible to measure the feed eaten by a cow, some of the factors contributing to her efficiency can be measured and recorded. These are discussed below.

## Reproductive performance

The number of calves weaned from every 100 cows maintained is the most important trait in influencing financial returns from the breeding herd.

Reproductive performance is complex because it involves the cow getting in calf at the planned time each year (preferably starting at 15 months of age) and producing a live calf which thrives until weaning.

It is clear that good reproductive performance is of high economic importance; however, its heritability is low, so it is of little value for selection. Related characteristics will help you select for improved reproduction, such as bull scrotal size and calving interval (Breedplan measures this as days to calving).

Culling cows which fail to breed or wean calves is a useful way to improve the efficiency of your herd. Similarly, don't overlook the importance of good management as a factor in improving reproductive performance.

Mating heifers to calve at two years of age is a valuable way to improve reproductive efficiency, by rearing an extra calf during the cow's lifetime. At the same time it reduces the interval between generations and so permits more rapid genetic improvement.

## Mothering ability (including milk production)

The easiest measure of a cow's mothering ability is the weight of its calf at weaning. The actual weaning weight requires adjustment for the age of the calf,

and in some cases for the age of the dam, to give a fair comparison between cows. Each animal is then compared with the average using the weaning weight ratio. If you record calves of both sexes in the same group, you also need to adjust for sex.

This measure of mothering ability includes the calf's own capacity to grow and the dam's ability to care for it, but to a large extent it reflects the milk production of the dam. The milk production of many cows is probably too low for really efficient weaner production. Improvements in milk production are being brought about through the selection on weight of calf weaned (eg Breedplan 200-day milk EBVs) within the beef breeds, and by introducing dairy and dual purpose breeds to the breeding herd.

However, in single-suckled herds, it is of little value to produce more milk than the calf needs. There is some evidence to indicate that a high level of milk production may lead to reduced reproductive performance if the cow is poorly fed, particularly between calving and mating. If this proves to be the case, selection against excessive milk production will automatically take place because these cows will have fewer calves.

The more calves you record from a single cow, the more certain you can be that she will produce similar weaners in future.

## Cow size

There have been several investigations into the relationship between cow size and efficiency. While the results are not clear-cut, it appears likely that comparing cows of the same breed will show that cattle selected for high growth rate and moderate mature weight will be more efficient as breeding cows.

Selecting cows on weight of calf weaned will tend to retain the larger cows. Exceptions to the rule – such as small cows which produce large weaners – will also be retained. Weight of calf weaned relative to dam size may be a useful way of comparing efficiency between cows.

This situation within a breed should not be confused with comparisons between breeds and crosses. It has been suggested that specialised small-cow lines could be developed through crossbreeding. For example, a small cow with good milk production, high calving percentage, and freedom from calving difficulties, crossed with a sire of one of the large breeds. Such a breeding system is designed to produce large weaners from small cows, but several specialised breeds are required for this.

## Longevity

A cow which regularly produces good weaners, and does so over many years, will be a more profitable member of the herd than a cow that left the herd earlier. Because a longer productive life will likely increase financial returns, the question of selecting for longevity is of interest.

While the heritability for length of productive life is low (about 0.2), you can still make measurable genetic progress through selection. It is hoped that an EBV for longevity will be produced soon, enabling breeders to select bulls which leave progeny that have a longer productive life.

At the same time, you should cull cows if they fail to breed or to rear calves to weaning, if they show bad temperament, if they have bad feet or an undershot jaw or other undesirable inherited conditions.

## Post-weaning performance

For the slaughter animal, the objective is to produce the maximum value of product for the least cost. This will usually mean producing the maximum amount of edible beef per kilogram of food consumed, provided the eating qualities of the beef are acceptable. The three characters to be discussed which contribute towards this are growth rate, appearance and carcass merit.

## Growth rate

Growth rate is currently the character of highest economic importance in slaughter cattle. A strong relationship between growth rate and feed conversion efficiency has been demonstrated under feed-lot and research pasture grazing conditions.

Most of the differences between animals, in weight of edible meat produced, are due to differences in liveweight (or carcass weight) rather than to differences in carcass composition.

To increase selection accuracy for this important character, a performance recording programme for growth rate should provide results in the form of age-corrected weight ratings at both 400 days and 600 days.



## Appearance

Selection on type and conformity, which are favoured in show judging, may not lead to increased profitability. Selection on appearance should be directed towards animals showing increased muscularity and against animals showing fat beyond the level acceptable to the market.

Selection effort directed towards characters of no importance in the slaughter animal, for example, coat colour or colour marking, will reduce the rate of progress in improving the characters that contribute to improved profitability.

Animals also need to be structurally and reproductively sound. You should select against any defect that reduces the animal's ability to move freely, graze efficiently or reproduce.

## Carcass merit

For a carcass of given weight, saleable meat yield is the most important attribute and this can be measured.

You can predict meat yield from a combination of measurements on the live animal. These include ultrasound scanning of the eye-muscle area, fat depth and live weight. A more accurate assessment of carcass yield can be gained through a progeny test when progeny are slaughtered, individual carcasses are boned and the meat is weighed.

Carcass quality (meat colour, fat colour, marbling, fat content) is important in some markets, and economic weightings for these characters are available in New Zealand.

It is difficult to assess the probable palatability (tenderness, flavour and succulence) of the cooked beef from an inspection of the raw meat. However, a progeny test may include a subjective assessment of meat and fat quality (colour, pH, marbling, texture) from an appraisal of the ribbed carcass.

# SECTION 2

## WHERE YOUR BREEDER GOES, YOU GO





To make progress in the desired traits, the bull buyer and bull breeder need to have similar aims and objectives. Cattle which perform well in one area may not somewhere else, so you should choose a bull breeder who farms in a similar environment to you. It's also desirable if they run their stock under similar management conditions to yours.

## Summary

- Set clear objectives for your herd
- Identify a bull breeder using similar objectives
- Look for a breeder with similar management in a similar environment to you
- Determine whether the breeder is using a genetically progressive selection programme (a genetic trends graph or table will demonstrate this)
- Make sure the breeder will follow up to see how you and the bulls are progressing

## Is the breeder making real progress?

The bull breeder's breeding programme should be clear, easily explained and backed up by good records and clear facts. It is important to ask questions to establish the genetic merit of the herd and whether genetic progress is being made in the traits that are of interest to you in your breeding programme.

Ten important questions ask a breeder before you buy a bull

1. What are the breeding objectives for the herd?
2. Is the breeder recording with a recognised performance recording service provider, such as Breedplan or CSU?
3. Can the breeder provide evidence they're making genetic progress in the traits in which you are interested, eg by showing you a favourable genetic trends table?
4. What is the average genetic merit of the breeder's herd in relation to the breed average?
5. Can the breeder supply you with percentile band information, enabling you to rank their bulls?
6. Can the breeder supply you with dollar indexes (estimated breeding values for profit)? These rank bulls according to their profitability in different production systems.
7. Where does the breeder source the herd sires from and what are their estimated breeding values / indexes?
8. What are the breeder's main criteria for sire selection?

9. Do the breeder mate yearlings – heifers and/or bulls?

10. What proportion of bulls are sold in relation to the number born?

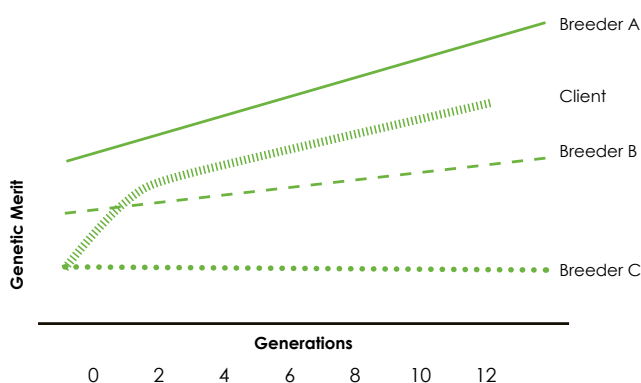
Using bulls for around two years means a short generation interval and faster genetic progress. Using bulls for longer than this is normally associated with a progeny testing programme or sire-referencing scheme.

The rate of progress will also be closely linked to how good the bulls are relative to the herd or breed average.

In reviewing a breeder's apparent progress you should bear in mind that changed management can produce a lift in performance similar to genetic improvement. For example, if breeders change the stocking rates or management of their herd they will usually change performance regardless of genetic change. The genetic trends table for the herd will tell you whether the change in performance is due to genetic improvement or merely a change in management / the environment.

## Choosing a bull breeder

Once you've set your breeding objectives and established your ideal bull, the next step is to choose the right breeder. The single most important factor in making that choice is that the breeder's herd must have higher genetic merit and rate of improvement than your herd, so your herd can improve.



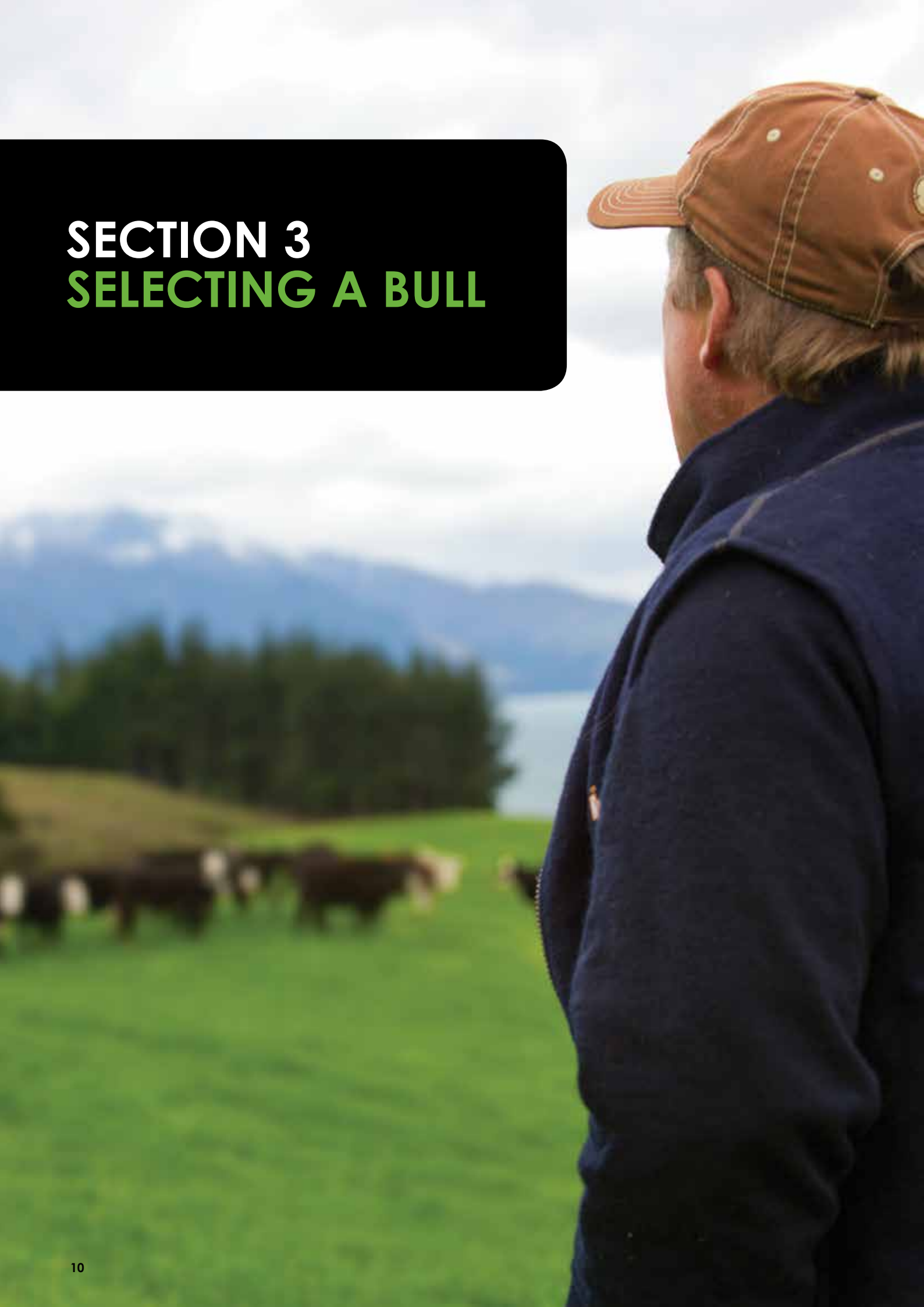
As shown in this diagram, you will progress at a similar rate to bull breeder A, but will remain two generations behind. If bull breeders B or C were chosen, little or no genetic progress would be made.

However, the two generation lag can be reduced by purchasing year after year at a level about the average of the breeder's bulls.

Once you've decided on a shortlist of bull breeders, you should try to visit them in the six months leading up to bull buying time.

# SECTION 3

## SELECTING A BULL





## Breeding soundness

The first procedure in selecting a bull is to rank the traits involved in your breeding objectives in order of economic importance. Fertility is the single most important economic trait to consider in a commercial herd.

In economic terms, a 1 per cent increase in fertility is equivalent to approximately a 10 per cent rise in growth rate.

Fertility within a herd is influenced by four major factors:

- reproductive soundness
- structural soundness
- management
- genetics

In selecting a bull you need only consider three of these, namely reproductive and structural soundness and genetics. The first two constitute overall breeding soundness and will be dealt with in the next two sections.

It is economically prudent to get your vet to conduct a breeding soundness evaluation on all service bulls 30-60 days before the breeding season starts. A 2005 survey of commercial and stud herds in Gisborne revealed that 14 per cent of young bulls (one to two years old) were unsound for the purpose of breeding and a further 5 per cent were sub-fertile. Of the mixed age bulls, 22 per cent were unsound and 13 per cent were sub-fertile.

Examining bulls for breeding soundness before the breeding season will detect most bulls with potential fertility problems. This examination should be performed by a veterinarian who has had significant experience in bovine herd health and fertility evaluation of bulls. However, even with the best personnel, it's not possible to accurately predict degrees of fertility. Breeding soundness evaluations are really a screening process used to assess probable bull fertility. Results from an actual breeding season remain the only true test of a bull's fertility.

## Evaluation guidelines

### PHYSICAL EXAMINATION

This will cull bulls with undesirable physical characteristics or abnormalities.

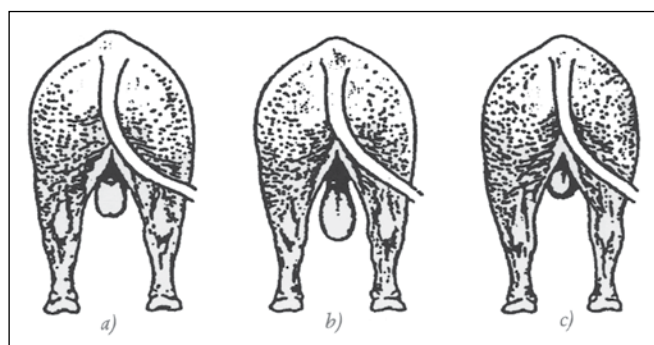
### PALPATE SCROTUM AND TESTES

Bulls with a normally shaped scrotum which has a distinct neck generally have the best testicular development. Testes are located in the scrotum because sperm can only be produced within a narrow temperature range, several degrees cooler

than internal body temperature. Normal scrotal anatomy permits effective temperature regulation.

Bulls with straight-sided scrotums often have only moderate testicle sizes. The straight-sided neck of the scrotum is generally due to fat deposits that will probably impair proper thermoregulation, particularly in the summer. As bulls mature and lose fat, they often develop a more normal-shaped scrotum.

Wedge-shaped scrotums are pointed towards the bottom and tend to hold the testes close to the body wall. Bulls with this scrotal configuration have undersized testes that seldom produce semen of adequate quality and should be avoided.



*Scrotal shapes encountered in beef bulls*

- a) Straight-sided scrotum.** This shape is usually due to a fat-pad at the base of the scrotum which could interfere with testicular thermoregulation. The testicles in a straight-sided scrotum are frequently only moderately sized.
- b) Normal scrotum.** Note the definite neck. Large sized testicles are most frequently found in a normal-shaped scrotum.
- c) Pointy scrotum.** Testicles in a pointy scrotum are held too close to the body and are most often undersized.

Palpate the scrotum and testicles, noting position and consistency. This should be done by your local veterinarian who can properly evaluate testicular tone as it relates to testicular function. Deviations from normal testicles vary from extremely hard and fibrous to soft and flabby. Inflammation of the testes affects the consistency and size of the testicles and results in abnormal sperm production. Scrotal size is influenced by a bull's genes, age, level of feeding and health status.

### EXAMINE EXTENDED PENIS AND PREPUCE

The external genitalia should be examined with great care; the penis is palpated through the external sheath and by protruding it manually. Prolapse of the prepuce is occasionally found, more often in the Brahman and Brahman-derived breeds. Unless there are lesions on the prolapsed membrane, the

prolapse does not interfere with mating. However, the exposed membrane is predisposed to injuries. Record any injury or abnormality as acceptable or unacceptable. Bulls with gross deficiencies or abnormalities detected by physical examination should be culled. Corkscrew penises are a mayor cause of poor in-calf rates in cow herds.

**SCROTAL SIZE**

Scrotal size is important because:

- in conjunction with a bull's serving capacity, it influences the number of cows he can mate during a breeding season (mating potential)
- it is the best known indicator of when a bull reaches puberty
- it is positively related to the age at which female relatives reach puberty
- it is positively linked to later female fertility
- it is moderately correlated to growth rate
- it directly influences semen quality

**MATING POTENTIAL**

Since testicles are composed of 75-80 per cent of sperm producing cells, it is not surprising that the larger they are the more sperm they will produce. Therefore, bulls with larger scrotal size are able to 'settle' a larger number of cows (assuming other factors such as libido and serving capability are satisfactory).

**PUBERTY**

Bulls experience a rapid increase in scrotal size as they approach puberty. This is a more accurate indicator of when a bull reaches puberty than age or weight, regardless of breed or breed cross.

**SCROTAL SIZE – FEMALE FERTILITY LINK**

Australian studies have shown a very positive genetic link between scrotal size and the female fertility trait days to calving. That is, bulls with large scrotal size had female relatives with shorter days to calving. Days to calving identifies a mix of early puberty (in maiden heifers), early conception and return to oestrus, and gestation length. Recent research shows this relationship is not necessarily linear – female fertility increases at the same rate with increasing scrotal size – and it may in fact decline with increasing scrotal size beyond an arbitrary size.

**SEMEN QUALITY**

As scrotal size increases:

- sperm motility (activity) and the percentage of normal sperm increase
- the number of abnormal sperm decrease

**WHAT IS ADEQUATE SCROTAL SIZE?**

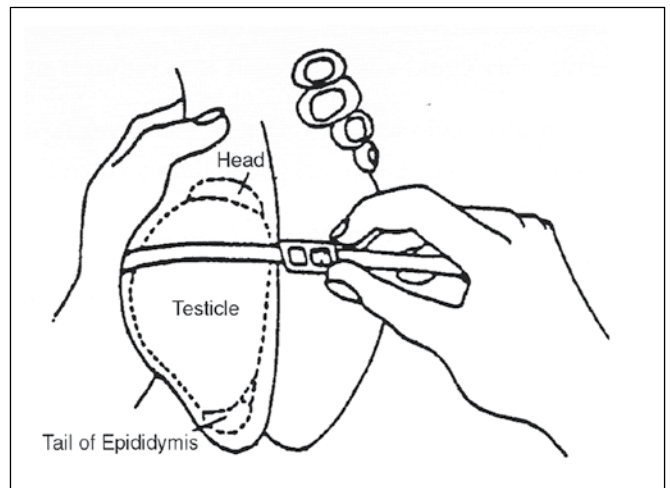
A number of contributing factors affect scrotal size in relation to age.

British Breed Bulls Age (months)	Minimum Scrotal Circumference (cm)
12 – 14	26
14 – 16	28
16 -18	29
18 – 20	30
20+	32

Recommended minimum scrotal circumference for British breed bulls

A general recommendation for Bos Taurus breeds, at a working age of 18-24 months and a mating load of 30-40 cows over a two-month period, is a minimum scrotal size of 30-32cm. However, you should aim for 35cm. It is always wise to be on the more generous side. Because Bos Indicus breeds are later maturing, the recommendation of 30-32 cm should apply to bulls aged 24-30 months.

**SCROTAL SIZE VARIES WITH CONDITION**



*Measuring scrotal circumference*

Scrotal size increases 1-2 cm when bulls are in good condition, compared to store condition.

**WHEN TO MEASURE SCROTAL SIZE**

Scrotal size measurements taken in a large experimental herd in Queensland, Australia, showed the positive link between scrotal size and female fertility applied at any age between 12-20 months. However, measuring at a time that is closest to puberty will give the strongest link.

In British breeds, on good feed, this will be around 10-13 months. With later maturing breeds and strains, measurements should probably be around 18 months. These measurements are used to



produce the Breedplan fertility estimated breeding values (EBVs). These EBVs are more valuable at identifying the female fertility link than a single scrotal measurement at sale time.

The female fertility link is thought to be some mix of earlier puberty and earlier conception. If Breedplan fertility EBVs are available, they offer the best way of selecting for this beneficial link with female fertility.

### TESTING SEMEN QUALITY

Most bulls with "firm springy" testicles and no obvious abnormalities in the epididymis have good quality semen.

Semen testing is usually not necessary and results are often inconclusive. However, if you suspect a problem, consult your veterinarian.

### LIBIDO

Sound structure and testicles are of course no use without libido or the will to serve. Testicle size and libido are separate traits with no genetic link. Bulls with large testicles do not necessarily perform any better in serving tests.

Differences in libido in bulls are due to genetic as well as environmental factors. Several studies have shown that the dominant bulls in a group often sire the largest number of calves. However, if the dominant bulls happen to be sub-fertile, this could actually result in a reduced number of pregnant females.

In a group of bulls with varying ages, social ranking affects a bull's serving capacity. It is therefore unwise to mix young bulls (one and two year olds) with older bulls.

### SERVING CAPACITY TESTS

These tests count the number of serves a bull performs in a set time with restrained females. This is used to predict the number of cows a bull can be mated to and to rank bulls accordingly. When correctly performed by experienced operators, this test has generally given useful results for mature Bos Taurus bulls. Yearling bulls are difficult to test and results can be inaccurate.

Serving Capacity Score	1st Oestrus Conception Rate (%)		Pregnancy Rate (%)	
	Range	Av	Range	Av
0 - 2	4 - 40	21	4 - 67	33
3 - 5	55 - 65	60	89 - 97	92
6 or more	62 - 78	73	90 - 100	97

*Paddock conception rates \* achieved by bulls with varying serving capacities*

\* Bulls with serving capacity as measured in a pen test were mated for six weeks to 40 maiden heifers each.

### SERVING CAPABILITY TEST

This shorter, simpler test only gives a bull a couple of test serves. There is no ranking, but capability is proven. It is a valuable technique to detect arthritis and joint problems, particularly with older bulls.

Animal welfare aspects need to be observed at all times with these tests. It is recommended a veterinarian supervise serving capability tests.

$$\begin{aligned} \text{Libido + Structure/ Mobility} &= \text{Serving Capability} \\ \text{Scrotal Circumference + Serving Capacity} &= \text{Mating Potential} \end{aligned}$$

To assess the mating potential of a bull, refer to the following two tables:

Serving capacity in minutes		Mating potential
40 minutes	20 minutes	(number of cows cycling in first three weeks)
3	2	40
4 or 5	3	45
7	4	50
8	5	55
9	6	60
10	7	65
11	8	70

**Table 1**

To be successfully mated to X number of females...	... a bull must have a minimum scrotal circumference of Y
X – number of cows	Y – scrotal size
40 females	30cm
60 females	32cm
80 females	34cm
	28
	29

**Table 2:** to be successfully mated to X number of females, a bull must have a minimum scrotal circumference of Y

Using Table 1, determine the bull's mating potential from the bull's serving capacity – for example, if a bull has a serving capacity of 9 in 40 minutes, its mating potential is 60 cows.

If the bull has a scrotal circumference of 32cm or more, it can produce enough sperm to "settle" 60 cows. It therefore has a mating potential of 60. If the same bull of serving capacity 9 has a scrotal circumference of only 30 cm, it can produce enough sperm to "settle" only 40 females. Therefore it only has a mating potential of 40.

## Other selection considerations

### BODY CONDITION

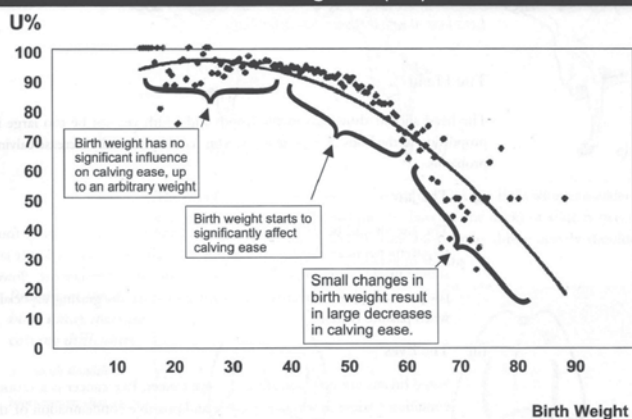
Bulls should have enough body condition to be strong, with some reserves of energy in the form of fat. Over-fat bulls have decreased fertility and decreased stamina for mounting and seeking cows in heat.

### PELVIC MEASUREMENTS

Some breeders overseas perform pelvic measurements on yearling bulls because of this trait's high heritability (50-55%). The hypothesis is that bulls with larger pelvic areas will sire daughters with larger pelvic areas which should result in a reduction in calving difficulty. However, pelvic measurements and other physical measurements, such as pelvic slope, have generally served as poor predictors of calving difficulty. Generally, larger-framed cattle have larger pelvic areas and also produce calves with heavier birth weights. Calf birth weight and age of dam at calving are the most important factors affecting calving difficulty.

Generally, larger framed cattle have larger pelvic areas and also produce calves with heavier birth weights. Calf birth weight and age of dam at calving are the most important factors affecting calving ease. However, the relationship between birth weight and calving ease is not simple, as you can see in the following graph.

The Relationship Between Group Means of Birth Weight and Calving Ease (U%)



### STRUCTURAL SOUNDNESS

The bull's fertility is the most important of his traits. You want him to be able to sire many calves, and sire them early each joining season. To do this, a bull must be sound in his structure so that he lasts many years, serving many cows in a short period of time, without suffering injury.

Structural soundness is therefore an integral part of this fertility. The bull's ability to remain fertile is dependent on his structural soundness. Let's look at each of these areas individually.

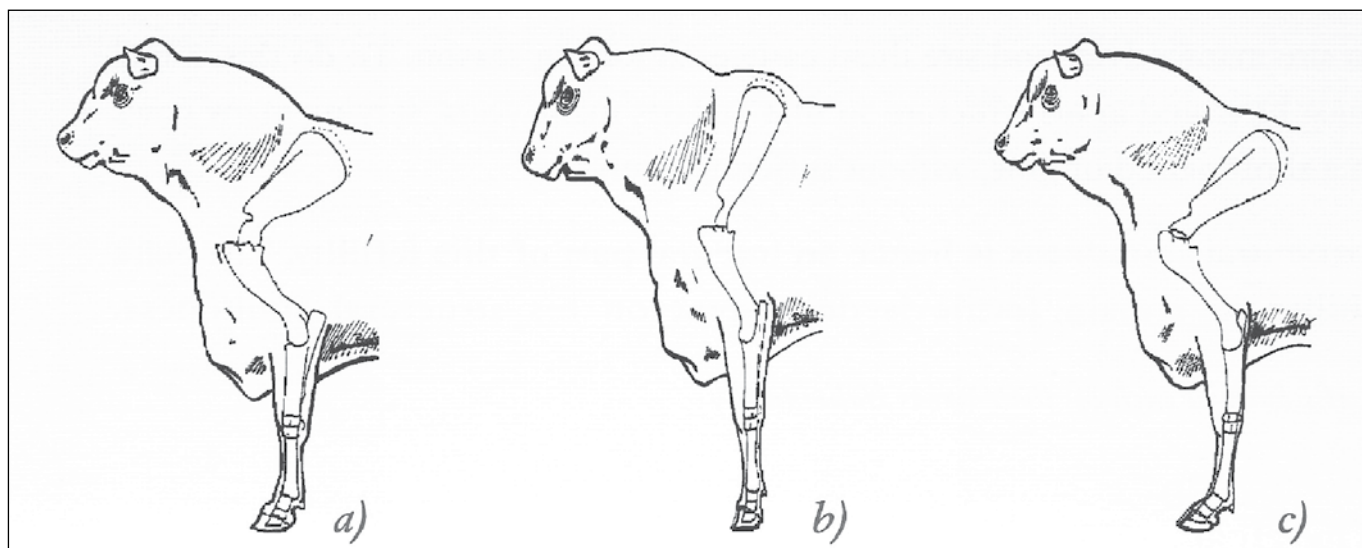
**Head:** The head should show reasonable length and width yet not be too large in proportion to the body. A head that is too big could potentially increase calving problems.

**Jaw:** The jaw should be wide, enabling the animal to harvest its daily food requirements in as short a time as possible. The teeth on the lower jaw should meet squarely with the upper pad. Bulls with overshot jaws (lower jaw protruding) and undershot jaws may have difficulty grazing, especially when pasture is short.

**Eyes:** Some breeds are very susceptible to eye cancer. Eye cancer is a serious condition leading to wastage in cattle and possible condemnation of the carcass. It can be minimised by ensuring that animals are well pigmented around the eyes, have eyes which are well set into the head, and have a well "hooded" forehead. Susceptibility to eye cancer is a heritable trait.

**Neck:** The neck should appear to be of a reasonable length and held high. Often the neck appears to be short because there is too much angle to the shoulder and the point of the shoulder pushes forward into the neck region (refer to Bull C on shoulder structure illustration). If the head and neck are held low, this can indicate the shoulder is too straight (see Bull B).

**Shoulders:** The shoulders are naturally sloping. A slope of 45-60 degrees is considered acceptable. A beast whose shoulder blade is tipped forward (straight shouldered) has less angle at the shoulder joint and elbow joint. This reduces the shock-absorbing ability of these front joints.



Prominent shoulder blades may increase calving difficulties

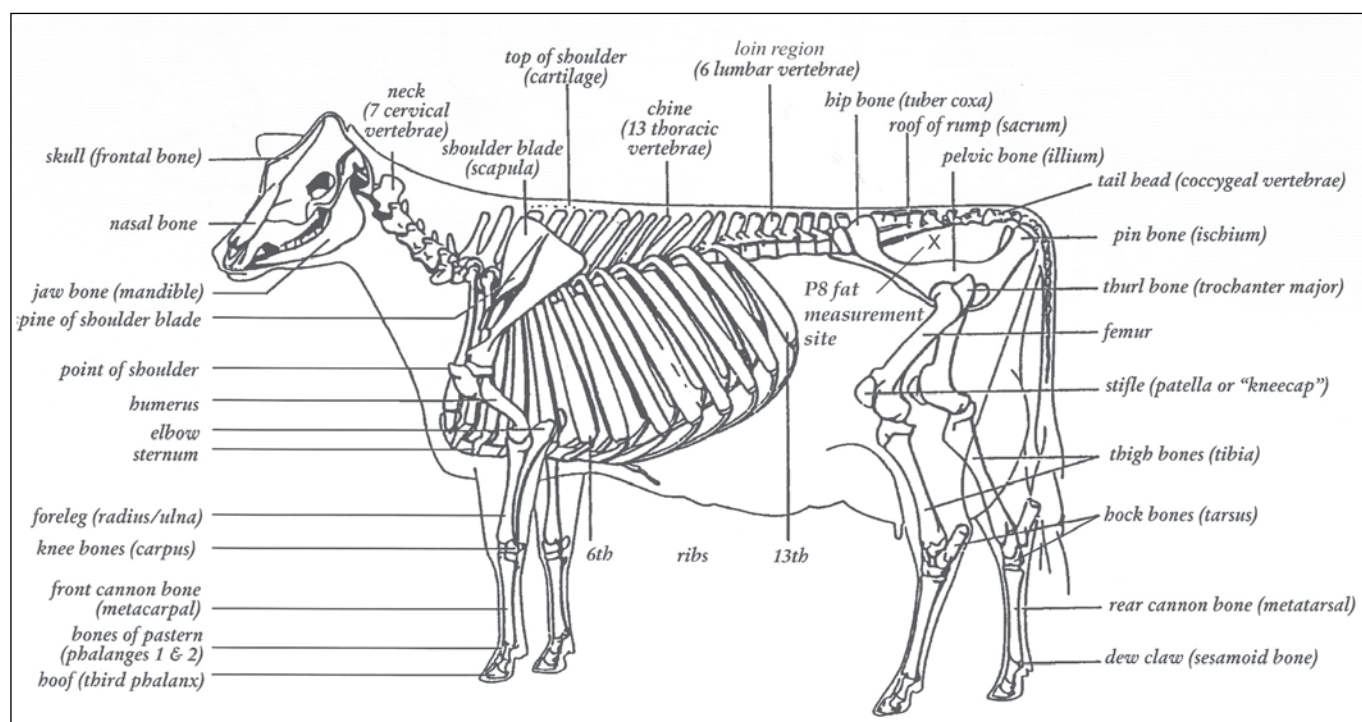
- a) smooth shoulders
- b) prominent shoulders

Front legs and feet: The front legs of the bull should be straight when viewed from in front. On a structurally sound animal, you can draw a vertical line from the point of the shoulder to the middle of the claw. This line should intersect the knee. As the knee joints carry more than half the bull's body weight, deviations from this line will cause excessive wear in these joints.

A 'knock-kneed' bull may have turned out front feet (up to 10 degrees is considered normal). A bull is considered knock kneed when the knee joints lie inside this line, which may eventually lead to overgrown outside claws.

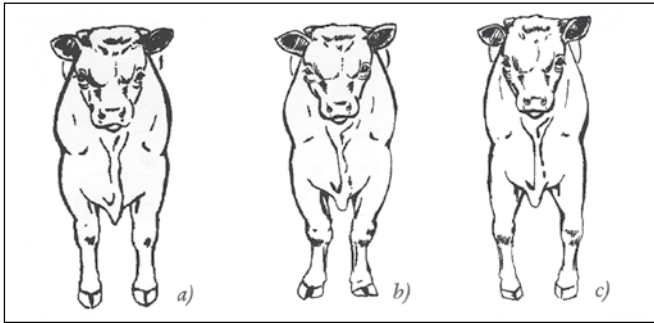
A bull that is wide at the knees (bow-legged) presents a more serious problem. These animals are often narrow in their stance and may roll their feet as they walk. They can also be wide in their shoulders.

From the side, the foreleg and cannon bones should be in a straight line. The knee joint forward of this line (buck-kneed) can be associated with steep shoulders and pasterns, and may be a serious fault.





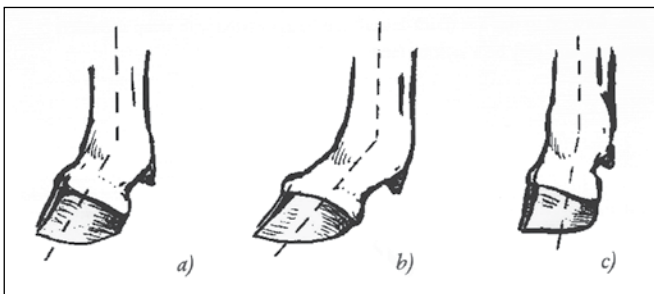
The way the claws of the feet grow often indicates structural problems higher up the legs. Long or excessively short, even claws may indicate too much or not enough pastern angle, causing both claws of the hoof to grow or wear excessively. Overgrown claws affect the mobility and performance of the animal.



Front leg structure

- a) normal
- b) knock-kneed
- c) bow-legged

The figure below indicates the correct angle of the pastern joint. Uneven wearing of the two claws, where one grows longer than the other, is often due to a problem in the leg structure. It is caused by an uneven distribution of weight through the foot.



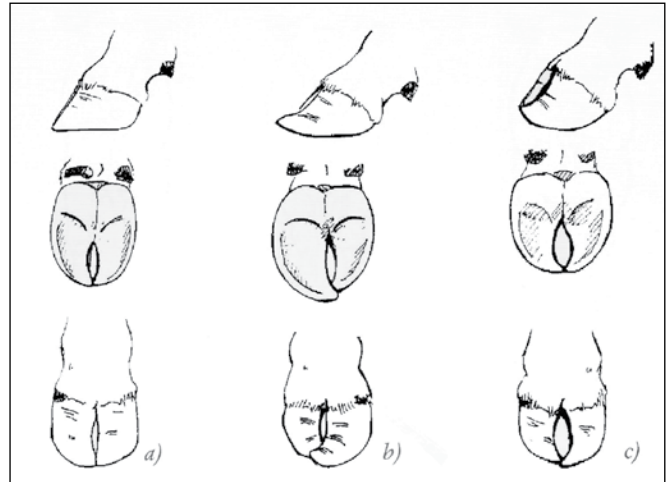
Pastern angle of front and hind legs

- a) correct
- b) too much angle
- c) too straight

If the claws curl across each other without growing long, this may indicate a serious genetic fault known as 'scissor claw'. These cattle wear the back of the hoof, causing lameness and reduced mobility.

Where excessive claw growth is caused by things other than structure (soft soil, heavy grain feeding, lack of exercise), extra pressure is placed on the leg joints – eventually causing lameness.

**Feet:** Avoid overgrown, scissor or curved claws. Mild curling is normal. It is exaggerated by heavy feeding and soft soils. Overgrown, uneven claws usually indicate poor limb structure or early signs of hip arthritis. Avoid extremely short feet, which are often associated with over-straight legs.



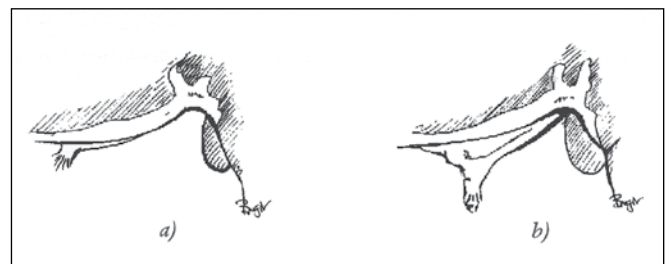
Feet

- a) normal
- b) large outside claw and long curled toe
- c) scissor claw

**Sheath:** The sheath should be trim and close to the body. A long or excessively angled sheath is more prone to injury or infection (from grass seeds and other foreign objects) and should be avoided. Some breeds are more susceptible to these problems and buyers of these cattle must be critical in their selection.

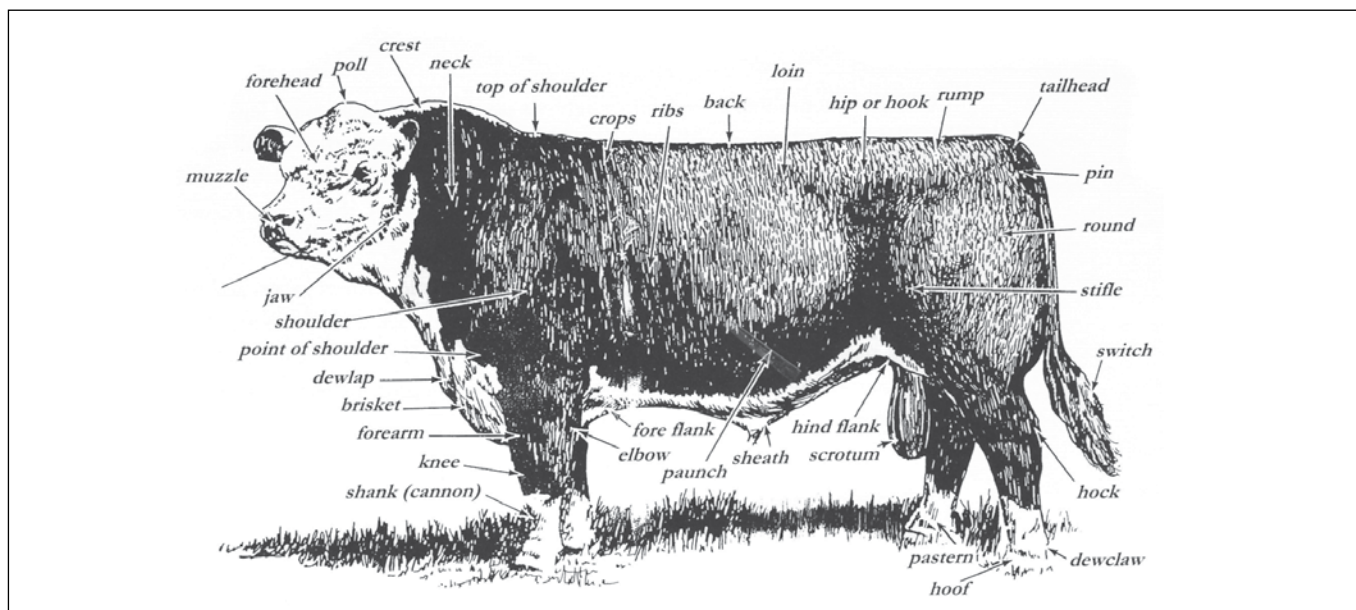
A slack prepuce (the fold of skin covering the penis) should also be avoided. A bull who lets his prepuce hang out for long periods of time should be regarded as having a serious structural fault.

The sheath should be close up against the body to prevent injury.



Sheath

- a) desirable sheath
- b) loose, undesirable



**Hind legs and feet:** When a bull mounts a cow, he straightens up the joints in his hind legs. When he thrusts, he further straightens the legs. This places enormous stress on all joints, but particularly the hock. If these joints don't have enough angulation they become swollen and painful, leading to their eventual breakdown.

Straightness in the hind leg can be seen in the hock and pastern joints, and this indicates straightness in the stifle and hip. These cattle will wear the front of the claws, resulting in short upright hooves. Straight-legged bulls are also much less athletic than the sound bull and appear to suffer a higher incidence of broken or damaged penises during serving.

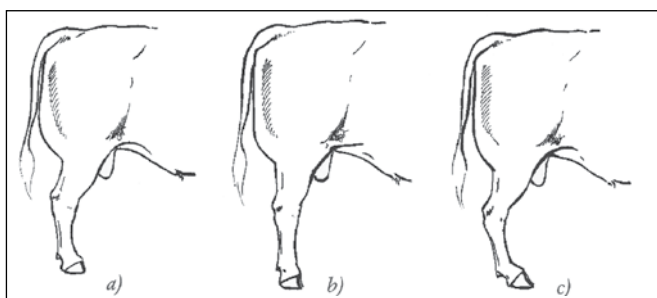
If the degree of the angle in the leg joints is greater than ideal, a 'sickle hocked' condition may exist. This is less of a problem than straight legs, but in extreme cases may cause strained ligaments (pastern and hocks) and long claw growth, increasing the chance of injury, and affecting serving ability.

Viewed from behind, the tibia and metatarsus (hock joint) should be in a straight line. A bull is 'cow hocked' when the hocks are rotated inwards and the hooves rotated outwards. This may cause problems, but usually only in extreme cases where uneven pressure on the claws causes the outside claw to grow long.

A more serious problem occurs where the legs are wide at the hocks but the feet are turned in (bow-legged). Extra strain is placed on the ligaments of the hock joints causing lameness and even permanent damage.

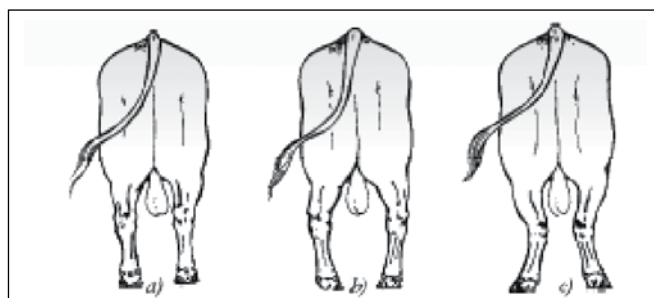
Where an animal places its feet when walking naturally tells you a lot about its structure:

- a structurally correct animal will place its hind foot in the imprint left by the front foot.
- an animal with sickle hocks will tend to overstep the imprint of the front foot.
- a straight-legged (post-legged) animal tends to place its hind foot short of the imprint of the front foot



Hind leg structure, from the side

- a) correct  
b) too straight  
c) sickle-hocked



Hind leg structure, from the back

- a) correct  
b) too straight  
c) sickle-hocked





**SECTION 4**  
**SELECTING A BULL USING**  
**THE 'GENETIC PACKAGE'**



Buying bulls at sales can be difficult, especially when more than one vendor is presenting stock.

- How do you tell if the bulls look better due to feed?
- Are the bulls really genetically superior?

Certainly you can visually check structural aspects, temperament and other things, and you may have experience with some studs or sire lines, but it would be good to have a better indicator of likely breeding values. For example, what are the expected growth rates, milking ability and female fertility levels? Buying bulls on the property allows better selection within that particular herd, but how do you compare that herd with others?

## Using Breedplan to help bull selection

We need to ensure the genetics are right. That is, will the calves the bull sires suit your cows, country and markets?

Breedplan can help many of these decisions – particularly for growth rate and milk, and also with some fertility, calving ease and carcass predictions. Other attributes such as temperament still need to be assessed by eye, although some breeds now report estimated breeding values (EBVs) for docility, which describe this trait.

Breedplan uses EBVs to describe how a bull's calves will perform. EBVs are calculated from:

- the animal's own performance (weight, scrotal size and other factors)
- the performance of relatives (parents, relations and progeny in AI linked herds)
- other related measurements (yearling and weaning weight, for example), which are genetically linked so both weights contribute to estimates of the other trait

EBVs are a much better predictor of the performance of a bull's progeny than single measurements on the bull near sale time (weight, scan, and scrotal size).

EBVs are expressed in everyday units; kg for weight; cm for scrotal size, mm for fat. They can be positive (+) or negative (-), depending on where an animal ranks within a breed for a particular trait. Some traits are more desirable when their value is negative – for example, days to calving. Other traits, such as carcass weight, are more desirable when their value is larger and more positive.

### CALCULATING AN EBV

Before calculating an EBV, certain adjustments must be made to the raw data to remove biases created by differences due to things like date of birth and age of dam.

Example: the adjusted 400-day weight of an animal is 380kg compared to the average 350kg for its contemporary group (that is, calves of the same sex born within a 60-day calving spread and reared in the same group from birth). No information is available on relatives. The heritability of 400-day weight is 0.3 – ie, 30 per cent of the measured performance difference is genetic and will be passed on to the progeny.

$$\begin{aligned} \text{400-day weight + EBV} &= (\text{weight of individual} - \\ &\text{average weight of group}) \\ &\times \text{heritability} \\ &= [(380 - 350) \times 0.3] \text{ kg} \\ &= [30 \times 0.3] \text{ kg} \\ &= +9\text{kg} \end{aligned}$$

*Note: This is the simplest calculation of an EBV using the information on the animal's own performance. It does not include any information from its relatives. This EBV will rank animals in the same order as the old Breedplan system.*

In modern performance recording systems, information about relatives and the effects of related traits is used to make the EBV a more accurate ranking of the animal than a ratio.

Check whether the EBVs are within that herd (Breedplan), or across the whole breed (Group Breedplan). Most major breeds now produce annual sire summaries with Group Breedplan EBVs.

Group Breedplan EBVs are recommended as the best performance data a bull buyer can use. The major advantage of Group Breedplan is that herds for a given breed are compared, enabling the bull buyer to assess the relative merit of different herds and individual bulls from different herds.

Group Breedplan EBVs are the best indication a bull buyer can get on the future breeding potential of a bull.

### SEPARATING GENETICS FROM THE ENVIRONMENT

One of the main areas of confusion with Breedplan relates to understanding how animals which have been treated quite differently can be compared to each other. For example:

- How can calves on finishing country be compared to calves reared on steep hill country?
- How can cattle in Northland be compared with cattle in Southland?

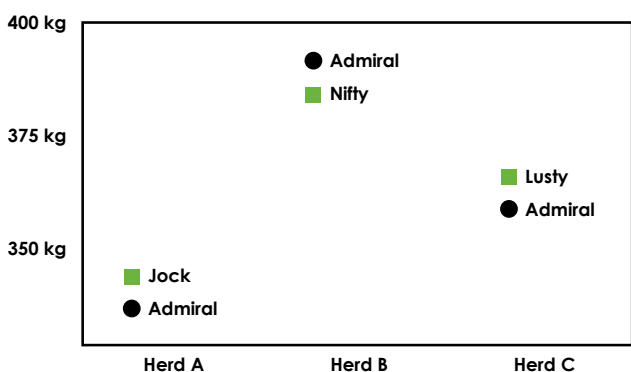
In other words, how can Breedplan differentiate between the amount of a calf's growth that is due to its environment, and that which is due to genetics?

Breedplan differentiates between environmental and genetic performance in the following ways.

First, by having breeders note on their performance forms any individuals or mobs of cattle which have been treated differently, that is, management groups. Breedplan comparisons are initially done within these groups, then linked to others.

Second, by having link animals in the various mobs, eg, a sire on one property with progeny in three mobs or an AI link sire with progeny in three herds.

Take an example where three properties are compared. They all use a link sire (Admiral) by AI, and compare his progeny with those of a different home sire on each property. Property A has poor nutrition, C average and B very good.



When compared to Admiral (the link sire), Jock, tested in herd A, is superior to Nifty from Herd B. Lusty from Herd C has the greatest genetic performance.

**In herd A:** Jock's progeny are on average 5kg heavier than Admiral's. Therefore Jock's EBV for 400-day weight will be +10kg (5kg x 2). Remember, Jock only contributes half of his genes to his progeny, with the other half coming from the cow.

**In herd B:** Nifty's progeny are on average 5kg lighter than Admiral's. Therefore Nifty's EBV will be -10kg (-5 kg x 2).

**In herd C:** Lusty's progeny are on average 10kg heavier than Admiral's. Therefore Lusty's EBV will be +20kg (+10 kg x 2). These EBVs assume that Admiral's 400-day EBV is 0, that reasonable numbers of progeny were measured, and that the cows had similar 400-day EBVs.

The 'link' sire system also allows indirect comparisons to be made. For example:

Jock's progeny are on average 10kg heavier than Nifty's

$$[+5\text{kg} - (-5\text{kg})] = +10\text{kg}$$

Jock's progeny are on average 5kg lighter than Lusty's

$$[+5\text{kg} - 10\text{kg}] = -5\text{kg}$$

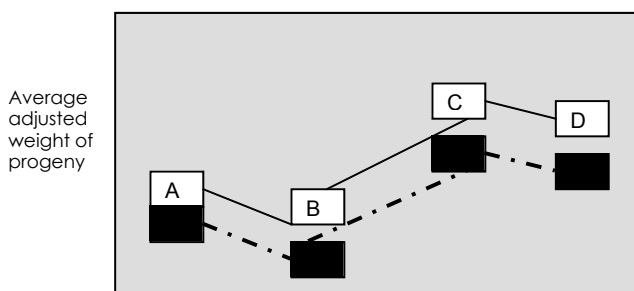
Nifty's progeny are on average 15kg lighter than Lusty's

$$[-5\text{kg} - 10\text{kg}] = -15\text{kg}$$

With the use of AI many such links occur between herds in most breeds. Most breed societies now use an integrated pedigree and performance system, which makes it much easier to trace these links. This allows all the cattle in participating herds to be compared by Group Breedplan and reported in individual breed sire and dam summaries, individual herd reports and, with some breeds, trans-Tasman genetic evaluation reports.

### GENETIC TRENDS

As well as using link animals to compare individuals across herds, we can also use them to compare genetic changes within a herd and a breed in a specific trait, over a period of time (genetic trend). For example, if link sire's progeny (black square) are compared to the progeny of four new sires A,B,C and D in four successive years.



Although the seasons have varied, we can see the rising genetic trend as each year the new sire's progeny are further ahead of the link sire's progeny.

Genetic trends are printed as graphs in national sire summaries and are tabulated in herd reports.

### ENVIRONMENTAL TRENDS

Using this same example, we can see the average weights of link sire progeny rising and falling with the seasons. Breedplan herd reports tabulate this information as environmental trends. These show the effects on progeny of the season, management, feeding technique and so on, free of genetic change.

### USE OF EBVS OF A SIRE AND DAM TO PREDICT THE OUTCOME OF THE MATING

It is easy to do. For example take an Angus bull with an EBV of +80kg for 600-day weight. On average he will pass half of his genes for 600-day weight on to his progeny (equivalent to +40kg). The Angus dam will also contribute to half of the calf's genetics. If the dam's EBV for 600-day weight is +50kg then the calf will get +25kg from her. In this example, the calf would be expected

to be (40+25) kg = +65kg above the fixed base for the Angus breed for 600-day weight EBV. To find

how this figure compares with other individuals of the same age and sex within the Angus breed, you need to know the Angus breed average EBV for the particular year the animal was born. The 600-day weight breed average EBV for calves born in 1997 is +59kg (Angus Trans-Tasman Genetic Evaluation Report) which makes the animal in this example 6kg (65-59) kg above the breed average.

#### USE OF EBVS TO PREDICT THE FINANCIAL OUTCOME OF USING TWO DIFFERENT SIRES

Sire 1 has an EBV for 600-day weight (the age of selling your cattle) of +40kg and Sire 2 an EBV of +10 kg for the same trait. The difference is 30kg, half of which is passed on to the progeny.

That is, calves from Sire 1 would be expected to be +15kg on average heavier than those from Sire 2, if used on dams of similar genetic value run under similar conditions. Over a single year's drop of 30 calves this amounts to a production difference of 450kg liveweight, worth \$675 at 2004 commercial beef prices (\$1.50/kg liveweight) at an average 600 days of age.

#### COMPARING ANIMALS USING EBVS

The current genetic level for this example breed can be determined from the average EBVs for all calves born.

**Table 2**

Birth Weight	200-Day Milk	200-Day Growth	400-Day Weight	600-Day Weight
+1.1	+1.1	+0.6	+5.3	+6.1

Average EBVs in kilos for calves analysed from a New Zealand Group Breedplan example herd

If you are interested in using a sire with a 200-day milk EBV of +5kg then a comparison with the averages in Table 2 will show you that the required sire is above the current average genetic level for the breed for milk (+5kg compared with +1.1kg).

By then comparing the sire's EBV with a full set of percentile bands as shown in Table 3, you can determine that the sire's milk EBV is in the top 20 per cent of all the animals in this analysis.

**Table 3**

Percentile Band	Birth Weight	200-Day Milk	200-Day Growth	400-Day Weight	Day-600 Weight
Top 10%	-0.9	5.8	13.2	22.5	31.2
Top 20%	-0.2	4.1	8.7	16.4	22.2
Top 30%	0.3	2.9	5.5	12.1	15.9
Top 40%	0.7	1.9	2.9	8.5	10.8
Top 50%	1.1	1.1	0.6	5.4	6.2
Top 60%	1.6	0.2	-1.6	2.5	1.9
Top 70%	2.0	-0.8	-3.9	-0.5	-2.5
Top 80%	2.6	-1.9	-6.4	-3.8	-7.4
Top 90%	3.4	-3.5	-9.7	-8.2	-13.8

*Percentile bands for trait values for all animals in example breed*

The figures above shown in the top 50% percentile band are a reasonable representation of the breed average for the trait.



## Presentation of EBVs

Since Breedplan was first introduced, an ever-increasing number of EBVs have been developed in an endeavour to improve profitability. The bull buyer is now confronted with so many figures it can make selecting a herd sire very confusing, especially if there are no closely defined breeding objectives.

There are two ways of rationalising the number of EBVs for presentation to the bull buyer:

### 1. USING ESTIMATED BREEDING VALUES FOR ECONOMICALLY RELEVANT TRAITS

These are traits that directly affect profitability. These are often very difficult to measure, so others which are more readily measured are used as a means of indicating the merit of the economically relevant traits. For example, birth weight is measured, not because a commercial producer gets more or less money based on the weight of a calf at birth, but because it helps to indicate whether progeny are likely to contribute to a difficult birth. Therefore, birthweight could be regarded as an indicator trait for the economically relevant trait of calving ease.

### 2. THE USE OF SELECTION INDEXES

Selection indexes rank animals for a single selection goal: profit (profit per cow mated). They take the hard work out of knowing how much emphasis should be placed on each of the many EBVs when selecting breeding animals. In other words, an index is a single EBV (EBV for profit) that reflects the profit which the animal is predicted to make when used in a particular production system or for a particular market. For example, as a terminal sire or a bull to sire cattle to produce a branded product, such as New Zealand Hereford Prime.

Indexes allow balanced selection in the true sense of the word – they balance the amount of selection pressure that needs to be applied for growth, material, carcass and fertility traits to produce the most profitable herd over the long term. High indexing animals will rarely have the highest EBV for any single trait.

The process of balanced (index) selection involves a couple of steps to combine financial with genetic (EBV) information. Economic values for performance measures are calculated for each production system and/or marketing situation. Using tried and tested genetic theory these economic values are then used to calculate appropriate weightings for all the EBVs currently available. These weightings apply pressure to the right EBVs to achieve the greatest long-term herd profit. In other words, the weightings are calculated to maximise profit by emphasising the

EBVs that are most related to profit, but at the same time they compensate for antagonisms (correlated responses) between traits. For example, the quest for higher growth may encourage a positive birthweight response. However, the negative relationship between birthweight and direct calving ease will moderate the positive selection pressure on growth.

Indexes can be constructed for any production system and/or market situation. However it is only practical to produce standard (genetic) indexes, which represent the most common situations. These standard indexes are very useful for sorting potential sires on profitability. Once the top ranked bulls for the index most closely representing a breeder's production system have been examined, it may be necessary to slightly modify selection by looking at individual EBVs that make up the index. For example, the breeder may decide to reject a top-ranked bull because his birthweight is too high.

Financial implications of using an index: If two Hereford bulls with NZ Hereford Export Indexes (an index representing a pasture-based production system in which some females are retained for breeding and all steers slaughtered at an average liveweight of 555kg by 20 months of age) of \$40 and \$20 are mated to 200 genetically similar females during their lifetimes, the first bull will generate \$2,000 more profit than the second bull  $[(\$40-20)/2 \times 200] - \$40-20/2$  because the bull only provides half the genes, the other half coming from the cow.

#### SELECTION INDEX SUMMARY:

- Selection indexes are very user-friendly
- Simplify genetic selection by combining EBVs with financial information for particular production systems and/or markets
- Rank bulls genetically for specific production systems/markets using a single selection goal – profit per cow mated
- Allow balanced selection in the true sense of the word by applying relative pressure to those EBVs that will maximise the long-term profitability of the herd
- Take all the hard work out of financially prioritising EBVs and accounting for favourable or unfavourable genetic relationships (correlations) between traits
- May need to be further modified (customised) to meet individual breeder requirements, by viewing EBVs that constitute them



**Straight shoulders:** Note the straightness throughout the front leg. Poor structure is often obvious as early as six months, like this bull.



A well placed sheath, lying close up to the body.



**Heavy shoulders:** A bull such as this may increase the chance of calving difficulties.



An excessively long and badly angled sheath, exposing the prepuce and prone to injury.



**Bow legged:** The legs are out at the hocks, placing stress on these joints, and leading to an uneven hoof growth and early breakdown.



**Spiral Deviation 'corkscrew' Penis:** A serious fault preventing full service.  
*Note: it occurs more in the poll breeds than in the horned breeds.*

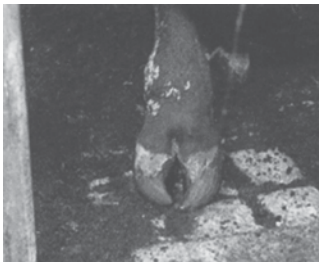




**Low pasterns:** Often associated with sickle hocks, the result will be long hooves and eventual lameness.



A sound commercial bull ready to work.



**Scissor claw:** A very serious genetic fault that causes lameness.



**Uneven claw growth:** Often caused by incorrect structure in the legs.



**Post legged:** The straightness in the stifle and hip. The bull is very prone to breakdown, particularly in the hip joint.



Poppy, unprotected eyes make the bull very prone to eye cancer.



Well set hooded eyes.



**Sickle hocked:** Too much angle in the leg joints seen here in the hock and pastern.



**Table 4** Proposed Economically Relevant Traits and their Indicators<sup>1</sup>

Economically Relevant Trait EBV	Indicators
Sale Weight <sup>2</sup> Weaning Direct Weaning Maternal (Milk) 600 Day Wt Direct Carcass Direct Kgs of Retail	200 Day Wt. 400 Day Wt 600 Day Wt Carcass Weight Birth Weight Yield Fat Thickness
Probability of Calving Ease	Calving Ease Score Birth Weight Gestation Length
Cow Maintenance Feed Requirement	Mature Cow Weight Cow Condition Score Milk Production <sup>3</sup> Gut Weight
Stayability (or LPL <sup>4</sup> )	Calving Records Days to Calving Calving Interval Milk Production <sup>3</sup>
Heifer Pregnancy Probability	Pregnancy Observations Scrotal Circumference
Tenderness	Amount of Intramuscular Fat Shear Force
Feed Requirement for Gain <sup>5</sup>	
Docility	Docility Scores

<sup>1</sup> "Indicators" means traits which are measured to provide information to produce the economically relevant trait EBV. This list contains just the most obvious indicators. It is likely that different situations will be able to use other indicators.

<sup>2</sup> Sale weight is a category of EBVs. Different breeders will have different times at which they believe that future sales will occur for calves resulting from the current breeding decision. Each situation will require the breeder to use only sale weight EBVs.

<sup>3</sup> Milk production will most likely be measured using the maternal weaning EBV.

<sup>4</sup> LPL means Length of Productive Life. It is conceptually the same as stayability but expressed on a different scale (Snelling et al, 1995)

<sup>5</sup> No adequate indicators exist for this EBV yet.

**SECTION 5**  
**HOW MUCH CAN YOU PAY  
FOR A HIGH ESTIMATED  
BREEDING VALUE BULL?**



There is a large range of estimated breeding values (EBVs) in any herd and significant differences will exist which cannot be detected by eye. The maternal attributes which a bull will pass to his daughters cannot be detected by even the most experienced stock worker. For these reasons, EBVs should be an important consideration in the selection of an individual bull.

Between 1990 and 1995 a comprehensive sire evaluation analysis was carried out for the New Zealand Charolais Cattle Society. In this analysis 27 sires were evaluated for growth and carcass traits. If we took yearling weight as an example we would find that the top four sires had EBVs of plus-23 kilos and the bottom four sires had EBVs of minus-8 kilos – a difference of approximately 30 kilos. These sorts of differences exist in all breeds.

## Summary

- Small per head differences in weight of offspring, through the use of superior EBV sires, result in large per year and per life contributions
- Differences in breeding values between sires are not likely to be detected by visual appraisal
- Bull purchase price should relate to the contribution the bull will make in your herd.

## How do estimated breeding values work for us?

What difference would a bull with a +30kg EBV for 400-day (yearling) weight make as a terminal sire in a commercial herd?

The sire and dam each contribute 50 per cent of the genes to their offspring. The sire has an EBV advantage of +30kg and we will assume the dam has no influence.

ie 0kg EBV

Sire	Dam	Progeny
30 + 0		= 15kgs

Let us assume that a bull sires 40 calves a year for four years and yearlings sell at \$1.80 per kilo liveweight. So 40 calves in each of four years, each 15kg heavier (because only half the genes come from the bull) will result in an extra 160 calves x 15kgs or 2400kg of yearling weight. Multiply the kilos by \$1.80 per kg liveweight and you have returned an extra \$4320 over the bull's lifetime.

## RETURNS

Sire advantage: 400-day (yearling) value

	per year	lifetime
+30 kg EBV (400 day )	\$1080	\$4320

Naturally, high growth cattle will require additional feeding. However, fast growing cattle are also recognised as being more efficient converters of feed to beef.

## Using selection indexes to compare the lifetime profitability of bulls

Using selection indexes is more accurate than EBVs to determine the relative lifetime profitability of a bull – assuming the availability of an index that represents the production system or market you're interested in. Establishing the relative lifetime profitability of bulls will enable you to determine their purchase price.

As an example, you run a straight Angus herd generating female replacements and finishing surplus females and all steers to 200kg at 16-20 months. The Angus self replacing index best represents your production system, so you would use this index to compare your bulls. Bull A has an index per cow mated of \$40 and Bull B one of \$30. It is assumed that each bull mates 200 cows during its lifetime. Bull A is predicted to generate \$1000 more profit during its lifetime than Bull B. Based on this, you can afford to pay \$1000 more for Bull A than Bull B and still be just as well off financially.



An aerial photograph of a mountain range. The mountains are rugged and rocky, with some snow patches. A valley runs through the center, with a river or stream winding through it. In the foreground, there is a farm with several buildings, including a large barn and a smaller house, surrounded by trees and a fence.

# **SECTION 6**

## **EXPLAINING THE DIFFERENT ESTIMATED BREEDING VALUES**

## Calving ease traits

Calving ease is an important economic trait because of its impact on calf and heifer mortality, labour and veterinary expenses at calving time, and subsequent re-breeding performance.

Estimated breeding values for calving ease are calculated from calving ease scores, birth weight data and gestation length information provided by breeders. Due to the many non-genetic influences on calving ease, the trait has a low heritability. Usually only proven bulls or cows with several progeny recorded have EBVs for calving ease with sufficient accuracy to be reported. Two calving ease EBVs are provided – calving ease direct and calving ease daughters.

### CALVING EASE DIRECT ESTIMATED BREEDING VALUES

Calving ease direct EBVs are estimates of genetic differences between animals in the ability of their calves from two year old heifers to be born unassisted. The EBVs are reported as differences in the percentage of unassisted calvings.

Higher, more positive calving ease direct EBVs are more favourable. For example, a bull with an EBV of +4% would be expected to produce easier calving progeny from two-year-old heifers than a bull with an EBV of -4%.

### CALVING EASE DAUGHTERS ESTIMATED BREEDING VALUES

Calving ease daughters EBVs are estimates of genetic differences between animals in the ability of their two-year-old daughters to calve without assistance. The EBVs are reported as differences in the percentage unassisted calvings.

Higher, more positive calving ease daughters EBVs are more favourable. For example, a bull with an EBV of +3% would be expected to produce two-year-old daughters that have fewer calving problems than the daughters of a bull with an EBV of -3%.

### GESTATION LENGTH ESTIMATED BREEDING VALUES

Gestation length EBVs are estimates of genetic differences between animals in the number of days from the date of conception until the calf birth date. These EBVs are calculated from the joining and birth date records for calves conceived by artificial insemination or hand mating. The analysis accounts for differences in the 'maternal' effect of dams on the gestation length.

Shorter gestation lengths are usually associated with lighter birth weights, easier calving and improved cow re-breeding performance. Calves born with a shorter gestation length are often heavier at weaning due to more days of growth compared to their contemporaries.

Lower or more negative gestation length EBVs are generally more favourable. For example, a bull with an EBV of -2 days would be expected to produce calves that are born earlier, with easier calving, than a bull with an EBV of +2 days.

### BIRTHWEIGHT ESTIMATED BREEDING VALUES

Birthweight EBVs are estimates of genetic differences between animals in kilos of calf birthweight. Calf birthweight is the biggest contributing factor causing calving difficulty in heifers. To minimise the risk of calving difficulty it is recommended that you only use bulls over your heifers that have similar or lower birthweight EBVs to the heifers.

While low birthweight EBVs are favoured for calving ease they are also often associated with lower growth potential. Consequently, birthweight and growth need to be carefully balanced.

Fortunately, animals do exist with moderate birthweight EBVs and above average EBVs for later growth.

Small or moderate birthweight EBVs are more favourable. For example, a bull with an EBV of +2 kg would be expected to produce lighter calves at birth than a bull with an EBV of +6 kg, with a lower risk of a difficult calving if joined to heifers.

## Fertility traits

Fertility is a critical component influencing the profitability of a breeding herd. EBVs are provided for two fertility traits – days to calving and scrotal size. These traits contribute important information to assist in making breeding decisions to maintain herd fertility. Days to calving EBVs are calculated from the joining and calving date records provided by breeders. Scrotal size EBVs are based on measurements recorded on yearling bulls and known genetic relationships with recorded growth traits.

### DAYS TO CALVING ESTIMATED BREEDING VALUES

Days to calving EBVs are estimates of genetic differences between animals in female fertility, expressed as the number of days from the start of the joining period until subsequent calving.

Variation in days to calving records is mainly due to differences in the time taken for females to conceive after the commencement of the joining period. Females with shorter days to calving EBVs tend to be those which also show early puberty as heifers, which return to oestrous earlier after calving, and which conceive early in the joining period. Only natural / paddock joinings are used to calculate days to calving EBVs. Data from artificial insemination and embryo transfer is excluded. Cows which do not calve are given a 'penalty' figure.

Days to calving EBVs for bulls are based on the performance of their daughters and female relatives. Differences in scrotal size among bulls can also contribute to variation in days to calving EBVs.

Lower or more negative days to calving EBVs are more favourable. For example, a bull with a days to calving EBV of -5 days would be expected to produce daughters that conceive earlier in the joining period, and subsequently calve earlier, than the daughters of a bull with a days to calving EBV of +5 days.

### SCROTAL SIZE ESTIMATED BREEDING VALUES

Scrotal size EBVs are estimates of the genetic differences between animals in scrotal circumference at 400 days of age.

Increased scrotal size is associated with increased semen production in bulls, and earlier age at puberty of bull and heifer progeny. Scrotal size also has a favourable relationship with days to calving – bulls with larger scrotal size EBVs tend to have daughters with shorter days to calving intervals.

Larger more positive scrotal size estimated breeding values are more favourable. For example, a bull with a scrotal size EBV of +4cm would be expected to produce sons with larger scrotal size at yearling age and daughters which reach puberty earlier than the progeny of a bull with a scrotal size EBV of -4cm.

## Growth traits

EBVs are provided for three growth traits: 200-day weight, 400-day weight and 600-day weight, enabling breeders to tailor their selection decisions to achieve desired growth rates for particular market requirements.

In general, with all other things being equal, higher growth rates will lead to higher profitability. However, in most situations an optimum point is reached where less emphasis should be placed on further increases in growth. One of the consequences of continued selection for increased growth EBVs is an associated increase in body size at all ages, together with increases in herd feed requirements.

Growth EBVs are calculated from weight data submitted by breeders, adjusted to relevant age classes prior to analysis. In addition, birthweight data also contributes to variation in growth EBVs due to its positive relationship with later weights.

### 200-DAY WEIGHT ESTIMATED BREEDING VALUES

200-day weight EBVs are estimates of the genetic differences between animals in live weight at 200 days of age. This is a measure of an animal's early growth to weaning. It is an important trait for breeders turning off animals as vealers or weaners.

Larger, more positive 200-day weight EBVs are generally more favourable. For example, a bull with a 200-day weight EBV of +30kg would be expected to produce heavier calves at 200 days of age (or weaning) compared to a bull with a 200-day weight EBV of +5kg.

### 400-DAY WEIGHT ESTIMATED BREEDING VALUES

400-day weight EBVs are estimates of the genetic differences between animals in liveweight at 400 days of age. This is an important trait for breeders turning off animals as yearlings. Larger more positive 400-day weight EBVs are generally more favourable. For example, a bull with a 400-day weight EBV of +50kg would be expected to produce heavier calves at 12 to 14 months of age compared to a bull with a 400-day weight EBV of +30kg.

### 600-DAY WEIGHT ESTIMATED BREEDING VALUES

600-day weight EBVs are estimates of the genetic differences between animals in liveweight at 600 days of age. This is an important trait for breeders targeting the production of animals suited for heavy weight grass or grain fed markets. Larger, more positive 600-day weight EBVs are generally more favourable. For example, a bull with a 600-day weight EBV of +50kg would be expected to produce heavier calves at 18 to 20 months of age compared to a bull with a 600-day weight EBV of +3kg.

## Maternal traits

Differences in calf growth are influenced by a combination of the genetic potential for growth among the calves and the genetic differences in maternal ability of their dams. The differences in maternal ability can largely be attributed to variation in milk production of the dams.

Group Breedplan separates the growth and maternal components of 200 and 400-day weight records to produce EBVs for milk production. A bull's milk EBVs are based on the growth performance of his daughters' calves.

Mature cow weight is a newer maternal trait in Group Breedplan. This EBV provides useful information to help breeders match cow size to the environment. It is also a useful indicator of later growth performance for breeders targeting heavyweight bullock production.

### MILK ESTIMATED BREEDING VALUES

Milk EBVs are estimates of the genetic differences between animals in milk production potential, expressed through variation in calf growth performance.

A bull with a milk EBV of +10kg would be expected to sire daughters with higher milk production than



a bull with a milk EBV of +2kg. This higher milk production should be reflected through higher weaning weights among the daughters' calves. There is a considerable time lag before a bull obtains a reasonable accuracy for its milk EBVs, due to the time taken before growth performance data is available from his daughters' calves. If a bull is to be used as a terminal sire, with no daughters kept as female replacements, then his milk EBVs can generally be disregarded.

The optimum level of milk production potential in beef cows is dependent upon the production system and environment in which the cows are run. Selection for increased milk production might be warranted when cows are run under good nutritional conditions and calves are sold as weaners or vealers. However, not all environments will support high milking cows.

Depending on the environment, the more favourable 200-day milk EBVs are either moderate, or larger and more positive.

#### **MATURE COW WEIGHT ESTIMATED BREEDING VALUES**

Mature cow weight EBVs are estimates of the genetic differences in cow weight between animals at five years of age.

Mature cow weight EBVs for sires are based on weights recorded on their daughters (following the weaning of their calves), plus consideration of overseas genetic information and the genetic relationships known to exist between cow weight and earlier growth performance.

While moderation in cow weight is desirable for reducing herd feed costs, it is also often associated with lower overall growth potential. Consequently, mature cow weight and early growth performance need to be carefully balanced to optimise overall herd productivity.

Sires with above-average EBVs for 400 or 600-day weight will also tend to have above-average mature cow weight EBVs. However, the analysis of weight records on their daughters has identified some sires with smaller (or larger) mature weights, relative to that predicted from their early growth performance.

Smaller or moderate mature cow weight EBVs are generally more favourable. For example, a bull with a mature cow weight EBV of +50kg would be expected to produce daughters with lighter mature weights and lower feed requirements than a bull with a mature cow weight EBV of +80kg.

## **Carcass traits**

Breedplan uses data obtained from ultrasonic real-time scanning of live animals and abattoir chiller assessment data to calculate EBVs for carcass weight, eye muscle area, rib and rump fat cover, percentage retail beef yield, and intramuscular fat percentage (marbling).

To date, the majority of the data used in the calculation of carcass EBVs has come from ultrasound scan measurements taken by accredited scanning technicians. Group Breedplan can now use relevant abattoir carcass data collected on animals in structured progeny test programmes together with suitable overseas genetic information.

Use EBVs for carcass traits, together with visual assessment for muscularity and maturity type, to assist in breeding cattle for specific market requirements.

#### **CARCASS WEIGHT ESTIMATED BREEDING VALUES**

Carcass weight EBVs are estimates of the genetic differences between animals in untrimmed hot carcass weight at 650 days of age.

Differences in carcass weight EBVs are calculated from available abattoir carcass weight records and known genetic associations with growth traits. Animals with high 400 and 600-day weight EBVs will also tend to have high carcass weight EBVs.

Larger, more positive carcass weight EBVs are more favourable. For example, a bull with a carcass weight EBV of +40kg would be expected to produce progeny with heavier carcasses at 650 days of age than a bull with a carcass weight EBV of +10kg.

#### **EYE MUSCLE AREA ESTIMATED BREEDING VALUES**

Eye muscle area EBVs are estimates of the genetic differences between animals in eye muscle area (cm<sup>2</sup>) at the 12/13th-rib site on a standard 300kg carcass. Eye muscle area has a positive relationship with retail beef yield. Progeny of animals with higher eye muscle area EBVs will tend to have superior visual muscle expression.

Larger, more positive eye muscle area EBVs are generally more favourable. For example, a bull with an eye muscle area EBV of +2 cm<sup>2</sup> would be expected to produce progeny with a greater degree of muscle expression and higher retail beef yield at any particular carcass weight than a bull with an eye muscle area EBV of -2 cm<sup>2</sup>.

#### **RIB FAT ESTIMATED BREEDING VALUES**

Rib fat EBVs are estimates of the genetic differences between animals in fat depth (mm) at the 12/13th rib site, on a standard 300kg carcass.

The use of rib fat EBVs depends on your goals relating to the finishing ability of your animals. Breeders aiming to breed leaner cattle may select for lower fat values, while a breeder aiming to use a bull over dairy cross cows to produce vealers may need to choose a bull with higher fat EBVs to ensure meeting market demands. Fat depth has a negative relationship with retail beef yield.

Analysis of a breed database indicates a general tendency for animals with positive fat EBVs to have shorter days to calving intervals. Consequently, breeders should be cautious about applying intense selection for lower fat EBVs in situations where female replacements are kept.

Either more positive OR more negative rib fat EBVs may be more favourable, depending on your breeding goals. For example, a bull with a rib fat EBV of  $-1\text{mm}$  would be expected to produce leaner carcasses at any particular carcass weight than a bull with a rib fat EBV of  $+1\text{mm}$ .

### RUMP FAT ESTIMATED BREEDING VALUES

Rump fat EBVs are estimates of genetic differences between animals in fat depth at the P8 rump site on a standard 300kg carcass (see illustration page 15).

There is a strong positive genetic relationship between rump fat and rib fat. Animals with extreme (high or low) rib fat EBVs also tend to have extreme rump fat EBVs. Differences between rib and rump fat EBVs for individual animals may indicate differences in carcass fat distribution.

Either more positive OR more negative rump fat EBVs may be more favourable, depending on your breeding goals. For example, a bull with a rump fat EBV of  $-1\text{mm}$  would be expected to produce leaner carcasses at any particular carcass weight than a bull with a rump fat EBV of  $+1\text{mm}$ .

### RETAIL BEEF YIELD PERCENTAGE ESTIMATED BREEDING VALUES

Retail beef yield percentage EBVs are estimates of genetic differences between animals in percentage retail beef yield in a standard 300kg carcass.

Retail beef yield percentage reflects economic differences in carcass value and refers to the bone-out yield of a carcass, with 2-3mm fat trim, adjusted to 85% chemical lean. Variation in retail beef yield percentage EBVs is determined largely from differences in ultrasound fat and eye muscle area measurements between animals and a small negative relationship with growth and carcass weight EBVs.

Larger, more positive retail beef yield percentage index values are more favourable. For example, a bull with a retail beef yield percentage EBV of  $+1\%$  would be expected to produce calves with higher

yielding carcasses at any particular carcass weight than the calves sired by a bull with a retail beef yield percentage EBV of  $-1\%$ .

### INTRA-MUSCULAR FAT PERCENTAGE ESTIMATED BREEDING VALUES

Intra-muscular fat percentage EBVs are estimates of genetic differences between animals in percentage intra-muscular fat (marbling) in a standard 300kg carcass.

For markets like Japan where marbling is important, differences in intra-muscular fat percentage can contribute significantly to carcass value.

Differences in intra-muscular fat percentage EBVs are calculated from information obtained from overseas genetic evaluations of marbling together with data obtained from animals sampled in Australia's Cooperative Research Centre for Beef Genetic Technologies progeny test programme, and genetic relationships found to exist with ultrasound scan fat depth measurements. We are now also beginning to use ultrasound scan of intra-muscular fat percentage data recorded on live animals. In future, chiller assessment marble score data recorded on animals in structured progeny test programmes will also contribute to these EBVs.

Depending on your market targets, positive intra-muscular fat percentage EBVs may be more favourable. For example, a bull with an intra-muscular fat percentage EBV of  $+0.5$  would be expected to produce calves with higher average marble score at any particular carcass weight than a bull with an intra-muscular fat percentage EBV of  $-0.5$ .

### NET FEED INTAKE ESTIMATED BREEDING VALUES

Net feed intake EBVs are estimates of genetic differences between animals that relate to the amount of feed they eat when compared with what they would be expected to eat, based on their weight and liveweight gain. Animals which eat less than expected are regarded as being more feed efficient than those which eat more. This EBV therefore is independent of an animal's weight and growth rate and so does not necessarily favour large mature size as does the other measure of feed efficiency – feed conversion ratio (a measure of feed intake divided by weight gain).

Net feed intake EBVs are reported as kilos of feed eaten per day. Like most EBVs they can be positive or negative relative to the breed average. The more negative the EBV, the least feed eaten and the more efficient the animal. For example, two bulls with these EBVs:

Bull **A**  $+ 0.5$  kg/day (breed average is 0)

Bull **B**  $- 0.7$ kg/day

A simple interpretation is that Bull **B**, having a more negative net feed intake EBV, would be expected to breed 'more efficient' progeny, than Bull **A** or a breed average bull. If the two bulls were similar in weight EBVs and were joined to average cows, the progeny of **B** would eat 0.6kg less per day than the progeny of **A** i.e.  $[0.5 - (-0.7)]/2$ , since the cows contribute half the genes.

## Accuracy of estimated breeding values

By definition, EBVs are **estimated** breeding values. They are estimates because it is impossible to predict with 100 per cent certainty the genetic merit of an animal and therefore the genetic merit of the progeny of a particular mating.

The accuracy of an EBV increases as more performance information on an animal and its relatives becomes available. The following examples indicate how accuracies are related to progeny numbers and relatives. If the only information available is a bull's own performance for one trait with a heritability of 30 per cent, the accuracy will be 55 per cent. If information is also known on about 10 paternal half siblings and two maternal half siblings, then accuracy increases to 61 per cent. Animals with parents of high accuracy could have higher accuracies than those shown in Table 5.

### THE ACCURACY OF AN EBV DEPENDS ON TWO MAJOR FACTORS:

1. The heritability of the trait. That is the proportion of an animal's superiority that is passed on to its progeny
2. The amount of performance information available on an animal and its relatives.

**Table 5:** Accuracy of estimated breeding values for a trait with heritability of 30 per cent

Information available	Accuracy (%)
Individual	55
Individual + Sire + Dam	60
Individual + 10 PHS* + 2MHS**	61
Individual + 20 PHS* + 4MHS	64
10 progeny	67
32 progeny	85
55 progeny	90
Individual + 10 progeny	74
Individual + 20 progeny	82
Individual + 45 progeny	90

\* PHS = calves by the same sire

\*\* MHS = calves from the same dam

Accuracy for a particular trait and heritability for that trait can be used to calculate confidence intervals for EBVs. For various accuracy levels the possible changes in EBVs (standard errors) for each trait are shown in Table 6.

A trait with a low heritability, such as milk, requires considerably more information to achieve the same level of accuracy compared with a trait with high heritability. This is why high levels of accuracy on a bull are not achieved with his milk EBV until his daughters have weaned several calves.

**Table 6:** Possible changes in estimated breeding values at different levels of accuracy (an example table only)

### Accuracy %

EBV	60%	75%	85%	90%	99%
Birthweight (kg)	2.0	1.6	1.3	1.1	0.3
Milk (kg) 200-day	5.65	4.6	3.7	3.1	1.0
200-day growth (kg)	7.9	6.5	5.2	4.3	1.4
400-day weight (kg)	1.8	10.6	8.4	7.0	2.3
600-day weight (kg)	16.0	13.2	10.5	8.7	2.8

Highly accurate EBVs are very reliable; there is little risk that the progeny performance of an individual with high accuracy will be much different from what the EBVs indicate. For example, the possible change in a 200-day growth EBV which is reported with 99 per cent accuracy is only 1.4kg. That is, there is a 66 per cent chance that the animal's true breeding value will be somewhere between +1.4kg of its reported EBV or a 95 per cent chance it will be somewhere between +2.8kg of its reported EBV. Alternatively, the average progeny performance of an individual with low accuracy values may be quite different from what his EBVs indicate.

### HOW TO USE ACCURACIES

As a general rule animals should be compared on EBVs regardless of accuracy. However, the individual breeder will use accuracies according to his or her attitude to risk. A risk taker will tend to ignore the accuracy of an animal and choose an animal with an extremely high EBV but with a low accuracy, whereas a risk-averse person will tend to purchase a less extreme EBV animal with high accuracy. Breeders with small herds tend to be risk averse, because they may be buying one replacement animal that year. If you're buying 10 bulls you can take more risks because you know that on average you will achieve the result.



# SECTION 7 BRINGING YOUR NEW BULL HOME



## Summary

- Consult with your veterinarian and draw up a policy for treating and inspecting bulls on an annual basis.
- Bulls are a large investment for breeding herds and they have a major effect on herd fertility. It is worth your while to spend a little time making sure they adjust to their new environment, are fit, free from disease, and actively working.

## Health and handling considerations

It is wise to set up an annual breeding soundness evaluation and health treatment programme with your vets for all your breeding bulls. The more information you have on a bull's reproductive and structural soundness, the greater the guarantee of him leaving you offspring. This applies equally to young bulls as when you're buying mixed age sires. Evaluations that can be carried out include:

- serving capability
- serving capacity
- semen evaluation, including a full morphology
- palpation of the testicles and reproductive tract
- measuring scrotal size

When you buy a new bull for your herd, you can reduce problems by getting him settled in properly in his new environment.

Bulls of all breeds can become upset and excited in the sale and delivery process. They are subjected to strange yards, different noises, loss of their mates, different people, different handling methods, trucking, unloading, new paddocks and different water and feed. This combination is often enough to upset even quiet animals.

New bull buyers are often concerned about the apparent bad temperament of a bull that seemed quiet enough when purchased. Understanding why bulls become upset, and reducing these causes of stress, allows them to settle down quickly.

## Purchase

Temperament is a major thing to check when you buy bulls. Inspect them in the yards or paddock before sale and note any unusual behaviour or activity. Note bulls that are continually pushing to the centre of a mob, running around, unreasonably nervous, aggressive or excited. This behaviour should be written down in the sale catalogue and referred to during the auction.

At the sale, note any changes of temperament by individual bulls. Some bulls which are quiet in the yard or paddock may not like the pressure and noise of the auction and become excited. Others that were excited before, get much worse in the sale ring and can really perform. Using the yard or paddock behaviour as a guide, rather than the temperament shown in the ring, you can often buy such bulls cheaper, provided they were satisfactory in other respects.

It's important to check the animal health status of the bull breeder's herd before you buy. This is especially relevant when purchasing from areas where TB is prevalent.

Bovine Viral Diarrhoea (BVD) has become an endemic disease in New Zealand and can cause serious financial losses in breeding herds. It is wise to only purchase bulls that have been tested BVD-antigen negative and are vaccinated against the disease. An annual vaccination is required following the two initial sensitising ones.

## Delivery

At auction sales, possession is yours after the fall of the hammer, so careful treatment of animals from then on is important. Sometimes the vendors provide insurance against loss in transit, accidental loss of use or infertility. However insurance is usually the responsibility of the buyer.

When you buy a bull, ask what health treatments he has received. Knowing what has been done can reduce any future health treatments.

When you use a professional carrier:

- make sure they know which bulls can be mixed together
- discuss resting procedures for long trips, expected delivery time, truck condition and quiet handling with the carrier
- ensure you give explicit instructions on the delivery docket. Important details include ear tag details and / or brand numbers, your address and your contact telephone numbers
- when buying bulls from distant locations you may have to fit in with other delivery arrangements to reduce cost. You should make it clear how you want your bulls handled

## Arrival

When the bulls arrive home, unload them at the yards into a group of quiet stock – for example, steers or herd cows. Never jump them from the back of

a truck into a paddock. Bulls from different origins should be put into separate areas with other cattle for company.

Provide feed and water, then leave them alone until next morning. The next day, bulls should receive routine health treatments. A bull's behaviour will decide how quickly he can be separated and moved out to paddocks.

Bulls should be drenched and held in the yards for 24 hours to prevent introducing worms and, if necessary, treated for lice. Horned bulls should be well tipped to allow easier working through yards and races.

New bulls should be paddocked separately from older bulls to avoid fighting and the risk of injury. The new bull may be paddocked with the older bulls after their first mating.

## Mating new young bulls

Newly purchased young bulls should not be multiple-joined with older herd bulls. They will often not be allowed to work effectively, with the older dominant bulls bossing them and preventing them from mating.

Use new bulls in either single-sire groups or with young bulls their own age. If you're planning to do the latter, run them together for a few weeks before joining starts. They will sort out their pecking order quickly and have fewer problems later.

When the young bulls are working, inspect them regularly and closely to ensure they are successfully serving the cows. This is critical in a single-sire mating situation.

## Managing older herd bulls

Older working bulls also need special care and attention before mating starts. Field data indicates up to 35 per cent of mixed aged bulls used in a mating programme have some defect which will affect their ability to get cows in calf.

They should be tested or checked each year for physical soundness, testicle tone and serving capacity or ability. All bulls you plan to use must be free moving, active and in forward store condition. The best time to inspect bulls for physical soundness is at the end of mating. Often permanent injuries suffered during mating will heal with time and are unable to be detected later. Working bulls may need feeding before the joining season, to improve their condition.

Check with your veterinarian for advice on bull inspection and animal health treatment.

## During mating

Check bulls at least twice each week for the first two months. Get up close to them and see each bull walk; check for swellings around the sheath and for lameness.

Have a spare bull or bulls available to replace any that break down. Replace any suspect bull immediately.

Rotate bulls, in single-sire groups, to make sure that any bull infertility is covered. Single-sire joining works well but it has risks. The bulls must be checked regularly and carefully or the bulls rotated every cycle.





**SECTION 8**  
**YEARLING BULLS, TAPPING  
THEIR IMMENSE POTENTIAL**

Some beef producers use bulls at yearling age (12-18 months). This allows introduction of superior genetic material into herds a year earlier than normal, resulting in faster genetic improvement.

Introducing yearlings offers breeders the potential to extend the working lives of bulls by a year or more, lowering the bull costs of a herd. This extra workload is achieved at the time in their lives when they are young, lean, fit, and sexually keen. They are also more likely to be free of some of the structural problems that affect older bulls.

Yearling bulls have much to offer, both genetically and financially. However, poor management can reduce calving percentages, compromise animal welfare and limit their lifetime potential. In order to harness the immense potential of yearling bulls, special management is required – their age and physiological status demands it.

## Why yearlings are different

Apart from their age, yearling bulls are different from older bulls in a number of ways. They are still growing strongly, and tend to be leaner, carrying less body fat. They are also smaller in size and subordinate to older bulls. This makes them more injury prone when mixed with older bulls in the sexually competitive environment of a joining group.

Yearling bulls are usually sexually inexperienced, are more likely to be sexually immature and their health and body condition are far more sensitive to poor nutrition, and the challenges of internal and external parasites.

## The benefits of using yearlings

Experienced cattle producers often say they prefer yearlings because they settle in better, mix with other cattle more easily and are easier to handle than older bulls. However, there are some far more tangible incentives in using yearlings.

The average working life of a bull is less than four years. If you first use a bull as a yearling, you can extend his working life by a year or more (a 20 per cent increase). As a result, you can spread the purchase price and running costs of the bull over more calves. This reduces bull costs per calf and helps boost profitability.

Yearling bulls give cattle breeders the opportunity to achieve faster rates of genetic improvement. This is due to the influence of what geneticists call 'generation interval', which refers to the average age of parents when their calves are born. By using genetically superior bulls as young

as possible, you achieve faster turnover rates of genes. Joining yearling bulls to yearling heifers can maximise genetic improvement by lowering generation intervals.

Yearling bulls are significantly less costly to produce. Seed-stock suppliers sell their bulls six to 12 months earlier, which simplifies their management and reduces overheads.

In addition to these advantages, there is strong circumstantial evidence to suggest that bulls used first as yearlings have longer working lives. This has been attributed to superior fitness and lower levels of body fat than some over-conditioned older bulls. The more active lives of these bulls means they are maintained at body weights below their genetic potential. As a result, serving places less stress on their skeletal structure, and breakdowns are less likely to occur.

The two biggest causes of breakdowns in bulls are from hip arthritis (more than half of all wastage) and broken penises. Over-conditioning bulls for shows and sales exacerbates both these conditions – especially multi-vendor sales. It appears that bulls used first as yearlings are less affected by these serious sources of economic loss.

## Observations on scrotal size and serving capability

### WILL YEARLING BULLS BE SEXUALLY MATURE?

British breed yearling bulls will generally be sexually mature if they:

- are well grown
- are in good condition
- are 12 months of age or older
- have a scrotal circumference of 28cm or more at 12-14 months

The onset of puberty is directly related to age and bodyweight. Bulls on a high nutrition plan are more likely to reach puberty at a younger age. In some cases, this may be as young as eight-months-old. It is risky to use poorly grown or low conditioned bulls as yearlings, as they may not have reached puberty.

Around puberty, testicles grow very quickly, resulting in a rapid increase in scrotal circumference. In well grown British breeds this growth spurt is normally expected to take place between eight to 13 months of age, under optimal nutrition.

In general, some European breeds and *Bos indicus* or their derivatives reach sexual maturity later than British breeds. Because of this, they are often not suitable for use as yearlings.

## SERVING ABILITY

Yearling bulls are usually sexually inexperienced when joined for the first time. The learning phase may cause minor delays to the start of calving. If this will be a problem, start joining seven or 14 days earlier than normal to compensate for the slight delay.

## Mating management

Yearling bulls can be effectively joined either individually or in peer groups. They should not be joined with older, more dominant bulls. If you join them in a single-sire mating situation, rotate them around the mobs every 21 days.

Multiple joining groups have traditionally been used as an insurance policy against the risk of having a dud. If one bull in the group is freeloading, the others will cover for him, so conception rates don't suffer. However there is evidence of higher injury rates in multiple joining groups, especially when the bulls in the group are of different ages.

### THREE CRUCIAL MANAGEMENT REQUIREMENTS TO HARNESS THE POTENTIAL OF YEARLING BULLS

- Join yearling bulls either alone or with bulls of the same age, on high quality pasture
- Join yearling bulls for six to eight weeks only (two cycles), then spell for at least three months
- After removing yearling bulls from their joining groups, place them on high quality feed in specially prepared paddocks

### BUT WON'T YEARLINGS BE TOO SMALL TO 'REACH' MY COWS?

Compatibility in size between bulls and females will obviously be important. To ensure optimum conception rates, use only well grown yearling bulls and join them to heifers or young cows. This has the additional advantage that yearling bulls are lighter than older bulls, and are less likely to injure heifers.

### BUT WON'T JOINING BULLS AS YEARLINGS KNOCK THEM AROUND?

The joining period should be restricted to six weeks. The use of yearling bulls is limited only by their health and fitness. There is a challenge to our beef industry to advance genetic progress through the judicious use of yearling bulls. The value of a bull should be measured by the performance of his offspring, not by what he looks like.

### YEARLING BULLS DO NOT SIRE SMALLER CALVES

It is surprising how many cattle producers think that young bulls are more likely to sire small calves. They are purchased in the mistaken belief that they can reduce calving difficulties. Clearly that is not the case. There is no relationship between the age of a bull at joining and the weights of his calves.

The birthweight of calves is strongly heritable, so a bull will genetically influence the birthweight of his calves.

If you are concerned about birthweight, buy a bull that has a low EBV for birthweight, or one that had a significantly lower birthweight than the average of other bull calves in the same drop. If data on birthweights is unavailable, select a bull with moderate EBVs for growth or one that has been successfully delivered by a heifer.

### MATING POTENTIAL

Bulls should undergo thorough physical examinations and serving tests annually to eliminate the costly non-performers.

Under ideal conditions, correctly managed yearling bulls may be successfully joined to 30-40 females providing they have proven high serving capacity, with large testicles. If no serving capacity information is available, a more conservative approach is needed in the first year, until you have a track record for the performance of yearling bulls on your farm. In these situations, the recommended mating load is only 25-30 females.

Experience shows us that many young bulls have been ruined from being joined for too long and under poor levels of nutrition. If at any stage yearling bulls lose excessive condition or liveweight, withdraw them from their joining group immediately.



# SECTION 9

## BULL BUYING EXERCISES

### Bull Selection Exercise 1

#### GROUP BREEDPLAN ESTIMATED BREEDING VALUES (KILOS)

Bull	Bull weight	200-day milk	200-day weight	400-day weight	600-day weight
A	- 1	+ 5	+ 10	+ 30	+ 45
B	+ 2	+ 2	+ 14	+ 25	+ 28
C	+ 5	- 8	+ 16	+ 40	+ 50
D	+ 2	+ 10	+ 10	+ 25	+ 30
E	+ 1	0	+ 10	+ 28	+ 40

All bulls are structurally sound and fertile.

The following four buyers are selecting from this sire list. Which bulls should they choose?

#### BUYER 1

Has a herd of crossbred cows with no calving problems. He wants a sire to produce fast growing weaners and does not keep heifers.

#### BUYER 2

Sells vealers but also breeds replacement heifers and believes increasing the level of milk production in his herd would benefit profitability.

#### BUYER 3

Wants to increase yearling and final weights, avoid calving difficulty, and increase milk production slightly. His main product is steers and he retains his own replacement heifers.

#### BUYER 4

Is straight breeding in a harsh environment where cows with high EBVs for milk are slower to breed again. He wants to maintain his current level of birthweights and milk production while increasing growth rate in two-year-old steers.

**ANSWERS**  
 Buyer 1 Bull C – the high birthweight and low milk EBVs do not matter, so select highest 200-day weight  
 Buyer 2 Bull D – the high milk EBV is the deciding factor  
 Buyer 3 Bull A – high 400 and 600-day weight EBVs, with low birthweight and positive milk EBVs  
 Buyer 4 Bull E – adequate 600-day weight, low milk and neutral birthweight EBVs

## Bull Selection Exercise 2

From this example catalogue, advise the buyers on their bull choice. Assume all bulls have adequate scrotal size for current mating load.

### GROUP BREEDPLAN ESTIMATED BREEDING VALUES

Bull	400-day weight	600-day weight	Scrotal size (cm)	Days to calving (days)
A	+ 40	+ 50	+ 1.2	- 9
B	+ 44	+ 40	+ 2.0	- 6
C	+ 34	+ 40	- 0.5	+ 9
D	+ 48	+ 58	- 1.0	+ 12

#### BUYER 1

Has a commercial herd of the same breed turning off two-year-old steers. He seeks to improve female fertility while maintaining heavy steer weights.

#### BUYER 2

Intends to use the bull as a terminal cross over crossbred cows, selling both the heifers and steers as finished yearlings.

#### BUYER 3

Wishes to increase scrotal size on his stud herd. His clients are predominantly breeders of yearling steers.

**ANSWERS**  
 Buyer 1 Bull A – the highest priority is the negative (short) days to calving EBV, and 600-day weight is also good  
 Buyer 2 Bull D – fertility EBVs relating to progeny are not important, so select highest 400-day weight EBV  
 Buyer 3 Bull B – has the highest scrotal size EBV and a good 400-day weight EBV

## Bull Selection Exercise 3

The following is a selection of sires from a British breed catalogue. Which bull should the two buyers buy?

### GROUP BREEDPLAN

Bull	400-day weight	600-day weight	Fat depth (mm)	Eye muscle area (cm <sup>2</sup> )
A	+ 40	+ 50	- 0.9	+ 4.2
B	+ 44	+ 40	+ 1.9	+ 4.1
C	+ 34	+ 40	- 0.2	- 0.7
D	+ 44	+ 48	+ 0.2	+ 2.2

#### BUYER 1

Sells yearling steers to a feedlot which is long-term feeding for Japan. He has been advised to increase size and growth to two years, reduce fatness and maintain or improve muscularity.

#### BUYER 2

Breeds yearling steers, from European x dairy cross cows. He has difficulty in finishing yearling steers and seeks to improve this.

**ANSWERS**  
 Buyer 1 Bull A – fat EBV is negative and eye muscle area EBV positive; 400-day weight is also good  
 Buyer 2 Bull B – fat EBV is positive and 400-day weight EBV the best



**0800 BEEFLAMB (0800 233 352) | [WWW.BEEFLAMBNZ.COM](http://WWW.BEEFLAMBNZ.COM)**  
**INVESTMENT BY NEW ZEALAND SHEEP + BEEF FARMERS**