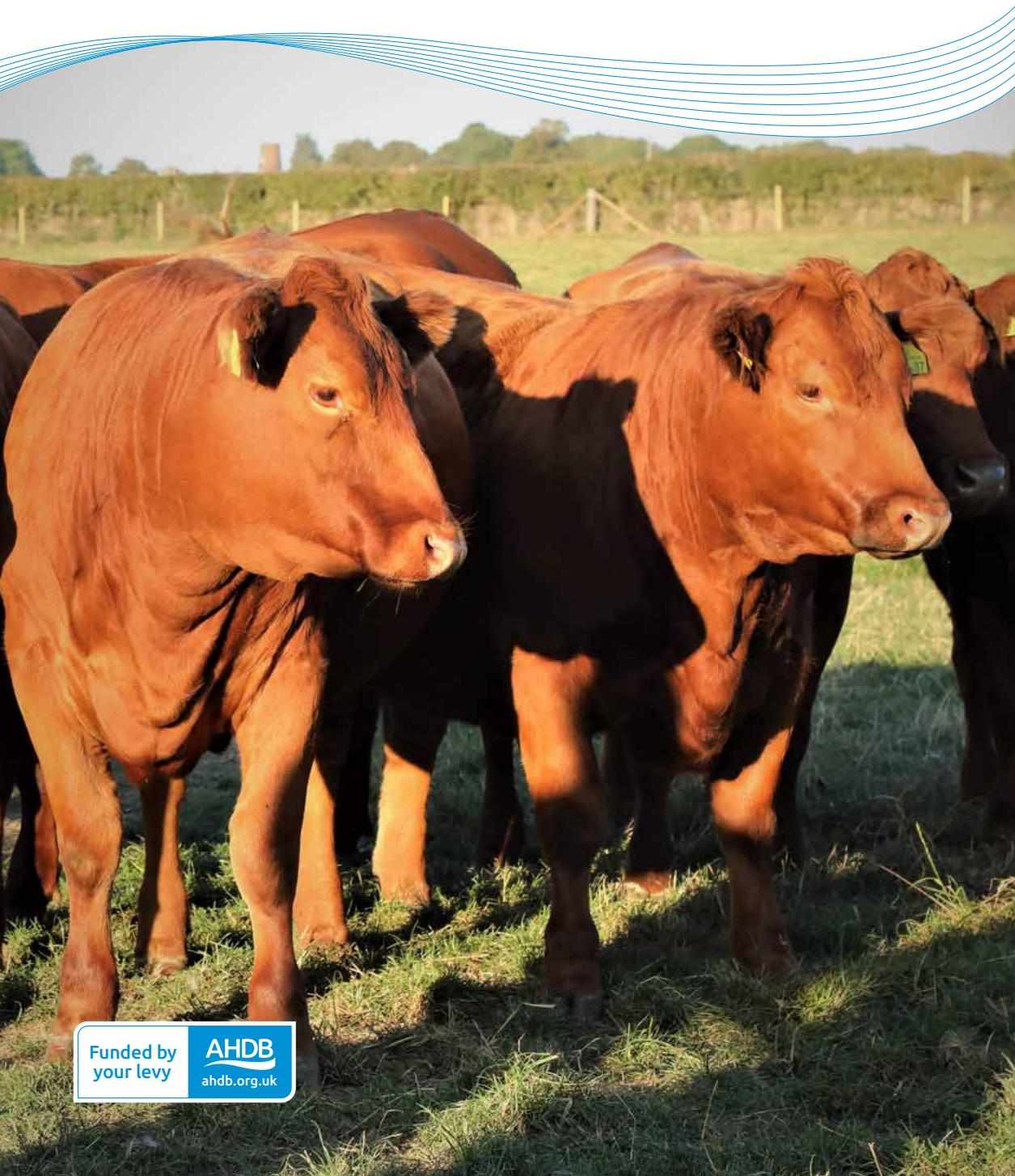
Managing beef replacement heifers



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Introduction

The way in which heifers are bred, selected and managed has a huge impact on their lifetime productivity. Fertility is one of the key drivers of profitability in the suckler herd and it is at least twice as important as growth and carcase characteristics. Therefore, every effort must be made to ensure heifers are developed effectively so that fertility is optimised and profits are generated.

Numerous research papers suggest that calving heifers for the first time at two years of age is an effective method of reducing cost of production and increasing cow lifetime reproductive performance. However, it is estimated that only 35% of English suckler producers carry out the practice.

Successful heifer development is underpinned by nutrition, genetics and effective selection. Nutrition has a significant impact on age at puberty and rebreeding rates; if this isn't optimum, calving heifers at two years of age will be a challenge. The age at which a heifer reaches puberty, along with other maternal attributes, is also influenced by genetics. As an industry, we must place more emphasis on maternal traits, rather than on the terminal characteristics that have dominated selection decisions for many years.

Selection is key; we shouldn't fight to keep unsuitable heifers within the herd. Creating weight targets, implementing tight breeding patterns and applying rigorous visual and genetic selection criteria ensure that only the most productive heifers enter the herd. This in turn results in the creation of a functional suckler cow that calves unassisted every 365 days, has low maintenance costs and remains productive for a sufficient period to cover her development or purchase costs.

A considerable amount of information in this manual was taken from the Nuffield Scholarship Report; Heifer replacement strategies: Cost reduction in the UK suckler beef herd written by Sarah Pick, Senior Engagement Manager (Beef and Lamb). The full report is available at **nuffieldscholar.org/reports**

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Calving heifers at two years of age

Calving heifers at two years of age has been commonplace across most beef-producing countries since the 1970s. This is mainly due to economic reasons, with heifers that calve at two having significantly lower development costs than those that calve for the first time at three years of age, as shown in Table 1.

The lifetime productivity of the heifer increases with heifers that calve at two, producing more calves and more calf weight over their lifetime, while also remaining in the herd longer.

Furthermore, calving at two also allows you to carry 10% more breeding cows and any barren heifers identified post-breeding to be finished as prime beef, before reaching the 30-month cut-off date.

Although calving at two requires good management, if you can ensure the basics are right including nutrition, selection and genetics, implementing a two-year-old calving policy can bring huge benefits to your business.

Table 1. Development cost and production output differences by age at first calving

	Calving at two years of age	Calving at three years of age
Heifer development costs (to first calving)	£1,500	£2,100
Number of calves produced during lifetime	8	7
Number of generations in a 10-year period (within the herd)	5	3

What makes a functional suckler cow?

A 'functional' suckler cow is one that calves unassisted every 365 days, has low maintenance costs and remains in the herd long enough to cover her development costs (between three and five calves).

Suckler farmers across England have a variety of systems, resources and end markets, each of which has its own requirements in terms of female performance. Identifying your business needs from a female replacement, whether bought in or homebred, will provide a good place to start when thinking about maternal breeding. The next step is to assess the current performance of your suckler herd by using key performance indicators (KPIs) and comparing the results against industry targets, which will help to identify areas of improvement. Altering breeding, selection or management practices can help to address these areas.

A heifer cannot outperform her genetics. Breeding or purchasing a heifer with the correct genetics will set a ceiling height for her performance as a cow.

The following questions will aid the evaluation of your farm resources, end market and herd's current performance, helping to identify areas for improvement. The rest of the manual will discuss how you can improve those areas through more effective use of genetics and improved selection and management practices.

Market requirements – stores or finished

In the next 5–10 years, what is your target market and what specification do they require?

Whether you sell as stores or finished animals, you want to derive the maximum benefit from early feed conversion efficiency, driven by the milking ability of your females. If breeding your own replacements, this can be influenced by considering milk EBVs when selecting sires and looking at the efficiency of the dam. If buying in replacement heifers, consider the EBVs of their sires along with their weaning weights and efficiency of their dams. For more information on buying in replacements, see page 25.

Conformation of cattle is another area to think about when selling both stores and finished animals. If selling deadweight, the specification required may be different from what store buyers would want through the market. If E and U grades are generating the highest prices in the store market, it's important to consider whether these animals are profitable when feed, labour and possible calving difficulties are accounted for. If they're not, is it viable to change your outlet and therefore, your product? Although conformation can be heavily influenced by sire choice, the conformation of your females will play its part as well. For more information on EBVs for carcase traits, see **ahdb.org.uk/knowledge-library/national-beef-evaluations**

Mature cow weight influences the weight achieved by store and finished animals, but this only increases revenue up until a certain point before higher feed costs become prohibitive. For more information on optimal mature cow weight, see page 7.

Farm resources

Suiting the breed and size of your cows to the resources available on your farm will help reduce inputs, improve cow longevity and cut costs. Ask yourself the following questions when deciding what type of cow would suit your farm best:

- How well can you grow grass? Could the grass grown be better used by a different breed or management?
- How long is your housing period? Could this be reduced without compromising soil health, cattle nutrition or welfare?
- What access do you have to non-forage feeds and at what expense? Can you better utilise home-grown grass and forage by changing breed? Or can you need to take advantage of access to cheap non-forage feed by selecting replacements based on growth rate potential?
- How effective is your handling system? Do you need to invest to make it safer or could you change your breeding and selection of females to improve temperament and reduce calving interventions?
    - Improved temperament or reduced calving interventions can never fully compensate for not having a safe handling system
- Do your cattle need to be more 'low maintenance' to enable less labour hours?

Cull cow revenue

It's a given that a heavier cow will result in a higher cull cow value, but the increased cost of feeding that cow over her lifetime may not leave you with much profit. Heavier cows (>700 kg) have also been shown to have reduced fertility at second calving. It is important to calculate whether the increased value achieved from heavier cull cows outweighs the increase in inputs and reductions in performance. Reducing the mature weight of your cows, with the correct breeding and selection, could potentially allow you to keep more cows on the same area that get back in-calf more easily and that are more efficient in weaning calf weight.

Optimising cow mature weight – how heavy is too heavy?

When breeding heavier cows, we make a trade-off in terms of whether the cost of keeping a heavier cow outweighs the extra value she provides by producing heavier offspring and having a higher cull cow value.

Research carried out by AbacusBio International in 2022 (A vision for improving the UK sheep and beef sectors through breeding over the next ten years), on behalf of AHDB, QMS and HCC has used industry data to create a model of UK beef production systems. This model demonstrates how an increase in mature size affects other traits of economic importance and how these changes influence costs and revenue on farm.

The team at AbacusBio compared the cost of producing cows with a mature weight of 651 kg compared with those with a mature weight of 751 kg. The results in Table 2 show that heavier cows did benefit the modelled farm through higher cull cow revenue and by producing offspring with higher carcase revenue and quality. However, heavier cows have higher costs in terms of maintenance feed and replacements. They also suffer from a decrease in fertility, potentially producing fewer offspring in their breeding lifetime. Heavier cows require more land than lighter cows, resulting in a reduced stocking density on farm. Once you combine all of these factors, the cost of production is higher for heavier breeding females and therefore, profitability is poorer.

Table 2. Herd margin over feed for different cow mature weights

Animal	Mature weight 651 kg		Mature weight 751 kg	
	Cost	Revenue	Cost	Revenue
Maintenance feed	£11,771		£21,655	
Cull cow		£10,924		£13,144
Replacement growth	£10,620		£16,588	
Heifer carcase value	£15,834	£28,906	£18,278	£34,292
Steer carcase value	£24,522	£42,920	£29,296	£46,175
Bull carcase value	£5,465	£8,120	£6,602	£9,948
Total	£68,213	£90,872	£92,420	£103,561
Margin over feed*	**£22,658**		**£11,140**	

*Your margin over feed is the net revenue when feed is the only varying cost. In this model, every other cost remains the same.
Calculations based on a 100-head suckler herd, with a 14% replacement rate. It is assumed cows are culled at 10 years of age.

Having taken all of these effects into account and applying the model across a range of cow mature weights, AbacusBio confirmed that the optimum breeding female mature weight is between 680–685 kg.

The average carcase weight limit for maximum price across UK processors at the time of AbacusBio study was 440 kg. With carcase weight limits being reduced in the UK over time, the optimum mature weight for a breeding female is also likely to decrease.

Beef producers who feed primarily home-grown feedstuffs may be able to keep breeding females of up to 700 kg to optimise their profits, as the cost of producing home-grown feed is lower than the cost of buying feed in.

To optimise mature weight on your farm, follow the below principles:

1. Weigh breeding females regularly and compare this to the weight of the calf they produce at weaning. Aim for a cow to produce a minimum of 45% of her weight at weaning.
2. Don't retain heifers from your biggest cows in the herd, mature weight is heritable.
3. Buy sires where it is possible to assess the size/weight of the breeding females and gather information about the genetic merit of the males for growth, mature weight and other genetic merit estimates.
4. Build a relationship and communicate with breeders producing the type of sires you need.
5. Where possible, use an index to select sires.
6. Make use of information on both maternal and terminal genetic merit, to capture terminal benefits, while controlling breeding female weight.

Breeding period

Keeping your breeding period to less than 12 weeks is an excellent way of improving herd fertility, as only the most fertile animals will get in-calf. Breeding heifers for an even shorter period (6–9 weeks) ensures a supply of highly fertile animals coming into the herd. When managed and selected correctly, heifers should have no problem conceiving within two cycles. Breeding your heifers to calve at the start of the calving season also allows them to be managed more closely and gives them extra time to recover and resume cycling again before the start of the next breeding season.

Options for reducing the length of your overall calving block include use of synchronisation or heavily culling the late calvers. Speak to your vet for more information.

Case study

Dan Kelly, Nebraska, USA

Dan Kelly runs a herd of 1,200 Simmental X Angus suckler cows. He has a unique heifer selection process. After weaning, heifers are turned back out to graze and are supplemented with alfalfa hay. Three months before the breeding season, supplementation is increased to include distiller's grains, silage and hay. At the end of May, all 500 heifers are synchronised and inseminated to one service. Dan achieves a conception rate of 60% to the one service, which results in a replacement rate of 20%. Any barren heifers are culled. Dan has calculated that the difference between selling an open heifer in August and an in-calf heifer in November is only £200; therefore, it makes more economic sense to sell the barren heifer post-pregnancy diagnosis, rather than struggle to get her in-calf to sell later in the year.

Case study source:
Heifer replacement strategies: cost reduction in the UK suckler beef herd (Sarah Pick, NSch19).

Reproduction

As an industry, we have focused heavily on terminal traits, meaning that not only have maternal traits taken a back seat, they have often been hindered by calving difficulties from bulls with a large terminal focus. Good reproductive performance is of high economic importance in a suckler herd but is of relatively low heritability, making it slow to influence by genetics. However, genetics still play a part, and maternal traits should be selected when choosing a bull from which to breed replacement females.

Below are a series of questions for you to answer in relation to your business to create an accurate picture of your herds performance. Effective selection and management of females as well as appropriate selection of bulls can heavily influence reproductive performance, to avoid difficult calvings.

What percentage of cows and heifers calve in the first six weeks of the calving block?

Industry target: 80%

$$\frac{\text{Number of cows calved in first six weeks of calving block}}{\text{Cows in herd}} \times 100 = \quad \%$$

How many calves are born (alive after 24 hours) per 100 cows put to the bull?

Industry target: >95%

If your figures are below target for this, it's important to identify why and at what point calves are dying. Speak to your vet for more advice.

$$\frac{\text{Number of calves alive after 24 hours}}{\text{Number of cows put to the bull}} \times 100 = \quad \%$$

What percentage of your cows have a calving interval of less than 370 days?

Industry target: >90%

Although historic, calving interval gives an idea of how quickly cows get back in-calf again.

$$\frac{\text{Number of cows calved within 370 days of their last calf}}{\text{Number of cows put to the bull}} \times 100 = \quad \%$$

What is your average scanning percentage?

Industry target: >96%

It's important to ask why cows haven't got in-calf. Is it a cow problem or a bull problem?

$$\frac{\text{Number of cows confirmed in-calf}}{\text{Number of cows put to the bull}} \times 100 = \quad \%$$

How long are the bulls running with cows?

Industry target: <12 weeks

Calving in a tight block makes management of cows and calves easier and more efficient and encourages good fertility within a herd.

Bulls running with cows = weeks

What percentage of calves are lost between scanning and calving?

Industry target: 2%

If losses are more than 2%, consult your vet.

$$\frac{\text{Number of cows that don't have a calf after confirmation of calf at scanning}}{\text{Number of cows put to the bull}} \times 100 = \quad \%$$

What is your average age at first calving?

Industry target: 2 years

Research has proven that calving heifers at two-years old results in a more profitable cow over her lifetime. See management sections later on in this manual to ensure heifers are managed appropriately for two-year-old calving.

Average age at first calving = years

Calving ease

Calving ease has a huge impact on female reproductive performance and the lifetime performance of the calf. Calving ease is managed by:

- Selecting the correct bulls, based on calving ease direct EBVs and calving ease maternal/daughter EBVs (see page 13)
- Management of heifers and cows to ensure correct body condition score at calving
- Correct selection of heifers to ensure they are heavy enough at bulling and have been pelvic checked to ensure they can birth a calf

How many of your mature cows need assistance at calving?

Industry target: <5%

Assisted calvings have a big impact on future reproductive performance of the cow.

$$\frac{\text{Number of cows assisted}}{\text{Number of cows calved}} \times 100 = \quad \%$$

How many of your heifers need assistance at calving?

Industry target: <10%

A difficult calving as a heifer can set her up for poor reproductive performance for life. For more information on how to avoid this, see sections ‘pelvic measuring’ and ‘bull selection'.

$$\frac{\text{Number of heifers assisted}}{\text{Number of heifers calved}} \times 100 = \quad \%$$

Cow efficiency

Herd efficiency considers the relationship of cow size (weight) and calf output and is linked to profitability. It’s a reflection of herd fertility, herd health, genetics, feed quantity and quality, and management practices.

What is your herd replacement rate?

Industry target: 14–16%

Lower replacement rate can reflect increased cow longevity, with lower overall costs and higher lifetime productivity. However, after about eight years of age, cow productivity declines and older cows can be replaced by heifers.

$$\frac{\text{Number of heifer brought into herd}}{\text{Total number of cows and heifers}} \times 100 = \quad \%$$

What is the average weight of your mature cows?

Optimum 680 kg

For more information, see results from the maternal cow size project on page 7.

$$\frac{\text{Total combined weight of all your cows}}{\text{Number of cows}} = \quad \text{kg}$$

What is your 200-day weaning weight per kg of cow or heifer bred?

Industry target: >45%

This can be easily calculated in a software program or by using this calculation:

$$\frac{\text{Total adjusted 200-day kg of weaned calf}}{\text{Total kg of cows and heifers bred}} \times 100 = \quad \%$$

Investing in the right genetics

Using genetic selection techniques when making breeding decisions is a long-term investment that will result in cumulative and permanent herd improvement.

The fastest way to make genetic progress in a beef enterprise is through accurate and effective bull selection. On average, males will pass their genetic merit on to around 50–150 calves throughout their working life, whereas females will pass their genetic merit to only 5–10 calves. If we want to improve the efficiency of our national herd, it is essential that the bulls we use to breed heifer replacements supply the best possible genetics in terms of maternal performance.

The best independent estimate of an animal's genetic potential as a parent is its estimated breeding value (EBV), which is generated using information on an animal's own performance, along with that of its herd mates (contemporaries) and relatives, along with information about the heritability of the trait and trait correlations.

In this section, we will focus specifically on maternal traits that can be influenced by genetic selection. For a more comprehensive overview of bull selection, including a detailed explanation of EBVs, how they are displayed and how they should be interpreted, see **Choosing bulls,** available to order online and in hard copy and at **ahdb.org.uk**

Maternal traits

Maternal traits are those seen only in females, for example, milk production or calving interval.

In the UK, there are three providers of EBVs – ABRI Breedplan, Signet Beefbreeder, and Taurus. All three of these providers use the same underlying BLUP technology to run their genetic evaluation service, but the EBVs that they produce sometimes have slightly different trait definitions. The maternal EBVs currently produced by each system are listed below. The service providers for each breed can be found in Table 3 on page 15.

Maternal EBVs

Maternal calving ease (Signet and Taurus) or Calving ease daughters (Breedplan)

Maternal calving ease identifies bulls whose daughters have characteristics that will help facilitate easier calvings. This EBV should be considered alongside the calving ease direct EBV which gives a prediction of calf factors such as size.

On BREEDPLAN, Calving Ease (Daughters) EBV estimates the genetic influence a bull has on the ease with which his daughters will calve as first-time heifers.

Measurement: %
Interpretation: Positive values mean more unassisted calvings.

200-day milk

Identifies how well heifers will perform when they become mothers, e.g. the potential milk yield of the cow

Measurement: Kg of calf weight at 200 days of age.
Interpretation: Positive values identify females that will rear heavier calves at weaning.

Age at first calving (Signet and Taurus)

Identifies heifers more likely to calve at a younger age, given the mating opportunity.

Measurement: Days.
Interpretation: Negative values mean heifers will potentially get pregnant at a younger age when given the opportunity.

Scrotal size

An indicator of male fertility with regard to semen quality and quantity. There is also a small favourable correlation with age of puberty in female progeny.

Measurement: Centimetres.
Interpretation: Positive values indicate higher fertility in males and earlier puberty in females.

Calving interval (Signet and Taurus)

A measure of the cow's ability to get back in-calf again quickly post-calving.

Measurement: Days.
Interpretation: Negative values indicate heifers/cows that get back in-calf more quickly (i.e. are more fertile).

Mature cow weight (BREEDPLAN)

An estimate of the genetic difference in cow size/liveweight at five years of age.

Measurement: Kg of cow weight when the calf is weaned (200 days of age)
Interpretation: Positive values indicate cows that are heavier when their calves are weaned.

Longevity (Signet and Taurus)

Predicts the length of an animal's breeding life in the herd.

Measurement: Parities.
Interpretation: Positive values indicate a longer breeding life.

Gestation length

Predicts the length of gestation of an animal.

Measurement: Days of gestation.
Interpretation: Negative values indicate a shorter gestation length.

Using data to inform decisions

Selection indexes, also known as breeding indexes, combine data from individual trait EBVs to provide an overall score of genetic merit. Check whether economic weighting is assigned to each of the selected traits. Index figures are published as £ figures. Most breed societies involved in performance recording also publish selection indexes. Breed-specific selection indexes have been designed to cater for the different markets and production systems in the UK that are most relevant to the given breed. Both pedigree and commercial breeders can use these indexes.

When selecting bulls for breeding heifer replacements, the appropriate index to use for shortlisting would be one designed for maternal traits, as opposed to a terminal index. The individual breed societies have slightly different names for their maternal indexes, as shown in Table 3. For more information on specific indexes, please contact the relevant breed society in the first instance.

When using selection indexes, we recommend that you complete the following steps as well as carrying out a visual assessment:

1. Identify the selection index of most relevance to your breeding plan.
2. Rank bulls (within a breed) based on this selection index.
3. For each shortlisted bull, consider the EBVs that relate to the traits you have identified in your breeding plan (see pages 10–12).

Table 3. Breed service providers

Service provider	Breed society	Maternal index(es)
ABRI BREEDPLAN	Aberdeen Angus Cattle Society	Self replacing index
	Beef Shorthorn Cattle Society	Self replacing index Maternal index
	British Blue Cattle Society	BBB pedigree breeding index
	British Charolais Cattle Society	BCCS self replacing index
	British Simmental Cattle Society	Self replacing index (GBP)
	Hereford Cattle Society	Hereford self replacing index (GBP)
	Red Ruby Devon Cattle Society	Self replacing index
	South Devon Herd Book Society	Suckler replacement index
Signet Breeding Services	British Blonde Cattle Society	Calving value Maternal value Maintenance value Maternal production value
	Highland Cattle Society	
	Lincoln Red Cattle Society	
	Luing Cattle Society	
	Red Poll Cattle Society	
	Sussex Cattle Society	
Taurus	British Limousin Cattle Society	Calving value Maternal value

*The Murray Grey Beef Cattle Society, the Salers Cattle Society of the UK, and the Welsh Black Cattle Society also use ABRI Breedplan to generate EBV information, but they do not currently publish any selection index data.

Unfavourable relationships between traits

A large number of traits impact suckler cow performance, but fertility, calving ease, calf growth, mature size and longevity all have a bearing on profitability.

However, not all these traits are complementary to each other. For example, a narrow breeding goal with calf growth rate as its only driver will also have an impact on cow traits, and will result in larger cows that cost more to maintain, alongside increased birth weights and potential calving issues.

Even when two traits are negatively correlated, it is possible to find bulls that perform well for both traits. These types of bull are known as 'curvebenders', and they are highly valuable animals for beef producers trying to make genetic progress (see Figure 1). Widespread uptake of performance recording within a breed is the best route to identifying these curvebender bulls.

Spotlight on calving ease

Unfortunately, there is a negative genetic correlation between the direct elements (those relating to the calf, e.g. birth weight) and maternal elements (those relating to the mother, e.g. pelvic area) of calving ease. There is a danger, therefore, that selection purely for the maternal elements of this trait can still result in higher levels of calving difficulty. ABRI Breedplan has accounted for this by using both the direct and maternal elements of the trait when calculating their Calving Ease Daughters EBV. For Signet and Taurus breeds, you must consider both the Calving Ease Direct and Calving Ease Maternal EBVs when selecting bulls for breeding heifer replacements. It is not appropriate to select bulls with extreme EBVs for one calving ease trait at the expense of the other.

Effect of EBV accuracy

Alongside the EBV information, all providers show an accuracy value for each trait. The accuracy is a measure of how close the estimated breeding value is to the animal's true genetic merit and is expressed in percentage points.

The higher the accuracy, the less likely it is that the current EBV value will change significantly over time as more data becomes available.

The accuracy of an EBV is influenced by:

- The amount of information on the trait from the animal itself
- The amount of information on the trait from relatives of the animal
- The heritability of the trait concerned
- The amount of information from the animal and its relatives on traits correlated with the trait of interest and the strength of the correlations
- The number of contemporaries recorded

EBVs for maternal traits often suffer from low accuracies. This is because the heritability of these traits is usually low and also because of a long generation interval (see Figure 3 on page 19). This makes it difficult to select superior young bulls with confidence.

If the accuracy is low – will I make any progress?

Yes, genetic progress is still possible despite maternal traits having lower heritability. Research from Teagasc and the Irish Cattle Breeding Federation, shows that when comparing Irish beef cows with a five star replacement index rating (those with the best genetics), to cows with a one star rating, the five star cows will have their first calf one month earlier, have a shorter calving interval (8 days), and their progeny will be heavier on weaning (26 kg). The five-star cows are 73 kg lighter than the cows on average, and as a result, cost less in terms of feed and maintenance.

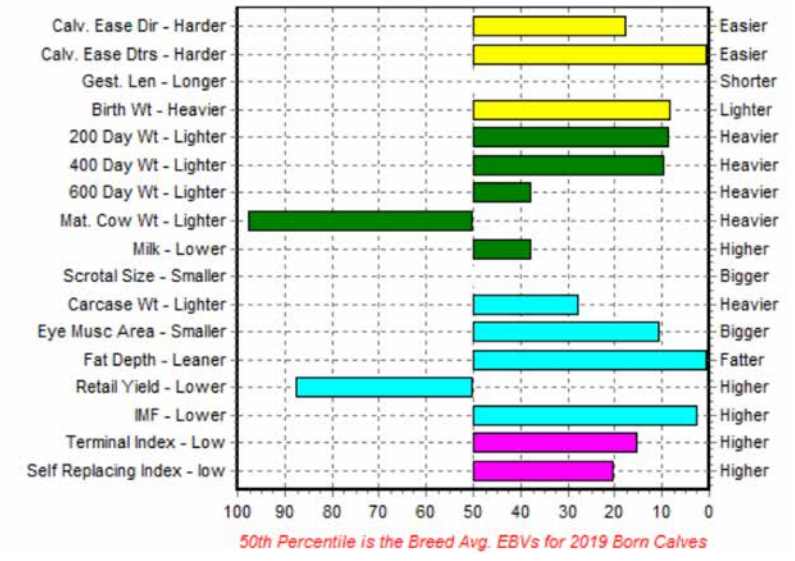

Figure 1. An example of a curvebender bull, who has a low EBV for mature cow size, but whose 400-day weight EBV is in the top 10% of the breed

Case study

Fertility in the UK Holstein population

Throughout the 1990s, when the dairy industry selected heavily for production, fertility declined in the UK Holstein population. Since the introduction of the fertility index in 2007, (when the average calving interval was as high as 424 days), fertility in Holsteins has started to recover and, the UK's average calving interval has fallen back to the levels seen in the 1990s (back to an average calving interval of 395 days).

The genetic evaluations published by AHDB Dairy make use of performance data from milk recording organisations. With approximately 60% of UK dairy cattle registered for milk recording, the evaluations are based on a large and robust set of performance records, allowing efficient and accurate selection. In the beef industry, it's essential we support and encourage the recording of maternal trait data whenever and wherever possible to allow us to accelerate genetic improvement for maternal traits.

Selection for maternal traits will result in genetic progress, but accurate selection of good maternal bulls when breeding heifer replacements should be considered a long-term investment.

Genomic selection

Genomic selection is a new technology that may be of particular use in making genetic progress for maternal traits. The technique relies on using DNA samples rather than pedigree to establish the relationships between animals when estimating breeding values and produces a genomic breeding value (GEBV).

The advantage of the technique for maternal traits in particular is that it can provide a more accurate breeding value for a young animal than is available based on the parent average performance. This allows for more accurate selection of young bulls, and will accelerate genetic progress by reducing the generation interval outlined in Figure 3.

Currently some, but not all breed societies offer GEBVs. Check the relevant society website to see if it is available.

The success of genomic selection relies on having a large reference population of animals that have both phenotype (performance) and DNA (genotype) information, on which the computer model can be trained. The 'SNP key' generated from this reference population will then be used to produce GEBVs for animals with only genotype data available (the selection candidates). The reference population must be maintained by introducing newer bulls once their performance data is available, as the accuracy of GEBVs will also decline as the number of generations between the reference population and the selection candidates' increases. Accurate and widespread performance recording is key for any successful genomic selection programme.

Currently, the level of performance recording for maternal traits in beef is low. So to successfully implement genomic selection across the beef industry, a much wider uptake of performance recording will be necessary to see good results.

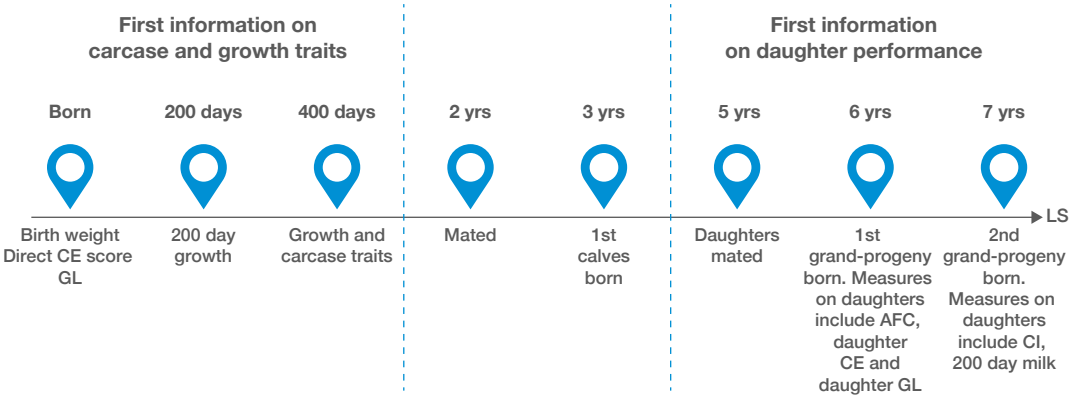

Figure 2. The generation interval between the birth of a breeding bull and when we can collect information on the performance of his daughters to use for estimating maternal trait breeding values. Key: AFC: Age at first calf. CE: Calving ease. GL: Gestation length. CI: Calving interval

Benefits of crossbreeding

It can be challenging to find one breed of cattle that excels for all the traits required for the 'ideal' suckler cow, as each breed has its own merits. Crossbreeding is a long-used method that allows you to combine the benefits of multiple breeds when breeding replacement heifers.

A good crossbreeding strategy will allow you to take advantage of breed complementarity, and capture 'hybrid vigour' – an increase in performance of the crossbred offspring over and above the average performance of its two parents. This is particularly important for traits with low heritability such as fertility, calf survival, longevity and other maternal traits. The effect of hybrid vigour on crossbred cows is shown in the brown box.

There are a number of different crossbreeding strategies that could be implemented in a beef production system.

There is no one size fits all system and the different strategies vary in terms of difficulty. Factors that can influence the success of a crossbreeding system include:

- Number of cows in the herd
- Number of available breeding pastures
- Labour and management
- Production and marketing system
- Availability of high-quality bulls of the various breeds

The positive effects of hybrid vigour on cows:

- Conception rate: +10%
- Calving ease: +10%
- Number of calves weaned: +7.5%
- Milk yield: +5–10%
- Calf weaning weight: +13%

Case study

John Maddux, Nebraska, USA

One suckler producer who is making full use of hybrid vigour is John Maddux, of the Maddux Cattle Company, Nebraska. He stated, 'there is no single management practice which can have more impact on your bottom line than crossbreeding'. To capture the benefits of hybrid vigour, John has developed a 'Maternalizer' cow that consists of six different breeds including Red Angus, Tarentaise, South Devon, Red Poll, Hereford and Devon – all chosen for the breed traits for growth rate, age at puberty, milk production and percentage retail product.

The cows have been selected to thrive on minimal, low-cost feedstuffs. Cows calve in May, so they don't require any additional supplement after calving. They are then outwintered on corn stalks and supplemented with wet distillers. Heifer calves are weaned at 11 months of age, weighing on average 283 kg.

They are then fed a total mixed ration for 3–45 days depending on their weight before being turned out to grass. John aims to get heifers to 306 kg before bulling, which is 61% of his average mature cow weight. John has one overriding selection parameter for heifers – 'that they get in-calf'. Heifers are synchronised and then put to the bull for 70 days. John only uses bulls from first calved heifers, which are generally yearlings. Only those heifers that conceive within the first 30 days of the breeding period are retained, which means he gets bigger calves at weaning and the first calved heifers have more time to recover before the next breeding season. In a typical year, John can expect 80% of yearling heifers to conceive in the first three weeks of the breeding season, while 96% of two-year-old heifers and 94% of mature cows conceive within the first 48 days of the breeding season.

How many heifers are required?

The rearing of heifer replacements on farm can tie up significant resources and consequently reduce the size of the breeding herd. The two factors that have the biggest impact on the total number of heifer replacements required, are:

1. Cow longevity
2. Age at first calving

Table 4 shows that three times as many replacements are required for a herd that calves heifers at three years of age and only rears four calves per cow, compared with a herd calving heifers at two years of age and rearing eight calves per cow.

Table 4. Factors affecting the total number of heifer replacements on farm

Number of calves reared per cow	Age at first calving (years) (100-cow breeding herd)		
	2	2.5	3
	Total number of replacements on farm		
4 *(25%)	50	63	75
6 *(17%)	33	42	50
8 *(13%)	25	31	38

*Replacement rate

In the case of homebred replacements, more heifers need to be born than are required as breeding females. This is because not all weaned heifer calves will meet the standard for entry into the herd, perhaps due to poor physical soundness, temperament or performance, and not all will become pregnant in a short 6–9 week service period. However, it's important to remember that you only want your best heifers entering the herd and so it's important not to get disheartened if not all conceive.

It's always better to have too many heifers than too few. Mating a relatively large group of heifers (i.e. more than are needed as replacements, at the start of the breeding season has two advantages:

1. Only those heifers that become pregnant in a short six-week breeding season can be kept for breeding, allowing the others to be finished as prime beef. This is one of the most effective ways of selecting for fertility.
2. These heifers will then calve at the beginning of the next calving season the following year, allowing them to recover before the next breeding season starts.

Breeding your own replacements

The decision about purchasing or breeding homebred heifers needs to be considered carefully, there are advantages and disadvantages when breeding your own, as shown in Table 5.

Contract-reared heifers

Contract-rearing heifers is a widely used practice in the dairy industry. Specialist units focus on producing high-quality, healthy animals. This frees up space, feed and labour on the herd owner's farm. Contracts usually apply to heifers from weaning to 4–6 weeks before calving. They are generally costed on a daily or per kg liveweight gain basis. Detailed knowledge of the costs involved in rearing heifers and a well-planned contract, detailing performance targets and health protocols, are essential for a successful contract-rearing arrangement.

Table 5. Advantages and disadvantages of breeding your own replacements

Advantages	Disadvantages
Good knowledge of breeding history and health	Can limit the size of the herd by using up land and feed
Parents can be selected based on specific desirable traits	May not have the desired genetics for maternal traits
No risk of buying in health problems. Animals will be resistant to some on-farm infections and already part of the farm health plan	May require the purchase of another bull or the use of AI with good maternal traits from which to breed heifers. Bull calves from a maternal bull may be of lower value than if they were bred from a terminal sire
Heifers are managed to the herd's own protocol over which the herd owner has full control	More groups of cattle to manage
Sexed semen can be used on selected cows from which to breed replacement heifers, which will minimise the production of bull calves with lower terminal ability	May be difficult to find an even batch of heifers if the calving season has been protracted
Should provide a good batch of similar-sized heifers with same breeding background	

Successful breeding of homebred replacements relies on making a conscious decision to use a sire with strong maternal traits on some of the herd's most maternal cows.

Use production data and good management records to select cows from which to breed replacements.

Cows should not be used to breed heifers if they:

- Required assistance at calving
- Calved late in the breeding season – preferably they should have calved in the first three weeks but definitely in the first six weeks
- Failed to wean a calf
- Have large teats making it difficult for a newborn calf to suckle
- Weaned a light calf (growing less than 1 kg/day)
- Have a bad temperament
- Have health or structural issues

Selecting replacements at birth

Identifying heifer calves at birth that should not be kept as replacements, by use of a coloured management tag, makes selection easier and quicker at weaning. If not properly recorded, issues such as difficult calving can be forgotten by the time it comes to wean.

Selecting replacements at weaning

Calf growth rate from birth to weaning is a good indicator of the dam's milking ability and the calf's genetic potential for growth. When comparing calf growth rates, take account of any creep feed offered, calf sex and cow age.

Larger cows cost more to feed. By keeping heifers from moderately sized cows that have reached their target weight at weaning, future feed inputs can be reduced, while maintaining or improving calf weights.

Heifers usually start cycling once they reach around 50% of mature weight. Keep young heifers separate from bulls from the age of five months to avoid any unplanned matings.

Heifers must have sound legs and feet and be able to move well. Also, take into account the structural soundness of the parents.

Do not keep flighty and excitable heifers, or heifers from flighty cows. Research has found that cows with flightier temperaments have reduced fertility and produce calves with poorer weaning weights.

Measuring pelvic area can be done as part of a pre-breeding check that is carried out by a vet before breeding heifers. Assessing the pelvic area at this stage allows identification of heifers with abnormally shaped or particularly small pelvises, so that a decision can be made as to whether or not to breed from them. The pre-breeding check should also cover structural soundness, weight-for-age, BCS and an assessment of the reproductive tract. See page 36 for more information.

Keeping heifers from older cows vs younger cows

It is common practice in the dairy industry to breed replacement heifers from heifers to maximise conception rates from AI and to increase the rate of genetic progression within a herd. Research on dairy cattle has found that heifers produced from two-year-old heifers go on to be more productive during their first lactation but they are lighter than those produced from more mature cows (Hancock et al., 2019).

However, research in America has found that in beef cattle, heifers born from cows that are 4–8 years old had higher reproductive success in their first and second breeding season, which increased their longevity within the herd (Da Silva et al., 2016). There is also the argument that breeding heifers from older cows is sensible due to those cows having the traits required to stay in the herd.

If breeding heifers from heifers, it's vital to ensure that the correct nutrition is maintained throughout pregnancy and after calving to improve calf growth whilst in utero and milk production post-calving. For more information on nutritional management of replacement heifers, see page 30.

Use of sexed semen to breed replacements

Sexed semen has been widely adopted by the dairy industry and is a technology that has been used for some time with success. Conception rates to sexed semen can be slightly lower than using conventional. Sexed semen providers report that 90% of the conception rate from conventional is achievable using sexed semen. For example, if you are achieving 60% conception rate to first service using a bull or conventional AI, you should achieve 54% conception rate to sexed semen under the same conditions. However, it does offer in excess of 90% gender accuracy, meaning that 9/10 cows will have a heifer calf. Using sexed semen from a bull with the desired maternal traits that fit your herd can speed up the rate of genetic progression and when used selectively, can ensure you have the correct amount of replacements available from your best cows.

Buying in replacement heifers

Sourcing healthy, fertile replacement heifers that fit a farm's production system is vital to any suckler herd. The decision about purchasing or breeding homebred heifers needs to be considered carefully.

The main advantage of purchasing heifers lies in its simplification of herd management, all cows are bred to terminal sire and there are fewer groups of stock on the farm. It also enables more breeding cows to be kept.

Research in Ireland suggests that it costs £300 less to purchase dairy replacements than it does to develop a homebred heifer.

In addition, purchasing dairy replacements is a great way to access superior dairy and beef genetics due to the high proportion of AI used within the industry. Dairy cross heifers are also likely to be good milkers resulting in more calf weight being produced at weaning. However, it is important to consider that increased milk production can increase cow maintenance costs and reduce fertility.

Purchasing heifers can also increase the risk of disease and it's imperative that the herd from which you are sourcing heifers is operating within a recognised cattle health scheme.

It is important to be aware that dairy cows may be served with beef semen as a control measure for health and fertility issues, which may lead to subsequent problems in the suckler herd. Furthermore, there is an increasing influence of Holstein genetics within the dairy herd, which can have a detrimental impact on cow fertility and carcase conformation.

Breeding heifers should be purchased well ahead of the breeding season and allowed at least two months to settle into their new surroundings. Screen for infectious diseases and treat or vaccinate according to the herd health plan and ask your vet to perform a pre-mating check to identify any structural issues.

If purchasing in-calf heifers, check that they have been bred to a desired/known bull with good calving ease EBVs and will calve at the start of the breeding season.

Maintaining a healthy herd

Buying in stock is the most common way for new diseases to arrive on farm.

Before agreeing to a purchase, it's crucial to ask the vendor if they are in a CHeCs accredited scheme, what diseases they test for and, most importantly, the results.

Do not rush any buying decisions. Consult a vet to plan how to manage the introduction of purchased breeding stock. Testing animals before they come may be more effective than testing them once they arrive.

Quarantine all bought-in stock for at least three weeks, until all treatments and tests are complete and the results have been received.

Follow an active health plan that covers vaccination, internal and external parasite treatments. Consider testing for:

- Bovine Viral Diarrhoea (BVD)
- Campylobacter
- Infectious Bovine Rhinotracheitis (IBR)
- Johne's disease
- Leptospirosis
- Bovine tuberculosis (TB)
- Neospora

Serious outbreaks of these diseases will cause major financial loss to a beef business.

Levels of risk

Different replacement policies have different levels of herd health risk associated with them, as shown in the table below.

Table 6. Risk assessment guidelines for common replacement policies in relation to five important beef cattle diseases that affect fertility

Common replacement policies	Level of risk that each policy holds for each disease					
	BVD	Campylobacter	IBR	Johne's disease	Leptospirosis	Neospora
Purchase of bulling heifers from accredited free herds	Low	Low	Low	Low	Low	Low
Purchase of bulling heifers from herds of unknown status	Moderate	Low	Mod-high	Mod-high	Moderate	Moderate
Purchase of in-calf heifers from herds of unknown status	Mod-high	Moderate	Mod-high	Mod-high	Moderate	Moderate
Purchase of cows with calves at foot	Mod-high	Moderate	Mod-high	Mod-high	Moderate	Moderate

Adapted from: QMS – **A Guide to Improving Suckler Herd Fertility**

Management of replacements

To calve heifers successfully at two years of age, make sure they meet the target liveweight for service at 15 months and thereafter. Steady growth rates during the rearing phase are important to avoid the heifers becoming overfat and to ensure sufficient frame growth.

The target weight gains are expressed relative to mature cow weight (Table 7), so it is important that recorded mature cow weights are used to calculate the target heifer liveweight. A good indication of mature cow weight can be gained from sale weights of cull cows, provided they are sold in reasonable body condition.

Assuming heifers grow at around 1 kg/day while suckling their dam, subsequent growth rates to bulling need to be approximately 0.7–0.8 kg/day until the last two months of pregnancy, depending on breed type.

Liveweight is a more important determent of the onset of puberty than age, so regular weighing is essential to make sure adequate growth rates are achieved.

If heifers fail to reach their liveweight targets but do conceive, they are more likely to struggle to become pregnant as second calvers. This is due to increased nutrient demand post-calving, making it difficult for them to maintain sufficient body condition while growing themselves, feeding a suckling calf and potentially supporting another pregnancy.

Table 7. Example growth rates and liveweight targets for replacement heifers aiming to calve at 24 months

Mature cow weight (kg)	Growth rate from birth to service (kg/day)	First service (15 months of age) target: 65% of mature weight (kg)	Start of second breeding season target: 85% of mature weight (kg)	Start of third breeding season target: 95% of mature weight (kg)
600	0.80	390	510	570
650	0.85	423	553	618
700	0.90	455	595	665

Onset of puberty

If we can ensure that more heifers are cycling before the first breeding season, by reducing age at puberty, more heifers are likely to become pregnant during the first three weeks of the breeding period. Age at puberty is mainly influenced by genetics and nutrition. Therefore, a good heifer development plan should aim to maximise both of these factors.

Heifers that calve within the first three weeks of the breeding season have higher pregnancy rates, remain in the herd longer and produce one more calf in their lifetime compared with heifers that calve later.

Heifers that reach puberty before the breeding season and have at least two cycles before being exposed to the bull, have much higher conception rates than those that are exposed to the bull on their first cycle.

Within genetics, the greatest determinates of age at puberty are breed and mature cow size, as shown in the table below.

For more information on the nutritional management of heifers, see page 7 of **Feeding suckler cows and calves**, available at **ahdb.org.uk/knowledge-library/feeding-suckler-cows-and-calves**

Table 8. Average ages and weights at puberty by breed

Breed group	Age at puberty		Weight at puberty (kg)	Suckler cow sires in the UK (% of total population)
	Days	Months		
Belgian Blue	347	11.5	329	10
Simmental	359	12.0	324	6
Angus	378	12.6	312	14
Charolais	389	12.9	343	7
Limousin	396	13.2	324	18
Hereford	402	13.4	318	6

Source: Van Eenennaam, 2013 and 2019

Spring-calving herds

Weaning to breeding

For spring-calving herds the time between weaning and breeding is during winter. Performance of those weaned heifer calves will be determined by the quality of the silage offered and level of supplementation.

Maintaining a steady growth rate after weaning is crucial. The aim is to keep heifers growing well without getting overfat. For spring-born heifers, excessive growth rates during their first winter should be avoided (>1.2 kg/day), particularly during the two or three months before they go outside. See Table 9 for example feed rates. Heifers should not have any signs of patchy fat on the tail head and should be fed a high forage diet pre-turnout so they can acclimatise to grazing as quickly as possible.

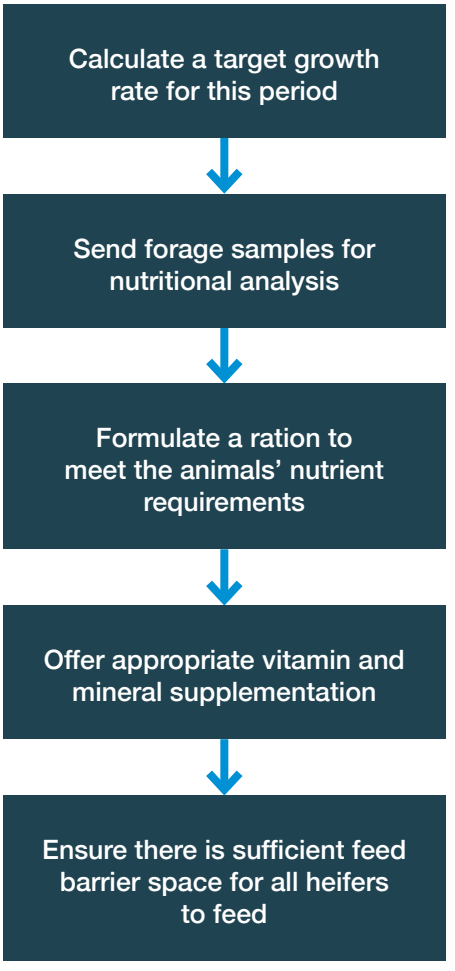

Table 9. Concentrate feed rates for spring-born heifers' calves fed different quality silages

Average liveweight over winter (kg)	Target growth rate (kg)	Level of concentrates* required	
		Poor quality (ME = 9.5 MJ/kg, CP = 10%)	Good quality (ME = 11.5 MJ/kg, CP = 16%)
300	0.8	3.7	1.9
	1.0	N/A	3.2
400	0.8	4.1	1.2
	1.0	N/A	2.9

*Assuming concentrate value of 12.5 MJ ME/kg DM and 12% CP in the DM

N/A = not achievable with a minimum of 45% long roughage in the DM

If concentrates are fed at more than 0.5 kg per 100 kg liveweight, they should be given in two feeds per day. Quantities over 4 kg per day should include a source of digestible fibre such as sugar beet pulp.

Use the beef ration calculator to calculate the cost, energy and protein density of simple cattle rations, available at **ahdb.org.uk/blend-calculator**

The additional feed costs required to ensure heifers reach 65% of their mature weight before breeding will easily be covered by the additional calf produced by calving heifers one year earlier.

At grass

If well managed, good-quality grass can sustain growth rates of more than 1 kg/day in weaned cattle, particularly during spring.

However, this growth rate can be difficult to maintain over the whole season if grass quantity and quality decline. Grazing grass at the right height will optimise the quality of forage eaten over a longer period (see Table 10).

For more information visit **ahdb.org.uk/knowledge-library/ahdb-grass**

Table 10. Sward height targets for grazing growing beef cattle

Grazing period	Rotational grazing		Set stocking (cm)
	Pre-grazing (cm)	Post-grazing (cm)	
Turnout–May	10–12	5–6	5–6
June–July	10–14	6–7	6–7
Aug–Nov	10–15	7–8	7–8

Autumn-calving herds

Management around mating for autumn-calving replacements can be tightly controlled as it occurs during the winter feeding period. With heifers normally being weaned about three months before housing, they will be well over the weaning check and should not be too fat.

The target is to have heifers on their full winter rations at least three weeks before the start of mating. Target growth rates should be between 0.7 and 0.8 kg per day depending on their mature size. Rations should be kept constant until at least six weeks after mating ends. Thereafter, rations can be adjusted for the rest of the winter to ensure heifers are fit but not fat at turnout. Heifers should be pregnancy diagnosed (PD) before turnout, remembering that the earliest pregnancy can be diagnosed five weeks after service.

On spring grass, growth rates will be high – often over 1 kg per day. This can potentially result in heifers becoming overfat and having more calving difficulties. To avoid this, the condition of the heifers should be carefully assessed in June and if necessary, the grazing adjusted accordingly.

Before mating:

- Ensure all health treatments are up to date
- Assess trace element status and address any deficiencies identified
- Complete the vaccination programme, e.g. for BVD or/and Leptospirosis at least two weeks before service
- Treat all heifers for worms and fluke, if required

Breeding to first calving

After service, heifers should be fed for maintenance and growth as well as for developing the foetus.

If possible, heifers should be kept and managed separately from the main herd throughout pregnancy. This means they can be given supplementary feed without being bullied by more dominant herd mates. Pregnant heifers can be grouped with thin cows needing to regain condition.

Major adjustments in growth rates should be avoided, particularly in early pregnancy where embryonic loss is most likely to occur. The embryo does not attach fully to the uterus until 42 days after fertilisation and therefore, any dietary changes during this time can affect embryo survivability and placental growth.

Heifers require a higher quality ration compared with mature cows because they are growing as well as producing a calf, as shown in Table 11.

The aim should be a steady rate of liveweight gain throughout pregnancy up to the last two months, see Table 12 for example diets. Maternal weight should then be maintained until calving.

Heifers have an extended post-partum interval (time between calving and first oestrus), compared with cows because they require energy for both growth and lactation before finally directing some of it towards reproduction.

Body condition is the single most important factor linked to resumption of oestrus cycles, and nutrition prior to calving has a greater impact than nutrition post-calving. Studies have shown that heifers that are thin at calving (BCS <2.5) have a 30-day extended post-partum interval compared with those in good body condition (BCS 3). Restricting nutrition prior to calving not only affects rebreeding success but also reduces colostrum quality and quantity, impacting calf survivability.

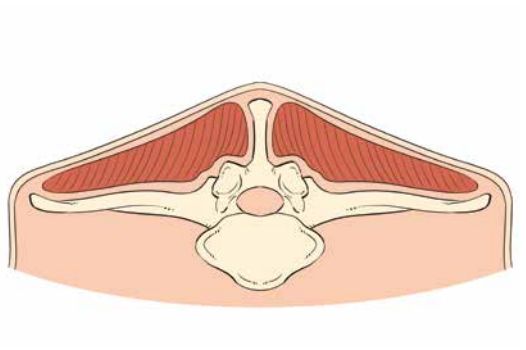

Figure 3. BCS 3

Table 11. Comparison of the nutrient requirements for pregnant heifers (calving at two years of age) and mature cows

	Heifer in mid-pregnancy	Heifer in last two months of pregnancy	Mature cow in last two months of pregnancy
Heifer/cow weight excluding calf and membranes (kg)	520	580	650
Heifer/cow weight including calf and membranes (kg)	530	635	705
Weight gain of heifer/ cow herself (kg/d)	0.7	0	-0.25
Energy requirements (MJ ME/d)	90	92	75
Crude protein (CP) % of diet	11	11	9

Table 12. Example diets (kg fresh weight per day) for pregnant heifers and cows

	Heifer in mid-pregnancy		Heifer in last 2 months of pregnancy	
	Example diet 1	Example diet 2	Example diet 1	Example diet 2
Silage*	34	-	32	-
Straw	1	7	2	8
Concentrates**	-	4.5	-	4.2

*Silage composition: 24% DM, 10.6MJ ME/kg DM, 13% CP in DM

**Concentrates should contain 22% CP in DM

Nutrition post-calving

The nutrient demands of heifers after calving are greater than those of a mature cow. This is because they are still growing, as well as maintaining themselves and lactating. This requires an average liveweight gain of 0.5 kg/day while pregnant and lactating, as shown in the table below (Table 13).

It is best to keep heifers separate from the main herd so that they can be given better quality grazing and avoid competition for feed with mature cows.

In autumn-calving herds, it is important to provide supplementary magnesium post-calving to minimise the risk of staggers (hypomagnesaemia).

Heifers are prone to significant body condition loss during their first lactation. Post-calving, feed them well to minimise this loss of condition and encourage oestrus cycling before their second breeding season.

For those first calvers (or other cows) in poor condition, early weaning offers a useful means of allowing them to regain body condition before calving.

One of the key factors for success when calving at two years of age is to feed the heifers as well as possible post-calving. In addition, spring-calved heifers should be turned out onto the best grass available and autumn calvers should be the first to be housed, so they can go onto full winter rations as soon as possible.

Table 13. Post-calving nutrition

Cow type	Liveweight (kg)	Liveweight change (kg/day)	Milk yield (kg/day)	Grass silage (kg/day)	Barley (kg/day)
Mature cow	650	-0.25	10	Ad lib	0.8
Heifer	580	+0.5	8	Ad lib	2.6

Note: Ad lib is based on average silage quality and the assumption that they are in good condition. Do not feed more than 2 kg of concentrate per feed to reduce acidosis risk.

Options for serving replacement heifers

Serve heifers for 6–9 weeks at the start of the service period so that:

- Only fertile heifers that conceive quickly join the herd (target 80% in-calf in eight weeks)
- Heifers will calve early and have more time to recover before the next breeding season starts, than if calved later
- They can be monitored closely at calving time and given assistance, if required

Heifers tend to have a longer anoestrus period (the time between calving and when they start cycling) than cows. Calving them early allows for this and minimises the risk of the calving interval slipping.

Any that are not in-calf at the end of nine weeks should be transferred into the finishing system and not kept as breeding females. Don't be disappointed if 100% don't get in-calf – the aim of a tight breeding period is to ensure that the heifers are challenged and that only the best enter the breeding herd.

Remember

Late-calving heifers usually become late-calving cows.

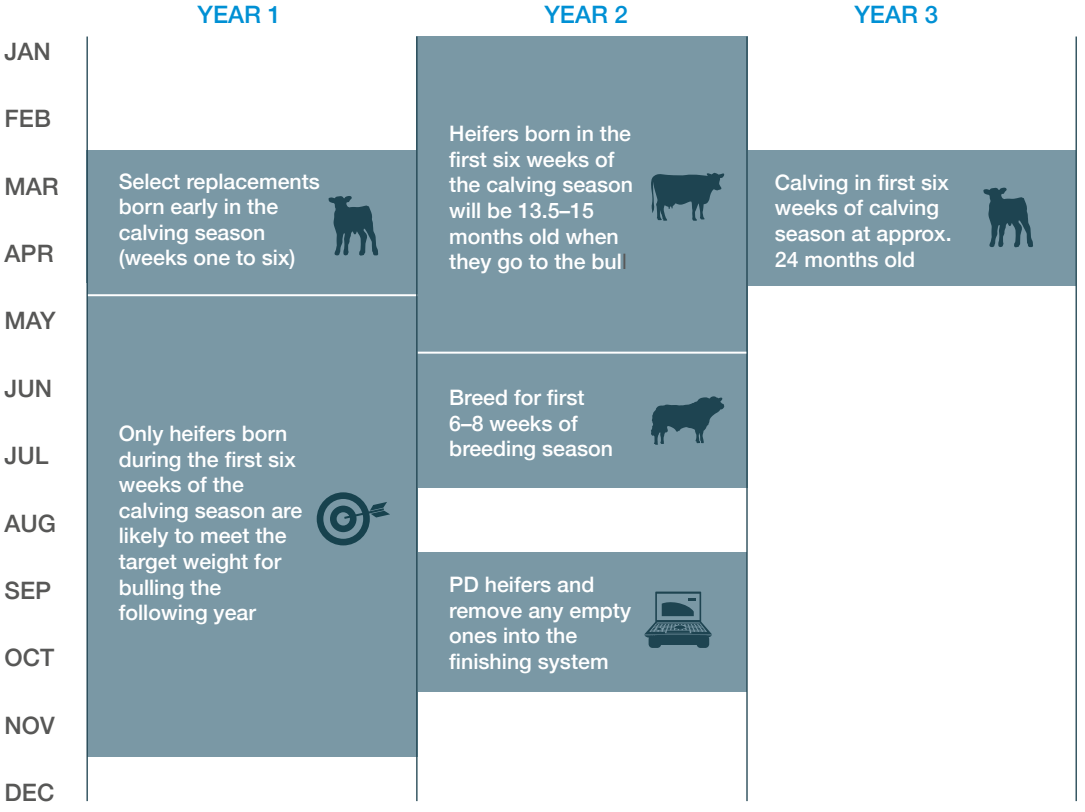

Figure 4. Strict selection and a short breeding period ensure heifers calve at the start of the calving season

*This is for a spring-calving herd (calving at two-years-old)

Management to achieve good conception rates

- Apply the same management principles for natural service and AI
- Feed heifers a consistent ration so they are on a rising plane of nutrition that meets their requirements, including any required minerals, for a minimum of six weeks before service and six weeks after (for more information see page 30)
- Heifers should be in the correct body condition. They should be fit, not fat. The ideal body condition score (BCS) at service is around 2.5–3. Exclude heifers that are very thin (BCS < 2) or very fat (BCS > 4)
- Heifers should be kept in a stable social group for at least six weeks before and after service to reduce stress
- Heifers should weigh at least 65% of their mature body weight at first service
- All stock must be checked for disease
- All medication, e.g. vaccines and parasite treatments, should be given in advance of service or any synchronisation programme
- Heifers should have two cycles before service and some females should be observed bulling before service or AI*
- Heifers should have a pre-mating vet check to ensure they have a healthy and functional reproductive tract, are cycling and have big enough pelvises to be bred

Pre-mating checks

It is a good idea to get your breeding heifers checked by your vet pre-mating. During the check, they will assess:

- The overall condition of the heifers
- If they have a functioning reproductive tract (identify any freemartins)
- If they are cycling*
- If they are capable of physically birthing a calf (this is often done by pelvic measuring)
- If they are up to date with vaccinations and worming and test for any disease or trace element deficiencies

Investing in pre-mating checks will save money by avoiding:

- Service of any heifers that will physically not get in-calf due to reproductive tract issues
- Service of any heifers that will not get in-calf because they are not cycling
- Difficult calvings from those that have small or misshapen pelvises (this can't be assessed from the outside appearance of the animal)
- Low conception rates caused by disease or mineral deficiencies

Service with a bull vs Artificial Insemination

Calving ease direct EBV is vitally important when selecting a bull or AI sire for use on heifers. Heifers that have difficult calvings are likely to have a longer period of anoestrus post-calving and struggle to get back in-calf next time. There are advantages of service by bull and AI, as shown in Table 14.

*Some progesterone-based synchronisation protocols can help overcome non-cycling animals. However, heifers that are not cycling due to being underweight are not suitable for service due to possible calving difficulties and reduced future fertility

Table 14. Serving with a bull vs AI

Bull		AI
Advantages	Less labour involved	Gives access to sires with higher EBV reliabilities
	No requirement for heat detection	Gives access to sires with higher genetic merit
	Animals don't need to be kept near the farm for handling	Sires can be matched more closely to individual females
	Can be used with synchronisation to tighten calving blocks	Reduced risk of introducing disease to a herd
		No difference in conception rates compared with using a bull, in well-managed cattle
		Can be used with synchronisation to tighten calving blocks and reduce the need for heat detection
Disadvantages	Higher risk of introducing disease	Is more time-consuming
	Safety issues with keeping bulls	Can be difficult to get an AI technician to serve cattle at the correct time unless you go DIY
	Can be difficult to find a stock bull with the desired EBVs, unless genomicaly tested bulls are selected	If used with synchronisation, it can be more expensive per calf than using a stock bull
	EBVs of young bulls have low reliability	Requires detailed management of cattle to achieve conception rates that are on par with natural service
	Is often more expensive per calf than using AI when purchase and maintenance costs of the bull are taken into account	Synchronisation programmes require great attention to detail and accurate timing
	Stock bulls with good EBVs are often very costly to purchase	

For more information on using AI and synchronisation in beef cattle, see **Artificial insemination and oestrus synchronisation in beef cattle**, available at **ahdb.org.uk**

Pregnancy diagnosis in heifers

Having heifers scanned for pregnancy diagnosis at 40 days post-removal of the bull/AI service, is a good investment because it identifies those that are not in-calf sooner, enabling farmers to finish and sell them, rather than keeping an empty heifer until the calving period.

Pregnancy diagnosis at this stage will also allow your vet to give you an idea of when the heifers are due so you know when to start observing them and can arrange any extra labour needed for calving.

Pregnancy diagnosis can be performed right up until calving, but the bigger the foetus, the more difficult it becomes to give an accurate calving date.

Monitoring heifer performance

Measuring performance helps to evaluate current heifer management and identify areas that can be improved. Use a few key targets (Table 15) to monitor the progress of each heifer as it becomes an established member of the herd.

It is also useful to record and monitor information such as number or severity of assisted calvings, pregnancy rate of first and second calvers, age at culling, reasons for culling and longevity.

Table 15. Heifer performance targets

Performance indicator	Target
Heifer liveweight at service	65% of mature weight
Service period	Six weeks or two AI attempts
Liveweight at start of second breeding season	85% of mature weight

Further information

Other publications from AHDB

- A Nuffield Farming Scholarships Trust Report: Heifer replacement strategies: cost reduction in the UK suckler beef herd
- Feeding suckler cows and calves
- Herd notebook
- Bull MOT leaflet
- Choosing bulls
- Bull testicle tapes
- Optimising suckler herd fertility

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- Visit **farm events and agricultural shows**
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