The InCalf guide

for GB farmers with block calving herds

DAIRY

Contents

Through a Memorandum of Understanding between Dairy Australia and AHDB, as well as a technical review from DairyNZ, British dairy farmers and advisers can access InCalf, adapted for GB conditions by AHDB.

AHDB gratefully acknowledges the contributors of the first edition of the InCalf block herds guide. This publication has been written and developed through a team of technical specialists from the following organisations:

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Foreword

Phil Kinch from Buscot Wick Farm, has 360 autumn-calving cows, averaging 1,277 kg milk solids per hectare. Buscot Wick Farm is an AHDB Strategic Dairy Farm.

Phil Kinch
Buscot Wick Farm

Attention to detail is of paramount importance to us and an autumn block-calving system provides the simplicity we desire. It allows us to focus on producing the best milk we can in the most efficient way. The beauty of block calving is that even if it is a big task now, the end is always in sight and you know you are soon moving onto something else.

Ben Redman, our herd manager, has been instrumental in us achieving a 6-week calving rate of 86% and a herd replacement rate of 22%. Ben highly values using quality data and spends time analysing many different aspects of our fertility information. This, alongside a very high level of attention to detail, has meant we increased the heifer first-service conception rate by over 20% by moving away from contracted fertility management, despite now using timed artificial insemination (AI) and sexed semen on the heifers.

Historically, we were an autumn block herd, but digital dermatitis reduced our fertility and then we had TB, which meant we lost the calving pattern and cow numbers. At that time, we had no choice but to calve all year. It was a huge amount of work; we had cows calving and calves to feed every day of the year, so we were keen to get back to block calving once our health status was back on track.

To tighten the block from all year round, in year one we stopped serving for a time and we had our first calf born 3 June and our last in December. Then, in year two, we were calving July to November and in year three we should be starting 16 August and be done by 2 November.

Once calving is complete, the team are able to focus on the detail in order to run the farm as profitably as possible. For example, a straw of semen from every batch is checked under a microscope to ensure its viability is satisfactory.

I've always enjoyed the challenge of people on farm coming up with ideas and better solutions, which is why I was keen to be an AHDB Strategic Dairy Farm. I also wanted the team to receive the recognition for what they achieved. I hope that people will see that block calving can make dairy farming more interesting, efficient and less stressful because of the distinct periods during the year.

How to get the most out of this resource

The InCalf guide for GB farmers with block-calving herds pulls together the accepted knowledge on dairy herd fertility management, drawing on AHDB's extensive amounts of research and resources, as well as industry experts across Great Britain and beyond.

This publication provides detailed information relevant for herds calving in blocks of 12 weeks or less, and those aspiring to achieve this. By focusing on one calving system, the information provided is specifically tailored to your business. Every herd is different; however, there are key fundamentals within every block-calving system that will provide the foundation to achieving a profitable and sustainable business.

We hope this publication provides a reference to help you step through the InCalf process of assessing your own herd situation, considering the scope for improvement in fertility performance, looking at options for change and implementing the most appropriate ones for you. This book will also be useful for professionals providing you with advice in this process.

Use this resource frequently to find specific information and stimulate thought and discussion. It can be used as part of farm team meetings or as a day-to-day reference for best practice.

Optimal Dairy Systems

Following discussions with a number of stakeholders and farmers across the industry, our sense is that those farms that focus on a clearly defined production system tend to be more profitable and competitive. We also know the best British dairy farmers can compete on a 'marginal cost' basis with the best in the world.

However, there is significant scope for the industry to narrow the range in performance. The key is to identify the production systems that will enable British farmers to compete, while still satisfying both domestic and international market demand.

Fundamentally, we believe that British dairy farmers should focus on one of two systems:

- Block-calving system – all cows calve within a 12-week window (or less) usually during spring and/or autumn, get back in calf, peak in milk production and are dried off together
- All-year-round calving system (AYR) – cows calve all year round with no seasonal emphasis and no period where the entire herd is dry. Inputs may vary from extensive herds mainly grazing to fully housed herds with very high yields

In Britain, over 80% of dairy farmers identify themselves as all-year-round calvers. This raises a question as to whether this is a conscious decision based on every farmer deciding what is the best system for them, or whether the system has just evolved.

We want farmers to understand their current system, judge their performance by holding a mirror up to themselves and make a conscious, strategic choice about the system that is optimum for them. The following is designed to help farmers start to make that decision.

This resource has been developed to support farmers who are all-year-round calving herds. Should you wish to learn more about block-calving systems, specific resources for these are available on the AHDB website.

For further details, including background, evidence and our commitment, please read our ***Delivering a more competitive industry through optimal dairy systems*** paper, available on the AHDB website.

Watch our Chief Strategy Officer, Tom Hind, and others from across the industry speaking about Optimal Dairy Systems, available on our AHDB Dairy YouTube channel.

The ***Dairy performance results*** provide full economic costings of GB dairy herds for three different calving systems – all-year-round (AYR), 12 weeks or less autumn block and 12 weeks or less spring block. The figures allow dairy farmers to compare the performance of their own business with others operating the same system and help identify areas where changes might improve profit margins.

For the most up-to-date figures across all systems, please see the latest version available from the AHDB website.

Getting what you want from your system

The following summarises key factors to consider when reviewing your business.

Review current farm performance

1. Mindset

Think about the mindset and approach you have to your business. Do they match with what you are trying to achieve? Will your mindset get you what you are striving for? For example, could you be open-minded to new ideas?

2. Current system performance

A thorough understanding of the farm's current financial performance and recognition of its key strengths and weaknesses will help inform decisions about future plans. Before considering any change to farming systems, you can benchmark your current performance and compare it against other block systems.

Use the **ODS KPI benchmarking calculator** to input your own data and benchmark yourself.

3. Current calving pattern

Is the system that you operate giving you what you want, such as a sufficient income, a good lifestyle, a legacy for your family?

Consider business implications

4. Milk buyer requirements and milk contract

Understand your current contract and how you can most efficiently produce milk to meet its requirements. If considering making changes, discuss your plans with the milk buyers and, where possible, secure the contract best suited to your chosen system.

5. Cash availability

If you are considering a change of system, then be aware that cash flows throughout a year are significantly different between all-year-round and block-calving systems. And so any change in system will require careful budgeting and a cash requirement to manage the change process.

6. Labour

Consider whether you have the right labour required to successfully run your dairy herd. If labour shortages are an issue, would a change of system help?

Consider your technical challenges

7. Physical farm limitations and strengths

There are key aspects of housing and infrastructure that are required to successfully operate a block calving system. Reviewing these can provide ideas on how farm layout can be further improved to suit the system.

InCalf block – You are here!

If you are jumping in at this step to improve your technical skills, it may be beneficial to go back a few steps and review your whole farm performance and consider your business implications.

A thorough understanding of your farm's current financial performance and recognition of its key strengths and weaknesses will help inform decisions about future plans and how to get what you want from the business.

This will help you identify where to focus to get maximum return for your effort.

8. Skills and knowledge

Review your own skills and knowledge and/or that of your staff and be honest in assessing areas of strengths and where further skills and knowledge would help the business become more focused in the system you choose to operate.

9. Cow type

Select the right genetics for traits that reflect the needs of the block calving pattern, feeding system and milk quantity/quality desired.

Maintain and further develop

10. Continue to monitor and review current performance and your future plans

On-going performance checks and regular reviews of best practice will help ensure that the farm maintains focus and knows its key strengths and areas for development. Testing plans with trusted advisors and fellow farmers is a valuable way of avoiding common mistakes made by others.

11. Personal development

Maintain your own skill sets through initiatives, workshops and courses local to you. These will support you in reaching your business aims.

Fertility for life

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Overview

From the birth of a heifer calf, you control the factors that influence her future fertility and whether she gets in calf on time, every time.

What you do each day of the heifer's life will determine how well she grows, if she is healthy at calving time, if she recovers before mating, if she is correctly detected on heat and mated and if she conceives. The cycle then starts again.

The life cycle of a dairy cow

The fertility-for-life cycle for an individual cow includes calf and heifer rearing; first mating, pregnancy and calving; then subsequent cycles of mating, pregnancy and calving as a member of the milking herd, and eventually culling.

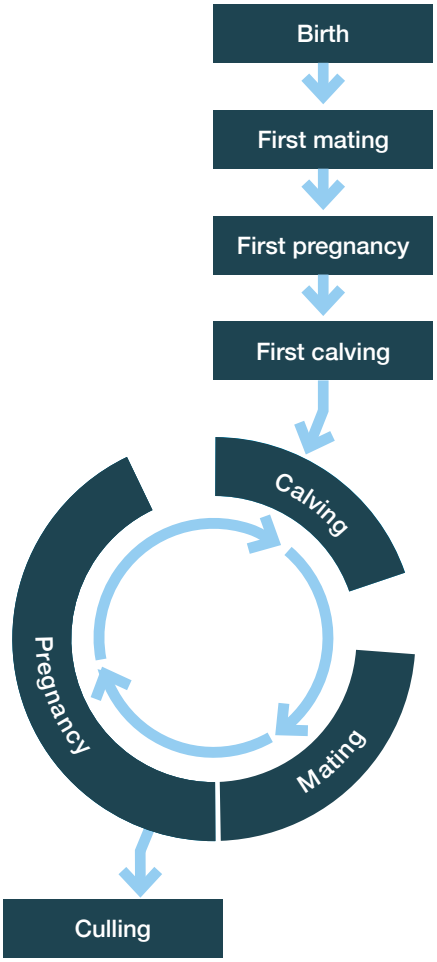
Attention throughout the whole cycle pays dividends – especially if you can do this for every animal.

Table 1 (overleaf) has some of the essential questions to ask at each stage of the fertility-for-life cycle to help achieve success.

These materials summarise considerations for each stage in the fertility-for-life cycle. A fertility management plan for each animal gives your herd the best chance to achieve good reproductive performance.

The basis of the framework is the fertility cycle of the cow, helping you think about what needs to be done at each stage of the cycle. To get started, the framework in this chapter provides:

- A summary of the actions and options at each stage of the fertility cycle
- A useful index for tracking down the information you need within the other chapters



Thriving rather than just surviving when the pressure is on

Everyone who has experience of block calving will be able to relate to those intensive 12 weeks when it seems like there is no light at the end of the tunnel, no coming up for air and little time to even think.

No one is perfect, yet there are some things you can do to make the busy period less stressful and more profitable. The aim is to not only survive the busy period but also get through it feeling energised and engaged.

Knowing how to survive your busy period without burning out is key for any manager and their team. Consider some of the following tips:

- Make sure people understand their role and purpose so that they appreciate and understand what they do but also why they do it and the difference they make
- Carry out a potential-problem analysis, thinking about what might go wrong, and develop a plan to prevent problems or a contingency plan to tackle them
- Make sure you take care of your mental and physical health: eat well, talk to each other and take breaks
- Give regular feedback and remind people of what they are good at
- Keep people informed about how their effort is making a difference to the business
- Use your quieter time to step back and review, learn from mistakes and build on success
- Celebrate success

Block-calving systems

The key measures of success and your approach to improving herd reproductive performance varies according to your calving system.

This resource covers block-calving herds:

- Block calving – All cows calve in a 12-week period (or less) each year during either spring or autumn
- Split-block calving – Cows calve in two distinct 12-week periods each year (or less), usually spring and autumn

This chapter describes all the aspects of reproduction management that you need to consider at each stage of the fertility cycle. It provides a framework that can be used to ensure that you don't forget any important tasks and that your reproduction management plan is complete. It will include tasks that will help you assess performance and define and achieve your targets.

The basis of the framework is the fertility cycle. You have to start thinking about all the things that need to be done to animals at each stage of the cycle. That involves understanding the information presented in the chapters on the key reproduction management areas and deciding what's needed at each stage of the fertility cycle for all the animals on your farm.

Here are some of the essential questions to ask at each stage of the fertility-for-life cycle to help achieve success.

A fertility management plan

The planning process gives you a chance to think about different options and to decide which ones you wish to implement. Input from an adviser may help, such as your vet to benchmark figures, a business consultant or even a discussion group.

This reference provides a framework to help make sure you do not forget any important tasks and that your fertility management plan is complete. It includes tasks that will help you assess performance, define and achieve your targets.

The objective of all fertility management plans is to get every cow pregnant as soon as possible after you start breeding her.

Table 1. Essential questions to ask at each stage of the fertility-for-life cycle

Part	Questions
Calf and heifer rearing	Are heifers reaching target liveweights and frame sizes you have set?
Mating heifers for the first time	Are heifers big enough to be mated? What bulls have you selected? Are you going to synchronise heifers? How many bulls do you need?
First pregnancy	What is your pregnancy-testing strategy for heifers?
Calving heifers	How do you minimise body condition losses after calving?
Calving cows	Will they calve at an appropriate body condition score? How do you manage cows with calving or health problems? Are pre- and post-calving diets sufficient and balanced
Pre-mating and mating cows	What is your heat-detection strategy? What format do you use to keep breeding records? How do you deal with non-cycling cows? Have you checked your artificial insemination (AI) protocol? Have you got the right handling facilities for your breeding system? When was your handling system last appraised?
Pregnancy	Have you planned early +/- follow-up pregnancy testing? How and where are you recording pregnancy-testing results? What is your protocol for dealing with non-pregnant cows?
Culling	Which cows will be culled?

Benefits of improved fertility

Improving fertility gives you flexibility to better manage your dairy farm and your herd. Better fertility performance allows you to maximise the efficiency of each individual cow in your system to produce milk.

A fertile herd:

- Is more profitable
- Has better lifetime performance
- Is healthier and more productive
- Calves more easily and when you want it to calve
- Offers more opportunity to sell surplus animals or increase herd size
- Is more resilient, flexible, adaptable and responsive to management than less-fertile herds

In a block-calving system, good reproductive performance improves herd profitability through:

- Fewer cows culled as empties allows increased culling of genuine low-producing cows
- Increases in herd size or a reduction in the number of heifer replacements required
- Increased profit since cows calved earlier generate more milk income than cows that calve later in most herds
- More compact calving pattern with fewer late-calved cows, fewer empty cows and fewer cows requiring hormonal intervention
- More cows getting in calf early in the AI period, providing more replacement heifers, or the potential for a shorter AI period
- More AI heifers born early in the calving season, which streamlines calf rearing and heifer management, allowing farm staff to focus on other tasks
- Fewer days feeding dry cows and observing cows for calving problems

The economic value of improved fertility is of high value in any system and is heavily influenced by milk price and feed costs. It is, therefore, useful to estimate this on a case-by-case basis.

Process for improvement

Figure 1 illustrates the stages from initial assessment through to improving your results.

Measuring reproductive performance is a critical first step in improvement and allows you to decide which part of the process you should focus on. This is discussed in the Measuring and monitoring chapter.

Thinking about change

Herd reproductive management has a significant impact on other areas of farm performance. The principles that support a well-managed reproductive programme are consistent with other aspects of farm management.

- Small steps can build up to big gains. A gain of 1–2% in many areas that affect fertility may not seem like much, but the cumulative effects can make a big difference to your bottom line
- Detail makes the difference. In many cases, the solutions are not expensive or time-consuming but take careful planning and attention to detail. Cutting corners and poor timing can delay or prevent improvements
- Focus on the most limiting things. Applying all of your effort in only one area rarely provides a large improvement in herd performance if there are other areas also holding the herd back. You make greater gains in herd performance when you work on the key limiting areas together. It is better to make modest gains in each of them than to focus on achieving high performance in one area alone

It is one thing to realise there are opportunities for improvement, but another to take advantage of them.

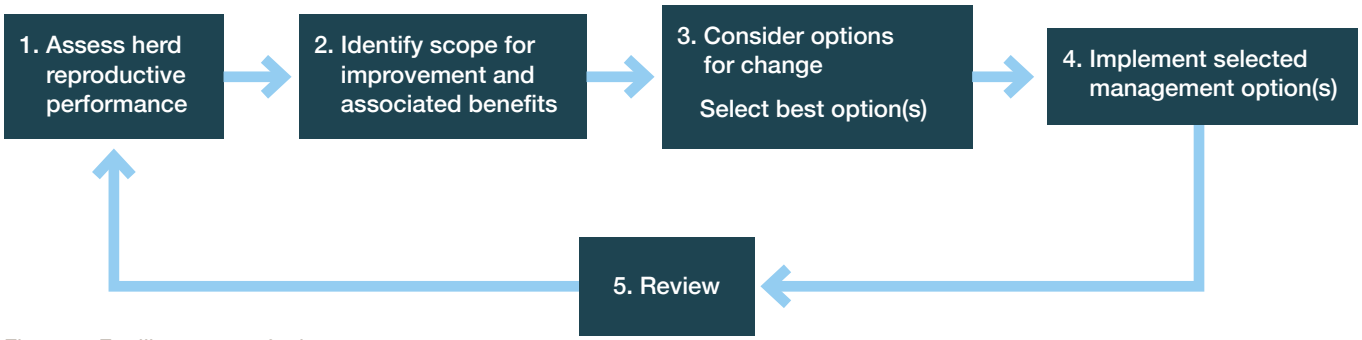


Figure 1. Fertility process for improvement

Preparing for change

As part of our Horizon series, our report ***Preparing for change: The characteristics of top performing farms*** identifies eight factors which set apart the top-performing farms across all agricultural sectors. Importance of these factors will vary for each farm, depending on the system, environment, existing skills, resources and performance on the farm, but for the industry overall our assessment of the factors in priority order is as follows:

1. Minimise overhead costs
2. Set goals and budgets
3. Compare yourself with others and gather information
4. Understand the market
5. Focus on detail
6. Have a mindset for change and innovation
7. Continually improve people management
8. Specialise

Taking a step back from the day-to-day running of the farm and spending some time considering the dairy enterprise against these factors can prove time well spent.

Where to start

In a block-calving system, efforts to get cows pregnant need to be continually refined year on year, which requires careful planning.

Without a good system of recording and measuring performance, and comparing the results with targets, it is almost impossible to assess performance and determine your priorities. Without good records, you and your team won't know whether performance is satisfactory and will find it difficult to manage key tasks, such as treating, inseminating and pregnancy testing cows.

Results require team effort and good communication. Make sure everyone has well-developed skills and knows what the targets are. It is also good to give yourself and your team a pat on the back for achieving a target.

Accurate and timely record-keeping, regular measuring and checking against the targets will help identify opportunities to improve. For example, some farms have an office whiteboard with a tally of each season:

- Milk solids per hectare
- Cows calved in weeks one, three and six
- Empty rate
- Anything else you are targeting

Measuring and monitoring

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Measuring and monitoring

Overview

Getting an accurate picture of herd reproductive performance offers a starting point for improvements. This chapter discusses measures that allow you to compare between years and to identify what is achievable.

It is important that these measures are accurate and can be calculated consistently year after year. This isn't easy without a good record system. Taking little steps can often make the biggest gains, so accuracy is important. Accurate records begin with the birth of every calf.

Key points

- Effective managers measure and monitor performance
- You need to measure a few things in reproduction but you also must do this consistently, completely and regularly
- Don't just record data – use it to analyse performance. This will identify areas to focus upon
- Pregnancy testing is fundamental to timely measurement of performance

What is meant by measuring and monitoring?

Reliable, accurate measures of herd reproductive performance offer a starting point for identifying areas for improvement and provide a means of monitoring progress and effectiveness as you implement change.

Effective measuring and monitoring of your herd's reproductive performance with the best measures and at the best times enables you to:

- Confidently compare your herd's reproductive performance to previous years and the results achieved by top farmers
- Respond more quickly when measures indicate that herd reproductive performance is not as good as desired
- Establish which aspects of the system are most likely to be limiting performance, allowing you to target efforts to improve in the right places
- Assess whether the changes you have made to improve herd reproductive performance have worked
- Motivate your farm team and guide them towards better performance

Establishing a monitoring system

Accurate measurement and monitoring of herd reproductive performance relies on:

- Good record-keeping of all relevant reproductive data in an accurate, accessible, complete and timely manner, starting with the birth of every calf and continuing until the animal exits the herd
- A system for storing and accessing your records. For most, this is a choice about which computer program to use. You need to consider how the program can be used on your farm (e.g. are mobile application versions available?) and if the software can easily exchange data with places where data is stored (e.g. milking plant, milk-recording organisation, BCMS)
- A team approach on farm to ensure everyone knows:
  - What data is to be collected, when and how it is collected – and who is to do this
  - What data is to be analysed, when and how it is analysed – and who is to do this

What exactly do I need to record?

Checklist for the minimum information needed to effectively measure herd reproductive performance:

- Whole herd planned start of mating (PSM) and planned start of calving (PSC) dates
- Cow details – ID, date of birth, breed
- Do-not-breed, or select-to-cull events – cow ID, date of decision not to breed
- Artificial inseminations – cow ID, date of insemination, operator, sire, how long you AI'd for
- Which bulls were introduced, when and rotations
- Pregnancy test results – cow ID, date of pregnancy test, test result, estimated number of weeks pregnant (if not pregnant to most recent insemination)
- Actual start of calving date
- Calving details – cow ID, calf ID, date, assisted calvings
- Cow exits – cow ID, date of exit, whether culled, sold or died, and reason

Important

The more up-to-date the reproductive records are, the more up-to-date any analysis will be. This is especially important for reproduction, as many of the measures have some degree of time lag because there is a delay before measures can be calculated, e.g. to allow time for cows to be pregnancy tested.

Supporting information

Other information that helps measure herd reproductive performance includes:

- Natural matings – cow ID, date of service and bull identification
- Cow milk-production records (from official milk recording, or from the milking plant)
- Cow health events – cow ID, date of event, type of event (e.g. retained cleansing, metritis, oestrus not observed, etc.), treatment
- Youngstock weights

How are records analysed?

For block-calving herds, measuring reproductive performance can be quite simple to calculate. Information and data can be analysed manually or via a spreadsheet program, so don't be put off starting – just having a count up of your calving records can be a great exercise.

Key measures of block-calving herd reproduction performance

A range of measures is needed to assess the fertility performance of a herd. A useful way to consider this is to think of layers of measures:

- **Overall reproductive performance** – AHDB has defined key performance indicators (KPIs) for reproduction in each of the Optimal Dairy Systems
- **Drivers of overall performance** provide more detail on which specific parts of the reproductive process are working well and badly – when something fails to meet target, these measures highlight where best to focus to improve
- **Detailed measures of particular aspects of reproduction** allow you to drill down into the detail of a specific area

An example of how this approach works for a block-calving herd is shown in Figure 2 (these terms are defined in more detail in the next section).

Overall measure	Cows and heifers calved in first six weeks	
Drivers of performance	3-week submission rate	Conception rate
Detailed measures	6-week in-calf rate	Empty rate

Figure 2. Fertility KPIs and drivers of block herd performance

How they are calculated

The key measure of overall reproductive performance in a block-calving herd is:

- **Cows and heifers calved within the first six weeks (%)** – defined as (number of cows and heifers calved in the first six weeks from the planned start of calving ÷ total number of cows and heifers due to calve) × 100 = 6-week calving rate

Example:

$$\frac{\text{90 cows calved}}{\text{100 cows \& heifers in-calf}} \times 100 = 90\%$$

Further information on this is available in the Starting and stopping mating chapter.

The figure should include served heifers (AI or natural) but not include cows and heifers that haven't been served. If the target 6-week calving rate is not being reached, it is an indicator of issues such as fertility and/or cow management.

The cows and heifers calved within the first six weeks (%) doesn't account for the effect of culling the previous season and/or high replacement rates. Therefore, to give an accurate picture of reproduction in your herd, it must be used in conjunction with the following two key drivers to give a clear picture.

Measuring drivers of overall performance

Two key drivers of cows and heifers calved within the first six weeks are:

- **3-week submission rate** – tells you the percentage of cows submitted in the first three weeks of mating
- **Conception rate** – percentage of inseminations that were successful, i.e. resulted in a positive pregnancy test. It will be difficult to achieve a good 6-week in-calf rate unless the conception rate is at least moderately good

Detailed measures of performance

Two key drivers of cows and heifers calved within the first six weeks are:

- **6-week in-calf rate** – describes the percentage of cows in the milking herd that became pregnant in the first six weeks of the mating period. Early rectal pregnancy testing provides the most accurate assessment of this

- **Empty rate** (also known as not-in-calf rate) – describes the percentage of cows that were not pregnant at the end of mating. It requires pregnancy testing after the end of mating and cannot be calculated before this time

Note: The empty rate does not give an indication of how quickly cows get in calf and must be used with 6-week in-calf rates to assess overall herd performance.

Comparing performance for each of these measures against expectations or targets allows you to decide whether to focus on submission or conception to improve. Benchmarking values for top-performing, good and average farms are shown in the next chapter: Setting targets.

Having these figures where all the team can access them allows everyone to see if things are going to plan.

A recommended approach to measuring and monitoring

Once you know where your herd is at, it is often useful to understand a bit more about what is contributing to the result. A number of measures re available to help here.

To get cows in calf quickly, they need to be inseminated early in the mating period and this is measured by the 3-week submission rate.

You also need to ensure that a reasonable proportion of inseminations result in pregnancy, as measured by conception rate. To measure this, you have to be able to tell whether a cow is conceived to an insemination. There are two ways of doing this – directly, through early-aged pregnancy testing, or indirectly, using non-return to heat.

Finally, a number of detailed measures are available to assess specific management areas, for example, 3-week submission rate of first calvers and pre-mating heats for the whole herd. These measures will be described in later chapters.

It is best to monitor performance in lactating animals and heifers at first breeding separately because they are managed differently, affected by different factors and have quite different targets and expectations.

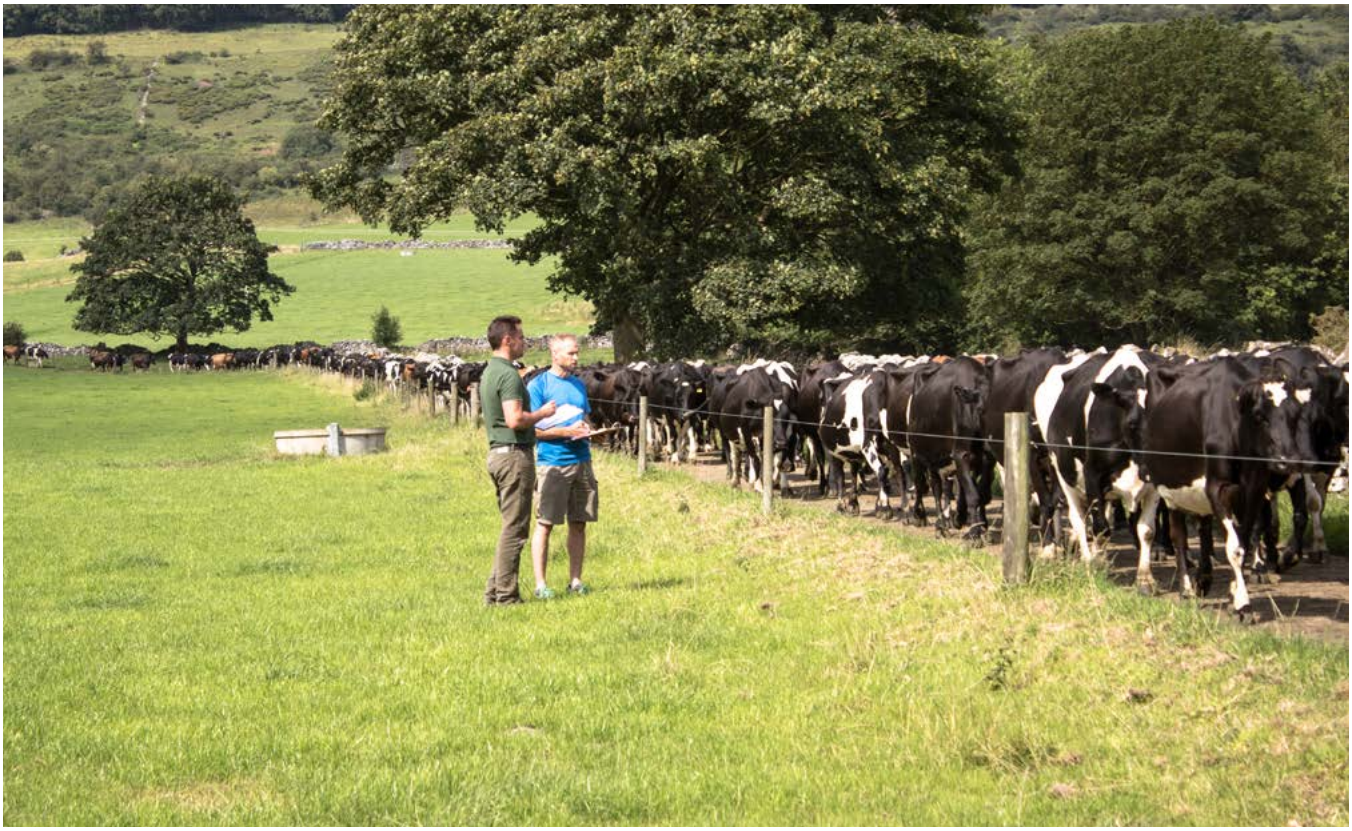
Involving the vet or other adviser when assessing performance adds substantial value, especially when you are investigating a problem highlighted by the KPIs.

Challenges in measuring and monitoring

Making good use of data and monitoring reproduction can be hard. Here are some common problems.

Poor records

Without complete reproductive records (see the section on establishing a monitoring system), it can be impossible to monitor fertility in a meaningful way and, worse, you can get a misleading picture of what's going on. Missing service records are a common problem, particularly where stock bulls are running with cows, but it is important to remember this when analysing data.



Missing pregnancy tests

It is critical to ensure that all cows are pregnancy tested at the determined time after their most recent insemination. When cows are missed, it leads to inaccurate performance measurements and if testing is delayed, additional lag (i.e. delay between an insemination and your ability to measure its success) is introduced.

Difficulties with software

Products vary substantially in how easy they make it to review the measures described above. It is important that you understand how to access the measures in your system and how they are being calculated and presented. Using specialised software can make this much easier and this is often accessible via an adviser (such as your vet) who will also be able to help with interpreting results.

Setting targets

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Setting targets

Overview

It is important to set realistic objectives and know how to use your measurement and monitoring system to assess the performance of your herd. This will help you as you apply and adapt your reproductive management plan for your farm. This chapter discusses:

- The reproductive performance that can be and is being achieved by GB farmers
- Industry performance targets and triggers
- How targets and triggers can be used to identify areas for attention in your reproductive management plan

Key points

Reproductive performance is too hard to manage without good records.

Good records help you to:

- Identify weak points in your system
- Make meaningful comparisons to others
- Set realistic targets for next mating

Definitions

Key performance indicators and drivers

Cows and heifers calved within the first 6 weeks (%)

Number cows and heifers calved in the first 6 weeks from the planned start of calving ÷ Total number cows and heifers due to calve × 100.

6-week in-calf rate

The percentage of a herd that gets in-calf during the first six weeks of mating.

Empty rate

The number of cows confirmed empty/number of cows joined.

> *Important*
>
> What's the difference between empty and not in calf rate? Not in calf rate is the number of cows not confirmed pregnant/number of cows joined. Cows joined is the whole herd less any cows genuinely selected as do-not-breed.
>
> The herds where this figure is at great variance will be ones who have cows removed without confirming their pregnancy status or large numbers of cows in the herd with unknown status. For example, forced removal because of TB is a situation where this can skew figures.

3-week submission rate (%)

The percentage of cows receiving at least one insemination in the first three weeks of the mating period.

Conception rate (%)

The number of cows actually conceiving as distinct from maintaining a pregnancy.

Herd replacement rate (%)

The number of animals required to replace animals that have left the herd (including voluntary culls, involuntary culls, deaths and sold milking animals) during a defined period (usually 12 months) expressed as a percentage of the average herd size during the same period.

Industry targets for block-calving herds

The herd reproductive performance measures for your farm give a picture of where you stand relative to other herds. The targets shown in Table 2 are based on data taken from Optimal Dairy Systems specifically for block calving, GB herds.

Individual herd targets need to be revised as they are achieved, or as the farm situation changes. For example, the introduction of a modified heat-detection programme may increase the success of mating and result in the need to revise your future targets.

Table 2. Suggested targets for the main performance measures in block-calving herds

Measure (%)	Excellent	Good	Average
Key performance indicator and drivers			
Cows and heifers calved within the first six weeks	>90	80	70
Heifers only calved within the first four weeks	>90	80	70
6-week in-calf rate	78	72	65
Empty rate	<9	<12	16
Other performance measures			
3-week submission rate	90	85	75
Conception rate	65	60	50
Herd replacement rate	>20	22	26

Excellent: Top 5% performer or aspirational target
Good: Top 25% performance
Average: Industry average where available

> *Important*
>
> Empty rates will vary depending on your mating period. See Table 3 for more detail.

Table 3. Performance targets for empty rates dependent on length of mating

Length of mating (weeks)	Empty rate (%)	
	Good (top 25%)	Seek help if equal to or below
6	22	32
9	13	20
10	12	17
11	11	15
12	10	14

Setting achievable targets for your herd

Setting targets for your herd situation gives you a framework to help identify what needs to change.

After you have evaluated your current level of herd reproductive performance and considered standard

GB targets, it makes sense to select your own target for each measure of reproductive performance:

- If you have achieved the target, is it economically viable to raise it?
- If you are far from the target, take small steps to improvement by setting a slightly easier target

Discuss your results and proposed targets with your farm team and advisers so they can help to achieve them. Review progress and targets regularly to make sure you are making timely decisions and good progress.

Individual herd targets need to be revised as they are achieved or as the farm situation changes. For example, the introduction of a modified heat-detection programme may increase the success of mating and result in the need to revise your future targets.

Get some help to assess last season's reproductive performance. As a minimum, calculate the cows and heifers calved in the first six weeks, 6-week in-calf rate and your empty rate.

Going from good to excellent – Matt Ford, Lime End Farm, East Sussex

600 autumn calving, Holstein and Fleckvieh herd, averaging 8,147 litres at 4.23% butterfat and 3.44% protein.

Results from last season	Excellent (Top 5% performer or aspirational target)	Good (Top 25% performance)	Average (Industry average where available)	Lime End Farm 2018
Key performance indicator and drivers				
Cows and heifers calved within the first 6 weeks (%)	>90	80	70	82%
Heifers only calved within the first 4 weeks (%)	>90	80	70	89%
6 week in-calf rate (%)	78	72	65	67%
Empty rate (%)	<9	<12	16	17%
Other performance measures				
Herd replacement rate (%)	<20	22	26	26%
3 week submission rate (%)	90	85	75	90%
Conception rate (%)	65	60	50	53%

"Autumn block calving suits our farm, we are in one of the sunniest places in the UK which means we can grow good maize crops and tend to dry up during the summer. Our soil type is quite sandy which enables us to turn out early and get good grass utilisation in the spring through until drying off, by which time we are usually starting to suffer from lack of rainfall.

We then buffer feed fresh calvers with maize to drive milk yield through the winter. The system suits my desire to see good milk yields while still being able to graze cows. It also means I don't have to run different groups – it's nice to be able to rear the youngstock as a whole group each year.

I aim to finish calving before we start serving as ideally we want all cows to be eligible for serving on day one. This means we don't have to worry about assisting with calvings when we should be spending all our time on heat detection. We can schedule our holiday time for the spring and early summer when the weather is nicer and routine is very simple, with just milking and fences to move. Autumn calving is also a good fit for the seasonality bonus on our Arla milk contract.

Our six week in calf rate and empty rate are still in need of improvement and we have been using replacement rate to drive our 6 week calved rate. I'm hoping that in time we will be selecting for a more fertile herd and should see improvements in these figures.

Simplicity of system and ability to graze efficiently really help to reduce cost of production and ultimately help improve the bottom line for us. Autumn calving is also good for lifestyle, it's nice to know that we only have the hassle of cows calving for a few weeks of the year which means we can then focus on each job as it comes."

Acting on priorities

< Back to main contents

Acting on priorities

Overview

The birth of a heifer is the start of the journey. She needs to grow effectively to perform well as a milking cow. Her health at and after calving is also important. You need to manage each of these to get cows cycling when you want to mate them. You will also need to implement effective heat detection and good AI techniques to get cows pregnant. If you use suitable genetics, ensure there is a cycle of continuous improvement in your calves. Managing the herd bulls and controlling bull mating is also necessary to catch those straggler cows not pregnant to AI.

The relationship between each of these components is complicated and this can make it difficult to identify which parts may be holding you back. The good news is that each part can be readily understood and effectively managed individually. They can also be monitored in isolation. This section describes the essentials of each component and how to measure and monitor performance. Remember that you will need to work on each component if your herd is to achieve their best result.

Key points

Almost everything you do will affect reproductive performance. Make sure you:

- Grow good youngstock
- Effectively manage the nutrition of the herd

Focusing on detail during mating will help you get cows mated and pregnant. This means good:

- Heat detection
- AI technique
- Bull management

There are few days in a year when you can't influence reproduction.

Setting priorities

Some things are more important than others

You control many management areas that affect herd reproductive performance. Your herd will achieve high levels of reproductive performance if you make the best possible management decisions.

Key fertility management areas

There are key areas of fertility management that must be successfully managed for good reproductive performance. These areas include:

- Calf and heifer management
- Body condition and nutrition
- Heat detection
- Sire selection
- AI practices
- Bull management
- Cow health

Getting results

To achieve good reproductive performance, changes in several areas may be necessary. However, not all of these areas are of equal importance – some will be limiting your herd's reproductive performance more than others and these may be different from other herds in your region. You need to identify and prioritise, putting your effort and resources into the areas contributing most to improved herd reproductive performance rather than areas you find easiest to manage or in which you have the most interest or skill.

Small steps can make big gains

The concept of attention to detail has developed in recent years to one of 'Aggregation of Marginal Gains'. It became popularised from the successes of the UK cycling team in the 2012 London Olympics, when Team GB took eight of the eighteen available gold medals, with no other country winning more than one.

This remarkable achievement was based on a belief held by the Performance Director of the Team GB cycle team, Dave Brailsford, that if everything that could be managed improved by a marginal 1%, then the impact overall would be noticeable. Not only did he examine wheel size, bike weight, training schedules and so on, but also hand cleanliness and sleeping patterns of the racers in question.

In fact, he determined to find 100 things that might affect cycling performance and improved them by 1%. If 100 equal things improve by 1%, then the impact on performance is multiplied, giving a 2.7-fold rise in performance.

Put key things first

This chapter will help you and your advisers identify the most important areas that will improve the reproductive performance of your herd. For each key fertility management area, this chapter will show you:

- How to tell whether you need to change management in this area
- What to do and when to do it
- How to monitor progress

The key messages in this section of The InCalf guide are:

- Don't get caught with light heifers
- Strive to continually improve your heat-detection performance
- Deal proactively with any non-cycling problems
- Select the most suitable genetics for your herd
- Organise well for AI
- Make sure you've got a good bull team for natural mating

Special circumstances

In special circumstances, other factors can result in reduced reproductive performance, e.g. trace element nutrition, lameness or abortions. These factors occur less frequently but they can reduce fertility in some herds. You may need to work with specialist advisers (e.g. vets, nutritionists) to determine if other factors are affecting the fertility of your herd.

Treating reproductive disorders

There are many forms of treatment available for use in cows with reproductive disorders or to synchronise heats. These therapies and approaches can be used to streamline labour requirements in some herds and can help improve reproductive performance. However, they do not provide the solution to problems arising within the key fertility management areas. You are best to control these by working on the fundamental cause of the problem. The InCalf guide can help you to address problems in these root cause areas.

Points to remember

- Small steps can make big gains
- Detail can make the difference
- Try to focus on the most limiting things
- Record-keeping makes for easier management
- Good results require a team effort and good communication

Supporting information for setting priorities

For further guidance on heifers pre-weaning, please see our comprehensive collection of calf management resources available on the AHDB website.

For further guidance on cow health, please see our resources, including:

- AHDB Healthy Feet Programme
- AHDB Mastitis Control Plan
- BVD Free
- Action Johnes

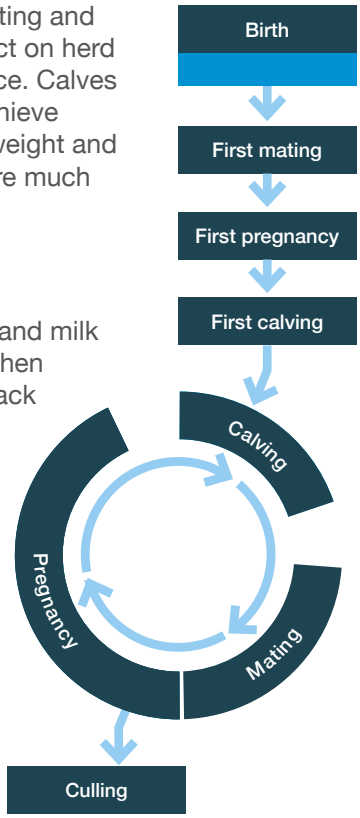
Heifers weaning to calving

Overview

Heifer liveweights at mating and calving have a big impact on herd reproductive performance. Calves and heifers reared to achieve mating and calving liveweight and height-for-age targets are much more likely to:

- Cycle
- Conceive
- Calve without delay, and milk well as first calvers, then succeed in getting back in calf early in the next mating period

Well-grown heifers also produce more milk in their first and subsequent lactations, compete better with mature cows and can survive longer in the milking herd than poorly grown animals.



Key points

- The reproductive performance of replacement heifers is directly related to liveweight at mating and calving
- Calves and heifers must be reared to achieve liveweight targets and reach puberty by start of mating, otherwise their first calving will be delayed
- Measure liveweights, set liveweight targets and assess the calving pattern for first calvers
- Also assess the 3-week submission rate, and 6-week in-calf rate if available, of first calvers
- Doing a good job of rearing calves from birth to weaning and growing heifers from weaning to mating will help you achieve optimal pre-calving liveweight targets for your heifers

Please note – for information on calves from birth to weaning, there is a large range of resources available, which can be found on the **AHDB website**.

Planning your replacement heifer strategy

Begin by asking yourself two fundamental questions:

How many replacement heifers do I need?

Consider:

- Herd goals
- Expansion plans
- Heifer availability
- Health and genetics

What breeding targets should I set for my heifers?

Consider:

- Where do I want heifers to fit into my herd's planned start of calving (PSC)?*
- How does this impact my planned start of mating (PSM)?*
- What weight, age, and size do I want them to calve at?

* The Starting and stopping mating chapter has more detailed information on these considerations.

Proactive versus reactive management

Rearing heifers to enter the herd at the correct weight and age for best production and fertility performance can be managed either proactively or reactively.

Data provides insight into recurring patterns and factors that maximise fertility and production capacity.

When your approach to managing heifers is reactive, you never really know if you are going to achieve the results you want. And if you leave it all to chance, then it can end up being a significant drain on resources. If you keep putting off your heifer management plan until later, you create additional pressure for you and your team.

Take a minute to stop and think about what you want to achieve. Start with the end in mind and put together a plan of how you will get there. Once you know what you want to achieve, you can establish clear targets and monitor performance closely over the rearing period.

When you take a more proactive approach, time and resources are allocated more effectively and less time is spent firefighting, which can throw you off your schedule and distract you from other important work.

Being in control and preventing problems escalating means you can motivate and lead your team with confidence, which has a direct result on team morale.

Calculating replacement numbers

Age at first calving, losses that occur from birth to first calving and culling rate (replacement rate) are the factors which determine how many heifers you need in your heifer pipeline. A higher number gives rise to more cost. Controlling these factors leads to better efficiency.

If your herd size is stable, then a replacement rate of around 22% is a reasonable target for most herds, ensuring genetic gain and maintaining an optimal heard age profile. The target ratio of voluntary (e.g. age, poor milk yield or composition, conformation, temperament) to involuntary (i.e. forced e.g. not in-calf, mastitis, disease) culls is 50:50 or better – that is 11% or fewer involuntary culls. This is only achievable if you have excellent health and reproductive performance.

The next thing to consider is how to successfully calve at target weight. The heifers must be well grown when they enter the main herd. They also need to reach puberty and be ready for service on time, from 13 months of age. Calving heifers at the start of the block is also more economically beneficial.

Onset of puberty relates to genetics and liveweight gain, not age.

Figure 3 shows how failure to meet early growth-rate targets will result in a delay in puberty. This delays when first service can occur and, therefore, age at first calving. It is difficult to make up for poor growth rates early on. It is important to reach the target weight before serving, not just to serve based on age.

The mature body weight used in the calculations in Figure 3 is 550 kg, which is typical for a crossbred cow. It can be seen that a suitable target average growth rate for the heifer from weaning to first calving is around 0.8 kg/day. Otherwise, the heifer will be too small when she calves.

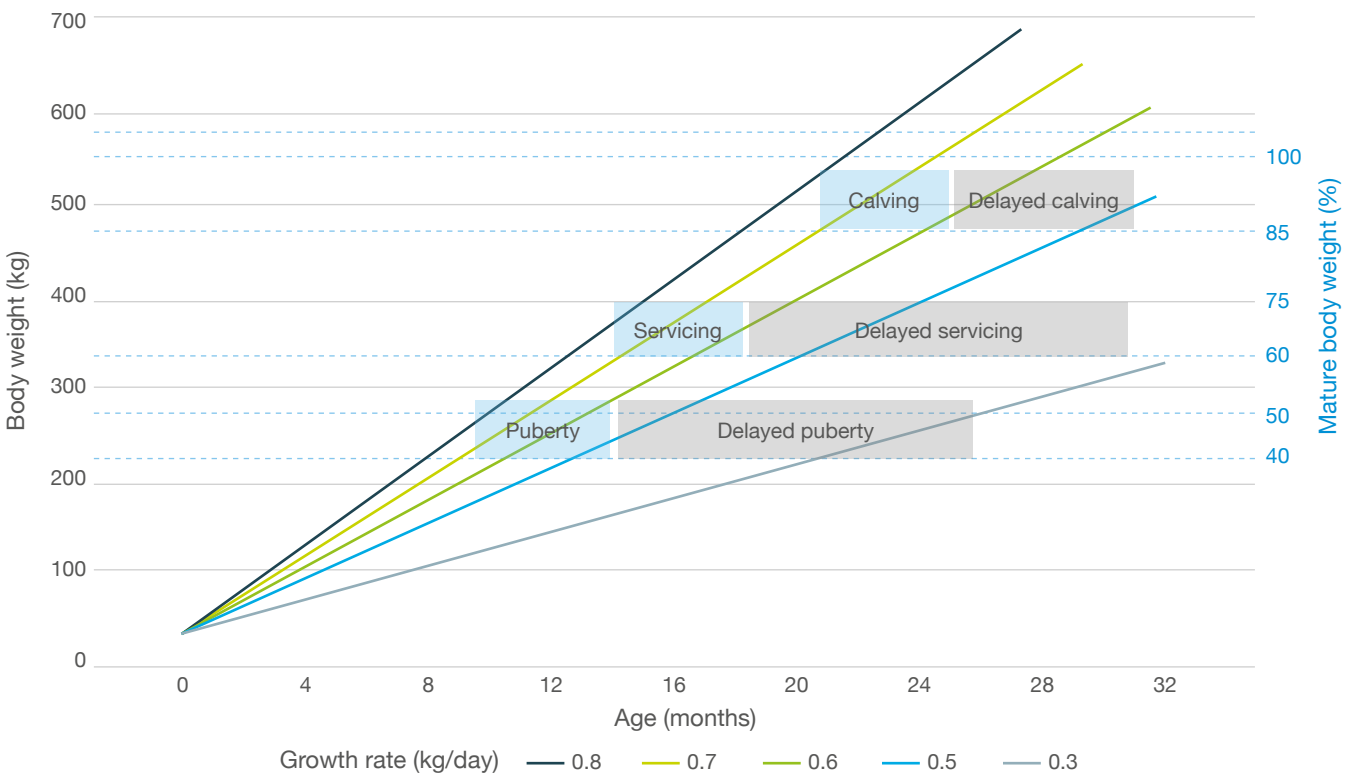


Figure 3. Five different average growth rates and the effects on the potential weight at calving

Source: Dairy Veterinary Consultancy

Growing heifers weaning to mating

Good calf management should be followed by effective growth from weaning to first calving. Otherwise, all the hard work you have put into calf rearing can be lost. Table 4 outlines weight-for-age targets for heifers.

Calving a heifer at 24 months old is fundamental to a block-calving herd and means she is more likely to get back in calf compared with calving at an older age. However, heifers need to be at least 85% of mature body weight at first calving, which requires good nutrition and good management from weaning to mating.

- The average weight of a heifer mob should meet the target weight-for-age, but individual heifer weights will fall on either side of this average
- No more than 10% of a mob should be more than 10% behind their target weight-for-age
- If an animal is below the minimum weight, the reason(s) should be identified

Table 4. Weight-for-age targets (highlighted) for animals of different mature liveweights, with guide weights for other ages. Source, DairyNZ heifer factsheet

Mature weight (%)	Age	Liveweight				
100	6–8 yrs	420	465	500	550	600
20	3 months	84	93	100	110	120
30	6 months	126	140	150	165	180
40	9 months	168	186	200	220	240
50	12 months	210	232	250	275	300
60	15 months	252	279	300	330	360
80	19 months	336	372	400	440	480
90	22 months	378	419	450	495	540

Steps to setting liveweight targets

Meeting heifer liveweight targets can improve farm productivity and profitability by optimising reproduction and milk production. There are four steps to heifer liveweight target setting:

1. Select a mature liveweight for your group of heifers.
2. Set mob weight-for-age targets based on meeting a percentage of mature liveweight.
3. Set individual weight-for-age minimums.
4. Create an expected, or targeted, seasonal growth rate plan so that heifers achieve their target liveweights.

Costs of rearing heifers

There are significant cash costs associated with rearing dairy heifers. Herd replacement costs was in the top three drivers of for the difference in profit between top and bottom 25% of farms in the AHDB Dairy performance report 2017/18 (please see our latest figures on the AHDB website).

The **AHDB Heifer Rearing Cost Calculator** allows you to input your own costings under three distinct rearing periods: birth to weaning, weaning to six months and six months to calving. It allows you to explore how changes in your heifer-rearing regime might affect these costs, for example, reducing the age at first calving from 27 to 24 months.

There is also a webinar available, **'The economics of heifer rearing'**, which supports this tool available on the AHDB Dairy YouTube channel.

Important issues which are common bottlenecks during this phase include:

- **Pneumonia** – the biggest cause of mortality and ill health after weaning, affecting an estimated 20% of dairy heifers[1]
- **Coccidiosis** – a 2017 UK survey[2] showed half of calf dung was positive for disease-causing coccidiosis, which was likely to be reducing growth rates. Coccidiosis is common and if not diagnosed or managed is very likely to result in a growth-rate check. In severe cases, calves will scour, sometimes with blood, and death occurs

[1] A survey of the current practices and performance to determine the success factors for rearing replacement dairy heifers in Wales. Final Report, June 2015, Dairy Development Centre, Gelli Aur.
[2] A summary of the submissions for coccidia screening and speciation from calves in UK dairy herds 2012–2017. BCVA proceedings, October 2017.

- **Nutritional problems** – the rumen must be well developed to cope with the diet after weaning. A poorly acclimatised rumen, or poor diet, can lead to scour, rumen acidosis and poor growth
- **Worms** – intestinal worms are common and will affect growth rates if not managed; lungworm can cause death but more usually severe setbacks. Liver fluke is a consideration too
- **Uneven sizes** – small calves get relatively smaller while the big heifers in the group outperform the others in growth rates and this can be entirely due to competition for feed, with the smallest in the group suffering the most
- **Failure to weigh** – despite all of the above, the greatest single reason for delay in first service (and hence calving age) is poor organisation and failure to keep track of heifer age and development[1]. One week soon slips into the next and, before you know it, your intention to fetch the heifers back for mating at 13 months old becomes delayed by a week or two, or six

Fundamentals for heifer rearing

- It is possible to grow calves adequately on pasture alone. However, this requires training of the heifers to graze properly and rotational grazing management for high-quality pasture (11.5 MJ ME/kg DM) as if you were feeding milking cows. It also requires careful monitoring of weights to ensure calves are on track
- If pasture alone is not enough, good-quality concentrates (at least 11.5 MJ ME/kg DM and 16% crude protein) can be supplemented until calves reach 200 kg at the appropriate level required
- Adequate protein content and quality is needed to drive skeletal and muscle growth (see Table 5)
- Differentially feed groups of heifers according to size and weight, so smaller heifers reach their target weight for mating
- Monitor liveweights at least monthly. If results are below targets, review your parasite control programme and consider further supplementary feeding
- Aim for at least 0.8 kg/day growth rate to puberty (8–10 months old). You want good skeletal and muscle growth (frame, not fat)
- Tailor the diet to the changing requirements of the heifer as she grows (see Table 5). Look out for poor palatability and low intakes of forages
- Watch for mineral shortage, e.g. salt, cobalt, which might lead to pica (eating things they shouldn't). Heifers are notorious for eating poisonous plants in hedge bottoms, which can lead to problems such as CCN (cerebral cortical necrosis: blindness, stargazing and fits)
- If housed indoors, ensure heifers have enough feed space (Table 6)

Table 5. Energy and protein requirements of growing heifers

	Energy (MJ)	Crude protein (%)
Weaning to 8 months	12.0–13.0	17
8 months to mating	11.5–12.0	16
In calf	10.5–11.5	13–14
8 weeks before calving	10.5–11.5	14

Table 6. Guidelines for minimum feed space requirements per heifer fed at a feed barrier

Age (months)	Minimum space requirement (cm)
4–8	15
8–15	31
16–21	47

Case study – managing heifer growth rates

A group of 18 weaned heifer calves (about 4–5 months old) were fed ad-lib hay at a feed barrier (see Figures 4a and 4b). Fresh hay was provided every second day. Rearer pellets were fed twice daily in a trough at 3.5 kg/head/day (Figure 4c). There was some loose dung in the calves, and some in the group failed to grow as well as the farmer had hoped. What do you see here? What should be checked? What could be improved?

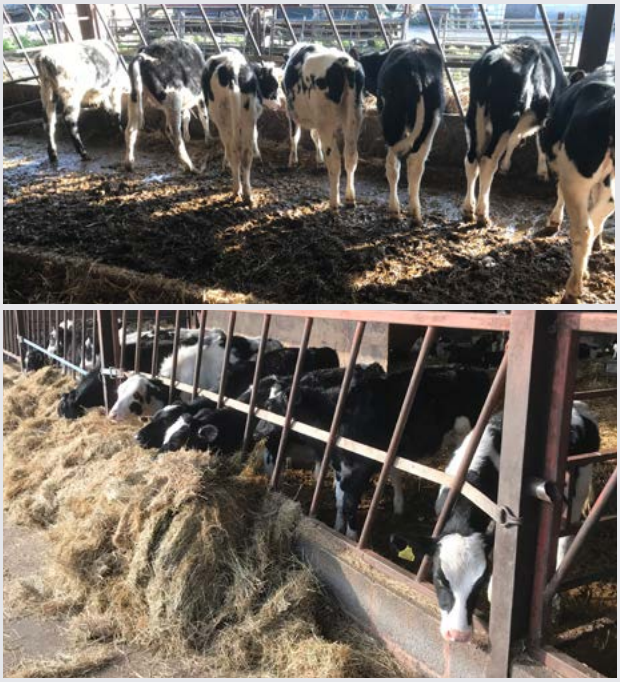


Figure 4a and 4b. Heifers at the feed barrier

Figure 4c. The same pen of heifers, showing the trough for feeding concentrates

See: uneven sizes of calves in the group. The body condition of some calves appears poor. Calves can access the hay easily and there is reasonable access at the barrier (22 spaces for 18 calves), although it is not fully distributed in front of the whole barrier. The feed trough is designed with individual spaces to reduce competition. There are 18 spaces for 18 calves.

Check: growth rates of the whole group by weighing every 10–14 days. Despite efforts to avoid competition for feed, where there are large differences in size, smaller calves may still be underfed and larger calves may be eating more than their fair share of concentrate. This may be the reason for scour (cereal overload), but coccidiosis is a possibility too.

A pooled dung sample should be checked for coccidiosis by the vet. A diet of 3–4 kg/day of heifer concentrate and ad-lib good-quality hay should be adequate to give growth rates of around 0.75–0.85 kg/day. Other reasons for poor growth rates might include poor-quality hay or poor rumen development pre-weaning.

Improve: diet presentation. Calves are more sensitive to poor smells and tastes than even cows, so the diet must not be poorly conserved or badly presented. Intakes soon fall and growth rates suffer. The heifers fed this diet were underweight for their age and suffered from coccidiosis. They improved once the group was divided into two groups based on size and treated for coccidiosis. More attention was given to hay provision every day, with poorer-quality, rejected hay removed to avoid being eaten.

The dietary management of pre-weaned calves on this farm was also improved to improve rumen development. This was done by adopting the following:

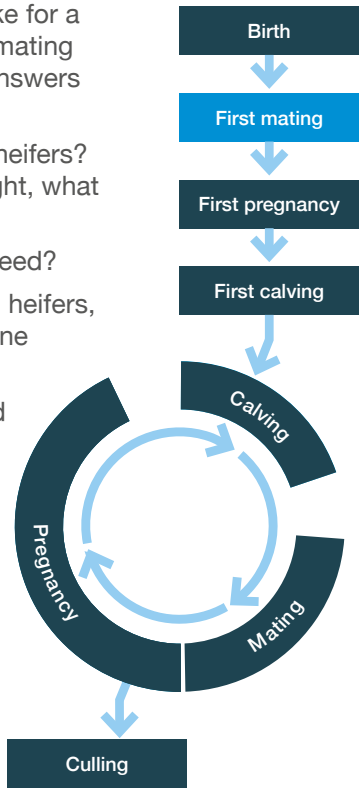
- Providing starter pellets, ad-lib water and chopped dried lucerne from the first week of life. The starter pellets were refreshed daily until intakes were around 250 g/day
- Rearing in pairs or threes, rather than individually, from a few days old (increases hard feed intake; reduces stress at weaning by early socialisation)
- Starting a step-down weaning regime: from four weeks of age, calves were reduced from 6 litres of milk per day to 4 litres, then 3 litres at five weeks, and 2 litres at six weeks

By weaning at eight weeks, calves were eating over 2 kg/head/day of concentrate. They subsequently grew at 0.85 kg/day after weaning and no longer suffered from scour or coccidiosis, on the same diet of hay and 3.5 kg/day rearer pellets.

The farmer had not seen that the reason why his calves were performing badly was as simple as how they were being fed, rather than primarily infectious diseases. It is very common to be blind to something on your own farm because you pass it every day. An important skill is to learn to look at your own farm with a fresh pair of eyes.

Heifer mating considerations

Planning ahead will make for a more successful heifer mating period. What are your answers to these questions?



- When will you mate heifers? What age, what weight, what time of year?
- What bulls will you need?
- If you are going to AI heifers, what needs to be done before mating?
- Have you considered using a professional AI technician, as heifers can be more difficult to inseminate?
- Have you allowed for the extra time and skilled people required to implement a heifer AI programme?
- Will you heat-synchronise heifers to allow planned use of people's time?
- If heifers are to begin calving before the cows, you will need to plan the labour and skills required to manage them during the calving period and when being introduced to the milking routine

Mating is determined by the target age at first calving. It is important to have good records of heifer age and monitor them to ensure that they reach target liveweight for mating by this age. It is easier to reach target weights by delaying the time of first mating, but remember this significantly increases rearing costs.

See our AHDB DairyLeader webinar, **Heifer fertility, the benefits of getting it right**.

Strategies to minimise calving problems in heifers:

- Use AI sires with PTAs for calving ease. This will help you select suitable sires for your heifers
- Use bulls with known Direct Calving Ease (dCE %) available for Friesian and Holstein sires. The scale is -3 to +3, centred on a breed average of zero. Positive figures indicate that calvings are predicted to be easier than normal
- Choose bulls which are between 0 to +3 with a minimum reliability of 60%, or a smaller breed that will naturally provide easy calving in heifers

For further information, see our ***Calving Ease Index*** factsheet, available on the AHDB website.

One approach to minimising calving difficulties and to produce extra replacements is to use Jersey AI sires on Holstein heifers and rear the crossbred replacements. This is likely to be particularly beneficial in grazing herds utilising crossbred genetics. Using sexed Jersey semen will reduce the number of low value bull calves which are difficult to sell.

Short gestation or sexed semen

You may also consider using short-gestation-length sires or sexed semen to reduce calving difficulties in heifers, taking into account:

- Bulls which are known to have a shorter gestation period are sometimes used in block-calving systems. They may not have desirable production, daughter fertility, type or temperament characteristics. They are selected solely for their capacity to provide small calves. Heifer calves from short-gestation sires may not perform well as milking cows, but the strategy can be used to tighten a calving block and/or produce small calves which are likely to be easier calving
- Sexed semen increases the odds of pregnancy with a female calf. Heifer calves tend to be smaller than bull calves and this can help reduce the risk of difficult calving in heifers. It is an additional benefit of sexed semen

Heifers need to be managed particularly well to achieve good conception rates with sexed semen. However, conception rates in heifers are typically 10% higher than in cows.

AI or stock bull?

Pros: stock bulls can be convenient, as long as they serve well and are fertile. Check that no more than 20% of heifers repeat to service and at least 80% are in calf after the first 21-day cycle.

Cons: bulls are dangerous and should never be trusted. They are untested and, in almost every case, a stock bull will produce calves with a lower genetic merit than an AI bull. Oversized calves can arise, whatever the breed. Under normal circumstances, fertility is no better than AI and is, occasionally, catastrophic if not working properly or subfertile. Bought-in stock bulls can bring in pathogens (biosecurity risk), particularly hire bulls which have visited other herds.

See the chapters on Bull management and AI for further information.

Useful targets

- Wean heifers on weight and feed consumption (not age) at least twice birth weight; 2.5 times birth weight is to top-performer standard
- Serve at 13–15 months (start at 13 months) Correct weight is at least 50% of mature weight (see Table 4 on page 31)
- Expect 1.4 to 1.6 inseminations per pregnancy
- Inseminate at the first possible moment after you observe standing heat (assuming you check once or twice a day)

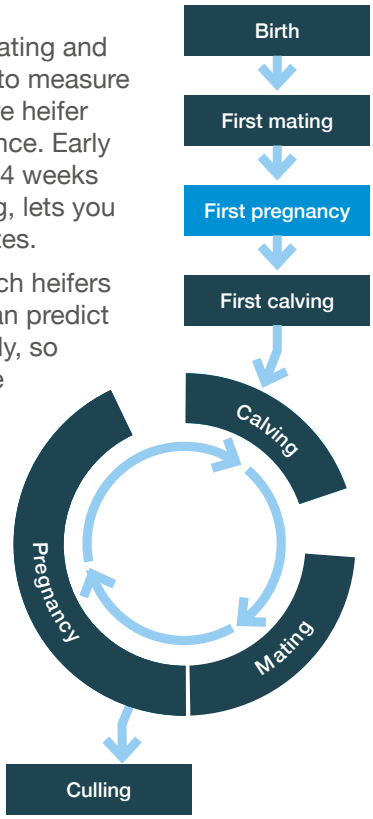
- Start serving heifers two weeks before the main herd
- Mate replacement heifers for 12 weeks or less

Pregnancy testing

The period between mating and calving is a good time to measure weights and to measure heifer reproductive performance. Early pregnancy testing, 5–14 weeks after the start of mating, lets you identify conception dates.

You will also know which heifers conceived early and can predict calving dates accurately, so you can better manage heifers through the transition period and at calving.

Pregnancy testing 6–8 weeks after the end of mating identifies non-pregnant and later-calving heifers but cannot reliably identify conception dates in heifers more than 15 weeks pregnant.



Note: When pregnancy testing heifers in a block-calving herd, assess their predicted calving pattern.

Investigating failure to get in calf

Heifers coming into heat every three weeks, but failing to conceive. Possible causes are:

- Heifers showing poor signs of heat
- Difficulty in AI technique (e.g. through heifers being too fat so cervix difficult to handle and pass through)
- Poor semen handling
- Inseminating too late
- Nutrition problems, e.g. mineral deficiency, excess protein, insufficient energy
- If kept inside, shed is too dark

Heifers are irregularly on heat and fail to conceive. Possible causes are:

- Poor oestrus detection
- Disease, including BVD
- If kept inside, overcrowding, slippery floors, dark sheds, all reduce the quality of heat expression

Growing heifers from mating to calving

Once heifers are in calf, they still need to grow at the correct rate right up until calving if they are to achieve targets.

Heifers are still growing when they calve for the first time. Even though they are smaller, they should receive at least the same quantity of feed as mature dry cows.

If heifers have not reached their target weight when close to calving, consider running them separately from springing cows. Provide feed separately so you can be sure of correct intakes. Otherwise, include them in the cow-transition programme as calving approaches.

Monitor liveweights at least every three months. If results are less than targets, consider supplementary feeding to increase heifer growth rates and review your parasite control programme. See Figure 5 of expected liveweights.

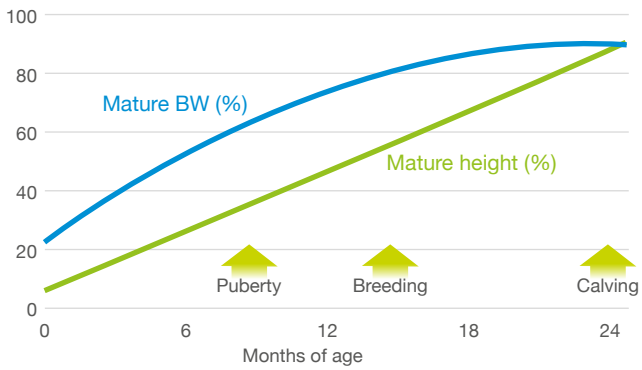


Figure 5. Expected liveweights and withers heights of Holstein heifers at various ages

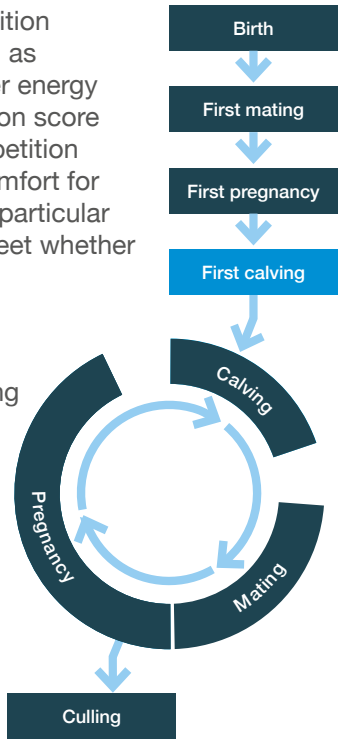
Using a weigh tape gives a good guide for when to begin serving. Measuring the height of the withers is better than nothing but is not as accurate.

Going from good to excellent

It is good to use a weigh band to ensure target service heights are being met. It is excellent to have a purpose-built race and weigh crush for regular and accurate youngstock measuring, as the weight is more important than the withers height. This raises standards of heifer management to the next level.

Transition into the herd: special considerations for heifers

As well as the usual transition cow considerations, such as acclimatisation to a higher energy diet, correct body condition score at calving, reducing competition for feed and providing comfort for lying space, heifers have particular needs which you must meet whether at grass or a feed face.



These include:

- Heifers should be fully vaccinated to bring them up to date with the herd's vaccination plan and to protect them from diseases the adult herd may carry (e.g. IBR)
- Run heifers as a separate group if the herd is big enough
- Unless managed as a separate group in their first lactation, heifers should mix with adult dry cows for at least 4–6 weeks before calving
- Ensure heifers get used to the type of environment they will be expected to use after calving. Exposure to concrete floors for six weeks prior to calving will reduce hoof problems if housed after calving
- Ensure heifers are fully adapted to plenty of contact with people, the footbath, milking facilities (particularly robots), water troughs, shedding gates, concrete flooring (or slats) or anything else they may encounter after calving. Clipping heifers' tails and backs gets them used to standing still and being touched. Be gentle and relaxed to encourage your heifers to be gentle and relaxed too

Heifers are more curious and eager to learn than older age groups. Acclimatising heifers before calving is time well spent.

Monitoring success of your heifer-rearing programme

Reproductive and milking performance of first-calf heifers compared against the mature cows in your herd are key indicators of the overall success of your calf- and heifer-rearing programme.

You can also examine reproduction, milk production and survival records of heavier and lighter heifers at first calving to see how the two groups performed.

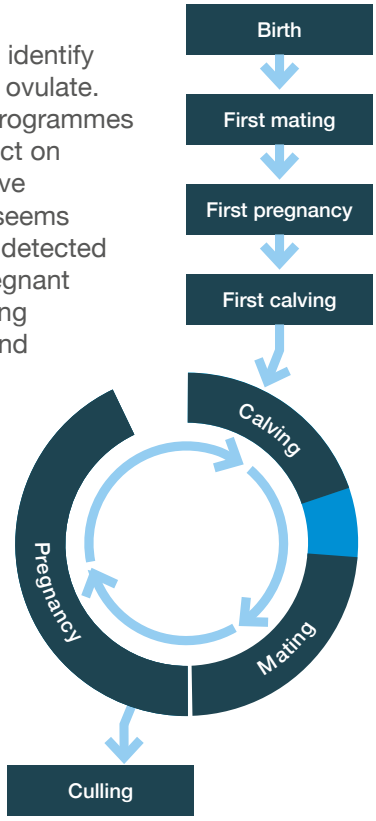
In block-calving herds:

- Top farmers have more than 90% of their heifers calved in the first four weeks
- If there are less than 70% of heifers calved by week four, then review:
  - Calf and heifer management
  - Bull management
  - AI technique and heat detection (where used)
- Top farmers achieve milk production in first calvers of at least 85% of the milk production of mature cows
- Top farmers will have at least 85% of their heifers go on to calve within the first 6 weeks of the next calving period
- If your figure is less than 80% for both of these target above, review calf and heifer management as this may also indicate that heifers were underweight at calving

Heat detection

Overview

Heat detection aims to identify cows that are about to ovulate. Good heat detection programmes can have a major impact on overall herd reproductive performance. While it seems obvious that cows not detected on heat will not get pregnant to AI, the key to ensuring semen is not wasted and cows conceive at the right time is accurate heat detection.



Key points

Heat detection identifies cows suitable for mating.

Your system should identify as many cows truly on heat as possible but without presenting cows not on heat for service.

Cows show characteristic signs of heat, such as standing to be mounted. You need to dedicate time and people to observe these activities and/or use systems to identify cows that are on heat.

Heat-synchronisation programmes can help but they cannot substitute for dedicated effort to get cows cycling and to detect them on heat.

Requirement for regular assessment

Regular assessment of your heat-detection practice can help you see how it can be improved. However, it will be difficult to know if you have a problem, or what type of problem, without measuring performance.

Calculating the 3-week submission rate (the percentage of cows submitted in the first three weeks of mating) is a good first step. Other calculations also help you to assess the quality of heat detection and identify if you are missing too many heats or submitting too many cows for mating that are not on heat.

Early-calved mature cows have every reason to be cycling normally and should be detected and submitted to AI in the first three weeks.

A high insemination (or submission) rate needs:

- Your cows to be cycling and showing heat
- Your team to detect cows when they show heat

A low submission rate suggests a problem requiring action. Submission rates can be low for two reasons:

- Your cows are showing heat normally, but you are not detecting them
- You have lots of non-cyclers and/or cows which are cycling but not showing heat well in your herd

Effective heat detection is the cornerstone of a successful, tight block-calving herd.

What is a non-cycler?

A non-cycler is a cow that has not started normal heat cycles after calving. This may be due to low body condition at calving, excessive body condition loss, lameness, or other health problems after calving.

Caution – If excessive numbers of cows are being inseminated when not on heat, the submission rate will be high but conception rates poor. Check your herd's conception rate is as expected.

Exploring heat detection errors

Examining the pattern of heats and returns in individual cows pinpoints the type of heat-detection errors that may be occurring. The two basic ones are:

- Failing to detect a cow showing signs of heat – This is a false negative, or missed heat. If you have too many missed heats, your heat-detection efficiency will be low and your submission rate reduced
- Submitting a cow as being on heat when she is not – This is a false positive heat. If you have too many false positive heats, your heat-detection accuracy will be low, so while your submission rate may be high, your conception rate will be reduced. Inseminating a cow which is already pregnant may result in the loss of that pregnancy

The power of observation

We try and juggle more than we have ever done before and multitasking is an easy habit to slip into. However, there are some jobs where multitasking actually makes you less productive and isn't as helpful as people often think.

Setting aside time specifically for cow observation and heat detection, quite separate from time spent feeding, scraping and milking, gives you better results. Some jobs need focus and concentration to deliver success.

Critical observation is an essential skill and, when used effectively, can provide your business with good-quality information that helps you make good decisions and solve problems. It also gives you some clues about where to focus precious time and resources.

When staff are trained in this skill, they see problems even before they happen. Without this skill, all the trends, statistics and graphs in the world are meaningless, because no one can bring them to life or relate them to what is really happening on the ground.

What to look for in a cow that is on heat

Observable changes

Many changes occur in cows around the time of heat: they may behave differently and milk production, feed intake and rumination can change. Cows also experience physiological changes, such as increased vaginal mucus and altered levels of progesterone and oestrogen. These changes occur in patterns that can be used to better identify when a cow is on heat.

A cow is most likely to be on heat if:

- She is standing to be mounted by other cows
- Tail paint is removed
- The heat mount detector is triggered

A cow may be on heat if:

- She attempts to mount other cows (especially attempting to 'head mount' other cows)
- Tail paint is rubbed, but not removed
- She is restless or bellowing
- She has poor milk let-down
- She has mucus around the vulva
- She has mud marks on the flanks
- The heat mount detector is lost

It's worth noting that in some cases false positives can occur from day-to-day activity, such as tail paint being rubbed on cubicle bars. No method is a silver bullet, but they are there to support identifying cows on heat.

Confirming on heat

Cows with at least two of these may-be-on-heat signs are possibly on heat but showing only weak signs. Some will not be on heat. Make sure everyone on the farm team knows how to recognise heat signs and what to do with cows that are showing weak signs of heat.

The normal cycle

Normally, you can expect a cow to:

- Show signs of heat every 19–26 days, with an average of around 22 days in cows and 21 days in heifers. Cycles may be shorter (e.g. 18–24 days) in breeds other than Holstein, or in crossbreds
- Often have a short cycle following their first heat after calving and be on heat again 8–12 days later
- Have an average interval from calving to first heat of 30–35 days when body condition is well managed. This can be 10 days longer in first-calved heifers

Visit the Dairy Australia YouTube channel for tips on good heat detection to maximise cow fertility at AI, the different signs to look for when cows are on heat and the best times and places to do heat detection.

Table 7 shows the expected number of cows to be seen bulling depending on your herd size. This gives a useful guide for staff through the heat-detection weeks. Having over 85% of the herd cycling will give you the best chance of achieving your 3-week submission rate target.

Improving heat detection by the farm team

It is important that everyone on the farm knows the signs of heat. You may know them, but do all of your farm team?

The best heat-detection programmes start with careful timing, good observation and the effective and considered use of detection aids. Distinguishing and interpreting cow behaviour and other signs is critical. Commit to training and refreshers for the farm team and keep good records if you are to improve.

Steps to follow

Measure, analyse and discuss heat-detection performance to reinforce training and keep skill levels and motivation of the farm team high.

Step	Questions and actions
1	Review the heat-detection skills of your farm team: Are they up to scratch? Does everyone involved know exactly what to look for when detecting cows on heat? Do they know what to do when a cow is detected on heat?
2	Determine which aids you will use. Farmers with the best heat-detection results use a combination of observation and heat-detection aids No single method is perfect. Be prepared to test several combinations of options to identify the one most suitable to your herd
3	Determine how cow heats and matings will be recorded, how information will be shared between workers and how data will be entered into the computer Good record-keeping will help farm work flow and support analysis that can identify problems on heat detection. This will help you continually improve
4	Finally, keep an eye on the detail. Schedule regular times to monitor the success of the programme. You need to measure from the start and monitor if you are to spot problems early and have a successful heat-detection programme

Table 7. Herd cyclicity vs herd size to give expected bulling numbers

Herd cyclicity	100-cow herd		250-cow herd		450-cow herd	
	Expected number bulling per day	Expected number bulling per week	Expected number bulling per day	Expected number bulling per week	Expected number bulling per day	Expected number bulling per week
55%	2.6	18	6.5	46	11.8	83
65%	3.1	22	7.7	54	13.9	98
75%	3.6	25	8.9	63	16.1	113
85%	4.0	28	10.1	71	18.2	128
95%	4.5	32	11.3	79	20.4	143

Recommendations

- If heat detection and drafting at milking are separate processes, ensure that cows in heat are clearly identified to make it easier
- If using an aerosol stock marker, apply the mark to a different location each day, rotating every three days to prevent cows being inseminated wrongly over two consecutive days
- If you have automatic shedding, the operator can immediately enter the cow's identification number the computer so she can be auto-drafted at milking. Ensure you have backup if the auto system malfunctions. Note, this data can be used for other tasks such as pregnancy testing

Training and refreshing the farm team

You should always be on the lookout for opportunities to train the farm team. Experienced people should work with, and help, less experienced team members to interpret signs of heat. The person in charge of heat detection should be appropriately skilled and experienced.

Observation

Less experienced members of the team should be trained by more experienced staff, and refresher training sessions for the whole team can help to share best practice and ensure consistency. Checking records can help spot differences between team members, which can be used to target extra training or support.

Clear processes

Make sure everyone understands the processes that follow the detection of a cow on heat. Where is this recorded? Who needs to know? When is the cow to be drafted? All the farm team should know exactly what needs to be done when a cow on heat is detected. Everyone involved on heat detection should have a way of recording a cow seen on heat – ideas for this include notebook and pen, messenger app groups, a notepad app on a smartphone or by photographing cow ID.

Heat detection before mating

- Pre-mating heat detection. Monitor and record heats from 35 days before planned start of mating (PSM) if you wish to have the option to treat cows not detected on heat early
- Calculate your herd's pre-mating cycling rate. This tells you the percentage of cows in your herd that have shown signs of heat before mating begins

Top farmers have 75% of all cows recording at least one pre-mating heat 10 days before mating start date (MSD), and 85% of all cows recording at least one pre-mating heat before MSD.

If you are recording less than 65% by 10 days before MSD, your heat detection has not been effective or you have too many non-cyclers in the herd. You may need to modify your pre-mating heat-detection strategy, ensure that most cows calve early in future calving periods, calve your cows in better condition at the next calving period or make sure that heifers reach their target liveweight at calving.

Also check that your cows calved in condition scores 2.75 and 3.25 are holding or improving body condition coming into the mating period.

Paddock observations and detection aids

Research has shown that the best heat-detection results are achieved by combining paddock observations and heat-detection aids such as tail paint, heat mount detectors and activity meters.

During a paddock check, observe cows quietly, paying particular attention to restless groups of cows. A twice-daily time commitment is required. This is a very accurate method if your farm team is well-trained and cows can be easily identified and drafted. Automatic drafting systems can make that a lot easier.

Sexually active groups contain cows standing to be mounted as well as those attempting to mount other cows and help pinpoint cows most likely to be on heat.

- Check that all cows in the herd are individually identified using ear tags that can be read from some distance
- Do paddock checks two hours after the morning milking. Cows show strongest heat signs once most of the feed in their paddock has been grazed
- After insemination, return cows to the milking herd as soon as possible, if practical, to encourage formation of new sexually active groups
- Consider evening paddock checks two hours after the afternoon milking if you wish to maximise the number of cows detected on heat
- If several people are involved in heat detection, implement a system to ensure that all involved share their records. For example, a whiteboard at the dairy or use of apps

- Observe cows for heat without disrupting their activity. Walk up quietly – no quad bikes or dogs
- Record the identity number of every cow detected on heat at each paddock check

Vasectomised 'teaser' bulls can help improve expression of heat. They also allow you to use a chin marker or raddle to help identify bulling cows.

Heat detection in at milking times

Where heat-detection aids (such as tail paint or mount detectors) are used as the main method of heat detection, some herds choose to check these at milking time. However, this will generally yield worse results compared with the same system with more observation time away from milking.

However, if this is what you choose to do, here are some important things to consider:

- Your heat-detection programme must be well planned and consistently executed. Ensure that all heat-detection aids (e.g. tail paint and/or heat mount detectors) are correctly applied and well maintained
- Your staff must be accurate in their interpretation of heat-detection aids. Designate a person experienced and confident in reading the signs of a cow on heat solely by heat detection during milking and give this job high priority

It is easy to miss a heat. The average duration of heat for dairy cows is around 12 hours. Heats can be as short as 2 hours or as long as 28 hours. Paddock checks should be performed at least twice daily to catch short heats. This is a real commitment but doing them well is key to achieving good results from observation.

Heat-detection aids

Several options are available to aid heat detection and increase success, particularly for cows that do not overtly display any signs.

Selecting an aid

Determine which of these options best suits your heat-detection strategy, budget, facilities and farm team skill level. For the best results, use a combination – and continually measure and monitor performance.

Tail paint

Correctly used, tail paint is an inexpensive and effective aid for people detecting heat. Only commercial products labelled for use as tail paint should be used.

Apply a strip of tail paint to the rear portion of the backbone. Cows on heat will stand when mounted by herd mates or a bull and the tail paint will be gradually rubbed off as the other animal dismounts.

A competent person using tail paint and paddock checks is capable of achieving the high levels of heat detection required to achieve in-calf-rate targets.

Correct placement of tail paint. Apply a strip:

- No more than 20 cm long
- No more than 5 cm wide over the rear segment of the backbone
- No further back than the start of the tail
- Direction should be tail to head, opposite to hair growth, should be rough and stand up like a Mohican, not be flat down
- Sufficiently thick to cover the skin with some hair fibres still visible

Table 8. Heat-detection aid notes

Option	Notes
Tail paint	Cheap Requires some maintenance (i.e. checking and repainting) Can be successful if implemented correctly and with diligence
Heat mount detectors	More expensive than tail paint Easier to read Require less maintenance once applied
Automated heat-detection technology, including activity meters	Can be integrated into computerised herd-information systems Require considerable initial expense and fine-tuning to operate to best effect in your herd
Heat synchronisation	Allows for intensive periods of heat detection, insemination and calving May avoid the need for heat detection in some cows

Using tail paint effectively

- Ensure every cow eligible for service (except those actually on heat at the moment) has an unbroken strip of paint
- At each milking, check for cows with rubbed or broken tail paint
- Only cover the uppermost ridge of the spine/tail
- Apply with forward strokes to make the hair stand on end and leave a rough finish
- Only use commercial tail paint or sprays, not house or roof paint or aerosol raddles (these are less effective)
- Touch up tail paint as required
- For cows on heat: check that the tail paint has been rubbed immediately before each cow is inseminated to avoid serving cows that are not on heat
- Reapply a different-coloured paint to recently inseminated cows once other cows no longer try to mount them. This:
  - Identifies cows not yet inseminated
  - Helps you to decide whether to inseminate a cow showing only weak signs of heat

Heat mount detectors

Heat mount detectors can result in higher detection rates than tail paint, particularly in all-year-round calving herds, or herds where less time and expertise are available for heat detection.

However, best results are achieved when heat mount detectors are combined with regular observations for heat.

How they work

Heat mount detectors are applied to the back of cows in a position where they can be triggered by pressure or rubbing from a mounting animal. Some detectors use pressure-activated tubes of paint that burst on pressure. Others use scratch-off patches that reveal a bright colour when activated and cows can easily be recognised as being on heat – even when not showing any obvious display of heat.

False mount

Remember that detectors can be activated by a false mount, which occurs when a cow is mounted when not on heat but can't escape a herd mate in a confined area, or when detectors are activated by the environment (e.g. cow brushes). Where a cow has already been inseminated and is not in the 'normal' range for return to service (i.e. the previous serve was not 19–26 days ago), you should be cautious about serving based solely o n a triggered heat mount detector or rubbed tail paint. Milk progesterone testing can be a useful way to help confirm heat in this situation.

Using heat mount detectors

- Apply heat mount detectors to individual cows as they pass their voluntary waiting period (VWP), or 26 days before if using to detect a 'reference' heat during the VWP
- Remove activated heat mount detectors at the time of insemination
- Apply a new heat mount detector after insemination, when the cow is no longer being mounted. Continue doing this until the cow has been confirmed pregnant
- Check heat mount detectors regularly and replace if they are damaged or coming loose
- Some heat mount detectors work better than others in particular farm environments – for example, if you have cow brushes you may want to avoid scratch-card types

Note: Check for other signs of heat if a heat mount detector is lost, as it may indicate a cow is on heat.

Using automated heat-detection systems, including activity meters

How they work

Automated heat-detection systems use electronic sensors to record one or more hormonal, physiological or behavioural indicators that change around the time of heat and ovulation in cows. A computer algorithm analyses the records and, based on alarm threshold settings, identifies those cows most likely to be on heat.

A feature of many automated systems is identifying the time that cows first come into heat, which can be useful for predicting the time of ovulation and therefore the best time for insemination.

Monitoring cow movement

Most automated detection includes a cow movement monitor because cows coming into heat become restless and move about more. This activity is recorded with a motion sensor attached to a collar, leg band or ear tag and can be analysed to identify the time and level of increased activity, signalling the onset of heat.

Monitoring more than movement

Increasingly, systems are analysing more than just movement, for example:

- Milk production
- Rumination
- Body temperature

Benefits

These combination systems typically provide both better performance on heat detection and other useful information on the cow's health. Systems vary in the number, type and position of cow sensors used, the amount of data collected, the way data is transferred, analysed and interpreted. All of these factors can affect the practicality and performance of the system for detecting cows on heat.

What to consider

When considering an automated heat-detection system, compare cost against potential benefits. The cost is easier to estimate as a benefit depends upon current reproductive performance, the expense of achieving this and the likely improvement in performance (or convenience) expected from the new system.

Pros and cons

Automated systems for detecting cows on heat help improve reproductive management and performance. But they are a tool and not a set-and-forget solution, as they require time and expertise to set up and to optimise. Automation can achieve very high submission rates and heat-detection accuracy on some units (especially with the newest technology, optimal settings and best cow environments), yet can lead to disappointing results on others.

Best performance occurs when information from the automated system is combined with other methods.

Automated heat-detection systems – the alarm threshold

Adjusting the system's alarm threshold settings is critical for heat-detection efficiency and accuracy:

- Raise the threshold (i.e. the increase in activity required to trigger an alert) too far and your heat-detection efficiency will be reduced and more false negatives will result. More heats will be missed and your submission rate will fall
- Lower the threshold too far and your heat-detection accuracy will be reduced and more false positives will result. Your submission rate may be high, but conception rate will be lower

Choosing the best option

If you have an automated heat-detection system, or are considering installing one, work with the manufacturer and your reproductive adviser to fine-tune it to best suit your herd and its needs. Don't just rely on the factory default settings.

Managing heat detection in larger herds

The period before mating begins offers an opportunity to train farm team members before accurate heat detection becomes really crucial. Below is a list of key things to check:

- In the week before mating starts, rehearse heat detection and drafting procedures
- Check and repair any faults in drafting gates to ensure cows for inseminating do not escape
- Decide whether or not bulling cows seen at or before the afternoon milking are to be drafted out and held separately, close to the shed overnight (this may depend on the time in the morning that the AI technician usually calls. The AI technician will need your assistance with bringing in the cows and locking them in for inseminating)

- Clear forms of animal ID that can be read from some distance are essential to ensure you and others can correctly identify each cow detected in heat while grazing or moving around in a sexually active group
- Everyone involved in drafting and inseminating tasks (herd owner, manager, employers, employees and contractors) has responsibility to ensure that facilities are safe, accessible, convenient and comfortable for both the people and animals

Heat detection in larger herds brings its own challenges – careful planning and a team approach are key.

Recommendations

- Clear forms of animal ID, easily read from some distance, are essential to ensure correct identification of each cow detected in heat
- Clip freeze brands at calving or when tail painting for the first time
- Consider assigning a dedicated staff member to lead the heat-detection team
- Ensure that facilities are safe, accessible, convenient and comfortable for both people and animals
- Where large numbers of cows will be inseminated each day, consider seeking advice on the best handling system

Should we accept poorer heat detection in a larger herd?

There is no reason why cows in larger herds should be less fertile than those in smaller herds. Heat detection just needs to very well planned, because staff won't have the advantage of knowing individual cow behaviours or their identification by sight. However, larger herds tend to have a larger number of cows bulling at one time, which can make them easier to spot.

We achieve good heat detection in larger herds by making it a key priority, assigning the best people to the job and backing that up with meticulous planning. The best large herds can achieve outstanding fertility performance and high levels of production.

Deciding whether to inseminate

I think she's on heat, but I'm not sure. Should she be inseminated?

- Look up any previous insemination and heat records for the cow
- Inseminate if the cow has not been served since calving and is showing reasonable signs of heat
- If the cow's previous service was more than 20 days ago, check pregnancy test records and look for more signs of heat if previously diagnosed as pregnant (resubmit for pregnancy test at next routine herd fertility visit to check for pregnancy loss). If not previously diagnosed pregnant, inseminate
- If the cow's previous insemination was less than 20 days ago, serve if the previous heat was weak (marked with a question mark). Otherwise, look for more signs of heat. If these are seen, inseminate
- Milk progesterone testing can also be extremely useful in this situation – a cow on heat will have a low milk progesterone level, and this is a quick and easy technique to support inseminating this type of cow
- Record a question mark in the AI record when you inseminate a cow that is possibly on heat but you are not sure

If you decide to inseminate a doubtful cow:

- And you have difficulty passing the insemination gun through the cervix, perform a deep cervical insemination. In other words, don't pass the gun right through into the uterus
- Consider using less expensive semen

Heat synchronisation

Heat synchronisation can improve reproductive performance in some situations – any programme should be discussed and designed with your vet.

Synchronisation programmes help increase heat-detection rates in large herds, where people are less skilled or have limited time because they allow a focus on heat detection for only short, predicted periods.

Some programmes:

- Require fixed-timed inseminations, meaning that no heat detection is required at all during that period
- Allow re-synchronisation of returns to service to help achieve increased heat-detection rates for returns to service

Conception rates

Depending on which specific synchronisation regime is used, conception rate may be similar to that for observed heat, or lower. For some of the longer and more complex regimes, there is some evidence that they improve conception rates in some situations, but this is not the case for most of the protocols commonly used in GB.

Key considerations for heat synchronisation

If thinking about synchronisation for the first time, consult your vet and other farmers/advisers who have experience using heat-synchrony options.

Planning is the key to a successful heat-synchronisation programme. Start by talking to your vet to determine the best one for you. Take time to fully understand when, and how, treatments work to give you an idea of the additional labour, facilities, time and cow identification needed.

Where batch synchronisation of large numbers of animals for insemination over a short time is considered (e.g. some herds use this approach to get heifers pregnant), think about:

- How will the necessary synchronisation treatments be administered? What are the correct dose rates and times?
- How will synchronisation treatments and inseminations be recorded?
- Is heat detection necessary and, if so, how will it be done?
- How will cows be drafted and held for insemination?
- How will large numbers of cows on heat each day be inseminated?
- Are extra staff required – including AI technicians and stock handlers?
- Have sires been selected, semen bought and storage arranged?
- Does your AI technician(s) know about the synchrony coming up? When and how many?
- What about the synchronised returns 18–26 days later? Stock bulls or AI again?
- Will there be intense periods of calving next year? Do you need to:
  - Account for peak periods in calving in your feed budget?
  - Have more staff during peak times to supervise calving and identify calves correctly?
  - Increase colostrum storage capacity and calf-rearing facilities?

Managing cows not detected on heat

Why cows not seen bulling (NSB) are important

Cows that don't come on heat when you are ready to mate cost your business time and money. They can prevent you from achieving your 21-day-pregnancy-rate target by decreasing both the key drivers of in-calf rates: submission rate and conception rate.

Both drivers are important, but the submission rate has a bigger impact because your management more readily influences it. Good heat detection is essential to reach submission targets. However, too many non-cyclers will hold back herds with good heat-detection rates.

Two types of cows not detected on heat

There are two types of cows not detected on heat:

- **Not SEEN bulling** – Cows that are cycling but are either not showing signs of heat or are not being detected
- **NOT bulling** – Cows that haven't started ovulating since calving and can't have a heat (anoestrus cows)

Common causes

- Some cows have a silent heat, which is very brief and difficult to detect and, although they are fertile, they are only mounted once or twice – if at all
- About 80% of cows do not show heat at their first ovulation after calving. Most healthy cows will have their first visible heat within six weeks of calving

A veterinary examination can identify causes and ensure appropriate treatment if required.

Assessing pre-mating cycling

The level of pre-mating heat activity is an early indicator of how fertile the herd is approaching AI.

- If the herd is meeting pre-mating cycling rate targets, then it is on track to achieve a 90% 3-week submission rate without non-cycling treatments
- You should also expect a good conception rate, as 85% of cows will be first inseminated on their second or third heat post-calving

Speak to an adviser about the likely causes among the key management areas and what options can limit the negative impact on this and next season's mating.

Post-calving recovery

After the first visible post-calving heat in a healthy cow with an uncomplicated calving, a second genuine heat may follow it 8–12 days later in about 30% of cows. A genuine short cycle should only occur once and only after the first post-calving ovulation. During the post-calving recovery period, the cow's reproductive tract must return to normal and cycling restart.

It is incredible what a cow needs to do between calving and getting back in calf in good time:

- The uterus must first recover through a process called uterine involution, which generally takes four weeks, provided there is no infection present
- The cow's ovaries are attempting to reactivate after a long dormant period during the previous pregnancy

The onset of cycling starts with a stutter, with silent heats and short cycles, but then normalises to cycles of 19–26 days with strong signs of heat. Cows are more fertile on their third and fourth heats than their first or second heats. Cows that calve in the first four weeks and start having strong heats five weeks after calving will be fertile for the first round of AI.

All cows are technically 'non-cycling' (anoestrus) post-calving until they return to heat. When too many cows in the herd are unduly delayed in resuming normal cycling, this becomes a problem at the herd level. Preventative management of the well-known risk factors can increase the proportion of cows in the herd naturally having a pre-mating heat. With that we can expect increases in both the 3-week submission rate and the conception rate, and a higher 6-week in-calf rate.

Factors affecting the number of NSB

The better a herd's heat detection, the fewer NSB cows they will have. However, there are a number of things which can affect this:

- Poor heifer rearing – underweight heifers have a longer interval to first heat and at least a 10% lower submission rate unless treated
- Young cows – more first-calving heifers are treated as non-cyclers compared with mature cows. First calvers generally need an extra 10 days to start cycling
- Body condition score – calving condition score, condition loss from calving to mating and condition score when mating starts affect the incidence of non-cycling. Thin cows (BCS 2 and below) take longer to start cycling. Fat cows (BCS 3.25+) tend to lose excessive body condition after calving due to suppressed appetite, going into severe negative energy balance. They also take longer to start cycling
- Abnormal calving and health problems after calving – cows with assisted calvings, twins, cystic ovaries, an infected uterus (metritis) and/or lameness are more likely to be treated as non-cyclers

Important

Always consider the possibility that a non-cycling cow may in fact be pregnant!

The easiest way to find non-cycling cows is to detect heats before you plan to mate the cow. Tail-paint or heat mount detectors can show you who is cycling.

Poor submission rates can be a consequence of too many non-cyclers in your herd.

Treating cows not detected on heat

Treatment programmes change as new technology is developed and external factors influence what veterinary products are available, so always consult your vet for the latest advice.

The costs of treating non-cycling cows are incurred in the first year, and the benefit seen the following year. This benefit are that treated non-cyclers calve earlier than if treatment had been delayed or not implemented at all. Earlier calving means:

Research shows that early treatment of non-cyclers:

- More AI calves
- A longer lactation with higher production, i.e. more days in milk
- More days from calving to mating, i.e. more recovery time

Actions to take

If you have a problem with cows not detected on heat, you should:

- Decide if the main problem is non-cycling cows or heat detection. If relevant, ask your vet about options for treating NSBs and find out the main causes of non-cycling cows in your herd
- Look at identifying cows not detected on heat before the end of the planned mating period

A range of options is available to treat cows not detected on heat. Your treatment option will depend on costs, practical requirements to successfully implement it and the expected performance of the treatment.

Recording and measurement

Record the treated cow, so you can measure and compare their reproductive performance after pregnancy testing. If an option suits your situation, plan the strategy for delivering the programme in your herd; meet your vet to discuss the strategy and its practical implications.

Managing cows not detected on heat

A routine fertility visit is needed to manage those cows not detected on heat. At each visit, you need to identify and present appropriate NSB cows for examination and treatment. These typically include:

- Cows not identified on heat during the VWP
- Cows not inseminated within the first 21–26 days after the cow's mating period ends
- Cows pregnancy tested negative or examined for NSB at a previous visit and not subsequently served

Determining causes

Following this routine also allows you to determine the main causes for your cows not being detected on heat.

- Some cows will have had a heat that was not spotted. In this case, they can be injected with prostaglandin (PG) or treated in the same way as other cycling herd mates due to be inseminated
- If most of the cows examined have had a heat that was not detected:
  - Review your heat-detection programme
  - Consider heat-synchronisation options

Note: Heat synchronisation can help increase heat-detection rates as a short-term option. Consider programmes that enable fixed-time insemination.

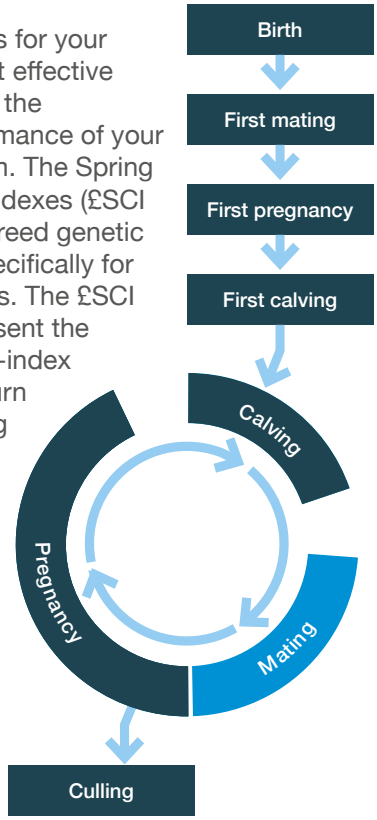
- Some cows will not have been on heat since calving. It may be better to delay treatment for cows that are in low body condition, are lame, or are first calvers

If most of the NSB cows are in poor body condition, measure body condition and assess nutrition. If first calvers are more commonly affected, also look at calf and heifer management. Where cows have suffered disorders such as cystic ovaries, an infected uterus, or lameness, control these health problems with advice from your vet.

Genetics and sires

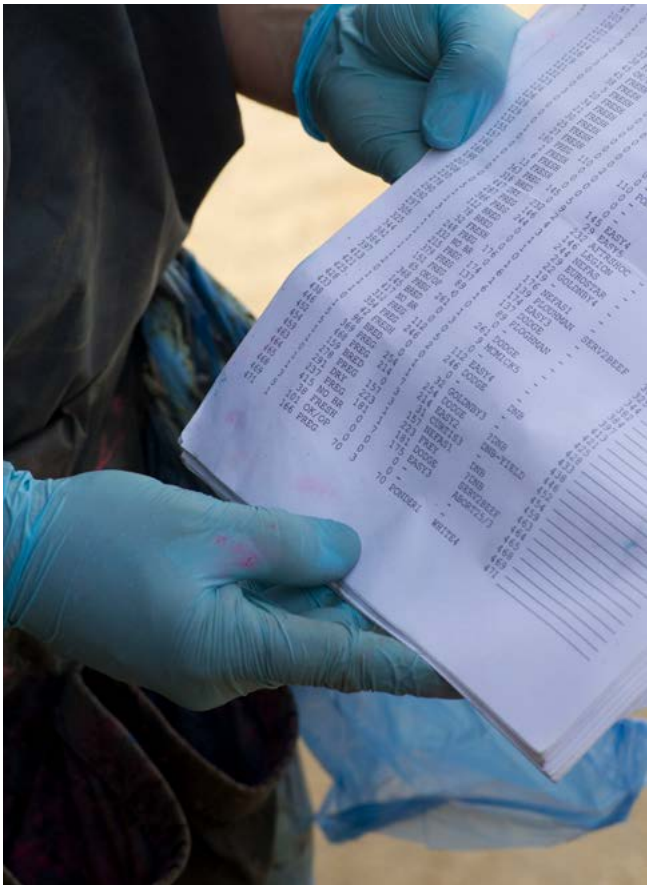
Overview

Choosing suitable sires for your herd is one of the most effective ways you can improve the profitability and performance of your herd over the long term. The Spring and Autumn Calving Indexes (£SCI and £ACI) are within-breed genetic indexes developed specifically for block-calving GB herds. The £SCI and £ACI values represent the additional profit a high-index bull is expected to return from each of its milking daughters over her lifetime compared with an average bull.



Key points

- Select £SCI or £ACI bulls with a higher value than your best cow
- Select fitness traits to maintain yourstrengths and address herd weaknesses (Fertility, Lifespan, etc.)
- Match conformation (type) to suit your herd
- Select bulls with easier direct calving ease for maiden heifers



Optimal Dairy Systems and the Genetic Merit KPI

The performance of a dairy herd is determined by two factors:

- The management of the herd
- The genetics of the herd

In order to drive progress and improve their performance through the Optimal Dairy Systems, genetics must be a consideration.

Herds which fully milk record can find their average milking herd genetic merit for block calving, £SCI and £ACI, through the AHDB Dairy Herd Genetic Report (HGR). Fully milk recording herds are those recording on an ICAR-approved scheme. During these recordings, each cow has its milk yield recorded and milk samples taken.

Herds who do not qualify for the Herd Genetic Report can use the AHDB Dairy Genetic Merit calculator to identify the genetic KPI.

The ODS Genetic Merit KPI is the percentile your milking herd's average £SCI or £ACI score falls into. For more information on how to obtain this value, please refer to the 'how to get your genetic merit value' section below.

Compare yourself to other producers using the **ODS KPI calculator**.

About the block calving breeding indexes

Spring Calving Index (£SCI)

The £SCI provides UK farmers operating a spring block-calving system, making extensive use of grass and targeting production of around 6,000 kg per year, with an across-breed evaluation to highlight bulls suitable for their system. The index has been calculated on its own base and for a specific farming system, so comparison of bulls on the Profitable Lifetime Index (£PLI) or £ACI list is not possible.

The index has been developed to provide an initial screening tool to ensure bulls used on farm meet specific criteria. It is then recommended that specific emphasis is placed on the management traits that require attention on individual farms.

Aims of the £SCI:

- Promotes milk quality rather than volume
- Has a strong emphasis on fertility
- Selects for reduced maintenance costs
- Improves udder and leg health
- Places a strong emphasis on longevity
- Promotes easier calving
- Protects functional type such as feet, legs and udders

Autumn Calving Index (£ACI)

The £ACI provides UK farmers operating an autumn block-calving system, with a higher requirement for winter feeding and targeting production of around 7,500 kg per year, with an across-breed evaluation to highlight bulls suitable for their system. The index has been calculated on its own base and for a specific farming system, so comparison of bulls on the £PLI or £SCI list is not possible.

As with the £SCI, the index has been developed to provide an initial screening tool to ensure bulls used on farm meet specific criteria. It is then recommended that specific emphasis is placed on the management traits that require attention on individual farms.

Aims of the £ACI:

- Promotes milk quality with more weight on volume than the £SCI
- Places strong emphasis on fertility
- Selects for reduced maintenance costs
- Improves udder and leg health
- Places a strong emphasis on longevity
- Promotes easier calving
- Protects functional type such as feet, legs and udders

For further information, see our £SCI and £ACI factsheets, available on the AHDB website.

Herd Genetic Reports

Herd Genetic Reports (HGRs) have been available for a number of years through AHDB Dairy to all UK dairy farmers who milk record. HGRs allow farmers to see the genetic potential of their herd by providing the following information for the cows registered on their farm:

- Milk (kg)
- Fat and protein (kg and %)
- £PLI
- Inbreeding level
- Management traits – SCC, Lifespan, Fertility, Mastitis and Maintenance, Calf Survival and Lameness Advantage

HGRs are available in three formats:

1. Individual cow reports (separated into Youngstock and Milking Herd).
2. Herd genetic report summary.
3. Benchmarking report.

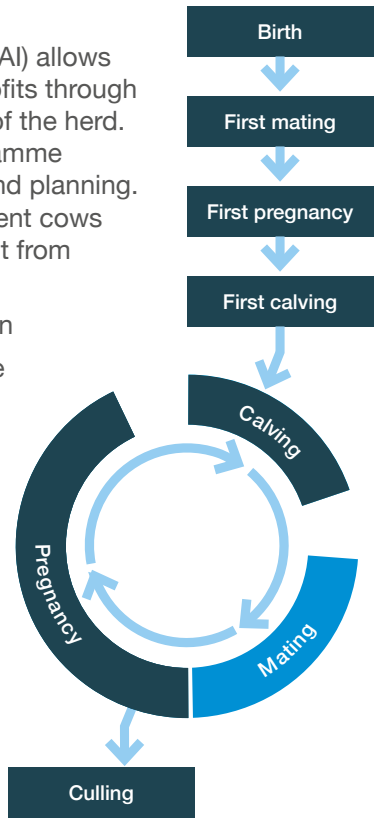
For further information, see the AHDB website, along with our webinar, **A guide to Herd Genetic Reports**.

Artificial insemination

Overview

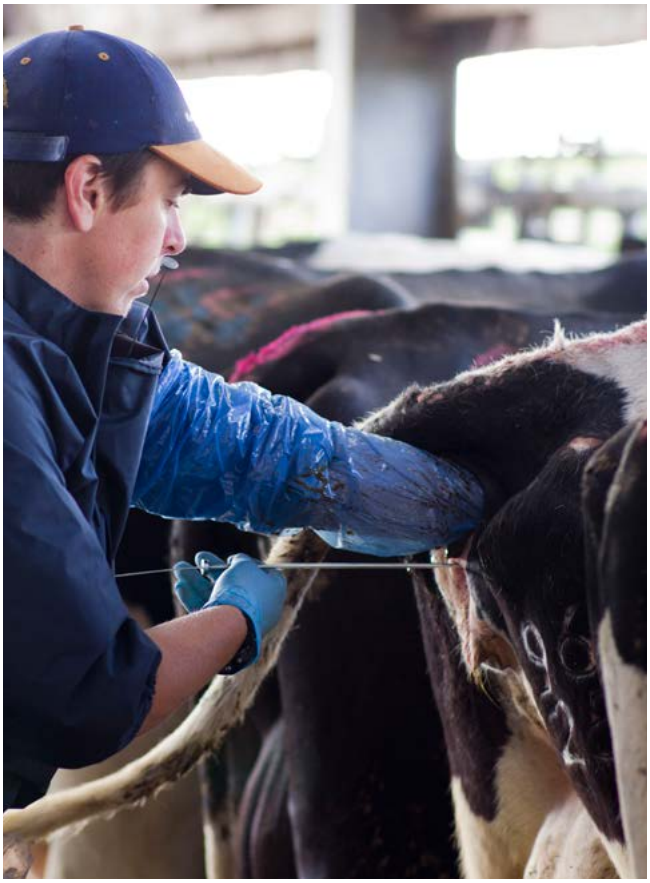
Artificial insemination (AI) allows farmers to improve profits through genetic improvement of the herd. Managing an AI programme requires preparation and planning. If you are to get sufficient cows pregnant and to benefit from using AI, you need:

- Good heat detection
- Proper AI technique
- Careful selection of AI sires



Key points

- AI provides a way for you to modify the traits in your herd
- Only use sires with superior breeding values for traits that can improve your herd
- Use £SCI and £ACI
- Weigh up the advantages and disadvantages of sexed semen, crossbreeding and other AI strategies before committing to change
- Always use good AI technique



Using sexed semen

Why use sexed semen?

The sex of the calf is determined by the sperm at fertilisation. Sperm carry either an X (female) or Y (male) chromosome. Technology for sorting an ejaculate into X and Y sperm fractions is under continual development and the industry has access to AI straws containing mostly female (90%+ purity) sperm. Using sexed semen within an AI programme offers potential advantages and some challenges.

How is sexed semen different from conventional semen?

Semen collected at AI centres can be sent for sexing, where the ejaculate is processed and sexed. The sexing process is another step which can reduce the lifespan of sperm after thawing. Typically, there are fewer viable sperm per straw of sexed semen when compared with conventional semen. Fewer sperm per straw does not necessarily reduce conception rates, but it does require:

- High cow fertility
- Proper semen handling
- Good AI technique and timing

> ***Warning***
>
> If cow fertility and AI practices are suboptimal, there may be a lower or more variable conception rate.

Potential advantages

In well-planned and managed mating programmes, the potential advantages of using sexed semen are:

- You can expect upwards of 90% (but not 100%) of calves born to be heifers – so fewer bull calves
- Breeding of your best cows can be targeted to produce only the replacement heifers that you need
- Fewer calving problems, as heifer calves are generally smaller than bull calves – an important advantage from use of sexed semen in maiden heifers
- Easier rearing of heifers in seasonal and split-calving systems. The replacements are born earlier in the calving period, are of the same age and can be managed as a more uniform group

Potential disadvantages

There are aspects to using sexed semen that you need to consider. These include:

- Conception rates tend to be lower than for conventional, unsexed semen. Under ideal conditions, the conception rate of sexed semen can approach 90% of that of conventional semen. For example: if conventional semen has a conception rate of 50%, sexed semen may average 50% x 90% = 45%
- Sexed semen straws typically cost more than conventional semen, which, combined with the reduced conception rate can increase the semen cost per pregnancy. However, this can be counteracted by the increase in genetic merit of the herd and an increase in profit from beef calf sales
- Increased conception rates with planning, concentrating on detail and excluding use in females with compromised fertility

> **You need to examine all the costs and benefits – it is not just the difference in price between a sexed straw and a conventional straw of semen. Work with your adviser to identify the opportunities in your herd.**

Practical considerations for using sexed semen

Work with your dairy breeding adviser to identify which groups of animals (heifers, cows, etc.) and which individuals you will mate with sexed semen and the mating programme and timing.

With careful planning, sexed semen can be used in eligible heifers and cows. Reserve use for:

- Heifers that are well-grown
- Cows that have been calved more than 40 days, healthy, cycling and fertile

Note: Genomic testing and Herd Genetic Reports can be used to select the best animals to breed with sexed semen.

Timing, facilities, planning and training

Timing of AI is important. Are your cattle-handling facilities suitable for quiet, stress-free and efficient insemination? Consider how many heifers will be born from the programme and if you have sufficient calf-rearing facilities.

Allow for the extra labour, feed, medication and vaccination costs involved. The farm team should be:

- Experienced on heat detection
- Briefed in the treatment and insemination protocols to precisely follow the plan on the day
- Trained in best practice for semen-handling and insemination and handling and thawing sexed semen

Impact on future calving pattern

Heifers and cows that calve late are less fertile in the subsequent mating period in seasonal and split-calving herds. Any delay in conception will extend calving dates, affecting future reproductive performance of the herd.

To minimise the impact of any reduction in sexed semen conception performance, it is recommended to:

- Use sexed semen for one or two cycles only, following on with high EBV beef semen or sweeper bull
- Mate heifers 2–3 weeks earlier than the herd to compensate for the effect of lower semen fertility on calving pattern. This requires a heifer-rearing programme that enables heifers to grow to their target mating body weight at a younger age – as young as 13 months

Recommendations for sexed-semen use in heifers

Synchronisation programmes can be used to make AI management easier in heifers as some avoid the need for heat detection.

Synchronisation programmes can sometimes effect conception rates however, so consult with your vet to determine the best one to use.

To maximise conception rates, ensure all heifers:

- Have reached the minimum target weight – even for the youngest heifer
- Are healthy, vaccinated and on a rising plane of nutrition
- Aren't mixed in their groups the six weeks before and after AI

Recommendations for sexed-semen use in cows

Herds with lower herd reproductive performance should seek professional advice from their vet before using sexed semen.

Fertility tends to be lower in cows than in heifers – conception rates in cows are often 10% or more lower than in heifers, due to the combined effects of age, previous calving, lactation and disease.

Limiting the use of sexed semen to the most fertile cows yields better, more reliable results. Selected cows should:

- Be free of reproductive, metabolic or other disease
- Be calved for a minimum of 40 days
- Be aged between 2–6 years old, and have transitioned well into lactation with minimal body weight loss

Cows may still experience a reduction in conception rate compared with that obtained from conventional semen. Consider the impact of any reduction in conception rate on your subsequent calving pattern before proceeding. Work with your adviser to make the best choice.

Some herd management software programs help you identify the cows most suitable for sexed semen.

Our AHDB **Semen Usage Calculator** can be used to run different semen scenarios for your farm.

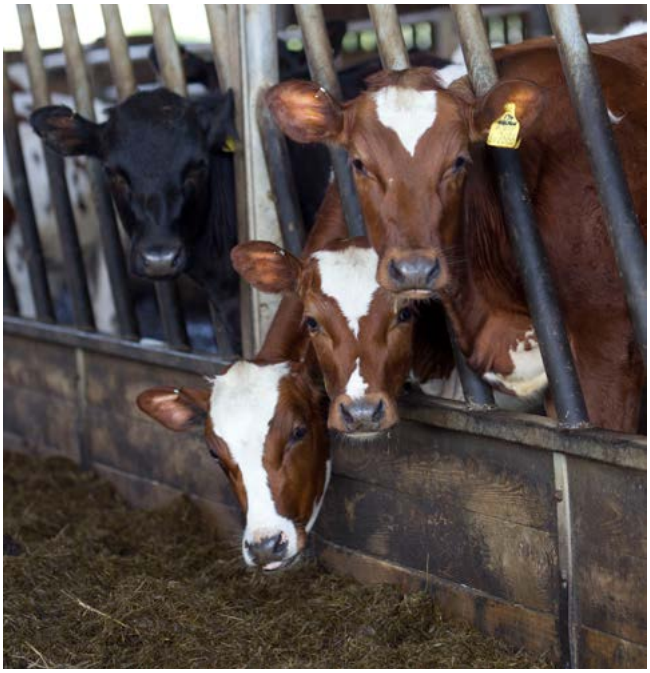
Crossbreeding

What is crossbreeding?

Crossbreeding involves mating of parents from different breeds. A crossbreeding strategy involves the selection of a sire from a different breed to the cow at each mating to increase the hybrid vigour of any offspring.

Hybrid vigour is the opposite of inbreeding, where inbreeding is a loss of genetic diversity in offspring that follows the mating of related parents. Greater genetic diversity in offspring typically allows them to outperform their parents across many traits. The extent of this hybrid vigour improvement will vary depending on the trait of interest.

Crossbreeding can provide gains when used in pure-bred Holstein and Jersey breeds, where inbreeding can be a problem.



Importance of sire selection

The most important factor for success with either system is sire selection. Hybrid vigour will improve many characteristics but not as much as the gain that can be made from selecting high-genetic-merit semen.

Using natural sires may eliminate many advantages that crossbreeding could provide. It is also important to remember that hybrid vigour cannot be transferred to the next generation. Any gain in genetic diversity achieved will be lost from future generations unless an ongoing crossbreeding strategy is applied.

Is it true that crossbreds are more fertile?

Crossbred cows are recognised as having higher fertility because the fertility trait has a good level of hybrid vigour. Young crossbred cows are less likely to be culled as empty than young Holstein-Friesian cows. Older crossbred cows are less likely to be culled as empty than older Jersey cows.

However, as in many straight-bred herds, the reproductive performance of many crossbred herds is reduced by problems in key fertility management areas.

Crossbreds are more fertile, but a straight-bred herd under good management will be more fertile than a crossbred herd that's poorly managed.

Table 9 shows some potential advantages and disadvantages of crossbreeding.

Requirements for successful crossbreeding

The two main options for a farmer considering crossbreeding are to use a two-breed or three-breed strategy. It can become complicated to manage sire selection. Every female requires a dedicated and individual decision to select the most appropriate sire. Good records are essential.

Crossbreeding strategies

Figure 6 shows two examples of crossbreeding strategies:

- Two-breed Holstein (H) x Norwegian Red (N) cross on the left
- Three-breed Holstein (H) x Norwegian Red (N) x Jersey (J) on the right

The circles represent the breed proportions in successive generations.

Table 9. Advantages and disadvantages of crossbreeding

Advantages	Disadvantages
Hybrid vigour (heterosis) can be significant. Crossbreeding is a way to reverse inbreeding	Hybrid vigour in the initial cross declines with any backcrossing to parental breeds
Complementary sire and dam traits can be selected for within each parent breed. The effects are additive in crossbred progeny	It is more difficult to manage the breeding programme in a crossbred herd – particularly if using three or more breeds
There is a wider range of genetics to choose from when more than one breed is involved	Crossbred animals are generally of lower value than pure-bred animals. Crossbred heifers often have fewer markets
Crossbred animals tend to be more robust and have greater longevity than pure-bred animals	Milk yield of crossbreed cows is lower than for Holstein
Crossbred herds typically have a better herd age structure and need fewer replacements than pure-bred herds	There can be: • Fewer desirable behavioural traits in the progeny • Greater variation in size and appearance, particularly with early generations of crosses

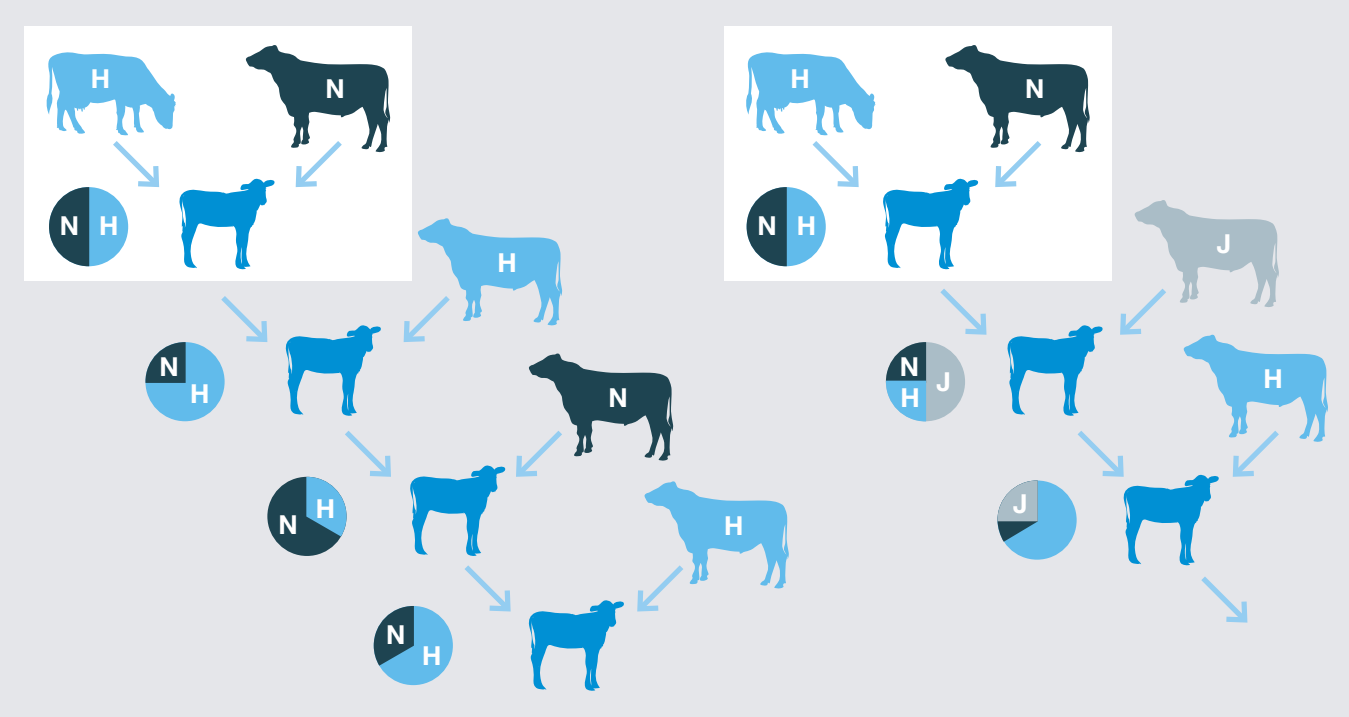


Figure 6. Cross breeding strategies

Measuring AI performance

Artificial Insemination (AI) practices can bring huge improvements to a herd's genetic merit. Sires can be chosen based on their breeding values and tailored to make specific improvements within your herd. However, just like using a bull, AI will only achieve good conception rates if your cattle are well-managed. Ensuring good AI performance requires management of five key areas:

- General preparation
- Semen storage and handling
- Insemination technique
- Timing of insemination
- Cow handling

Research shows that at least 40% of do-it-yourself technicians could achieve at least a 5% increase in conception rates by improving AI practices. What would this mean in your herd?

It can be easy to let things slip, so strive to maintain focus on AI.

Practice makes perfect. If you are DIY AI, send technicians to a refresher course every two years to ensure their AI technique is spot on.

What to measure

Monitor conception rates by inseminator. If one person is achieving considerably lower conceptions rates than is normal for your herd, it could indicate a problem with:

- Heat-detection accuracy
- Insemination technique
- Semen-handling technique
- Cow-handling technique

What to do if you have a low AI conception rate?

If you have evidence of a low conception rate to AI, you should systematically investigate potential causes, such as the following, and take the recommended action:

- Inadequate AI practices or poor-quality semen – review AI practices on your farm
- Poor body condition at calving or excessive loss of body condition following calving – review body condition score targets and herd nutrition
- Inaccurate heat detection – review your heat-detection programme
- Excessive numbers of late calvers in seasonal/split-calving herds – review calving pattern
- Poor transition management resulting in increased incidence of metabolic issues such as ketosis, metritis/endometritis, displaced abomasums. See the Post Calving Management chapter for further guidance for these specific issues.

There are other possible causes of low non-return rate and low conception rate. You may need to seek help from an adviser.

Getting ready for AI

It is important to prepare for AI. A well-planned system with your farm team ready, supplies at hand and facilities in good shape is more likely to be successful. Semen is a significant item in the farm budget, how effectively it's managed is up to you. Poor AI practice can be a costly and frustrating outcome of sloppy semen storage and handling, incorrect AI technique or poor timing of AI.

Checklist

- Check that AI facilities provide a safe working environment
- AI facilities may need to be upgraded to match increasing herd size
- If multiple sires are being used, organise/mark cows to assist the AI technician to get the right straw into the right cow
- DIY technicians should consider attending a refresher course before the start of service if they are not confident with their technique or have not inseminated cows for 12 months or more
- Place a bench for straw preparation in a stable, secure, clean and convenient working position away from direct sunlight, rain, dust or chemicals
- Provide clean cold and hot water, a rubbish bin to dispose of gloves, paper and sheaths, and a hose and scrubbing brush to clean
- Ensure cattle can be safely restrained in a crush or AI stall
- Ensure someone is there to help them move cattle if needs be

Are your AI facilities in good shape?

It is the farmer's responsibility to provide a safe workplace for the AI technician. AI facilities need to be:

- Safe
- Accessible
- Convenient
- Comfortable for both technician and animal

Semen storage and handling

The sperm contained within frozen semen straws are fragile and require great care when handling.

Checklist for good semen handling

Are you doing everything correctly? Follow this checklist to evaluate your semen-handling skills.

Item check

Tank

- Check that the semen tank is full of liquid nitrogen when delivered
- Twice weekly, check liquid-nitrogen levels in the semen tank
- Twice weekly, check the semen tank for 'frosting' on the outside of the neck of the tank. This indicates a tank insulation breakdown

- Identify straws using coloured marker rods placed in the goblets (or a similar system)
- Know the location of each bull's semen before you retrieve the straw from the tank. You only have two seconds to check the bull's name on the straw before it starts to thaw

Handling straws

- Know the location of each bull's straw before lifting the canister
- Only lift the canister up to the 'frost line' in the tank to select straws
- Lift selected straws using tweezers; only lift one straw at a time
- Only thaw as many straws as you can use within 10 minutes
- Handle sexed semen especially carefully

Thawing straws

- Thaw straws in a water bath kept at 32–38°C for at least 30 seconds. Keep straws in the water bath until shortly before use
- Thaw sexed semen especially carefully
- Monitor water temperature continuously with a thermometer in the water bath. Semen is rapidly damaged if thawed in temperatures outside the 32–38°C range. An automated thawing flask that controls water temperature is useful if you are inseminating large numbers of cows
- Ensure the water level covers all but the top 1 cm of the straw
- On cold days, rub the gun briskly with a dry paper towel to avoid cold shock and keep the loaded gun warm before use
- Only touch the ends of the straw and do not allow it to flick
- Dry each straw thoroughly with a paper towel before loading into the gun

- Load the straw into the gun, then cut it at right angles with clean scissors before covering with a sheath
- Keep the loaded gun free of contamination and out of direct sunlight

Insemination technique

Step-by-step guide for good insemination technique

1. Insert arm into rectum and remove any excess faeces before locating the cervix.
2. Wipe the vulva with a dry paper towel to ensure it is completely clean.
3. Direct the gun upwards at 45° to avoid the opening to the bladder.
4. Gently progress the gun forwards, pushing the cervix away to create a smooth passage. Direct the gun to the entrance of the cervix.
5. Work the gun through the cervix. Place the index finger at the front of the cervix to feel the gun passing through, preventing the gun progressing too deep into the uterus. Position the gun so it is only just protruding from the front of the cervix.
6. Deposit all the semen slowly into the body of the uterus just through the cervix. Wait a moment before withdrawing the gun.
7. Remove the gun with a smooth action while the arm is still inserted in the rectum.

Patience, practice, hygiene and proper technique are key to good insemination technique.

Recommendation: sperm placement

Sperm deposited in the cervix are less likely to progress to the uterus: they flow back into the vagina with the mucus. Deposit the semen into the body of the uterus at the point just past the end of the cervix (Figure 7).

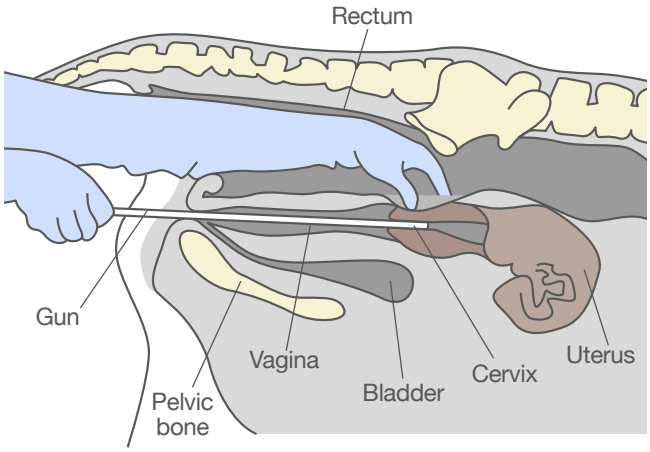


Figure 7. Correct placement of semen: deposit all the semen just through the cervix

Can I save money by splitting straws?

Splitting straws means using a single straw on more than one cow so you risk low conception rates and may spread disease.

- Halving the number of sperm inseminated can reduce conception rates, varying from less than 1% in some sires to more than 10% in others
- When the volume of semen is low, it is very difficult to ensure the semen is placed correctly in the uterus. Technicians must be highly skilled to perform the insemination
- The second half of a split straw will have been warmed to body temperature and then cooled a little before being inseminated in the second cow. Temperature fluctuations can be lethal for sperm
- Using the same AI gun and sheath for more than one cow, you run a risk of spreading infectious diseases

Splitting straws is not recommended. It is better to focus on improving AI conception rates by avoiding shortcuts.

Timing of AI

Timing for ovulation

Both sperm and eggs have a limited lifespan. Timing AI relative to when a cow ovulates is important. The best conception rates occur when insemination is 0–16 hours before ovulation as this provides for large numbers of fertile sperm to be waiting at the site of fertilisation, the oviduct, when the cow ovulates.

Cows in good reproductive health typically ovulate 23–33 hours after the start of their heat period. It is most practical to inseminate cows shortly after first detection on heat because most cows will have already been on heat for a number of hours by the time they are detected. For most cows, this will time insemination to occur just before ovulation.

The safest practice is to inseminate each cow detected on heat at the next opportunity for insemination. Your choice includes whether to inseminate once or twice daily during mating.

Once-daily versus twice-daily AI

Once-daily AI is where all cows identified on heat are sent for insemination at the next AI time and where there is only a single AI time per day. This provides a similar conception rate to twice-daily AI in most herds.

Note: If changing from once daily to twice daily, measure non-return rates before changing permanently.

Twice-daily AI uses the AM/PM AI system. This is an alternate to once-daily AI and requires you to use morning and evening AI each day. Insemination is delayed in each cow by approximately 12 hours from first detection. Cows first seen on heat:

- Before or at the morning milking – inseminate at the evening AI
- Through the day or at evening milking – inseminate at the next morning's AI

Will my conception rate improve if I switch to the AM/PM system?

Potential benefit

The benefit of twice-daily over once-daily insemination is small for most herds. Herds with a large number of cows having delayed ovulations may benefit from switching to the AM/PM rule. In these herds, the AM/PM switch could potentially increase the low conception rate by 3–5% over once-daily AI.

Challenging logistics

However, the logistics of identifying cows on heat and drafting those for next AI are more complicated than for once-daily AI systems. Discuss the pros and cons of the AM/PM system with your adviser before implementing – especially if you only use manual heat detection on your farm.

It is likely to be more effective for you to address any causes of delayed ovulation in the herd through better body condition management, nutrition and genetics.

Note: Before changing from twice daily to once daily consider the staff and facilities necessary to inseminate the larger number of cows once a day. Are there other ways to address the low conception rate problem?

Optimising automated heat detection

Many farms now have automated heat-detection systems. These can accurately identify the start of heat. Automated systems make it easier to apply the AM/PM rule by identifying which of the next two AI times best suit each individual cow.

The system can also be instructed to draft the right cows for insemination before each AI time. Work with your system provider and adviser to implement these features if you are currently using twice-daily AI.

Once daily is easier than AM/PM AI. There is minimal impact on conception rates if cows are in good health, body condition, naturally cycling and long calved.

When to re-inseminate

It is not necessary to re-inseminate a cow if she is still on heat at the next milking. However, if the cow is on heat two milkings (24 hours) later, re-inseminate her according to the system you are using. Once mating begins in block calving herds, inseminate all cows seen on heat, calved more than three weeks before.

Minimise stress in separated cows

Good management practice is required to minimise stress for cows being inseminated.

- Do not hold animals for extended periods on concrete, especially as bulling cows may injure themselves on concrete and yard rails
- Provide access to pasture and water if animals are to be held for more than an hour. Move the cows back into the yards for inseminating with the minimum degree of pressure
- Avoid holding a single cow alone. Provide a couple of companions, even if they are not to be inseminated
- Load up the inseminating race for the technician without stressing them. Remember, the AI race may not be familiar territory to the cows, or they may associate the race with 'adverse' experiences, such as vaccinating, vet visits or lameness or pregnancy testing
- Be patient with difficult/temperamental cows – don't add further to their stress levels

Cows can tolerate some stress without affecting their chances of conception. Just being on heat and riding other cows, as well as reducing feeding time, will be somewhat stressful, but following the principles of good management practice will eliminate unnecessary stress.

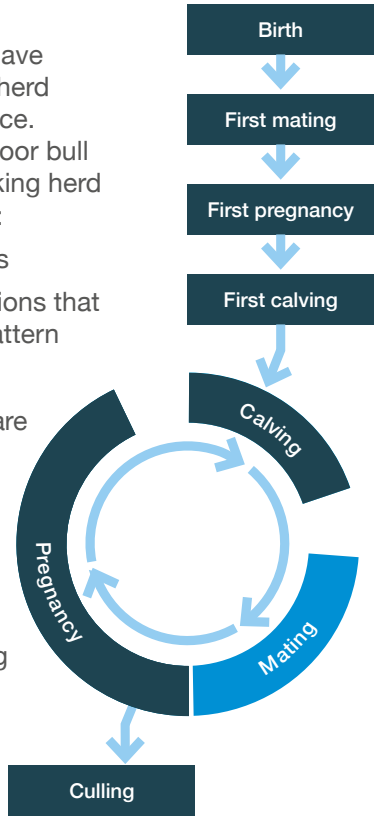
Bull management

Overview

Bull management can have a significant impact on herd reproductive performance. The consequences of poor bull management in the milking herd and heifers can include:

- High not-in-calf rates
- A spread in conceptions that can affect calving pattern
- Spread of disease
- Adverse animal welfare

Ensuring good bull performance requires management of three key areas: selection (and rearing) of bulls, day-to-day management of working bulls and bull power.



Key points

- Herd bulls are an important part of many mating programmes. They are not an 'afterthought' after AI
- Use sufficient well-grown, locally adapted, disease-free and fertility-tested bulls to effectively mate your cows and heifers
- Rotate bulls regularly and watch for problems and breakdowns

Good bull management

- Running adequate numbers of healthy, fertility-tested, well-grown bulls with the herd
- Reducing the stresses to bulls, such as those caused by heat, overworking or dominant animals
- Handling bulls to minimise the risk of injury to people and animals

Optimal bull management, selecting and running appropriate numbers of healthy fertile bulls with the herd to:

- Reduce stress
- Minimise the risk of injury to people and animals
- Maximise natural mating performance

Bull management checklist

- Measure performance
- Calculate bull power required: 1/15 young bulls, 1/30 mature bulls
- Source appropriate bulls. Consider age, breed, conformation, feeding history, disease risk
- Get them onto the farm, foot trimmed, vaccinated and grouped 2–3 months before required
- Bull Breeding Soundness Examination six weeks prior to use
- Assess temperament – handle calmly and assertively
- Decide on bull teams – group by similar age/size/breed
- Rotate teams – work/rest each team for 12–72 hours
- Train bulls – aim for them to stay off concrete as much as possible and restrict access to concentrate/TMR
- Observe daily mating ability and mobility; address problems early

How do bulls measure up?

Bull performance is difficult to measure directly. Begin by measuring herd reproductive performance during the time when natural bull mating was used in the herd. If the herd's reproductive performance during this period is less than satisfactory, one possible cause is poor bull performance.

- Obtain the 6-week in-calf and the empty rate for your herd (as described in the Setting targets chapter)
- Work out the total weeks of mating (AI period + bull mating period)
- Look up the expected empty rate for your herd using Table 10
- If the actual not-in-calf rate is higher than expected, it indicates that reproductive performance after week six of mating is unexpectedly low. Poor bull performance is one possible cause

Table 10 shows the expected empty rate (%) based on a given 6-week in-calf rate and length of mating. For 6-week in-calf rates, top farmers achieve >78%, good is 72% and average is 65%. Seek help for anything less than 65%.

Table 10. Expected empty rates from 6-week in-calf vs. total weeks of mating

6-week in-calf rate	Total weeks of mating (AI + bull mating period)			
	9	10	11	12
50%	35%	30%	27%	24%
55%	30%	26%	24%	23%
60%	26%	23%	21%	19%
65%	22%	19%	17%	16%
70%	19%	17%	15%	14%
75%	17%	15%	13%	12%
80%	13%	12%	11%	10%

Source: Data taken from Dairy Australia

Keep records

Record all heat dates to bull matings. This information can help you measure bull performance and can help with identifying conception dates at pregnancy testing. A chin-ball harness on bulls can help you detect the cows that they serve.

Assessing performance of bull mating of heifers

To check bull performance in heifers, start by measuring how quickly the heifers became pregnant after the bulls were introduced.

Use pregnancy testing with foetal ageing 12 weeks after the group's MSD. Calculate the percentage of heifers that became pregnant in the first three and six weeks of mating.

Good performance is indicated by:

- 75% of heifers conceive in the first three weeks of mating
- 92% conceive in the first six weeks

Review calf and heifer management and bull management if:

- Less than 65% of heifers conceive in the first three weeks of mating, or
- Less than 85% in the first six weeks

See the Heifers weaning to calving chapter for further information.

Table 11. Example of information required in the Bull Power Calculator

Herd size	Sub rate	Conception rate	Estimated 3-week in-calf rate	Estimated 6-week in-calf rate	Estimated number of cows not pregnant when bulls introduced	Number of mature (24m+) bulls required	Age of young (15–24m) bulls in months	Number of young bulls required
100	75%	50%	38%	61%	39	1	15	3
200	80%	55%	44%	69%	63	2	16	4
300	80%	55%	44%	69%	94	3	17	6
400	80%	55%	44%	69%	125	4	18	7

Table 12. Bulls required depending on herd size against expected pregnancy rates

Herd or group size	Likely % of herd pregnant at start of bull mating			
	Very low (less than 40%)	Low (40–50%)	Moderate (50–70%)	High (more than 70%)
100	2–4	2–3	2	2
200	5–6	4–5	3	2
300	7–8	6	4–5	3
400	9–11	7–8	5–6	3–4
500	12–13	9–10	7	4–5
600	14–15	11–12	8–9	5–6

Power up – how many bulls do you need?

The Bull Power calculator allows you to input your own farm data to calculate how many bulls are needed on your farm depending on herd size and expected submission rates and conception rates. You can use the Bull Power Calculator on the **ahdb.org.uk** website.

Table 12 outlines the minimum number of bulls required to run with the herd or mob at any one time, with a minimum of two bulls per mob at all times.

Rule of thumb: Bulls from 15 months old can handle one female per month of age up to 30 months old, then one mature bull per 30 non-pregnant cows. For example, 16 females at 16 months of age, 17 at 17 months of age and so on.

Bull power for yearling heifers

The ratio should be 1 bull to 15–20 heifers at all times to cover the poorer performance of yearling bulls. Ensure at least two sexually active bulls running with each group throughout the mating period. Typically, run on an all-in basis. Swap bulls between groups after 2–3 weeks if feasible.

Bull power after a synchrony treatment

You will need to double the ratio when returns are occurring, i.e. 1:10 non-pregnant cows. Alternatively, recommence heat detection for 3–4 days and use AI alongside the bulls, commencing 18 days after the previously synchronised treatments.

Before mating

Selecting bulls

Breed

Calving ease has a significant impact on cow fertility. While breed selection is no guarantee of calving ease, some breeds on average have a higher likelihood of calving difficulties (Table 13).

Table 13. Calving difficulty by breed

Low risk	Jersey
Medium risk	Holstein, Angus, Holstein
High risk	Charolais, Limousin, Simmental

Age

- Avoid bulls that are more than four years old. Older bulls can be temperamental and are more likely to be suffering from injuries to the penis, back or legs
- Choose virgin bulls whenever possible as they are less likely to introduce venereal diseases to the herd
- If sourcing bulls less than 15 months of age, ensure they have had a Bull Breeding Soundness Examination (BBSE) performed to establish that they have adequate semen production

Conformation

The increased pressure of serving cows can expose weaknesses in bull conformation. Check for bowing of legs and abnormalities of joints. Ensure toes point forward and that there are no deformities of the feet.

Biosecurity

As with any stock being introduced to your farm, the introduction of bulls poses a potential disease risk. Consider your own herd's status before sourcing bulls. Quarantine incoming stock and perform appropriate testing to avoid the introduction of disease. Remember, while the bull poses a risk to your herd, your herd may also pose a risk to the bull, so take steps to safeguard his health as well.

Temperament

Do not tolerate bulls who show signs of aggressive behavior. The risks posed to on farm staff should not be underestimated and it is all too easy to lose track of bulls within a herd of cows. Look out for warning signs like stalking or obstructive behavior. Remember, previous temperament is no guarantee for the future.

Bull handling: making it safe for people and other animals

Start by clearly explaining the risks associated with bulls to your farm team. Don't expect your relief milkers to work with bulls that they have not been trained to handle. Establish routines so the bulls know what to expect and how to behave every day.

Aggressive bulls that fight with other bulls, especially when they are running with the herd, can injure other bulls, cows, people and themselves. Get rid of overly aggressive bulls that:

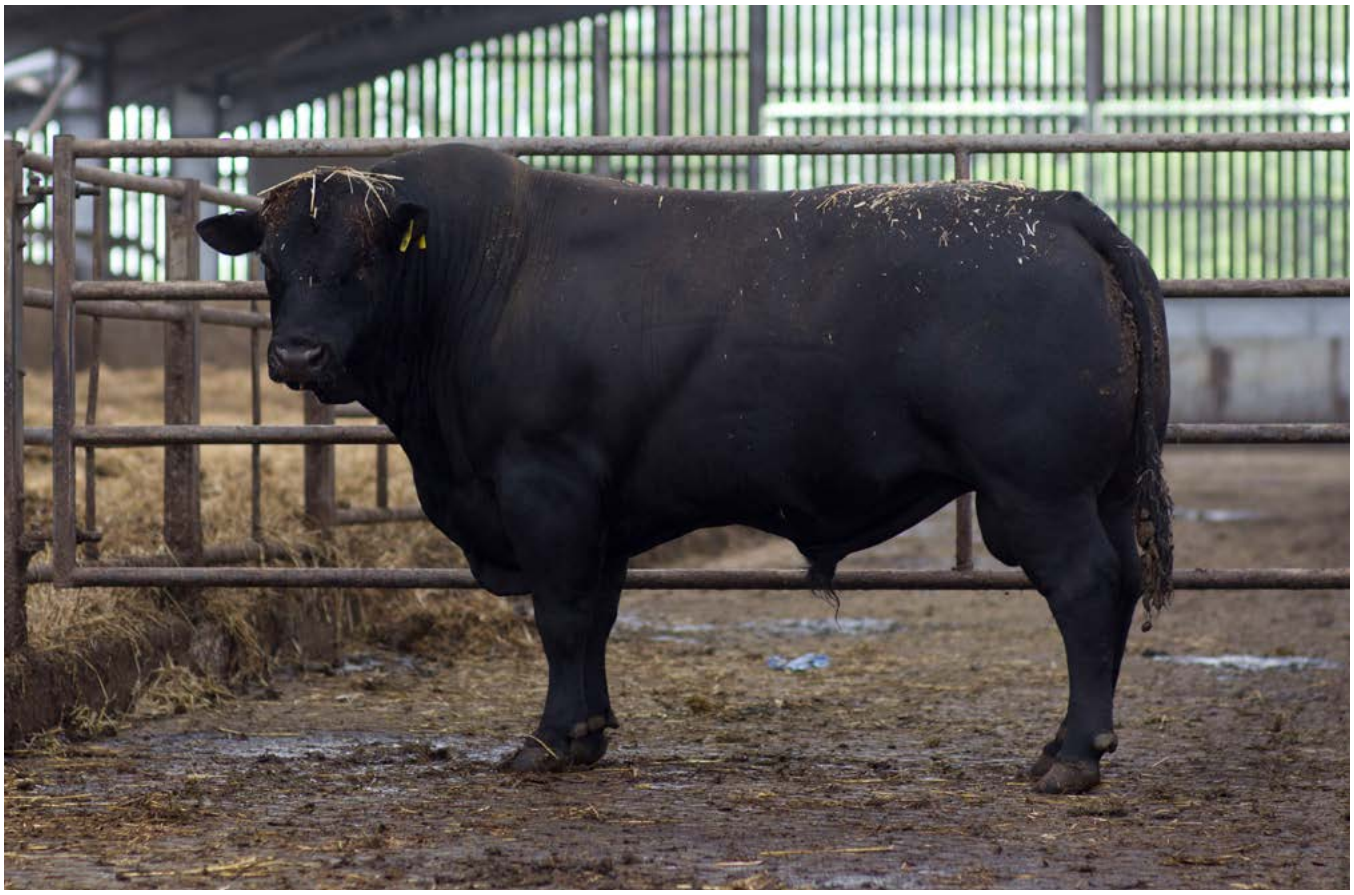
- Become obstructive and block the herd's progress from the paddock to the shed
- Show stalking behaviour towards farm staff

Tasks like fitting chin-ball harnesses or trimming feet will require special care and suitable facilities that will protect both the bull and the people. These actions can prevent injury.

Body condition

Bulls in body condition score 2.5 to 3.0 perform best. Bulls under condition often have poor semen production, while those over condition may suffer from reduced libido and sperm motility. Ensure bulls are in optimal body condition well before breeding commences. Introduce them to the cow ration before use to avoid gastric upsets and checks in semen production during mating.

If using juvenile bulls, ensure they are adequately grown for their age. At 14 months they should be at least 50% of adult body weight.



Bull MOT

Assess your bull

Toes

Check feet and locomotion

Testicles

Measure – check scrotal circumference recommended for age and breed
Feel – firm (like a tennis ball) with no lumps

Tone

Body condition score (BCS) of 2.5–3.0 at start of breeding season

Treat

Check vaccinations are up-to-date (e.g. BVD and Leptospirosis), internal and external parasites, etc.

Test

Consult your vet for a thorough examination of your bull's physical soundness and semen quality

Figure 8. Bull MOT

Veterinary Bull Breeding Soundness Evaluation (BBSE)

Despite appearing outwardly normal, a high proportion of bulls may still be infertile. Studies have demonstrated that approximately one in five bulls is subfertile, leading to poor reproductive performance.

A BBSE is the best way to identify and remove infertile bulls and those not fit for work from your bull team. The BBSE comprises three parts:

1. Physical examination – This involves examination of the bull for size, body condition, eyes, conformation, feet and legs and mobility. The bull's penis, prepuce, scrotum, testicles and internal sexual organs are also examined. Bulls need to have no detectable abnormalities to pass.
2. Semen evaluation – This involves collecting a semen sample from the bull and sending it to a laboratory for microscopic examination.
3. Serving ability test – Conducted if a serving problem is suspected.

Passing the BBSE does not guarantee that a bull will perform well at the next mating periods, due to risk of breakdowns, illness and injury, but a bull that fails a BBSE is very unlikely to be able to perform at the next mating period.

Remove the bull that fail the BBSE but continue to observe the bulls that pass the BBSE when they are with the females.

Working

Increasing activity and reducing health risks

When bulls are running with the herd, you can take several steps to increase bull activity and reduce health risks.

- Ensure there are at least two sexually active fertility-tested bulls with the herd at all times
- Avoid using overly aggressive, dominant bulls
- Swap bulls in the milking herd regularly through the bull mating period. Rest bulls for several days before returning them to the herd to help them refresh and maintain sexual interest
- Do not allow bulls to enter the concrete milking yard with the milking herd. Concrete can produce excess hoof wear and lameness
- If bulls are kept at any time outdoors, train them to stay in paddocks
- Mark bulls with reflective tape to make it easier to see them in the dark and hold them back from the herd
- Keep bulls from gaining access to the dairy platform. Do not let them consume the dairy concentrate ration as it may provide excessive amounts of carbohydrate and lead to rumen acidosis, sickness and reduced fertility
- Monitor bulls for lameness each day. Remove, treat and rest lame bulls promptly. Replace them with healthy bulls
- Consider the use of preventative hoof trimming or rubber blocks to help prevent lameness
- Regularly observe bulls that are serving to ensure they are working correctly. Immediately remove bulls that are unable to serve properly and replace them with more capable bulls

Manage heat-stress risk

Heat stress can reduce bull performance. Try and run individual bulls with the herd for no longer than two days before resting during periods of high heat-stress risk. Further reduce heat-stress risk by:

- Providing adequate shade and cool water
- Considering strategies such as:
  - Using more bulls
  - Providing bulls with extra or longer rest periods between work

A study showed that bulls over four years of age were seven times more likely to break down during the joining period.

Effect of temperature on sperm production

The optimum temperature for sperm production is 33–36°, which is 3–6° below body temperature. Higher temperatures caused by fever or heat stress affect sperm production and will increase the number of abnormal sperm.

Even a slight increase in temperature of 1–2° will cause major disturbance to sperm production. Sperm production takes two months and once a bull recovers from fever, sickness or any stress, it may take two months before normal fertility is restored.

Starting and stopping mating

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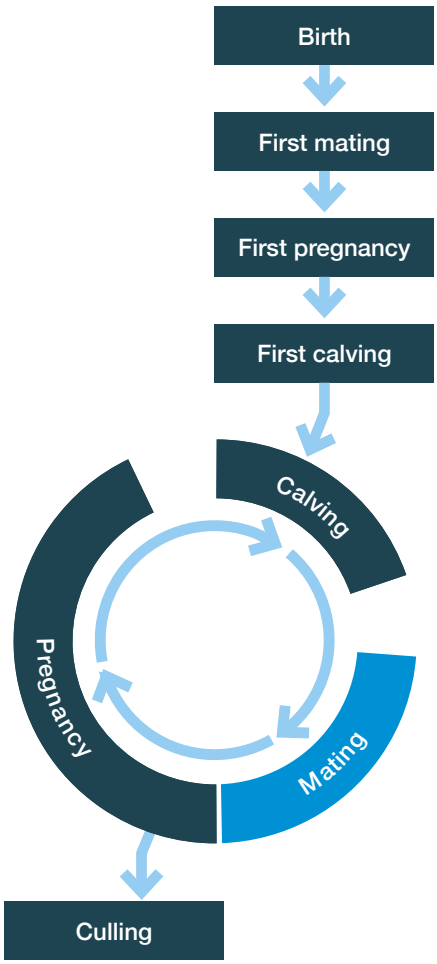
Starting and stopping mating

Overview

To be a true block-calving system, all cows will calve within a 12-week window. Cows calved in the first three weeks of the calving block have substantially better reproductive performance, hitting peak fertility earlier than those calving later. Cows need time for their reproductive tract to recover from calving.

Key points

- Late-calving cows reduce the herd's reproductive performance. Aim to have 90% of the herd calved within six weeks
- Heifers take longer to recover after first calving. Calving them 1–2 weeks before the herd can help to maintain a tight calving block
- Getting a cow to advance her calving date is difficult. Her chances improve if she has fully grown, is in good body condition, has had a good transition period and an easy calving and cycling before the start of mating



What is a desirable pattern?

A desirable calving pattern has most cows calving in the first six weeks of the calving period, with few late-calving cows to reduce herd reproductive performance. Many herds have calving periods that stretch beyond eight weeks. Not only does this contribute to reduced reproductive performance, it also has implications for many key aspects of farm management, including:

- Scheduling of tasks
- Cash flow
- Labour
- Pasture
- Feeding management

Calving pattern (the spread of calvings in a given calving period) has a major impact on subsequent herd reproductive performance.

Cows that calve in the first three weeks of calving typically have 6-week in-calf rates around 70%.

Very-late-calved cows that calve after week nine of calving, typically have 6-week in-calf rates around 20%. Not-in-calf rates are also affected.

Measuring the herd calving pattern

In block-calving herds, striving to have cows become pregnant as soon as possible after the start of mating is critical (Figure 9). This is because every week that calving is delayed, the cow has one week less to recover from calving before the next mating start date.

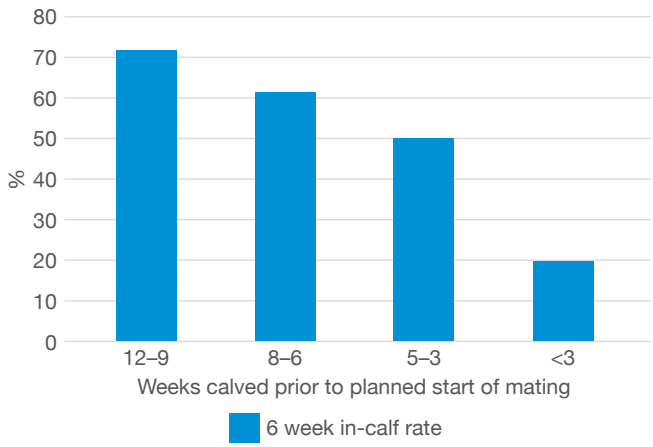


Figure 9. 6-week in-calf rate in relation to percentage of cows calved prior to planned start of mating

The value of thinking in three-week blocks

As a cow's normal oestrus cycle is three weeks, dividing the herd's calving period into three-week blocks relative to the planned start of calving (PSC) date is a useful way to group cows facing similar reproductive challenges.

The same principle divides the intervals from calving to planned start of mating (PSM) and from PSM to the end of mating into three-week blocks.

Calving date and reproductive performance

There is a strong relationship between calving date and subsequent reproductive performance. The more days from calving to PSM, the better the reproductive performance will be. Table 14 shows the comparison between these three-week block intervals and subsequent performance.

Table 13. PSM vs performance

Calving group	Time from calving to PSM^	6-week in-calf rate	Not-in-calf rate
Very early – before PSC*	>12 weeks	76%	5%
Early – first 3 weeks	9–12 weeks	71%	6%
Mid – second 3 weeks	6–9 weeks	61%	9%
Late – third 3 weeks	3–6 weeks	51%	13%
Very late – within 3 weeks of PSM^ or later	<3 weeks	22%	23%

*Planned start of calving (PSC) = date of planned start of calving in a particular calving period

^Planned start of mating (PSM) = date of first day in a particular mating period

Assessing your herd's pattern

If your herd's reproductive performance is not as high as you would like, the first thing to look for is a spread calving pattern. In turn, a tighter calving pattern gives better reproductive performance.

To assess your herd's calving pattern, calculate the percentage of the herd - both cows and first-calving heifers - calved by weeks three, six and nine following the planned start of calving and compare your result with Table 15.

Note: For split-block-calving herds, do the calculations separately for each calving period.

Table 15. Targets to show performance rates of calved by rates

Calved by week	Top farmers achieve	Seek help if less than
3	61%	51%
6	94%	77%
9	100%	94%

Planning the calving period

Selecting mating start dates

Once the planned start of calving (PSC) is chosen, the planned start of mating (PSM) is automatically determined (Table 14). Selecting the ideal time to start and stop mating and, therefore, the subsequent calving pattern are individual farm decisions that depend upon factors such as:

- Labour availability
- Feed supply
- Facilities/infrastructure
- Milk price
- Climate

An example of breeding dates and periods for PSM and PSC is below:

Gestation length (term of pregnancy)

		Average period (days)	Range (days)
Cow	9 months plus 9 days	282	279–289

Breeding dates and periods

Conception date		Expected calving date	
July	9	April	17
July	23	May	1
August	6	May	15
August	20	May	29
September	3	June	12
September	17	June	26
October	1	July	10
October	15	July	24
October	29	August	7
November	12	August	21
November	26	September	4
December	10	September	18
December	24	October	2
January	8	October	17
January	22	October	31
February	5	November	14
February	19	November	28
March	5	December	12
March	19	December	26
April	2	January	9
April	16	January	23
April	30	February	6
May	14	February	20
May	28	March	6
June	11	March	20
June	25	April	3

Breeding replacements

When to stop breeding for replacements depends heavily on the herd's expected replacement rate and anticipated in-calf rate.

Remember to allow for planned expansion and that not all heifer calves will make it to the herd. Also, generating a large number of early-born replacements, from say the first three weeks, will make them easier to rear and older at key stages of development.

Front-end loading with heifers

Many herds benefit from making the PSM for 15-month-old heifers 1–2 weeks before the main herd.

The target is to calve 90% of heifers by the end of week four of calving, alongside aiming to calve 90% of the whole herd by the end of week six.

This is because first-lactation heifers take, on average, 10 days longer to get back in calf compared with their mature herd mates. Calving them slightly ahead of the herd gives them the extra time they need and sets them up for a lifetime of calving at the start of the block. It also brings social advantages, such as having a large group of their own age, with older cows joining it, instead of the other way around.

Stopping mating

Once you have determined your herd's PSM, you need to think about the duration of mating and when to stop. There are several factors to consider, including:

- How long you want to calve
- How many replacement heifers you seek to rear
- The number of non-pregnant (empty) cows you are willing to accept at the end of mating

Acceptable number of empties?

The acceptable number of non-pregnant animals varies between farms and depends on:

- The number of heifer replacements available
- Whether you are building up herd numbers
- The number of cows that need to be culled for reasons other than reproduction, such as mastitis

Table 16 outlines some key targets you can use to compare your figures.

Table 16. Example of likely non-pregnant cow rates.

	Top 25% farmers	Seek help
6 weeks	22%	>32%
9 weeks	10%	>15%
12 weeks	6%	>9%

Maintaining and tightening the block

The biggest predictor of your 6-week in-calf rate is the spread of the preceding calving period. Improving a herd's calving block needs action at both ends of the calving period:

- Pushing more cows to the beginning of calving
- Reducing the number of late-calving cows

Remember that you also need well-grown heifers that calve early in a compact calving pattern and require minimal assistance to calve to maintain your herd calving pattern.

Strategies to tighten and maintain the calving pattern

The biggest gains are due to strategies that directly influence the calving pattern, although smaller gains can be made by optimising reproductive performance, so cows get back in calf quickly.

- Calve heifers early – ensure target liveweights at mating. Aim to calve heifers two weeks before the main herd and consider using synchronisation to increase calving rate
- Target cow health and body condition – focus on transition period and body condition management. Take action to make sure cows are fit and ready to serve by planned start of mating
- Maximise 3-week submission rate – it is usually easier to influence submission rate than conception rate. Prioritise heat detection to drive in-calf rates
- Consider using shorter-gestation-length sires – using bulls with shorter gestations towards the end of mating can help advance the calving dates in cows conceiving late
- Take prompt action on non-cyclers – identifying and treating non-cycling cows improves performance. Begin heat detection at least four weeks before PSM to allow time for treatment before mating begins
- Increase the number of replacement heifers to allow extra culling of late-calving cows

Choosing a pregnancy-testing strategy

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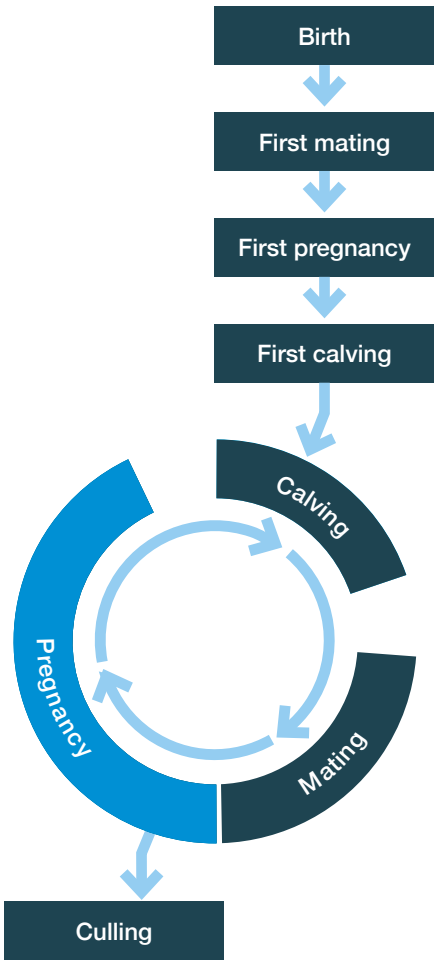
Choosing a pregnancy-testing strategy

Overview

It is important to know which cows are pregnant and when they conceived to allow effective management. Many critical management decisions revolve around knowing when a cow will calve. An effective pregnancy-testing strategy is an essential measurement activity.



Key points

For effective management decisions, it is essential to know which cows are pregnant and when they conceived, as this determines when they will calve. This allows you to:

- Accurately measure the 6-week in-calf rate to assess overall herd reproductive performance
- Confidently cull cows as empty at the right time
- Confidently dry off cows at your preferred time before their due-to-calve date
- Differentiate AB from natural-mating pregnancies
- Identify cows due to calve late
- More accurately select cows that are close to calving
- Provide due-to-calve dates if selling cows
- Plan feed and labour management right through the dry period, to next calving and mating
- Refine your dry-cow treatment decisions with the vet

Using pregnancy testing

To measure and monitor herd reproductive performance

Pregnancy testing, in conjunction with good record-keeping, enables you to accurately measure and monitor herd reproductive performance with as little time lag as possible. See the Measuring and Monitoring chapter for more detail on how and what to monitor.

Decisions on individual cows

Pregnancy testing (with foetal aging where natural service is used) is required for you to determine cow conception dates with confidence and is an important component of a herd's reproductive management strategy. Effective and complete pregnancy-testing data enables you to:

- Confidently re-breed, or cull cows as empty
- Provide calving dates when selling cows
- Confidently dry off cows at your preferred time before their calving date, potentially leading to longer lactations and more milk income
- Move springing heifers and dry cows into transition cow groups on time, so they get the transition diet three weeks before calving and minimise transition diet costs
- Know the calf's sire – this helps you manage the herd's genetics and avoid inbreeding

Pregnancy testing at an early stage (11–14 weeks after mating start date) allows accurate identification of conception dates to the first 6–9 weeks of mating.

Pregnancy-testing methods

There are two main methods for pregnancy testing:

- Manual (rectal) examination of the cow's reproductive tract by an experienced operator, using manual palpation (from around 42 days onwards) and/or an ultrasound probe (from around 28 days onwards)
- Laboratory testing of milk or blood samples to determine the level of specific proteins or hormones associated with pregnancy (detection can be possible from as early as 28 days, although testing at this stage is not usually recommended; speak to your lab before deciding on this)

For either approach, it is important to remember that pregnancy loss between 28 and 60 days can be quite common – so although early pregnancy testing allows identification of empty cows sooner, the need to recheck later in the pregnancy should be considered.

The advantages and disadvantages are listed below in Table 17.

Table 17. Advantages and disadvantages of the different pregnancy-testing approaches

Measurement	Manual (rectal) examination	Lab testing of milk samples
Advantages	Experienced operators are very accurate at identifying both pregnant and non-pregnant cows Results available immediately. Testing is completed cow-side and cows can be treated/drafted immediately Foetal ageing can be performed by an experienced operator in cows 5–14 weeks pregnant Some reproductive diseases can be detected at testing	Most tests are very accurate at identifying pregnant cows Tests are non-invasive Can be convenient – especially when added to routine herd milk recording Can be cost-effective – especially when small numbers of animals require testing and/or samples can be stored before sending to the laboratory
Disadvantages	Time and stress of drafting cows for examination Rectal examination is an invasive procedure There is a small risk of injury to cow, operator and foetus Requires good facilities for safe examination Needs an experienced operator Can be expensive when only small numbers of cows are tested	Some tests are only moderately accurate at identifying empty cows Unable to directly age pregnancies with accuracy Results are not immediately available. Samples sent to a laboratory for testing May give false positive results in cows recently calved and in cows that have recently lost their pregnancy

Importance of accurate record-keeping

All pregnancy tests demand accurate cow identification and correct recording of results (or samples). Think about all the steps required to get an accurate pregnancy-test record:

- The cow has to be identified correctly at the test
- The pregnancy-test result needs to be accurate
- The correct result must be recorded against the correct cow ID on the data sheet
- The results have to be correctly transcribed from the result sheet to the herd records

To make pregnancy testing as efficient as possible, everyone needs to know their role. A pre-printed list helps to avoid recording errors.

Return to heat is an unreliable measure of pregnancy

Not all cows that have been served and not seen returning to service will be in calf. The proportion of served cows not returning to heat can provide an estimate of herd conception rate, but it is not a reliable test in individual cows.

An empty cow may not be detected returning to heat because she:

- Was not seen on heat
- Did not have, or display, a visible heat, or is a non-cycler
- Lost her pregnancy
- Has cystic ovaries

Why do cows with the same expected calving date calve two weeks apart?

Cows vary in the length of their pregnancy. The average pregnancy is 282 days and hormones from the calf trigger calving, although this process varies. Natural variation in pregnancies means that pregnancy testing cannot be exact in all cows.

The wrong insemination date can be selected as the conception date, when:

- Mating records are incomplete or inaccurate
- The cow had two inseminations, or services less than two weeks apart
- Bulls are running with the herd and service dates are not all recorded
- Cows are pregnancy tested when more than 14 weeks pregnant

Cow identification and recording errors are common causes of cows not calving within a week of their due date.

Time-efficient manual PD

In many situations, being well organised and efficient on pregnancy-testing days reduces the cost substantially. Prepare for manual pregnancy testing by:

- Ensuring all cows are clearly identified and no two cows have the same identity number
- Checking the facilities are suitable with the person who will be doing the pregnancy testing
- Generating a list of all cows to be tested, including the number of days that the cow should now be in calf if pregnant to either her last recorded mating or each of her recent matings

Note: Most herd-management software programs can automatically generate a PD list.

Evaluating discrepancies

During pregnancy testing, as a cow is being examined, tell the operator how many weeks pregnant she is, based on her last recorded service. Where there is any discrepancy in due date between mating data and the manual estimate of the pregnancy tester, discuss the result, agree, then record the estimated date of conception and due calving date.

Record each result before moving to the next cow.

An example of a pregnancy-test worksheet is below:

Pregnancy Test Worksheet

Date: 20/12/16

Cow no.	Last 3 services (days ago)			No. of days pregnant
1		56	35	35
2			65	35
3			48	?
4		72	50	50
5			71	71
6		64	42	42
7			53	53
8		70	48	48
9		68	45	?
10			49	49
11			70	70
12		59	38	38
etc				

Choosing a suitable method for your herd

Pregnancy-testing methods vary in their performance because some are naturally better at identifying pregnant cows, while others are better at identifying empty cows. The most suitable testing method to use varies according to the herd's pregnancy status (are they mostly in calf or mostly empty?) and the test's ability to correctly identify either pregnant or empty cows.

Mistakes to avoid:

- Calling a pregnant cow empty – a false negative
- Declaring an empty cow pregnant – a false positive

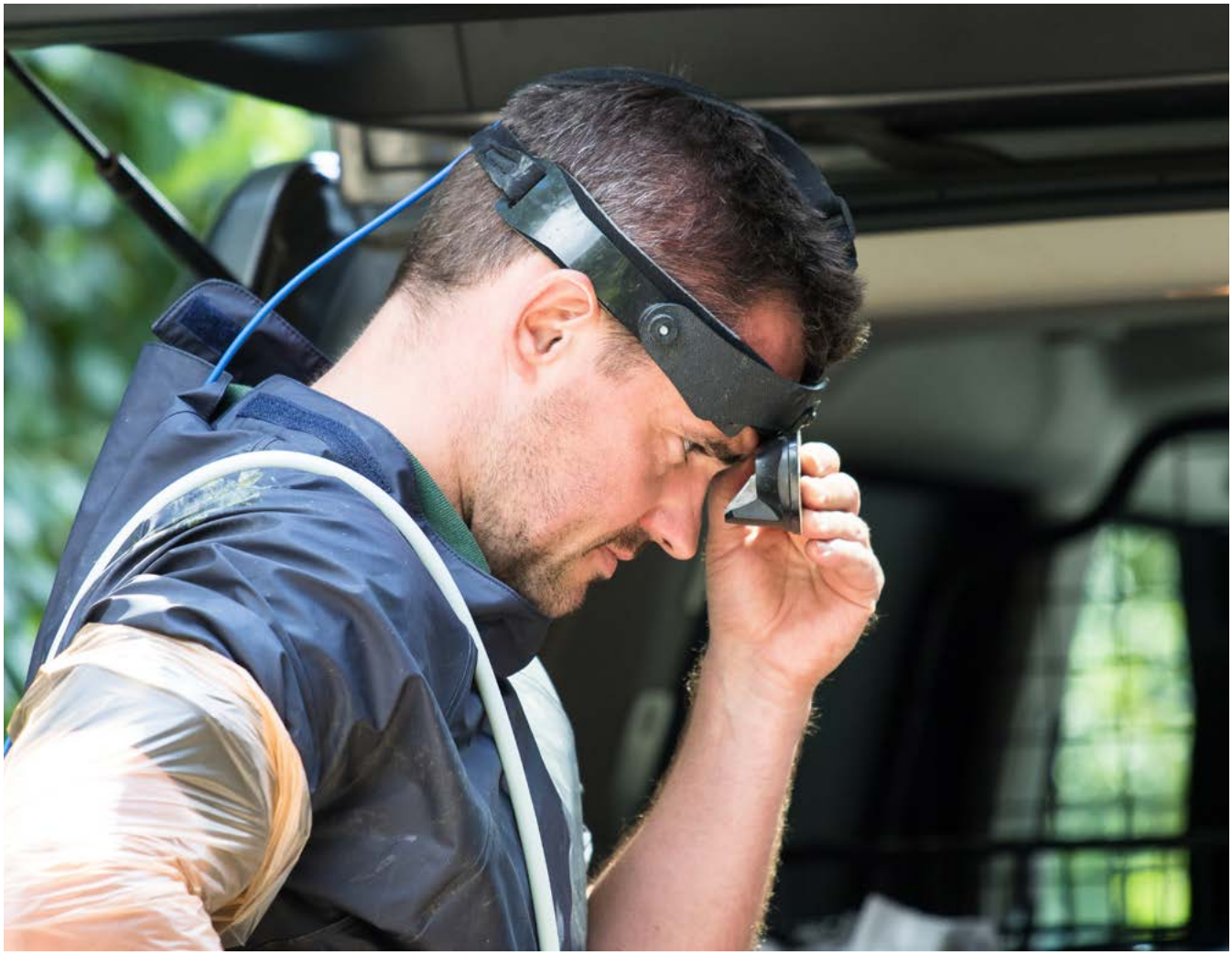
A general summary of testing-method performance

Each testing method has two performance specifications (Table 18). These can be used to help select the most suitable test to use at each testing point. The performance specifications for tests for pregnancy are:

- Sensitivity – the proportion of pregnant cows that return a positive test result
- Specificity – the proportion of empty cows that return a negative test result

Table 18. Pregnancy-test performance specifications, sensitivity and specificity

Test	Test sensitivity (finding pregnant cows)	Test specificity (finding empty cows)	Foetal ageing	Comment
Early manual/ultrasound	Good/Excellent	Excellent	Good	Requires an experienced operator and mating dates
Late manual	Excellent	Excellent	Inaccurate	Ageing is too inaccurate
Lab test	Excellent	Good	Does not measure	Assumes pregnant cows conceived to last service



Follow-up pregnancy testing

You need to plan follow-up pregnancy testing. This is recommended (especially where pregnancy testing is carried out early) because up to 10% of confirmed early pregnancies are subsequently lost. Consider re-examining cows diagnosed pregnant within six weeks of service at a later date to confirm that they have held.

Some cows confirmed pregnant by pregnancy testing may fail to calve. This is most likely to be due to abortion sometime after the PD. Where the rate of loss is higher than three to five abortions per 100 cows, a specific reason should be investigated.

Pregnancy-testing strategies

You need to select an appropriate method of pregnancy testing for each purpose and you also need to develop a pregnancy-testing strategy for the herd. This is because there is simply no single time for testing that will suit all cows in your herd.

There a number of different of pregnancy-testing strategies. For the most effective management and best data for analysing reproductive performance, opt for early pregnancy testing of every cow.

Options for organising pregnancy testing in a block-calving herd involves testing certain groups of cows at particular times, using an appropriate method.

Different strategies provide different amounts and quality of information. The keys to success for all pregnancy-testing strategies include discussing your information needs with the pregnancy tester and deciding the best date(s) to pregnancy test your herd.

This is the most accurate way to monitor reproductive performance, predict the upcoming calving pattern and milk production and plan drying-off activities. Regular pregnancy testing is the only appropriate strategy to use if bulls are run with the herd.

Cows for testing include:

- All cows mated more than a specified number of days ago (commonly 30–40 days)
- All cows eligible for service which are running with a bull
- Cows previously diagnosed pregnant but which you suspect may have been on heat and/or lost the pregnancy since then

Pregnancy-testing heifers

Early rectal pregnancy testing enables you to identify reproductive problems early and better plan your heifers' transition management.

It is not possible to provide the transition diet for the optimal three weeks before calving without early pregnancy testing, including foetal ageing where a bull is used. Most heifers do not bag up until much closer to calving.

It is a good idea to test all heifers at a maximum of 12 weeks after last service (or every 12 weeks until confirmed pregnant, where heifers are running with a bull). This can often be integrated easily with routine fertility visits for the adult herd. The more frequently heifers are included in the visit, the earlier you will be able to detect and treat any fertility abnormalities, but this increases costs.

Early rectal pregnancy testing also allows the reproductive performance of a group of heifers to be identified as soon as possible. Fertility in heifers can be monitored using a similar approach to that in the milking herd (see Measuring and monitoring chapter).

Ideally, more than 75% of eligible heifers (those past target breeding weight, or based on time of movement into the breeding group, and not already pregnant) should get pregnant within the first 21 days, then 90% within the first four weeks. Where performance is less than industry average (i.e. <70% calved within first four weeks), review:

- AHDB website, calf management
- Heifers weaning to calving chapter, page 29
- Heat detection chapter, page 38
- Genetics and sires chapter, page 49
- Artificial insemination chapter, page 51
- Bull management chapter, page 59

Managing transition and calving

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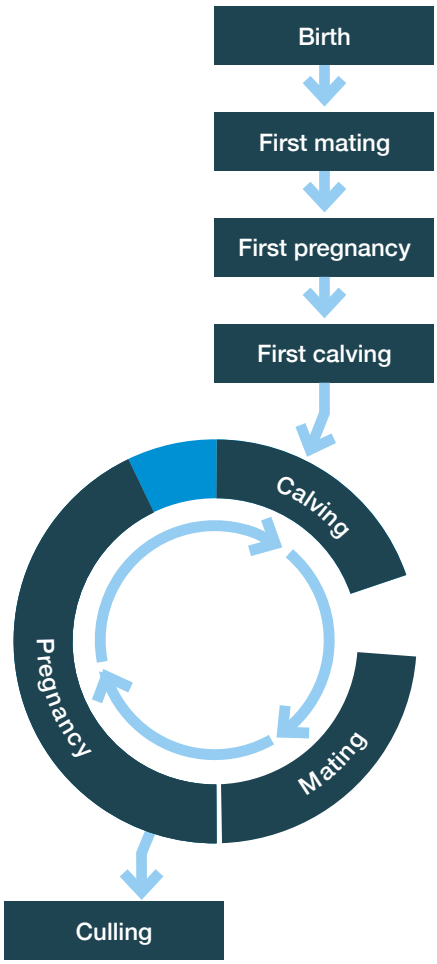
Managing transition and calving

Overview

Good transition management sets up the cow for a successful lactation. Ideally, after calving, she should have a low risk of metabolic disease, limited changes in body condition score and her uterus should quickly return to full health in order to accept the next pregnancy. In addition, her ovaries should be able to release fertile eggs (oocytes) as soon as possible during the next lactation.

Key points

- Ensure you have calculated how many spaces are needed for your dry cows – they should never be overstocked
- Have a dry-cow grouping strategy that takes into consideration encouraging intakes, allowing the appropriate diet to be fed and reducing stress for the cow
- A stress-free calving line will make things easier for the cow and the team
- Provide yourself and the team with the necessary training to know when to properly assist a calving and when to give nature a chance



From drying off to calving to early lactation

Good fertility management is all about a successful transition period. Get it right and the rest is relatively plain sailing. Get it wrong and the results can be catastrophic.

Important issues to consider during this phase include:

Dietary management

This is so important that this has its own chapter in the Forage First publication. In essence, cows need to maintain a steady body condition score after calving and should not be too fat at calving or mobilise fat excessively prior to calving. A cow also needs to have her rumen acclimatised to the milking cow ration so she does not suffer rumen acidosis after calving. Finally, minerals need to be considered, not least a strategy to avoid milk fever.

Immunity

Two things in particular take their toll on the immune system around calving. Firstly, hormonal changes mean immunity takes a dip, which is almost inevitable. Secondly, the metabolic challenge of increased milk production in early lactation often has an adverse effect. This means cows are more susceptible to infection immediately after calving. All infections can lower fertility. The dip in immunity must be mitigated against.

Uterine health

A lowered immunity, plus the fact that the uterus is open to the outside environment during and immediately after calving, can both contribute to uterine infection (metritis). Some low-grade infection is likely to occur in almost 100% of calving cows. How they respond to this and how quickly the uterus can return to good health are keys to fertility success. Good hygiene and a careful approach to calving reduces the severity of risk.

Stress

Social interactions are important for cows. Movement between environments and between groups, which is almost inevitable for all calving dairy cows, needs careful planning to reduce stress. Stress lowers immunity and reduces feed intakes, both leading to fertility problems.

Comfort

Giving birth is traumatic – even when it goes smoothly. Cows need extra-special care around calving to ensure they have optimal comfort. This means they should be able to eat, drink, lie down and get back up again as comfortably and easily as possible. If not, for example due to competition, overcrowding or unsuitable beds, they will not have good fertility when the time is right to serve them again.

Transition period key success points

Some people consider the transition period to be just three weeks before to three weeks after calving. While this is perhaps the most crucial time zone, the transition period really incorporates more than that. Figure 10 (overleaf) shows the different phases and the impact of each on fertility.

All problems in early lactation are interlinked: one problem leads to another, and all result in a slower start to normal cycling and getting back in calf.

Key areas for consideration during transition include:

Target lameness

Have a zero tolerance of lameness before calving. Make sure all feet are checked prior to drying off or immediately after drying off. Treat visible lesions, using foot blocks and NSAIDs for claw horn lesions (bruising, sole ulcer, white line disease) and individual topical treatments for digital dermatitis. Continue to monitor closely for new lame cows and treat immediately.

Reduce unnecessary movements of cows between groups

If a two-group dry period is adopted, move cows in at least pairs between groups. Dry cows off in small groups too so they are never introduced into a dry group by themselves. Setting one day a week for drying cows off and moving between groups is a sensible plan. After the first dry period, it might be preferable to have a shorter dry period (35–40 days) and keep cows in a single group. This cuts out a movement and also means a single diet can be fed.

Body condition score

Monitor (and record) body condition scores weekly and rumen fill scores daily. This allows early action when things are off target. Target rumen fill score for pre-calvers is at least 4.

Ensure there are enough water points

Always have at least two water points per group of dry cows. Provide 10 cm of linear water trough space per cow and always clean water. Dry cows don't have a very strong drive to eat and their diet can be less appetising compared with the lactating diet. A good supply of fresh water helps to improve feed intakes and maintain rumen fill.

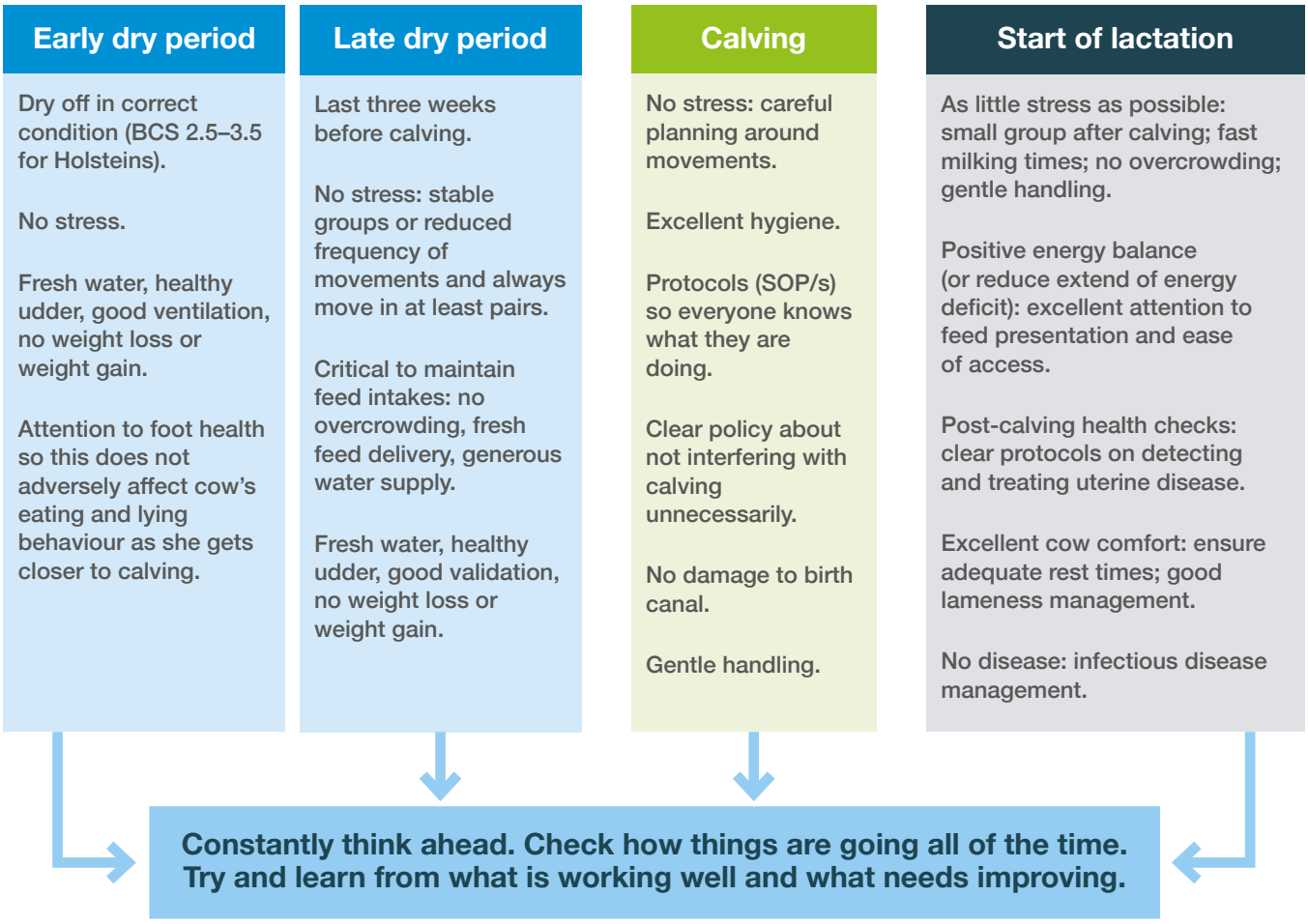


Figure 10. The phases of transition management

Correct diet for point of transition

Tailor the diet to the changing requirements of the cow as she gets closer to calving. Look out for poor palatability and low intakes of forages.

Watch for mineral shortages

For example, selenium, vitamin E and iodine. High-magnesium minerals, or DCAD minerals, coupled with restricted potassium, are often used as part of milk fever control. An alternative approach is to use a calcium binder pre-calving, followed by calcium supplementation immediately after calving.

Ensure there is enough feed space

Provide at least 75 cm feed space per cow during the dry period and at the start of lactation. More preferable still is 85 cm per cow. This helps ensure adequate feed intakes by reducing competition.

Loose and cubicle housing considerations

Provide at least 1 m^2 of lying space per 1,000 litres milk production per cow. For example, a 9,000-litre cow (305-day lactation) would require at least 9 m^2 lying space. She will need approximately a third as much again loafing area (hardstanding) near the feed and water.

If dry and fresh cows are housed in cubicles, these should be extra-wide and have deep soft beds with plenty of grip, such as deep sand.

Moving groups

Avoid moving cows 1–4 days prior to calving. Either move to a calving area 'just-in-time', only after second-stage labour has started (first water bag or feet showing), or avoid moving at all to calve. Alternatively, move to a dedicated calving area approximately one week or more before expected calving date.

Moving cows close to calving is likely to delay calving, which reduces calf viability, increases the risk of retained placenta and increases the chance that calving assistance will be required. Moving cows also reduces feed intake, which you should especially avoid at this critical time.

Provide warm water to fresh calvers

Give 15–20 litres of warm (tepid) water to the fresh-calved cow. This may contain a fresh cow additive. Commercially available additives often contain an energy source, a source of calcium, or both, and sometimes makes the drink more palatable.

Consider a calcium bolus for at-risk cows immediately after calving (e.g. lactation 3+). Even if clinical milk fever is not an issue, subclinical hypocalcaemia is common and can lead to slower expulsion of the placenta, general muscle weakness and a reduced appetite immediately after calving.

Dry-cow-grouping considerations

Planning ahead will make for more successful transition management. You will probably need to liaise with your nutritionist and vet too, to make the right decisions. Have you answers for these questions?

- How long a dry period do you intend to have? Will it be the same for all cows?
- How many dry cows do you need to cater for at any one time? How many spaces do you need for in-calf heifers and how soon before calving do you intend introducing them to the dry cows? (A minimum of four weeks is recommended, preferably 6–8 weeks)
- Do you intend to have a single dry group (and diet) or far-off and close-to groups?
- Do you intend housing all dry cows indoors?
- What building space do you have?
- Have you allowed for busy periods?
- Where do you intend to calve cows and heifers?
- How soon after calving will you move cows and heifers? What provisions do you intend to make for a 'special needs' group? Always consider that freshly calved cows and heifers will have special needs

Cows can be dried off in one or two blocks and kept in stable groups with other cows due to calve at a similar time. This reduces movements between groups and reduces stress. Otherwise, dry cows can be kept in one large stable group, with smaller cohorts of cows which are closer to calving being drafted into a calving group. Be careful not to move cows too near to the calving date.

Be careful not to overstock the calving group. This means you need adequate space to cater for the peak calving period.

If calving inside, there can be a far greater pressure on calving accommodation in block-calving herds. Bacteria and diseases can build up as the calving period progresses, so there needs to be a plan for regular cleaning. If cows are calved outside, they should be given a fresh break daily, back-fenced and you should not rely on just one calving paddock.

If outwintering dry cows on crops, special consideration needs to be given to their mineral requirements – for example, many crops are low in selenium, iodine and magnesium.

See our **outwintering video** on the AHDB Dairy website and YouTube channel for further information.

Heifers may be calved at the start of the block: this is best practice and a good approach. If they are moved into a smaller calving group, this has the advantage of reducing competition for feed from mature boss cows at a critical time and reduces stress.

Feeding considerations

Seasonal calving herds that feed concentrate post calving, should to introduce concentrate pre-calving, preferably at least 3 weeks before. As little as 1kg/head/day is enough to start the cows digestive system adjusting to this feed and prevent a whole host of problems post-calving that will occur if they are introduced to concentrate more abruptly. Concentrate feeds also provide a handy carrier vehicle to feed minerals to dry cows. Some herds also use this as a way of introducing the heifers to the milking shed by running them through to feed them. This provides an ideal opportunity to check udders and feet and teat spray or footbath if required.

Milk fever prevention is crucial for seasonal calvers – adequate magnesium supplement given to dry cows is key, and the best approach is to have multiple sources of magnesium i.e. in the feed and in the water. In high-risk animals e.g. older channel island breed cows, a magnesium bolus administered 3 weeks pre-calving can also be added to the regime.

Going from good to excellent

Keeping everyone informed

Figure 11. Clear signage for staff in a dry cow shed

- What do you do when you have calculated your correct space allowances and know how many dry spaces you can cater for in each shed?
- How can you be sure you never overstock your dry pens?

This dry-cow yard (straw pen) has been calculated to be sufficient for up to 30 cows (Figure 11). That is because there is 25 metres of feed space and there is a straw lying area of 274 m².

In this instance, the feed space is not the limiting factor (there would be sufficient space for 33 cows, at 75 cm per cow), but the lying space is. The herd

averages 9,000 litres (305-day yields), so it has been calculated that each cow should have 9 m² lying area (274 ÷ 9 = 30.4 cows).

The maximum limit for the shed is clearly written on a sign for everyone to see. In addition, this herd keeps Johne's-positive cows (red-tagged) in a separate dry group. There is a second notice to remind staff that this pen should not have Johne's-positive cows in it.

Stable dry groups, single dry groups and short dry periods

Research indicates that moving cows before calving reduces dry matter intakes at a crucial time and also delays the calving process. This in turn reduces calf viability and increases the risk of retained placenta. Subsequent fertility is reduced.

The policy you adopt will depend on the farm's individual circumstances, but some thought is required to work out what will be the best for your own herd. Reducing unnecessary movements can be achieved in the following ways.

Stable dry groups

In block calving herds, it may be possible to have several smaller (say 10–12 cows) stable dry cow social groups. Cows with a similar expected calving date are all dried off at the same time and kept as a stable social group, right up to calving (Figure 12).

Block-calving herds can achieve stable dry-cow groups. The more accurate your calving dates, the easier this is, so record-keeping and pregnancy testing cows early enough to be able to stage them is good practice. Some farmers find it useful to mark cows by period of calving with different tail tapes or tail paint.

Single dry groups and shorter dry periods

Many herds in the UK operate a two-group dry cow system: far-offs for around five weeks, and a close-to group, usually for around the last three weeks of pregnancy. A two-group dry cow system allows some flexibility, which may be useful, as two different diets can be fed.

Cows can be moved from one group to the next depending on expected calving date and other factors too. Cows known to be carrying twins, for example, or with low body condition score, can be moved sooner into the close-to group. However, the inherent additional movements associated with a two-group system, and the provision of two separate diets, can be negative.

A single dry group eliminates a move, and this is a good thing. However, a single diet for eight weeks runs the risk of far-offs getting too fat. It also becomes expensive if special minerals or supplements, such as a calcium binder, are being fed to all dry cows, when only the close-to cows really need it.

A solution which is gaining popularity in high-yielding year-round-calving herds is to reduce the dry period to around 40 days. Then a single ration and a single dry group becomes more achievable.

Research suggests there is no detriment to shorter dry periods, as long as it as least 35 days. There is some evidence that subsequent fertility can be better, and this is probably linked to single dry ration feeding (usually a high-fibre, controlled-energy ration). Done correctly, dry matter intakes can be higher in early lactation and body condition can be more stable after calving.

Note: Cows carrying twins are likely to have a shorter pregnancy, so if short dry periods are used, it is preferable to scan for twins at pregnancy diagnosis. Dry off cows known to be carrying twins at least a week earlier. Scanning for twins is not 100% accurate but is more reliable when carried out at 35–56 days post-service.

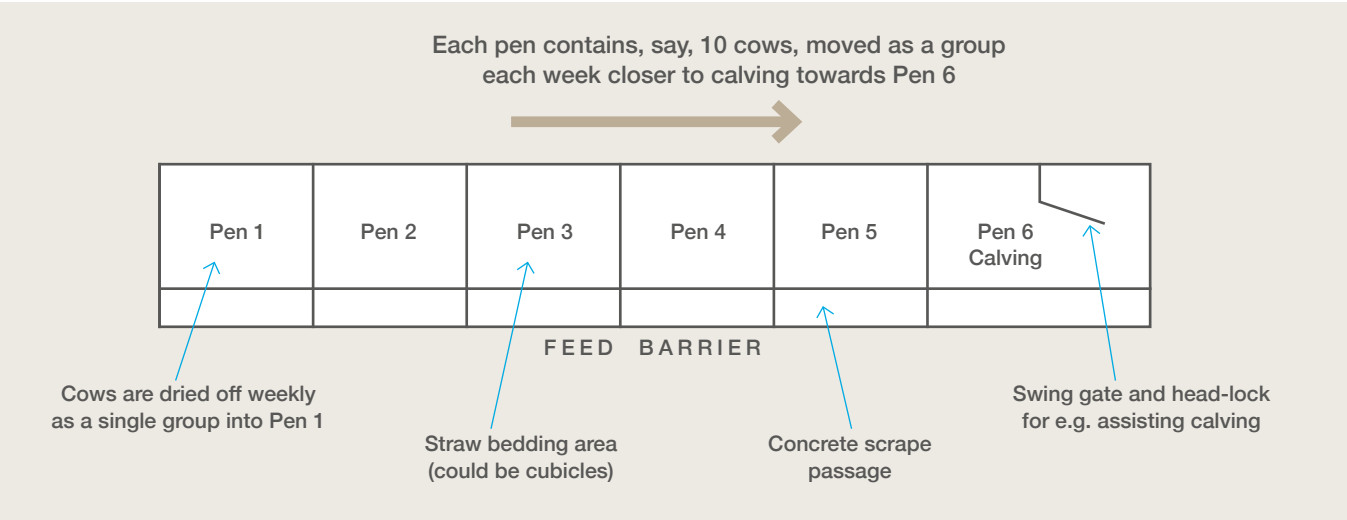


Figure 12. A stable dry-cow group system

Just-in-time calving

Moving cows into a calving pen 12–24 hours before calving, which is common practice in the UK, might not be the best thing to do, both for the cow or the calf. Some key issues of moving the cow at this point include:

- Reduces her feed intakes at a crucial time when good intakes are needed the most
- Carries a high risk of delaying the birth, which
- Increases the odds of calving difficulties and a retained placenta, which means
  - The cow will be harder to get back in calf again
  - Calf viability is likely to be reduced

What are the alternative options?

Option 1

Do not move cows into calving pens – let them calve where they are. e.g. outdoor calving paddocks or large straw yard

Pros

No move required: no social disruption. Easy.

Cons

The calving area is likely to be communal, increasing the risk of:

- Mis-mothering
- Calf being trodden on
- Build-up of bacteria
- Disease transmission (for example, Johne's, but also other diseases such as cryptosporidiosis)

Option 2

Move the cow into the calving area earlier – approximately a week before calving. Cows should be moved in at least pairs.

Pros

- May be suitable where loose housing is limited, for example only a small straw yard available
- Easier to keep within stocking limit of calving area (avoiding overcrowding)

Cons

- Communal calving area, with similar disadvantages to above
- Social disruption and reduced feed intake still occurs, albeit hopefully not delaying calving

Option 3

Just-in-time move at calving. This is moving the cow into an individual calving pen only once the feet or first water bag are showing. This is second-stage labour; the cervix will be fully open and pushing has started. Calving will proceed, regardless of the move.

Pros

- Can calve in a hygienic environment. Pen can be washed between cows: for example, rubber mattress floor
- No build-up of bacteria
- Close supervision of calving
- No risk of mis-mothering
- Can provide easy milking facility to harvest colostrum immediately after calving

Cons

- Need to have 24-hour supervision of calving cows
- Getting it wrong – cow may calve before being moved; for example, in the cubicles
- Close supervision may lead to overzealous calving assistance
- Not practical if cows need to be walked any distance to the calving area

Be wary of intending to operate a just-in-time calving policy, but moving cows at precisely the least favourable time: 12–24 hours before expected birth.

Useful targets for the special-needs pen

- At least 85 cm feed space per cow
- More than one water point. Either 10 cm linear water trough space per cow or one rapid drinker per 10 cows
- Loose housing: at least 1 m^2 bedded area per 1,000 litres milk, plus a third as much again hardstanding feeding/loafing area
- Deep bedded cubicles: 127–130 cm wide; 180 cm long beds, plus an unrestricted lunge space in front of the brisket locator (bob zone). This should be at least 155 cm if shared head-to-head cubicles, or at least 140 cm if against a wall (suitable for 700 kg cow)
- Milking time (time away from beds) of less than one hour per day
- Cows moved from fresh group into milkers in at least pairs
- Centrally located for good observation
- Capacity for at least 10–14 days' worth of calvings

Managing calving cows

Important factors to consider are:

- Avoiding assisted calvings
- Avoiding milk fever
- Cow comfort and welfare
- Getting the cow eating and drinking as quickly as possible after calving
- The most appropriate policy for removing the calf

Minimising the number of calvings that require assistance

When farmers are asked how many calvings they assist, the answers they give can be very different.

- One person's definition of 'assist' can be quite different to another's. We must avoid comparing pears with apples
- Breed of cow, breed of bull, choice of bull, nutrition, body condition score and parity number will all influence if the calf is too big. There are many factors which can lead to difficult calvings which are more likely to require assistance
- There is a very wide range to individuals' approach as to when to intervene. This makes it impossible to say what a 'normal' rate of assistance is. Certainly, some farmers assist less than 2% of calvings and others assist more than 20%. And let's define assistance here as any level of traction or manual guidance of the calf (in other words, not just those where a calving aid is used)

Assisted calvings, even minor, are associated with lower chances of conception and higher risk of cull.

What is certain is that cows which have received assistance at calving, for whatever reason, are less likely to conceive early, more likely to be empty at the next mating period and more likely to develop other health problems such as uterine infections.

It is important to:

- Reduce calving difficulties which **require** assistance
- Reduce unnecessary interference where assistance is **not** required

See the Genetics chapter on page 49 for further information on selecting sires for calving ease.

How to minimise calvings which require assistance

1. Select bulls with known PTAs for calving ease in your AI programme.
2. Use herd bulls with low breed-related risk for assisted calving when used on your herd.
3. Ensure replacement stock reach their liveweight targets at mating and at calving.
4. Have a transition management programme and transition diet that minimises milk fever.
5. Avoid overfat cows and heifers; in particular heifers, and in particular those which are too old at first calving (greater than 28 months).
6. Avoid delaying the calving process by moving cows at the wrong time.

Use AI sires with PTAs for calving ease. This will help you select suitable sires for heifers and smaller cows.

Use bulls with known Direct Calving Ease (DCE %, available for Friesian and Holstein sires). The scale is -3 to +3, centred on a breed average of zero. Positive figures indicate that calvings are predicted to be **easier** than normal.

For easier calvings, choose bulls which are between 0 to +3, with a minimum reliability of 60%, or a smaller breed that will naturally provide easy calving.

When is the right time to assist at calving?

Indicators that it is time to assist:

- Heifers not calved beyond 5–6 hours after first sign of straining
- Cows not calved beyond 3–4 hours after first sign of straining
- Calving has not occurred within 3–4 hours of the membranes rupturing
- Delivery has started and the calf is visible externally but the calf presentation appears abnormal
- Delivery has started and the calf has not been delivered within 30 minutes of being visible externally
- There is abnormal bloody discharge, or the discharge is smelly
- Abnormal signs of severe pain, such as sweating and prolonged bellowing

Do not intervene too early: give nature a chance.

If you are unsure about whether to intervene, ask yourself:

- Are you inclined to intervene too early?
- Could you alter anything about your behaviour to assist less often?
- What remote surveillance do you have in place for calving cows (e.g. CCTV, electronic alert systems)?
- Would you benefit from more calvings during the day by changing the time you feed your dry cows?
- Are all staff clear about when to assist and when to wait a little longer?

Feeding pre-calvers in late afternoon (instead of morning) leads to a higher proportion of cows calving during the daytime.

How to help cows calving

Has training been provided to all the people who need it?

When it is the right time to assist a cow calving, be clear about what to do with these key points:

- Be scrupulously hygienic. Wear arm-length gloves. Dry-wipe the area around the vulva with paper towels. If you are using calving ropes, these should be machine-washed between uses. Calving ropes which are not washed between cows are a common source of infection
- Use lots of lubricant. Proper obstetrical lube is far better than soap
- During a careful vaginal examination, check the presentation and the size of the calf. If there is a simple malpresentation, for example a head back, then correct before assisting the cow to deliver. Could there be twins? If you cannot easily correct a malpresentation or if the calf appears to be too big, then stop and call your vet
- How to check if the calf can be delivered: for normal presentations, feel the space over the calf's head and how the shoulders are lying with respect to the pelvic entrance. You should be able to slide your hand over the head comfortably If the head is not through the cervix yet, either you are too early or you should call the vet
- You should also vaginally examine any cow that you are unsure of having calved, for example she may have afterbirth showing and you have not found the calf to confirm calving. Cows that continue to strain after having one calf should also be examined. Twins are not uncommon
- Use good-quality calving ropes on each leg and, for normal, front-feet-first deliveries, a head rope too. The loop of this needs to be placed behind the ears and in the mouth
- Know when to stop and call the vet. If no progress is being made after approximately 10–15 minutes of steady gentle traction, equivalent to two adults pulling, in harmony with the mother's contractions, there is a high possibility that a caesarean will be required. Success of surgery is generally high but is much lower if the decision is delayed or after protracted excessive pressure has been applied

Remember

- If you assist too early, the cervix and vagina may not be fully dilated. You risk trauma and pain to the cow and calf as it is harder to extract a calf when the cow is not ready to deliver
- A calving aid should only be used by competent, trained persons. It is a potentially dangerous piece of equipment capable of causing immense damage. Considerable skill is required for its correct use and this means first being trained
- Record all cows that you assist. These cows are at increased risk of infection and of reduced reproductive performance at the subsequent mating. They should be flagged for a pre-mating vaginal examination

Dealing with a high level of calving difficulty

Sometimes, a run of difficult calvings occurs. For example, a batch of heifers which are in calf to a stock bull which is giving large calves, or another unsuitable sire choice. Check:

- Mineral supplementation: low iodine in heifers is common and leads to high levels of stillbirth. Low calcium in cows is common (subclinical milk fever) and delays natural calving
- Can other cows/ heifers in the batch be induced to calve a little earlier? You need to discuss this with your vet, as induction also carries a higher risk of retained placenta and lower subsequent fertility. Induction is not always suitable (more so with reliable and accurate calving dates), but it can be the better option than a series of very difficult births

Case studies – Calving, what would you do?

Case study 1: A heifer with a difficult calving

This heifer had been calving for four hours with no progress. The farmer did a vaginal examination and found the calf was normally presented but was already dead (with a slight smell). The calf was not large but the cervix was still not fully dilated. The heifer's straining efforts were becoming progressively less. What is happening? What should you do?

Happening: The heifer is aborting a near-term calf, which means that it is near fully grown but the birth canal has not softened. The calving is not progressing. This heifer will need assistance.

To do: As the birth canal has not dilated, the vet should be called. The heifer is likely to require considerable assistance, possibly with an episiotomy (surgical cut) and definitely an epidural anaesthetic. This is certainly a job for a vet.

Case study 2: The busy calving pen

Ken has a herd of 200 Holstein-Friesians. He wakes on Monday morning to find two cows in the calving pen have calved overnight. What do you see? What could be improved?

See: one of the calved cows is flat on her side. She needs checking for milk fever (can she get up?), nerve damage, or other disorder, such as toxic mastitis. The pen is overcrowded and clearly exceeds the required minimum lying space of 10 m²/cow, plus loafing area.

Could be improved: more calving space is needed for the farm. This pen is likely to significantly raise the risk of mastitis and uterine infection, both of which will severely affect fertility. If clinical milk fever occurs in over 5% of adult cow calvings, a plan must be put in place to reduce this.

Going from good to excellent

Communal calving yard with milking facility

This is the close-to dry pen of a 200-cow AYR Holstein herd, averaging 11,000 litres per 365 days. It is not practical to operate a just-in-time calving policy, so cows calve in the pen. The lying area allocated per cow is at least 11 m² and the pen is never overstocked. There is a swing gate in one corner, with a milking machine above, so cows can be milked in the pen if necessary.

The pen is cleaned out every two weeks and bedded with fresh straw daily. There is a stone base beneath the straw to aid drainage and provide extra grip after cleaning out. There are multiple water points (rapid drinkers), which are checked for cleanliness and operation daily. Fresh feed is provided daily and particular attention is paid to monitoring rumen fill.

The farm uses quarterly whole-herd Johne's testing using milk. High-risk cows are calved in a separate pen to reduce the risk of contaminating the main calving area with Johne's bacteria.

Case study 3: The fresh-calved heifer

What does this newly calved heifer tell you about her transition? What should you do?

See: she has sound hocks and legs, and has clearly passed her placenta. However, she has a poorly filled rumen and the calving pen is dirty. This puts her at greater risk of metritis.

To do: She should be offered a bucket of warm water to drink (+/- fresh cow supplement or powders). Her colostrum should be milked from her as soon as possible and she should be watched carefully to make sure she eats, drinks and lies down enough over the coming days.

What are the rumen fill scores like in the pre-calvers? Is any attention needed here to improve dry matter intakes?

Post-calving management

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Post-calving management

Overview

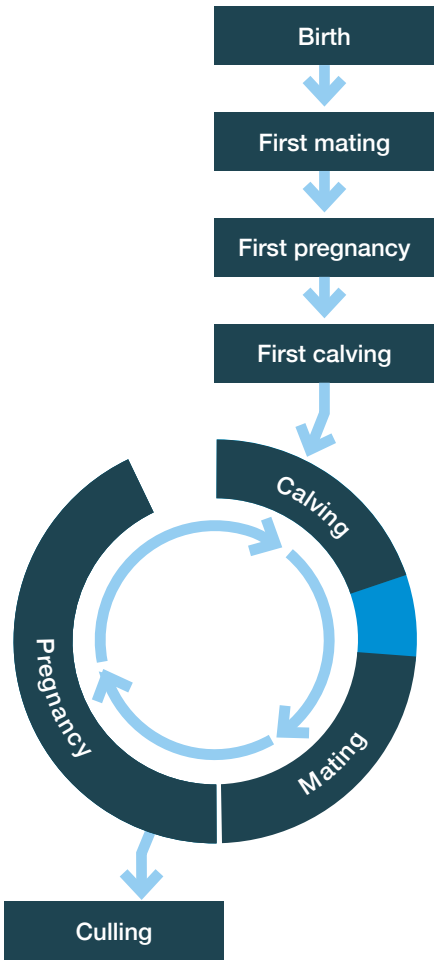
Everyone's focus must be on reducing problems after calving; this is why transition management and nutrition are so important. However, health problems of some description will occur – unfortunately, in around 25% of calving cows.

It is good to know how to measure yourself against targets so you can put in place measures to correct things that are wrong. It is also good to have protocols for dealing with problems.

The VWP gives time for the reproductive organs to recover, ready for the next pregnancy. Cows with any health problems in this period are likely to have a reduced chance of becoming pregnant again.

Key points

- The cow should have her first heat by day 8–14 after calving. This is often a silent heat
- The first observable heat should be by day 35
- Less than 10% of cows require treatment for uterine disease
- Less than 1 in 200 cows (0.5%) has uterine disease detected for the first time beyond day 70, or at PD. Otherwise this indicates your early-warning systems are not good enough
- Less than 5% of cows intended for service fail to get in calf by day 200 post-partum



Important issues to consider post-calving

Monitoring

Define disorders carefully and have in place a simple recording system which works for your farm. Review performance regularly with your advisers to know where you can improve.

Health checks

Decide with your vet the best approach for checking fresh-cow health. There are many options – choose the one which is right for your circumstances. There is a risk of both over- and under-treatment if health checks are not at the right timing, or frequency, or when protocols are not suitable.

Stockmanship

Good stockmanship during this period is important in two regards – observation to detect cows requiring treatment or attention, and correct handling to reduce stress. Fresh cows are likely to require more during this phase than later in lactation. Stockmanship training is very useful to improve observation skills and to learn correct cow handling.

Treatment protocols

Adopt a logical approach to dealing with the common disorders, such as retained placenta. Treatment protocols should always be devised by the vet. Good protocols and good training mean that complicated decisions need not be taken in a rush.

Using standard operating procedures is more likely to ensure work is quick, easy, enjoyable and efficient. When everyone knows what to do, there is less panic, less stress and less chance of making bad decisions. And cows are more likely to get back in calf on time.

Targets for good health after calving

Problem	Trigger for action	Immediate action	Prevention
Calvings requiring assistance (even minor assistance)	> 3%	Seek veterinary attention. There may be an issue which can be partially resolved immediately, such as underlying mineral imbalance. Your vet may recommend induction if there is a risk of oversized calves Schedule a post-calving vet check for metritis and vaginal damage in cows which have required assistance	Select easy-calving proven sires. Avoid unknown bulls on heifers and choose small breeds (e.g. Angus or Jersey) Ensure replacements reach target weights, not become overfat. Plan transition cow management to avoid milk fever
Retained foetal membranes (RFM = membranes visible the day after calving. It is abnormal if a cow has not passed the placenta after six hours)	> 6%	On the day after calving, cut the membranes off below the vulva. Do not pull on membranes or attempt to remove manually. Schedule a post-calving vet check for metritis after 14 days	Minimise assisted calvings. Seek vet advice to investigate causes, such as ketosis or fat mobilisation. Plan transition cow management to avoid ketosis and milk fever Ensure adequate dry-cow minerals. A strong reason for RFM is that the cow has an impaired immune system. A healthy immune system is necessary for normal detachment of membranes
Vaginal discharge (abnormal discharge more than 14 days after calving, on vaginal examination)	> 10%	Consult your vet for a treatment plan Cows which are sick (high temperature) require immediate attention	Investigate causes with your vet (similar to RFM)
Displaced abomasum	< 2%	Suspected cases require vet attention within 24 hours	Give attention to transition cow management
Milk fever (including wobbly cows given preventive treatment before becoming full-blown cases)	> 3% (1 case per 30 cow calvings) EXCLUDING HEIFERS	Treat affected cases. Consult your vet to investigate immediate protocol changes, such as administering oral calcium to all at-risk cows immediately after calving	Review your transition cow management and milk fever control strategy. Utilise external expertise, such as your vet and nutritionist. That is their job
Clinical mastitis (first 30 days after calving)	> 1 case per 12 cows calving (8%)	Likely to be dry period infection. Attention to dry-cow stocking rates, hygiene of calving area and dry-cow pens	Use internal teat sealants (if not already) Review dry-off procedures. Use the ***Mastitis control plan*** factsheet **Important:** Mastitis reduces fertility
Lameness (proportion of cows showing any degree of favouring one or more feet)	> 1 cow in 7 (15%) mobility score 2 or mobility score 3	Treat cases as soon as possible, with the help of a vet or a licensed foot trimmer. Use painkillers and blocks. Poorer fertility is one of the biggest financial impacts of lameness	Know what is causing lameness and have a plan to reduce and control it Use the AHDB Healthy Feet Programme resources
Other health problems (such as clinical ketosis)	> 5%	Any health problems that cause body condition loss in early lactation can indirectly affect reproductive performance, e.g. ketosis and sub-acute ruminal acidosis (SARA) Other problems, such as cystic ovaries, can affect reproductive performance more directly. Seek professional assistance for treatment and prevention when these types of problems occur	

Use the ***Fresh Cow Health Recording Sheet*** to monitor your herd's health post-calving.

Understanding high-risk cows for uterine infection

At calving, the cervix opens and bacteria can get into the uterus. Research shows that almost all cows will have some bacterial contamination. However, not all develop disease. Why is this so?

Metritis, endometritis and subclinical endometritis

Uterine infection is classified into metritis, endometritis and subclinical endometritis. All three conditions are interlinked and all significantly reduce fertility. Severe metritis can result in a very sick cow, but most cases are less severe and often resolve by first developing into endometritis. Subclinical endometritis is also very common, where there is infection present which reduces fertility, but there are no obvious signs or abnormal discharge.

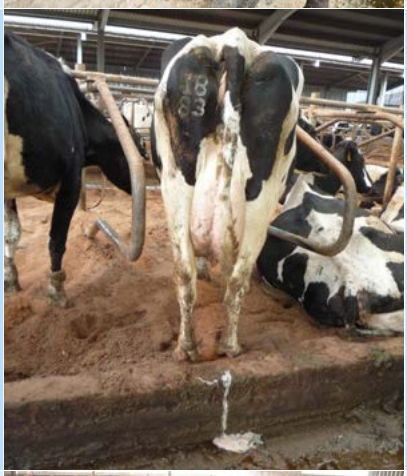
There are no universally agreed and precise definitions of the different degrees of uterine infection. In general, metritis is the more severe condition, occurring more immediately after calving, which often progresses to endometritis and/or subclinical endometritis, and hopefully, eventually to a healthy uterus. However, animals don't always follow the textbook, and there are no hard and fast rules. Table 19 gives an overview of the different conditions.

High-risk cows

There are several factors which increase the risk of a uterine infection being severe enough to reduce fertility:

- Difficult calvings. A damaged and bruised birth canal has much higher risk of infection. Local immunity is lowered and there is more chance of significant bacterial contamination

Table 19. Examples and definitions of uterine disease

Condition	Image example	Definition and symptoms
Metritis		Metritis can occur from calving up to day 21 post-partum[3] Grade 1: enlarged uterus, red/brown foetid discharge (bad smell) Grade 2: as Grade 1, but cow has a temperature and may show other signs of sickness Grade 3: cow is toxic (e.g. cold extremities, sunken-eyed, collapsed). The infection has got into her system and she may die, particularly if not treated appropriately
Endometritis		Occurs from day 21 post-partum[3] and is characterised by a purulent discharge, which can be detected by vaginal examination. Some people classify grades of endometritis depending on the thickness, colour and amount of discharge. Commonly known as whites The cow will not be sick, or have a high temperature
Subclinical endometritis		This is inflammation of the uterine lining. It is associated with a significant reduction in reproductive performance. However, there is no discharge and diagnosis can only be made by taking uterine swabs or biopsies. Strictly, it is defined by a certain abnormal level of white blood cells in the uterine wall The cow will not be sick or have a high temperature

[3] Sheldon et al, 2009. Defining postpartum uterine disease and the mechanisms of infection and immunity in the female reproductive tract in cattle.

- Assisted calvings. This is not necessarily the same thing as a difficult calving. Any assistance increases the risk of infection and it is why it is important to avoid unnecessary assistance or interference during a normal birthing process
- Retained foetal membranes (RFM). This is a complex disease process. Clearly, membranes hanging from the uterus can act like a wick for infection and, when they rot, bacteria are usually involved. However, the fact the cow failed to expel her placenta in the first place means there is already some problem, usually including an immune system that isn't working properly. This is the second reason why there is a very strong association between RFM and metritis/endometritis
- Dead calves/stillbirths
- Abortions
- Twins

Any cow which suffers any of the above should be targeted for a post-calving check by the vet.

High-risk cows have over twice the level of metritis at 14 days post-partum compared with other cows. Cows with metritis at day 14 are three times as likely to be culled for not getting back in calf.[4]

Strategies for post-calving checks

Post-calving checks are designed to help ensure the cow – particularly her reproductive organs – is in good working order before the end of the VWP. This is so she has the best chance of getting back in calf.

Failure to diagnose a uterine problem (needing treatment) early wastes good cows. But overdiagnosis of problems which don't require treatment is expensive and wastes antibiotics. Finding the correct balance is a skill and requires expertise.

There is no single strategy which is suitable for every farm. You must tailor your post-calving checks to your requirements and to your herd's risk. Figure 13 shows the typical proportion of cows with the different uterine diseases in the first 10 weeks post-partum.

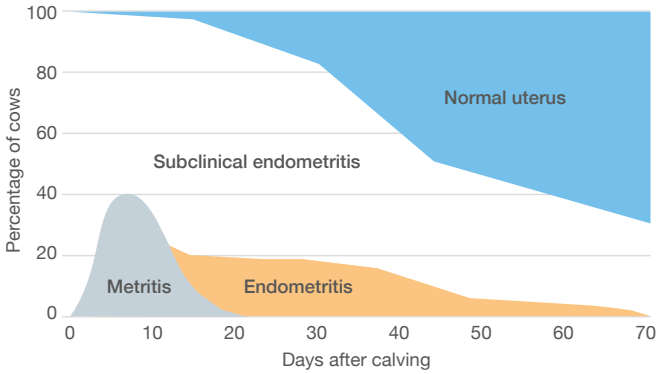


Figure 13. Fertility process for improvement

Every farm and every cow will be different. So, while nearly all cows start off with some degree of inflammation of the uterus, typically, by 70 days post-partum, only around 30% of cows have inflammation (subclinical endometritis) and very few have endometritis (an actual discharge).

By day 50, usually the end of the VWP, around 7% of cows have endometritis (virtually no chance of getting in calf yet) and only 50% of cows have a perfectly healthy uterus. If the uterus is not perfectly healthy, the chances of pregnancy will be lower.

The proportion of cows with a healthy uterus varies, however, from farm to farm, depending on:

- The proportion of cows which start off with uterine infection (e.g. the number of high-risk cows)
- The rate of self-cure (which will depend on general health, nutrition and stress within the herd)
- The rate of treatment cure (which will depend on how good the treatments are; how efficient the farm is at finding cows which will benefit from treatment; and how soon treatment begins)

Table 20 outlines some typical herd protocols for post-calving checks

[4] Based on research by Dubuc et al, 2010: Canadian all-year calving Holstein herds. Final in-calf rate for non-infected cows was 88%; final in-calf rate for cows with metritis at day 14 was 61%.

Table 20. Protocols for post-calving checks

Protocol	Advantages	Disadvantages and considerations
Post-calving temperature checks	High detection rate of cows with possible abnormality Low level of skill required Low risk of uterine contamination (no vaginal examination)	Cows may have a high temperature but be clinically normal. Fresh-calved cows can have high rectal temperature due to local inflammation after calving May lead to overtreatment High temperature may be due to something else (e.g. mastitis) Regular temperature checks can result in long lock-up times for fresh calvers and this may be detrimental to their health and lying times Consider when to take temperatures in relation to the calving date e.g. once a week for all cows calved less than three weeks? Every day for all fresh calvers in first week?
Every cow has a vaginal examination after calving, at a certain time point	More specific test than rectal temperature Degree of infection can be assessed (e.g. endometritis scores) No cow should be missed: high detection level Simple: no records required to classify cows as high risk or low risk Allows for early intervention, if done soon enough after calving (e.g. after day 14, or day 21)	May result in overtreatment Requires skill. Done with poor technique, a vaginal examination may introduce infection to an otherwise healthy uterus If cows are examined too soon after calving, it can be difficult to assess healthy (normal) versus unhealthy (abnormal) discharge Needs to be done soon enough after calving to allow time for treatment to take effect before service period begins (or end of voluntary waiting period)
Targeted checks (e.g. vaginal examination) for high-risk cows	May be more cost-effective than checking every cow May reduce risk of infecting healthy cows (not subjected to vaginal examination) Allows for very early intervention if done soon enough after calving (e.g. next available vet fertility visit after calving) Targets cows which have a lower chance of self-cure and thus more targeted use of resources and treatment medicines	Requires higher levels of skill and judgement (vet diagnosis) Requires organisation and record-keeping to know high-risk cows Risks missing some cows requiring treatment, particularly if records are poor and risk-scoring of cows is inadequate
Cows with observed vaginal discharge are checked	Simple Reduces possibility of overtreatment Allows for very early intervention if done soon enough after calving (e.g. next available vet fertility visit after calving) Targets cows which have a lower chance of self-cure, and thus more targeted use of resources and treatment medicines	
Cows are only checked if no heat observed by a certain period after calving	Simple Relies heavily on self-cure Reduces chance of overtreatment	Many cows will slip under the net and not be treated soon enough Likely to result in higher failure-to-conceive and culling rates Some cows will have a heat but still have uterine disease which may benefit from treatment Will work better if intervention (non-bulling check) is done before end of voluntary waiting period/before start of service period, for example, from 35 days post-calving
No checks	Simple Reduced risk of overtreatment	Likely to have very high cow wastage in most herds May be suitable for herds with genuinely very low levels of uterine disease and very high self-cure rates (e.g. low-yielding, high-health herds)

Finding the correct balance for your farm

Protocols are about having a standard approach. All good businesses know when they should use external expertise to help them develop their protocols and where to go to find that external expertise. Modern farm vets are trained in these kinds of skills. A vast part of veterinary education is learning data analysis, disease risks and other aspects of patterns of disease and health.

It would be foolish to imagine that the most valuable use of your vet is in treating sick cows which you present for them. Actually, it is in analysing your data (even if it is very patchy initially) and developing the correct protocols which are right for your farm – and then continuing to monitor, analyse and refine. This is the way the veterinary profession has been moving. It is the way vets can bring best value to your business, because it results in better health, higher efficiency and more profit.

Figure 14 shows that there is a balance between neglect (underdiagnosis) and overtreating (overdiagnosis) when it comes to uterine health. Both extremes lead to poor economic efficiency. Use a good veterinary adviser to find where the balance lies between the two.

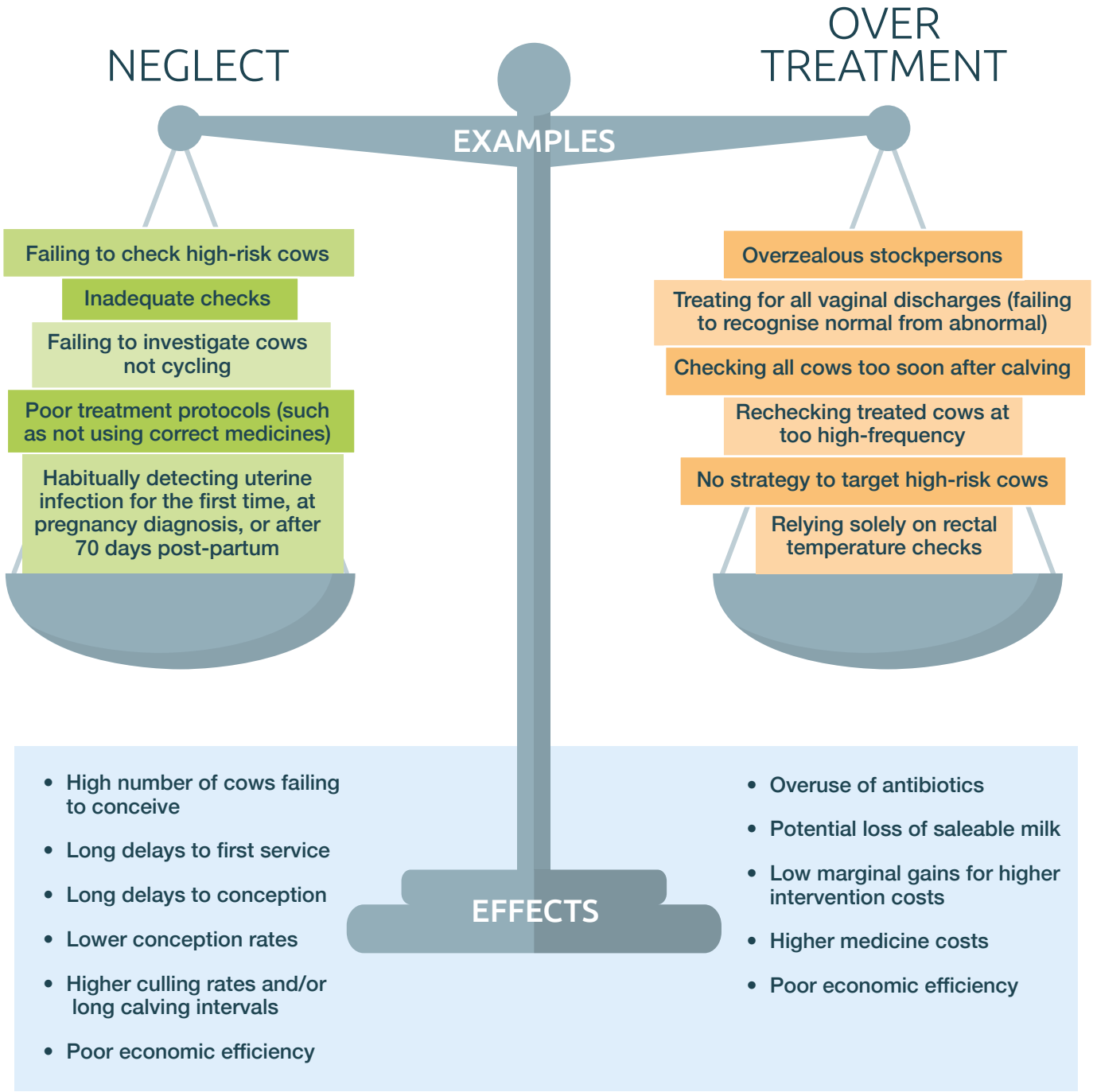


Figure 14. Finding the balance of post-calving management

Case study – post-calving protocols

Going from good to excellent

Liz and Nick Haines run Hardwick Farm, their 330 cow, spring calving herd in Shropshire. Liz is one of our current AHDB Dairy board members.

Protocols have been put in place for staff to ensure they achieve excellent rates of fertility and post-calving health to keep their block tight.

We have always Metrichecked our herd, it has been very useful for picking out cows with whites which we may not have seen otherwise. Some people don't Metricheck every cow, but we aren't achieving a low enough level of retained cleansings yet to have the confidence not to check them all. We use beef bulls and this results in a larger number of cows with calving issues, which is another reason why Metrichecking is important for us.

For the cows calving early in the block, we give them 3–4 weeks before Metrichecking. With later calvers, it can be as soon as two weeks after calving, as they have less recovery time before the start of mating. Recording any cows that have had issues at calving, e.g. milk fever, hard calving, retained cleansing, is essential.

People skills for post-calving management

Staff training for post-calving health should focus on:

- Knowing and recording high-risk cows
- Recognising and defining abnormalities. For example, a retained placenta beyond six hours is abnormal
- Recognising abnormal vaginal discharge, compared with normal discharge
- Post-calving checks, if these are to be done by staff
- Monitoring and recording heats
- Gently handling cows: post-partum cows are handled relatively more frequently than others in the herd and they are the most vulnerable, for example for lameness and long standing times
- Care of the fresh-calved cow, e.g. providing warm water to drink immediately after calving; importance of good access to fresh feed; importance of cow comfort, adequate rest and low stress

For further resources in this area, see the AHDB Healthy Feet Programme and also the Managing transition and calving chapter in this guide (page 77).

Making culling decisions

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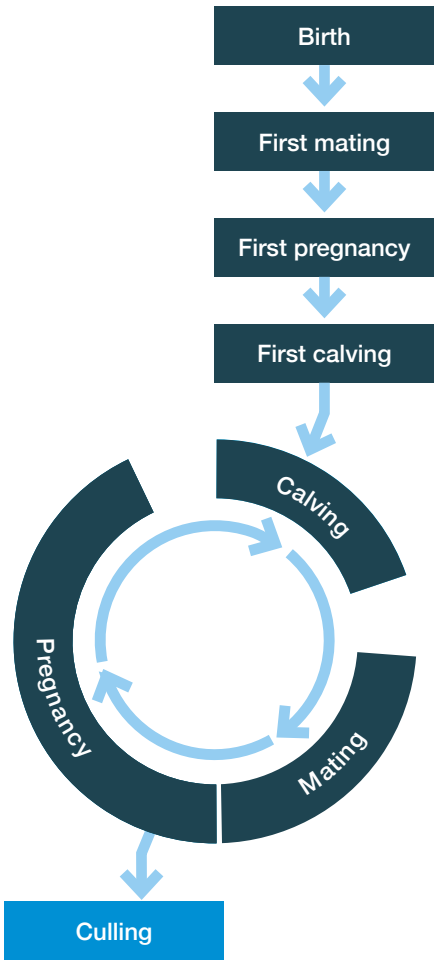
Making culling decisions

Overview

The fertility performance of a herd must always be viewed alongside its culling figures. The two are inevitably linked.

Key points

- Culling is an important component of maintaining herd reproductive performance
- Excessive culling is costly. You need to minimise the number of culls required through effective reproductive management
- You need a system for ranking and identifying cows for culling



Understanding the effect of culling decisions on overall profitability

Targets for culls and deaths

The fertility performance of a herd must always be viewed alongside its culling figures. The two are inevitably linked (see Table 21).

Table 21. Link between fertility performance and cull rates

Targets	Seek help	Top performers
Cull rate (% of peak number of cows in milk)	> 20%	< 15%
Culls due to not-in-calf	> 15%	< 7%
Died or culled on farm	> 5%	< 1%
Average age of cull (years)	< 7	> 8.5
Average lifetime production (litres or kg solids)	< 25,000 l or < 1,900 kg	> 32,000 l or > 2,700 kg

The fertility performance of a herd must always be viewed alongside its culling figures. The two are inevitably linked.

Good fertility figures can be achieved at the expense of an unsustainably high culling rate. Alternatively, sticking to an unrealistically low cull rate (replacement rate) can be a false economy.

If it is done at the expense of lengthening the calving interval, then the economics simply won't add up. Furthermore, keeping cows which don't get back in calf can store up further problems for you along the line.

Fertility performance can't be viewed in isolation from culling figures: one influences the other. Both affect overall production efficiency and the economics of your farm.

Important issues to consider

Important issues to consider with culling decisions include:

Overall lifetime performance
Average whole-life daily yields are a key driver of economic efficiency and, without doubt, the average age of cull cows (i.e. their longevity in the herd) will influence this figure.

Availability of replacements
A closed herd will be entirely dependent on what replacement heifers it has in the pipeline. If the herd plans to expand, it puts extra pressure on controlling culling rates. It makes sense to rear slightly more replacements than you plan to need.

Cull values

Are your cull cows high value (fit barrens), or low value (thin cows, lame cows and on-farm deaths/casualties)?

Swap price

This is the difference between the value of your cull cows and the cost of a replacement, whether bought-in or home-reared. Clearly, your cull-cow values will greatly affect the average swap price for your herd.

Breaking old habits

Controlling production costs while maximising income is a priority for any dairy farmer and culling rates can significantly impact dairy-herd profitability.

It is the role of the management team to critically evaluate their culling and replacement strategy and decide if this is fit for purpose by asking the following questions:

- What do we want to achieve?
- What are we currently doing?
- What is working well and what could be working better?
- What if we tried this – benefits/consequences?

This will generate a targeted plan aimed at maximising income and putting you in control of the choices you make.

When something isn't working and you are not getting the results you want – or even worse, losing money – it is tempting to put in a quick fix, or resist any sort of change and just bury your head. When you are faced with this situation, remember the following quote:

"If you always do what you've always done, you will always get what you've always got."

Culling rate and lifetime daily yields

Lifetime daily yield (LDY) is the total milk a cow gives in her lifetime divided by her age when she leaves the herd as a cull (measured in days). Cows which leave the herd to milk in other herds and premature TB culls should be excluded.

It is a good measure to look at, as it is affected by heifer rearing, mastitis, fertility, lameness, infectious disease and nutrition. It is therefore an indicator of overall performance that can be checked before digging down into data to identify areas which can be improved.

National milk recording data shows the top 10% of herds average an LDY of around 15 litres per day and the bottom 10% only 6 litres per day. This is clearly a huge variation and accounts for the greatest part of

the variation in farm profitability. The average of all recorded herds is around 11.5 litres per day.

Lifetime yield is a similar measure, comprising longevity and production. A cow can achieve a lifetime yield of 40,000 litres as either:

- 5 lactations of 8,000 litres
- 8 lactations of 5,000 litres

There is a known negative correlation between longevity and lactation yield within a herd: higher-yielding cows generally live shorter lives within the same herd than lower-yielding herd mates. However, a Northern Ireland study showed this correlation does not occur between different herds. The top-performing herds achieve excellent lifetime yields through good longevity and good yields in all their cows.

Figure 15 shows the performance of herds in a recent UK study. It can be seen that the herds which had a longer productive life are in the top 10% performers and this is irrespective of lactation yields. A longer productive life is achieved through:

- Reducing age at first calving (youngstock management)
- Raising longevity (herd health, controlling the culling rate)

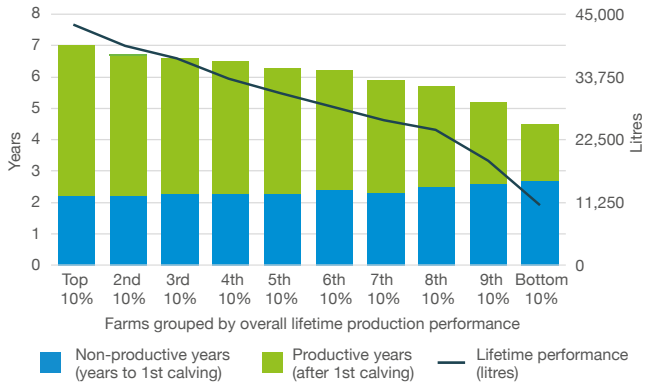


Figure 15. Comparison of lifetime yields and production performance in UK herds

The data represented in this graph presents a persuasive argument to pursue longevity (good health and low culling rates) rather than yields alone, to achieve good efficiency and profitability. The top-performing herds had a low average age at first calving and long-living cows.

Lifetime yield doesn't reflect the inputs necessary to achieve the output, i.e. the cost of production. Therefore, while the measure is a reasonable indicator of overall health and production performance, you should also examine inputs such as feed costs, to give a more accurate economic performance assessment.

LDY partly achieves this and is a useful within-farm benchmark, on the assumption that total overheads per cow per day remain largely stable, but between farms, overheads per cow per day are very variable, so the measure has its limits for between-farm comparisons.

For farms of similar types (e.g. low input, spring block calvers, or high input AYR Holstein herds), it becomes more reasonable to make between farm comparisons of LDY. Bear in mind that for flying herds relying on bought-in replacements, the date at first calving may be beyond their control and this does affect LDY.

Is a low culling rate always a good thing?

A low cull rate represents low wastage, high longevity and good lifetime yields. This is a major determinant of profitability. A low cull rate can be a good indicator of good health.

There are instances when pursuing a low culling rate, at the expense of all other factors, can be a false economy:

- Persisting to serve cows at the expense of keeping a tight calving block will lead to less milk solids sold per cow per day and lower efficiency
- Mastitic cows, chronically lame cows and high-cell-count cows should not be kept in the herd to keep a low culling rate. It is simply not efficient to keep these broken cows. It is also clearly not kind to keep cows in the herd if they are in chronic pain. As well as culling, it is essential to ensure measures are in place to prevent more cows becoming broken and taking their place

What is a normal cull rate?

In GB, a typical culling rate is around 25%, but there is a wide variation.

Lower-yielding herds (e.g. block calving) tend to have slightly lower culling rates and higher-yielding (e.g. fully housed) tend to have slightly higher culling rates. But this is not a universal rule.

In the USA, a typical culling rate is around 35–40%. In New Zealand, it is around 15%. It is interesting to consider why normal in one country is not normal in another. Part of the reason is probably what people accept (a cultural difference) and part is the difference in swap prices. In the USA, cull cows have a greater value for meat compared with UK and New Zealand. On many USA farms, the heifer lactation yields exceed the cow lactation yields, so a high cull rate has become normal. With GB's higher swap price, regular cull rates of this magnitude would be unsustainable. In New Zealand, where cull beef prices are lower, if a farm had 25% of its herd sent to the meat factory each year, it might not be in business for very long.

Closed herds can have cull rates limited by the supply of replacement heifers. This can make culling decisions more difficult; it is better to budget for a greater number of replacements than you are likely to need. Ideally, surplus cows can be sold as milkers in other herds.

Calculating the swap price and the net culling cost for your herd

Swap price – the difference between the value of your cull cows and the cost of a replacement.

For 12 complete months, calculate the overall cost of all new heifers, or cows added to the herd. If heifers are home-reared, allocate a fair market price per heifer, or your own calculated cost if you know it. This is Figure A.

For the same 12 months, find the real overall sale values for ALL adult cows which left the herd, dead or alive. Include a minus value for any on-farm losses where you paid for disposal. Exclude cows sold for milking in other herds or TB culls. This is Figure C.

Worked example:

A 100-cow herd which has total annual milk sales of 787,500 litres

30 cows and heifers were bought in (a slight herd increase), with a total net value of £52,500 (A)

£52,500 ÷ 30 = £1,750 average replacement cost per animal (B)

25 cows left the herd, with a total net value of £12,500 (C)

£12,500 ÷ 25 = £500 average cull value per animal (D)

£1,750 - £500 = £1,250 mean swap price (S)

£1,250 (S) x 25 (number of culls/losses) = £31,250 total net cost of culls (T)

(£31,250 x 100) ÷ 787,500 (litres) = 3.97 pence per litre net culling cost

Try it for yourself:

	Your farm	Figure
12-month period start and end		
Herd size		
Annual milk sales (litres)		
Total value of all cows entering the herd (replacements)		A
Average (mean) replacement cost per animal		B
Total value (minus cost) of all cows exiting the farm		C
Average (mean) value of cull animal		D
Mean swap price (B - D)		S
Net culling costs (S x number of cows exiting herd)		T
Culling costs per litre (T ÷ annual milk sales)		

Though industry standards are not available, a suggested good performance for net culling cost would be consistently below 3 ppl year-on-year.

Note: If your herd is contracting or expanding, the result is slightly affected, but this method of calculation smooths out the effect.

Culling costs are not the be-all and end-all, but they account for waste when culling rates are high and/or culls are of low value. Cull wastage forms a significant part of production costs, which is affected by herd health.

On a ppl basis, the calculation accounts for herds which might maintain a low culling rate at the expense of poor production (e.g. due to poor fertility performance). The calculation may, however, be greatly affected by replacement cow prices, which does not necessarily reflect herd health performance.

Minimising the replacement cost per cow is important. For home-reared heifers, calving them at 24 months reduces costs. For all herds, reducing the number of low-value culls is critical.

From an economic perspective, the important thing about culls is to maximise their value. The cost of a cull is influenced by the swap price, i.e. the difference between what a cull is sold for and the cost of her replacement. In addition, there is a cost if the replacement doesn't give as much milk as the cow she replaces, which, in the case of a heifer replacing a cow, is likely.

The swap price is lower if the cull value is maximised. Culls early in lactation, forced culls due to lameness or mastitis, and any on-farm losses are all likely to be low-value culls. Barren cows, high-cell-count cows or voluntary culls can usually be sold as high-value culls.

Does culling empty cows get rid of bad fertility genes?

A cow's reproductive performance is determined both from genetic and non-genetic factors. Non-genetic factors include the way the cow is managed.

Genetics only make a small contribution to whether a cow gets in calf on time. The biggest contribution comes from how she is managed from the day she is born.

Non-genetic factors

Non-genetic factors may be temporary, such as a short period of time where cows were inseminated using poor AI technique. Alternatively, non-genetic factors may be fairly permanent, for example if a cow aborted and her reproductive tract became infected. The result may be permanent damage to one ovary.

Examples of non-genetic factors that may contribute to a cow being empty at the end of mating, or after 200 days in milk include:

- Some of her heats were not detected
- The semen flask was not maintained properly and many of the AI straws were affected
- There was insufficient bull power during the bull mating period and she was not served
- She got pregnant but aborted following a period of heat stress or due to disease after conception
- She is pregnant but her result was incorrectly recorded at pregnancy testing

Limits of culling

Culling cows with poor reproductive performance may only have a small effect on overall herd reproductive performance, through both non-genetic and genetic effects. When you cull an empty cow, you don't usually know if it was because of genetics or a management issue. Not all non-pregnant cows have undesirable genes for fertility. Some non-pregnant cows may actually have genes for normal fertility and others for poor fertility.

Culling cows with poor reproductive performance won't change the herd's genetics for fertility very much at all.

Remember, the female is only half the story: the sire contributes the other half of the genes. Selecting AI bulls with high daughter fertility predicted transmitting ability (PTA) will have a much stronger influence across the herd than culling a few cows with poor reproductive performance.

Don't be too quick to blame genetics. This is probably not the biggest problem for cows not getting in calf.

Informed culling decisions

How culling affects the herd's reproductive performance

Depending on your block-calving system, culling strategies may affect your herd's reproductive performance:

- Single-block-calving herds – non-pregnant cows are usually culled in 12 weeks or less block herds, so it is unlikely that large numbers of consistently less-fertile cows will be retained. Less-fertile cows are unlikely to have a negative effect on reproductive performance
- Split-block-calving herds – it is poor practice to carry over non-pregnant cows from one mating period to the next. By doing this, large numbers of consistently less-fertile cows are kept in a herd. This may have a small negative effect on herd reproductive performance

You need to weigh up how much future profit you might forego if you cull a cow now, as well as how much profit her replacement could potentially generate.

By improving herd reproductive performance, you can cull on the basis of profit, not pregnancy. You reach this point when you have more replacement heifers than you have empty cows. This should be the overarching goal of your fertility management plan – a slight surplus of replacement heifers each year.

By deciding based on profit, you maintain control over your farm's calving system, which is the best way of maximising performance and satisfaction with your farm business.

Importance of records for culling decisions

If you keep good records, you can quickly determine the impact of keeping less-fertile cows in your herd.

Any decision to cull a cow must also take into account her:

- Milk production ability
- Current milk yield and solids
- Other economically important traits
- Age

If more than 10% of the herd has been carried over, having failed to get in calf in at least one previous mating period, this may reduce overall herd reproductive performance. How much depends on the percentage in your herd that have been carried over after any previous mating:

- If less than 10% in block-calving herds, carry-over cows are unlikely to be having much effect on overall herd reproductive performance
- If less than 20% in split-block-calving herds, carry-over cows are unlikely to be having much effect on overall herd reproductive performance

Warning: It can be easy to slip into a habit of rolling non-pregnant cows over to the next mating period, quickly resulting in retention of too many low-fertility cows in the herd. You need to understand the cost of generating and rearing extra heifers against the cost of culling (young) non-pregnant cows to identify the right number of carry-over cows in split herds.

Choosing individual cows to cull

Basis of selection

Choosing cows to cull has to consider more than their reproductive performance. The potential they have to remain in the herd and create additional profit has to be weighed against the performance of any replacement that you may have available now or in the near future. There are also costs of keeping them until their next calving.

Identifying cows for culling

Culling decisions are easier when you have sufficient replacements to hand. Aim to have enough replacements each year to allow you to make some voluntary culls, as well as involuntary culls, due to failure to get in calf and pregnancy losses.

Record identities of all cows that are not pregnant. Have any cows you suspect may have aborted pregnancy tested again. Consider culling non-pregnant cows, taking into account the following factors:

- Current milk yield, cell count, mastitis history, lameness history, Johne's status, health and reproductive history from last calving for each non-pregnant cow
- Consider obvious reasons for non-pregnancy, such as thin, lame, etc., as these may be resolved in later lactations
- Has the cow been non-pregnant after any previous mating period? In a split herd, is the cow still not pregnant after two consecutive mating periods?
  How much will it cost you to keep her until her next calving?

Consider culling or selling pregnant cows due to calve late if:

- You have enough pregnant cows to cull based on production; think about the due-to-calve date and age of low-producing cows
- It may be more profitable to keep average-producing cows that are due to calve early and cull higher producers that are due to calve very late, especially if they are older cows
- Late calvers don't have above-average production potential to compensate for the lower income from later calving

Going from good to excellent

There are several systems available which can help you to prioritise cows for culling. A simple method would be to allocate a point for each case of mastitis, high cell count, lameness and poor yield. Cows with the highest score should be at the top of the cull list. Some herd health and fertility software will do this for you. Of course, any system relies on full and accurate recording.

Summary of culling considerations

Planning ahead will make for a more successful culling and replacement policy. Can you answer the following questions:

- What culling rate are you targeting?
- What culling rate has the herd had over the past five years?
- What herd expansion or contraction are you planning?
- What are the main historical reasons for forced culls?
- How many cows leave the herd each year as deaths, casualties or on-farm slaughter and why?
- How do you rank and identify cows for culling? Have you done an analysis of individual cows to calculate their value to the herd, e. g. based on cell count, mastitis history, Johne's status, yield, genetic value?
- What is the length of your calving block? What is your target in-calf rate? What are your expected losses from confirmation of pregnancy to calving?
- What was your net culling cost last year? What is your budget for this year?

Good reproductive performance, with minimal non-pregnant cows, gives you the choice to make profitable culling decisions.

Case study – cull selection

John has a 450-head autumn block-calving crossbred herd. He is targeting a 15% culling rate. He has enough replacement heifers for a 20% replacement rate, but he wishes to expand his herd size.

He has a 12-week calving block. At pregnancy testing, he has an empty rate of 7% (32 cows).

John sold his 32 empty cows as barren cows and a further 30 cows as in-calf cows to another herd. These were selected mainly because they were predicted to calve later in the block. However, when calving time arrived, 18 cows which had been diagnosed pregnant turned out to be empty. A few cows had difficulty in calving and, with other miscellaneous mishaps, around 25 cows either left the herd in early lactation or were not suitable for serving again.

Despite a reasonably low empty rate at PD, John ended up with an overall culling rate of 23% (105 cows) and his herd expansion plans from home-reared heifers could not go ahead.

What's realistic?

John should work on keeping around 8% more pregnant cows than he requires, as:

- 4% of pregnant cows may fail to calve (pregnancy losses, abortions, casualties)
- 4% of cows may be lost in early lactation

For a 9-week calving block (mating period), it is reasonable to aim for less than 10% empty.

For a 12-week calving block (mating period), it is reasonable to aim for less than 5–7% empty.

So, without taking into account culls based on choice (e.g. old cows, lame cows, mastitic cows, etc.), it is likely John will need at least 12–15% replacements if aiming for a 12-week calving period (5–7% empty, plus 8% further losses). He realised that if he wanted to grow his herd, he needed to rear more replacement heifers than he first calculated.

In the following year, John reared more replacement heifers, which allowed him to cull the empty cows, those pregnant cows that failed to calve and a few extra cows he chose not to retain.

John's comment: "Initially, I had an unrealistically low culling target. We were focused entirely on the empty rate, which I was very satisfied with, but failed to take account of pregnancy losses, some of which are almost inevitable. Now, we don't try and cut it too fine with our culling expectations, so we can be a little more selective with the cows we choose to replace, on top of those culls which are forced upon us."

Summary

Fertility can be influenced by many factors. Monitoring herd performance, identifying areas of improvement and considering selection options can help build a framework to help improve fertility in your herd.

The key points to remember are to:

- Identify the best calving systems for your business
- Ensure you have accurate ways of measuring and monitoring to understand how your herd is performing
- Set realistic targets, get the team involved to achieve them, and celebrate success
- Focus and act on the priorities that will make the biggest impact on your business
- Get the detail right at crucial times, such as youngstock, transition management and heat detection, which heavily influence success further down the line

For a range of resources to help you improve fertility in your herd, take a look at our website, ahdb.org.uk and our YouTube channel, AHDB Dairy.

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