The InCalf guide

for GB farmers calving all year round

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Contents

Through a Memorandum of Understanding between Dairy Australia and AHDB Dairy, British dairy farmers and advisers can now access InCalf, adapted for GB conditions.

AHDB gratefully acknowledges the contributors of the first edition of the InCalf guide. This publication has been written and developed through a team of technical specialists from the following organisations: Chris Hudson and John Remnant of the University of Nottingham, Owen Atkinson of Dairy Veterinary Consultancy, Andrew Henderson of LLM Farm Vets, Will Tulley of Evidence Group, Kate Burnby MRCVS and Dave Gilbert of Horizon Veterinary Group.

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Foreword

The InCalf Guide for GB farmers calving all year round (AYR) brings together the best of current knowledge on dairy herd fertility management, drawing on AHDB research, industry expertise and practical experience from across Great Britain and beyond. By focusing on AYR calving, it offers tailored guidance to help you achieve a profitable, sustainable business.

Every herd is different, but the fundamentals of a successful AYR system remain the same: accurate monitoring, realistic targets, attention to detail and acting on priorities that make the greatest impact.

Success in fertility comes from getting the details right at crucial stages – youngstock rearing, transition management and heat detection – while celebrating progress along the way.

This guide will help you assess your herd's situation, explore opportunities for improvement and implement the changes that work for you.

For more tools and resources, visit **ahdb.org.uk** or explore our AHDB Dairy YouTube channel.

Getting what you want from your system

The following flow diagram 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 AYR systems.

Benchmark yourself using the online KPI tool, available at **ahdb.org.uk/all-year-round-calving-key-performance-indicators**

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. 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 an AYR system. Reviewing these can provide ideas on how farm layout can be further improved to suit the system.

InCalf AYR – 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. 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 all-year-round or block-calving system, feeding system and milk quantity/quality desired.

Maintain and further develop

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

Ongoing 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 advisers and fellow farmers is a valuable way of avoiding common mistakes made by others.

11. Personal development

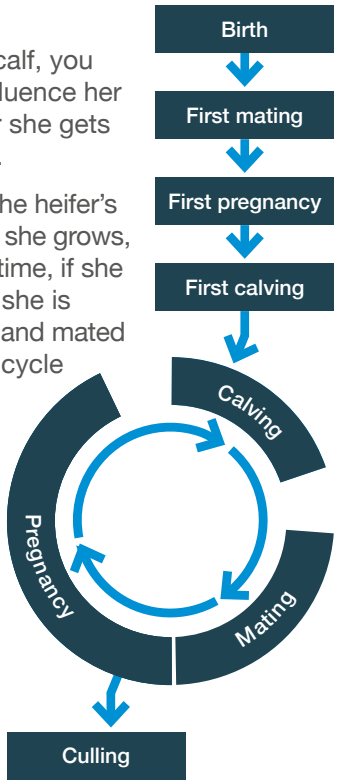
Maintain your own skill sets through initiatives, workshops and courses local to you. These will support you in reaching your business aims.

Fertility for life

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.



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.

At each stage of a cow's life, a good management plan provides answers for an important question: today, have I done all I can to ensure high reproductive performance?

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

All-year-round calving (AYR) systems

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.

As animals in all stages of the fertility cycle are present on the farm at any one time, tasks in the framework must be scheduled for particular groups at particular times. This results in a calendar of events for the year that schedules all tasks.

Table 1 has 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 objective of all fertility management plans is to get every cow pregnant as soon as possible after you start breeding her.

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 plan 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.

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 an AYR calving system, good reproductive performance improves herd profitability through:

- Fewer cows with long lactations
  - Cows with long lactations increase average days in milk and so reduce the efficiency of the herd
  - These cows are also at risk of becoming overfat: an excessively long lactation (e.g. greater than 350 days) often increases the risk of culling in the following lactation
- Increased calf value (including both beef-cross and dairy calves)

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

Stage	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? Will you use sexed semen? (easier calvings) Have you done genomic testing? (continual herd improvement, for example breeding replacements only from heifers with the best fertility index)
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 AI protocol? Have you got the right handling facilities for your breeding system?
Pregnancy	Have you planned early +/- follow-up pregnancy testing? How and where do you record pregnancy-testing results? What is your protocol for dealing with non-pregnant cows?
Culling	Which cows will be culled?

- Fewer cows culled because of failure to become pregnant
  - This gives you more flexibility to make culling decisions based on other factors (such as disease) and potentially can facilitate increasing herd size or income from animal sales
- Where conception rate is improved, semen costs are lower (although this is often a small part of the benefit compared with the other points above)

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.

You can use genomics to continuously improve your cow fertility. For this it is important you know your herd's Fertility Index and genetic merit for fertility. You can check this by signing up for the AHDB **herd genetic report**, available on the AHDB Dairy Breeding website.

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
- Tackle key limiting factors together. Small improvements across multiple areas boost herd performance more than focusing on just one

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

Preparing for change

In the AHDB report The Characteristics of **Top-Performing Dairy Farms in the UK – 2024 Update** six factors were identified which set apart the top-performing dairy farms to those not performing as well. 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. Keep a ruthless focus on cost control, without impacting milk quality or output.
2. Calculate what your most efficient stocking rate is, then make sure you get to it.
3. Concentrate on what you are best at – including your farm system.
4. Know exactly what the market requires and make sure you produce exactly that.
5. Know what you and the management team wants to achieve.
6. Keep a very close eye on detail.

For more information on the factors that set apart top-performing farms, see **ahdb.org.uk/ways-you-could-improve-your-dairy-farm**

To view the report, visit **ahdb.org.uk/knowledge-library/characteristics-of-top-performing-farms-2024**

Where to start

In an all-year-round calving system, efforts to get cows pregnant need to be sustained throughout the 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 farm team 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.

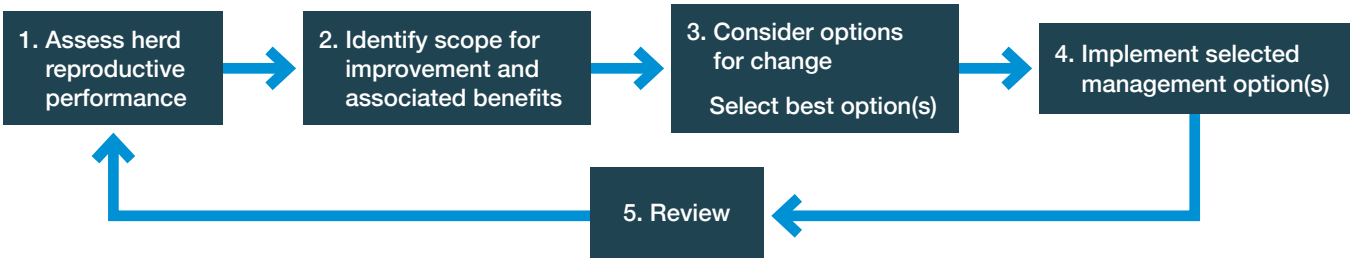


Figure 1. Fertility process for improvement

Measuring and monitoring

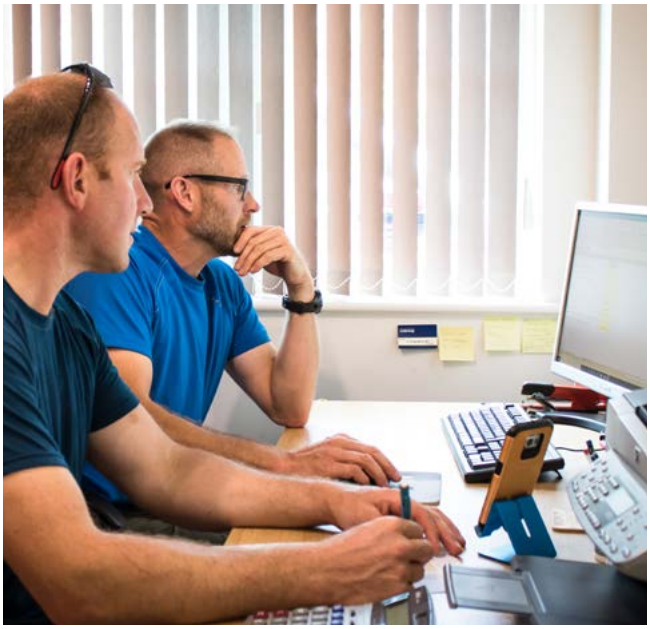
Overview

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. 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 and do this consistently, completely and regularly
- Don't just record data – use it to analyse performance. This will identify areas to focus upon and provides a means of monitoring progress and effectiveness as you implement change
- Pregnancy testing is fundamental to timely measurement of performance



What is meant by measuring and monitoring?

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 by whom
  - What data is to be analysed, when and how it is analysed and by whom

What exactly do I need to record?

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

- 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
- Pregnancy test results – cow ID, date of pregnancy test, test result, estimated number of weeks pregnant (if not pregnant to most recent insemination)
- Calving details – cow ID, calf ID, date, assisted calvings
- Cow exits – cow ID, date of exit, whether culled, sold or died, and reason

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 and heifer genomic ratings
- Cow health events – cow ID, date of event, type of event (e.g. retained cleansing, metritis, oestrus not observed, disease diagnosis, etc.), treatment
- Youngstock weights

How are records analysed?

Many measures of reproductive performance can be quite complex to calculate, so it is important to think about who will be responsible for analysing the above information in a way that best helps decision-making. Analysis is best done using computer software, so there are two main ways for this to happen:

- The same (on-farm) software system is used to record and store the data and carry out analysis
- A specialist computer program is used to analyse data stored in the on-farm system. In this case, the vet or consultant would usually do the analysis

Each of these approaches has its own pros and cons.

Key measures of AYR herd reproductive 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. See Dairy key performance indicators **ahdb.org.uk/dairy-kpis**
- **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 an all-year-round calving herd is shown below (these terms are defined in more detail in the next section).

Overall measure	21-day pregnancy rate		
Drivers of performance	21-day insemination rate		Conception rate (CR)
Detailed measures	Days in milk (DIM) at first insemination	Inter-service intervals (ISI)	CR by operator, DIM, etc.

Figure 2. Fertility KPIs and drivers of AYR herd performance

How they are calculated

The key measure of overall reproductive performance in an all-year-round calving herd should be the 21-day pregnancy rate:

- **Definition** – the percentage of eligible cows which become pregnant in a given 21-day period of time. An eligible cow is one which is further into lactation than the herd's voluntary waiting period[1] (VWP), is not currently pregnant and has not been identified as do-not-breed (i.e. selected for culling). Further information on this is available in the Starting and stopping mating chapter
- **Using the measure** – it gives an excellent picture of how well the whole reproductive process is working on a dairy farm with a relatively short time lag. To calculate the measure for a given 21-day period, an accurate outcome is required for all inseminations occurring within the time period. For example, in a herd where pregnancy testing is carried out from 30 days after insemination onwards, the 21-day pregnancy rate can be calculated up to the date 30 days before the most recent pregnancy-testing session
- **Interpreting the results** – a graph of 21-day pregnancy rate over time is a highly useful way to visualise changes in reproductive performance. Especially in smaller herds, the number of eligible cows in a given 21-day period may be relatively small: in this case it is better to average the rate over a longer time period (e.g. a three-month average)

There are several details of exactly how 21-day pregnancy rate is calculated (e.g. how to handle cows eligible to serve for only part of a 21-day period) which can make a big difference to the result. So long as these details remain the same each time you evaluate this measure, you can still accurately assess your herd's progress. But it is important to be aware that different software packages can give different results from the same data.

Comprehensive recording of do-not-breed cows (i.e. those selected for culling so not eligible for insemination) is also critical to calculate pregnancy rate accurately – if they are not recorded, the number of eligible cows will always appear larger than it really is, making the pregnancy rate look lower. Conversely, avoid using do-not-breed events to make performance look better than it really is.

[1] The voluntary waiting period (VWP) is the number of days after calving at which cows are considered eligible to be inseminated. Choice of VWP is covered in the Starting and stopping mating chapter.

Measuring drivers of overall performance

Two key drivers of 21-day pregnancy rate are 21-day insemination (or submission) rate and conception rate.

- 21-day insemination rate – the proportion of eligible cows which are inseminated in a given 21-day period. Most software systems which calculate pregnancy rate also calculate this and it is convenient to look at both measures for each 21-day period
- Conception rate – the proportion of inseminations resulting in a pregnancy (usually determined by pregnancy testing)

Comparing performance for each of these measures against expectations or targets allows you to decide whether to focus on submission or conception to improve.

Detailed measures of performance

You get even greater insights by evaluating the drivers of overall performance for subsets of the herd. For example:

- 21-day insemination rate by days in milk – this reveals possible issues with cows being slow to start cycling again after calving, or where insemination rate is affected by post-calving disease. In both cases, insemination rate would be expected to be worse early in lactation. Insemination rate in first versus other services can also be worth checking
- Conception rate by factors which could influence it, e.g. days in milk, service number, parity, operator, sire, AI/natural service and observed heat compared with fixed-time insemination. This can show why the overall conception rate may not meet expectations

There are also some interval-type measures which tell you something useful. Although harder to use for regular monitoring, they are worth evaluating on a less frequent basis. These include:

- Calving to first service interval – an alternative way to look at heat detection for first service. It can also be useful for exploring options such as synchronisation for first service
- Inter-service interval – is effectively the equivalent for return services. For each return, the interval is calculated from that service to the previous service. Intervals are then compared with the expected normal length of a cycle (typically 19–26 days)
- Calving interval – is a measure of overall reproductive performance and is also affected by herd decisions such as VWP and culling policy
- Age at first calving – measures the effectiveness of reproductive management of heifers being bred for the first time but is affected by farm policy on age/size at first service, as well as ability to achieve target growth rates

When looking at interval-type measures, look at the range of intervals across the animals in the herd, rather than relying on the average.

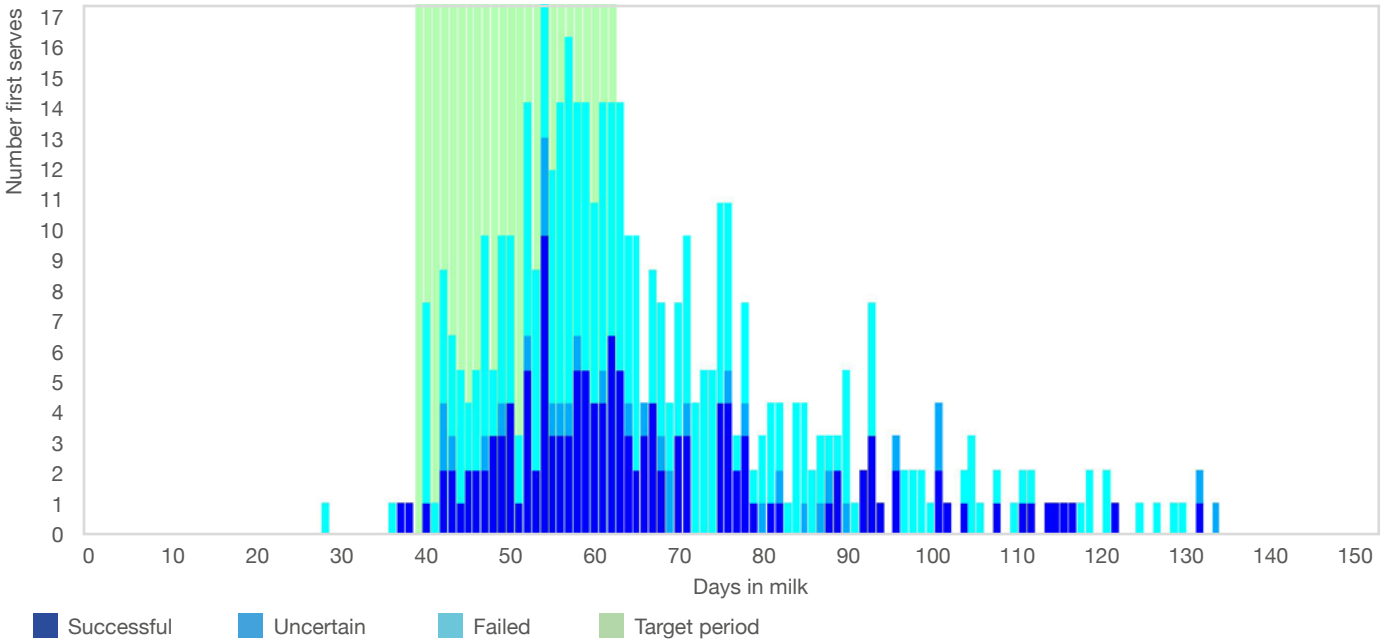


Figure 3. Range of intervals across a herd (DIM at first service). Days in milk (DIM) at first service. An example of the distribution of intervals from calving to first service: in this herd, although almost half of the cows are getting a first service at the target time (the first 24 days after the end of the VWP of 40 days), there is a long tail to the distribution, with a substantial number of cows not getting served until >100 DIM.

Source: TotalVet

A recommended approach to measuring and monitoring

In an all-year-round calving herd, keep regular tabs on the main measures of reproductive performance so you can spot any problems early.

How often performance reviews should be done depends largely on herd size: in smaller herds, you see more variation in performance measures just through chance, so it makes sense to monitor these less often.

As a guideline, review performance in:

- Herds of over 250 cows on a monthly basis
- Smaller herds, less than 250 cows, on a quarterly basis

Within these reviews, monitor the:

- 21-day pregnancy rate
- 21-day insemination rate
- Conception rate

The more detailed measures of performance (such as conception rate by days in milk or inter-service interval data) are especially useful when the main performance measures highlight a problem. However, it also makes sense to review these detailed measures occasionally, even when overall performance appears to be meeting targets.

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 another 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

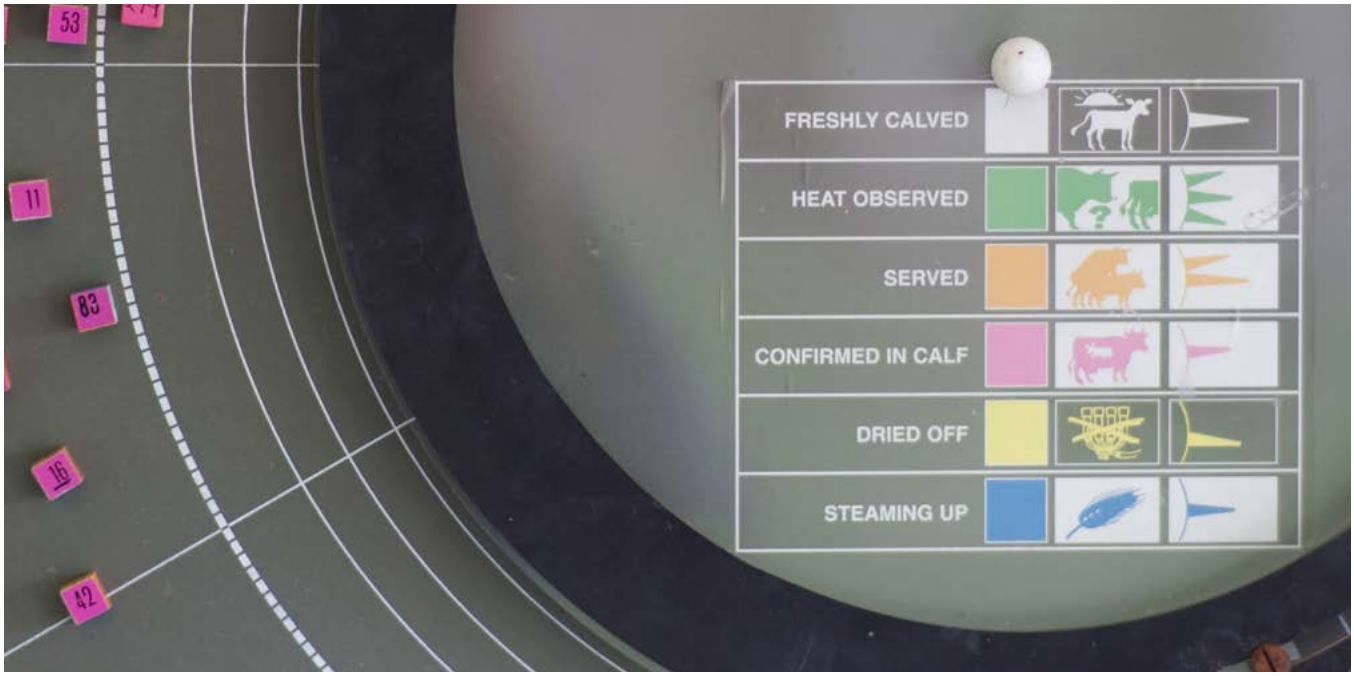
Without complete reproductive records (see the section on establishing a monitoring system), it can be impossible to monitor fertility in a meaningful way and, worse, you can get a misleading picture of what's going on. Missing service records are a common problem, particularly where stock bulls are running with cows, or if only the latest service is recorded during monthly milk recording (record all services), 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. In general, the ideal window for pregnancy diagnosis (PD) is between 30 and 42 days after service. This is not so early that a high number of pregnancy losses would be expected, and yet early enough so that actions can be taken with cows not in-calf.

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

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

21-day pregnancy rate

Proportion of eligible cows becoming pregnant in a given 21-day period. This is the best overall measure of reproductive performance in an AYR system, as it combines heat detection and conception rates.

21-day insemination rate

Proportion of eligible cows being inseminated in a given 21-day period. This is a good measure of submission for service but varies according to how it is calculated.

Conception rate

Proportion of inseminations leading to a pregnancy. Measures success of inseminations, can be misleading where service or PD records are missing.

Other performance measures

Age at first calving

Average (mean or median) age at which an animal has its first calf. Achieving target weights and ensuring that heifers calve down at 24 months will benefit animal health and fertility of the herd and drive profitability through better fertility in the first lactation and more productive days in a lifetime.

100-day in-calf rate

Proportion of eligible cows pregnant by 100 DIM, measures overall performance, especially in early lactation.

% Inter-service interval (ISI) 19–26 days

Proportion of inter-service intervals falling within the expected normal range. Approximation of the proportion of return heats detected at the first opportunity.

% ISI <19 days

Proportion of inter-service intervals which are shorter than the normal expected range. Short ISIs commonly represent inseminations where the cow was not on heat.

Industry targets for AYR 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 from AHDB KPIs and National Milk Records, specifically for AYR-calving GB herds.

Conception rate tends to become more challenging to manage at higher levels of production, so varying targets with herd 305-day yield is often useful.

For yields over 10,000 litres, a conception rate of 45% is a very tough target and 38–40% may be more appropriate. When yields get above 11,000 litres, a target of 35–38% is more sensible. This means that higher-yielding herds will typically have to achieve higher 21-day insemination rates to hit the overall 21-day pregnancy rate target.

Table 2. Industry targets for key performance measures in all-year-round calving herds

	Measure	Excellent	Good	Average
KPIs and drivers	21-day pregnancy rate (%)	>30	25	18
	21-day insemination rate (%)	>65	55	50
	Conception rate (%)	>48	45	40
Other performance measures	Age at first calving (months)	23 (but not less than 22)	24	26.8
	100-day in-calf rate (%)	>55	48	<40
	ISI (%) 19–26 days	>60	55	<50
	ISI (%) <19 days	<5	7	>10

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

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, 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.

Case study – using reproductive data

Going from good to excellent

Michael Ball, along with his brother Tony, run Coton Wood Farm in Derbyshire, a former Strategic Dairy Farm. They have a 500 Holstein-cow herd, averaging around 10,000 litres on a robotic system.

Often, good use of herd data can help herds move from good to great performance. A routine review of 21-day pregnancy rates on Michael's farm revealed that overall performance was good, at around 22%.

However, looking at first-lactation heifers and cows separately showed that heifers were performing exceptionally well, while the cows were just below target (green lines on charts overleaf). This was clearly driven by a lower 21-day insemination rate in cows compared with heifers (blue lines). Reviewing the distributions of calving to first service intervals revealed some individual, mature cows with very delayed first serves. This led to a focused review of:

- Differences in management practices between heifers and cows – these included management of grouping around calving
- Protocols for cows not receiving a first serve within the target window

Fertility performance: Horizontal axis represents time in three-week periods; for each period, the yellow bar shows number of cows eligible to serve, the blue bar the number served and the green bar the number becoming pregnant (left-hand scale). The green line shows the 21-day pregnancy rate and the blue line the 21-day insemination rate (both as nine-week averages, right-hand scale). Software source courtesy of TotalVet (©QMMS Ltd).

See Figures 4 and 5 for a comparison in performance between first-lactation heifers and mature cows.

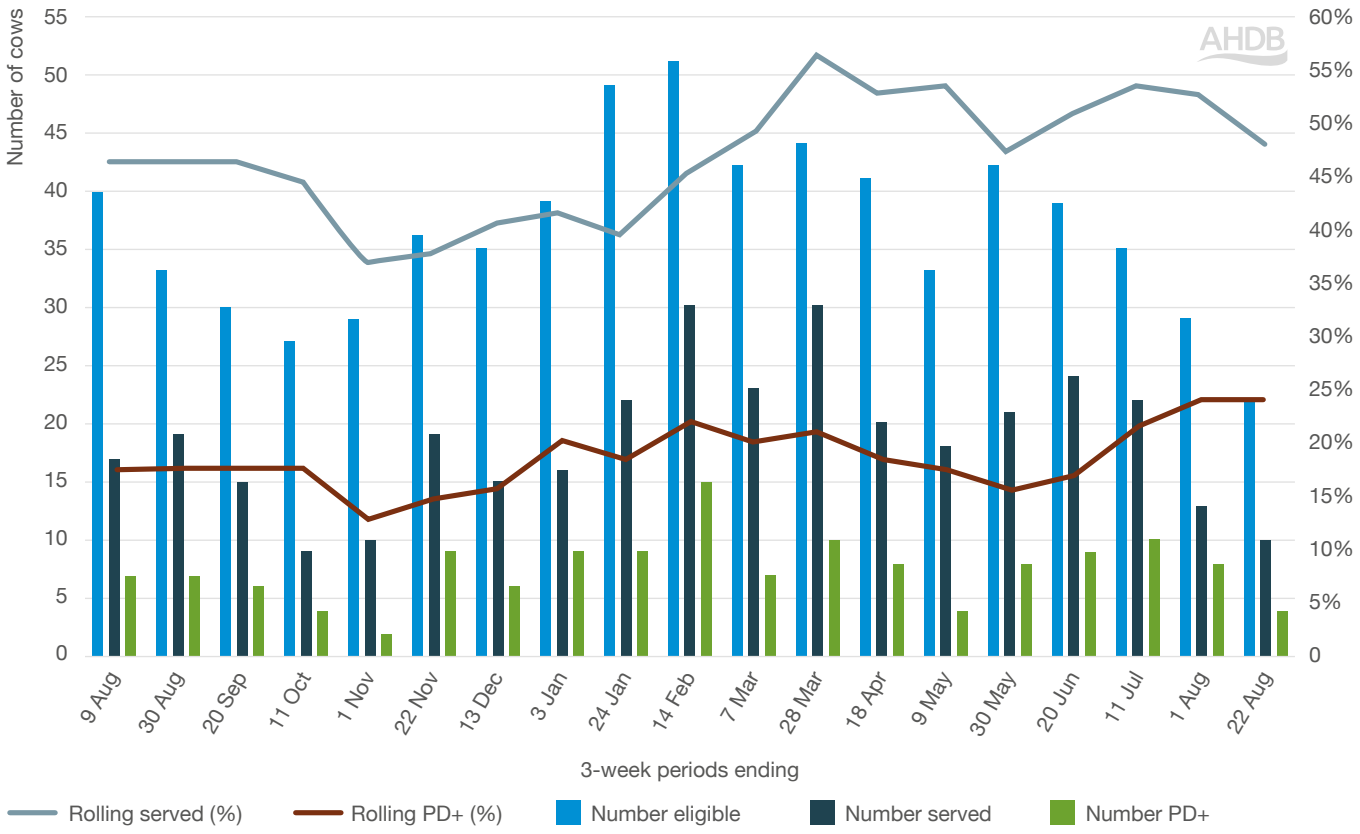


Figure 4. Fertility performance in first-lactation heifers

Source: AHDB

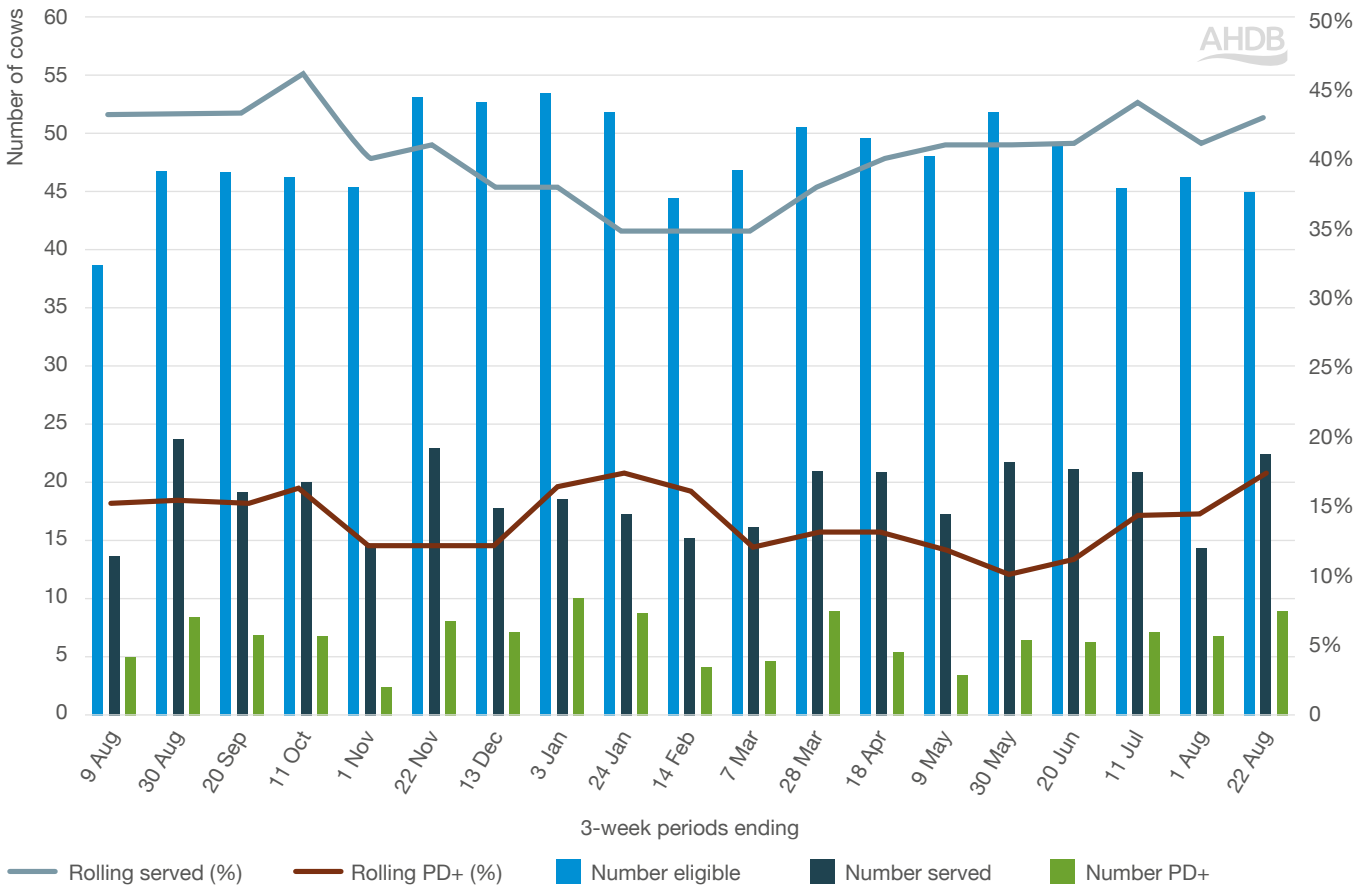


Figure 5. Fertility performance in mature cows

Source: AHDB

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 are 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, you 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.

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, if you decide you still wish to use any natural service

Setting priorities

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.

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 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, and consider sexed semen for easier calvings
- Organise well for AI
- Make sure you've got a good bull team for natural mating, if using

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.

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

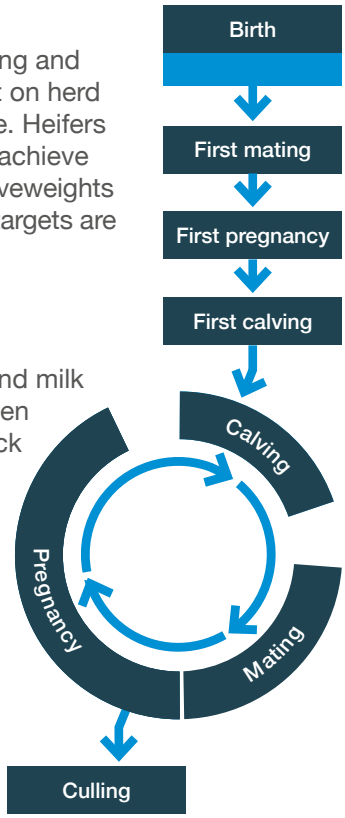
For further guidance on heifers pre-weaning, please see our comprehensive collection of calf management resources available on the AHDB website.

Heifers weaning to calving

Overview

Heifer liveweights at mating and calving have a big impact on herd reproductive performance. Heifers that have been reared to achieve their mating and calving liveweights as well as 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

- Control your replacement rate and aim to calve heifers at 24 months if you want to reduce your replacement costs
- Calving at 24 months is not only more economically beneficial, but research shows that heifers last longer in the herd too when they calve at this younger age, compared with 28 months or more

For information on calves from birth to weaning, there is a large range of resources available on the AHDB website.

Planning your replacement heifer strategy

One of the largest drivers for the difference in profit between the top and bottom 25% of AYR-calving farms is herd replacement rate.

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:

- What age should I breed them?
- What weight, age and size do I want them to calve at?

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.

Calculating replacement numbers

Age at first calving and herd replacement rate (culling rate) are the two factors which govern how many heifers you need in your heifer pipeline. A higher number gives rise to more cost. Controlling both factors leads to better efficiency. As a guide, Table 3 shows the effect of cull rate and age at first calving on the number of replacement heifers needed each year.

Table 3. Effect of cull rate and age at first calving on the number of replacement heifers needed per year to maintain herd size in a herd of 100 mature cows (adapted from Fricke, 2003)

Replacement rate %	Age at first calving (months)				
	24	26	28	30	32
	Number of heifers needed each year				
24	53	57	62	66	70
26	57	62	67	72	76
28	62	67	72	77	82
30	66	72	77	83	88
32	70	76	82	88	94
34	75	81	87	94	100
36	79	86	92	99	106

If you calve at 32 months and have a 36% culling rate, you will have twice the number of heifers to feed, compared with calving at 24 months old and a 24% cull rate.

The next thing to consider is how to successfully calve at 24 months old. 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.

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

Figure 6 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 6 is 685 kg, which is typical for a Holstein cow. It can be seen that a suitable target average growth rate for a Holstein heifer from weaning to first calving is 0.75–0.9 kg/day. Otherwise, the heifer will be too small when she calves.

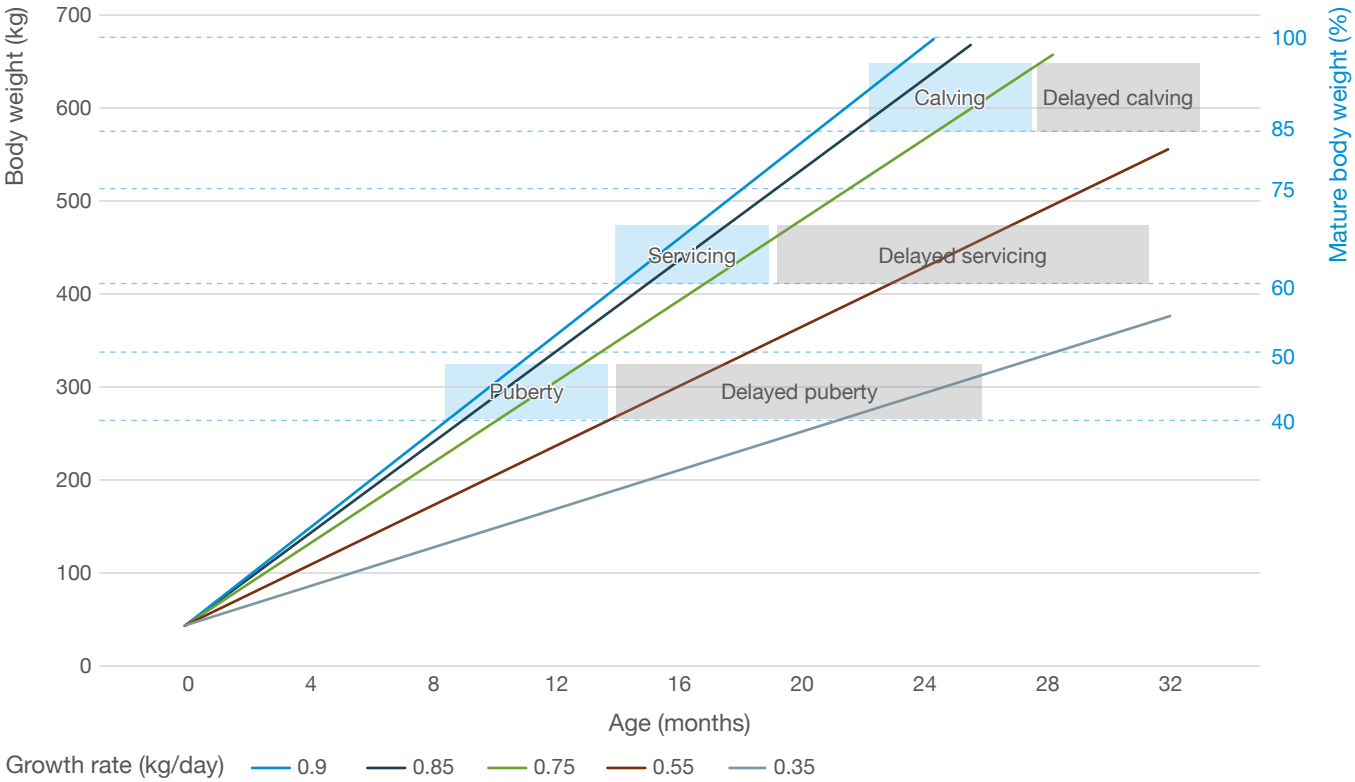


Figure 6. Five different average growth rates and the effects on the potential weight at calving

Source: Dairy Veterinary Consultancy

Growing heifers from weaning to mating

Key targets for heifers in AYR herds

	Targets
Puberty weight	40% of mature body weight
First service weight	55–65% mature weight
First service age	From 13 months
First service height	85% of mature withers height
First calving weight	At least 85% of mature body weight (after calving)
First calving height	96% of mature withers height
Age at first calving	24 months
Serves per conception	1.6 or below
Oldest age at final service	17 months
Failure to conceive	Less than 5%
First-lactation milk yields	85% of 2+ lactation cows
Survive for second lactation	At least 90%

Good calf management needs to be followed by effective growth from weaning to first calving. Otherwise, all the hard work you have put into calf rearing can be lost.

Calving a heifer at 24 months old is more economical and 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 – that requires good nutrition and good management from weaning to mating.

Costs of rearing heifers

Herd replacement cost was in the top three drivers of profit difference between the top and bottom 25% of farms in the AHDB farm performance review. The significant cash costs associated with rearing dairy heifers make up a large proportion of investment into herd replacements. This can be a key driver in profit difference between farms.

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.

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[2]
- **Coccidiosis** – a 2017 UK survey[3] 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
- **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 failure to keep track of heifer age and development

Don't become distracted by a previous batch of heifers you are still serving, to the detriment of serving the next batch in good time.

Fundamentals for heifer rearing

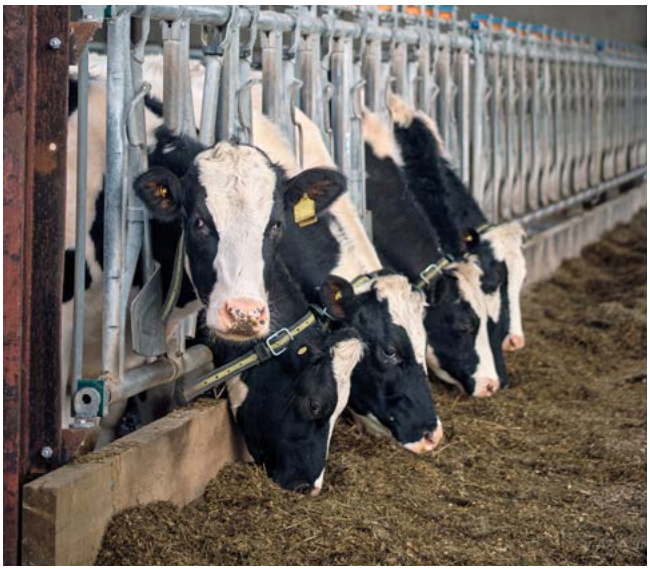
- Feed good-quality concentrates (at least 11.5 MJ ME/kg DM and 16% crude protein) until calves reach 200 kg, unless they are fed abundant, high-quality pasture (11.5 MJ ME/kg DM). Adequate protein content and quality is needed to drive skeletal and muscle growth. Calves are picky grazers, particularly if not trained, so most farms will need to supplement with concentrate, typically 3–4 kg/head per day
- Differentially feed groups of heifers according to size and weight, so smaller heifers reach their target weight for mating
- Monitor liveweights at least every three months. If results are below targets, review your parasite control programme and consider further supplementary feeding
- Aim for at least 0.85 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 4). 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)
- Ensure heifers have enough feed space (Table 5)

Table 4. 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 5. 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



[2] 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.

[3] A summary of the submissions for coccidia screening and speciation from calves in UK dairy herds 2012–2017. BCVA proceedings, October 2017.

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 7a and 7b). Fresh hay was provided every second day. Rearer pellets were fed twice daily in a trough at 3.5 kg/head/day (Figure 7c). 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 7a and 7b. Heifers at the feed barrier

Figure 7c. 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 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

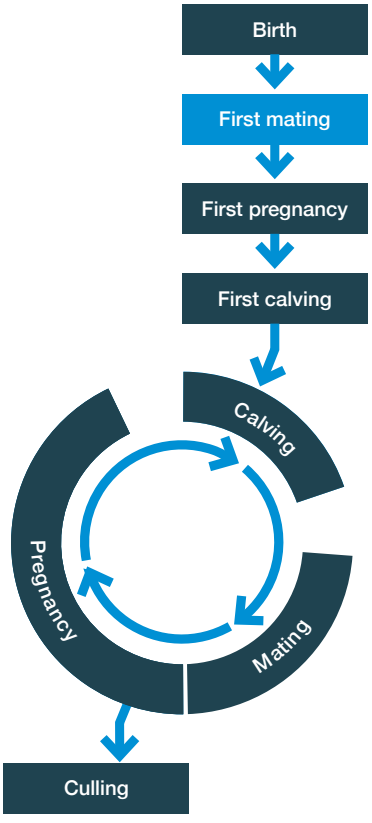
By weaning at eight weeks, calves were eating over 2 kg/head/day of concentrate. They subsequently grew at 0.85 kg/day after weaning and no longer suffered from scour or coccidiosis, on the same diet of hay and 3.5 kg/day rearer pellets.

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 the heifers been genomically tested? How can you maximise genetic gain in your herd?
- 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 this significantly increases rearing costs.

Strategies to minimise calving problems in heifers:

- Use sexed semen to breed your replacements: heifer calves are generally easier calving
- Use AI sires with positive predicted transmitting abilities (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 **Traits and Indexes** on the AHDB Dairy Breeding 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

The conception rates for sexed semen have improved considerably over the past decade. Many herds will not notice much difference in conception rates when using sexed semen for their heifers, compared with conventional semen. It makes particular sense to use sexed semen with heifers because these animals offer your best genetics; the easier calvings are especially important, and heifer conception rates 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 at 70 days, at least twice their birth weight
- Serve at 13–15 months (start at 13 months). Correct weight is at least 50% of mature weight: 375–400 kg for Holstein. Height for Holstein is at least 1.32 m to the withers. Use a baton on the wall or an L-shaped measuring stick
- Expect 1.4 to 1.6 inseminations per pregnancy (generally slightly higher in higher-yielding breeds)
- Inseminate at the first possible moment after you observe standing heat (assuming you check once or twice a day)
- 100% of replacement heifers pregnant by 16–17 months old. Seriously reconsider keeping any heifer which is not in-calf by this age, particularly if they have been having fertility difficulties

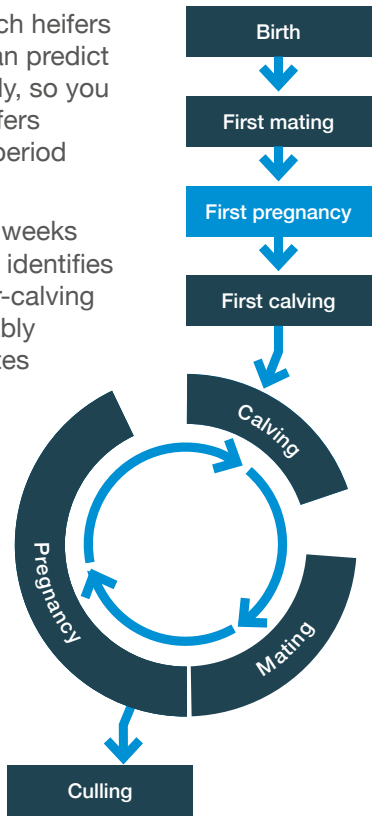
Pregnancy testing

The period between mating and calving is a good time to measure weights and heifer reproductive performance. If using a stock bull, 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.

If using AI, pregnancy test each heifer as soon as possible – ideally 32–45 days post service is the better practice – to react quickly on results.



Investigating failure to get in-calf

For 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 in relation to onset of heat
- Nutrition problems, e.g. mineral deficiency, excess protein, insufficient energy
- Shed is too dark

For heifers irregularly on heat and failing to conceive, possible causes are:

- Poor oestrus detection
- Disease, including BVD
- Overcrowding, slippery floors and dark sheds, which 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 8 of expected liveweights
- Identify non-pregnant heifers early on and consider culling them if not in-calf by 16–17 months old

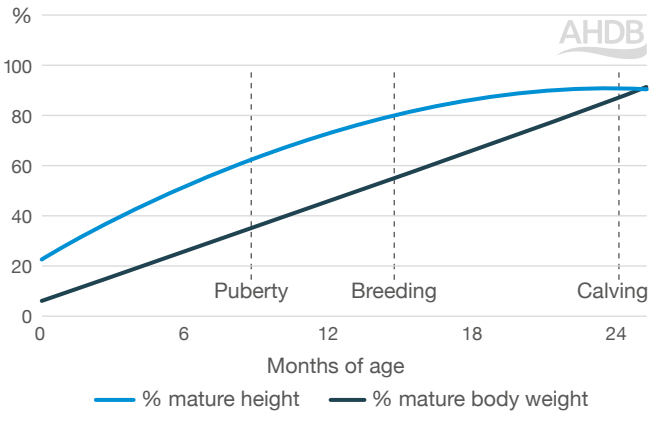


Figure 8. Expected liveweights and withers heights of Holstein heifers at various ages

Source: AHDB

Using electronic scales or a weigh tape gives a good guide for when to begin serving. You can measure the height of the withers but it is not as accurate.

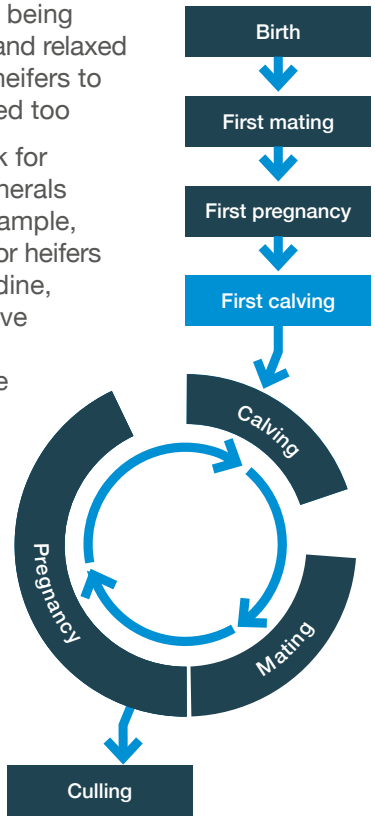
Going from good to excellent

It is good to use a breed-specific weigh tape to ensure target service weights 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 the milking cow diet, correct body condition score at calving, reducing competition for feed and providing extra-spacious and comfy beds, heifers have particular needs which you must meet. 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)
- Unless they will be housed 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 feed rails and cubicles they will be expected to utilise 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
- Remember to check for and supplement minerals if necessary. For example, it is quite common for heifers to be deficient in iodine, especially if they have been reliant on just grazed grass. Iodine deficiency leads to weak calves and stillbirths



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

On-farm examples of heifer-transition management

What do you see in this picture of an in-calf heifer, close to calving? What should be done about it?

Figure 9. In-calf heifer close to calving

See: The rumen fill score is too low (score 2), indicating that she has not eaten enough food in the past 12–24 hours. This increases her risk of post-calving disorders, which may affect her production and fertility in her first lactation.

Check: Is this an individual problem or a group problem? Is there enough space at the feed barrier (at least 75 cm/cow, pre-calving) and can all cows eat without conflict when fresh feed is first delivered? Is feed fresh and palatable (e.g. delivered fresh daily)? Is there clean water available without conflict? Are heifers introduced to the dry cows soon enough before calving (at least 4–6 weeks)? Are heifers introduced in groups (at least two at a time)?

Do: Recheck rumen scores. This heifer had recently been introduced into the dry-cow group. The farmer was encouraged to check that she acclimatised quickly by scoring her rumen fill over the following week. The target rumen fill score in the weeks before calving is 4 or above.

What do you see in this picture of a fresh-calved heifer, two weeks after calving? What should you do?

Figure 10. A freshly calved heifer in the milking herd

See: This fresh-calved heifer is standing at the edge of the feeding area, looking nervous. She may be struggling to adjust to herd life and her intakes may be low.

Check: What her rumen fill score is – the target is at least 3 in milking cows. Is she losing body condition? Target no more than half a BCS point loss in the first six weeks of lactation.

Can she come to feed without conflict, even when fresh feed is delivered? Target at least one feed space, or 65 cm/cow, in the milking group.

Does she lie comfortably in the cubicles when not eating? Is there at least one lying space (cubicle) per cow in the group? Remember, a contented cow will be standing while eating (about 4–5 hours) or lying down chewing her cud (around 12–14 hours) for the vast majority of time in the shed.

If not eating, drinking, grooming or socialising, cows standing in passageways are not exhibiting their normal behaviour and their rest time is likely to be reduced. They have a greater risk of becoming lame and will be more difficult to get back in-calf.

Do: Move animals in at least pairs into the main milking group to reduce stress. But if a heifer is not adapting well, she should be housed in a smaller special needs group, preferably on straw or deep sand beds. Check to see if you can acclimatise your heifers better prior to calving in the future and make sure the shed is never overstocked.

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.

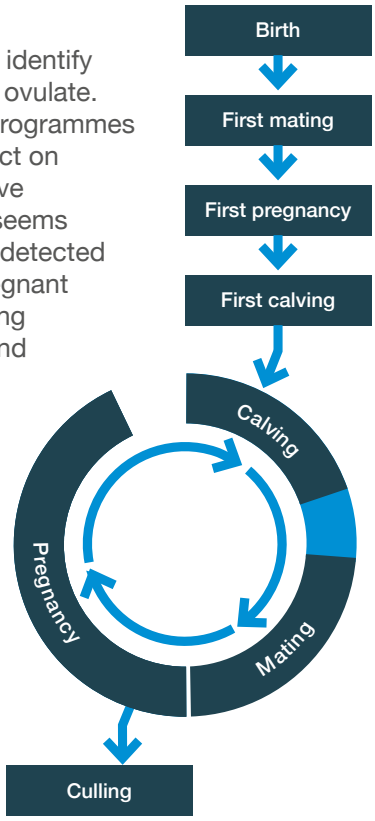
In AYR-calving herds:

- Top farmers achieve milk production in first calvers of at least 90% of the milk production of mature cows
- If your figure is less than 85%, review calf and heifer management as this may indicate that heifers were underweight at calving
- Top farmers will have at least 90% of their first calvers go on to calve a second time within 400 days of their first calving
- If your figure is less than 85%, 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

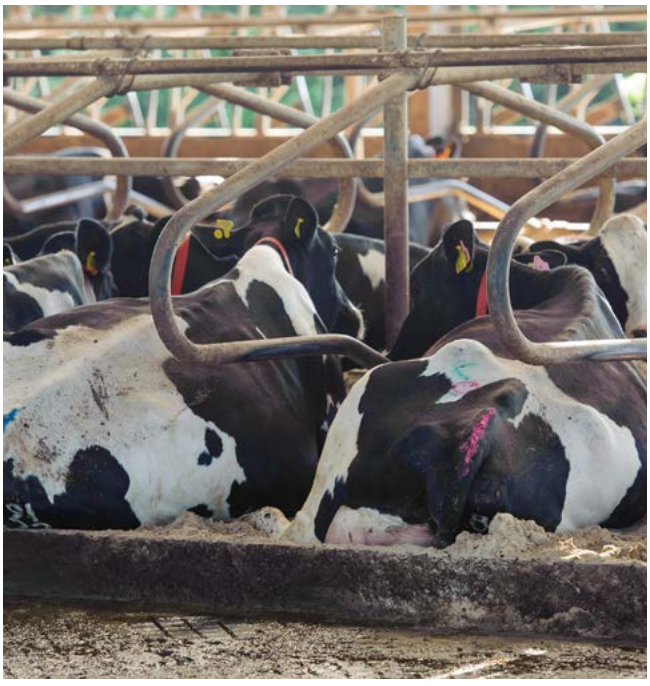
Heat detection identifies cows suitable for mating.

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.

There are many automated heat-detection systems available. While not replacing good stockmanship, the research evidence shows that they are very effective at lifting heat-detection rates and very quickly become cost effective, even in herds with already-good heat detection.



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 insemination or submission rate (the proportion of eligible cows detected on heat and inseminated every 21 days) 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.

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

Accurate heat detection is key to ensuring semen is not wasted and cows conceive at the right time.

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.

Calculating insemination rate

Insemination rate is the proportion of eligible cows – those past the VWP, not pregnant and not selected for cull – submitted for insemination every 21 days. Sometimes insemination rate may be divided into first services and subsequent serves.

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.

You need both high heat-detection efficiency (few false negatives) and high heat-detection accuracy (few false positives) to get a high conception rate and a good overall 21-day pregnancy rate.

The power of observation

Setting aside time specifically for cow observation and heat detection, quite separate from time spent feeding, scraping and milking, gives you better results.

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

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.

Penn State Extension provides a comprehensive overview of what to look for with primary and secondary signs of heat in their articles **Heat Detection with Cattle** and **Timing of Insemination for Dairy Cattle**.

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

Automated heat detection, usually using some form of accelerometer and motion detection, has been a game changer in improving heat detection for many UK herds. This technology should not just be considered for the larger farms, as all herds are likely to benefit. Even a very modest lift in heat detection is likely to have a cost benefit. It is not unusual to see a side benefit of better conception rates too, due to the better accuracy of heat detection and onset of heat, which allows better timing of insemination.

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 or automated heat detection 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	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

Recommendations

- Use technology: modern activity meters/ automated heat detection can significantly lift fertility performance on most farms
- If heat detection and drafting at milking are separate processes, ensure that cows on 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 into 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

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. Using messenger app groups are a common way, but a whiteboard in the office can still work well.

Heat detection before mating

- Record dates for observed heats between calving and insemination so you can anticipate when cows may next be on heat (this also identifies cows not seen on heat during the VWP which may benefit from further checking)
- If you are using anticipated heat dates, be sure cows are not being submitted too early, when they are coming on to heat, rather than after standing heat has occurred
- Records of past heats help confirm that cows showing weak signs of heat about three weeks after a recorded date are actually on heat

Using observations and detection aids for best results

Research indicates that relying on just visual observation, even if three times per day, or just heat-detection aids such as tail paint or heat-mount detectors, is not as effective as using a combination. Going a step further and adding in modern activity meters for automated heat detection will improve results even further.

Recommendations

- Ensure that all cows in the herd are individually identified using ear tags and/or freeze brands that can be read from some distance
- Timing of heat-detection sessions is controversial, although it is logical to space sessions as evenly as possible through the day and to avoid times when cows are in the collecting yard
- The more time spent detecting heat, the better results are likely to be – but at least 20 minutes per observation session for at least two sessions per day is a sensible minimum where observation is relied on
- Consider evening heat-detection checks two hours after the afternoon milking 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 each day, for example a whiteboard at the dairy or using a messaging app

Rarely used nowadays, 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.

What to look for on a heat-detection check

Sexually active groups contain cows standing to be mounted as well as those attempting to mount other cows and they help pinpoint cows most likely to be on heat. During a heat-detection check, observe cows quietly, paying particular attention to restless groups of cows.

- Observe cows for heat without disrupting their activity
- Only mark cows detected on heat if this does not disturb them
- Record the identity number of every cow detected on heat at each check

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 two hours or as long as 28 hours. Weather conditions, high yields and smaller numbers of bulling cows can affect how strongly cows display heat. Observing (for about 30 minutes) at least three times a day will help you to catch cows with all but the shortest of heats.

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

Table 6 shows some of the considerations for different heat-detection aids. 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.

Table 6. 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 Modern systems have good reliability and provide continuous monitoring of activity
Heat synchronisation	Allows for intensive periods of heat detection, insemination and calving May avoid the need for heat detection in some cows

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.

You can achieve high heat-detection rates using well-maintained tail paint and regular checks.

For the 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

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

Note: Tail paint can be used before the VWP has been reached in all-year-round herds, to monitor heats before mating.

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 may be 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 on 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 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.

Heat detection at milking

Some farms choose to check heat-detection methods (such as tail paint or mount detectors) at milking time and focus on this method for their heat detection. However, this will generally yield worse results compared with the same system with more observation time away from milking.

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: they have a higher step count. This activity is recorded with a motion sensor attached to a collar, ear tag, leg band or intra-rumenal bolus 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:

- Rumination
- Eating times
- Body temperature
- Lying behaviour

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. A modest improvement in heat detection can often justify the cost. Side benefits might include: more accurate timing of insemination (so better conception rates) and earlier detection of sick cows.

Pros and cons

Automated systems for detecting cows on heat help improve reproductive management and performance. Automation can achieve very high submission rates and heat-detection accuracy (especially with the newest technology, optimal settings and best cow environments). Like any technology, they do require some time and expertise to set up, optimise and maintain. They are generally user-friendly, but they do not work so well if the information is not utilised properly or the system is poorly maintained.

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

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.

Looking ahead to the future

Artificial intelligence is transforming technology in many areas, and dairy herds are no different. At the time of writing, there are systems under development which use cameras, GPS positioning, or both, to accurately track the behaviours and movements of every cow in the herd. Artificial intelligence allows rapid development of computer algorithms to accurately detect subtle changes in behaviour. This is one example of how technological advances are likely to improve heat detection. A further example is the possible detection of chemicals in milk or even directly from the cow, using a 'robotic nose': if cows can detect other cows in heat this way, be sure that technology will soon find a way too.

Managing heat detection in larger herds

There is no reason why cows in larger herds should be less fertile than those in smaller herds. Heat detection just needs to be 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.

Recommendations

- Clear forms of animal ID easily read from some distance are essential to ensure correct identification of each cow detected on heat
- 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, seek advice on the best handling system

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 previous heat was 19–26 days ago, then inseminate; if previous heat was longer than this, then check pregnancy-diagnosis records
- 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

In general, routine heat synchronisation is becoming less popular where it was once practised in large herds, in part due to better automated heat-detection systems and in part due to societal expectations around the unnecessary use of fertility hormones.

Increased heat-detection rates

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 resynchronisation 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 the UK.

Key considerations for heat synchronisation

If you are 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. Consider whether the routine use of hormonal treatments is acceptable to your milk buyer or yourself and whether investment in alternative technologies might be better suited to your needs (e.g. upgrading your automated heat-detection system).

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?

Synchronisation may also be used on smaller numbers of cows spread throughout the year (e.g. for cows not served within a set time of their VWP ending). Here you may need to consider:

- How will this be organised? Will cows be grouped into small batches so that all programmes begin on a specific day of the week?
- Whose responsibility will it be to produce lists of cows for treatment and insemination, and who will do these tasks?

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.

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. Not surprisingly, the incidence of non-cyclers is affected by calving date relative to the VWP.

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.

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 the proportion of cows not cycling by the end of their VWP:

- 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
- Herd waiting policy – a very short VWP will increase the number of cows that reach the end of the period and are still not cycling

Note: High levels of milk production do not necessarily increase the number of non-cyclers.

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. Automated heat detection, tail paint or heat mount detectors can show you who is cycling during the VWP.

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.

It is important to distinguish NSB cows which are cycling but not showing heat or being detected, from those which are not cycling. Your vet will be able to help with this.

Research shows that early treatment of non-cyclers:

- Increases herd submission rate
- Helps more high-risk cows get back in-calf earlier

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 VWP

A range of options are 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 VWP 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.

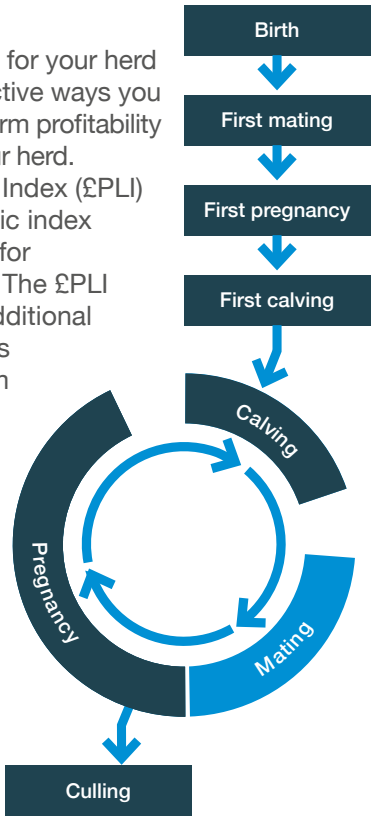
- Some cows will not have been on heat since calving. It may be better to delay treatment for cows that are in low body condition, are lame or are first calvers

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

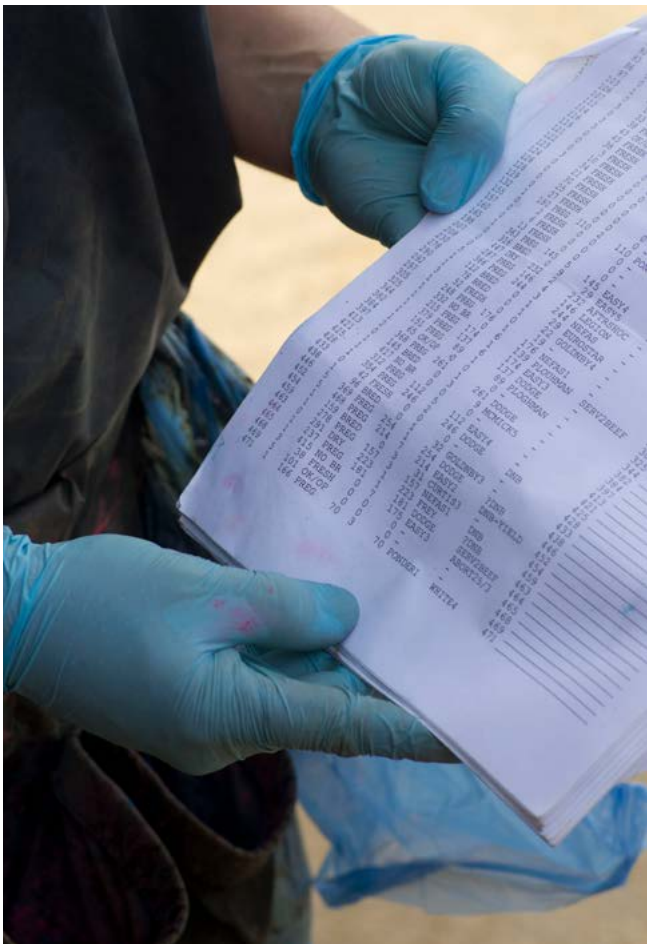
Overview

Choosing suitable sires for your herd is one of the most effective ways you can improve the long-term profitability and performance of your herd.
The Profitable Lifetime Index (£PLI) is a within-breed genetic index developed specifically for AYR GB dairy farmers. The £PLI value represents the additional profit a high-£PLI bull is expected to return from each of its milking daughters over her lifetime compared with an average bull of £0 PLI.



Key points

- Select £PLI bulls with a higher value than your best cow
- Select fitness traits to maintain your strengths and address herd weaknesses (fertility, lifespan, etc.)
- Match conformation (type) to suit your herd
- Select bulls with higher direct calving ease for maiden heifers



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 performance, genetics must be a consideration.

Herds which fully milk record can find their average milking herd genetic merit for AYR calving, £PLI, 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.

AYR-calving breeding indexes – £PLI

The £PLI is recommended for use by all-year-round calving UK farming operations. The index should be used as the initial screening tool in bull selection, then look within this group for the traits that most need improving in your herd. This will vary with individual herds but should include the Lifespan and Fertility Indexes. By using the £PLI to select the best bulls for your herd, you can breed more profitable cows which are suited to the typical all-year-round calving UK systems.

Aims of the £PLI include to:

- Promote yield while protecting milk quality
- Increase emphasis on fertility
- Improve functional type – feet and legs and udders
- Increase emphasis on longevity
- Improve udder health and lameness
- Reduce costs associated with maintenance
- Improve calving performance

For further information, see **Profitable Lifetime Index £PLI** on the AHDB Dairy Breeding 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:

- Individual cow reports (separated into Youngstock and Milking Herd)
- Herd genetic report summary
- Benchmarking report
- For further information, see **Herd genetic reports** on the AHDB Dairy Breeding website

Genomic testing

Genomic indexes are calculated using a young animal's own DNA or genetic material rather than being estimated from the performance of its parents and ancestors. Genomic evaluations have long been used to test the genetics of young bulls for the main dairy breeds found in the UK.

These give higher reliability proofs compared to traditional pedigree indexes and have helped accelerate the rate of genetic gain in the dairy industry.

It is becoming increasingly common to test females too, as a further tool to select the animals with superior genetics to breed the next generation of replacement heifers. With wide availability of sexed semen, fewer females are needed to produce the next generation of dairy replacements, and this gives you more scope to target which females you want to breed your replacements from. This can accelerate the rate of genetic gain in your herd, but only if you first take time to identify these females. The herd genetic report is a tool that allows you to look at the genetics of individual females and select your best milking cows and heifers to put to sexed semen for replacements, leaving the remainder to be put to beef semen to maximise profitability.

To find out more about using genomics, and genetic management as a whole, see the **Genetics workbook** on the AHDB Dairy Breeding website.

GB Dairy Calf Strategy

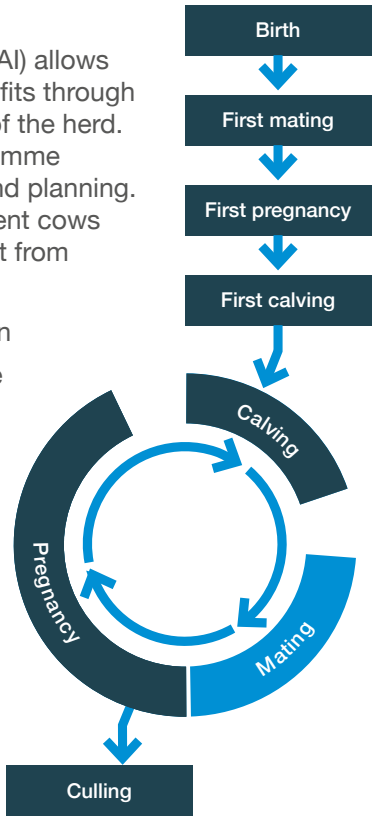
The British dairy industry prides itself on being a pioneer in dairy cattle welfare. Choosing sires to maximise the value of beef calves and reduce the production (and early slaughter) of dairy bull calves should be a priority. For further guidance on the choice of sires for dairy beef calves, search **GB Dairy Calf Strategy** on the AHDB website.

Artificial insemination

Overview

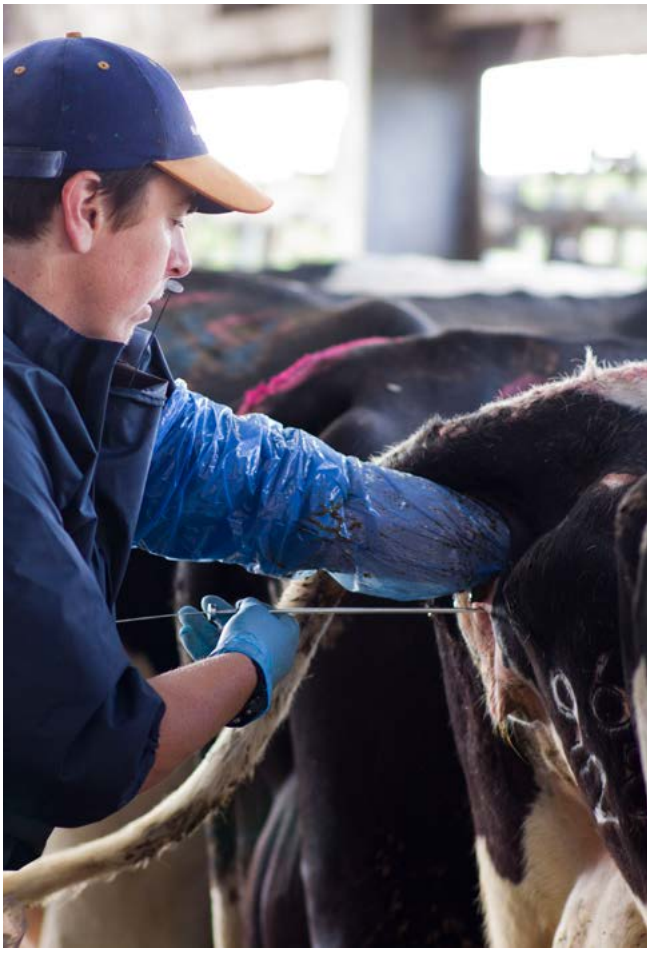
Artificial insemination (AI) allows farmers to improve profits through genetic improvement of the herd. Managing an AI programme requires preparation and planning. If you are to get sufficient cows pregnant and to benefit from using AI, you need:

- 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 the £PLI breeding index to select sires
- 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 sexed AI straws containing mostly female (90%+ purity) sperm are now widely available for most of the common dairy breeds. Using sexed semen within an AI programme offers considerable advantages, and the majority of dairy semen used in the UK is now sexed.

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

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 and heifers 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 some things to consider when using sexed semen. These include:

- Conception rates tend to be lower than for conventional, unsexed semen. Under ideal conditions, the conception rate of sexed semen is around 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

Sexed semen offers great potential for most UK dairy herds, especially if used selectively on your best females and by excluding its use in animals with compromised fertility.

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, are healthy, cycling and fertile

For optimal cost benefit, use genomic testing and herd genetic reports 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 at 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 affect 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 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 7 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 11 shows two examples of crossbreeding strategies:

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

The circles represent the breed proportions in successive generations.

Table 7. 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

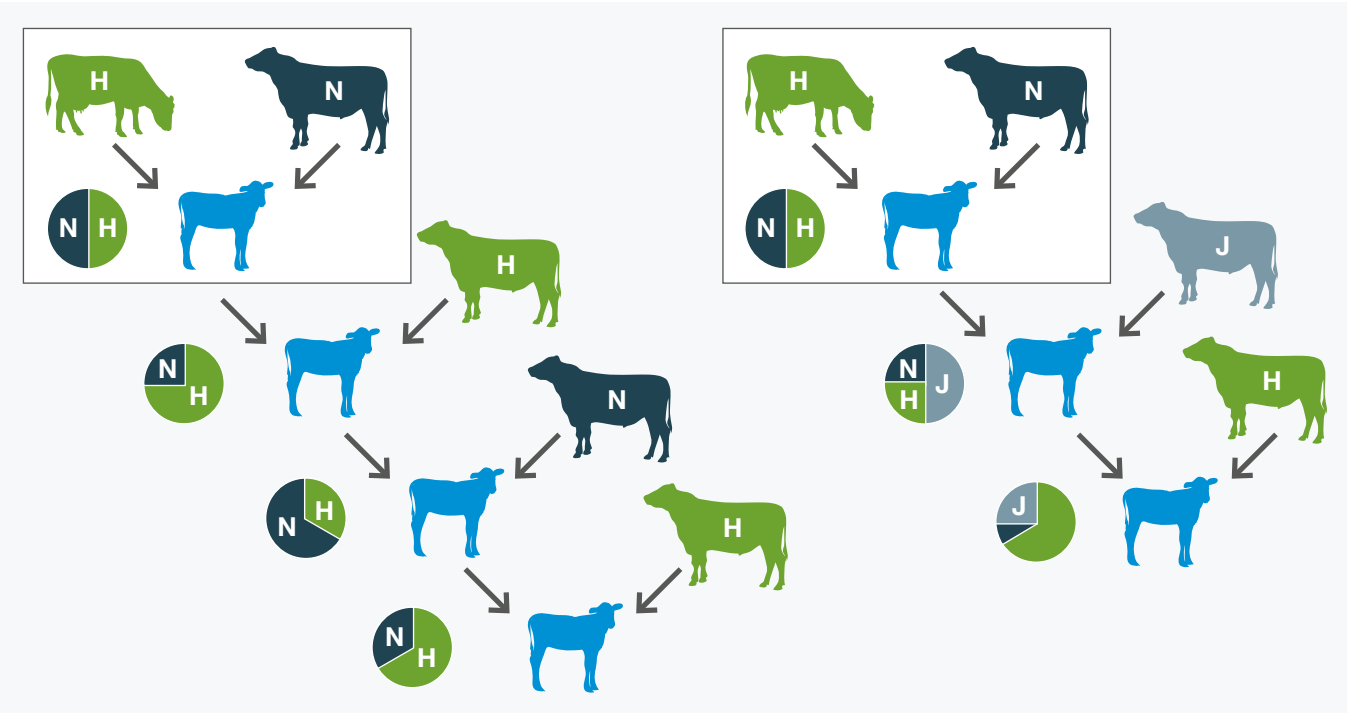


Figure 11. Crossbreeding strategies

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.

If you're doing DIY AI, make sure your technicians attend 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
- 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)

Handling straws

- 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
- 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 a wise investment for any herd
- 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 locate 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 12).

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.

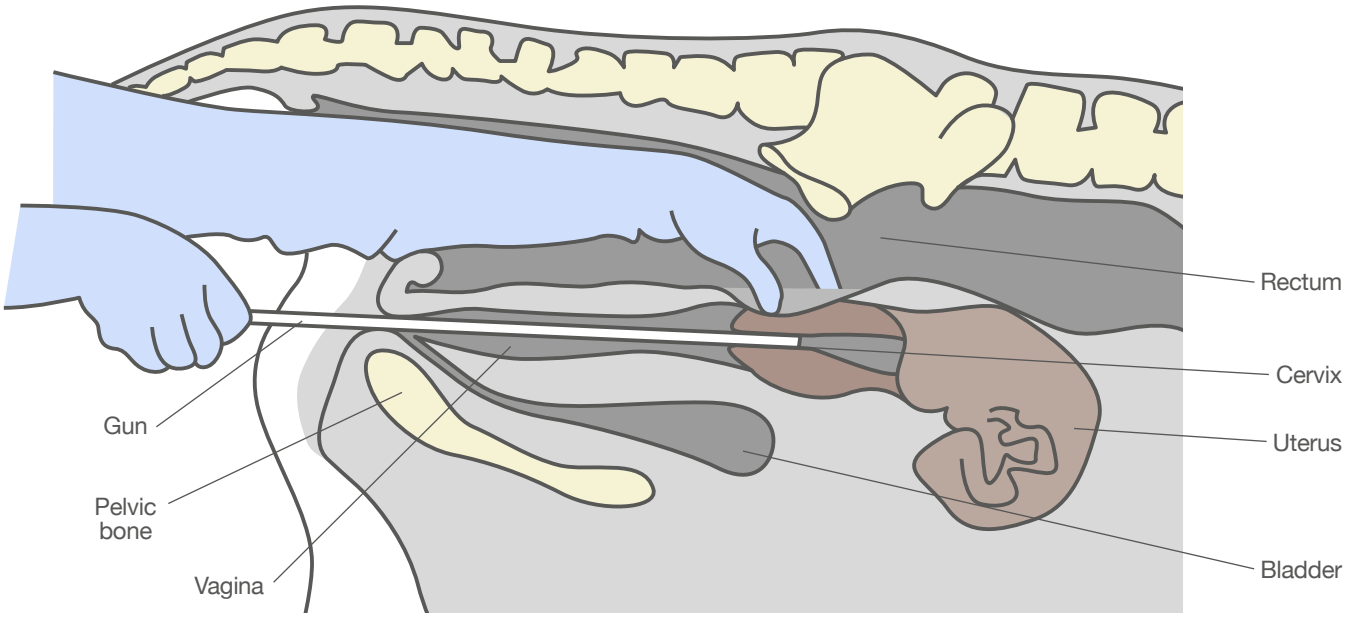


Figure 12. Correct placement of semen: deposit all the semen just through the cervix

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 alternative 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 all-year-round calving herds, inseminate all cows seen on heat after their VWP, except cows definitely to be culled and cows where a synchronisation programme is being used.

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
- Provide access to feed, water and beds if animals are to be held for more than one 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, foot trimming or pregnancy testing
- Be patient with difficult/temperamental cows – don't add 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 good management practice will eliminate unnecessary stress.

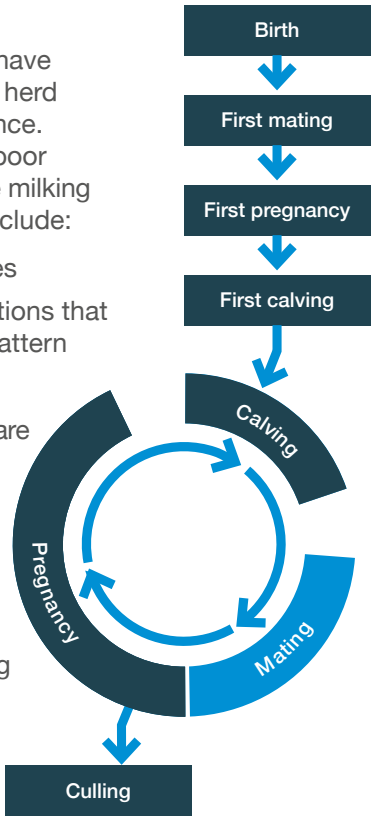
Bull management

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 is 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
- 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 evaluation (BBSE) 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.

When using bull mating in the herd, use frequent pregnancy testing to allow you to calculate the 100-day in-calf rate on a regular basis. Review bull management if the 100-day in-calf rate is less than 58% and if bulls ran with the herd or many cows on heat were mated to bulls.

Note: Seek professional assistance if the 100-day in-calf rate is less than 45% with bull mating.

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.

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 are more prone to calving difficulties on average (Table 8).

Table 8. Calving difficulty by breed

Risk	Breed
Low risk	Jersey
Medium risk	Holstein, Angus, Hereford
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 BBSE performed to check they have adequate semen production

Size

Consider the size of cows to be served and the environment in which mating will occur. Bulls need to be tall enough to achieve intromission in all cows. Avoid using bulls that are oversized, particularly in heifers and when mating on concrete, as this can increase the risks of injury.

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 behaviour. 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 such as stalking or obstructive behaviour. 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. Remove 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 injuries.

Preparing bulls for mating

Planning

Stress can have a profound effect on bull fertility and willingness to serve. Ensure bulls are well adjusted to their environment and social group before mating.

- Move bulls to your farm at least two months before they are required for work
- If mixing different groups of bulls do so 2–3 months prior to use and allow plenty of space while the group hierarchy is established
- Ensure you have adequate bull power, allowing for contingencies. Avoid alterations to established social groups where possible

Health checks

- Check bulls for any signs of injuries or ill health
- Ensure vaccination courses are completed at least two months prior to breeding
- Examine feet and trim if necessary to minimise risks of lameness
- Consider parasite control, particularly lungworm and liver fluke, and take appropriate action if required

Body condition

Bulls in body condition score 2.5–3.0 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 13. Bull MOT

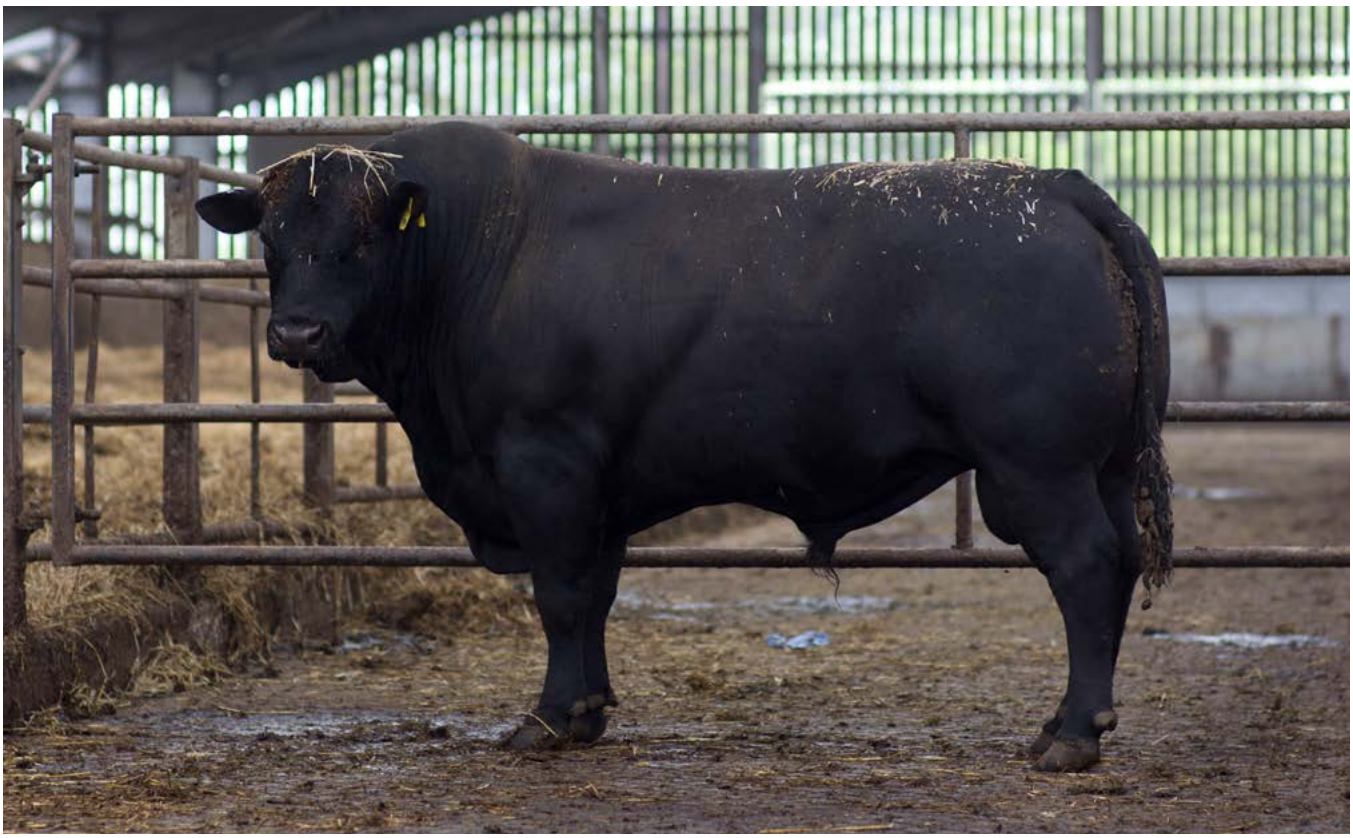
Veterinary bull breeding soundness evaluation (BBSE)

Approximately one in five bulls are 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. Performing a veterinary BBSE for every bull before each breeding period is highly advisable. The evaluation 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 examining it microscopically for motility and for abnormalities. It is a very important part of any BBSE.
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 period, 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.

Bulls can undergo significant periods of infertility after illness or being treated with some medicines, even if they had previously passed a BBSE. Remove the bulls 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
- Use preventative hoof trimming to help reduce 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 to 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

Effect of temperature on sperm production

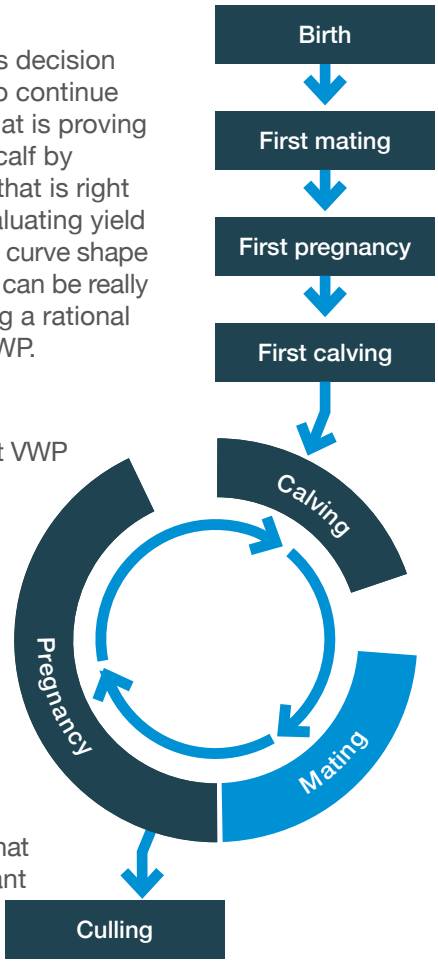
The optimum temperature for sperm production is 33–36°, which is 3–6° below body temperature. Higher temperatures caused by fever or heat stress affect sperm production and will increase the number of abnormal sperm.

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

Overview

Make a conscious decision about how long to continue to breed a cow that is proving difficult to get in-calf by choosing a VWP that is right for your herd. Evaluating yield data and lactation curve shape for your own herd can be really valuable in making a rational decision about VWP.



Key points

- Select the right VWP for your herd. You will need to balance cow fertility and herd milk production impacts of your VWP choice
- Decide when you will stop mating cows that are not pregnant
- You need to manage cows individually to achieve your goals. This requires good record-keeping and regular assessment

Selecting a voluntary waiting period (VWP)

In an all-year-round calving herd, it is easy to lose track of the length of time between cows calving and when they should be first mated, as well as how many times they have been mated this lactation.

It is important to make a conscious decision about how long to continue to breed a cow that is proving difficult to get in-calf.

A long gap between calving and first service, and/or allowing cows too many matings, increases the number of extended lactations in the herd, leading to a rise in the average days in milk, lower milk production and less profit.

The key decisions that you need to make are:

- How long you will delay mating in freshly calved cows
- How long you breed non-pregnant cows before listing them for culling

The VWP is a term used to describe the time after calving during which no inseminations are to be performed – even if the cow is detected on heat.

The main roles of the VWP are:

- To allow the cow sufficient time to recover from calving and let her reproductive tract repair and prepare for the next mating and pregnancy. Once cows pass their VWP, their reproductive tract is more able to conceive and to hold a pregnancy
- To avoid too many cows being dried off while still giving a high milk yield. This can cause difficulties at drying off, as well as potentially being less profitable for individual animals

How to choose your VWP

Reproductive performance is very low immediately after calving. Fertility slowly returns to normal 7–12 weeks post-calving for most cows. Breeding cows too soon or delaying mating for too long are both inefficient, so choose a VWP for your herd that provides an adequate conception rate for first matings and gets a sufficient number of cows pregnant early in lactation to provide a low average days in milk.

The idea is to begin inseminations just at the right time – not too soon, nor too late.

What if the waiting period is too short?

Overly short VWPs – less than 40 days – tend to result in more cows pregnant earlier in lactation and fewer reproductive culls but also increased semen use and cost by reducing conception rates (often to gain a small number of extra pregnancies). In higher-yielding herds, they can also lead to problems with cows at the end of lactation being dried off while still giving a high milk yield.

What if the waiting period is too long?

Overly long VWPs – greater than 60 days – may lead to higher conception rates and reduced semen use, but they also create unnecessary delays to cows becoming pregnant and increase the average days in milk for the herd, plus result in higher reproductive culling.

A 'persistent' lactation curve

A key consideration when selecting a VWP is the herd's lactation persistence. This is a measure of how much an individual cow's milk production declines from mid to late lactation. Herds with a small drop are said to have good persistency and may wish to consider a longer VWP.

This is possible because production doesn't fall greatly in herds with good lactation persistence, even though the average days in milk increases for the herd after a longer waiting period. However, it is better to use as short a VWP as practical.

The right VWP for your herd

Most herds use a VWP of 40–60 days, with 45–50 days appropriate for the majority of situations.

Table 9 shows situations in which shorter or longer VWPs may be appropriate.

Table 9. Situations for different-length VWPs

Short VWP – 40 days	Long VWP – 60 days
May be more appropriate where: • Heat-detection rates are lower • Overall production is lower (e.g. 305-day yields <7,000 litres) • Milk yield declines steeply after peak lactation (e.g. >2 litres/cow/day decrease per month after peak) • Cheaper semen is used	May be more appropriate where: • Fertility performance (both heat detection and conception) is good • Overall production is high (e.g. 305-day yields >10,000 litres) • Milk yield declines slowly after peak lactation (e.g. <1 litre/cow/day decrease per month after peak) • More expensive semen is used

Heifers tend to have much flatter lactation curves than cows; there is therefore an argument that a longer VWP (typically an additional 10 days) is appropriate for heifers. This may be a profitable strategy, but:

- It increases complexity – the benefit can easily be lost in confusion over which animals are eligible
- It makes monitoring (especially measures like 21-day pregnancy and insemination rates) harder, as animals of different parities become eligible at different days in milk

Trading off

The losses from slightly reduced conception rates to first insemination are usually more than offset by the gains in shorter time to conception, reduced average days in milk and increased milk production per cow per day. Do not lengthen the VWP to avoid small numbers of cows having to be dried off at high yields if this comes at the expense of longer lactations and decreased productivity for far more of the herd.

Example: Choosing an effective VWP

Neil, the farm manager in our example, was very aware that some cows in his high-yielding herd were due to dry off as they were yielding a substantial amount of milk when due to go dry. This was making it difficult to dry these cows off, as well as potentially being an unprofitable way to manage them. In order to avoid this, the herd VWP was set at 70 days.

However, evaluating yield records and lactation curve shape (below) showed that although some cows remained high-yielding later in lactation, the majority of cows were actually yielding less than 20 litres/day by the time they reached 300 DIM. The lactation curves below are relatively 'peaked' in shape, indicating potential to improve profitability by reducing VWP (e.g. to 50 days). By delaying first serves until after 70 DIM, many more cows would still be milking well past 300 DIM, at which stage they are clearly much less productive.

Lactation curve shape: This pair of charts shows daily yield records (each blue point represents a cow's yield on a milk-recording test day, with DIM on the horizontal and yield on the vertical axis) with fitted lactation curves (red lines).

When to stop mating

If a cow is not pregnant and reaches 200 days after calving, you need to decide whether to keep inseminating her when she returns to heat.

Consider the following questions in making this decision:

- What is the cow's current production?
- What is her total production for the lactation?
- How old is she?
- Does she have a high cell count and has she had clinical mastitis?
- Is her foot health good?
- Has she been hard to get in-calf before?
- If I stop inseminating her, will I get sufficient heifer replacements?
- What is the cost of continuing to inseminate the cow? Should I use cheap semen or a bull?
- If she gets in-calf now, how will I prevent her getting over-fat before drying off, and then becoming a problem for me in her next lactation?

These decisions should also be made in the context of the number of pregnant replacements due to calve and the number of cows in the herd due for culling for non-reproductive reasons.

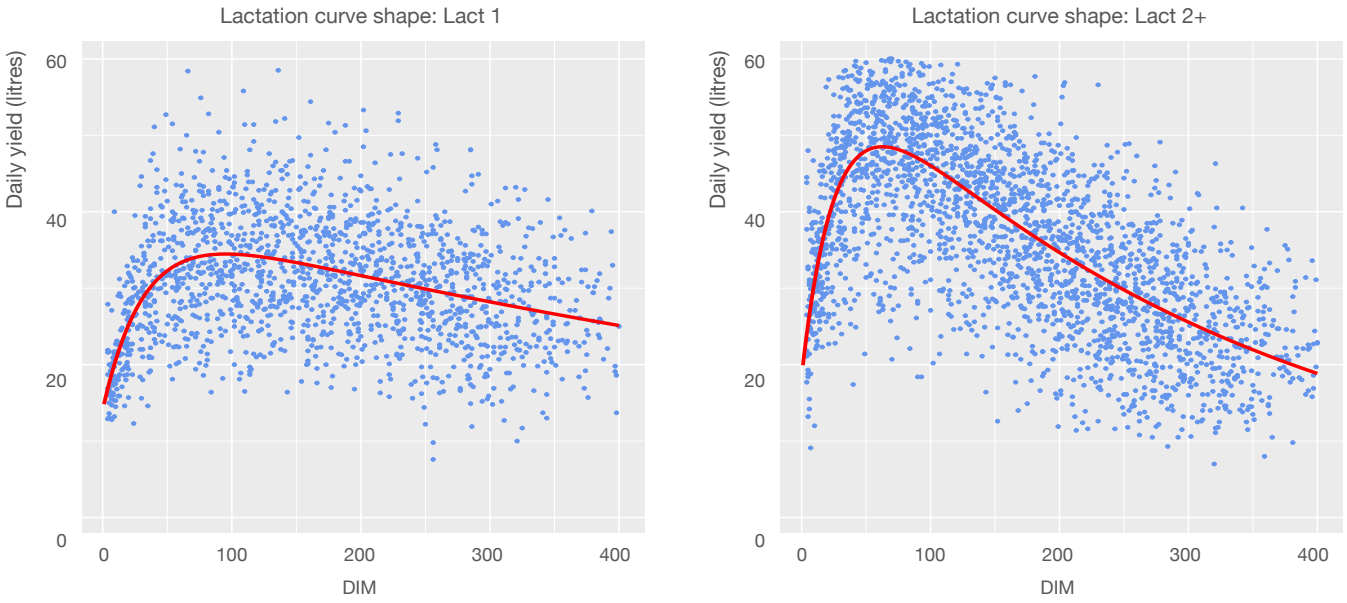
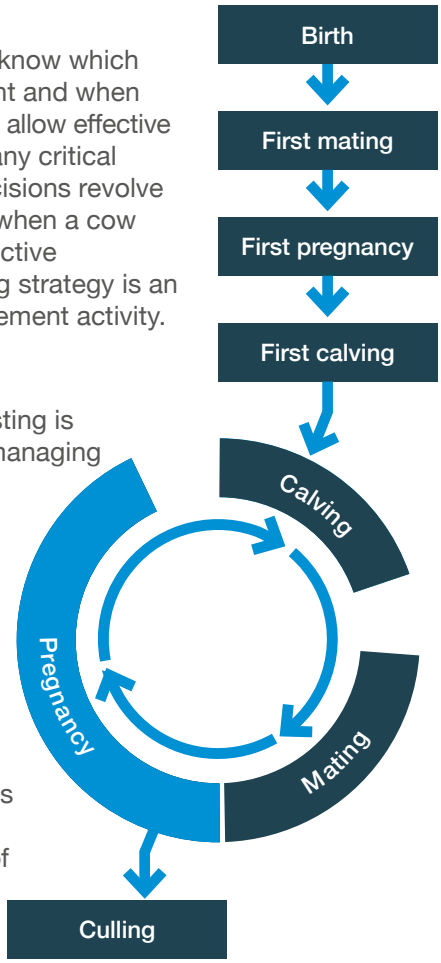


Figure 14. Daily yields vs DIM for prima- and multiparous cows

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

- Pregnancy testing is essential for managing reproduction
- Rectal pregnancy tests and milk pregnancy tests are available
- Early pregnancy detection gives timely identification of non-pregnant animals so they can be managed to re-breed

Using pregnancy testing

To measure and monitor herd reproductive performance

Pregnancy testing and 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 ageing, 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

In AYR-calving herds, pregnancy testing enables you to:

- Focus extra heat-detection efforts on non-pregnant cows
- Use heat synchrony to induce heats in non-pregnant cows
- More accurately predict milking herd size for the coming six months

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 30 days onwards). Ultrasound is more usual nowadays and offers several potential advantages over manual palpation
- Laboratory testing of milk or blood samples to determine the level specific proteins called pregnancy-associated glycoproteins (PAGs). Accurate pregnancy diagnosis is possible from 28 days onwards

For either approach, pregnancy loss between 28 and 60 days can be quite common, up to around 5–10% – 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 in Table 10.

Table 10. Advantages and disadvantages of the different pregnancy-testing approaches

Measurement	Trans-rectal ultrasound examination	Lab testing of milk samples
Advantages	Experienced operators are very accurate at identifying both pregnant and non-pregnant cows Results are 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, as the ovaries and uterus can be examined at the same time Experienced operators can detect twin pregnancies	The test is very accurate at identifying pregnant cows Tests are non-invasive Testing can be convenient – especially when added to routine herd milk recording Cows do not need to be drafted, reducing stress and time away from feed. Consequently there is no reduction in production
Disadvantages	Drafting cows for examination can take time and cause stress Rectal examination is an invasive procedure There is a small risk of injury to cow, operator and foetus Good facilities are required for safe examination An experienced operator is needed Can be expensive if only small numbers of cows are tested	The test is unable to detect twins The test does not allow ageing of the pregnancy Usually, there is a short delay before the result is known, due to transport of the milk sample to the laboratory If cows are recently calved (less than 60 days) or have recently lost their pregnancy, the test can give a false positive result

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:
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				

Follow-up pregnancy testing

Using follow-up or confirmatory pregnancy testing can be useful. It is especially recommended where early pregnancy testing is carried out because up to 10% of diagnosed early pregnancies may be subsequently lost. A confirmatory test is usually done after around 10–12 weeks post-service, as after that time the pregnancy is quite stable.

You have the choice again between using manual testing/trans-rectal ultrasound examination or chemical testing (PAG test in milk). The pros and cons are as listed in Table 10. However, because at this stage there is not the same need to get quick results or to age the foetus, a milk test done on samples taken at the usual monthly milk-recording date may make sense even if you choose to detect early pregnancies manually.

You then have a further choice to make with the cows found to be empty which you had previously diagnosed as pregnant. If they are more than 200 days in milk, it is probably not sensible to serve them again – see the section When to stop mating on page 59.

If more than 10% of cows which had been diagnosed pregnant at the early pregnancy test are then later found to be empty at the confirmatory test, the reason should be investigated with your vet.

Some cows may fail to calve even after a confirmatory (follow-up) pregnancy test has diagnosed a pregnancy. This is most likely due to an abortion, which can still sometimes go unnoticed even at this later stage of pregnancy. If the abortion rate is higher than 3–4 per 100 cows, the reason should again be investigated; an unmanaged disease problem is a possible cause.

Pregnancy-testing strategies

You need to select an appropriate method of pregnancy testing for each purpose and 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 are a number of different 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 AYR-calving herds include:

Routine fertility visits

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

This approach also provides the opportunity to present other categories of cow for examination (e.g. not seen bulling). Routine visits are commonly carried out at intervals of 1–4 weeks, depending on herd size.

Occasional pregnancy-testing sessions

Testing eligible cows every 2–4 months accurately identifies cows that are pregnant and can provide usable estimates of conception dates for most cows, provided AI is being used in the herd and mating information is available at pregnancy testing.

Note: About a quarter of cows may have an inaccurate estimate of conception and calving date using this approach.

Pregnancy testing selected cows

Only cows suspected of being empty or having resorbed/aborted are pregnancy tested. Other cows are assumed to have conceived at their last recorded AI or natural mating. This strategy is not recommended due to inherent inaccuracy in identifying pregnancy status and conception dates from heat records.

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.

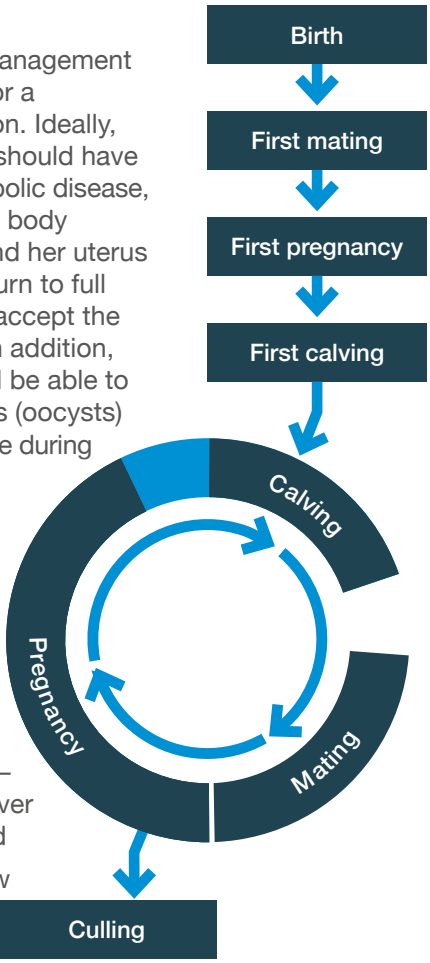
Early rectal pregnancy testing also allows the reproductive performance of a group of heifers to be identified as soon as possible. Fertility in heifers can be monitored using a similar approach to that in the milking herd (see Measuring and monitoring chapter).

Ideally, more than 50% of eligible heifers (those past target breeding age/weight, or based on time of movement into the breeding group, and not already pregnant) should get pregnant every 21 days. Where performance is disappointing (e.g. <35% eligible heifers getting pregnant every 21 days), review:

- Calf management resources
- Heifers weaning to calving chapter, page 20
- Heat detection chapter, page 29
- Genetics and sires chapter, page 39
- Artificial insemination chapter, page 41
- Bull management chapter, page 49

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 (oocysts) 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.

Important issues to consider during this phase include:

Dietary management

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.

For further guidance on dietary management and the inclusion of forage in the dry cow diet, read **Forage First**.

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 reduce 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 16 (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 on 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 (40–50 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.

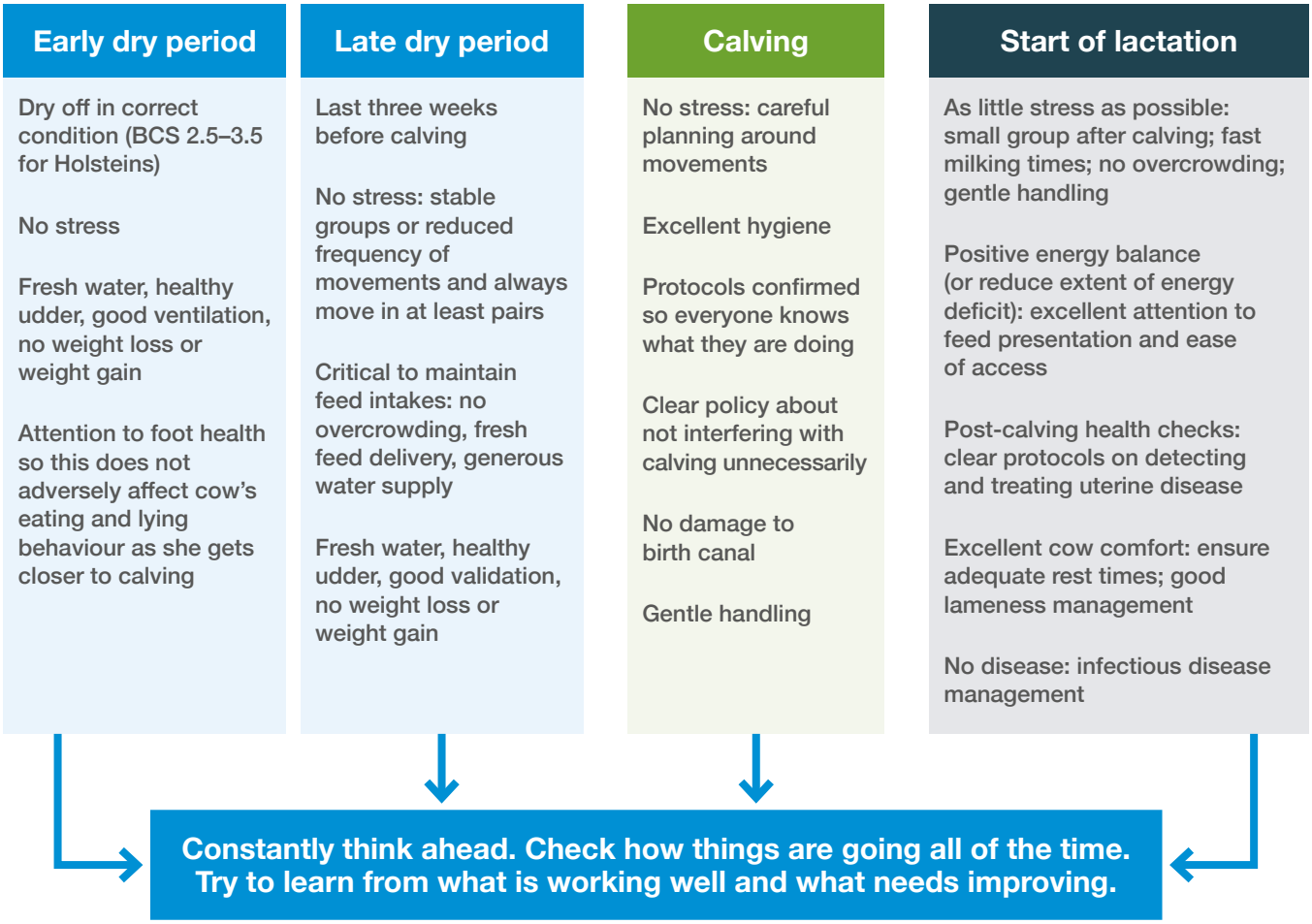


Figure 15. The phases of transition management

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

Mineral shortages, such as selenium, vitamin E and iodine, can be problematic. 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. Do you have 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 to house 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? Freshly calved cows and heifers will have special needs

A steady number of dry cows/in-calf heifers might be expected at all times of the year. However, most farms still have busy and quiet calving periods, so to cater for this fluctuation, it is customary to provide accommodation for 130–140% of the average number of dry cows. This is because it is important to never overstock dry cows.

A continuous cycle of drying cows off and calving cows means that there will usually be regular movements of cows between groups (for example, from milking cow to dry cow; or far-off to close-to dry cows). While it is possible, in large herds only, to have stable groups of dry cows, it is far harder to achieve than for block-calving herds.

Calculating how many dry spaces you need

- Know your calving interval, number of cows and replacement rate
- Know your dry period length
- Know if your herd size is expanding, contracting or staying constant

Assuming that you calve all your heifers (rather than buying in fresh-calved heifers or cows), the average number of calvings per week will be:

$$\text{Average number of calvings per week} = \frac{\text{Number of adult cows in herd} \times (365 \div \text{calving interval})}{52}$$

For an eight-week dry period, all housed, heifers introduced eight weeks before calving, you need an average of 8 x (average number of calvings per week). A six-week dry period will be 6 x (average number of calvings per week), etc.

However, you may sell 25 fresh-calved heifers a year: add in these (approximately half an extra calving every week). Or you may introduce in-calf heifers only in the last four weeks of the dry period – reduce your figure accordingly.

Whatever your average figure, you must multiply it by 1.3–1.4 (130–140%) to cater for the busy periods.

A golden rule is never overstock dry cows.

Worked example

John has a herd of 176 year-round-calving cows. His replacement rate is 25%. He has far-off and close-to dry groups, both of which are housed. He introduces in-calf heifers to the close-to pen four weeks before they are expected to calve. His far-off group is for the first five weeks of the dry period and the close-to group is for the last three weeks. All cows are dry for around eight weeks. The calving interval is 410 days, and the herd size is expected to stay constant.

- There will be an average of (176 x 0.75) x 365/410 = 118 cows calving per year, 2.27 per week
- There will be an average of (176 x 0.25) x 365/410 = 39 heifers calving per year, 0.75 per week
- He needs an average of 5 x 2.27 = 11.35 far-off spaces (cows only)
- He needs an average of (3 x 2.27) + (4 x 0.75) = 9.81 close-to spaces (cows plus in-calf heifers)
- His accommodation should have enough flex so that the groups are never overcrowded. That means that there is enough for 140% of the average
- The far-off group should have 1.4 x 11.35 = 16 spaces
- The close-to group should have 1.4 x 9.81 = 14 spaces

Going from good to excellent

Keeping everyone informed

- 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. There is 25 metres of feed space and 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.

Figure 16. Clear signage for staff in a dry-cow shed

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.

Any movement of cows during the dry period can reduce dry matter intakes and disturb social stability.

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 larger herds, it may be possible to have several smaller (for example 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 17 shows this method for a herd operating a six-week dry period and drying off cows once a week. One of the practical difficulties can be to maintain even group sizes, particularly if the calving pattern is not evenly spread.

Each pen must never be overcrowded. A small but usually necessary compromise is that not all cows will have calved (in pen 6) by the time the next group is moved along, so some mixing inevitably occurs.

Stable dry-cow groups are difficult to achieve in even very large AYR calving herds – and become nigh on impossible in smaller herds.

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

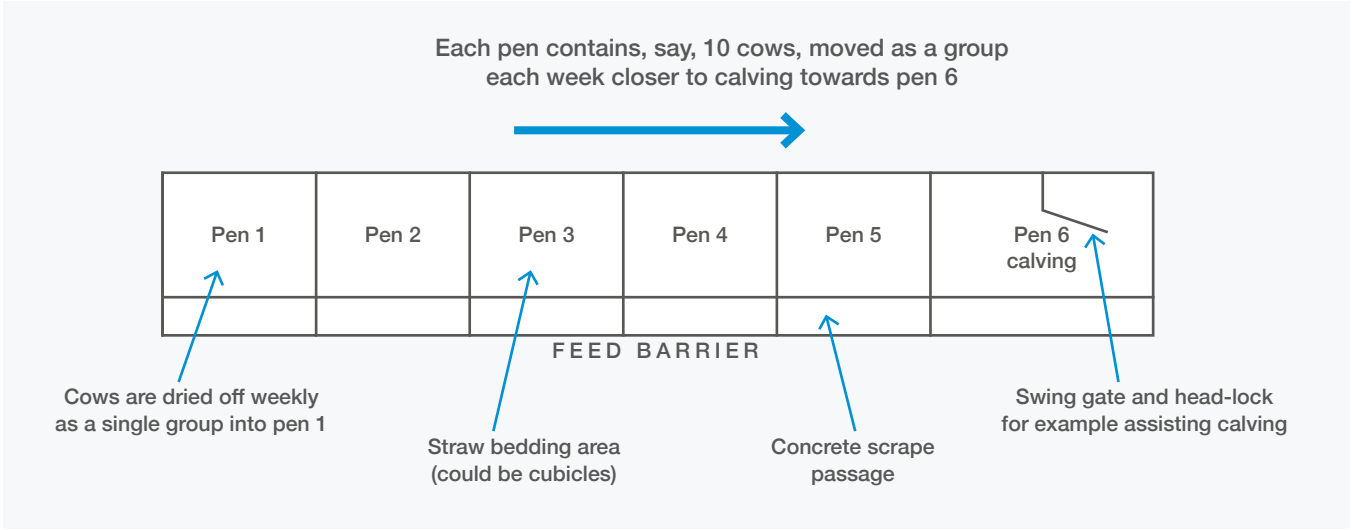


Figure 17. A stable dry-cow group system

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 sometimes used in high-yielding AYR calving herds is to reduce the dry period to around 42 days. Then a single ration and a single dry group becomes more achievable.

Research from large, high-yielding herds in the USA suggests that there is no detriment to short dry periods, as long as it is at least 35 days for all cows. There is some evidence that subsequent fertility can be better, and that 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. In the UK, it is very rare for farms to use a shorter dry period than six weeks. Too short a period can lead to lower production in the next lactation.

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.

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 and 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 and 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
- 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.

Case study

Chris had a 100-cow AYR calving herd, averaging 7,000 litres (305-day yields). During the winter months, his far-off dry cows and in-calf heifers were housed together in cubicles and fed low-quality big-bale silage and had access to dry-cow mineral buckets. He moved the cows and heifers to a straw pen for calving (Figure 18). There was only room for a few cows in the pen, so they were moved just 2–4 days before he expected them to calve (when they were bagging up). Once they had calved, he left the cow or heifer with their calf for 24–48 hours before moving them to the main milkers' cubicle shed.

In the summer months, the in-calf heifers and dry cows calved outside. The far-offs were taken to some rough pasture with access to mineral buckets. They were brought to a calving paddock close to the house in the last few days before calving, where they were fed a dry cow nut.

The problem: 10% of the cows were affected by clinical milk fever, which was particularly bad in late summer/autumn months. Fresh-calved heifers and cows lost too much weight after calving. They tended to have variable body condition scores at calving. Many were calving at the lower end of BCS in any case (BCS 2.5), having lost weight in the late dry period. It was common for cows to have retained placenta: around 10% had not fully cleansed by 24 hours after calving. Fertility suffered as cows were not showing good heats after their VWP of 50 days, as well as a high proportion of cows showing 'whites' (vulval discharge) in the first few weeks of lactation.

The solution: After discussions with his vet, Chris transformed his transition cow management to virtually eliminate milk fevers and ensure cows and heifers did not lose as much weight in the late dry period and early lactation. Fewer cows and heifers required assistance at calving. Cows also cleansed better. As a consequence, his herd's fertility improved immediately and milk yields were higher.

Chris decided that housing his cows and in-calf heifers during the last three weeks before calving would allow him to have more control over their diet. He continued to feed big-bale silage but fed an additional 2.5 kg/head/day of dry-cow pellets, which contained minerals to reduce milk fever and starch to acclimatise the rumen to the milking cow ration.

He paid greater attention to the way the diet was presented and fixed a good water supply.
He learned to use rumen fill scoring to daily check that his pre-calvers had a rumen fill score of 4 or 5 (full). Third lactation and older cows were given a calcium chloride bolus immediately after calving to further reduce milk fever and subclinical cases of low calcium.

Calves were removed as soon as possible after birth and fed colostrum harvested from the cow. Previously, Chris had feared taking many fresh cows through the parlour due to the risk of slipping (subclinical milk fever). Calf health improved through better colostrum management and earlier removal from the cows.

Chris calculated he would need eight spaces in his close-to group if he was always to avoid overcrowding. This figure was derived by first working out the average number of calvings per week (1.8). He multiplied this by 140% to account for busy periods (2.5). Then he multiplied this by 3 as this is the number of weeks he intended cows to be housed in the group.

The floor area of the pole barn was 11 m x 6 m. Assuming his cows were really capable of 8,500 litres, this would give enough lying space for 7.8 cows (1 m^2 for every 1,000 litres of milk, so 66 m^2 ÷ 8.5).

Figure 18. The pole barn. The calving pen was the left bay with access to the adjoining brick building. The middle bay was for silage, topped up twice a week. The right-hand bay, behind the sheeted gate, housed some weaned calves

So the pole barn was just the right size for a bedded area for the required eight cows. All he then needed to do was to create an outside loafing/feeding area (see Figures 19 and 20). He no longer used the brick building for livestock as it was poorly ventilated.

Figure 19. The pole barn after conversion

Figure 19 shows the pole barn after converting it into a close-to dry-cow shed. This provided 66 m^2 of lying space: enough for a maximum of eight of Chris's cows, which now average nearly 8,500 litres (305 days). However, the pen usually contains less than this; it is never overstocked. A new opening at the rear of the shed allows access to the outside feeding area, which has a concrete hardstanding.

Figure 20. The pole barn after conversion

Figure 20 shows feed presented in a long trough which provides at least 85 cm feed space per cow. There is a water trough which provides plenty of access to clean fresh water (meeting the target of over 10 cm per cow). Having feed and water away from the bedded area keeps the lying area cleaner and drier. Fresh feed is delivered daily and the trough cleaned out each day. Chris recognises that keeping the rumens full in his pre-calvers is an important goal.

Chris's comment: "The changes we made were incredibly simple really. We hadn't considered them before because we just managed the dry and calving cows like we always had. I wish we'd done it sooner. Everything is better and easier now."

The vet's comment: "The changes came about because we recognised cows were too thin when Chris was trying to get them in-calf. Pregnancy testing usually gave disappointing results. I think we all had a tendency to blame the milking cow diet at first, when really it was the transition period which needed fixing as a priority."

Going from good to excellent

The changes made in this example resulted in positive improvements in performance. Next steps could include:

- A swing gate and head-lock in the straw pen to make calving assistance easier and safer, where it is required. It would also make offering a post-calving drink and administering calcium boluses easier
- A portable milking unit for harvesting colostrum as soon as possible after calving without needing to move the cow to the parlour (Figure 21)
- A stress-free calving line (see next section). This would mean having an adjoining area for fresh-calved cows and heifers before being moved into the main milking herd. This would allow them to receive extra care, space and comfort at a critical time while being fed the milking cow ration
- A clear sign to ensure that the maximum stocking density of eight cows is never exceeded
- A smoother feed trough which is easier to clean daily
- A water trough which can easily be drained to clean daily. This should be on a solid plinth so it is easier to scrape around, keeping the area around the trough as clean as possible

Figure 21. Portable milking unit, very useful for fresh calvers

A stress-free calving line

What do calving cows need?

- An easy calving with little interference
- As little stress as possible, including from social disruption and bullying
- A spacious lying area with good grip so it is very easy to get up and down, particularly if sore after calving and carrying a large udder which is engorged with milk
- As little competition as possible for feed and water, so they can eat as much as possible
- A short milking time so they are not long away from feed and beds
- Short distances to walk to and from being milked
- A fresh-cow diet which they have been acclimatised to before calving and which provides all the nutritional needs (in particular, sufficient energy and calcium, now that they are producing milk)

The concept of a stress-free calving line is to provide these needs as best as possible. It involves housing pre-calvers next to a small fresh-cow group so cows can socialise over a gate.

Once calved, cows are simply walked from one side of the gate to the other (see Figure 22). The fresh-cow group (special needs group) might be housed in a straw yard, which can ensure cows get adequate rest, compared with cubicles. However, deep sand cubicle beds, typically slightly wider than usual, can work well too.

The stocking rate is strictly limited so each cow has her adequate lying and feeding area.

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 m² 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

For herringbone parlours, make the fresh group the size of one or two sides of the parlour, for convenience. These cows can be milked and returned to their beds and fed more quickly than if they were part of a larger group.

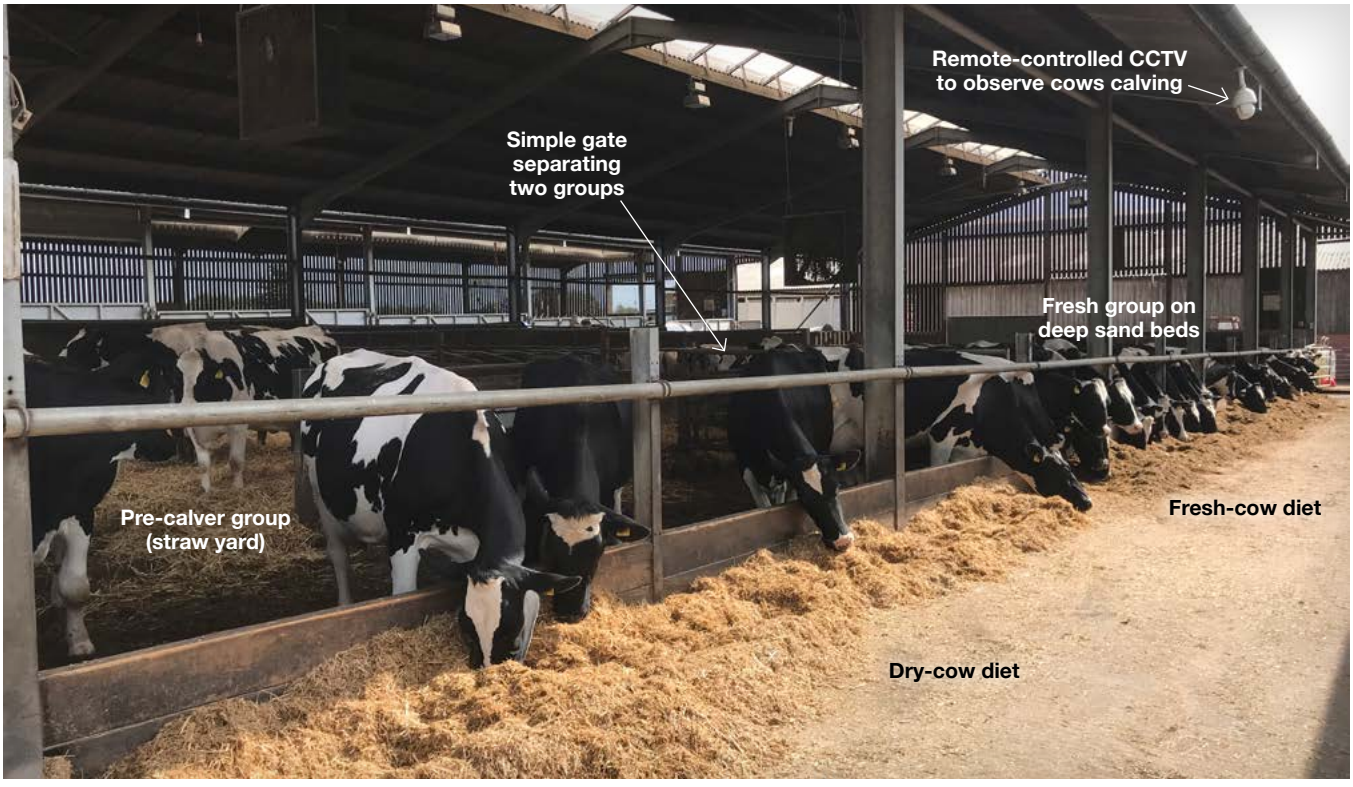


Figure 22. Example of a stress-free calving line

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.

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. Some farmers assist less than 2% of calvings and others assist more than 20%. Assistance means 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

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

How to minimise calvings which require assistance

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

Do not intervene too early: give nature a chance.

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. Use these to select suitable sires for heifers and smaller cows.

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

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 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
- Check the presentation and size of the calf during a careful vaginal examination. 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
- 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
- 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 (not around the neck)
- 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 dam'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
- 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? 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.

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 m^2/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.

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.

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?

Best practice

1. Fresh cow management

This cow has been moved from sand cubicles to an individual calving pen, once second-stage labour has begun (i.e. straining, and feet or water-bag showing). The farm is an AYR 1,000-head housed herd. It has 24-hour supervision of dry cows so can operate a true just-in-time calving policy.

Immediately after calving, she is offered a large (30 litre), wide-necked bucket of warm water with a commercially available fresh cow powder added. She is also offered a barrow of fresh milking cow ration. While she licks her calf, which is placed in front of her, through a head-lock, she is secured behind a swing gate and is milked using a portable milking unit. Her calf is moved to a clean pen and is fed colostrum.

Her details are recorded on a whiteboard. She will join the fresh-calved milking group when the stockperson is satisfied she is eating well, has drunk sufficient fluids and is fit to move. It is very rare (less than 2%) that a cow has not cleansed within six hours of calving and before joining the larger milking group.

The pen is cleaned out before the next calving.

2. 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 of milk. High-risk cows are calved in a separate pen to reduce the risk of contaminating the main calving area with Johne's bacteria.

3. Calving on sand

This AYR 400-cow Holstein herd uses a just-in-time calving policy as far as it is able to. A sand calving area has been chosen for its hygiene, to reduce the risk of metritis and mastitis. It also provides maximum grip and comfort for calving cows.

Cow dung is regularly removed throughout the day to keep it as clean as possible. Calves are removed very quickly after birth. The herd manager comments that calves can more easily suffer from hypothermia when born on sand compared with when they were calved in a straw yard which was used previously.

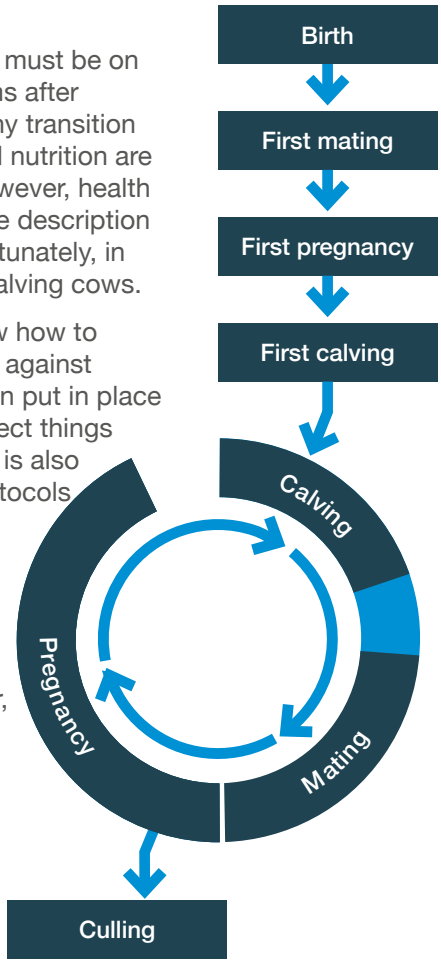
Post-calving management

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 targets

- 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 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
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 **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
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

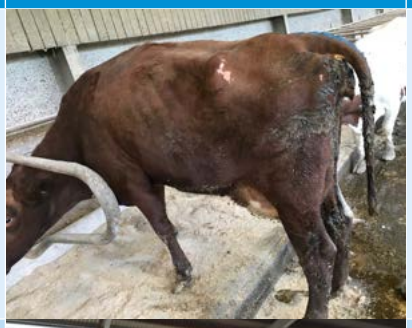
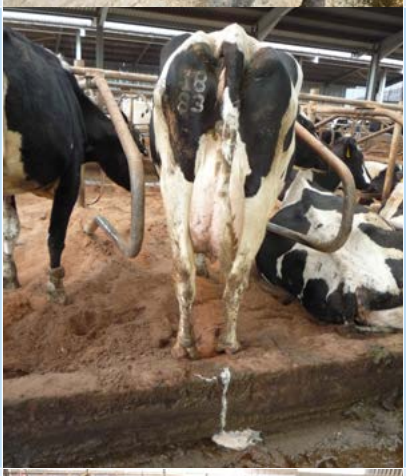
At calving, the cervix opens and bacteria can get into the uterus. Research shows that almost all cows will have some bacterial contamination. However, not all develop disease. Why is this so?

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. Table 11 gives an overview of the different conditions.

Table 11. Examples and definitions of uterine disease

Condition	Image example	Definition and symptoms
Metritis		Metritis can occur from calving up to day 21 post-partum[4] 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[4] 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

[4] Sheldon et al, 2009. Defining post-partum uterine disease and the mechanisms of infection and immunity in the female reproductive tract in cattle.

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
- 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. 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 have 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.[5]

Figure 23. Retained foetal membranes (RFM)

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 that needs 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 24 shows the typical proportion of cows with the different uterine diseases in the first 10 weeks post-partum.

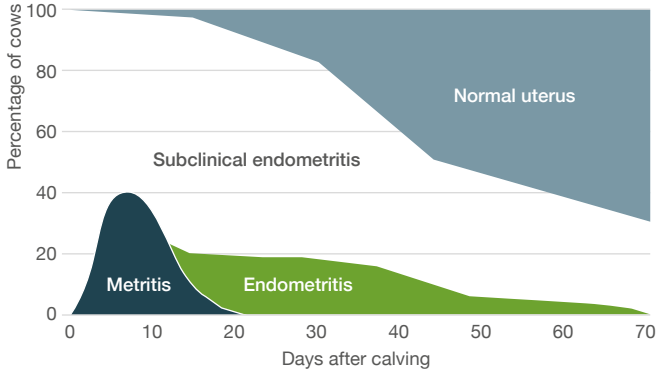


Figure 24. The proportion of cows with different levels of infection after calving

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)

[5] 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 12. 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 VWP/before start of service period, for example, from 35 days post-calving
No checks	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 25 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.

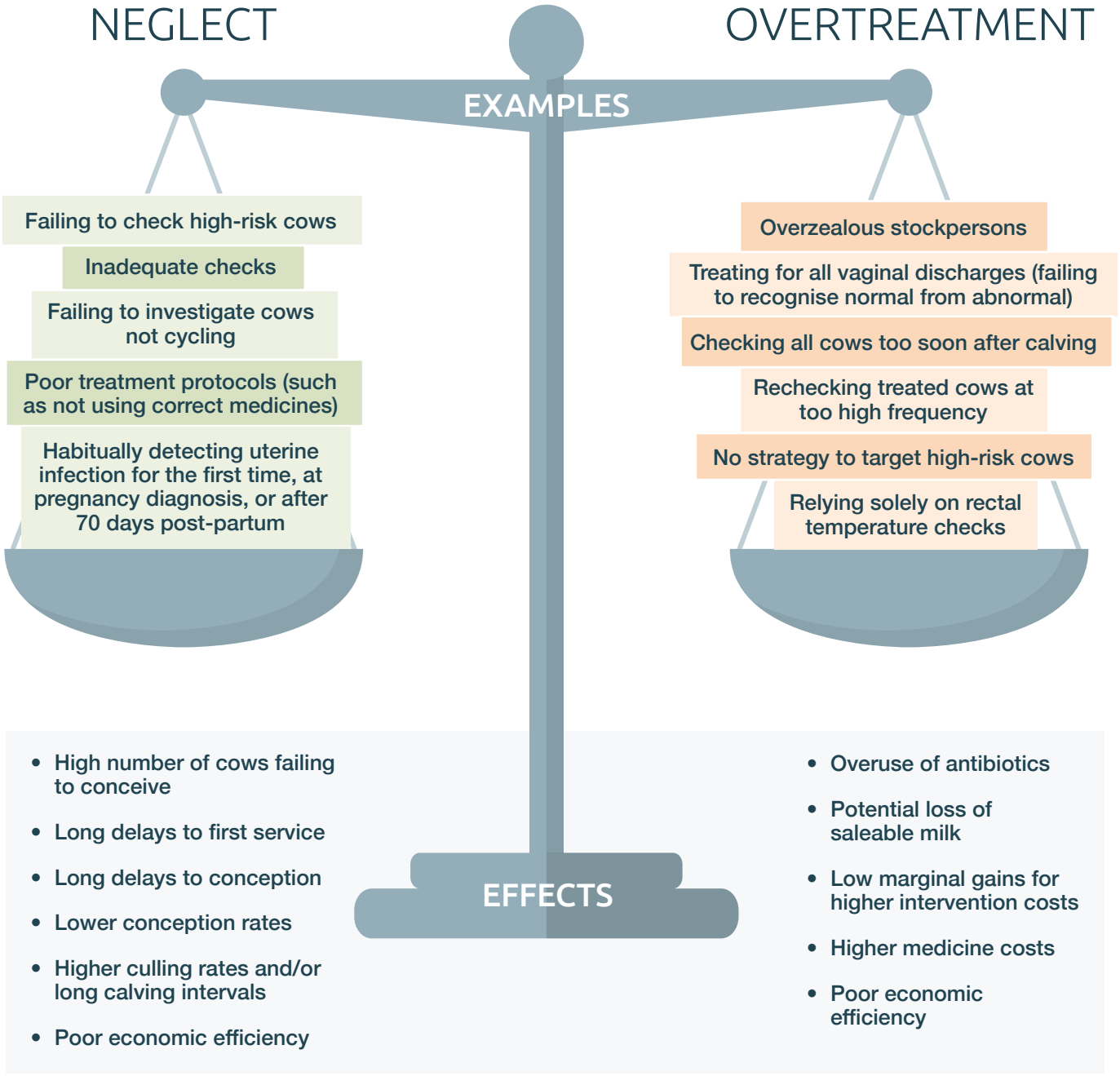


Figure 25. Finding the balance of post-calving management

On-farm example – post-calving management

Stephen has a 300-head herd of high-yielding, all-year-round calving and fully housed Holsteins. His herdsman notices that there appears to be an increased frequency of cows with white vaginal discharge. The farm has a fortnightly vet fertility visit. Cows are selected for pregnancy diagnosis and fertility examinations if they have not been observed on heat by day 42 after calving. If any cows are known to have whites, they are also shown to the vet. It is not uncommon that cows at this stage are found to have whites and so are treated for the first time.

What could Stephen do differently? What could be measured to investigate if there is an underlying uterine health problem which needs addressing?

Do differently: If NSB cows are checked by the vet from day 42, on a fortnightly regime, some of these will be day 56 post-partum (42 days + 14 days). If this is the main way of detecting cows with endometritis which requires treatment, it is too long after calving. (Remember, endometritis is one of the most common reasons for cows not bulling.) Stephen should have a protocol for detecting these cows sooner so they can be treated in good time, increasing their chances of getting back in-calf and being retained in the herd.

A protocol could be adopted where high-risk cows are recorded and presented to the vet at the first opportunity post-calving (or beyond 14 days post-partum). Alternatively, every cow can be presented for a post-partum check as soon as possible after day 21. Increasing the frequency of fertility visits to weekly will ensure cows are detected and treated as soon as possible. For a 300-cow herd, a weekly fertility visit is very feasible and other benefits will accrue. However, it will be wise to consider the risks of overtreatment which could result from rechecking endometritis cows at too short an interval after treatment.

To measure: It's not possible to know if the farm has an underlying problem as it does not have an accurate record of its metritis or endometritis rate. Despite this, there is a perception that the rate has increased. A list of all calving cows can record whether each cow has had an assisted calving, a stillbirth, milk fever, twins, retained foetal membranes or clinical mastitis in the first 30 days. If any condition is above the trigger-for-action level (see table KPIs at start of chapter), this needs investigating.

In addition to recording these high-risk cows, a post-calving vaginal check at day 21 to day 28 will help determine the true endometritis rate. From Figure 24 earlier, a level approaching 20% is certainly above average. A suggested intervention level is when more than 10% of cows have an abnormal vaginal discharge beyond day 14. The vet should be asked to investigate this, with a view to reducing it.

Going from good to excellent

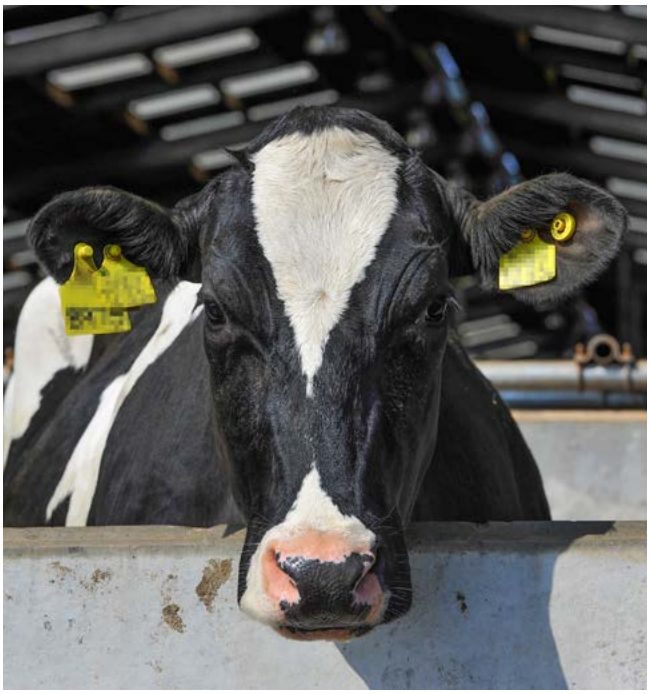
Top farmers have very good monitoring and early-warning systems for problems. Regular ketosis blood tests in fresh-calved cows (particularly AYR, high-yielding herds) can be done quickly and cheaply cow-side by trained staff. This is a more accurate (and earlier) way of detecting transition cow problems which are likely to affect reproductive health, rather than waiting for cows to show endometritis, cystic ovaries or anoestrus (non-cycling) further down the line.

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

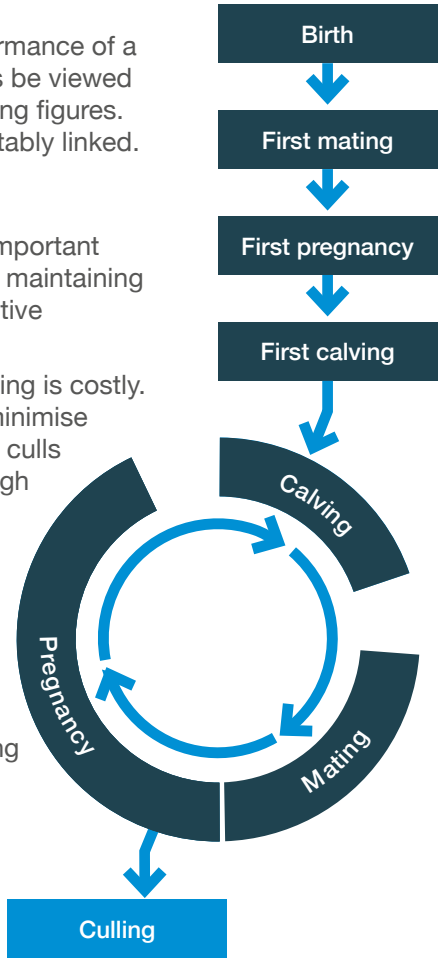
For further resources in this area, see the AHDB Healthy Feet Programme and also the Managing transition and calving chapter in this guide (page 63).



Making culling decisions

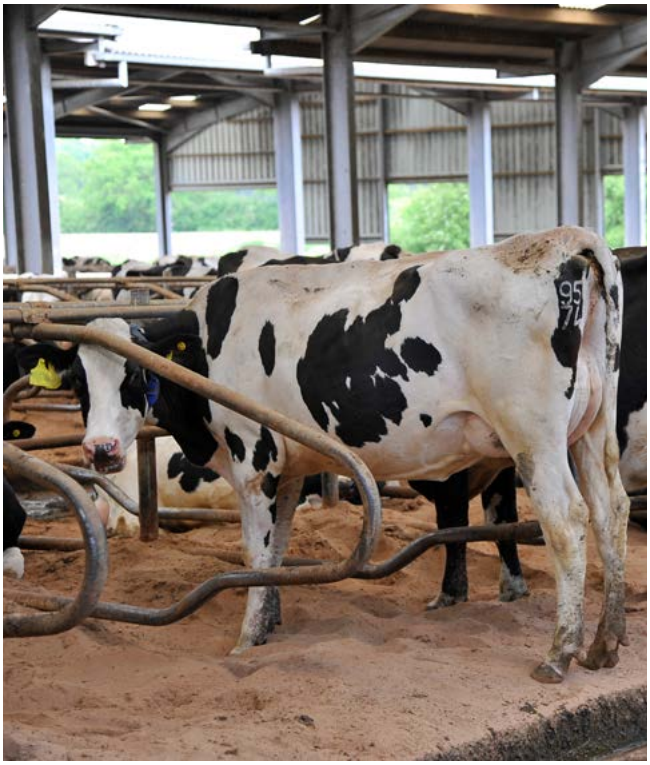
Overview

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 13).

Table 13. Link between fertility performance and cull rates

Targets	Seek help	Top performers
Cull rate (% adult herd/year)	>30%	<20%
% of calved cows culled in first 60 days in milk	>4%	0
% first-lactation cows culled	>15%	<2%
Died or culled on farm (% adult herd/year)	>5%	<1%
Average age of cull (years)	<5.5	>7
Average completed lifetime daily yield (litres per day of life)	<13	>15
Average completed lifetime total daily yield (litres)	<25,000	>35,000

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 cause further problems for you along the line.

For example, in all-year-calving herds, these cows can get fat when they are in late lactation (stale cows), leading to ketosis and many transition cow difficulties in the next lactation.

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 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.

Average days in milk and average daily yields across the herd

For AYR herds, the main thrust of the argument for keeping the calving interval close to 365 days is that you have an average days in milk of around 160 days,[6] which means your average daily yields remain high.

A high proportion of stale cows simply produces less milk. Yet the cost to keep these cows in the herd is broadly similar to those in earlier lactation and producing more milk. The net result is significantly less profit. Therefore, it is rarely profitable to keep serving a cow once she has been calved more than 200 days.

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.

[6] A 365-day calving interval allows a milking period of around 305 days; the average days in milk across the herd should be around half of this, so close to 160 days

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 that the top 25% of herds average a LDY of around 15 litres per day and the bottom 25% only 10 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 12.5 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 26 shows the performance of herds in a previous 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)

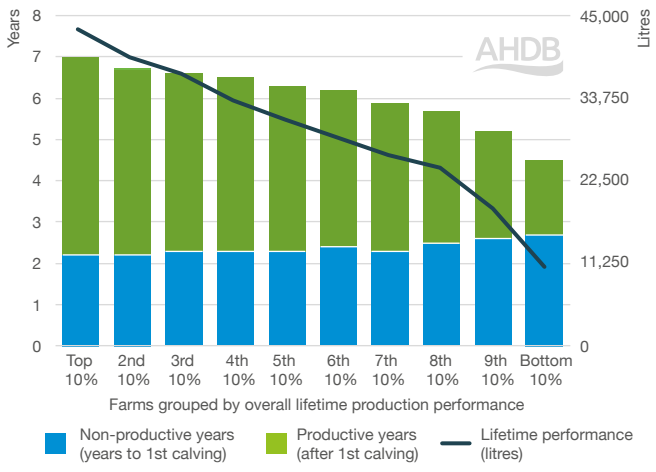


Figure 26. Comparison of lifetime yields and production performance in UK herds

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. 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 which are not in calf by about 200 days in milk, to keep a low culling rate, will reduce the daily milk output of the farm
- Poor fertility coupled with low culling rates increases the risk of fat, stale cows becoming a problem in the following lactation due to poor transition success. In such cases, it is better to accept a higher culling rate to maintain better overall 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 the UK, a typical culling rate is around 28%, 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.

The USA typically has a higher cull rate than New Zealand. 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 the UK and New Zealand. On many US farms, the heifer lactation yields exceed the cow lactation yields, so a high cull rate has become normal. With the UK's higher swap price, regular cull rates of a similar magnitude to that of the USA 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 bought-in animals with total net value of £58,500 (A)

£58,500/30 = £1950, average replacement costs per animal (B)

25 cows left herd with a total net value of £20,000 (C)

£20,000/25 = £800, average cull value per animal (D)

£1,950 - £800 = £1,150 mean swap price (S)

£1,150 (S) x 25 (number of culls/losses) = £28,750 total net cost of culls (T)

(£28,750 x 100)/787,500 (litres) = 3.65 pence per litre net culling cost

Enter your numbers below to work out the swap price for your herd:

	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 less than 10% of the milk price (in 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 factor is 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.

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.

Informed culling decisions

How culling affects the herd's reproductive performance

Depending on your calving system, culling strategies may affect your herd's reproductive performance. For all-year-round herds, some cows continue to be inseminated for a long time after calving. If they become pregnant, these less-fertile cows are retained. But if this continues over several years, increasing numbers of less-fertile cows are kept, which may have a small effect on herd reproductive performance.

You need to weigh up how much future profit you might forgo 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
- Other economically important traits
- Age

If a large number of cows in the herd had a long interval between previous calvings, they may be contributing to a lower herd reproductive performance. Determine the percentage of cows currently in your herd that went more than 16 months between any previous calvings (calving interval greater than 480 days). If less than 10% of cows, less-fertile cows are unlikely to be having a large effect on herd reproductive performance.

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

Prepare your list by:

- Identifying cows that have not become pregnant by 200 days after calving
- Checking these cows' records for the following:
  - Current production level
  - Age
  - Cell count, Johne's status, mastitis history, lameness history
  - Previous long interval between calvings

When not to cull

Are you a closed herd? Do you have enough heifers to replace culled cows and what does this cost?

Continue to inseminate the cow if:

- She is not a high priority to cull – she is still milking well, is not excessively old, has a low cell count and has not had unduly long intervals between calvings before
- You have insufficient heifer replacements
- It is expensive for you to replace cows with heifers

Note: Cows inseminated after day 200 of lactation can still be culled later even if they become pregnant.

A decision not to serve again does not mean the cow needs to be culled immediately. It can be a very economic option to continue to milk her until her yield drops (depending on the space you have and the ability to replace her with a more productive cow). At a later point, she can be sold as a high-value cull.

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.

Case study

Brothers Sam and Richard had built up a 500-head all-year-calving, housed Holstein herd, expanding rapidly from 250 cows through purchased cows and heifers. The cows averaged nearly 10,000 l/cow/year sold and the milkers were fed two different TMR diets: a highs diet (for 70% of the milkers) and a lows diet for the remaining 30%.

After two years, they became increasingly frustrated with transition cow problems: a high mastitis rate in early lactation, too many displaced stomachs and rapid weight loss in some cows. Their calving interval averaged 425 days. They knew a lot of their transition cow problems stemmed from those cows which had had a long calving interval (450 days or more), as they tended to get overfat during late lactation. The brothers toyed with the idea of creating a further milking group for these cows, with a lower-energy-density TMR (a diet, or 'fat cow' group).

The culling rate was around 33% – higher than their target of 25% which they had been able to maintain before the herd expansion. Far too many of the culls were involuntary, due to cows which had transition failure, including mastitis. This meant the brothers felt they needed to persevere more than usual with cows which were failing to get in-calf, so it was difficult to reduce the calving interval.

What advice would you give regarding their culling rate?

The adviser's recommendation

Sam and Richard had a lot of good nutritional and management practices already in place. However, they were caught in a vicious cycle of having too many stale cows which became fat, had difficult transition periods, lost weight rapidly at the start of the next lactation and then became difficult to get back in-calf again. The metritis rate (14 days post-calving) was 20% – double the 10% level which should trigger some action for change.

The adviser was sure this was contributing to the long delay in getting many cows back in-calf.

The adviser recommended that if cows were not in-calf by 200 days, they should no longer be served. In the short term, this would result in an even higher culling rate, but these barren cows could be culled as high-value culls at the end of their lactation. As the herd was not closed, buying extra replacements was possible.

The outcome

Sam and Richard implemented the strict 200-day cut-off point for service. In the first year, the culling rate rose to 38%. However, fat cows going into the dry period and having a difficult transition were no longer such a problem. No cow had a calving interval of greater than 480 days. The average milk sold rose to 11,000 l/cow/year, despite a higher proportion of first-lactation heifers in the herd.

Importantly, after one year, fertility improved so the proportion of cows pregnant by day 200 hit target (>90%) and the projected calving interval fell to 380 days. The culling rate in the second year fell to 30%, and in the third year to 25%. A lower proportion of culls was forced, allowing Sam and Richard to select more on the basis of yield and genetic potential.

Sam and Richard's comment: "This has been a long-term project to reduce our culling rate and improve fertility. When our adviser first suggested we adopt a strict cut-off for serving cows not in-calf, admittedly we were a little nervous as we knew that would mean increasing our culling rate. This went against the grain when we had just invested so heavily to build up our herd size. However, looking back, it was exactly the right thing to do. We now have a herd of cows on the right track, whereas previously too many of our cows were set up to fail by the fact that they had had a long calving interval.

"One of our biggest concerns at the time was a high mastitis rate in early lactation. Because we no longer have fat cows coming into the dry period, we have seen a good reduction in mastitis too, which we put down to better transition and less ketosis or metabolic stress."

Adviser's comment: "When herds expand rapidly, particularly by purchasing a lot of cows, my experience is that the culling rate almost always needs to be relaxed in the first year or so to avoid keeping cows which will become a problem in future lactations. I would have been less confident to give this advice if I did not have absolute faith that Sam and Richard were focused on a more sustainable culling rate longer term. It would be a big mistake to continue to cull yourself out of trouble if the basics weren't in place to reduce forced culls.

"I remember Sam and Richard were originally considering having an extra diet group for stale milkers. Now they are in the far more enviable position of considering just a single TMR diet for all milkers, as the calving interval is so much tighter."

Checklist for culling considerations

Planning ahead will make for a more successful culling and replacement policy. Are you able to 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 slaughters 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 your target 200-day in-calf rate? How does this compare with your results from previous years?
- 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.

Further information

Other publications from AHDB

- Breeding briefs guide
- Calf management guide
- The InCalf guide: Block calving
- Forage First

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