The InCalf book

for New Zealand dairy farmers

incalf

DairyNZ

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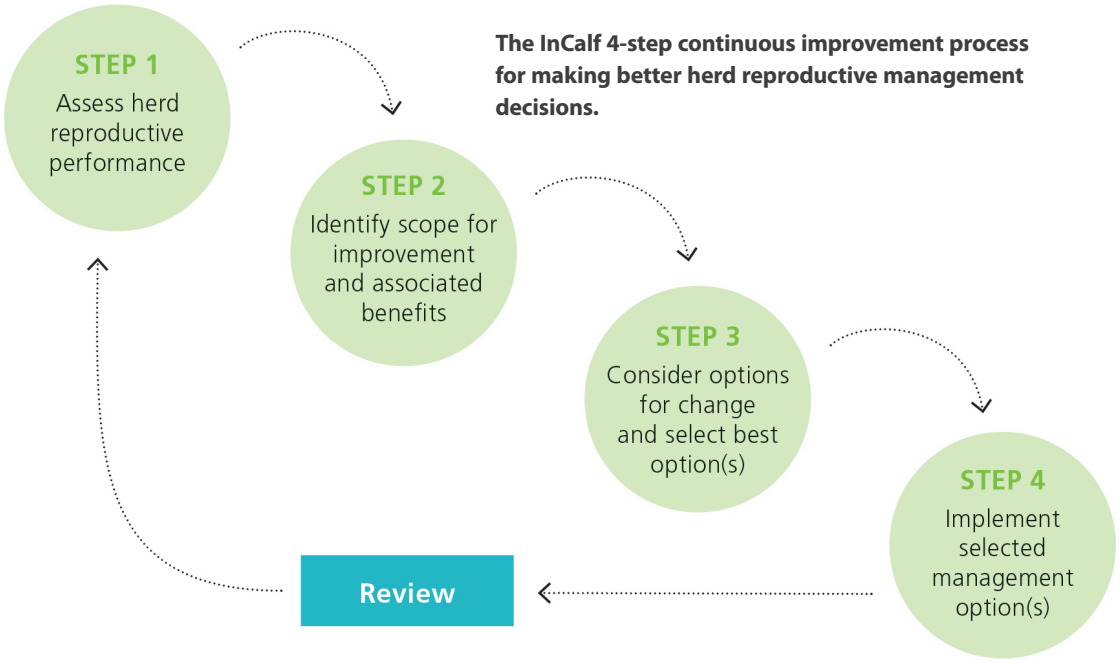


The InCalf 4-step continuous improvement process for making better herd reproductive management decisions.

Publisher	DairyNZ Ltd
Editors	Australian edition 2003 – John Morton, Mike Larcombe and Steve Little
	New Zealand 1st edition 2007 – Chris Burke, Mark Blackwell and Steve Little
	New Zealand 2nd edition 2017 – Mark Blackwell, Katrina Roberts, Roger Ellison and John Penry.
Instructional design	Joanne Campbell and Michelle Axford
Design	David Hughes, The DCP Group
Layout and Prepress	Anne Burgi, SUBStitution
Cover design	DairyNZ
Photographs	Dairy Australia, DairyNZ, AnexaFVC, Adrian Roberts, Katrina Roberts. Roger Ellison, Laura Beasley, Susanne Meier.

InCalf inquiries in New Zealand:

DairyNZ Ltd
Private Bag 3221
Hamilton
New Zealand
e-mail: info@dairynz.co.nz
web: www.dairynz.co.nz

The InCalf Book for New Zealand dairy farmers 2nd edition

ISBN 978-0-473-42232-5 (paperback)

ISBN 978-0-473-42233-2 (pdf)

Contents

Foreword

The need to improve herd reproductive performance is a high priority for New Zealand's dairy farmers.

This 'second edition' of The InCalf Book is a timely update capturing the learnings gained using the InCalf programme in New Zealand since 2008. I believe it will continue to be an essential resource for dairy farmers wanting to improve reproductive performance.

An industry target of achieving a 6-week in-calf rate of 78% remains the focus of DairyNZ's InCalf programme launched in 2008. The previously reported decline in herd reproductive performance has now been reversed as shown in NZ Dairy Statistics. However, progress towards the 78% 6-week in-calf rate target is slow.

It is clear that this target will not be achieved using current knowledge and technologies alone and a biological breakthrough is required. Cow fertility research is being well-resourced through industry and Government funding, with the expectation of providing solutions that increase genetic gain in fertility and enable farmers to get more success in their management of herd reproduction.

Meanwhile, dairy farmers and their advisers need a process with up-to-date support material that provides:

- improved herd fertility performance measures and monitoring systems;
- an agreed knowledge base and approach for pasture based dairying; and
- improved people skills and planning for improved fertility.

When faced with similar herd fertility challenges in 1996 the Australian dairy industry initiated the InCalf project. Under John Morton, the 3-year InCalf study showed that dairy farmers have control over many of the factors that affect fertility. InCalf found that change for the better does not necessarily follow provision of information; there needs to be a process that engages and supports the farmer into action.

InCalf developed and rolled out in New Zealand an impressive extension programme, which includes The InCalf Book, Fertility Focus report, Herd Assessment Pack, and InCalf training programmes for both dairy farmers and advisers.

Tim Mackle, PhD
CEO DairyNZ

Through a Memorandum of Understanding between Dairy Australia and DairyNZ, New Zealand dairy farmers and advisers can access the InCalf resources, adapted for New Zealand conditions by DairyNZ.

This revised InCalf Book for New Zealand dairy farmers is the result of contributions from many leading experts on both sides of the Tasman. The expected outcomes are:

- economic gains through improved production efficiencies and fewer empty cows;
- streamlined breeding management systems, reducing stress;
- less reliance on hormonal interventions, and
- improved animal welfare and assurance of market acceptability for dairy products.

This is a great opportunity for New Zealand's dairy industry to take advantage of these benefits, to help us maintain our competitive advantage on the international stage. Thanks to all those involved in producing this programme and making it available to New Zealand's dairy farmers.

Tim Mackle, PhD

CEO DairyNZ

About InCalf

The Australian InCalf project developed a vision: "To enable dairy farmers to achieve measured improvement in herd reproductive performance."

That vision is equally applicable in New Zealand for dairy farmers seeking to improve their herd reproductive performance towards industry targets.

In both Australia and New Zealand, farmers indicated that they needed a supporting process to bring about real improvement in their herds.

Farmers need to be able to:

- assess the current reproductive performance of their herd;
- assess their scope for improvement and the likely benefits;
- determine their options for change; and
- implement their chosen changes.

InCalf's next challenge was to determine how to achieve the vision. This stage of the planning has drawn on the best available extension and technical expertise, and the team has developed the InCalf extension package which includes:

- The InCalf Book;
- The InCalf Fertility Focus report;
- The InCalf Herd Assessment Pack tools; and
- InCalf training programmes for farmers and their advisers.

In producing *The InCalf Book for New Zealand dairy farmers* the editors were deliberate in retaining the excellent design features of the Australian InCalf Book. This book is the result of contributions from many leading experts on both sides of the Tasman. It has become an essential resource for dairy farmers wanting to improve herd reproductive performance.

In 2007 the original technical review team gave the InCalf Book a New Zealand dairying context.

In this second edition, the reviewers have incorporated many more learnings from farmer and adviser experiences using InCalf tools, resources and training. This second edition also draws on NZ research studies based on InCalf, in particular:

- The National Herd Fertility Study by Tom Brownlie & Scott McDougall
- Improving reproductive performance in large herds by Chris Burke
- Validation of Fertility Focus reports by John Morton

The majority of New Zealand herds are seasonal calving involving just one calving period in spring. *The InCalf Book for New Zealand dairy farmers* is written directly to farmers with seasonal calving herds.

Farmers with split-calving systems can derive just as much benefit from *The InCalf Book for New Zealand dairy farmers*, as the principles of seasonal calving apply equally to split-calving systems. Farmers seeking information about year-round-calving systems are referred to the Australian InCalf Book 2nd edition available from www.dairyaustralia.com.au.

Mark Blackwell, leader of editorial team
InCalf Project Manager in New Zealand

How to get the most out of this book

The InCalf Book pulls together the accepted knowledge on dairy herd fertility, drawing on InCalf's extensive on-farm research project as well as a huge number of experts on both sides of the Tasman, and in other countries.

We all understand that there is (unfortunately!) no one simple recipe for achieving optimal reproductive performance in all dairy herds. Every herd is different, so we have not produced a prescriptive manual on what to do to optimise herd fertility. We also know that farmers want a practical reference, not a scientific textbook.

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

We don't want you to read this book from cover-to-cover in one sitting and then file it away on a bookshelf. This is a book designed to be left out where you and your farm team meet. Use it frequently to find specific information, and stimulate thought and discussion. Let it get tattered through regular use – that's what it's for!

Finding the information you want

We have designed the book so you can find the specific information you are looking for quickly and easily. Here are some ways of finding the particular bit of information you are looking for:

- The contents page lists the topics in each chapter.
- 'Actions and options at each stage of the fertility cycle' (pages 7–12) lists what to consider and when through each stage of the cow's life, and directs you to the right Chapter or page number.
- Within 'Section 3 – Acting on Priorities', the chapters start with a page listing topics/headings covered in that chapter. The revised sequence of chapters follows the time series illustration of the 'ingredients of the herd fertility cake' found on page 36.
- To search for key words, download the *InCalf Book* pdf file from DairyNZ website and use Edit/Find or Ctrl+F.
- Also look out for recommended website addresses in the *InCalf Book*.

Special features to help you use the book

The book has a number of special features within each chapter in addition to a hierarchy of headings to make it easy to find and read information quickly.

This symbol indicates the achievable target for a given performance measure. These targets are based on the actual results achieved by the top 25% of dairy farmers in New Zealand (NZ Monitoring Fertility Project Report). Use these targets to see what performance is realistically possible in your herd.

This symbol indicates the trigger level. Half the farmers in the Monitoring Fertility Project study and the more recent National Herd Fertility Study achieved a better result than this. Further investigation is warranted if your herd's performance is less than this figure.

This symbol marks a short segment providing you with more technical detail on a specific topic.

This symbol indicates that a separate InCalf herd assessment tool is available from the DairyNZ website. The InCalf tools have been developed to help you (and your adviser) investigate key management areas which affect your herd's reproductive performance. They allow you to assess past and present performance and also consider likely future outcomes.

This symbol refers to the InCalf Fertility Focus report that is available separate to this book to assist you to measure and assess past and present herd reproductive performance. This easy-to-use single page report is software generated and can be obtained for your herd from licensed herd improvement organisations, LIC, CRV and Infovet.

These sections are common questions or statements by farmers. They provide another practical angle on the topic discussed in the text.

Appendices – Down to Details

When reading certain chapters you may be referred to one of seven appendices towards the back of the book. These appendices contain extra, more detailed information and look-up charts (pages 165–191).

Definition of terms

Use this list to look up the meaning of terms used in this book that you are not familiar with or when you are unsure of a precise meaning (pages 193-196).

Acknowledgements

DairyNZ and the InCalf New Zealand project team gratefully acknowledges the original contributors of the Australian InCalf Book, on which this revised edition for New Zealand dairy farmers is based.

The InCalf New Zealand project team could not have successfully revised *The InCalf Book for New Zealand dairy farmers* without the technical and administrative expertise of numerous people; and the valued test reader contributions from farmers, advisers and industry experts.

First edition reviewers

Dieter Adam, Nikki Barnard, Mark Blackwell, Anne Burgi, Chris Burke, Dave Campbell, Joanne Campbell, Steve Forsman, Caroline Fowler, Victor Gahamadze, Jason and Lorna Garmonsway, Charlotte Glass, Chris Glassey, Phillipa Hedley, Ian Hodge, Colin Holmes, Murray Holt, Lisa King, Eric Kolver, Lynelle and Paul Kuriger, Mike Larcombe, Chris Lewis, Steve Little, Kevin MacDonald, Jock Macmillan, Neville Maindonald, David McCall, Katherine McCusker, Scott McDougall, Selwyn McLachlan, William McMillan, Bill Montgomerie, Pete and Ann Morgan, John Morton, David Nation, Helen Percy, Wayne and Raewyn Reynolds, John Roche, David and Leanne Silvester, John Simmonds, Julian Stevens, Mark Stevenson, Natalie Stewart, Erik Stolte, Kath Taylor, Richard Tiddy, John Troutbeck, Phil Urlich, Adrian van Bysterveldt, Ian Williams, Ross Wrenn, Zhenzhong Xu.

Second edition reviewers

Stacey Bateman, Laura Beasley, Mark Blackwell, Tom Brownlie, Anne Burgi, Chris Burke, Sarah Dirks, Roger Ellison, Mark Forsyth, Wilma Foster, Nita Harding, Eric Hillerton, Bruce Holmes, Louise Holmes, Murray Holt, John Howie, Anna Irwin, Anna Kempthorne, Katrina Knowles, Nicola Kloeten, Jair Mandriaza-Munoz, Scott McDougall, Trish McIntosh, Lorna McNaughton, Peter Morgan, Cara O'Connor, Mat O'Sullivan, Sally Peel, John Penry, Frank Portegys, Katrina Roberts, Adele Preston, Katie Saunders, Corrigan Sowman, Melissa Stephens, Adrian van Bysterveldt, Joyce Voogt, Nicola Wilson.

Funding organisations

InCalf acknowledges funding support from New Zealand dairy farmers through DairyNZ.

InCalf acknowledges co-funding support from MPI Sustainable Farming Fund.

Supporting organisations

InCalf recognises the many organisations that have and continue to support the InCalf project.

- Dairy Australia
- Dairy Cattle Veterinarians (DCV) of the New Zealand Veterinary Association (NZVA)
- New Zealand Institute of Primary Industry Management (NZIPIM)
- LIC
- CRV Ambreed
- Infovet
- New Zealand Animal Evaluation Ltd (NZAEL)

Section 1

Focus on fertility

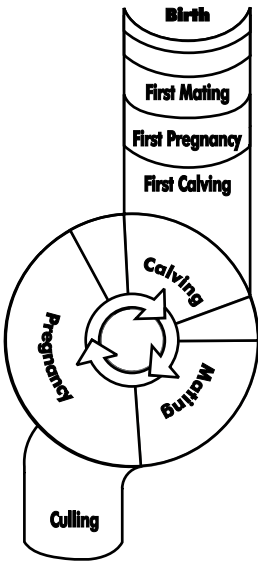
1

Fertility for life

From the day a heifer calf is born, 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 the time of first calving, if she recovers before mating, if she is correctly detected on heat and mated, and if she conceives. The cycle then starts again.

The 'fertility for life' cycle of that animal involves calf and heifer rearing; first mating, pregnancy and calving; subsequent matings, pregnancies, calvings; and, eventually, culling. Success will require your attention throughout the cycle.



At each stage of a cow's life, you should have a management plan in place that answers an important question: "Today, have we done all that we can to ensure high reproductive performance?"

Here are just some of the questions that need to be asked at each stage of the 'fertility for life cycle' to help you achieve high reproductive performance.

- Fertility genetics
  - Are the fertility breeding values of the new born calves appropriate for your pasture based farm system?
- Calf and heifer rearing
  - Are your heifers reaching the target liveweights you have set for your farm?
- Mating heifers for the first time
  - Are the heifers big enough to be cycling before mating?
  - Which bulls have you selected?
  - Are you going to synchronise the heifers?
  - How many bulls do you need?
- First pregnancy
  - What is your pregnancy testing strategy for heifers?
- Calving heifers
  - Do they start calving before the cows?
  - Will they calve at body condition score 5.5?
- Calving cows
  - Will they calve at body condition score 5.0 for mature cows, 5.5 for young cows?
  - How will you manage cows with health problems?
  - Is the total feed supply sufficient?
  - Are there too many late-calvers?
- Pre-mating and mating cows
  - What is your heat detection strategy?
  - How will you minimise the number of non-cyclers?
  - Do your AB facilities meet current guidelines?
- Pregnancy
  - Have you submitted your records (heats, non-cycling treatments, mating and pregnancy diagnosis) to your herd improvement organisation so you can receive your InCalf Fertility Focus report?
- Culling
  - Which cows will be culled and for what reasons?

The InCalf Book summarises the actions and options you need to consider at each stage in the 'fertility for life' cycle.

Reproduction management plan: a framework for your herd

There is no simple recipe for achieving good reproductive performance. Every farm is different and will require its own reproduction management plan. The aim of a reproduction management plan is to maximise the rate at which the cows in your herd get in calf. This is done by implementing the options described in *The InCalf Book* and using *The InCalf Tools* that focus on the key fertility management areas of:

- genetics, Chapter 8;
- calf and heifer management, Chapter 9;
- calving pattern, Chapter 10;
- body condition and nutrition, Chapter 11;
- cow health, Chapter 12;
- heat detection, Chapter 13;
- AB practices, Chapter 14; and
- bull management, Chapter 15.

The planning process requires you to think about the different options described and to decide on those you wish to implement. You may need input from an adviser in deciding the best options to use.

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

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

To help you get started, the framework presented in this chapter gives a summary of the actions and options at each stage of the fertility cycle. The framework also provides a useful index for tracking down the information you need within the other chapters.

> ***It's not as simple as just heat detection and a few weeks AB, is it?***
>
> **There are many jobs that have to get done properly to get fertility right. A plan to pull it all together is important to make sure you're on top of all the bits that make up the whole.**
>
> **Sometimes you can get so caught up in the day-to-day stuff that you lose the plot a bit. This overall plan will help you see where all the pieces of 'the herd fertility cake' (page 36) fit into the big picture.**

It's just getting all too hard. There is no way I can juggle all of these priorities! With a nutrition plan and a mating plan and a heifer plan and a health plan – I've got a new plan for every day of the week!

Our farm doesn't work like that. I need to have a summary of what to do for each group of animals. I don't want to forget all of the little points.

This framework might be just what I need to sort out my priorities.

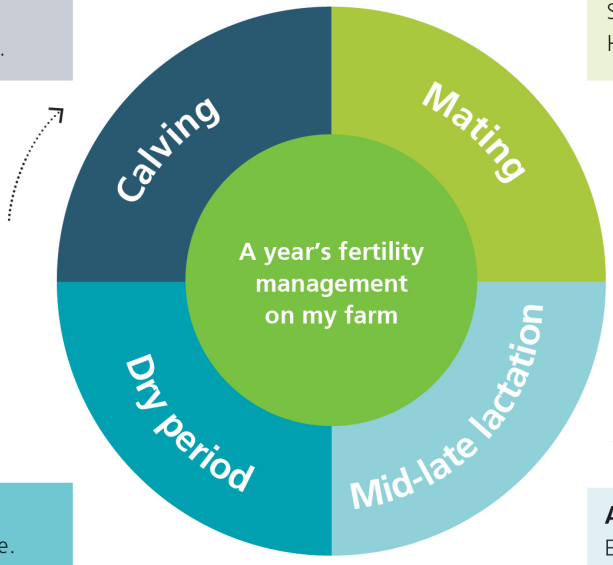
The framework can be used to develop a reproduction management plan for different times of the year. This plan becomes a calendar of events for the season to accommodate cows at different phases or stages of the fertility cycle.

Careful construction of a reproduction management plan that provides you with a calendar of events will allow you to take a complex topic like fertility, and implement a programme on your farm that will improve the reproductive performance of your herd.

The four phases of the fertility cycle and management aims for each phase

Aims:
Cow health problems under control.
Transition managed well.
Spring rotation planner in place.

Aims:
Pre-mating cycling on track.
Submission rate on target.
Heifer weights on target for mating.

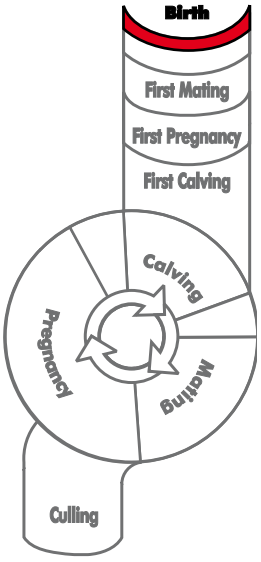


Aims:
Plans for calving pattern in place.
BCS at calving on track to targets.
Heifer weights on target for calving.

Aims:
Early-aged pregnancy test completed.
Herd nutrition and BCS on track.
Desired plan for dry period in place.

Improving herd reproductive performance is a whole farm systems challenge, going on all year-round, not just at mating. It is helpful to identify aims for each of the four phases; Calving, Mating, Mid-late lactation and Dry Period.

Actions and options at each stage of the fertility cycle



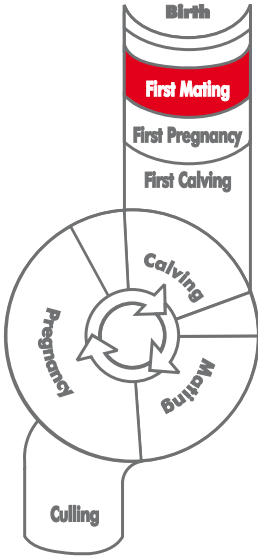
Birth

Calves (Chapter 9)

- Identify the best person on the farm to rear calves well.
- Ensure feeding, housing and disease prevention allow optimal growth rates and minimise disease.
- Feed 'gold' colostrum to newborn calves.
- Schedule vaccination, trace element supplementation and disease control programmes.
- Wean calves once they reach the target weight for weaning and they are regularly eating enough calf meal or pellets, and fresh clean pasture each day.

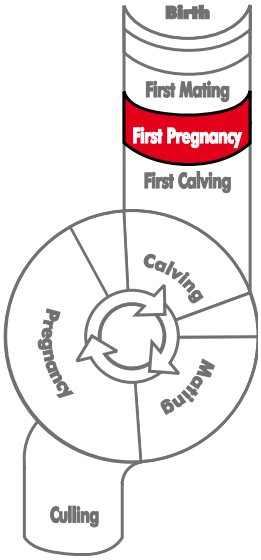
Heifers (Chapter 9)

- Set target 'weight-for-age' liveweights.
- Grow heifers to achieve target liveweights.
  - If necessary, continue to supply good quality supplements after weaning.
  - Protect heifers from facial eczema where it is a risk.
  - Schedule vaccination, trace element supplementation and parasite control programmes.
- Monitor liveweight every 2–3 months from weaning to calving and feed to ensure heifers achieve target weights.
- Give special attention to underweight heifers.
- Consider differentially feeding groups of heifers according to their required liveweight gain.



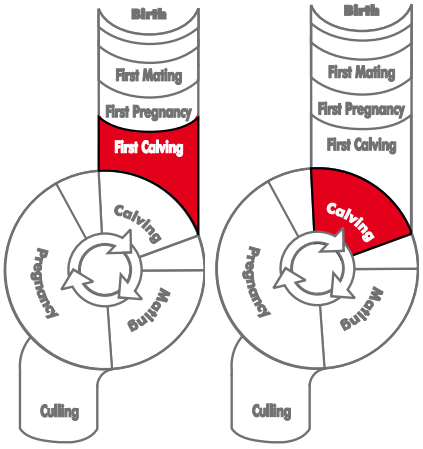
First mating

- Decide when to start and stop mating heifers (Chapter 9).
- Look at the advantages of mating heifers to start calving 1 to 2 weeks earlier than the milking herd.
- Feed to ensure heifers achieve target weights and gain weight continually throughout the mating period.
- Decide whether to use AB or bulls with your heifers.
- Select bulls that reduce calving difficulty.
- Will it be beneficial to heat synchronise your heifers?
- Monitor bull-serving behaviour throughout mating.



First pregnancy

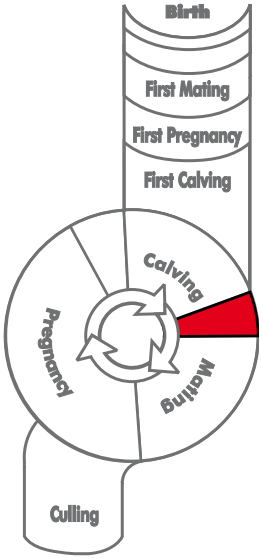
- Decide when you will pregnancy test heifers (Chapter 18, page 159).
- Feed to ensure heifers achieve target liveweights.
- Weigh and body condition score heifers 2 months before calving (Chapter 11, page 80).
- Run the heifers as a separate mob leading up to calving (page 82).



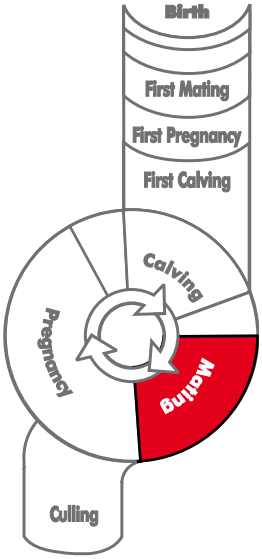
Calving heifers and cows

- Prevent health problems around calving (Chapter 12, page 96).
- Record each cow's calving: cow ID, date, calf ID, and whether assisted.
- Consider metrichecking your cows post-calving (page 98).
- Learn how to assist a cow that is having trouble calving (page 97).
- Promptly treat and record details for cows that had a twin calving, an assisted calving, retained fetal membranes, a vaginal discharge or lameness.
- Plan to have mineral/trace element levels at optimum by calving.
- Body condition score cows prior to calving (Chapter 11, page 80).
- Check the calving pattern of heifers (page 51) and the whole herd (Chapter 10, page 65).

Pre-mating (early lactation)



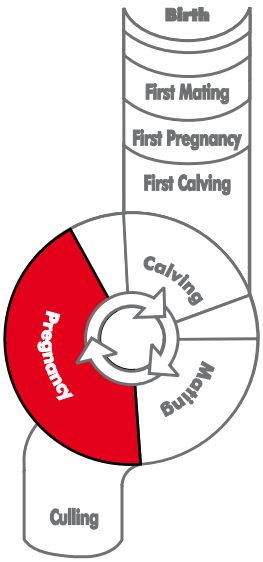
- Decide when to start and stop mating the herd (Chapter 10, page 63).
- Body condition score the herd a couple of weeks before mating (Chapter 11, page 75).
- Make sure your cows are well fed and pasture is allocated as per spring rotation planner (page 85).
- Review your heat detection programme (Chapter 13, page 105).
- Ensure everyone knows how to detect heats.
- Consider a combination of heat detection aids (page 111).
- Use both paddock observation and heat detection aids.
- Plan extra-well for heat detection if managing a larger herd (page 116).
- Use tail paint to detect cycling and non-cycling cows before mating.
- Check pre-mating cycling rate (Chapter 17, page 109).
- Decide if you will treat any non-cyclers (Chapter 17, Appendix 5).
- Prepare for AB and check your facilities (Chapter 14, page 122).
- Select the best type of 'natural mating' bulls for your system (Chapter 15, page 131).
- Cull older and aggressive bulls.
- Select bulls to minimise difficult calving.
- Quarantine imported bulls for 10 days.
- Do you have enough 'bull power' or need extra bulls?
- Are the bulls in good health and condition for mating?
- Ensure you have sufficient young bulls.
- Prepare bulls for use in the herd.
- Run bulls as a group before mating.
- Arrange a bull drenching and vaccination programme.
- Consider veterinary examination of bulls.
- Check BVD status of all animals coming onto the farm (Chapter 12, page 99).



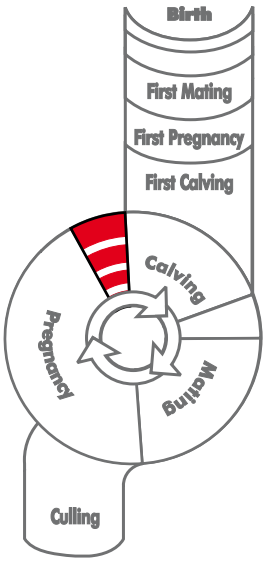
Mating

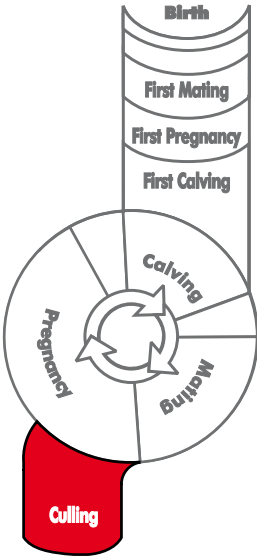
- Make sure your cows are well fed and pastures grazed consistently to target residuals (Chapter 11, page 84).
- Record the date and sire for all inseminations and natural matings.
- Are you regularly recording mating events into an InCalf-accredited software programme, so you can receive your InCalf Fertility Focus report (Chapter 5)?
- Track your progress towards the 3-week submission rate target (page 28).
- Observe for heats in the paddock 2 hours after milking and in the early afternoon (Chapter 13, page 106).
- Do you and your employees know what to do when you are not sure if a cow is on heat?
- Consider heat detection as a high priority task that gets designated to the 'best' person/people for that job.
- Make sure AB technicians use recommended practices (Chapter 14, page 120).
- Look after cows separated out for insemination.
- Don't delay mating once a cow has been detected on heat.
- Avoid inbreeding.
- Rest and rotate bulls, daily if possible, and monitor for lameness and service problems (Chapter 15, page 133).
- Ensure at least two sexually active bulls are running with the herd at all times.
- Handle bulls safely.

Pregnancy (mid to late lactation)



- Use drying-off decision rules that include body condition and days to next calving (Chapter 11, page 79).
- Who will regularly and accurately body condition score your herd?
- Consider options to maintain or increase body condition score in late lactation.
- Make sure your cows are well fed, pastures grazed consistently to target residuals and rotation length is appropriate for the conditions.
- Consider implementing an early-aged pregnancy testing strategy for your herd (Chapter 18, page 156).
- Use your pregnancy test results for future planning (Chapter 10, page 65).
- Arrange to get your InCalf Fertility Focus report and review reproductive performance (Chapter 5).
- What is your 6-week in-calf rate and not-in-calf rate?
- Assess bull performance (Chapter 15, page 134).
- Have cows suspected to have aborted checked by a veterinarian (Chapter 12, page 100).
- Monitor abortion rates and implement prevention. Seek professional advice if the herd abortion rate is excessive.
- Be careful when handling aborted cows, calves or membranes.
- Check your herd for excessive difficult calvings, retained fetal membranes, discharges, endometritis, lameness or clinical mastitis, and implement prevention if required (Chapter 12, page 93).
- Start planning for calving and transition cow management (Chapter 11, page 82).





Pregnancy (dry period)

- Mature cows should calve at condition score 5.0 , young cows 5.5 (Chapter 11, page 74).
- Prepare cows for lactation for calving and lactation (page 82).
- Ensure trace elements are on track (Chapter 11) and vaccinations up to date (Chapter 12).
- What are your options to prevent disease at calving and in early lactation?
- Review your herd's genetics for fertility and your sire selection criteria (Chapter 8, page 41).
- Choose an AB bull team with a high Breeding Worth, balanced with desirable breeding values for traits best suited to your system.
- Consider the advantages of crossbreeding.

Culling

- Consider your priorities and prepare a culling list (Chapter 19, page 163).
- Have cows suspected to have aborted pregnancy tested by a skilled pregnancy tester before culling (Chapter 12, page 100).
- Will you carry over empty cows and how will these be managed (page 162)?

Using a framework like this helps you be sure you've covered all bases so you end up with a good, all-round plan.

A reproduction management plan helps you make sure that your day-to-day actions are working toward the goal of better reproductive performance.

When you come to the practical realities of 'what should we be doing today?' you'll be able to feel confident that it all fits in.

2

Calving systems

The key measures of success and your approach to improving herd reproductive performance will vary, depending on your calving system.

The InCalf Book does not aim to help you decide which calving system you will use in your herd. Rather, it will help you achieve optimal performance within whatever calving system you have chosen.

More than 90% of cows, and most herds in New Zealand, calve in one block in the spring. Some herds calve in two distinct blocks, one in spring and one in autumn. A few herds calve in one block in the autumn.

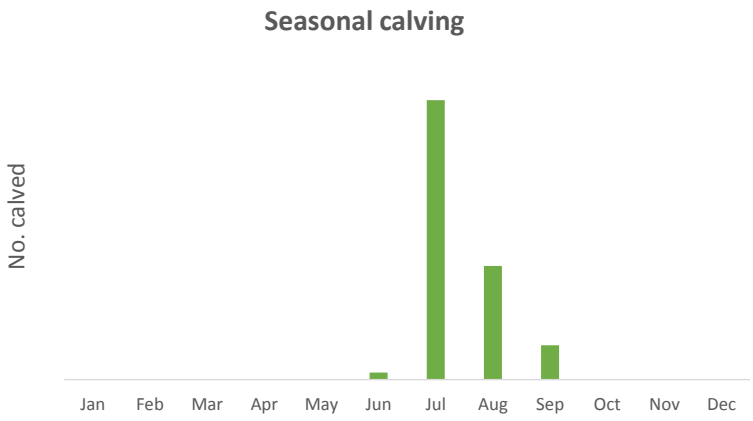
The InCalf Book for New Zealand dairy farmers deals exclusively with these seasonal and split calving systems, with no distinction between herds with one or two calving periods each year.

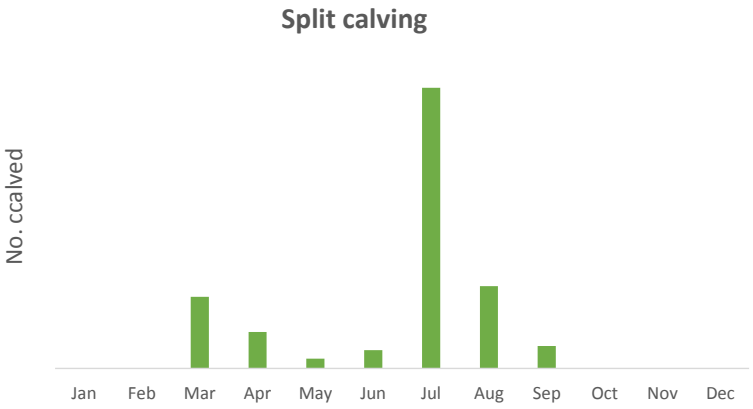
If you are one of a small number of New Zealand herds that use a year-round calving system, refer to the Australian InCalf Book for information on how to achieve optimal reproductive performance.

The InCalf Fertility Focus report has the ability to identify herds by calving system, and reports on reproductive performance as a Seasonal, Split or Year-round calving herd.

The two charts below illustrate for the same herd the proportions of cows calving as a seasonal calving herd, and in the following year as a split calving herd.

When farmers consider making calving system changes they take into account their herd's current reproductive performance and the number of empty cows they have to manage.
Farmers should seek advice on all options before making significant calving system changes such as from seasonal to split calving.





3

What are the benefits of improved fertility?

How much is improved reproductive performance worth to you? The answer will depend on your own situation. However, improved performance can make a sizeable impact on your bottom line, as well as simplify your farm management (see table below).

The value of these benefits will depend on how much you increase your herd reproductive performance. To see what top farmers are achieving, and to decide if you have room for improvement in your herd, take a look at Chapter 5.

The InCalf Tools can provide estimates of economic benefits which may be gained from improving your performance in key fertility management areas.

Farmers from throughout Australia and New Zealand have told InCalf why they value high herd reproductive performance. You can expect the following benefits from improved fertility.

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

The economics of reproductive performance

Because herd reproduction is an integral part of the farm system it is difficult to quantify the contribution of reproductive performance to the operating profit of a farm business.

In 2008, InCalf developed an economic model, based on commercial dairy farms, and a tool to help farmers and their advisers estimate the value proposition of improving the herd's reproductive performance. This economic model underpins the training and advice of InCalf trained advisers listed at dairynz.co.nz/incalf.

This economic model is also used within the InCalf herd assessment tools to help prioritise which areas of reproductive management offer the biggest opportunity to improve.

The **Economics of Reproductive Performance Tool** is a gap calculator and can be found at dairynz.co.nz/incalf. The calculations made with this tool are estimates of the 'opportunity cost' of less-than-optimal reproductive performance in a specific herd.

The dollar gap is based on the 6-week in-calf rate and not-in-calf rate gaps between actual and target performance.

Points to note:

- The economic benefits from improved reproductive performance occur next year and the year after, not this financial year.
- The InCalf gap calculator is for strategic planning and is not a cash forecast to take to the bank.
- The milksolids payout used in the tool is a conservative long-term figure to get a perspective of how much money is at stake.
- The farm costs of improving reproductive performance are not included in the calculations. The costs incurred are case specific.
- The main investment to improve reproductive performance is better management, doing the right things at the right time, and being proactive not reactive.
- The InCalf economic model predicts benefits similar in size to the Animal Evaluation economic values for fertility used in calculating Breeding Worth.

Section 2

Analysing for action

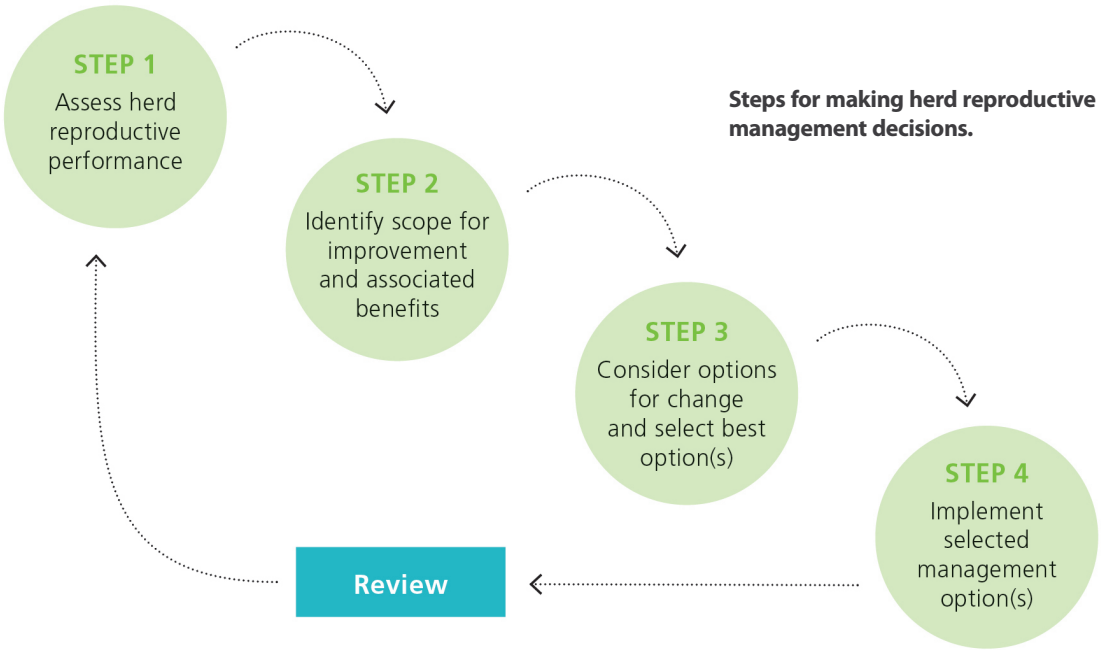
4

Where to start

It is important to continually refine your herd management strategies. The following key steps can be used to improve herd reproductive performance:

1. Assess herd reproductive performance.
2. Identify scope for improvement and associated benefits:
   - Compare your performance to previous years, to other herds and to what's possible.
   - Weigh up the benefits from increased herd reproductive performance.
3. Consider options for change and select the best option(s).
   - Weigh up the costs of implementing each change.
4. Implement the selected management option(s).

Review the effects of these changes as part of your management cycle.



Steps for making herd reproductive management decisions.

The focus

High reproductive performance means that cows become pregnant without undue delay. To compare your herd's current reproductive performance to previous years and to other herds, it is necessary to assess what percentage of cows in your herd became pregnant quickly.

InCalf recommends some specific measures to describe herd reproductive performance.

Performance measures

InCalf recommends the 6-week in-calf rate and the not-in-calf rate.

The 6-week in-calf rate tells you the percentage of cows in your herd that became pregnant in the first 6 weeks of the mating period. These cows will calve early in the calving period next year. Where artificial breeding (AB) is used for the first 3-6 weeks of the mating period, many or all of these cows will be pregnant to an AB sire.

The not-in-calf rate tells you the percentage of the herd that failed to become pregnant during both the AB and bull mating periods.

To reduce the number of empty cows in a herd normally requires an increased 6-week in-calf rate. As a result of that, a decreased not-in-calf rate can be expected for a given length of mating.

Why is 6-week in-calf rate such an important measure?

Six weeks makes sense because it represents two oestrus cycles, and the half way point through a 12-week mating period. At about week six the difference in how quickly cows are conceiving is most evident between herds.

The 6-week in-calf rate also captures both the drivers of in-calf rate – the 3-week submission rate and the conception rate.

Terminology change to not-in-calf rate

In this second edition of *The InCalf Book* the term Empty rate is changed to Not-in-calf rate. This is to be consistent with the way Fertility Focus has always calculated this performance measure.

Not-in-calf rate is calculated as 100% less the in-calf rate at any stage of mating, as well as at the end of mating.

For example after 6 weeks of mating the 6-week in-calf rate might be 60%. The remainder, 100-60% = 40% of cows, are not-in-calf after 6 weeks.

At the end of 12 weeks of mating the in-calf rate might be 90%. The remainder, 100-90% = 10% is the not-in-calf rate at the end of 12 weeks mating.

Thinking about change

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

- **Small steps can make big gains.** A gain of 1-2% in many of the management areas that affect fertility may not seem like much, but the cumulative effects can make a big difference to your bottom line.
- **Detail can make the difference.** In many cases, the solutions are not expensive or time consuming. However, they do take careful planning and attention to detail. Cutting corners and poor timing can make improvement a slow process.
- **Record keeping makes for easier management.** Without a good system of recording and measuring performance, and comparing the results with targets, it is almost impossible to determine your priorities. Without good records, you and your farm team will not know whether performance is satisfactory and will find it difficult to manage key tasks, such as treating, inseminating and pregnancy testing cows.
- **Results require a team effort and good communication.** Make sure everyone on the team has well-developed skills and knows what the targets are. It's also good to give yourself and your farm team a pat on the back for achieving a target. It's one thing to realise there are opportunities for improvement, but another to take advantage of them. Accurate and timely record keeping, regular measuring and checking against the targets identify these opportunities.

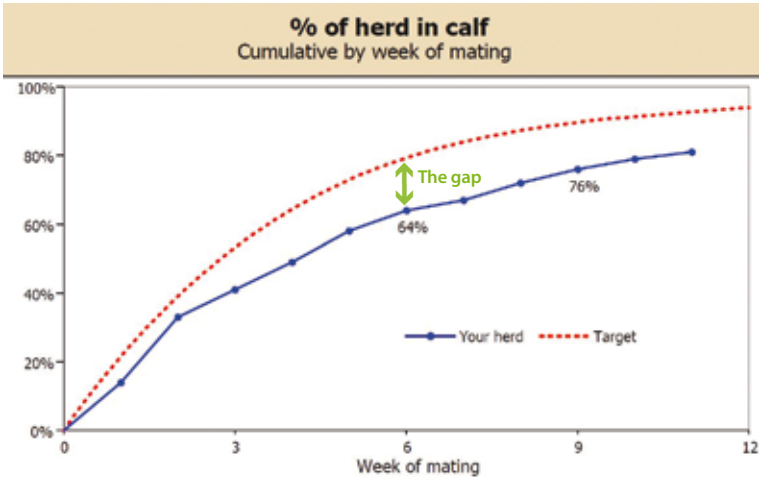
> **Electronic herd recording is easier, accurate and timely. Involve the team in setting, monitoring and achieving targets.**

How you respond is an individual choice. You need to keep an eye on the costs of change compared to the expected benefits. Your advisers can support you in each step of the process and provide ideas for change, what to do and how to do it.

Your adviser network could include your veterinarian, breeding company rep, farm consultants (private and industry), financier, farm owner or trusted mentor.

Each of your advisers offers specific knowledge, skills and experience. It is important that you encourage your advisers to talk to each other about your farm's reproductive programme and, when appropriate, to co-operate in its implementation. Using *The InCalf Tools* is a great way to get advisers talking.

How quickly do cows in the herd become pregnant?



This shows the '% of herd in calf' graph on a detailed Fertility Focus report.

The red dotted line is the industry target line. The blue line is the actual in-calf rate for a 'typical' NZ dairy herd.

This 'typical' herd takes 9 weeks to reach 76% in calf. This is 3 weeks longer than a 'top' performing herd, with about 78% in calf after only 6 weeks.

Note how the gap between the two lines increases from the start of mating.

The gap persists to the end of mating, leaving 18% of cows not confirmed pregnant after 11 weeks of mating.

That gap represents:

- fewer early born AB calves;
- fewer days in milk in early lactation;
- more non-cycling cows at mating; and
- more empty cows at end of mating

For the maths behind the graph go to Appendix 4.

5

Measuring performance

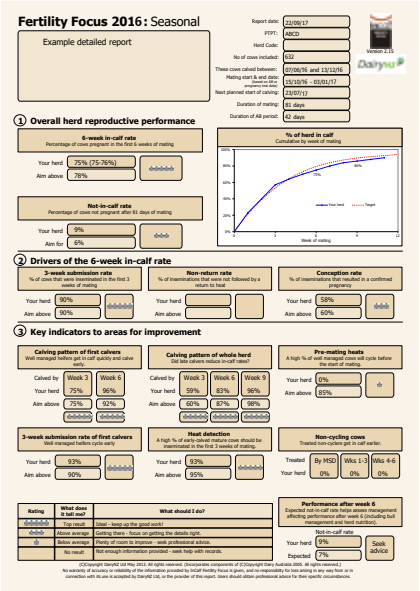
Getting an accurate picture of herd reproductive performance offers a starting point for improvements. This chapter discusses measures that allow you to compare between years and to identify what is achievable.

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

If you measure the reproductive performance of your herd with the best measures and at the best times, you will be able to:

- confidently compare your herd's reproductive performance to previous years and to the results achieved by top farmers;
- respond more quickly when the measures indicate that reproductive performance is not as good as desired;
- assess whether the changes you have made to improve herd reproductive performance have worked; and
- use reliable, accurate measures to help motivate your farm team and guide them towards better performance.

There are a number of measures available to assess reproductive performance. Some give you an overall picture; others an insight to a particular component of reproductive performance.



The best overall measures describe the rate at which cows get pregnant once mating begins and the number of cows that remain empty at the end of mating. The following two measures are used to determine where your herd is at:

- **6-week in-calf rate**
- **Not-in-calf rate.**

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

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

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

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

FF

The InCalf Fertility Focus report provides you with your herd's results for overall performance, the drivers of overall performance and key indicators that are useful for assessing specific areas of farm management. Obtain this report from LIC MINDA Live, CRV Insight Web or Infovet.

You keep talking about good records but what exactly do we need to record?

Information that is critical for measuring herd reproductive performance includes:

- **Mating start and end dates, for both AB and natural bull mating.**
- **Calving details (cow ID, calf ID, date, assisted calvings, health problems).**
- **Pre-mating heat records (Cow ID, date recorded).**
- **Non-cycling treatment records (Cow ID, date, treatment).**
- **AB inseminations (cow ID, date of insemination, technician, bull and any doubt as to whether the cow was on heat).**
- **Pregnancy test results (cow ID, date of pregnancy test, test result and, if pregnant, number of days (or weeks) pregnant or the service date she conceived to).**
- **Cows culled or died (cow ID, date of culling or death, whether culled or died, and reason).**
- **Natural matings (cow ID, date of service and bull identification).**

Make sure you keep your records up to date to make the information easier to find and use.

Your herd improvement organisation can help with recording systems (paper and electronic), supplies of pocket books, wall charts, etc

Is she pregnant … or not?

How do you know if a cow is pregnant? How do you know if she's not? The best way to tell is by using pregnancy testing. Pregnancy testing allows you to calculate in-calf and conception rates, if done within 11–14 weeks from Mating Start Date. The conception rate tells you the percentage of inseminations that result in a confirmed pregnancy at pregnancy test.

If you don't spend the money on pregnancy testing, you need to rely on watching for heat. You may presume a cow is pregnant if she doesn't return to heat after service. The non-return to heat rate (shortened to the **non-return rate)** is often used to estimate the conception rate. It tells you the percentage of cows that were mated more than 24 days ago and have not been detected on heat since.

Conception rate and non-return rate are not the same thing: a high non-return rate is not the same as a high conception rate.

After a cow has been inseminated:

- some cows become pregnant and do not come back on heat – on average about 53% of inseminations are successful; and
- others do not become pregnant and come back on heat 18–24 days later.

If all cows did one of these, a high non-return rate would always indicate a good conception rate. But the absence of heat doesn't necessarily mean that a cow is pregnant. Unfortunately, cows are more complicated than this!

- Some cows will not become pregnant and will cycle 18–24 days later, but the heat will be missed.
- Others will not become pregnant and will cycle 18–24 days later, but will express no (or very weak) heat signs.
- Others will become pregnant but will later lose the embryo; some may come back on heat 4 or more weeks later.
- Other cows will not become pregnant but will not cycle again.
- Some cows may become pregnant but still show signs of heat at some stage.

These points mean that the conception rate is almost always lower than the non-return rate. Conception rate is typically about 10 percentage points lower than non-return rate.

Alarm bells should ring if the non-return rate is less than 64%. Ask your adviser to help you set a plan to improve.

The normal cycle of a cow is 18–24 days. This is why the non-return rate is measured after 24 days.

Why would you bother using a 'non-return rate'?

Non-return rates give you an estimate of conception rate. They don't require pregnancy testing, only good heat detection. Non-return rates are available 11–18 days earlier than conception rates and give an earlier but less accurate indication of the success of the AB programme.

Conception rate is about confirmed pregnancy. Non-return rate is about the 'non-return' to heat!

Targets and triggers

These two symbols represent the targets (tick) and triggers (alarm clock) referred to here.

The InCalf Book for New Zealand dairy farmers provides you with targets to aim for. The targets describe the results achieved by the top 25% of farmers from the NZ Monitoring Fertility Project 2003. These targets are also validated by results from the National Herd Fertility Study 2013, and reproductive statistics reported in NZ Dairy Statistics since 2014.

Triggers are provided to prompt you to investigate a result further. These triggers give an indication that 50% of farmers achieved a better result.

The targets and triggers described in this book should be compared with results for your herd calculated using the InCalf approach, as used in the InCalf Fertility Focus report. Results from other methods of calculation should not be compared to the targets and triggers presented in this book.

What to do to measure herd reproductive performance

- Establish a system for recording cow information.
- Choose and implement a pregnancy testing strategy for your herd.
- Regularly obtain reproductive performance measures for your herd by:
  - having cow information entered into InCalf-accredited herd management software and printing an InCalf Fertility Focus report;
  - providing cow information to a participating herd improvement organisation or adviser and requesting an InCalf Fertility Focus report; or
  - calculating some measures manually (Appendix 7).
- Compare your herd's results with the targets and triggers presented on page 29 to determine if you should seek help or to confirm that you are already achieving top results.
- If any of these measures indicate that you need help, seek assistance from an adviser to review herd management.

What to measure

You will need to achieve a high 3-week submission rate and conception rate to achieve a high 6-week in-calf rate.

6-week in-calf rate

The 6-week in-calf rate describes the percentage of cows in the milking herd that became pregnant in the first 6 weeks of the mating period.

Top farmers achieve a 6-week in-calf rate of around 78% (target).

If less than 68% (trigger), seek advice.

Early rectal pregnancy testing provides the most accurate assessment of 6-week in-calf rate.

Not-in-calf rate

The not-in-calf rate describes the percentage of cows that were not pregnant at the end of mating. It requires pregnancy testing after the end of mating and cannot be calculated before this time. Not-in-calf rates do not give an indication of how *quickly* cows get in calf and must be used with 6-week in-calf rates to assess overall herd performance.

To assess the not-in-calf rate, you need to take into account the length of the herd's mating period.

- Select your herd's length of mating and check the not-in-calf rate trigger at which professional advice should be sought using the following table.

Not-in-calf rates for mating periods of different lengths.

Length of mating	Performance: Seek help	Top farmers achieve about
6 weeks	32%	22%
9 weeks	20%	13%
10 weeks	17%	12%
11 weeks	15%	11%
12 weeks	14%	10%
15 weeks	11%	8%

To assess overall herd reproductive performance, you need both the 6-week in-calf rate and the not-in-calf rate.

The InCalf Fertility Focus report calculates the 6-week in-calf rate from early rectal pregnancy testing results. If these are not available, the InCalf Fertility Focus report can provide an estimate of the 6-week in-calf rate.

These not-in-calf rate targets and triggers, updated in 2017, are derived from large Fertility Focus report data sets from LIC MINDA.

Drivers of the 6-week in-calf rate:

The 6-week in-calf rate depends on several drivers. Two important drivers are 3-week submission rate and conception rate.

3-week submission rate

The 3-week submission rate tells you the percentage of cows submitted in the first 3 weeks of mating.

Top farmers achieve 3-week submission rates of about 90% (target).

If less than 81% (trigger), seek immediate professional advice.

Depending on the causes of the poor submission rate, it may be possible to take immediate corrective action. Consider heat detection management and management options for cows not detected on heat.

Conception rate

Conception rates describe the percentage of inseminations that were successful, i.e. resulted in a positive pregnancy test. It will be difficult to achieve a good 6-week in-calf rate unless the conception rate is at least moderately good.

Top farmers achieve conception rates of about 60% (target).

If less than 53% (trigger), seek advice.

A poor non-return rate (less than 64%) provides an early warning that the conception rate is likely to be poor.

It's been 3 weeks since the start of mating. I thought I should have mated more cows than I have. How can I estimate my 3-week submission rate?

3-week submission rate = $\frac{\text{No. of cows inseminated in first 3 weeks of mating} \times 100}{\text{No. of cows at Mating Start Date}}$

- Select all cows that need to be mated this season. Use the number present at Mating Start Date.
- Count how many of these had at least one service in the first 3 weeks of mating.
- Cows are only counted once. Don't simply count the number of inseminations that were performed in the first 3 weeks – some cows may have had two inseminations in that period.
- You will obtain a more accurate submission rate for your herd by obtaining an InCalf Fertility Focus report.

Measure	What this tells you	Keep in mind…	Performance: Seek help	Top farmers achieve about
Overall herd reproductive performance				
6-week in-calf rate	% cows pregnant in the first 6 weeks of mating	6-week in-calf rate and not-in-calf rate are needed to assess overall herd reproductive performance.	<68%	78%
Not-in-calf rate	% cows not pregnant at the end of mating	6-week in-calf rate and not-in-calf rate are needed to assess overall herd reproductive performance.	Depends on length of mating (see table on page 27)	
Drivers of 6-week in-calf rate				
3-week submission rate	% cows inseminated or served in the first 3 weeks of the mating period	This must be good if 6-week in-calf rates are to achieve target.	<81%	90%
Conception rate	% inseminations that were successful, i.e. resulted in a positive pregnancy test	It will be difficult to achieve a good 6-week in-calf rate unless conception rate is at least moderately good.	<53%	60%

We want to know our 6-week in-calf rate but haven't pregnancy tested. Is this possible?

You can get an estimate of your herd's 6-week in-calf rate, even if you don't have early rectal pregnancy tests recorded. An InCalf Fertility Focus report will provide you with this estimate based on mating information if available (if so, this is called an 'intermediate' level of analysis, as indicated on the back of the report).

Even if you don't have matings recorded, you can still get an estimate of your herd's 6-week in-calf rate. However, this relies on when cows calve in the following year. It will be an approximate measure and can only be supplied after the next calving period (This is called a 'basic' level of analysis, as indicated on the back of the InCalf Fertility Focus report).

It would be much more accurate if you recorded mating dates and used early pregnancy testing.

Detailed report for an example herd

Fertility Focus 2016 : Seasonal

Example detailed report

Report date:	22/09/17
PTPT:	ABCD
Herd Code:	
No of cows included:	632
These cows calved between:	07/06/16 and 13/12/16
Mating start & end date: (based on AB or pregnancy test data)	15/10/16 - 03/01/17
Next planned start of calving:	23/07/17
Duration of mating:	81 days
Duration of AB period:	42 days

incalf FERTILITY FOCUS Version 2.15

DairyNZ

1 Overall herd reproductive performance

6-week in-calf rate
Percentage of cows pregnant in the first 6 weeks of mating

Your herd	75% (75-76%)
Aim above	78%

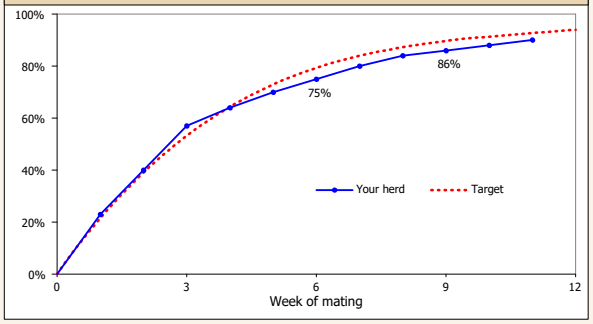
☆☆☆☆☆

Not-in-calf rate
Percentage of cows not pregnant after 81 days of mating

Your herd	9%
Aim for	6%

☆☆☆

% of herd in calf
Cumulative by week of mating



2 Drivers of the 6-week in-calf rate

3-week submission rate
% of cows that were inseminated in the first 3 weeks of mating

Your herd	90%
Aim above	90%

☆☆☆☆☆

Non-return rate
% of inseminations that were not followed by a return to heat

Your herd	
Aim above	

Conception rate
% of inseminations that resulted in a confirmed pregnancy

Your herd	58%
Aim above	60%

☆☆☆

3 Key indicators to areas for improvement

Calving pattern of first calvers
Well managed heifers get in calf quickly and calve early.

Calved by	Week 3	Week 6
Your herd	75%	96%
Aim above	75%	92%
	☆☆☆☆☆	☆☆☆☆☆

Calving pattern of whole herd
Did late calvers reduce in-calf rates?

Calved by	Week 3	Week 6	Week 9
Your herd	59%	83%	96%
Aim above	60%	87%	98%
	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆

Pre-mating heats
A high % of well managed cows will cycle before the start of mating.

Your herd	0%
Aim above	85%

☆

3-week submission rate of first calvers
Well managed heifers cycle early

Your herd	93%
Aim above	90%

☆☆☆☆☆

Heat detection
A high % of early-calved mature cows should be inseminated in the first 3 weeks of mating.

Your herd	93%
Aim above	95%

☆☆☆☆☆

Non-cycling cows
Treated non-cyclers get in calf earlier.

Treated	By MSD	Wks 1-3	Wks 4-6
Your herd	0%	0%	0%

Rating	What does it tell me?	What should I do?
☆☆☆☆☆	Top result	Ideal - keep up the good work!
☆☆☆	Above average	Getting there - focus on getting the details right.
☆	Below average	Plenty of room to improve - seek professional advice.
	No result	Not enough information provided - seek help with records.

Performance after week 6
Expected not-in-calf rate helps assess management affecting performance after week 6 (including bull management and herd nutrition).

Not-in-calf rate	
Your herd	9%
Expected	7%

Seek advice

DairyNZ incalf

6

Setting targets

The herd reproductive performance measures for your farm give a picture of where you stand relative to InCalf targets. Setting targets for your herd situation gives you a framework to help identify what needs to change.

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.

To be sure that your targets are useful as you improve herd reproductive performance:

- use consistent and accurate measures, which requires good record keeping;
- use the standard measures described in this book so you can compare your herd between years and to what is possible;
- regularly check your performance against the targets; and
- act when you see that you have not met your targets or when herd performance is near a trigger level.

What are top farmers achieving?

From the results gathered during the InCalf research project, and from New Zealand's Monitoring Fertility Project 2003, InCalf has established industry targets for the important measures of reproductive performance in New Zealand herds. The targets reported here as 'Top farmers' describe what the top 25% of New Zealand herds achieved on average in the 2003 study. This means that the targets are realistic for most New Zealand herds.

Measure	Top farmers achieve about
6-week in-calf rate	78%
Not-in-calf rate	Depends on length of mating
3-week submission rate	90%
Conception rate	60%

How to set targets for your own herd

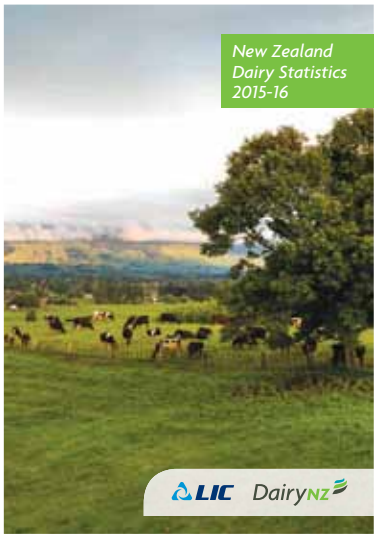
- Evaluate your current level of reproductive performance, relative to InCalf targets and triggers.
- Select your herd's target for each measure of reproductive performance:
  - If you are already at the achievable target, is it economically viable to set a higher target?
  - If you are far from reaching the achievable target, consider taking small steps towards improvement by setting a slightly lower target.
- Discuss your targets with your farm team and advisers so they can better assist you in achieving them.
- Review your targets and progress often to make sure you are making timely decisions.

What would be a reasonable target for the 6-week in-calf rate next year?

If your herd has a 6-week in-calf rate of only 65%, it would be a big jump to get to 75% in one year. If you're only at 65%, you could aim to get to 75% next year. Pin the targets up in the dairy so you don't forget about them!

This year		Next year's target	
6-week in-calf rate	65%	6-week in-calf rate	75%
Not-in-calf rate	15%	Not-in-calf rate	15%
Mating length (weeks)	12	Mating length (weeks)	11

New Zealand Dairy Statistics



NZ Dairy Statistics reports annually on herd reproduction statistics including the tables below.

Actual 6-week in-calf rate 2015-16

If your Fertility Focus report is a 'detailed' report, based on early-aged pregnancy testing, you can assess your actual 6-week in-calf rate against the actual performance of MINDA herds also with 'detailed' reports (below).

These results validate that the InCalf 6-week in-calf rate targets and triggers are still appropriate in 2015-16.

	No. of herds	Median	Top 10%	Top 25%	Bottom 25%	Bottom 10%
Actual 6-week in-calf rate	3,646	68	>76	>72	<62	<56

Estimated 6-week in-calf rate 2015-16

If your Fertility Focus report is an 'intermediate' report, you can assess your estimated 6-week in-calf rate against the estimated performance of MINDA herds also with 'intermediate' reports (below).

	No. of herds	Median	Top 10%	Top 25%	Bottom 25%	Bottom 10%
Estimated 6-week in-calf rate	4,778	65	>71	>69	<60	<54

Estimated 6-week in-calf rate results taken from many herds provide a good indication of the actual 6-week in-calf rate for the average herd in a population.

However, for individual herds, the estimated 6-week in-calf rate is within 5% of actual about two-thirds of the time, and within 10% of actual about 90% of the time.

Therefore, use the actual 6-week in-calf rate, not estimates, to compare your herd's result with previous seasons' results, and with other herds' results.

To choose a pregnancy testing strategy, and get a 'detailed' report with an actual 6-week in-calf rate, see Chapter 18.

The median is the middle point of a set of numbers, in which half the numbers are above the median and half are below.

My estimated 6-week in-calf rate is 71%. Is that a good result?

Yes, on an intermediate Fertility Focus report 71% is possibly in the top 10% of herd performance.

An 'intermediate' report may underestimate the 6-week in-calf in herds with above average performance. Likewise an 'intermediate' report may overestimate the 6-week in-calf rate in herds with below average performance.

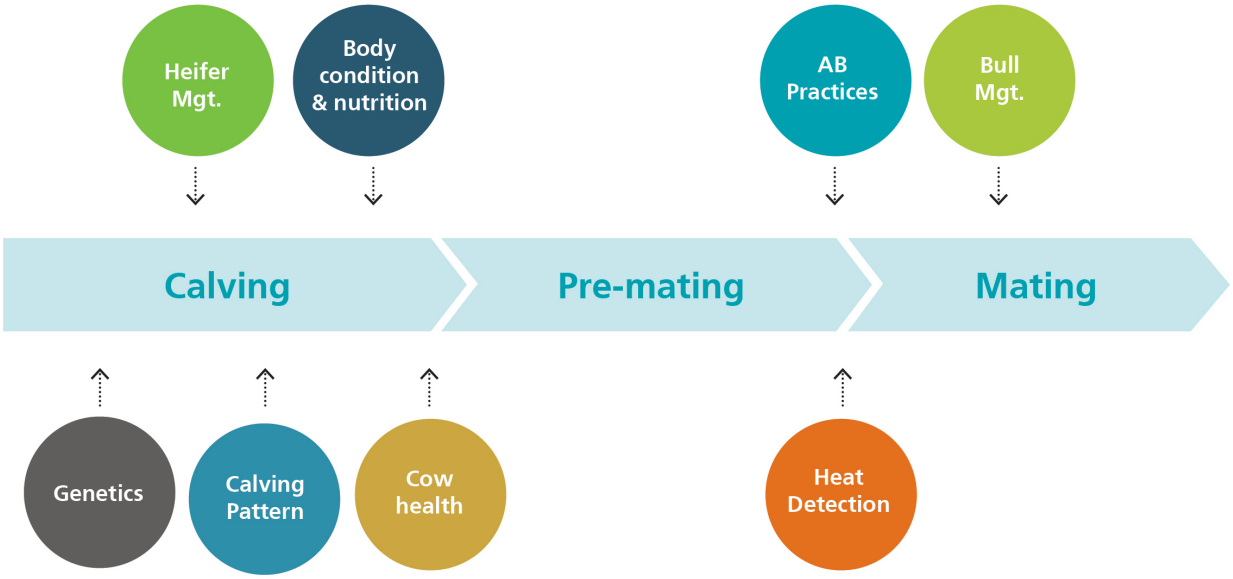
To know for sure get a detailed Fertility Focus report.

Section 3

Acting on priorities

The herd fertility cake

Herd fertility is dependent on eight key management areas, each playing an important role in herd reproduction. Getting the herd back in calf quickly is like baking a cake, with each ingredient contributing to the mix at the right time.



The InCalf herd fertility cake has 8 ingredients (in circles above) representing the multi-factorial nature of herd fertility.

The five management areas to the left contribute directly to maximising the pre-mating cycling rate, so the cows are in a fertile state before Mating Start Date.

A high pre-mating cycling rate gives a herd the potential to achieve a high submission rate and conception rate throughout mating, thus driving high in-calf rates via the three management areas to the right.

Planning for mating needs to start during mid-late lactation, not in the few weeks before mating starts.

7

Setting priorities

Some things are more important than others

As a dairy farmer, you control many management areas that affect reproductive performance. Your herd will achieve high levels of reproductive performance if you make the best possible management decisions.

To achieve good reproductive performance, it may be necessary to make changes in several key fertility management areas. One or more areas may be limiting your herd's reproductive performance more than others and may well be quite different from other herds in your district.

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

- how to tell whether you need to change management in this area; and
- what to do and when to do it.

Where there are a number of management options, *The InCalf Book* will tell you the benefits of each and what you need to do to implement them.

Put the key things first

Getting the best possible reproductive performance from your herd requires attention to detail in a number of areas. InCalf research has clearly identified the eight key fertility management areas that must be successfully managed if good reproductive performance is to be achieved. The key messages are:

- Consider your herd's fertility genetics, Chapter 8 (Genetics).
- Don't get caught with light heifers, Chapter 9 (Calf and heifer management).
- Late calvers are hard to get back in calf, Chapter 10 (Calving pattern).
- Feeding affects body condition, and condition affects fertility, Chapter 11 (Body condition and nutrition).
- Healthy cows are more fertile, Chapter 12 (Cow health).

Improved performance in the five key management areas (above) will increase your herd's pre-mating cycling rate (Chapter 17).

A higher pre-mating cycling rate gives the herd the potential to improve both submission rate and conception rate, and drive up the in-calf rate throughout the mating period, through the three key management areas (below).

- Improve your heat detection programme, Chapter 13 (Heat detection).
- Organise well for AB, Chapter 14 (AB practices).
- Make sure you've got a good bull team for natural mating, Chapter 15 (Bull management).

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 need to be able to determine whether they could be an issue on your farm.

There are many forms of treatment available for treating cows with reproductive disorders or to synchronise heats. These therapies can be used to streamline labour requirements in some herds and may help improve reproductive performance of some cows. However, they do not provide a magic answer to overcome the root cause of problems arising within the key fertility management areas.

I've heard this before and I'm already doing all that. What's the point of investigating it again?

Thinking that you know it all or do it all already may actually be the problem! InCalf research has identified that most of the differences in performance between farms can be pinpointed to the key fertility management areas covered in *The InCalf Book*.

If you want better herd reproductive performance, challenge yourself to take a closer look.

8

Genetics

Sire selection and AB

Artificial breeding (AB) allows farmers to improve profits through the genetic improvement of their herds, using artificial insemination (AI) of semen from proven high Breeding Worth (BW) sires.

In New Zealand, the term 'AB' is preferred over 'AI' to reflect the fact that a successful breeding programme is more than just the inseminating process.

Managing an AB programme is another process that requires careful planning.

Good AB programmes pay attention to sire selection, providing suitable insemination facilities, proper insemination practice and good heat detection (Chapters 10 and 11).

Choosing a team of sires with high BW rankings is the first step in making sure herd genetics for profit are maximised.

The genetics for fertility are already included in the BW, along with milk production and several other traits.

By taking fertility genetics into account in the BW, there will be no future genetic decline in reproductive performance due to selection for efficiency of milksolids production.

Rather, selecting for BW is resulting in positive progress in the fertility breeding value.

Why use a team of bulls?

It is important to use a team of bulls to spread the risk that any of the individual bulls in the team might not be as good as expected, or might be transmitting undesirable traits that are not recorded in the New Zealand Animal Evaluation system. A team also reduces risk through increasing genetic diversity.

For more information go to dairynz.co.nz/animalevaluation

Sire selection and fertility genetics

It is increasingly recognised that genetics for cow fertility is a key driver of herd reproductive performance in New Zealand dairy herds.

Some AB sires produce daughters that are genetically more fertile than others. This means that the genetic make-up of your herd for fertility may be a little better or worse than the average herd.

You can check your herd's fertility genetics by requesting your herd's average fertility breeding value (BV) from your herd improvement organisation. However, the genetic differences between New Zealand herds for fertility are generally small, because most New Zealand farmers use recommended teams of proven high BW bulls.

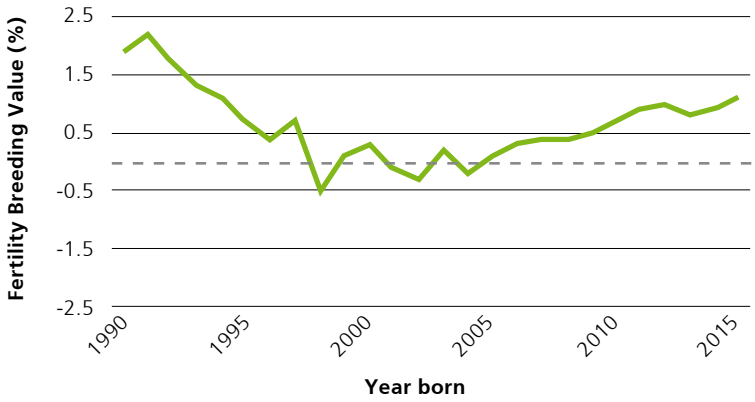
BW takes reproductive performance into account, ensuring there will be ongoing genetic progress long term in cow fertility (see graph below).

In recent years the economic value for fertility has more than doubled within BW calculations, putting a greater emphasis on the value of fertility genetics.

Breeding high-fertility cows:

- Fertility was incorporated into BW in 2002 and since then fertility genetics in the national herd have increased by around 0.1% per year.
- Daughters of higher-ranking fertility bulls are more likely to re-calve within the first six weeks.

Genetic trend over time: cow fertility



What is being done to speed up genetic gain for fertility?

An 'animal model' research herd with extreme diversity in genetic fertility has been established and these heifers calved in 2017.

- **This herd will help answer industry questions around cow fertility, including:**
- **How accurate is the current fertility breeding value?**
- **What new traits can we measure to help us better predict fertility?**
- **What underlying physiology is driving differences in fertility?**

For more search 'animal model' at dairynz.co.nz

Use of fertility breeding values

Fertility BVs are comparative measures expressed as percentages of daughters that re-calve within the first 6 weeks of calving. The fertility BVs can be used to compare sires of all ages, breeds and crosses in New Zealand.

Fertility BVs for bulls and cows are relative to a genetic base, being the average of cows born in the base year (currently 2005). So cows with Fertility BVs of 0% have the same genetic merit for fertility as the base cows born in 2005.

In comparing cows with fertility BVs of +5% (high genetic merit for fertility) with cows with fertility BVs of -5% (low genetic merit for fertility), you can expect 10 more high-merit cows per hundred to re-calve in the first 6 weeks of the herd's calving period.

Bulls transmit half their fertility BV to their daughters. The other half comes from the dam.

If you want to avoid breeding from sires with low genetic merit for cow fertility you can inspect the Ranking of Active Sires (RAS) list on the website for New Zealand Animal Evaluation at dairynz.co.nz.

What if I want to put more emphasis on daughter fertility when picking sires?

Recent analysis of cow fertility data suggests herds with low reproductive performance have more to gain by using a team of high BW sires that also have high fertility BVs. This is called secondary selection.

You should be aware of the fertility BVs of the sires you are using!

Is that fertility BV connected to the fertility of the semen or that of the daughters?

Semen fertility does not influence the fertility BV of a sire. Fertility BVs are based entirely on the fertility of the sire's daughters.

Semen fertility – Bulls with higher semen fertility produce semen that is more likely to get cows pregnant and so conception rates are higher. While conception rates are similar for semen from most bulls, a small number of bulls and particular batches of semen have a reduced conception rate. This is not related to the fertility BV.

Daughter fertility – AB sires with higher daughter fertility BVs produce daughters that are more likely to become pregnant sooner, due to genetics. This is because daughters of some bulls cycle sooner after calving or have higher conception rates.

By choosing a team of high BW sires , you also select for daughter fertility.

Crossbreeding adds hybrid vigour

If you are breeding crossbred cows they will have additional hybrid vigour for fertility. New Zealand Animal Evaluation data measures the hybrid vigour enhancement of fertility beyond the effects of the breeding values.

The hybrid vigour advantage for first crosses is that the 6-week in-calf rate is around 3.4% higher than you would expect from mating parents of the same single breed.

The hybrid vigour advantage for subsequent crosses is that the 6-week in-calf rate is around 2% higher than you would expect from mating parents of the same single breed.

Crossbred AB sires will retain a 1.7% hybrid vigour advantage.

Gestation length

In New Zealand , the average gestation length of dairy cattle is 282 days, but there is genetic variation around this.

Dairy sires have gestation length BVs that can be obtained from the Animal Evaluation pages at DairyNZ website.

Since 2014, interest in short gestation length breeding options has increased. Some farmers are including short gestation length sires in their mating programme, at the tail end of the AB period or as an AB restart near the end of mating.

You should be aware of the gestation length BV of the sires you are using (both beef and dairy), as it will affect the calving date of your cows. (See more in Chapter 10, page 65).

Is it true that crossbreds are more fertile?

Crossbred cows are recognised as having the highest fertility. 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 pure-bred herds, the reproductive performance of many crossbred herds is reduced by problems in other key fertility management areas.

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

Selecting bulls to minimise calving difficulty

Some sires, especially Holstein-Friesian, cause higher rates of assisted calving when mated to yearling heifers. This is a direct genetic effect of the bull.

Subsequent reproductive performance is worse after assisted calving.

This sire effect is reflected in a sire's calving difficulty BV.

A sire's calving difficulty BV predicts the percentage of assisted calvings expected when he is mated to yearling heifers. It can also be used to identify bulls that are expected to increase the rate of calving assistance for cows carrying the bull's calves.

Jersey sires have calving difficulty BVs typically less than zero, for example -2.5%. This means that they sire fewer calves requiring assistance than the average of all sires born in the same year.

Holstein-Friesian sires have BVs typically positive in value, for example +1.4%.

Crossbreds have BVs intermediate between these two breeds, for example -1.3%.

When artifically inseminating yearling heifers, use sires proven under New Zealand conditions with a low calving difficulty BV.

Breeding companies may provide groups of Holstein-Friesian or crossbred bulls that are selected for use on Holstein-Friesian yearling heifers.

Alternatively, all Jersey bulls are suitable for use on Holstein-Friesian yearling heifers (Chapter 9, pages 57-58).

In summary, sire selection considerations for fertility include:

- Breeding Worth
- fertility BV
- crossbreeding
- gestation length
- calving difficulty.

Avoid inbreeding

Inbreeding tends to have a negative effect on cow profitability through lower fertility, lower production and a higher incidence of genetic disease. Avoid inbreeding by not mating sires with closely related cows. Your AB company has programmes to help you avoid inbreeding.

9

Calf and heifer management

Assessing calf and heifer management

The reproductive performance of replacement heifers is directly related to liveweight at mating and calving. Calves and heifers must be reared to achieve liveweight targets, and reach puberty by start of mating, otherwise their first calving will be delayed. Also, their liveweight at calving will be too low and their fertility during their next mating period reduced. Well-grown heifers also produce more milk in their first lactation, compete better with mature cows and can survive longer in the milking herd than poorly grown animals.

Calf and heifer management on many farms is a limiting factor to herd reproductive performance. The first step in making improvements is to assess the calves and heifers in your herd.

Measuring liveweights, setting liveweight targets and assessing the calving pattern for first calvers are ways to do this. Also assess the 3-week submission rate, and 6-week in-calf rate if available, of first calvers.

Doing a good job of rearing calves from birth to weaning and growing heifers from weaning to mating will help you achieve optimal pre-calving liveweight targets for your heifers.

Achieving optimal liveweight targets by heifer Mating Start Date ensures that maiden heifers cycle early, conceive early and calve early.

- **Weigh your heifers at least every 2 months, and monthly in high-risk periods.**
- **Take action to improve nutrition and ensure good parasite control if the average weight is below target.**

Measuring liveweights

Weigh your heifers at least every 2 months, and more often if you want to be more accurate and able to make management changes more quickly. Scales are by far the best option for weighing calves. Check that you are using the scales according to the manufacturer's instructions. Weigh bands are an improvement on the 'eye-o-meter' but are not recommended for estimating liveweight of individual animals because they are not very accurate.

Weigh heifers at a similar time of day, preferably in the morning, or let them stand in the yard for 2 hours before each weighing to minimise the effect of changes in gut fill.

These tips may make your job easier:

- Walk through the heifer group regularly to get them used to people.
- Handle heifers quietly and do not force them through your set-up with items like polythene pipe. Although it's sometimes difficult, be patient! It gets easier with practice.
- Use a bit of rubber matting or old carpet to cover the platform of the scales and reduce noise stress.
- It might be worth running the heifers through the dairy and yard when you bring them in for weighing, as this gets them used to the yard and shed.
- Portable cattle yards may be a worthwhile investment if cattle handling facilities are not suitable for weighing. Chat with the neighbours as these costs could be shared.
- Remember to upload electronic results to the herd improvement database to check out how they are tracking over time.

I don't see how a few light heifers will make a difference to herd fertility.

You can expect poorer reproductive performance when heifer liveweights are low for two reasons: 1) delayed first calving; and 2) delayed interval from calving to the next conception.

When calf and heifer growth rates are low, by the time you start mating the heifers, liveweights are lower than necessary. Low liveweight delays puberty, so these heifers are less likely to have started cycling at heifer Mating Start Date. They often take longer to get in calf and will calve late.

Late-calving heifers commonly become late-calving cows and reduce overall reproductive performance in the next mating period.

The 6-week in-calf rate in first lactation can be more than 15% lower in underweight heifers.

Making sure heifers calve on time, and at the right size, takes planning.

I've seen graziers out there weighing heifers. Surely they've got something better to do?

Weighing is the only way you can know how your heifers are growing compared with your targets. Make sure your grazier is regularly giving you weight reports so you can know how your heifers are doing? Allow your grazier third-party access to view reports e.g. MINDA Weights™. The InCalf Tools provide quick and easy methods for weighing heifers and assessing the results against targets.

Make regular weighing a habit.

Setting liveweight targets in heifers

If you are concerned about your herd's reproductive performance, young stock rearing may be a part of that, and your targets and weighing protocols should be reviewed.

Setting targets for heifers is an individual farm decision. Targets are best customised to the herd's genetics for liveweight and the farmer's objectives.

Breed-based mature cow weights and targets are often used. Another way is to get a measure of your cows by weighing mature cows of 6-8 years.

Aim to have your heifers at 30% of estimated mature cow liveweight at 6 months, 60% at 15 months and 90% at 22 months of age.

An easy way to estimate mature cow liveweight is using the liveweight breeding value (Lwt BV) of the group of heifers.

Targets are set using the following formula:

- Expected mature liveweight = 500 kg + Lwt BV
- So a heifer group with average Lwt BV of +5 would expect to grow to an average mature cow liveweight of 505 kg.

Once you have determined the expected mature liveweight for your heifers, you can plan target liveweights for the group of heifers at different ages.

- Set individual farm targets for heifer liveweight from weaning through to calving (see table on page 49).

  MINDA Weights™ can calculate Lwt BV based targets for each heifer age group.

- Weigh and measure heifers at least every 2 months.

  If the average liveweight of heifers is below the target, take action to increase growth rates of the whole group.

Don't get caught with underweight heifers. They are far less likely to have a long and productive life in the herd. It is more efficient to grow heifers to target earlier in their life. Playing catch up at any stage is costly.

Get the preferred size of mature cow to fit your system by selecting appropriate genetics and/or breed – and not by under-growing heifers.

Setting liveweight targets in heifers

Example targets for dairy heifers of different liveweight genetics are shown below. Modify these tables to suit your herd based on the information available for your herd.

The table below assumes reasonably constant growth rates from weaning to calving. If it is not possible to maintain high growth rates from mating to calving, you will need to set higher target weights to achieve before mating.

The table also is based on the birth date of an early-born calf, born on the herd Planned Start of Calving date. The task to achieve liveweights by Mating Start Date is more difficult for late-born heifers. These heifers will not be 15 months of age when mating starts. You may need to preferentially feed late-born calves, before and after weaning, to achieve the higher growth rates required.

Breed differences are factored into these 'weight-for-age' targets through their Lwt BV. The 15-month (60%) targets relate to heifer Mating Start Date. The 22-month (90%) target relates to two months prior to heifer Planned Start of Calving date, before the fetus, fetal fluid and membranes dramatically increase in weight.

Use the table below to target heifer liveweights for high reproductive performance based on 30%, 60% and 90% of the heifer group's estimated mature cow liveweight.

When	Liveweight for typical heifers (kg)				
Mature cow liveweight	**400**	**450**	**500**	**550**	**600**
Lwt BV	-100	-50	0	+50	+100
3 months	80	90	100	110	120
6 months (30% of mature liveweight)	**120**	**135**	**150**	**165**	**180**
9 months	160	180	200	220	240
12 months	200	225	250	275	300
15 months (60% of mature liveweight)	**240**	**270**	**300**	**330**	**360**
18 months	290	330	365	400	440
22 months (90% of mature liveweight)	**360**	**405**	**450**	**495**	**540**

I've got a mixed breed herd. How do I know what targets to aim for?

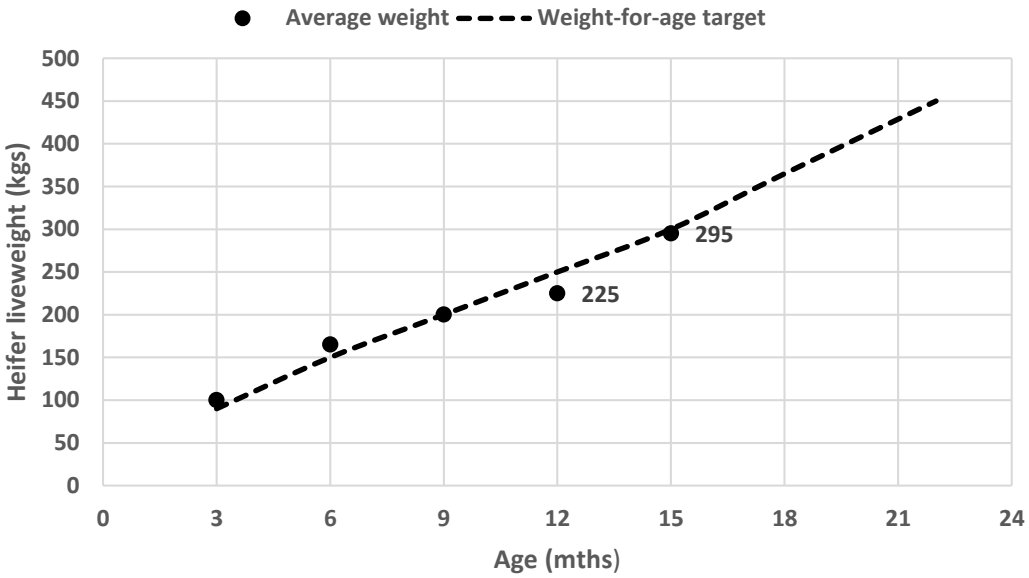
You could weigh a sample of mature cows of the desired size for each breed group, to determine their mature cow liveweight, and estimate their targets from the table.

You can request a 'trait evaluations' report from your herd improvement organisation showing average Lwt BVs for different age groups, and estimate targets from the table.

Or use MINDA Weights™ to save time. Options include the same actual versus target graph for breed sub-groups within your herd.

There isn't really a good excuse for not knowing the expected mature liveweights of your replacement heifers.

This group of heifers is on target except at 12 months when they were on average 25 kg (10%) below the target 250 kg.



MINDA Weights™ creates, using the Lwt BV formula, a 'weight-for-age' based target graph (like above) showing trends for a specific group of heifers. The system also reports on weight ranges within the group. And it tracks each animal's weight, and weight gain, against individualised targets. These targets take into account her Lwt BV, her birth date, and the days remaining before the group's Mating Start Date and Planned Start of Calving date.

The InCalf Heifer Rearing Tool provides an easy-to-use process for identifying the gap between current and target liveweights, and assessing potential benefits from improved heifer management.

We don't have much confidence in the liveweight BV records of the heifers we bought.

Individual animal Lwt BVs are of low reliability, so focus on performance at the group level. The error for any single animal's target weight estimate is large, about +/-35 kg. For the group average this error is small, depending on group size (e.g. +/-5kg for a group of 50 heifers).

When using targets, the group will be 'on target' when the average weight of the group is sitting on the group target. When the group is 'on target' there will be as many individuals below as above the group target. That does not necessarily mean individuals below the group target need special attention to catch up. Check these individual's weight gain trends, and make a physical assessment of each.

See appendix in the InCalf Heifer Rearing Tool for a method to assess the size of the 'tail-end' problem, within the group.

Assessing the calving pattern of first calvers

The calving pattern of first calvers is an indicator of how successful your calf and heifer management has been.

You can use the table at the bottom of this page to determine how well your heifers calved (Chapter 10, page 65).

Expect higher calving pattern results if Mating Start Date for your heifers was earlier than Mating Start Date for the milking herd.

If heifers are mated 1-2 weeks ahead of the herd:

Top farmers have 82-87% of their heifers calved by week 3 and 96-98% by week 6 of calving in the herd.

If less than 75-80% of heifers calved by week 3 and less than 89-93% of heifers calved by week 6 of calving in the herd, review:

- calf and heifer management;
- bull management; and
- heat synchrony programme or heat detection if AB was used.

Mating Start Date for heifers should be earlier than the main herd to ensure heifers conceive early in the mating period that follows their first calving.

Mating well-grown heifers 1–2 weeks earlier means they calve 10 days earlier. That gives them the 10 more days they need on average to recover before the next mating begins.

The InCalf Fertility Focus report calculates the calving pattern of first calvers.

I have my calving pattern for first calvers but what does it tell me?

Imagine you started mating your herd on 23 October. That gives you a Planned Start to Calving date next season of 1 August. If your Mating Start Date for heifers was also 23 October, you should expect 75% of the first calvers to have calved by week 3 of the herd's calving pattern (21 August).

If your Mating Start Date for heifers was 9 October, 2 weeks earlier than for the herd, you should expect 87% of the first calvers to have calved by week 3 of the herd's calving pattern (21 August). The table below can help you determine what to expect.

Calving pattern targets for first calvers with differing Mating Start Dates relative to the cows

	% of heifers calved by week 3 of calving in the herd		% of heifers calved by week 6 of calving in the herd	
Mating Start Date for heifers last year.	**Seek help**	**Top farmers achieve about**	**Seek help**	**Top farmers achieve about**
Same as cows	Less than 70%	75%	Less than 85%	92%
1 week earlier than cows	Less than 75%	82%	Less than 89%	96%
2 weeks earlier than cows	Less than 80%	87%	Less than 93%	98%

The InCalf Fertility Focus report calculates the 3-week submission rate of first calvers.

Assessing the 3-week submission rate of first calvers

The 3-week submission rate of first calvers, during their second mating, may be a good indicator of how successful your calf and heifer management has been, and how they are performing now they are in the milking herd.

Review the 3-week submission rate of first calvers:

Top farmers have 90% of their first calvers submitted by week 3 of AB, with minimal or no hormonal intervention.

If less than 81% of first calvers in the herd are submitted by week 3, review:

- calf and heifer management;
- management of feed supplies and animal nutrition;
- pre-mating heat detection and non-cycling cow treatment;
- heat detection during AB; and
- cow health.

Expect higher results than 81% if Mating Start Date for yearling heifers was earlier than for the milking herd, and the yearling heifers achieved their liveweight targets.

Assessing the 6-week in-calf rate of first calvers.

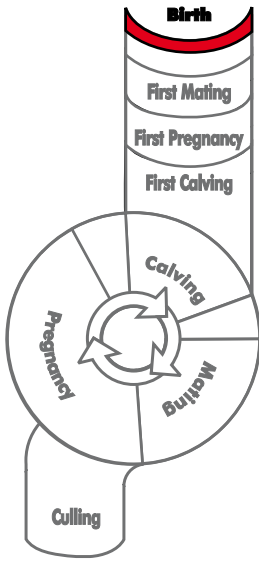
Some reporting systems can estimate the percentage of first calvers pregnant in the first 6 weeks of mating.

Top farmers have 78% of their first calvers confirmed pregnant by week 6 of mating.

Identify and promote the best person to rear calves. For more information go to dairynz.co.nz/calves

Observe calves closely for 2–3 weeks after weaning off milk as they are disease prone during this time.

Rearing calves from birth to weaning



From the day a heifer calf is born, you start the process of maximising her potential to get in calf. You need to rear healthy calves, provide them with good nutrition and adequate housing, and run an accurate identification and record keeping system.

Identify the best person on the farm to rear the calves. Successful calf rearing demands patience, skill and an empathy with young animals, as well as an eye for detail, and knowledge of diseases and feeds.

Identify calves as soon as possible after birth in accordance with NAIT requirements. For more information go to nait.co.nz.

A healthy environment is essential to rearing healthy calves. Housing should be clean, dry, well ventilated and draught free. If bedding is provided, use non-edible types such as untreated shavings, sawdust or bark chips. Group calves together according to age and size. It is not a good idea to mix batches of calves. Sick calves should be isolated so that infectious diseases are not transferred to healthy calves. Think about 'biosecurity', and go to dairynz.co.nz/biosecurity.

Minimise calf exposure to Johne's bacteria. For more information on Johne's Disease management go to dairynz.co.nz/johnes, or speak to your vet.

Isn't it enough just to make sure the calf's had a good drink soon after it's born?

The calf has to drink colostrum, but it's got to be enough of the right stuff – 'gold' colostrum, from the first milking after calving.

Calves are born with very low immunity. Colostrum provides antibodies that are absorbed across their gut wall into their bloodstream within the first 12 hours of life. Many calves get insufficient high-quality 'gold' colostrum early enough. This is called Failure of Passive Transfer (FPT) making the calf more likely to get sick and die. NZ research has found about 33% of calves born have FPT. The level of FPT on farms ranges from 5% to 80%.

If you have any doubt that calves have received colostrum by suckling the mother, give them 1.5-2 litres of colostrum by bottle, or by tube if not sucking. For this initial feed, only use colostrum from the first milking of a healthy cow. Feed up to 10% of the calf's bodyweight as colostrum, split into at least two feeds, within the first 6-12 hours after birth.

Bacterial contamination and low immunoglobin (IgG) levels lead to poor quality colostrum and FPT. Carefully clean colostrum storage and feeding equipment with hot, soapy water. You can measure the IgG quality of colostrum using a BRIX-scale refractometer.

Use a marking system so you know which calves have been fed their first two litres of colostrum, and their second feed and if tubed or bottle fed.

Avoid colostrum from cows possibly infected with Johne's Disease.

For more on colostrum go to dairynz.co.nz/calf-care and 'Calvingsmart' or speak to your vet.

You don't want to lose that calf for lack of a few litres of good colostrum.

An 'all-in all-out' system works best to reduce exposure to disease. Once calves go into a pen they do not leave the pen (unless sick) until the pen is emptied.

There are many successful ways to rear calves, including early weaning, restricted milk systems and *ad lib* milk systems. For all systems, make any change to the quantity or type of milk fed gradually, and be consistent with time of feeding, milk temperature and milk concentration.

- Remove the calf from its mother soon after birth and ensure it receives adequate, good-quality colostrum. Identify and record birth and dam details.
- Spray or dip calf navels with a strong (2%) alcohol-based iodine solution as soon as possible after birth and again once in the pen.
- Clean all equipment being used to collect and store milk with hot soapy water to get rid of bacterial contamination which reduces colostrum quality.
- Check that fresh water, clean straw and high-quality calf meal or pellets (at least 12 MJ ME/kg DM and 18% crude protein) are available at all times to stimulate rumen development.
- Separate sick calves and feed them last. Don't forget to wash your hands, boots and feeding equipment after handling them. Also disinfect with a reputable product (viracide and bactericide).
- Vaccinate against clostridial diseases and leptospirosis according to the manufacturer's instructions. Consider vaccinating against IBR (Infectious bovine rhinotracheitis) and BVD (Bovine viral diarrhoea) where there is a history of these diseases in your herd. Herds and farms have different specific additional disease risks and there are slight variations in the requirements of the timing and number of vaccinations required. Develop an appropriate vaccination programme with your vet.
- Check that all calves are drinking milk and eating meal and pasture on a daily basis.
- Thoroughly clean and disinfect calf sheds between seasons. Consult your vet to find out about appropriate disinfectants.
- Do not re-use pens that have housed sick calves unless the bedding has been replaced and the pens have been thoroughly disinfected.

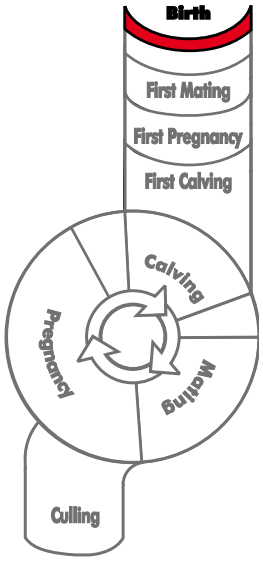
Should we wean calves off milk on age or on weight?

Age and weight are both important, hence we refer to 'weight for age' targets appropriate for the animals' genetics. But the main criteria is a fully functional rumen digesting pasture.

Observe calves closely for 2–3 weeks after weaning off milk as they are disease prone. Separate calves not growing well and preferentially feed them. If scouring, coughing or looking hollow, isolate them and seek vet advice. If calves are going out to grazing mixing with others, ask your vet about disease control including BVD.

Weaning off milk is a high-risk time for calves.

Growing heifers from weaning to mating



Good calf management must be followed by a focus on heifers in the time from weaning to their first calving. This will provide the best opportunity for heifers to calve on time in the first and subsequent years.

Selecting the right time to wean groups of calves depends on the calf rearing system used, and is a two part decision. First, they must have reached their minimum weaning target weight. This is about 2.5–3 times their normal birth weight, and at least 17.5% of expected mature weight based on the Lwt BV formula, on pages 48-49.

Secondly, all calves need to be consuming one kilogram of meal per day before they are weaned off milk. If a mob of 20 calves is eating 20 kg of meal, some calves will only be eating 0.5 kg and will not be ready for weaning.

Disbudding calves as early as possible before weaning using local anaesthetic according to animal welfare requirements will minimise any setback in growth that may occur. Discuss this with your vet.

The key to feeding heifers is to ensure they achieve targeted weights with good frame development. Remember that the first 12 months are the most critical for skeletal and muscle development. Heifers require a plentiful supply of high-quality pasture to achieve liveweight targets. If pasture supply is inadequate or quality is poor, then consider adding a high-quality supplementary feed or find alternative grazing.

Differentially feeding groups of heifers according to their size and weight for age can help smaller, lighter heifers reach their target liveweight for mating. During mating, avoid sudden reductions in feed. The reproductive performance of heifers can be poor if feed is reduced during mating.

For more go to dairynz.co.nz/calf-care.

My heifers are way too light! How do I manage underweight heifers?

Groups of heifers below target liveweight are often the result of too little pasture or from offering pasture that was mature, dry and of low quality. When pasture allowance is inadequate or of poor quality, you should consider adding supplements to the diet, or find alternative high-quality grazing. There are supplements that can be added to provide energy alone, or a combination of energy and protein. You should discuss the options with an adviser.

Don't forget to control parasites as they can also reduce heifer growth rates. Review your current drenching routine with your vet.

Don't get caught with light heifers.

Every time you vaccinate or drench your heifers, check if they are due to be weighed – it may be convenient to do both jobs at once.

- Make sure calves graze abundant, high-quality pasture so that they are achieving their liveweight targets. If not, feed good quality supplements (at least 11.5 MJ ME/kg DM and 16% crude protein) until calves reach about 40% of mature weight. Remember that protein content and quality is important to ensure good skeletal and muscle development.
- Develop a parasite control programme in consultation with your vet.
- Monitor liveweights at least every 2 months. If results are below targets revise pasture-feeding management. Are they getting enough high-quality pasture? If high-quality pasture cannot be provided, consider supplementary feeding to increase heifer growth rates. Review your parasite control programme.
- Protect your heifers from facial eczema during late summer and autumn with zinc dosing, fungicide spray and supplementary feed options.

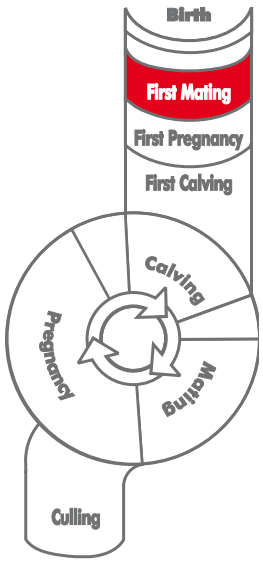
If considering contract grazing dairy heifers off the dairy farm, look for resources at dairynz.co.nz/heifers.

- Keep calves and heifers away from areas irrigated or contaminated with effluent.
- Consider the need to supplement heifers with trace elements, vitamins and other feed additives with advice from an adviser.
- Keep heifers away from poisonous plants, farm dumps and garden clippings. Take care when grazing potentially high nitrate crops/new grass.

For good reproductive performance, late-born heifers must achieve the same liveweights as the earlier-born heifers by Mating Start Date. To achieve this, they must grow more quickly than earlier-born heifers and may benefit from heavier weaning targets. Consider preferentially feeding late-born heifers to achieve the same liveweights as their older counterparts.

These heifers are in good condition, but you won't know if they are up to target weights unless you weigh them. Looks can be deceiving.

Planning mating



Planning ahead will make for a more successful heifer mating period.

When to start mating yearling heifers

Think about mating well grown heifers to start calving 1-2 weeks earlier than the milking herd to help them achieve calving pattern targets and good reproductive performance at their next mating.

- You will need your yearling heifers at the required target mating weight 1-2 weeks earlier if you want to do this.
- 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.
- You should train the heifers to go through the dairy with the help of some cows, over 5-6 consecutive days, well before calving starts. This will also help with insertion of internal teat sealant for mastitis control.

Systems for mating heifers

Decide if you are going to AB the yearling heifers or use bulls for natural mating. You will still need natural mating bulls for follow up to an AB programme. How many natural mating bulls will you need?

If you are going to AB your heifers, check what needs to be done.

- Is your AB technician experienced, as heifers can be more difficult to inseminate than cows?
- Have you allowed for the extra time, skilled people and facilities required to implement an AB heifer programme?
- Will you heat synchronise heifers to allow planned use of people's time?
- What aids will you use for heat detection? Tail paint alone might not be good enough. Use of heat mount detectors in addition may help.
- Check that the type of heat mount detectors you are planning to use will stay on yearling heifers.

Why would you go to all that trouble of doing AB over yearling heifers?

There are several reasons to AB your yearling heifers. It allows you to rear extra AB replacements to increase herd size more rapidly. You can also get the same number of AB replacements with a shorter AB period in the milking herd. As a bonus, you can increase the rate of genetic gain of your herd by using this strategy. Don't take AB'ing heifers on without serious consideration.

Bull selection to minimise calving difficulty with heifers

When using bulls for natural mating yearling heifers, use a breed of bull known to be low risk for assisted calving , which essentially means using Jersey bulls (Chapter 8, page 44).

Use of Holstein-Friesian sires on yearling heifers is not recommended. Look for crossbred or Jersey sires instead with calving difficulty BVs as close as possible to -2.5%, the typical Jersey figure.

When artificially inseminating yearling heifers, use sires proven under New Zealand conditions with a negative calving difficulty breeding value (BV). The lower the calving difficulty BV the better! This will reduce, but not eliminate, the calving difficulties you are likely to experience.

A sire's calving difficulty BV predicts the percentage of assisted calvings expected when he is mated to yearling heifers. The lower the BV, the fewer expected assisted calvings, and the higher the BV, the more expected assisted calvings.

- Jersey sires have calving difficulty BVs typically less than zero (e.g. -2.5%) and don't cause a problem.
- Holstein-Friesian sires have calving difficulty BVs typically positive in value (e.g. +1.4%) and many will cause calving problems in heifers.
- The calving difficulty BVs for crossbreed sires are intermediate (e.g. -1.3%).

If yearling heifers Mating Start Date is 1-2 weeks ahead of the herd, their age would then be only 14-15 months. The yearling bulls to be used with these heifers might be the same age 14-15 months. The libido and fertility are lower in very young bulls. Ensure all yearling bulls used are at least 15 months of age at the heifer Mating Start Date.

What to do during mating

The focus during the mating period is on maintaining growth and implementing a successful mating programme.

- Monitor liveweights at least every 2 months. If weights are lower than targets, consider supplementary feeding to increase heifer growth rates and review your parasite control programme.
- Monitor bull serving behaviour throughout mating to ensure heifers are being mated successfully. Ensure bulls that are lame or ineffective are replaced. Remove dominant bulls.
- Ensure sufficient bulls are used and that there is sufficient feed available throughout the mating period.

So how long should the mating period be for heifers?

Heifers total mating period should not exceed 9 weeks, or 3 oestrus cycles. If they start mating 1-2 weeks ahead of the herd, there will be very few heifers calving beyond week 6.

What to do with pregnant heifers

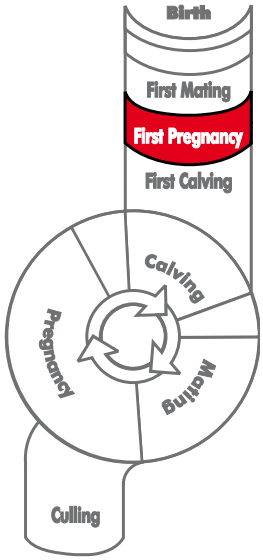
Once heifers are in calf, they still need to grow right up until calving at a rate sufficient to achieve liveweight targets.

The period between mating and calving is a good opportunity to assess the reproductive performance of the heifers. Early pregnancy testing (no more than 14 weeks after mating started) allows you to identify which heifers conceived early in the mating period as well as predicting calving dates. Knowing when heifers are expected to calve can help in their management at calving. Pregnancy testing from 5 weeks after the end of mating will identify empty and later calving heifers. (For more, go to Chapter 18, page 159.)

- Monitor liveweights at least every 2 months. If results are less than targets, consider supplementary feeding to increase heifer growth rates and review your trace element, facial eczema and parasite control programmes.
- Identify empty and later calving heifers and cull them. And watch out for the odd abortion.

If you are pregnancy testing heifers, assess their predicted calving pattern.

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. A 30 kg unborn calf requires 32 MJ ME/day in the last 4 weeks before calving. This is equivalent to 2.8 kg DM/day; and is over and above what the heifer requires for her own maintenance and growth. If heifers have not reached their target weight when close to calving, consider running them separately from the springer cows and feeding them preferentially.



I am told these heifers are a bit too fat?

As well as targets for liveweight, heifers have an optimal body condition target at first calving, 5.5 body condition score. Heifers weighing 85-90% of their mature liveweight at 21–22 months are likely to be at this level of body condition, which is associated with an early return to heat and improved in calf rates.

The aim is to grow heifers to liveweight targets, while being neither too fat nor too thin.

10

Calving pattern

The importance of a good calving pattern

A desirable calving pattern has at least 88% of the whole herd calving in the first 6 weeks, with 12% of cows calving beyond that.

Late-calving cows are hard to get in calf and excessive numbers reduce herd reproductive performance substantially. Many herds suffer reduced reproductive performance because calving periods spread over more than 9 weeks.

Good planning is required to take a spread calving pattern and make it more compact. The process begins by selecting the dates when mating will start and stop, and then ensuring that most cows get in calf early.

The link between a cow's calving and mating dates is influenced by the expectation for her to calve no later than the same calendar date next year. A normal pregnancy is 40 weeks so conception must occur within 12 weeks after calving if she is to calve on or before the same date next year. As a cow's normal cycle is 3 weeks, it makes sense to divide a herd's calving dates into 3-week blocks in relation to **Planned Start of Calving date (PSC)**. These also relate to the intervals from calving to **Mating Start Date (MSD)**. The table below shows the comparison between these intervals.

NZ Dairy Statistics (2015-16) reports that the average herd-tested NZ dairy cow has an interval between calvings of around 368.5 days.
This means the average cow's re-calving date is slipping more than 3 days later each year. This reflects the average herd's reproductive performance being less than that required to maintain a 365-day calving interval. The performance of top farmers meets the 365 day expectation because their cows get back in calf earlier.

Calving date and calving to MSD interval.

Calving Group	Calving to MSD
Very early – before PSC	More than 12 weeks
Early – 1st 3 weeks	9–12 weeks
Mid – 2nd 3 weeks	6–9 weeks
Late – 3rd 3 weeks	3–6 weeks
Very late – within 3 weeks of MSD or later	Less than 3 weeks

Planned Start of Calving (PSC); Mating Start Date (MSD).

Selecting mating start and end dates

Selecting the ideal time to start and stop mating – and the subsequent pattern of calving – are individual decisions dependent on factors such as feed supply, labour availability and climate. Once the calving start date is set, MSD is automatically determined as 282 days before that.

For a handy reference to relate your MSD to Planned Start of Calving, see the look-up chart in Appendix 4.

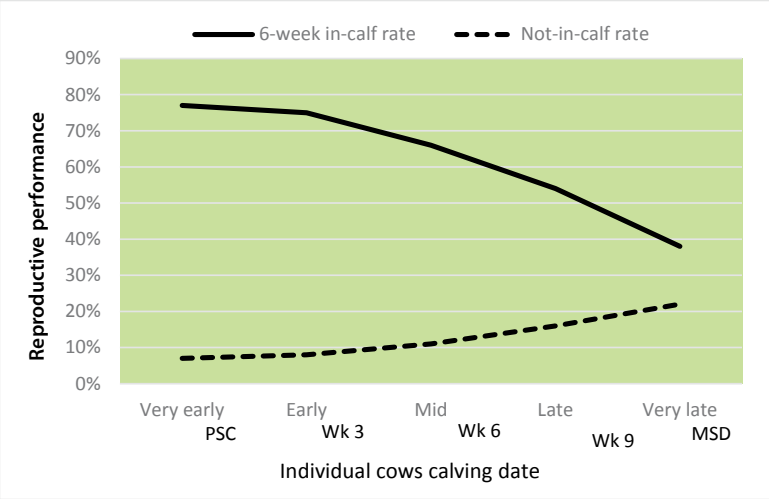
Consider starting your heifer mating programme 1 to 2 weeks before the main herd. This increases the number of heifers that will calve before or during the first 3 weeks of the herd's calving period and increases their chance of conceiving early in the next mating period.

Once you have determined your herd's MSD, you need to think about the duration of mating – when to stop mating. This again is an individual decision, but the number of empty cows you are willing to accept at the end of mating will be one factor you need to consider.

Effect of interval from calving to Mating Start Date on reproductive performance (NZ Monitoring Fertility Report 2003).

Calving to MSD interval	6-week in-calf rate	Not-in-calf rate
More than 12 weeks	77%	7%
9–12 weeks	75%	8%
6–9 weeks	66%	11%
3–6 weeks	54%	16%
Less than 3 weeks	<40%	>20%

The data in table above are also shown in the graph below.



The acceptable number of empty animals will vary between farms depending on:

- the number of heifer replacements you have available;
- whether you are building up herd numbers;
- the number of cows that will need to be culled for reasons other than reproduction, such as mastitis;
- whether you can carry empty cows over to a second mating period (e.g. split calving herds), or carry over for a full year.

Consider each of these factors when deciding on the duration of mating that would be appropriate for your herd. You can also use the table below to estimate the likely number of empty cows you will have to manage for a given length of mating.

Since 2014, the typical herd's duration of mating has reduced from 12-15 weeks to 10-12 weeks. More herds are now using short gestation length AB sires, for example, in the last two weeks of mating to ensure a clean break between end of calving and MSD.

These not-in-calf rate targets and triggers, updated in 2017, are derived from large Fertility Focus report data sets from LIC MINDA.

Estimating the percentage of cows that will not become pregnant from the start to end of mating.

Total length of mating	Estimated % of cows not-in-calf at the end of mating	
	Common result	The best you could hope for
6 weeks	32%	22%
9 weeks	20%	13%
10 weeks	17%	12%
11 weeks	15%	11%
12 weeks	14%	10%
15 weeks	11%	8%

What's the big deal about getting more cows calved before or during the first 3 weeks of calving?

After calving, the cow's reproductive tract must contract to normal size. Fluids and contamination must be eliminated and she must commence normal heat cycles. Some cows recover from calving quickly and can become pregnant very soon after calving. More typically however, recovery takes longer. For this reason, a cow's reproductive performance is usually low soon after calving, increasing to a peak around 12–15 weeks after calving.

Cows must become pregnant as soon as possible after Mating Start Date. For every week that calving is delayed past PSC date, the cow has one week less before the next Mating Start Date to recover from calving. This is why cows calved in the first 3 weeks of calving have substantially better reproductive performance than cows calved later.

Cows that calve more than 9 weeks after the planned start of calving have less than half the chance of conceiving during the first 6 weeks of mating, and double the chance of remaining non-pregnant at the end of mating, compared with cows calving in the first 3 weeks (see table and graph on page 63).

I'd back the early calver every time! Keep calving compact.

Assessing the herd calving pattern

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

- Consider the percentage of the herd (cows and first calving heifers) calved by weeks 3, 6 and 9 relative to the herd's Planned Start of Calving date. Compare your result with the following table:

	Seek help	Top farmers achieve
		
Calved by week 3	less than 62%	67%
Calved by week 6	less than 84%	88%
Calved by week 9	less than 96%	98%

- Assess the calving pattern of your first calvers depending on their Mating Start Date as yearlings, relative to the herd (Chapter 9, page 51).
- View successive years Fertility Focus reports side by side, to pick up trends in calving pattern percentages. This allows you to observe how the prior season's herd reproductive performance is reflected in the current season's calving pattern.

The InCalf Fertility Focus report calculates the calving pattern of your herd, i.e. the percentage calved by weeks 3, 6 and 9.
It also calculates the calving pattern of your first calving heifers separately.

The InCalf Calving Pattern Tool will enable you to estimate your herd's likely calving pattern for the upcoming calving period, compared to targets, and assess the benefits of closing this gap on herd performance.

Some herd reporting systems such as MINDA report calving pattern results for different age groups such as 3-year-old and mixed age cows.

I have just got my final PD results and want to check my calving pattern for next season.

Once early-aged pregnancy test data is entered electronically it is possible for your herd improvement organisation to predict individual cow's calving dates, and the calving pattern for these cows. Expected calving reports are available in either Due Date Order or Cow Number Order, and expected calving pattern may be available in graphical format.

Remember some cows are still to be removed as culls. First calving heifers mating dates may or may not be known or entered into the database.

Individual cow's due calving date may now include her gestation length breeding value. This is evident on reports when a cow's due calving date is before the herd "Planned Start of Calving date". This cow may have a gestation length less than the standard 282 days (Chapter 8, page 43).

Use The InCalf Calving Pattern tool to estimate next seasons calving pattern more accurately and compare it with calving pattern targets (above) as per Fertility Focus report.

Improving the herd calving pattern

Once pregnancy test results are in, the immediate options to improve next season's calving pattern are limited to selling late calvers and buying in early calvers.

- Consider culling later-calving cows. Late-calving cows must be above-average Production Worth to compensate for later calving.
- When buying animals, check the vendor's biosecurity measures in place, and that the cows will calve no later than week 6 and preferably by week 3 of your herd's calving pattern.

The feasibility of these depend on the difference in value between buying early and selling late calvers , which will vary from year to year. Unfortunately, that strategy will become a recurring expense if the following longer-term options are not addressed.

- Check you have a high percentage of first calvers due to calve before or during the first 3 weeks of calving. If not, consider starting mating the heifers earlier so they calve 1-2 weeks ahead of the herd.
- Monitor the growth of your next batch of calves and heifers to ensure they meet target liveweights.
- Check bull management and/or AB mating management of the heifers.
- Maximise the herd 3-week submission rate and conception rate to help achieve a high 6-week in-calf rate.
- Explore for your situation the use of sires with proven short gestation length.
- Consider targeted intervention for selected late calvers such as once-a-day milking, non-cycling treatment.
- Re-evaluate your herd's Planned Start of Calving date in consultation with your advisers (see below).

Some farms with poor reproductive performance may consider a shift from seasonal to split calving as a potential solution. Split calving is a major farm systems decision whose success depends on good reproductive performance. Seek external advice (Chapter 2, page 14).

We think we need a strategic review of our whole farm system

Many herds use the tactical options above yet calving pattern remains short of the targets and herd reproduction is poor. This situation may warrant adviser input into a 'whole farm assessment' to get to the root cause of issues and break the cycle of poor calving patterns.

- **Farm system adjustments may include delaying the herd Mating Start Date (MSD) while retaining the same mating end date. This will improve calving pattern relative to MSD and shorten the duration of mating towards e.g. 10 or 11 weeks.**
- **Delaying herd MSD might seem counter-intuitive, but a few days lost at the start of calving can soon be made up as a result of improving overall in-calf rate and calving pattern next season.**

Go to www.dairynz.co.nz/farm/business/whole-farm-assessment/ and search 'whole farm assessment'.

Good reproduction at low cost

This might seem impossible but it is achievable.

Improving performance in many areas of the reproduction 'cake' often just involves some additional time investment and extra attention to detail. These are low-cost initiatives that return enhanced reproductive performance.

Top farmers seem to achieve repeated good reproductive performance, sustaining good calving patterns and allowing culling for reasons other than infertility. This also leads to faster genetic gain.

Conversely when reproductive performance is below average for 6-week in-calf rate, the not-in-calf rate is excessive and lost days in milk are costly.

These effects result from performance issues in multiple key management areas and the issues are often difficult to resolve.

Every herd is unique, demanding a tailored solution based on analysis and planning. InCalf trained adviser support is the key to progress.

Capturing opportunities demands herd reproduction becomes the number one priority. This will involve a shift in management from reactive, to proactive, with more attention to detail.

Often, management changes are the result of better observation and timing of key actions, such as body condition scoring and drying off.

By following the 4-step continuous improvement process (page 19), through all four phases of the herd fertility cycle (page 6), you can gain greater control over your herd's reproductive performance.

11

Body condition and nutrition

Body condition (BCS) and nutrition

Optimum BCS is described as the point from which most of the milk production and reproduction benefits are achieved, BCS loss post-calving is acceptable, and the risk of metabolic diseases (milk fever and ketosis) is minimised. (DairyNZ Technical Series Issue 29)

Effective management of body condition and nutrition over the whole season improves herd reproductive performance, cow health and milksolids production.

Pasture fed spring calving cows face a profile of condition score change over the season in the shape of the letter W. After cows calve they lose condition in early lactation and gain condition after mating. They can, in dry summer conditions, then lose condition again in mid to late lactation, and only regain condition once dried-off (see graph below).

Most New Zealand herds have some cows that are too thin at calving. They may also have some cows that are too fat at calving and lose too much body condition in early lactation. Both are problems that reduce reproductive performance.

Cows calving in body condition score (BCS) 5.0 for mature cows, and 5.5 for first and second calvers, have substantially better reproductive performance than cows in lower body condition.

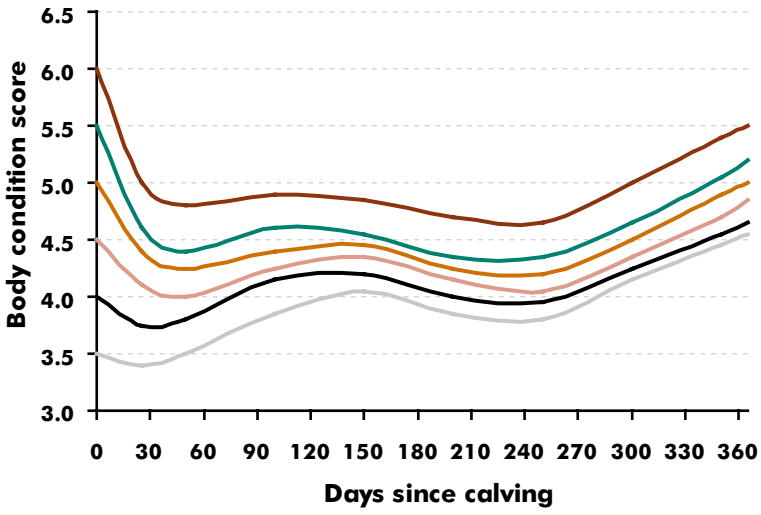
Losses of one body condition score can be expected in early lactation, and cows calving at (BCS) 5.0 and 5.5 targets will likely be condition score 4.0–4.5 at Mating Start Date.

Cows that calve in low condition score (4.0-4.5) may lose less condition but end up at condition score less than 4.0 at mating. They produce less milksolids, take longer to start cycling and their reproductive performance suffers.

Excessive losses of condition score (1.5 scores or more) can occur when cows calve in body condition score above 5.5, reducing their reproductive performance. First calvers are at risk of losing more than one condition score, but as long as they calved early, and are gaining condition prior to Mating Start Date (MSD), they have every chance of getting back in calf early.

Pattern of condition score change for cows calving at different condition scores on research farms in Waikato.

Cows calving in BCS 5.0-5.5 tend to return to the same body condition score for next calving. An exception are first calvers (See graph on page 78).



Managing body condition score is all about managing your herd's nutrition and lactation programme. Condition scoring at critical times throughout the year lets you know if you need to consider changing herd nutrition or shortening lactation of some cows.

It's common to find a lot of variation in the condition score of cows at calving within the herd. Second calvers and early calving cows tend to calve in poorer condition than the rest of the herd whereas late calving mature cows may calve too fat. These groups need extra attention during mid to late lactation and in the dry period if they are to achieve target condition score at calving.

Switching to once-a-day milking in mid-late lactation can reduce condition score loss if done early enough, and if feeding level is maintained.

Cows, especially first calvers, milked once-a-day from calving, may achieve higher submission rates and in-calf rates with fewer non-cycling treatments, than if milked twice-a-day.

Detecting small changes in condition score over a short period is difficult, especially during the weeks leading up to the start of mating. Liveweight monitoring would be a more sensitive measure and you'd be looking to see average cow liveweights gaining from 3 weeks before MSD.

For more information on once-a-day milking options and their effects on body condition score go to dairynz.co.nz/oad.

Body condition score is now included in the Breeding Worth, representing the improved profitability of animals that are able to maintain body condition over their lactation.

It's frustrating to see those cows lose condition in early lactation.

Cows naturally lose body condition during early lactation because their daily appetites take several weeks longer to peak than their daily milksolids yields. Until a cow's daily intake of energy from the feed eaten exceeds the amount of energy she needs each day for milksolids production, walking and regular body function, she will 'milk the fat from her back'.

Cows will stop losing body condition at about 6 weeks after calving (8 weeks for first calvers and cows older than 6 years), but only if good energy intakes are being maintained. This point is called the post-calving body condition 'nadir'. The sooner the cow passes this point and starts gaining weight, the better her chance of having heats before Mating Start Date (MSD), and getting pregnant early.

Cows, especially first calvers, may lose excessive condition and prolong their period of negative energy balance if their energy intake is reduced further below daily needs. Reduced energy intake can be the result of cows being offered insufficient feed or feed of less than ideal quality. Other reasons may be cows fed poorly balanced diets, inefficient feeding systems that don't provide adequate access for all cows, or diseases that affect individual cows.

Cows with a condition score of 4.0 or better at MSD get back in-calf more quickly and are less likely to be empty than those that are less than 4.0 when mating starts. Herds and cows that achieve high milksolid yields without excessive body condition loss in early lactation and achieve condition scores of 4.0 or better at MSD have good reproductive performance.

The key is to keep cows eating as much high-quality pasture as their appetites allow, while maintaining consistent even grazing residuals to ensure pasture quality is maintained for the next grazing.

Minimising condition loss improves fertility.

Herd managers need to regularly track against budget all aspects of feed and nutritional management. This allows you to anticipate and detect problems early and take action to avoid excessive loss of condition and reduced reproductive performance.

When considering changes to nutritional management, you need to think about the whole farm system:

- What are the likely benefits now and further on?
- Will these benefits outweigh the costs involved?
- Will there be added costs in terms of time or extra labour?
- Will this change affect other parts of the farm?

Keep in mind that a diet is the total feed actually consumed by cows – it includes both grazed pasture and supplements, including by-products. Forage supplements are conserved silages and hays, and grazed fodder crops. Concentrates are supplements such as cereal grains or pellets that have a high energy and/or protein density often fed in the dairy.

Diet balance refers to the relative proportions of energy, protein, effective fibre, vitamins and minerals in the diet. Pasture generally provides a balanced feed source. A profitable response to supplementation occurs only if there is a pasture deficit.

For more go to dairynz.co.nz/feed and search for FeedRight.

The farm manager has to work out the herd's feed requirement – how much pasture, and how much supplement may need to be fed to achieve BCS and pasture cover targets.

Go to DairyNZ 'Facts and Figures' booklet or seek adviser help.

Assessing herd body condition

What is body condition scoring?

Body condition scoring is the assessment of the amount of fat covering the bones of a dairy cow, regardless of her body size. It involves assessing the amount of fat covering specific locations on the cow, such as around the head of the tail and over the backbone, to determine how thin or fat the animal is.

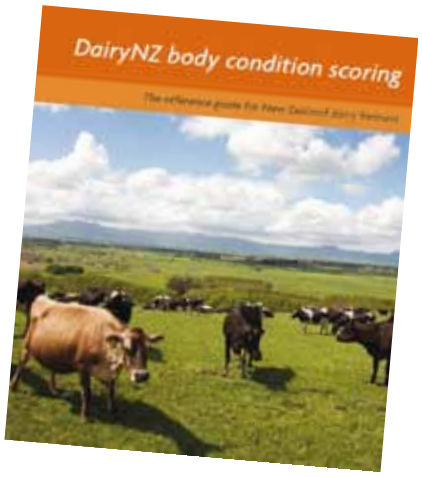
Condition scoring is a simple process. It involves using the 'hands on' method at the dairy to calibrate your eye for visual assessment of condition score.

InCalf body condition recommendations for New Zealand use a condition scoring system which rates cows on a scale from 1 to 10 – 1 is extremely thin and 10 is extremely fat. The critical points on the cow to assess and the procedure for condition scoring using a 1 to 10 system are fully described in the DairyNZ body condition scoring guides.

By scoring a representative sample (e.g. 70 cows) of the whole herd or particular groups of cows, you can calculate the percentage that are either too thin or too fat, and this can be used as a tool to assess herd nutritional management and drying off policies.

InCalf recommends routinely scoring the whole herd at four key times of the season.

Go to dairynz.co.nz/bcs to watch the "how to body condition score" videos. Look for Certified BCS assessors also listed there who can accurately score your herd.



The BCS reference guide (above)

The BCS field guide (below)

Isn't the connection between body condition scores and getting cows in calf a bit of a stretch?

The link between body condition scores and herd reproductive performance is much stronger than most think. Cows that calve too thin (less than score 5.0 for mature cows, and less than 5.5 for young cows [first and second calvers]) generally take longer to start cycling after calving. This can reduce submission rates and conception rates, and consequently reduce 6-week in-calf rates and increase not-in-calf rates. Conception rates are usually about 7–8% higher for cows inseminated at their second heat after calving, rather than their first. Cows that calve too thin are more likely to be inseminated at their first heat, resulting in lower conception rates.

Cows that lose excessive condition in early lactation also have reduced reproductive performance. First and second calvers are especially vulnerable. These cows take longer to start cycling after calving, reducing submission and conception rates. Poor expression of heat signs can also occur in some situations.

If you have more than 15% of your cows tracking to be at calving below targets 5.0 for mature cows, and 5.5 for first and second calvers – take action. If you have more than 15% of mature cows above 5.0 at calving you may need to take action too.

Body condition targets

Body condition targets are based on the 1 to 10 scale, as described by 'Condition Scoring Made Easy'.

Cows calving at less than body condition score 5.0 for mature cows, and 5.5 for first and second calvers, have 6-week in-calf rates lower than if they had calved in the optimal condition score.

Cows that lose 1.5 or more body condition scores between calving and mating can be expected to have reduced reproductive performance compared to cows with more moderate losses.

To maximise herd reproductive performance, every farm must have a strategy in place to effectively assess body condition score. You may want to implement your own system of regular condition scoring, using the procedure suggested in *Body Condition Scoring Made Easy*. Alternatively, get a Certified BCS Assessor who is condition scoring cows on a regular basis to perform this task. Make sure your adviser calibrates themselves regularly against 'Body Condition Scoring Made Easy', and the on-line calibration system at dairynz.co.nz.

Once you have a system in place to measure body condition, then feed budgets, milking frequency and drying-off plans can be developed to achieve body condition targets while milksolids production targets are also met.

A sound BCS programme allows you to meet the following herd targets:

- not more than 15% of mature cows are below body condition score 5.0 at calving and not more than 15% of mature cows are above body condition score 5.0 at calving;
- not more than 15% of first and second calvers are below body condition score 5.5 at calving and not more than 15% of first and second calvers are above body condition score 5.5 at calving;
- the average decrease in body condition score for the herd between calving and mating is not more than 1.0;
- not more than 15% of cows are below body condition score 4.0 at mating; and
- cows maintain or gain body condition from the commencement of mating.

Easily record and track cow body condition score with e.g. the DairyNZ 'BCS Tracker' app. It allows you to record cows in the field on your smartphone and have ready access to the results. It also takes the hassle out of recording BCS data on paper and then transferring it to a computer. It can now all be done electronically.

The risk to reproduction of the whole herd depends on the percentage of young cows and mature cows in the herd that are below and above their respective target BCS at calving. Tracking BCS against targets requires an assessment of the range of BCS, as well as the average BCS.

When to body condition score

Regular condition scoring will allow you to monitor nutritional trends and provide sufficient warning to take action even 6 months before poor condition reduces reproductive performance.

Monthly checks using the scoring sheet in *Body Condition Scoring Made Easy* or the BCS tracker app, are recommended in late lactation and dry period. Record and monitor your first and second calvers' profile separately from the mature cows.

If you wish to condition score at the most important times, they are:

- after the end of mating, before dry summer/autumn conditions reduce pasture quantity and quality;
- in late lactation (90-150 days or 3-5 months) before Planned Start of Calving date;
- just before Planned Start of Calving date;
  - at this time, calculate the average condition score for at least 70 cows per mob selected at random, the percentage below and above 5.0 for mature cows, and the percentage below and above 5.5 for first and second calvers.
- two weeks before Mating Start Date;
  - at this time, calculate the average condition score for at least 70 cows selected at random, and the percentage below 4.0.

Also calculate the difference in condition score from calving to 2 weeks before the start of mating.

Certified BCS Assessors using the 'BCS tracker' app, make it feasible to score and track individual cows regularly with the precision needed to achieve BCS targets at calving.

With enough data the body condition loss between calving and mating can be estimated for the first calvers, second calvers and mature cows separately. These age groups may differ in the amount of BCS loss.

How do I know what cows to body condition score? What's a representative sample?

If you cannot score all cows individually, randomly score at least 70 cows in each mob or herd using the system described by *Body Condition Scoring Made Easy*. That means, if there are three mobs of animals, you need to score at least 70 cows in each mob, a total of at least 210 cows.

Ideally, record the scores of mature cows separately from young cows (first and second calvers) because young cows will need to be managed differently to reach their higher target of 5.5.

If scoring cows in the dairy, arrange to see the cows from a position above and to the rear of the cow. In a rotary you can stand on a raised platform that is close to the cows. In a herringbone, step up to view selected cows. Once marked and drafted, a secondary assessment can be made in the holding pen to confirm BCS decisions.

If you wish to score cows in the paddock, take care to select cows at random and position yourself close to the cows. Score 70 cows from the right-hand side and the rear of the cow to minimise the effect of rumen fill. Keep referring to the photos in *Body Condition Scoring Made Easy* as your reference point. It may be better to get someone in who is certified and properly calibrated to do the job regularly.

It is hard to body condition score your own cows that you see every day.

Interpreting condition scores

The InCalf body condition tools provide alternative ways to interpret results and estimate the likely impacts on herd reproductive performance. These are the Body Condition at Calving Tool, and the Body Condition Loss in Early Lactation Tool, found at dairynz.co.nz/incalf.

Individual cow BCS scoring is very important in late lactation, when drying off decisions are made, increasing the chance of achieving the calving targets for all cows.

Interpret body condition score results carefully, and use them to make decisions that improve the herd's reproductive performance.

These decisions are about achieving condition score targets for calving (5.0 for mature cows and 5.5 for first and second calvers) and mating (at least 4.0) through changing both feed supply and feed demand.

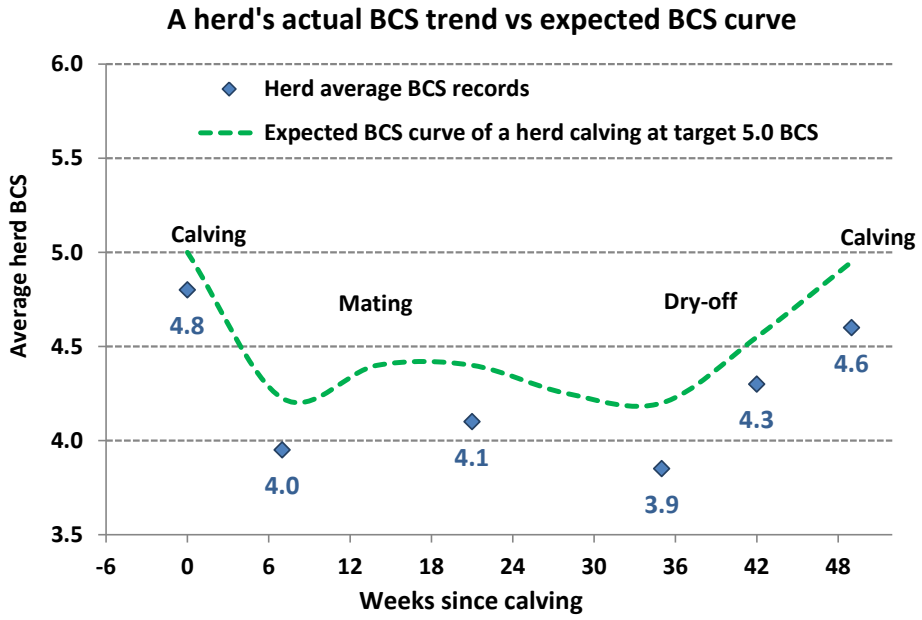
There are decision rules to help, but you may still need professional advice to refine these rules for your own herd and farm system.

The purpose of calculating (and graphing, as below) your herd's average condition score is to ensure herd average condition score is following a critical path towards achieving the targets.

The range of condition score within your herd is also used to assess what percentage of the herd you need to do something about. For example what percentage of cows should get preferential feeding, or how many cows should you dry off this week?

Decisions vary through the season and relate to the four most important times to condition score the herd. These times may relate to the peaks and troughs on the W-shaped BCS curve as below.

Farming situations differ and expected BCS curves do not always follow the W-shaped curve, e.g. under irrigation. So you need to customise your own BCS tracking programme.



This example herd has a whole season average BCS well below the optimum (calving at 5.0 and 5.5). It will take more than drying off to change this situation. A strategic overview of the whole farm system may be warranted to address total feed supply and demand, including stocking rate, calving date and how supplements are being used on the farm.

Body condition score results	What to consider immediately	What to consider to prevent it happening again
In late lactation, 90-150 days (3-5 months) before Planned Start of Calving date		
Drying off trigger levels reached for individual cows and rising 3-year cows.	Apply drying off decision rules using cow's BCS score, age and expected calving dates. If possible, increase feed inputs in late lactation. Feed to increase condition during the dry period.	Examine the costs and benefits of increasing feed inputs during late lactation. Determine if reducing stocking rate is appropriate. If most cows in low body condition are first calvers, then review management of heifers.
More than 15% of mature cows have a body condition score above 5.0.	Feed to only maintain condition during the dry period. More closely monitor BCS in late-lactation – avoid cows reaching 5.5–6.0 BCS.	Seek help from an adviser to: check diet balance; and determine if cows are being overfed in late lactation.
Before Planned Start of Calving date		
More than 15% of cows have a body condition score below target (5.0 for mature cows, and 5.5 for first and second calvers).	Apply transition feeding rules of 100% of feed requirement to cows below their BCS target, from one month before their due calving dates.	Review drying off policy. Increase body condition in late lactation. Increase condition during dry period. See above for strategies described for cows in low condition at drying off.
More than 15% of cows have a body condition score above 5.0 for mature cows.	Apply transition feeding rules of 85-90% of feed requirement to over fat mature cows from one month before their due calving dates.	Monitor BCS in late-lactation more closely –avoid cows reaching BCS 5.5–6.0. Carryover cows are at a high risk for being too fat at calving.
2 weeks before Mating Start Date		
More than 15% of cows are below 4.0 condition score, or the herd average condition score dropped by more than 1.0 during early lactation.	Examine the costs and benefits of increasing feed supply to prevent any further losses in body condition.	Consider strategies to minimise body condition loss in early lactation. Manage springer cow's feeding depending if they are on or below BCS calving target.
After the end of mating, and before dry summer/autumn conditions reduce pasture quantity and quality		
More than 15% of the herd is still less than 4.0, e.g. at first pregnancy test.	Plan to protect condition score loss in mid-late lactation. Quantify feed supply available. Identify and remove culls early. Consider once-a-day milking for mid-late lactation. Anticipate early drying-off of first calvers.	Plan with your adviser to review the overall farm system, comparative stocking rate and calving date. Review pasture and supplementary feed management

There are three effective strategies for BCS gain prior to the next calving:

1. Changing from twice-a-day to once-a-day milking.
2. Providing supplementary feeds to milking cows and dry cows.
3. Drying off cows early.

An effective strategy to achieve calving BCS generally involves a mix of all three.

How to achieve body condition targets

Body condition score targets are achieved by manipulating the quantity and type of feed provided to the herd, frequency of milking (once vs. twice-a-day), and the length of lactation. In all cases, the costs and benefits of changing these will need to be carefully analysed. Seek help from an adviser if you are unsure of the benefits of changing or modifying your herd's feeding, milking frequency and/or drying-off programme.

Learn how Greg and Rachel Roadley use body condition scoring in their farm system from as early as February, for a herd calving early August. Visit dairynz.co.nz/bcs-strategies (video).

1. *Put condition on cows in late lactation*

It can be difficult to put condition on spring-calving cows in late lactation. Extra pasture eaten tends to increase milksolids production rather than condition score. Also, you may need to be increasing average pasture cover for winter feed at this time.

The 'transition process' for the herd in a pasture-based system starts some 6 months before the cows next calving, not just in the last few weeks. (DairyNZ Technical Series Issue 29)

The options to consider include:

A. Changing cows from twice-a-day to once-a-day milking

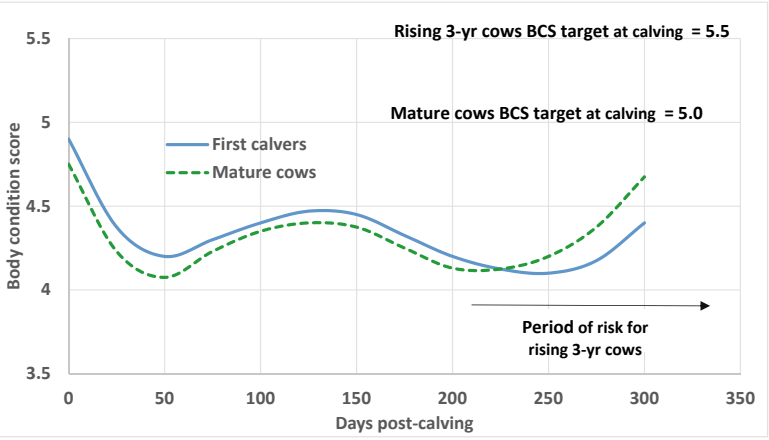
Cows milked once-a-day in late lactation gain about 0.25 BCS units more in three months than cows milked twice-a-day over the same period. This can be part of an effective strategy to keep cows milking and gain BCS if once-a-day milking starts early in January or February.

However, cows must be offered the same amount of feed as if milked twice-a-day.

Changing from twice-a-day to once-a-day milking at a later stage of lactation (March) is only an option if cows are BCS 4.0 or greater, as the amount of BCS that will be gained before dry-off is very small.

First calvers typically calve in better condition than mature cows, but take longer to gain the same amount of condition at the end of the season. They need to be dried off earlier than mature cows and need preferential feeding to reach their 5.5 BCS target , which is half a score higher than the mature cow target.

BCS trends of first calvers and mature cows in late lactation



B. Feeding supplement to milking cows and dry cows

When fed supplements, and while pasture is not being wasted (grazing residuals no higher than 7-8 clicks on the plate meter), cows will produce more milk. Most of the extra energy consumed goes into milk production and little goes into body condition.

This means providing supplements to milking cows is not an effective strategy for gaining BCS. It can, however, prevent BCS loss when grazing residuals are low (less than 7-8 clicks on the plate meter).

Whereas supplements fed to dry cows will increase BCS (see table below), but different feed types have different effects on the amount of BCS cows gain per 100 kg DM of supplement fed.

C. Drying off cows early

Dry cows need time to gain BCS as well as more energy. A maximum gain of 0.5 BCS units/month for dry cows is a good rule of thumb for planning, taking account of no BCS gain in the final month of pregnancy.

The table below provides guidelines or 'decision rules' for action, to assist individual cow drying off decisions.

Drying off thin mature cows (BCS 3.5) at least 100 days before the planned start of calving is required for them to have time to achieve BCS target 5.0, if grazing Autumn pasture with high-quality supplements.

Drying off thin first calvers (BCS 4.0) at least 130 days before the planned start of calving is required for them to have time to achieve BCS target 5.5 if grazing Autumn pasture with no supplement.

- Identify first calvers and cows with body condition scores less than 5.0, less than 4.5, and less than 4.0. You will need to body condition score the whole herd for this.
- Dry off individual cows at the number of days before calving, depending on their age, expected calving date and condition score using the table below.

Drying-off time based on BCS and time to calving to achieve the target BCS, based on cow age and BCS at dry off, when fed pasture only or pasture plus high-quality supplement.

Body condition score		Days cows need to be dry before calving	
Mature cows	**First calvers (Rising 3-yr)**	**Autumn pasture (days)**	**Autumn pasture and high quality supplements (days)**
3	3.5	160	120
3.5	4	130	100
4	4.5	100	80
4.5	5	70	60
5.0	5.5	30	30

Note: Includes 10 days when cows are being dried off and not gaining BCS and 30 days when cows do not gain BCS before calving. For this strategy to work, dry cows must be allocated a minimum of 9-11 kg DM/day depending on breed.

Drying off may occur progressively using condition score 'triggers' shown in the table below. These drying off 'decision rules' provide you enough time to rebuild condition on cows before next calving. See *Body Condition Scoring Reference Guide* for how long it takes cows to regain condition, for feeds of different quality and intake allowances.

> I never realised how long it takes for cows, especially first calving heifers, to turn around and start gaining BCS once dried off.

2. Ensure mature cows achieve condition score 5.0, and first and second calvers 5.5 at calving

Cows need to be maintaining or gaining body condition during the dry period to ensure they calve in the optimum condition for high reproductive performance. However, many pastures and supplementary feeds provided to dry cows are of lower nutritional quality, providing inadequate total daily intakes of energy and protein, even if available in large amounts.

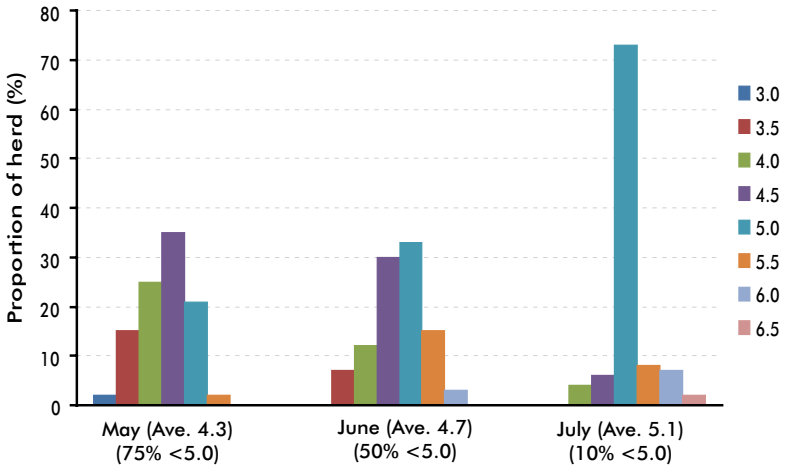
- Test supplementary feeds for nutritional value (especially hay and silage) to ensure they are suitable for feeding to dry cows.
- Ensure that all cows in the group have equal access to supplements. Make sure you allow for the likely wastage of feeds based on the feeding method and the on-farm conditions at the time.
- Separate thin cows at drying off by age, expected calving date and body condition score, and feed them preferentially to achieve their respective condition targets. Redraft them periodically on required condition score gain, the amount of time remaining and feed available.
- Manage mature cows, especially late calvers, so that they do not calve in body condition score 5.5 and above.

Monitor and record the condition score of your herd throughout the dry period. After drying-off using 'decision rules' there may still be a large range of condition scores within the herd that demands separate mobs, and preferential feeding to close the condition score gap for different groups.

Crops such as fodder beet and kale can be a major source of dairy feed during the dry period. For information on these feeds and their management go to dairynz.co.nz/feed/crops/.
For more about supplement types, their feed value, wastage and responses, go to dairynz.co.nz/feed/supplements.

Example of young cow at BCS 5.5

By calving you need to lift the mature cows average condition score at calving to 5.0, and also tighten up the variation within the herd, as shown in the chart below. For this example herd that starts calving on 30 July, average condition score in May was 4.3, with 75% of cows below condition score 5.0. In June the average condition score had lifted to 4.7, but there were still 50% of cows below calving target 5.0. By July the herd was on target with average condition score 5.1, with only 10% below 5.0 and 17% above 5.0.



An example of how preferential feeding in the dry period can ensure that the majority of cows in a herd can achieve calving condition targets.

Example of mature cow at BCS 5.0

For more details on transition management go to DairyNZ Technical Series Issue 26. Also refer to DairyNZ FeedRight TechNotes 11-15.

Prevention of milk fever is better than cure.

If using fodder beet, seek advice on extra mineral supplementation (especially phosphorus), and about transition onto beet and back onto pasture.

3. Prepare cows for lactation from one month before due calving dates

Around calving, the cow undergoes a dramatic transition from dry and heavily pregnant to fully lactating. This is a very stressful period for the cow and she is vulnerable to many problems and disorders that can affect her health and productivity.

Feeding during the last weeks before due calving date provides an opportunity to prepare the cow for the coming lactation. Differential feeding of mature cows on or above BCS target 5.0, separate from those mature cows below target 5.0, can reduce diseases and disorders around calving and reduce the potential for condition score loss following calving.

The principles of feeding springers at this time include:

- Cows should not be fed more than requirements in the two weeks before due calving date, irrespective of their pre-calving BCS.
- Assess the herd twice weekly from one month pre-calving and draft out cows based on due calving date, rather than on signs of springing.
- Differential feeding described above requires these due-to-calve mature cows to be body condition scored and redrafted into those below target 5.0 and those 5.0 and above, and then to consume either 100% or 85-90% of their requirement respectively.
- Supplement cows daily with magnesium (Mg) so that they receive at least 20g mg/cow/day (40g magnesium oxide/cow/day).
- Do not supplement cows with calcium (Ca) until she has calved. Then, during the colostrum period, provide the colostrum cows with 100 grams limeflour/cow/day, and for cows at increased risk of milk fever, 300 grams limeflour/cow/day.
- Avoid grazing effluent paddocks in the month pre-calving (too high in potassium). Pastures can be naturally high in potassium but this potential problem can be reduced by magnesium supplementation before and after calving, and by calcium supplementation after calving in colostrum cows.
- If a cow is to be fed more than 3–4 kg/day of e.g. maize silage or concentrate supplement after calving, it will be necessary to adapt her rumen to this feed type to reduce the risk of rumen upsets. Feed 2–3 kg/cow/day of this feed in the last 2-3 weeks before due calving date.

4. Minimise body condition loss in early lactation

Body condition score loss in early lactation is normal, driven by the cows' genetic makeup. Cows most likely to lose excessive condition in early lactation are those that calve above body condition score 5.5.

For the first 6 weeks after calving the cows' genetics and body condition at calving determine the rate of body condition loss. Extra feed eaten during this period is simply converted into more milksolids. After 6 weeks, however, the cow's metabolism will have altered and her appetite increased so that a positive energy balance will start to replenish body reserves and condition score. The aim is to ensure that happens before the mating period begins.

Many NZ herds are below BCS targets at calving, and at mating, but BCS loss between calving and mating is not necessarily greater than1.0 BCS. Typically, condition score loss in early lactation in these herds is 0.5-0.75 BCS scores.

Principles of pasture-based feeding at this time include:

- Feed the highest quality pasture to your cows after calving and throughout their early lactation. Make sure cows have access to as much pasture as your spring rotation planner will allow, while maintaining consistent even grazing residuals to recommended levels (i.e. 7-8 clicks on a rising plate meter).
- Allow your cows to increase their energy intake naturally by increasing the pasture allocated according to the spring rotation planner, but without you allowing their grazing residuals to lift above recommended levels.
- Walk the farm weekly to assess changing pasture cover and shape of the feed wedge, in anticipation of early surpluses or deficits. Respond to pasture deficits proactively with the addition of supplements, nitrogen and/or alteration to rotation length.
- If supplements are used after the first 6 weeks in milk, balance nutrient intakes from pastures with supplements as required to ensure daily energy and protein intakes are sufficient to prevent excessive loss of condition as cows approach peak lactation. Work with an adviser to ensure the diet is balanced for energy, protein, effective fibre, vitamins and minerals.
- When you must make changes to the diet of early lactation cows, make them gradually. Increase or reduce concentrate supplements in half-kilogram steps over several days. Work with your vet to recognise early signs of ruminal acidosis in early lactation.
- Monitor cow health in the herd as any issues will increase BCS loss in affected cows (Chapter 12).

There are lots of feed and nutrition tools and resources available for pasture-based dairy systems at dairynz.co.nz/feed.

You can only manage what you measure. Regular pasture assessment such as a farm walk is important for cow nutrition and pasture utilisation.

Make sure the farm system feed supply and demand is in balance and that your cows are well fed

Dairy cow nutrition is about understanding the nutrient and energy requirements of dairy cows at different stages of lactation and combining various feed options to meet those needs in a cost-effective manner. Cows require a diet that supplies sufficient energy, protein, effective fibre, vitamins and minerals in the correct balance.

At the farm system level this means deciding how feed supply and demand will be matched, and making appropriate adjustments to ensure herd BCS targets and nutrition and energy requirements are met.

In a pasture-based system the balance of nutrients becomes more important once the level of non pasture-based supplement fed reaches one third of the total diet. In that situation, when problems arise, seek help from an adviser to review the provision and balance of these dietary components.

For more information (including macro minerals such as magnesium and calcium), go to FeedRight at dairynz.co.nz.

Trace elements

Trace elements are an important part of dairy cow nutrition. Inadequate intake of any of the essential trace elements can result in decreased reproductive performance. Important trace elements in pasture systems are cobalt (Co), copper (Cu), iodine (I), selenium (Se) and zinc (Zn).

Deficiencies can be primary or secondary. Primary deficiencies arise because of insufficient levels of the particular trace element in the diet. Secondary deficiencies arise when the pasture contains something else that reduces the uptake of the trace element (e.g. pasture with high molybdenum reduces the adsorption of copper).

Trace element monitoring in dairy animals is not that complicated and there are supplementation options available.

Discuss with your vet:

- what trace elements are likely to be limiting for your region;
- whether or not some blood tests or liver biopsies would be worthwhile; and
- what your trace element supplementation strategy should be for your herd.

Pasture management and dairy cow nutrition

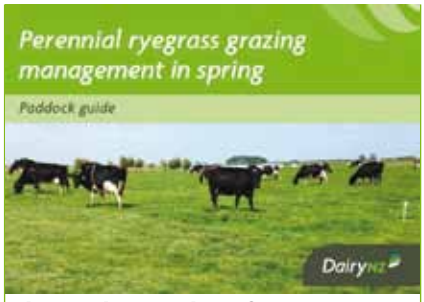
Pasture-based dairy farming is a balance between managing the pasture and the cows to maximise sustainable profit.

Grazed pasture drives farm profit irrespective of the milk solids payout, and grazed pasture underpins body condition and nutrition requirements of dairy animals.

Pasture management skills, as well as animal husbandry skills, are critical to herd reproductive performance in pasture-based dairy farm systems.

A "Pasture first" approach to dairy cow nutrition is appropriate and necessary for improved reproductive performance.

In turn, improved reproductive performance contributes to the efficient and profitable utilisation of pasture, through better matching the herd calving pattern with the onset of spring pasture growth.



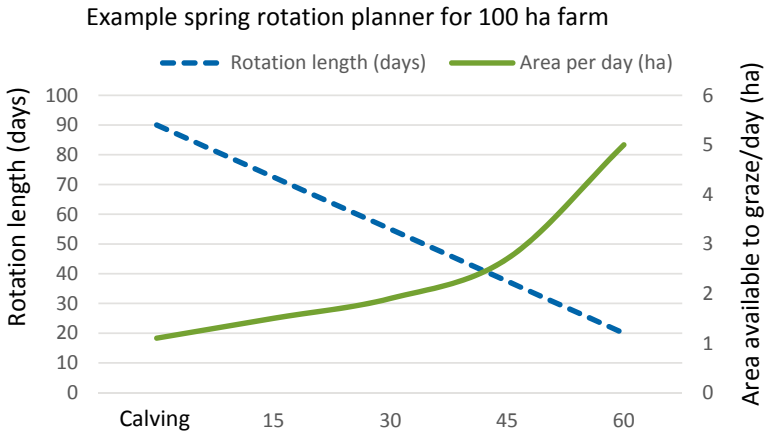
This guide provides information to enable you to answer key grazing management questions.

The 8 habits of a successful pasture manager

1. Residual targets are consistently met.
2. Pre-graze targets are a priority.
3. Weekly farm walks inform decision making.
4. Average pasture cover is measured and calculated weekly.
5. Pasture is considered a complete feed source.
6. Data is used to drive decisions.
7. Surplus is identified early (using the feed wedge).
8. Pasture biology is top of mind.

The spring rotation planner

For spring rotation planner and tools go to dairynz.co.nz/feed



The spring rotation planner dictates how much area should be allocated each day from calving to balance date. The farmer must ration this area between dry and lactating cows. The area allocated increases with time, matching the increasing number of cows calved and the increasing dry matter intake of the cows. (Technical Series Issue 30 June 2016).

Grazing management principles

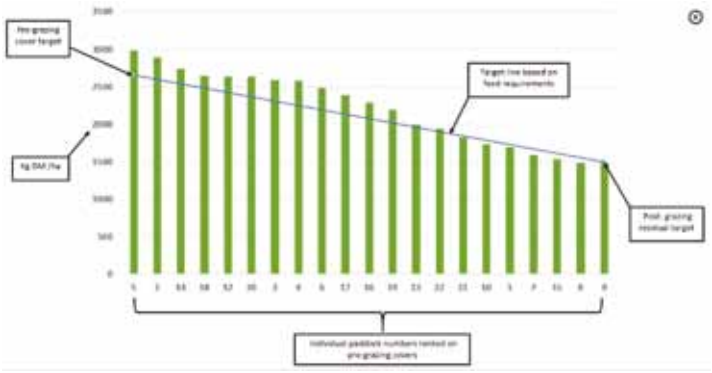
Today's grazing management must optimise tomorrow's pasture production and quality, while maximising cow performance in both herd reproduction and milksolids production.

Grazing intensity and pasture cover affects subsequent pasture quality and pasture production. Pasture intake is affected by the quantity and quality of pasture offered each day.

- Control the area grazed each day (or rotation length) to make sure pasture eaten meets average pasture cover targets for the farm.
- Allocate pasture to the herd based on the target grazing residual. Adjust this allocation after observing when or if the cows achieve a 'consistent, even, grazing height'.
- Make management decisions to maximise production per cow for the season not at any one grazing. Apply the 'main course – no dessert' principle.
- Treat pasture as a crop – remove pasture grown since last grazing and prevent post-grazing height increasing over the season.
- Have pasture cover distributed between paddocks in a feed wedge to ensure that high quality pasture is offered on all paddocks.
- Keep average pasture cover above 1,800kg DM/ha in early spring and between 2,000 and 2,400kg DM/ha for the season to maximise pasture growth rates.
- Over the season, the height of post-grazing residuals (cover) does not change but the dry matter mass does increase. This is the value of using 'clicks' on the Rising Plate Meter (RPM) or one formula for the RPM for the season.

Go to dairynz.co.nz and search for Pasture Road Map and other pasture management tools.

If supplements are part of the system, the feed wedge and target line provides a template to determine when and how much supplement should be fed in the weeks ahead, without pasture substitution or supplement wastage.



A feed wedge is a chart of each paddock's pasture cover (kg DM/ha) sorted from longest to shortest.

Other nutritional indicators

Body condition scoring your cows to detect short-term underfeeding has limitations as small changes over a short period are difficult to detect. Other indicators can alert you to nutritional problems occurring in your herd.

Learn to be observant of any change from normal, especially before and during the mating period. You can then take early action to get things back on track before excessive loss of condition affects reproductive performance.

Nutritional indicators fall into three types:

1. Feed inputs being offered to the herd.
2. Milksolids outputs and milk composition.
3. Cow behaviour and on-farm physical observations.

The first is the best indicator as it detects a problem early and can be easily corrected.

Keep in mind that a sudden change may be due to a temporary fluctuation in herd nutrition, for example adverse weather. Provided things return to normal quickly, herd reproductive performance will not likely be adversely affected. Be prepared to act when something remains abnormal for several consecutive days or several indicators change at the same time.

Liveweight monitoring would be a more sensitive measure and you'd be looking to see average cow liveweights gaining from 3 weeks before Mating Start Date.

1. Feed inputs being offered to the herd

Plan your herd's Pasture Road Map (Autumn to Spring balance date):

Like managing body condition score, the farm's pasture cover and rotation length can be mapped out over a 6-month period providing a clear path ahead that can be monitored against.

- If average pasture cover is falling off track, best options should be taken to reduce demand or increase supply of feed.

Do weekly pasture assessment:

When pasture assessment is a routine weekly task the manager can use the latest weekly feed wedge and weather forecasts to plan how to manage the week ahead so that target grazing residuals are met and the cows are well fed.

- Weekly pasture assessment provides paddock data to update changes to the feed wedge, average pasture cover, and pasture growth rates.
- The changing shape of the wedge, relative to the target line, indicates emerging feed surpluses and deficits, and the need to take proactive steps.
- During extremely wet spring conditions it is easy to overestimate the amount of dry matter in the pasture, and to underestimate the amount of feed being wasted.

Assess pre-grazing pasture and post-grazing residuals daily

The amount and quality of pasture in each paddock, and the residual pasture after each grazing, are important to both nutrition of the herd and the management of the pasture.

- The post grazing residual of each paddock is the most important daily indicator on pasture-based dairy farms.
- Residuals can be assessed by calibrated 'eye-o-meter', or measured, e.g. with a rising plate meter (0.5 cm clicks).

The spring pre-mating period coincides with the "balance date" when daily pasture growth starts to exceed pasture feed demand.

- Managers need to be alert to daily changes as both feed demand and pasture growth change quickly.
- Seasonal variations mean each year is different, but planning and monitoring key indicators gives lead time to minimise these effects.

Check your cows are eating the supplements you offer

Excessive supplement left in the feed-pad bins or on the paddock might indicate that:

- cows have not had enough time to eat the amount offered;
- the pasture allowance is sufficient and the supplement is simply being wasted; or
- the supplements are unpalatable or of low quality.

2. Milksolids outputs and milk composition

Milksolids yield is usually linked to energy intake. If milksolids yield drops daily by more than 0.07 to 0.1 kg milksolids/cow/day over 2–4 days:

- Be sure to account for differences in number of cows milked into the vat, milking times and milk removed from the vat for feeding calves.
- Check that cows have had sufficient access to drinking water.
- Review your grazing management and daily feed allocation and residuals, especially in adverse weather conditions.
- Consider increasing energy intake by increasing supplementary feeding or pasture allocation, if your grazing rotation allows.
- Pasture quality may have declined as a consequence of lax grazing residuals in previous grazing rotations.
- If milksolids yield does not increase within 5 days of increasing the energy intake, seek help from an adviser to review feeding levels and dietary balance.

The **milk protein percentage** may be related to the energy intake from the diet. If the milk protein percentage falls, it is likely that energy intake has fallen.

Compare the current milk protein percentage in the vat with the same time last year, using a 10-day period average (assuming last year's milk protein percentage was a good result):

If it is more than 0.2% below the same time last year:

- review your grazing management, daily feed allocation and residuals;
- consider increasing daily energy intake by increasing supplementary feeding or pasture allocation if your grazing rotation allows;
- complete the checks described in this section to ensure no other nutritional problems are present; and
- seek help from an adviser if increased milk protein percentage does not follow increased energy intake and other adjustments to the diet within 5 days.

3. Cow behaviour and on-farm observations

Any unusual or abnormal cow behaviours, and observations, are worth getting a second opinion on, especially if it coincides with changes in nutritional indicators 1 (Feed inputs) and 2 (Milk solids outputs).

If cows' rumen function is normal, a proportion of cows should be seen to be lying down and a good proportion of them happily chewing their cud. If not there might be something unusual going on, so seek help.

If manure consistency or smell is abnormal for the diet the cows are eating, seek advice from your vet. If cow urine is red, contact your vet.

The early symptoms of magnesium deficiency (grass staggers) are nervousness, ears pricked, nostrils flaring, eyes alert and head held high. Movement is stiff, like walking on stilts, and cows stagger when forced to move quickly.

12

Cow health

Cow health

Cows that suffer health problems around the time of calving or in early lactation can suffer reduced reproductive performance. Common health problems include giving birth to twins or stillborns, difficult calvings, retained fetal membranes, vaginal discharges, lameness, mastitis and metabolic diseases (like ketosis, milk fever).

Some health problems, such as retained fetal membranes, affect the reproductive tract directly while others, such as lameness, can affect reproductive performance because they reduce feed intake and so result in body condition loss. Lame cows are also less willing to show strong heats.

Cows that abort are frustrating and costly, and pose health risks to other animals and humans.

Keeping an eye on cow health has other benefits:

- Preventing health problems can reduce costs and labour requirements, simplify management and even increase milk production and income.
- Preventing calving problems and lameness improves cow welfare and reassures consumers that animal welfare is being maximised in New Zealand dairy herds.

If your herd has only a small number of cows affected by these health problems, it is unlikely that they are reducing herd reproductive performance. However, if too many cows are affected, you can expect overall herd performance to be substantially reduced. Good record keeping will help identify if too many cows in your herd are being affected.

Assessing cow health

To improve cow health, you need accurate records and a strategic approach to treatment and prevention. The records are used to assess current level of conditions against triggers contained in the tables on pages 94–95.

Keep records for cows with the following health problems:

- Twin calving – any cow having twins.
- Assisted calving – any assistance required to deliver the calf.
- Stillborn calf – calf born dead or died within 24 hours of birth.
- Retained fetal membranes – membranes visible externally 24 hours after calving.
- Vaginal discharge – pus discharge from vulva more than 14 days after calving.
- Endometritis – cows identified as positive with the Metricheck device, whether treated or not.
- Lameness – cow not bearing full weight on at least one leg and walking is affected (lameness score 2 and 3).
- Clinical mastitis, abnormally cycling cows, and other health problems such as ketosis, salmonella and Theileria. (These disorders can affect reproductive performance directly or indirectly). Displaced abomasum and cystic ovaries will also affect reproductive performance but these are uncommon health problems in New Zealand.

Using these records, count the number of cows affected by each type of health problem and express this number as a percentage of cows present at start of calving. Compare this percentage affected with the trigger levels shown in the table to determine if a review of management is required. Some cows may appear in more than one category.

The InCalf Cow Health Tool will help you further assess the level of these cow health problems within your herd and their economic importance. Go to dairynz.co.nz.

A checklist for acting on cow health problems.

Health problem	Prevention	Immediate actions
Twin calving		
	There are no practical strategies to prevent twin calvings.	Check for external signs of retained fetal membranes on the day after calving. • If retained fetal membranes are present, treat as described below. • Seek veterinary assistance promptly if affected cows go off milk, lose condition, stop eating or look sick.
Assisted calving		
Implement prevention strategies if more than trigger level **2–3%** of cows require assistance to calve.	• Carefully select AB sires and bulls. • Ensure calves and heifers reach liveweight targets. • Feed cows and heifers to calve at appropriate body condition score targets. • Check nutrition during the late dry period and calving time and control milk fever in cows close to calving.	• Closely monitor heifers and cows leading up to calving. • Provide appropriate assistance to calve if required. • Seek veterinary assistance promptly if affected cows go off milk, lose condition, stop eating or look sick.
Stillborn calf		
Implement prevention strategies if more than trigger level **4%** of calves are stillborn or die within 24 hours of birth.	Seek professional help. • Look at calving conditions, and when stillbirths occur. • Consider earlier assistance. • Review sire selection.	Check for external signs of retained fetal membranes on the day after calving. If retained fetal membranes are present, treat as described below. Seek veterinary assistance promptly if affected cows go off milk, lose condition, stop eating or look sick.
Retained fetal membranes		
Implement prevention strategies if more than trigger level **2%** of cows have retained membranes 24 hours after calving.	• Minimise assisted calvings (see above). • Prevent access to cypress or pine trees. • Feed cows and heifers to calve at body condition score targets. • Check nutrition during the late dry period and around calving time. Control milk fever in cows close to calving. • Consult your vet on whether selenium and vitamin E nutrition is adequate.	• On the day after calving, cut membranes off below the vulva. • Do not pull on or manually remove membranes. • Seek veterinary advice promptly if affected cows go off milk, lose condition, stop eating or look sick.
Vaginal discharge after calving		
Implement prevention strategies if more than trigger level **1%** of cows have a discharge more than 14 days after calving.	Adopt strategies that prevent assisted calvings and retained fetal membranes (see above).	Seek veterinary assistance promptly if affected cows go off milk, lose condition, stop eating or look sick.

A checklist for acting on cow health problems (continued).

Endometritis		
Implement prevention strategies if more than trigger level **10%** of the herd are Metricheck positive 4 weeks before Mating Start Date.	Adopt strategies to reduce other cow health conditions at calving (assisted calvings, stillbirths, retained fetal membranes). Ensure feeding and transition management around calving are on track.	Discuss treatment options with your vet. There are options available for treatment for these individual cows.
Health problem	**Prevention**	**Immediate actions**
Lameness in early lactation		
Implement prevention strategies if more than trigger level **5%** of first calvers or more than 5% of older cows become lame between calving and week 6 of mating.	For more information about managing lame cows and preventing lameness, speak to an adviser who is a Healthy Hoof Provider. Go to dairynz.co.nz/healthyhoof.	• Remove cows in lameness score 2 from the herd and milk once-a day • Treat lame cows promptly and safely. • Seek veterinary advice on the correct treatments for different causes of lameness. • Ensure that lame cows have easy access to sufficient high-quality feed to minimise body condition loss. • Move lame cows slowly and graze them close to the dairy.
Clinical mastitis		
Implement prevention strategies if more than trigger level **5%** of cows are diagnosed with clinical mastitis during the first 6 weeks of mating.	Implement SmartSAMM guidelines and seek veterinary advice. Go to dairynz.co.nz/mastitis.	Seek veterinary advice about the causes and treatment of mastitis.
Abnormally cycling cows		
There are a number of conditions that will cause cows to cycle irregularly or not at all, e.g. cystic ovaries.	Seek veterinary advice on cows with abnormal cycling activity.	
Other health problems		
Seek advice if more than trigger level **5%** of cows suffer other health problems at calving or in early lactation.	Any health problems that causes body condition loss in early lactation, e.g. ketosis, salmonella, Theileria and displaced abomasums, can indirectly affect reproductive performance. Other problems, such as cystic ovaries, will affect reproductive performance more directly. Seek professional assistance for treatment and prevention when these types of problems occur.	

Strategies to limit the impact of cow health problems

Every year you will experience some cow health problems in your herd, so your team needs to be prepared and ready. Prevention is always better than cure, with the aim to limit the number of cow health cases to a low level.

Strategies include:

- Systems for biosecurity - keeping infectious diseases like BVD out of your herd.
- Learn about locally specific animal health issues like facial eczema, Theileria, swede associated toxicity, nitrate poisoning, acidosis with fodder beet feeding.
- Record all cow health issues and review their prevalence at the end of season.
- Managing BCS and nutrition, especially in the transition period. Ensure adequate minerals are supplied (Chapter 11, page 82).
- Consult with your vet prior to calving on the best treatment and prevention options for the different diseases.
- Farm staff training and refreshers, attending pre-calving workshops.
- Plan with your vet for the detection and treatment of cows with vaginal discharge/endometritis.
- Detect and treat cow health problems as early as possible.
- Reduce risks of abortion.

Lameness may stop her from getting in calf because she stops eating and loses weight, and won't show a good heat.
The lameness scoring system rates cows from 0 (no lameness) to 3 (severe lameness) and gives recommended actions to take. Early detection of lameness is key to early recovery. For more go to dairynz.co.nz/healthyhoof.

Assisting at calving

Provide assistance to calving heifers and cows when any of the following occur:

- Heifers not calved within 2–3 hours after first sign of abdominal straining.
- Cows not calved within 1–2 hours after first sign of abdominal straining.
- Calving has not occurred within 2–3 hours for heifers, 1–2 hours for cows, after membranes have ruptured.
- Delivery has commenced, the calf's legs or head are (just) visible externally and it is obvious that the calf's presentation is abnormal.
- Delivery has commenced, the calf's legs or head are (just) visible externally and the calf is not delivered within 30 minutes.

If you think that a cow may have calved (e.g. she may have placenta hanging from the vulva) but have not found the calf, perform a vaginal examination immediately to ensure that she has in fact calved.

If you assist too early, the cervix and vagina may not be fully dilated and you risk severe trauma to the cow and more difficulty in removing the calf.

I hate helping heifers calve. What's the best way to go about it?

- **Wash the external parts of the birth canal thoroughly with warm water containing disinfectant. Stop and wash again if the cow dirties this area.**
- **Wash your arms and hands and lubricate your arm with obstetrical lubricant.**
- **Feel for the position of the calf by inserting your arm into the vagina. Normally, you will find the calf presented with two front legs and the head entering the birth canal or, alternatively, two hind limbs.**
- **If the calf isn't in either of these two positions, bring it into the correct position before any form of traction is applied to the calf.**
- **If you cannot feel the calf's head, do not presume that the two legs presented are hind limbs. The legs may in fact be front legs and the head is twisted back. Check to make sure you can positively identify the hocks of both back legs and the calf's tail.**

If you cannot bring the calf into the correct position within 10 minutes or if you are not sure what you are feeling or how to proceed, stop and seek immediate veterinary attention.

Prolonged attempts at correction can lead to severe damage to the birth canal, loss of the calf and in severe cases loss of the cow. Use calving jacks or pulleys carefully. Excessive or prolonged traction to deliver a large calf can result in severe damage to the cow.

Next year, get your heifers in shape and be careful which bulls you use. Prevention is much better than this cure!

Endometritis (uterine infections)

Using the Metricheck® device.

Cows that have any of the following have an increased risk of infection of the reproductive tract:

- twin calving;
- assisted calving;
- stillborn calf;
- retained fetal membranes;
- vaginal discharge after calving; and
- abortion.

Infections can persist for weeks or even months after calving. These cows have poorer reproductive performance even though many show normal heat cycles and no abnormal discharge is detected externally.

Cows with these infections often self-cure over time. Repeated heat cycles increase the chance of this occurring. However, it takes time for cows to heal themselves.

Should we be metrichecking our cows?

Commonly, 10% to 20% of cows have a uterine infection if the herd is checked with the Metricheck® device 4-5 weeks before mating starts. However, the prevalence of Metricheck-positive cows is variable.

Cows with uterine infections at this time have lower conception rates, 6-week in-calf rates and higher not-in-calf rates. Many of these cows have had no recorded diseases around calving.

Cow and herd-level factors associated with uterine infections have not been well documented. Transition management and early lactation nutritional management may influence this condition, but more research is needed.

Talk to your vet about the best time to check your herd using the Metricheck device. As many cows will self-cure with increasing time post-calving, the timing of checking the whole herd will influence the prevalence of Metricheck-positive cows. The cure rate may be lower in cows with a chronic uterine infection.

Treating infected cows, usually with intra-uterine antibiotics, will improve fertility. However, the treatment takes time to work. Ensure all cows with uterine infections are treated at least four weeks before Mating Start Date. This gives the best chance of them getting in calf early in the mating period.

While more research is required to fully understand the factors associated with endometritis, there are ways, in addition to treatment, to manage the impact of endometritis on subsequent reproductive performance:

- **Minimise cow health problems around calving.**
- **Optimise transition and post-calving nutrition (Chapter 11).**
- **Minimise the number of non-cyclers (Chapter 17).**

Bovine viral diarrhoea (BVD)

BVD is a viral infection widespread in NZ dairy and beef herds. BVD infection reduces both cows and bulls fertility, resulting in

- lower conception rates, embryonic loss, abortion,
- birth of stillborn, weak and deformed calves and
- birth of persistently infected (PI) calves.

It also depresses animals immune system making every day diseases such as scours and pneumonia in calves, and mastitis in cows more common and severe.

- If a live calf is born from a cow that became infected in the first four months of pregnancy, it is likely to be persistently infected.
- PI animals show little obvious signs of infection yet shed large amounts of BVD virus throughout their life and are the main means of BVD spread.
- By detecting and eliminating PI animals from the herd, the spread of BVD is controlled.

Testing cattle at a young age for persistent infection with BVD is an important control step so that PIs can be detected and culled before they can infect the herd.

You can get a bulk tank milk sample collected by your milk company tested for BVD.

How do we know if we have BVD in the herd?

To get a bulk milk sample tested for BVD talk to your vet or herd improvement organisation. This test is best done when all the cows have calved and before mating starts. In split calving herds, get two samples taken - before spring and autumn matings.

Discuss with your vet what the results mean and what to do next. Consider setting up a BVD control plan for your farm. An effective BVD control plan will contain at least the following elements:

- annual vaccination of breeding stock; and/or:
- annual testing of all keeper calves for virus and culling any PIs identified

and, irrespective of whether you do one or both of the above:

- virus testing all cattle coming onto farm and excluding any PIs.

For further information, go to www.controlbvd.org.nz

A mummified calf.

Minimising abortions

Having a high number of cows abort is a major cost to the farm.

Cows abort for a range of reasons and show different signs.

Some of the common reasons for abortions are:

- infection with neospora;
- infection with bovine viral diarrhoea (BVD);
- infection with leptospirosis;
- eating branches or needles from macrocarpa (cypress) or pine trees (including radiata and ponderosa pines);
- fungal abortion from poorly made silage; and
- nitrate poisoning.

The common signs of abortion include:

- membranes hanging from the cow's vulva;
- the cow passing or licking its fetus;
- a return to heat or a vaginal discharge after a cow is thought to be pregnant; and
- failure to calve at or around the expected time.

If a cow aborts, take steps to minimise risks to the people, the aborted cow and other cattle. Good management of aborted cows will reduce the risks to both humans and other cows, and maximise subsequent reproductive performance.

One of my best heifers has aborted. Now what do I do?

If possible, you should start milking her. She is at risk of contracting a severe reproductive tract infection after aborting, so call your vet. She may need prompt treatment if she goes off her milk, loses condition, stops eating or looks sick.

Check for external signs of retained fetal membranes on the day after aborting. If observed, manage retained fetal membranes.

If you are not going to cull her, consider follow-up treatment options to reduce uterine infections.

Some infections that cause abortion in cattle can affect humans, so handle aborted fetus and membranes wearing disposable gloves and avoid contact with vaginal discharges from aborted cows. Consult your vet on the best way to minimise the risks.

Where possible, do not allow dogs access to aborted fetuses or membranes. Remove aborted fetuses and membranes from the paddock and bury them.

By managing her well now, you will have a better chance of getting her in calf again.

How do we assess the abortion rate in our herd?

- Observe pregnant cows for signs of abortion;
- Record the identity of aborting cows, date and observed signs;
- Have suspect cows rectal pregnancy tested. Cows can show return to heat or vaginal discharge and still be pregnant.

Calculate your herd's abortion rate by adding up the number of cows in the following categories:

- cows with membranes hanging from their vulva or seen passing or licking their fetus more than 3 weeks premature;
- cows identified as empty at a second rectal pregnancy test following a confirmed pregnancy at a previous pregnancy test; and
- cows that have failed to calve at or around the expected time following a positive pregnancy test.

Use the following formula at every calving period:

$$\frac{\text{No. of cows aborted x 100}}{\text{No. of cows diagnosed as pregnant during the previous mating period (excluding cull cows)}}$$

Seek professional advice if the abortion rate

- exceeds 6% following early pregnancy testing (less than 17 weeks after Mating Start Date), or
- exceeds 2% following late pregnancy testing (20 or more weeks after Mating Start Date).

If your vet recommends the cause of abortions be investigated, retain the freshly aborted fetuses and placenta for laboratory examination.

Phantom Cow Syndrome

A true phantom cow is one that conceives early to AB but the embryo dies, while the cow continues to believe she's pregnant and doesn't return to heat. Phantoms show up later as unexpected empties.

The Phantom Cow Syndrome is largely evident in North American type Holstein-Friesians, with the cause being poorly understood.

Sometimes cows may simply appear as phantoms but the real reason is inaccuracies with heat detection and poor heat detection efficiency as mating progresses.

One method of diagnosing the size, and possible cause, of a phantom cow problem is to implement an early pregnancy testing strategy, that may involve repeat examinations. Consult your vet on options to alleviate a phantom cow problem.

Non-cycling cows (treated or untreated) have a higher prevalence of Phantom Cow Syndrome than cycling cows, and it is often in this group that you identify the problem (Chapter 17, page 147).

If diagnosed early in the mating period there may be time to use hormonal treatment to resynchronise and mate them before the end of the mating period.

13

Heat detection

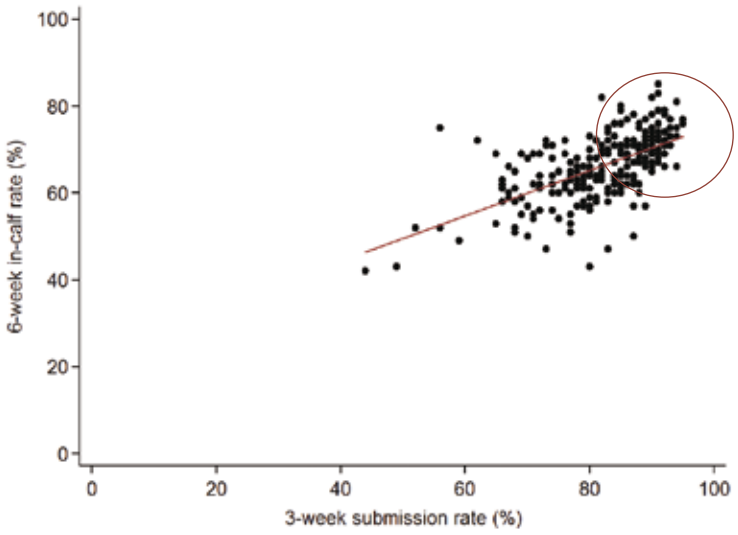
The importance of good heat detection

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

The first step towards getting better results is to assess current heat detection practices to see if they can be improved. There are two types of errors that can occur during heat detection. You can miss a cow that is actually on heat or you can misinterpret the signs shown by a cow and think she's on heat when she's not.

If you miss a lot of heats, the submission rate of your herd will be low. The submission rate is a key driver of the 6-week in-calf rate. You are aiming for high submission rates, but you don't want to achieve this by inseminating cows that are not on heat.

3-week submission rate drives a high 6-week in-calf rate



High submission rates and good conception rates are essential for high 6-week in-calf rates. The graph shows that herds with high submission rates (circled) also have high 6-week in-calf rates. (Source NZ National Herd Fertility Study)

I've been mating cows for years. Surely I know how to detect heat?

It's fine to say that you are a good heat detector but InCalf research has shown that in around one-quarter of seasonal calving herds, heat detection errors are likely to be limiting reproductive performance.

There are two mistakes that are commonly made by many farmers when detecting heat. They miss heats and invent heats. It sounds unusual to invent heats, but how many times have you recorded the wrong cow ID or confused the cow that was on heat. Sometimes these misdiagnosed or misidentified cows are inseminated when they were not on heat. These mistakes may delay cows becoming pregnant, and lower the reported conception rate and 6-week in-calf rate.

Heat detection errors could well be holding you back.

Assessing heat detection using submission rate

Submission rates are a useful tool in assessing your current management of heat detection.

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' in your herd that are not showing heat normally (Chapter 17).

Submission rates below trigger levels suggest action is required. Start by reviewing heat detection practices. Then look at other areas such as body condition, lameness or other health issues.

To assess heat detection efficiency it is best to look at the 3-week submission rate of cows likely to be cycling normally.

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

Failure to detect a cow showing signs of heat may be called a 'missed heat', or a 'false negative' heat. Whereas submitting a cow as being on heat when she is not, may be called a 'false positive' heat.
If excessive numbers of cows are being inseminated when not on heat, the submission rate may be high but your conception rate may be poor.
Effective heat detection has minimal numbers of false negatives and false positives.

Using submission rates of early-calved mature cows

The 3-week submission rate of this group of cows in the herd is a good indicator of heat detection efficiency.

You can obtain your herd's 3-week submission rate for early-calved, mature cows from day 22 of mating. Early-calved, mature cows are cows that are 4 or more years of age at calving and that calved 8 or more weeks before the start of mating.

Top farmers achieve a 95% 3-week submission rate for early-calved, mature cows.

If less than 90%, the low submission rate in early-calved mature cows is a strong indicator that heat detection rates are low and reviewing detection strategies should be a high priority.

The other most likely possible cause is an excessive number of non-cyclers in this sub-group of cows. See InCalf Heat Detection Tool, and go to Chapter 17.

The InCalf Fertility Focus report calculates your herd's 3-week submission rate for early-calved, mature cows.
For more help go to the InCalf Heat Detection Tool at dairynz.co.nz/incalf. This tool is also complemented by the InCalf Non-cycling Tool.

What to look for in a cow that is on heat

Signs that a cow is on heat:

> **The cow that is standing to be mounted is on heat.**

> **Tail paint is removed and mud marks on flank.**

A cow is most likely to be on heat if:

- she is standing to be mounted by other cows;
- tail paint is removed; or
- heat mount detector is triggered.

A cow may be on heat if:

- she attempts to mount other cows;
- tail paint is rubbed but not removed;
- she is restless or bellowing;
- she has poor milk letdown;
- you see mucus around the vulva;
- you see mud marks on the flanks; or
- the heat mount detector is lost.

Cows with at least two of these signs are possibly on heat but showing only weak signs. Some will not be on heat. Make sure everyone knows what to do with cows that are showing weak signs of heat.

Normally, you can expect cows or heifers to show signs of heat every 18–24 days with an average of around 21 days.

Cows often have a short cycle after their first heat post-calving and are in heat again 8–12 days later. The average interval from calving to first heat in pasture-fed cows in good body condition is 35–45 days. It is about 10 days longer than this in first calving heifers.

It is important that everyone on the farm knows the signs of heat. You may know them, but do all the members of the farm team? And is there a communication system in place to ensure all cows on heat are drafted for AB?

Signs that a cow *may* be on heat:
> Part of a restless groups of cows.

> Trying to mount other cows.

Standing heat

Heat signs and ovulation are coordinated within the cow by reproductive hormones and the brain, giving the cow the best chance of being detected and inseminated at the right time.

The definitive sign of heat (in oestrus) is the cow that is standing to be mounted. The cow mounting (riding) is also likely to be on heat, but this will need to be confirmed by herself standing to be mounted.

Other cows that are on heat will be attracted by this activity. A sexually active group (SAG) will form. Identifying and investigating SAGs is easy when doing paddock checks. Studies indicate that early morning, and late evening are when cows on heat are most active.

The duration that cows are in standing heat varies a lot (e.g. range 2-28 hours, but typically 12-18 hours). As a result, many short duration heats can go undetected.

In practice, the use of aids, such as tail paint and heat mount detectors, are necessary for heat detection. When combined with skilled observation of all the other signs, it is possible to detect more than 90% of cows on heat.

As the number of cows conceived during mating increases, the number of sexually active cows in a SAG will reduce, especially during weeks 4-6. This makes heat detection more challenging, requiring more attention to detail, when operator fatigue is a big risk.

The intensity of heat activity varies and can be reduced by low body condition score and restricted feeding. This will result in missed heats particularly during adverse weather. Stress is known to reduce the expression and detection of heat. This means the person responsible for heat detection must be skilled, committed and attentive to detail.

A 'silent heat' is when no signs of heat are detected, but ovulation has occurred. This is common and normal with the cow's first ovulation post-calving.

Detecting when a cow starts and stops 'standing heat' is not practical.

Ovulation occurs about 32 hours after the onset of heat, well after heat signs have stopped. This involves the rupture of a large mature follicle on the ovary and release of an egg to be fertilised. The expelled egg passes down the oviduct where fertilisation takes place. Successful fertilisation requires that sperm are ready and waiting for the egg. This illustrates the importance of timing of insemination to a detected heat. Cows are only fertile at this particular time.

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

- Record a '?' in the AB record whenever you inseminate a cow that is possibly on heat but you are not sure.
- Look up any previous insemination and heat records for the cow that is possibly on heat.
- Inseminate if the cow has not been inseminated since calving and is showing reasonable signs of heat.
- If the cow's previous insemination was more than 20 days ago, inseminate.
- If the cow's previous insemination was less than 20 days ago, inseminate if the previous heat was weak (marked with a '?'). Otherwise, look for more signs of heat. If these are seen, inseminate.

If more than 10% of inseminations are cows with weak heat signs, or many intervals between consecutive inseminations are less than 18 days, then …

Take a long hard look at your heat detection practices

How to improve your heat detection

The best heat detection programmes start with careful planning, good observation and the effective use of detection aids. Being able to distinguish and interpret cow behaviour and other signs is critical – so are good record keeping and training for the people responsible for heat detection.

Step 1 is to review the heat detection skills available on your farm – are they up to scratch? Does everyone involved know exactly what to look for when detecting cows on heat?

Step 2 involves determining which aids you will use; remember, farmers with the best heat detection results use a combination of observation and heat detection aids. No one method is perfect. Be prepared to test several combinations of options to identify the one most suitable to your herd. Tail paint is the most commonly used heat detection aid.

Step 3: Decide how best to record cows on heat and train staff to do this. Make sure all cows are tagged and numbers can be clearly identified for accurate drafting.

Finally, keep an eye on the detail. Schedule regular times to monitor the success of the programme. This information is critical if you are to spot trends early. A successful heat detection programme relies on monitoring and fine-tuning all through the mating period.

Using mobile apps and some automated systems make electronic data entry of herd mating events quick and easy. You still need staff induction and training about heat detection and the recording systems you are using.

If you enter your pre-mating heats electronically, Fertility Focus report will calculate the % of cows that had a pre-mating heat.

Recording heats before mating begins

The period before mating begins offers an opportunity to practise heat detection skills, check for cows not detected on heat and anticipate when cows may next come on heat. Farm team training should be organised at this time. The most experienced person can help less experienced team members interpret signs of heat.

Train team members by making a paddock visit at the recommended time for a 'look-and-learn' session. Next day, let team members do the detecting with you just checking; monitor that heat detection efficiency is being maintained by checking tailheads during milking and comparing daily heat records.

I now get the importance of 'pre-mating' heat detection.

Pre-mating cycling rate is like the herd's submission rate in the 3-4 weeks before mating even starts.

If we get 85% of cows cycling pre-mating, we should romp in with a 90% 3-week submission rate to AB along with a good conception rate.

Heat detection before mating

- Monitor and record heats from 35 days before Mating Start Date (MSD) if you wish to have the option to treat cows not detected on heat early (Chapter 17).
- Calculate your herd's pre-mating cycling rate (see below). This tells you the percentage of cows in your herd that have shown signs of heat before mating begins.

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

If less than 65% by 10 days before MSD, your heat detection has not been effective or you have too many non-cyclers in the herd. You may need to modify your pre-mating heat detection strategy, ensure that most cows calve early in future calving periods, calve your cows in better condition at the next calving period or make sure that heifers reach their target liveweight at calving. Also check that your cows calved in condition score 5.0 and 5.5, and are holding or improving body condition coming into the mating period.

Is there a simple way to check for non-cycling cows?

- Apply tail paint of one colour (e.g. green) to every milker from 35 days before MSD.
- Apply a different tail paint (e.g. blue) to later calvers when they first enter the milking herd.
- Check tail painted cows for rubbed tail paint at least twice weekly until MSD.
- At these checks:
  - ensure all cows have an unbroken strip of paint throughout the monitoring period; and
  - repaint rubbed cows with a different colour paint (e.g. red).

The cows with the original tail paint colour (green or blue) are unlikely to have come on heat since tail paint was first applied. Cows with the other tail paint colour (red) have had at least one heat since tail paint was first applied.

You can also estimate your herd's pre-mating cycling rate with this method:

$$\text{Pre-mating cycling rate} = \frac{\text{No. of red painted cows} \times 100}{\text{No. of total cows at Mating Start Date}}$$

It seems like an extra job at a busy time of year, but this system can let you know early how many cows are cycling and is essential for treating non-cyclers early.

The NZ Monitoring Fertility Report reported that one or two people doing heat detection is better than three or more.
Also herd owners and managers are better heat detectors than others who perhaps have less invested in the herd.

Boy, it doesn't take long to miss a heat!

The average duration of heat in dairy cows is about 14 hours as long as weather conditions are normal. Heats can be as short as 2 hours and as long as 28 hours.

That is why most herds rely heavily on heat detection aids only.

Paddock checks work best when the cow number observed on heat can be entered directly into the electronic records for automatic drafting.

Using paddock observations and detection aids for best results

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

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

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

- Check that all cows in the herd are individually identified using eartags that can be read from some distance.
- Do paddock checks 2 hours after the morning milking. Cows show strongest heat signs once most of the feed in their paddock has been grazed.
- After insemination, return cows to the milking herd as soon as possible if practical to encourage formation of new sexually active groups.
- Consider evening paddock checks 2 hours after the p.m. milking if you wish to maximise the number of cows detected on heat.
- If several people are involved in heat detection, implement a system to ensure that all involved share their records. For example, a whiteboard at the dairy, or use of apps.
- Observe cows for heat without disrupting their activity. Walk up quietly – no motorbikes or dogs!
- Record the identity number of every cow detected on heat at each paddock check.

Heat detection at the dairy shed only

Relying solely on heat detection at the milking shed will increase the risk of missed heats, but if this is what you choose to do, here are some important things to consider:

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

Heat detection aids

Several options and innovations are available to aid heat detection and increase heat detection rates. Each cow must have a unique number so that it can be readily and accurately identified.

Determine which of the following options will suit your heat detection strategy. Remember, for the best results use a combination.

1. Tail paint, when combined with paddock checks, requires the least expensive materials. This combination can be successful if implemented correctly and with diligence.
2. Heat mount detectors are a little more expensive than tail paint, but are easier to read, require less maintenance once applied and can increase heat detection rates.
3. Activity meters (including pedometers) can be integrated into computerised herd information systems, but are expensive.
4. Vasectomised bulls.

Each of the heat detection aids has advantages and disadvantages, so it is a matter of working out what suits your work routines, budget and goals.

Combination of two heat detection aids

Paddock checks may simply not be practical in your situation. A better option may be a combination of two different heat detection aids. For example, some people use both a heat mount detector and tail paint on all cows at the same time. Combining two heat detection aids may reduce the risk of both missed heats, and inseminating cows at the wrong time.

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

1. 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 purchased.

A strip of tail paint is applied to the rear portion of the backbone of each cow. Cows on heat will stand when mounted by herdmates or a bull and the tail paint will be gradually rubbed off as the other animal dismounts.

It is possible to achieve high heat detection rates using tail paint alone provided the person is highly skilled and the paint is maintained appropriately.

▶ Apply or refresh existing tail paint to all cows just prior to MSD.

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; and**
- **sufficiently thick to cover the skin with some hair fibres still visible.**

How do I make sure I get the tail paint on right?

When we first started tail painting, we often made the mistake of applying the paint too thickly and in too wide a band. You only need to cover the uppermost ridge of the spine/tail head region that will be rubbed by the brisket of the riding cow. A common recommendation is to apply the paint with forward strokes to make the hair stand on end and leave a rough finish.

Be sure to use commercial tail paint or sprays, not house paint, roof paint or aerosol raddles. Follow the manufacturer's instructions.

Applying tail paint correctly can really improve detection rates.

- Ensure every cow (except those actually on heat) has an unbroken strip of paint throughout the AB period.
- Have the same person examine and touch up the paint twice weekly.
- At each milking, check for cows with rubbed or broken tail paint.
- For cows on heat, re-check that the tail paint has been rubbed immediately before each cow is inseminated. This will help avoid inseminating cows that are not on heat (e.g. drafting errors).
- Reapply tail paint to recently inseminated cows once the cow has gone off heat – generally at the next milking. Use a different coloured paint on cows after their first insemination. This will help identify cows that have not yet been inseminated and this helps you decide whether to inseminate a cow that is showing only weak signs of heat.
- Continue this at least until the end of the AB period.

Try to tailpaint a couple of days before you plan to check heats.

> **Tailpaint is more effective if it has weathered a bit.**

> **Only use commercial tail paint.**

> **Follow the manufacturer's recommendations.**

Applying a heat mount detector:

> **Follow the manufacturer's instructions for applying the heat mount detector.**

> **Use the recommended adhesive.**

This heat mount detector signals that the cow has been mounted and is likely to be on heat:

> **Remove activated heat mount detectors from cows on heat at the time of insemination.**

A scratch-off heat mount detector.

2. Heat mount detectors

InCalf research has shown that using heat mount detectors can result in higher detection rates than tail paint, particularly in herds where less skilled or unmotivated staff are checking for cows on heat. Best results are achieved when heat mount detectors are combined with paddock checks for heat.

There are several types of heat mount detectors – pressure-activated 'tubes', scratch off 'patches' and now electronic devices are available. They are applied to the rear portion of the backbone or rump region of each cow. Cows on heat will stand when mounted by herdmates or a bull and the detector responds to the pressure or rubbing from the mounting animal, becoming brightly coloured and easily recognised.

- Apply heat mount detectors according to manufacturers' instructions to every cow on the day before mating starts.
- Check for other signs of heat if a heat mount detector is lost as it may indicate a cow is on heat.
- Remove activated heat mount detectors from cows on heat at the time of insemination.
- Replace the heat mount detector following insemination, when the cow is no longer being mounted. Continue this replacement policy until the end of the AB period.
- Switch to tail paint after the first insemination if you are confident high levels of heat detection can be maintained. If you are not confident, use heat mount detectors after the first round of AB because the sexually active groups are smaller and less active making some cows harder to detect.
- Check heat mount detectors regularly and replace if they are damaged or are coming loose.
- Avoid using heat mount detectors if cows have access to low tree branches that are likely to rub them off.
- Check that the type of heat mount detectors you are planning to use will stay on yearling heifers.
- Consider combining heat mount detectors with tail paint.

3. Activity meters (including pedometers)

Activity meters are electronic transponders that detect movement. Pedometers are one type of activity meter that are strapped onto the lower leg of each cow in the herd. Other pedometers hang around the cow's neck. They record cow movement. Cows on heat walk more as they are restless and mount other cows. Walking is recorded and the amount is compared to the record of activity on previous days when the cow was not on heat. Some brands make the comparison to the rest of the herd on the same day. The cows most likely to be on heat can be automatically drafted if facilities are installed.

- Before installing activity meters, visit herds that have used them with measurable success (high submission and conception rates) as validated by an InCalf Fertility Focus report).
- Check the reliability and durability of more than one system before you buy.
- Thoroughly train your farm team in the use of this technology.
- This kind of technology likely has more application in confinement systems than in pasture-based systems.

4. Vasectomised bulls

In some situations vasectomised bulls may be used to help identify cows on heat for AB. The general management of these bulls is the same as for the entire bulls run with cows (Chapter 15). Discuss this option first with your vet.

Search 'Automated heat detection' at DairyNZ website and find a technology guideline about automated heat detection systems.

Managing heat detection in larger herds

If the task of detecting heats and drafting at the dairy shed are separate processes on your farm, ensure that the cows in heat are clearly identified (e.g. stock marker aerosol or shaving foam) to make your drafting easier. If using an aerosol stock marker, apply the mark to a different location each day; rotating every 3 days. This will prevent cows being inseminated wrongly over two consecutive days.

If you have automatic drafting facilities, the heat detector can immediately enter the identification number of the cow on heat into the computer for this cow to be auto-drafted when exiting the dairy shed. This same data can be a great source of information for further reproductive tasks, such as pregnancy testing (Chapter 18).

Ensure you have a contingency plan in case the auto drafting facility malfunctions!

Missed heats are more likely in larger herds, where staff are unable to recognise individual cows, so more planning and attention to farm team training and communication are required.

- The period before mating begins offers an opportunity to train farm team members before accurate heat detection becomes really crucial.
- In the week before mating starts, rehearse heat detection and drafting procedures. Check and repair any faults in drafting gates to ensure cows for inseminating do not escape. You should also decide whether or not bulling cows seen at or before the p.m. milking are to be drafted out and held separately close to the shed overnight. This may depend on the time in the morning that the AB technician usually calls. The AB technician will need your assistance with bringing in the cows and locking them in for inseminating.
- Clear forms of animal ID that can be read from some distance are essential to ensure you and others can correctly identify each cow detected in heat while grazing or moving around in a sexually active group.
- Everyone involved in drafting and inseminating tasks (herd owner, manager, employers, employees and contractors) has responsibility to ensure that facilities are safe, accessible, convenient and comfortable for both the people and animals. You should consult with the Area Manager for the AB service about the handling facilities required for inseminating large numbers of cows in larger herds (Chapter 14, page 122).

Larger herds present different challenges to heat detection.

Should we accept poorer heat detection now that we're managing a larger herd?

There is no real reason why cows in larger herds should be less fertile than those in smaller herds. Heat detection in larger herds needs to be very well planned and communicated, because staff won't have the advantage of knowing individual cow behaviours or their identification by sight. On the other hand many larger herds are supported by electronic systems and automatic drafting that makes the job easier.

Who will be doing the heat detection? Are they conscientious and skilled at it? Will it be their sole job at the milkings during AB, or are they also expected to put cups on? What process is in place to ensure that a cow detected in heat does indeed get inseminated when the AB Technician turns up? Who is looking after the records?

We achieve good heat detection in our larger herd by making it a key priority during AB, assigning the best people to the job and backing that up with meticulous planning and communication to ensure that heat detection fatigue is managed.

The NZ National Herd Fertility Study found herd size and region were not risk factors for overall herd reproductive performance as measured by 6-week in-calf rate.
It is just as possible to achieve good herd reproduction in larger herds as in smaller herds. And region does not matter.
Larger herds present different challenges to heat detection and these can be managed to achieve excellent results.

Heat synchronisation

Most synchronisation programmes will have a limited effect on 6-week in-calf rate, but can increase 3-week in-calf rate and give more early born AB calves. It is the management benefits you need to consider in deciding whether to use synchronisation or not.

Heat synchronisation programmes may involve fixed time inseminations, or may still rely on normal heat detection methods.

Heat synchronisation can offer efficient use of labour as the work of heat detection and AB is shortened into planned, intensive periods.

It can be used to compress three cycles of breeding (9 weeks) into a 7-week mating programme, or two cycles (6 weeks) into a 4-week mating programme.

Synchronisation programmes may help increase heat detection rates in herds where less skilled or unmotivated staff are employed or where the herd manager's time is limited. This is because people detecting heat can focus on the job for short, predicted periods.

When detecting heat during a synchronisation programme, simple aids such as tail painting or heat mount detectors are essential. Some programmes require fixed timed inseminations, meaning that no heat detection is required at all during that period. Some options allow resynchronisation of returns to service. This helps achieve increased heat detection rates for returns to service.

Details describing synchronisation programmes for use in cows and heifers can be found in Appendix 6 'Options for heat synchronisation'.

If considering using heat synchronisation for the first time, consult your veterinarian and other farmers/advisers who have experience using heat synchrony options, which create their own set of risks, e.g. adverse weather on critical days.

Minimising the number of cows not detected on heat

Cows that don't come on heat when you expect them, cost money and time when there is already enough to do.

The reasons why a cow wasn't detected on heat vary but the result is the same: she doesn't get inseminated and she won't get in calf as early as you want.

This is critical important in seasonally calving herds (Chapter 17 and Appendix 5).

14

AB practices

Assessing insemination practice

In New Zealand, professional AB technicians managed by breeding companies do the majority of inseminations. They are responsible for semen storage, handling and insemination technique, and have control procedures in place to ensure the best possible service is provided. Make sure this is the case for inseminations done in your herd.

Conception rates are reduced substantially when semen is not stored and handled correctly or when insemination technique is unsound. Australian InCalf research has shown that at least 40% of DIY (do-it-yourself) technicians could achieve at least a 5% increase in conception rates by improving insemination practices.

The non-return rate can provide an early warning of a low conception rate and is a worthwhile first check. If, from your Fertility Focus report, the 2-24 day non-return rate for your herd is less than 64%, or conception rate is low (less than 53%) you need to investigate potential causes, such as the following, and take the recommended action:

- Poor inseminating practice – report your concern to the field supervisor of your AB service.
- Poor body condition at calving or excessive loss of body condition following calving – review body condition score targets and herd nutrition.
- Inaccurate heat detection – review your heat detection programme.
- Excessive numbers of late calvers – review calving pattern.
- Excessive numbers of treated non-cyclers.

A non-return rate result on Fertility Focus report is available from about week 4 of mating. Whereas the first estimate of conception rate is available much later, e.g. at first scan about week 11 after Mating Starrt Date.

The InCalf Fertility Focus report provides estimates of conception rate based on early-aged pregnancy testing.

If you are a DIY inseminator you should ensure that your insemination technique is spot on by attending a refresher course.

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

The non-return rate or conception rate achieved in a herd can vary for a number of reasons. That makes it difficult to compare the conception rate achieved by a single AB technician to expected performance targets. However, the field supervisor can access results obtained by one technician working in several herds. These results can also be compared with those obtained by different technicians working in the same herd.

Assessing technician non-return rate

The 18-24 day non-return rate is used by breeding companies to monitor AB technician performance. The eligible inseminations exclude both short returns (<18 days) and long returns (>24 days).

Be aware that the (2-24 day) non-return rate reported on your Fertility Focus report is likely to be 10% less than the 18-24 day non-return rate of eligible returns used to monitor AB technicians.

If you are a DIY technician a disadvantage is that, if the non-return rate or conception rate is low, it is difficult to determine whether your technique needs improving or whether factors other than insemination technique are reducing the conception rate. If you have any doubt, you should consider an insemination refresher course or have a professional technician do half the inseminations and compare your results. You will need at least 50 inseminations each to get a valid comparison.

If you have more than one DIY technician operating in the herd, you might compare non-return rates or conception rates achieved by each technician. Be aware that apparent differences based on small numbers of inseminations done at different times might not be real.

What assurances do we have that our AB technicians are doing the best job possible?

Professional AB technicians are fully trained in proper storing and handling of semen, as well as inseminating technique. Their performance is also monitored by their field supervisor. Very seldom can a poor result be attributed to poor technician performance. Contact your breeding company if you have concerns, but the problem is much more likely to be things under your control; like too many late calvers; too many non-cyclers needing treatment; inaccurate heat detection; and poor cow condition.

Consider the more likely causes of poor non-return rates before complaining about the AB technician.

What do you mean by having AB facilities in good shape?

Inseminating facilities should be safe, accessible, convenient and comfortable for both the technician and the animal. Remember, the herd owner and management are responsible for providing a safe workplace for the technician.

Getting ready for AB

It is important to prepare your AB programme. Have a well-planned system with your farm team ready, supplies at hand and facilities in good shape. All the details for providing good facilities, including platforms, are included in the 'Guidelines to Artificial Breeding Facilities' available from LIC.

- Check that AB facilities provide a safe working environment.
- Think about and plan for AB facilities when upgrading the farm dairy, or adding new equipment, e.g. meal feeders.
- The On Farm Mating Record books need to be completed before the AB technician arrives.
- Where multiple sires are being used, organise/mark cows to assist the AB technician get the right straw into the right cow.
- DIY technicians should:
  - Consider practising their technique on cows in heat before mating starts. This can be done without using semen by placing a sheath over the pistolette.
  - Consider having their technique checked by the local AB service supervisor on the farm.
  - Attend a refresher course if they have not done one for two years or are not confident with their technique.
- Place a bench for straw preparation in a stable, secure, clean and convenient working position away from direct sunlight, rain, dust or pungent chemicals.
- Provide clean cold and hot water, a rubbish bin to dispose of gloves, paper and sheaths, and a scrubbing brush to clean gumboots.
- Arrange for the technicians to check the facilities and to familiarise themselves with the yards and gates.
- Plan to have two people present for cow handling and inseminating. More staff may be required if a synchronisation programme has been used.

Liquid semen storage and handling

Liquid semen (fresh semen), rather than frozen semen, is widely used in New Zealand because about 5-10 times as many straws of liquid semen can be produced from the same ejaculate.

Liquid semen has a shelf life of about 3 days. It is important that it not be used after the stated 'use-by' date.

Liquid semen straws are stored in an insulated container to maintain a steady temperature and prevent sperm damage. It is important to keep liquid semen straws in this insulated container until use.

Fertility of liquid semen is similar to frozen-thawed semen.

When using liquid semen, AB technicians are instructed to:
Choose a safe and comfortable place to work, away from direct sunlight, rain, dust and pungent chemicals.
Place the required number of inseminating pistolettes (with plungers pulled back 75mm) on the opened lid of your AB-case with the tips well clear of any contact.
Select and remove only the number of straws that can be used within 15 minutes.
Ensure that the semen container is returned to its insulated state as quickly as possible.
Handle straws at their ends to minimise temperature changes to the semen.
If required by the semen distributor, ensure each straw is given a gentle, downward flick to move the nitrogen bubble through the semen and locate the nitrogen at one end of the straw.
Place these straws in the pistolette and cut the end off the straw at right angles with clean sharp scissors before covering with sheath.
Carefully prime the straw by slowly and firmly moving the plunger into the pistolette until you see movement of the semen at the tip of the sheath, taking care not to expel any semen.
Place the loaded pistolette into a sterile inseminating glove. Use different gloves for different sires/breeds.
Inseminate the cow using the same technique as for frozen-thawed semen.

Proper inseminating practice using frozen semen:

> **Know the location of each bull's straw before lifting the canister.**
> **Lift the canister only as high as the 'frost line'.**
> **Lift selected straws using tweezers.**

Frozen semen storage and handling

The sperm contained within frozen semen straws is fragile and requires great care when handling.

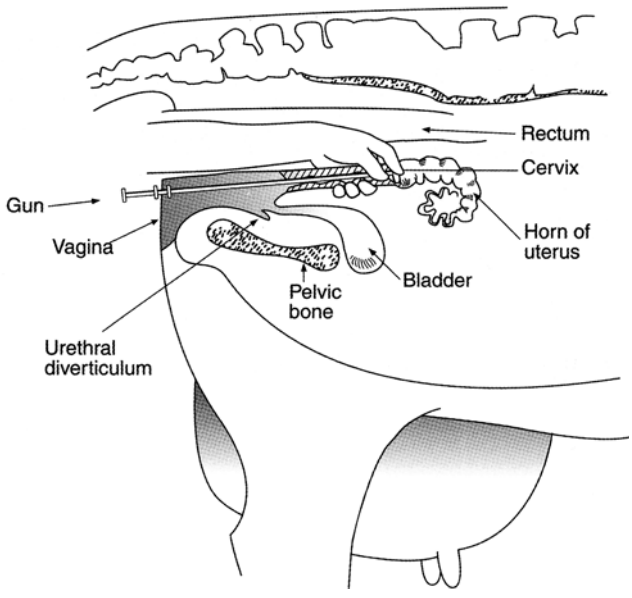
Checklist for frozen semen handling	
Tank	
Check that the semen tank is full of liquid nitrogen when delivered.	
Daily, check liquid nitrogen levels in the semen tank.	
Twice weekly, check the semen tank for 'frosting' on the outside of the neck of the tank. This indicates a tank insulation breakdown.	
Identify straws using coloured marker rods placed in the goblets (or a similar system).	
Know the location of each bull's semen before you retrieve the straw from the tank. You only have two seconds to check the bull's name on the straw before it starts to thaw.	
Handling straws	
Lift selected straws using tweezers; only lift one straw at a time.	
Only thaw as many straws as you can use within 15 minutes.	
Only lift the canister up to the 'frost line' in the tank to select straws.	
Thawing straws	
Thaw straws in water at ambient temperature for at least 30 seconds. If using an automated thaw unit (37.5°C) or warm water bath (32-38°) then the straws must be removed after 30 seconds to prevent the semen 'cooking'.	
An automated thawing flask that controls water temperature is useful if you are inseminating large numbers of cows.	
Ensure the water level covers all but the top 1 cm of the straw.	
Only touch the ends of the straw.	
Dry each straw gently and thoroughly with a paper towel or wipe before loading into the pistolette.	
Load the straw into the pistolette, then cut it at right angles with clean, sharp scissors before covering with a sheath.	
Carefully prime the loaded pistolette.	
Keep the loaded pistolette free of contamination and out of direct sunlight.	

Insemination technique

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

Checklist for insemination technique
Put on and lubricate glove, and enter hand into the rectum.
Wipe the lips of the cow's vulva clean of mucus, dirt and faeces using a clean paper towel or wipe.
Provide a clean entry for the pistolette through the vulva – Open the lips by pressing your arm down in the rectum or with the aid of paper towel.
Direct the pistolette upwards at 45° to avoid the opening to the bladder.
Follow the progress of the pistolette with your hand in the rectum. Do not push your hand towards the cervix ahead of the pistolette.
Work the pistolette into and through the cervix. Manipulation of the cervix is all done with the left hand.
Once through the cervix roll the left hand over the cervix and check with forefinger (at 90 degrees) for correct placement only 1 mm into the uterus.
Deposit all the semen slowly (3-4 seconds) and steadily into the body of the uterus just through the cervix. Wait a moment before slowly withdrawing the pistolette.
Remove the pistolette with a smooth action while the arm is still inserted in the rectum.

Sperm deposited in the cervix are less likely to progress to the uterus and will lower the conception rate.



Correct placement of semen: deposit all the semen through the cervix 1 mm into the uterus.

** The pistolette is referred to as a gun in this figure.*

Timing of insemination

Both sperm and eggs have a limited lifespan in the race for the two to meet. The timing of an insemination in relation to a cow's heat signs is important to the likelihood of conception. Best conception rates occur following insemination 6–12 hours after a cow has first stood to be mounted, but detecting when the cow started standing is not practical.

Extensive field trials in New Zealand and elsewhere show no advantage in conception rates by inseminating cows under the 'am/pm' rule. The key thing is to inseminate cows at the next opportunity after detection of standing heat. Advances in semen processing technologies allow for once-daily inseminating to be sufficient.

- Cows first seen on heat detected before or at the morning milking – inseminate that morning.
- Cows first seen on heat detected through the day or at evening milking – inseminate next morning.
- If inseminating twice-daily, do not delay insemination unnecessarily.

Refresh tail paint or heat mount detectors when the cow has gone off heat – generally at the next milking. Re-inseminate any cow that is still on heat two milkings later (24 hours later).

Managing cows separated out for AB

Once-daily inseminating means that cows will need to be separated from the herd while waiting for the AB technicians to call. This may include overnight separation in large herds when bulling cows are drafted out during the evening milking. They will need to be held separately and also milked separately (preferably before the rest of the herd). Cows first detected bulling at the morning milking may only need to be separated from the herd for a few hours.

'Good management practice' is required to minimise stress for these separated cows.

- Provide access to drinking water and shelter from wind.
- Do not hold animals for extended periods on concrete (especially as bulling cows may injure themselves on concrete and yard rails).
- Provide cows access to pasture. Arrange for the technician to text ahead indicating expected time of arrival. This allows you to bring in the cows from the paddock ready in time for the technician.
- Avoid holding a single cow out on its own. Provide it with a couple of companions even if they are not to be inseminated.
- Move the animals back into the yards for inseminating with the minimum degree of pressure.
- Don't force the cows with farm bikes or dogs.
- Load up the inseminating race for the technician without use of polythene pipe and noise. Remember, the inseminating race may not be familiar territory to the cows; or they may associate the race with 'adverse' experiences, such as vaccinating, vet visits or lameness or pregnancy testing.

Cows can tolerate some stress without affecting their chances of conception. Just being in heat and riding other cows as well as reducing grazing time and pasture intake will be somewhat stressful. But following the principles of 'good management practice' will always eliminate unnecessary stress.

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Bull management

Bull management

Good bull management means running adequate numbers of healthy, fertile, well-grown bulls with the herd; reducing the stresses caused by high temperatures, over-working or dominant animals; and handling bulls to minimise the risk of injury to people and animals.

Growing bulls

For information on expected mature weights of different bulls, refer to breed websites, or seek experienced advice.

By the time a bull reaches 14–15 months, he should have achieved 50% of his mature weight. This should increase to 85% by 2 years of age.

If rearing your own bulls, growing them to the recommended targets is the best way to ensure their future performance. If purchasing or leasing bulls, request virgin bulls whenever possible as they are less likely to introduce venereal diseases to the herd.

Bulls can carry and spread several types of venereal disease that cause infertility and occasional abortions in cattle. Work with your veterinarian to decide what are the appropriate tests to perform on any incoming bulls.

To maintain health of bulls and all other animals, ensure that bulls receive the same vaccination programme as the heifers and cows. In addition, develop a drenching programme with your vet.

Bulls need to be kept in good body condition, particularly in the 3 months prior to their Mating Start Date. Several weeks before the bulls will be used, make any required diet changes to ensure bulls are not too fat or too thin. They should be in body condition score 4.5 to 5.5.

Can we skimp on feed for the bulls if we're short on grass through autumn?

No. Sexual maturation in bulls is a continuous process starting from before birth. There is particularly rapid testicular growth between 7 and 10 months of age. Underfeeding at this time significantly reduces testicular growth with a delay in the onset of puberty. Underfeeding in older bulls will reduce their stamina.

- **Don't forget to vaccinate and drench the bulls.**
- **Reduce fighting by grouping bulls well before mating.**
- **Body condition score bulls well before mating to give you time to make diet changes.**

Selecting the best bulls to use

When choosing bulls to use, you must consider their age, size, health and the breed-related risk of assisted calvings. Before selecting bulls, review your herd records to assess the risks experienced in previous seasons, using the InCalf Bull Management Tool.

- Select bulls from a bull rearer or leasing service with a reputation of growing and delivering healthy bulls. If in a Thieleria infected area, preferably avoid sourcing bulls from a non-infected area.
- Older bulls can be temperamental, difficult to manage and are more likely to have injuries to the penis, back or legs. Use bulls that are no more than 3 years old.
- Choose virgin bulls whenever possible as they are less likely to introduce venereal diseases to the herd; but avoid using bulls that are less than 15 months old. If using non-virgin bulls, discuss testing for the venereal diseases, Trichomoniasis and Campylobacter with your vet.
- Use bulls that are likely to minimise the number of calvings requiring assistance, especially with the heifers.
- Insist on bulls certified free of TB, BVD, IBR and EBL, and blood test negative for Johne's Disease. If unsure about Johne's, discuss with your vet.
- Insist on bulls certified fully vaccinated for leptospirosis and BVD. They must have been vaccinated twice initially, 4 weeks apart and then boosted with a single shot annually for each of these diseases.
- Select bulls ideally from the same mob. This will reduce fighting when they are with the herd. Otherwise the bulls need to arrive earlier to establish their social order well before Mating Start Date.
- Exclude fully horned bulls and those with deformed feet.
- Select bulls of similar size to the cows or heifers to be mated. If bulls are substantially heavier than the cows or heifers (e.g. >100kg heavier) then injuries to both bulls and cows are more likely. Observe bulls serving tall cows; ensure they are able to serve correctly. Also observe larger bulls serving cows. If the cows collapse under the weight, find lighter bulls.

Make calving easier by avoiding bulls whose calves required assistance in previous years, as well as bulls with prominent shoulder blades.

Bull breeds and risk of assisted calving.

Low risk of assisted calvings
Jersey
Medium risk of assisted calvings
Holstein-Friesian
Murray Grey
Angus
Hereford
Poll Hereford
Red Poll
High risk of assisted calvings
Limousin
Charolais
Simmental
Belgian Blue

> **Select bulls of similar size to the cows or heifers to be mated.**

> **Source beef bulls from a reputable breeder selecting for low birthweight calves and calving ease.**

Preparing bulls for work

Bulls under 15 months of age are too young to be used because libido and fertility are lower in very young bulls.

Watch out for bulls born in late August being used with yearlings in September-October at only 13-14 months old.

Good bull management requires planning to ensure bulls are well adjusted to their environment prior to mating. Move bulls to your farm 2–3 months before they are required for work. Buy bulls from the same mobs and split them into two teams for a rotational bull mating policy ('half resting, half working'). This will reduce fighting. Once the teams are established try to avoid swapping bulls between teams.

When the bulls arrive on farm:

- check for any injuries that may have occurred during transport;
- quarantine for 10 days and observe for any disease or walking defects;
- trim hooves if necessary; and
- walk among them observing for any individuals showing aggression or 'stalking' behaviour, especially Jersey bulls – they may not be suitable to run with the milking herd.

Arrange for a veterinary examination of all bulls at least a month before you wish to put them with the herd. This can reduce the risk of reduced reproductive performance due to poor bull performance. Several types of examination are possible ranging from a simple physical exam, to a serving ability test, or a full assessment of semen quality. Discuss the options with your vet.

Sometimes bulls can be really hard to handle on the farm. What do you do to make handling safer 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.

Get rid of overly aggressive bulls; bulls that become obstructive and block the herd's progress from the paddock to the dairy shed; or bulls that show stalking behaviour towards farm staff. Aggressive bulls will spend time fighting with other bulls, especially when they are running with the herd. They can injure other bulls, cows, people, as well as themselves.

Tasks like fitting a chinball harness or trimming feet will require special care facilities to protect bulls and people.

The last thing you want is an injury that could have been prevented!

Managing working bulls

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 bulls running with the herd at all times.
- Avoid using overly aggressive, dominant bulls.
- Swap bull teams in the milking herd throughout the bull mating period, daily if possible. This will help maintain sexual interest.
- Do not allow bulls to enter the concrete milking yard with the milking herd as concrete can cause excessive hoof wear and lameness. To further reduce the risk of bull lameness and injury to bulls, cows and farm staff – train bulls to remain in the paddock when cows are brought to milkings. Identify bulls with reflective tape or some other means for easy location of bulls in the dark. It usually takes just 2-3 days to train bulls to hang back and let the cows go down the race.
- In larger herds, there may be too many bulls hiding among too many cows to draft out in the paddock or race. The only alternative is to draft at the dairy shed. In this case, allow for extra bulls to replace those who go lame or stop cows moving on the race.
- If applicable, ensure bulls do not gain access to, and consume excessive amounts of, concentrate rations. This can disrupt rumen function, causing sickness and reduced fertility.
- Monitor bulls for lameness each day. Remove lame bulls immediately and replace with healthy bulls.
- Regularly observe bulls serving to ensure they are serving correctly. Immediately remove bulls that are unable to serve properly and replace them with more capable bulls.

The optimum temperature for sperm production in the testes is 33–36°C (3–6°C below body temperature). Higher temperatures caused by fever or heat stress affect sperm production and increase the number of abnormal sperm. Even slight increases in temperature (1–2°C) can cause major disturbances in semen production. Sperm production takes 2 months; once a bull recovers from fever or sickness, it can be 2 months before normal fertility is regained.

Watch out for signs of a broken penis, a penile haematoma, low libido and hip or back injuries.

These conditions will not prevent bulls being interested and detecting cows on heat. But they will prevent affected bulls getting cows pregnant.

If dominant bulls are affected, they will also prevent other bulls in the mob mounting.

> **Ensure there are at least two sexually active bulls running with the herd or mob at all times.**

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Bull management
129-138

Assessing bull performance

Bull performance is difficult to measure directly so begin by assessing 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.

Bull mating of yearling heifers

To check bull performance in heifers, start by assessing how quickly the yearling heifers became pregnant after the bulls were introduced. Consider using pregnancy testing 11-14 weeks after Mating Start Date for the yearling heifers. Use these results to calculate the percentage of yearling heifers that became pregnant in the first 3 and 6 weeks of mating.

72% of yearling heifers conceive in the first 3 weeks of mating, and 87% conceive in the first 6 weeks, when managed by top farmers.

If less than 62% of yearling heifers conceive in the first 3 weeks of mating or less than 81% in the first 6 weeks, review:

– calf and heifer management; and

– bull management.

FF

Calving pattern of first calvers is reported against target on the Fertility Focus report. If the yearlings Mating Start Date is 1 or 2 weeks ahead of the herd, the "aim above" targets need to be referred to the table on page 51.

> **Observe bulls for mating activity and ensure the bulls are actually serving the heifers!**

> **70% of these yearling heifers were confirmed in calf 21 days after mating started. The yearling bulls were run at 1 bull to 20 heifers, with a few bulls in reserve.**

I'm confused. Were 3 yearling bulls not enough? The heifer calving pattern was a disaster. For 90 heifers we ran 3 yearling bulls for 9 weeks, a ratio of 1:30.

Bulls are typically run with yearling heifers on an all-in basis, with no support team used to provide rest and rotation.

You really needed a 1:20 bull to heifer ratio. Divide 90 heifers by 20 = 4.5 bulls, which must round up to 5 bulls required.

Bull mating in the herd

In many herds, the period following the first 6 weeks of mating reflects the bull mating period. Herd reproductive performance during this time is an indicator of bull performance. By assessing performance at this time, you may be alerted that changes to bull management may be required.

- Obtain the 6-week in-calf rate and the not-in-calf rate for your herd.
- Identify the total weeks of mating (AB period plus bull mating period).
- Look up the expected not-in-calf rate for your herd using the table below.
- If the actual not-in-calf rate for your herd is higher than expected, this indicates that herd reproductive performance after week 6 of mating was unexpectedly low. If bulls were running with the herd for most of this time, poor bull performance is one possible cause.

Expected not-in-calf rate (%), given 6-week in-calf rate and length of mating.

6-week in-calf rate	Total weeks of mating (AB period plus bull mating period)			
	9	10	11	12
50%	34%	30%	27%	24%
55%	30%	26%	24%	23%
60%	26%	23%	21%	19%
65%	22%	19%	17%	16%
70%	19%	17%	15%	14%
75%	17%	15%	13%	12%
80%	13%	12%	11%	10%

If I use my 6-week in-calf rate of 75% and look up my mating period, 6 weeks of AB and 5 weeks of bulls, I should expect 13% empty. But our not-in-calf rate was 15% on our detailed Fertility Focus report.

We'd better check our bull team as it doesn't look like they were up to it and we don't want a repeat performance next mating!

FF

The detailed InCalf Fertility Focus report calculates your herd's 'Performance after week 6' and compares the herds not-in-calf rate with expected values as in the table. This indicates the success of your herd's mating programme after the first six weeks. If bulls were used after week 6 of mating, this gives an assessment of how well they got cows in calf. Also review the '% of herd in calf graph' on the detailed Fertility Focus report. What happens to the slope of the line when the bulls enter the herd?

Using sufficient bull power

Knowing that enough bulls are available when cows are likely to be on heat is important in ensuring good reproductive performance. The number of bulls required will depend on the number of cows or yearling heifers likely to come on heat during the period the bulls are with the group.

Bull power for yearling heifers

Run 1 yearling bull per 20 yearling heifers at all times to cover the poorer performance of yearling bulls. Ensure there are always at least two sexually active bulls running with each mob throughout the mating period.

Bulls are typically run with yearling heifers on an all-in basis. You may want a few extra bulls around in case any need to be replaced. With these and 'rounding up' the bull numbers, the ratio will be about 1 bull to 15-20 heifers.

Managing return heats after a synchrony treatment

Remember, if you are using heat synchrony, and returns will occur when bulls are running, you need to estimate the minimum number of bulls running with the yearling heifers during this period (using one bull per 10 non-pregnant heifers). Alternatively, recommence heat detection and AB for 3 or 4 days, starting 19 days after the previously synchronised inseminations (Appendix 6, page 180).

Bull power for the herd

Minimum number of bulls required to run with the herd or mob at any one time, with a minimum of 2 bulls per mob at all times.

No. cows in the herd or mob	Likely % of herd pregnant at start of bull mating					
	30%	40%	50%	60%	70%	80%
100	3	2	2	2	2	2
200	5	4	4	3	2	2
300	7	6	5	4	3	2
400	10	8	7	6	4	3
500	12	10	9	7	5	4
600	14	12	10	8	6	4

FF

Use the graph on last year's detailed Fertility Focus report to estimate the percentage of the herd pregnant at start of bull mating, and then refer to the table to calculate the minimum number of bulls required at any one time.

It is assumed for a full bull rotation policy during mating, that the total number of bulls required is double the numbers in the table above.

Ensuring sufficient bull power in the herd

When bulls are run with the herd after AB, at least one bull is required at any one time for every 30 cows still not in calf. But at the end of AB you do not know how many cows are already in calf, and how many will return.

- Using your herd size, check the table to estimate the number of bulls required.
- If you are unsure what percentage are pregnant at start of bull mating, consult with an adviser or estimate at a low percentage of 40-50%.

Multiple herds or mobs

If the herd is managed during mating in separate herds, estimate the bulls required for each herd at any one time.

- Always round-up numbers to the nearest bull.
- Never run fewer than two bulls with any herd or mob.

Bull rotation

You will also need additional bulls to allow for regular bull rotations during the mating period and to replace bulls that become inactive or unhealthy (e.g. lame).

- A 'half resting, half working' bull rotation policy will require **double the numbers of bulls** shown in the table.
- As mating progresses, fewer bulls will be needed as the number of non-pregnant cows decreases. If in doubt seek advice.

Using synchrony in the herd

Don't forget to at least **double the ratio of bulls** for the 6-day period when these cows are due back on heat (18-24 days after first synchronised insemination). Allow frequent rest periods by rotating bull teams in and out at least every 24 hours during this period.

If you suspect that bull numbers will be insufficient, consider doing heat detection and AB for 3-4 days starting 19 days after the previously synchronised inseminations.

When bulls are running with the herd, keep track of cows on heat.

- This can provide early warning of poor herd reproductive performance, and helps determine which cows may be empty and when cows became pregnant.
- Record in the database all dates of cows observed on heat whenever possible. This is essential if you do not use pregnancy testing or if you choose a pregnancy testing option that relies on heat detection to identify when cows became pregnant.

The InCalf Bull Management Risk Assessment Tool may be useful in helping identify areas of bull management that may increase your risk of reduced herd reproductive performance.

Speak to experienced farmers about managing and rotating larger bull teams (more than 5 or 6 bulls in the herd at any one time).

We find recording heats during the natural mating period is incomplete and inaccurate. It may be far better to do whole herd early-aged pregnancy testing.

Section 4

Pulling it all together

16

The big picture

When you are faced with a complex issue, such as herd reproductive performance, you quickly realise that the solution doesn't come in a single package – often many actions are needed to meet your targets.

To ensure success, these actions need to be part of the overall farm management. This takes into account factors such as the farm's pasture and livestock resources, human resources, farm finances and business objectives.

The first question to ask is, "What is the best date for my herd's Mating Start Date (MSD)?". This will govern when you start your AB programme and will also influence when you decide to stop mating. Given your MSD, how fertile is the herd in terms of the ingredients of the herd fertility cake (pages 36 and 145), especially the first five areas that contribute directly to a high pre-mating cycling rate?

Measuring reproductive performance without the critical information leaves you open to surprises. A planned pregnancy testing programme will give you the information you require to accurately measure current performance and plan ahead.

What cows do you want to cull to meet farm objectives? How many cows are you forced to cull because they are empty? Improved reproductive performance gives you the choice to cull based on your farm's objectives.

The final step is to pull it all together in a reproductive management plan. A reproductive management plan identifies the targets, your preferred strategies and a schedule of routine tasks to be completed. The plan addresses animals at all stages of the 'fertility for life' cycle (Chapter 1).

To help you develop your own reproductive management plan, *The InCalf Book* provides a framework as a starting point for improving your herd's reproductive performance.

Herd reproduction and dairy farm systems

Dairy farmers understand the importance of a good calving pattern. It drives the efficient utilisation of pasture growth for profitable milksolids production. A good calving pattern is also important to achieving good herd reproductive performance.

This is a circular 'chicken and egg' situation where reproductive performance and calving pattern interact around the fertility cycle.

> ***The key to success is often doing things at the right time.***

Reproduction management is an ongoing series of tasks embedded within the farm system, that is going on all year-round, not just at mating. It is helpful to break the year into four phases; Calving, Mating, Mid-late lactation and the Dry Period.

Aims and action plans can be developed within each phase to address performance gaps and risks associated with each ingredient of the herd fertility 'cake'.

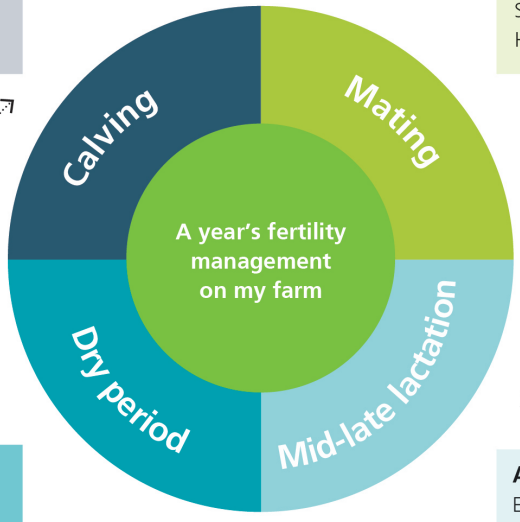
Mid-late lactation is a good time to take the first Steps 1 and 2 of your continuous improvement programme once final pregnancy test results are available.

With the latest Detailed Fertility Focus report and adviser support you can reassess your herd's reproductive performance to identify opportunities for improvement and create real benefits in future.

The four phases of the fertility cycle and management aims for each phase

Aims:
Cow health problems under control.
Transition managed well.
Spring rotation planner in place.

Aims:
Pre-mating cycling on track.
Submission rate on target.
Heifer weights on target for mating.



Aims:
Plans for calving pattern in place.
BCS at calving on track to targets.
Heifer weights on target for calving.

Aims:
Early-aged pregnancy test completed.
Herd nutrition and BCS on track.
Desired plan for dry period in place.

17

Maximising pre-mating cycling

Non-cyclers reduce herd reproductive performance

Cows cycling normally at the start of mating are much more fertile than non-cycling cows.
Cycling cows have a 6-week in-calf rate 16% higher than non-cycling cows (treated or untreated). And the not-in-calf rate for cycling cows is typically 6% lower than for non-cycling cows.
So too many non-cyclers in the herd can have a large effect on overall herd reproductive performance.
(NZ Monitoring Fertility Report)

Too many non-cyclers will prevent you achieving your target 6-week in-calf rate. This is because too many non-cyclers depress both of the two key drivers of 6-week in-calf rate:

- 3-week submission rate; and
- conception rate to first insemination.

Both of these drivers are important, but the 3-week submission rate has a bigger impact because it is more readily influenced by your management during that first 3 weeks of the AB programme.

Of course, good heat detection is essential to reach the submission target of 90% or more. The cows not inseminated in the first 3 weeks in a herd with good heat detection rates will mostly be 'non-cyclers'.

There are two types of non-cyclers:

1. Cows that have ovulated (ie. ovaries are 'cycling') but not shown any visible signs of heat.
2. Cows that have not even started ovulating since calving, and cannot have a heat – a true non-cycler.

Those in the first type may have had a 'silent' heat. About 70–80% of cows will not have a visible heat at the first ovulation after calving.

The cows in the second type are technically described as non-cycling or 'anoestrus'. It is the most common form of infertility in New Zealand herds.

A veterinary examination can distinguish cows in each category. However, the current practice is not necessarily to palpate these cows. The recommendation is that both types of non-cyclers will benefit from receiving the standard form of treatment. For this reason non-cyclers are often described as NVOs, having had 'no visible oestrus'. (See Appendix 5).

"We have great heat detection, so why do we get 3-week submission rates of only 75%?"

Having good heat detection skills and a strong desire to not miss any heats is crucial to getting cows back in calf quickly, but this only applies to cows that are cycling. Too many non-cyclers will reduce both submission and conception rates no matter how good your heat detection skills are.

Non-cycling is the most common form of infertility in New Zealand herds.

Assessing pre-mating cycling

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

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

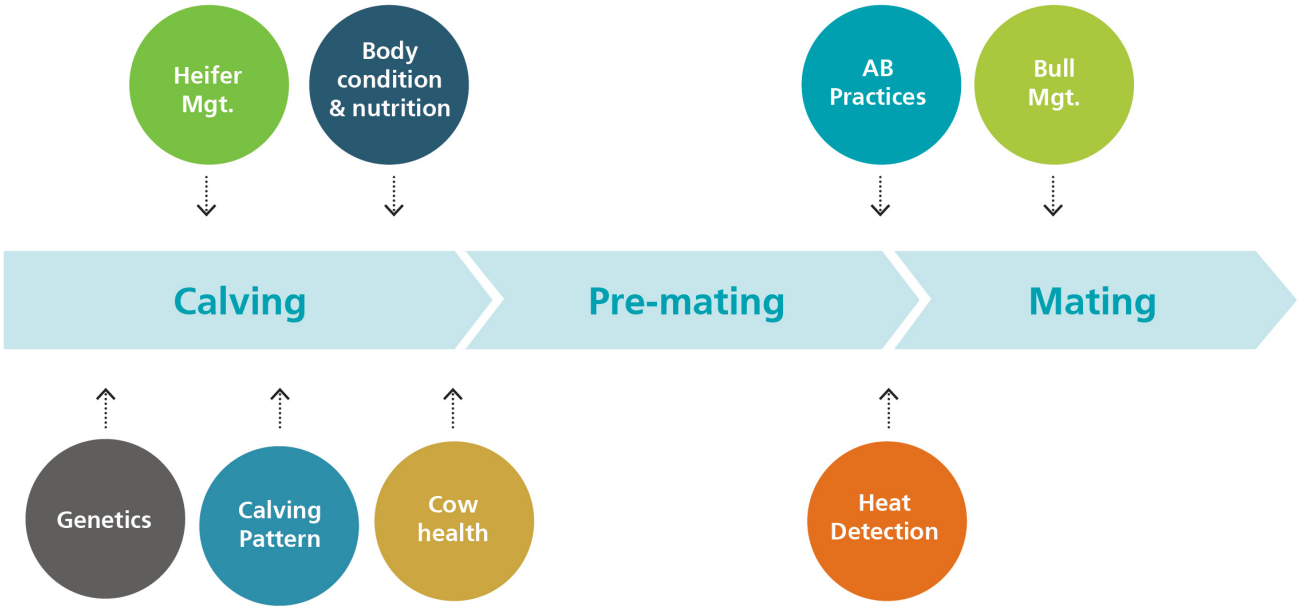
Top farmers have 75% of all cows recording at least one pre-mating heat 10 days before MSD, and 85% of all cows recording at least one pre-mating heat before MSD.

If less than 65% of the herd have cycled 10 days before MSD, you have too many non-cyclers or your pre-mating heat detection has not been effective.

Whatever the cause of this situation it will lead to reduced reproductive performance. Hormonal intervention may be warranted.

Speak to your InCalf trained adviser about the likely causes amongst the key management areas illustrated below and what options can limit the negative impact on this and next season's mating.

All ingredients of the InCalf herd fertility cake (below) contribute directly or indirectly to pre-mating cycling, and a high 6-week in-calf rate.



Post-calving recovery

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

The first visible post-calving heat in a healthy cow that has had an uncomplicated calving will normally occur within 6 weeks. A second genuine heat may follow it 8 to 12 days later in about 20–30% 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 must start again. Not surprisingly, the prevalence of non-cycling cows is affected by calving pattern relative to Mating Start Date.

The NZ National Herd Fertility Study found most farmers ranked non-cycling cows as the highest perceived constraint to reproductive performance.

The good news is that proactive management of the herd can improve the fertility of cows well ahead of mating so that genuine non-cycling is less prevalent. This is achieved through better year-round management of all key management areas covered in this book.

It's incredible what a cow needs to do between calving and getting back in-calf

A cow has only 12 weeks after calving to get back in-calf, if she is to calve at the same time next year.

The uterus must first recover through a process called uterine involution. This generally takes 4 weeks provided there is no infection present. Meanwhile, 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 eventually normalises to cycles of 18-24 days with strong signs of heat. Cows are more fertile on their 3rd and 4th heats than their 1st or 2nd heats. Cows that calve in the first 4 weeks and start having strong heats 5 weeks after calving, will be fertile for the first round of AB.

Manage cows to transition well through calving and be fertile again for the first 3 weeks of mating.

Factors causing a non-cycling problem

As well as calving pattern, other risk factors (Section 3) that affect the number of non-cyclers in a herd include:

- Poor heifer rearing, especially in Friesian heifers – under-weight heifers have a longer post-calving interval to first heat and at least a 10% lower 3-week submission rate unless treated.
- Young cows – more first-calving heifers are treated as non-cyclers compared to mature cows. First calvers need an extra 10 days to start cycling. You can ease this problem by mating the yearling heifers a week or two before AB starts in the milking herd.
- Breed – more Friesians, especially Friesian heifers are treated as non-cyclers compared to crossbred or Jersey cows.
- Body condition score – calving condition score, condition loss from calving to mating, and condition score when mating starts all affect the incidence of non-cycling. Thin cows take longer to start cycling and have 3-week submission rates that are around 10% lower than cows (or heifers) that calve at the recommended body condition score of 5.0 (or 5.5 for first and second calvers). Older cows with a calving condition score above 5.0 derive minimal benefit from their greater body reserves.
- Abnormal calving and uterine infections (endometritis) – cows with assisted calvings, twins and uterine infections are more likely to be identified as non-cyclers.

High levels of milk production do not increase the numbers of non-cyclers at start of mating. Rather, high-producing cows start cycling sooner in better-fed, higher-producing herds.

First calvers losing excess condition score may warrant separation from the herd and preferential treatment, including once-a day milking. However, this needs to be done well before mating starts. By the time non-cycling is diagnosed, it is too late to intervene other than by hormonal treatment.

Since 2014, mating length has reduced to an average of 11 weeks, almost eliminating very late calving cows. The challenge is to increase 6-week in-calf rate and with that reduce not-in-calf rate for that length of mating, through addressing the root cause of reproductive performance issues that we see as non-cycling problems.

Are those better milkers going to be non-cyclers?

Cows producing well are less likely to be non-cyclers. InCalf and NZ research have shown that there is no negative link between milk production and the fertility of cows within dairy herds.

The better milkers and better milking herds tend to have the best reproductive performance!

The InCalf Non-cycling Tool will help you identify your risks and likely benefits of having fewer non-cyclers. This tool complements the InCalf Heat Detection tool which also considers non-cycling effects on heat detection efficiency.
The conditions on farm that result in too many non-cyclers in the herd, also increase the risk of missed heats.

Pre-mating heat detection to find the non-cyclers

The way to identify non-cycling cows is to do pre-mating heat detection. Use tail paint or heat mount detectors to pick out the cycling cows. Every cow in the herd should be tail painted initially with a common colour; say green. As cows cycle and lose their tail paint, repaint them with a second colour; say red. By 2 weeks after applying tail paint, about half the cycling cows will have been identified. At 3 weeks, those cows still with the original paint colour will be the non-cyclers. You can draft them out for the herd veterinarian and treat appropriately (see Appendix 5).

- **Option 1:** Every cow in the herd will need to be tail painted 4–5 weeks before MSD. This will allow non-cyclers to be identified, treated and inseminated within the first few days of the AB programme. This is because it takes at least 3 weeks to find the non-cyclers and another 9 to 10 days from veterinary treatment to first insemination.
- **Option 2:** If tail paint is first applied 21 days before MSD, then the non-cyclers will be identified, examined and treatment started co-incidentally with AB start date. Most of the treated non-cyclers on this regime will be inseminated from 9 to 12 days later (during the second week of the AB programme).
- **Option 3:** Apply tail paint on the day before the first day of AB mating. This may seem to be the most convenient option but it does mean the non-cyclers will not be identified until the end of the third week of the AB programme. Delaying identification and treatment will mean that most of them will be inseminated during the fifth week of mating. Consider extending AB into week 5, to cover the large number of synchronised heats expected, rather than bulls.

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The InCalf Fertility Focus report can tell you what proportion of your herd was cycling before the start of mating. Make sure your pre-mating heats are entered into your electronic herd record system.

Once you know how many non-cyclers you have, decide on a plan of action. Knowing who the non-cyclers are helps understand the underlying cause.
Treatment economics favour timing of Option 1 over Options 2 and 3. Also select the best candidates (e.g. young cows).
Early treatment will increase 3-week in-calf rate giving more days in milk next season.
More aggressive steps may also be warranted to deal with farm systems imbalances of feed supply and demand for next season.

Whichever option you use, give your AB technician at least a week's notice of the increased semen demand from the group of non-cyclers coming into synchronised heats on the same day.

No matter which date is selected for initial tail painting, the paint strips should be checked and touched up at least every 3 to 4 days during the pre-mating period. Repaint cows that have clearly been ridden with a second colour. If a cow has not been ridden, you may still need to touch up the paint strip with the original colour because of weathering and hair shedding.

Make good use of heat detection aids to identify non-cyclers. Regularly repaint cows that have cycled with a different colour.

Since 2014, mating length has reduced to an average of 11 weeks, almost eliminating very late calving cows. The challenge is to increase 6-week in-calf rate and with that reduce not-in-calf rate for that length of mating, through addressing the root cause of reproductive performance issues.

Treating non-cycling cows

The InCalf Fertility Focus report can tell you what proportion of your herd was treated for non-cycling and when these treatments were applied. Make sure your non-cycling treatment events are entered into your electronic herd record system.

If once-a-day milking (OAD) is used proactively (at least 6 weeks before mating) and cow energy balance improves, reproductive benefits are likely. Be aware there will be a reduction in milk production.
Many herds are routinely managed split by age and body condition, allowing proactive use of OAD in early lactation, with at least a part of the herd.
If OAD is delayed closer to Mating Start Date, the size of the problem may become clearer. But little time remains for OAD to benefit reproduction, especially if multiple issues are involved.

Treatment programmes change as new technology is developed and external factors influence what veterinary products are available. Refer to Appendix 5 for current recommendations, but always consult with your veterinarian for latest advice.

The costs of treating non-cycling cows is incurred in one season and the benefits flow the following season. These benefits are treated non-cyclers calve earlier than if treatment had been delayed or not implemented at all. Earlier calving means more AB calves, a longer lactation with higher production and more days from calving to mating.

Non-cyclers are a less-fertile group of cows and treatment only goes part way to restoring them to 'full-fertility'. Treating non-cyclers is a short-term solution of necessity in many cases.

New Zealand research shows that early treatment of non-cyclers:

- increases their 3-week submission rate; and
- helps these cows get back in-calf quicker.

This will contribute to a higher herd 3-week in-calf rate, but not necessarily a higher 6-week in-calf rate.

You're best to minimise non-cycling from the outset by addressing the multiple factors that cause cows to be non-cyclers.

"Should I treat those non-cyclers, or hope they sort themselves out?"

As a rule of thumb, about 45-65% of cows identified with 'no visible oestrus' (NVO) before mating starts will if left untreated, begin cycling by themselves and be mated within the first 3 weeks. Their chance of conceiving to this mating will be about 45%, since it is their first heat after calving. Of greater concern is the other 35–55% of non-cyclers that will not be inseminated in the first 3 weeks of mating.

Identifying and treating non-cyclers early is the most effective way to ensuring non-cyclers receive their first insemination within the first few days of the AB period, and return heats in the 4th week of mating are more fertile than otherwise.

Treating non-cyclers early is the most effective way to immediately alleviate a non-cycling problem."

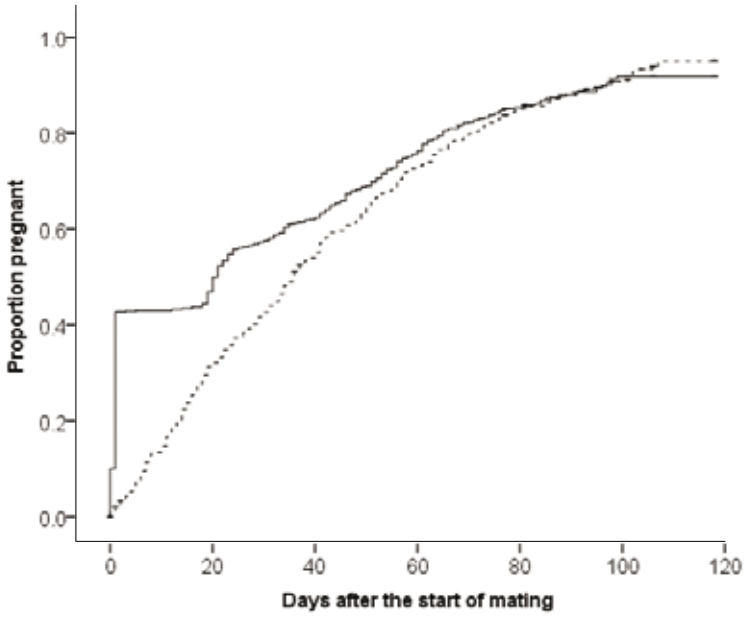
When reviewing your herd's reproductive performance, list the non-cyclers and check their records individually to determine why they became non-cyclers and why they needed to be treated.

What were the underlying reasons for these cows being non-cyclers?

If you don't consider this question and address the underlying causes, non-cyclers will continue to impact on your herd's reproductive performance.

Some software packages can now report on the reproductive outcomes of treated groups of non-cycling cows. Review outcomes along with other measures such as body condition score to understand what is going on in an individual herd.

The NZ National Herd Fertility Study found that about 45% of the herds treated some 20% of their cows as non-cyclers. Most started these treatments early, before Mating Start Date. Others waited until after mating had started.
The upside to delaying treatment is that there will be fewer non-cyclers needing treatment. The downside of delaying treatment is that it is increasingly less effective and less economic.



The graph shows the typical response curve of early treated non-cycling cows (solid line) vs untreated non-cycling cows (dashed line).

Is it normal to be treating 25% of our cows for non-cycling every year?

There will always be some non-cycling cows in the herd; no matter how tight your calving pattern is or how good condition score was at calving. The prevalence of non-cyclers may vary between seasons, depending on climatic conditions.

Herds that achieve industry targets for reproductive performance have fewer than 25% of cows not showing visible heat 10 days before Mating Start Date. Choosing to treat more than 15% of the herd each year for non-cycling indicates an underlying problem that needs to be addressed.

Making sure heifers reach target liveweights, improving body condition and nutrition, implementing an effective heat detection programme, and attending to any cow health issues, are all important activities for minimising the number of non-cyclers.

Having to treat too many non-cyclers each year indicates an underlying management problem that should be addressed!

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Choosing a pregnancy testing strategy

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

- accurately measure the 6-week in-calf rate to assess overall herd reproductive performance;
- confidently cull cows as empty, at the right time;
- confidently dry-off cows at your preferred time before their due-to-calve date;
- differentiate AB from natural mating pregnancies;
- identify cows due to calve late;
- more accurately select cows that are close to calving;
- provide due-to-calve dates if selling cows;
- plan feed and labour management right through the dry-period, to next calving and mating; and
- refine your dry cow treatment (DCT) decisions with the vet.

Early-aged pregnancy testing helps ensure individual cows are dried off at the right time, based on age, body condition score and accurate due-to-calve dates. This enables dried off cows to be better allocated to dry cow mobs for wintering. This results in accurate feed allocation, especially on crop, and easier management and observation of springing cows through the calving transition.

Each farm needs a strategy to identify and record which cows are pregnant and when they conceived. Several strategies are available.

The best strategy for your herd will depend on what information you require from pregnancy testing.

Pregnancy testing 5 weeks after the bull removal date allows for accurate estimates of natural bull pregnancy dates.

Pregnancy testing at an early stage (11-14 weeks after Mating Start Date) allows accurate identification of conception dates to the first 6-9 weeks of mating.

Rectal pregnancy testing using ultrasound.

Pregnancy testing methods

The main methods used for determining the pregnancy status of cows are rectal examination using a hand or ultrasound probe. Other methods exist such as milk or blood pregnancy testing.

Pregnancy status can be recorded aged in days or weeks for manual or ultrasound testing, while all methods can be used to record non-aged results.

Early-aged rectal pregnancy testing by a skilled operator is the most accurate method to identify cows that are 5 weeks pregnant or more. If tested between 5 and 14 weeks of pregnancy it gives a good estimate of when cows conceived.

Alternatively pregnancy status may be estimated using continuous heat detection.

Some cows confirmed pregnant by pregnancy testing may fail to calve. This is most likely to be due to pregnancy loss (abortion) occurring after the pregnancy testing has been done. When the loss rate is higher than normal, a specific reason for abortion (e.g. neospora or BVD) should be investigated to prevent a recurrence.

Most pregnancy testing done in NZ dairy herds uses ultrasound rather than manual palpation. There are also blood and milk tests for pregnancy.

I reckon they're just guessing when they tell me how far pregnant the cow is.

Rectal pregnancy testing, between 5 and 14 weeks of pregnancy, is the best way of getting reasonably accurate estimates of when cows will calve.

Skilled pregnancy testers estimate the age of the pregnancy by examining the cow's reproductive tract for the presence of:

- **fluid;**
- **fetal membranes;**
- **the fetus;**
- **round placental attachments (cotyledons); and**
- **enlarged arteries.**

Early in pregnancy, the feeling and appearance of these change quite quickly as pregnancy progresses. For example, a 7-week pregnancy feels different and looks different on an ultrasound scan to a 10-week pregnancy. This makes it easier for the operator to determine whether the last recorded insemination date is, in fact, the conception date, or whether the cow conceived to an earlier or later insemination.

In contrast, later in pregnancy the part of the reproductive tract that is examined changes much less. For example, a 24-week pregnancy cannot be distinguished from a 27-week pregnancy.

It is more difficult to estimate the age of the pregnancy in cows that are extremely fat (over body condition score 6).

Pregnancy testing within 14 weeks of a mating date is pretty accurate.

How should I use my pregnancy test list with the vet/technician?

When using rectal pregnancy testing, the vet/technician should provide an estimate of the number of days (or weeks) pregnant each cow is.

You should compare this estimate with the figure on your pregnancy test worksheet or computer, which shows the number of days (or weeks) since each recorded mating.

If there is a discrepancy, discuss it with the vet/technician and agree on the likely age of the pregnancy before proceeding to the next cow.

Pregnancy testing strategies

A pregnancy testing strategy involves testing certain groups of cows at particular times, using an appropriate method. Different strategies provide different amounts and quality of information. The keys to success for all pregnancy testing strategies include:

- discussing your information needs with the pregnancy tester and deciding the best date(s) to pregnancy test your herd;
- ensuring all cows are clearly identified and no two cows have the same identity number;
- a check of the facilities with the person performing the pregnancy testing before the appointment;
- a means of accurately recording the results at cow-side, including the estimated date of conception (and notes, e.g. misidentified cows); and
- accurate and up to date electronic mating records for all cows, ideally both AB and natural matings.

You also need:

- A list of all cows to be tested, including the number of days (or weeks) since each cow's last recorded mating (previous mating dates can also be handy). Remember that pregnancies less than 5 weeks (35 days) old cannot be reliably confirmed.
- Use a pregnancy test worksheet (paper or digital) for your cows, available from your herd improvement organisation or vet/technician.

An example of a pregnancy test work sheet with the number of days pregnant recorded.

Pregnancy Test Worksheet

Date: 20/12/16

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

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The Fertility Focus report can add a lot of value to your pregnancy testing strategy by reporting your herd's actual 6-week in-calf rate and not-in-calf rate. Make sure your pregnancy test results, including age of pregnancies, are entered into your electronic herd recording system.

Early-aged rectal pregnancy testing

This is the most accurate way to determine which cows are pregnant and when they conceived. It involves testing and recording aged pregnancies for groups of cows both during and after the end of mating.

- Test all cows at 11–14 weeks after Mating Start Date.
- Re-test cows that have not been confirmed pregnant, at least 5 weeks after the end of the mating period, and no more than 10 weeks after the first test.
- Also re-test cows previously diagnosed as pregnant but that you suspect may have aborted.
- Use the look-up chart in Appendix 4 for help with the dates.

You may wish to pregnancy test earlier to make final total mating length decisions depending on how the early mating period has gone.

Rectal pregnancy testing once only after the end of mating

All cows in a mating programme of 9–10 weeks are pregnancy tested once, 5–6 weeks after the end of the mating programme. This strategy identifies empty cows accurately, and can also differentiate between those that became pregnant during the first 6 weeks of mating.

A single pregnancy test 5–8 weeks after the end of a mating programme of 11 or more weeks will be too late if you want to know precisely when cows got pregnant to early AB mating dates. You'll need to get the early test done as well to get this information.

Rectal pregnancy testing of selected cows

Cows suspected to be empty or to have aborted are pregnancy tested 5–8 weeks after the end of mating. Other cows are assumed to have conceived at their last recorded insemination or bull mating. This strategy is less accurate as it relies on continuous and accurate heat detection. If you need to accurately identify which cows conceived during the AB period, you should adopt an early-aged pregnancy testing strategy as described above.

Which cows to test:

- Cows seen on heat in the last 6 weeks of mating or after the end of the mating period.
- Cows with any question marks on their AB dates.
- Cows that had vaginal discharges, membranes observed, or suspected of aborting during or after the mating period.
- Treated non-cycling cows with only one mating date.

I'd better get the calendar out!

We want to start calving on 17 July.

Our Mating Start Date is 8 October. We'll do 6 weeks of AB followed by 5 weeks of natural mating using bulls that are removed on 24 December, Christmas Eve.

If we want to use an early rectal pregnancy test strategy, my first pregnancy test according to the chart on page 175 will be as early as Christmas Eve! I guess that one will have to shift a few days later!

The second pregnancy test to pick up the empties should be done by 4 February. That would be 6 weeks after the bulls came out.

Using continuous heat detection to estimate pregnancy

Continuous heat detection can be used to estimate when cows become pregnant but it has limited accuracy. Cows seen on heat are assumed to be non-pregnant. Cows that are not observed to return to heat following service are assumed to have conceived at their last recorded AB date or bull mating.

Using heat detection to determine which cows are pregnant and when they conceived has shortcomings. The accuracy of the strategy depends entirely on whether all heats are accurately detected and recorded. This means you need a system of accurate and continuous heat detection in place. You will also be fooled by any pregnant cows that show heats (which does happen!), and cows that are not having heats even though they're empty.

Detecting heats in empty cows is difficult when most other cows in the herd are pregnant because there is less riding activity. Heat detection operator fatigue is also a risk.

Many herds find continual heat detection difficult and many cows will have heats that are missed or misdiagnosed. If this is the case in your herd, you will require a pregnancy testing strategy. In nearly every herd, a pregnancy testing strategy will be superior to relying on heat detection in determining which cows are pregnant and when they conceived.

We use continuous heat detection but pregnancy test the cows we are not sure of, and confirm the cows we suspect to be empty as well. Misdiagnosis is a costly mistake!

If you decide that heat detection is the appropriate option for your herd, you need to:

- ensure that all cows are clearly identified and that no two cows have the same identity number;
- plan a continuous and effective heat detection strategy (which has to run until at least 6 weeks after the end of mating);
- use heat detection aids continuously; and
- record all observed heats accurately.

Pregnancy testing strategies for heifers

Early identification of empty heifers allows prompt assessment of reproductive performance and quick action to be taken. The approach you take to determining the pregnancy status will depend on the information you require. If you choose not to pregnancy test heifers at all, you must be highly confident that their reproductive performance will be good and that you do not require their due calving dates.

1. Early rectal pregnancy testing

A strategy using early rectal pregnancy testing will accurately identify empty heifers, and also give the best estimate of the conception date and predicted calving date. Knowing when heifers are expected to calve can assist management at calving time.

> ***If we mate our heifers for only 9 weeks, we can get away with one pregnancy test 5 weeks after the bulls are removed."***

When to test heifers:

- Test all heifers at 11–14 weeks after mating begins; and if necessary
- Re-test heifers not detected pregnant at the first test, 5-8 weeks after the end of mating to confirm later calving and empty heifers.

Early rectal pregnancy testing also allows the reproductive performance of a group of heifers to be identified as soon as possible.

72% of heifers conceived in the first 3 weeks of mating, and 87% conceived in the first 6 weeks, when managed by top farmers.

If less than 62% of heifers conceive in the first 3 weeks of mating or less than 81% in the first 6 weeks, review:

- *calf and heifer management;*
- *bull management; and*
- *Insemination technique and heat detection if AB was used.*

2. Late rectal pregnancy testing

This strategy involves one pregnancy test of all heifers in a mating group, 5-8 weeks after the end of mating. It will accurately identify empty heifers, but may be too late to accurately identify conception dates or predicted calving dates, depending on the total length of mating.

Using pregnancy testing results

Now that you have your herd's pregnancy test results, you can put them to work.

- Use your software or submit your information to your herd improvement centre or your adviser to obtain an InCalf Fertility Focus report. Compare your herd's performance to what top herds achieve and use the methods described in Chapter 5 to obtain insights to areas where improvement is possible.
- Run an 'Expected calving' report or 'Due to calve' list.
- Plan your feeding strategy based on the expected calving pattern.
- Prepare a culling list.
- Look for patterns among empty cows.
  - Are they late calvers?
  - Were they treated as 'non-cyclers'?
  - Are they mainly first calvers?

The InCalf Calving Pattern Tool will enable you to estimate your herd's likely calving pattern for the upcoming calving period, compared to targets, and assess the benefits of closing this gap on herd performance.

How can I have two cows with the same due calving date but they calve two weeks apart?

Even where early-aged pregnancy testing is implemented, quite a few cows will calve more than a week earlier or later than their due date based on pregnancy test records.

There are several reasons for this:

1. **Cows will vary in the length of their pregnancy. On average the length of pregnancy is 282 days. Hormones released from the fetal calf trigger calving. Individual calves vary in the time at which they trigger the calving process. Generally, 95% of cows will calve within +/-9 days of their expected calving date, if gestation length is included in the prediction.**
2. **In some cows, even experienced pregnancy testers will select the wrong insemination date as the conception date. While early rectal pregnancy testing gives the best chance, it is not always possible to distinguish between two possible conception dates. Natural biological variation in pregnancies means that pregnancy testing cannot be exact in all cows. The wrong insemination date is more likely to be selected as the conception date where:**
   - **mating records are incomplete or inaccurate;**
   - **the cow had two inseminations or services less than 3 weeks apart;**
   - **bulls are running with the herd and service dates are not all recorded; or**
   - **cows are pregnancy tested when more than 14 weeks pregnant.**
3. **Cow identification and recording errors are common causes of cows not calving within a week of their due date.**

Calving wouldn't be normal without a few surprises!

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Making culling decisions

The number one reason for cows being culled in New Zealand is because they are not pregnant. Empty cows make up about half of the culling in most herds. Too many of them are young cows.

When deciding the fate of an empty cow, you have to weigh up her potential to produce milk and the negative effect she may have on future herd reproductive performance.

Good reproductive performance with a minimal number of empty cows gives you the choice to make profitable culling decisions.

Those empty cows just have bad fertility genes. Culling them will get rid of the problem. Right?

A cow's reproductive performance is determined both from genetic and non-genetic characteristics. Non-genetic characteristics include the way the cow is managed.

Genetics only makes a small contribution to whether a cow gets in calf on time. The biggest contribution comes from how she is managed, right from the day she's born.

Non-genetic characteristics can be temporary (such as a short period where the cow was lame) or fairly permanent. For example, if a cow aborted after eating macrocarpa branches and her reproductive tract then became infected, the result may be permanent damage.

Culling cows with poor reproductive performance can 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 management. Some empty cows may actually have genes for normal fertility, and others for poor fertility. So culling cows with poor reproductive performance will not change the herd's genetics for fertility very much.

Lastly, the dam is only half the story. Culling will also have only a small effect on the herd's genetics for fertility because the sire contributes half the genes. Selecting AB sires with a high fertility breeding value will have a stronger influence across the whole herd than culling particular cows with poor reproductive performance.

Don't be too quick to blame genetics – they're probably not the cause!

Assessing culling decisions

Culling strategies can affect your herd's reproductive performance. Empty cows are usually culled so it is unlikely that large numbers of consistently less fertile cows are retained in the herd.

However, a shortage of replacement heifers will sometimes mean that selected empty cows are carried over to the next season's AB programme; particularly when the value of in-calf cows is very high relative to their meat value.

To determine the impact of keeping less fertile cows in your herd, well-kept records are required. These records should reveal whether or not carryover cows keep having trouble getting back in calf; or if it may have been your fault, not theirs, that they were empty in the first place.

The decision to cull a cow must also take into account each cow's milk production ability and other economically important traits, as well as age. Timing of culling decisions will also be influenced by the overall farm situation, especially feed supply.

By improving herd reproductive performance, you can cull on the basis of profit, not pregnancy.

It is estimated that about 2.5% of cows calving in seasonal calving herds are cows carried over after missing one season's lactation.
In split calving herds there will be a number of cows not-in-calf after one mating period that are carried over to the next mating period. The Fertility Focus report for split calving herds considers the % of cows still not pregnant after two mating periods.

If a large number of cows currently in the herd have been carried over (having failed to get in calf in at least one previous mating period), then they may be reducing overall herd reproductive performance.

How much these cows reduce herd reproductive performance depends on the percentage in your herd that have been carried over after any previous mating period; and also whether the reason they were empty in the first place was their fault or yours.

Determine the percentage of cows in your herd carried over after any previous mating:

If less than 10%, carryover cows are unlikely to be having much effect on overall herd reproductive performance.

If we hadn't had so many empties, we could have got rid of more of those cows on our 'ideal' culling list. Life would have been much easier.

We thought we had plenty of replacement heifers so that we could get rid of our low PW cows and a few of the older cows that are really getting past it. But by the time we cull the empties, chronic mastitis and high cell count cows, there's no room left to make any further culling.

Achieving a 78% 6-week in-calf rate will reduce the not-in-calf rate and provide you with more culling choices.

Choosing cows to cull

Choosing cows to cull has to take into account more than their reproductive performance. The potential they have to remain in the herd and create additional profit has to be weighed against the costs of keeping them until their next calving.

Preparing a culling list

There are many reasons for culling cows from the herd. Consider and prioritise these reasons. Some of these will be 'must cull' reasons to you. Others will be 'would like to cull', but only if we can.

The task of preparing the culling list can be made easier using a computer-based programme available through your herd improvement organisation. Contact them for advice.

The first group of cows to go on the likely culling list are the empties. Also list the cows that you suspect may have aborted and will need to be checked by your vet.

You will have to take account of the following factors in making a decision to cull or keep empty cows:

- Production Worth (PW), somatic cell count and age.
- The health and reproductive history from last calving for each empty cow. Take into account obvious reasons, like poor health or lameness, as these may have been resolved.
- Are any of the empties carryover cows?
- Whether you are going to generate a profit from retaining empty cows for future breeding. How much will it cost you to keep her until her next calving?

The second candidates for the cull list are cows with persistently high somatic cell counts (SCC), or they have had several episodes of clinical mastitis. The following factors need to be taken into account in ranking these cows from most likely to least likely for culling:

1. Cows that have had two or more cases of clinical mastitis in a season are twice as likely to get clinical mastitis in the next season. Go to SmartSAMM guidelines at dairynz.co.nz/mastitis.
2. Cows with SCC greater than 150,000 at any herd test are twice as likely to get clinical mastitis in the next season.

So, consider culling cows that have had two or more cases of clinical mastitis, have had elevated SCC at multiple herd tests over multiple years and have previously been treated with dry cow therapy.

Next, consider culling low producers and cows due to calve late.

- If you have enough pregnant cows to cull on production, think about the due-to-calve date and age of low-producing cows.

- Base these decisions on Production Worth (PW) while taking into account the expected future life of the cow. The Lactation Worth (LW) is suited to culling decision involving older cows as it can show up those that are no longer as good as they used to be.
- Late calvers should be above average PW to compensate for the reduced income resulting from later calving.
- You may be able to sell cows due to calve late to other herds with later calving periods.

The final category in creating your herd's 'ideal' culling list is to add the cows that don't fit into your herd because they are:

- slow milkers;
- temperamental in the milk shed;
- 'stirrers' that bunt and upset other cows;
- cows with collapsed udders that are difficult to put the cups on;
- too big or small for the dairy shed set-up; and
- cows with health issues, e.g. chronic lameness.

Appendices

Down to details

A1 InCalf farmer training framework

The *InCalf Book for NZ Dairy Farmers* captures the knowledge that underpins herd reproduction in NZ seasonal dairy herds and the practices to achieve great performance.

Whatever your farming experience there is something in the InCalf Book for you. This book is a core resource for Primary ITO training, and for advisers supporting dairy farmers.

InCalf Farmer Action Group programme

This is no longer available but key learnings can be applied by farmers, their advisers, and on-farm teams in a less formal but semi-structured way. The training considers all four phases of the fertility management cycle and all eight ingredients of the herd fertility cake.

An adviser becomes the farm team's coach facilitating learning through real experience, encouraging the team to be proactive and self-managing learners through a cycle of Plan, Do and Review.

Review session (looking back)

Each phase of the fertility management cycle has a review component, looking back at what we experienced and learnt in the last few months. What worked well, and what didn't work so well? Sharing these learnings in small farmer groups enhances the quality of the learning experience. Celebrating progress and success against goals is very important.

Capturing these learnings for use next time is the final part of any review session. You can record future actions and dates into an electronic calendar or wall planner. For example, at a mating review session you might enter into your diary or calendar a reminder to discuss, with your vet, an earlier pregnancy test strategy next year.

There are four key review questions to consider:

1. What did you set out to achieve?
2. What actually happened?
3. What did you learn from that?
4. What will you do differently next time?

Planning session (looking forward)

Each phase of the fertility management cycle has a planning or preparation component, looking forward so we are ready for what is coming up in the next 3, 6 or 9 months.

Planning for your situation can be initiated by asking **four key training questions** starting with Why, What, How and What-if?

For example, a plan to manage heifer rearing better might ask :

Why is heifer rearing important?

What currently happens with our heifers, and what should we be aiming for? Do we have an opportunity to improve? **How** can we keep our heifer management on track?

What-if the grazing situation changes and we need to action Plan B?

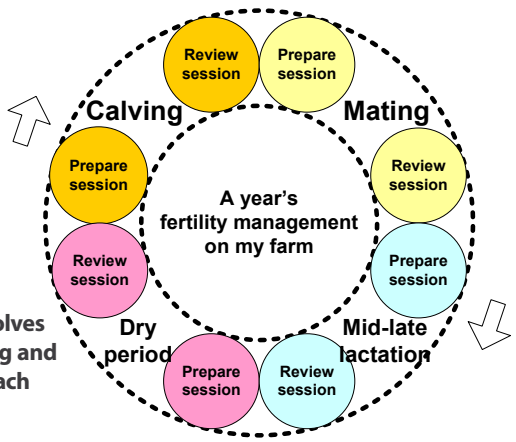
A framework for a reproduction management plan is outlined in Chapter 1 Fertility for Life. These plans must integrate with the whole farm system, and other essential areas of management.

Three good tips for planning:

1. Action plans should be recorded and made SMART (Specific, Measurable, Achievable, Realistic, and Time-bound).
2. "Less is more" – Too many action plans reduce the chance of success in any one of them (NZ National Herd Fertility Study findings).
3. "Plans are useless, but planning is indispensable!" (Dwight D. Eisenhower).

Three more planning questions to create SMART action plans

1. How satisfied are you about this issue? What would be good to do about it?
2. Who would be good to discuss the options with?
3. By when should we have this done?



The full 12-month cycle involves planning for the next calving and mating, and reviews once each phase is over.

A2 National Herd Fertility Study findings

DairyNZ, with Cognosco Ltd, took a detailed look at what it means to New Zealand dairy farmers if they participate in InCalf. Between 2009 and 2013, 169 herds from around New Zealand contributed their time and effort to the National Herd Fertility Study. Here are some of the key findings:

Farmers who participated in an InCalf Farmer Action Group had a modest but incremental improvement in their herd reproductive performance.

Just as the introduction to this book implies, your herd's reproductive performance is complex but improvement is achievable. By getting involved in InCalf, farmers improved their herd reproductive performance.

Improvements were sustained during the study.

Farmers' participation in InCalf was rewarded beyond the first season. It is worthwhile getting involved; the improvements you make are likely to endure. Improving reproductive performance is a multi-year process.

Greatest gains were seen in the lowest performing herds.

All herds improved on average, but herds with the poorest performance at the outset of the InCalf programme made the greatest improvements. So, don't give up if your performance isn't the best, you're likely to make the biggest gains if you commit to making changes.

Neither the region a herd was from nor its herd-size made a difference to results.

A wide range of reproductive performance was found in every region and herd-size. Improvement is not constrained by where you farm or how large your farm is. Different regions and herd-sizes face different problems but good management can always succeed.

InCalf participants found review sessions most engaging.

Farmer feedback on participation in the InCalf Farmer Action Group was highly positive. The benefit of the periodic review sessions, where experiences were shared with other farmers, was considered

a highlight. InCalf follows a process of planning, doing and then reviewing in order to improve. Many of us don't stop to review our actions but this is often where the biggest lessons can be learnt and improvements gained.

Most InCalf participants did not make S.M.A.R.T. action plans.

Interestingly, 97% of the InCalf participants did not make Specific, Measureable, Achievable, Realistic and Time-bound (S.M.A.R.T.) objectives when participating in InCalf despite evidence that making plans SM.A.R.T. increases the chance that you will do as you say. Commitment to change starts here.

The average farmer did not meet any InCalf targets in the key management areas.

At the start of the study, the average dairy farm did not achieve target performance for risk factors identified by InCalf. Optimal calving pattern, heifer live-weight targets, ideal pre-calving and pre-mating body condition score, oestrus detection, anoestrus cow, bull and animal health management targets were not achieved in most herds. It is very likely that you will have plenty of scope to improve reproductive performance in your herds.

There is a high-level of satisfaction with current reproductive performance and that is a barrier to improvement.

When interviewed, most study farmers rated their herd reproductive performance as satisfactory or good. This satisfaction is likely to be a barrier to making changes on farm. Most farmers don't meet InCalf performance targets so challenge yourself to look critically at your own herd's performance to see whether it is as good as you think, and identify where there is room for improvement.

Study farmers perceived non-cycling cows to be the biggest cause of poor reproductive performance and heat detection one of the least likely contributors to poor reproductive performance.

The majority of farmers ranked non-cycling cows as their biggest concern for reproductive performance yet ranked their oestrus detection as a low concern. These two factors are inseparable on most farms which suggests farmers perceived that their cows were a greater restriction to performance than their ability to detect heat.

For further information web search Tom_Brownlie_PhD_thesis.pdf – Massey University

A3 Determinants of pre-mating cycling rate

This second edition of The InCalf Book for NZ Dairy Farmers aims to increase the emphasis on pre-mating cycling rate (Chapter 17) as a determinant of reproductive performance.

The drivers of 6-week in-calf rate, 3-week submission rate and conception rate, have a high dependency on pre-mating cycling rate. Hormonal interventions do not fully compensate for a poor pre-mating cycling rate.

This follows a recommendation supported by the results of the 2010 Lincoln University Dairy Farm Trial indicating that pre-mating cycling rate was a major determinant of the 6-week in-calf rate and not-in-calf rate (SIDE Proceedings 2012).

The priority should be to maximise the percentage of the herd having pre-mating heats (i.e. 85%) as this will allow achievement of a 90% 3-week submission rate without compromising conception rate.

A focus on pre-mating cycling status will deliver a much greater benefit for farmers than previous training approaches. It will allow for submission rate and conception rate to be simultaneously maximised, rather than conflict with each other as is the case when short-term, reactive decisions are made close to the start of mating.

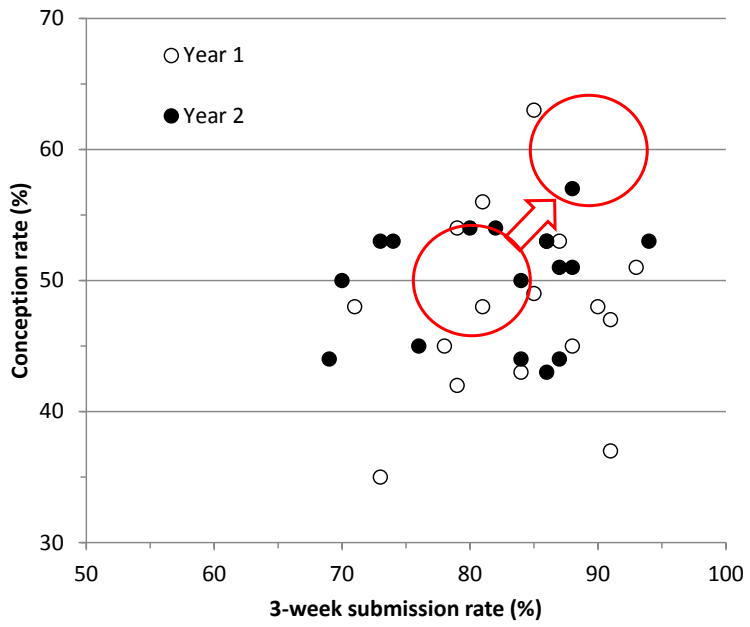


Figure 1 shows the lack of a relationship between submission rate and conception rate among the 16 case-study herds for Years 1 (Y1; 2010/11) and 2 (Y2; 2011/12).

A 6-week in-calf rate of 78% requires a 90% submission rate and a 60% conception.

The red arrow indicates that both submission rate and conception rate need to improve for the industry to achieve a 78% 6-week in-calf rate.

The red circle at centre-left represents the reproductive performance typical of the average NZ dairy herd.

The red circle at upper-right represents the reproductive performance of the top quartile of NZ dairy herds.

Strategic efforts for improving reproductive performance need to start in the mid to late lactation period to begin addressing calving pattern and body condition score (BCS) management.

The important messages are that:

- submission rate and conception rate can only be simultaneously maximised through a high pre-mating cycling rate (Table 1), and
- achieving a high pre-mating cycling rate requires that planning and decisions are made in mid-lactation to address the calving pattern and BCS at calving to underpin pre-mating cycling rate.

This corresponds to when early-aged pregnancy test data is available to review previous season performance and plan for next dry-off and calving, with accurate expected calving dates.

The 2010 Lincoln University Dairy Farm (LUDF) Trial

An examination of numerous factors that influence conception rates was achieved by constructing a progesterone profile for every cow, beginning 3 weeks before Mating Start Date until the end of the 10-week mating period. Progesterone was measured in milk samples collected once or twice weekly throughout this period.

Table 1. Reproductive performance of cows that were ovulating at the commencement of the milk sampling period (Early Cycler), started ovulating (Late Cycler) or remained anovulatory (Non-cycler) during the 3-week period before Mating Start Date (MSD) at the Lincoln University Dairy Farm in 2010.

Reproduction measure	Non-cycler	Late Cycler	Early Cycler	Overall
Number of cows	116	116	434	666
% of herd	17.4	17.4	65.2	–
Calving to MSD (d)	46	56	69	62
3-week submission rate (%)	66	91	94	89
First service conception rate (%)	39	47	57	52
Second service conception rate (%)	49	54	53	52
3-week in-calf rate (%)	26	43	56	48
6-week in-calf rate (%)	53	70	76	71
Not-in-calf rate (%)	23	12	10	13

Reference:
C. R. Burke, S. Meier, C. Kamphuis, and R. Pellow. 2012. An evaluation of a progesterone-based diagnostic as an aid to insemination decisions in a seasonal, pasture-grazed dairy herd. Proceedings of the New Zealand Society of Animal Production, 72:38-41.

A4 Look-up charts

The mathematical framework for achieving target reproductive performance.

The fundamental difference between typical and the higher target levels of reproductive performance can be represented mathematically (below).

The upper panel portrays target level in-calf rates through three-weekly periods when submission (90%) and conception (60%) rates are maintained over a 12-week mating. The lower panel reflects what is more typical, when submission (80%) and conception (50%) are below target.

Weeks	To get in calf	Submission Rate	Conception rate	No. in calf	Total in calf
1 – 3	100	x 0.9	x 0.6	= 54	54
4 – 6	46	x 0.9	x 0.6	= 25	79
7 – 9	21	X 0.9	x 0.6	= 11	90
10 – 12	10	x 0.9	x 0.6	= 5	95
			Not-in-calf		5

Weeks	To get in calf	Submission Rate	Conception rate	No. in calf	Total in calf
1 – 3	100	x 0.8	x 0.5	= 40	40
4 – 6	60	x 0.8	x 0.5	= 24	64
7 – 9	36	X 0.8	x 0.5	= 14	78
10 – 12	22	x 0.8	x 0.5	= 9	87
			Not-in-calf		13

These calculations illustrate how differences in submission rate and conception rate drive large differences in both the 6-week in-calf rate, and the not-in-calf rate at end of mating.

Use this look-up chart to establish the dates when your herd has been calved 3, 6 and 9 weeks.

This chart is useful in planning and measuring herd reproductive performance. Once the Planned Start of Calving date has been established, you can look up the appropriate Mating Start Date (MSD). It is also useful when assessing the herd's calving pattern in terms of the number of cows calved within 3, 6 and 9 weeks of Planned Start of Calving.

MSD last year	Planned start of calving this year	3 wks	6 wks	9 wks
1 Jan	10 Oct	30 Oct	20 Nov	11 Dec
8 Jan	17 Oct	6 Nov	27 Nov	18 Dec
15 Jan	24 Oct	13 Nov	4 Dec	25 Dec
22 Jan	31 Oct	20 Nov	11 Dec	1 Jan
29 Jan	7 Nov	27 Nov	18 Dec	8 Jan
5 Feb	14 Nov	4 Dec	25 Dec	15 Jan
12 Feb	21 Nov	11 Dec	1 Jan	22 Jan
19 Feb	28 Nov	18 Dec	8 Jan	29 Jan
26 Feb	5 Dec	25 Dec	15 Jan	5 Feb
5 Mar	12 Dec	1 Jan	22 Jan	12 Feb
12 Mar	19 Dec	8 Jan	29 Jan	19 Feb
19 Mar	26 Dec	15 Jan	5 Feb	26 Feb
26 Mar	2 Jan	22 Jan	12 Feb	5 Mar
2 Apr	9 Jan	29 Jan	19 Feb	12 Mar
9 Apr	16 Jan	5 Feb	26 Feb	19 Mar
16 Apr	23 Jan	12 Feb	5 Mar	26 Mar
23 Apr	30 Jan	19 Feb	12 Mar	2 Apr
30 Apr	6 Feb	26 Feb	19 Mar	9 Apr
7 May	13 Feb	5 Mar	26 Mar	16 Apr
14 May	20 Feb	12 Mar	2 Apr	23 Apr
21 May	27 Feb	19 Mar	9 Apr	30 Apr
28 May	6 Mar	26 Mar	16 Apr	7 May
4 Jun	13 Mar	2 Apr	23 Apr	14 May
11 Jun	20 Mar	9 Apr	30 Apr	21 May
18 Jun	27 Mar	16 Apr	7 May	28 May
25 Jun	3 Apr	23 Apr	14 May	4 Jun
2 Jul	10 Apr	30 Apr	21 May	11 Jun
9 Jul	17 Apr	7 May	28 May	18 Jun
16 Jul	24 Apr	14 May	4 Jun	25 Jun
23 Jul	1 May	21 May	11 Jun	2 Jul
30 Jul	8 May	28 May	18 Jun	9 Jul
6 Aug	15 May	4 Jun	25 Jun	16 Jul
13 Aug	22 May	11 Jun	2 Jul	23 Jul
20 Aug	29 May	18 Jun	9 Jul	30 Jul
27 Aug	5 Jun	25 Jun	16 Jul	6 Aug
3 Sep	12 Jun	2 Jul	23 Jul	13 Aug
10 Sep	19 Jun	9 Jul	30 Jul	20 Aug
17 Sep	26 Jun	16 Jul	6 Aug	27 Aug
24 Sep	3 Jul	23 Jul	13 Aug	3 Sep
1 Oct	**10 Jul**	**30 Jul**	**20 Aug**	**10 Sep**
8 Oct	**17 Jul**	**6 Aug**	**27 Aug**	**17 Sep**
15 Oct	**24 Jul**	**13 Aug**	**3 Sep**	**24 Sep**
22 Oct	**31 Jul**	**20 Aug**	**10 Sep**	**1 Oct**
29 Oct	**7 Aug**	**27 Aug**	**17 Sep**	**8 Oct**
5 Nov	**14 Aug**	**3 Sep**	**24 Sep**	**15 Oct**
12 Nov	21 Aug	10 Sep	1 Oct	22 Oct
19 Nov	28 Aug	17 Sep	8 Oct	29 Oct
26 Nov	4 Sep	24 Sep	15 Oct	5 Nov
3 Dec	11 Sep	1 Oct	22 Oct	12 Nov
10 Dec	18 Sep	8 Oct	29 Oct	19 Nov
17 Dec	25 Sep	15 Oct	5 Nov	26 Nov
24 Dec	2 Oct	22 Oct	12 Nov	3 Dec

Use this look-up chart to establish when your herd should be pregnancy tested in relation to herd Mating Start Date (MSD).

MSD	MSD +11 weeks	MSD +14 weeks	MSD + 17 weeks
1 Jan	19 Mar	9 Apr	30 Apr
8 Jan	26 Mar	16 Apr	7 May
15 Jan	2 Apr	23 Apr	14 May
22 Jan	9 Apr	30 Apr	21 May
29 Jan	16 Apr	7 May	28 May
5 Feb	23 Apr	14 May	4 Jun
12 Feb	30 Apr	21 May	11 Jun
19 Feb	7 May	28 May	18 Jun
26 Feb	14 May	4 Jun	25 Jun
5 Mar	21 May	11 Jun	2 Jul
12 Mar	28 May	18 Jun	9 Jul
19 Mar	4 Jun	25 Jun	16 Jul
26 Mar	11 Jun	2 Jul	23 Jul
2 Apr	18 Jun	9 Jul	30 Jul
9 Apr	25 Jun	16 Jul	6 Aug
16 Apr	2 Jul	23 Jul	13 Aug
23 Apr	9 Jul	30 Jul	20 Aug
30 Apr	16 Jul	6 Aug	27 Aug
7 May	23 Jul	13 Aug	3 Sep
14 May	30 Jul	20 Aug	10 Sep
21 May	**6 Aug**	**27 Aug**	**17 Sep**
28 May	**13 Aug**	**3 Sep**	**24 Sep**
4 Jun	**20 Aug**	**10 Sep**	**1 Oct**
11 Jun	**27 Aug**	**17 Sep**	**8 Oct**
18 Jun	**3 Sep**	**24 Sep**	**15 Oct**
25 Jun	**10 Sep**	**1 Oct**	**22 Oct**

MSD	MSD +11 weeks	MSD +14 weeks	MSD + 17 weeks
2 Jul	17 Sep	8 Oct	29 Oct
9 Jul	24 Sep	15 Oct	5 Nov
16 Jul	1 Oct	22 Oct	12 Nov
23 Jul	8 Oct	29 Oct	19 Nov
30 Jul	15 Oct	5 Nov	26 Nov
6 Aug	22 Oct	12 Nov	3 Dec
13 Aug	29 Oct	19 Nov	10 Dec
20 Aug	5 Nov	26 Nov	17 Dec
27 Aug	12 Nov	3 Dec	24 Dec
3 Sep	19 Nov	10 Dec	31 Dec
10 Sep	26 Nov	17 Dec	7 Jan
17 Sep	3 Dec	24 Dec	14 Jan
24 Sep	10 Dec	31 Dec	21 Jan
1 Oct	**17 Dec**	**7 Jan**	**28 Jan**
8 Oct	**24 Dec**	**14 Jan**	**4 Feb**
15 Oct	**31 Dec**	**21 Jan**	**11 Feb**
22 Oct	**7 Jan**	**28 Jan**	**18 Feb**
29 Oct	**14 Jan**	**4 Feb**	**25 Feb**
5 Nov	**21 Jan**	**11 Feb**	**4 Mar**
12 Nov	28 Jan	18 Feb	11 Mar
19 Nov	4 Feb	25 Feb	18 Mar
26 Nov	11 Feb	4 Mar	25 Mar
3 Dec	18 Feb	11 Mar	1 Apr
10 Dec	25 Feb	18 Mar	8 Apr
17 Dec	4 Mar	25 Mar	15 Apr
24 Dec	11 Mar	1 Apr	22 Apr

Use this look-up chart to establish predicted calving date from conception date (based on standard 282 days).

Conception date	Expected calving date
1 Jan	**10 Oct**
8 Jan	**17 Oct**
15 Jan	**24 Oct**
22 Jan	**31 Oct**
29 Jan	**7 Nov**
5 Feb	14 Nov
12 Feb	21 Nov
19 Feb	28 Nov
26 Feb	5 Dec
5 Mar	12 Dec
12 Mar	19 Dec
19 Mar	26 Dec
26 Mar	2 Jan
2 Apr	9 Jan
9 Apr	16 Jan
16 Apr	23 Jan
23 Apr	30 Jan
30 Apr	6 Feb
7 May	13 Feb
14 May	20 Feb
21 May	27 Feb
28 May	6 Mar
4 Jun	13 Mar
11 Jun	20 Mar
18 Jun	27 Mar
25 Jun	3 Apr
2 Jul	10 Apr

Conception date	Expected calving date
9 Jul	17 Apr
16 Jul	24 Apr
23 Jul	1 May
30 Jul	8 May
6 Aug	15 May
13 Aug	22 May
20 Aug	29 May
27 Aug	5 Jun
3 Sep	12 Jun
10 Sep	19 Jun
17 Sep	26 Jun
24 Sep	3 Jul
1 Oct	**10 Jul**
8 Oct	**17 Jul**
15 Oct	**24 Jul**
22 Oct	**31 Jul**
29 Oct	**7 Aug**
5 Nov	**14 Aug**
12 Nov	**21 Aug**
19 Nov	**28 Aug**
26 Nov	**4 Sep**
3 Dec	**11 Sep**
10 Dec	**18 Sep**
17 Dec	**25 Sep**
24 Dec	**2 Oct**
31 Dec	**9 Oct**

A5 Treatment options for non-cycling cows

Treatment options for cows not detected on heat are being frequently updated as further trial results become available. This means that your vet should be consulted about current recommendations and programmes. Generally, two treatment options are available. Both can be used before, at or after Mating Start Date (MSD).

1. Intravaginal device (including progesterone). Intravaginal devices include CIDR® or CueMate®.
2. 'GPG' (e.g. Ovsynch®). In this case no progesterone is included (page 182).

1a Intravaginal device before MSD

Intravaginal devices inserted before MSD allow most of the treated cows to be inseminated early in the mating period.

Begin the programme by checking for heats from 35 days before MSD. Commencing 9 days before MSD, cows which have not been detected on heat and which have been calved more than 3 weeks are eligible for treatment and receive a sequence of injections and an intravaginal device. The majority of cows are inseminated at a set time 3 days after device removal. Some cows will come into heat before then and should be inseminated upon heat detection.

This option will routinely involve some 12–50% of cows being inseminated on detected heat 2-3 days after device removal, with the remainder being fixed-time inseminated. Conception rates to first inseminations of these treated cows may only be 35% to 45%, as these are to first heats post-calving.

The intravaginal device treatment option can increase the 3-week in-calf rate of the treated cows by up to 20%, compared to no treatment at all. Results may vary between herds, depending on the herd's calving pattern (too many late calvers) and on the herd's body condition score (Chapter 17, page 151).

If this option is combined with Why Wait heat synchrony for cycling cows, it is possible to inseminate almost all cows in the herd early in the mating period. The combined programme means the effort of heat detection can be focused on short predictable periods.

- Start monitoring for heats from 35 days before MSD.
- 9 days before MSD, identify cows not detected on heat. Generally this will be about 25–30% of the herd.
- Discuss the criteria for inclusion of cows for treatment with your vet. It may not be worth treating older cows.
- Implement the programme of injections and intravaginal devices **exactly** as advised by your vet. The timing of injections relative to each other, and to planned time to AB, is critical.
- Clearly mark treated cows. Accurate cow identification is critical when administering injections and intravaginal devices. It also ensures that intravaginal devices can be removed from every treated cow on the designated day and subsequent injections correctly administered.
- If treated cows are retreated/resynchronised, either ensure adequate numbers of bulls are running with the herd, or recommence heat detection and AB for the 4 days following the resynchrony treatment when most of the cows that come back on heat are expected to do so. Don't forget to cover the second round of returns as well.

- Analyse records to identify which particular groups of cows (heifers, late calvers, lame cows, etc) were actually treated. This may assist future management planning.
- Analyse results to see how cows responded to treatment. If below expectations discuss possible reasons with your adviser.

1b *Intravaginal device 3 weeks after MSD*

Fewer cows will require treatment for non-cycling than Option 1a. If 100 cows required treatment with Option 1a, only 30 to 40 cows would require treatment under Option 1b, but the proportion will vary between herds.

Relative to Option 1a, this option will further delay the first insemination in some cows. This may result in even fewer cows conceiving early in the mating period than under Option 1a.

- Commence heat detection and AB from MSD.
- About 3 weeks after MSD, identify cows not yet inseminated and present these cows for veterinary examination to help identify the reasons that cows have not been detected on heat.
- Treat cows in the same manner as Option 1a (intravaginal devices used before MSD).

Cows not visibly cycling before MSD have low blood progesterone levels. That is why they need addition of progesterone to the 'GPG' treatment (via a CIDR like device).
This results in conception six days earlier than if the cows just have the 'GPG' injection programme. And more of these cows have normal luteal function after treatment. This occurs in both cows that have had a silent heat, and in cows that are truly anoestrous.
Another benefit of addition of progesterone is fewer short returns occurring following the programme. Even with the cost of including progesterone, the higher conception rates give extra early days in milk and more AB calves making it the most cost-effective treatment option for non-cycling cows before MSD.

If using any non-cycling treatment during the mating period, be very careful NOT to include cows that have already been inseminated. The second injection (prostaglandin) will cause abortion if given to a cow in early pregnancy.

2. GPG (Ovsynch®)

A 'GPG' treatment, such as Ovsynch®, is a sequence of three injections (GnRH, Prostagladin, GnRH) with rigid time constraints.

Every cow is inseminated between 12 and 24 hours after the third injection. This system requires no heat detection for the first insemination, however heat detection is required for all subsequent inseminations.

The GPG treatment was designed for treating cows that are already cycling, but is now being used to treat non-cyclers as well. This treatment can be applied before or during mating, as described above for intravaginal device treatments.

Use of 'GPG' on non-cyclers within pasture-based herds has been rigorously tested. Without inclusion of progesterone the 'GPG' treatment results in lower conception rates and later conception dates than if progesterone is included.

The economic comparison for non-cycling cows in NZ conditions favours the inclusion of progesterone as in option 1.

Work with your vet when arranging the use of any of these options for treating non-cyclers.

A6 Options for heat synchronisation – yearling heifers and cycling cows

Several heat synchronisation options are available for yearling heifers, and for cycling cows. The purpose here is to synchronise the heats of animals that are already cycling, so they can be inseminated at the same time and within the first few days of the mating period.

If you choose to use heat synchronisation on yearling heifers and cycling cows, it is important that the options are thoroughly investigated. The benefits of synchronising heifers and cycling cows need to be offset against the extra costs and time required to plan and implement the programme. It is also important to investigate the practical requirements of any programme.

Work with your vet to develop the best strategy. Take time to understand when and how the treatments work. This will give you an idea of the extra labour, facilities, time and cow identification required. Provide ample warning to your AB organisation that large numbers will be inseminated on planned dates.

Check things like:

- How will the synchronisation treatments be administered at the right times? Are the facilities suitable?
- How will synchronisation treatments and inseminations be recorded?
- Is heat detection necessary, and how will it be done?
- How will cows be drafted and held for insemination?
- Do we have easy access to the heifers and what yard facilities are available?
- How will large numbers of cows on heat each day be inseminated?
- Are extra staff required, including AB technicians and stock handlers?
- Have you selected the sires to be used?
- Does your AB technician know about the synchrony coming up? When and how many?

- What about the synchronised returns 18-24 days and 36-48 days later? Enough bulls or AB again?
- Will there be intense periods of calving next year? Do we need to:
  - account for a rapid start to calving in our feed budget?
  - have more staff on during peak times to supervise calving and identify AB calves correctly?
  - increase colostrum storage capacity and calf rearing facilities?

If we've got a big group to synchronise, what else do we need to consider?

Administering treatments

- Treat cows during milking but check the safety of platforms, etc.
- Although the synchronisation treatments should not affect milk yields, disturbances to the normal milking routine can disrupt normal cow flow.
- Ensure animals for treatment are clearly identified.
- Ensure that recently calved animals (or pregnant animals?) are excluded. Mark these cows with paint or marker at the start of the programme to avoid treating them by mistake.

Coping with large numbers of cows on heat

- Consider providing extra feed to the synchronised cows on the day before the peak heat period is expected to ensure adequate feed intakes and reduce damage to pasture.
- Monitor cows for signs of milk fever in the two days following these heat periods.

Inseminating large numbers of cows or heifers

- Ensure that inseminating facilities allow efficient cow flow and minimise bending or walking by AB technicians and helpers.
- Rest AB technicians during these insemination programmes.
- Do not exceed 3 hours. AB technician fatigue can be a bigger problem for novice AB technicians.
- Before inseminating large groups of cows or heifers, seek advice from a professional AB technician experienced in these programmes.

Bull selection

- The most convenient form of inseminating is to use semen from one sire for 20 to 50 inseminations as they occur and then switch to another sire. This minimises errors in recording, decreases the time taken, and avoids straws being left thawed for extended periods before they are used. Check you are using bulls that won't cause inbreeding with your cows if you adopt this approach.

Good planning saves time and helps ensure a good result.

I want to synchronise and AB my heifers, so what do I need to think about?

- Check the pro's and con's of AB'ing your heifers.
- Ensure heifers have achieved liveweight targets by mating, have no sudden reduction in feed intake and are gaining weight throughout the mating period.
- Heifers are not handled as frequently as milking cows, so make sure you have suitable facilities to avoid injuries to heifers and people while treating and inseminating them.
- Decide which synchronisation programme you will use.
- Decide how you will detect heats and select a suitable form of heat detection aid.
- Arrange to use a skilled AB technician who has had previous experience with heifers.
- If you use fixed-time insemination, still use a heat detection system and check that the treatment has produced a high degree of synchronisation. Heat detection is preferable to fixed-time insemination, especially with underweight heifers.
- Think about how heifers will be mated 3 weeks after their first insemination if they cycle again. Ensure bull ratios are at least doubled between 18 and 24 days after the main insemination date or use a heat detection aid to inseminate heifers a second time during this same period.
- Leave bulls with the heifers for at least 7 weeks after first insemination. If using AB for second inseminations, remove bulls during that period.
- Consider pregnancy testing 11–14 weeks after the first synchronised inseminations. This will confirm all conception dates, if the mating period is limited to the recommended 9 weeks for yearlings. If the mating period exceeds 9 weeks, you will need to do a follow-up pregnancy test 5-6 weeks after the end of mating to identify empty heifers.
- How will you calve the heifers to minimise mis-mothering and ID calves? (Consider DNA testing all calves)

Synchronising heifers takes the same level of planning as synchronising cows.

Treatment options for synchronising cycling animals

1. Prostaglandin (PG) programmes

A wide range of synchronisation programmes are available using prostaglandin (PG). PG options can be used in both cows and heifers. They involve one or two injections of PG.

Treatment with PG does not work in non-cycling cows and yearling heifers that have not yet started cycling (i.e. prepubertal). Also, a single PG injection will not work on any cows or heifers that have been on heat in the last 6 days; but the 2 PG injection programme will overcome this latter problem. Cows or heifers that respond to PG are usually on heat within 2–5 days of treatment, but some cows may take up to 7 days to respond.

This section describes the basic PG programmes, but there are a number of subtle variations that can be made to the basic programmes by vets to suit individual farm requirements.

- **Single Why Wait:** Cows or heifers are observed for heat for 6–7 days before Mating Start Date (MSD). Those that show signs of heat are then injected with PG 5 days after MSD. This option results in most animals coming on heat during the first 12 days of mating. This treatment does not work in prepubertal heifers and non-cycling animals.
- **Double Why Wait:** Cows or heifers are observed for heat for 12–14 days before MSD. Those that show signs of heat are then injected with PG either 2 days before MSD, or 5 days after MSD, depending on when they were on heat. This option results in most animals coming on heat during the first 12 days of mating. This treatment does not work in prepubetal heifers and non-cycling animals.
- **Modified Why Wait:** Cows or heifers are heat detected and mated normally during the first 6 days of mating. Cows not seen on heat during this time are given a single injection of PG on day 6 or 7 of mating. This option results in most animals coming on heat during the first 12 days of mating. This treatment does not work in pre-pubertal heifers and non-cycling cows. There is a risk that if a cow or heifer was mated and not recorded then she will be injected with PG when possibly pregnant.
- **Aggressive PG:** All cows or heifers are treated with two injections about 12 days apart, with the second injection being 2 days before MSD. This option results in most cows coming on heat during the first 5–6 days of mating. This option is commonly used with heifers as no pre-mating heat detection is required This treatment does not work in prepubertal heifers and non-cycling cows.

Check treatment dates when planning your strategy with your vet. The interval between the two injections of PG in some of these options can be modified if required.

Observe treated animals for heat. Most animals that respond will be on heat 2–5 days after PG injection, but some will take up to 7 days to respond. Inseminate animals only after heat is detected.

The success of the Double Why Wait programme hinges on the right animals being injected at the right time. To correctly identify cows for this programme, cows that come on heat during specific time periods need to be accurately identified. Cows must be showing good signs of heat to be enrolled into this programme, and the timing of each cow's PG injection is crucial.
The easiest way to do this is change tail paint colours every week for the 3 weeks leading up to MSD, i.e. all cows tail painted at day -21 one colour, and any cows that come on heat and lose their tail paint between day -14 and -21 MSD are painted Red; cows that are on heat between day -7 and -14 are painted blue and cows that are on heat between day -1 and -7 are painted yellow. All Red cows will come on heat over the first 7 days of mating. These cows are left to cycle naturally and are mated to detected heat. Cows that are blue are injected at MSD (day 0) and most of these animals will be on heat 3-5 days after the PG injection (day MSD+3-5). Cows that are yellow are injected with PG at MSD +7 and these animals will be on heat day MSD+10-13 roughly.

2. Intravaginal devices

Intravaginal devices can be used in cows as well as heifers.
The programmes involve a series of injections and intravaginal inserts. Programmes can be used concurrently with cycling and non-cycling cows but are likely to be most effective in cycling cows. This option is preferable to PG options if heifers are substantially below target liveweights at mating or a high proportion of the herd is not cycling.

All animals commence treatment 9 days before MSD, with most treated cows showing signs of heat over a 3-day period following MSD.

Check treatment dates when planning your strategy with your vet. Do not vary the treatment dates without discussing this with your vet.

Options are available to use fixed time insemination or insemination following detection of heat. While fixed time insemination options may reduce the time required for the programme and increase submission rates, the conception and pregnancy rates may be lower. For programmes using heat detection, most animals that respond will show heat over a 3-day period following the last treatment.

Ensure adequate numbers of bulls are running with the herd or recommence heat detection and AB for the 4 days when most of the cows that come back on heat are expected to do so.

3. *'GPG' (e.g. OvSynch®) for milking cows*

A 'GPG' treatment, such as Ovsynch®, is a sequence of three-injections (GnRH, Prostagladin, GnRH) with rigid time constraints for use in milking cows. It is not recommended for use with heifers.

Every cow is inseminated between 12 and 24 hours after the third injection, with no requirement for heat detection. The programme enables all cows to be inseminated on the first day of mating. The 'GPG' programme can be used concurrently with cycling and non-cycling cows but is likely to be most effective in cycling cows as it requires cows to have adequate levels of progesterone.

This system has no heat detection for the first insemination. Heat detection is required for subsequent inseminations. Relatively few cows display heat signs after treatment, minimising disruption.

If using any non-cycling treatment during the mating period, be very careful NOT to include cows that have already been inseminated. The second injection (prostaglandin) will cause abortion if given to a cow in early pregnancy.

A7 Estimating herd reproductive performance

The most reliable method of estimating herd reproductive performance is to obtain an InCalf Fertility Focus report. It uses sophisticated calculation methods to give the best measures of reproductive performance. If it is not readily available, you will need to make your own estimate of your herd's reproductive performance.

This appendix provides simple methods for estimating the reproductive performance of your herd. Because it uses simplified methods which are less accurate, results calculated using these approaches may differ from those obtained on an InCalf Fertility Focus report (Chapter 5).

Estimating reproductive performance using a calculator and discussing the outcomes is a good start.

Your herd improvement organisation can provide a 'pregnancy test worksheet' to assist during pregnancy testing. The worksheet shows the days or weeks since your cow's most recent recorded mating. The vet's predicted days or weeks pregnant can be recorded against that cow and entered into the database. A Fertility Focus report can then calculate your herd's 6-week in-calf, not-in-calf rate, as well as submission rate and conception rate .

For more detail go to the InCalf Fertility Focus User's Guide at dairynz.co.nz.

Estimating herd reproductive performance

6-week in-calf rate

This is the best measure of overall herd reproductive performance.

The actual 6-week-in-calf rate can only be calculated reliably if early-aged pregnancy testing is performed.

How to calculate

1. Select all eligible cows that were present at Mating Start Date. This is the total number of cows (the denominator).*
   - Include all cows calved before and during the mating period.
   - Take note of how many culls and deaths occurred during the first 6 weeks of mating, and cows that you did not intend to be mated.*
2. Using early pregnancy testing results, count how many of these became pregnant in the first 6 weeks (42 days) of mating. This is the number of cows pregnant in the first 6 weeks of mating (the numerator).

6-week in-calf rate =

$$\frac{\text{no. cows pregnant in the first 6 weeks of mating} \times 100}{\text{total no. of cows}}$$

Example

At the start of mating, the count was 350 cows in the herd. We've just finished pregnancy testing and 255 were pregnant in the first 6 weeks. So:

$$\frac{255 \times 100}{350}$$

= 73%

I can check pages 27–30 to see how I'm going.

Not-in-calf rate

Tells you the percentage of non-pregnant cows at the end of mating. The Not-in-calf rate can only be calculated reliably if all available cows in the herd are pregnancy tested.*

This measure excludes empty carry-overs who last calved more than 130 days before Mating Start Date.*

How to calculate

1. Select all eligible cows that were present at Mating Start Date. This is the total number of cows (the denominator), the same number as above for 6-week in-calf rate.
   - Include all cows calved before and during the mating period.
   - Take note of how many culls and deaths occurred during the total mating period, and how many cows that you did not intend to be mated.*
   - Take note of how many cows remain in the herd that did not get pregnancy tested.*
2. From the pregnancy testing results, count how many of these cows were confirmed pregnant. Deduct the number pregnant from the total cows. This is the number of cows not confirmed pregnant (the numerator).

Not-in-calf rate =

$$\frac{(\text{total no. cows} - \text{no. of cows confirmed pregnant}) \times 100}{\text{total no. of cows}}$$

Example

We finished pregnancy testing today and we ended up with 315 confirmed pregnant and 35 empties from 350 cows after 12 weeks total mating. So:

$$\frac{(350-315) \times 100}{350}$$

is 10%

Check page 27 to analyse this result.

* These are all sources of discrepancy that explain differences calculated manually from those reported on the Fertility Focus report.

3-week submission rate

A good 3-week submission rate must be achieved if 6-week in-calf rates are to be good.

How to calculate

1. Select all eligible cows that were present at Mating Start Date. This is the total number of cows (the denominator).

- Include all cows calved before Mating Start Date.
- Exclude all culls and deaths up to and including day 21 of mating, and all cows you did not intend to be mated.

2. How many of these cows had at least 1 insemination or natural mating in the first 3 weeks (21 days) of mating? This is the number of cows inseminated in first 3 weeks of mating.

- Cows are only counted once. Don't count how many inseminations were performed in the first 3 weeks as some cows may have had two inseminations in that period.

3-week submission rate =

$$\frac{\text{no. cows inseminated or mated in first 3 weeks of mating x 100}}{\text{total no. of cows}}$$

Example

We had 350 cows at Mating Start Date. In the first 3 weeks, we've inseminated 275 cows. We had no hope of getting those late calvers mated. We'll have to do better next year! So:

$$\frac{275 \times 100}{350}$$

is 79%

I can check page 28 to see how I'm going.

Conception rate

It will be difficult to achieve a good 6-week in-calf rate unless conception rate is satisfactory.

Conception rates can only be calculated reliably if early-aged pregnancy testing is performed.

How to calculate

1. Include only AB inseminations on or after Mating Start Date, if the cow had one or more pregnancy test records 35 or more days later. Where two inseminations occurred on the same day or consecutive days only one of the two are included.

This is the total number of eligible AB inseminations (the denominator).

2. Each AB insemination is then classified as either a 'success' or a 'failure' based on pregnancy diagnosis evidence of conception occurring on that AB insemination date.

Count the number of 'successful' AB inseminations (the numerator).

Conception rate =

$$\frac{\text{no. of AB inseminations that resulted in pregnancy x 100}}{\text{total no. of AB inseminations}}$$

(where total no. of AB inseminations = no. successful AB inseminations + no. of unsuccessful AB inseminations)

Example

At the end of calving, the final count was 350 cows calved. We've just finished pregnancy testing and 255 were pregnant in the first 6 weeks of AB.

Of the 500 total AB inseminations used we deemed 490 as eligible, excluding those on consecutive days.

So:

$$\frac{255 \times 100}{490}$$

is 52%

I can again check pages 28 and 32. My 52% is a pretty average result.

Pre-mating cycling rate

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

If your pre-mating cycling rate is less than 65%, 10 days before MSD, you have a 'non-cycling problem'. This could be a result of deficiencies in pre-mating heat detection and/or the presence of too many genuine non-cyclers.

How to calculate pre-mating cycling rate

1. Select all cows that were present at Planned Start of Calving date, and exclude any deaths or culls since calving. This is the total number of cows (the denominator).

2. How many of these cows had at least one recorded pre-mating heat between calving and MSD? Cows are only counted once if they had more than one pre-mating heat.

$$\text{Pre-mating cycling rate at MSD} = \frac{\text{no. cows observed on heat} \times 100}{\text{total no. of cows}}$$

Example

We tail painted the whole herd of 350 cows 30 days before the start of AB, and recorded 250 cows with at least one recorded heat by MSD.

So:

$$\frac{250 \times 100}{350}$$

is 71% compared to the expected figure of 85% by MSD.

The non-cycling rate is simply the reverse of cycling rate (i.e. 100% – 71% = 29% were non-cyclers at MSD.

Non-cycling rate (for early treatment option)

You can calculate your herd non-cycling rate at any time relative to MSD. If opting for the recommended 'early' treatment option, then use the non-cycling rate at 9 to 10 days before MSD.

Example

We tail painted the whole herd of 350 cows 30 days before the start of AB, and identified 135 cows with no recorded heat by 9 days before MSD.

So:

$$\frac{135 \times 100}{350}$$

is 38%

Non-cycling treatment rate

Treated non-cyclers get in calf earlier, but not every non-cycler gets treated. Veterinary examination can determine the reproductive state and most appropriate action for individual cows.

Also treatments can occur at different times relative to MSD.

- Early – treatment started before MSD.
- Late – treatment started within the first 3 weeks of mating.
- Very late – treatment started after end of week 3 of mating.

Example

We presented 100 non-cyclers out of 350 cows to the vet after 3 weeks of pre-mating heats. The vet found 20 cows that had already cycled that we had not spotted. We decided to leave these untreated. That left 80 cows as genuine non-cyclers.

We chose to treat 50 of these right away ('early') so they would be inseminated in the first week of AB.

So:

$$\frac{50 \times 100}{350}$$

is 14%

We treated another group of 20 cows (6%) after 2 weeks of AB (late).

So:

$$\frac{(50+20) \times 100}{350}$$

is 20% treated in total, with 14% being early-treated and 6% being late-treated.

Definition of terms

3-week submission rate:	The percentage of cows that received at least one insemination or mating in the first 3 weeks of the mating period. *This measure must be high in order to achieve a high 6-week in-calf rate.*
6-week in-calf rate:	The percentage of cows that became pregnant in the first 6 weeks of mating. *This is the best measure of overall herd reproductive performance.*
Abortion:	A loss of a pregnancy any time following a positive pregnancy test, or observation of a cow expelling uterine contents prior to normal length of pregnancy. May also be referred to as a 'slip'.
AB (Artificial Breeding):	The breeding of specific superior dairy heifer replacements through mating cows to high genetic merit sires by artificial insemination (AI).
Adviser(s):	Professional or trusted people who can support you with the InCalf process (e.g. vets, breeding company rep's, farm consultants, farm owner or mentor).
Anoestrus cow:	See Non-cyclers, non-cycling cows.
Body condition score:	The assessment of the amount of fat covering the bones of the cow, using specific points on the cow's body.
Bovine viral diarrhoea (BVD):	A viral infection widespread in dairy and beef herds that reduces both cow and bull fertility
BV (Breeding Value):	A comparative estimate of an animal's genetic merit for individually measured traits.
BW (Breeding Worth):	An overall profit ranking for bulls and cows on their expected ability to breed repla****cements which will be efficient converters of feed into profit. It is used as a guide to making breeding decisions. BW estimates are comparable across herds, ages and breeds.
Calving pattern:	The percentage of calvings within a herd's calving period that occur by week 3, week 6 and week 9 following Planned Start of Calving (PSC) date.
Carryover cows:	Cows that are empty at the end of one mating period which are kept in the herd to be mated in a future mating period.
Conception rate:	The percentage of inseminations that resulted in a pregnancy as determined by pregnancy testing. *Taken alone, this measure does not describe overall herd reproductive performance, but a satisfactory conception rate is required to achieve a high 6-week in-calf rate.*
Condition Scoring Made Easy:	A systematic approach to body condition scoring using a 10-point scale.
Crossbreeding:	The act of using a different sire breed for mating a cow, resulting in crossbred progeny that have mixed characteristics of the parent breeds, in addition to some hybrid vigour.
Drying off decision rules:	Prescribed thresholds for drying-off cows based on age, body condition score and time to next calving date. The rules ensure there is sufficient time to achieve condition score targets at calving.

Early calved, mature cows:	Cows that are 4 or more years of age at calving and that calved 8 or more weeks before the start of mating.
Empty cows:	Cows determined by pregnancy test from 5 weeks after the end of mating to have failed to get in calf during the mating period.
Endometritis:	A uterine infection that may reduce cow fertility.
'Eye-o-meter':	An estimate by visual assessment.
Fertility for Life cycle:	The path a female takes from her birth until she is culled from the herd. This starts with birth, then follows calf and heifer rearing, first mating, pregnancy and calving, followed by subsequent cycles of mating, pregnancy and calving until she is eventually culled.
First calver:	A cow in her first lactation. Referred to as a 'rising 3 year old' later in that first lactation.
Genetic merit:	Characteristics of an animal that are determined by its genes and not influenced by environmental or management factors. The genetic merit of an animal is determined by its parents and can be passed on to its offspring.
Gestation length:	The expected duration between an insemination and the resulting calving date, typically 282 days in dairy animals.
Heat (oestrus):	The behavioural display by the cow to indicate the appropriate time for being mated. May also be referred to as 'bulling'.
Heat cycle (oestrous cycle):	The normal pattern of when cows show signs of heat. The typical interval between heats is 21 days, with the range being 18–24 days. Cows show signs of heat for between 2 and 28 hours, with an average of 14 hours.
Heat detection programme:	A combination of routine tasks, detection aids and recording systems selected and applied by a farmer to effectively determine if and when a cow shows signs of heat.
Heat synchronisation:	A procedure to aid herd management where cows or heifers are treated so that all or most come on to heat and may be inseminated within a short period.
Heifer:	A female that has not yet calved. Heifer age groups are further defined as 'heifer calves' (less than a year old), and 'yearling heifers' (1-2 years old).
Hormonal intervention:	Use of hormones to manipulate when a cow cycles. See non-cycling treatment and heat synchronisation.
Hybrid vigour:	The additional improvement in the traits (e.g. fertility or milksolids production) of a crossbred cow above and beyond the expected performance of the sire and dam, which are of different breed types. Can also referred to as heterosis.
Inbreeding:	The result of mating a cow or heifer with a closely related sire. Progeny can have congenital problems and perform poorer than expected given the genetic-merits of the sire and dam.
InCalf Fertility Focus report:	A single-page summary of reproductive performance in your herd,

	which is available from your herd improvement recording service.
InCalf Herd Assessment Pack tools:	A set of stand-alone worksheet calculators for assessing the key areas of reproductive management and prioritising for action.
InCalf 'process':	The continuous improvement process of assessing your herd reproductive performance, identifying scope for improvement and associated benefits, considering options for change and implementing selected management options.
In-calf rate:	See 6-week in-calf rate.
Liveweight targets:	Specific weights of live cattle, at clearly identified ages, used to monitor the success of a heifer or bull rearing programme. The specific target weights will vary with 'mature cow liveweight', breed, sex and overall farm management objectives.
Mating Start Date (MSD): Planned Start	The first day of mating in a particular mating period. (Also called of Mating date [PSM])
Mating Start Date for heifers:	First day of mating for the yearling heifers.
Mature cow liveweight:	Liveweight that a cow achieves when fully matured.
MJ ME/kg DM:	Megajoules of metabolisable energy per kilogram of dry matter of a feedstuff. One of the measures used to compare the nutritional value of feedstuffs.
Natural mating:	The period of mating when bulls are run with the herd or heifer mob to mate any animals that come into heat.
Non-cyclers, non-cycling cows:	Cows that have not yet started normal heat cycles after calving (as opposed to cows that are showing signs of heat but which have not been detected). These cows will not be detected on heat by paddock observation or the use of any heat detection aid.
Non-cycling treatment:	A hormonal intervention to induce non-cyclers to start cycling at an earlier date than they would otherwise.
Non-genetic characteristics:	Characteristics of an animal determined by environmental or management factors. These characteristics cannot be passed on to its offspring.
Not-in-calf rate:	The percentage of cows within a given mating group that failed to become pregnant by the end of a mating period. Can also be termed empty rate. *Taken alone, this is not a precise measure of overall herd reproductive performance in seasonal and split calving herds.*
Non-return rate (NRR):	The percentage of inseminations where the cow did not return to heat within 2–24 days after the insemination. *A poor non-return rate provides an early warning that the conception rate is likely to be poor.*
Non-return rate (18-24 days):	A form of non-return rate used by breeding companies to monitor AB technician performance that excludes both short returns (<18 days) and long returns (>24 days).

Oestrus:	See Heat.
Phantom cow:	A cow that was assumed pregnant but later found to be empty. True phantoms do conceive but the embryo dies while the cow continues to 'believe' she's pregnant. Cows can falsely appear to be phantoms when heat detection is inaccurate and poorly implemented as mating progresses.
Planned Start of Calving date (PSC):	The date of the planned start of calving in a particular calving period (This is 282 days after this group's previous Mating Start Date).
Preferential feeding:	Offering a daily feed allowance or diet to a specific group of animals, which is different (generally higher) in quantity and/or quality from that offered to the main herd.
Pregnancy test:	A diagnostic test to check if a cow is pregnant, and possibly the date of conception and age of the pregnancy. Skilled operators examine uterine contents by manual palpation or ultrasonography.
Pre-mating cycling rate:	The percentage of cows in the herd detected on heat before Mating Start Date (MSD) or by 9-10 days before MSD.
Production worth (PW):	A measure of the ability of the cow to convert feed into profit over her lifetime. PW is used for culling and buying decisions, and can be used to compare across different breeds and age groups.
Replacement heifers:	A female that has not yet calved, but which has been reared or purchased in the anticipation that this animal will become a member of the milking herd.
Reproduction Management Plan:	Your own documented plan for managing the 'Fertility of Life cycle' activities required for optimising herd fertility. The plan must at least describe what will be done, when and by whom? It may also include "what if" contingency options.
Submission rate:	See 3-week submission rate.
Supplements:	Any feed type provided to animals in addition to grazed pasture.
Targets:	Median level of performance for various reproductive measures achieved by herds in the top quartile (best 25%) of the *NZ Monitoring Fertility Report 2003*.
'Top farmers':	Herds with levels of reproductive performance in the top quartile (best 25%) of the *NZ Monitoring Fertility Report 2003*.
Weigh bands:	A device that measures girth width, from which liveweight is estimated based on known relationships between girth width and liveweight.
Yearlings, yearling heifers:	Females that are 1 to 2 years old.

Notes

Notes

Dairy cow fertility underpins the viability and productivity of every dairy business. InCalf Research involving nearly 40,000 dairy cows in more than 200 dairy herds across Australia clearly demonstrated the substantial potential to improve reproductive performance in most herds. New Zealand studies involving more than 50,000 cows in more than 200 seasonal calving herds, back up the findings of the Australian InCalf research.

For the first time, New Zealand dairy farmers now have an easy-to-use reference book covering the latest and most reliable information on dairy herd reproductive management.

What dairy farmers say about the book:

" This is one of the best reference texts for farm managers I have seen. It is easy to use, the right level of detail."

The InCalf Book is excellent... It gave me valuable knowledge in the area where my practical knowledge is limited."

"It makes training in the workplace very easy to fit into a busy schedule."

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