

# INSIDE DAIRY

Your levy in action

## REDUCING N FERTILISER



### Mythbuster

Is pastoral farming carbon neutral?

### Q&A

Transitioning off the farm

### Endometritis

Can we detect it earlier?

**Dairynz**



## OVER THE FENCE...

**This month's *Inside Dairy* looks at reducing nitrogen, and farmers who've sought out new ways to manage it on the farm.**

Nitrogen (N) is a key part of any farming – 50% of the global population is sustained through the use of N fertiliser, so it's an important tool for growing food.

But reducing N and being smart with its use is critical to us as dairy farmers, both for environmental and economic reasons. It has been for the past 20 years, as we've developed and found new ways to lower our N leaching. We've had great success in that: tools such as standing cows off, efficient irrigation, plantain, and Overseer are helping farmers cut their N loss by up to 30%.

I hope you enjoy the stories in this edition about why and how some farmers – including Jeremy Casey and Kim Solly from our cover story – are finding ways to drop their N use. We know there are a number of tools up our sleeve, but identifying options for your farm and establishing a plan are good steps to take.

Farmers in Selwyn and Hinds, Canterbury, are making multiple changes to lighten their environmental footprint, and it's worth reading their story page 23.

The future of our sector is closely knitted to our reputation as the world's most sustainable producer of milk. Our customers are demanding that, and so are our communities. So, driving down our footprint remains both a challenge and an opportunity, as we look to maintain our sustainability.

This month, nominations are also opening for the Board of Director elections. We have a farmer-elected director role up for election, and we encourage all interested farmers to put their name in the ring. See page 22 for details.

It's always great to hear from you, so please send me an email with any feedback or questions – [tim.mackle@ceo.dairynz.co.nz](mailto:tim.mackle@ceo.dairynz.co.nz)

**Tim Mackle**  
Chief executive  
DairyNZ

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### Transitioning off the farm

Agribusiness consultant James Allen offers advice for those looking to step back.



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Can we detect cows at risk of endometritis using a blood test?



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Daily battles with animal health were the catalyst for Jeremy Casey and Kim Solly to start tweaking their nitrogen fertiliser a decade ago.



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## TAKE 5

### Tips for farmers

#### 1. Get connected

Trying something new on-farm or facing challenges? Want to talk with someone who's been there and done that? We can put you in touch with a support farmer. It's free and confidential. Go to [dairynz.co.nz/dairy-connect](https://dairynz.co.nz/dairy-connect)



#### 2. Enviro need-to-knows

Want a quick overview of what's happening in the environment space? See our new web page for updates on freshwater requirements, intensive winter grazing controls, nitrogen fertiliser limits, and more. Go to [dairynz.co.nz/enviro-updates](https://dairynz.co.nz/enviro-updates)

#### 3. Spring grazing

Gain confidence in allocating pasture by using the Spring Rotation Planner. It provides guidelines to help you make pasture management decisions from calving through to balance date. Learn more at [dairynz.co.nz/srp](https://dairynz.co.nz/srp)



#### 4. Roll or lift?

A down cow should be lifted only if it's highly likely she'll be able to bear her own weight. Lifting a cow before she's ready to stand can do more harm than good. Remember to roll your down cows from side to side every few hours. Details at [dairynz.co.nz/down-cows](https://dairynz.co.nz/down-cows)

#### 5. Blood test

Make sure your calves are getting the colostrum they need by doing blood tests. Just call up your vet and they'll sample 12 healthy calves to test antibody levels. More info at [dairynz.co.nz/colostrum](https://dairynz.co.nz/colostrum)



#### We appreciate your feedback

Email [insidedairy@dairynz.co.nz](mailto:insidedairy@dairynz.co.nz) or call us on 0800 4 DairyNZ (0800 4 324 7969).



To find out how to recycle the plastic wrap used to protect this magazine during postage, visit [dairynz.co.nz/insidedairy](https://dairynz.co.nz/insidedairy)

# Heard at Fieldays

We caught up with farmers at Fieldays on some of the big issues and their future on-farms plans.

**Getting farm staff can be a challenge. Have you got any tips on how to attract and keep good people?**

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“ Provide staff with opportunities and support for study. ”

- Terrie White, 2IC, Kuratau



“ Value your staff. It's the little things that count, like birthdays off, BBQ breakfasts, and staff dinners. We give new team members a welcome pack, which could include food, socks and thermals. ”

- Carl Goudswaard, 50:50 sharemilker, Walton

**What will you be focusing on or changing over the next couple of years on your farm?**

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“ Knowing our Greenhouse Gas numbers, benchmarking against other agricultural businesses, and looking at what improvements we can make while waiting for the legislation to be finalised. ”

- Vern Brasell, farm owner and DairyNZ Climate Change Ambassador, Kaiwairua



“ We're focusing on upskilling staff and encouraging them to have achievable goals. On the environmental front, we're partnering with our farm owners to plant more trees and improve our waste disposal by recycling as much as possible. ”

- Virgilio & Genevieve Gamotea, 50/50 sharemilkers, Te Kauwhata

## How are you feeling about farming over the next year? What are the challenges and what's looking positive?

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“ The positive thing is that the payout is looking good. The challenges are the unknown aspects of the new environmental regulations. ”

- Shaun & Rochelle Stewart, farm owners, Waihi



“ It's our first year on the property, so teaching cows to use a herringbone, managing a massive surplus (as we're running fewer cows at a lower stocking rate) and eliminating imported feed are the challenges. ”

- Amanda Benson, farm owner, Okoroire

“ I've recently moved to a new job, and I'm really looking forward to getting stuck in. ”

- Paddy Raftice, farm manager, Eureka



“ The positive is the payout. The challenges are the Government's slant on environmental issues – for example, shelter belts and trees on-farm don't qualify for carbon credits. Then there's the taxes on new vehicles, the stance on significant natural areas, and the level of scrutiny. Everyone wants to know what you're doing. ”

- Campbell Johns, farm assistant, Whangarei



# REDUCING



**ABOVE** A strong desire to farm healthy, productive animals led Kim Solly and Jeremy Casey to try something different with their fertiliser regime.



**CHANGING THEIR NITROGEN (N) FERTILISER REGIME TO REDUCE ENVIRONMENTAL IMPACTS ISN'T A NEW THING FOR METHVEN FARMERS JEREMY CASEY AND KIM SOLLY. IT'S BEEN A 10-YEAR JOURNEY, SPARKED BY A DESIRE FOR HEALTHIER PLANTS AND HEALTHIER COWS.**

Jeremy and Kim's search for a better approach to fertiliser use began a decade ago, while they were sharemilking 1800 cows.

Despite good production figures and thinking they were doing all the right things when it came to minerals and feed, something wasn't right.

"Day-to-day battles with animal health, reproduction and illness had become a real bug-bear," says Jeremy.

The couple were interested in finding out if cows eating healthier, more well-balanced, and more palatable pasture would experience fewer health problems.

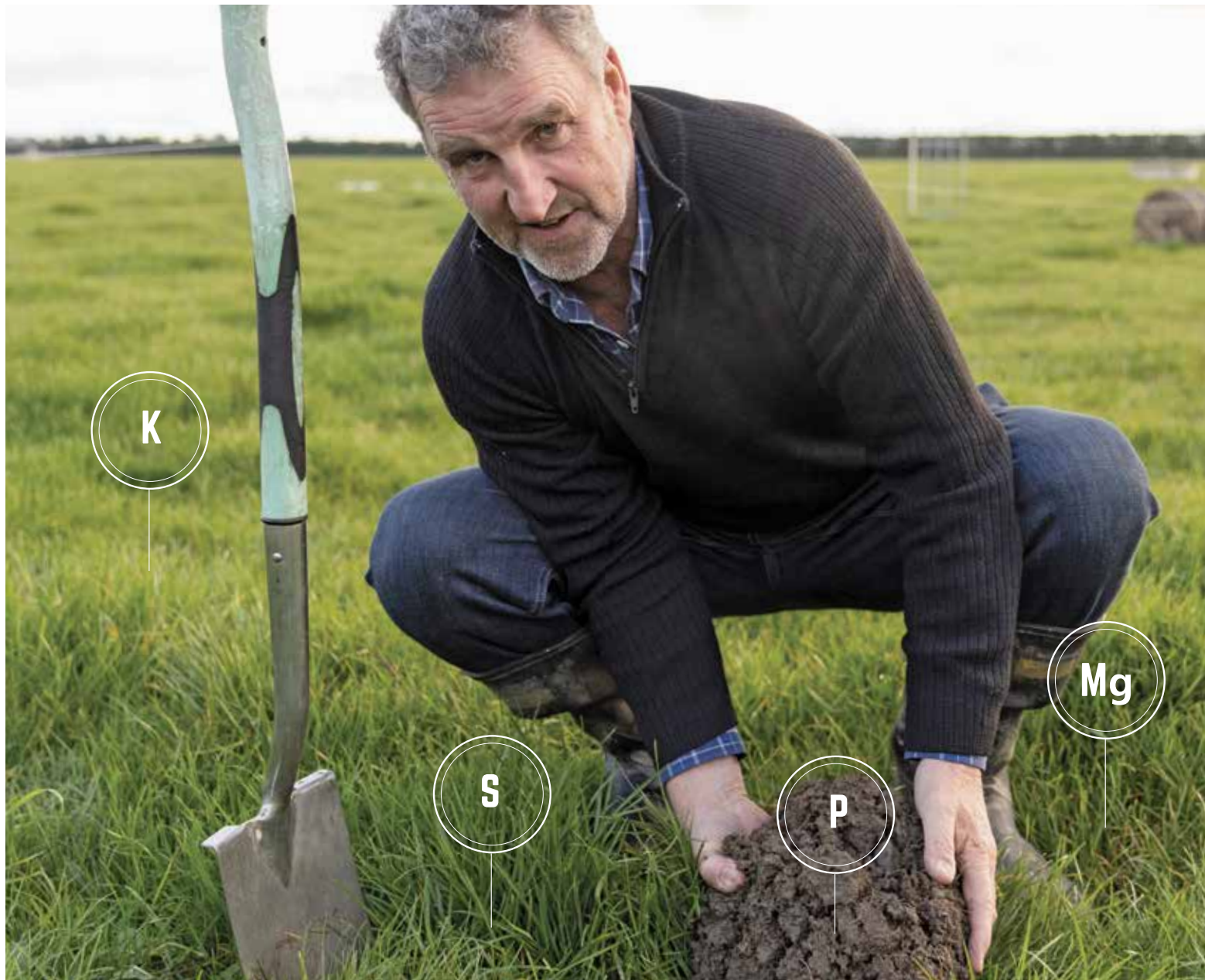
"We wanted to farm healthy and productive animals. We'd

started to read a bit about biological farming – using lower N inputs and balancing the soils – and thought this approach could be the solution to some of our problems," says Jeremy.

So, in 2012, when Jeremy, Kim, and equity partners the Murney family bought two farms across the road from each other near Methven, it gave them the opportunity to try something different with their fertiliser regime. They converted the farms from dryland sheep and cropping, with the same soil types and fertility, into two irrigated dairy units.

"When we came to this property with a road (Back Track) down the middle of two farms, it became obvious we'd be able





**CLOCKWISE FROM ABOVE** Annual soil testing is an important part of the process. // Six years ago, Jeremy and Kim planted a 4km shelter belt for wind protection, aesthetic appeal, and biodiversity. // The couple focus on applying nutrients to encourage clover growth. // Buying a property with a road running through it gave them the chance to test two approaches.

to compare a conventional fertiliser approach on one farm and a biological approach on the other, and measure the results," explains Jeremy.

The upshot was a five-year longitudinal study at Back Track Dairies, comparing conventional fertiliser use on one farm (Waioara – 210ha) with the Albrecht-Kinsey biological method on the other (Whakapono – 155ha). (Dr William Albrecht was an American soil scientist who believed in meeting the mineral requirements of soil, rather than plant. Neal Kinsey, a former Albrecht student, continues his work).

### Changes for the better

Jeremy and Kim had been making an effort to reduce their N fertiliser use well before the national freshwater regulations were put in place. So, in many ways, they were ahead of the game.

But because the farms were conversions, the couple started

off using reasonable amounts of N. "Around the 250kg N/ha/year mark, which quite a lot of people are still above now," says Jeremy.

"But we've gradually dropped that down by 30 to 40 units every year for the first three to four years, and even more on the biological farm, which has always been 40 to 50kg N/ha/year lower than the conventional."

On the conventional farm's pastures, Jeremy and Kim also use SustaN, a urease inhibitor that reduces N losses from ammonia volatilisation by 50% on average compared to urea.

N fertiliser use is now 150kg N/ha/year on the conventional farm, and 102kg N/ha/year on the biological farm. Reductions in fertiliser have not adversely affected milk production, which has been similar for both farms.

Kim says they've learnt a lot, but it cost a bit of money at the beginning because the biological farm received greater fertiliser inputs.

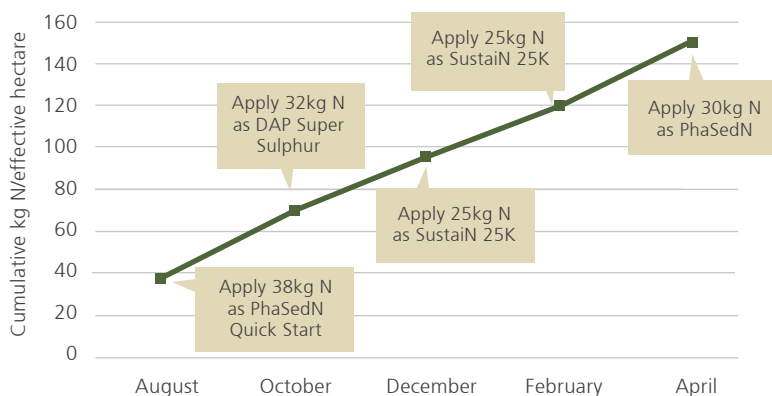


“WE’D STARTED TO READ A BIT ABOUT BIOLOGICAL FARMING – USING LOWER N INPUTS AND BALANCING THE SOILS – AND THOUGHT THIS APPROACH COULD BE THE SOLUTION TO SOME OF OUR PROBLEMS.”

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### PLAN FOR N APPLICATION AT WAIORA IN 2020/21



## FARM FACTS

**NAME:** Back Track Dairies

**OWNERS:** Equity partners Jeremy Casey & Kim Solly with Murney Family Trust

**LOCATION:** Highbank, Methven

**FARM SIZES:** Waiora 210ha (effective) + 25ha lease block; Whakapono 155ha (effective)

**HERD:** 840 KiwiCross at Waiora; 560 KiwiCross at Whakapono

**PRODUCTION:** 469kg MS/cow and 1675kg MS/ha at Waiora; 483kg MS/cow and 1744kg MS/ha at Whakapono (2020/21 season)

**IRRIGATION:** 86% pivot, 14% K-Line at Waiora; 90% pivot, 10% K-Line at Whakapono

## JEREMY & KIM'S TIPS FOR REDUCING N



Look at whether you can reduce applications of N in January and February. (Jeremy reviews the upper soil temperatures to assess the impact on fertiliser response.)



Take account of when clover is really growing and when mineralised N in the soil is coming through, and utilise this.



Make sure other nutrients are at optimum levels.



Reduce N gradually where you can: 30-40kg/ha/year reductions, to give the clover time to establish and contribute.

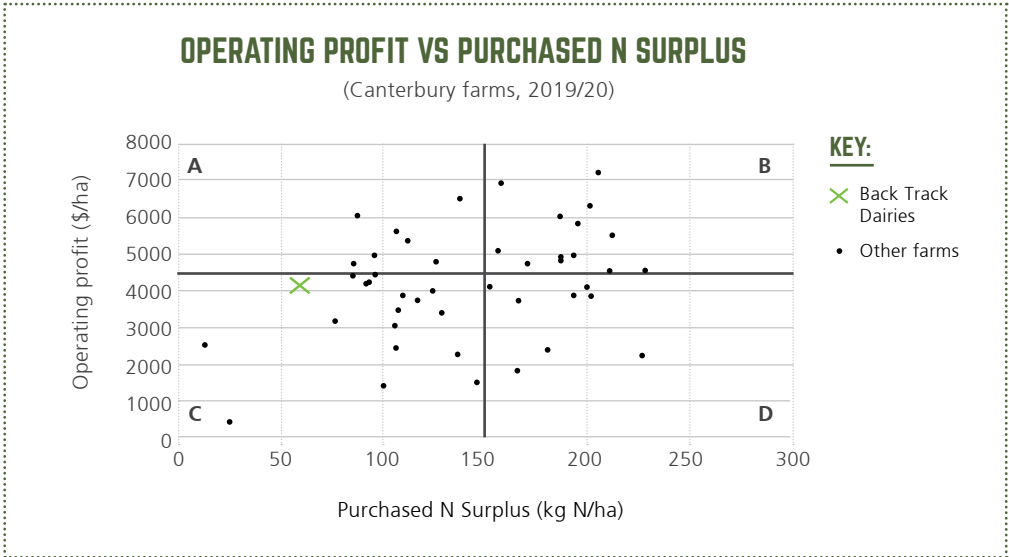


Take account of the N in your effluent and use it as a nutrient resource.

**“WE’RE NOT TALKING  
ABOUT ORGANICS, BUT  
MORE OF A MIDDLE GROUND  
BETWEEN CONVENTIONAL  
FARMING AND ORGANIC  
FARMING.”**







*This graph shows results for Canterbury farms in DairyBase. The solid black lines show the median for the national dataset in DairyBase, with each quadrant reflecting 25% of the NZ farms (50% below and 50% above the median operating profit; and 50% to the left and 50% to the right of the median purchased N surplus).*

“But now, we’re in a pretty good space. Not because of the milk price, but because we have a slightly higher stocking rate (from 3.2 to 3.5 cows/ha), it’s working out more in our favour. We’re definitely more efficient than we were, which has to be the overall aim,” says Kim.

### Applying knowledge

From early on, Jeremy and Kim focused more on improving nutrients other than N on the biological farm. They still place emphasis on the main minerals – applying phosphorus, sulphur, potassium, calcium, and magnesium – and they count on these to encourage clover growth. Both farms have grown similar amounts of pasture, though using lower N fertiliser on the biological farm has resulted in more clover growth.

The couple also apply lime and dolomite on both farms and the lease block to raise pH levels and improve animal health outcomes. The not-in-calf rate has improved to 8.5% on both farms.

**CLOCKWISE FROM TOP LEFT** At certain times of the year, Jeremy and Kim use targeted effluent application through pivots over 90% of the farm. // Second-in-command Roel Ermio (left) has been with Back Track Dairies for 14 years. // Improved reproductive performance and fewer health problems at calving have been a welcome side-effect on the biological farm.



**ABOVE** Jeremy and Kim say you'll never know how much N you can remove from the system until you give it a go.

Jeremy and Kim have learnt from the different approach to soil fertility. They now apply quite a bit of biological theory to the conventional farm, after realising clover responds well to a reduction in synthetic N. Independently of the two-system comparison, they manage to run the conventional system successfully using much lower N than many other operations.

"For a long time, farmers have known you can reduce your reliance on N and that clover will make up the difference. But we've got so dependent on that easy fix of following the cows with N every round, now the pressure's on to reduce it, we're going to have to suck it up and actually do it," says Jeremy.

This approach fits nicely with DairyNZ's and Environment Canterbury's recommendations, and with the way future environmental policy in New Zealand is going, says Jeremy.

"What we've done on the biological farm with N we've also been able to do on the conventional farm, without spending extra money on balancing the soil."

### Pivotal next steps

Jeremy says they'll continue doing things differently at Back Track, focusing on a sustainable approach. That includes adding shortfalls in any nutrients, trying foliar fertilisers on the biological farm, and at certain times of the year, using targeted fertigation through the pivots over 90% of the farm.

They apply 30kg of N equivalent per year in effluent over the whole farm. On a 21-day round, they apply it strategically behind the cows, so the grass has an opportunity to grow. Regardless, they'll be well under the 190kg N/ha/year cap, says Jeremy.

"In future, we want to spend less on fertiliser, especially N.



Visit [siddc.org.nz/research](https://siddc.org.nz/research) and/or [dairynz.co.nz/back-track](https://dairynz.co.nz/back-track) for more about the Soil Nutrient Management Project run through the South Island Dairying Development Centre.



Read more about the partner farms involved in the Selwyn Hinds Project at [dairynz.co.nz/selwynhinds](https://dairynz.co.nz/selwynhinds)

Low rates of N fertiliser encourage clover growth, which makes more N available to the pasture in a healthier way. Better soil structure will hold onto N, instead of it being leached into groundwater."

Jeremy says reducing N can be tricky to understand, and it takes a process of weaning to work out how efficient you can be.

"The main thing is to make sure other elements are neither lacking nor over-applied. I'd suggest taking some of the spending from things we tend to over-apply, like phosphate and N, and swapping some of that into potassium, sulphur, and other elements, especially when used in combination with N.

"We're not talking about organics, but more of a middle ground between conventional farming and organic farming, and you'll never know until you give it a go," says Jeremy.



# Simple changes managing N

When it comes to gaining efficiencies in managing nitrogen (N), Waikato farmers Rachel and Chris Numan see N-loss and N-use as two sides of the same coin.

Chris and Rachel's focus in the past was on improving the response rate from their N use. However, in recent seasons, a fluctuation in N-loss levels has prompted further changes on their System 4-5 farm at Pokuru, just outside Te Awamutu.

The couple are 50:50 sharemilkers running 700 cows at Riverland Dairy, owned in partnership with Chris' parents, John and Maria. In the 2018/19 season, their N loss to water was 50kg/ha, with a conversion rate of 30% efficiency.

"In 2019/20, that increased to 64kg with a conversion rate of 25%," says Chris. "We thought, 'what are we going to do to improve?' Although in 2019/20 our N-use/ha was 157kg/ha – well under the maximum threshold – we still wanted to get our N-loss figures better."

## What they did

The couple's changes in recent seasons, based on DairyNZ resources, discussion groups and personal research, were:

- using lighter/more frequent (not heavy/less frequent) N applications
- lowering N fertiliser application rates in summer
- changing from full cultivation to strip tillage for maize grown
- avoiding applying N to stock 'camping' spots (i.e. 15% of the farm's paddock areas)
- timing N applications to maximise pasture response rate per kg applied
- delaying applying N in the autumn to fully use mineralised N in the soil first
- soil-testing maize paddocks, resulting in no need to add extra N onto the crop



Chris loads urea into the fertiliser spreader.

- using DairyNZ's Effluent Spreading app to calculate appropriate application rates based on N loading.
- Chris says, in more recent times, they've been applying N fert up to five days pre-grazing to maximise the response rate.
- "I plucked that one out of a DairyNZ Tiller Talk group I went to," he says.
- "In early summer, we now wait until rain actually turns up – 10mls or more. We've also been training staff to avoid applying N to stock 'camping' areas and to turn the spreader off when we go through them."

## Early days but signs are good

Chris says any incremental changes so far happened in the 2020/21 season, so

they won't see full results from that until next year.

"At the end of May this year, I worked out how much N we used. It turned out to be about 137kg/ha of N (about 20kg/ha less than in 2019/20)," he says. "We finished 22,000kg MS ahead for the season. It was a much better season in 2020/21 for pasture growth rates through the winter and summer, and the cows held higher production from Christmas to May, so we've also fed more supplement through that period."

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Find out more about regulations and managing N on-farm at [dairynz.co.nz/step-change](https://dairynz.co.nz/step-change)



# Guided by history

**Fifth-generation Southland farmer Maurice Hanning and wife Suzanne tap into decades of farm knowledge for their wintering approach.**

At Bristol Grove Dairies, the farm's history is extremely important.

"My husband, his father and grandfather have grown up on this property, so they have a really good understanding of how the soil behaves," says Suzanne. "The experience of the generations tells them when and where and what to plant, what equipment to use, and how to treat the soil to get the very best result from it."

The Hannings' farm, 20 minutes outside Invercargill, has been in Maurice's family for 140-plus years. Maurice and Suzanne converted it from sheep and beef to dairying in 2007 – these days they have 650 crossbreeds on its 230ha and nearby support block.

The couple's farm management, including their wintering methods, draws on learnings shared by previous and current generations.

## Wintering ways

"We look at wintering as part of our whole farming system," explains Suzanne. "We do dry matter monitoring and measure the grass once a week, and look for paddocks that aren't performing, are compacting, or are full of weeds."

"We'll plough those and put them into winter crop for two years. Contractors are only used to plant the fodder beet; we do the rest ourselves. Ploughing helps break up our heavy soils in compacted paddocks and get them free-draining again. There also have to be multiple reasons to rip a paddock up – it's part of a much broader picture."

'Double cropping' (first swedes, then fodder beet) helps get rid of a lot of weeds, so the Hannings can minimise their use of sprays. Paddocks are put back into grass in the third year, and a tonne of lime per hectare gets things going, while keeping soil pH on track.

**"We look at wintering as part of our whole farming system."**



## Critical care and cultivation

"With critical source areas, we leave a big fat grass buffer around the bottom of them, and graze that area last, if it gets grazed at all," says Suzanne. "We also graze the cows from the top of the hill down, with the buffer at the bottom."

Maurice and Suzanne say, with cultivation, patience is key. "Don't try and get in there when it's too wet or it's not quite right, just for the sake of being able to say 'yes, I got my grass in'," advises Suzanne.

"Wait until the soil condition is perfect – if you get in there with heavy equipment and machinery, you'll make an even bigger mess. Waiting a week or two – until soils have a nice nutty texture, crumbling freely – makes a heck of a difference."

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Follow the Hannings at [facebook.com/bristolgrovedairies](https://facebook.com/bristolgrovedairies) and get more wintering advice, including how to plan your winter crop cultivation early, at [dairynz.co.nz/wintering](https://dairynz.co.nz/wintering)



# Pumped up with effluent gains

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**Switching to a new land application effluent system has put a Taranaki farming couple on the front foot ahead of upcoming regulatory changes.**

Farm owners Chris and Kathy Prankerd run 260 KiwiCross cows on their 97ha (effective) property in the small farming community of Tariki, east of Mount Taranaki. It was their time as a DairyNZ focus farm, from 2011 to 2013, that put them on the path to better efficiency and productivity, says Chris.

While their original three-pond effluent storage system handled effluent storage reasonably effectively, high rainfall events could mean an occasional discharge to a nearby waterway (they have a dual right for two years to discharge to water, which runs out in December).

So, the couple's switch in mid-2019 to a more effective irrigation system off one of the ponds was something they were keen to do sooner rather than later.

"I've always tried to be a bit ahead of the game," says Chris. "I've also found the Taranaki Regional Council is really good to work with too, if you're trying to be proactive."

## **Simplicity, safety, savings**

Chris says simplicity for their new system was key.

"It'll shut down if the pump pressure drops, and it's got lots of safety features that'll stop it if it's not operating correctly. That's what you need in our country – we've got lots of rivers and streams close by everywhere. My manager running the farm is never far from the ponds and he

monitors the system regularly. When we set it, it only goes for about three hours anyway."

With the old effluent system, they'd pump every second year – and it always seemed to be on the same paddocks, as those were the closest.

"Now we can cover 25ha of the farm with it," says Chris. "Every round, it saves us doing at least three paddocks with urea. I can already see our N use has improved. The paddocks we've been pumping onto are also definitely growing better now."

## **All under control**

Best of all, the Prankerds haven't had to discharge effluent to water at all for the last 18 months.

"It's easy for us to keep it under control, even though we're in a high rainfall area," says Chris. "It's also probably as cheap as it's ever going to be to do an upgrade. We're probably saving about a couple of tonnes of urea use a year, and I know in the coming years we're going to save a lot more."

"My advice is: 'Why leave it to the last minute when you can do it now?'"

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To find out about designing or upgrading effluent systems, go to [dairynz.co.nz/effluent](https://dairynz.co.nz/effluent)



*Kathy and Chris are chuffed with their new effluent system.*

# Strategies for lowering N fert

Looking to reduce fertiliser use on your farm? Small changes across the year can add up to big reductions.

## Spring

### Consider applying gibberellic acid

Replacing a small amount of nitrogen (N) with gibberellic acid (GA<sub>3</sub>) in early spring and/or autumn can still allow you to influence the timing of pasture supply. Be aware that there's a limit to the quantity of N that can be replaced without negatively affecting pasture production.

Both N fertiliser and GA<sub>3</sub> are used to influence the pattern of pasture production in the shoulders of the season. Learn more at [dairynz.co.nz/ga](https://dairynz.co.nz/ga)

## Summer

### Give N a miss in January/February

Try skipping one or two applications over the whole farm or over some areas of the farm, such as areas with higher clover content. (To find out if this option would work for you, visit [dairynz.co.nz/N-use](https://dairynz.co.nz/N-use))

Skipping N in January/February, when soil mineralisation rates are high and clover is fixing N, is unlikely to limit growth. To gain confidence and to check what's limiting pasture growth, take herbage samples. Farmers in DairyNZ's Selwyn and Hinds project reported pastures looking N deficient; however, herbage analysis showed potassium was deficient, not N.

## Year

## Winter

### Create an annual N plan

When forming a plan, try to ask yourself the following questions:

- How much N fertiliser did I apply, and when? Did I apply N fertiliser to the paddocks/areas we'd targeted in the plan? (If you used contractors, check their application tracking data. Some farmers have reported significant discrepancies between planned and actual N use.)
- How much N fertiliser did I apply on the effluent and non-effluent areas?
- How many applications, how often, and at what rate (kg N/ha application)?
- What type of N fertiliser did I use?
- Have I used the N-boosted grass to fill a genuine feed deficit?

## Autumn

### Walk the pasture

Good monitoring and planning are particularly important in autumn because it's a risky time for losing N. Use pasture walks to make sure you apply N only if a genuine feed deficit is forecast. Hold back in late autumn when pasture response can be slow and N loss risk is high due to drainage from autumn/winter rain.



## Putting a plan into practice

Canterbury farmers Mark and Devon Slee used their fertiliser plan to reduce N from 250-260kg N/ha to 190kg N/ha in the 2020/21 season. They did so without any significant effect on pasture or milk production, and without having to rely on extra supplements.

Mark and Devon's biggest focus has been on improving the farm's overall fertility, and reducing variability between paddocks and within paddocks with a more intense soil-testing regime (per ha) and variable rate fertiliser applications.

They've concentrated on getting most paddocks to 6.2 pH, getting all paddocks to optimum potassium levels (as this was quite low in some paddocks), and applying molybdenum as required.

Mark says their intensive soil-testing regime has paid off.

"With our focus on overall soil fertility, we've been able to grow more grass, reduce supplement use and reduce our reliance on N fertiliser," he says.

"It's about adding exactly what is needed, when it's needed."



Devon and Mark farm 2745 cows on 760ha (effective) over three properties in the Hinds catchment.

### Here's an example N fertiliser plan for an irrigated farm in Canterbury

Date	Product	Rate (kg N/ha)	Cumulative N/ha
Late August/September (when temperatures are above 7°C and rising)	Ammo 36 (if the farm is low in sulphur; if it isn't, they use straight urea)	40-50kg N/ha	40-50kg N/ha
Late September (second round)	Urea + GA <sub>3</sub>	20kg N/ha	60-70kg N/ha
October	Coated urea	20kg N/ha	80-90kg N/ha
November	Coated urea	20kg N/ha	100-110kg N/ha
December	Coated urea	20kg N/ha	120-130kg N/ha
January/February	Coated urea	20kg N/ha	140-150kg N/ha
March	Coated urea + GA <sub>3</sub> *	20kg N/ha	160-170kg N/ha
April	Urea	20kg N/ha	180-190kg N/ha

\*GA<sub>3</sub> applications depend on temperature being adequate for it.

# Step in the right direction



Early results from a Taranaki farm comparison show encouraging reductions in emissions and nitrate leaching, but currently at the expense of some profit.

*Taranaki farmers at an open day on Gibson Farm, May 2021.*

How can dairy farmers reduce their environmental footprint within profitable farm systems in the Taranaki environment?

To find solutions, Dairy Trust Taranaki (DTT) and DairyNZ have partnered up to run a three-year 'Step Change' project.

It started in June 2020, when DTT's Gibson Farm was split into two 54ha farms, with one representing current farm practice and the other representing a possible future farm system. The aim is to reduce greenhouse gas (GHG) emissions and nitrate leaching, while keeping profit high.

**CURRENT:** 169 cows (3.13 cows/ha), using up to 190kg N/ha and up to 700kg DM/cow of imported feed.

**FUTURE:** 139 cows (2.57 cows/ha), using up to 75kg N/ha and up to 300kg DM/cow of imported feed.

**Compared with the current farm, the FUTURE farm used:**

- 55% less N fertiliser input per hectare
- 100% less imported feed
- a 0.6 cows/ha lower stocking rate.

Compared with the CURRENT farm, the FUTURE farm offered 0.5t DM/cow more pasture annually.

Gibson Farm has two vats and supply numbers, which makes it easy to work out the two farmlets' milksolids production

differences. Pasture growth and pasture cover are recorded for most weeks of the year by a conscientious farm team, led by Debbie McCallum and Brett Thomson. Based on results from this regular measurement, management decisions are made separately for each farm.

These results provide encouragement that environmental targets (such as 10% reduced methane by 2030 outlined by the Zero Carbon Act) can be met using profitable farm systems in the Taranaki environment.

Unfortunately, at current milk prices, profit would be reduced by 12%. To bridge this gap, an additional 34kg MS/cow (85kg MS/ha) is required on the FUTURE farmlet – a challenge we'll be attempting in the next two years.

## Partnering up

DairyNZ has organised for five commercial dairy farms in Taranaki to become partner farms, alongside the Gibson Farm trial. At the first open day, in May 2021, farmers got to hear about some of the changes these partner farms are making to reduce their footprint and stay profitable.

Gibson Farm will test some of the bigger and riskier farm system changes. Then, using information gleaned from the farmlet study, the partner farms will most likely make smaller changes.

## Summary of what we've seen on the FUTURE farmlet:

- **N input** reduced by **91kg N/ha**
- **Pasture growth** reduced by **1.4t DM/ha**
- **Milk production** reduced by **211kg MS/ha**
- **Operating profit** reduced by **\$657/ha (12%)**
- **Total GHG emissions** down by **21%**
- **Methane** emissions down by **13%**
- **Nitrate** leaching reduced by **10kg N/ha.**

Keen to know more about this project and follow the results? Go to [dairytrusttaranaki.co.nz/dtt-gibson](https://dairytrusttaranaki.co.nz/dtt-gibson)



## Are we carbon neutral?

DairyNZ farm systems specialist Chris Glassey tackles the commonly held belief that pastoral dairy farming is carbon neutral.



We know that methane and carbon dioxide (CO<sub>2</sub>) released into the atmosphere by grazing animals eventually returns to be absorbed as CO<sub>2</sub> by pasture plants. Also, soils under pasture store considerably more tonnes of carbon per hectare than the pasture plants. So, why isn't pastoral farming carbon neutral?

Unfortunately, it's the conversion of the pasture carbon digested by cows to methane that causes the challenge. It means pastoral farming releases some carbon from the cycle that contributes to warming.

Although methane remains in the atmosphere for only a relatively short time before it becomes CO<sub>2</sub> again, it's about 25 times more potent for warming the planet than CO<sub>2</sub>.

This is above the warming that would have otherwise been caused by release as CO<sub>2</sub> alone. So, methane emissions can be 'carbon neutral' while also increasing warming.

### But isn't the carbon stored in the soil under pastures counted to offset carbon emissions from grazing?

I spoke to Professor Louis Schipper from University of Waikato about this. He says it's true that soils store a lot more carbon than the plants above them. New Zealand soils under pasture have higher soil carbon levels than the world average, but there appears to be little change over time in levels under well-managed grazing systems.

This is because soil carbon reaches an equilibrium under different land uses. CO<sub>2</sub> absorbed from the atmosphere by grass in the process of photosynthesis is either returned to the atmosphere via plant and soil respiration, methane (via animals), or when exported product (e.g. milk) is digested. Carbon enters the soil through decaying plant material (leaves and roots) and dung, but this is also slowly converted to CO<sub>2</sub>.

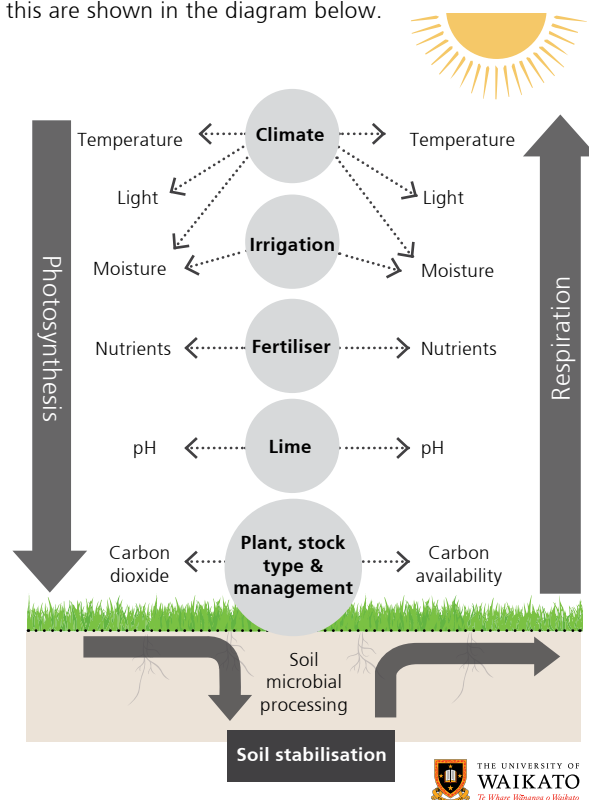
It's also difficult to monitor and measure carbon in soil at a national level, but this is now being done – see [agmatters.nz/topics/measuring-soil-carbon](https://agmatters.nz/topics/measuring-soil-carbon)

Professor Schipper says soil carbon takes a long time to build but is lost quickly through soil management practices such as tillage, which leave soils bare, stopping photosynthetic inputs and increasing soil erosion and exposure to drought. This suggests it may be challenging to achieve substantial carbon sequestration in New Zealand soils, but it remains an active area of research.

The loss of carbon from soil potentially adds to our greenhouse gas emissions and it's critical as part of wise farm management to hold onto the soil carbon we have.

### Carbon movement into and out of soil under pasture

Soil carbon under pasture is increased or decreased when there are small differences between photosynthesis and respiration. The amount also depends on the microbial processing of different soils. The processes that control this are shown in the diagram below.



### Myth

Pastoral dairy farming is carbon neutral because carbon gets stored in soils and captured in pasture growth.

### BUSTED



Carbon released from farms as methane contributes to warming before returning to the carbon cycle. Wise farm management will hold onto current soil carbon levels.

## TRANSITIONING OFF THE FARM

Stepping back from the day-to-day running of the farm can be an exciting stage of life – but also complex. James Allen, agribusiness consultant and managing director of AgFirst Waikato, has helped plenty of farm owners through the process.



### **James, tell us a bit about yourself and your experience working with dairy farmers.**

I'm a farm systems consultant, covering most types of agriculture, with a fair bit of dairy in the Waikato. We work across all farm management, which involves financial, technical, people and environment. The most complex part of farming is around the people side of things, and the issue of succession and progression is part of our service to dairy farmers.

### **What key things should a farmer consider if they're wanting to step away from the daily running of the farm?**

Firstly, why are you looking to step back? Is it simply because you're ready to retire, or is it because you're tired of dealing with staff, labour or compliance? Make sure it's for the right reasons.

We've seen farmers put a sharemilker on because they're over dealing with labour, but the problem doesn't go away – there'll still be people issues to sort out.

Once you're clear on why you're making the change, the next thing to consider is the degree of control or input you want to have. This will lead to the type of structure you put in place. Are you ready to step back and hand over the decision-making to someone else, and how much? It can be hard to let go. The key point here is you need to give the new person space, but you also need to create accountability. We've seen it many times where a farmer's put a sharemilker on, but they're still busy telling them what the round length needs to be and how much to feed the cows.

Next, look at the financial viability of the structure you're setting up. Be clear about the implications of whatever new system you're putting in place. You need to make sure your



**"You need to give the new person space, but you also need to create accountability."**



current farm is profitable, and your debt levels are under control. For example, if you sell your herd and put a herd-owning sharemilker on, you've sold an asset, but your returns are more than halved as well.

Think about infrastructure if you're making changes. In particular, have you got housing that's of good enough quality to get the right people on board? Is your farm machinery and plant in a condition that anyone can understand and safely use?

Then, make sure you're clear on who you're handing control to. Having a strong recruitment and selection process, and a thorough due diligence process for both parties, will mean you get the right people coming on-farm.

Finally, be clear on what you want to do with the extra time on hand once you step back. What are your medium- and long-term plans? Some farmers are good at creating off-farm interests, and some aren't. If you aren't and you suddenly retire, what next?

### **Should farmers take a planned approach to this?**

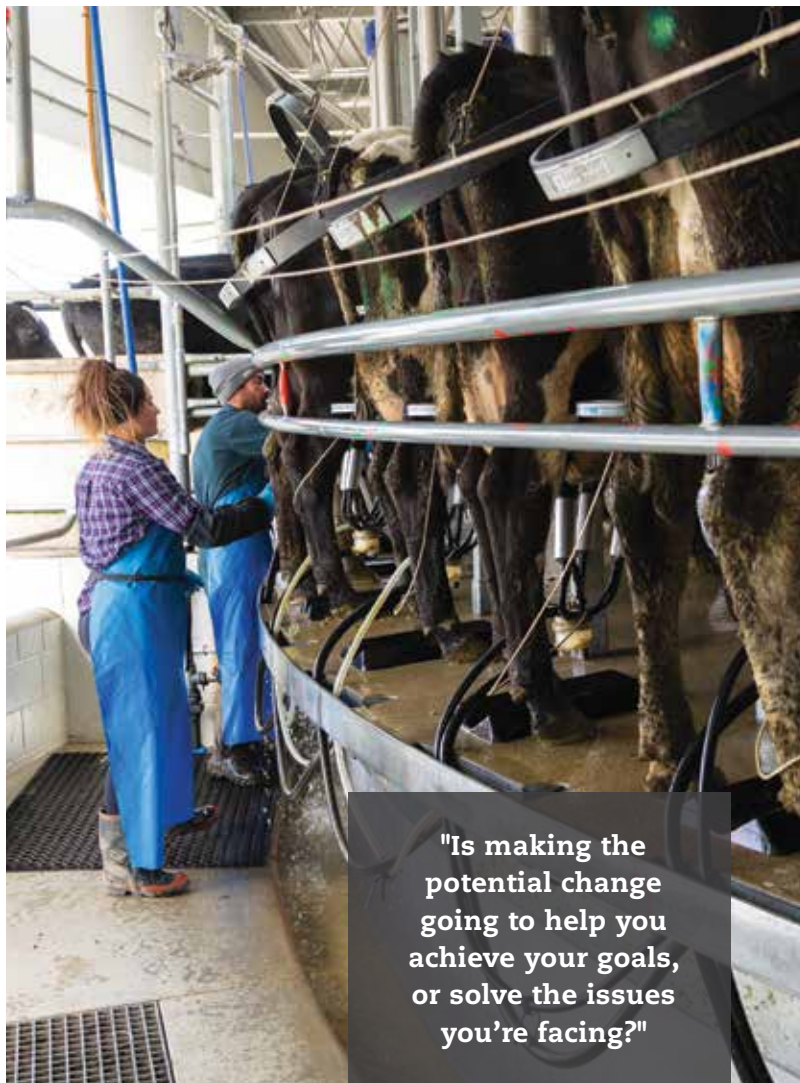
Yes. Transitioning off the farm is not something you want to make a snap decision on. Planning allows a bit of time to ensure you're making the right decisions. For some of our clients who are serious about getting out of the shed, it can often be a two-year transition.

### **Who would you recommend farmers involve in this decision?**

It's good to get a range of views from fellow farmers. But when you start getting down to the detail, your team should include your accountant, consultant, lawyer, and possibly your bank manager. Having that independence can give an objective viewpoint, removing some of the tension.

### **Some farmers will be concerned about the cost of external support. What would you say to them?**

Make sure you're clear about what you want before you engage the full team, so you're maximising the use of their time. If all the team's in the same place at the same time, the cost isn't massive in proportion to what you're trying to achieve. If you end up with the wrong legal or operating structure because you haven't sought advice, it could cost you hundreds of thousands, as opposed to a few thousand to engage the right rural professionals at the right time.



**"Is making the potential change going to help you achieve your goals, or solve the issues you're facing?"**

### **For farmers working towards stepping back in the 2022/23 season, what are three key things they can do now to be in the best position?**

1. Be clear on the 'why'. Is making the potential change going to help you achieve your goals, or solve the challenges you're facing?
2. Do your homework now on the financial viability of your decision. For example, if you sell your herd and bring on a herd-owning sharemilker, will your debt level be low enough to sustain that?
3. If you're seriously thinking about making changes for next season, the planning starts today. If you're putting a sharemilker on, for argument's sake, you need to be advertising for that position in October/November. So, you need to have your homework done pre-calving, before everyone's too busy.

Go to [dairynz.co.nz/succession-planning](https://dairynz.co.nz/succession-planning). Also, keep an ear out for our podcast on this topic with James Allen, at [dairynz.co.nz/podcast](https://dairynz.co.nz/podcast)

# Clearing up museum's water display

DairyNZ corrected perceptions of dairying when errors were made in an exhibition at New Zealand's national museum.



DairyNZ does a range of advocacy and media work behind the scenes – and occasionally, we respond to a Twitter storm. In December 2019, a furore developed after a Member of Parliament tweeted about Te Papa's *Te Taiao Nature* exhibition.

The tweet's photo showed a bottle of dyed brown water representing a farm stream, with a label of a cow defecating. The label's wavy lines represented rolling hills, but were easily mistaken for waves of water.

The impression? The cow defecating in a waterway and affecting the farm stream's water quality. Given our dairy farmers have so far excluded stock from 98% of waterways, the display was highly misleading.

## Action all sides

DairyNZ worked with Te Papa to help them understand the issues, so the exhibition could be updated to reflect a more balanced and science-based representation of dairying, water quality and sustainability.

The cow was then shown as being clearly on land (not in water); the bottle's water colour better reflected what might be found in a farm stream; and new video material showcased dairy farmers' water quality and other sustainability efforts on land.

## Credit where credit's due

Te Papa's team apologised and was eager to put things right based on DairyNZ's input, as head of marketing and communications Kate Camp explains.

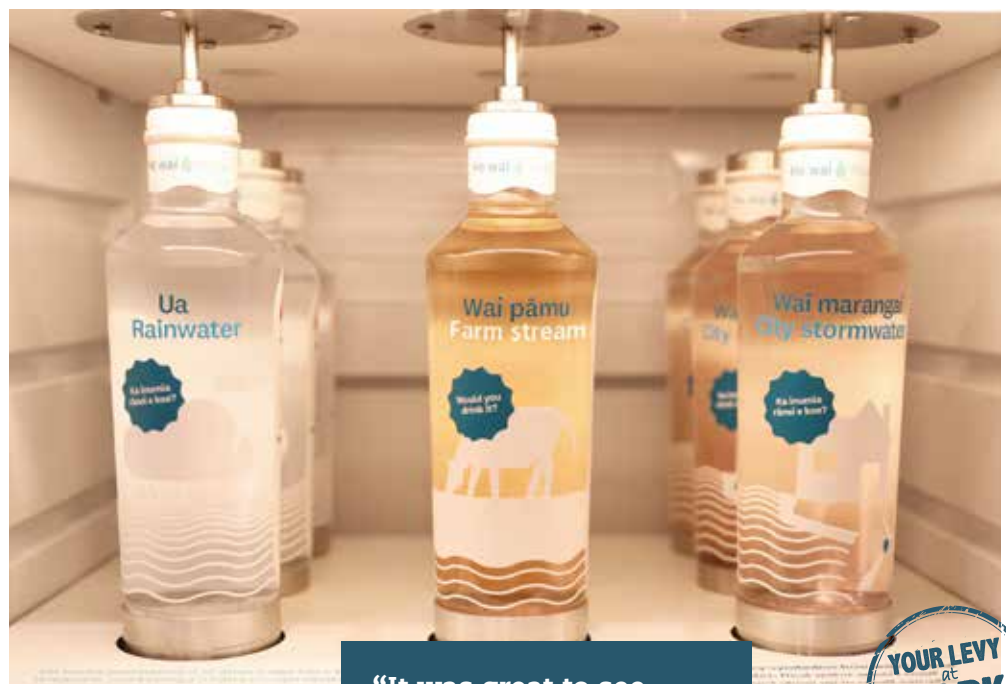
"Te Papa's challenge is to take a complex picture and present it in a simple way, while still being true to the science," she says.

"We were happy to work with DairyNZ to clarify the display –

and to highlight the great work our rural communities are doing to protect waterways."

Dairy farmer Andrew Booth, who features in one of the exhibition's sustainability videos, was impressed by the outcome.

"It was great to see DairyNZ actively engage with Te Papa to help set the record straight, to then build the relationship. That's resulted in showcasing farmers' environmental restoration efforts across the country in the national museum," says Andrew.



"It was great to see DairyNZ actively engage with Te Papa ..."



This work with Te Papa is just one example of DairyNZ's commitment to engage actively on behalf of farmers.

As a sector, we know we need to continue reducing our environmental impact and we're working hard on that.

At the same time, stories of sustainability and success are widespread across dairying. So, it's vital we all share our stories to create better awareness of the great work being done.



## White clover to the rescue



**White clover offers many benefits, so why isn't there more of it on our farms?  
And what are some strategies for increasing clover levels in your pastures?**

We all know the benefits that white clover brings to New Zealand pastures due to its ability to fix atmospheric nitrogen (N) and its high nutritive value. Nevertheless, clover typically contributes less than 15% of total annual DM/ha in our dairy pastures. This is well below the 30% contribution considered necessary to capture the animal productivity benefits.

One explanation for our low clover content is the rise in N fertiliser used on dairy farms in the past few decades. The negative relationship between N fertiliser and clover yield in mixed pastures is well-documented. Recent studies by DairyNZ and AgResearch in four regions showed that, overall, N fertiliser decreased the clover content of mixed pastures at a rate of about 1% for every 10kg increase in N fertiliser/ha above the low-N treatment levels used in the experiments.

These studies also showed clover can make strong and positive contributions to the total yield of pastures, especially in summer/autumn. This potential benefit is frequently overlooked.

A reduction in pasture growth due to a lower use of N fertiliser is possible and expected. However, the magnitude of this reduction will depend on clover's response to the reduced N inputs.

Also contributing to the sub-optimal clover content in New

Zealand pastures has been the failure to recognise that white clover requires more of the other major nutrients than ryegrass.

### **To achieve good clover content in pasture under lower N fertiliser use:**

- Follow best management practices for establishing new pastures and improving clover content of older pastures – see table below.
- Monitor soil fertility by conducting soil tests and clover-only herbage tests, and look for expert advice regarding fertiliser needs.
- Make sure your grazing management controls the competition from ryegrass for light, particularly in late winter and early spring.
- Review information about the life cycle stages of white clover plants, the natural cycles that affect clover's density, and the interactions between ryegrass and clover. Excellent summaries of these issues were published in *Technical Series* September 2016 and December 2016 ([dairynz.co.nz/techseries](http://dairynz.co.nz/techseries)), which will help you to manage your pastures.

	New pasture	Established pasture
<b>Autumn</b>	Clover seedlings are very vulnerable to shading. The first grazing requires a delicate balance between preventing shading by ryegrass and treading damage to the small and compact seedling. Do not graze lower than 3-4 cm.	
<b>Winter</b>	Clover seedlings are sensitive to treading damage from heavy animals on wet soils. Use young stock if available.	Avoid accumulating long pasture because ryegrass can shade the slow-growing clover at this time of year.
<b>Spring</b>	Avoid shutting for silage as this will intensify shading by ryegrass.	Graze as per normal management for this time of year.
<b>Summer</b>		Maintain residuals of at least 4-4.5cm, and 28-30 day grazing round, especially under dry conditions.

Table authors: Cosgrove, G. P. and Lee, J. M., 2016.

### More information

For guidance on seed selection, pasture renewal methods and seedbed preparation, go to [dairynz.co.nz/sowing](http://dairynz.co.nz/sowing)

If you'd like to discuss the content of this article with someone from DairyNZ, please contact post-doc scientist **Laura Rossi, 0272370352, [Laura.Rossi@dairynz.co.nz](mailto:Laura.Rossi@dairynz.co.nz)**

## Farmer leaders invited to join DairyNZ's Board

DairyNZ levy-paying farmers are invited to apply to join the organisation's Board of Directors.

Nominations are open from Monday, August 9 until noon, Friday, September 3, for one farmer-elected director.

Ideally, candidates would have:

- an understanding of farm systems, research and development, policy and advocacy
- an interest in progressing Dairy Tomorrow and DairyNZ's strategy
- good networks in the dairy sector
- strong commercial skills, and financial, governance and strategic expertise.

For more information, please visit [dairynz.co.nz/agm](http://dairynz.co.nz/agm)



## Showcase your farm

Entries are open for the Ballance Farm Environment Awards, run by the New Zealand Farm Environment Trust. The awards are an opportunity to showcase, benchmark, and improve the environmental, social and economic sustainability of your farm. Being part of the awards provides you with feedback on your business, and helps you identify your strengths and learn from others.

Entries close October 15. Find out more at [nzfeawards.org.nz](http://nzfeawards.org.nz)



## Pasture Summit: spring field days

Get great tips for achieving profitable food production from grass, with two farmer-hosted field days coming up in September – one in each island.

Find out what helps make two dairy businesses consistently and robustly profitable, and see how they're adapting to change.

### You'll enjoy:

- an overview of each farm, its financials and performance benchmarks, relative to the region
- a farm walk to view and discuss pasture management, the herd and mating plan, plus water and GHG strategies and measures
- a discussion on how to support and get the best from your on-farm team.

### NORTH ISLAND:

Nathan Joyce's farm in Taranaki on Thursday, September 23, 2021

### SOUTH ISLAND:

Dan Woolsey's (pictured above) farm in Southland on Thursday, September 30, 2021

Visit [pasturesummit.co.nz](http://pasturesummit.co.nz)

## New plantain research

DairyNZ is leading a \$22 million programme to prove plantain's effectiveness for reducing nitrate leaching, with the aim of improving freshwater quality. It will also develop regional plantain management strategies, and test the effect of plantain on milk, meat, and animal health.

Trials are underway from Northland to Southland, and we'll engage with farmers throughout the project. DairyNZ is partnering in this programme with MPI, PGG Wrightson Seeds and Fonterra.



Learn more at [dairynz.co.nz/plantain-research](http://dairynz.co.nz/plantain-research)



# Using every tool on hand

Farmers in Selwyn and Hinds catchments are making multiple changes to reduce their environmental footprint.

Phill Everest, flanked by DairyNZ's Hugh Jackson (light blue shirt) and son Paul Everest, speaks to Selwyn and Hinds farmers about reducing N.

Improving their farm environment is a major focus for Ashburton farmers Phill and Jos Everest, their son Paul and his partner Sarah.

"We've always been focused on learning how to do things better," says Phill. "We've got to learn fast to make changes, so we can continue to play a key role in contributing to local communities."

The Everests are active participants in a DairyNZ project called 'Meeting a Sustainable Future'.

Now in its third year, the project involves trialling new options to reduce nitrogen (N) losses with partner farms in Selwyn and Hinds, then sharing that knowledge through local field days and events.

As a result, farmers throughout the two catchments are making significant changes – see sidebar below left.

On the Everests' farm, the family has installed a variable rate irrigation system on one pivot. This allows water to be applied in different amounts across a paddock, which reduces drainage losses and nutrient losses.

They've also been preparing for the introduction of a new N cap by reducing the amount of N fertiliser applied by 35%. This has resulted in a small reduction in milk production this season.

"We developed an annual N application plan, so we knew what our target application rates were each month to meet the new targets. We also used a urease-coated urea product which reduces greenhouse gas and N losses," says Phill.

The family has added plantain and chicory to their pasture mix, and planted 22km of planting and shelter along their drains and fence lines.

The changes mean they've already met their 2030 target to reduce N losses by 25 percent.

Together with DairyNZ, the Everests hosted a field day on their farm in May, attended by 45 farmers.

Phill says continuing to reduce their environmental footprint will be a significant challenge for their family and other farmers.

"We're taking small steps each year and this will allow us to make the best improvements we can."



## TAKING ACTION

Dairy farmers in the Selwyn and Hinds catchments need to make significant reductions in N losses under Environment Canterbury rules.

In a recent assessment of 235 farms in the catchments:

**100%** reported\* adapting their farming practices to reduce N loss.

**81%** reported improving their irrigation systems or irrigation management.

**More than 50%** said they'd changed their fertiliser use and improved their effluent management or effluent systems.

**Most farms** were taking multiple steps to **meet the new rules** ahead of their introduction.



\* these changes are self-reported

To read more about the work being done by Selwyn and Hinds farmers, visit [dairynz.co.nz/selwynhinds](http://dairynz.co.nz/selwynhinds)

## Taranaki

DairyNZ's Flexible Milking Project pilot farmers Daryl and Karyn Johnson, in Stratford, are in their second season of milking three times in two days (3-in-2) year-round.

Their primary driver for making this switch was to increase not-in-calf rates, particularly in their younger cows. With long walks for cows up and down hills, 3-in-2 was already a tool the couple had used during mid to late-lactation with no loss in production, so it was a natural decision to look at this as an option.

A secondary driver focused on staff wellbeing and the ability to reduce staff hours, particularly over key times of the year, such as calving and mating.

Flexible Milking is a Sustainable Farming Fund project, co-funded by DairyNZ. Find out more at [dairynz.co.nz/3in2](https://dairynz.co.nz/3in2)



## Northland

An exciting four-year farm systems trial is underway, run by the Northland Dairy Development Trust (NDDT). The 'Future Farming Systems Trial', which kicked off in June this year, will compare three farm systems that adapt to or mitigate climate change effects.

This is a Sustainable Food & Fibre Futures project, co-funded by DairyNZ.

Fortnightly updates will be published at [nddt.nz](https://nddt.nz), at [facebook.com/NorthlandDairyDevelopmentTrust](https://facebook.com/NorthlandDairyDevelopmentTrust), and via email. Register at [info@nddt.nz](mailto:info@nddt.nz) if you'd like to receive the email updates.

## Waikato

Using the Halter programme has added a new level of interest and enjoyment to farming for owners and staff on a System 2, owner-operator farm in Pokuru.

This technology fits well with the vision Pete Morgan and Ann Bouma have for a simple, efficient, profitable and environmentally sustainable system that will allow them to enjoy a quality lifestyle with family and friends. Find out more at

[dairynz.co.nz/budget-case-studies](https://dairynz.co.nz/budget-case-studies)



## Bay of Plenty

Nick Dowson is the owner-operator of a 210-cow coastal farm in the Bay of Plenty, and one of the pilot farmers in DairyNZ's Flexible Milking Project.

For Nick, three-in-two milking (3-in-2) has been a steadfast summer strategy – it's working well on his farm.

Making the switch to full-season 3-in-2 is all about trying to reduce labour requirements and improve mating results, without taking the production hit of full-season once-a-day milking.

Flexible Milking is a Sustainable Farming Fund project, co-funded by DairyNZ. Read more and sign up for email updates at

[dairynz.co.nz/3in2](https://dairynz.co.nz/3in2)

To see what else is happening in your region, go to [dairynz.co.nz/events](https://dairynz.co.nz/events)



## Lower North Island

Want to see how the top operators are spending their money? Are there areas for improvement in your own business, where savings can be made?

To see the 2021/22 budget for a System 3 sharemilking business near the Tararua Ranges, go to **dairynz.co.nz/budget-case-studies**

The continued success of this farm is due to efficient use of pasture and imported feed, attention to detail to ensure high standards of animal health and welfare, and good genetic gain.

## Top of South Island/West Coast

Looking for some extra advice and ideas this calving season?

Level up your calf care with DairyNZ's Calf Care Toolkit.

Answer 12 simple questions and get instant tailored feedback and farmer suggestions to help you and your team. Try it out now at **dairynz.co.nz/calf-care-toolkit**

## Southland/ South Otago

As Environment Southland develops a new Regional Plan, DairyNZ is working on your behalf during the consultation process. We encourage you to get involved too.

Read more about the range of work underway to advocate for farmers throughout the Regional Plan development at **dairynz.co.nz/southland-regional-plan**



## Nationwide

Agri-Women's Development Trust is hosting a 'Know Your Mindset, Grow Your Influence' personal development programme during August and September.

The sessions cost \$30 and include an online and in-person workshop. Workshop locations are Pahiatua, Invercargill, and Lake Karapiro. To find out more, visit **awdt.org.nz/programmes**

## DairyNZ consulting officers

**North Island – Head: Rob Brazendale 021 683 139**

### Northland

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Hauraki Plains/Coromandel	Wilma Foster	021 246 2147
Hamilton	Wilma Foster	021 246 2147
Waipa South	Wilma Foster	021 246 2147
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Cambridge	Lizzy Moore	021 242 2127
Huntly/Tatuanui	Brigitte Ravera	027 288 1244
Matamata/Kereone	Frank Portegys	027 807 9685
Pirongia	Steve Canton	027 475 0918
Otorohanga/King Country	Phil Irvine	027 483 9820

### Bay of Plenty

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Central Bay of Plenty	Kevin McKinley	027 288 8238

### Taranaki

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North Taranaki	Ian Burmeister	027 593 4122

### Lower North Island

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Horowhenua/Coastal and Southern Manawatu	Rob Brazendale	021 683 139
Hawke's Bay	Gray Beagley	021 286 4346
Northern Manawatu/Woodville	Janine Swansson	027 381 2025

**South Island – Head: Tony Finch 027 706 6183**

### Top of South Island/West Coast

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West Coast	Angela Leslie	021 277 2894

### Canterbury/North Otago

<b>Regional Leader</b>	Rachael Russell	027 261 3250
South Canterbury	Rachael Russell	027 261 3250
North Otago	Rachael Russell	027 261 3250
North Canterbury	Amy Chamberlain	027 243 0943
Central Canterbury	Alice Reilly	027 379 8069
Mid Canterbury	Hugh Jackson	027 513 7200

### Southland/South Otago

<b>Regional Leader</b>	Ollie Knowles	027 226 4420
Western Southland	Ollie Knowles	027 226 4420
West Otago/Gore	Keely Sullivan	027 524 5890
South Otago	Guy Michaels	021 302 034
Northern/Central Southland	Nicole Cochrane	021 240 8529
Eastern Southland	Nathan Nelson	021 225 6931

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# Can we detect cows at risk of endometritis using a blood test?



**Olivia Spaans**  
PhD student, DairyNZ/  
University of Auckland



**Mallory Ross**  
Scientist, AgResearch

**DairyNZ and AgResearch scientists are investigating whether measuring specific proteins in blood can identify cows with persistent uterine inflammation prior to mating. The researchers are also exploring anti-inflammatory compounds as a way to treat this inflammation. This could mean cows can be identified and treated earlier for endometritis, with the potential to improve 6-week in-calf rates. Here, we discuss the results to date.**

## What is endometritis?

Endometritis is an infection or inflammation of the lining of the uterus (i.e. the endometrium)<sup>1</sup>. On average, around 25% of cows have endometritis about four weeks before mating starts, but this prevalence can range from 5% to 65% between herds<sup>2</sup>. If a high number of cows have endometritis before mating, this puts the herd at risk of a low pregnancy rate.

## How is it diagnosed?

Endometritis can be diagnosed on-farm by examining cows for purulent vaginal discharge (PVD), which results in a positive Metrichick™ score of 2 or more (PVD-endometritis). However, because endometritis triggers

## Key points

- All cows have uterine inflammation after calving, but unresolved, prolonged inflammation (endometritis) can lead to lower in-calf rates.
- We identified two proteins in blood that are potential early indicators of endometritis.
- Using a cell culture model of uterine inflammation, we identified three commercially available anti-inflammatory drugs that reduced inflammation, as indicated by a reduction in the two protein markers.
- We're now testing on-farm application of these findings in early lactation cows with endometritis.
- This research could lead to new methods for earlier diagnosis and treatment of endometritis with the aim of improving in-calf rates.



*Author Olivia Spaans taking a blood sample at Dairy 4, Massey University.*





*The higher the Metrichheck™ score, the greater the chances that cows also have cytological endometritis.*

inflammatory pathways, which results in an influx of immune cells (called polymorphonuclear cells; PMN) into the uterus, it can also be detected using an alternative method, under research conditions. A cytobrush is passed through the cervix, and a smear of uterine cells is taken to identify and count the PMN under a microscope. Cows with an increased percentage of PMN in the uterine smear are diagnosed with cytological (CYTO-) endometritis.

DairyNZ-led research in 2015 indicated only 58% of cows have a 'clean' uterus at four weeks before the mating start date, whereas 17% of cows have CYTO-endometritis only, 15% of cows have PVD-endometritis only, and 10% have both forms (Figure 1)<sup>2,3</sup>.

The higher the Metrichheck™ score (i.e. PVD), the greater the likelihood of cows also having CYTO-endometritis. In this earlier study, 6-week in-calf rates were lower in cows diagnosed with PVD-endometritis with a higher Metrichheck™ score of 3 or more, and in cows with CYTO-endometritis. This indicates that either form of endometritis can negatively affect reproduction<sup>2,3</sup>.

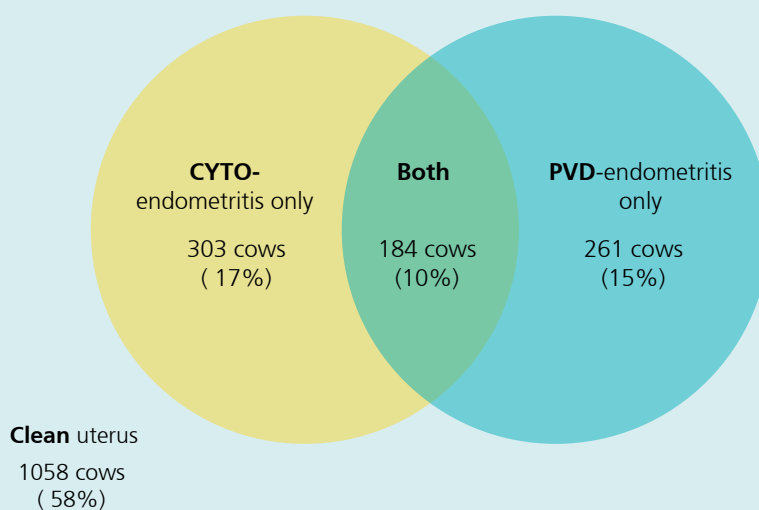
### Can postpartum inflammation be detected using blood markers?

It's not practical to routinely test for CYTO-endometritis in commercial herds, but if inflammatory pathways have been triggered, this can be measured in blood by detecting specific proteins. That was the focus of our lab-based experiment last year. We

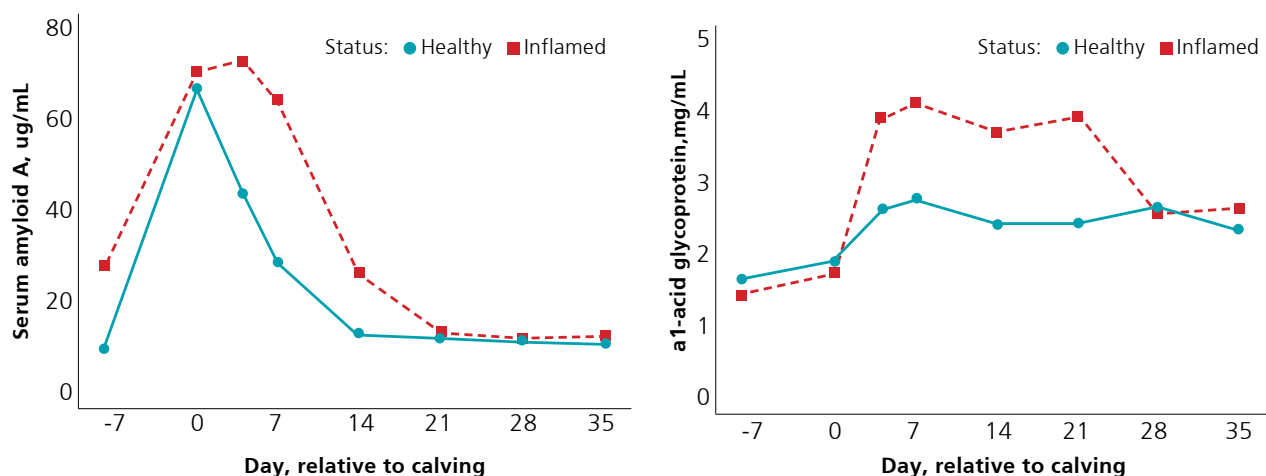
aimed to identify such blood markers in cows with both CYTO- and PVD-endometritis, as these animals have the greatest degree of persistent uterine inflammation. Consequently, these animals are at the greatest risk of poorer reproductive performance.

To do this, we screened blood samples from cows known to have both CYTO- and PVD-endometritis ('Inflamed') or be free of either condition ('Healthy') at five weeks post-calving. We measured 14 markers involved in inflammatory pathways. Two of these, serum amyloid A (SAA) and  $\alpha$ 1-acid glycoprotein (AGP), differed between Healthy and Inflamed groups (Figure 2). While all cows had an increase in blood inflammatory markers

**Figure 1.** The number and percentage of cows with Metrichheck™-positive endometritis (PVD-endometritis) and cytology-positive endometritis (CYTO-endometritis) or both forms at four weeks prior to mating start date (i.e. about six weeks post-calving). The study population comprised 1806 cows from 100 herds in Waikato and Canterbury<sup>2</sup>



**Figure 2.** Concentrations of serum amyloid A and  $\alpha$ 1-acid glycoprotein in Inflamed and Healthy cows from one week pre-calving to five weeks post-calving



at calving, which is a normal biological response, those with endometritis (i.e. Inflamed cows) experienced a greater and prolonged period of inflammation.

As early as four days post-calving, we saw differences between the SAA and AGP markers in Healthy and Inflamed groups. This means these two markers could provide an early indicator of cows at risk of persistent uterine inflammation. Although these markers show promise, we need to validate them in larger numbers of cows to determine their accuracy in predicting endometritis using routine testing protocols.

### Can persistent inflammation be treated?

We are also interested in whether uterine inflammation can be treated with anti-inflammatory compounds to improve animal health and reproduction. To test this in the laboratory, we cultured bovine uterine cells and used a bacterial toxin to induce a cell inflammation response. Using SAA and AGP as markers, we confirmed that inflammatory pathways were activated.

We then screened a range of non-steroidal anti-inflammatory drugs (NSAIDs) for their ability to reduce these markers of inflammation. Three of the NSAIDs we investigated, Metacam®, Flunixin, and Tolfedine®, reduced SAA concentration, and Tolfedine® also reduced AGP concentration. Metacam®, a commonly used NSAID in inflammation research and on-farm, and Tolfedine® were selected as candidates for the on-farm phase of research.

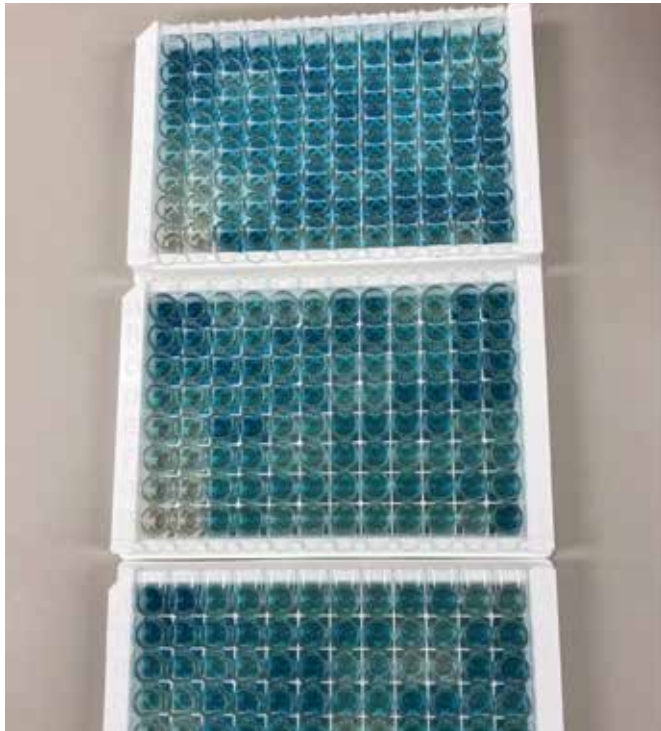
The next steps, now underway, will look at whether uterine inflammation can be resolved faster using NSAIDs at three weeks post-calving. We're currently analysing samples and data from a recent on-farm study. The aim of that study was

to investigate whether Metacam® or Tolfedine® treatments reduce inflammatory markers (such as blood SAA and AGP concentrations, white blood cell counts, and uterine PMN percentage etc.) in cows with evidence of a uterine inflammation (Metricheck™-positive at three weeks post-calving). If so, this would indicate that uterine inflammation can be dampened by NSAIDs. However, more work in larger numbers of cows will then be needed to refine the treatment protocols and investigate the subsequent effect on reproduction.



Checking a Metricheck™ sample.





Enzyme-linked immunosorbent assay (ELISA) is used to measure markers of inflammation in blood.



Passing a cytobrush through the cervix to take a smear of uterine cells.

## Summary

Although more research is needed, results-to-date indicate there is potential to use blood markers to identify cows at risk of persistent uterine inflammation. This would mean animals can be treated earlier. We're now doing further research to determine if uterine inflammation can be resolved faster using NSAIDs. If successful, this research could result in new strategies to increase six-week in-calf rates and reduce the number of empty cows at the end of mating.

## Acknowledgements

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