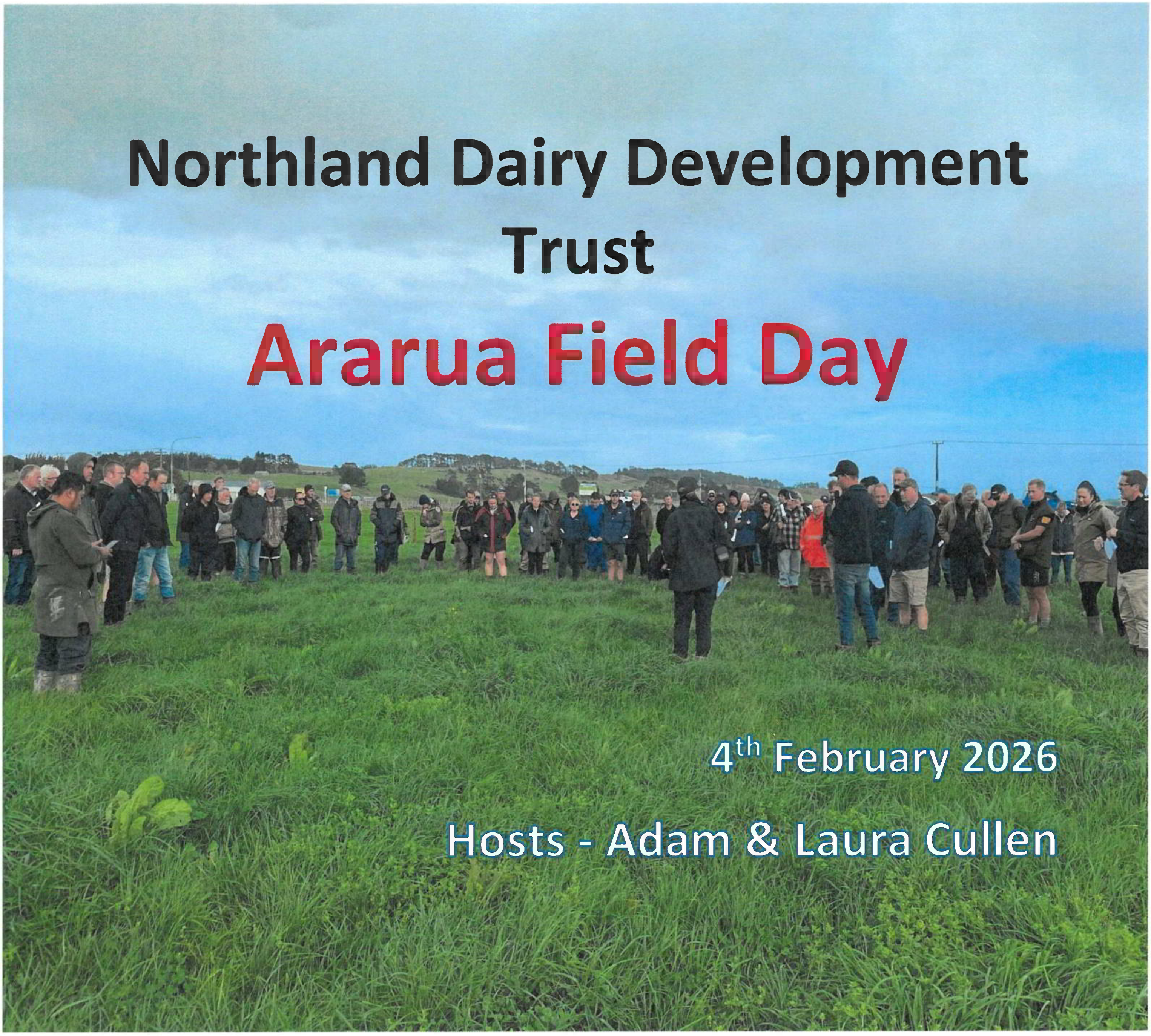
Northland Dairy Development Trust

Ararua Field Day



4th February 2026

Hosts - Adam & Laura Cullen

Northland Dairy NDDT Development Trust

Ministry for Primary Industries Manatū Ahu Matua

DairyNZ

Thanks to our sponsors and supporters for their continued support

Hine Rangi Trust

Ballance agri-nutrients

Fonterra

GEA | FIL

www.nddt.nz

Follow us on Facebook – Northland Dairy Development Trust

Email: info@nddt.nz

Future Dairy Farm Systems for Northland Project

Chris Boom and Kim Robinson
February 2026

Summary

This study compares three Northland dairy farm systems:

- **Baseline Farm** – Kikuyu/Italian ryegrass pastures, 3.0 cows/ha, up to 190 kg N/ha applied
- **Alternative Pastures Farm** - >70% of land in tall fescue/cocksfoot/chicory-based pastures, 3.0 cows/ha, up to 190 kg N/ha
- **Low Emissions Farm** - designed to have reduced greenhouse gas (GHG) emissions, kikuyu/Italian ryegrass pastures, 2.2 cows/ha, no N applied.

Each of the four completed seasons of this study have shown quite different results. Milk production was highest on the Baseline Farm in 2021/22 and 2024/25 which featured dry summers and cows on the Alternative Pastures Farm dried off early. Milk production in 2022/23 and 2023/24 seasons was highest on the Alternative Pastures Farm.

Milk production on the lower stocked Low Emissions Farm has been 25% to 39% lower than the Baseline Farm. Milk production on the Low Emissions Farm appears to be related to clover presence. Clover content on the Baseline Farm has averaged 7% while the Low Emissions Farm has averaged 23%.

Financial analysis of each farm (using actual milk price) across the four years of the study shows that on average the Baseline and Alternative Pastures Farms have had similar profitability. Although the Low Emissions Farm has not always been the least profitable farm, overall it averaged $730/ha lower than the Baseline Farm.

	Milk Solids kg/ha				Farm Operating Profit $/ha			
	2021/22	2022/23	2023/24	2024/25	2021/22	2022/23	2023/24	2024/25
Baseline Farm	1,284	1,204	1,112	1,289	$4,952	$1,906	$171	$5,183
Alternative Pastures Farm	1,213	1,269	1,178	1,188	$4,699	$2,669	$459	$4,261
Low Emissions Farm	794	910	790	1,002	$2,974	$2,234	-$463	$4,515

Averaged across the four seasons to date, the Low Emissions Farm reduced methane emissions/ha by 27% compared to the Baseline (using the Overseer model) and nitrous oxide emissions/ha by 50%. The Low Emissions Farm also reduced emissions intensity (GHG/kg MS) by 10%, primarily through a reduction in the embedded emissions associated with PKE and nitrogen fertiliser while maintaining relatively high milk production per cow.

Removing nitrogen fertiliser on the Low Emissions Farm quickly resulted in an increase in clover presence. However, this clover presence has been variable across the seasons and production has shown how dependent no-nitrogen systems are on clover presence.

Fluctuating climatic conditions have made results vary across seasons. Extended dry summers favoured kikuyu/Italian ryegrass-based pastures, whereas the Alternative Pastures Farm performed well in the normal to wetter summer rainfall seasons.

Background & Trial Design

In Northland, ryegrass persistence is relatively poor, rust and pest damage are increasing and regression to kikuyu often occurs within two to three years after sowing new ryegrass pastures. Many farmers are looking for alternative pasture species which may be more persistent and resilient in the face of climate change. Farmers are also being encouraged to lower GHG emissions on dairy farms.

This farm systems trial, conducted at Northland Agricultural Research Farm near Dargaville, is designed to test and compare farm systems which may be used in the future to mitigate and adapt to the effects of a warming climate.

This project compares three farm systems:

1. **Baseline Farm** – existing ryegrass/kikuyu pastures with imported feed (mainly PKE) to fill feed deficits. Stocking rate 3.1 cows/ha and up to 190 kg applied N/ha
2. **Alternative Pastures Farm** – target 70% of pastures in alternative pasture species to ryegrass/kikuyu – currently tall fescue, cocksfoot, legumes & herbs - with imported feed (PKE) to fill feed deficits. Stocking rate 3.1 cows/ha and up to 190 kg applied N/ha
3. **Low Emissions Farm** – existing ryegrass/kikuyu pastures. Targeting a 25% reduction in methane emissions and 50% reduction in nitrous oxide emissions (compared to the Baseline Farm). Stocking rate 2.2 cows/ha, no nitrogen application. Little or no imported feed

The trial commenced in June 2021 and will run for five seasons to test these systems under a range of climatic conditions. Trial measures capture pasture and milk production and composition, profit, labour input and management difficulty and environmental impact. All three farms have around 27.5 ha of land, balanced across farms to ensure even productive capability.

Introduction of New Pastures

The Alternative Pastures Farm was set up by sowing 74% of the farm area during 2020 and 2021, into tall fescue, cocksfoot, white and red clovers and chicory. Plantain and Persian clover were added in some paddocks. Between 15 - 20% of these alternative pastures have been resown each autumn.

Pasture establishment costs have been similar across each year, averaging $1,138/ha, including tractor time, man hours and contractor costs for drilling.

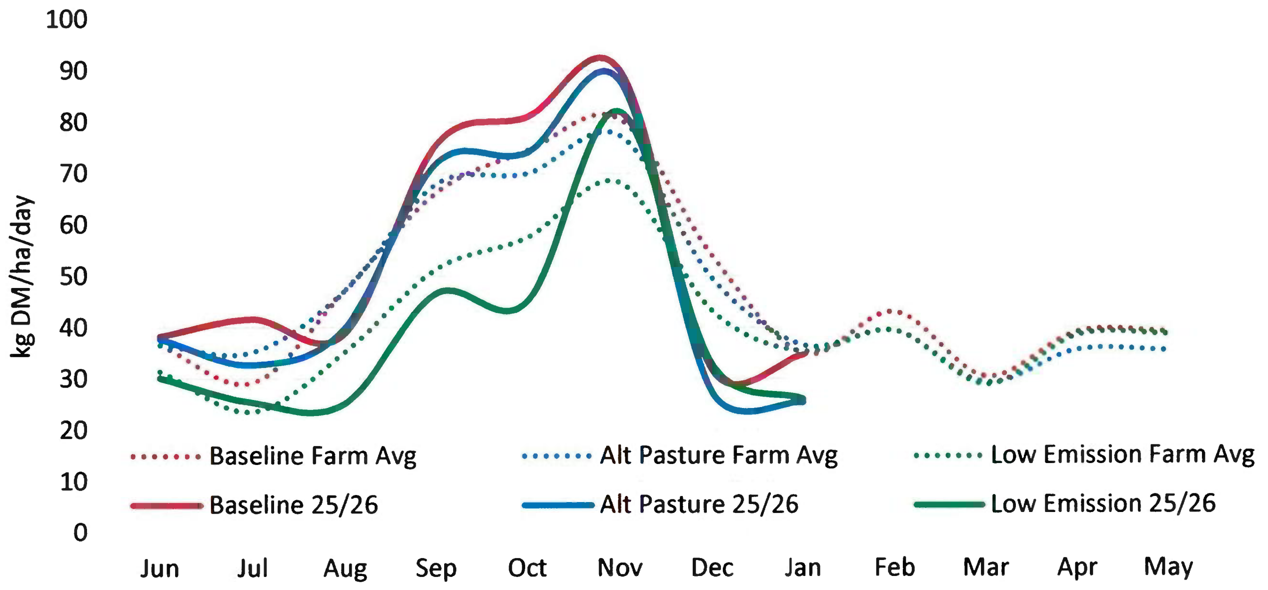
The other two farms (Baseline Farm and Low Emissions Farm), and the 26% portion of the Alternative Pastures Farm that was not sown in new species, have older pastures with approximately 70% kikuyu presence. All kikuyu-based paddocks on all three farms are mulched every autumn and under-sown with Italian ryegrass.

Pasture Growth

Figure 1 shows the pasture growth differences between these pastures as calculated by weekly rising platemeter assessments.

Pasture growth on the Baseline and Alternative Pasture Farms has generally been similar with some seasonal differences. The Low Emissions Farm had lower pasture growth during winter and spring than the other farms - the result of no nitrogen application, averaging 2.5 t DM/ha/annum lower. This indicates a nitrogen response of 15.6 kg DM/kg N applied on the Baseline Farm compared to the Low Emissions Farm.

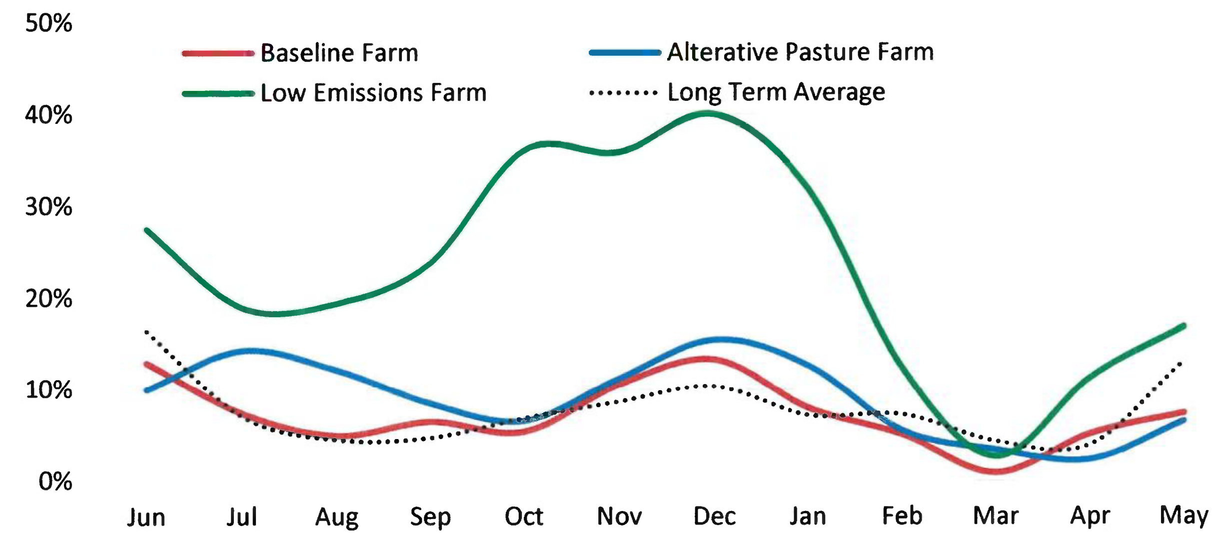
Figure 1. *Four-year average pasture growth rates and 2025/26 season, as calculated by pre – post grazing platemeter assessments.*



Pasture Composition

Pasture samples are collected monthly from the next three paddocks to be grazed on each farm and analysed for feed quality and species present. Figure 2 shows the presence of clover for the five seasons to date. Clover presence to date has averaged 8% of pasture on the Baseline and Alternative Pastures Farms compared with 23% on the Low Emissions Farm.

Figure 2. *Clover presence in pasture sampling to grazing height (% clover), average of four years.*



Supplement Fed & Pasture Eaten

Farms are managed so that if pasture supply is inadequate then home grown or purchased supplement is fed to cows to keep pasture grazing residuals at the desired level (1500-1600 kg DM/ha). There is a limit of 800 kg DM/cow/annum of imported supplement to avoid a failing farm system being propped up by supplements.

Over the first four years of the trial imported supplement has averaged 781 kg DM/cow on the Baseline Farm, 745 kg DM/cow on the Alternative Pastures Farm and 256 kg DM/cow on the Low Emissions Farm. In general the Baseline Farm has fed more supplement during winter and less during summer/autumn compared to the Alternative Pastures Farm.

The pasture eaten on each farm was calculated and indicates that cows on the Baseline Farm consumed 13.0 t DM/ha of pasture, compared to 13.3 t DM/ha on the Alternative Pastures Farm and 10.5 t DM/ha on the Low Emissions Farm.

Milk Production

Milk production is shown in table 2 and figures 3 & 4. Highest farm production each season has alternated between the Alternative Pastures Farm and the Baseline Farm, with no significant difference overall. Climatic variation between seasons is responsible for this difference. The two seasons with a dry summer saw the Alternative Pastures Farm dried off early while the Baseline Farm continued milking longer due to the higher level of kikuyu in the pasture.

On average, milk production on the Low Emissions Farm has been 348 kg MS/ha lower than the Baseline Farm. Milk production has been especially low during the 2021/22 and 2023/24 seasons when clover levels in the pasture were lower. The 2022/23 & 2024/25 seasons had high clover levels in the pasture, sometimes >50% of pasture, which appear to have supported relatively good milk production.

Table 2. *Seasonal Milk Production (kg MS/ha & kg MS/cow).*

	2021/22		2022/23		2023/24		2024/25		2025/26 to 17/1/26	
Farm	MS/ha	MS/c	MS/ha	MS/c	MS/ha	MS/c	MS/ha	MS/c	MS/ha	MS/c
Baseline Farm	1,284	409	1,204	392	1,112	375	1289	430	899	303
Alt Pastures Farm	1,213	397	1,269	406	1,178	386	1188	393	852	289
Low Emiss Farm	794	370	910	399	790	355	1002	450	693	297

Figure 3. *Milk Production – kg MS/ha/day (10 day average), average of four previous seasons, compared against the 2025/26 season to date.*

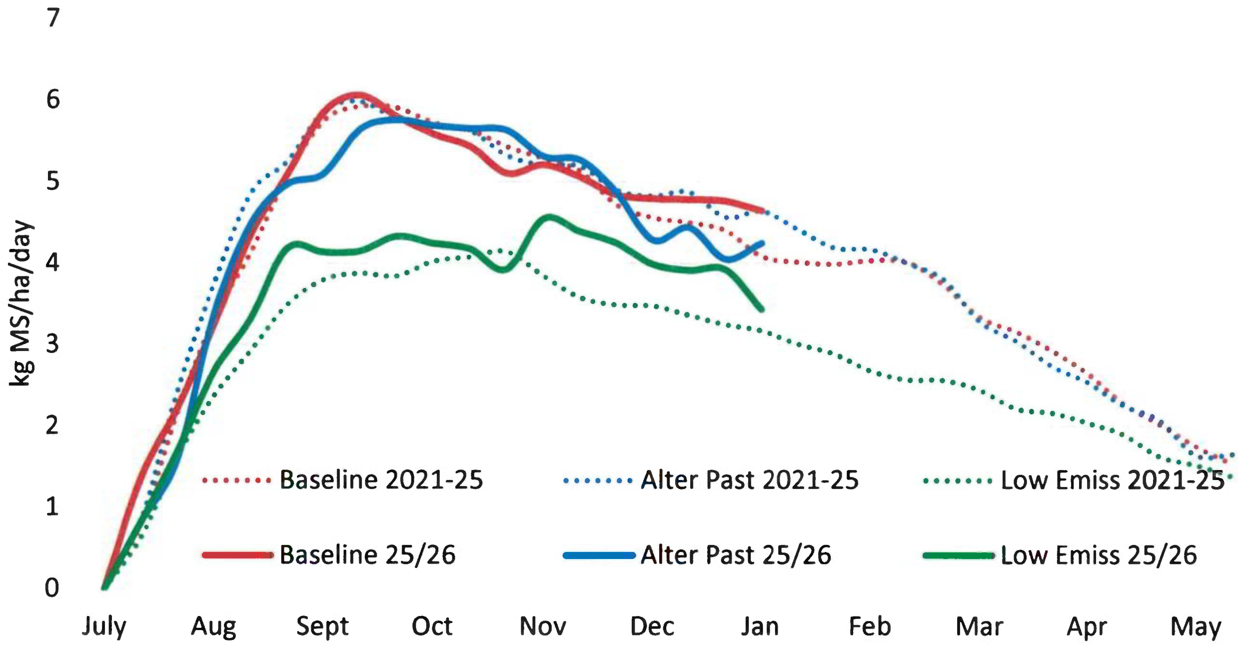
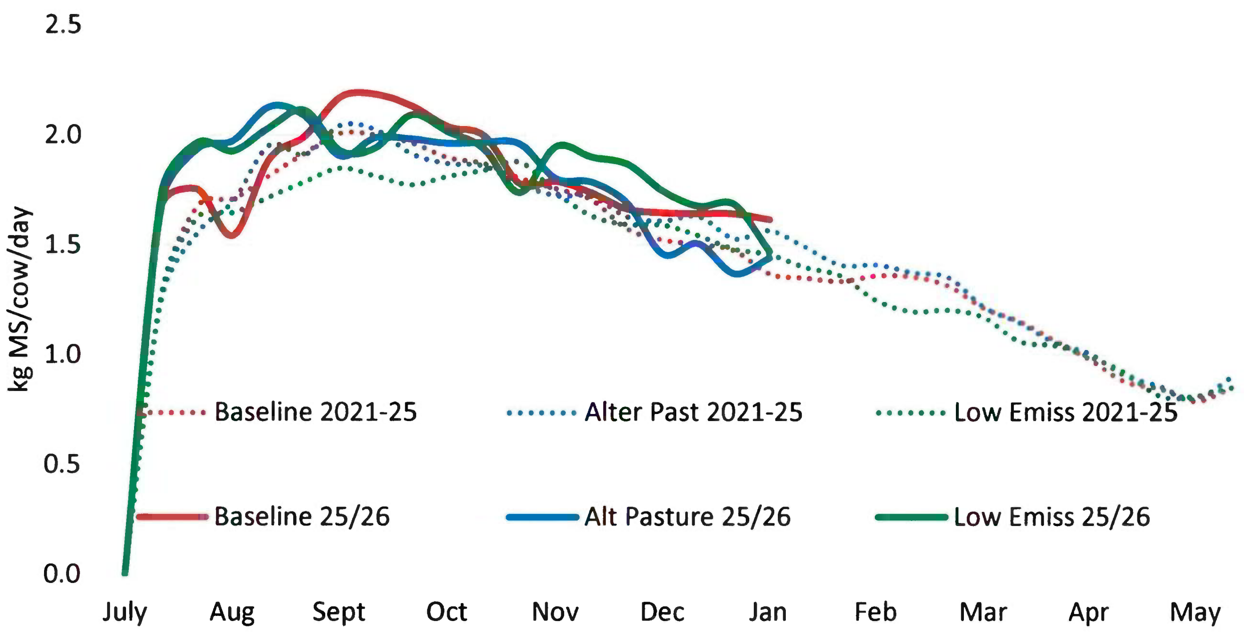


Figure 4. *Milk Production – kg MS/cow/day (10 day average), average of four previous seasons, compared against 2025/26 season to date.*



Greenhouse Gas Emissions

Greenhouse gas emissions were calculated using the Overseer model and are shown in table 3.

Table 3. *Calculated GHG Emissions using Overseer Model, average of four seasons.*

Farm	Methane (CO_2 eq) t/ha	Nitrous Oxide (CO_2 eq) kg/ha
Baseline Farm	8.3	2.0
Alternative Pastures Farm	8.5	2.1
Low Emissions Farm Compared to Baseline Farm	6.05 27% reduction	1.0 50% reduction

Emissions have been relatively similar between the Baseline and Alternative Pastures Farms, due to similar stocking rate, milk production, PKE and N inputs. The Low Emissions farm has averaged 27% lower methane and 50% lower nitrous oxide. The methane levels fluctuate somewhat in line with milk production and stocking rate, as methane is closely related to feed eaten.

Emissions intensity was calculated through the new Fonterra LCA model. The Low Emissions farm has consistently produced milk with lower emissions intensity, primarily due to three key factors – low emissions associated with PKE and N fertiliser, and good milk production per kg liveweight which dilutes maintenance feed methane across more kgMS.

Table 4. *Calculated Total GHG Emissions using Fonterra LCA for 2024/25.*

Farm	Total Emissions kgCO2e/t FPCM	% of Baseline Farm
Baseline Farm	825	
Alternative Pastures Farm	851	103%
Low Emissions Farm	743	90%

Financial Analysis

Four-year average milk production and operating profit for the three farms is summarised in Table 5. Average milk price has been $8.88/kg MS. Fonterra dividend income is excluded from this financial analysis. Expenses are based on actual farm expenses with some adjustments for labour and administration to compensate for extraordinary expenses involved in running the research trial. Records of additional labour and tractor time for each farm have been used to allocate the vehicle, R&M, and depreciation expenses.

The Baseline and Alternative Pastures Farms have shown similar farm operating profit across the four years. The Low Emissions Farm has averaged $730/ha lower than the Baseline Farm. However, this farm has not always been the least profitable which shows that this system can be competitive in some seasons when production has been relatively high, which seems related to proportion of clover in the pasture.

Table 5. Four-year average milk production and operating profit

Farm	Average Milk Production Kg MS/ha	Change relative to Baseline %	Average Farm Operating Profit $/ha	Change relative to Baseline %
Baseline Farm	1,222		$3,003	
Alternative Pastures Farm	1,212	-1%	$3,037	+1%
Low Emissions Farm	874	-28%	$2,273	-24%

Table 6 shows the 2024/25 season financial detail. In this season the Baseline Farm has been the most profitable, followed by the Low Emissions Farm. If the milk price had been $8.00/kg MS then the operating profit on the Low Emissions Farm would have been close to the Baseline Farm.

Table 6. *2024/25 Financial Results - income, expenses, and operating profit for the three farms ($/ha).*

Financial Summary 2024/25 Season	Baseline Farm	Alternative Pastures Farm	Low Emissions Farm
Income	$/ha	$/ha	$/ha
Milk Income ($10.16/kg MS)	$13,095	$12,071	$10,178
Other income (excl Fonterra Divid)	$570	$574	$423
Total Income/ha	**$13,675**	**$12,655**	**$10,611**
Expenses			
Total Farm Working Expenses	$7,889	$7,860	$5,598
Depreciation	$603	$543	$498
Total Operating Expenses/ha	**$8,646**	**$8,546**	**$6,250**
Farm Working Expenses $/kg MS	**$6.13**	**$6,62**	**$5.54**
Operating Profit (at $10.16/kg MS)	**$5,183**	**$4,261**	**$4,515**
2024/25 Operating Profit with Alternative Milk Prices			
Operating Profit at $6.00/kg MS	**-$179**	**-$682**	**$348**
Operating Profit at $8.00/kg MS	**$2,399**	**$1,694**	**$2,351**
Previous Seasons Operating Profit			
2021/22 Operating Profit - $9.30/kg MS	**$4,952**	**$4,699**	**$2,974**
2022/23 Operating Profit - $8.22/kg MS	**$1,906**	**$2,669**	**$2,234**
2023/24 Operating Profit - $7.83/kg MS	**$204**	**$494**	**-$439**

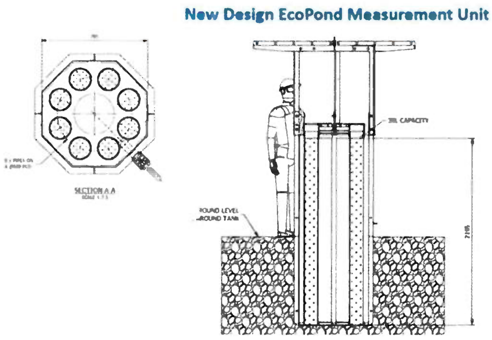
Summary

This project is in its final season. To date the project has shown that there has been no advantage (or disadvantage) to replacing kikuyu/Italian ryegrass based pastures with tall fescue/cocksfoot based pastures. It has also shown that achieving an aggressive GHG emissions reduction target through reducing stocking rate and removing nitrogen fertiliser would significantly reduce milk production and profit for most farmers.

EcoPond Technology to Reduce Methane Emissions on Northland Dairy Farms

Professor Keith Cameron and Professor Hong Di, Lincoln University.

An EcoPond test unit has been installed on the Northland Agricultural Research Farm (NARF) to measure the effectiveness of EcoPond treatment in reducing methane emissions from effluent in Northland.



Why is EcoPond Needed?

- Premium overseas customers (e.g., Nestlé) expect the NZ Dairy Industry to reduce greenhouse gas (GHG) emissions and so reduce the 'carbon footprint' of the food ingredients they purchase from NZ.
- NZ has a target of reducing methane GHG emissions by 10% by 2030.
- Methane emissions from dairy effluent ponds represents c. 8 - 10% of the total amount of methane emitted from a dairy farm (while 90% comes from the cow)
- EcoPond technology can reduce methane emissions from effluent ponds by over 90%.
- EcoPond technology could therefore help to achieve a 7 to 9% reduction in total on-farm methane emissions.

How does EcoPond work:

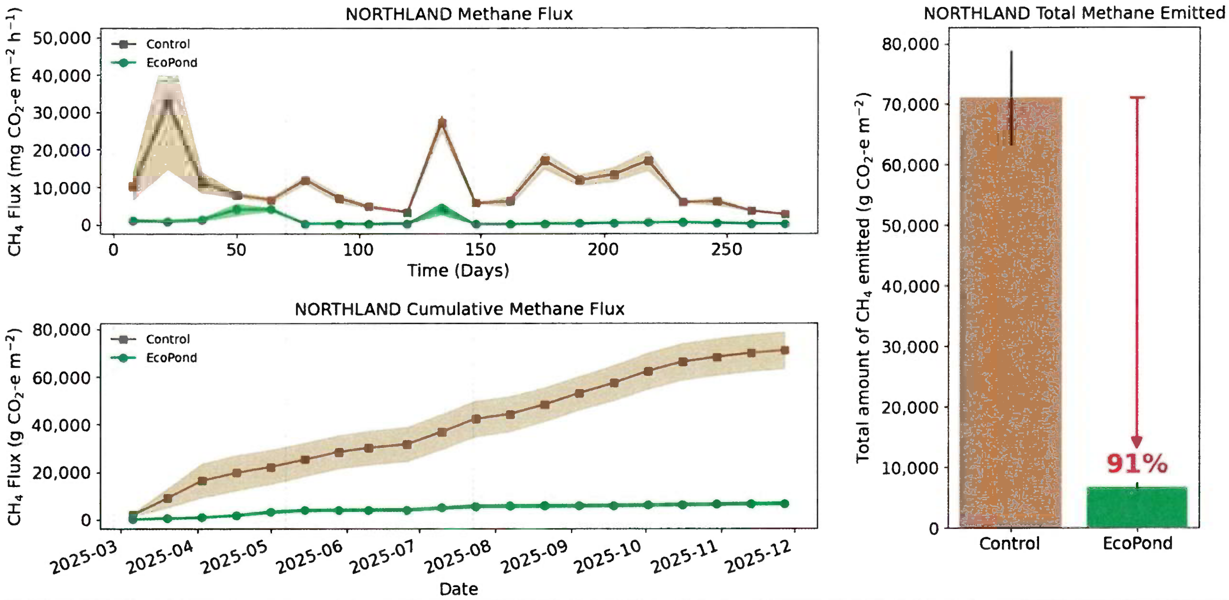
EcoPond technology uses two food additives (iron sulphate and sulphuric acid) to:

1. reduce the activity of the methane producing micro-organisms (methanogens) in the effluent,
2. boost the growth of naturally occurring 'sulphate-reducing bacteria' in the effluent. (The sulphate-reducing bacteria 'out-compete' the methanogens for the organic matter (food) in the effluent), and
3. increase the removal of methane from the effluent.

EcoPond technology mimics 'natural processes' - similar to how sulphate in seawater reduces methane emissions in coastal wetlands compared to freshwater wetlands.

The Results:

- Results from the NARF trial show that **EcoPond treatment has reduced methane emissions by over 90%.**



- Emission reductions of over 90% have been achieved in 23 trials across 8 regions and different seasons nationwide.
- Results remain consistent across different seasons.
- EcoPond treatment of the Lincoln University Dairy Farm effluent pond confirms that emissions can be reduced at farm scale and across the season.

Extra benefits: EcoPond treatment also:

1. reduces the risk of phosphate and *E. coli* leaching out of effluent application areas into freshwater,
2. reduces smell, and
3. reduces surface crusting on the pond.

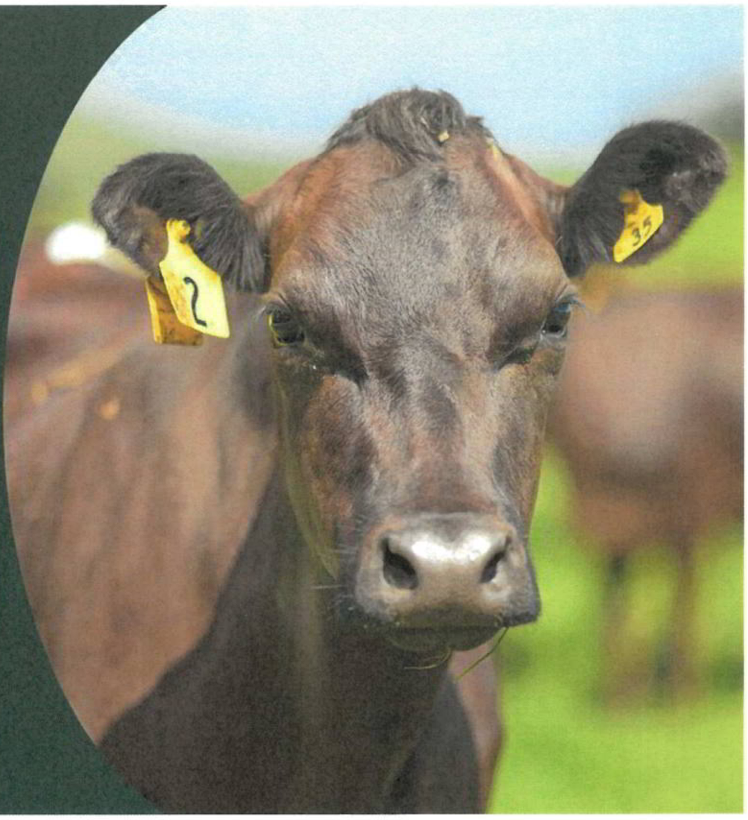
EcoPond was developed by Lincoln University in collaboration with Ravensdown Ltd and the Ministry for Primary Industries (MPI).

Dairy NZ

Extended Lactation Farmlet Study,
Results to date

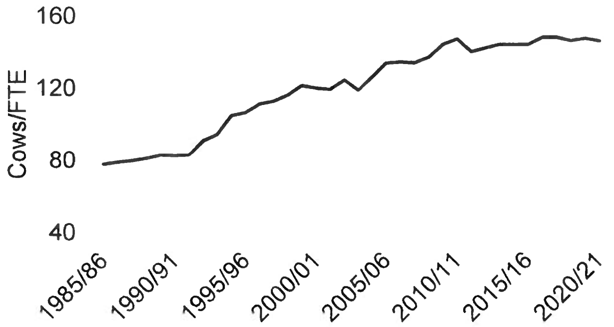
Chris Glassey on behalf of :
Paul Edwards, Lydia Farrell,
Yesi Lopez Moreno, Jessica Sheehy

4 February 2026
https://www.dairynz.co.nz/news/new-phase-for-extended-lactation-study/



Why Extended Lactations (EL)?

- Farmer workshop focused on future international competitiveness
- Intense peaks in farm workload for condensed seasonal calving and mating
- Issues around workplace attractiveness and staff retention
- Labour productivity on dairy farms appears to have plateaued since 2010



EL

- Reduce workload for calving
- Workload is more even across the year

Dairy NZ

24 month – half calving each year

- DairyNZ modelling compared annual calving, with 18- and 24-month options
- 50% calving each year showed profit potential, especially in regions with stronger winter pasture growth
- Greatest reduction in number of calvings/matings
- Aligns better with pasture growth than 18 month systems (less supplement)
- Pushing the boundaries of our genetics in a pasture-based system?
- Started two farmlets with Friesian-cross cows in 23/24 to test the viability of the system
- Two Jersey farmlets added from 25/26

		Year 1				Year 2			
		Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
Control	Herd 1	Calve		Dry off		Calve		Dry off	
EL	Herd 1	Calve						Dry off	
	Herd 2			Dry off		Calve			

Half herd milked through winter

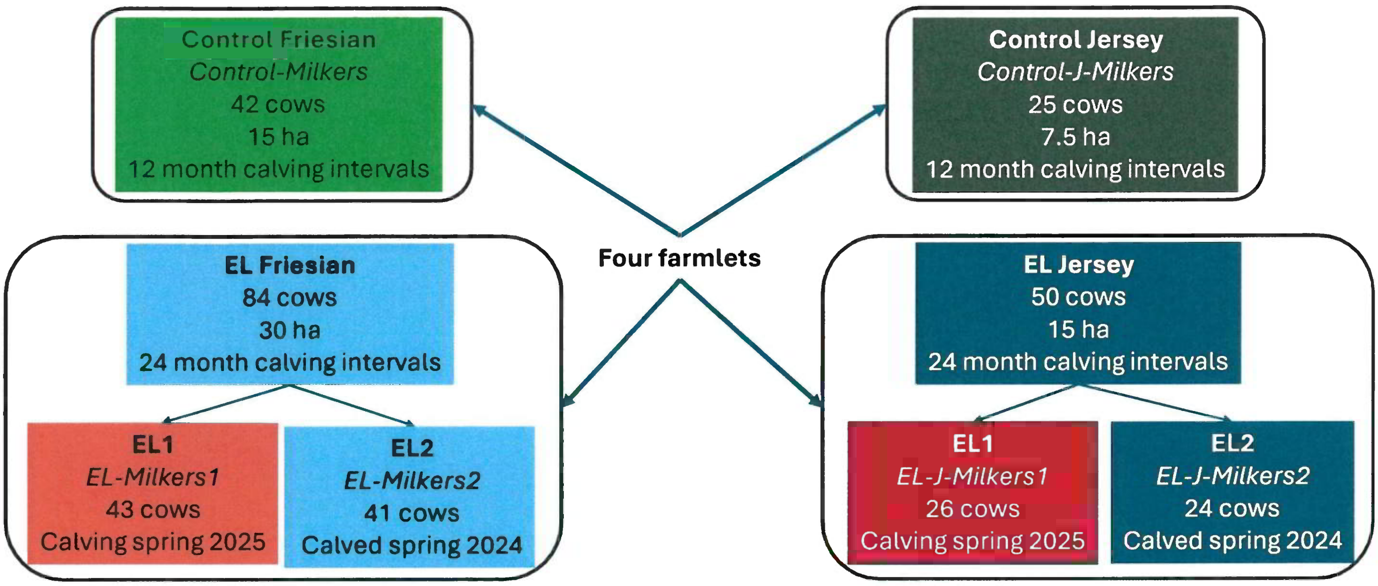
Extended Lactation Benefits and Issues

- Reduce non-replacement calves – risks around bobby calves
- Reduce cow attrition – higher than desired involuntary culling of non-pregnant cows
- Labour savings? In our farmlets this cannot be tested
- One commercial farm now testing the system. Calved 50% of herd in spring 2025

Why test Jerseys?

- Friesian Farmlet outputs promising, building confidence in the system
- Past EL research mostly Friesian cows, which doesn't represent the NZ herd
- Jerseys farmlets can inform on breed suitability (including crossbreed)
- Additional option for Jersey herds for reduced bobby calves

2025-26: 4 farmlets, 2 breeds, 201 cows, 67.5 ha



DairyNZ

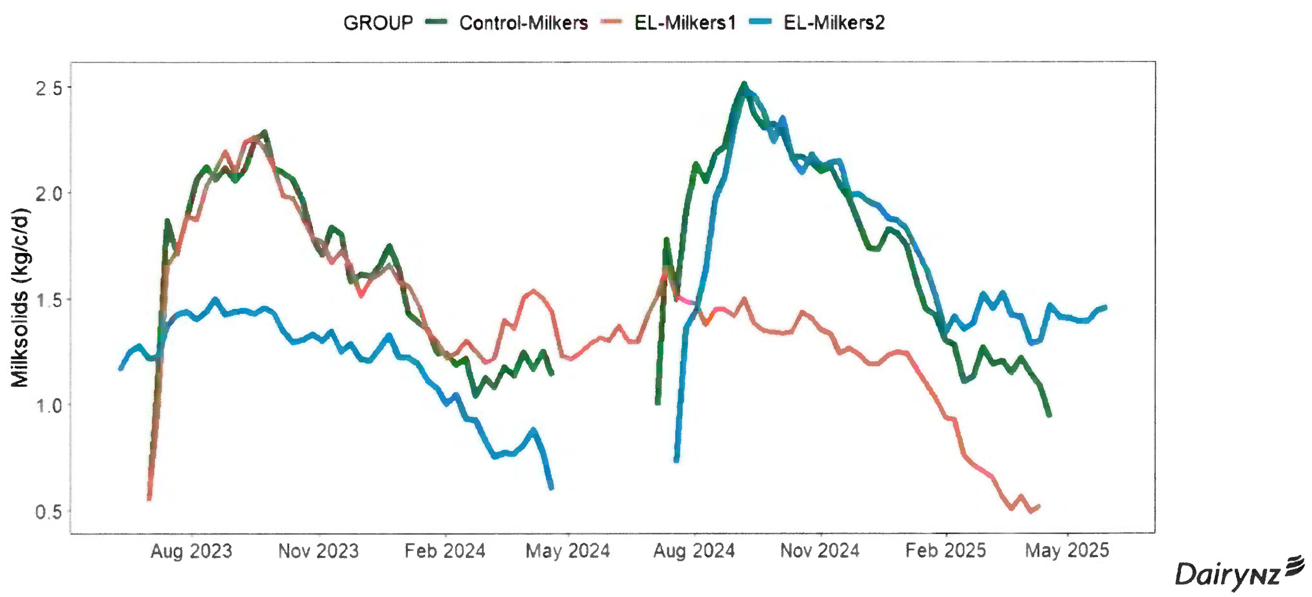
2023-25 farmlet summary

	2023/24			2024/25		
	Control farmlet	EL farmlet		Control farmlet	EL farmlet	
		Blue herd	Red herd		Blue herd	Red herd
Calved	Spring 2023	Spring 2022	Spring 2023	Spring 2024	Spring 2024	Spring 2023
Milksolids kg/cow	422	370	506	446	528	344
Final BCS at 31 May	4.7	5.8	4.1	4.8	4.1	5.8
Milksolids kg/ha	1,182	1,231		1,250	1,228	
Imported suppl. kg DM/cow	529	792		647	786	

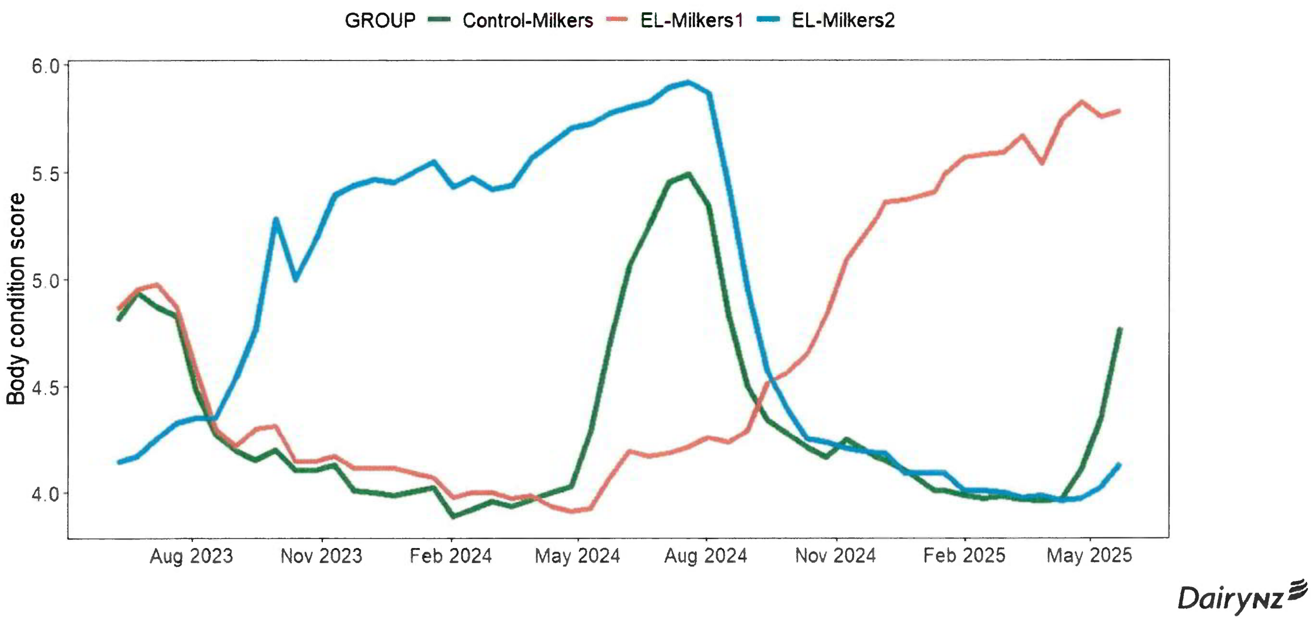
- EL kg MS/ha +4% in 23/24 (more DIM), -2% in 24/25 (delayed calving, drought)
- EL needs extra ~200kg DM/cow imported supplement (over winter)
- 23/24 similar $OP (no premiums, no labour differences)
- 24/25 EL $OP/ha reduced by 7% using same assumptions
- Overseer analysis: Farms have similar N leaching and GHG metrics

DairyNZ

Milksolids production 2023-2025

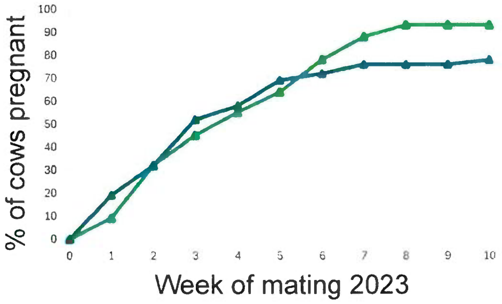


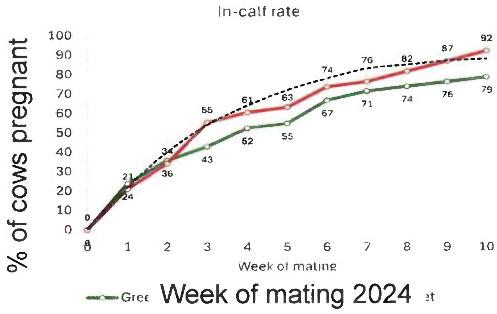
BCS 2023-2025



Mating results

Year	2023		2024	
Group	Control	Blue	Green	Red
Mating start date	28 September	16 October	26 September	
Three-week submission rate (%)	86	98	90	100
First service conception rate (%)	57	49	45	50
Six week in-calf rate (%)	79	73	67	74
Final not in calf rate (%)	7	22	21	8





DairyNZ

2025-26 season to 23 Jan 2026 (Friesian & Jersey)

		Friesian EL			Jersey EL	
	Control	Blue Herd	Red herd	Control	Blue Herd	Red Herd
Calved	Spring 2025	Spring 2024	Spring 2025	Spring 2025	Spring 2024	Spring 2025
Days in milk	184	235	184	177	209	184
Milksolids kg/c	351	336	338	294	223	298
Milksolids kg/ha	984	944		984	876	
BCS at 15 Jan	4.0	5.3	4.0	4.0	5.7	3.9
Imported Suppl. Kg DM/c	182	588		222	302	

DairyNZ

Key Findings to date

- Most current cows capable of worthwhile production beyond 600 days in milk.
- Dropout rate is 5-10% for low production prior to 600 days
- 24 month EL system has mostly matched the 12-month calving system for profit and production per ha so far.
- Requires some additional feed input, ~200 kg DM/c particularly in Winter.
- The later spring calving date in year 2 was detrimental for EL.
    - Don't calve later - obtain the feed to support lactation days.
- EL cows dry off above target BCS for calving. Saves winter feed.
- Jersey cows appear to have a slightly different lactation curve.

Extended Lactation for Northland

Background

Filling labour demand on New Zealand dairy farms is a constant challenge. Labour demand varies over the farming season with the calving period having the highest demand and the highest level of stress.

Recent trial work on small farmlets in the Waikato has shown that extending lactation, from 10 months to 22 months (calving every 24 months), can have similar, or improved, productivity and profitability compared to a standard 12 month calving regime. This has the potential to smooth out labour demand across the season. Combining this with once-a-day milking would further reduce labour demand and make dairy farming a significantly more 'people friendly' occupation. Extended lactation combined with sexed semen and selective beef semen could significantly reduce the number of surplus dairy calves.

Computer modelling has indicated that extended lactation would suit Northland better than other regions with an increase in farm profitability of >$400/ha compared to the normal 12-month calving system. In addition, a relatively high proportion of Northland farms already milk once-a-day for the full season. Combining extended lactation with once-a-day milking is a novel and untested system. If it is proven to work in a Northland commercial farming context then it will likely have applicability to other regions, especially as the climate warms.

This project will quantify the physical and financial performance, and impact on labour of three farm systems:

1. A standard 12 month calving regime being milked twice-a-day
2. A 24 month calving regime being milked twice-a-day
3. A 24 month calving regime being milked once-a-day

Questions that this project will answer are:

- Can extended lactation be productive and profitable under two different milking frequencies within a commercial farming context?
- Are additional supplements required to maintain production in the second season of lactation?
- Are certain cows more suited to extended lactation?
- What are the environmental impacts of extended lactation compared to a 12-month calving regime?
- How does extended lactation impact people and labour demand?

Trial Structure & Activities

The farm systems trial will commence on 1st June 2026 and run for up to three years. Each farmlet will be approximately 27.5 ha and have 80 cows (2.9 cows/ha).

Farmlet treatments will be:

1. **Baseline Farm** - A standard 12 month calving regime being milked twice-a-day
2. **Extended Lactation TAD** - A 24 month calving regime being milked twice-a-day
3. **Extended Lactation OAD** - A 24 month calving regime being milked once-a-day

All farms 27.5ha	2025/26	2026/27	2027/28	2028/29
Baseline Herd 80 cows 18 replacements /yr 22%	100% mated spring	100% mated spring	100% mated spring	100% mated spring
EL TAD 80 cows 14 replacements / yr 17%	41 cows AB mated 8 wks	40 cows AB mated 8 wks	40 cows AB mated 8 wks	100% cows mated spring
EL OAD 80 cows 14 replacements/yr 17%	41 cows AB mated 8 wks	40 cows AB mated 8 wks	40 cows AB mated 8 wks	100% cows mated spring

Imported supplements will be used when pasture grazing residuals are below predetermined levels depending on the season. Supplement use will be restricted to PKE, PKE blends and silage.

Nitrogen use will be consistent across all farmlets, up to 190 kg N/ha/annum. All kikuyu-based pastures will be mulched and under-sown with Italian ryegrass in autumn. Paddocks sown in alternative species (tall fescue & cocksfoot) will be balanced across farmlets.

Data collected will include:

- Milk production on a farmlet basis – daily
- Milk production on an individual cow basis – 6 weekly
- Milk quality measures on an farmlet basis – daily (provided by Fonterra)
- Cow condition score (farmlet average) – fortnightly
- Pasture allocation and supplement use – daily
- Pasture growth and pasture cover – weekly
- Pasture quality and pasture species composition – monthly
- Labour inputs for individual farmlets – daily
- Farm managers worry score – fortnightly
- Pugging damage, nutrient loss & greenhouse gas emissions – annually
- Individual farmlet income and expenses = individual farmlet profit – annually
- Halter data – animal insights such as health and behaviour

Extension of Results and Learnings:

- Annual Field Day at NARF in June
- Annual Northland Farmer Conference or Regional Field Day in February
- Fortnightly farmer management meetings, email updates, website and Facebook updates

Funders

DairyNZ – Committed to funding
NDDT and NARF

For further information contact:

Chris Boom - NDDT Science Manager
chris.boom@agfirst.co.nz
0274 884 463

Kim Robinson
info@nddt.nz
0274 339 465

Adam & Laura Cullen – Cullands Limited

Farming Philosophy

Cullands Limited's farming philosophy is built on the understanding that healthy soils are the foundation of productive plants, healthy animals, and a resilient farming business. By prioritising soil health, the business focuses on improving soil structure, biological activity, and nutrient balance to support strong root systems and efficient nutrient uptake.

Balanced plant nutrition is central to this approach. Cullands Limited aims to grow robust, nutrient-dense pasture and crops that maximise photosynthesis, improve feed quality, and reduce reliance on reactive inputs. This results in more consistent pasture growth, greater resilience to climatic variability, and improved nutrient cycling within the farming system.

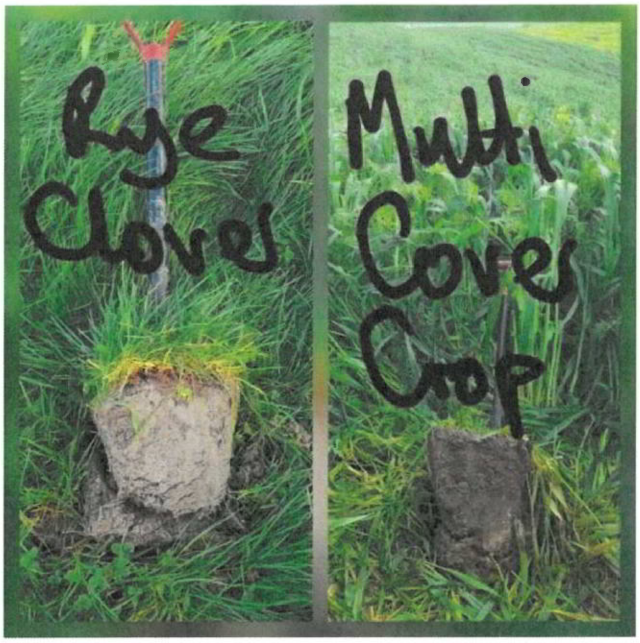
Animal health is viewed as a direct outcome of soil and plant health. Well-nourished pastures support healthier livestock with improved immunity, fertility, and performance, reducing the need for intervention and increasing overall efficiency.

By integrating soil, plant, and animal management, Cullands Limited builds both financial and environmental resilience. This systems-based approach supports long-term profitability, reduces environmental risk, and ensures the land remains productive and sustainable for future generations.

Ararua Hills Farm - Key Information

based on Fonterra Farm Insights Report

Metric	Units	2022/23	2023/24	2024/25
Dairy farm effective area	Ha	335	200	200
Maximum cow numbers	Cows (max numbers)	502	501	473
Stocking rate (dairy cows)	Cows/ha (max numbers)	1.50	2.51	2.37
Cows at peak milk	Cows	433	390	403
Production	kgMS	143,267	136,326	151,254
Production	t FPCM	1,856	1,764	1,959
Production per ha	kgMS/ha	428	682	756
Production per cow	kgMS/cow (peak milking)	331	350	375
Production per cow	kgMS/cow (max numbers)	285	272	320
Production per kg liveweight	%	72	71	82
Average somatic cell count	Cells/ml	212,522	236,545	207,333
Mastitis	Cases	102	89	83
Lameness	Cases	7	20	9
6-week in-calf rate	%	-	-	-
Not in-calf rate	%	-	-	-
Mating length	Days	-	-	-
Pasture & crop eaten (homegrown feed)	tDM/ha	6.6	11.6	10
Imported feed fed	tDM	138	258	234
Imported supplement per cow	tDM/cow (max numbers)	0.27	0.51	0.49
Nitrogen fertiliser applied per ha	kgN/ha	33	92	48
Nitrogen fertiliser conversion efficiency	kgDM/kgN	198	126	208
Purchased Nitrogen Surplus	kgN/ha	14	82	27
Feed converted to milk	%	47	45	50
Greenhouse Gas Emissions per tFPCM	kgC0_{2} e/tFPCM	925	1021	898
Biological emissions - Methane	kgCH4/ha	167	318	267
Biological emissions - Nitrous Oxide	kgN_{2} O/ha	3	7	5
Maize Area	ha	12	12	12
Maize Yield	tDM/ha	17	17	17
Cover Crop Yield	tDM/ha	4	4	4
Av Utilisation		90%	90%	90%
Total Maize & Cover Crop Eaten	tDM	227	227	227
Total Home Grown Feed Eaten	tDM	2,211	2,320	2,000
Home Grown Feed Grazed/ha	tDM/ha	6.1	11.1	9.4
vs P&C Eaten from above	tDM/ha	6.6	11.6	10.0



Visual Soil Assessment of multi species cover crop compared to rye and clover on Ararua Hills Farm.

Samples taken from paddocks next to each other.
Same contour and soil type.
Same treatment of soil until Cover Crop established.

Annual Maize Practice

April

Soil test
Cover crop establishment including fish hydrolysate

June

Cover crop grazed.
Feed value

September

Soil test
Terminate cover crop

October

Establish maize;
Seed
DAP (aim to use mineralisable N)
N (aim to use mineralisable N)

March

Harvest

Fact Sheet

Ballance's Soil Health Check

A simple health check for agricultural soils

What is soil health?

Soil is a functioning ecosystem rather than an inert substance, and soil health in farming systems goes beyond nutrient fertility. The most common definition of healthy soil is 'the continued capacity of the soil to function as a vital, living ecosystem that sustains plants, animals, and humans'[1].

Soil results from the interaction of the lithosphere (rock), atmosphere (air), hydrosphere (water) and biosphere (living things). This interaction, coupled with the effect of human management, is the essence of soil health.

Soil ecosystems can function in a natural state, and are remarkably resilient to the changes humans make to manage soil for our needs. But there is a limit to that resilience. In some situations, severe degradation of soil occurs, often associated with land use change and how the soil is managed.

What is Ballance's Soil Health Check?

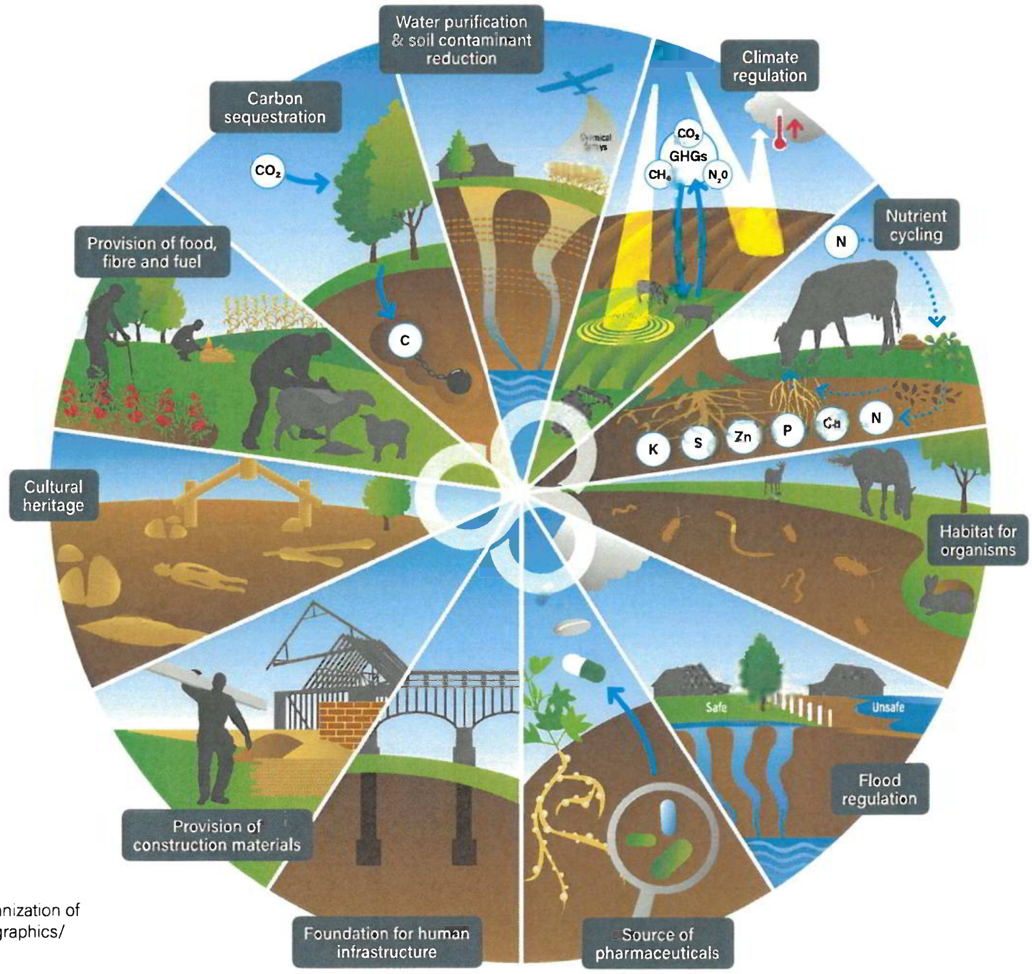
The Soil Health Check is a test that provides additional soil analyses, not included in standard soil fertility testing, which can deepen farmers' understanding of their soil.

The test is a biochemical assessment – it provides information on the soil's biological properties, as well as the chemical properties that standard soil fertility testing measures. The results can guide farmers to be more mindful in managing their soil's overall health.

Why only a 'check'?

The Soil Health Check is designed to align with standard soil fertility sampling protocols, so the samples do not allow the soil's physical health to be assessed.

While the Soil Health Check does not comprehensively assess soil health, it indicates the impact of land use on soil health by



Functions and services of soil

Adapted from the Food and Agriculture Organization of the UN - http://www.fao.org/resources/infographics/infographics-details/en/c/284478/

monitoring changes in certain indicators over time. If the general trend is a decrease in soil health, then a comprehensive test and remediation efforts are advised.

Where and when to measure?

No change to a standard soil testing programme is required, as the Soil Health Check is specifically designed to align with standard soil fertility sampling protocols.

Just a single set of samples is needed to measure the additional soil health parameters and standard fertility measures, and samples are taken in the same way as soil fertility sampling.

Transects for Soil Health Check sampling are based on Land Management Units (LMUs), and are taken at the same depth as soil fertility sampling (7.5 cm pastoral, 15 cm horticultural and arable).

The best time of year to measure soil health is late winter or early spring, but the test can be carried out at any time. For horticultural or arable systems, measure soil in a pastoral or restorative phase if possible, to minimise sampling error and allow comparison.

Many of the parameters measured in this test will not change rapidly, so the test is recommended every 3-5 years, with samples ideally taken at the same time of year for more accurate comparison over time. A good approach may be to test a different LMU each year.

What does it measure (and why)?

The following parameters, which account for both production and environmental goals, have been chosen to indicate the biological and chemical health of the soil being tested.

Total N (%)

Nitrogen (N) is an essential element required by all living organisms. Total N measures all of the N in the soil from all sources – organic and inorganic. In most topsoils, 95% of the total N will be in organic matter. The cycling of N between the organic pool and the inorganic (mineral) pool is necessary for supplying N for crop production and microbes. The organic N pool is also important for storing N added via biological N fixation.

Total C (%)

Carbon (C) is another essential element required by all living organisms. Total C measures all the C in the soil from all sources – in New Zealand this is mainly from organic carbon, which is the main component or building block of organic matter. Carbon is a food and energy source for microbes. Total C can only be used as a measure in mineral soils, not organic/peat soils (which by definition are very high in carbon).

Anaerobically mineralisable N (µg/g)

Anaerobically mineralisable nitrogen (AMN) shows the soil's ability to store N that can be supplied to plants through the decomposition of organic matter. Although more relevant for the soil health context, this test also correlates with the soil microbial biomass (bacteria, fungi etc in the soil) and is used as a proxy for measuring the health of the soil biological community. AMN is associated with organic N content contained in organic matter, which provides habitat and energy for soil microbes.

Organic matter (%)

Organic matter, which includes decomposing plant and animal residues, soil biota (organisms and plants) and root exudates, is described as proportion of the overall soil. Organic matter is a very important component as it influences all of the soil's chemical, biological and physical systems. Organic matter provides the energy source for microbes which drive nutrient cycling in soil, increases the soil's capacity to retain nutrients, improves and stabilises soil structure, improves water infiltration, and increases water holding capacity. In NZ soils the majority of C is of organic origin (with the exception of melanic soils). The non organic C contribution is negligible, therefore is not accounted for in the following calculation. Organic matter is calculated from the Total C result (Total C x 1.72).

pH

Indicates soil acidity (pH<7) or alkalinity (pH>7). Microbial activity and plant growth are affected when pH is not within the optimal range for the species. The pH also affects availability of nutrients in soil.

Olsen P (mg/L)

Indicates the level of phosphorus that is available for plant uptake in the short term. Olsen P is a marker for the productive potential of the soil.

What about worms?

Many people associate earthworms with soil health, however this test does not measure earthworms. If you or your customer are interested in measuring worms, you can dig a hole and count. As a rule of thumb, >20 worms per spade square is a good target, but note that worms may not have been introduced to the area, or dryness may have caused them to burrow deeper.

What about physical parameters?

Assessing the physical state of soil is important for fully understanding soil health. If a physical diagnosis is required, a Visual Soil Assessment is recommended, with a comparative fence line assessment. For more information see soils.landcareresearch.co.nz/describing-soils/visual-soil-assessment-vsa-field-guide/

How are results interpreted and used?

Results from the Soil Health Check are measured against soil health target ranges used for national (and regional) soil health monitoring programmes[1]. These targets take into account the farm system and soil type, and provide benchmarks or 'target' ranges for each of the measured parameters.

The national soil health target ranges reflect results expected from a sample collected to a depth of 10 cm (the depth to which soil health samples are generally collected). As Soil Health Check samples are aligned with soil fertility sampling (collected to 7.5 cm or 15 cm deep), the target ranges are corrected to allow for a more accurate comparison. For more information see the *Target ranges for Soil Health Check parameters* factsheet.

Although the purpose of the Soil Health Check is to provide an indication of the impact of the land use on soil health over time, Ballance also provides recommendations for managing and improving soil health, based on the results and some understanding of the farming system.

[1] Soil Health [accessed November 2020] https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/

[2] Hill RB and Sparling GP 2009. Soil quality monitoring. Land and soil monitoring: A guide for SoE and regional council reporting. Land Monitoring Forum, New Zealand, pp. 27-86.

Notes