siddc South Island Dairy Demonstration Centre

LUDF LINCOLN UNIVERSITY DAIRY FARM

LUDF FOCUS DAY
October 2023

LUDF Spring Update – Peter Hancox & Jeremy Savage

- **Season to Date**
- **Milking 10 in 7 from day one this season.**
- **Managing spring with 10 in 7.**
- **Mating Program. Learnings from Repro benchmarking.**
- **2022/23 Season financial results & 2023/24 Season budget.**

Presentations from Guest Speakers:

Richard Christie (Christie Consultants), A History of SIDDC. Challenges and Success's

Paul Edwards (DairyNZ) Research on Using Wearable Data for Pasture Management

Jeremy Savage . Break Even Milk Price for your Business

Blair Robinson (COO, Dairy Holdings). Cost Control in our Business

Stephen Esposito (CEO, Safer Farms). Safer Farms. Supporting our Farmers.

Omar Al-Marashdeh (Lincoln University) Plantain establishment and persistence.

Lincoln University Dairy Farm (LUDF)

@LUDairyFarm · Dairy Farm

Enquiries: Ph: 03 423 0022 Email: office@siddc.org.nz

Visit the website: www.siddc.org.nz for weekly updates on Farm Walk Notes

SIDDC South Island Dairying Development Centre

Partners Networking To Advance South Island Dairying

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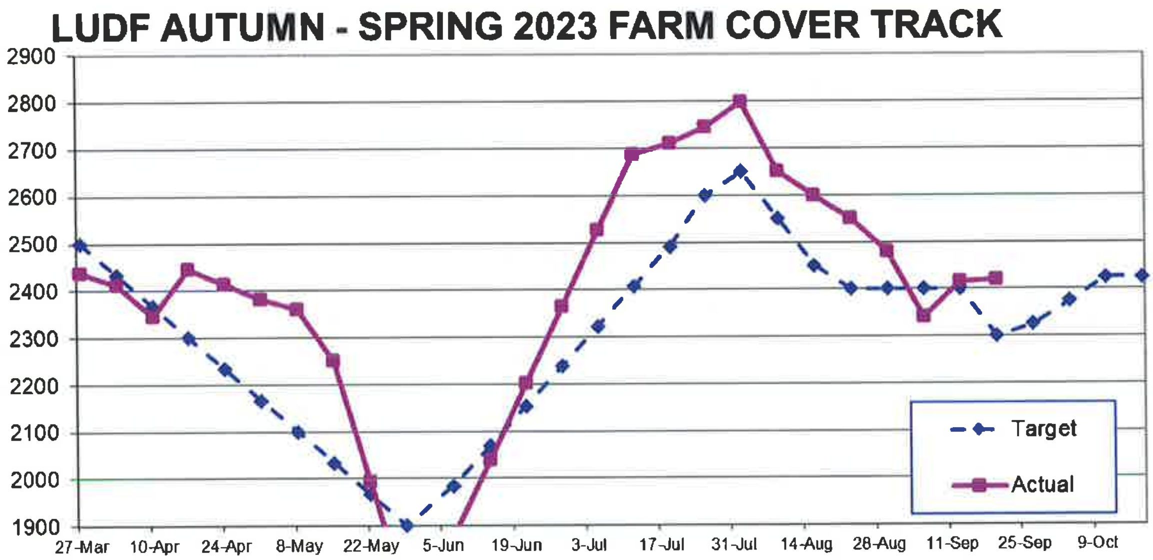
LUDF Spring 2023 Update

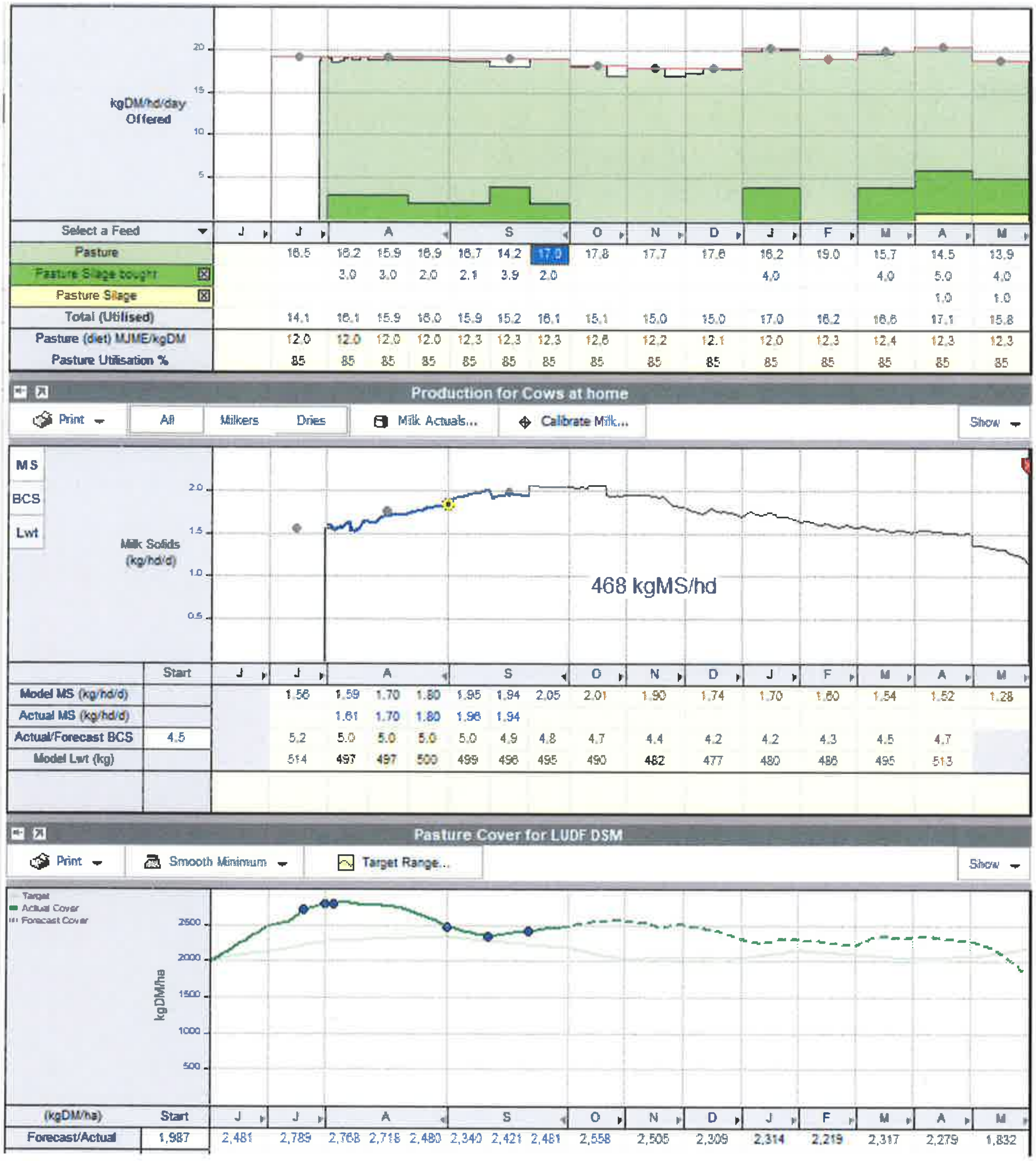
Pasture, Feeding & Milk Production

- Delayed the calving by 5 days.
- 1st round finished 23rd September. (14th September last year).
- Have fed 2-3 kgDM silage. Last season fed upto 7 kgDM/cow silage at the end of the 1st round to push it out. The delay on calving date has taken pressure off silage demand.
- Had a bit more grass on dairy support land – dryland grew well.
- Have not used progibb this spring with contractor issues and high winds. Will use some this week with cooler temperatures and to guarantee +66 kgDM/Ha growth.



October Feed Budget & Grazing Rules:

- 563 cows on 162 Ha = 3.52 cows/HA
- @ 2.2 kgMS/cow. Demand = 20.4 kgDM/cow (Feed quality high @ 12.6 MJME)
- Residual = 1,600 kgDM/HA for high performing cows.
- Demand = 72 kgDM/HA.
- Pasture required = demand X round length.
- Fastest Round = 22 days = 1,600 + 1,600 = 3,200 pre grazing (if less silage used to hold round)
- Longest Round = 24 days = 1,700 + 1,600 = 3,300 pre grazing (any more silage mown)



Stock Reconciliation

Wintered	576 cows
Peak Milk – 24 to calve	563
Winter losses	10 (1.72 %. Normally 2% LUDF) Exceptionally good, average 3-4%.

Winter Losses

2%	=	great result. Low disease, good transition etc.
3%	=	average / acceptable
4%	=	Look for disease issues, cows identified as calved?
5%+	=	Getting too high. May have disease on the farm (Johnes / BVD). Need to survey to confirm what is causing problems.

Calves:

AB Calves	154
Beef Calves to Sell	59

Will drop replacement rate to 115 calves. 20% to drop cost's structure and greenhouse gas emissions from herd. Will have 39 calves to sell.

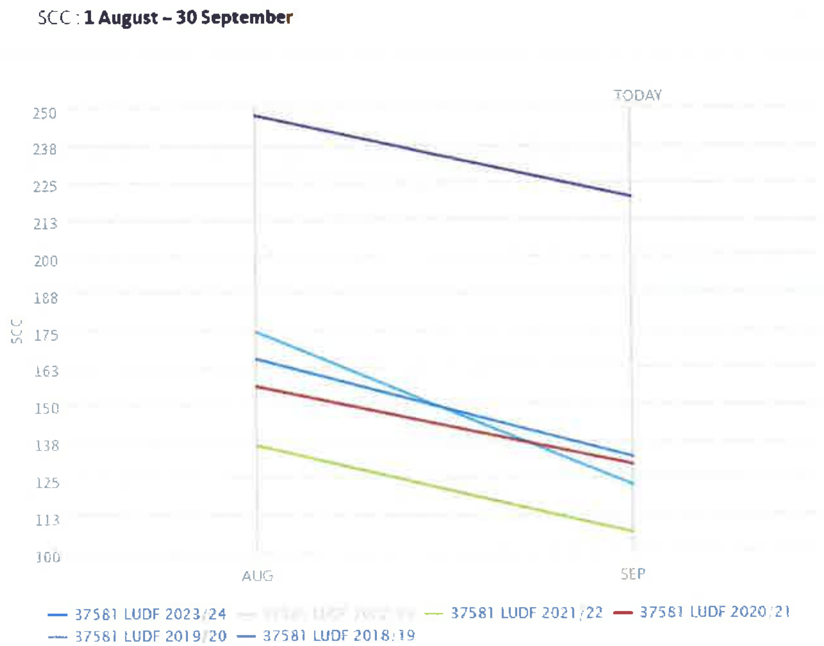
Fertiliser

Time	Rate	Product	kg N/ha
Early september	100	Ammo 30	30
late-September	87	Urea	40
late-October	87	Urea	40
late-November	43	Urea	20
late-December	43	Urea	20
late-January	43	Urea	20
early-March	43	Urea	20
			190 kg N/ha

Using high rates in the spring months to get better responses and encourage greater vegetative growth during the seed head phase of the pastures – from 8th November.

Animal Health

- Has been a great season, low incidence of mastitis and RFM's.
- Variable milking not impacting on SCC.
- 4th year with no Staph cows. SCC is significantly lower.



Staffing

- Winter and Spring 2023 completed with 4 full-time staff.
- One extra staff member with Peter's role in demonstration + Visitors increasing post covid.
- No Casual staff.
- Staff 5+2
- Peter 6+1 roster (in theory spring...) now 5+2

Body Condition Score

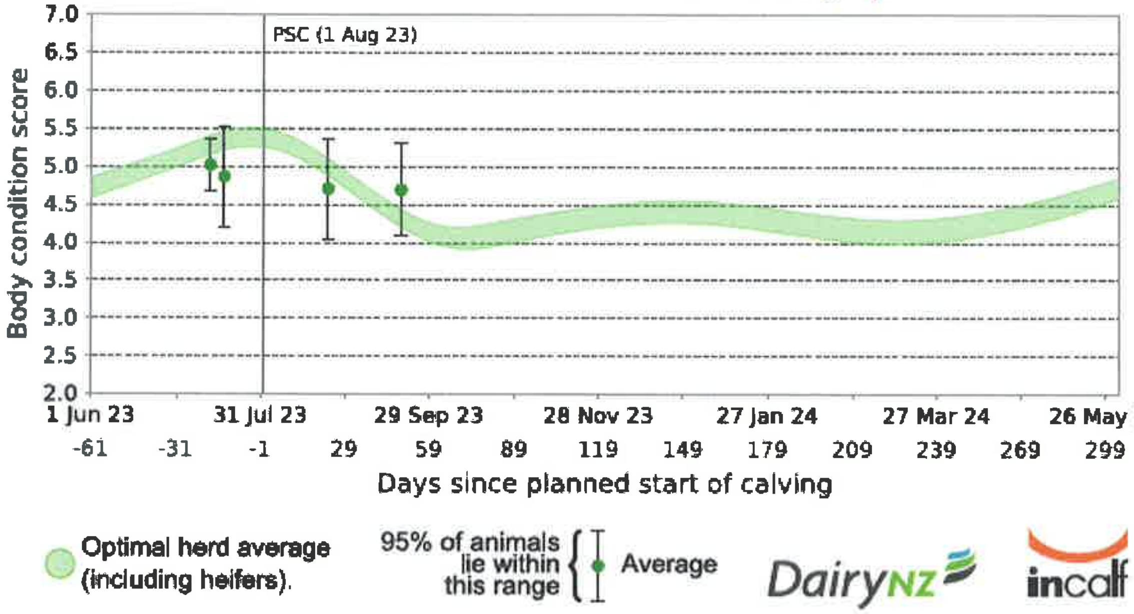
infovet LINCOLN UNIVERSITY DAIRY FARM Report Date: 19 Sep 23

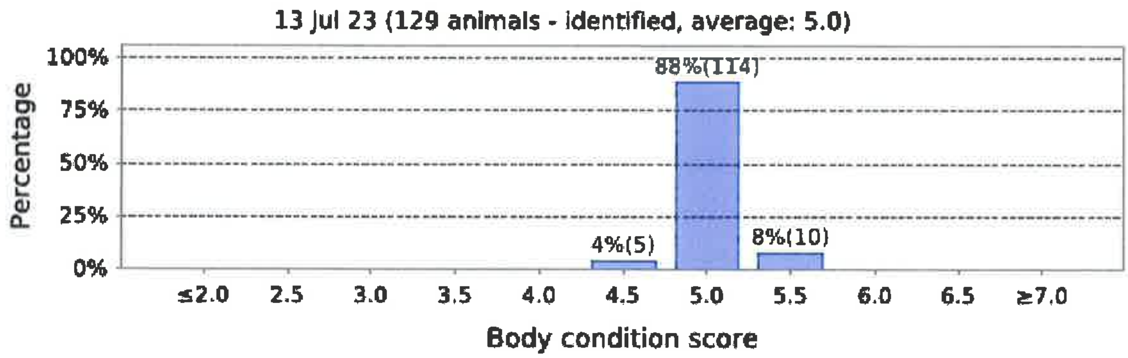
Body Condition Score

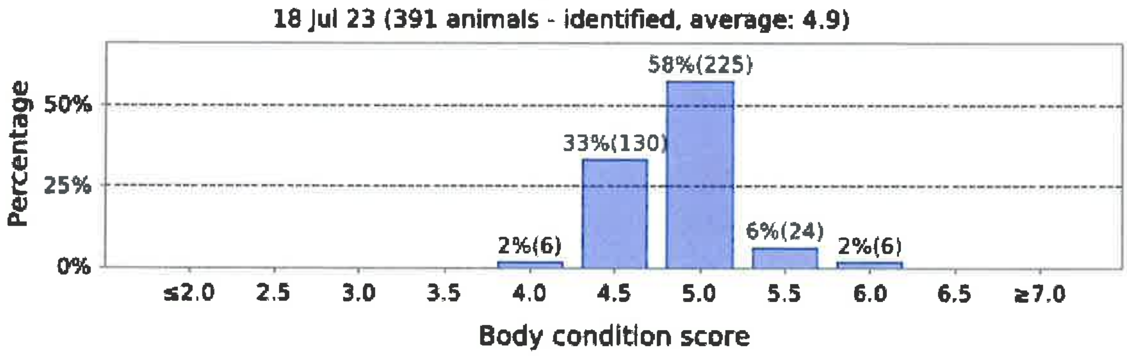
Animal group: BCS 19.9.23 AK

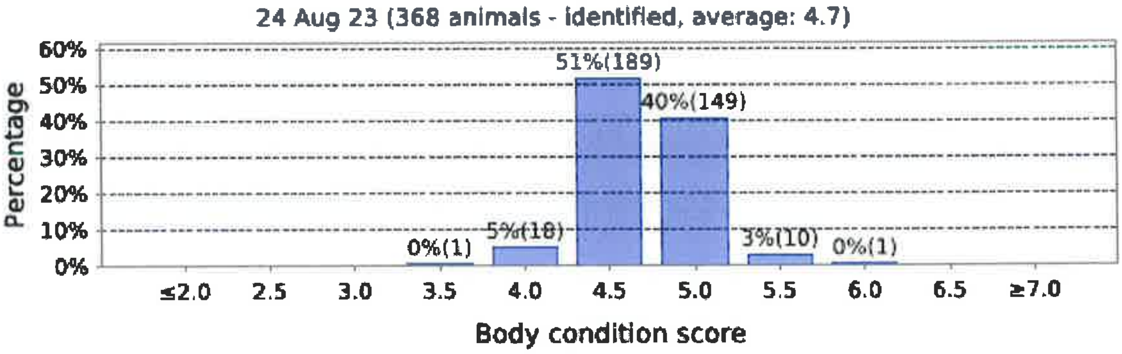
Planned start of Calving: 1 Aug 23

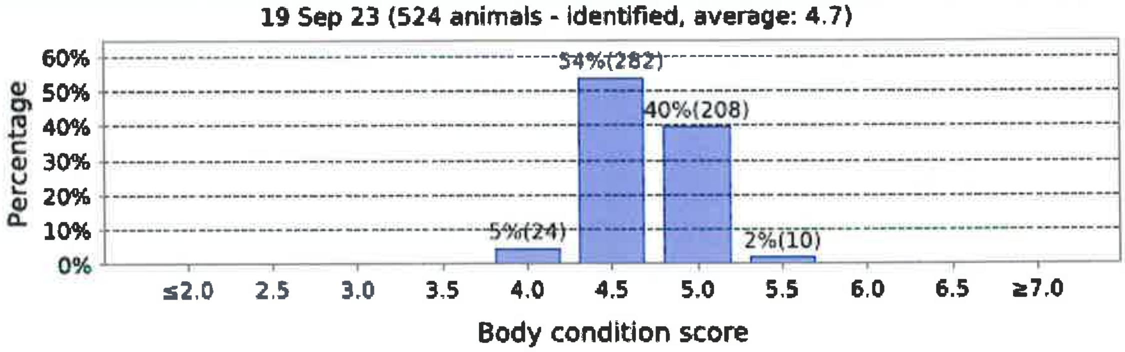
Denominator is limited to the scored cows within the group.











Mating

LUDF improved their not in calf (NIC) rate from a historic 18 – 20 %, to 12 % for the 2022 Spring. Two key changes made in 2022 spring were:

1. Extending mating by 2.3 weeks, using ultra short gestation semen. Mating traditionally was 10 weeks. This would have finished mating 1st January.

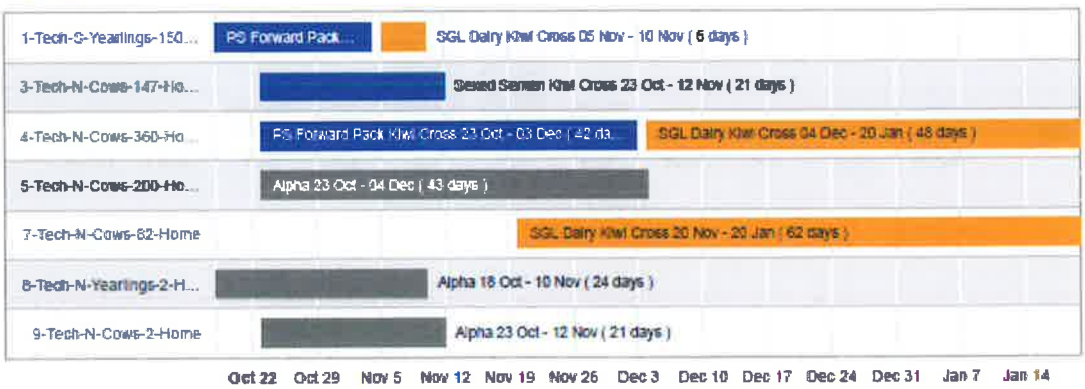
2. Collars used to identify mating's and monitor cow activity (and inactivity). LUDF

Improvement in NIC Rate=	8 %
Longer Mating	3.3 % additional cows in calf.
Collars + interventions	5.4 % additional cows in calf.

Reviews on previous mating's by LIC highlighted that Peter Hancox mating / drafting skills are very good. It was not anticipated that any improvement came from improvements in accuracy of drafting due to collars.

Mating Period / SGL Semen

The mating period was extended from the traditional 10 weeks to 12.3 weeks for the 2022 mating period. Ultrashort gestation semen was used for the tail end of mating:



Scanning was completed on a weekly basis through December, with a final scan in early March. It was confirmed that an additional 3.3% cows were in calf with combining the collar and short gestation technologies. Mating can be extended without collars, however we will be demanding staff do extra work (drafting) through the xmas/new year break. Collars are automated.

Prostaglandin Use & Phantom Cows

PG (Prostaglandin) was used in the first cycle of mating. LUDF had only 2 anoestrus cows at the PSM. An additional 19 cows were identified as non cyclers at day 19 of mating and PG'd.

The data from the collar technology was used to identify "Phantom Cows". These are cows that have cycled, have been inseminated and failed to get in calf, and failed to start cycling again. These animals will show up on the collar information pages as In calf, and give a likelihood. These cows identified with the collar technology, are scanned by the vet to confirm if they are pregnant. Scanning takes place 28 – 35 days after the mating. Cows that were not pregnant were administered a PG dose and blanket inseminated 3 days later.

41 cows were given a PG based on identifying them as Phantom cows with use of collar technology and scanning from 27th November to 9th January. Cows were scanned every 10-14 days. 67% of these cows were determined as pregnant in the final scan. This intervention could also be achieved with Tail paint / Kmars, but with some difficulty and high risks of inaccuracy.

In addition to the phantom identification, a further 11 cows were PG when it was noted the drafting numbers were wrong on a later 11 am Saturday milking. With 10 in 7 milking, staff need to change some parameters in the drafting program.

Intervention with PG
Mating Start Date 23-Oct

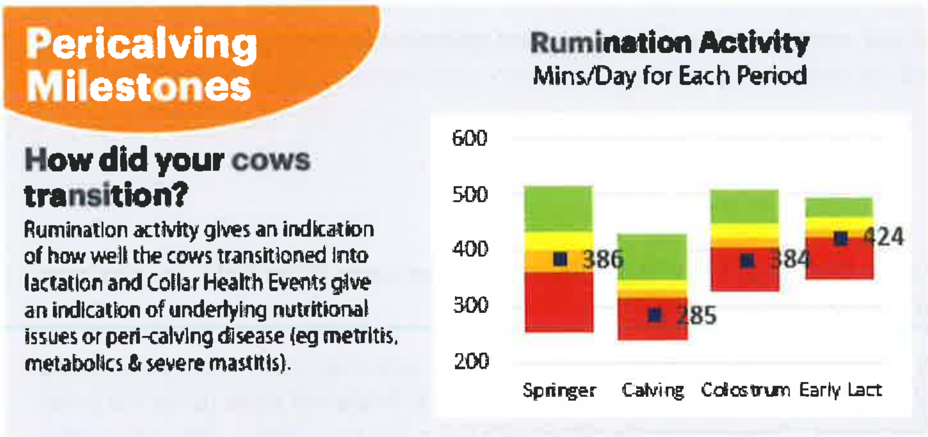
Traditional Intervention with PG	Date	Day of Mating	Cows	MT Cows	IC Cows	IC Rate	% Of 540 Herd IC
PG'd start of Mating.	21-Oct	-2	2		2	100%	
due to miss draft.	09-Nov	17	11	1	10	91%	
non-cyclers day 19 of mating.	11-Nov	19	39	10	29	74%	
Traditional Intervention Total			52	11	41	79%	7.6%
Collar + Scan + PG Intervention							
Phantom Cows	27-Nov	35	11		11	100%	
	08-Dec	46	16	4	12	75%	
	22-Dec	60	7	3	4	57%	
	09-Jan	78	9	7	2	22%	
Phantom Cows - Total			43	14	29	67%	5.4%

Spring Feeding & Transition

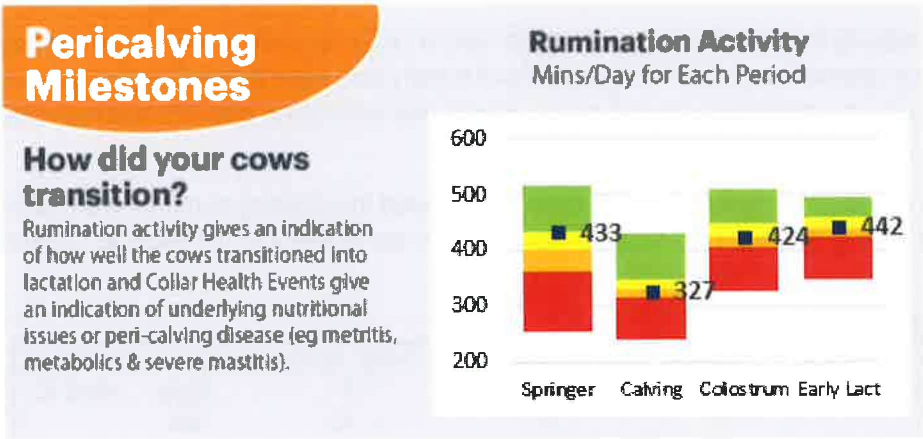
Collar data from the 2022 spring highlighted that the transition of the cow, from calving to milking could be better. Our management of this transition period after calving (Colostrum mob):

- Transition cows / colostrum's AB lib on silage, (typically 4 kgdM) fed on trailer
- All cows OAD – sent to night paddocks through auto drafter. TAD cows joined them at night.
- Typically 15 cows at any one time that needed more time, especially 2 year olds.
- Only 2 young cows post 30 days still struggling.

First where we came from - 2022



Then this season - 2023

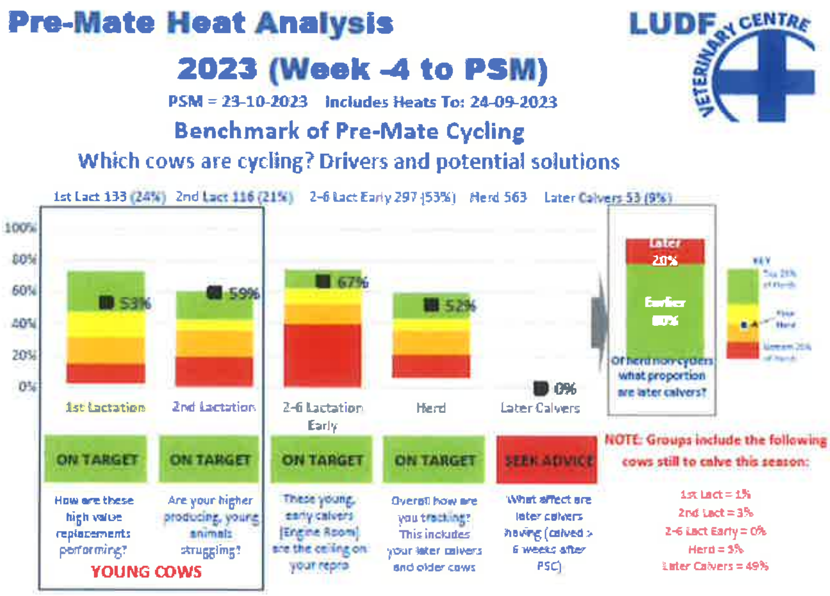


In summary:

- Springer + 47 minutes (12% increase)
- Calving + 42 minutes (15% increase)
- Colostrum + 40 minutes (10% increase)
- Early Lactation + 18 minutes (4% increase)

If you thought of it as getting around 10-15% more feed down the throats during that period, then you can see the effect would be massive. The equivalent of 1.5-2kg DM per day (probably).
To supply that amount of energy off their back, a cow would need to mobilise around 1/3 of a BCS over 30 days to make up for the deficit.

Feed Offered vs Demand (%)	Expected Weight Change
92%	-0.38 Kg/Day
-14.05 MJME	-0.35 BCS
NEGATIVE ENERGY BALANCE	Expected BCS Change over 30 days



Overall the 1st lactation are back slightly (but remember they calved VERY early last season).
Up 17% for the Engine Room (2-6 early lactation), and up 7% at the herd level, big gains compared to the 2022 premating.

Mating Heifers:

Program to be confirmed. Sexed semen not available this year for heifer mating which challenges the returns from the effort and costs involved.

LUDF Finances

The 2022/23 season witnessed a very high rate of dairy price inflation. LUDF weathered this inflation reasonably well with low inputs. However the costs and profitability was hampered by production not meeting budget for the 2nd season on 10 in 7. Cow numbers fell short with higher spring losses of cows. A very wet season and a slow spring hampered growth rates and per cow production. A drop milk price also dropped the gross farm in come.

22/23 Actual Finances

Peak Cows	541 cows
Total	251,463
Per cow	465 kgMS
Per Ha	1,552 kgMS
Payout	$8.20 / kgMS

Farm Operating Expenditure $5.63 / kgMS
Total Operating Expenditure $1,392,697

EBIT $808,567 ($4,991 / Ha)

22/23 Budget Finances

Peak Cows	557
Total	266,000
Per cow	478 kgMS
Per Ha	1,663 kgMS
Payout	$9.30 / kgMS

Total Operating Expenditure $1,340,824

Farm Operating Expenditure $5.04 / kgMS

EBIT $1,259,575 ($7,775 / Ha)

Key Points:

- LUDF held onto costs quite well (total Operating Costs) at $1.390 million.
- Cow numbers fell short with culling for Johnes and a few extra deaths in spring.
- Per cow production fell short of the mark with a tough spring.
- Combination of per cow production, and total cow numbers down meant that total production was well down.
- Actual cost per kgMS significantly higher than budget.

LUDF ACTUAL RESULTS 2022-2023

Account	Adj Season YTD 2022/2023 $	2022/23 budget $
REVENUE		
Dividend Income	59,413	
Sales - Calves	47,288	
Sales - R2 Heifers	4,294	
Sales - Steers	0	
Sales - Cows	121,896	126,599
Sales - Bulls	0	
Sales - Other Livestock	0	
Sales - Feed, Silage, Other Crops	0	
Sales - Milk Solids Current Season	1,546,394	1,907,077
Payments Milk Solids Prev Season	455,131	
Income - Rent	0	
Income - Other	0	
Milk Levy		
TOTAL REVENUE	2,234,416	2,033,676
EXPENSES		
Salary Costs		
Farm Salaries Perm & F/Term	231,009	
Farm Casuals	18,578	
Allowances	0	
Superan,ACC,Incr Provision	6,608	
Total Farm Salary Costs	256,196	259,000
Operating Expenses		
Internal Sales; Grazing, Feed	0	
Internal Services; Fees, LU Accom	0	
Appointment Expenses	665	
H&S/Prot Clothing/BioSecurity	717	
Staff Development	326	
Livestock Purchases	0	
Animal Health	76,429	72,189
Breeding	63,643	71,952
Feed & Grazing	535,661	417,294
Crops/Pastures	0	10,167
Seed	0	
Fertilisers	162,836	173,023
Weed & Pest Control	1,463	
Contractors	45,325	36,323
Electricity	66,517	84,408
Freight	14,685	12,627
Vehicle Expenses	24,073	24,000
R&M (except Farm Houses)	66,511	95,200
R & M (Farm Houses)	0	
Dairy Shed Operating Expenses	8,053	8,306
Farm Demonstration Costs	0	
Administration	13,135	22,540
Fixed Charges	19,553	12,706
Livestock Decreases (Increases)	0	
Feed Decrease (Increase) Stock	0	
Other Expenses	0	10,290
Milk Levy	17,310	11,199
Total Farm Operating Costs	1,373,097	1,321,224
East Block Adjustment to Operating Costs	19,600	19,600
Farm Operating Expenditure	1,392,697	1,340,824
Milk Production KgMs	247,291	266,000
Farm Operating Costs per kgMS	$ 5.63	$ 5.04
Milk Price	$ 8.20	$ 9.30
Milk Gross income	2,027,786	2,473,800
Stock Gross income	173,478	126,599
Total Gross income	2,201,264.41	2,600,399.00
Less		
Farm Operating Expenditure	1,392,697	1,340,824
Equals		
EBIT	808,567	1,259,575
Financial Ratios		
EBIT / Ha	$ 4,991	$ 7,775
Farm Operating Expenditure / kgMS	$ 5.63	$ 5.04

Production 23/24 Budget

Peak Cows 565
Total 265,550
Per cow 470 kgMS
Per Ha 1,552 kgMS

Farm Operating Expenditure
$5.51 / kgMS
(Farm Working $5.43 /kgMS)

LUDF		2023/24 budget
Production (kgMS)		**266115**
Payout	**$**	**6.75**
Income		
Milk income	$	1,796,276
+/- Changed in Milk Inc.	$	-
Stock income	$	129,400
Other income	$	-
Gross income	**$**	**1,925,676**
Expenses		
Wages	$	267,527
Contractors	$	-
Fertiliser	$	148,446
Cropping	$	19,560
Supplement + Grazing	$	541,547
Breeding	$	61,698
Animal Health	$	73,450
Calf rearing	$	21,750
General Farm Working	$	10,000
Vehicles and fuel	$	26,531
Dairy shed	$	8,475
Contractors	$	10,000
Freight	$	10,000
Dairy electricity	$	84,750
Weed and pest	$	23,347
Repairs and Maintenance	$	92,400
Irrigation		
Administration	$	15,000
Rates	$	15,792
DairyNZ	$	15,967
Support Lease	$	6,000
Insurance	$	-
Farm working expenses	**$**	**1,452,239**
Operating Ajustments		19600
Operating Expenditure	**$**	**1,471,839**
EBIT	**$**	**453,837**
Plus Fonterra Dividend		
Debt servicing		
Capital		
Principal repayments		
Tax		
Drawings/Dividend		
Total Capital / Income expenses		
Net Profit	**$**	**453,837**
Financial Indices		
EBIT	$	453,837
EBIT/ha	$	2,784
FWE/kgMS	$	5.46
Op Ex / kgMS	$	5.53
FWE:Gross farm income		75%
Debt servicing:EBIT		0%

LUDF Fonterra Farm Insights Report

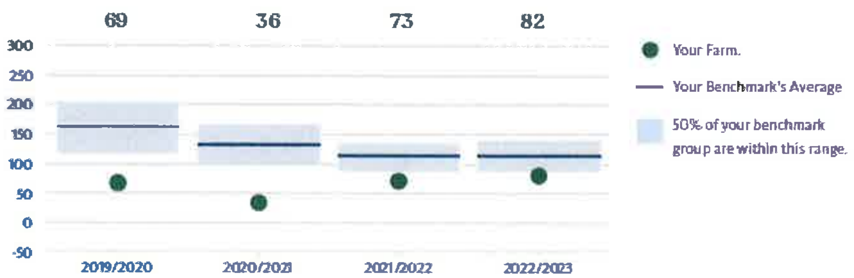
Your Farm's Key Information	Units	2020/2021	2021/2022	2022/2023
Dairy Farm Effective Area	ha	160	160	160
Peak Cows (Maximum Cow Numbers)	cows	558	558	547
Stocking Rate (Milking Cows)	cows/ha	3.5	3.5	3.4
Production (Milk Solids Produced)	kgMS	280,381	258,851	247,291
Production Per Cow	kgMS/cow	502	464	452
Production Per Hectare	kgMS/ha	1,752	1,618	1,546
Average Somatic Cell Count	cells/ml	117,358	142,485	140,252
Nitrogen Fertiliser Applied Per Hectare	kgN/ha	133	144	158
Imported Supplementary Feed Fed	tDM	262	418	321
Imported Supplementary Feed Fed Per Cow	tDM/cow	0.5	0.7	0.6
Purchased Nitrogen Surplus	kgN/ha	36	73	82
Greenhouse Gas Emissions Per kgMS	$kgCO_2e/kgMS$	9.1	9.5	9.8
Biological Greenhouse Gas Emissions Per Hectare	$kgCO_2e/ha$	14,390	13,938	13,574
Farm Grown Feed	%	100%	100%	100

Purchased Nitrogen Surplus

Purchased Nitrogen Surplus is the difference between the nitrogen inputs (fertiliser and imported feeds) and the nitrogen outputs (milk, meat, crop, supplementary feed or exported effluent) on your dairy farm effective area. A high number means more nitrogen is at risk of being lost from your farm to the receiving environment.

Your Farm's Purchased Nitrogen Surplus Per Hectare

Nitrogen Fertiliser		Imported Feed		Exported Product		Purchased Nitrogen Surplus
158 kgN/ha	+	32 kgN/ha	-	108 kgN/ha	=	82 kgN/ha



Your farm is benchmarked against other farms in the Canterbury region with production **between 1401-1700 kgMS/ha.**

Greenhouse Gas Emissions

Your farm's greenhouse gas (GHG) footprint consists of both **Biological** and **Non-Biological** sources of emissions. GHG emissions are expressed as Carbon Dioxide equivalents (CO_2) and account for practices on your dairy farm effective area.

Your Farm's GHG Emissions per kgMS 9.8

Biological 8.8
Emissions derived from biological sources on farm.

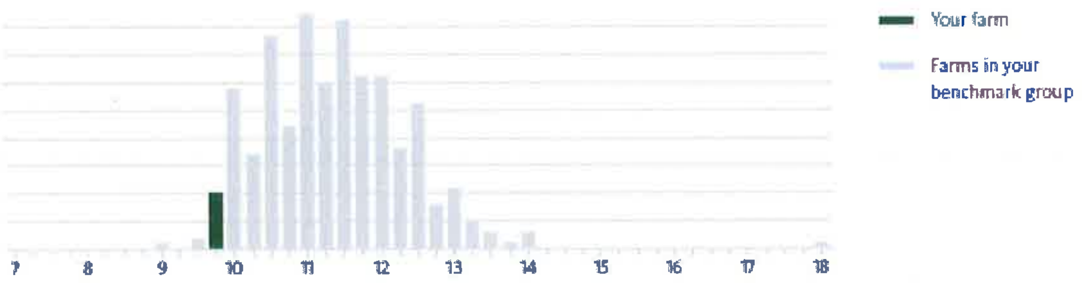
Non-Biological 1.0
Emissions derived from non-biological sources.

Methane 7.3
Produced during the breakdown of plant matter – either through digestion or manure decomposition.

Nitrous Oxide 1.5
Produced by the breakdown of urine, dung and fertiliser.

Carbon Dioxide 1.0
Produced in the manufacturing and transport of farm inputs, including all fertilisers, supplements, electricity and fuel.

Methane		Nitrous Oxide		Carbon Dioxide	
Enteric Methane	6.7	Urine and Dung	1.1	Nitrogen Fertiliser	0.4
Dung Methane	0.3	Effluent Storage	<0.1	Imported Supplements	0.3
Effluent Methane	0.3	Nitrogen Fertiliser	0.4	Other Sources	0.3



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A History of SIDDC – Challenges and Successes

Richard Christie

4 October 2023

SIDDC Purpose 2002

1. To facilitate the adoption of technology and best farm practices in dairying, with special reference to the South Island.
2. To leverage the capabilities of the SIDDC partners.
3. To use the Lincoln dairy farm as the centre piece to lead the South Island dairy sector, and as a platform for on-farm extension.
4. To provide a teaching platform for dairy farming systems.
5. To attract research funds to grow knowledge and capability.
6. To secure access to Lincoln University dairy and cropping farms.
7. To ensure activities of SIDDC recognise and embrace the dairy industry's objective of 4% per annum productivity growth and enhance all national activities in dairy optimisation.

Original Partners 2002 (plus LIC from 2006)

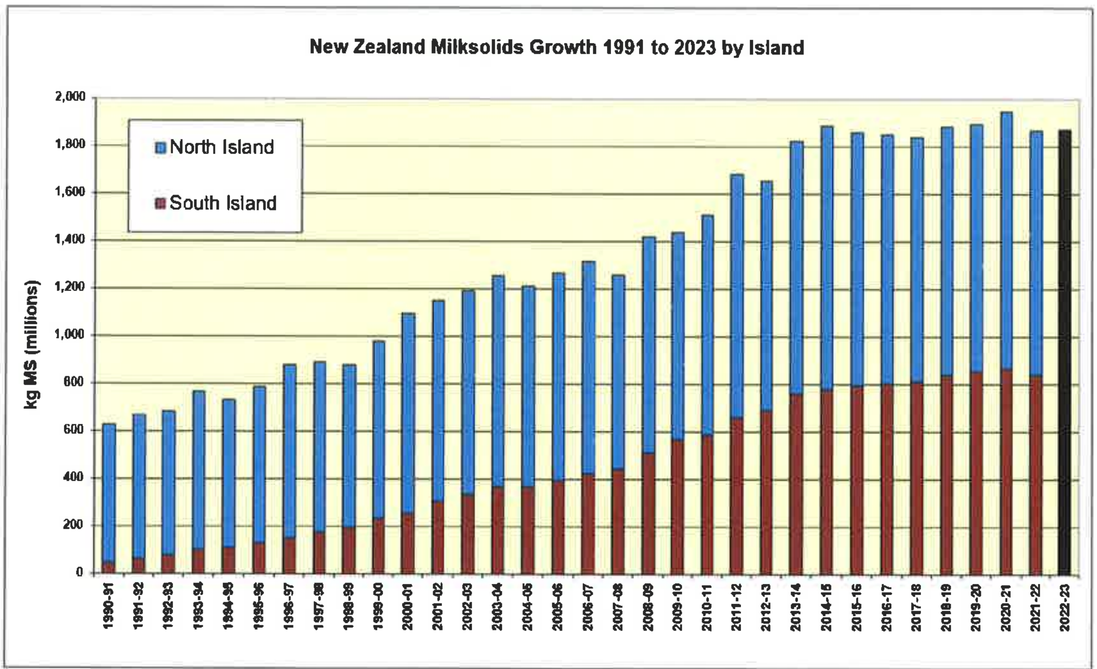
S I D D C

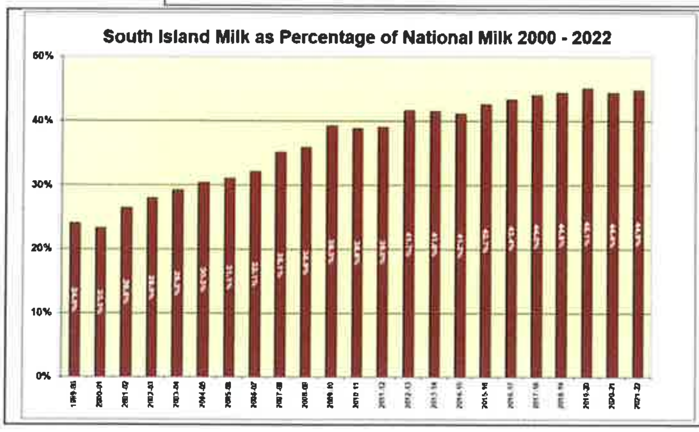
SOUTH ISLAND DAIRYING DEVELOPMENT CENTRE

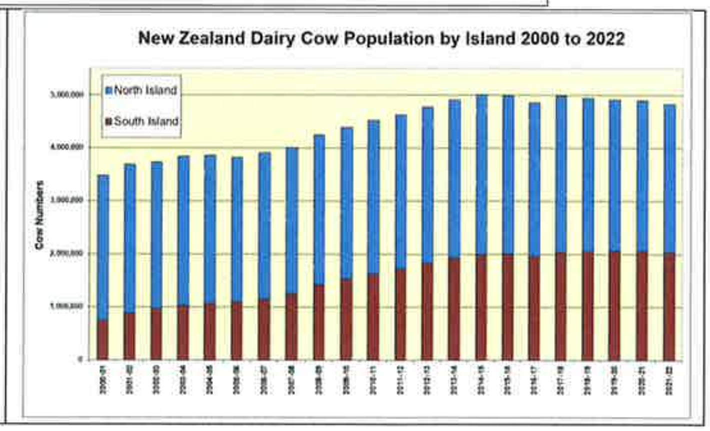
Partners Networking for South Island Dairying

Lincoln University · dexcel · CROP FOOD · Ravensdown · LIC · SIDE

South Island dairying had a vey different profile at the turn of the millennium when SIDDC was being established by Vice Chancellor Frank Wood and Dr Bill Kain (ex first CEO of AgResearch). The partners worked with Lincoln University to convert the LU sheep farm to irrigated dairying. The unique partnership manages LUDF, with the Lincoln University Vice Chancellor and the CEO's of the partner organisation forming the Board.







Since 2000, South Island milksolids have grown 257%, while North Island grew 39%. From SIDDC's formation, SI milksolids have grown at an average of 6% per year. That saw South Island milksolids lift from 24% of NZ production to 45%. But note that NZ milksolids production have now been static for 10 years, and the South Island has been close to static for 5 years. This partially explains name change form SI Dairying **Development** Centre to SI Dairying **Demonstration** Centre in 2020, as the industry enters a new phase.

Systems on LUDF

LUDF Historic Performance

Source 2003 to 2019:
NZIPIM Journal June 2020, LUDF 20 Years of Successful On-Farm Demonstration, Virginia Serra
Source 2019 to 2023:
LUDF Records via J Savage

								Root weevil impacts						ECan N loss limits		Irrigation changes	10/7 milking, plantain			
Conversion Phase	Pasture focus, 1500kgDM/ha residuals, feed wedge							High input/high output system				Nil infrastructure/low-input system (P21 model)								
	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
kg liveweight/ha	1,960	1,960	1,960	1,974	2,058	2,107	1,941	1,914	1,860	1,878	1,872	1,680	1,724	1,700	1,680	1,656	1,768	1,768	1,768	1,717
Cows/ha	4.0	4.0	4.0	4.2	4.3	4.3	4.1	4.2	3.95	3.94	3.9	3.5	3.5	3.5	3.5	3.4	3.5	3.5	3.5	3.4
kg MS/ha	1,684	1,719	1,772	1,703	1,741	1,634	1,710	1,638	1,861	1,878	1,725	1,742	1,812	1,789	1,571	1,733	1,752	1,753	1,618	1,545
kg MS/cow	422	426	440	404	410	338	415	392	471	477	440	498	522	517	451	504	505	504	465	457
Imported suppl. fed (kg DM/cow)	304	277	320	235	407	338	262	463	359	434	507	302	134	397	444	22	468	491	423	567
Imported suppl. fed (kg DM/ha)	1,213	1,117	1,291	945	1,715	1,437	1,119	1,911	1,500	1,714	1,996	1,186	468	1,377	1,538	76	1,638	1,719	1,481	1,928
kg N applied over 160 ha	200	200	187	187	164	200	185	260	340	350	250	143	179	173	178	148	172	135	161	172

* As estimated on DairyNZ's DairyBase

Refer NZIPIM The Journal, Vol 24, No. 2, June 2020 (pages 34-39) below for more details on LUDF systems changes.

Partnership Changes

- DairyNZ created from merger of Dairy Insight and Dexcel in 2008.
- Crop & Food CRI merges with HortResearch CRI to become Plant and Food in late 2008
- AgResearch Crown Research Institute joins the partnership in 2010
- Plant and Food leaves the partnership in 2018.
- Fonterra joins the SIDDC partnership today.

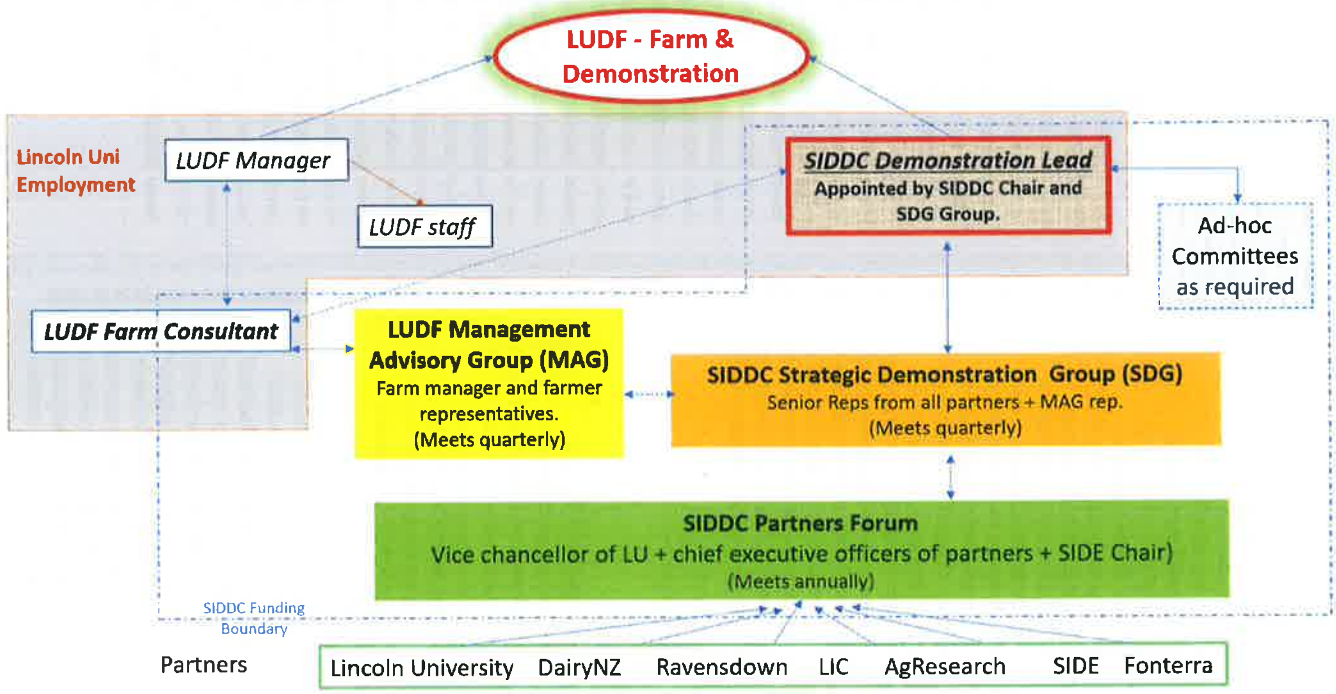
Current Aims & Principles

Demonstrate tomorrow's dairy farming today

1. People are the core of farm activities
2. Activities must be supported by the broader community
3. Mātauraka Māori to be adopted
4. The focus must be on future consumers
5. On-farm practices must be at the forefront of environmental sustainability, commercial profitability, animal care, and employment relations
6. Farm systems will be informed by sound science and underpinned by robust and transparent data collection and analysis

Current Operational Structure 2023

South Island Dairying Demonstration Centre Structure



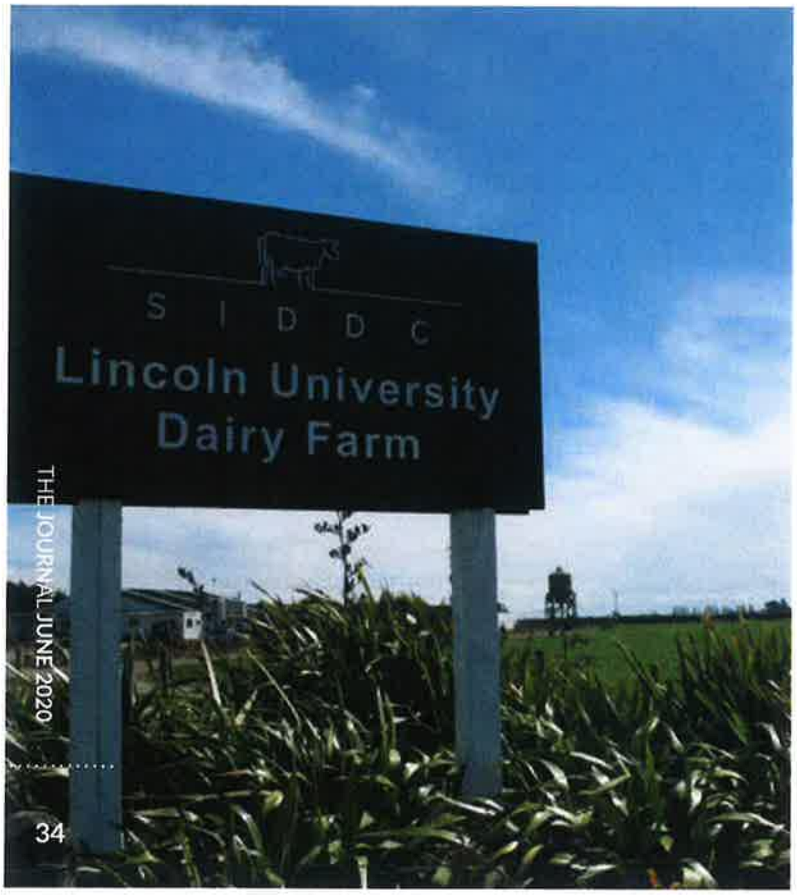
VIRGINIA SERRA

LINCOLN UNIVERSITY DAIRY FARM (LUDF) – 20 YEARS OF SUCCESSFUL ON-FARM DEMONSTRATION

LUDF has been one of the most successful demonstration farms in New Zealand, leading the way in on-farm demonstration of highly profitable/low-footprint dairy production systems. This article provides an overview of this success, including a summary of the key changes over time and how these have impacted on the farm's profit and environmental footprint.

About the farm

LUDF is a 160 ha milking platform owned by Lincoln University and managed by the South Island Dairying Development Centre (SIDDC) *(see Figure 1)*. It is a former university sheep farm converted to dairy in 2001. The farm is fully irrigated from ground water with a spray irrigation system, including two centre pivots (118.3 ha), small hand-shifted lateral sprinklers (32.2 ha) and k-lines (9.9 ha). It has a range of soils that represent most of the common soil types in Canterbury. The average PAW (profile available water) of the soils is 112 mm, ranging from 96 mm to 144 mm.



It is a well set-up farm with a good layout, but unlike many other farms in the region LUDF has no in-shed feeding system or any other feeding facilities. Effluent is distributed through pot spray applicators via a separate line underneath the pivot in the North Block. A 300,000 litre enviro saucer was built in 2011 and the Cleartech Effluent Treatment System was established recently to recycle water and reduce environmental impact.

Leading the way

LUDF has developed an impressive following among farmers and rural professionals. It has hosted well-attended field days and received thousands of visitors over the years. In 2001 when LUDF was established, irrigated dairy farming in Canterbury was still relatively new. LUDF has led the way in applying relevant and well-researched principles of successful pastoral dairying to irrigated systems in Canterbury. The farm also led the way in managing reproductive performance without induced calving before it was compulsory to do so.

After 10 years of a well-run production system, the environmental footprint from dairy farms became a key challenge, especially in Canterbury. It was then that LUDF led the way again in demonstrating high profit/low-footprint dairy systems. Since then several adjustments and fine-tuning of the 'new production system' have occurred, and no doubt LUDF will continue to evolve to adapt to future challenges and opportunities.

The original system – 2003/04 to 2009/10

Two seasons after its conversion, LUDF was well settled into the production system that would successfully run for the next seven years. It was based on a few well-implemented key decision rules that saw the farm achieving consistent high performance. It was a simple system with one herd, 24-hour grazing, low and consistent

Table 1: 2003/04 to 2009/10 seasons

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
kg liveweight/ha	1,960	1,960	1,960	1,974	2,058	2,107	1,941	**1,994**
Cows/ha	4.0	4.0	4.0	4.2	4.3	4.3	4.1	**4.1**
kg MS/ha	1,684	1,719	1,772	1,703	1,741	1,634	1,710	**1,709**
kg MS/cow	422	426	440	404	410	383	415	**414**
Imported suppl. fed (kg DM/cow)	304	277	320	235	407	338	262	**306**
Imported suppl. fed (kg DM/ha)	1,213	1,117	1,291	945	1,715	1,437	1,119	**1,263**
Pasture eaten (t DM/ha)*	15.3	16.1	15.3	16.4	17.9	17.2	16.2	**16.3**
kg N applied over 160 ha	200	200	187	187	164	200	185	**189**

**As estimated on DairyNZ's DairyBase*

Table 2: 2009/10 to 2013/14 seasons

	2009/10	2010/11	2011/12	2012/13	2013/14	AVERAGE
kg liveweight/ha	1,941	1,914	1,860	1,878	1,872	**1,893**
Cows/ha	4.1	4.2	3.95	3.94	3.9	**4.0**
kg MS/ha	1,710	1,638	1,861	1,878	1,725	**1,762**
kg MS/cow	415	392	471	477	440	**439**
Imported suppl. fed (kg DM/cow)	262	463	359	434	507	**405**
Imported suppl. fed (kg DM/ha)	1,119	1,911	1,500	1,714	1,996	**1,648**
Pasture eaten (kg DM/ha)	16.2	16.9	17.3	16.8	14.9	**16.4**
kg N applied/ha (over 160 ha)	185	260	340	350	250	**277**
Drainage mm/yr (Overseer)	333	333	333	333	na	**na**
Purchased N surplus (kg N/ha)	116	193	242	259	na	**na**

grazing residuals (seven clicks on the rising plate meter or 1480 kg DM/ha using the winter formula), and a focus on simple and replicable systems. Young stock were grazed off the milking platform as were cows over winter. The physical productivity of the farm during this period is summarised in *Table 1*.

There was no pre-grazing mowing during this period and grass silage was cut to control pasture surpluses. Nitrogen (N) was applied after each grazing with clear decision rules about when to start and stop applications. The cornerstone of this production system was to grow as much pasture as possible, and then optimise its management to harvest as much high-quality pasture (ME) as possible.

Wind of change

With time, other top-performing Canterbury farmers started to catch up and pass LUDF on performance. The profitability comparison of LUDF with other high-performing dairy farms that started in 2010 identified areas for improvement. At this time, the Canterbury Land and Water Regional Plan (LWRP) process started with clear indications that N in waterways was an issue and that N leaching from dairy farms was a contributing factor.

The spread of the clover root weevil in Selwyn in the early 2010s decimated clover on many local farms, including LUDF, prompting an increase in N fertiliser use from around 189 kg N/ha (average from 2003/04 to 2009/10 seasons as presented in *Table 1*) to 250-350 kg N/ha (from 2010/11 to 2013/14 seasons as presented on *Table 2*). Eco-N was used during this period to reduce the risk of N leaching until it was removed from the market in 2013. Reproductive performance (without inductions) and maintaining cow condition throughout the season, especially for younger animals, were other challenges that the farm was facing. LUDF had demonstrated how to run a successful and profitable production system for nearly 10 years, so it was a good time to demonstrate a different system that could address the challenges mentioned above.

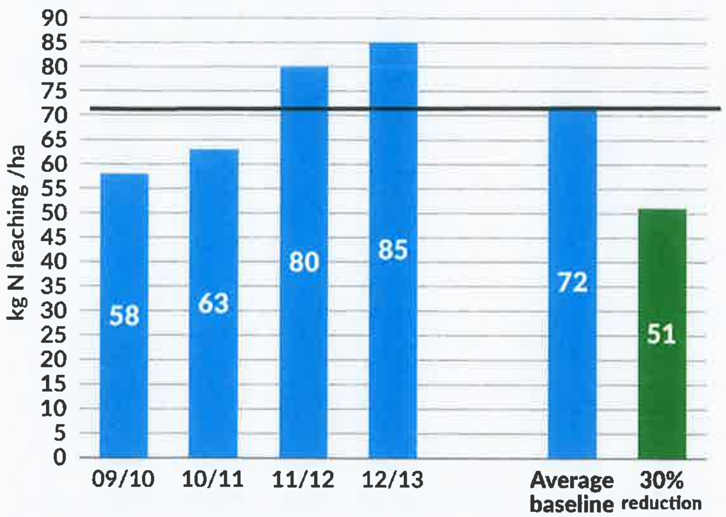


Figure 1: Estimated N leaching

High input/high output system – 2009/10 to 2013/14

LUDF is in the nutrient allocation zone of Selwyn Te-Waihora under Plan Change 1 (PC1) of the LWRP. Under this plan, from the 2017/18 season the farm is required to operate at or below its baseline N leaching figure based on the farming system between the 2009/10 to 2012/13 seasons, assuming industry agreed good management practices (gmps), and especially modified for PC1 and referred to as 'little gmp'. From 2022, dairy farms will have to operate 30% below the gmp baseline. All the Overseer modeling presented in this article was conducted by Ravensdown Environmental using OverseerFM v.6.3.2.

Table 2 presents key parameters for the period between 2009/10 and 2013/14. This period is important because the first four years represent the baseline period (2009/10 to 2012/13) and from 2010/11 to 2013/14 represent the transition period towards 'precision dairying'. During this period, the farm achieved higher production per cow with higher supplement and N fertiliser use.

As shown in ***Figure 1***, the average N leaching for the baseline period for LUDF was estimated at 72 kg N/ha/year, but significant changes occurred over these four years. Looking at N leaching in a simple way there are two key aspects to consider: drainage and N surplus.

The higher the drainage, the higher the risk that N will be leached into groundwater. Similarly, the higher the N surplus (N in inputs minus N in outputs), the higher the risk of N leaching.

Drainage (estimated by Overseer) remained unchanged during the baseline period at 333 mm/ha *(Table 2)* as the irrigation system and management was modelled the same over these four years. Therefore, the main reason behind the increase in N leaching during the baseline period was explained by the increase in N use (from 185 in 2009/10 to 350 kg N/ha in 2012/13) and supplement fed (from 262 to 434 kg DM/cow). As mentioned earlier, clover root weevil was a key driver behind the increase in N fertiliser.

The temporary suspension of Eco-N (DCD) in 2013 required a change in farm practice. As described in Pellow (2017) in early 2014, it became apparent that the farm would exceed the 2009/13 N leaching baseline for the 2013/14 season. Measures were taken in late lactation to stay below the baseline, including drying-off all cows in early autumn. It is estimated that these short-term reactionary responses cost the farm about $84,000. This experience prompted LUDF to seek alternative management strategies that would ensure N leaching would not be above the baseline and on target to achieve the required reduction.

Nil-infrastructure/low-input system – 2014/15 to 2018/19

From the 2014/15 season, LUDF adopted and scaled up the 'Nil-Infrastructure/low-input' farm system emerging from the Pastoral 21 (P21) research programme. This research was jointly funded by the Ministry of Business, Innovation and Employment, DairyNZ, Fonterra, Beef + Lamb New Zealand and the Dairy Companies Association of New Zealand.

This move was a further step to exploring systems with lower environmental footprint and higher efficiency. The changes have been well described by Pellow in 2017 and Chapman in 2017. The physical productivity of the farm during this period is summarised in *Table 3*.

Table 3: 2014/15 to 2018/19 seasons

	2014/15	2015/16	2016/17	2017/18	2018/19	AVERAGE
kg liveweight/ha	1,680	1,724	1,700	1,680	1,656	**1,688**
Cows/ha	3.5	3.5	3.5	3.5	3.4	**3.5**
kg MS/ha	1,742	1,812	1,789	1,571	1,733	**1,729**
kg MS/cow	498	522	517	451	504	**498**
Imported suppl. fed (kg DM/cow)	302	134	397	444	22	**260**
Imported supp. fed (kg DM/ha)	1,186	468	1,377	1,538	76	**929**
Pasture eaten (kg DM/ha)	15.7	16.6	16.0	16.2	16.5	**16.2**
kg N applied/ha (over 160 ha)	143	179	173	178	148	**164**

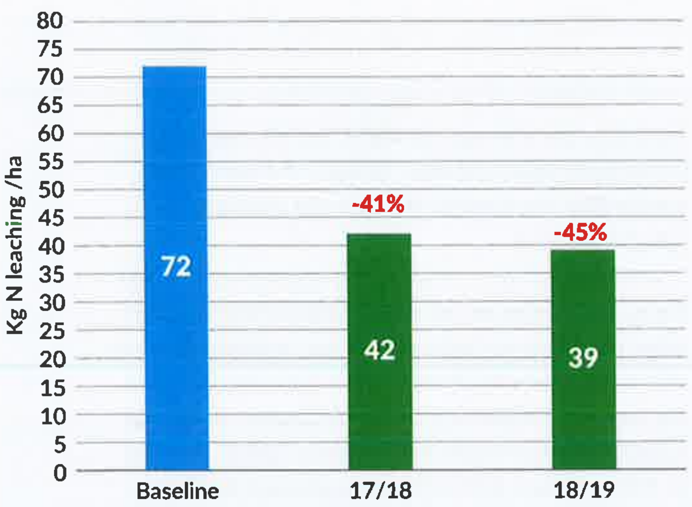


Figure 2: N loss reduction from baseline

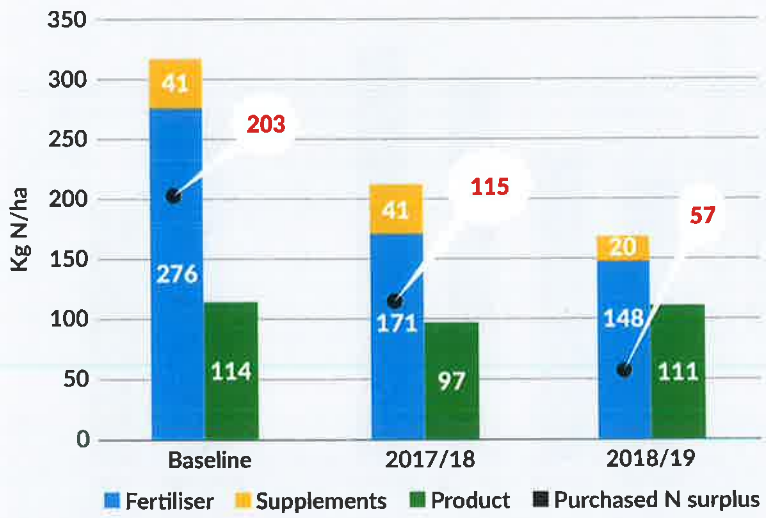


Figure 3: Purchased N surplus (kg N/ha)

During this period cows/ha (and kg LW/ha) was reduced by 12.5%. The focus on growing and harvesting pasture was still a key component of the system, but during this period more emphasis was placed on achieving high-performance per cow to compensate for the lower cow numbers. The key elements of this management included a split herd to preferentially feed young/light animals, pre-graze mowing and a more strategic use of N. The quality of the herd also improved because of the extra culling when moving to the lower stocking rate of the new system.

Environmental footprint

In the 2018/19 season, N leaching was 45% lower than during the baseline period *(Figure 2)*. This magnitude of N loss reduction exceeds the 30% reduction required by 2022, therefore LUDF has achieved compliance with Plan Change 1 and ahead of time. *Table 4* shows the estimated contribution of the key changes to the 45% reduction.

Table 4: Proportional contribution of changes to the reduction in N leaching

	CONTRIBUTION TO N LOSS REDUCTION
Soil moisture meters	14%
Irrigation system changes	14%
Effluent system change	2%
Farm systems change	15%
Total change	45%

Changes in the irrigation system and management

Changes in irrigation and management can explain 28% of the reduction from the baseline period. The key changes were: (a) improved decision rules around irrigation management with soil water meters (as the baseline was modelled without them); and (b) an increase in the area under pivot irrigation by 10.5 ha in the 2018/19 season. These changes improved the efficiency of irrigation with a lower volume of irrigation applied in the area irrigated by pivots and an overall reduction in drainage from 333 to 222 mm/ha/yr *(Table 5)*.

Changes in N surplus

The rest of the reduction is explained mainly by reductions in the farm N surplus resulting from the change in the production system. Farm systems changes explain approximately 15% of the reduction in N leaching compared to baseline. The main factors were: (a) a substantial reduction in N fertiliser use; (b) a reduction in supplements and therefore in N imported from that source; and (c) a reduction in herd size and feed demand, which resulted in less feed (and N) eaten per hectare. There was a small change in the effluent area from 34 ha to 39 ha in 2018/19, but this had only a minor effect on the modelled N leaching reduction (<2%).

As a consequence of these changes, the whole farm purchased N surplus (N in fertiliser + N in imported feeds minus N in products) fell from 203 kg N/ha in the baseline period to 57 kg N/ha in 2018/19 *(Figure 3)*.

Table 5: Drainage (mm/ha/yr)

	2009/10-2012/13	2017/18	2018/19
Whole farm drainage mm/ha/yr	333	201	222
Average drainage/average PAW	2.95	2.5	2.0
Irrigation applied pivots (mm/ha/yr)	508	355	355
Area pivots (ha)	107.5	107.8	118.3

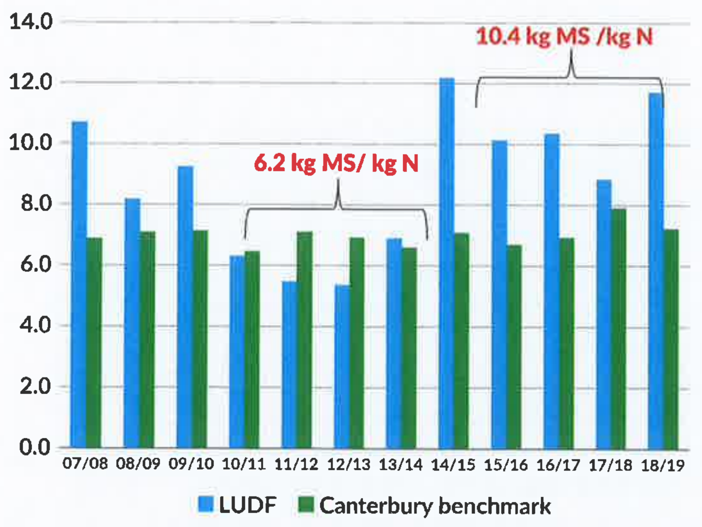


Figure 4: Kg MS produced/kg N fertiliser applied

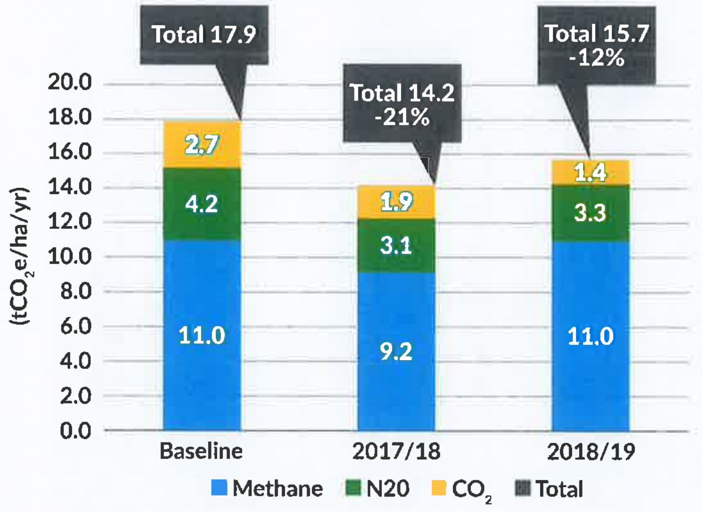


Figure 5: GHG emissions (t CO_2e/ha/yr)

This is substantially lower than what is commonly seen on Canterbury farms. Meanwhile, the overall N use efficiency of the farm (kg MS/kg N fertiliser applied) increased significantly compared with the baseline years (10.4 versus 6.2 kg MS/kg N fertiliser), a remarkable improvement in the overall system efficiency and a key step toward reducing the N footprint of the farm. This was achieved by halving N fertiliser input while 'losing' only ~40 kg MS/ha *(Tables 2 and 3)*. In doing so, LUDF went from similar or slightly below the Canterbury benchmark to markedly above it in N use efficiency *(Figure 4)*.

The reduction in N fertiliser was implemented using two main methods:

- Changing the frequency and amount of N applied at each event – contributing to 85% of the overall reduction in N applied
- Markedly reducing N fertiliser applied to the effluent areas – contributing to 15% of the reduction in total N applied.

A key feature of the change in fertiliser management was 2.4 fewer applications per year, and an average of 8 kg N/ha less N applied at each fertiliser spreading event (David Chapman, pers. comm.). The fewer applications per year was, in turn, facilitated by 1.7 fewer grazings per year reflecting a mean four-day increase in rotation length. The increase in rotation length resulted in an increase in leaf stage at grazing of ~0.3 leaves/grazing, which was estimated to have recouped about 1.1 t DM/ha of the expected reduction in pasture growth resulting from removing N fertiliser. This explains most, if not all, the 'buffering' of pasture yield reduction resulting from removing N fertiliser.

Having a high percentage of tetraploids in the pastures (95% of paddocks now have at least some component of tetraploids) has helped with the higher pre-grazing covers generated by the longer grazing rounds. Pre-grazing mowing has also been used to achieve the targeted residuals. It is important to mention that clover has returned to the pastures as it was before the clover root weevil outbreak.

There were also differences in the timing of N fertiliser applications with no N applied after the end of March. This can contribute to lower leaching not necessarily via direct leaching of N from fertiliser, but by having fewer grazing events into the late summer-autumn period where the N leaching risk of urinary N increases.

Stocking rate, dry matter intake and footprint

The total dry matter intake, estimated by Overseer, as an average for the last two seasons was 13% lower than during the baseline period. This difference reflects the lower demand per hectare driven by lower requirements from maintenance and milk production (reflected by lower liveweight/ha and lower MS production/ha). Less feed eaten translated into lower N excreted, from 787 kg N/ha to 652 kg N/ha.

As reported by Chapman et al. (2017), if we were accounting for the footprint of the whole business including wintering and young stock, the comparison would show an extra N loss reduction due to less dry matter intake consumed by fewer young stock and fewer cows over winter (about 122 t DM less feed eaten for the total farm operation). Carrying fewer cows over winter can have a significant impact because winter is a high-risk time of the year for N leaching. The caveat of this statement is to consider what would be the alternative use of land 'spared' by less animals and the alternative footprint compared with wintering or young stock grazing.

Greenhouse gas emissions (GHGs)

In light of the Zero Carbon Bill and possible commitments under He Waka Eke Noa it is important to note that GHG emissions, as an average for the 2017/2018 and 2018/19 seasons, were reduced by 16.5% from the baseline period *(see Figure 5)*. This was driven by the lower dry matter intake (as methane emissions are highly correlated to dry matter intake) and lower N surplus (as nitrous oxide is highly correlated to N surplus).

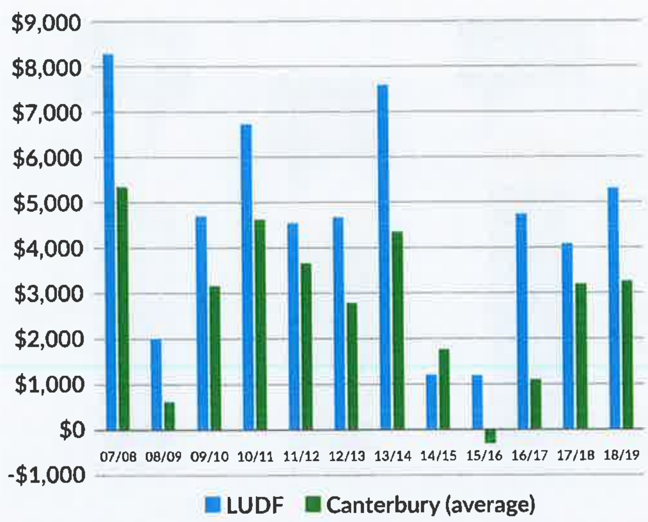


Figure 6: Operating profit ($/ha) LUDF and Canterbury benchmark

Changes in profit

Figure 6 compares operating profit per hectare for LUDF with the average Canterbury benchmark available on DairyBase. Except for the 2014/15 season LUDF achieved higher profit than the benchmarking group.

The comparison of the operating profit per hectare of LUDF and the Canterbury benchmark signal that the profitability at LUDF has not been severely affected by the changes over the last five years. Another way of comparing the impact on profitability of the changes is to compare the changes in milk production and the potential changes in cost.

Over the last five seasons, milk production per hectare is only 2% below the previous five but it was produced by 80 less cows, with less N fertiliser (-113 kg N/ha/yr) and less imported supplements (-0.77 T DM/ha) *(Tables 2 and 3)*. Therefore, it is likely that similar output was produced with lower expenses including lower cow costs (e.g. animal health and breeding), lower N fertiliser and supplement costs, and less young stock and wintering grazing costs. Therefore, it can be expected that the system run over the last five years has the potential of higher profitability compared to the systems run previously.

Final thoughts

LUDF has arrived at a production system that has reduced N losses and GHG emissions, with a high level of productivity and potentially higher profit. The principles of the P21 research have been successfully implemented at LUDF over the last five years. This is a clear and valuable example of how P21 research can be scaled-up from farmlets to commercial businesses to help give farmers confidence. In this case, confidence that the industry can meet current and future environmental regulations while retaining high productivity and profitability.

LUDF has successfully transitioned to a lower-input system while maintaining a strong focus on monitoring and decision-making, and the tactical use of supplements and N. A range of adaptation tactics were used to mitigate the impacts of lower N inputs on feed supply from pasture, so that the overall system remained strongly pasture-based and costs of production were controlled. These included longer rotations and appropriate decision rules for supplement use and N fertiliser applications.

Further changes to the system have been modelled, including further improvements to the irrigation system in the areas not currently irrigated by pivots, as well as some alternative strategies for autumn management (culling strategy and supplement use). These options can reduce N loss further, but the magnitude of reduction will be smaller now that the 'big ticket items' have been addressed. In the future, further reductions in N loss could be achieved with a different pasture base (e.g. plantain and the adoption of 'low-N' cow genetics). Both of these options are being investigated now in R&D programmes with promising results.

In 2020, after nearly 20 seasons under its belt, LUDF continues to be a reference for dairy farmers in Canterbury and across the country, leading the way on profitable and low-footprint grazing production systems.

Acknowledgements

I would like to acknowledge Arron Hutton and Clare Buchanan (Ravensdown) for providing the Overseer modelling, David Chapman (DairyNZ) for the data and analysis of the impact of farm system changes on N leaching, and Ron Pellow and Peter Hancox and the farm team for implementing the changes over the last five years.

Further reading

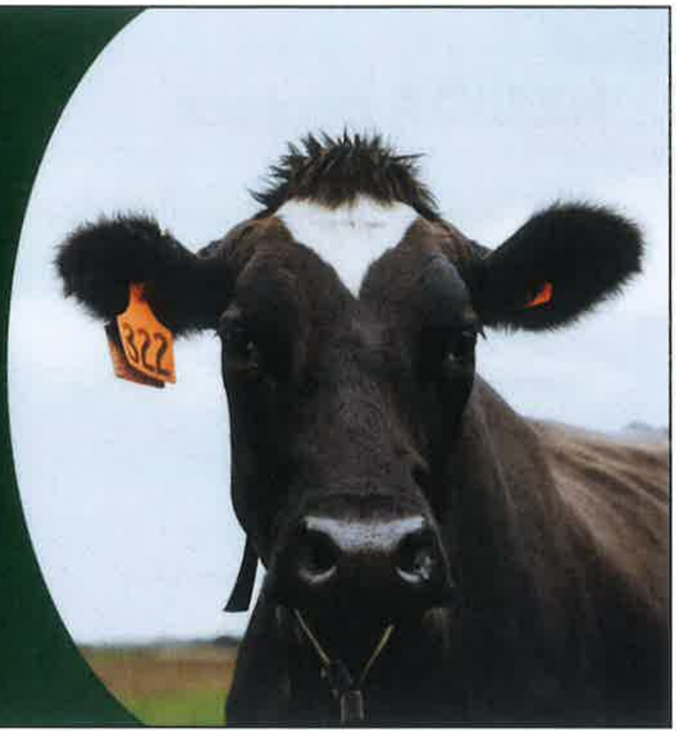
Pellow, R. 2017. Applying Pastoral 21 Farmlet Research to a Whole Farm – Results From Lincoln University Dairy Farm. In *Science and Policy: Nutrient Management Challenges for the Next Generation.* L.D. Currie and M.J. Hedley (Eds). Occasional Report No. 30. Palmerston North, NZ: Fertilizer and Lime Research Centre, Massey University.

Chapman, D.F. et al. 2017. Nitrogen Leaching, Productivity and Profit of Irrigated Dairy System Using Either Low or High Inputs of Fertiliser and Feed. The Pastoral 21 Experience in Canterbury. In *Science and Policy: Nutrient Management Challenges for the Next Generation.* L.D. Currie and M.J. Hedley (Eds). Occasional Report No. 30. Palmerston North, NZ: Fertilizer and Lime Research Centre, Massey University.

Virginia Serra is the New Systems and Co-Development Team lead at DairyNZ and has been part of the LUDF Management Team during the 2009-2011 years and of the Business Advisory group from 2010 to 2017. She is currently leading the Hinds and Selwyn Project aiming at supporting farmers reduce their footprint while maintaining profit. Email: virginia.serra@dairynz.co.nz.

DairyNZ

Proof of concept: Using wearable data for pasture management



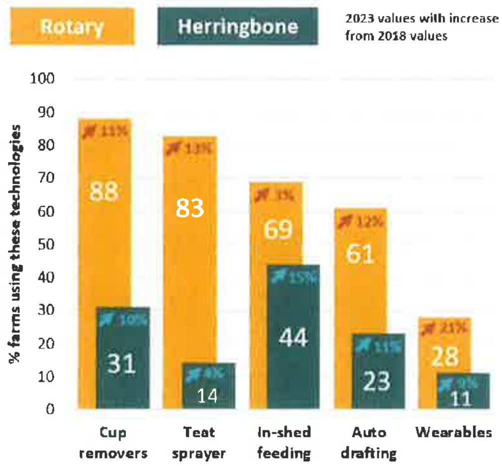
LUDF Focus Day

4 October 2023

1

Use of technology

- DairyNZ 5 yearly technology survey
- Automation technologies most widely adopted, particularly on rotary dairies
    - Clear value proposition
- Adoption of wearables historically low, large increase in 2023
- Wearables at the top of many wish lists (33% of respondents)



- How do make sure we maximise our investment in wearable tech?

DairyNZ

2

NZBIDA project

- AgResearch, Fonterra and DairyNZ collaboration
- Animal care increasingly important to customers, how could you measure cow experience through technology?
- Use cases:
  1. Heat stress
  2. Positive wellbeing
  3. Grazing management

DairyNZ

3

"Good grazing management is 'an art of successful compromise' between the several conflicting requirements of the pastures and the animals"

- Colin Holmes

DairyNZ

4

Rationale

- Farmers investing in wearable technology, or considering it
- Data typically used for alerts at cow level, e.g. oestrus, health
- Could this data add value for grazing management?
- Workshop with farmers to identify the research question
- Can we use animal sensor data as a non-subjective, near real-time indicator of feed availability?

Potential benefits

- Simply decision making
- Save time
- Increased profit through better resource utilisation
- Improve value of technologies
- Proof point for animal feeding

DairyNZ

5

Controlled grazing experiment

- 3× allocations, 80%, 100%, 120%
- Equivalent to 200-400 kg DM/ha
- Within range of subjectivity
- 24 hr grazing (AM)
- Spring and summer
- Pasture only

25 cows/group
5 day periods

Herd	Period 1	Period 2	Period 3	Period 4
1	100%	120% by area	100%	80% by area
2	100%	80% by area	100%	120% by area
3	100%	120% by cover	100%	80% by cover
4	100%	80% by cover	100%	120% by cover

Each group experienced a range of conditions

Can we see this in the sensor data?

DairyNZ

6

Adjusting area | Adjusting cover

80% allocation

120% allocation

Pasture measures

- Pre, Post
- Every 2-3 during daylight
- Calibration cuts
- Quality

DairyNZ

7

Animal sensors

- 5 sensors each cow

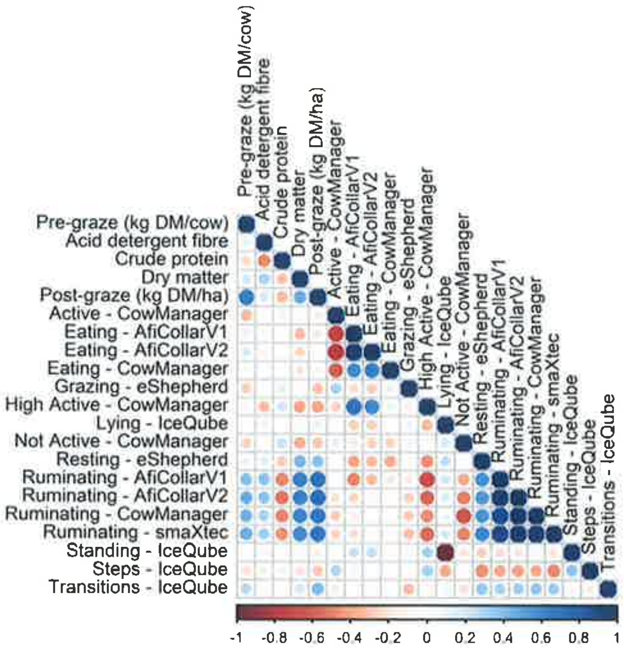
	Device	Frequency	Measures	
Leg	IceQube	15 min	Steps Lying time	Standing time Transitions up/down
Ear	CowManager	60 min	Ruminating time Eating time Not active time	Active time High active time Ear temperature
Neck	AfiCollar	60 min	Rumination time	Eating time
	eShepherd	10 min	Grazing time Moving time	Resting time GPS point
Rumen	smaXtec	10 min	Rumination Activity	Rumen temperature

DairyNZ

8

Correlations

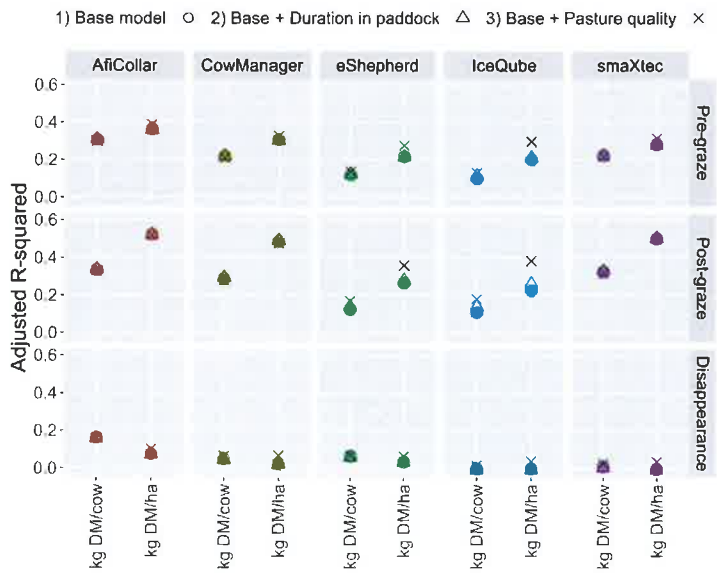
- Strong relationships between sensors for the same behavior
- Rumination the strongest single predictor of pasture mass
- Eating time not a great predictor



9

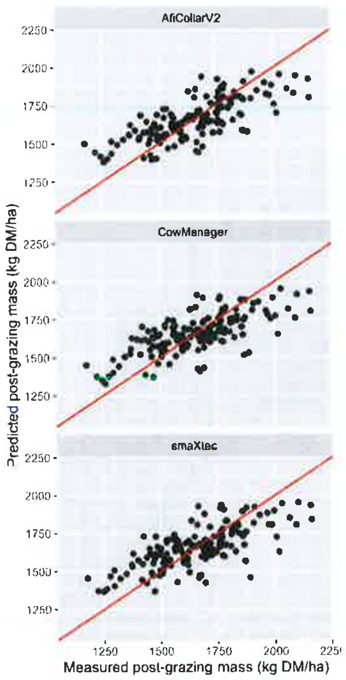
Performance

- Post-graze residual best predicted – most sensitive to allocation
- Disappearance poorly predicted – potential limitations of plate meter
- Within day measures, time out of paddock, multiple devices did not improve predictions



DairyNZ

10



Practical application

- Post-grazing residual predicted at 24 hr – what if 2 paddocks grazed or supplement used?
- Is the predictive ability good enough or limited to monitoring general direction?

- Successful proof of concept but need to determine value and impact on decision making

DairyNZ

11

12

Break Even Milk Price

Dairy NZ "Breakeven milk price (BEMP) is the milk income per kilogram of milksolids required to cover all costs or outgoings."

Outgoings:

- Farm working expenditure – Cash.
- Interest
- Principal for highly geared business's if covenants in place
- Drawings – Family members.
- Dividend – if 100% committed to with shareholders.
- Tax – on Drawings and Principal (if any)
- Standard plant replacement & HP's

Not included:

- Provisional Tax.
- Principal – if no covenants in place.
- Depreciation – use plant replacement instead.

Out Goings – Every Business is Different!

Family Business:

- Wages of Management – where is it?
- Drawings for parents and family members?
- Are Principal Payments required?

Equity Partnerships:

- Is dividend essential?
- Are principal payments required (2.6%)

Other Considerations:

- Are Fonterra shares owned?
- Other sources of income?
- Beef / Stock sales impact.

Break Even Milk Price		Equity - Low Debt	Equity - High Debt Debt	Owner Operator	Family Business 2 Gens.
	Farm Working Expenditure	$ 6.00	$ 6.00	$ 5.70	$ 6.00
Plus	Debt Servicing	$ 1.13	$ 2.04	$ 1.52	$ 1.52
	Depreciation / Plant replacement/Dev.	$ 0.30	$ 0.30	$ 0.30	$ 0.30
	Drawings / Dividend (above Mgmt Wage:	$ -	$ -	$ 0.30	$ 0.40
	Tax @ 28%	$ -		$ 0.08	$ 0.11
	Principal (@2.6%)	$ -	$ 0.62	$ -	$ -
Equals	Costs Of Business	$ 7.43	$ 8.34	$ 7.82	$ 8.22
Less	Stock Sales	$ 0.55	$ 0.55	$ 0.50	$ 0.50
Equals	**Break Even Milk Price**	**$ 6.88**	**$ 7.79**	**$ 7.32**	**$ 7.72**
Where	Actual Milk Price	$ 8.25	$ 8.25	$ 8.25	$ 8.25
	Fonterra Dividend	$ 0.20	$ 0.20	$ 0.20	$ 0.20
	Surplus/deficit	$ 1.38	$ 0.46	$ 0.93	$ 0.53
	Debt Levels $/ kgMS	$ 15.00	$ 24.00	$ 19.00	$ 19.00
	Interest Rate	7.5%	8.5%	8.0%	8.0%

Break Even Milk Price MRB		2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23 Est
	Operating Expenses/KgMS	$ 4.35	$ 3.87	$ 3.78	$ 4.24	$ 4.37	$ 4.47	$ 4.54	$ 5.17	$ 6.00
Plus	Debt Servicing	$ 1.37	$ 1.47	$ 1.35	$ 1.10	$ 0.97	$ 0.84	$ 0.72	$ 0.74	$ 1.52
	Depreciation / Plant replacement/Dev.	$ 0.30	$ 0.30	$ 0.30	$ 0.30	$ 0.30	$ 0.30	$ 0.30	$ 0.30	$ 0.33
	Drawings / Dividend +Tax	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.25	$ 0.30	$ 0.30
	Principal (@2.6%)					$ 0.56	$ 0.55	$ 0.52	$ 0.51	$ 0.49
Equals	Costs Of Business	$ 6.22	$ 5.84	$ 5.63	$ 5.84	$ 6.40	$ 6.36	$ 6.28	$ 7.02	$ 8.64
Less	Stock Sales	$ 0.41	$ 0.40	$ 0.50	$ 0.50	$ 0.46	$ 0.51	$ 0.56	$ 0.59	$ 0.55
Equals	**Break Even Milk Price**	**$ 5.81**	**$ 5.44**	**$ 5.13**	**$ 5.34**	**$ 5.94**	**$ 5.85**	**$ 5.72**	**$ 6.43**	**$ 8.09**
Where	Actual Milk Price	$ 4.40	$ 3.90	$ 6.12	$ 6.69	$ 6.35	$ 7.14	$ 7.60	$ 9.30	$ 8.25
	Surplus/deficit	**-$ 1.41**	**-$ 1.54**	**$ 0.99**	**$ 1.35**	**$ 0.41**	**$ 1.29**	**$ 1.88**	**$ 2.87**	**$ 0.16**
	Fonterra Dividend	$ 0.25	$ 0.40	$ 0.40	$ 0.10		$ 0.08	$ 0.10	$ 0.20	$ 0.45
	Debt Levels $/ kgMS	$ 19.50	$ 21.00	$ 22.50	$ 22.00	$ 21.50	$ 21.00	$ 20.00	$ 19.50	$ 19.00
	Interest Rate	7.0%	7.0%	6.0%	5.0%	4.5%	4.0%	3.6%	3.8%	8.0%

Fonterra cuts farmgate milk price again, putting further squeeze on dairy farmers

Tina Morrison · 12:20, Aug 18 2023

DairyNZ forecasts a national breakeven of $7.51 per kg/MS for this season, down from $8.16/kg MS.

How long will the dairy downturn last?

The Root of China's Growing Youth Unemployment Crisis

Fonterra's timetable for $800m capital return

Written by Sudesh Kissun

Fonterra posts record $1.6b annual profit, pays highest ever dividend

Tina Morrison · 17:16, Sep 21 2023

Hurrell said the co-operative recognised the pressure farmers were under and had designed a new advance rate guideline to get cash to farmers earlier in the season which would see it paying 75% of the opening price at the start of the season, up from 65%.

Wednesday, **21 June 2023**

Productivity threat looms as fertiliser use trends down

Tuesday, 20 June 2023 10:55

Fert prices begin to ease

Written by Sudesh Kissun

SELF CONTAINED FOR WINTER GRAZING AND YOUNG STOCK

DHL owns and leases 20 dairy support properties that allow for wintering of all cows and grazing of 14,000 R1's and 14,000 R2's. The majority of properties are irrigated providing consistency in the growth of youngstock. Being self-contained and a closed herd greatly reduces the biosecurity risk to all animals. Over 3,000 R1's and 3,000 R2's owned by our operators are grazed in-house.

Dairy Holdings milk production 15% up Yoy. Canterbury 3-4% ahead

76% six WIC

Non Negotiables – Health & Safety, Animal Welfare, Environment, People

With immediate effect, we are implementing the following changes:

1. Budgeted regrassing areas (grass-to-grass) are being halved, and the regrassing being undertaken is only to be by direct drilling. Regrassing following winter crop remains unchanged from the budgets.

2. Only essential repairs and maintenance is to be undertaken. All non-essential repairs and maintenance is to be deferred wherever possible.

3. Building of new houses is deferred, except for those currently underway.

4. Any budgeted special repair and maintenance and capital expenditure projects are only to proceed with the prior approval of our Chief Operating Officer, Blair Robinson.

5. Shelter belt planting is deferred, except for planting required to ensure compliance with farm environment plans.

6. Grazing block feed plans will be revised after spring to remove external feed purchases.

7. Budgeted wages and salaries for everyone remain unchanged. However, we expect all supervisors and farm operators to manage these budgets to ensure no overruns occur.

8. Farm fertiliser plans for maintenance phosphate remain unchanged. However, farms that have budgeted capital fertiliser to attain an Olsen P level of 30, will have their plans revised to now target an Olsen P of 25. This is a reduction in capital fertiliser applications of 25kg P per hectare.

Paper does not refuse ink.

Let the knife hit the floor before picking it up

safer farms
AGRICULTURAL LEADERS' HEALTH & SAFETY ACTION GROUP

SAFE FARMING STARTS HERE

Update September 2023

Stephen Esposito, Acting CEO
stephen@saferfarms.org.nz

1

Farm Without Harm: 5 system enabler pillars

Winning the hearts & minds of farming people

Widespread culture change that prioritises the wellbeing of people over productivity on our farms.

Leadership and collaboration

Collective policy-making across the system by farming leaders with a long-term commitment to the vision.

Growing capability & engagement on-farm

Moving on from the outdated 'she'll be right' attitude and bias. Supporting farming people with the information, skills and agency to actively engage in their own safety.

Focusing effort through insight & learning

Developing our understanding of harm and measuring our impact by sharing data openly & honestly across the system.

Supporting higher level hazard controls

Redesigning preventable harm out of our farming products and systems entirely.

FARM WITHOUT HARM

2

4 high-impact harm areas

Farm Without Harm is about improving outcomes across the four key types of harm that most impact farming people.

Psychosocial harm & wellbeing

Vehicle related harm

Ergonomics & animal handling

Exposure to chemicals & airborne risks

FARM WITHOUT HARM

3

1. Sign the pledge
Commit to being an active driver of change and designing harm out of farming

2. Join the movement
Get behind the campaign, share it and talk about it with your family and friends

3. Be part of the solution
Download posters, gate signs or vehicle stickers.

Join our workshops & think tanks.

Call out old attitudes and beliefs and make a stand that your workplace isn't half arsed when it comes to protecting its people.

If you're part of farming's future, give us a sign.

4

Pledge

ACS Dairy Holdings Ltd	East Gorge Farm & High Hills Hut (Puketiri) & Seaview Station (Patana)	pH7
AFFCO	Ebbett Agri	Philip Wareing Ltd
AgDrive	FAR	Plains Irrigators Ltd
Agmardt	Farm Chemical Supplies 2020 Ltd	Private
AgriHQ	Farm IQ	Purata Operation
Agri-Women's Development	Farmlands	Pye Group
AJ& an muir ptship	FarmRight	Rabobank
Alexander Organics Ltd	Federated Farmers	Rakaia Island Dairies
Allancroft Ltd	Fernleas Agriculture	Rataliwi Farm
Alliance	Fertigation Systems Ltd	RD & SD Young
Allott Contracting	FMG Insurance	RJK STRATEGIC DIRECTIONS LTD
Angel's Agribusiness Services Limited	Fonterra	Ross na clonagh ltd
Animal and Plant Health Association of NZ	Fortuna Group	RT Barton Ltd
Annic Dairies	Foundation for Arable Research	Rural Training Solutions NZ
Antrim	Fransannah Farms Ltd	Rural Transport
ANZCO	Fsc	Rural Women
Ariaha	Gilchrist Brothers Ltd	Samson Safety Solutions Ltd
Atihau-Whanganui Inc	Glenaray Station	Sianna farming ltd
Babylon Farms	gloppwerteas.com	Silver Fern Farms
BakerAg	GM Wairere Ranch	Southern Pastures Ltd
Ballance Agri-Nutrients	Grasslands	Synlait
Beacon hill farming	Greenlea Meats	Taylored LTD
Beef + Lamb NZ	Growing Future Farmers	Te Tumu Paeroa
Bell Group Dairy Farms	Haselden & Co NZ Ltd	The Country
Ben Chulin	HCN Ag Ltd	The Fresh Grower
Bio Rich	Individual	The Gullies
BL&TA Roughan Farming Co Ltd	Kaituna Farms Ltd	The Media Lab
Brancott station	Karatea trust	Theland
Bruce Bulk Transport	Knockenhair Farms Ltd	TJ & KM Humphries Ltd
Bruce Murphy	Kotahi Downs Ltd	Tony Coltman
Burwood Station Ltd	LIC	Transwest Freightliner
BW Howden farm	Manganui Partnership Limited	Trevor Hamilton Farms
Camden Group	Mani Kane	Tuapae Farm Ltd
Catalyst Performance Agronomy	Marangai	Turley Farms
Change for Good Consulting	McKavanagh Holdings 2021 ltd	Uruwhenua Farms Ltd
Charles nursery	Microsoft	Vet Marlborough
CL Whyte	Milking Mops Partnership	Waitawhiti Land Company (2017) Ltd
Clasby Estate Ltd	Miraka	Waiteko Station
Core HS	Mt Somers Station	Warthog Consulting Ltd
Coulter Farms	N&J Farming	Wealleans Groundspread ltd
Craigmore	Nelson Farms Partnership	Westland Milk
CRV	Ngai Tahu Farming	Woodstock Farming
D M & G Carr	NoBRR	Worksafe
Dairy farm	NZ Pork	
Dairy Holding	NZOHS Ltd	
Dairy Holdings Ltd	NZPork	
DairyNZ	Owner operator	
DB & JWS Kinney	Pamu	
Devenish Rural Holdings	Pamu Farms - Rangitaiki Station	
	PGG Wrightson	

Raise awareness through **targeted media, editorial, and social media.** Safer Farms and member content to keep driving the message home

Farmer-led "Up Our Game" workshops to learn from each other & find new ways of solving our HS&W challenges

Agri think-tanks focused on designing specific aspects of harm out of the system

Development of HS&W resources which are accessible, straight forward & all in one place

Safety Alerts to learn from each other

Engagement & visibility through **farming retailers**

Networking together on relevant topics like vehicles and animal handling

Are you on board?

Safer Farms

Farm Without Harm

Scan these QR codes for our web sites

7

Safety Alerts

What is a Safety Alert?

- Safety Alerts are learnings from real life incidents that have happened on farms.
- Members of Safer Farms have documented incidents and key lessons we can all learn from, these have been condensed into one-page handouts to print out, discuss with your team, agree some learnings, and/or post it somewhere for people to read.

What can I do with them?

- Safety Alerts are a great way to learn from incidents that have happened on other farms.
- Ask yourself: Could this happen on my farm? What do I have in place to prevent this from happening? How can I implement these learnings?

8

SAFETY ALERT: IMPACT OF LOADS ON TRACTOR STABILITY

Why has this alert been sent out?

This safety alert is being sent out to advise of an incident where an employee was driving a tractor with a hay feeder attached when it rolled at the bottom of a slope. The employee was wearing his seat belt and escaped unharmed.

What Happened?

The employee was driving a tractor with a hay feeder down a moderate slope, with the front-end loader raised to midway. His intention was to feed out the hay on the flat area at the bottom of the slope, as other flat areas in the paddock had been used before and have been cut up over several days by cattle hooves.

As he descended off high ground, he realised the conditions were slippery, as ground was still partially frozen. He was initially able to hold the tractor and bale feeder on course. However, the left rear wheel of the bale feeder hit a rock, altering the alignment of the bale feeder and causing the tractor to lose traction as the bale feeder jack knifed, and tipped onto its left side

⚠ DANGER

TO AVOID SERIOUS INJURY OR DEATH BY ROLLOVERS

1. Fasten your seatbelt at all times
2. Adjust rear wheels to the widest setting that is suitable for the work
3. Add recommended wheel ballast and rear weight for stability
4. DO NOT drive on steep slopes or unstable surfaces
5. Carry loader arms at low position during transport
6. Move and turn tractor at slow speeds

Check out this video:
https://www.youtube.com/watch?v=ehVwzKzpuEQ

Key Lessons & Considerations:

- When front end loaders are carried in the raised position the centre of gravity for the tractor is altered. Operators should minimise this practice. Loads and implements (front and back) should be carried as low as possible to retain the best possible weight distribution
- If a load is raised when going through a gate to aid visibility, lower when travelling again
- Know what effect a load has on the handling. A rear-mounted load, in particular, will make the steering lighter, a raised centrifugal force makes it easier for a tractor to turn over sideways
- Adjust rear wheels to the widest setting that is suitable for the work
- Add recommended wheel ballast and rear weight for stability
- Choose the right gear before going down the slope. When going downhill, too high a gear will give insufficient engine braking, while a gear that is too low will increase the risk of wheel sliding
- Take extra care when operating vehicles in wet or icy conditions, especially on slopes
- Route Selection - Plan to feed out on flat areas in the first instance
- Wear your seat belt and always use safety devices where fitted. Staying in the driving position during a loss of control event may prevent serious injury or death from being thrown from or under a vehicle

9

SAFETY ALERT: DISTRACTION

Why has this alert been sent out?

This safety alert is being sent out to advise of an incident where an employee lost control of a quad bike while working their dogs. A key lesson from this incident is the influence of distraction.

What Happened?

- A shepherd was working dogs while riding their quad bike.
- They lost sight of a dog and were looking for it while continuing to ride. The rider did not see that the bike was drifting off track until the vehicle started to tip
- Preliminary findings from this event suggest the shepherd was distracted, was not actively riding the quad and failed to see the risk of continuing to ride while looking for the dog.

Key Lessons

1. **Don't be distracted**
2. **All vehicles need to be actively driven**

All vehicles need drivers to be aware of where they are travelling to and potential risks ahead of them. You can't expect the vehicle to know where it's going!

In this case the rider needed to focus on actively riding the vehicle.

Multi-taking isn't worth it.

Multitasking doesn't save time.

Studies show drivers take longer to reach their destinations when chatting on cell phones and were 23 times more likely to be involved in an accident

Looking for the dog meant the rider wasn't concentrating on the main task. They could have stopped or looked for the dog on foot

FARM WITHOUT HARM

10

SAFETY ALERT: DIGGER CONTRACTOR ROLLOVER

Why has this alert been sent out?

A contractor operating his digger on an East Coast farm was trapped inside his digger after it had slide down a bank.

What Happened?

- A digger contractor was operating alone on farm on a weekend. As he moved along a track the bank gave way and the digger slide down a gully.
- The operator got out, alerted his company but then went back into the cab to fetch personal kit. The digger became unbalanced, slipped and tripped. The operator was trapped, broke a femur and cracks a vertebrae
- Fire & Emergency were required to rescue the operator

Key Lessons

Contract Management:

The contractor had been inducted on farm but the operator had not. Ensure all members of a contractor's crew know what the risks are on farm, where to go/not to go and what to do in an emergency.

Check in/out. The operator had been working on the Friday but farm staff were unaware he was back on site on the Saturday. Ensure all contractors check in and out. Ensure you discuss when they expect to be on/off the property

For Operators:

Always carry your PLB on your body, not in the glovebox or seat next to you. Ensure you can reach it and use it at all times

The unstable vehicle wasn't safe to re-enter. When in doubt, don't mount or re-enter and unstable platform

A NOTE ON DIGGERS:

Traction The digger tracks were triple gouser design. While these types of tracks do not rip up the tracks surface they also have less grip. On this type of terrain a single grouser would be safer

It is unlikely a contractor is going to change their grouser plates for our application however they could buy bolt on cleats for tracks which are quick change and offer a massive leap in traction

Lesson: Have a conversation with contractors about how they could improve traction on farm

Tractor size. At 2.5 m wide this type of digger had very little margin for error

Lesson: when discussing operations with operators, discuss where the narrow farm tracks are and whether the digger is suitable to operate in these areas

11

Plantain Forage: Exploring Opportunities and Challenges

Omar Al-Marashdeh, Senior lecturer, Lincoln University

Why plantain?

Attractive option for dairy farmers to reduce their environmental footprint because:

- Does not require major changes in the farm system
- Relatively cheap compared to other mitigation strategies (i.e. does not require significant capital investment or infrastructure)

How it works?

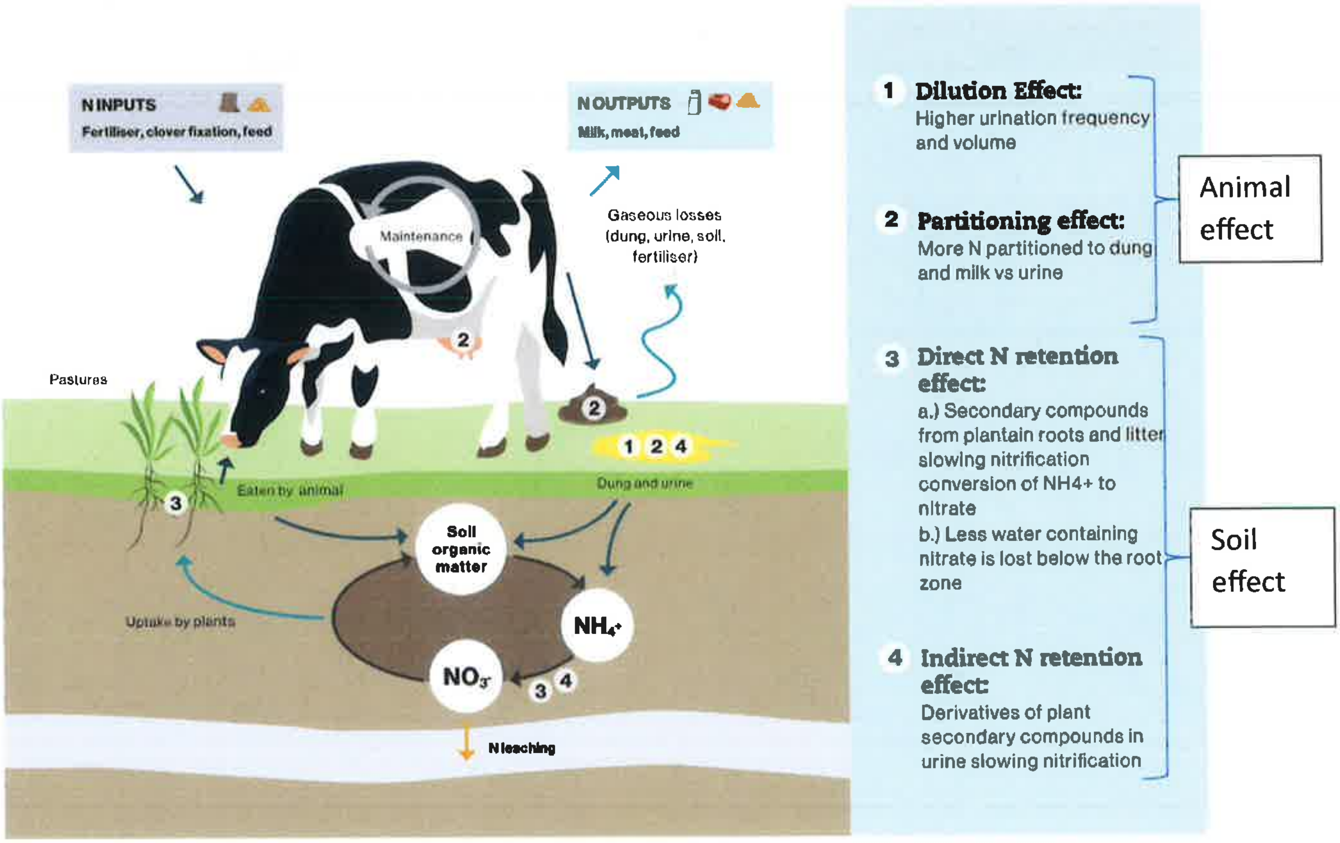


Figure 2. Nitrogen cycle and the four modes of action of Ecotain™ plantain.

https://www.dairynz.co.nz/feed/crops/plantain/environmental-benefits-of-plantain/

Opportunities: *Reducing N leaching while maintaining production*

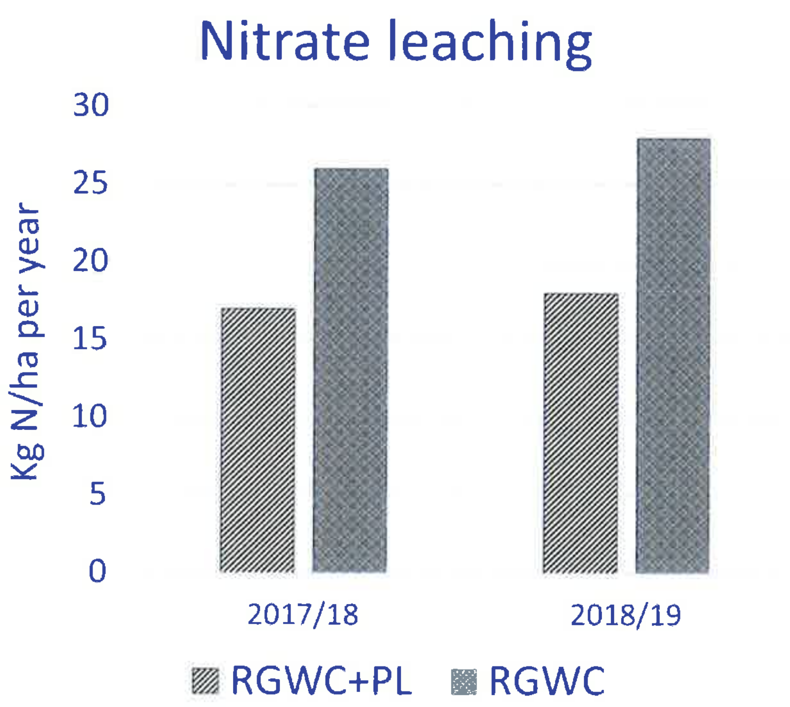
Two farm system trials:

1) **Ashley dene farm system trial**: Conventional RGWC vs RGWC+ PL (Plantain/White clover 40% of farmlet area)
   Ashley Dene soil: free-draining Balmoral/Lismore shallow stony silt loam soil

	2017/18		2018/19	
	RGWC	**RGWC+PL**	**RGWC**	**RGWC+PL**
Pasture grown (kg DM/ha)	13.8	13.3	13.5	13.9
Pasture intake (kg DM/ha)	11.7	11.6	11.8	11.7
Supplement intake (kg DM/ha)	3.9	3.8	2.6	3.4
Milksolids production				
Kg/cow	456	450	471	486
Kg/ha	1595	1575	1649	1702

Al-Marashdeh, O. et al. Animals 2021, 11, 376. https://doi.org/10.3390/ani11020376

- Annual N leaching (**estimated via Overseer**) - Plantain reduced N leaching by 35%



Al-Marashdeh, O. et al. Animals 2021, 11, 376. https://doi.org/10.3390/ani11020376

2) **Lincoln University Research Dairy Farm (LURDF) system study**: effect of increasing level of plantain in pasture on dairy farm productivity and N leaching (*Plantain Potency and Practice project*)
LURDF soil: well-drained silt loam soil

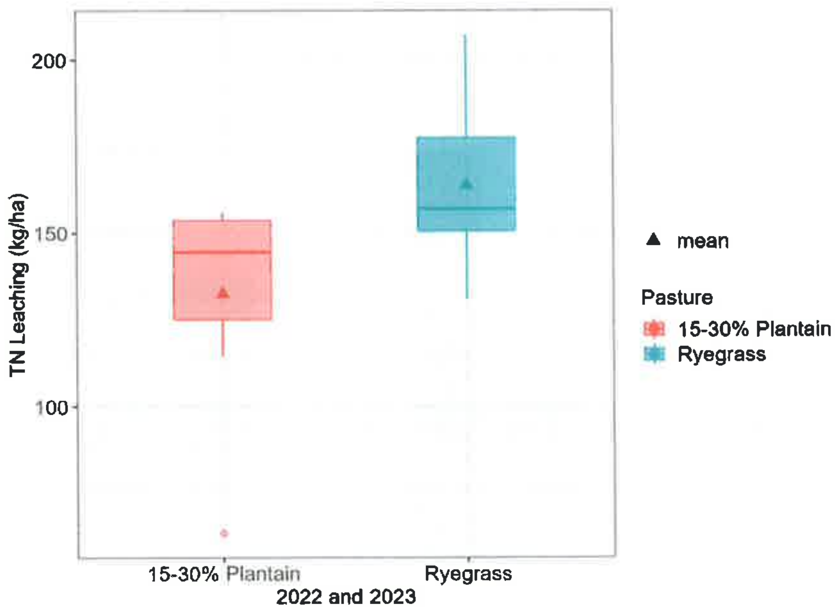
	2021/22			2022/23		
	Control	MPL	HPL	Control	MPL	HPL
Pasture grown (t DM/ha)	12.4	12.9	13.6	14.0[a]	14.2[a]	13.4[b]
Pasture conserved (t DM)	0.61	1.07	1.88	1.40	1.53	0.78
Silage offered to milkers (t DM)	1.99	1.95	1.95	4.7[a]	4.3[a]	6.0[b]
N applied (N kg/ha)	151	150	144	143	145	144
Days in milk	256	257	258	270	269	267
Milk solids (kg/cow)	410	401	410	471	449	451
Milk solids (kg/ha)	1,367	1,335	1,367	1570	1496	1503
Fat yield (kg/ha)	782	760	782	899	851	854
Protein yield (kg/ha)	584	575	585	671	645	649

MPL: med level plantain (aimed for 30% plantain in the sward DM)
HPL: high level plantain (aimed for 50% plantain in the sward DM)

LU Research Dairy Farm system study (*Plantain Potency and Practice project*)

- N leaching was measured in two out of the three treatments (Medium Plantain vs. Control) using a total of **735** suction cups and **28** lysimeters. Suction cups were installed in **23%** of the pasture area for each treatment.

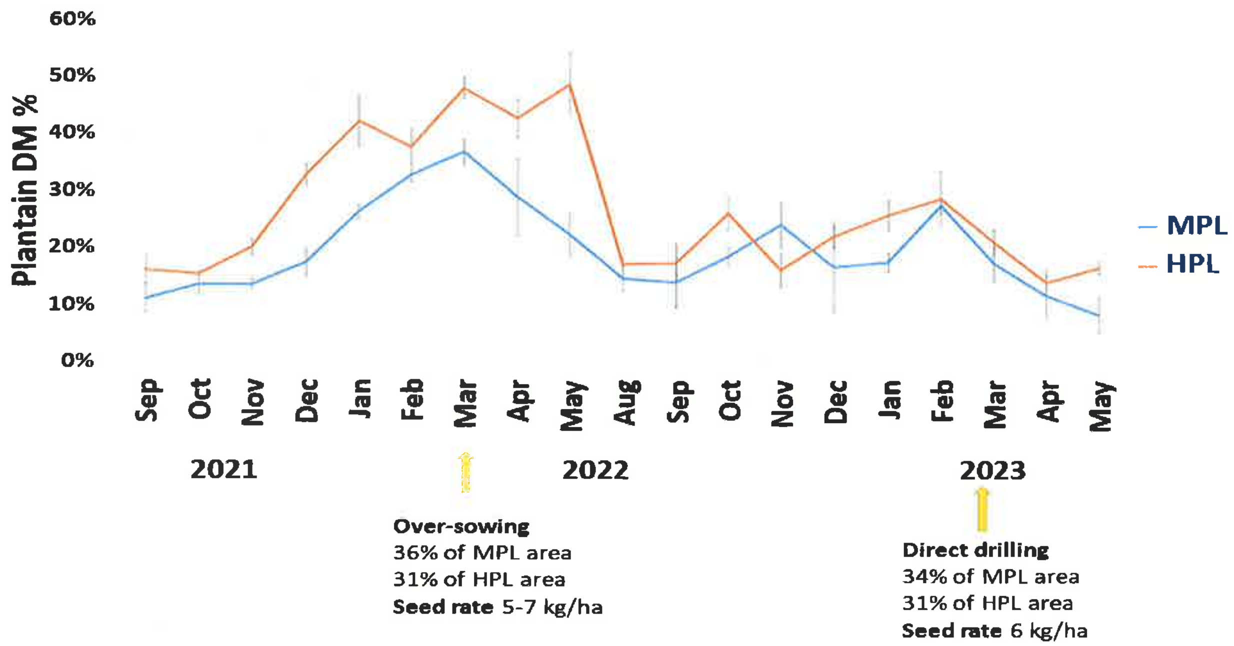
- Sward with 15-30% plantain reduced Total N leaching by 20% (P= **0.048**)
- Data is cumulative total N leached per ha from Feb 2022 to April 2023



Challenges- *maintaining plantain in mixed swards*

- Pasture established in March 2021
- Seed mixtures included: 18 kg Perennial RG, 2 kg WC and **3 kg Ecotain plantain** for MPL, 16 kg Perennial RG, 2 kg WC and **6 kg Ecotain plantain**.
- Under grazing condition, plantain content peaked at approximately **13-15** months after pasture establishment before it starts to decline.
- Doubling the seed rate in HPL compared with MPL, increased average plantain content from **24%** to **34%** across the 1st year, and from **17%** to **21%** in second year.
- Plantain re-seeding should be considered to maintain plantain in the mixed pasture but associated with additional cost. For example, re-establishing plantain at 3 kg/ha seed rate would approximately cost **NZ $60 per ha via broadcasting**. Direct drilling should be more expensive.
- Establishment of plantain in existing pastures? Under irrigation, **direct drilling** is more effective than **broadcast sowing** (Bryant et al. 2019, JNZG 81: 131-138). More successful establishment in summer-dry environments.
- Similar grazing managements have been applied across pasture treatments at LURDF. Less is known on best management or whether it affects persistency of plantain.
- To manage plantain seed heads and overall pasture quality, post grazing topping was applied on some paddocks during summer.

Plantain DM % in the mixed sward - Botanical composition at LURDF (pasture established in March 2021)



Challenges: *Weed management*

- Plantain shares physiological and morphological characteristics with other dicot weed (e.g. dock), thus limited herbicide options are available.

Summary of pros and cons of some available herbicides used or discussed to be used on plantain-based pasture at LURDF

Herbicide commercial name	Active ingredient	Pros	Cons
Kamba	Dimethylamine and Monomethylamine Salt	• Safe on plantain	• Kills clover • Effective only on seedling dock
Dictate	Bentazone as Sodium salt	• Is on label for plantain • Safe on clover	• Effective only on seedling weeds
Harmony	Thifensulfuron-Methyl	• Good control of dock	• Kills plantain • Prolonged plant back withholding
Dockstar	Asulam as Sodium salt	• Good control of dock • Safe on clover	• Kills plantain
T-Max	Aminopyralid as Triisopropylamine salt	• Safe on Plantain	• Kills clover • Prolonged plant back with-holding for clover
Dynamo	Flumetsulam and Bentazone as a soluble concentrate	• Is on label for plantain • Good general weed control • Safe on clover	• Can supress plantain

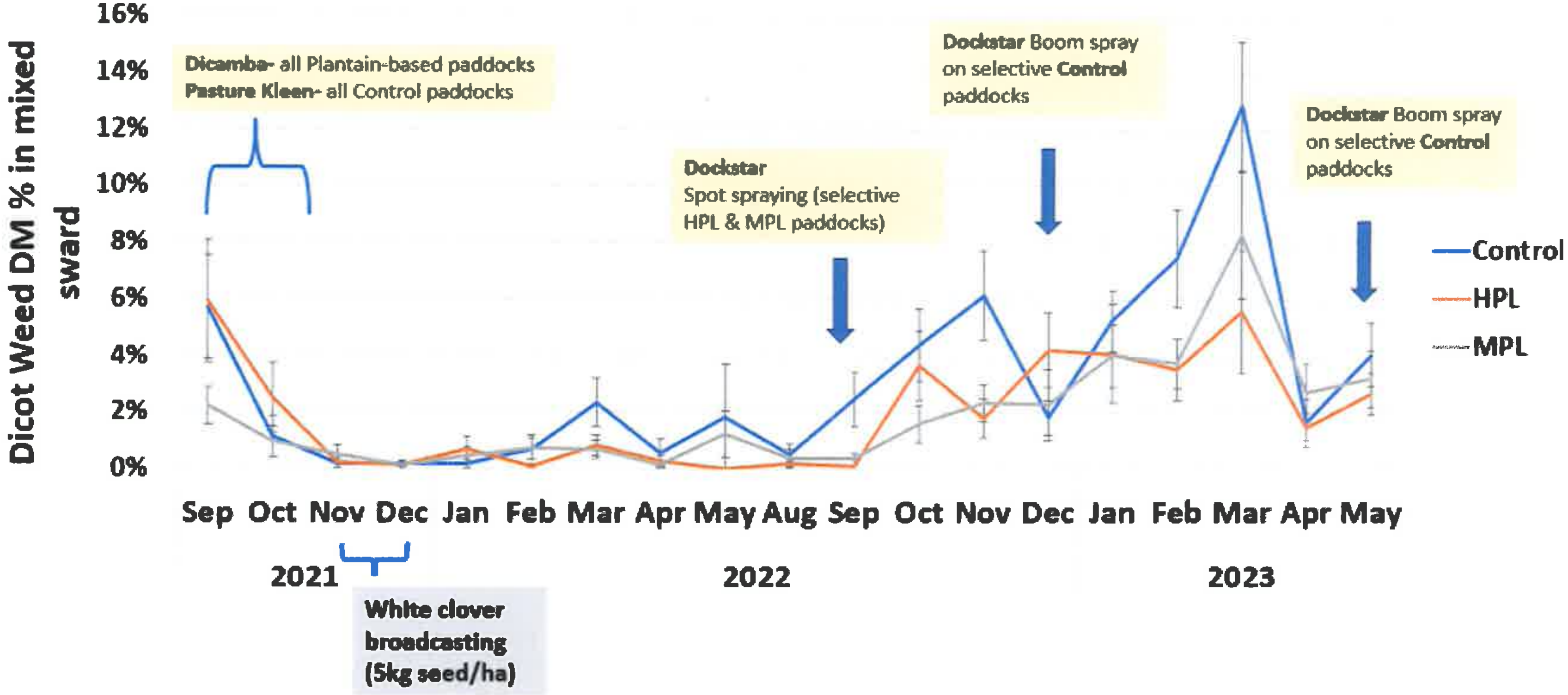


Figure: Effect of chemical herbicide applications on weed content in mixed pastures sown with an increasing plantain seed rate at LURDF: perennial ryegrass and white clover (RGWC) without plantain (**Control**); RGWC + 3 kg/ha plantain seed rate (**MPL**; medium PL) or RGWC + 6 kg/ha plantain seed rate (**HPL**; High PL).