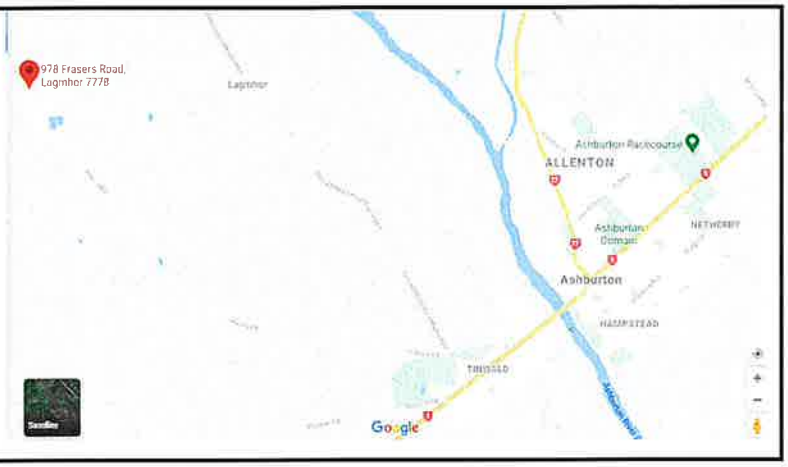
SIDDC
South Island Dairying Development Centre

Tuesday 23rd Feb 2021
10.15 am - 1.00 pm
Followed by a light lunch

LUDF Mid Canterbury Focus Day

Venue:
Balmaghie Farm,
SN 39654
978 Frasers Rd
Ashburton



Topics to be covered:

- **Introduction to Balmaghie Farm: 500+KgMS/cow, 700 cows, 1 herd, 3 staff, low supplement, low cost farming.**
- **Update on LUDF Season to Date – mating results, production, managing with low nitrogen use.**
- **LUDF profitability update.**
- **Successful regrassing: which grass, clover and herb to use.**
- **Nitrogen cap management tools and options for farmers.**
- **Profitability focus with Dairy Base results.**

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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SIDDC
SOUTH ISLAND DAIRY DEMONSTRATION CENTRE

LINCOLN UNIVERSITY DAIRY FARM

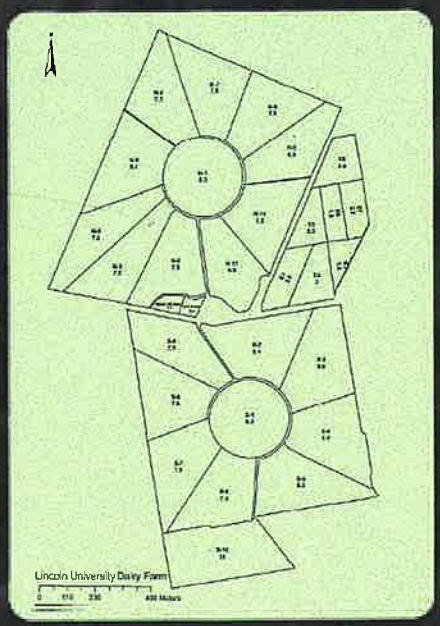
FOCUS DAY: BALMAGHIE FARM, ASHBURTON FEBRUARY 2021

STAFF

Peter Hancox	-Farm Manager
Farm 2IC	- James Beattie
Farm Assistant	- Rob Lochart

BALMAGHIE HAZARDS NOTIFICATION

1. Children are the responsibility of their parent or guardian.
2. Normal hazards associated with a dairy farm.
3. Other vehicle traffic on farm roads and races.
4. Crossing public roads.



PARTNERS NETWORKING TO ADVANCE SOUTH ISLAND DAIRYING

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Speakers & Contents

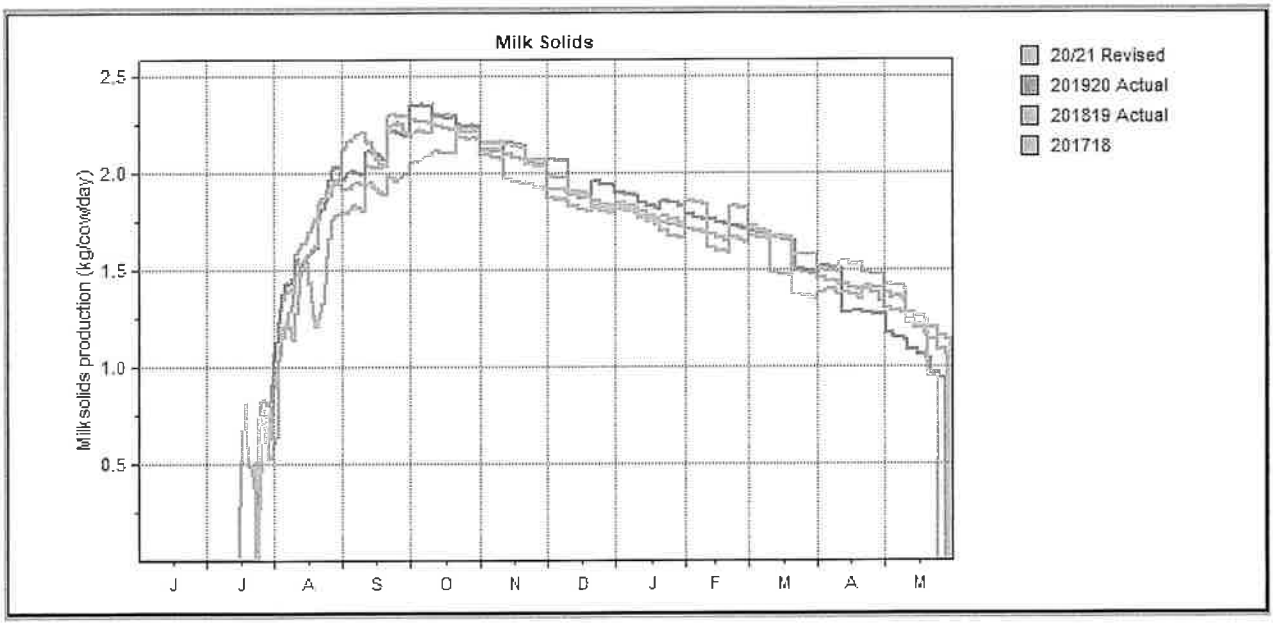
LUDF 2020/21 Season Update

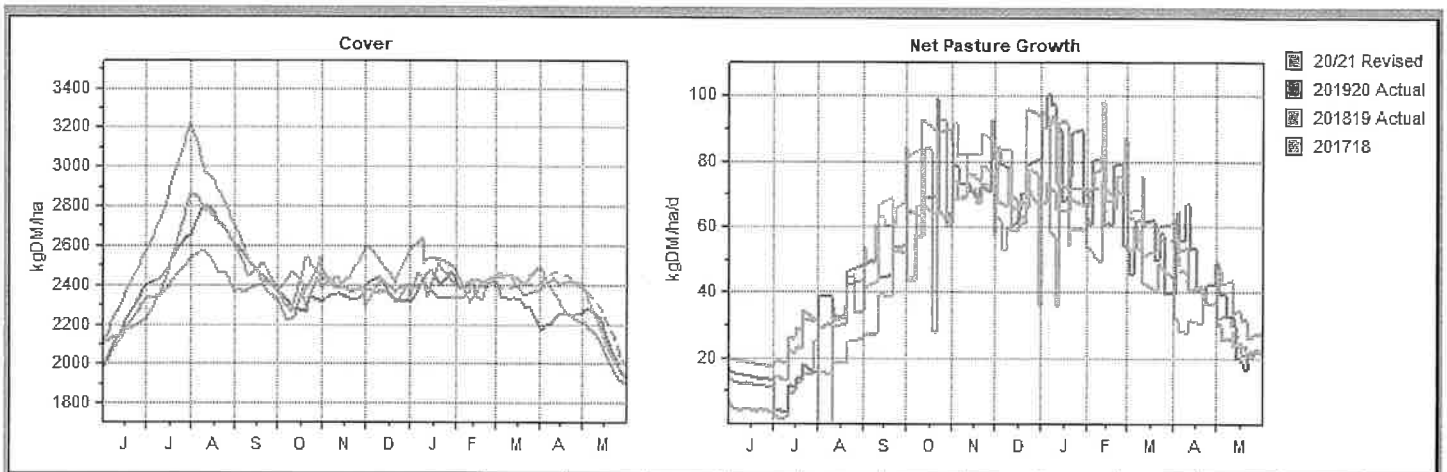
Focus for 2020/21 Season: Nil-Infrastructure, low input, low N-loss, optimise profit.
Farm system comprises 3.5 cows/ha (peak milked), target up to 170kgN/ha, 300kgDM/cow imported supplement, plus winter most cows off farm. FWE of less than $1.1 million and target production of over 500kgMS/cow (>100% liveweight in milk production).

Pasture, Feeding & Milk Production

- Really well managed spring feed budget – yet again.
- 1st Round finished approx. 12th Sept. Cover was a bit tight but farm grew well with average cover of 2,300+ kgDM/Ha plus maintained through September.
- Used 2 kgDM of silage to milkers – was poorer quality. Cow performance lifted when finished. 2nd round grass quality was better and also helped lift cows.
- Nitro/ProGibb from 7th Sept for several spreads boosted growth.
- Has been a dry summer to date. LUDF missed a lot of the rainfall experienced by the balance of Canterbury. Pumping hours have been up. Farm has grown very well and irrigation performed well. Getting good payback on the irrigation development completed last season.
- Have been able cut out nitrogen several times this season with good pasture growth.This was done in a block between 18th December and 28th January.

Category	Description	LUDF DSM 20/21 Revised	LUDF DSM 201920 Actual	LUDF DSM 201819 Actual	LUDF DSM 201718	
Farm	Effective Area	160	160	160	160	ha
	Stocking Rate	3.5	3.5	3.5	3.5	cows/ha
	Potential Pasture Growth	19.1	19.8	19.7	19.0	t DM/ha
	Nitrogen Use per total ha	161	172	166	172	kg N/ha
	Feed Conversion Efficiency (eaten)	10.4	10.3	10.3	11.2	kg DM eaten/kg MS
Herd	Cow Numbers (1st July)	556	555	552	558	cows
	Peak Cows Milked	556	555	552	558	cows
	Days in Milk	278	283	278	264	days
	Avg. BCS at calving	4.8	4.9	4.9	4.8	BCS
	Liveweight per total ha	1,656	1,665	1,665	1,662	kg/ha
Production (to Factory)	Milk Solids total	274,487	280,932	275,424	255,279	kg
	Milk Solids per total ha	1,715	1,756	1,721	1,595	kg/ha
	Milk Solids per cow	494	506	499	457	kg/cow
	Peak Milk Solids production	2.30	2.35	2.23	2.22	kg/cow/day
	Milk Solids as % of live weight	103.6	105.4	103.4	96.0	%
Feeding	Pasture Eaten per cow *	4.3	4.4	4.4	4.1	t DM/cow
	Supplements Eaten per cow *	0.3	0.2	0.2	0.4	t DM/cow
	Off-farm Grazing Eaten per cow *	0.6	0.6	0.6	0.7	t DM/cow
	Total Feed Eaten per cow *	5.1	5.2	5.2	5.1	t DM/cow
Diagnostics	Pasture Eaten per total ha	14.9	15.3	15.2	14.3	t DM/ha
	Supplements Eaten per total ha	1.3	1.2	0.9	1.7	t DM/ha
	Off-farm Grazing Eaten per total ha	4.3	4.3	4.3	4.2	t DM/ha
	Total Feed Eaten per total ha	20.5	20.8	20.4	20.2	t DM/ha
	Supplements and Grazing / Feed Eaten *	16.8	15.8	15.0	20.7	%
	Bought Feed / Feed Eaten *	8.9	7.8	5.6	9.8	%





		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Cover (kg DM/ha)	20/21 Revised	2,331	2,533	2,366	2,340	2,380	2,370	2,340	2,396	2,392	2,403	2,388	1,994
	201920 Actual	*2,400*	*2,650*	*2,608*	*2,374*	*2,318*	*2,400*	*2,319*	*2,438*	*2,403*	*2,170*	*2,273*	*1,919*
	201819 Actual	2,223	2,856	2,611	2,372	2,477	2,300	2,400	2,330	2,455	2,373	2,404	1,941
	201718	2,570	3,220	2,706	2,382	2,433	2,595	2,585	2,482	2,440	2,490	2,208	1,894
Net Pasture Growth (kg DM/ha/d)	20/21 Revised	12.1	10.3	33.9	60.2	65.3	74.8	67.8	70.3	67.6	59.8	41.9	26.1
	201920 Actual	*14.3*	*11.0*	*39.8*	*49.3*	*67.6*	*75.0*	*74.7*	*84.7*	*69.0*	*53.6*	*50.0*	*26.1*
	201819 Actual	4.2	23.2	29.8	54.5	79.2	73.5	70.5	69.2	74.0	59.1	43.8	23.9
	201718	18.4	25.9	11.6	39.3	68.2	79.8	73.0	76.0	65.4	47.7	32.1	34.5

DM Eaten tonnes	F2 Pasture Silage boug...	F2 Pasture Silage	Total
Jun 20	0.59		0.59
Jul 20	0.38		0.38
Aug 20	10.2		10.2
Sep 20	15.0		15.0
Oct 20	42.3		42.3
Nov 20			
Dec 20			
Jan 21			
Feb 21			
Mar 21	17.9		17.9
Apr 21	32.0		32.0
May 21	31.5		31.5
Total	**150**		**150**
kg/Milker	*269*		*269*

Supplement use has been very low this season to date. Currently on track to feeding 269 kgDM/cow of supplement for the season. (Original target: under 300kgDM/cow.)

Summer Feed Budget & Grazing Rules:

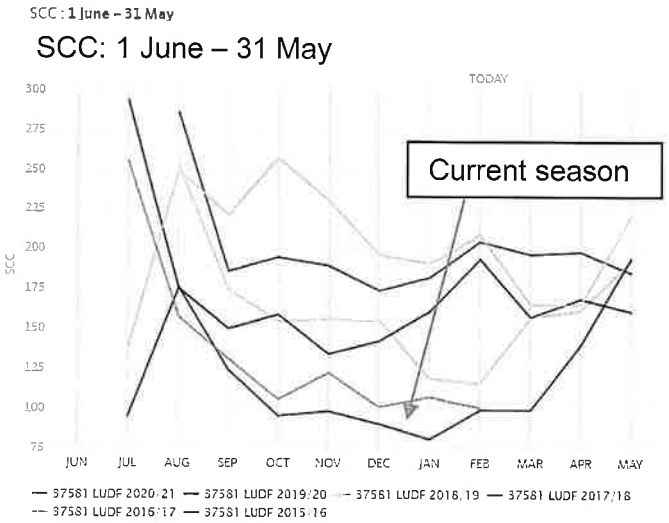
- 545 cows on 162 Ha = 3.43 cows/HA
- @ 1.8 kgMS/cow. Demand = 18.8 kgDM/cow (Feed quality high @ 12.1 MJME)
- Residual = 1,600 kgDM/HA for high performing cows.
- Demand = 64 kgDM/HA.
- Pasture required = demand X round length.
- Fastest Round = 22 days = 1,408 + 1,600 = 3,000 pregrazing (if less silage used)
- Longest Round = 26 days = 1,760 + 1,600 = 3,360 pregrazing (any more silage mown)
- Have mown 273 Ha STD (1.7 X the farm) This includes area mown for silage.

Fertiliser

- Nitrogen Spread season to date 93 kgN/HA
- Effluent area 28 kgN/Ha
- Non effluent area 109 kgN/Ha
- On track to use 170 – 180 kg/Ha nitrogen over the farm
- Some parts of the farm currently getting close to 190 kg/Ha nitrogen this year, so will monitor closely to avoid exceeding the limit in any given paddock.
- Our limited effluent (28 Ha) area does not fit will with new nitrogen legislation. We are investigating options to spread nitrogen over a bigger area.

Animal Health

- Cell count tracking at very low levels.
- Staph cows culled out at the close of 2018/19 season.
- 2nd year with no Staph cows.
- SCC significantly lower (see graph)
- Less penicillin required.
- No cows being quarantined.

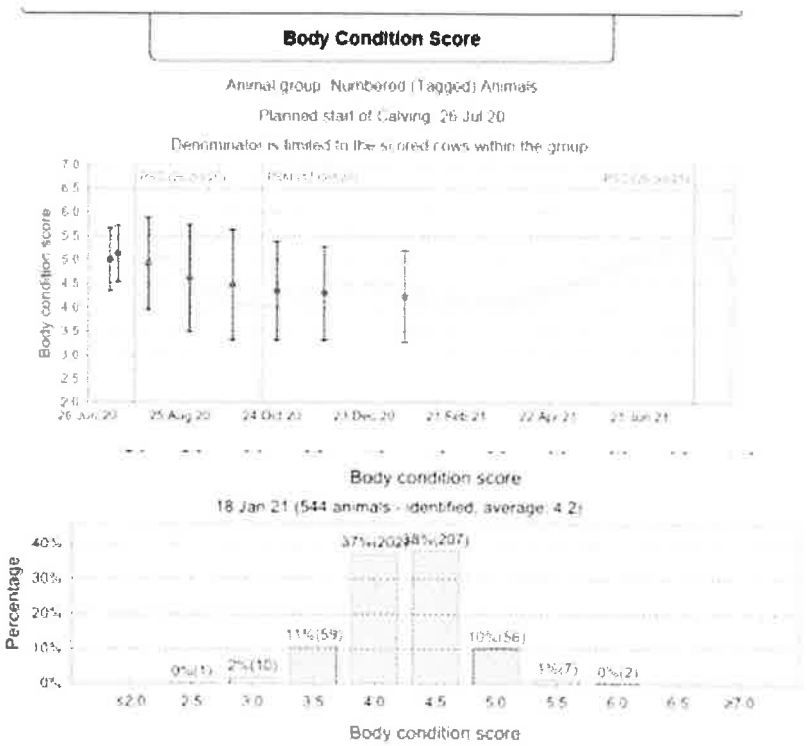


Mating

- R2 heifers were pregnancy tested on 17th December. 144 out of 165 confirmed pregnant in the first 5 weeks (87%).
- Bulls removed from heifers 17 December. Total 10 weeks of mating.
- Second Preg test of heifers 11 February: only 5 empty (3%)
- Pregnancy Test on 5th January confirmed 66% 6 week in calf rate for cows in milk. Original conception rate was 71%, but a significant number of pregnancies appear to have been lost in late December, cows knocked about by a respiratory illness. R3s were the worst hit. 3 cows died, currently 37 cows on OAD to recover.

Cow Condition

- Currently running 2 herds. One herd of 490 and a small herd consisting of 37 light cows and 15 lames, which are being milked once a day.
- BCS of cows in milk was done on Tuesday 18th January, showing an average of 4.2 BCS.



Finances

- Budget was 275,000 kgMS @ $3.89 farm operating costs per kgMS.
- Current revised forecast is $4.11 / kgMS.
- Significant savings in calf rearing this season with selling all surplus dairy AB calves and beef calves at 4 to 9 days old.
- Farm operates finance on calendar year, we convert to the farm season from the university finance program.
- Demonstration costs include extraordinary costs not on a commercial farm, eg, lysimeter testing.

LUDF	Variance Report						
		Actual	Budget	Variance	Annual Budget	Expected Variance	Revised Forecast
Account	Code	To 31st January, 2021			For the Season 31st May 2021		
REVENUE							
Fonterra Dividend Income	1302	16,424	0	16,424	24,800	16,424	41,224
Sales - Bobby Calves	1821	16,211	5,300	10,911	5,300	10,911	16,211
Sales - R2 Heifers	1823	0	0	0	3,000	0	3,000
Sales - Cows	1825	19,500	6,800	12,700	96,860	0	96,860
Sales - Bulls	1831	0	0	0	0	0	0
Sales - Other Livestock	1822,1824,1	0	13,200	(13,200)	13,200	(13,200)	0
Sales - Milk Solids Current Seas	1911	697,368	702,503	(5,136)	1,379,038	(5,136)	1,373,903
Payments Milk Solids Prev Seas	1912	542,267	335,921	206,346	335,921	206,346	542,267
Income - Rent	1971	7,374	11,715	(4,341)	17,842	(4,341)	13,501
Income - Other	Various	(375)	0	(375)	0	(375)	(375)
TOTAL REVENUE		1,298,768	1,075,439	223,329	1,875,961	223,329	2,099,290
					0	0	0
Stock Purchases		36,090	0	(36,090)	35,000		(36,090)
					0	0	0
EXPENSES						0	0
Salary Costs		0				0	0
Farm Salaries Perm & F/Term	2041-2043	173,963	170,667	(3,297)	206,000	0	206,000
Farm Casuals	2046	15,699	15,000	(699)	15,000	0	15,000
Allowances	2061	40,931	44,136	3,205	0	0	0
Superan,ACC,Incr Provison	2044,2062-2	6,113	8,160	2,047	12,240	0	12,240
Total Farm Salary Costs		236,706	237,963	1,257	233,240	0	233,240
						0	0
Operating Expenses						0	0
Appointment Expenses	2081	1,206	500	(706)	1,000	0	1,000
H&S/Prot Clothing/BioSecurity	2085	319	1,250	931	1,500	500	1,000
Staff Development	2095	0	6,667	6,667	10,000	5,000	5,000
Animal Health	2201	51,651	50,139	(1,512)	83,673	(1,512)	85,185
Breeding	2241	63,198	56,632	(6,565)	60,120	(6,565)	66,685
Feed & Grazing	2271	364,003	277,186	(86,818)	334,591	(45,000)	379,591
Crops/Pastures	2301	0	7,260	7,260	7,260	3,500	3,760
Seed	2311	167	0	(167)	0	(167)	167
Fertilisers	2331	73,264	72,500	(764)	97,500	0	97,500
Weed & Pest Control	2351	0	109	109	509	109	400
Contractors	2361	10,776	4,500	(6,276)	6,000	0	6,000
Electricity	2401	46,118	32,533	(13,585)	65,999	(10,000)	75,999
Freight	2411	13,331	15,009	1,679	15,509	0	15,509
Vehicle Expenses	2421	14,077	12,000	(2,077)	18,000	0	18,000
R&M (except Farm Houses)	2441 *	104,059	60,000	(44,059)	75,000	(18,059)	93,059
R & M (Farm Houses)	2442	0	800	800	800	800	0
Dairy Shed Operating Expenses	2461	8,306	8,653	348	12,653	348	12,306
Administration	2601	19,611	16,667	(2,944)	25,000	(2,944)	27,944
Fixed Charges	2651	7,834	15,835	8,001	21,721	0	21,721
Livestock Decreases	2911					0	0
Feed Decrease (Increase) Stock	2912		0	0		0	0
						0	0
Other Expenses	Various	0	0	0		0	0
Total Farm Operating Costs		1,014,623	876,202	(138,422)	1,070,075	(73,991)	1,144,066
		0	0		0		0
Milk Production KgMs	M1911	188,110	187,398	(712)	275,120	(3,000)	278,120
Operating Costs per kgMS	*				$ 3.89		$ 4.11

LUDF – The Lean Approach Introduction

LUDF – The last 5 years:

- Management (Peter Hancox) has achieved operational excellence. Peter has consistently achieved 500 kgMS/cow on a grass based system, with great feeding.
- Running multiple herds has added complexity and costs to the farm system. The cost structure has been typically running in the range of $4.30 - $4.40 / kgMS (Excluding Depreciation). Although this year, coming below this at $4.11. Goal for LUDF to be in the top 20% of profitability. Challenge from the LUDF MAG (Management Advisory Group) is to have a $3.XX cost structure.
- Demonstration activities and monitoring have been a burden on Peter Hancox, which does add costs to the system which we have struggled to quantify.

Current System

- Manager. Managing staff, reporting and hosting.
- + 3 staff. All farm jobs and calf rearing.
- 2 herd system.
- Relief milker required with manager not achieving 100% leave.
- 8+2 8+3 Roster.
- Management focus on perfection.
- Complex grazing program with 2 herds.
- High amounts of topping required.
- 500 kgMS/cow

Proposed System - Lean

- Manager. Focused on farm and execution.
- +2 staff.
- Calf Rearer + Relief milker in summer.
- Admin support for demonstration gathering of data.
- 5+2 Roster average
- 1 herd + Simpler grazing program.
- Intervention to manage condition – eg, OAD, but stay in the herd.
- Less topping should be required.
- Expectations of 490 kgMS/cow
- External Support on extension program, visitors etc.

The challenges we need to work on, and will not compromise on;

- Health and safety. Running the farm with one person at times.
- Mating time, resourcing staff, 5+2 roster through this period when 2 needed in the shed.
- Animal health, lameness and cow condition with one herd.
- Collection of quality data for extension, research and teaching.

LUDF has just started changing to this Lean program in the last 2 weeks. We will have ongoing focus and learnings at future focus days. LEAN management has a strong focus on Kaizen (continuous improvement). No doubt there will be learnings on farm, but also existing lessons and expertise on LEAN from within the industry which we will tap into.

Balmaghie Farm

Owners	**Mark + Pennie Saunders, Ormsby Group.**
Contract Milker	**Joseph Williams + Jen (Teacher).**

Background

- Mark & Pennie have been farming Waioto since 2005.
- Originally 1,300 cows on 352.28 ha.
- Nine years of 1600 cows at 452 ha
- Purchased neighbouring farm which increased area to 563Ha effective.
- Farm was already too big for the shed. Were struggling with diseconomies of scale and complexity.
- Balmaghie shed built in 2015.
- Waioto now 1,270 cows, 363 ha effective.
- Mark oversees the two dairy farms, and dairy support.
- Pennie administrator for their business and Ormsby group (6 farms).
- Joseph has managed the farm for 2 seasons, 1st year as contract milker.

Goals & Vision:

- A profitable business, which will be a vehicle for growth and development of a family business.
- To have a light foot print. High per cow performance with healthy well fed cows. Responding to the expectations of our community. Adopting best practice and technology to achieve this.
- Work with like-minded people.

Farm System:

- Stocking rate has been set with multiple years' analysis of Farmax Dairy Results. Key principles to the farm program:
    - Feed harvested of 13.5 TDM/ha harvested. This represents the better performing farms in the DSM (Dairy Systems Monitoring) data base that the farm contributes to.
    - Originally aiming for 480 kgMS+ per cow. *Joseph excels at this.*
    - Feeding as much grass as possible.
    - Setting a stocking rate that harvests all of the summer growth, and requires supplement only to manage pasture growth checks. Farmax has a summer growth rate of 68 kgDM/Ha. With a summer stocking rate of 3.56 cows/HA, 19 kgDM/cow is available. This is good for cows at 1.9 – 2.0 kgMS/cow.

- Use beet in April/May. Low cost option to supplement, a good regrassing tool. Use catch crops to mop up any leaching risks.

Operating Waioto with similar principles. Challenge to replicate at scale with 1,270 cows, 2 herds. Currently tracking to 480 kgMS/cow.

- Operate under the MHV (Mayfield Hinds Valletta) irrigation scheme, but supplemented with well water.
- Balmaghie is 90% deep wells.
- Farm system results in operating costs (excluding depreciation) of $3.82 / kgMS for 2019/20. This includes all costs and lease associated with dairy support land. Includes Waioto dairy farm. Suspect this farm would be even more profitable if benchmarked on its own.

Efficiencies

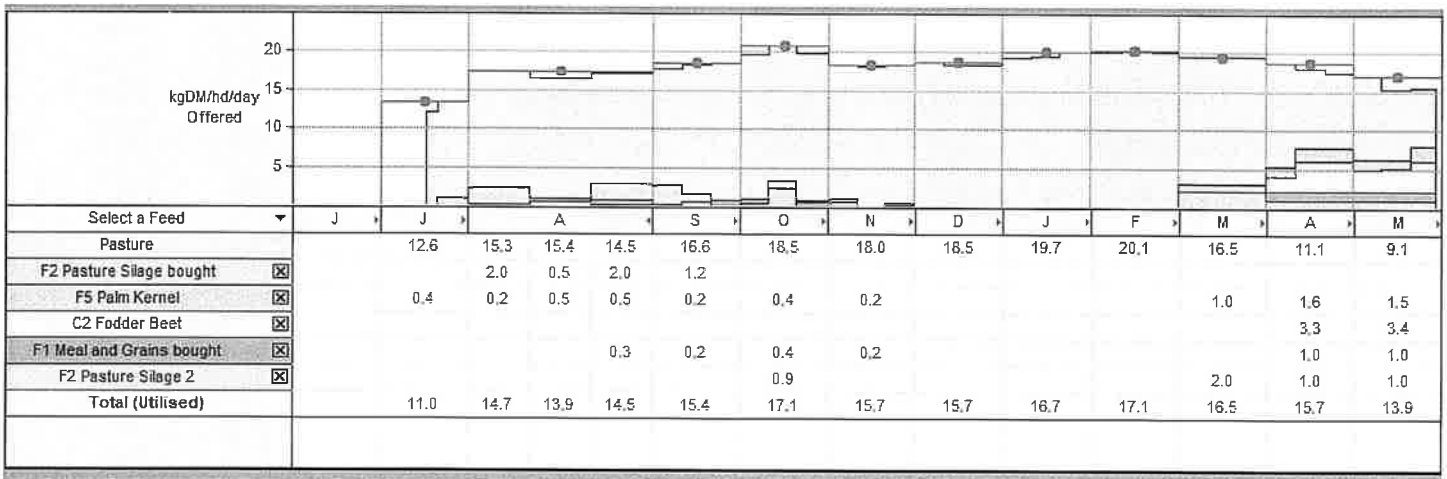
- 700 cows
- 3 staff.
- Staff on 8+2, 8+3 roster (Preferred by staff).
- Centre pivot irrigation with minimal shifts needed with Rotorainer.
- 54 bale Rotary. Cup removers + single feed head.
- Operate as one herd system from the start. Need a 2nd person in shed for mating (AB in afternoon).
- All staff get a total of 110 days off per year. Contract milker not too far behind (roughly 85 days).

Pasture management & Feeding

- Weekly farm walk. Use the information to maintain pasture cover between 2,200– 2,350 kgDM/ha.
- Use supplements to manage pasture (not for making milk). Use supplements to get back into sweet spot cover range. Make silage if needed to lift cover.
- This season have topped 16 ha (1st time ever) in 1st week January.
- Have dropped nitrogen down to 200 kgN/ha this year and operated with a longer round length (eg, LUDF October day). Found the intakes and residuals a challenge late December, early January and keeping production up, hence a short, sharp top.
- Use the PKE/ grain feeder as little as possible. Do not like to turn it on as it stuffs up cow flow.

Environment:

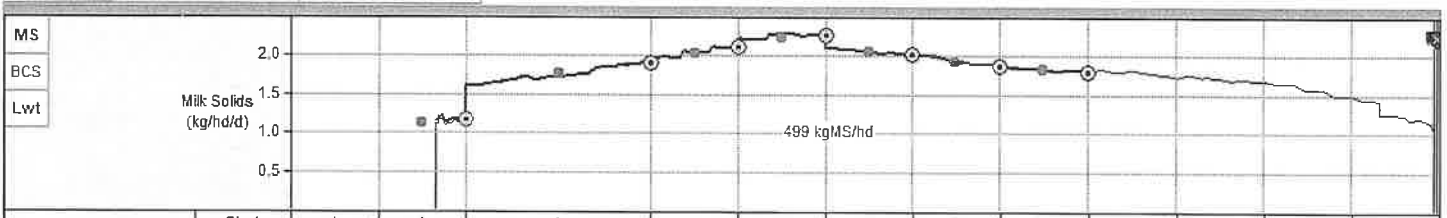
- Mark a member of DairyNZ, Environment Leader Farmers Group
- Early adopters to convert from Rotorainers to Pivot to minimise nitrogen leaching.
- Farming on light Lismore soils. Some of Canterbury's most challenging soils to hold nutrients.
- Current Overseer results 42 kgN/Ha of leaching. Down from baseline 82 kgN/HA.
- Current Environmental audit "B". Was down graded from previous "A" with not enough detail on irrigation management, training and water use.



Select a Feed	J	J	A		S	O	N	D	J	F	M	A	M
Pasture		12.6	15.3	15.4	14.5	16.6	18.5	18.0	18.5	19.7	20.1	16.5	11.1	9.1
F2 Pasture Silage bought			2.0	0.5	2.0	1.2								
F5 Palm Kernel		0.4	0.2	0.5	0.5	0.2	0.4	0.2				1.0	1.6	1.5
C2 Fodder Beet													3.3	3.4
F1 Meal and Grains bought					0.3	0.2	0.4	0.2					1.0	1.0
F2 Pasture Silage 2							0.9					2.0	1.0	1.0
Total (Utilised)		11.0	14.7	13.9	14.5	15.4	17.1	15.7	15.7	16.7	17.1	16.5	15.7	13.9

Production for Cows at home

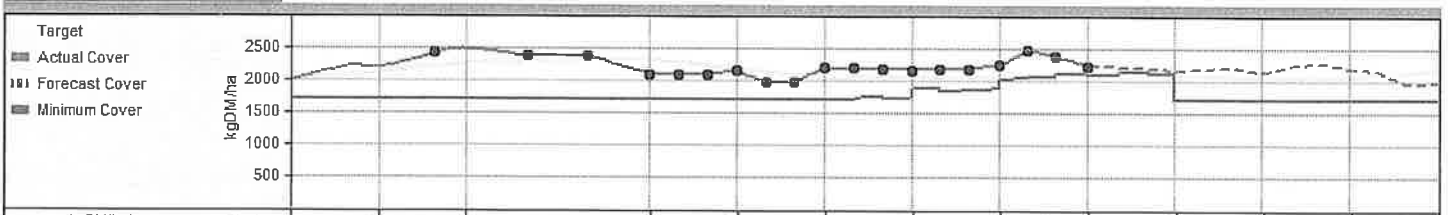
Dries | Milk Actuals... | Calibrate Milk...



	Start	J	J	A		S	O	N	D	J	F	M	A	M
Model MS (kg/hd/d)			1.13	1.68	1.74	1.88	2.05	2.26	2.06	1.93	1.84	1.78	1.71	1.58	1.26
Actual MS (kg/hd/d)			1.17	1.68	1.74	1.88	2.05	2.26	2.06	1.93	1.83				
Actual/Forecast BCS	4.6		4.7	4.8	4.8	4.7	4.5	4.5	4.4	4.4	4.5	4.7	4.9	5.1	
Model Lwt (kg)			446	456	456	457	451	452	449	449	454	462	469	480	

Pasture Cover for Balmaghie

n | Target Range...



(kgDM/ha)	Start	J	J	A		S	O	N	D	J	F	M	A	M
Forecast/Actual	2,000	2,197	2,488	2,380	2,380	2,100	2,150	2,194	2,170	2,254	2,236	2,161	2,128	2,193	1,968

DM Eaten tonnes	F3 Maize/ba... Silage boug...	F4 Hay/ Straw bought	C2 Fodder Beet	F1 Meal and Grains bou...	F5 Palm Kernel	F2 Pasture Silage	F2 Pasture Silage boug...	F2 Pasture Silage 2	Total
Jun 20									
Jul 20		2.15			2.13	5.12			9.40
Aug 20	13.8	5.51		1.43	5.44		16.1		42.2
Sep 20	6.66	2.66		4.51	3.92		15.7		33.5
Oct 20	0.030			8.31	7.42			14.7	30.4
Nov 20				4.90	3.24				8.14
Dec 20									
Jan 21									
Feb 21									
Mar 21					17.9			31.8	49.6
Apr 21			48.6	15.6	24.0			13.1	101
May 21	1.58	1.58	54.4	14.5	20.0			12.2	104
Total	22.0	11.9	103	49.3	84.0	5.12	31.8	71.8	379
kg/Milker	*31.8*	*17.2*	*149*	*71.2*	*121*	*7.39*	*45.9*	*104*	*548*

Category	Description	Value	Units
Farm	Effective Area	200	ha
	Stocking Rate	3.5	cows/ha
	Potential Pasture Growth	16.2	t DM/ha
	Nitrogen Use per total ha	245	kg N/ha
	Feed Conversion Efficiency (eaten)	10.2	kg DM eaten/kg MS
Herd	Cow Numbers (1st July)	692	cows
	Peak Cows Milked	692	cows
	Days in Milk	274	days
	Avg. BCS at calving	4.8	BCS
	Liveweight per total ha	1,550	kg/ha
Production (to Factory)	Milk Solids total	343,026	kg
	Milk Solids per total ha	1,715	kg/ha
	Milk Solids per cow	496	kg/cow
	Peak Milk Solids production	2.29	kg/cow/day
	Milk Solids as % of live weight	110.6	%
Feeding	Pasture Eaten per cow *	3.9	t DM/cow
	Supplements Eaten per cow *	0.5	t DM/cow
	Off-farm Grazing Eaten per cow *	0.5	t DM/cow
	Total Feed Eaten per cow *	5.0	t DM/cow
	Pasture Eaten per total ha	13.7	t DM/ha
	Supplements Eaten per total ha	2.2	t DM/ha
	Off-farm Grazing Eaten per total ha	3.4	t DM/ha
	Total Feed Eaten per total ha	19.3	t DM/ha
	Supplements and Grazing / Feed Eaten *	21.7	%
	Bought Feed / Feed Eaten *	6.9	%

Economically Reducing Inputs to 190kg N from fertiliser

- tools and trade off's to consider -

Mark Everest

Macfarlane Rural Business Ltd

23 February 2021

Considerations

Good news

- Reducing to 220kgNfor mostis relatively easy.
- A large amount of Canterbury is close.
- For many, this will induce a solid review of the whole farm system as well as inputs/costs.

Not without a challenge...

- From notification, given 12 months to make the change (first report 12 months to June 2022).
- Our systems are Psychological as well as Biological, therefore needing change to thought process of farmers.
- Some are using over 300kgN.
- During "development" phases using 190kgN is yield limiting.
- Have to make some changes at a system level, so no more recipe farming.

How Easy?

300+kgN → 270kgN
(Minor Tweaks)

270kgN → 220kgN
(System and Management Changes)

220kgN → 190kgN
(Transformational Change Required)

Thoughts from the crowds

Decrease supplements made on farm (T1)	Increase Round Length (T1)	Pasture Measurement (T1)	Strategic crop use (T1)
Diverse Pastures and Pasture Type (T3)	Coated urea (T5)	Manage within paddock variation (T6)	Improve soil fertility (T6)
Pro Gibb (T6)	Effluent management (T1)	Import more supplements (T1)	Let someone else develop a solution/technology

6 Key "Tool Groups"

1. **Feed budgeting**
2. **Promote clover**
3. **Diverse pastures**
4. **Inhibitors**
5. **Tetraploid grasses**
6. **Growth promotants and N application technologies.**

Tool 1

Eat the grass that we grow

There is about a 10:1 responsekgDM:kgN (range 5-25)

- Using 400kgN should grow 16.5t
- Using 200kgN should grow 14.5t
- Using 0kgN should grow 12.5t

Why grow 16t when you only eat 12.5t?

- The average punter's stock consume 12-12.5t/year
- Leaching increases from 40kgN to 120kgN when go from 200-360kgN
- Topping is 200-500kgDM wasted feed
- Missed opportunity for growth on 18 day round (N uptake is over 20-24 days)
- If 60 days on 22c.f 18 day round = 0.6grazingsat 30kgN = 18kgN saved

Tool 1

Grow the grass we can eat

N is the cheapest form of feed but its not cheap!

- Urea @ 10:1 = 13c/kgDM
- But if you aren't eating it?

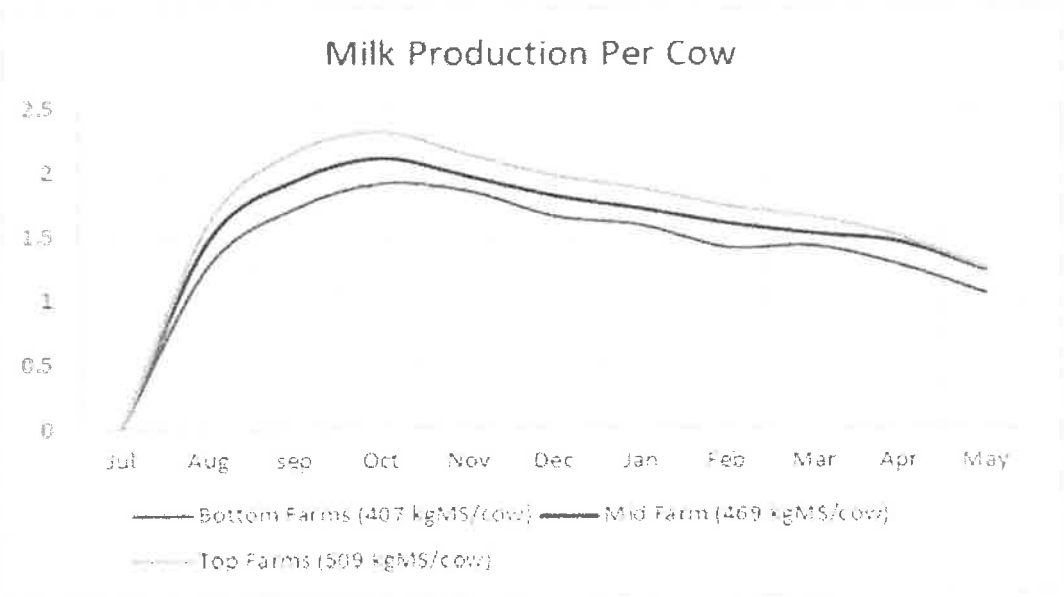
Budget the feed

- Maintain as close as possible a 2100-2300 cover
- If you need the feed, use the N
- If you produce too much feed and have to top…
- Broad acre application of high rates?
- Suggested gains of up to 300-600kgDM/ha that doesn't have to be grown for those who excessively top (or 30-60kgN less)

Tool 1

Budget The Feed

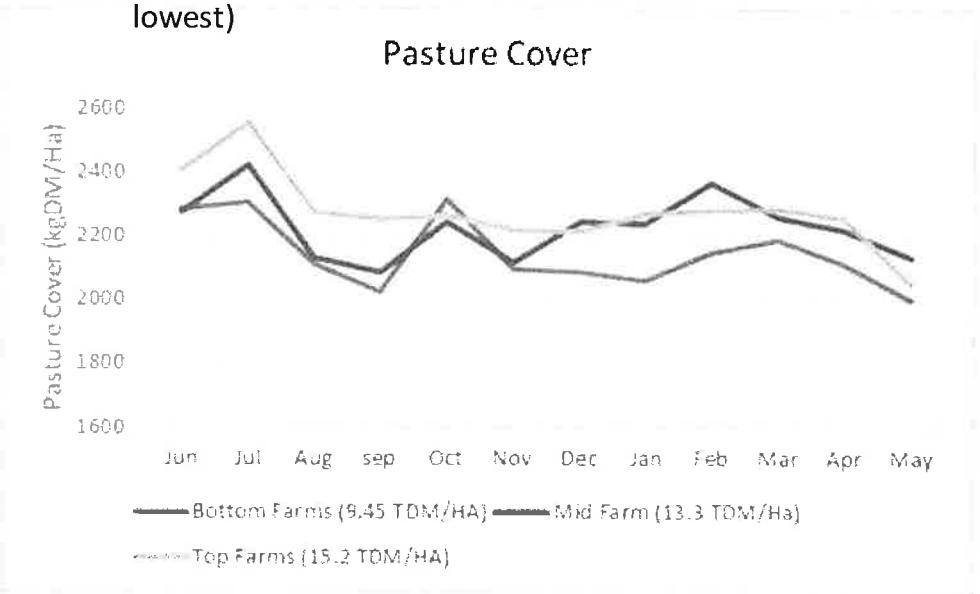
- DSM 2020– Milk Production



Tool 1

Budget The Feed

- DSM 2020– Average Pasture Cover (same farms as previous slide – Green best milk production per cow, Red mid; Blue lowest)



Tool 2

Enhance Clover

Its free N!

- 25-50kgN/tDM
- 0kgN = 16% clover
- 200kgN = 12-15% Clover
- 300kgN = 3% Clover
- 400kg N = 3% clover

- More N is a death spiral–over 300kg, the clover population drops, then you need more N, eventually ending up at 400kg.

Tool 2

Enhance Clover

Cost?

grass %	clover%	MJME/ha	Feed Cost	kgN Fixed	N Value	nett value
95%	5%	169,578	$0 ha	36	$48 ha	$48 ha
90%	10%	168,106	$57 ha	73	$96 ha	$39 ha
85%	15%	166,588	$117 ha	109	$145 ha	$28 ha
80%	20%	165,025	$178 ha	145	$193 ha	$15 ha

How?

- Appropriate grass planting rates (D:12kg, T:16kg)
- Modest N rates (smother)
- Manage covers pre and post
- Soil conditions (Herbage test on November)

Tool 3

Ecotain/Agritonic

Reduces N leaching

- Maintain 30% in pasture.
- Can reduce leaching by up to 20%.
- If its not lost it can be used.
- 60kg leached withoutEcotain.
- 20% saved is 18kgN.

How?

- Plant 3kg.
- Top up every year with 2kg in with super.
- Cost neutral.

Tool 4

Coated Urea

Urease Inhibitors

- Slow the conversion from Urea to Ammonia gas that can be volatalised
- Urea un-watered for 48 hours = 25% loss
- Urea un-watered for 8 hours = 12% loss
- Spring use
- Summer (perhaps) depending on watering
- Say 200kg N used, if can save even 9% from loss = 18kgN
- Cost = 10% more than Urea (nett zero)

Ammonium Versus Urea

- Urea to Ammonium = 310 days (season dependant, conflicting research)
- Can help with feed budgeting

Tool 4

Nitrification Inhibitors

NCD/Nitrostop/Agrotain etc

- Actives that slow the conversion from ammonium to nitrate.
- Useful over urine patches or to pastures and crops where crop growth is low.
- Pasture growth improvements of 8-15%
  - (discount by 50% to allow for possible effects on excess N we no longer use and say 5% pasture growth improvement)
  - (discount by a further 70% for urine patch cover effect, therefore only 1.5% pasture growth improvement)
  - = 65kgN saved?

Tool 6

Growth Promotants & Application Technologies

Gibberellic Acid

- Needs nitrogen with it, and after grazing (nothing is free)
- Can generate a flatter feed curve
- N use efficiency not any greater so need be mindful of early use and impacts later in the season.
- Growth 30kg, soil temp 7-10°C (rising) or 10-16°C (falling)
- Apply 5 days after grazing
- Don't graze for 3-4 weeks
- 36% gain in growth rates (300kg)

Tool 6

Growth Promotants & Application Technologies

Soil Fertility*

- If theres something to fix

Precision Placement (good theory but policy prohibits)

- Avoid the first 50m of each paddock (0.5ha/paddock/7%)
- Avoid 12m radius around water troughs and gateways (0.08ha/1%)

Variable Rate Spreading

- From 0-15% saving in product for same response.
- (seemingly much less when underlying fertility is corrected)

Tool 6

Growth Promotants & Application Technologies

Fertigation

- Similar principals as watering in Urea or using coated products.
- 20-30% savings in N applied (volatilization saved)
- (cant double dip with coated products– Tool 4)

Tool 5

Grass Type

Tetraploids vs Diploids

- In theory Tetraploids last 7 years (12?)
- In theory Diploids last 10 years (15?)

	Tetraploid	Diploid
Average Age	5	7
Annual Yield	14,569	12,391
Normalised Yield	13,694	11,824
N Use	194	221
NUE	76	56

- 1.8tDM/ha gain like for like management
- 27kg N use less
- Caution regrassing 1 in 8 rather 1 in 11 years
- Caution low (under 13%)DM in spring with Tetraploid

Tool Summary

Tool 1	Tool 2	Tool 3	Tool 4	Tool 5	Tool 6
Grow what you can eat (18kgN not used to grow unused feed) **Eat what you grow** (30kgN feed betterutilised)	**Allow +5% Clover** (36kgN more made available)	**Agritonic Plantain** (18kgN more efficiently used)	**Urease inhibitors** (18kgN retained in profile) **Nitrification Inhibitors** (19kgN able to reduce)	**Tetraploids** (27kgN less input for 1.8tDM more)	**Promotants** (Assume Gibb Acid used to substitute supplement) **Application Technologies** 8% less N with compoundfert 0-15% (5%) less N with variable rate spreading* (35kgN not applied) (20% saving with Fertigation if not using T4)

Total Savings 118kgN

Systems Approach

All on Board

- Driven by the farmer
- All staff
- Agronomists/Advisors/Fert Reps
- Bankers/Accountants/Shareholders

Fertiliser/Promotants

- A month by month N plan/budget (rates by month)
- Detail of product type by season
- A monthly reconciliation and reporting system (to yourself)
- Use Ammo type products if you feel you must still apply 65kg of product
- Reduce use marginally on the increments
- Be hard on spreading operators not to "empty the bin".

Feed budget

- Maintain 22 day round minimum, let the N do its job
- Rotationally graze
- Weekly pasture covers
- Record history to predict the future (Year on Year)
- Back out the concentrates and avoid substitution

Less Efficient Farm

Impact of Nitrogen Use on Farm System			
Starting	Current Nitrogen use	280	kgN/ha
less	Legislated Nitrogen use	190	kgN/ha
Gives	N Input reduction required	90	kgN/ha
less	N input saved with tools employed		
	Increased clover proportion by 10%	44	kgN/ha
	Diverse pastures @ 10% more yield	6	kgN/ha
	Shoulder season pasture @ 30% more clover	8	kgN/ha
	Coated urea used for 50% of use options	15	kgN/ha
	Precision placement and application	24	kgN/ha
	Nitrification inhibitor (effectiveness 50%, effectiveness	10	kgN/ha
	Gluconic Acid use (50%) farm/a scale	3	kgN/ha
	Gluconic Acid use (40%) farm/a system	2.4	kgN/ha
	Other biological control and/or farm products	0	kgN/ha
	Gross N use savings from tools employed	113	kgN/ha
	Discounted farm use by error at 50%	56	kgN/ha
Gives	Further reductions in N use required	34	kgN/ha
Where	Response Rate (kgDM grown/kgN used)	10:1	
Gives	Feed from extra N to be recovered	342	kgDM/ha

Impact of Nitrogen Use on Profit			
@ $1.33/kgN	=	$120	/ha saved
(may incure capital cost of seed)			
@ 2.0 kg/year	=	-$34	/ha cost
(requires green real time NDVI tech or certified contractor)			
@ $24.90/ha	=	-$12	/ha cost
@ $24.90/ha	=	-$10	/ha cost
@ 20% more cost than Urea	=	$0	/ha cost

Less Efficient Farm

Impact of Nitrogen Use on Farm System			
Starting	Current Nitrogen use	280	kgN/ha
less	Legislated Nitrogen use	190	kgN/ha
Where	Opportunities to optimimise feed harvested		
plus	Silage produced from (kgDM/ha)	0	kgDM/ha
plus	Topping carried out (100% form x 200 kgDM)	300	kgDM/ha
plus	Feed wasted / decay measure with precise cover (2000-2300 = 0kgDM additional decay) (2400 for 3 months = 90kgDM additional decay)	0	kgDM/ha
Gives	Total improvement in feed utilisation	300	kgDM/ha
Where	Feed deficit from less Nitrogen	42	kgN/ha
Divide by	Stocking Rate	3.3	kgN/ha
Gives	Deficit per cow	13	kgDM/cow
Where	Options:		
	Less milk production (same cow no, assuming 8.5 : 1 response)	1	kgMS/cow
	More supplements	13	kgDM/cow
	Lower stocking rate (same milk per cow)	0.01	cows/ha
	Lower stocking rate (same total milk)	0.01	cows/ha

Impact of Nitrogen Use on Profit			
@ $45/ha	=	$68	/ha saved
@ $6.01/kgMS	=	$101	/ha nett gain
@ $0.48/kgDM Fed	=	$111	/ha nett gain
0.30% reduction in milk total*	=	$123	/ha nett gain
0.30% increase in milk per cow*	=	$128	/ha nett gain
(*seasonal effects)			

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More Efficient Farm

Impact of Nitrogen Use on Farm System				Impact of Nitrogen Use on Profit		
Starting	Current Nitrogen use	220	*kgN/Ha*			
less	Legislated Nitrogen use	190	*kgN/Ha*			
Gives	N input reduction required	30	*kgN/ha*	@ $1.33/kgN	=	$40 /ha saved
less	N input saved with tools employed					
	Increased clover production by 5%	22	*kgN/ha*	(may incur a capital cost of seed)		
	Diverse pastures @ 5% more plantain	3	*kgN/ha*	@ 2.0kg/year	=	-$34 /ha cost
	Shoulder use of ryegrasses @ 10% more urea	3	*kgN/ha*			
	Coated urea used for 0% of applications	0	*kgN/ha*	(assume using coated in base farm model)		
	Precision placement and application	19	*kgN/ha*			
	Variable rate N spreading 20% effectiveness	4	*kgN/ha*	(requires green real time NDVI tech or certified contractor)		
	Gibberellic Acid use (30%) farm in spring	1.5	*kgN/ha*	@ $24.90/ha	=	-$7 /ha cost
	Gibberellic Acid use (20%) farm in autumn	1	*kgN/ha*	@ $24.90/ha	=	-$5 /ha cost
	0% Use of compounds/ offfarm products	0	*kgN/ha*	@ 20% more cost than Urea	=	$0 /ha cost
	Gross N use savings from tools employed	53	*kgN/ha*			
	Discounted for reliability error of 50%	26	*kgN/ha*			
Gives	Further reductions in N use required	4	*kgN/ha*			
Where	Response Rate (kgDM grown/kgN applied)	12:1				
Gives	Feed from extra N to be recovered	44	*kgDM/ha*			

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More Efficient Farm

Impact of Nitrogen Use on Farm System				Impact of Nitrogen Use on Profit		
Starting	Current Nitrogen use	220	*kgN/Ha*			
less	Legislated Nitrogen use	190	*kgN/Ha*			
Where	Opportunities to optimimise feed harvested					
plus	Silage made on farm (kgDM/Area)	0	*kgDM/ha*			
plus	Topping cut/ladder (10% farm x200kgDM)	20	*kgDM/ha*	@ $45/ha	=	$5 /ha saved
plus	Feed wasted / decay in pasture with excess cover (2200-2300 = 0kgDM additional decay) (2400 for 2 months = 50kgDM additional decay)	0	*kgDM/ha*			
Gives	Total improvement in feed utilization	20	*kgDM/ha*			
Where	Feed deficit from less Nitrogen	24	*kgDM/ha*			
Divide by	Stocking Rate	3.3	*cows/ha*			
Gives	Deficit per cow	7	*kgDM/cow*			
Where	Options:					
	Less milk production (same cow no, assuming 8.5 : 1 response)	1	*kgMS/cow*	@ $6.00/kgMS	=	-$19 /ha nett loss
	More supplements	7	*kgDM/cow*	@ $0.48/kgDM Fed	=	-$14 /ha nett loss
	Lower stocking rate (less total milk/same milk per cow)	0.01	*cows/ha*	0.17% reduction in milk total*	=	-$7 /ha nett loss
	Lower stocking rate (same total milk/increase per cow)	0.01	*cows/ha*	0.21% increase in milk per cow*	=	-$4 /ha nett loss
				(*assumptions)		

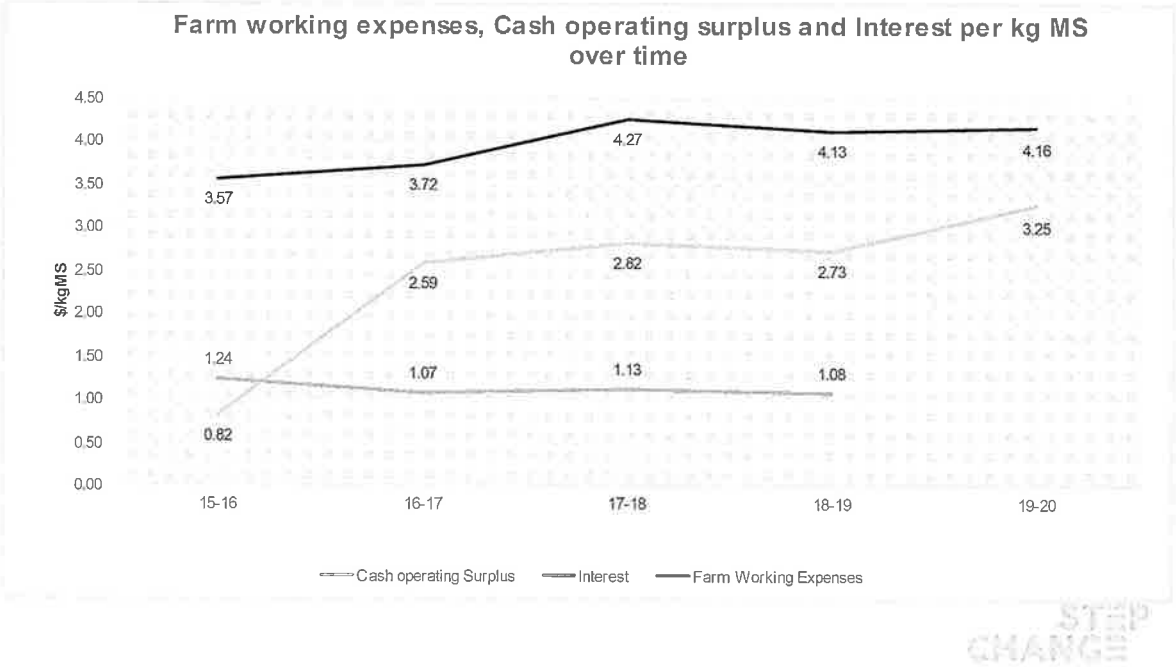
Dairy Base: What is driving Profit for Canterbury?

Robb Macbeth, Dairy NZ

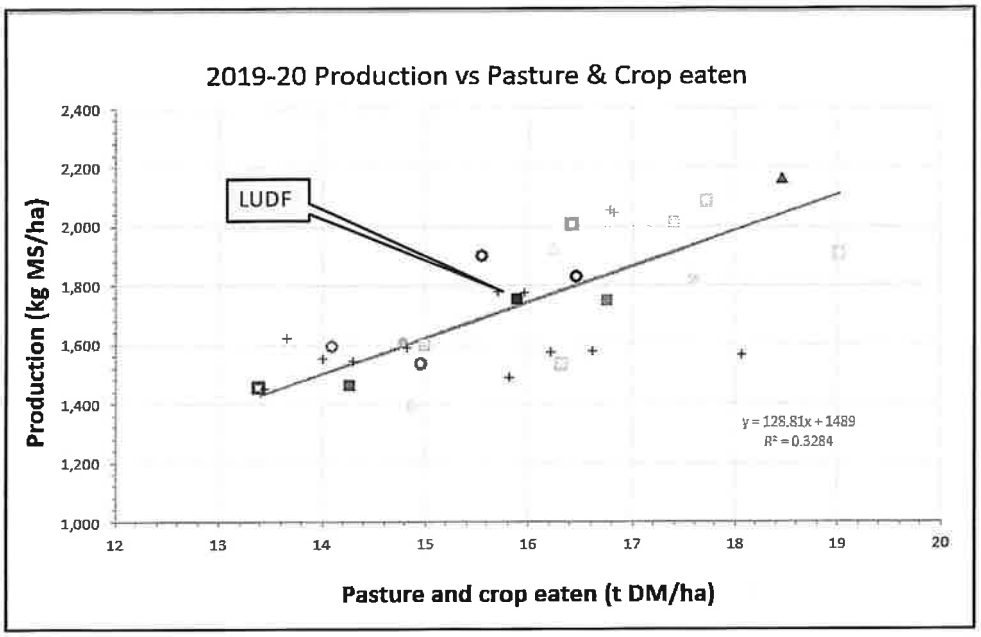
Canterbury Benchmark Group

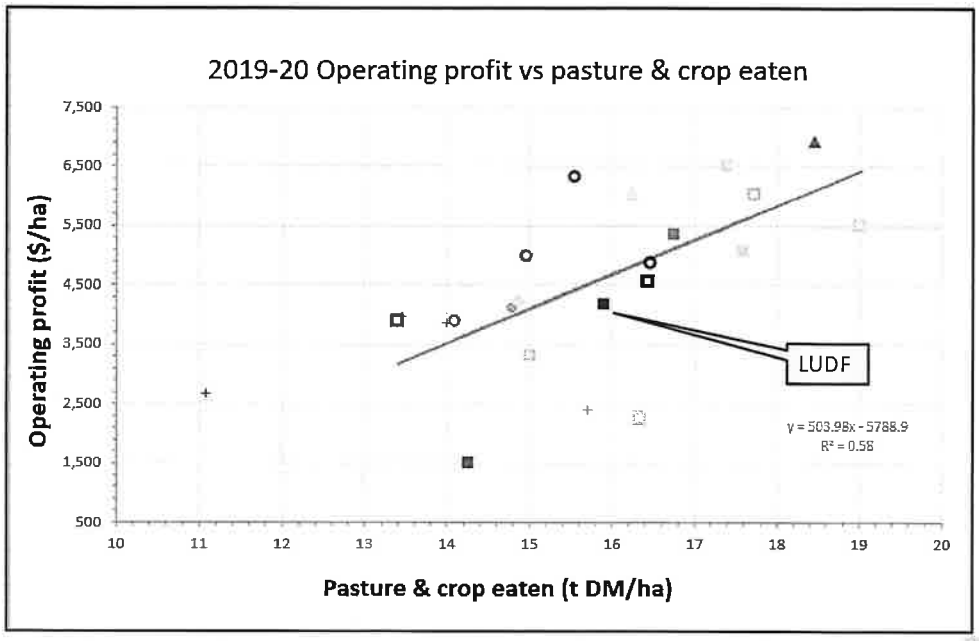
2019-20 Profitability and environmental data

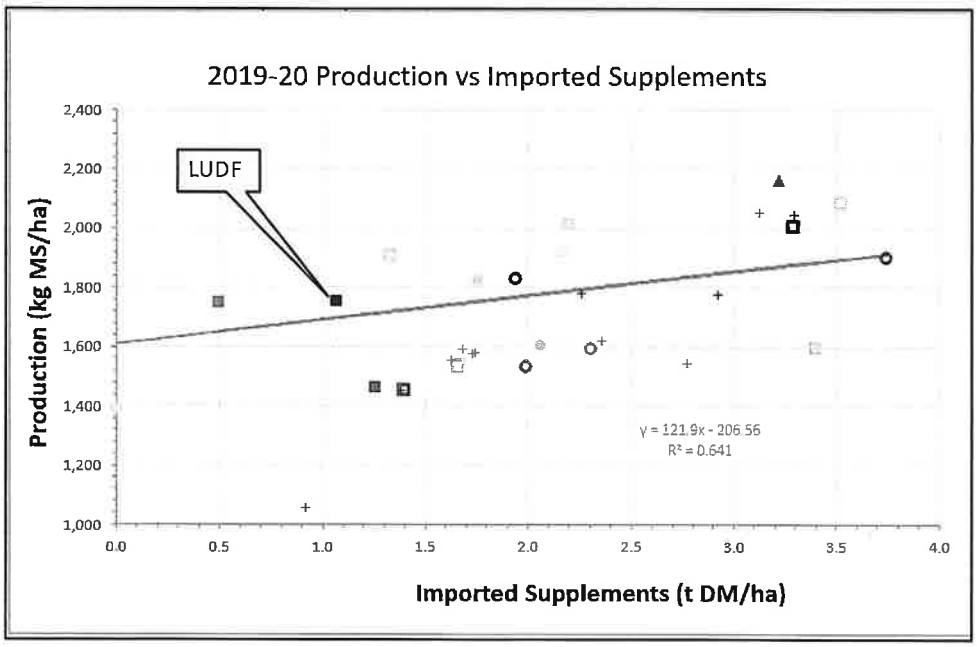
DairyNZ

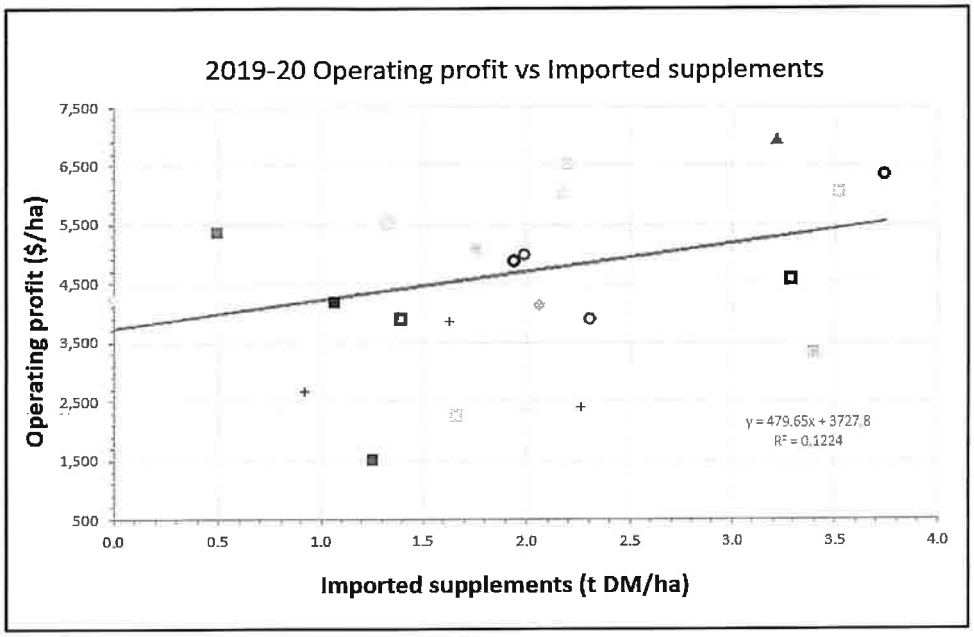


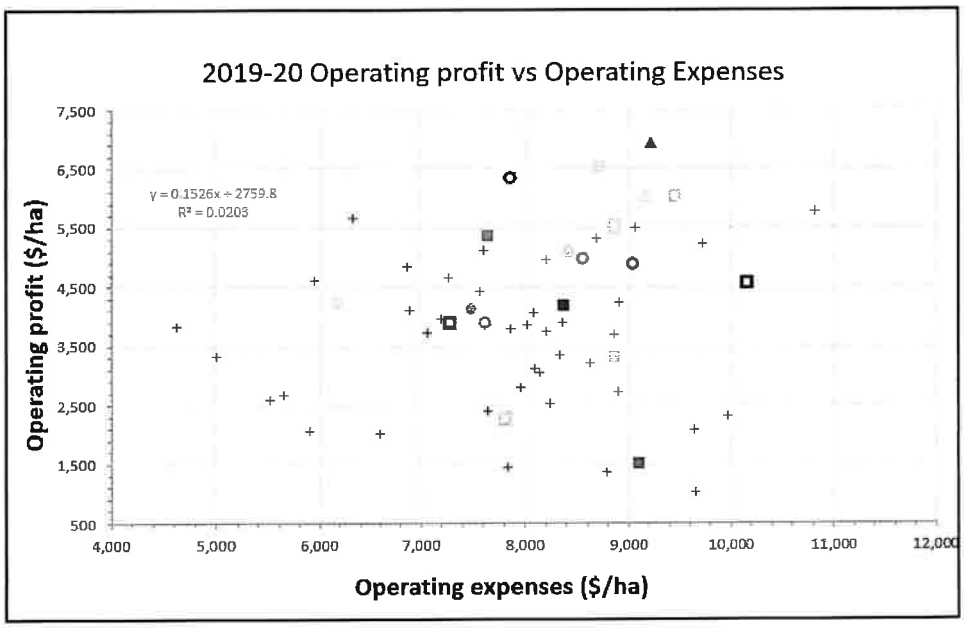
STEP CHANGE

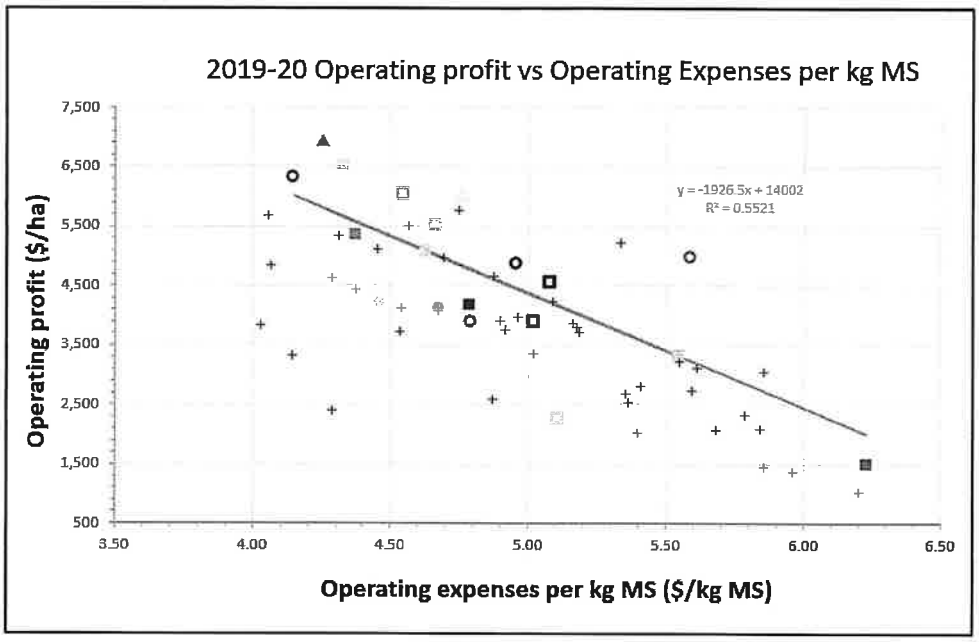

2019-20 Production vs Pasture & Crop eaten
Production (kg MS/ha)
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
12
13
14
15
16
17
18
19
20
LUDF
y = 128.81x + 1489
R² = 0.3284
Pasture and crop eaten (t DM/ha)

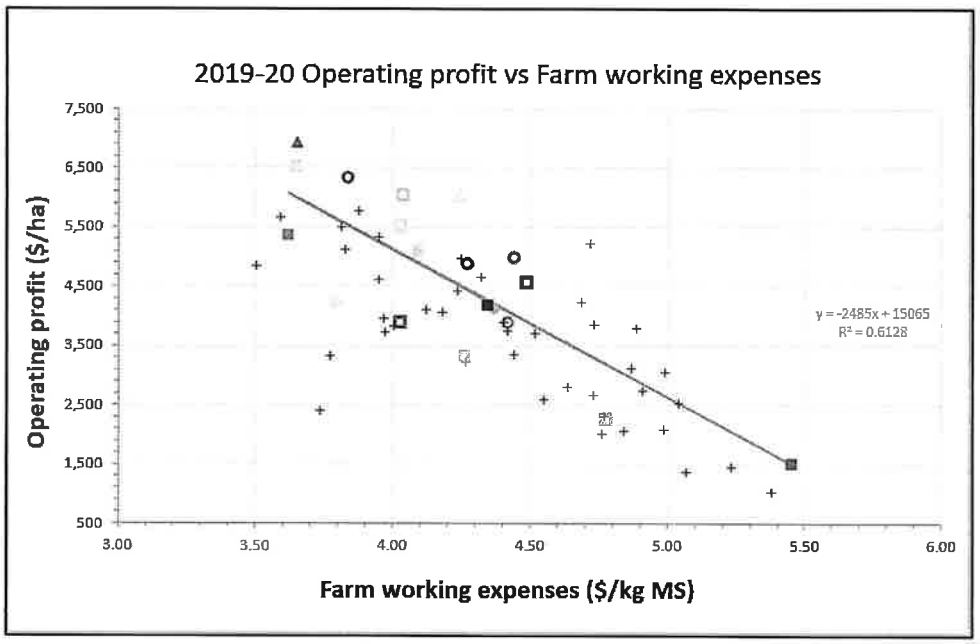






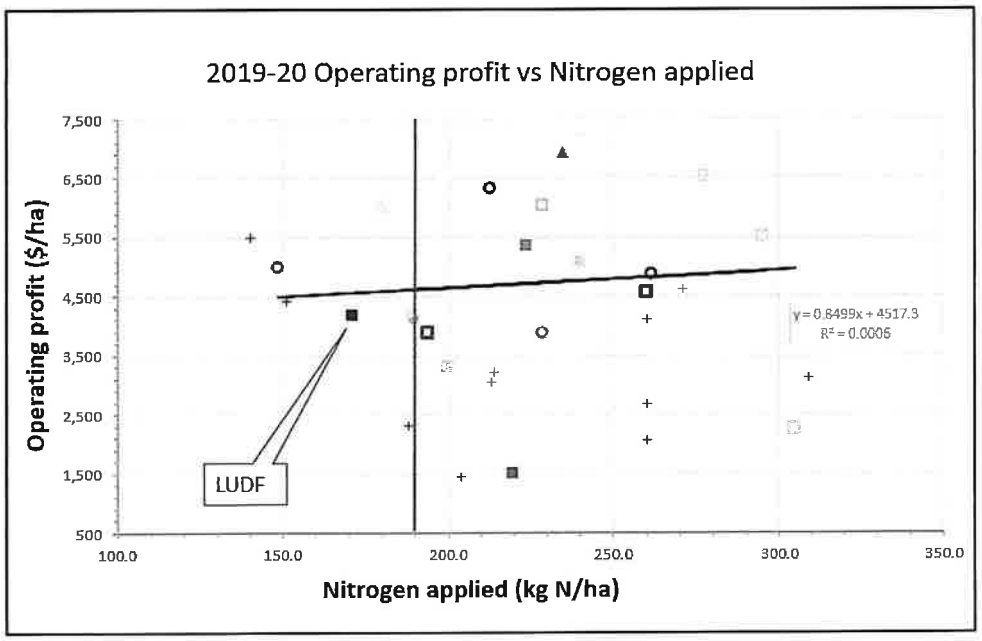


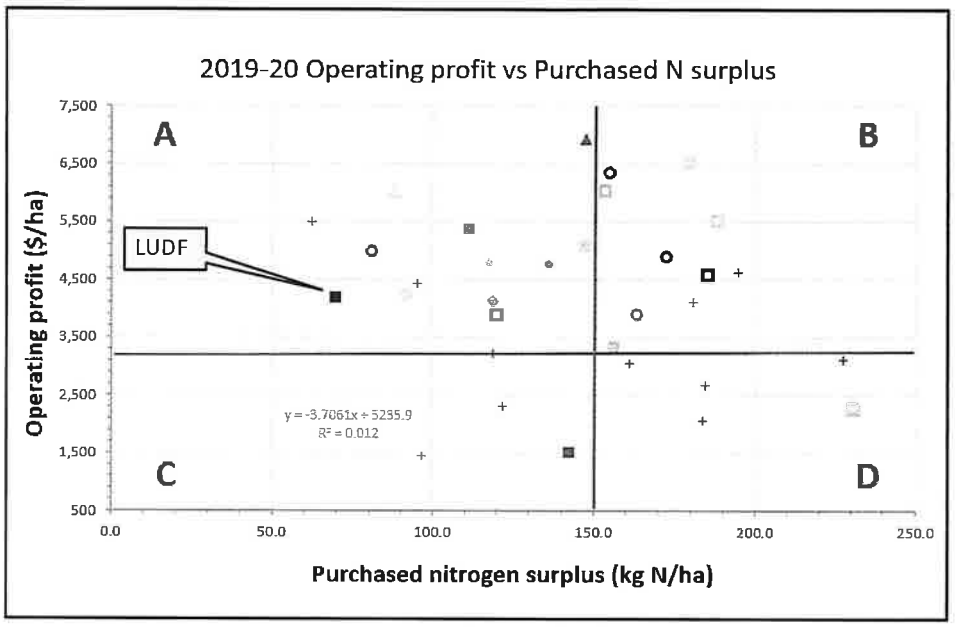

2019-20 Operating profit vs Operating Expenses per kg MS
Operating profit ($/ha)
7,500
6,500
5,500
4,500
3,500
2,500
1,500
500
3.50
4.00
4.50
5.00
5.50
6.00
6.50
y = -1926.5x + 14002
R² = 0.5521
Operating expenses per kg MS ($/kg MS)


2019-20 Operating profit vs Farm working expenses
Operating profit ($/ha)
7,500
6,500
5,500
4,500
3,500
2,500
1,500
500
3.00
3.50
4.00
4.50
5.00
5.50
6.00
y = -2485x + 15065
R² = 0.6128
Farm working expenses ($/kg MS)

Quick nitrogen quiz

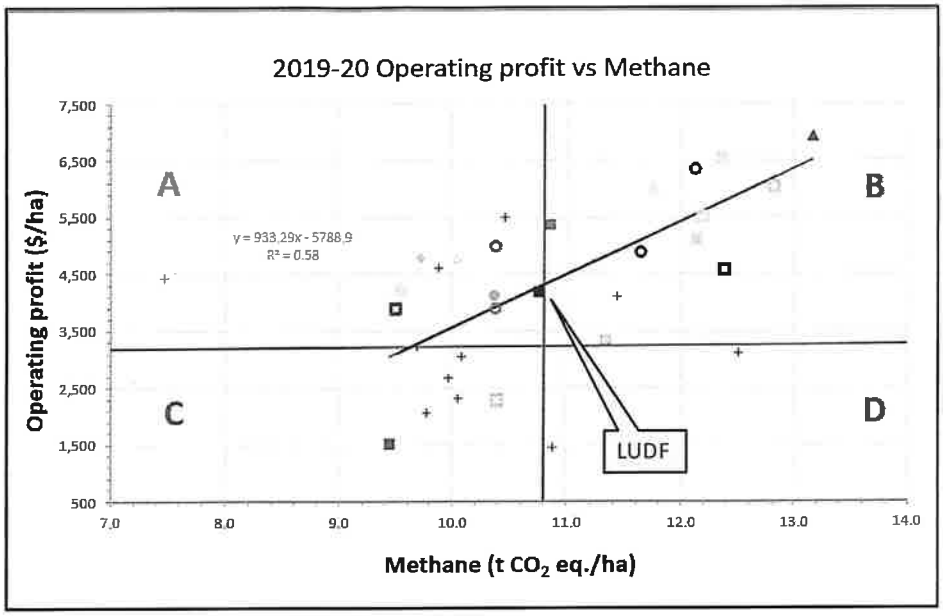
1. Nitrogen use;
   a) What was the average N applied for Canterbury in 2019 -20?
   b) In 2015-16?
2. Purchased N surplus; - If a farmer applies 190 units of N, imports no supplementary feed and produces 1,800kg MS/ha, what is their approximate N surplus?
   a) 190 kg N/ha
   b) 112 kg N/ha
   c) 64 kg N/ha

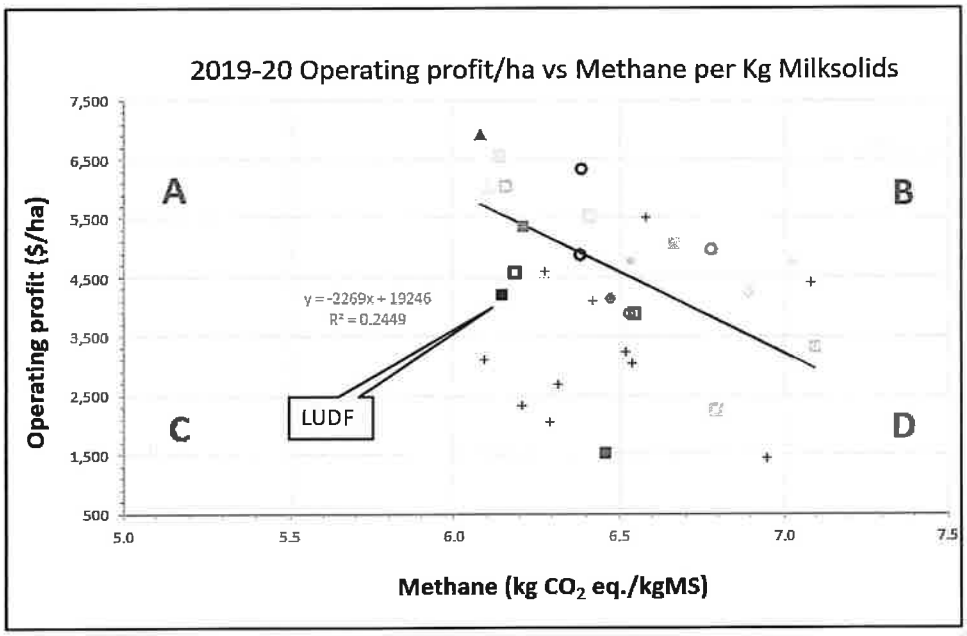


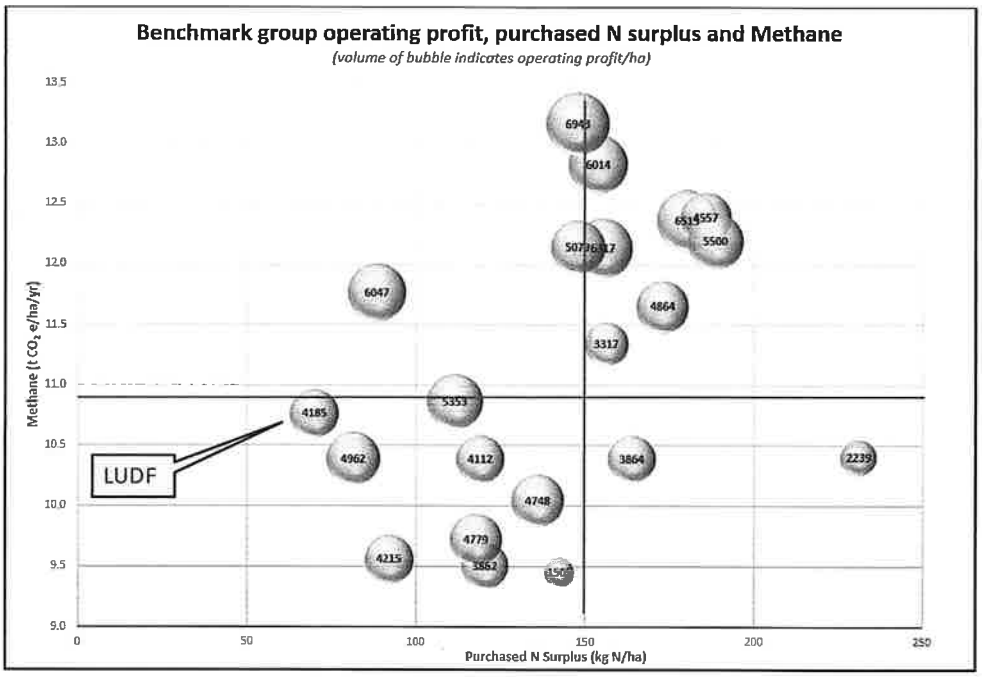


Quick Quiz – Methane

1. If your herd is eating 20t total DM/ha, approximately how much Methane/ha will you generate?
   a) 15.2t/ha CO_2 equiv.
   b) 1,080 kg/ha CO_2 equiv.
   c) 10.8 t/ha CO_2 equiv.
   d) 158kg/ha CO_2 equiv.
   e) Heaps



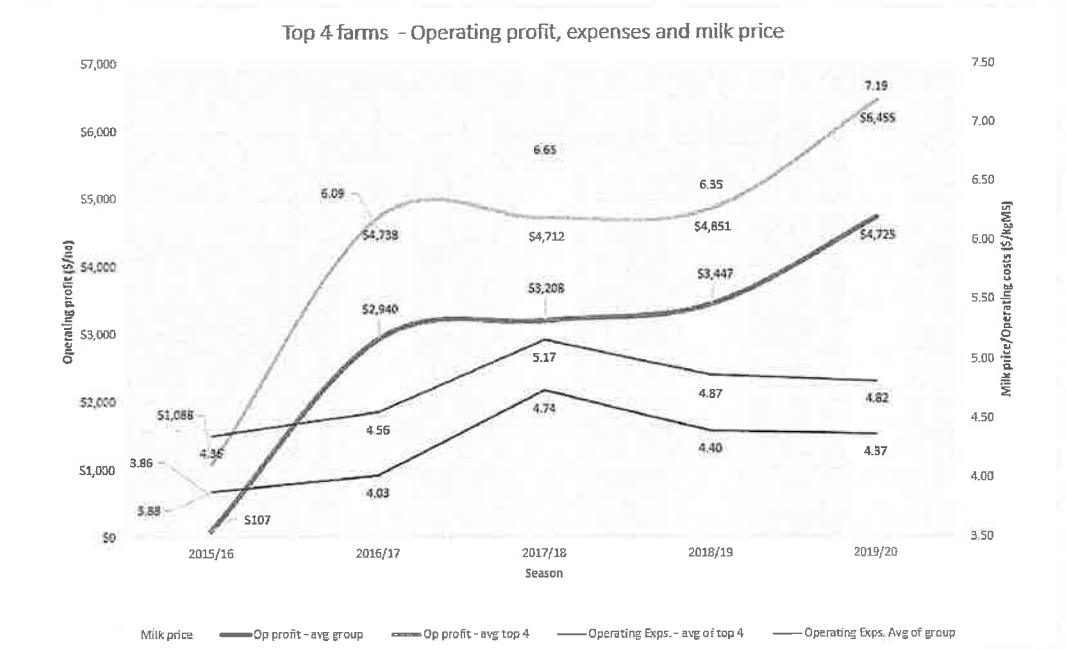




STEP CHANGE

Top 25% of Benchmark farms

Ranked by Operating profit/ha



Return on Assets

Operating return on dairy assets – 2019-20	R.o.A
Top 25% C.B.M.G. farms	9.1% +
Canterbury DairyBase average	6.5%
Southland sharemilker Dairybase average	20.2%
Sample current term deposit rate	0.97%

Top 25% - What do they do?

(compared to benchmark average)

Differently

- Have a 40% higher return on assets
- Generate 31% more profit
- Produce 16% more MS/ha and 8% more MS per cow
- Eat 7% more pasture
- Run operating costs per kgMS 7% lower ($4.41 vs $4.75)
- Have 7% more days in milk (18 days)
- Peak milk 10% higher (2.2 vs 2.0 kgMS/cow/day)
- Burp and fart 11% more Methane per hectare, but 5% less Methane per KgMS

The same

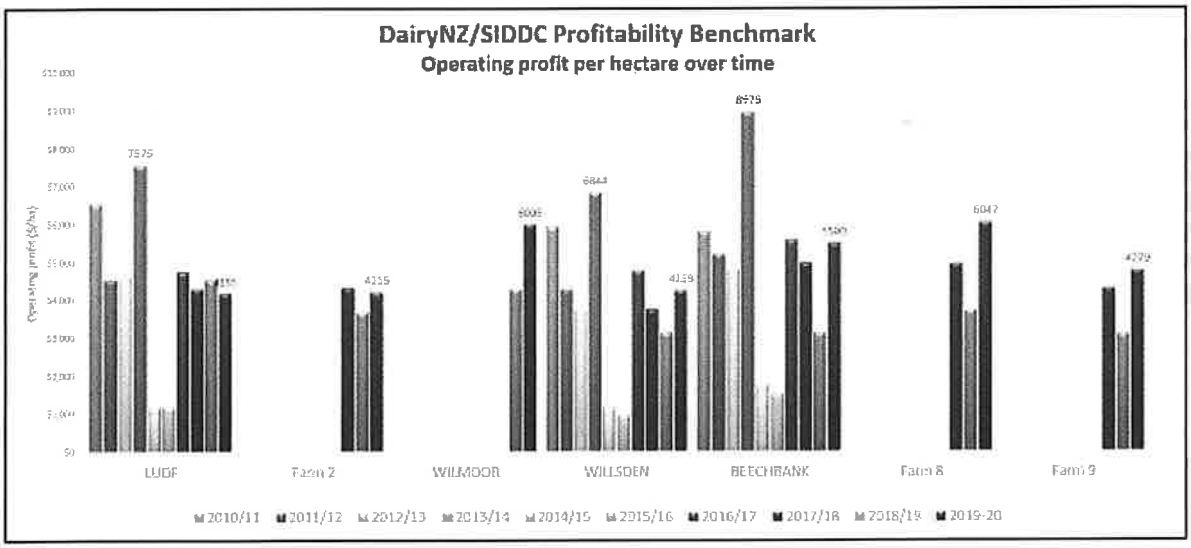
- Apply the same range of N/ha (180 277kg/ha) as the rest
- Have the same average N surplus (145kg/ha)
- Have a similar range of herd and farm size
- Have the usual range of ownership structures from "family business" to "family corporate" to "corporate"

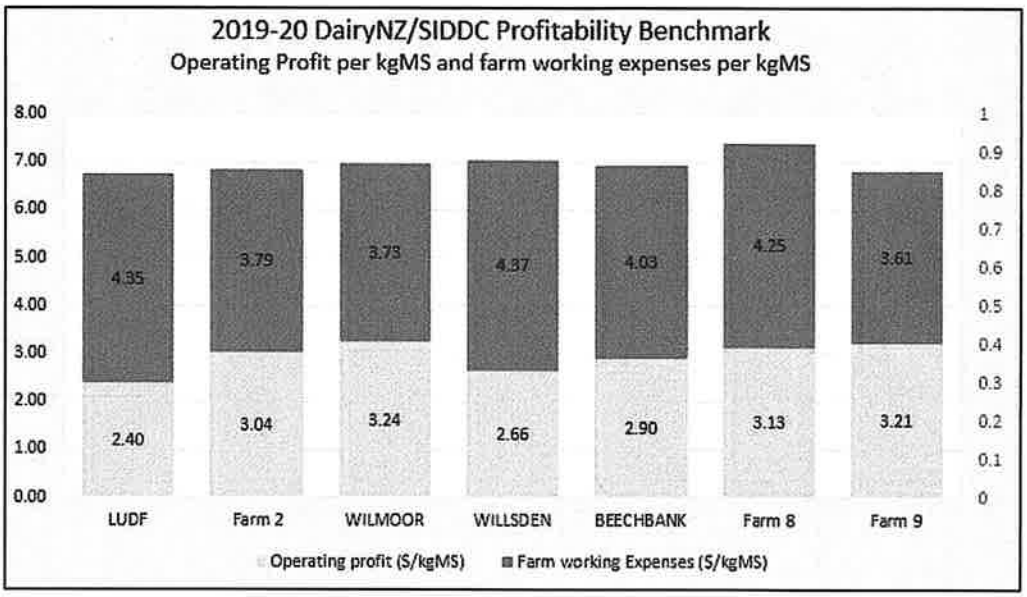
Top 25% - How do they do it?

Common Factors

1. Clear strategy
2. Profit focus
3. Very good people skills
4. Astute, smart, progressive managers
5. Simple, repeatable systems
6. Very good pasture managers who maximise growth and utilisation of home -grown feed first
7. Run tight cost structures
8. They invariably say they are not doing anything special

DairyNZ/SIDDC Profitability benchmark




2019-20 DairyNZ/SIDDC Profitability Benchmark
Operating Profit per kgMS and farm working expenses per kgMS
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4.35
3.79
3.73
4.37
4.03
4.25
3.61
2.40
3.04
3.24
2.66
2.90
3.13
3.21
LUDF
Farm 2
WILMOOR
WILLSDEN
BEECHBANK
Farm 8
Farm 9
Operating profit ($/kgMS)
Farm working Expenses ($/kgMS)

LUDF Re-Grassing Analysis – and Pasture Genetic Improvement

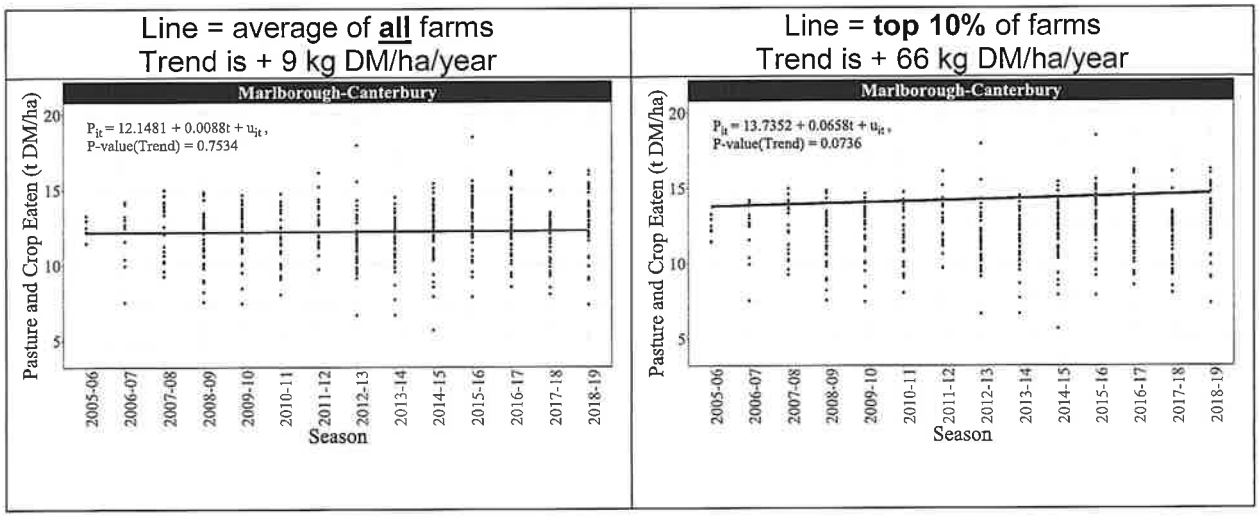
David Chapman, DairyNZ, Lincoln

Context: Trends in pasture eaten

Trends in pasture eaten on dairy farms in the Marlborough/Canterbury region from 2005-06 to 2018-19 are shown in the two graphs below, using DairyBase data. The graph on the left is the average for all of the farms in DairyBase each year (left hand graph), and the graph on the right is for the top 10% of farms.

The trend for the average is dead flat at just over 12 t DM/ha per year. Depending on your point of view, this is either a major worry, or a major opportunity. Top 10% show an upward trend, reaching 2.5 t DM/ha more than the average farms in 2018-19, so the optimistic view is that there is still considerable scope for improvement in our industry. However, the trend for the top 10% is hardly earth-shattering: + 66 kg DM/ha per year from the base of 13.7 t DM/ha per year in 2005-06, which equates to 0.5% per year.

Pasture eaten at LUDF each year is shown along the bottom of the right-hand graph. The overall average pasture eaten for LUDF was 16.1 t DM/ha. This is further evidence for untapped potential on other farms. But the LUDF pasture eaten trend also appears to be flat – ideally, that should still be increasing.



Source: Ryan Mills and Mark Neal, DairyNZ Economics team

The trend for the top 10% farms (+0.5% per year) is less than the potential that is theoretically available from plant breeding gains alone:

> 13.7 t DM/ha/year x 0.7% gain in yield per year of breeding effort = 96 kg DM/ha/year

Reasons?

1. Farmers aren't using new genetics aggressively (value of doing so is not clear?).

and/or

2. Actual gains on farm are much less than indicated by the trial data that produced the 0.7% figure? This is being tested at the moment in DairyNZ systems trials.

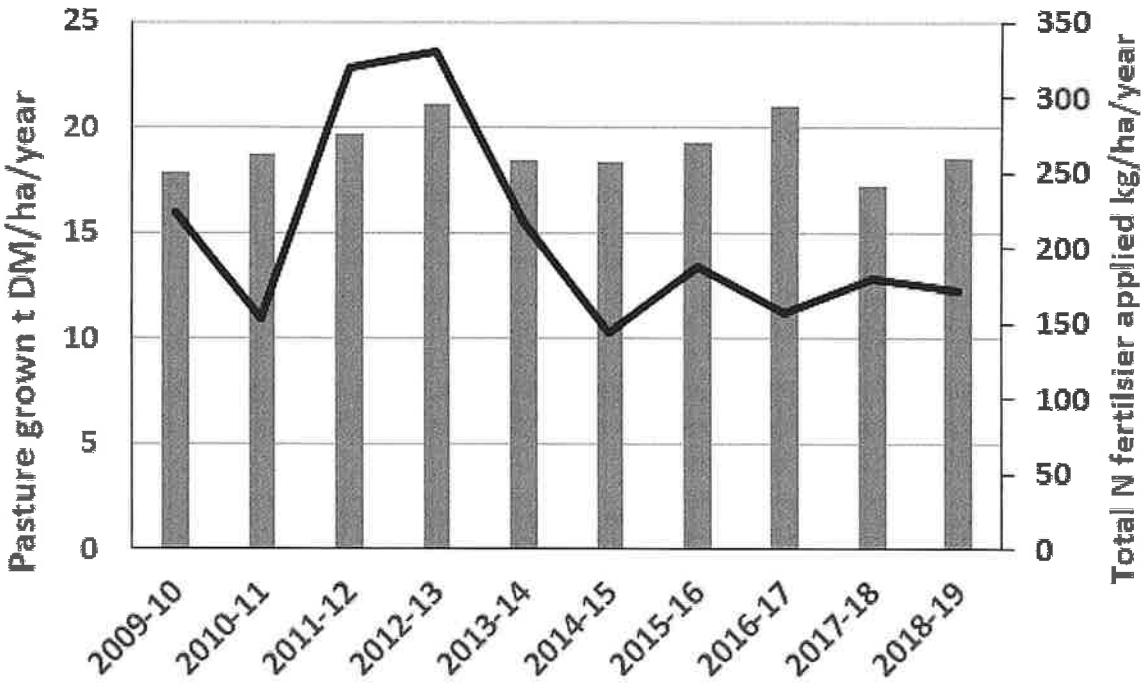
There is value in new plant genetics, but we do not know for sure exactly what that value is, where it's coming from, and how to increase it in the future. These were key reasons for setting up the DairyNZ Forage Value Index (FVI), which estimates that currently perennial ryegrass plant breeding is creating the potential for around $15/ha per year

additional profit on NZ dairy farms. That figure may change as the results of systems trials mentioned under 'reason 2', above, come in.

Pasture grown on LUDF

The graph below shows the average (of 20 paddocks) total pasture DM grown at LUDF between 2009-10 and 2018-19 (in the bars), plus the total amount of N fertiliser used each year (in the line).

The average pasture grown across all years was 19 t DM/ha per year.



Re-grassing at LUDF

Since ~ 2005, there have been 24 re-grassing events on the farm. Details of these are shown in the Table below.

Paddock	Period Regrassed	Grass Cultivar	Paddock	Period Regrassed	Grass Cultivar
N1	Dec-17	Plantain, Shogun	S1	Dec-05	Bealey
N2	Feb-11	Trojan	S2	Dec-10	Troj. Bealey
N3	Nov-12/Sept-13	Shogun/Chicory/Plantain/Troj	S3	Feb-10	Bealey/Arrow
N4	Feb-19	Viscount/Troj/Chicory/Plantain	S4	Dec-13	Bealey/Troj/Chicory/Platain
N5	Dec-11/Aug-13	Shogun	S5	Dec-16	Shogun/Trojan
N6	Apr-14/Sept-16	Shogun (spray/drill)	S6	Dec-14	Shogun/Chi/Plant (spray/drill)
N7	Jan-14	Bealey/Troj/Chicory/Plantain	S7	Nov-15	Base/Troj/Plantain
N8	Jan-13	Bealey/Troj/Chicory/Plantain	S8	Oct-11	Troj. Bealey
N9	Oct-13	Bealey/Troj/Chicory/Plantain	S9	Dec-09	Bealey/Arrow
N10	Jan-12	Tetraploids (FVI trial)	S10	Nov-14	Shogan/Chicory/Plaintain
N11	Nov-07	Bealey	all paddocks also sown with clover		

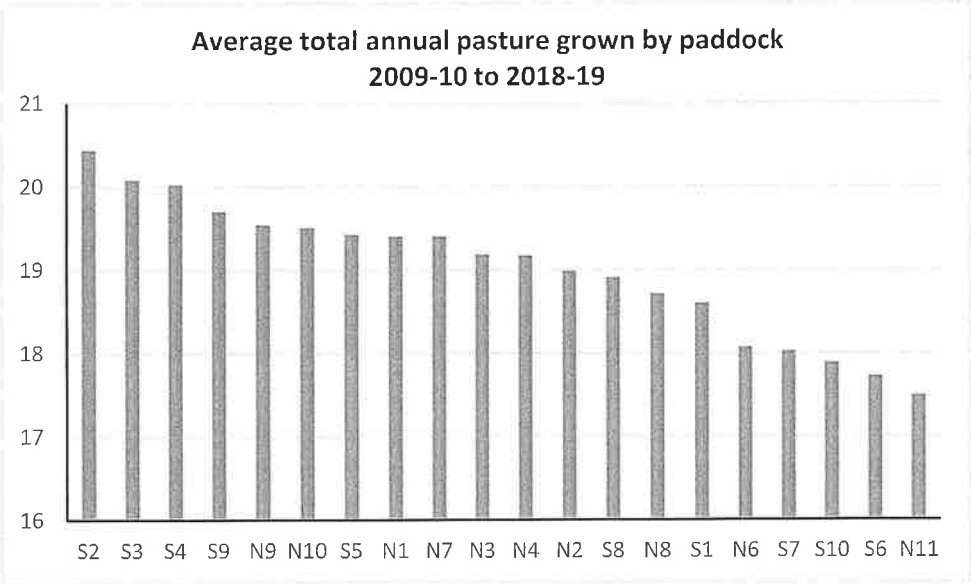
Between 2009-10 and 2012-13, a steady 2 paddocks/year were re-grassed (10% of farm area per year – see graph below). There was a spike of 7 paddocks across 2 years (35% of the farm) in 2013-14 and 2014-15, then re-grassing rates reverted to one or two paddocks per year.

The **rationale** behind the re-grassing policy at LUDF has been to:

- Quantify how much pasture each paddock on the farm is growing each year
- Identify under-performers, with a view to lifting their production
- Identify likely reasons for under-performance; and
- If appropriate (e.g. pasture is run-out and/or open and/or weedy), renew the pasture.

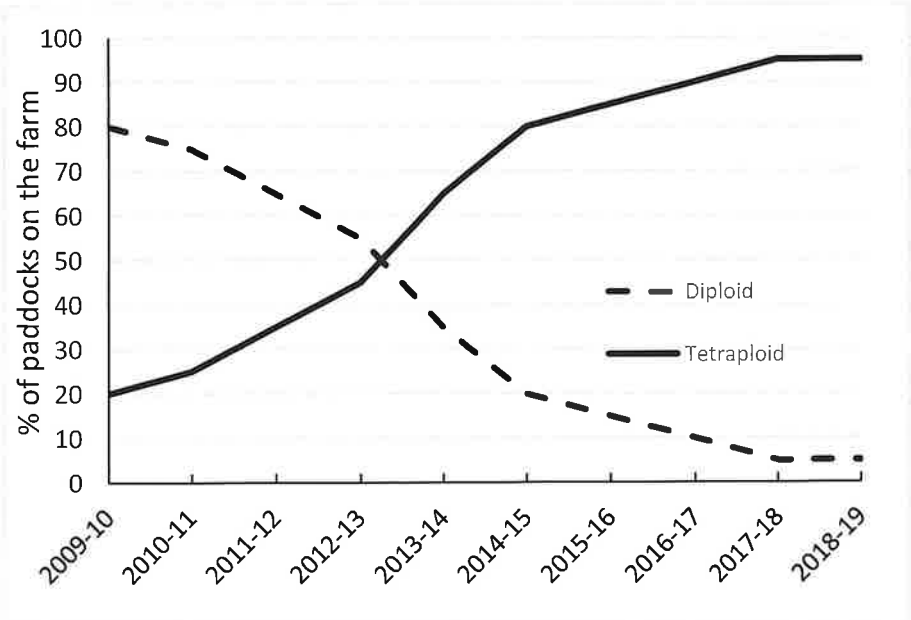
The **overall aim** has been to keep every square metre of LUDF growing as well as possible (Graham Kerr, pers. comm.)

There will still be variation between paddock, but the graph below shows the policy at LUDF has been pretty successful: over ten years, the range in average pasture DM grown per year is about 3 t DM/ha (from 20.5 t in S2 to 17.5 t in N11). Most farms have a much wider range that this.



The **dominant trend** over this period was the inclusion of tetraploids in pasture mixtures. By 2018-19, 95% of paddocks on the farm included some tetraploid ryegrass, almost always in a mixture with a diploid cultivar and often with chicory and plantain.

By 2018-19, there was only one diploid-only paddock left on the farm: N2 (Trojan).



The **main reason** behind this trend was to utilise the better palatability of tetraploids to help consistently achieve target post-grazing residuals. This became particularly important after 2014-15 when the farm moved to lower rates of N fertiliser and longer grazing rounds which tended to increase pre-grazing pasture covers – and therefore the risk of not hitting residuals.

Pasture growth benefits from re-grassing.

For all re-grassing events between 2009-10 and 2018-19, farm walk data from Pasture Coach were analysed for every grazing for every paddock to calculate **pasture grown** per hectare per year in the year in which the paddock was re-sown, and for up to 5 years after sowing.

Paddocks that were re-grassed after the end of the 2014-15 season were excluded because they only provided data for 1 to 3 years post-sowing – not long enough to establish the trend. This left a total of 15 re-grassing events to analyse: not a lot, but enough to get a picture of the response in pasture grown in those paddocks ***compared to the average grown for the whole farm in the same years.***

Key results are shown in the Table below.

Note, the minus and plus values are for the re-sown paddocks ***relative to the average of all paddocks across the farm in the same production year.***

Year 0 (Year of sowing)	**Total change** in DM grown /ha over:		**Average change** in DM grown/ha	
	Years 1-3	Years 1-5	Years 1-3	Years 1-5
-2.6	+2.5	+5.5	+0.8	+1.1

In the year of sowing, paddocks that were re-grassed grew 2.6 t DM/ha less than the farm average. Some of that 2.6 t DM was due to the paddock being out for cultivation and re-sowing for 6-8 weeks.

For the 5 years following sowing, DM grown increased by about 1.1 t DM/ha per year relative to the farm average, or 5.5 t DM/ha in total over those five years. Thus, referring back to the Manhattan graph, re-sown paddocks would have moved to the far left of the graph, at or near the top of the pack. There was a lot of variation between paddocks and years in these responses. But these numbers are a reasonable guide to what to expect.

Paddocks S2, S3 and S4, which had the highest overall average pasture grown for the farm in down-town Manhattan, were sown in 2010, 2010 and 2013 respectively, and obviously maintained high productivity thereafter. The Pasture Coach data show these paddocks grew a total of +10.9, +5.8 and +7.7 t DM relative to the farm average over the five years post-sowing. These look to be the serious over-achievers on the farm.

Financials

The direct cost of re-grassing at LUDF is estimated to be about $1,080 per hectare (Graham Kerr pers. comm.). A simple margin analysis using a rough average $ value per tonne DM of $320 (Forage Value Index) applied to the + 5.5. t DM/ha over five years (table above) suggests re-grassing is returning about $680/ha, or ~ $135/ha per year.

However, ***the key benefit of re-grassing at LUDF has been to help maintain a good supply of relatively cheap home-grown feed that enables the system to maintain high and consistent milk production and profit.*** This is the context in which financial benefits should be considered. The benefits will be greater for a farm utilising a lot of grass and turning that grass into milk efficiently. LUDF clearly falls in that category. Conversely, the benefit would be less for a farm with lower pasture utilisation, or for a farm transitioning to higher production, e.g. by increasing stocking rate, where more of the extra DM grown would be converted directly into additional milk.

The other way to look at it is, if LUDF had not re-grassed those 15 paddocks between ~ 2009 and 2014, then the farm would be faced with finding another ~ 115 t DM of feed in total per year to maintain the current system settings. The alternative would be to drop cow numbers and/or production and (most likely) profit.

Plant genetics

What we can't tease out from the LUDF data is the contribution of improved plant genetics to the story.

Interestingly, the over-achieving paddocks noted above (S2, S3 and S4) were all sown to Bealey, which is no longer commercially available – but was obviously a good performer on this property.

There are often unique features of a farm that we don't fully understand that match well with a particular cultivar(s) – even if that cultivar isn't among the highest-ranked (5-star band) in the FVI. Genetics is only part of the story.

Over time, however, we should expect to see higher productivity coming through from improved plant genetics. Looping back to the graphs at the start of these notes, currently we aren't seeing a strong signal.

The DairyNZ FVI, and the associated relationship that has been developed between DairyNZ and the plant breeding companies via the NZ Plant Breeding Research Association, is the industry initiative / response to the 'opportunity' to drive more productivity through plant breeding. This is a long game, given the 10+ year time frames required for cultivar development through to commercial release.

Choosing a grass

Graham Kerr, Barenbrug

Summary

- There are many ways to farm, including what species and cultivars you choose. Decide on your strategy and seek help to develop a pasture plan for your operation.
- Over 95% of proprietary seed sales in NZ are ryegrass, as it is quick and easy to establish, easy to graze and managed well grows a lot of high ME feed.
- **Perennial ryegrass** remains 'King' in NZ dairy systems. But there are advantages of greater tetraploid perennial ryegrass use.
- **Italian/annual ryegrasses** provide great short term feed, with extra cool season growth.
- **Hybrid ryegrass** sit between Italians and perennials, where your plan needs 2-5 year options.
- The DairyNZ FVI is a great starting place to look at ryegrass cultivar performance.

Ryegrass species

There is no perfect ryegrass species! There is a trade-off between persistence versus cool season growth and establishment speed as shown in the table below, along with examples of a few (of the many) cultivars available.

Increasing persistence →

Italian or annual	**Hybrid**	**Tetraploid perennial**	**Diploid: Tetraploid perennial mix**	**Diploid perennial**	**Persistent perennial: cocksfoot**
Hogan *Tabu+* *Winter star* *Asset*	*Shogun* *Forge* *Mohaka*	*Viscount* *Base*	*E.g. Maxsyn: Viscount*	*Maxsyn* *Trojan* *One50* *Platform*	*E.g. Rohan: Safin*
↑ cool season growth ↑ establishment speed		↑ cow intake over diploid perennial		↑ persistence ↑ density	

Perennial ryegrass remains the main choice for NZ dairy systems in Canterbury as it has better persistence, so needs less resowing, than shorter term options.

Our main 'go to' has been diploid perennial ryegrass, which we normally sow seed at around 20kg/ha, with about 4kg/ha of white clover seed, to produce a good all round pasture.

The persistent perennial: cocksfoot mix on the right of the table is not for irrigated dairy farms, as it won't provide the performance of some of the other options. But for a dryland block where persistence is the key requirement, these type of cultivars fit well.

Opportunity for tetraploid perennials

There is significant potential to change our pasture systems in Canterbury, to better improve our environmental footprint through reducing N leaching and production of greenhouse gases.

The LUDF has shown this is possible, through reducing cow numbers, N fertiliser applied, and associated per cow costs, while increasing MS/cow production and feed conversion efficiency. This has meant a different system, with similar profitability, summarised below.

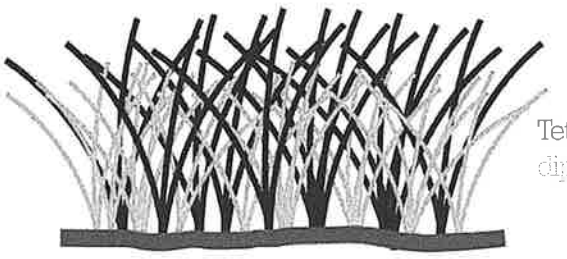
LUDF 10 years ago - 325 kgN/ha/year (45 leached)	**LUDF now - 170 kgN/ha/year (27 leached)**
631 cows 474 kgMS/cow Cows at peak eat = 19 kgDM/day	555 cows 505 kgMS/cow Cows at peak eat = 20 kgDM/day
	4 day longer round (1.7 less grazings) Higher pre-grazing 3400
	Higher allowance = harder pasture management = tetraploids help.

The current LUDF system is running higher farm covers (and higher pre-graze covers) which is growing an estimated extra 1.1 t DM/ha/year, a significant efficiency gain.

The downside of the current LUDF system is that pasture management needs to be on the ball. Surpluses happen more quickly, so a weekly farm walk is a key part of monitoring and responding quickly to growth rate changes.

The use of diploid: tetraploid perennial ryegrass mixes is a key part of the success at LUDF for several factors:

1. Tetraploid perennial ryegrasses are more palatable, with softer leaves. This is important as it greatly helps get the extra 1-2 kgDM/cow/day you need for greater per cow MS production.
2. They have a longer grazing window, as their stems stay soft at higher covers. In practice a diploid ryegrass can start to get "chewy" at the base to cows when cover is ≥3200 kgDM/ha (lower if the pasture has a high old grass or weed content), whereas for a tetraploid perennial cows will still eat well up to 3400-3500 kgDM/ha.
3. Tetraploid ryegrasses have higher feed value, with research showing they can improve MS production by 5-10%.



Pre-grazing
Tetraploid plants (dark green) & diploid (light green) are mixed up.

Post-grazing
Tougher diploid stems help protect tetraploid plants from over-grazing.

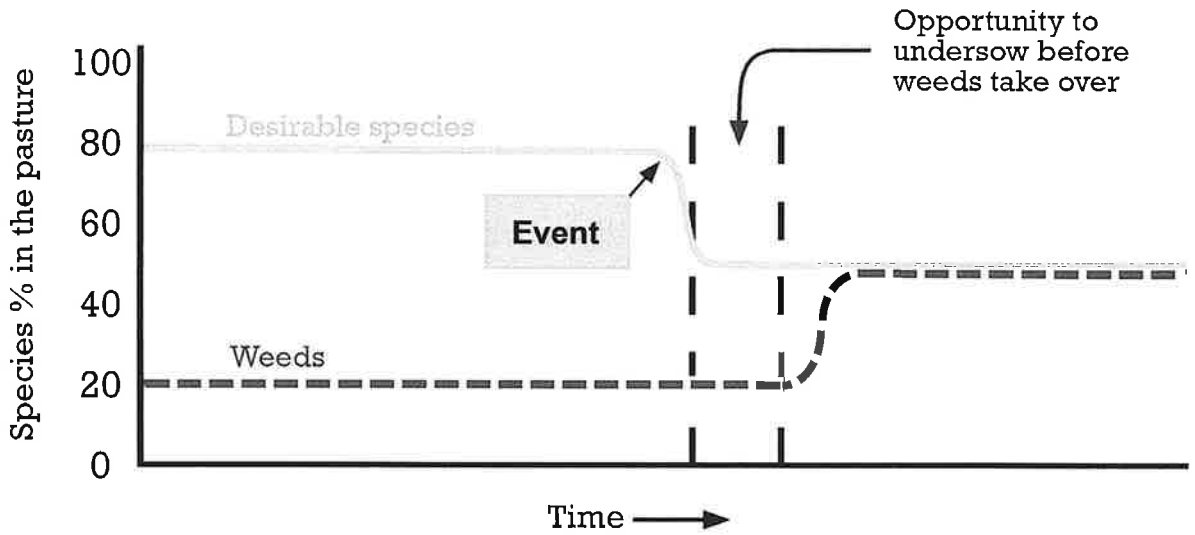
The diploid : tetraploid perennial mix (sown at about 10 kg/ha of diploid ryegrass seed, 15kg/ha of tetraploid ryegrass seed as it is larger, plus 4 kg/ha of white clover) has shown better persistence over sowing just tetraploid ryegrass, for the reasons shown above.

Italian and annual ryegrass

Have a good place in a pasture renewal programme, where a 6-18 month pasture is needed.

If you look at the data, the Italian ryegrass cultivars pretty much always establish faster and outgrow the annual ryegrasses. Italian ryegrass would be our starting point for a recommendation. Annual ryegrasses are typically sold as they are cheaper.

The fast establishment of Italian ryegrass is particularly useful where undersowing, for example after spring pugging damage, as it is a race between you and the weeds to fill the empty ground.



Where catch crops need to be sown by 1 October following autumn or winter grazed crops, Italian ryegrass mixed with oats is also showing some good advantages in producing high bulk of early feed, plus good regrowth for further grazing or silage.

Hybrid ryegrass

Also have a good fit in a pasture renewal programme, where an 18 month – 5 year pasture is needed. The hybrid ryegrass cultivars vary a lot in type, but the good ones establish faster and have better cool season growth than perennial ryegrass, so make them a strong proposition for sowing over this time period.

DairyNZ FVI ryegrass data

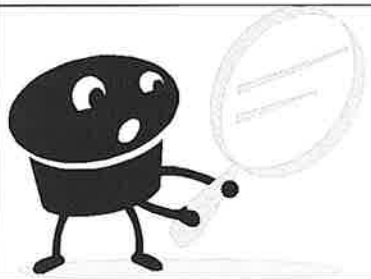
We are lucky now to have the DairyNZ Forage Value Index (FVI) to present independent rankings on cultivar performance. This is a great starting point for short-listing cultivars based on their DM yield, and seasonal growth (rated 1-5) available at https://www.dairynz.co.nz/ In addition extra information such as tiller density can be found in the data presented by reputable seed companies.

Welcome to Balmaghie Farm.

The farm is a fully operational, commercial dairy farm with a number of potential hazards for both visitors and staff. Many of the potential hazards cannot be eliminated while also providing access to visitors therefore all staff and visitors MUST watch for potential hazards and act with caution.

Hazard Summary: Look, think, act.

The following chart provides a reminder of the types of hazards at Balmaghie. Watch for these and any other hazards that may be on farm today.

People: • Uninformed / ill prepared visitors may be the greatest risk	**Animals:** • **You are in their space**	**Milking shed:** • Moving rotary platform • Confined animals • Chemicals
Eyes / Ears: • Water / oil / milk / chemical splashes • Welding flashes • Loud machinery		**Touch:** • Hot / cold surfaces, hot water, chemical burns • Electric fences – treat them as high voltage power sources
On farm machinery and tools • Chainsaws, hand tools etc. generate noise, fragments	**Potential slips / trips:** • Uneven surfaces occur across the farm • Fences • Drains • Underpass • Effluent pond	**Vehicles:** • Contractors and farm equipment – **act as though they can't see you** – keep out of their way • Centre Pivot takes precedence over your plan

ARE YOU TRAINED FOR WHAT YOU ARE ABOUT TO DO? If not, STOP.
If you are uncertain how you should act or proceed, stop and contact the farm manager, other farm staff or your host.

By entering this farm, you are acknowledging your receipt of this hazard summary, and your agreement to take personal responsibility to watch out for potential hazards, and act in such a manner as to protect yourself and any others also on-farm.