SIDDC
South Island Dairying Development Centre

LINCOLN UNIVERSITY DAIRY FARM

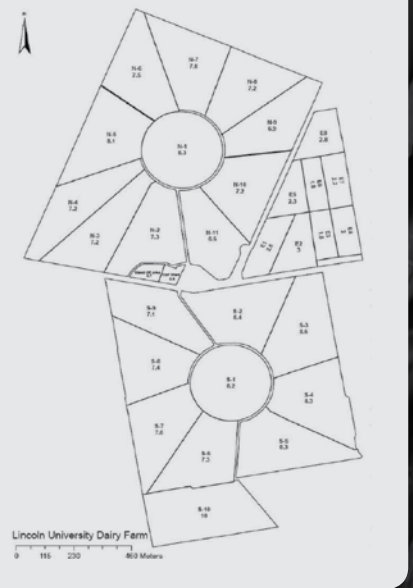
FOCUS DAY
FEBRUARY 2018

STAFF

Peter Hancox	– Farm Manager
Sean Collins	– 2IC
Erica Taylor	– Dairy Assistant
Charlotte Munnik	– Dairy Assistant

LUDF 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
5. Underpass may be slippery



Partners Networking To Advance South Island Dairying

Lincoln University
Te Whare Wānaka o Aoraki
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Plant & Food RESEARCH
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INTRODUCTION

The LUDF is a progressive farming development facility that is committed to advancing dairy farming practice across the South Island, with particular consideration to productivity and environmental sustainability. Formerly the University sheep farm, the converted 186 hectare Dairy Farm is an excellent cross section of the various soil types evident across the Canterbury Plains. The property, of which 160 hectares is the milking platform, is irrigated using a spray system that includes two centre pivots, small portable lateral sprinklers and k-lines.

STAGE 1: 2001/2 AND 2002/3

The farm initially wintered approximately 630 cows, peak milking just over 600 and producing about 1400kgMS/ha from 200kgN/ha and up to 550kg DM/cow of imported feed. The milk payout (income) in 2002/3 was $4.10/kgMS.

STAGE 2: 2003/4 THROUGH TO 2010/11

During this period the primary development was the increase of the stocking rate to between 4 and 4.3 cows per ha. 654-683 cows peak milked and as a result production averaged 1700kgMS/ha and 411kgMS/cow. LUDF ran a single herd during stage two, to allow us to focus primarily on simple systems, and low and consistent grazing residuals.

STAGE 3: 2011/12 TO 2013/14

The further development of LUDF during stage 3 was a move into 'Precision Dairying', resulting from the implementation of the strategic objective (below). This stage focused on minimum standards, two herds were run to increase productivity and profitiability, from a similar environmental impact. Production lifted to 1878kgMS/ha or 477kgMS/cow (630 cows). A change in farm practice was initiated in 2013/14, with the temporary suspension of Eco-n (DCD), in an attempt to hold nitrogen losses without the mitigation effect of Eco-n.

STAGE 4: CURRENT

LUDF is adopting a 'Nil-Infrastructure, low input' farm system emerging from the P21 (Pastoral 21) research programme, in partial response to the tightening environmental requirements of some catchments across NZ. Targeted milk production is 1750kgMS/ha or 500kgMS/cow from 3.5 cows/ha with up to 150kgN/ha and 300kgDM/cow imported supplement.

LUDF STRATEGIC OBJECTIVE:

To maximise sustainable profit embracing the whole farm system through increasing productivity;

- without increasing the farm's total environmental footprint;
- while operating within definable and acceptable animal welfare targets; and
- remaining relevant to Canterbury (and South Island) dairy farmers by demonstrating practices achievable by leading and progressive farmers.
- LUDF is to accept a higher level of risk (than may be acceptable to many farmers) in the initial or transition phase of this project.

ADDITIONAL OBJECTIVES

1. To develop and demonstrate world-best practice pasture based dairy farming systems and to transfer them to dairy farms throughout the South Island.

2. To ensure optimal use of all nutrients on farm, including effluent, fertiliser, nutrients imported from supplements and atmospheric nitrogen; through storage where necessary, distribution according to plant needs and retention in the root zone.

3. To manage pastures and grazing so per hectare energy production is optimised and milkers consume as much metabolisable energy [ME] as practicable (within the constraints of the current system and the associated nutrient losses).

4. To optimize the use of the farm automation systems and demonstrate / document improved efficiencies and subsequent effect on the business.

5. To achieve industry targets for mating performance within a 10 week mating period, including a 6 week in-calf rate of 78% and 10 week in calf rate greater than 89% i.e. empty rate of less than 11%.

6. To actively seek labour productivity gains through adoption of technologies and practices that reduce labour requirements or makes the work environment more satisfying.

7. To assist Lincoln University to attract top quality domestic and international students into the New Zealand dairy industry.

ONGOING RESEARCH

- The effect of farm management on groundwater and nutrient losses. (includes 10 groundwater monitoring wells, 60 lysimeters and 6 drainage plots to monitor and manage the effect of fertiliser, grazing, irrigation and effluent inputs over a variety of contrasting soil types.
- Pasture growth rates, pests and weeds monitoring, including a Forage Value Index paddock scale cultivar trial.
- Winter cropping effects on subsequent cow and calf performance.
- Yield mapping of pastures across the season
- Native Plantings – biodiversity effects
- Resource Inventory and Greenhouse Gas Footprint

CLIMATE

Mean Annual Maximum Temperature **32° C**
Mean Annual Minimum Temperature **4° C**

Average Days of Screen Frost
36 Days per annum

Mean Average Bright Sunshine
2040 Hours per annum

Average Annual Rainfall **666 mm**

SOIL TYPES

Free-draining shallow stony soils (Eyre soils) **5**
Deep sandy soils (Paparua and Templeton soils) **45**
Imperfectly drained soils (Wakanui soils) **30**
Heavy, poorly-drained soils (Temuka soils) **20**

FARM AREA

Milking Platform **160 ha**
Runoff [East Block] **15 ha**
Unproductive land on platform **6.7ha**

SOIL TEST RESULTS AND FERTILISER APPLICATIONS

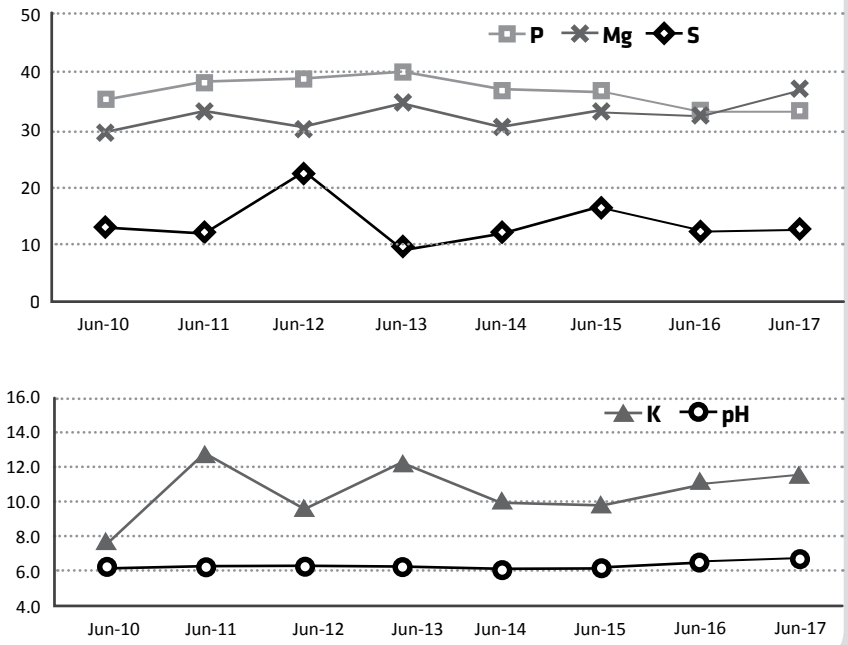
Target Soil Test Ranges:

pH: **5.8 – 6.2** P: **30 – 40** K: **5 – 8**
S: **10 – 12** Mg: **20+**

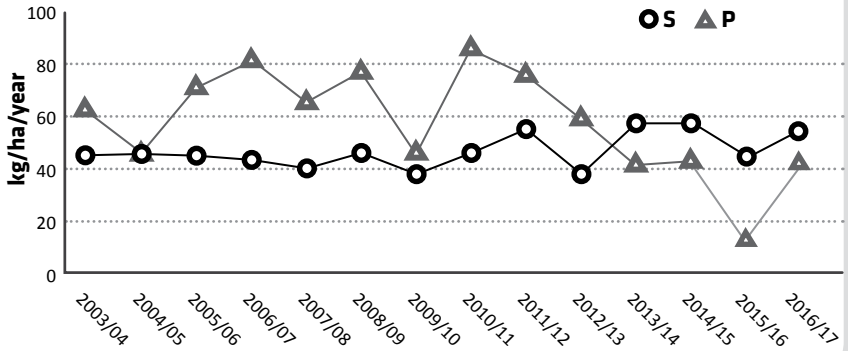
PASTURE

The milking platform was sown at conversion [March 2001] in a mix of 50/50 Bronsyn/ Impact ryegrasses with Aran and Sustain white clovers, and 1kg/ha of Timothy.

WHOLE FARM AVERAGE SOIL TEST RESULTS



WHOLE FARM AVERAGE P AND S APPLICATIONS 2003/04 - 2016/17



Paddock	Period Regrassed	Grass Cultivar
N1	Dec-17	Plantain, Shogun
N2	Feb-11	Trojan
N3	Nov-12/Sept-13	Shogun/Chicory/Plantain/Troj
N4	Feb-15	Base/Troj/Chicory/Plantain
N5	Dec-11/Aug-13	Shogun
N6	Apr-14/Sept-16	Shogun (spray/drill)
N7	Jan-14	Bealey/Troj/Chicory/Plantain
N8	Jan-13	Bealey/Troj/Chicory/Plantain
N9	Oct-13	Bealey/Troj/Chicory/Plantain
N10	Jan-12	Tetraploids (FVI trial)
N11	Nov-07	Bealey

Paddock	Period Regrassed	Grass Cultivar
S1	Dec-05	Bealey
S2	Dec-10	Troj. Bealey
S3	Feb-10	Bealey/Arrow
S4	Dec-13	Bealey/Troj/Chicory/Plantain
S5	Dec-16	Shogan/Bealey
S6	Dec-14	Shogan/Chi/Plant (spray/drill)
S7	Nov-15	Base/Troj/Plantain
S8	Oct-11	Troj. Bealey
S9	Dec-09	Bealey/Arrow
S10	Nov-14	Shogan/Chicory/Plantain
All paddocks also sown with clover		

STAFFING AND MANAGEMENT

Roster System – 8 days on 2 off, 8 days on 3 off
Milking Times – cups on 5.00am / 2.30pm

IRRIGATION AND EFFLUENT SYSTEM

Centre-pivots	127 ha
Long Laterals	24 ha
K-Lines	10 ha
Irrigation System Capacity	5.5 mm/day
Length of basic pivot	402
Well depth	90m

A full rotation completed in 20.8 hours for 5.5 mm [at 100% of maximum speed].

- Average Annual Rainfall = 666 mm. Average irrigation input applies an additional 450 mm.
- Average Evapotranspiration for Lincoln is 870 mm/year.

EFFLUENT

- Sump capable of holding 33,000 litres and a 300,000 litre enviro saucer.
- 100 mm PVC pipe to base of North Block centre pivot, distribution through pot spray applicators.

MATING PROGRAMME – SPRING 2017

Yearling heifers - AI mated for 10 days, then PG & continue AI. Daughter Proven Kiwi XX. Follow with bulls, total 9 weeks mating.

MA cows – sexed semen for 1 week prior to normal PSM. 3 weeks Forward Pack Premier Sires then Short Gestation Dairy and natural mating weeks 7-9.

Heifers to start calving 2 weeks prior normal start mating.

HERD DETAILS – OCT 2017

Breeding Worth (rel %) 101 / 46
Production Worth (rel%) 121 / 63
Recorded Ancestry 99%

Average weight / cow
Herd monitored walk over weighing
454 kg [Oct 2017]

Calving start date 2017
Heifers 14 July, Herd 1 August

Est. Median calving date
12 August 2017

Mating start date
25 October 2016 (heifers 15 days earlier)

Empty rate (nil induction policy) after 10 weeks mating - 15% (2016-17 mating). 6 week in-calf rate 63%.

	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Total kg/MS supplied	278,560	261,423	273,605	262,112	297,740	300,484	276,019	278,654	289,906	286,189
Average kg/MS/cow	409	384	415	391	471	477	440	498	522	516
Average kg/MS/ha	1,744	1,634	1,710	1,638	1,861	1,878	1,725	1742	1812	1789
Farm working expenses /kgMS	$3.37	$3.88	$3.38	$3.86	$3.91	$3.84	$4.28	$3.87	$3.47	3.76
Dairy operating profit/ha	$8,284	$2,004	$4,696	$6,721	$4,553	$4,665	$7,578	$1200	$1182	$4728
Payout (excl. levy) $/kg (Milk price + div)	$7.87	$5.25	$6.37	$7.80	$6.30	$6.12	$8.50	$4.60	$4.30	$6.52
Return on assets	14.6%	4.8%	7%	7%	6%	6%	10%	1.6%	1.6%	6.5%
1 July cow numbers	704	704	685	694	665	650	650	580	578	580
Max. cows milked	680	683	660	669	632	630	628	560	555	554
Days in milk	263	254	266	271	272	273	259	263	267	270
Stocking rate cow equiv./ha	4.2	4.3	4.13	4.18	3.95	3.94	3.92	3.5	3.47	3.62
Stocking rate Kg liveweight/ha	2,058	2,107	1,941	1914	1860	1878	1872	1680	1724	1700
Grazing off - Dry Cows (tDM/ha)	546/9	547/7	570/9	652/8.4	650/9.8	650/9.8	650/11.4	580/10.7	3.5	3.2
No. yearlings grazed - On/Off	0/171	0/200	0/160	0/166	0/141	0/138	0/140	0/126	0/126	0/133
No. calves grazed - On/Off	0/200	0/170	0/160	0/194	0/190	0/156	0/150	0/126	0/155	0/150
Past eaten (dairybase) (tDM/ha)	17.9	17.2	16.2	16.9	17.3	16.8	14.9	15.7	16.6	16.0
Purch. Suppl - fed (kgDM/cow)	415	342	259	463	359	434	506.8	300	126	397
Made on dairy/platform (kgDM/cow)	95	64	144	160	154	93	0	40	277	104
Applied N/160 eff. Ha	164	200	185	256	340	351	252	143	179	173

SIDDC
South Island Dairying Development Centre
T: 03 423 0022
E: office@siddc.org.nz
W: www.siddc.org.nz

Contents

Future use of dry cow products – what's the latest?

Jane Lacy-Hulbert PhD, BSc (Hons)
Technical Developer (SmartSAMM), Senior Scientist (Animals), ***DairyNZ***

1. There is growing pressure to reduce use of antibiotics in agriculture.

Concerns about antimicrobial resistance in human health are leading to a change in the way that antimicrobials are used for food-producing animals. Dairy industries in The Netherlands and the UK are changing the way that antibiotic dry cow products are used, moving from a whole herd or "blanket" approach back to the a more selective, or targeted, approach.

DairyNZ is looking at ways to support farmers to reduce reliance on antibiotic dry cow products, and at the same time, sustain good animal health and milk quality.

2. Protecting cows at dry off is effective

In winter 2015, a study on two herds in Southland compared the effectiveness of different types of treatments at dry off, compared to no treatment, for preventing and treatment of mastitis during the dry period.

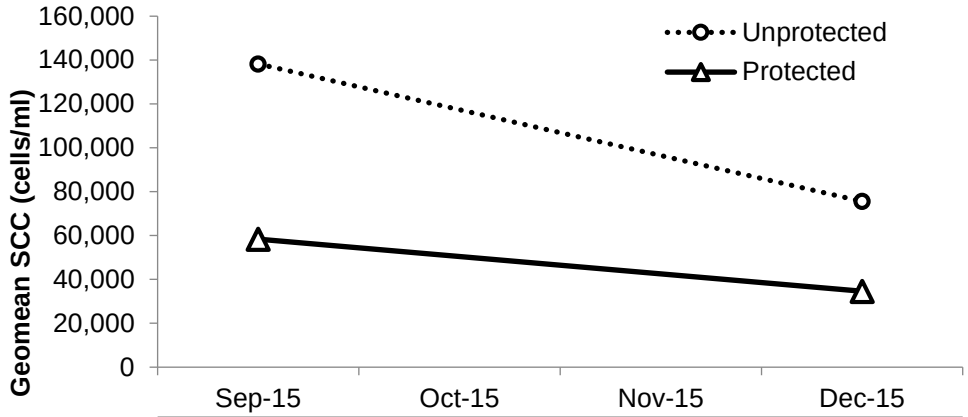
We found that

- As expected, cows that received no protection at dry off had a higher rate of clinical mastitis and subclinical infections at calving, and a higher SCC in the next lactation, compared to cows that received antibiotic dry cow treatment (DCT), internal teat sealant only (ITS) or a combination of the two.
- For low SCC cows, the level of protection afforded by ITS was similar to DCT alone or a combination of DCT and ITS.

Table 1. Outcomes for low SCC cows that received no protection at dry off or received protection.

Outcome:	Unit	Unprotected cows	Protected cows
Clinical mastitis			
Dry period	% cows enrolled	4.4	0 – 1.0
Post calving, first 30d	% cows calved	11.7	3.4 – 4.4
New intramammary infections			
Dry off to 1d post calving			
CNS		19.3	2.8 – 9.9
Strep. uberis	% cows calved	19.8	0.7 – 3.4
All pathogens		50.6	5.1 – 15.1
Dry off to 2-4d post calving			
CNS		26.2	3.2 – 9.8
Strep. uberis	% cows calved	4.2	0.3 – 0.7
All pathogens		46.2	5.2 – 12.3

Figure1. Average SCC at first 2 herd tests for previously low SCC cows that received no protection at dry off or received protection.



	Sep-15	Dec-15
Unprotected	138,229	75,596
Protected	58,357	34,624

3. Internal teat sealant provides effective protection

In winter 2017, a DairyNZ study across 36 herds tested the process by which we select cows for treatment at dry off, as well as the efficacy of treating cows with internal teat sealant only. Across 80 cows per herd, and 1800 in total, the prevalence of intramammary infections by different pathogens at dry off was determined. The efficacy of internal teat sealant to prevent clinical mastitis was also tested across 50 low SCC (<200,000 cells/ml) cows per herd, and 1500 cows in total.

We found that:

1. Prevalence of major pathogens infections at dry off was low. About 12% of quarters (30% cows) were infected with any bacteria at dry off and only 2.4% of quarters (7.5% cows) were infected with a major pathogen.
2. In the absence of culture, cow SCC was the best way to identify cows infected with major pathogens. The cut-point, or threshold, was not affected by cow age or herd.
3. The last herd test was as predictive of infection status as multiple herd tests, and a herd test in the last 80 days of lactation was equally predictive.
4. The rate of clinical mastitis in cows treated with internal teat sealant was low, with about 1% of cows treated with teat sealant being reported with clinical mastitis.

Prepare your system – improve prevention during lactation

As we move closer to 2020, prepare your herd for less reliance on antibiotic dry cow therapy. An aspirational goal has been set by NZVA, that by 2020, antibiotics at the end of lactation (dry cow therapy) will only be used in cows that are likely to be infected.

Talk to your vet about the best way to prepare your herd for this change. Make sure that people who administer treatments this autumn are properly trained in aseptic technique. Refer to ***Healthy Udder*** for reminders on this technique.

LUDF Farm System Overview:

Strategic Objective

To maximise sustainable profit embracing the whole farm system through:

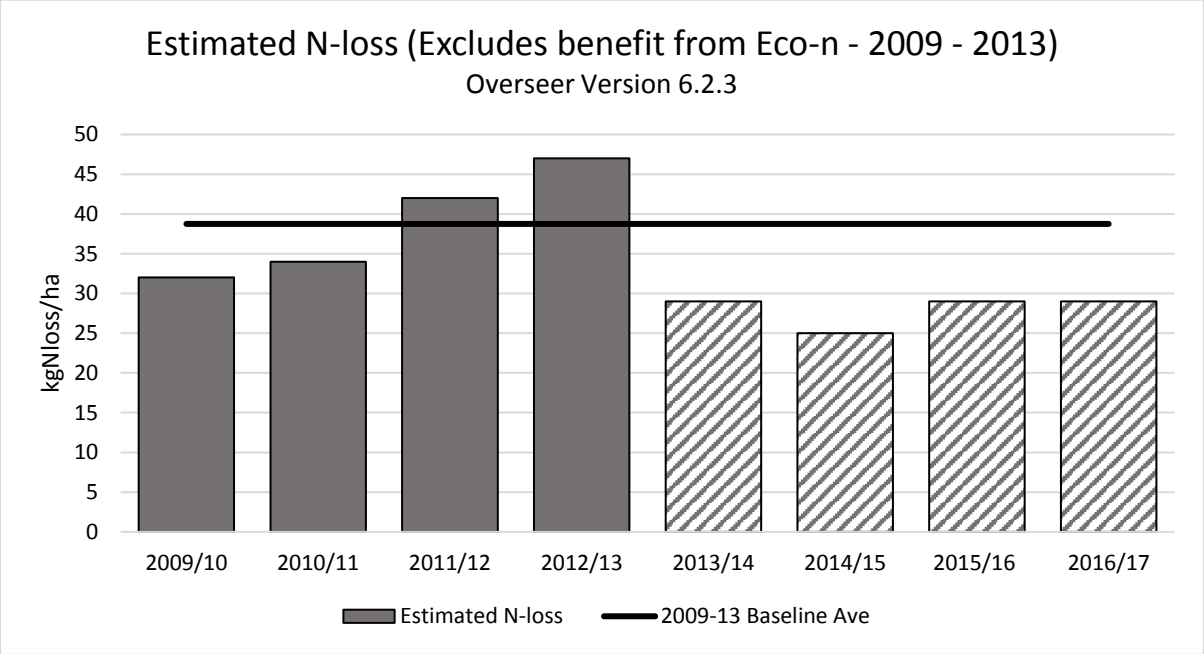
- *increasing productivity;*
- *without increasing the farm's total environmental footprint;*
- *while operating within definable and acceptable animal welfare targets; and*
- *remaining relevant to Canterbury (and South Island) dairy farmers by demonstrating practices achievable by leading and progressive farmers.*
- *LUDF is to accept a higher level of risk (than may be acceptable to many farmers) in the initial or transition phase of this project.*

To achieve the above objectives, and considering the changing environmental regulations to reduce nutrient losses, LUDF has since the beginning of the 2014/15 season adopted and scaled up research emerging from the P21 Phase 2 programme. This research (jointly funded by the Ministry of Business, Innovation and Employment, DairyNZ, Fonterra, Beef + Lamb New Zealand and the Dairy Companies Association of New Zealand) identified a "low input, highly productive farming system" that reduced nutrient losses while maintaining profitability when estimated against the LUDF data at the time.

Following three years implementing (and refining) this system, the farm has achieved over 25% less nitrogen leached (as estimated with Overseer) and largely has achieved the same profitability, if adjusted for payout, as the farm was previously generating.

	Ave 11/12 - 13/14	**Ave 14/15 - 16/17**
Peak cows milked	**631**	**557**
Stocking Rate	**3.9**	**3.5**
Total kgMS sold	291414	284916
Per Cow Milk Production	463	512
Milk Production /ha	1821	1781
Total N fert applied kgN/ha	313	165
Total Imported Silage Fed tDM	273	153
Total Imported Silage Fed / peak cows (kgDM/cow)	433	274
Dec Lwt	475	490
kgMS/kg LWT	97%	104%
Farm Working Expenses	4.01	3.70

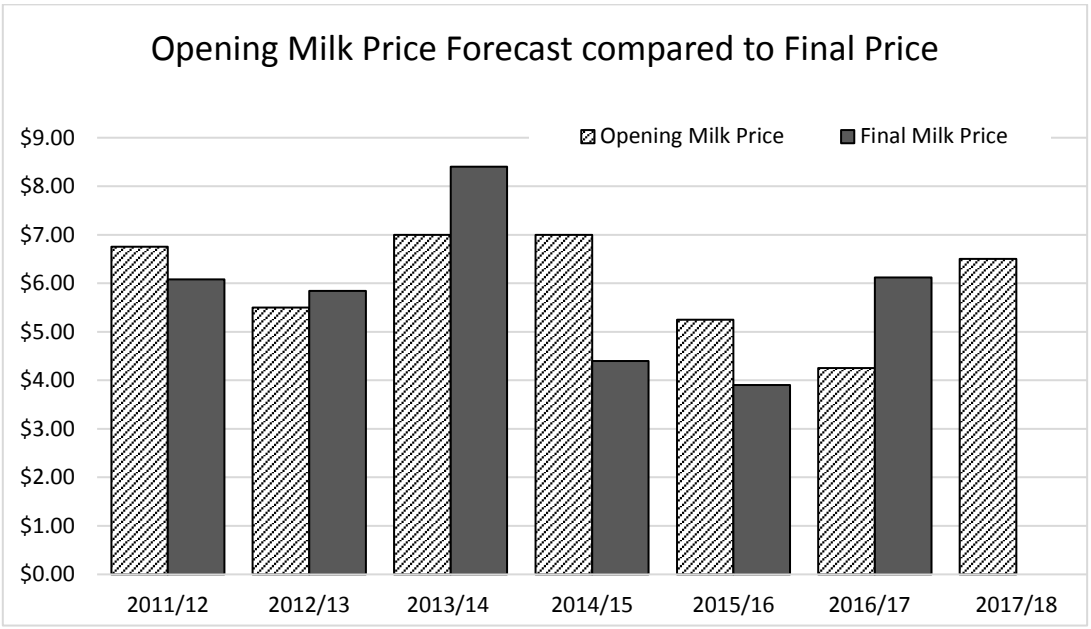
As seen in the summary of results above, LUDF has reduced its imported feed and N-fertiliser use, and through better matching of its stocking rate to feed supply, largely maintaining profitability. Estimated N-losses from Overseer® are shown below.



Results to date (to the end of January 2018):

	2013/14	2014/15	2015/16	2016/17	2017/18
Total kgMS sold	197000	184000	190000	188000	166455
Total Cows in Milk (vat)	620	549	548	544	553
Total N fert applied (kgN/ha)	184	100	129	125	139
Total Silage Fed / peak cows (kgDM/cow)	460	141	114	55	194
Total Silage Fed tDM	290 tDM	79 tDM	64 tDM	31 tDM	107 tDM
Whole Herd Average Liveweight (WOW)	482 kg	493 kg	497 kg	494 kg	475 kg
Herd Ave CS (mid Jan)	4.2	4.2	4.3	4.3	4.3
Silage made on farm (tonnes DM)	0	22	125	58	49
Silage made on farm (kgDM/cow)	0	40	223	104	88

Farm Profitability: Milk Price



The Milk price (per kilogram milk solids) remains a key driver of farm profitability. Volatility in milk prices in recent years has reinforced the need to run an efficient farm system that can accommodate lower milk income while still capitalising on higher milk prices. It is useful to also keep in mind the variability that has occurred in recent years between the opening milk price and the final milk price.

2017-18 Budget:

The budget was developed in Autumn 2017 with a conservative milk price (at the time) of $6.00/kgMS + 30 cents /share dividend income. It was prepared on the basis of seeking to maintain the long term productivity of the farm in relation to soil fertility, herd quality and pasture performance. Similarly R&M was budgeted on the basis of maintaining the farms assets, noting the farm uses a calculated regular replacement policy for items like motorbikes that have been previously shown to incur little R&M in the first 2 years, but increasing costs and decreasing trade-in values in subsequent seasons.

Production was budgeted at just over 295,000kgMS, based on past production from 560 cows with limited bought in grass silage and nitrogen fertiliser, but with the addition of some fodderbeet to feed in the autumn.

Dividend income is calculated on the assumption the farm holds one share for each kilogram milk supplied for the season.

Budgeted expenses were $1,114,105, up $38,000 from last year's actual expenses, while budgeted production was also up nearly 9000kgMS, based on increased use of fodderbeet and thus autumn milk production. This results in budgeted farm working expenses of $3.77/kgMS.

Expenses to date and year end forecast:

Year ending May 31		2016/17 Actual	2017/18 Budget	Actual to end Jan	Budget to End Jan	Variance (Act—budg)	Forecast - YE (act + rem bdg)	Notes
Milk production (kgMS)		286,189	295,181	168,242	192,500	-24,258	272,000	
160ha		1789 /ha	1845 /ha			0	1,700	
Peak Cow Nos and Prod.		555	560	554	560			
Income	Payout $/kgMS	$6.12	$6.00	$6.40	$6.40	0		
	Dividend /share	0.40/share	0.30/share	0.35/share	0.35/share	0		
	Milksolid Revenue	$1,751,477	$1,771,086	$1,076,749	$1,232,000	-155,251	1,740,800	1
	Dividend	$114,476	$88,554	$58,885	$67,375	-8,490	95,200	2
	Surplus dairy stock	$127,290	$112,961	$61,404	$33,060	28,344	141,304	3
DairyNZ Levy		-$10,303	-$10,627	-$6,057	-$6,930	873	-9,786	
Stock Purchases		-33,900	-24,000	-33,000	-24,000	-9,000	-33,000	4
Gross Farm Revenue		**1,949,039**	**1,937,975**	**1,157,981**	**1,301,505**	-$143,524	**1,934,518**	
Expenses								
Cow Costs	Animal Health	$74,535	$62,304	$45,767	$40,448	$5,319	$60,735	5
	Breeding Expenses	$43,546	$47,634	$46,519	$42,139	$4,380	$48,500	6
	Replace. grazing & meal	$144,462	$143,504	$98,663	$90,890	$7,773	$151,004	7
	Winter grazing - incl. freight	$152,769	$159,575	$149,212	$153,203	-$3,991	$159,712	8
Feed	Grass silage purch.	$74,849	$74,928	$59,212	$43,771	$15,441	$89,212	9
	Silage making on farm	$6,926	$18,240	$5,832	$16,320	-$10,488	$5,832	10
	Giberillic Acid	$0	$6,560	$0	$6,560	-$6,560	$0	11
	Nitrogen	$38,597	$48,470	$29,029	$37,082	-$8,053	$36,129	12
	Fertiliser & Lime	$32,343	$26,240	$30,648	$25,257	$5,391	$30,648	13
	Irrigation - All Costs	$82,017	$83,600	$46,421	$55,257	-$8,836	$71,421	14
	Re-grassing	$11,762	$20,215	$10,540	$20,215	-$9,675	$13,540	15
Staff	(net of housing)	$248,264	$255,429	$158,296	$164,812	-$6,516	$246,372	16
Land	Electricity-farm	$28,011	$30,000	$18,080	$18,800	-$720	$30,000	
	Administration	$25,035	$24,700	$12,775	$14,384	-$1,609	$23,090	
	Rates & Insurance	$21,020	$21,020	$0	$0	$0	$21,020	
	Repairs & Maintenance	$61,297	$50,000	$24,320	$38,315	-$13,995	$43,320	17
	Shed Expenses excl. power	$8,685	$9,850	$7,443	$9,472	-$2,029	$9,850	
	Vehicle Expenses	$21,184	$31,336	$13,514	$24,939	-$11,425	$16,192	18
	Weed & Pest	$1,223	$500	$0	$500	-$500	$500	
Cash Farm Work Expenses		**1,076,525**	**1,114,105**	**$756,271**	**$802,364**	-$54,593	**1,057,077**	19
FWE/kgMS		**$3.76**	**$3.77**				**$3.89**	
Depreciation est.		$116,000	$116,000					
Total Operating Expenses		1,192,525	1,230,105	$756,271	$802,364	-$54,593		
Dairy Operating Profit		$756,514	$707,870					
DOP/ha		**$4,728**	**$4,424**					
Cash Operating Surplus		$872,514	$823,870					
Cash Operat. Surplus /ha		**$5,453**	**$5,149**					

Notes to Expenses to date and Year End Forecast:

1. Effect of less milk production.
2. Effect of less milk production (LUDF assumes one share is held for every kilogram MS produced for dividend comparisons).
3. Higher prices received.
4. Incorrectly budgeted stock purchases (bulls).
5. Includes CS monthly - $3500 to date.
6. More AI, less Bull costs.
7. $7500 more on milk powder.
8. Reduction in August grazing but plan for light cows off in May.
9. 300kgDM/cow purchased to date, forecast further 180kgDM/cow.
10. Less silage made on platform.
11. Not used in the spring.
12. Lower N price.
13. More maintenance fert (based soil tests).
14. RM has not incurred costs as budgeted but left pivot inoperable for too much of early season.
15. Regrassing 5% farm not 10%, may do some undersowing in the autumn.
16. Gap in employment of permanent staff.
17. Less maintenance than budgeted.
18. Less fuel, lower costs with new ute and bikes.
19. Overall, the farm expects to operate with lower FWE than initially budgeted, helping to offset the lower production and resulting in forecast FWE of $3.89/kgMS.

Sensitivity to Production

Note also the year end forecast remains very sensitive to production:

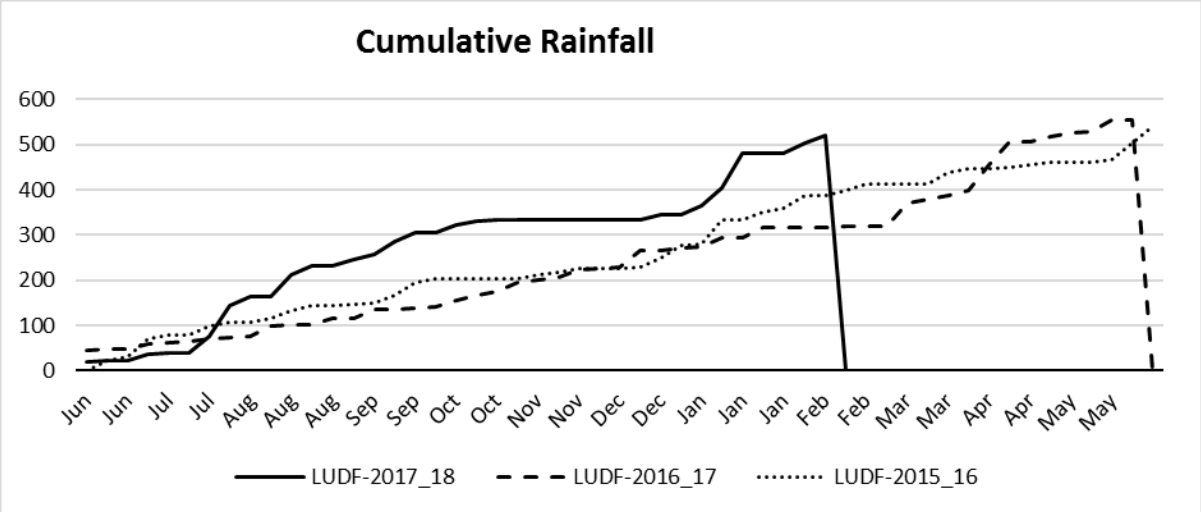
Total Milk Production	**265,663**	**280,422**	**295,181**
Variance in production	-10%	-5%	(as budgeted)
Total Forecast Expenses	$1,057,077	$1,057,077	$1,057,077
Milk Production /cow	474	501	527
Expenses /kgMS	$3.98	$3.77	$3.58

Forecast Year End Milk Production is currently 272,000 kgMS, 8% below budget.

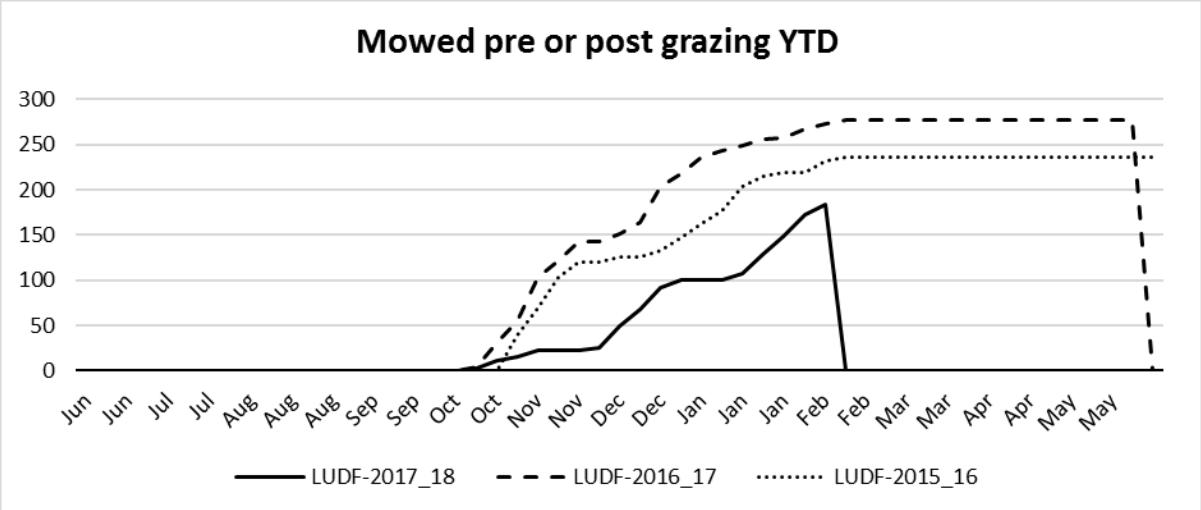
LUDF - Overview of Season-to-date

The 2017-2018 season has been characterized by unusual weather patterns, with a very wet start to calving, followed by very hot and dry days with intermittent rainfall events. This has caused challenges in terms of maintaining pasture quality and cows having the best environment for milk production.

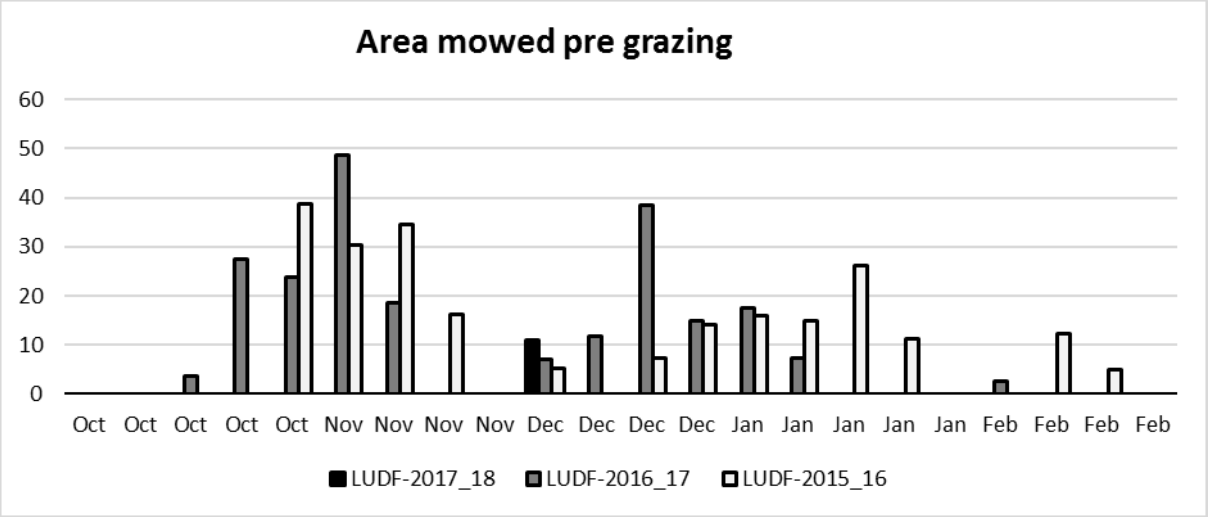
In terms of pasture management, utilisation during the first round of grazing was a challenge. Very wet grazing conditions meant that areas allocated were at times larger than the Spring Rotation Planner allowed and residuals were not achieved in most paddocks. Adding to this mix, a few of the paddocks were damaged with pugging, which were later heavy rolled and stitched with new pastures (about 10 hectares were over-drilled across the farm).

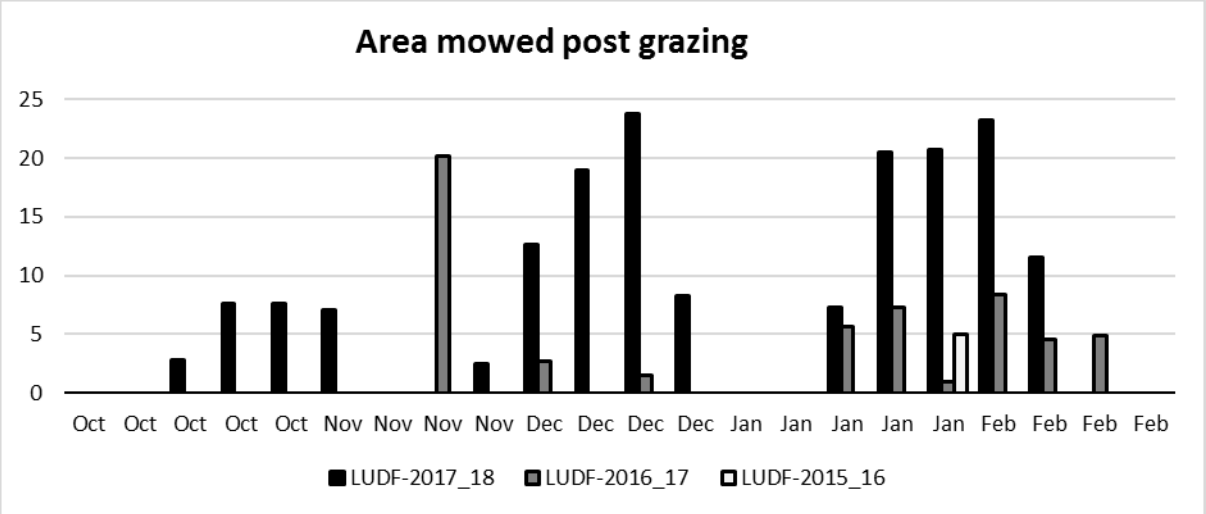


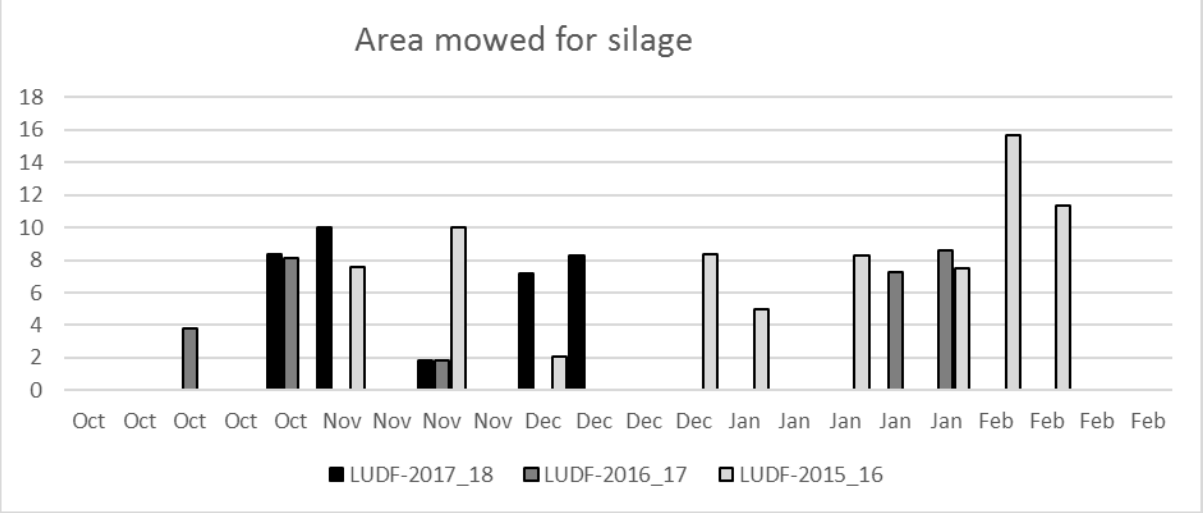
Maintaining high quality pasture to the base of the sward was a consistent challenge after the first grazing, with some paddocks unable to be tidied up for the next couple of grazings due to intermittent rainfall events. These paddocks were managed with the harvesting of some silage (with early surpluses) and by mowing post-grazing rather than pre-grazing when conditions allowed this. The graphs below show the difference between pre and post grazing mowing management this season compared to both season's previous.



The season's weather patterns has also contributed to the reduction in the total amount of mowing on farm this season (whether pre or post grazing).

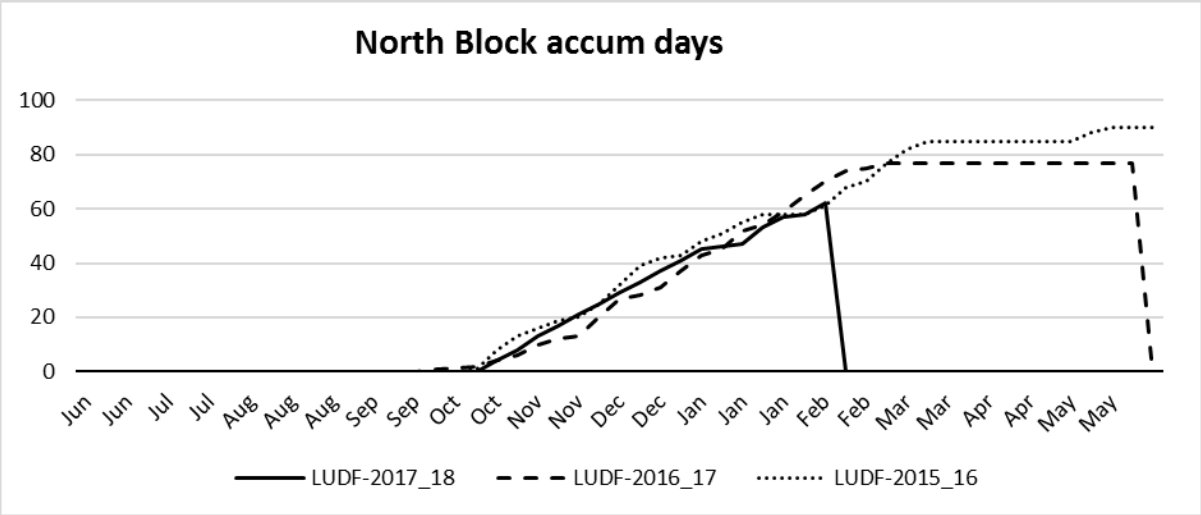




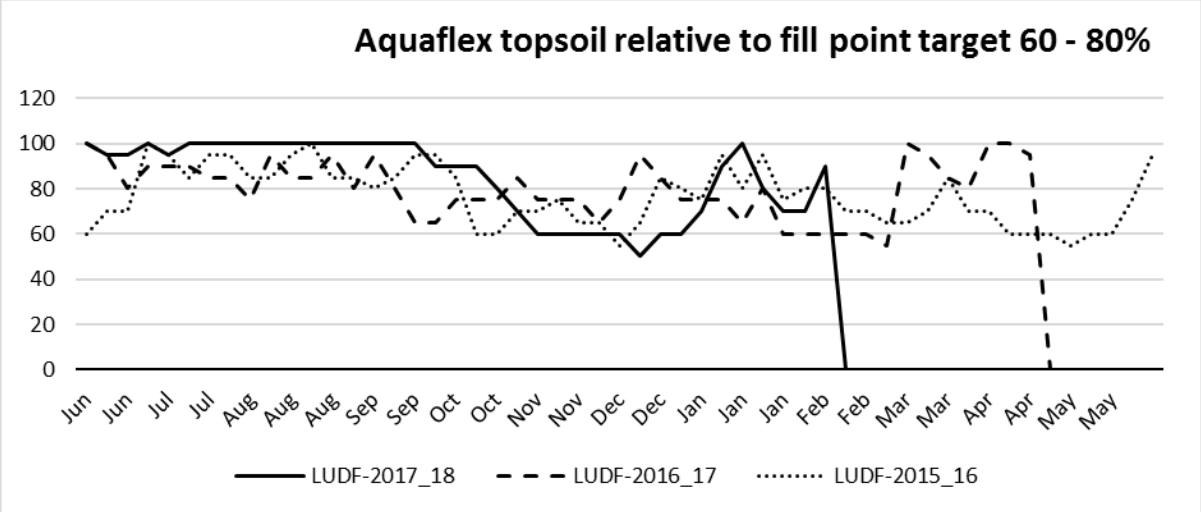


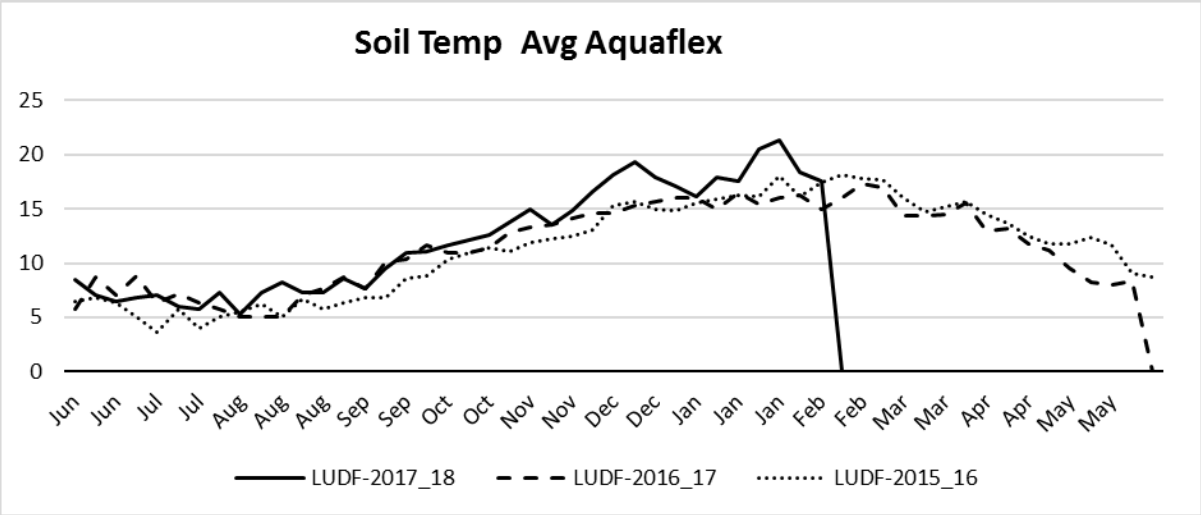
Total silage harvested remains below past years - an effect of the lower overall growth this season.

Irrigation in the north block has been a challenge through the first half of the season with ongoing technical malfunctions causing the pivot to stop (going out on “safety”).

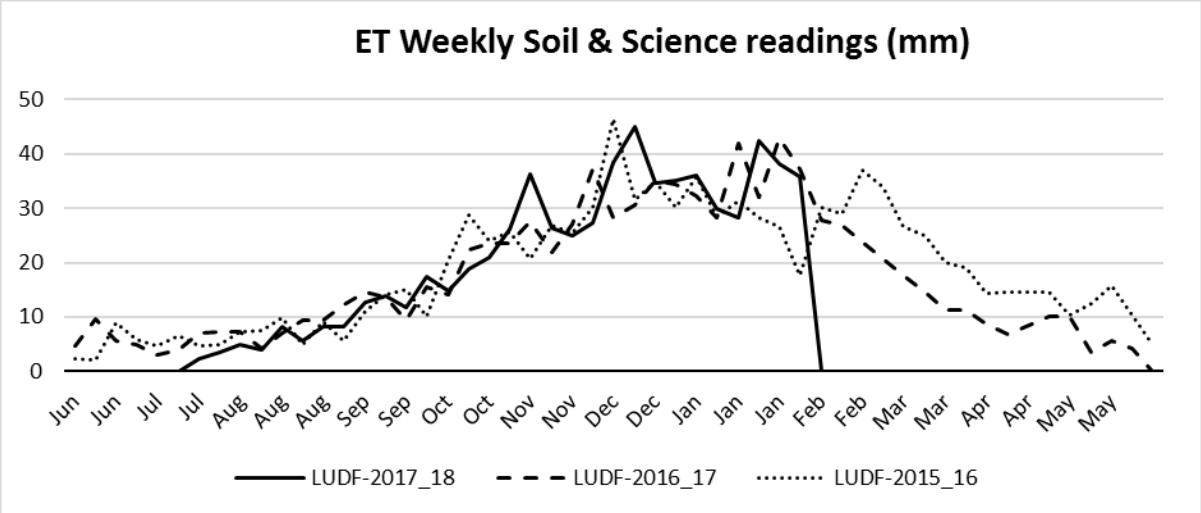


The graphs below shows clearly how the high temperatures, intense sunshine and inoperability of the north pivot resulting in topsoil moisture levels dropping below the target range of 60-80% soil moisture during November and December. Welcome rain in January enabled the farm to return to target soil moisture levels.



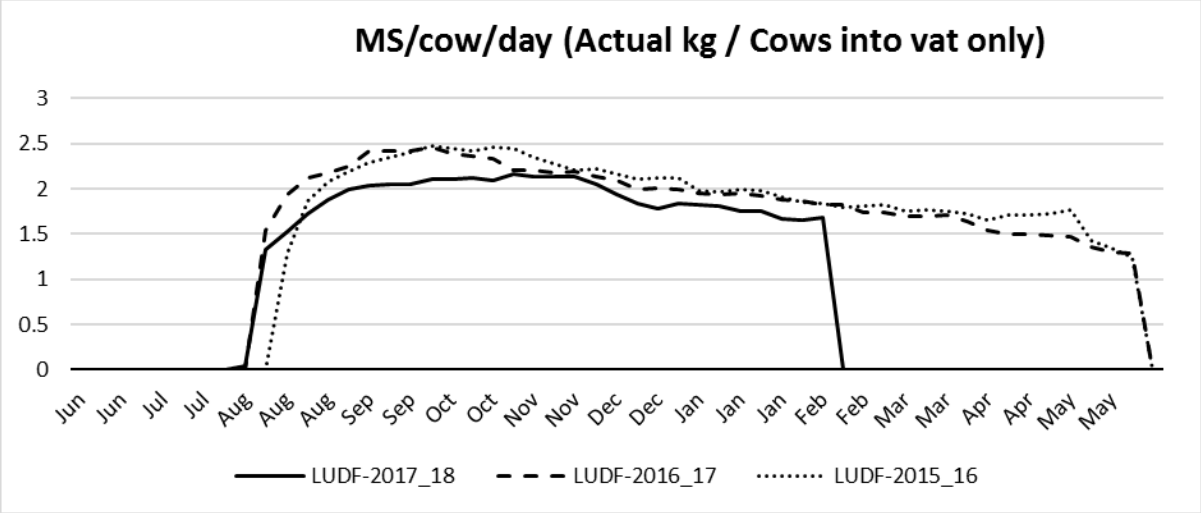


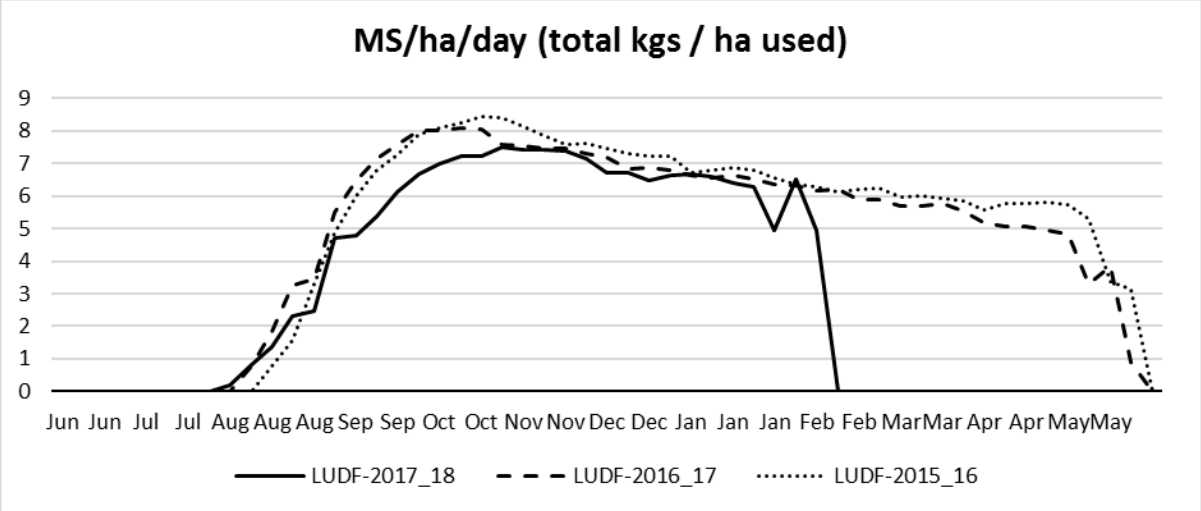
The high soil temperatures reported above are in part the result of much higher night time temperatures this summer. Higher night time temperatures and high daytime temperatures increased evapotranspiration (ET) rates as plants needed more soil moisture. LUDF typically applies up-to 35mm irrigation water / week (in applications of 5mm/day) so cannot hold soil moisture levels when ET is above 35mm/week.

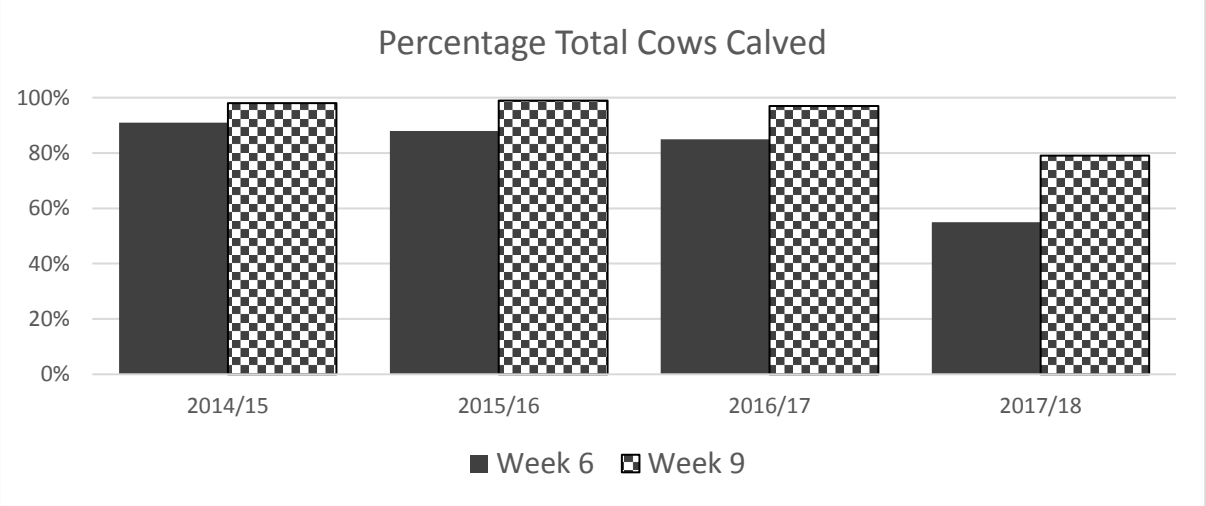


The temperatures experienced also resulted in cows changing their grazing behaviour during the heat of the day. Cows were more often choosing not to graze, standing by the troughs and in some cases bothered by flies as well as the heat.

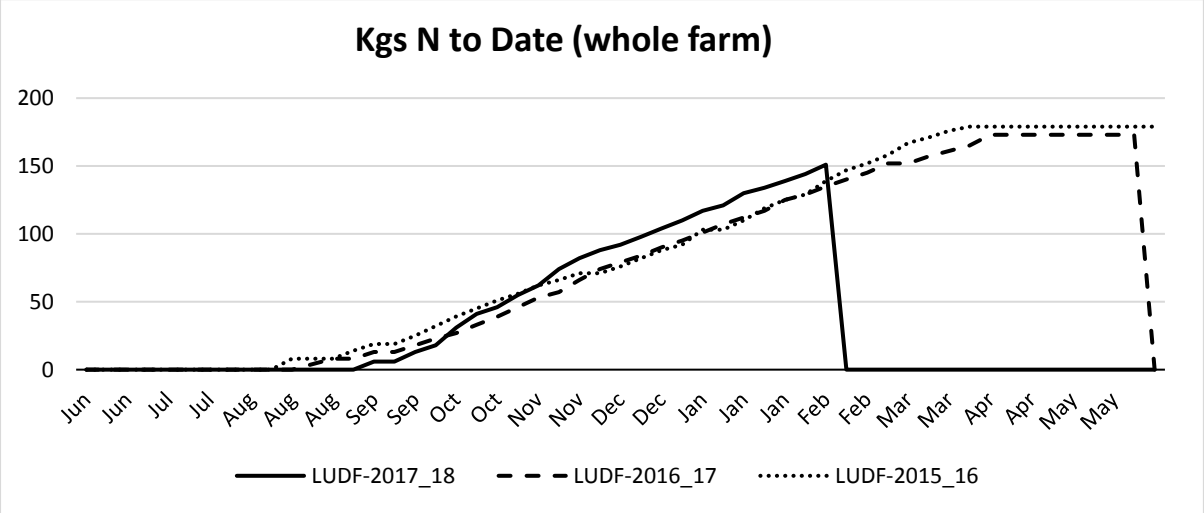
Together with the challenging start to the season and the slower calving spread (see below), it has therefore been difficult to maintain target milk production this season. Clearly cows did not peak as they have in past seasons (see October focus day notes) and dropped significantly at 2 points in November and December - coinciding with the hot weather.


MS/cow/day (Actual kg / Cows into vat only)
3
2.5
2
1.5
1
0.5
0
Jun Jun Jul Jul Aug Aug Aug Sep Sep Oct Oct Nov Nov Dec Dec Jan Jan Jan Feb Feb Mar Mar Apr Apr May May
LUDF-2017_18
LUDF-2016_17
LUDF-2015_16


MS/ha/day (total kgs / ha used)
9
8
7
6
5
4
3
2
1
0
Jun Jun Jul Jul Aug Aug Aug Sep Sep Oct Oct Nov Nov Dec Dec Jan Jan Jan Feb Feb Mar Mar Apr Apr May May
LUDF-2017_18
LUDF-2016_17
LUDF-2015_16


Percentage Total Cows Calved
100%
80%
60%
40%
20%
0%
2014/15
2015/16
2016/17
2017/18
Week 6
Week 9

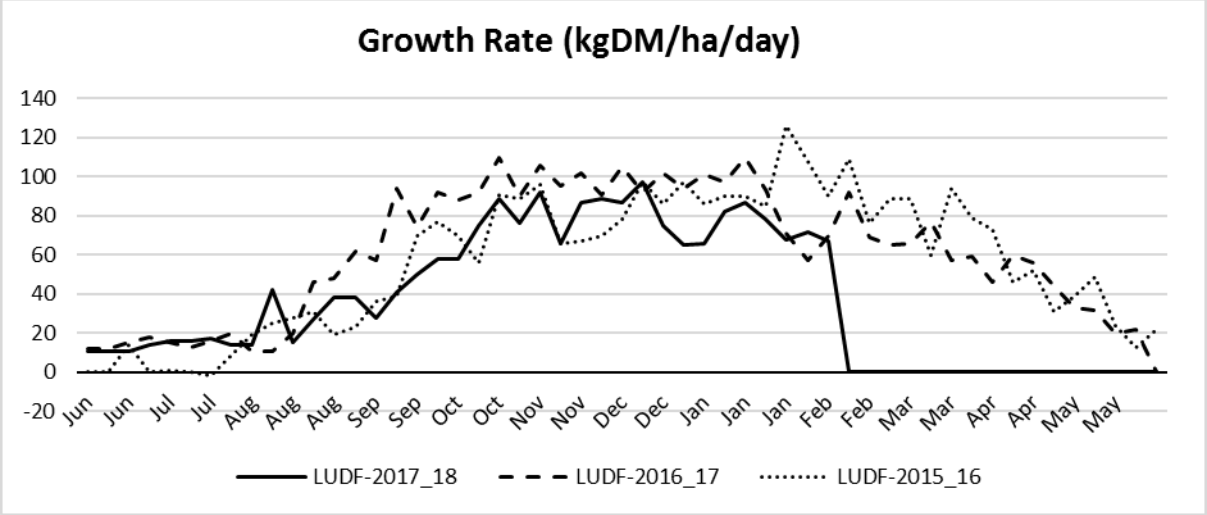
Prior to the season beginning the farm made the decision to increase the rate of N application during October and November - when plants were likely to be at peak vegetative growth, demand was high, and surpluses - if occurred could be harvested as silage. This can be seen in the steeper rise in N-applications through this period (compared to past years) in the graph below.

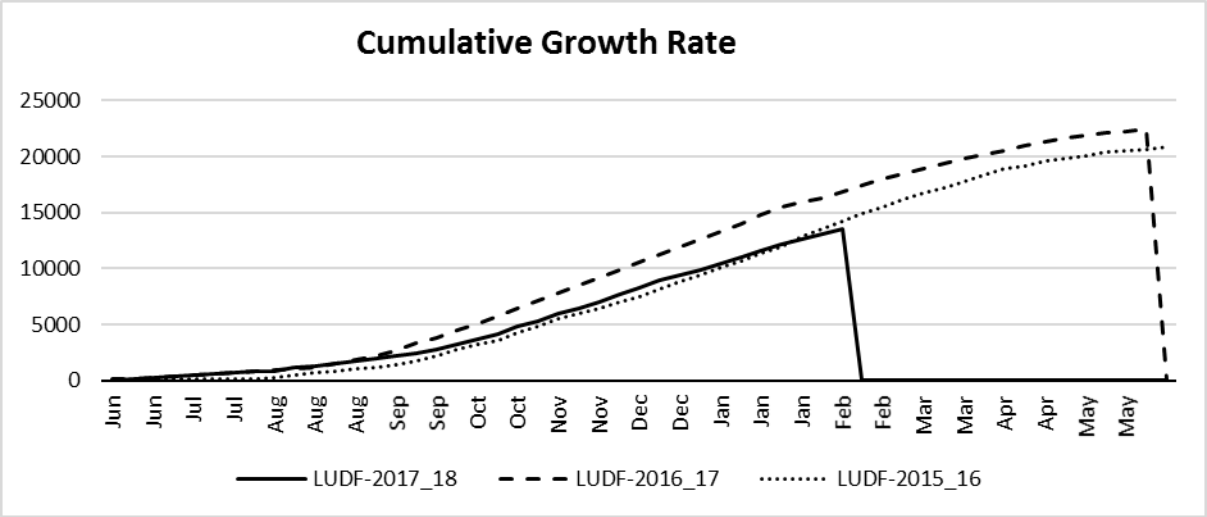


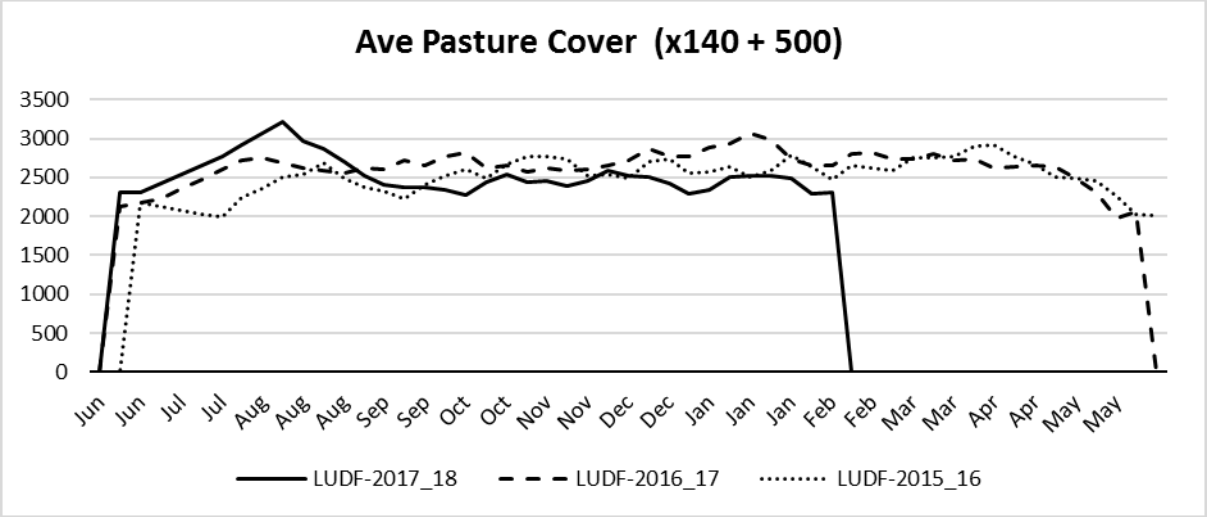
Rising Plate Meter Yield Estimates, Growth Rates and Average Pasture Cover

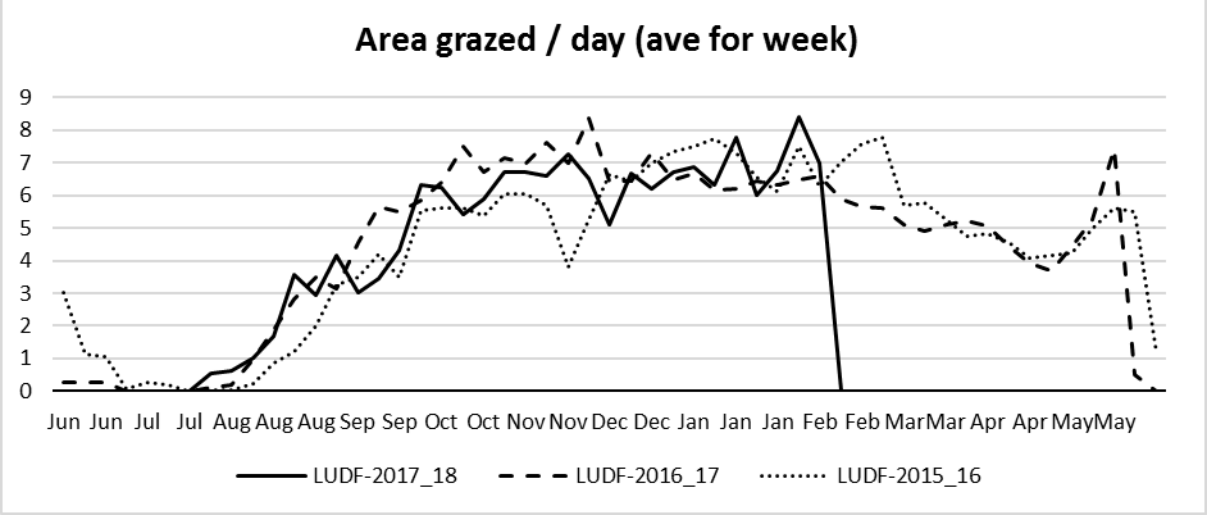
The graphs below show the estimated growth rates as calculated weekly from the farm walks and rising plate meter data. As evident in the comparative seasonal growth rates, the farms pastures really struggled through the high heat of the season (November/December and again now during February).

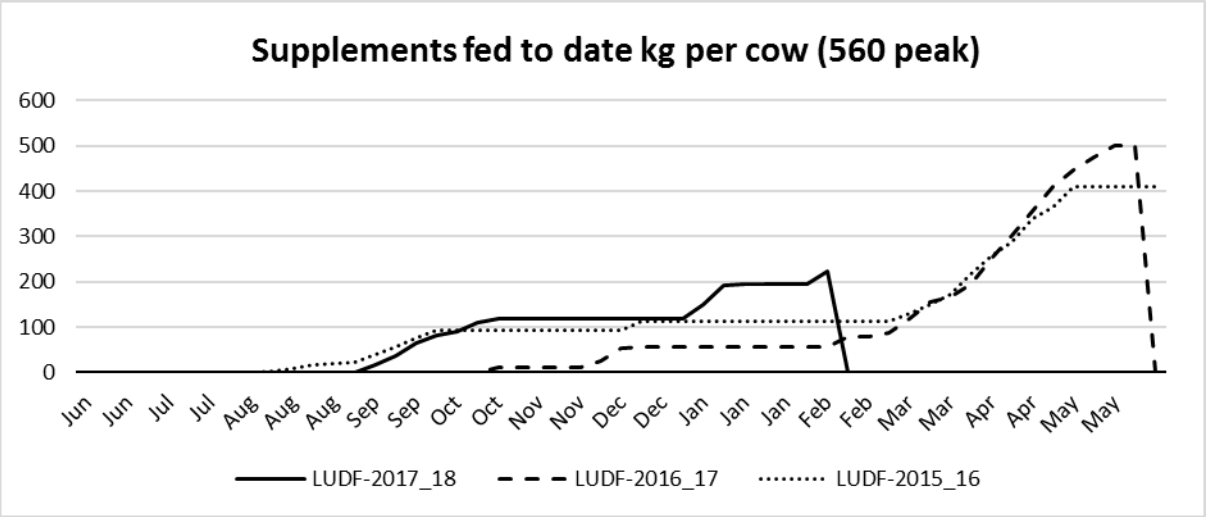
This has resulted in lower milk production and more use of supplement to-date compared to previous seasons.




Cumulative Growth Rate
25000
20000
15000
10000
5000
0
Jun Jun Jul Jul Aug Aug Aug Sep Sep Oct Oct Nov Nov Dec Dec Jan Jan Jan Feb Feb Mar Mar Apr Apr May May
LUDF-2017_18
LUDF-2016_17
LUDF-2015_16

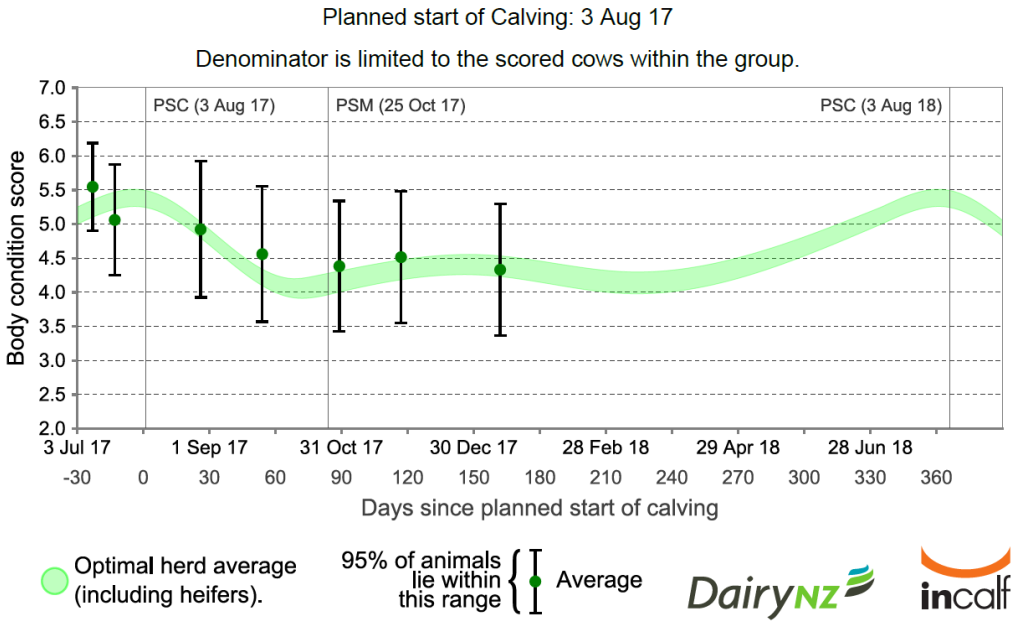

Ave Pasture Cover (x140 + 500)
3500
3000
2500
2000
1500
1000
500
0
Jun Jun Jul Jul Aug Aug Aug Sep Sep Oct Oct Nov Nov Dec Dec Jan Jan Jan Feb Feb Mar Mar Apr Apr May May
LUDF-2017_18
LUDF-2016_17
LUDF-2015_16

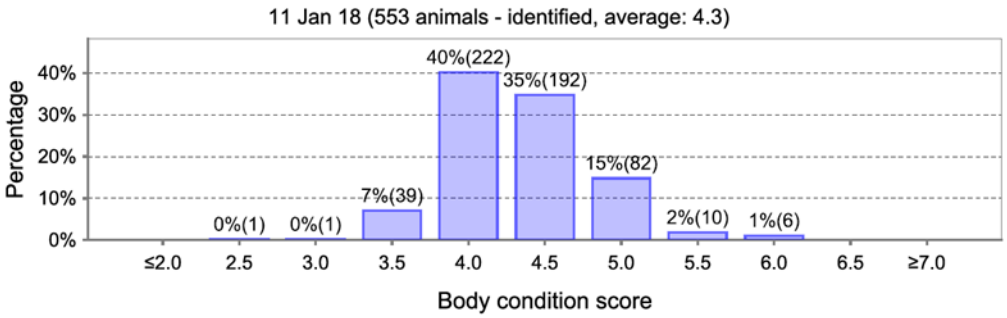

Area grazed / day (ave for week)
9
8
7
6
5
4
3
2
1
0
Jun Jun Jul Jul Aug Aug Aug Sep Sep Oct Oct Nov Nov Dec Dec Jan Jan Jan Feb Feb Mar Mar Apr Apr May May
LUDF-2017_18
LUDF-2016_17
LUDF-2015_16



Herd health

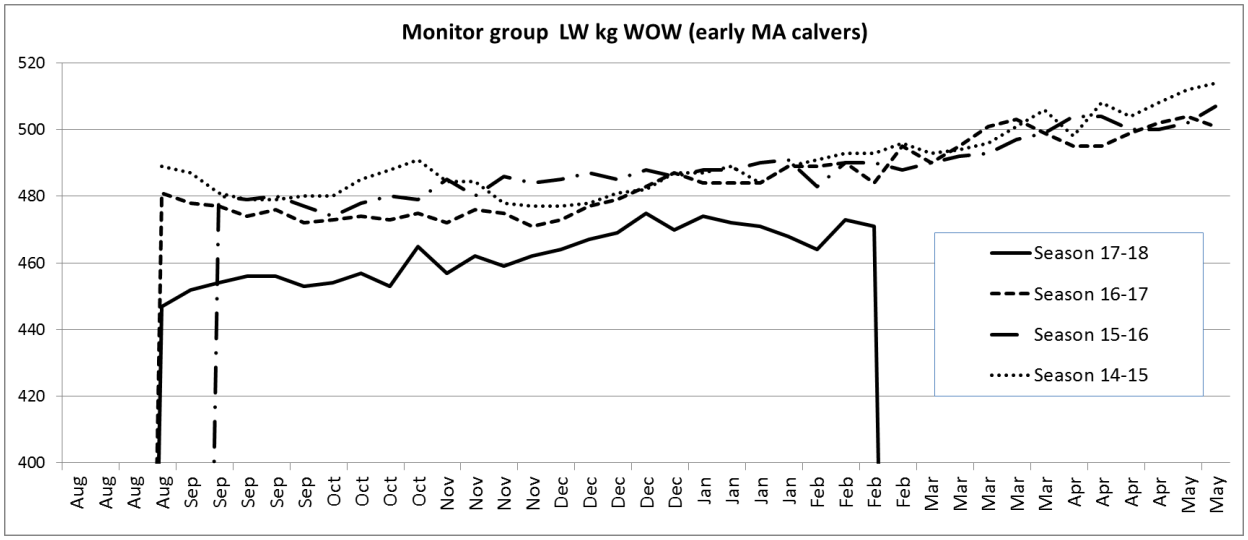
Average Cow Condition Score:





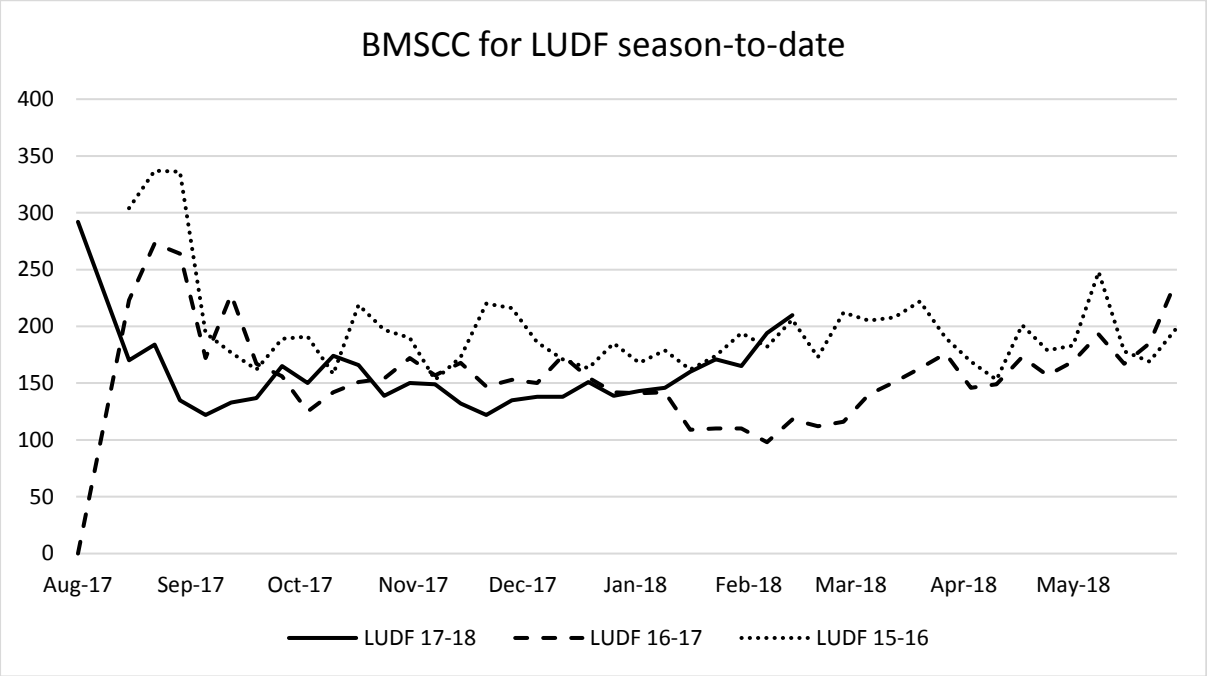
Cow Live Weight:

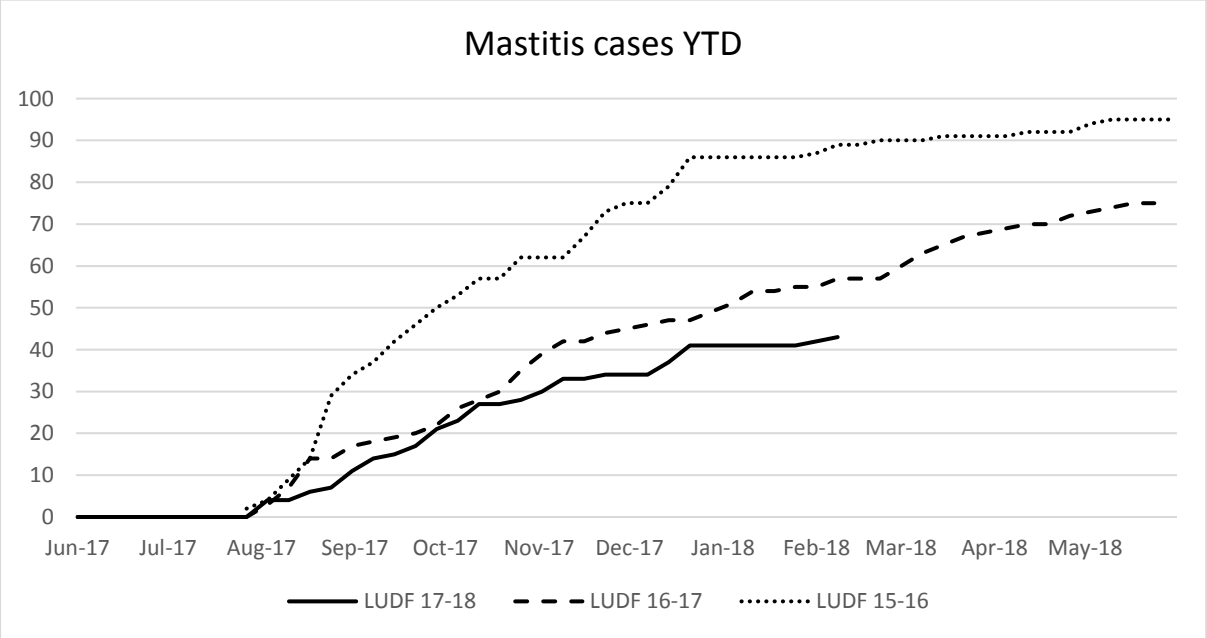
Cow live weight is recorded daily and live weight tracked of a monitor group of all cows (including first calvers) that have calved by the end of week 2 from planned start of calving. This year the monitor group has 260 cows, compared to over 300 in past years and has a higher percentage of heifers - in part reflected in the lower average weight compared to past seasons.

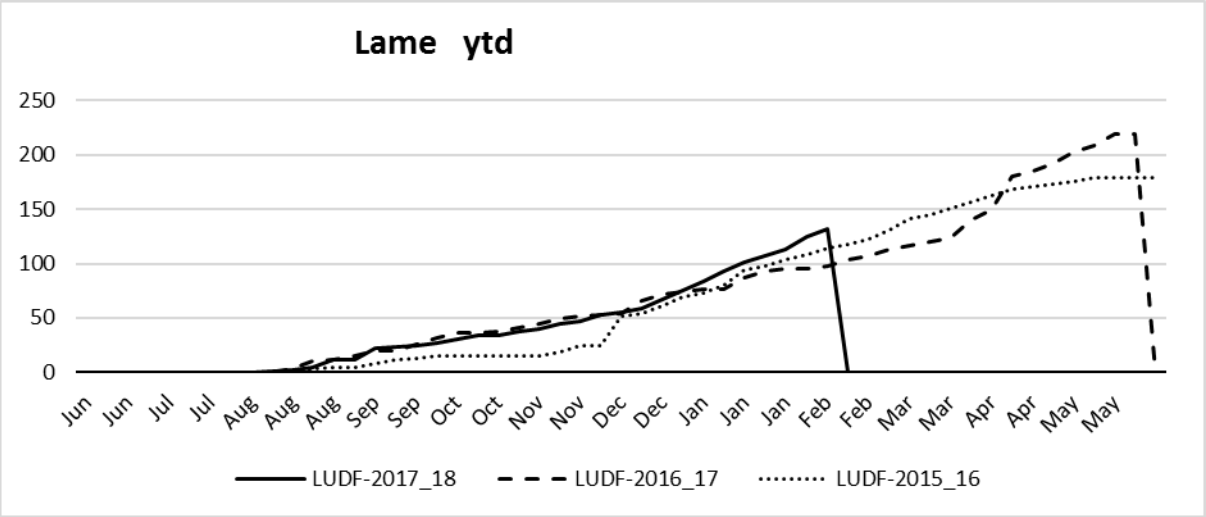


Animal Health:

In terms of animal health, mastitis cases have generally been lower than past years, but lameness remains a challenge. The team at LUDF have done a lot of preventative work on cow's feet, proactively hoof trimming.


BMSCC for LUDF season-to-date
400
350
300
250
200
150
100
50
0
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
May-18
LUDF 17-18
LUDF 16-17
LUDF 15-16


Mastitis cases YTD
100
90
80
70
60
50
40
30
20
10
0
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
May-18
LUDF 17-18
LUDF 16-17
LUDF 15-16



Reproductive performance of the LUDF herd

Reproductive performance improved slightly this year, pleasing given the slow calving pattern and decision to start mating one week earlier.

The Fertility Focus report (following) shows a 6-week-InCalf rate of 66%, 3% higher than last season. This includes the effect of using sexed semen for 50% of the cows mated during the first week. (details on the performance of sexed semen use will be available at the May Focus day).

Whilst the 6 week incalf rate improved modestly, the farms not-InCalf rate for the 2017 mating is 19%, the highest it has been. This poses some challenges for the farm which has had minimal culling in recent years and wants to remains a closed herd.

Fertility Focus 2017: Seasonal

Lincoln University
The Manager (University Dairy Farm) Hancox

Report date:	14/02/18
PTPT:	BQCY
Herd Code:	6/114
No of cows included:	558
These cows calved between:	10/06/17 and 16/12/17
Mating start & end date: (based on AB or pregnancy test data)	18/10/17 - 04/01/18
Next planned start of calving:	27/07/18
Duration of mating:	79 days
Duration of AB period:	49 days

incalf FERTILITY FOCUS
Version 2.15

DairyNZ

LIC

1 Overall herd reproductive performance

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

Your herd	66%
Aim above	78%

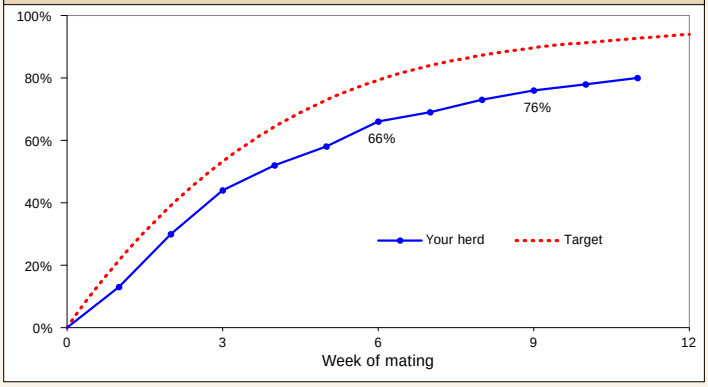
☆

Not-in-calf rate
Percentage of cows not pregnant after 79 days of mating

Your herd	19%
Aim for	6%

☆

% of herd in calf
Cumulative by week of mating



2 Drivers of the 6-week in-calf rate

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

Your herd	82%
Aim above	90%

☆☆☆

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

Your herd	
Aim above	

Conception rate
% of inseminations that resulted in a confirmed pregnancy

Your herd	51%
Aim above	60%

☆

3 Key indicators to areas for improvement

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

Calved by	Week 3	Week 6
Your herd	88%	97%
Aim above	75%	92%
	☆☆☆☆☆	☆☆☆☆☆

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

Calved by	Week 3	Week 6	Week 9
Your herd	47%	72%	92%
Aim above	60%	87%	98%
	☆	☆	☆☆☆

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

Your herd	61%
Aim above	85%

☆

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

Your herd	91%
Aim above	90%

☆☆☆☆☆

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

Your herd	91%
Aim above	95%

☆☆☆

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

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

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

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

Not-in-calf rate

Your herd	19%
Expected	10%

Seek advice

Behind Your Detailed Fertility Focus Report

Version 2.15

Report period: Cows calved between 10/06/17 and 16/12/17.
This was the most recent period with sufficient herd records that enabled an analysis to be completed.

Calving system: Seasonal
Your herd has been classified as seasonal calving because most calvings occurred in a single batch lasting less than 21 weeks.

Level of analysis: Detailed.
Your good record keeping means a detailed analysis was possible for your herd.

Report date:	14/02/18
PTPT:	BQCY
Herd Code:	6/114
Calvings up to this date requested for analysis:	13/02/18
No of cows included:	558
These cows calved between:	10/06/17 and 16/12/17
Mating start & end date: (based on AB or pregnancy test data)	18/10/17 - 04/01/18

Part A) Herd records cross check

Check that the herd records in the table are complete and correct.

2017/18	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
No. of calvings		114	261	147	36								558
No. of AB matings					324	408	35						767
No. of preg tests								553	172				725
No. of non-aged/late aged positive preg tests													0
No. of cows culled or died						1	2						3

Part B) Notes on the calculations

Use the following notes to see how your results were calculated.

1 Overall herd reproductive performance

6-week in-calf rate

Your report has been based on the mating and pregnancy test results you supplied. The ACTUAL 6 week in-calf rate is shown for your herd.

Records available for not-in-calf rate

Recorded pregnant	448
Recorded empty	101
Doubtful/recheck*	4
Culled without pregnancy test	3
No record of cull or pregnancy test	2
Cows analysed	558

*Includes cows whose most recent empty diagnosis was less than 35 days after mating end date.

2 Drivers of the 6-week in-calf rate

3-week submission rate

558 cows had calving dates in the required range and were not culled before day 21 of mating and 82% of these were submitted during the first 21 days of mating.

Non-return rate

Non-return rate is not calculated when pregnancy test results provide an accurate estimate of conception rate.

Conception rate

The conception rate was calculated for 761 AB inseminations on and between 18.10.17 and 05.12.17.

3 Key indicators to areas for improvement

Calving pattern of first calvers

129 cows with eligible calving dates were recorded as calving at less than 34 months of age. The calving pattern of first calvers was calculated from their records.

Calving pattern of whole herd

558 cows had calving dates that were eligible for this report.

3-week submission rate of first calvers

129 first calvers had calving dates in the required range and were not culled before day 21 of mating and 91% of these were submitted during the first 21 days of mating.

Heat detection

136 cows at least 4 years old at calving had calved at least 8 weeks before mating start date and were not culled before day 21 of mating and 91% of these were submitted during the first 21 days of mating.

Pre-mating heats

558 cows had calving dates in the required range and were not culled before day 21 of mating and 343 of these had a pre-mating heat recorded.

Non-cycling cows

558 cows had calving dates in the required range and were not culled before day 21 of mating and 1 of these were identified as being treated for non-cycling.

Performance after week 6

Your herd's not-in-calf rate and 6-week in-calf rate were used to determine the success of your herd's mating program after the first six weeks. If bulls were used after week 6 of mating, this gives an assessment of how well they got cows in calf.

Induced cows

No cows were identified as having induced calvings. If cows were induced, ensure all inductions are recorded.

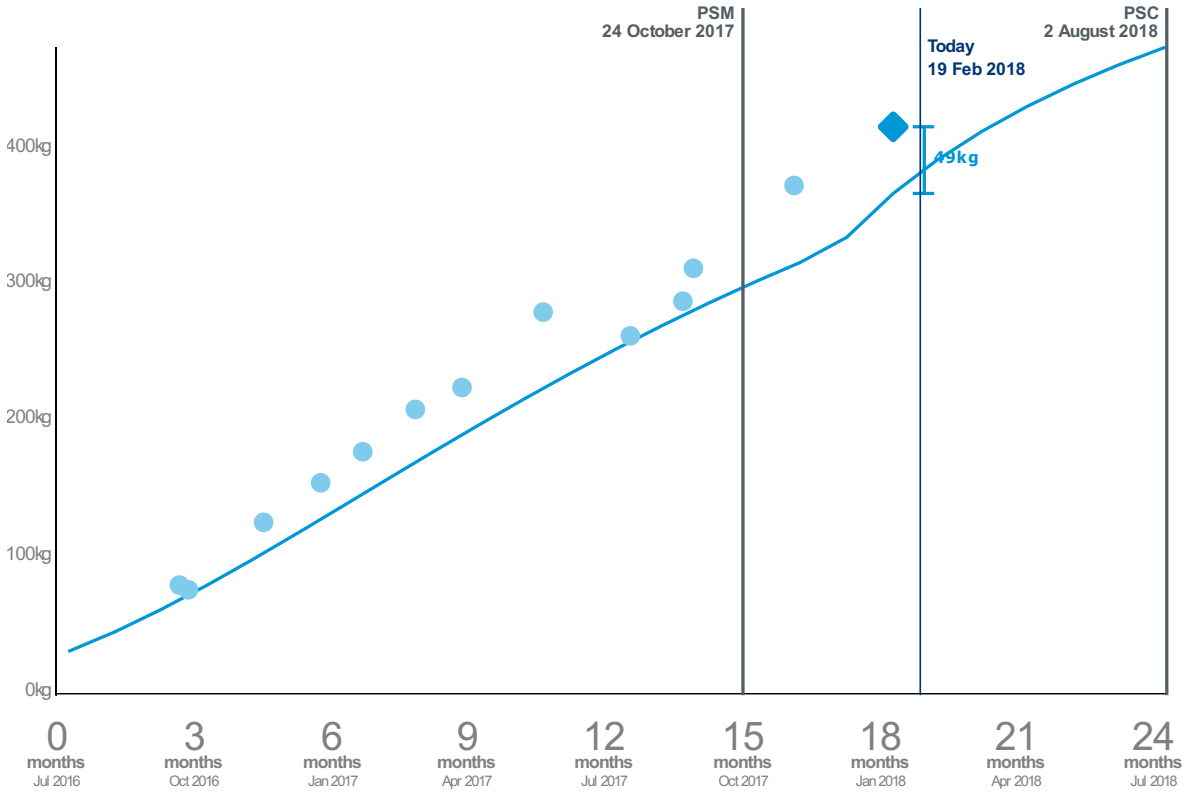
2016 Spring Born

1/02/2018

BQCY

Young stock trend

All 146 animals in this weighing are displayed



LUDF Farm Walk Notes - Tuesday 20th February.

LUDF – focus for 2017/18 Season: Nil-Infrastructure, low input, low N-loss, maximise 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).

Critical issues for the short term

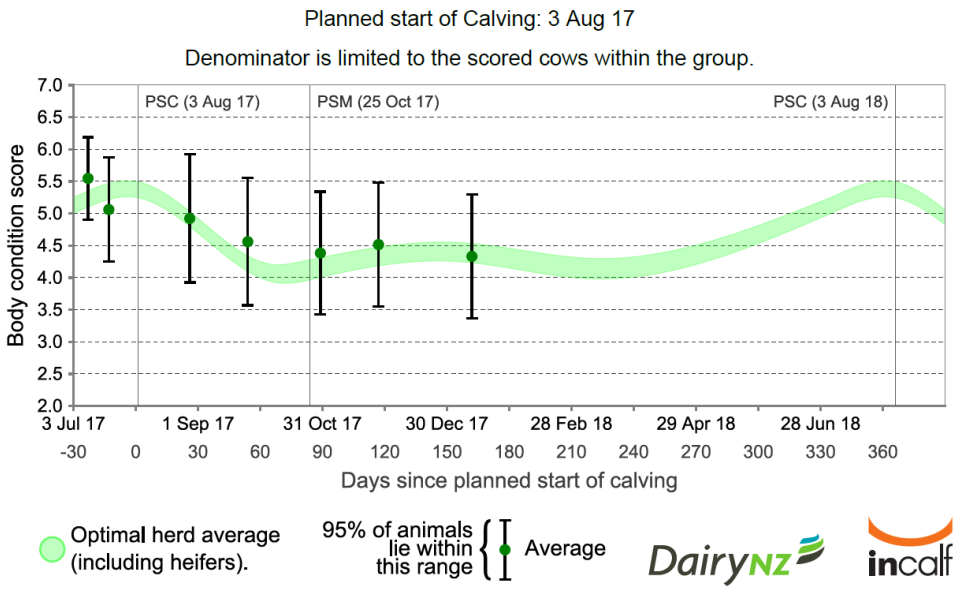
1. **Managing average pasture cover / cow intakes / residuals**
2. **Monitor Soil moisture and irrigate accordingly.**
3. **Start setting the farm and herd up for next season with round length and BCS monitoring and management.**

Key Numbers - week ending Tuesday 20th February 2018

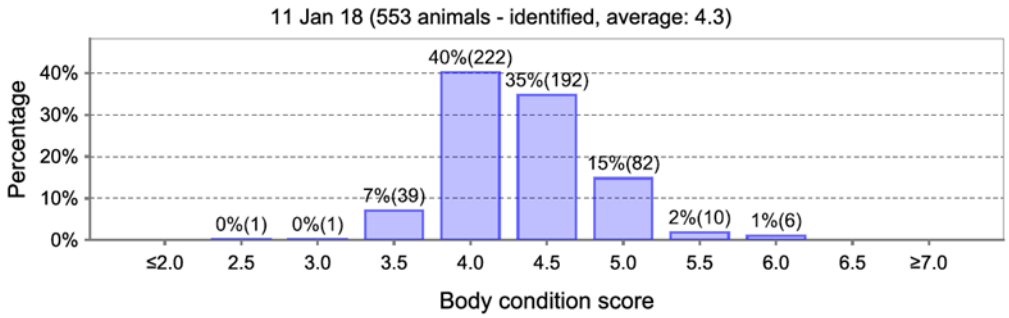
Ave Past Cover	2419 kgDM/ha (Rising Plate Meter)	Past Growth Rate	70 KgDM (Rising Plate Meter) / 63 kgDM/ha/day based demand.
Round length	25 days (for 160ha)	Ave Supplement used (Milking cows)	4.54 kgDM/cow/day
No Cows on farm	554 (total cows)	Ave Soil Temp (week)	18.2°C
SCC	189,000	Ave kgMS/cow/day (cows in vat)	1.61kgMS
Protein / Fat	0.79	Milk Fat – 5.25%	Milk Protein – 4.06%

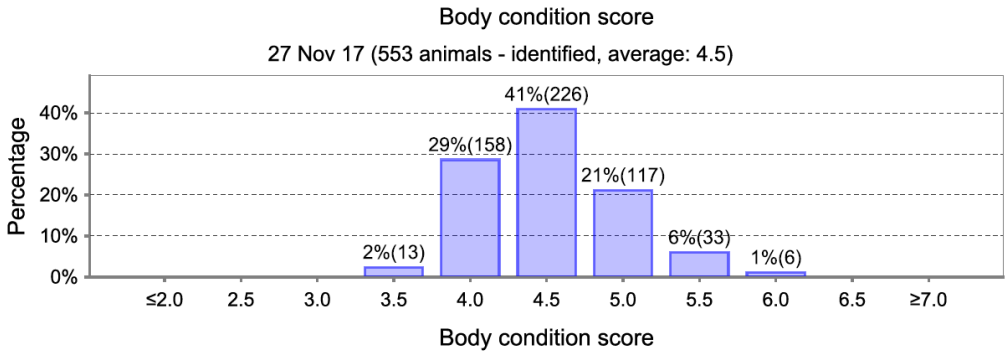
Herd Management

4. The milking herd has a total of 552 cows in milk - 511 twice-a-day milkers, and 41 once-a-day milkers (lames)
5. Trace minerals, including magnesium chloride are supplemented through the stock water to all cows on the milking platform. Extra Iodine and Selenium is being added to the mix.
6. 3 new lame cows this week and one new mastitis case
7. The farm continues to run 2 main herds plus the OAD herd. The makeup of the small herd changed on 15 January to a group of 164 mixed age cows that are below 4.5 and calving in the first 3 weeks of 2018-2019 lactation
8. The herd was body condition scored on Thursday the 11th January. The average BCS for the whole herd was 4.3, a decrease of 0.2 BCS from the previous month.



9. At 11th January CS event, the number of cows at BCS 4.0 or below had increased from 171 to 263, and the number of cows at 5.0 BCS or above had dropped from 156 to 98.

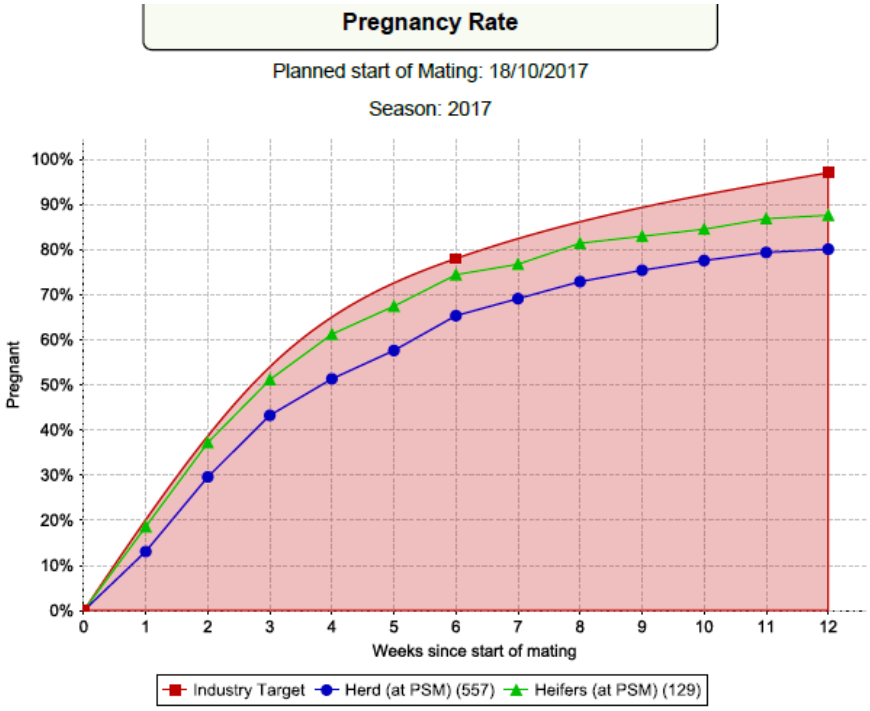




Mating Results

10. The first scan was completed on 8th Jan.
11. The fertility focus report shows a 66% 6 week Incalf rate, still well below the 78% target but acceptable given the farm had a slow calving rate and started mating one week early. Additionally, sexed semen was used in ½ of the cows mated in the first week. Conception rates show nearly 52% of cows mated in weeks 1-3 are in calf.
12. Last year, in part due to IBR, the farm had 63% 6-week InCalf.

13. First calvers have a 6 week Incalf rate of 75%, up from 69% last year.
14. A scan of the whole herd on Monday 12 Feb indicates 81% in calf / 19% empty after 11 weeks mating (including the additional week of mating 1 week earlier than the normal start). This is naturally disappointing for the farm and will impact the number of cows available for next season. It suggests 4 weeks of bull mating generated a further 15% cows in calf.



15. Yearling heifers were scanned on Thursday 1 February. There were 7 empty and 1 free martin out of 146 total giving us a 5.4% empty rate. These were AI for 11 days then naturally mated for 52 days giving a total of 9 weeks mating.

Growing Conditions

16. The average 9 am soil temperature for the past week was 18.2°C (up from 17.6°C last week).
17. No rainfall occurred this week (but rain is subsequently falling on Tuesday 20th Feb)

Figure 1: Soil temperature history for the last 2 weeks

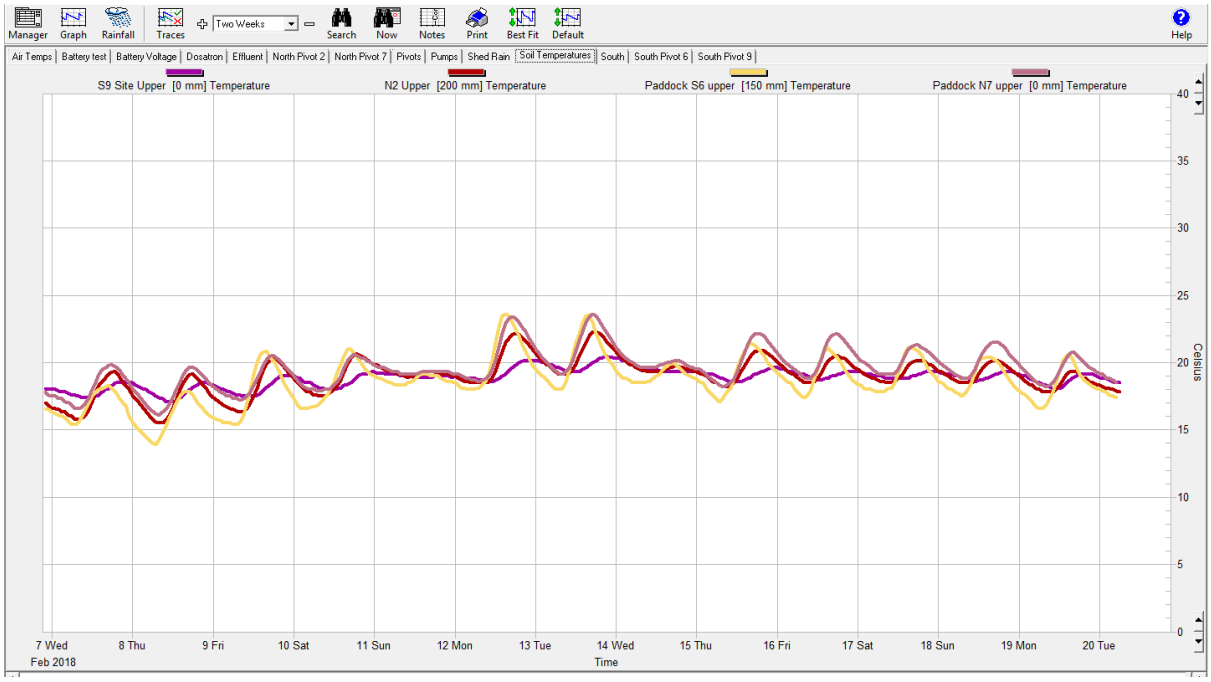
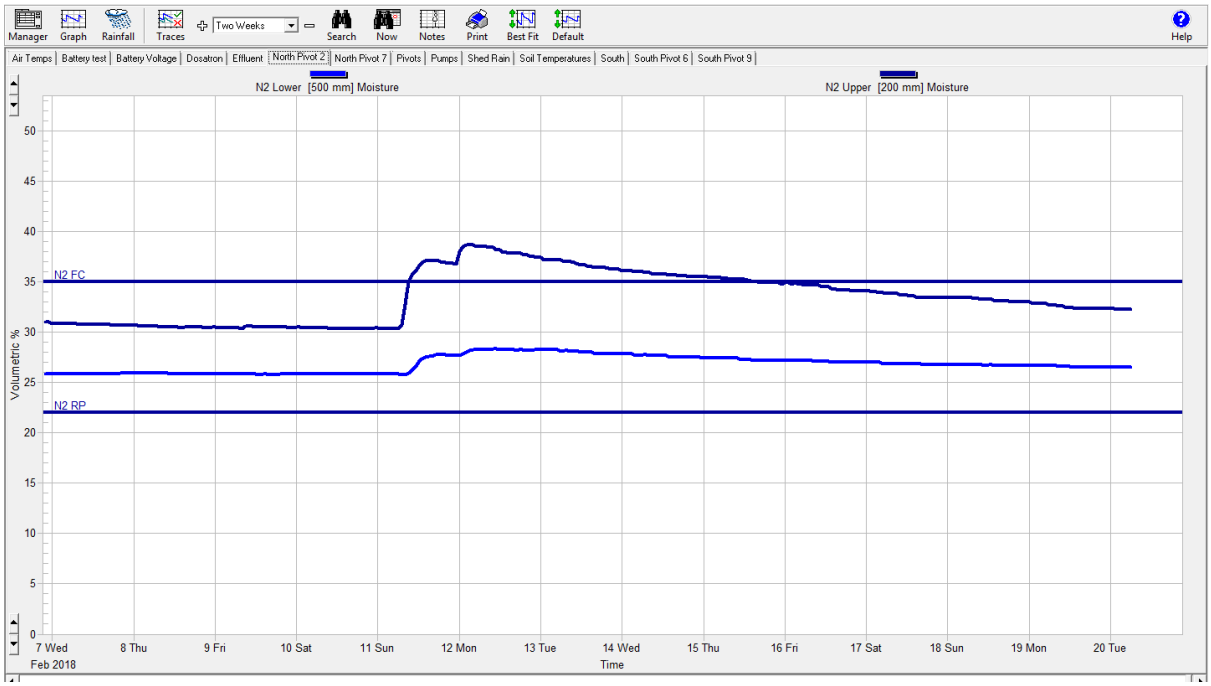


Figure 2: Soil moisture history for the last 2 weeks (Paddock N2).

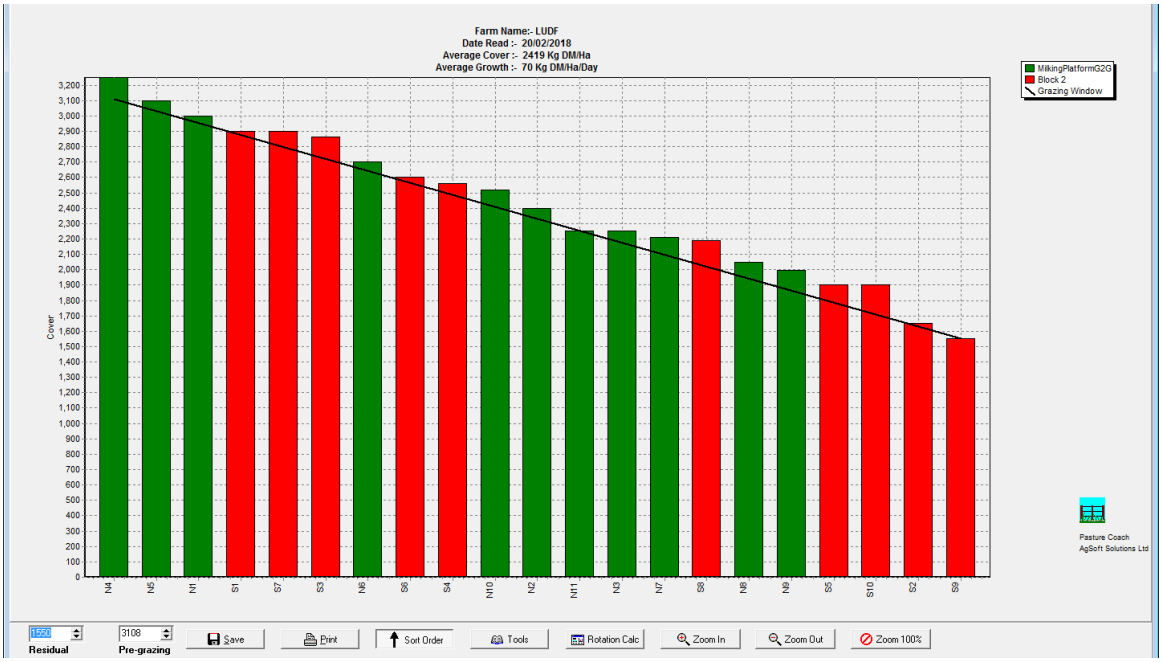
18. This week's graph represents the reading from the North Block moisture meters.
19. There was 3 days of irrigation on North Block and 2 days irrigation on the South Block for the week.



Pasture and Feed Management

20. Nitrogen, in the form of N-Protect has been applied to 34.7 ha for this week at a rate of 25 kgN/ha (except in effluent areas). N-Protect (Urease inhibitor coated urea) will be used until the risks of ammonia volatilisation losses have reduced. This is likely to be shortly, depending on the weather conditions over this time.
21. The total average Nitrogen application to date across the whole farm is 156 kgN/ha
22. No mowing occurred this week.
23. 17.6 tonne DM of silage was fed over the last week.
24. The farm grazed an average of 6.43ha/day, giving a round length of 25 days.
25. Cows grazing behaviour was a bit more normal this week

Figure 3: This week's feed wedge



26. The pregrazing required for the demand line is calculated as follows:
    a. 554 cows eating 18 kgDM/cow/day = 9,972 kgDM/day (Demand of 62 kgDM/ha/day over 160 ha)
    b. We want to graze the farm on a 25 day round (160ha/25days) = 6.4 ha grazed/day
    c. 9,972 kgDM/day / 6.4 ha/day = 1,558kgDM/ha
    d. Pre-graze cover required is therefore 1,558 + 1,550 = 3,108 kgDM/ha
27. The reported APC increased this week, from 2310 kg DM/ha last week to 2419 kgDM/ha this week (119 kgDM/ha or 17 kgDM/ha/day).
28. Pasture Coach estimated a growth rate of 70 kgDM/ha/day for this week, however:
    a. The herd received on average 4.5 kgDM/cow/day as silage, effectively reducing demand from pasture by nearly 16 kgDM/ha/day - to approximately 46 kgDM/ha/day.
    b. Based on demand from pasture of 46 kgDM/ha/day and a 17 kgDM/ha/day increase in APC, growth rate is likely to be closer to 63kg DM/ha/day, not 70 as estimated by Pasture Coach.

c. This growth rate based on demand is closer to the pasture coach calculated growth rate than we have seen in recent weeks.

Feeding Management for the coming week:

29. We will get rid of some obvious culls over the next few days to reduce demand from pasture.
30. Milkers will continue to be fed on grass to hold to the targeted 25 day round, and silage will be fed if required to achieve this. If we find we have a slight surplus we will use this to slowly push out our round length
31. Pasture regrowth appears to be of good quality.
32. Nitrogen will continue to be applied through the week following grazing.

LUDF Weekly report	30-Jan-18	6-Feb-18	13-Feb-18	20-Feb-18
Farm grazing ha (available to milkers)	160	160	160	160
Dry Cows on farm / East blk /Jackies/other	0/0/0/0	0/0/0/0	0/0/0/0	1/0/0/0
Culls (Includes culls put down & empties)	0	0	0	0
Culls total to date	20	20	20	20
Deaths (Includes cows put down)	0	0	0	0
Deaths total to date	14	14	14	14
Calved Cows available (Peak No 560…)	554	554	554	553
Treatment / Sick mob total	0	1	1	1
Mastitis clinical treatment	0	1	1	1
Mastitis clinical YTD (tgt below 64 yr end)	41	42	43	44
Bulk milk SCC (tgt Avg below 150)	165	194	210	189
Lame new cases	6	12	7	3
Lame ytd	113	125	132	135
Lame days YTD (Tgt below 1000 yr end)	2125	2405	2650	2902
Other/Colostrum	0	0	0	0
Milking twice a day into vat	520	520	532	511
Milking once a day into vat	34	33	21	41
Small herd	153	156	159	157
Main Herd	367	364	373	354
MS/cow/day (Actual kg / Cows into vat only)	1.67	1.65	1.67	1.61
Milk Protein/Fat ratio	0.81	0.79	0.79	0.79
Milk Fat %	5.02	5.06	5.15	5.25
Milk Protein %	4.04	4.02	4.10	4.06
MS/cow to date (total kgs / Peak Cows 560	300	313	323	336
MS/ha/day (total kgs / ha used	4.96	6.51	4.95	6.35
Herd Average Cond'n Score				0.00
Monitor grp LWkg WOW 281 early calvers	464	473	471	469
Soil Temp Avg Aquaflex	21.3	18.4	17.6	18.2
Growth Rate (kgDM/ha/day)	68	72	67	70
Plate meter height - ave half-cms	14.2	12.8	12.9	13.7
Ave Pasture Cover (x140 + 500)	2482	2288	2310	2419
Surplus/[defict] on feed wedge- tonnes	0	0	0	0
Pre Grazing cover (ave for week)	0	3122	3089	2888
Post Grazing cover (ave for week)	1550	1550	1550	1550

LUDF Weekly report	30-Jan-18	6-Feb-18	13-Feb-18	20-Feb-18
Highest pregrazing cover	0	3200	3222	3165
Area grazed / day (ave for week)	6.74	8.39	6.99	6.43
Grazing Interval	24	19	23	25
Milkers Offered/grazed kg DM pasture				
Estimated intake pasture MJME				
Milkers offered kg DM Grass silage				
Silage MJME/cow offered				
Estimated intake Silage MJME				
Estimated total intake MJME				
Target total MJME Offered/eaten (includes 6% waste)				
Pasture ME (pre grazing sample)			11.5	
Pasture % Protein			19.1	
Pasture % DM - Concern below 16%			16.7	
Pasture % NDF Concern < 33			38.6	
Mowed pre or post grazing YTD	148.6	171.8	183.3	183.3
Total area mowed YTD	189.6	212.8	224.3	224.3
Supplements fed to date kg per cow (555peak)	194.9	194.9	222.2	253.9
Supplements Made Kg DM / ha cumulative	237.17	237.17	237.17	237.17
Units N applied/ha and % of farm	25units / 19.5%	25units / 24.4%	25units / 27.5%	25units / 21.7%
Kgs N to Date (whole farm)	139	144	151	156
Rainfall (mm)	0	24	16.8	0
Aquaflex topsoil relative to fill point target 60 - 80%	80	70-80	90-100	70-80

Next Farm Walk - Tuesday 27 February 2018. Farmers or their managers and staff are always welcome to walk with us. Please call to notify us of your intention and bring your plate meter and clean gumboots. Phone SIDDC – 03 423 0022.

Peter Hancox, Farm Manager, Natalia Benquet, Chris Norton.

Please note - LUDF Focus Day - Thursday 22 February at Ashley Dene Research and Development Station - 736 Bethels Rd, Burnham. 10.15 - 1.00pm.

New Zealand's specialist land-based university

Lincoln University

www.lincoln.ac.nz | 0800 10 60 10

Ashley Dene Research & Development Station

Supporters of Ashley Dene Research & Development Station

CLAAS Harvest Centre | FARM SOURCE | OPUS | PGG Wrightson Seeds | PIONEER | WAIKATO MILKING SYSTEMS

Goal: Conduct farm systems research to improve the profitability, environmental and welfare performance of dairy and livestock farming systems.

Current research and development projects, Ashley Dene Research and Development Station (ADRDS)

Project title	Funder	Research providers at ADRDS
Forages for Reduced Nitrate Leaching (FRNL)	MBIE with co-funding from all six programme partners	Lincoln University, Plant & Food Research, Manaaka Whenua
Reducing nitrogen losses from farms	MBIE	Lincoln University, Manaaka Whenua, Plant & Food Research, SCION
Innovative agricultural microbiomes	Our Land and Water, NSC, MBIE	AgResearch, Lincoln University, Manaaka Whenua, Plant & Food Research, Otago University, DairyNZ
Livestock genetics and management to reduce farm environmental impacts	MBIE	Lincoln University, DairyNZ
Engineering solutions to reduce N losses (stand off pads)	DairyNZ	Lincoln University, AgResearch
Plantain to reduce N losses	NZAGRC, Lincoln University, PGG Wrightson Seeds	Lincoln University, Plant & Food Research
Eddy covariance flux measures of C and N losses from soil	Manaaka Whenua, NZAGRC	Manaaka Whenua

Forages for Reduced Nitrate Leaching

Reducing nitrate leaching from dairy, arable, sheep & beef industries

Ina Pinxterhuis , Paul Edwards, Dawn Dalley (DairyNZ)

LUDF Focus Day, 22 February 2018

Ministry of Business, Innovation & Employment

DairyNZ

agresearch

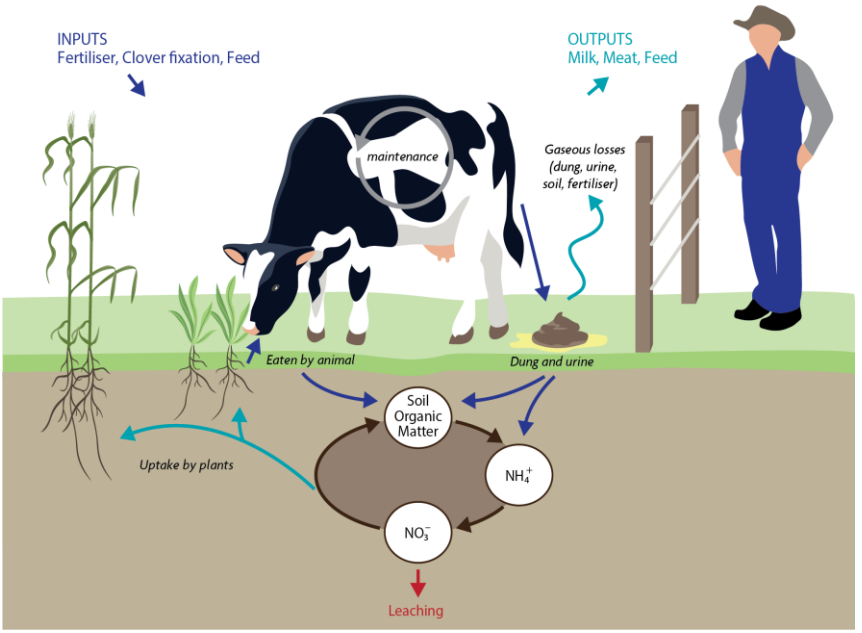
FAR

Landcare Research Manaaki Whenua

Plant & Food RESEARCH

Lincoln University

The nitrogen cycle



Research to break links

- Generally strong correlation between environmental impact and production intensity (within soil/climate combination)
- Research to reduce leaching at same production
- OR increase production at same N loss
- Profitability paramount

Proposed solutions Pastoral 21

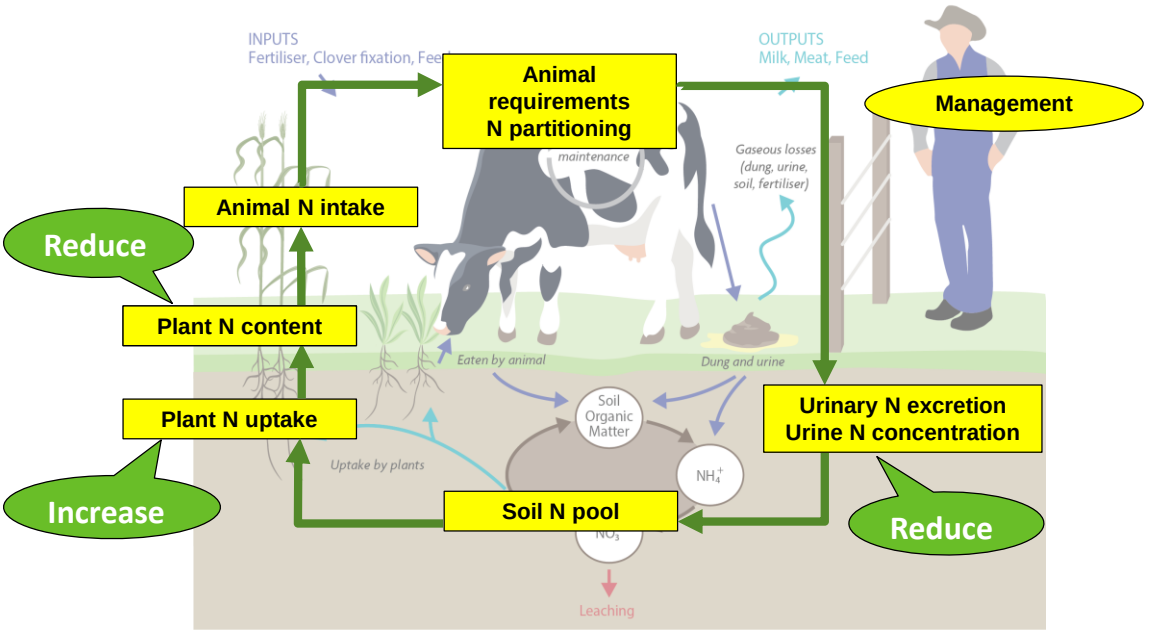
Reduce, re-use, recycle

- Reduce N fertiliser use and adjust stocking rate
- Increase production per cow
- Improve cow longevity & fertility
- Use low-N supplements
- Stand-off in high-risk periods


Experimental stand-off facility

	Average production	N leached	
	kg MS/ha	kg N/ha	% Reduction
LUDF 2011/12 -2013/14	1821	57	
P21 Future system	1782	35	39

Proposed solutions FRNL



FRNL: Crops and crop rotations

Potential benefits:

- Reduced Crude Protein (CP) content, improved ME:

  maintain animal performance + reduce urinary N
- Improved yield and N uptake

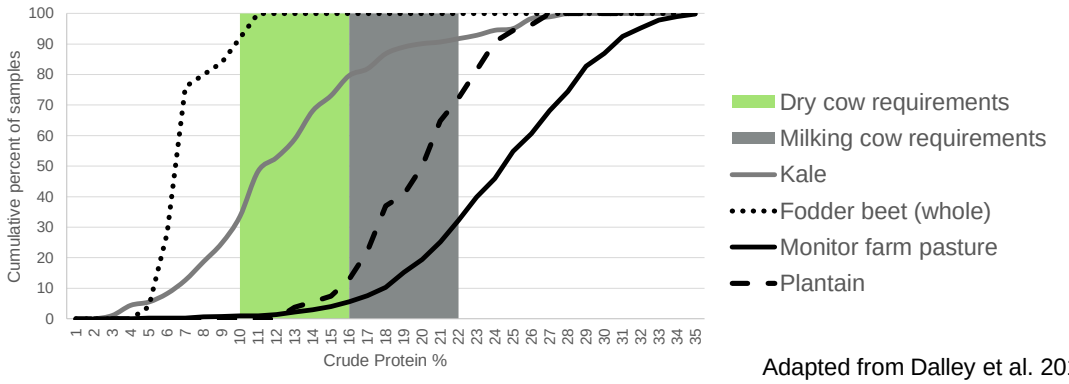
Risks:

- N supply and demand not in sync, e.g. following cultivation or winter grazing, increasing risk of N leaching



Analysis of crop data: CP% in plant species varies

- Kale: CP% varied from 4 to 26% = wide range in N content
- Fodder beet: low CP%, 92% of samples below requirements for non-lactating cows
- Plantain: lower CP content than grass/clover



Adapted from Dalley et al. 2017

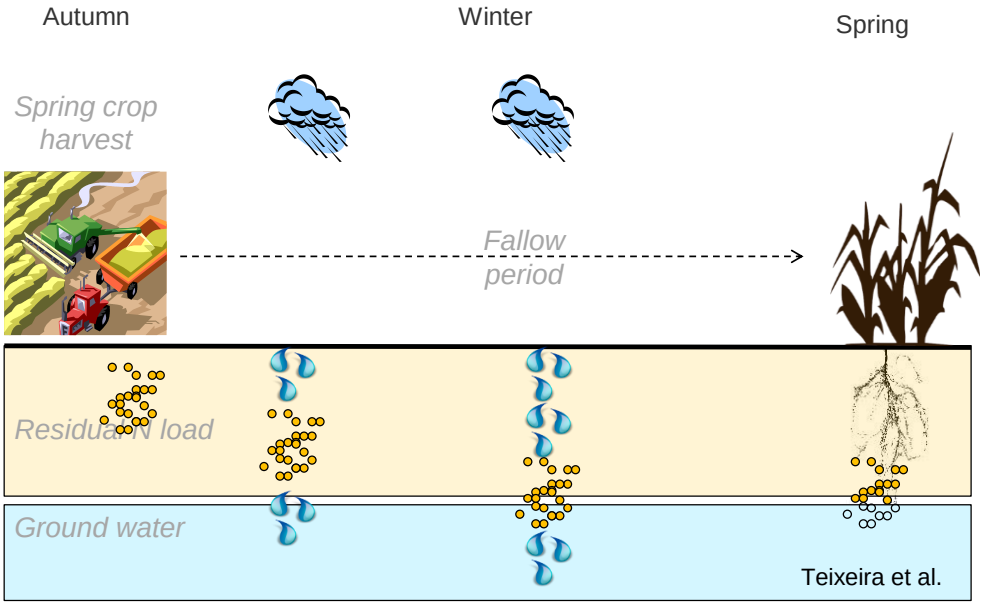
Fodder beet reduces urinary N concentration and excretion

Late lactation cows	Pasture	Pasture + 23%FB	Pasture + 45%FB	
N intake (g/c/d)	460	407	317	**
Urine N (g/c/d)	205	155	112	***
Urinary N concentration(%)	0.86	0.78	0.60	**

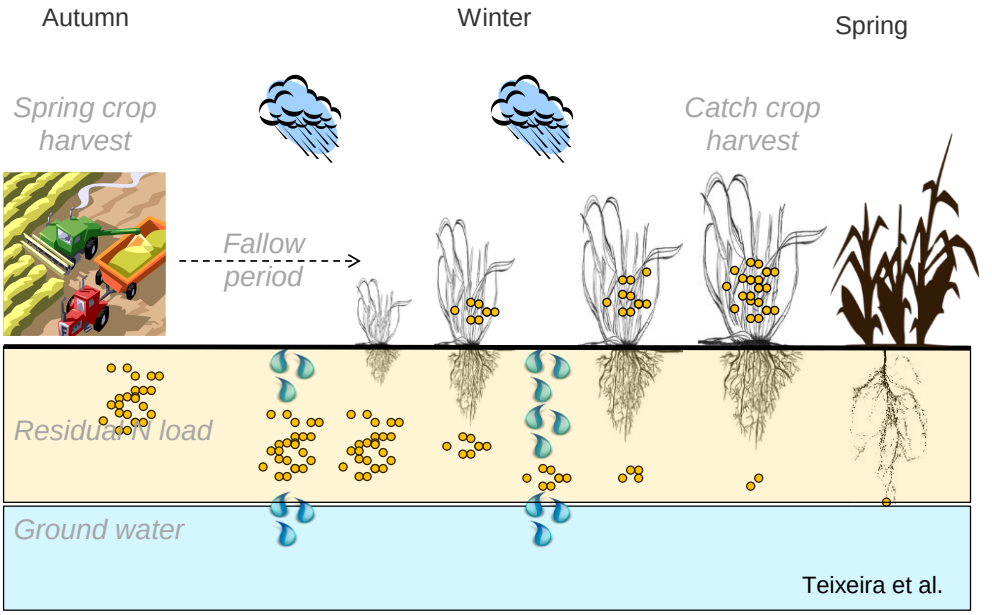
Non-lactating cows	70% FB + pasture silage	85%FB + cereal straw	
N intake (g/c/d)	144	74	**
Urine N (g/c/d)	87	52	***
Urinary N concentration(%)	0.45	0.54	**

Waghorn, Dalley et al. submitted.

The catch crop concept: when nothing grows, soil mineral N is at risk of leaching

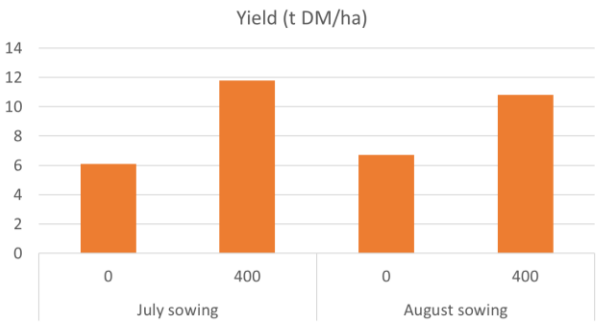


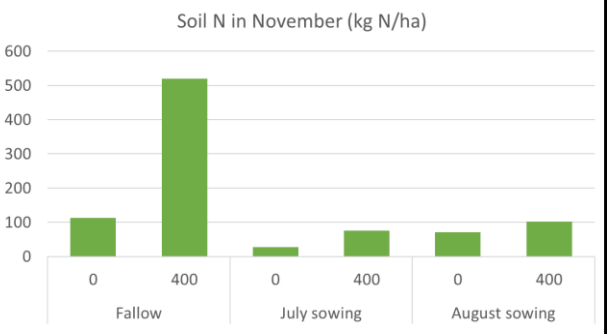
Catch crops take up N, reducing risk of leaching



Catch crops reduce risk of nitrate leaching

Oats reduced soil mineral N (0 - 120cm) under simulated urine patch of 400 kg N/ha compared with fallow:
- by 23-43% in September 2015
- by 71-75% by harvest in November 2015





Malcolm et al. 2016

Establishing catch crops

Ex-kale 14 t DM/ha
20 cows/ha for 60 days

Ex-fodder beet 24 t DM/ha
50 cows/ha for 60 days

Photos captured 1 Nov 2016, M. George

Malcolm et al. 2017

Lower plant population of catch crops showed compensatory growth - yield difference smaller, soil N removal significant

Oat yields:
Post-kale
~8-10 t DM/ha
Post-FB
~7-9 t DM/ha

Post-FB N removed (kg/ha):
Sep 15-45
Oct 61-96
Nov 104-132

Malcolm et al. 2017

Farmer adoption & adaption: catch crops after autumn grazed fodder beet

- Looking at yield, N uptake and soil mineral N

Early's – oats sown on 30 May and 13 June,
- sprayed in Sep to get back in pasture asap;
- 2-3 t DM/ha (ME 12.6, CP 21%); baling rained out;
- direct drilled in Oct and back in rotation in late Dec

Rathgen's – oats/Italian sown 20 June,
- harvested mid-Nov at flag-leaf stage;
- 7 t DM/ha (ME 10.7 and 11.5, CP 13.8 and 11.5%),
- re-sown 1 Dec (light cultivation and roller-drilled) and now ready to be grazed again

Paritea – oats/Italian sown on 19 June,
- harvested middle of Dec,
- 10 t DM/ha (ME 8.4 and 12.1, CP 7%),
- regrowth from Italian, back in rotation now but may have compromised autumn feed

DairyNZ

FRNL: Alternative pasture species

Measured benefits:

- Reduced DM and Crude Protein content, improved ME
  - maintained animal performance and reduced urinary N excretion
  - increased urine volume and reduced urine N concentration
- Greater root depth and cool season growth
  - improved water and nutrient efficiency
  - increased N uptake by plants and improved yield

Forages for Reduced Nitrate Leaching is a DairyNZ-led collaborative research programme aimed at reducing nitrate leaching through research into diverse pasture species and crops for dairy, arable and sheep and beef farms.

The main funder is the Ministry of Business, Innovation and Employment, with co-funding from research partners DairyNZ, AgResearch, Plant & Food Research, Lincoln University, Foundation for Arable Research and Landcare Research.

Ministry of Business, Innovation & Employment

DairyNZ

agresearch

FAR

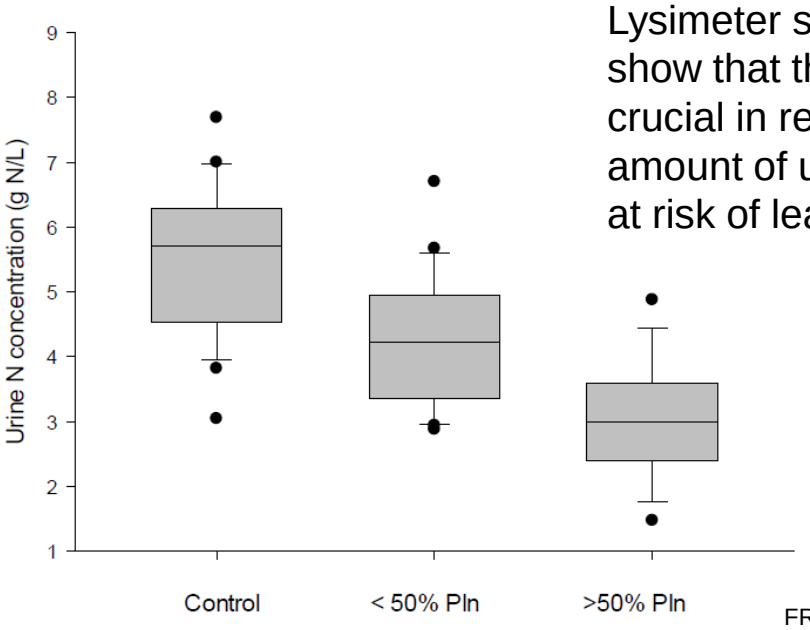
Landcare Research Manaaki Whenua

Plant & Food RESEARCH

Lincoln University

Lincoln University Research Results

Plantain (cv Tonic) reduces urine N concentration



Lysimeter studies show that this is crucial in reducing amount of urine N at risk of leaching

FRNL: Bryant et al. 2017

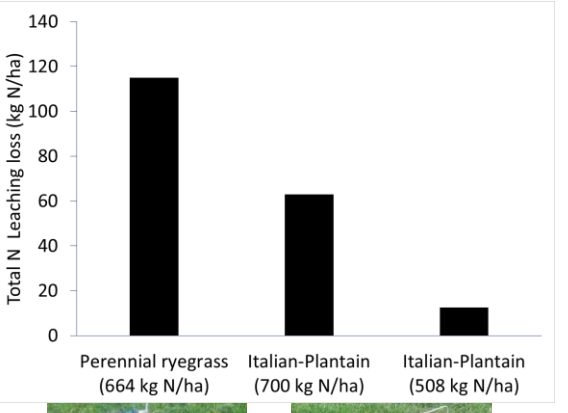
Urine N loading is lower from cows grazing plantain

	Ryegrass-white clover	50% Plantain	100% Plantain
Autumn			
Urine N (g N/L)	5.4	3.6	2.4
Urine volume (L/cow/day)	46	59	74
Urine patch load (kg N/ha)	**698**	**579**	**450**
Spring			
Urine N (g N/L)	4.7	3.4	2.2
Urine volume (L/cow/day)	44	34	54
Urine patch load (kg N/ha)	**666**	**503**	**321**

FRNL: Box et al. 2017, NZJAR, Box et al. 2016 Proc NZSAP

Leaching from autumn applied urine N was lower from Italian ryegrass/plantain/white clover than from standard perennial ryegrass/white clover

The reduction was much stronger when urine was used from cows grazing the Italian/plantain/white clover mixture.



Urine 664 and Urine 508 were collected from cows grazing perennial ryegrass/white clover and Italian/plantain/white clover, respectively. Urine 700 was standardised for comparison

FRNL: Woods et al. 2017

Farm systems trial: Ashley Dene Research and Devel. Station

Farmlets/treatments	Plantain 150N	Ryegrass 150N	Ryegrass 300N
Stocking rate (cows/ha)	3.5	3.5	5
N fertilization (kg/ha/yr)	150	150	300
Forage type	50% Mix (RG+PL) 50% Pure Plantain	Ryegrass	Ryegrass
Target supplement (kg / cow / lactation), maize, fodder beet, grass silage	300	300	1000
Measurements and monitoring	Pasture and milk production, Milk composition N cycle (inputs and losses), N leaching 'Scalar', Decision rules		
Milk production kg MS/cow/day (at 13 Feb) kg MS/cow (to 13 Feb) kg MS/ha (to 13 Feb)	 1.73 325 1137	 1.55 313 1096	 1.59 294 1470

Example of Ecotain incorporated on farm

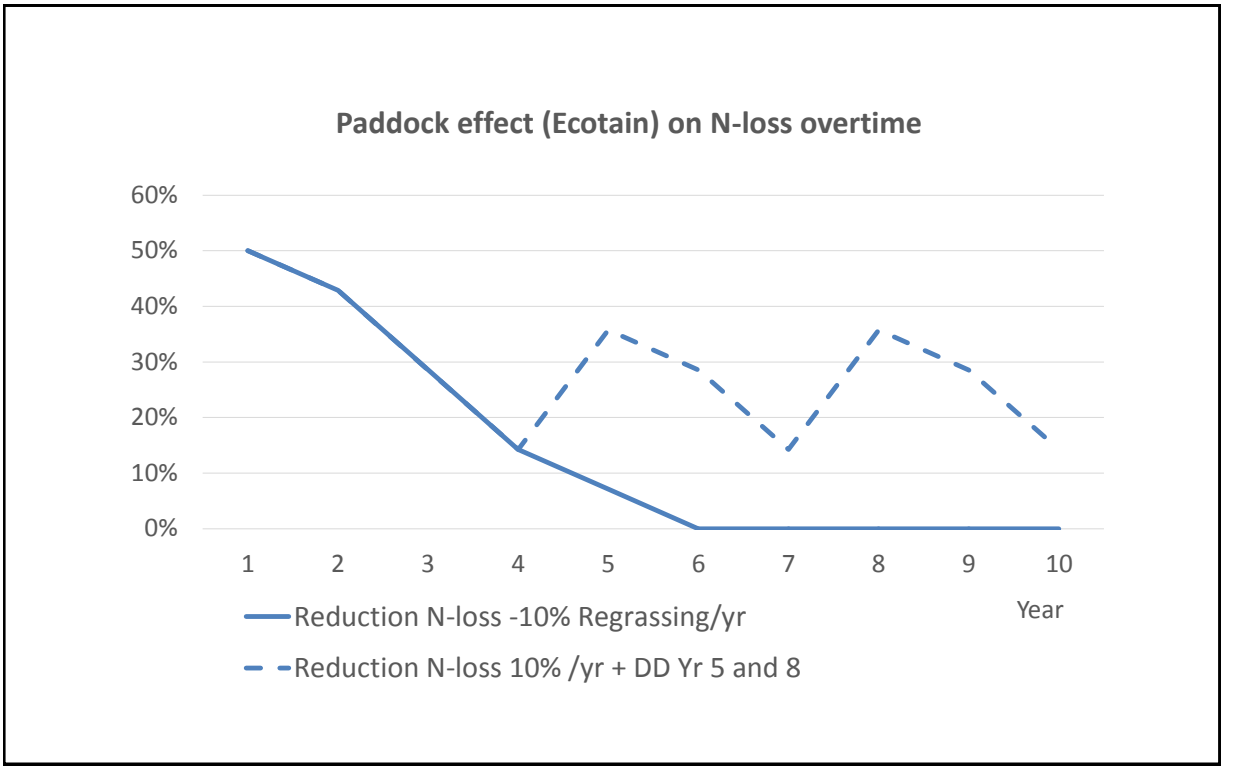
	PERENNIAL PASTURES			
By age of pasture of crop (year)	1	2	3	4-10
Renewal rate by area (%)	8	8	8	60
Content Ecotain (%)	35-40	25-30	15-20	5-15
Nitrogen reduction from the urine patch (%)	50+			
Broadcasting (%)			25-30	25-30

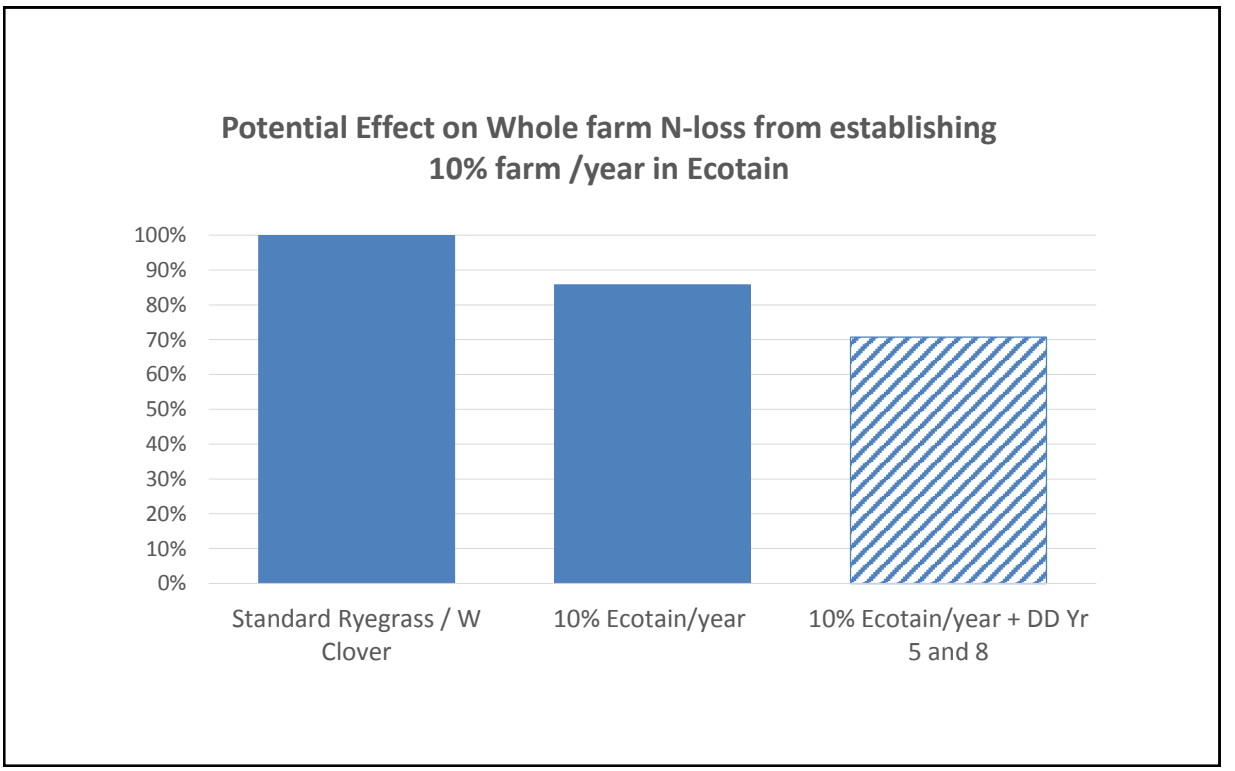
Example of Ecotain incorporated on farm

	PERENNIAL PASTURES				ITALIAN/ECOTAIN PASTURES	
By age of pasture of crop (year)	1	2	3	4-10	1	2
Renewal rate by area (%)	8	8	8	60	4	4
Content Ecotain (%)	35-40	25-30	15-20	5-15	35-40	25-35
Nitrogen reduction from the urine patch (%)	50+				90	50-90
Broadcasting (%)			25-30	25-30		

Example of Ecotain incorporated on farm

	PERENNIAL PASTURES				ITALIAN/ECOTAIN PASTURES		ECOTAIN CROPS	
By age of pasture of crop (year)	1	2	3	4-10	1	2	1	2
Renewal rate by area (%)	8	8	8	60	4	4	4	4
Content Ecotain (%)	35-40	25-30	15-20	5-15	35-40	25-35	100	100
Nitrogen reduction from the urine patch (%)	50+				90	50-90	90	90
Broadcasting (%)			25-30	25-30				


Paddock effect (Ecotain) on N-loss overtime
60%
50%
40%
30%
20%
10%
0%
1
2
3
4
5
6
7
8
9
10
Year
Reduction N-loss -10% Regrassing/yr
Reduction N-loss 10% /yr + DD Yr 5 and 8


Potential Effect on Whole farm N-loss from establishing 10% farm /year in Ecotain
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Standard Ryegrass / W Clover
10% Ecotain/year
10% Ecotain/year + DD Yr 5 and 8

Forages for Reduced Nitrate Leaching

Reducing nitrate leaching from dairy, arable, sheep & beef industries

Tony Coltman

LUDF Focus Day, 22 February 2018

Ministry of Business, Innovation & Employment

DairyNZ

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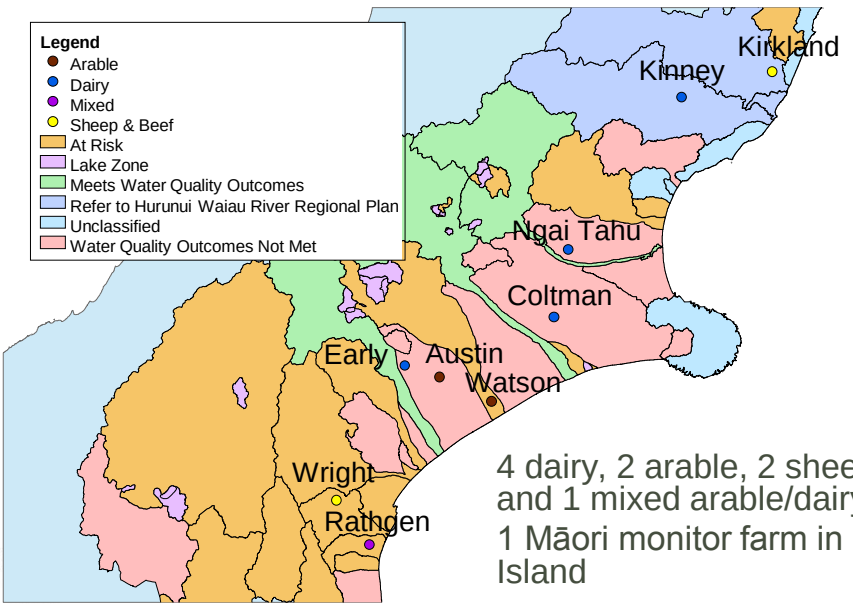
Plant & Food RESEARCH

Lincoln University

Monitor farm network



4 dairy, 2 arable, 2 sheep & beef and 1 mixed arable/dairy farm

1 Māori monitor farm in North Island

Canlac Holdings, Dunsandel

- 335 ha milking platform, 1437 cows (4.3 cows/ha)
- 2 Pivots, 1 Rotorainer + sprinklers
- CPW (stage 1) + bore if necessary
- Focus on optimising grass harvested and utilisation of supplements with feedpad

2016/17 Production Season

- 900 kg DM/cow feed imported – maize silage, grass silage, PKE and fodder beet
- 18,600 kg DM/ha eaten (DairyBase)
- 243 kg N/ha fertiliser used
- 500 kg MS/cow and 2147 kg MS/ha produced

N surplus and N leaching

Nitrogen summary	Calculation	14/15	15/16	16/17
Simple N surplus (kg N/ha)	Fert N +	285	288	228
	Supplement N	86	84	93
	– Product N	128	138	129
	– Stored supplement N	5	7	3
	= Surplus	**238**	**227**	**189**
N leach. (kg N/ha)	Overseer v6.2.3	69	68	57
Nitrogen use efficiency	(Product N + Stored suppl.N) / (Fert N + Supplement N)	36%	39%	41%
Milk production	kg MS/ha	2044	2082	2147
	kg MS/cow	500	502	500

Pinxterhuis and Edwards in prep.

Implementation of plantain

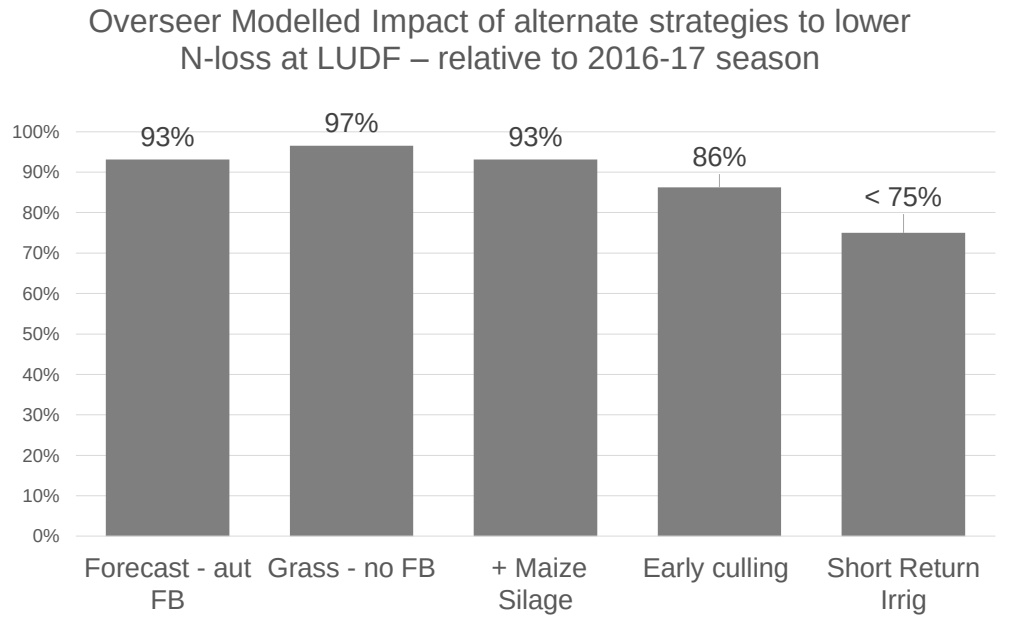
- Establishment
- Recalibrating what the paddock looks like – perception it looks untidy may stop people from using it
- Reducing N fertiliser and still harvesting 18 t DM/ha pasture – effluent management, grazing management

No catch crop used

- Reason for not trying catch crop after autumn fodder beet
- Fat hen post fodder beet – can't establish pasture with plantain there
  - Catch crop might control fat hen
- Would Italian be an option to get paddock back in pasture asap?

Other Options to reduce N-losses

- Overseer modelling can also be used to investigate possible scenarios – management or system changes - that influence N-losses from grazed systems
- Total Production, imported feed, drying off decisions and infrastructure (including irrigation) can impact N-losses
- Check the opportunities with a Certified Nutrient Management Advisor and Farm Consultant



Winter feeding systems and standoff pads

Measurements (over 7 weeks)	Paddock 24hrs on Paddock	Carpet 16hrs off paddock	Stones 16 hrs off paddock	Sand 16 hrs off paddock	Woodchip 16 hrs off paddock
Lying time (hrs) for a WET winter (2017)	8.1	8.8	9.5	7.6	8.4
Lying time (hrs) for a DRY winter (2016)	11.0	11.6	9.6	-	10.3
Cow Hygiene (2017) (Score 0-2)	1.1	1.4	1.0	1.7	1.3
Lameness (2017) (Score 0-3)	0.1	0.1	0.2	0.1	0
Relative capital cost for surface	Nil	High	Low	Med	Med
Relative operational cost	Nil	High	Low	Med	Med

Ashley Dene Research & Development Station Health & Safety

The farm is a fully operational dairy farm with a number of **potential hazards** for both visitors, students and staff.

Many of the potential hazards cannot be eliminated while providing access to visitors, therefore **all** staff and visitors **MUST** watch for potential hazards and act with caution.

PEOPLE: **Uninformed/ ill prepared visitors may be the greatest risk**	**ANIMALS:** **You are in their space, treat them with respect**	**MILKING SHED:** **Confined animals** **Moving Backing Gate** **Chemicals**
TOUCH: **Hot/Cold surfaces** **Hot water** **Chemical burns** **Electric fences - treat as on and high voltage current**		**EARS / EYES:** Loud Machinery Splashes - water, oil, milk, chemicals, animal urine & faeces, welding flash
SLIPS / TRIPS: **Uneven surfaces across the farm Drains** **Effluent Pond** **Fences** **Concrete**	**VEHICLES:** Contractors and farm equipment- act as though they can't see you - keep out of their way	**MACHINERY:** Centre Pivot takes precedence over your plan. Chainsaws, hand tools etc generate noise, fragments

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.

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* MPI, Future capability needs for primary industries, April 2014

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