SIDDC
South Island Dairying Development Centre

LINCOLN UNIVERSITY
DEMONSTRATION DAIRY FARM

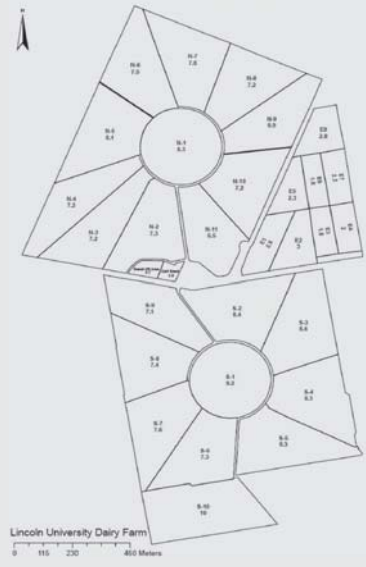
FOCUS DAY - JULY 2016

STAFF

Peter Hancox	– Farm Manager
Sean Collins	– 2IC
Matthew Costello	– Dairy Assistant
Shaun Snoxell	– Dairy Assistant

LUDDF 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
New Zealand's specialist land-based university

DairyNZ

ravensdown

LIC

Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

agresearch

SIDE
SOUTH ISLAND DAIRY EVENT

INTRODUCTION

The LUDDF 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. LUDDF 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 LUDDF 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: 2014/15

LUDDF 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.

LUDDF STRATEGIC OBJECTIVE 2011-2015:

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

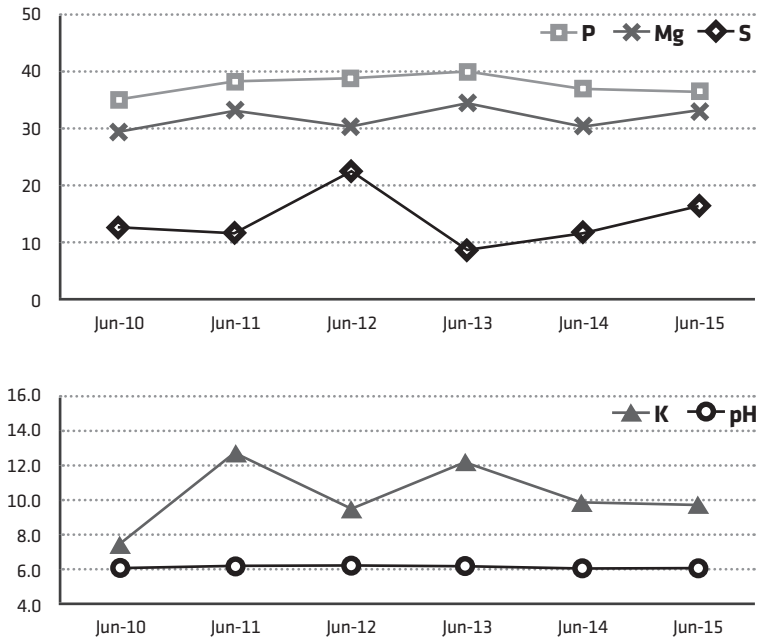
Target Soil Test Ranges:

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

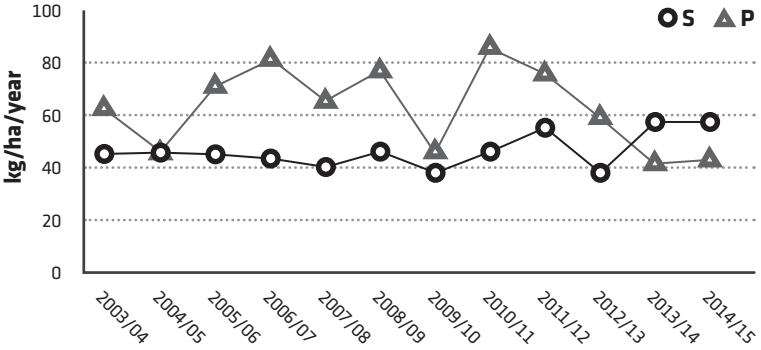
PASTURE

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 – 2014/15



Paddock	Period Regrassed	Grass Cultivar
N1	Feb-01	Brons. Imp
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	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
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-08	Arrow - Alto
S6	Dec-14	Shogan/Chi/Plant (spray/drill)
S7	Sep-06	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 2015

KiwiX DNA for 365 cows [F8-F16]; Holstein Friesian Daughter Proven for 280 cows [F0-F7 then follow with Jersey bulls. Heifers start mating 10 days early, Syncro + AI the natural mate for 9 weeks. 10 weeks mating for milking herd. Expect to rear 150 heifers.

HERD DETAILS – FEBRUARY 2015

Breeding Worth 91 / 47%
(rel%) / Production Worth (rel%) 123 / 70%
Recorded Ancestry 99%

Average weight / cow (Dec)
Herd monitored walk over weighing
488 kg [Dec 2015]

Calving start date 2016
Heifers 18 July, Herd 1 August

Est. Median calving date
12 August 2016

Mating start date
25 October 2015

Empty rate (nil induction policy) after 10 weeks mating - 14% (2015-16 mating). 6 week in-calf rate 69%.

	2002/03	2003-07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Total kg/MS supplied	228,420	**277,204**	278,560	261,423	273,605	264,460	297,740	300,484	276,019	278,654	289,906
Average kg/MS/cow	381	**425**	409	384	415	395	471	477	440	498	522
Average kg/MS/ha	1,414	**1,720**	1,744	1,634	1,710	1,653	1,861	1,878	1,725	1742	1812
Farm working expenses /kgMS	$2.98	**$2.68**	$3.37	$3.88	$3.38	$3.86	$3.91	$3.84	$4.28	$3.87	$3.47
Dairy operating profit/ha	$1,164	**$2,534**	$8,284	$2,004	$4,696	$6,721	$4,553	$4,665	$7,578	$1200	$1182
Payout (excl. levy) $/kg (Milk price + div)	$4.10	**$4.33**	$7.87	$5.25	$6.37	$7.80	$6.30	$6.12	$8.50F	$4.60	$4.30
Return on assets	4.4%	**6.18%**	14.6%	4.8%	7%	7%	6%	6%	10%	1.6%	1.6%
1 July cow numbers	631	**675**	704	704	685	694	665	650	650	580	578
Max. cows milked	604	**654**	680	683	660	669	632	630	628	560	555
Days in milk	-	**-**	263	254	266	271	272	273	259	263	267
Stocking rate cow equiv./ha	3.75	**4.05**	4.2	4.3	4.13	4.18	3.95	3.94	3.92	3.5	3.47
Stocking rate Kg liveweight/ha	1,838	**1964**	2,058	2,107	1,941	1914	1860	1878	1872	1680	1724
No. cows/weeks wintered off	500/8	**515/7.8**	546/9	547/7	570/9	652/8.4	650/9.8	650/9.8	650/11.4	580/10.7	578/11.6
No. yearlings grazed - On/Off	0/118	**0/157**	0/171	0/200	0/160	0/166	0/141	0/138	0/140	0/126	0/126
No. calves grazed - On/Off	0/141	**0/163**	0/200	0/170	0/160	0/194	0/190	0/156	0/150	0/126	0/155
Past eaten (dairybase) (tDM/ha)	-	**-**	17.9	17.2	16.2	16.9	17.3	16.8	14.9	15.7	16.6
Purch. Suppl - fed (kgDM/cow)	550	**317**	415	342	259	463	359	434	506.8	300	126
Made on dairy/platform (kgDM/cow)	0	**194**	95	64	144	160	154	93	0	40	277
Applied N/160 eff. Ha	-	**-**	164	200	185	260	340	350	250	143	179

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

Contents

LUDF Strategic Objectives

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 proposed, and now operative subregional requirements to reduce nutrient loss in the local catchment, LUDF has (over the past two seasons) 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.

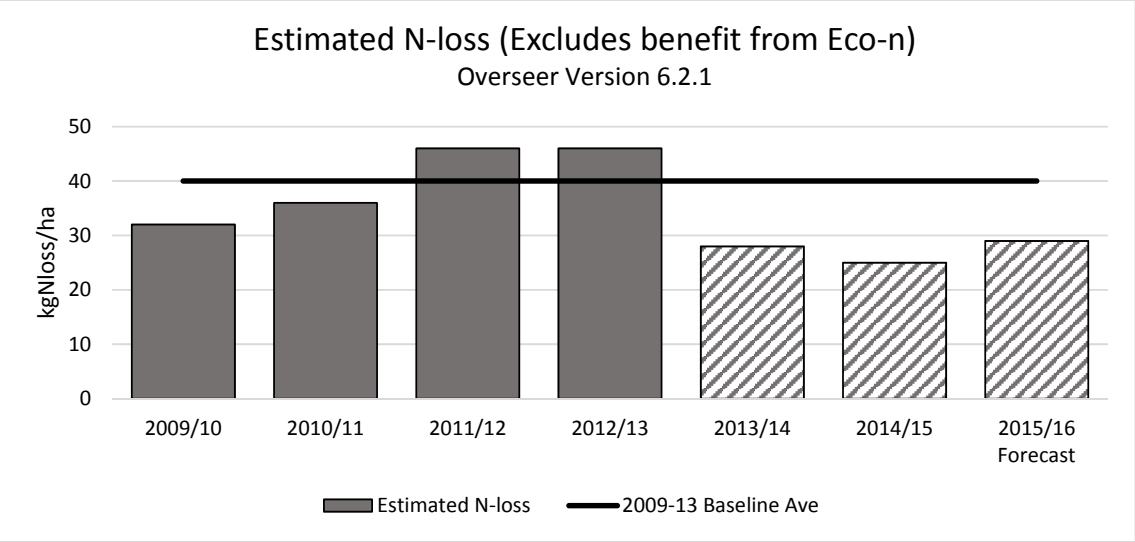
Low Input, High Production, Highly Profitable, Low Nutrient Loss Farm System

Targets / Results:

	Initial Target	2014/15 Result	2015/16 Result
Stocking Rate	3.5 cows /ha		
Nitrogen Fertiliser Input	150 kgN/ha	143 kgN/ha	179 kgN/ha
Imported Supplement	300 kgDM/cow + winter off		126 kgDM/cow + winter off
Milk Production	500 kgMS/cow and 1750 kgMS/ha	498 kgMS/cow and 1742 kgMS/ha	522 kgMS/cow and 1812 kgMS/ha
Farm Working Expenses	$4.00 /kgMS	$3.87 /kgMS	$3.47 /kgMS

Results from the 2014-15 season identified the system was scalable, but could be improved at LUDF. In particular, the research had not included any regrassing, where-as LUDF, based on prior identification of poorer performing paddocks planned to, and regrassed 3 paddocks (15%) in the 2014-15 season. This put considerable pressure on the farms feed supply, so the plan was reduced to 10% in 2015-16. The reduction in payout subsequently led to this being restricted to only 5%. This was a much more manageable area in a low input system and contributed to generating a surplus of home grown silage that was cost effectively fed back to extend lactation of 'cull' cows.

Environmental footprint: estimated Nitrogen Loss with Overseer



Estimated N losses for LUDF through 7 seasons, compared to baseline as run through Overseer.

Overseer estimated the farm system in 2014-15 reduced its N-leaching by over 30%, providing confidence the farm could allow the use of a little more Nitrogen fertiliser to push total drymatter production, milk production and profitability. Total N applied as fertiliser therefore increased from 143 kgN/ha to 179kgN/ha last season. The additional Nitrogen was largely applied in the late spring / summer when irrigation plus Nitrogen was likely to give high N-response rates.

Feed Conversion Efficiency – Low Input System:

The farm system operated at LUDF over the past two seasons has demonstrated the farm can achieve high levels of production from its pasture base. Successful adoption of this requires understanding of the available feed supply, then matching this with feed demand to achieve high(er) levels of feed conversion efficiency into milk production.

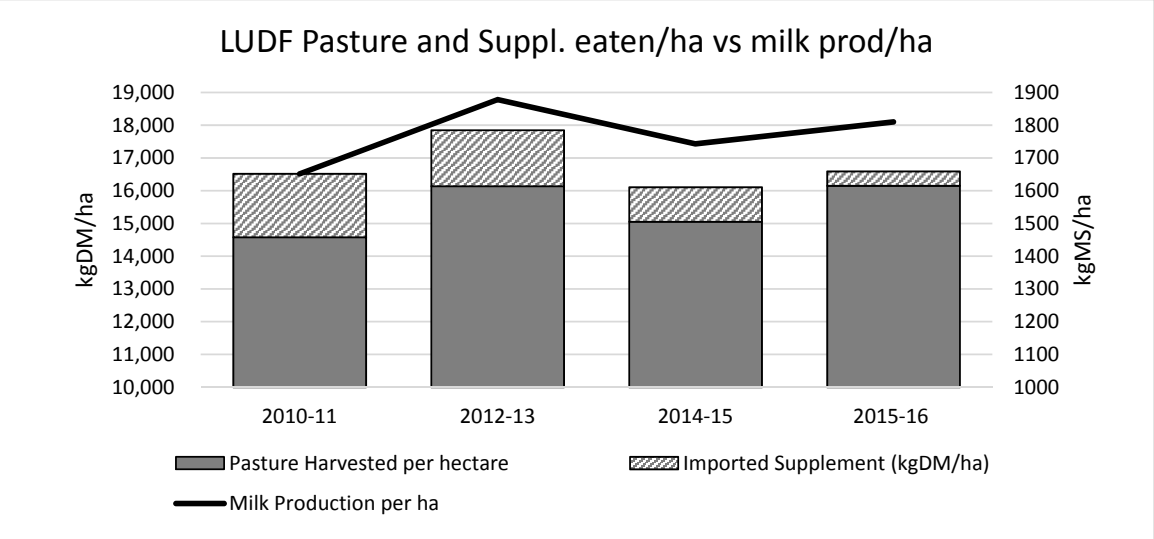
Factors influencing Feed Supply

a. Pasture Available / Eaten
b. N-fert use
c. Supplement use, including type and quality
d. Expected wastage, availability of facilities for feeding out supplements
e. Ryegrass leaf stage and impact on total growth
f. Pasture quality
g. Grazing residuals and return period.

Factors influencing Feed Demand

a. Stocking rate - Cows per ha / BW per ha /Liveweight per ha
b. Production per cow / per hectare
c. Grazing off young stock / dry cows / late calvers / springers

Whilst supply of supplements and off farm grazing are relatively easily quantified, the best estimate of pasture supply at LUDF remains that back calculated from milk production (demand).



Feed demand above has been calculated from milk production, while feed supply is similarly estimated from feed demand plus feed available from imported supplements. As seen in the graph above, feed harvested per hectare (as pasture) has fluctuated from around 14,500 kgDM/ha back in 2010-11 to close to 17,000 kgDM/ha estimated for 2015-16.

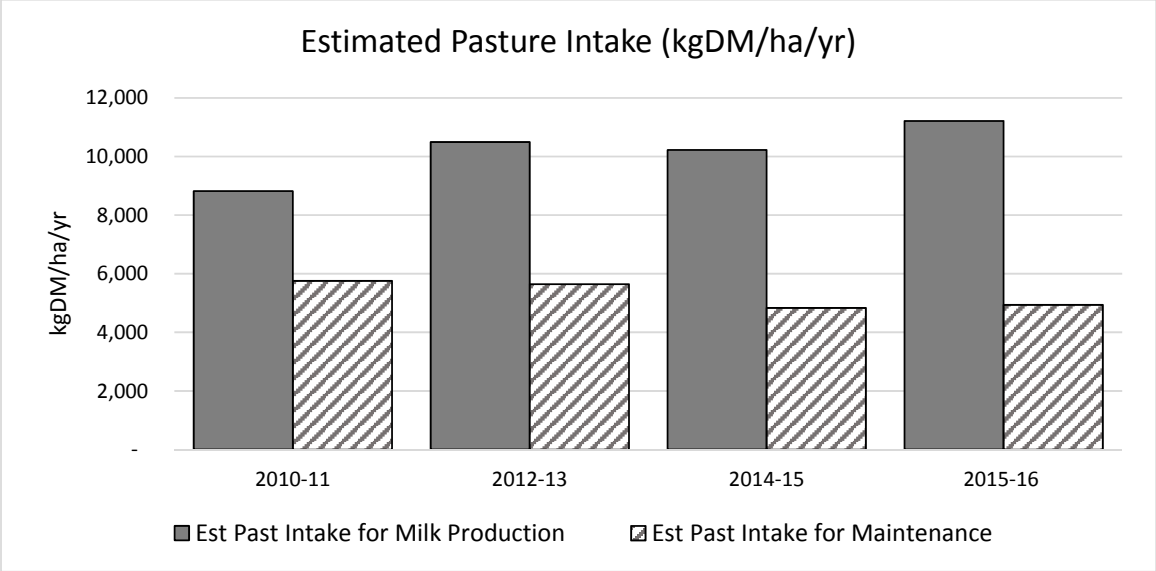
Similarly milk production has ranged from 1650 kgMS to nearly 1900 kgMS /ha over this period. The graph highlights:

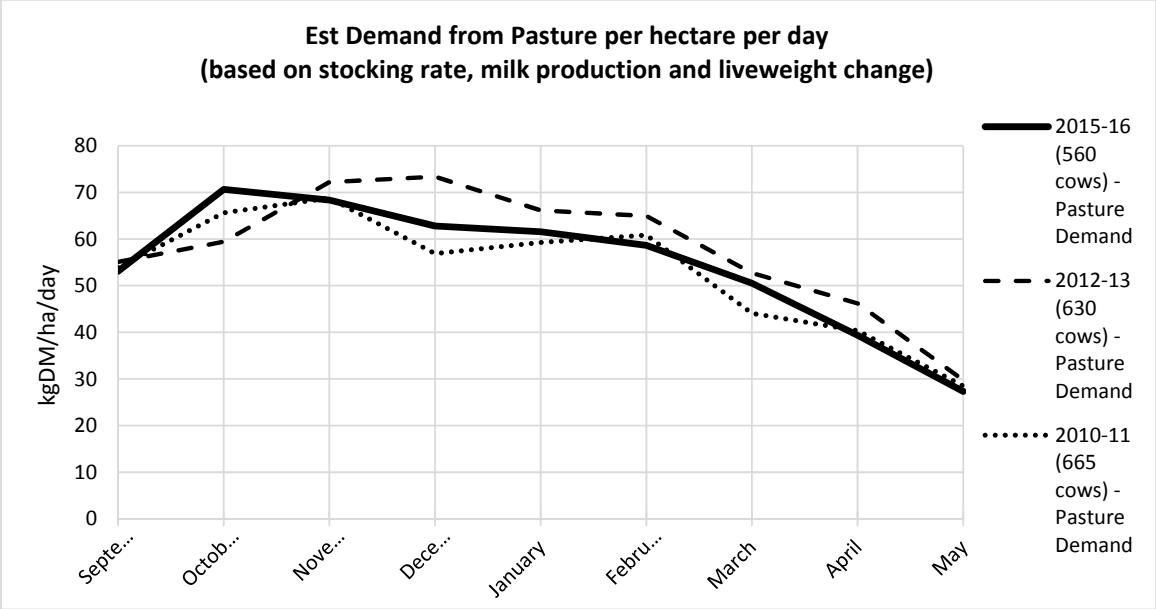
- Pasture harvested has generally increased over this time
- Imported supplementary feed by comparison has decreased year on year for the past 3 years
- Total milk produced has increased over the past 3 years.
- In 2011-13, higher inputs of N-fert and supplements contributed to more pasture consumed than last year, and with more supplements used, total milk production was higher.

Achieving more pasture eaten becomes much more valuable when this also results in a greater percentage of pasture converted into milk production.

Feed Conversion Efficiency

Using the energy requirements for maintenance, walking, change in CS and milk production, enables calculation of the proportion of pasture consumed for milk production to be compared to that required for maintenance (etc). Total pasture consumed for milk production has increased since 2010-11 and changed from 61% of pasture eaten to 69% pasture. The farm is thus now both 'harvesting' more pasture, AND turning this into more milk for sale.



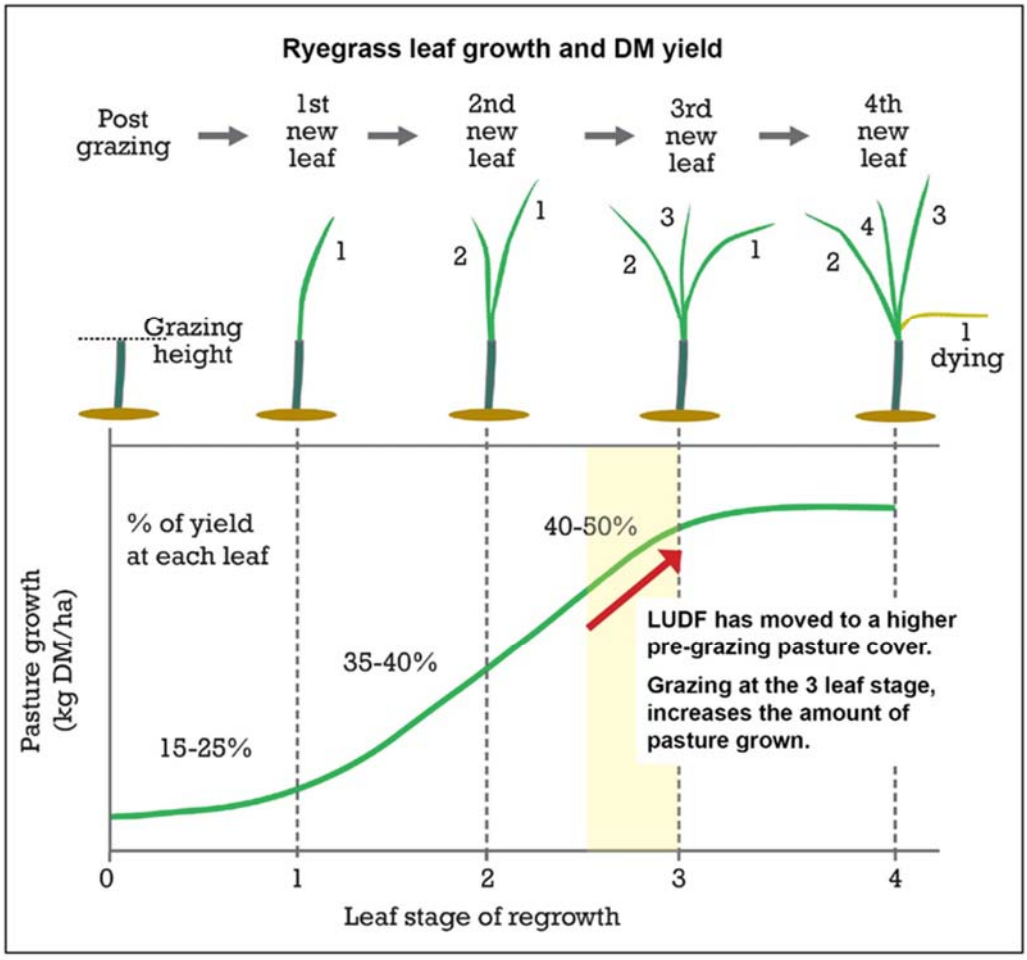


Why (how) LUDF has grown more pasture

A key reason is that LUDF has increased its pre-grazing pasture cover by 200 kgDM/ha. The science behind this is shown in the diagram below.

The farm has moved from grazing ryegrass at around *2.5 leaves/tiller* to around *3 leaves/tiller*. This has a significant effect as 40-50% of the ryegrass DM yield in a regrowth cycle is produced with the third leaf. Simply put "grass grows grass", and with more leaves the pasture captures more light, has greater photosynthesis, and grows faster.

Post-grazing residual has remained similar to previously (average 15 kgDM/ha higher) and a consistent, even post-grazing residual remains a key requirement for LUDF. Running higher pre-grazing covers means the grazing round is longer (by an average of 6 days) and each paddock will be grazed 1-2 times less over the season.



Two other things are key to managing higher pre-grazing covers (as LUDF has):

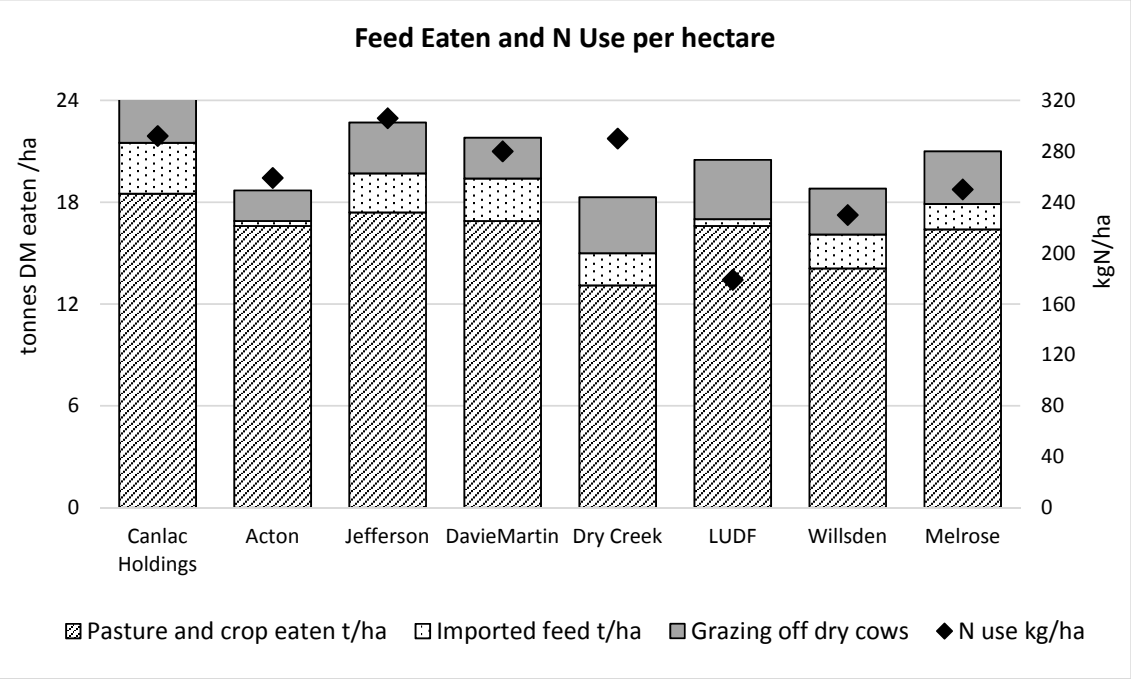
1. Tetraploid ryegrass, or a tetraploid/diploid ryegrass mix, have a significant advantage for this system. On LUDF 18 of its 21 paddocks have tetraploids, which maintain high cow intakes at higher covers. Whereas cows may struggle to graze a straight diploid ryegrass >3300 kgDM/ha, a tetraploid/diploid mix will typically still be well grazed at 3600.
2. Pasture quality issues occur more quickly – Pasture ME is still very high (12+) at the 3 leaf/tiller stage of ryegrass growth, but beyond this it starts to drop off. Having higher covers means your farm is growing more, and you can move past 3 leaves/tiller into quality issues more quickly. Monitoring and controlling pasture quality when necessary (e.g. pre-graze mowing, making silage) are important.

2015-16 Profitability Analysis - Comparison of Expenses and Profitability across eight Canterbury farms

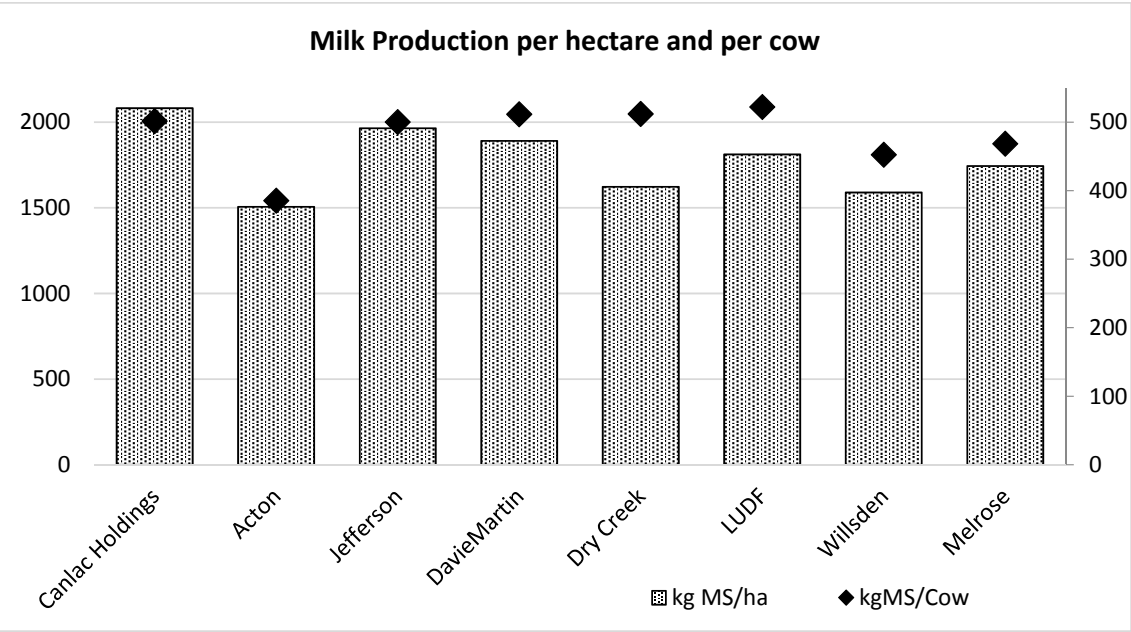
LUDF, in conjunction with DairyNZ is fortunate to have a range of well-respected highly profitable dairy farms across Canterbury who make their farm physical and financial results available to provide an annual benchmark of performance.

The following table highlights the key parameters of each farm, along with a range of performance measures. In addition to the details below, each farm has its own constraints and opportunities; the results below are the outcome of how each farm has chosen to operate in the past 12 months, given the climate, market and their own circumstances. For LUDF, this includes voluntarily endeavouring to lower its N-leaching (as above).

SEASON 2015-16	Canlac Holdings	Acton	Jefferson	Davie-Martin	LUDF	Dry Creek	Willsden	Melrose
Effective ha (MP)	335	174	140	141	160	160	306	715
Support Block	155	0	102	90	0	0	0	215
Peak cows milked	1391	680	550	521	555	507	1075	2662
Cows/ha	4.15	3.91	3.93	3.70	3.47	3.17	3.51	3.72
Total kgMS	697625	262146	275180	266634	289906	259677	486558	1247273
kgMS/Cow	502	386	500	512	522	512	453	469
kg MS/ha	2082	1507	1966	1891	1812	1623	1590	1744
kgMS as % of ave liveweight	104%	85%	99%	102%	105%	109%	96%	100%
10 day peak	2.25	1.78	2.33	2.28	2.47	2.45	2.05	2.26
DIM	270	255	268	262	267	255	259	267
% Drop from peak to End Dec	7.7%	5.8%	6.9%	4.5%	6.5%	5.3%	4.7%	5.9%
Pasture and crop eaten - tDM/ha	18.5	16.6	17.4	16.9	16.6	13.1	14.1	16.4
Imported feed t/ha	3	0.3	2.3	2.5	0.4	1.9	2	1.5
Grazing off dry cows – tDM/ha	3.2	1.8	3	2.4	3.5	3.3	2.7	3.1
Total feed eaten	24.4	18.8	22.7	21.8	20.5	18.3	18.8	20.8
N use kg/ha	292	259	306	280	179	290	230	250
Length of AB	5	4	6	11	6	6	5	6
% herd treated for non-cycling cows	14%	9%	12%	5%	0%	16%	0%	8%
6 week-InCalf rate	68%	55%	66%	70	69%	63%	58%	65%
Not InCalf rate	21%	12%	21%	16%	14%	19%	14%	17%
1st calvers on farm @ end of season	77%	87%	78%	81%	84%	83%	84%	88%

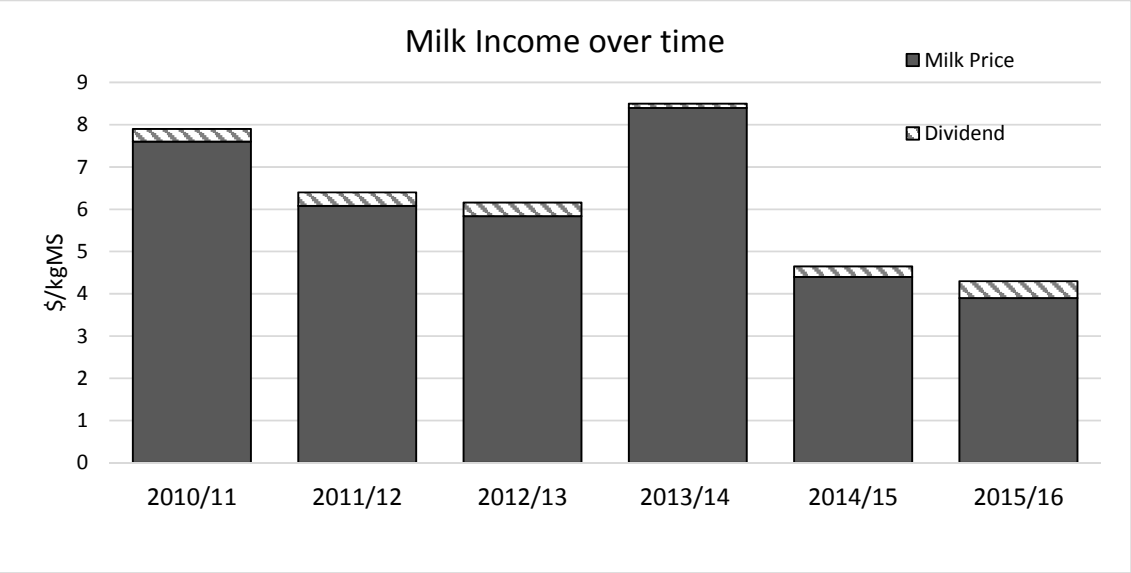


As seen above the farms have a range of pasture eaten, use of imported feed, grazing off and Nitrogen fertiliser use. Milk Production per hectare and per cow also vary considerably amongst this group of farms.



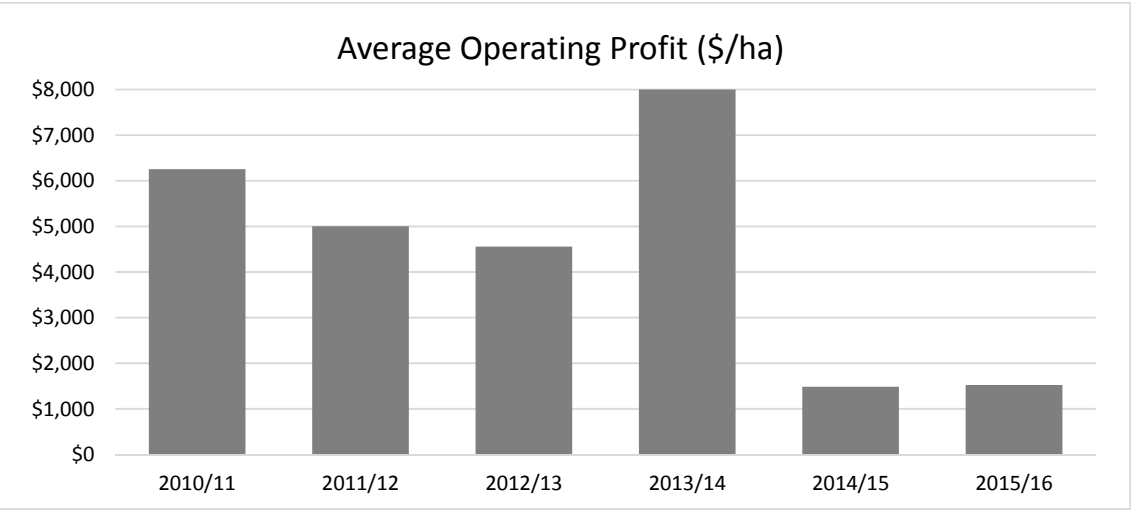
Overall Drivers of Profitability

Milk income remains the major driver of actual profitability per year. The graph below shows the range in total milk income (milk price and dividend) earned per season.



Profitability below is calculated based on milk production x full year forecast milk income, ignoring any retrospective payments, and assuming one share is held for each kilogram of milk solids produced.

Average profitability of the benchmark farms over the past 6 seasons is shown below and includes depreciation and adjustments for changes in livestock numbers, feed inventory and management wages. Note the number of farms contributing to the benchmarking dataset has changed over time, with the average per year reflecting the data available that year, rather than the average of all farms currently in the dataset.



Note while milk income is 35 cents/kgMS lower this year, average farm profit is the same as last year.

Calculation and adjustments required in determining Profit

The following table highlights the adjustments required when calculating profit for LUDF. Data from each of the farms in the benchmark analysis is treated similarly to accommodate the following changes

- Differences between opening and closing stock numbers and feed levels,
- Owned Support land
- Wages of management and
- Depreciation

DairyBase protocol is used for all these adjustments, which provides a consistent methodology to adjust for wages based on herd size, average feed cost and IRD livestock values. These aspects may over or under estimate the impact of these on any individual farm, but in all cases provides a consistent approach.

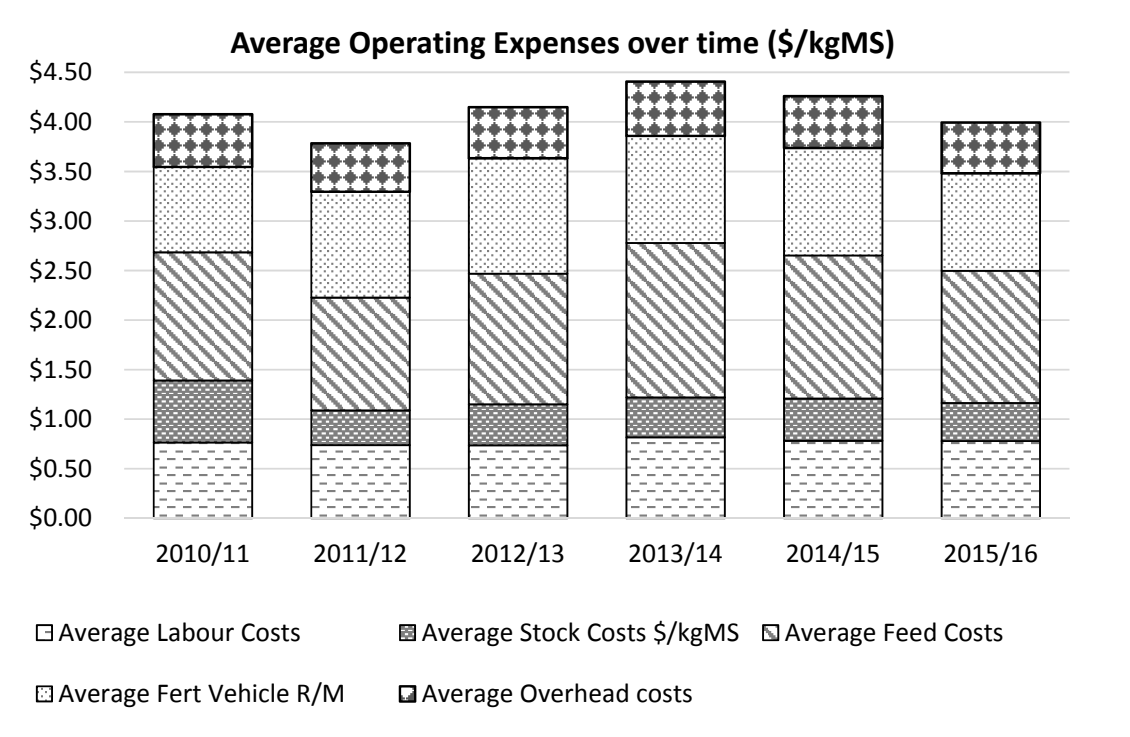
	LUDF Cash Costs	**Adjusted LUDF data when calculating operating Profit**
Milk Income + Dividend (less levy)	$4.26/kgMS	$4.26/kgMS
Total Milk Income	$1,236,159	$1,236,159
Livestock Sales - purchases	$44,283	$44,283
Stock Adjustment		PLUS $15,253
Total Income	$1,280,442	$1,295,695
Farm Working Expenses	$1,006,610	$1,006,610
Labour Adjustment		-
Feed Adjustment		-
Owned Support Land		-
Depreciation		$100,000
Total Operating Expenses		$1,106,610
Cash Surplus	$273,832 ($1711/ha)	
Operating Profit		$189,085 ($1182/ha)

Across the range of farms within the following analysis, the range of total adjustments varies from $207/ha to $2181/ha. Changing the values associated with these adjustments could therefore markedly change the calculated operating profit.

Total operating expenses, expressed per kgMS, are showing a small but steady decline over the last three seasons amongst this group of farms. Overall average production is reasonably static so the reduction expressed per kgMS is a decrease (on average) of operating expenses, rather than a dilutionary aspect. Within total expenses however there are a number of interesting changes:

- Labour and livestock related costs are generally static,
- Feed costs had risen through until 2013-14 but have decreased in both of the past 2 years. They remain the largest group of costs identified below
- Fertiliser, vehicle costs, regrassing and R/M have varied over time but are typically lower than in the earlier period of this analysis
- Overhead costs are also largely being held at a constant level per kg MS.

Within the above data, some costs may have moved categories over time as greater emphasis has been placed on coding expenses to specific activities.



For simplicity the categories above reflect the DairyBase coding of Labour, Stock, Feed, Other and Overhead Expenses. In this analysis, Other has been renamed 'Fert Vehicle R/M' to better define its grouping. These categories can be further broken down as follows:

Labour:

- Wages (including Housing)
- Unpaid labour adjustment
- Management adjustment

Stock:

- Animal health
- Breeding and herd Improvement
- Farm Dairy
- Electricity (Farm dairy and water supply)

Feed:

- Supplements Made / Purchased / Cropped
- Feed Inventory Adjustment
- Calf Feed
- Young stock grazing
- Winter cow Grazing
- Support Block lease
- Owned Support Block Adjustment

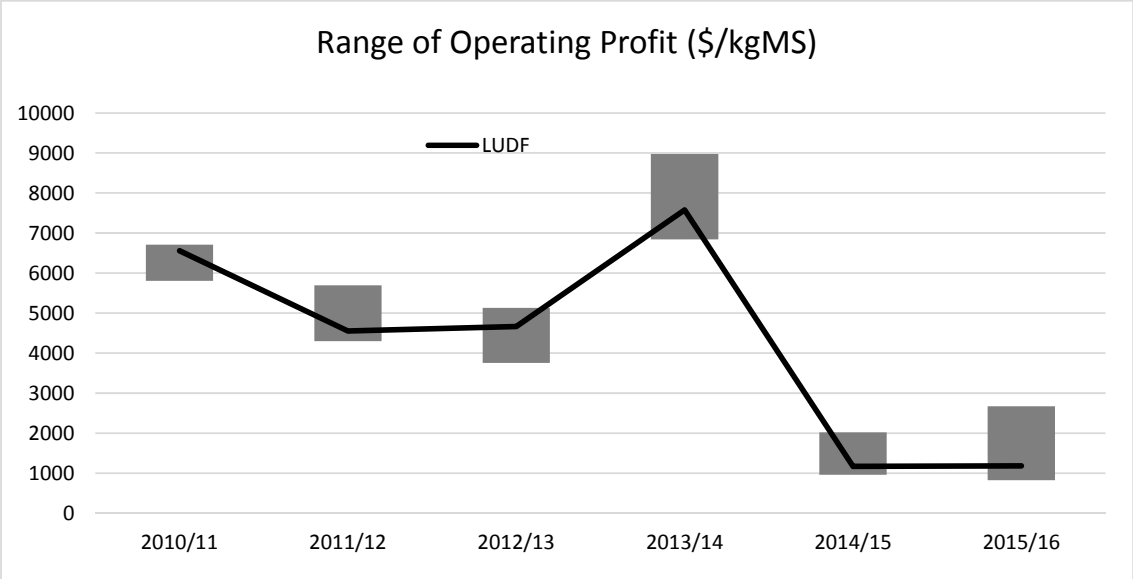
(Other) Fert Vehicle R/M

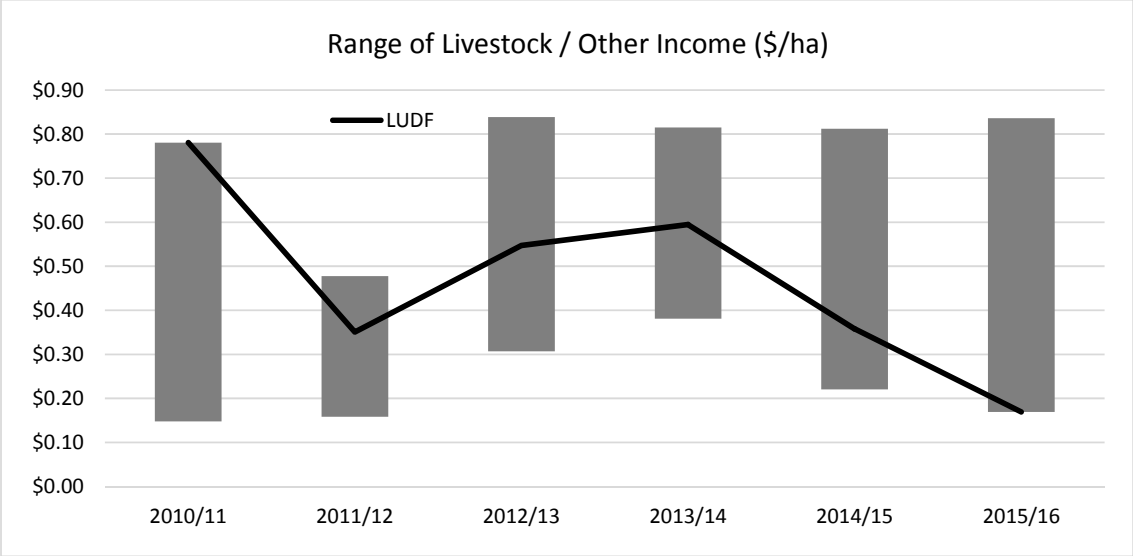
- Fertilizers (including Nitrogen)
- Irrigation
- Regrassing
- Weeds and Pests
- Vehicle
- Fuel
- R&M land and buildings
- R&M Plants and equipment
- Freight and General (incl farm travel)

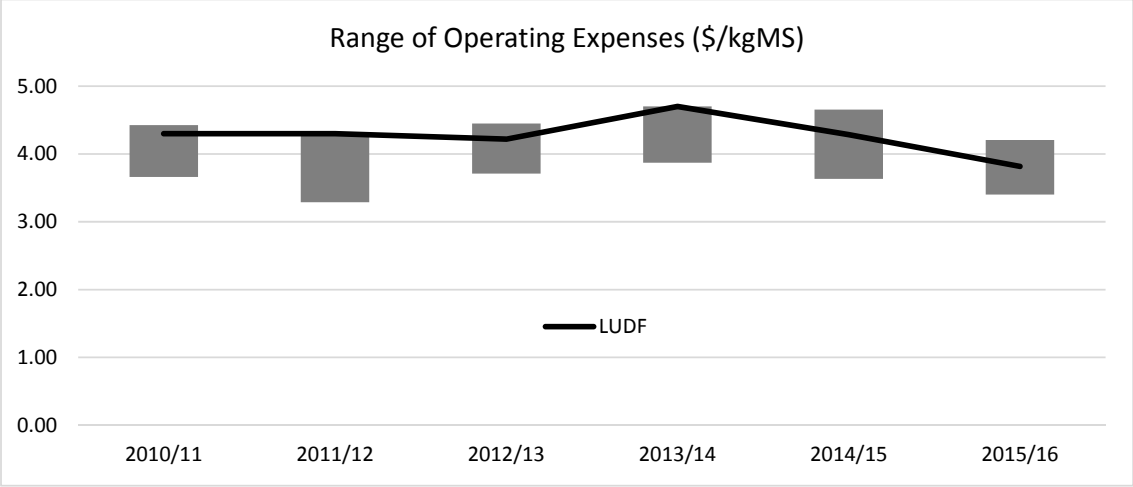
Overheads:

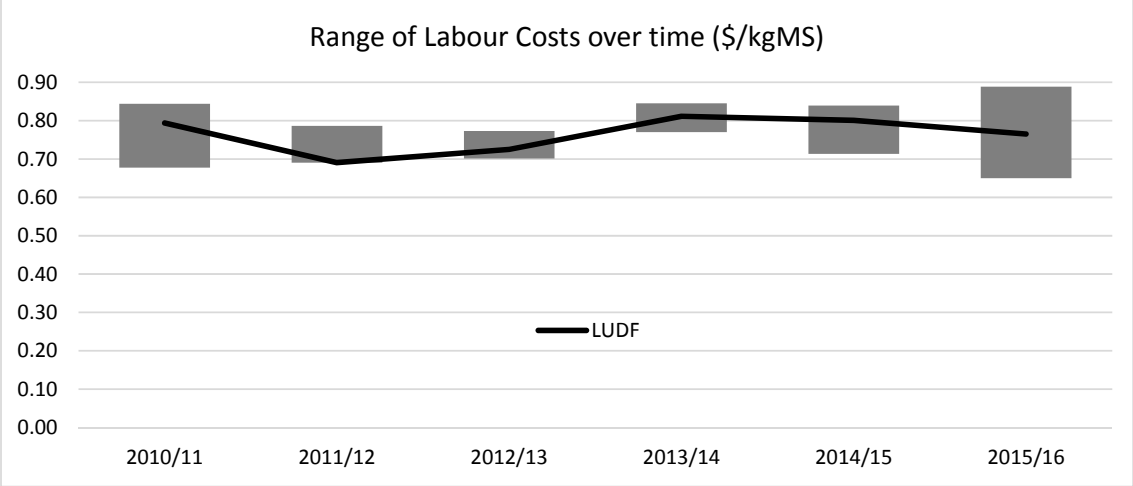
- Administration
- Insurance
- ACC
- Rates
- Depreciation

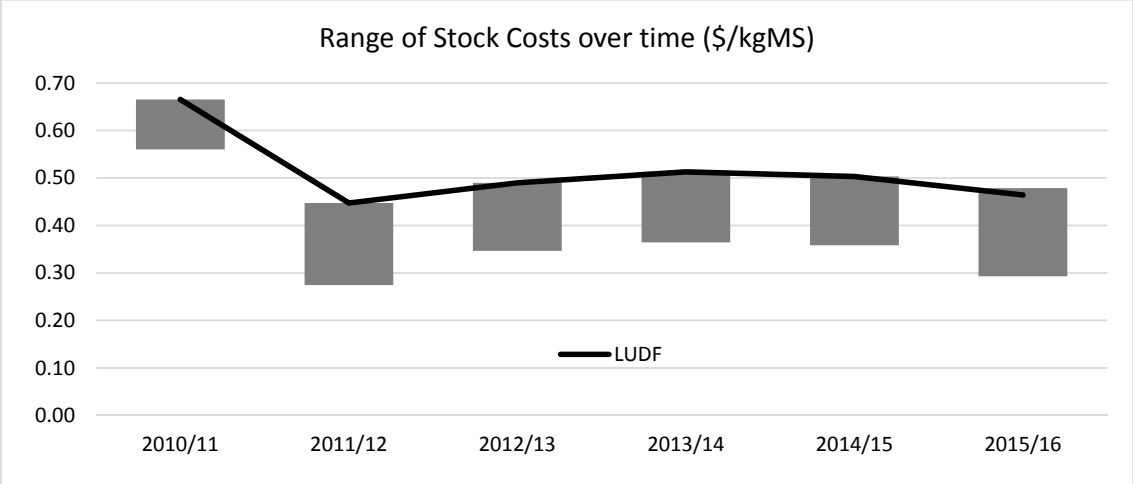
LUDF conducts this benchmarking exercise to measure its own performance and also to provide data on actual performance for other farms to benchmark against. The following set of graphs compare the position of LUDF against the range of performance of the remaining farms in the analysis. The grey boxes represent the highest and lowest figures amongst the data set each year, while the black line identifies the LUDF position. Note these are visual representation of where the range of costs are for each category and as such can be swayed by a particular farm with either high or low costs for subset or category of the data.

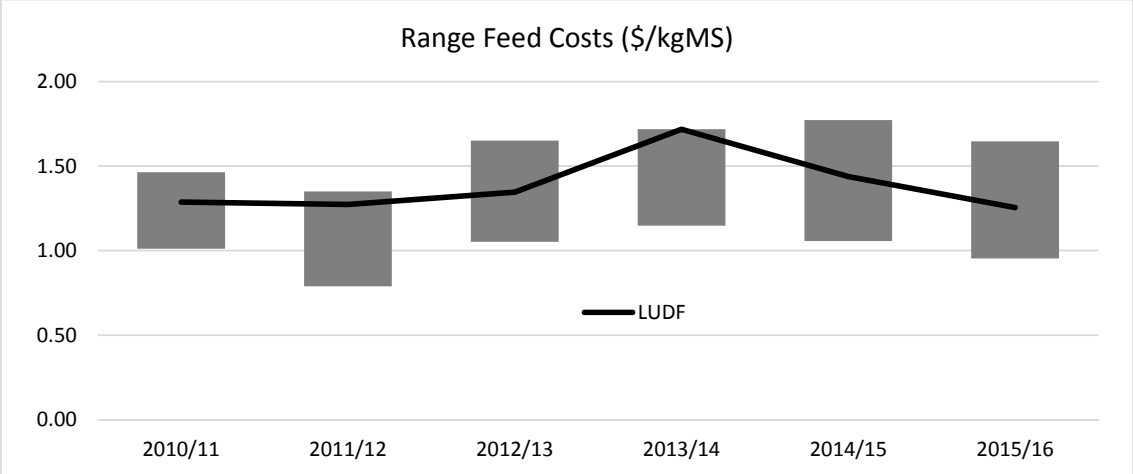


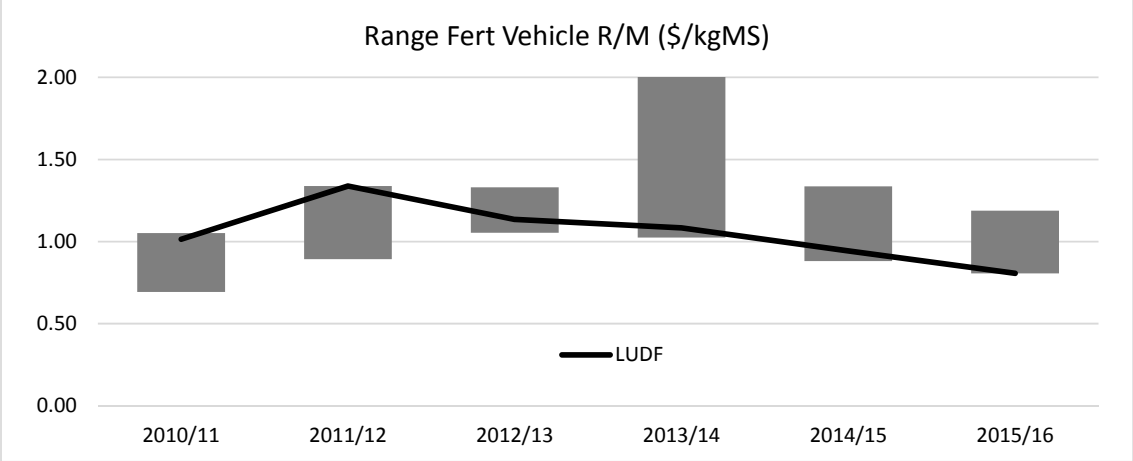

Range of Livestock / Other Income ($/ha)
$0.90
$0.80
$0.70
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
$0.00
LUDF
2010/11
2011/12
2012/13
2013/14
2014/15
2015/16

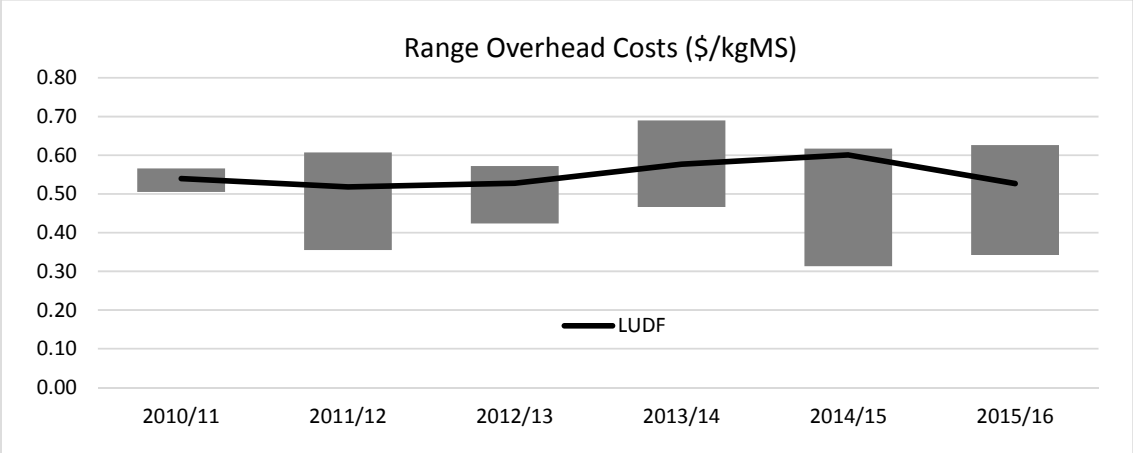

Range of Operating Expenses ($/kgMS)
5.00
4.00
3.00
2.00
1.00
0.00
LUDF
2010/11
2011/12
2012/13
2013/14
2014/15
2015/16


Range of Labour Costs over time ($/kgMS)
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
LUDF
2010/11
2011/12
2012/13
2013/14
2014/15
2015/16


Range of Stock Costs over time ($/kgMS)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
LUDF
2010/11
2011/12
2012/13
2013/14
2014/15
2015/16


Range Feed Costs ($/kgMS)
2.00
1.50
1.00
0.50
0.00
LUDF
2010/11
2011/12
2012/13
2013/14
2014/15
2015/16


Range Fert Vehicle R/M ($/kgMS)
2.00
1.50
1.00
0.50
0.00
LUDF
2010/11
2011/12
2012/13
2013/14
2014/15
2015/16



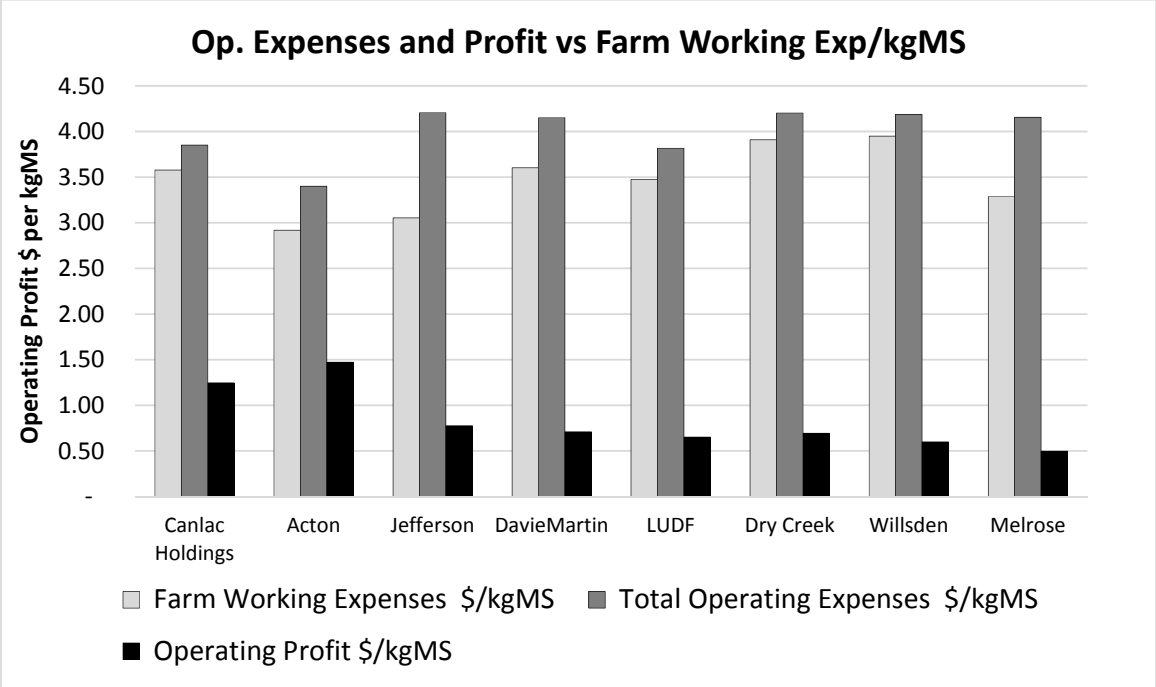
Data Warning:

1. Its possible to 'over-analyse' any of this data. For simplicity data is grouped which can mask some of the uniqueness of individual farms. Data is also averaged where possible to aid the presentation, but averaging can lessen the value.

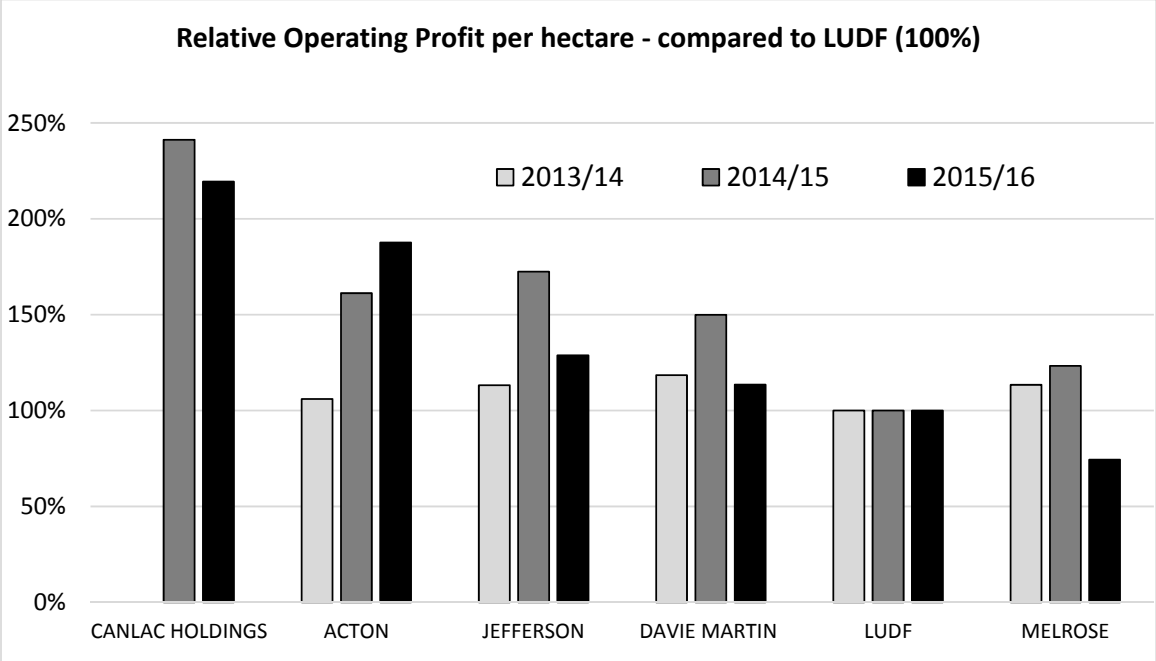
2. Low farm working expenses don't always equal low operating expenses (and vice versa), particularly if there are significant adjustments in feed inventory, livestock numbers from the start to the end of the year, or labour adjustments (for owner input).

3. Note also in the following table and graph, high profitability can occur with higher expenses, providing income is high, while low operating expenses can also contribute to high profitability. The highest profit per hectare was achieved at Canlac Holdings, which had the highest income and second highest operating expenses per ha, while the highest profit per kgMS occurred at Acton which had the lowest operating expenses per kgMS (and was the second highest profit per hectare).

	Canlac Holdings	Acton	Jeffer-son	Davie Martin	LUDF	Dry Creek	Willsden	Melrose
TOTAL INCOME/ha	**10,615**	**7,342**	**9,791**	**9,192**	**8,098**	**7,950**	**7,612**	**8,234**
Total Operating Expenses $/ha	8,023	5,125	8,269	7,851	6,916	6,822	6,659	7,355
Operating Profit $/ha	**2,592**	**2,217**	**1,522**	**1,341**	**1,182**	**1,128**	**953**	**879**
Total Operating Exps $/kgMS	3.85	3.40	4.21	4.15	3.82	4.20	4.19	4.16
Operating Profit $/kgMS	**1.24**	**1.47**	**0.77**	**0.71**	**0.65**	**0.69**	**0.60**	**0.50**

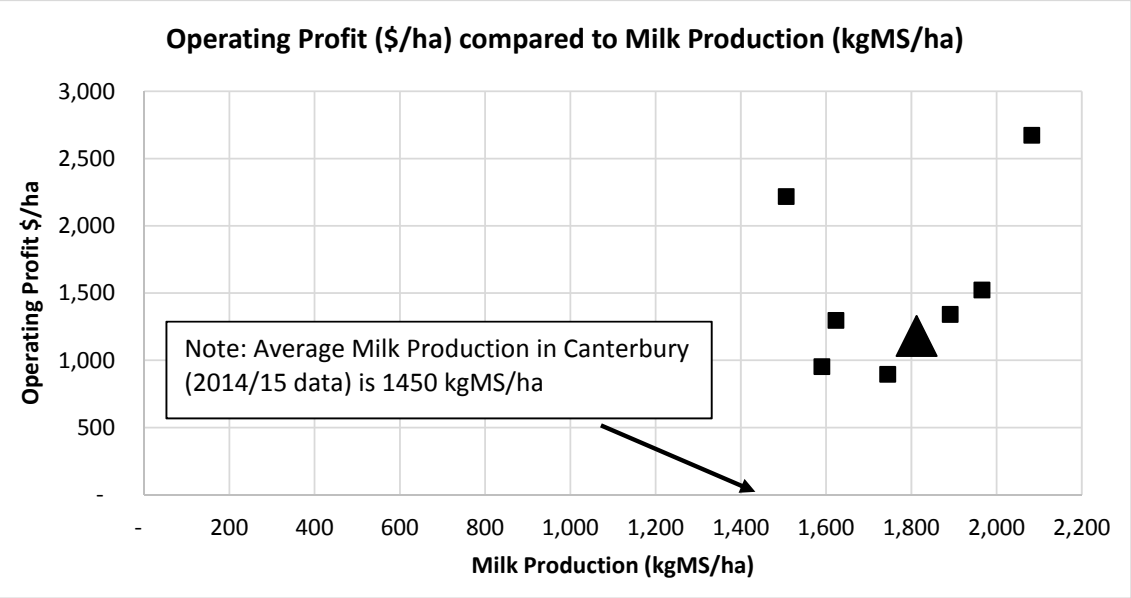


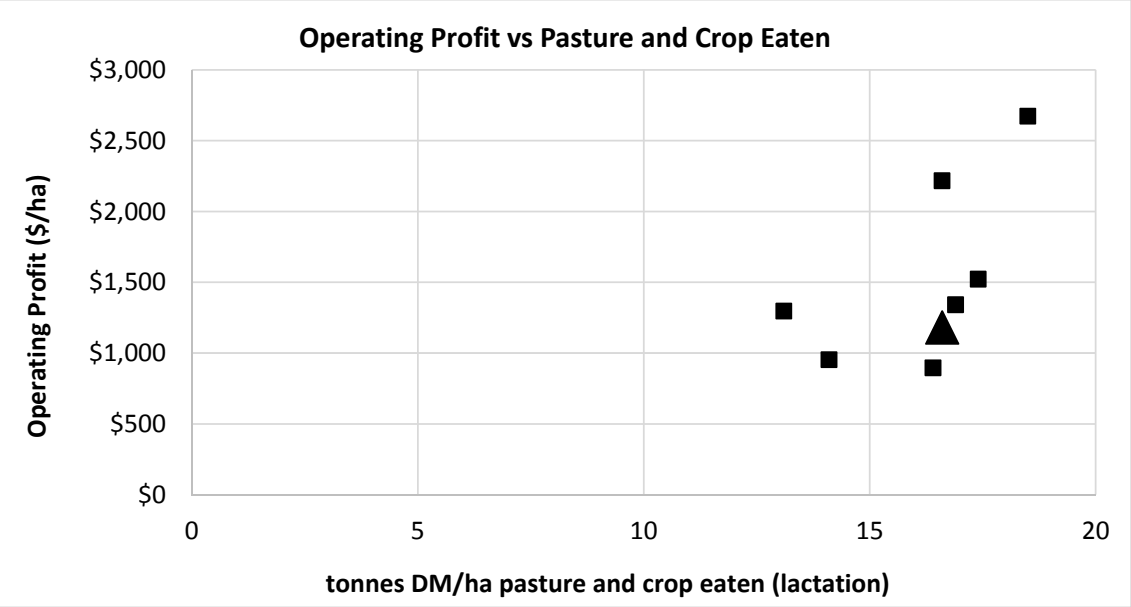
Farm Working expenses are a useful indicator of farm performance, but as is evident above, FWE may not reflect operating expenses, if there are significant adjustments required to reflect true profitability. As examples, LUDF's FWE and Operating expenses are similar, largely reflecting the addition of depreciation, whereas Jeffersons FWE are more than $1/kgMS lower than the farms operating expenses.



Production vs Profitability

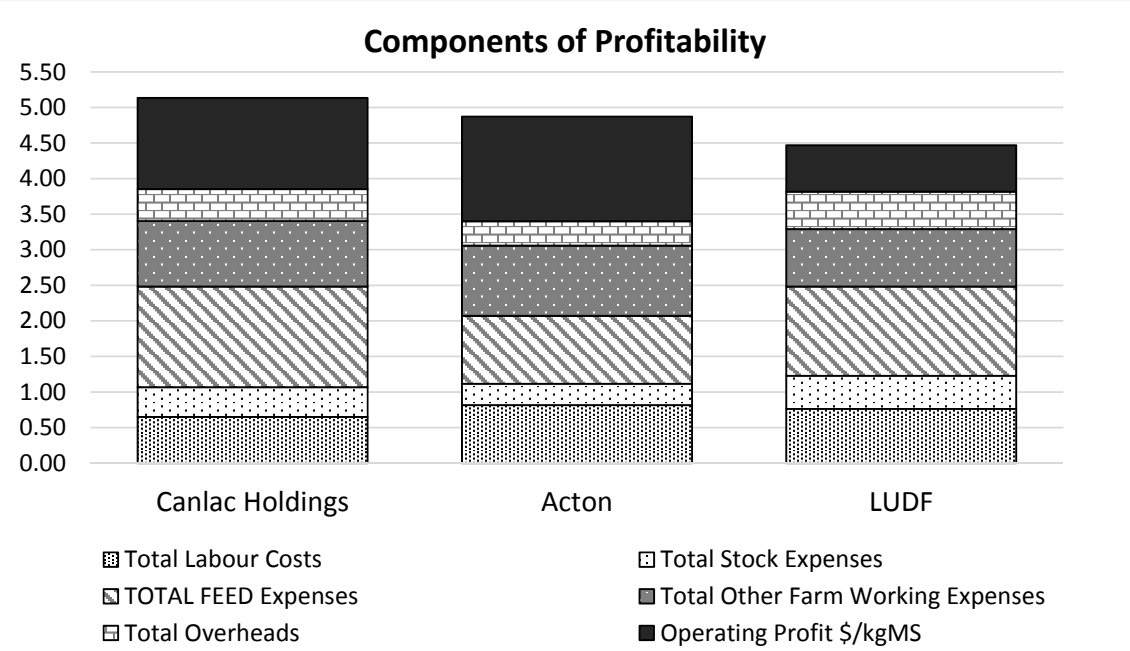
While production does not signal profitability, all farms are producing well above the regional average milk production per hectare. This year the two highest profit farms represent the highest and lowest milk production per hectare from this group of farms.





Interestingly, while the most profitable farm per hectare this season had the highest pasture eaten, the second most profitable farm per hectare had approximately 2000kgDM/ha less pasture eaten. LUDF, represented by the black triangle in both graphs above, had lower profitability than two farms with similar or lower milk production, indicating the production costs at these other farms were lower, relative to their production.

Lessons for LUDF: Looking into the most profitable two farms:



Total Income:
LUDF has substantially lower profitability than Canlac Holdings and Acton. A standout difference is the higher total income of these farms compared to LUDF. Comparing the income for these three farms identifies the following differences:

PER HECTARE INCOME	Canlac Holdings	Acton	LUDF
Milk income ($4.30/kgMS)- levy	8,047	5,821	7,001
Dividends ($0.40/kgMS)	833	603	725
Stock Sales	939	649	808
Stock Purchased	0	- 109	- 531
Stock Adjustment	330	377	95
Net stock income	1,269	918	372
Other Income*	467	0	0
TOTAL INCOME	10,615	7,342	8,098
Total Income /kgMS	$5.10	$4.87	$4.47

*Other Income primarily includes dividends and rebates etc associated with the milking plaform.

Milk Income for LUDF is midway between the other two farms, reflecting the varying milk production levels of these properties. Stock sales are not markedly dissimilar, however LUDF's decision to continue culling Johnes cows, and replace with purchased R2yr heifers, ontop of its decision 12 months earlier to run with a lower replacement rate, and no gain in empty rates combines to shows as a significant difference in stock purchased. Further, stock adjustments to

account for changes in opening and closing numbers of youngstock and MA cows further increases the stock income for both Canlac Holdings and Acton.

Calculating the impact of continuing to carry more youngstock at LUDF - to avoid purchasing the replacement R2's - would have reduced the stock purchases to approximately $160/ha, and almost eliminated the stock adjustment. This would have lifted net stock income to over $800/ha, much more similar to the other farms. These decisions at LUDF (to reduce the number of youngstock carried over the past season, and continue culling for Johnes) have incurred a cost of approximately $460/ha or $0.25cent/kgMS lost income. This was offset by a small reduction in grazing costs of approximately 6 cents/kgMS for additional R2's.

Labour costs:
Total labour costs are broadly similar for these three farms, though one has a significant labour adjustment for owner input.

Stock Expenses:
Stock expenses, as in the table below range from approximately $450/ha to nearly double this, with Acton typically operating with half or less expenditure of LUDF on animal health and breeding. This may reflect differing strategies in regard to both the current payout environment and individual breeding / animal health objectives. Theoretically, LUDF's objective to maintain a high genetic worth, healthy herd (managing for the impact of BVD, Johnes etc) should contribute over time to higher productivity and less costs – including costs associated with replacement rates etc.

STOCK EXPENSES	**Canlac Holdings**	**Acton**	**LUDF**
Animal Health	208	133	362
Breeding and Herd Improvement	240	118	264
Farm Dairy	149	63	57
Electricity (Farm Dairy and Water Supply)	275	139	159
Total Stock Expenses	**872**	**453**	**841**

Feed:
Feed expenses in part reflect the difference in wintering practices and volume of imported feed between these three farms.

LUDF's high use of the East Block as additional winter grazing pre calving may explain part of the increased cost per hectare for its winter grazing compared to Canlac Holdings, given LUDF are wintering 16% less stock. Similarly, Actons lower volume of grazing off for dry cows is evident in the reduction of winter cow grazing costs for Acton, compared to LUDF and Canlac Holdings.

LUDF has high calf feeding costs, relative to both of these other farms, even though it has fewer cows. LUDF typically rears a higher portion of replacement calves than many other farms do, to ensure calves kept are true to parentage (Genemark DNA parentage verification) and uses milk powder rather than whole milk. Last years milk powder pricing was approximately equivalent to the milk price at $3.90/kgMS.

Total feed purchased and made on farm costs reflect the volume of imported feed at Canlac Holdings, and largely show the amount of home-made silage at LUDF.

	Canlac Holdings	Acton	LUDF
Cows/ha	4.15	3.91	3.47
Imported feed t/ha	3	0.3	0.4
Grazing off dry cows tDM/ha	3.2	1.8	3.5
SUPPLEMENTS AND GRAZING EXPENSES			
Net Made/Purchased/Cropped	937	174	280
Feed Inventory Adjustment	-123	2	-
Calf Feed	86	9	131
Young stock grazing	966	488	701
Winter cow Grazing	1,082	765	1,162
Support Block lease	0	-	-
Owned Support Block Adjustment	0	-	-
TOTAL FEED Expenses	2,948	1,437	2,274

Other Expenses – Fertiliser, Regrassing, R&M etc:
Irrigation costs for Canlac Holdings add over $340/ha compared to Acton and LUDF, while the variance in Nitrogen fertiliser usage is also evident in the difference in expenses below. Fertiliser savings at LUDF (relative to the other farms) only apply maintenance phosphate one third of the farm. Whole farm soil testing over a number of years has shown the farm has a range of Olsen P levels, so some of this was utilised last season to reduce costs.

LUDF's regrassing costs were constrained due to the payout, with only 5% regrassing rather than the intended 10% annual regrassing rate.

Total R&M costs vary by nearly $200/ha from Acton to LUDF, with Canlac Holdings similar to LUDF. LUDF deliberately chose to maintain all necessary R&M expenditure, rather than defer non-urgent R&M to a later point in time.

OTHER RUNNING EXPENSES	**Canlac Holdings**	**Acton**	**LUDF**
Fertiliser	183	126	94
Nitrogen	390	487	282
Irrigation	726	383	328
Regrassing	76	17	54
Weeds and Pests	0	13	7
Vehicle	75	62	79
Fuel	60	65	64
R&M land and buildings	278	47	311
R&M Plants and equipment	130	245	168
Freight and General (incl farm travel)	0	43	73
Total Other Farm Working Expenses	1,917	1,488	1,461

Overheads:
A difference of nearly $400/ha in depreciation between Acton and the other two farms below adds significantly to the difference in overall operating expenses. Depreciation figures are primarily sourced from prior years accounts and may have been calculated using differing assumptions for each farm.
Other changes in overheads reveal relatively minor differences, though highlight variances in coding – for example separation of ACC as a direct cost, or inclusion of this in labour costs.

OVERHEADS	**Canlac Holdings**	**Acton**	**LUDF**
Administration	140	76	156
Insurance	54	88	59
ACC	0	31	42
Rates	42	56	72
Depreciation	696	265	625
Total Overheads	932	515	954

Operating Profit:
Combining the above categories identifies the significant impact of many small differences adding to a substantial difference in overall operating profit. Individual savings may look small, though cumulatively contribute to the overall results. Summarising the above comparisons between LUDF, Acton and Canlac Holdings, net stock income has contributed at least 40 cents/kgMS.

Dilution of expenses with high production can be a valuable component of profitability – as seen in the different approaches between Acton and Canlac Holdings to imported feed. Equally approaches to breeding, regrassing, fertiliser inputs and R&M are often a combination of farm goals and responses to economic conditions.

LUDF has begun a journey to lessen the impact of Johnes on the herd. This could be a 4-6 year outcome before milking cow losses to Johnes are significantly lowered. When this occurs, the farm should have fewer deaths and culls, and therefore have more selection pressure at culling. Till then, it may have to accept some higher costs than these other farms are operating with.

	Canlac Holdings	**Acton**	**LUDF**
Operating Profit $/ha	$2,592	$2,217	$1,182
Operating Profit $/kgMS	$1.24	$1.47	$0.65

Individual Farm Income and Expenses – per hectare:

SEASON 2015-16	Canlac Holdings	Acton	Jefferson	Davie-Martin	LUDF	Dry Creek	Willsden	Melrose
Milk Inc ($3.90/kgMS)- levy	8,047	5,821	7,595	7,307	7,001	6,271	6,144	6,836
Dividends ($0.40/kgMS)	833	603	786	756	725	649	636	708
Stock Sales	939	649	1,076	1,268	808	1,396	774	1,087
Stock Purchased	0	-109	-20	-	-531	-163	-	-336
Stock Adjustment	330	377	85	-	95	-219	-	-157
Net stock income	1,269	918	1141	1268	372	1013	774	594
Other Income	467	0	269	-	-	16	58	96
TOTAL INCOME	**10,615**	**7342**	**9791**	**9192**	**8098**	**7950**	**7612**	**8,234**
Wages	1,354	770	1,141	1,204	1,386	1,298	1,177	1,381
Labour Adjustment Unpaid	0	-	32	133	-	-	-	21
Labour Adjustment Mngt	0	461	277	248	-	-	-	170
Total Labour Costs	**1,354**	**1,231**	**1,450**	**1,585**	**1,386**	**1,298**	**1,177**	**1,572**
Animal Health	208	133	428	414	362	187	199	354
Breeding and Herd Imp.	240	118	329	77	264	178	177	149
Farm Dairy	149	63	58	80	57	25	51	97
Elect (Dairy and Water)	275	139	126	171	159	145	38	104
Total Stock Expenses	**872**	**453**	**941**	**741**	**841**	**535**	**466**	**705**
Supp Made/Purch/Crop	937	174	1,412	772	280	844	823	761
Feed Invent Adjustment	-123	2	-	6	-	-92	-28	109
Calf Feed	86	9	-	70	131	74	59	55
Total Suppl Expenses	**900**	**185**	**1,412**	**849**	**411**	**826**	**853**	**926**
Young stock grazing	966	488	-	-	701	913	728	-
Winter cow Grazing	1,082	765	4	905	1,162	933	927	551
Support Block lease	0	-	-	989	-	-	-	-
Own Supp Blk Adjustment	0	-	1,093	-	-	-	-	457
Tot Grazg Supp Blk Exps	**2,049**	**1,253**	**1,097**	**1,894**	**1,863**	**1,846**	**1,656**	**1,009**
TOTAL FEED Expenses	**2,948**	**1,437**	**2,508**	**2,743**	**2,274**	**2,672**	**2,509**	**1,935**

SEASON 2015-16	Canlac Holdings	Acton	Jefferson	Davie-Martin	LUDF	Dry Creek	Willsden	Melrose
Fertilizers	183	126	524	413	94	258	623	715
Nitrogen	390	487	300	441	282	403	7	327
Irrigation	726	383	501	285	328	296	884	427
Regrassing	76	17	96	12	54	117	82	155
Weeds and Pests	0	13	18	2	7	1	16	100
Vehicle	75	62	72	145	79	87	26	72
Fuel	60	65	136	135	64	53	55	56
R&M land and buildings	278	47	340	187	311	61	25	183
R&M Plants and equip	130	245	122	90	168	135	48	59
Freight/Gen /farm travel	0	43	29	13	73	4	-	7
Total Other Farm Wkg Exp	**1,917**	**1,488**	**2,139**	**1,721**	**1,461**	**1,413**	**1,767**	**2,102**
Administration	140	76	122	220	156	103	174	116
Insurance	54	88	136	100	59	116	60	72
ACC	0	31	14	22	42	50	32	4
Rates	42	56	95	66	72	67	66	66
Depreciation	696	265	864	652	625	568	408	783
Total Overheads	**932**	**515**	**1,231**	**1,061**	**954**	**905**	**740**	**1,041**
Total Oper Exps $/ha	**8,023**	**5,125**	**8,269**	**7,851**	**6,916**	**6,822**	**6,659**	**7,355**
Operating Profit $/ha	**2,592**	**2,217**	**1,522**	**1,341**	**1,182**	**1,128**	**953**	**879**
Farm Working Exp $/ha	**7,449**	**4,397**	**6,003**	**6,812**	**6,291**	**6,346**	**6,279**	**5,813**

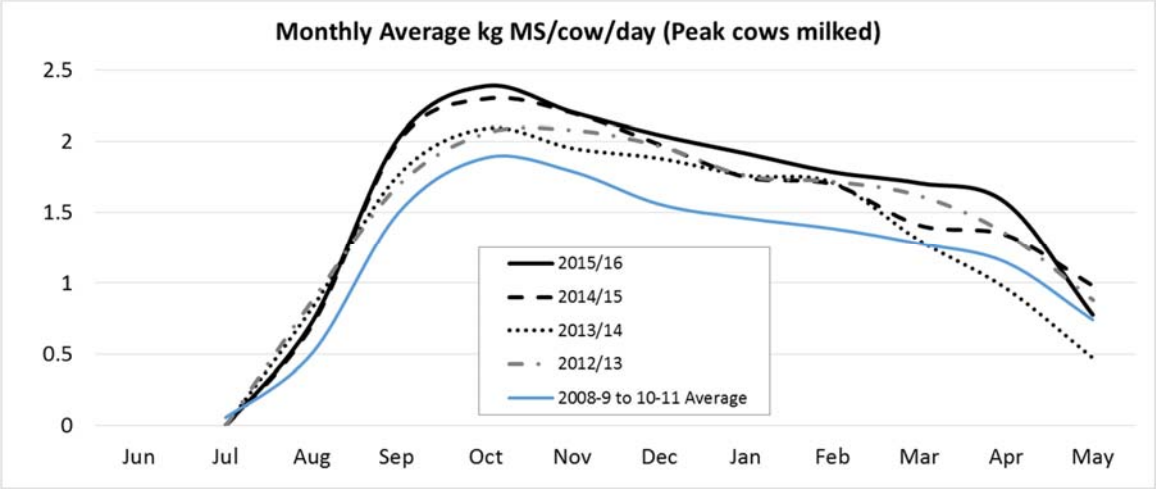
Individual Farm Income and Expenses – per kgMS:

SEASON 2015-16	Canlac Holdings	Acton	Jefferson	Davie-Martin	LUDF	Dry Creek	Willsden	Melrose
Milk Inc ($3.90/kgMS)- levy	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86
Dividends ($0.40/kgMS)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Stock Sales	0.45	0.43	0.55	0.67	0.45	0.86	0.49	0.61
Stock Purchased	0.00	-0.07	-0.01	0.00	-0.29	-0.10	0.00	-0.19
Stock Adjustment	0.16	0.25	0.04	0.00	0.05	-0.14	0.00	-0.09
Net stock income	0.61	0.61	0.58	0.67	0.21	0.62	0.49	0.34
Other Income	0.22	0.00	0.14	0.00	0.00	0.01	0.04	0.05
TOTAL INCOME	**5.10**	**4.87**	**4.98**	**4.86**	**4.47**	**4.90**	**4.79**	**4.65**
Wages	0.65	0.51	0.58	0.64	0.76	0.80	0.74	0.78
Labour Adjustment Unpaid	0.00	0.00	0.02	0.07	0.00	0.00	0.00	0.01
Labour Adjustment Mngt	0.00	0.31	0.14	0.13	0.00	0.00	0.00	0.10
Total Labour Costs	**0.65**	**0.82**	**0.74**	**0.84**	**0.76**	**0.80**	**0.74**	**0.89**
Animal Health	0.10	0.09	0.22	0.22	0.20	0.12	0.13	0.20
Breeding and Herd Imp.	0.12	0.08	0.17	0.04	0.15	0.11	0.11	0.08
Farm Dairy	0.07	0.04	0.03	0.04	0.03	0.02	0.03	0.06
Elect (Dairy and Water)	0.13	0.09	0.06	0.09	0.09	0.09	0.02	0.06
Total Stock Expenses	**0.42**	**0.30**	**0.48**	**0.39**	**0.46**	**0.33**	**0.29**	**0.40**
Supp Made/Purch/Crop	0.45	0.12	0.72	0.41	0.15	0.52	0.52	0.43
Feed Invent Adjustment	-0.06	0.00	0.00	0.00	0.00	-0.06	-0.02	0.06
Calf Feed	0.04	0.01	0.00	0.04	0.07	0.05	0.04	0.03
Total Suppl Expenses	**0.43**	**0.12**	**0.72**	**0.45**	**0.23**	**0.51**	**0.54**	**0.52**
Young stock grazing	0.46	0.32	0.00	0.00	0.39	0.56	0.46	0.00
Winter cow Grazing	0.52	0.51	0.00	0.48	0.64	0.57	0.58	0.31
Support Block lease	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00
Own Supp Blk Adjustment	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.26
Tot Grazg Supp Blk Exps	**0.98**	**0.83**	**0.56**	**1.00**	**1.03**	**1.14**	**1.04**	**0.57**
TOTAL FEED Expenses	**1.42**	**0.95**	**1.28**	**1.45**	**1.26**	**1.65**	**1.58**	**1.09**

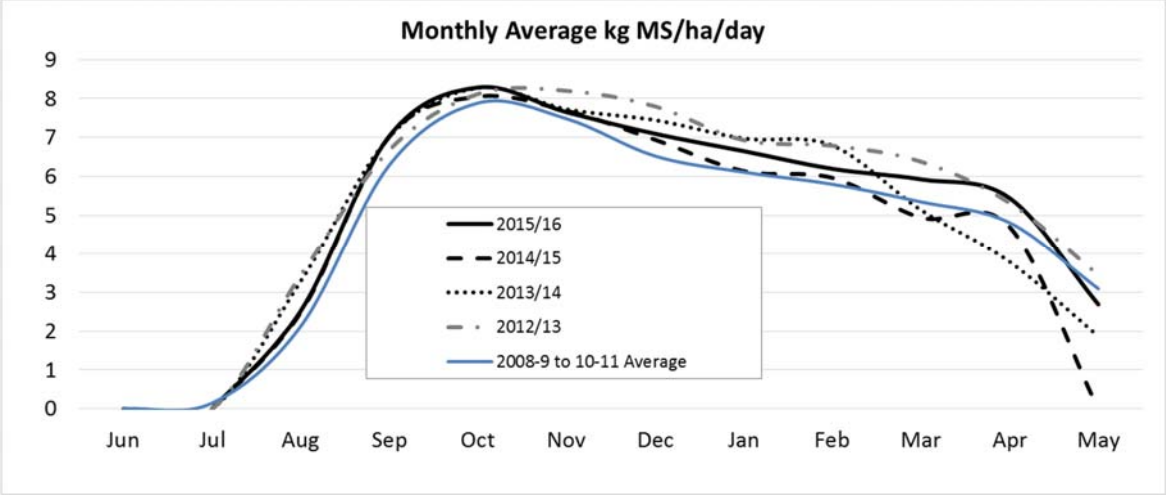
SEASON 2015-16	Canlac Holdings	Acton	Jefferson	Davie-Martin	LUDF	Dry Creek	Willsden	Melrose
Fertilizers	0.09	0.08	0.27	0.22	0.05	0.16	0.39	0.40
Nitrogen	0.19	0.32	0.15	0.23	0.16	0.25	0.00	0.18
Irrigation	0.35	0.25	0.25	0.15	0.18	0.18	0.56	0.24
Regrassing	0.04	0.01	0.05	0.01	0.03	0.07	0.05	0.09
Weeds and Pests	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.06
Vehicle	0.04	0.04	0.04	0.08	0.04	0.05	0.02	0.04
Fuel	0.03	0.04	0.07	0.07	0.04	0.03	0.03	0.03
R&M land and buildings	0.13	0.03	0.17	0.10	0.17	0.04	0.02	0.10
R&M Plants and equip	0.06	0.16	0.06	0.05	0.09	0.08	0.03	0.03
Freight/Gen /farm travel	0.00	0.03	0.01	0.01	0.04	0.00	0.00	0.00
Total Other Farm Wkg Exp	**0.92**	**0.99**	**1.09**	**0.91**	**0.81**	**0.87**	**1.11**	**1.19**
Administration	0.07	0.05	0.06	0.12	0.09	0.06	0.11	0.07
Insurance	0.03	0.06	0.07	0.05	0.03	0.07	0.04	0.04
ACC	0.00	0.02	0.01	0.01	0.02	0.03	0.02	0.00
Rates	0.02	0.04	0.05	0.03	0.04	0.04	0.04	0.04
Depreciation	0.33	0.18	0.44	0.35	0.34	0.35	0.26	0.44
Total Overheads	**0.45**	**0.34**	**0.63**	**0.56**	**0.53**	**0.56**	**0.47**	**0.59**
Total Oper Exps $/ha	**3.85**	**3.40**	**4.21**	**4.15**	**3.82**	**4.20**	**4.19**	**4.16**
Operating Profit $/ha	**1.24**	**1.47**	**0.77**	**0.71**	**0.65**	**0.69**	**0.60**	**0.50**
Farm Working Exp $/ha	**3.58**	**2.92**	**3.05**	**3.60**	**3.47**	**3.91**	**3.95**	**3.29**

On farm performance - 2015/16

Milk Production

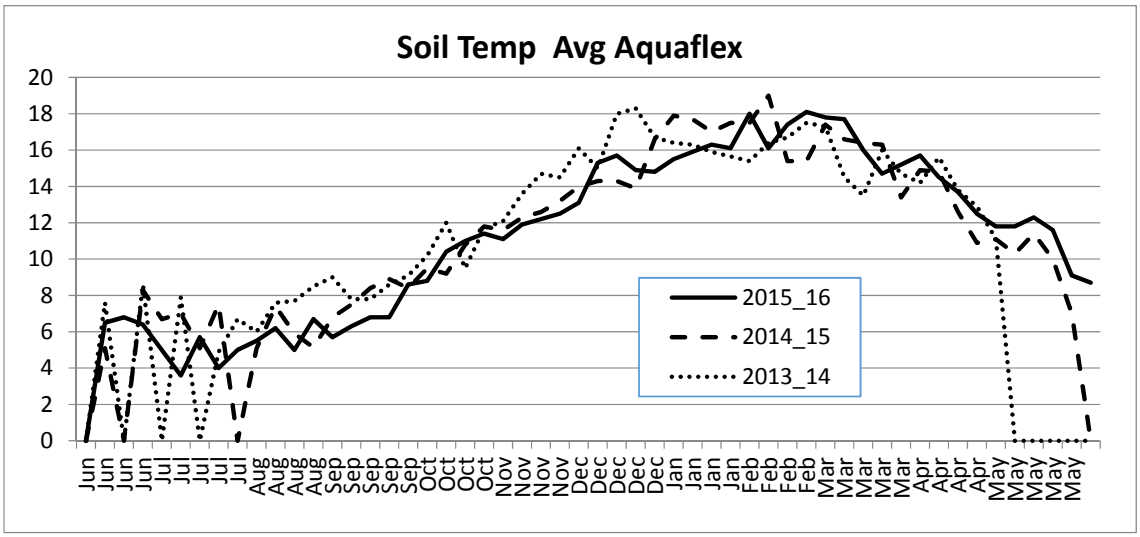


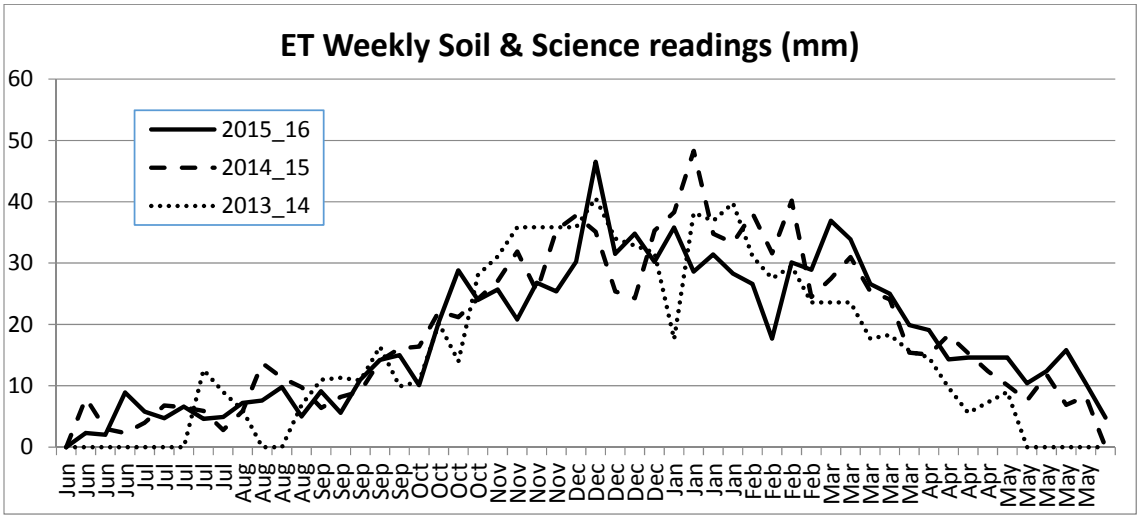
Milk production per cow per day over the season has been at or above previous levels achieved for the farm. The drop from peak was smooth and steady, contributing to higher performance per cow through the whole season.

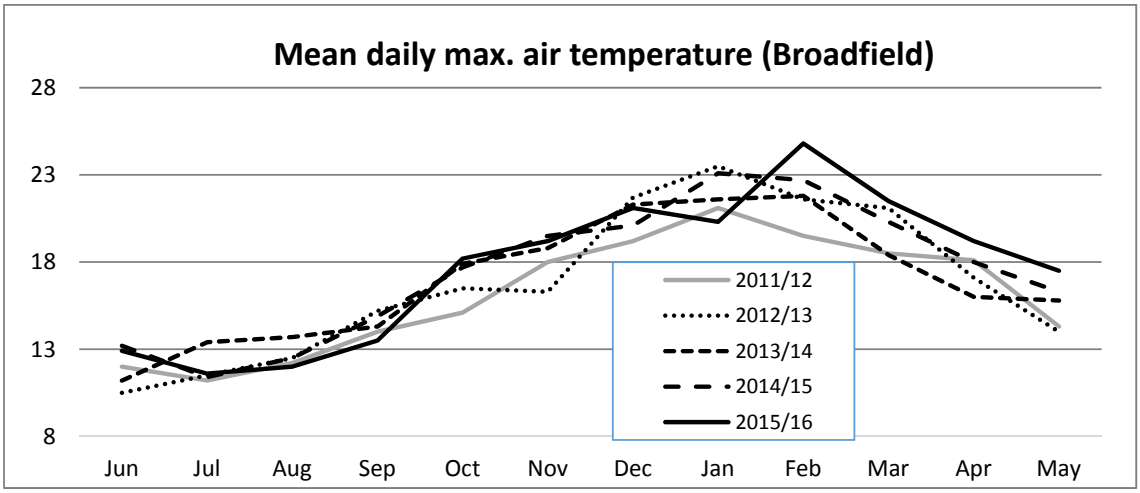


Milk production per hectare peaked at a similar level to that occurring previously when LUDF had 11% more cows (2011-13 seasons). The decline from peak in late October was initially steeper this season (and last season). Summer and autumn production was more consistent this season than last year.

Weather and Environment

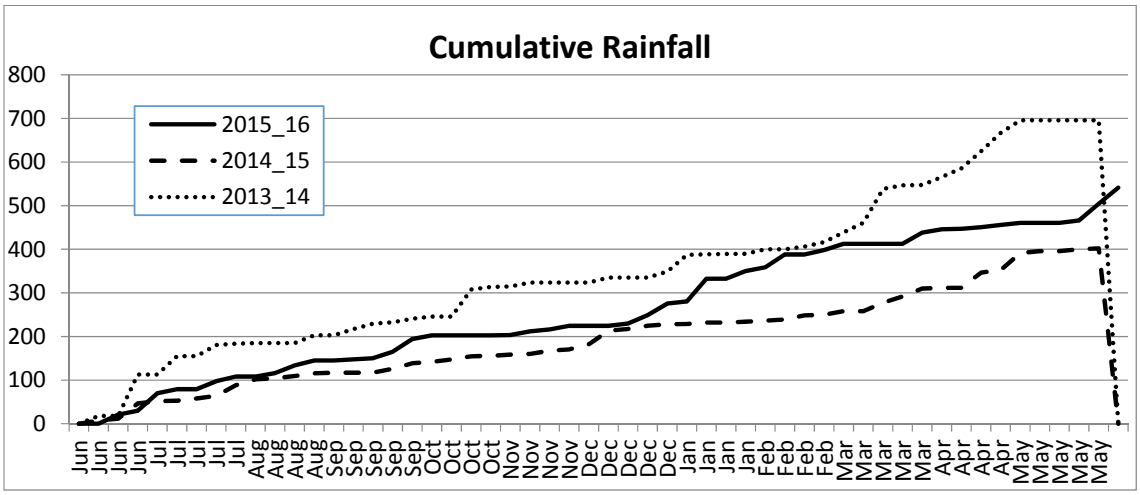


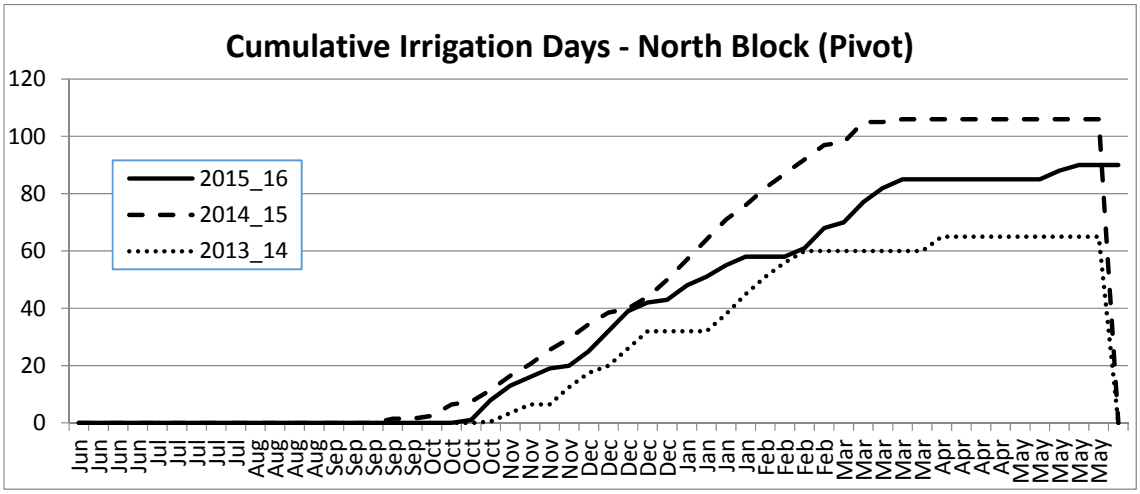




The above figures show a slow start to the season, with colder than previous season's temperatures for the winter months and August-September. January temperatures and rainfall (below) gave the farm a welcome boost with ideal conditions for pasture production and cow productivity. Warmer than 'normal' conditions then continued through the autumn and into early winter. Rainfall for the past two seasons has been well below the annual average of 666mls.

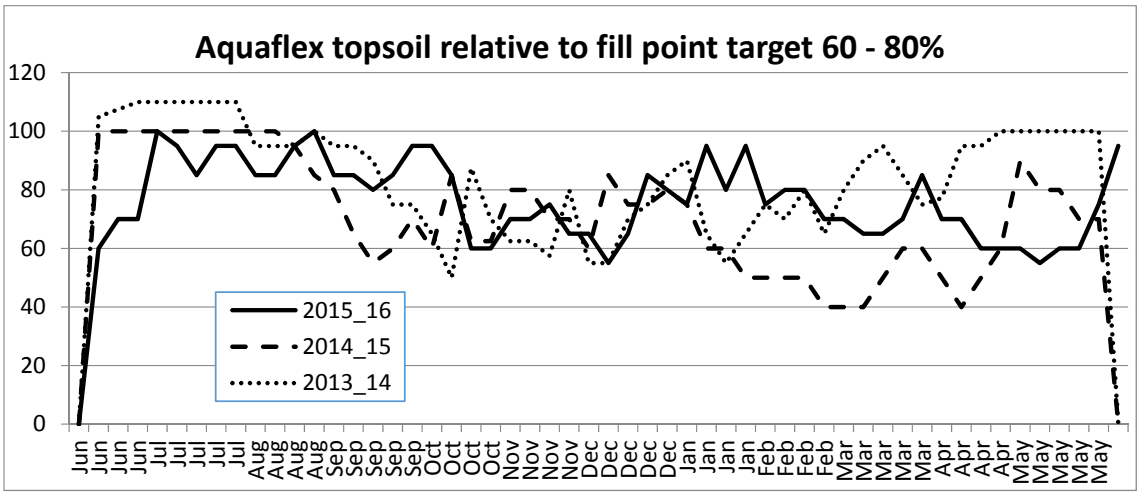
In terms of rainfall, 2015-16 was better than the previous year, with the January rains enabling reduced irrigation through this time.



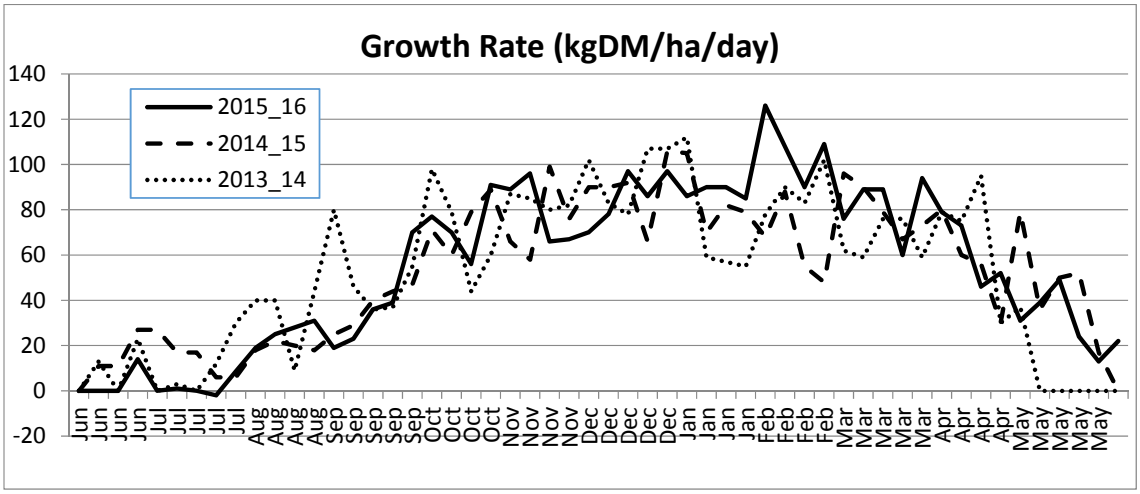


The graph above shows how Irrigation usage was reduced through January, then stopped from end-March till a small amount was applied again in early May to address the soil moisture deficit occurring as the result of higher than expected ET's in late April / early May and virtually no rainfall from late March till mid-May.

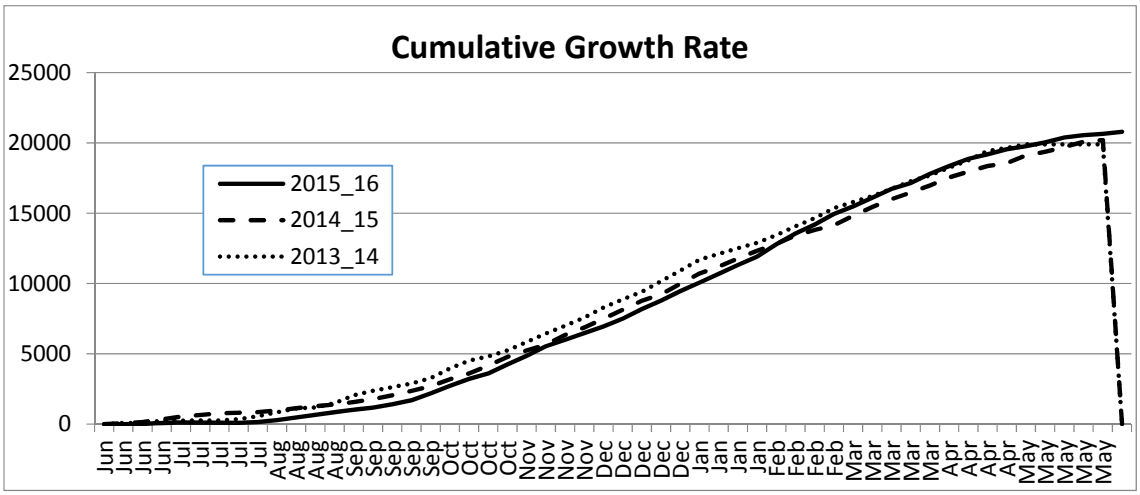
Total irrigation water use was lower than last season, but higher than the season before. Bucket tests were performed on the pivots to check irrigation efficiency in November.



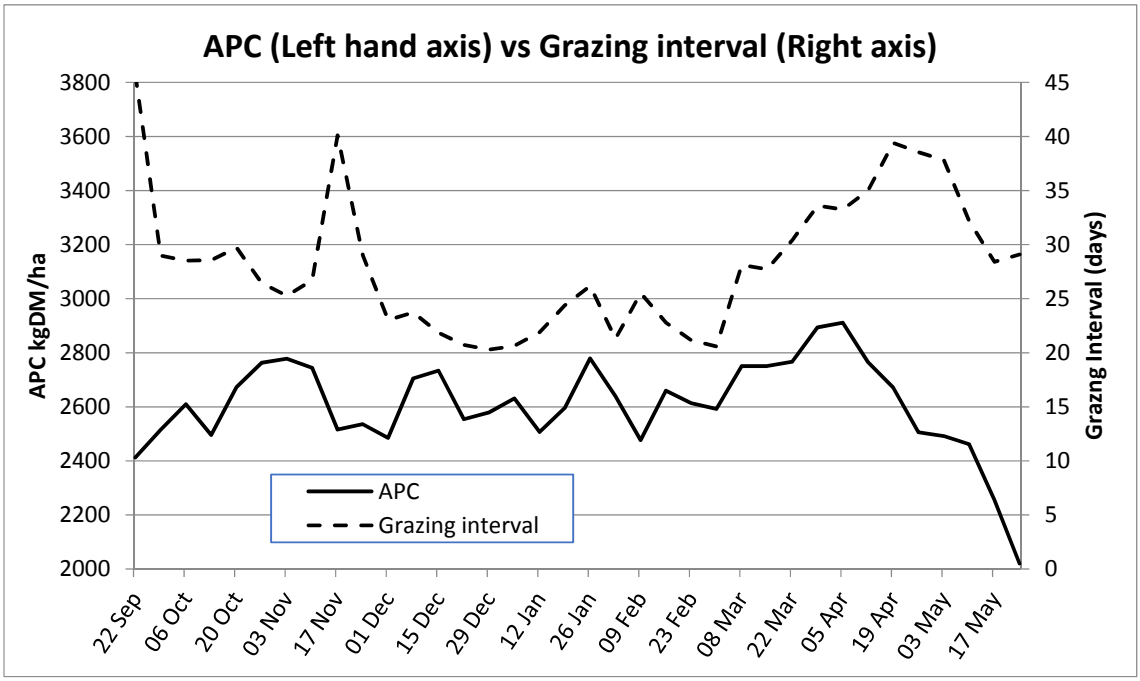
Pasture Management



Week to week growth rates remained significantly variable over the season. The cool start referred to above contributed to lower growth rates and less cumulative pasture production occurring until the end of January. Variable growing conditions made for an interesting October-December time in terms of grass quality management. Limited amounts of pre-graze mowing, along with targeted harvesting of silage and a little more summer nitrogen were utilised to assist with providing high quality pasture through the season.



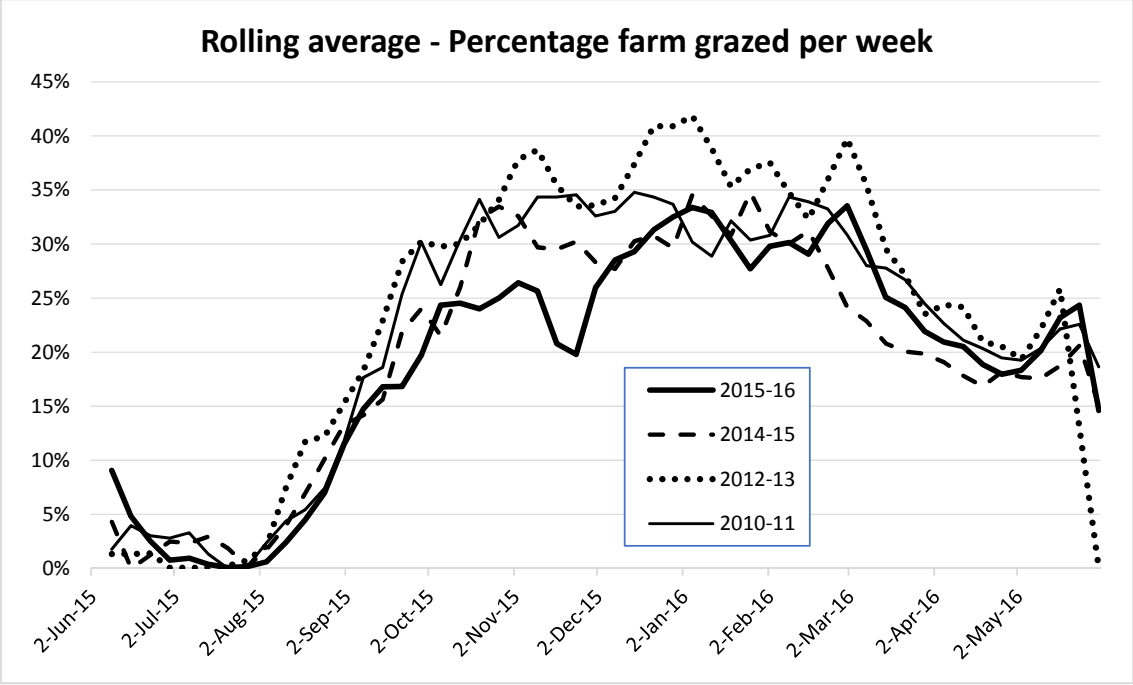
The increased use of nitrogen in January this year (see below) helped ensure good quality grass was available to the herd at all times. This, together with the decision to regrass only 1 paddock helped the farm maintain summer pasture production well above demand and above the previous season. Surplus pasture was harvested as high quality silage, which was fed back out through the autumn period, and allowed the farm to make savings in feed costs by using home-grown silage rather than purchased silage. The purchased silage intended to be fed in the autumn was transferred out of the accounts and will be purchased back for use in the coming season.

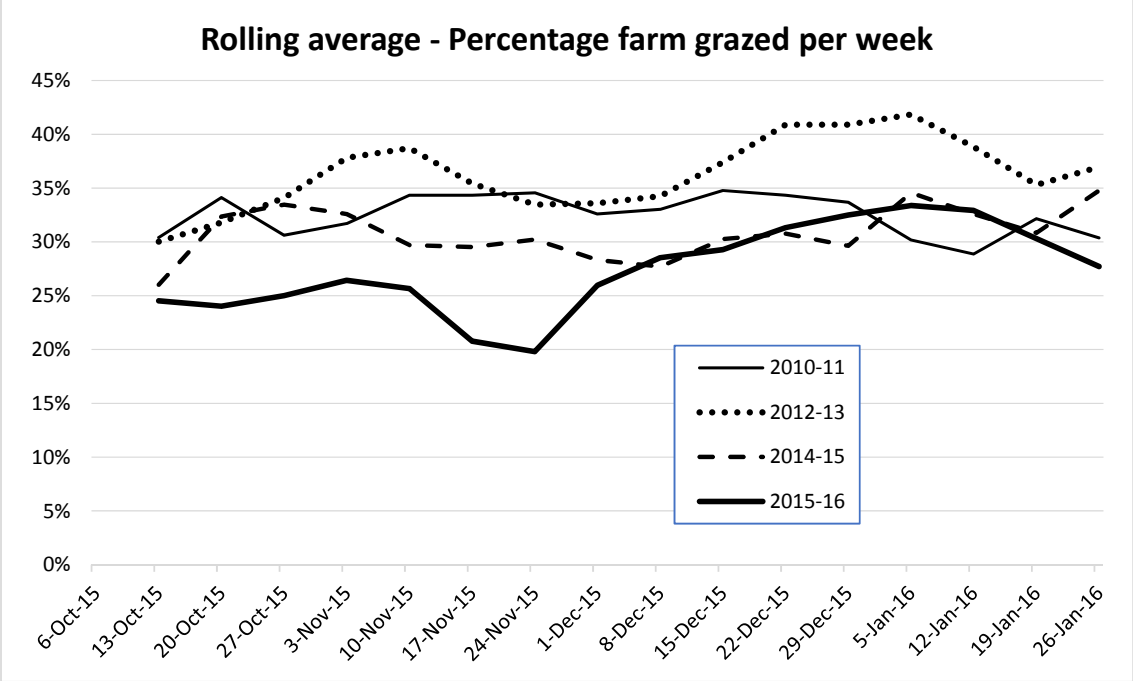


High growth rates in late October – early November, followed by a couple of rainfall events in early November made it difficult to manage the resulting high pasture cover in early – mid November (wet soils precluded pre-graze mowing or harvesting silage). This meant that the farm briefly had a 40 day round as pregrazing pasture covers averaged 3800 kgDM/ha in mid November. The problem was rectified as soon as conditions allowed for the harvesting of 10 ha silage. Apart from this period,

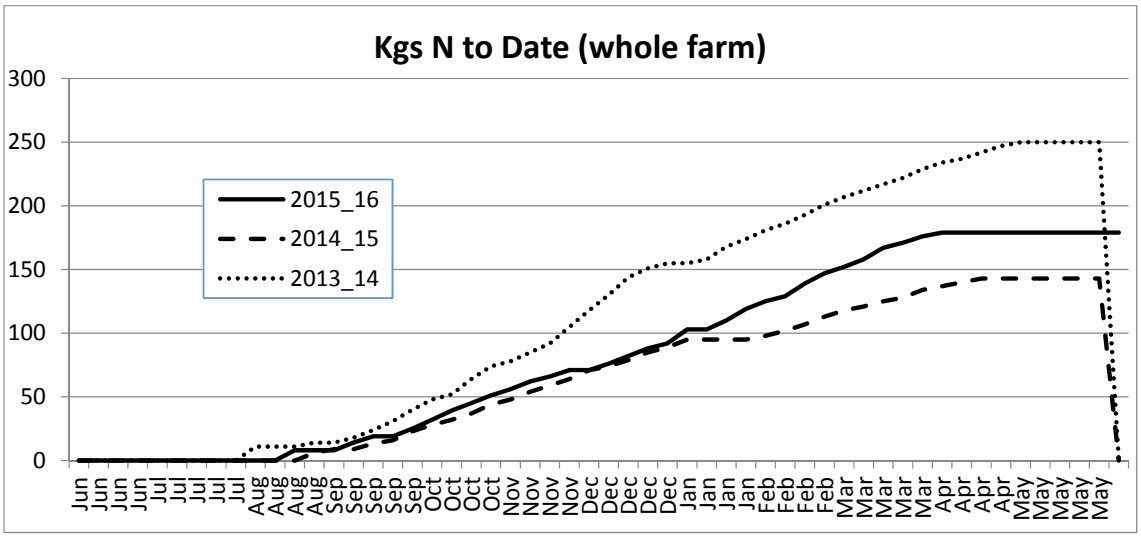
through the majority of the season, the farm ran on a 23-25 day rounds until early March and held average pasture covers between 2400-2600 kgDM/ha.

In March, the round length increased slowly, while pasture growth remained high and average pasture covers increased to around 2800kgDM/ha. This, together with the silage harvested through late spring-early summer, allowed the herd to be milked until end-May without the use of purchased silage.





SIDDC South Island Dairying Development Centre
Partners Networking To Advance South Island Dairying
Lincoln University
DairyNZ
ravensdown
LIC
Plant & Food RESEARCH
agresearch
SIDE

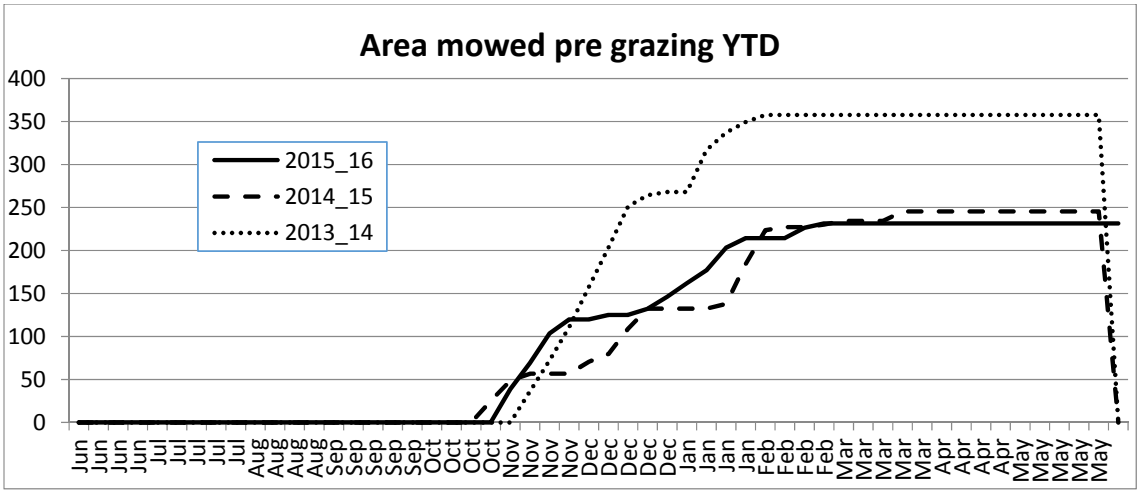


The key differences in terms of N utilization from the previous season were:

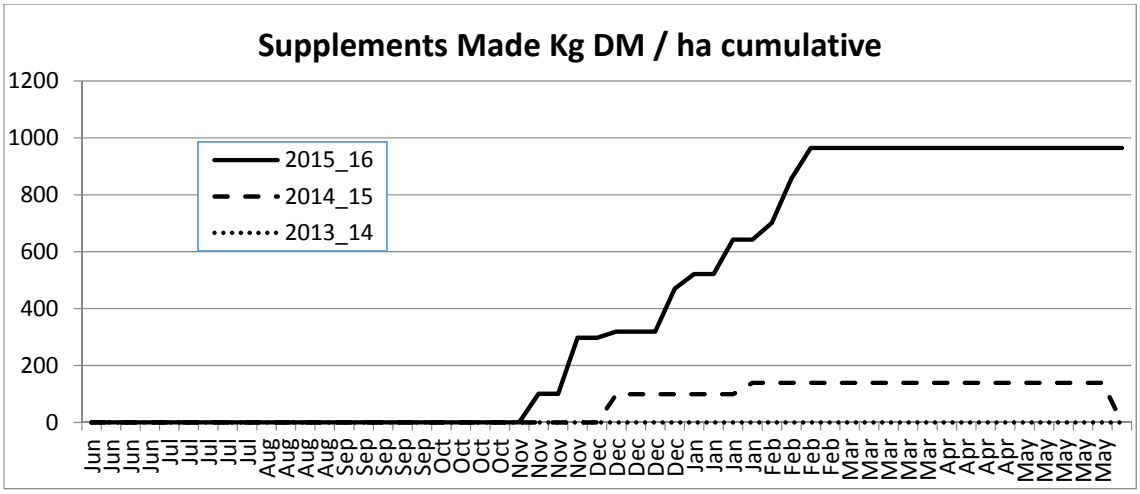
- We used 179 kgN/ha in the 2015-16 season, instead of 143 kgN/ha in the 2014-15 season
- We applied N through the whole of the summer period
- We finished N application on 14th April for the 2014-15 season and in late March for 2015-16

One key learning from the 2014-15 season was that the slower rounds gave us less opportunity to apply all the nitrogen that we had available. Together with the decision to "save" nitrogen for autumn by not applying it in January, we ended up only using 143 kgN/ha in the 2014-15 season. This also contributed to the above reduction in N leaching.

Reviewing the effect of N applications through 2014-15, it was decided to lift total N applications by continuing to apply nitrogen through the January period with a targeted annual application of 170kgN/ha. By the end of February, 150kgN/ha had been applied (on average). To maintain N through March, application rates were reduced from 25kgN/ha to 20kgN/ha for the last 3 weeks. With hindsight, favourable growing conditions in April would have provided reasonable response rates to ongoing N-application had the farm had more N available.

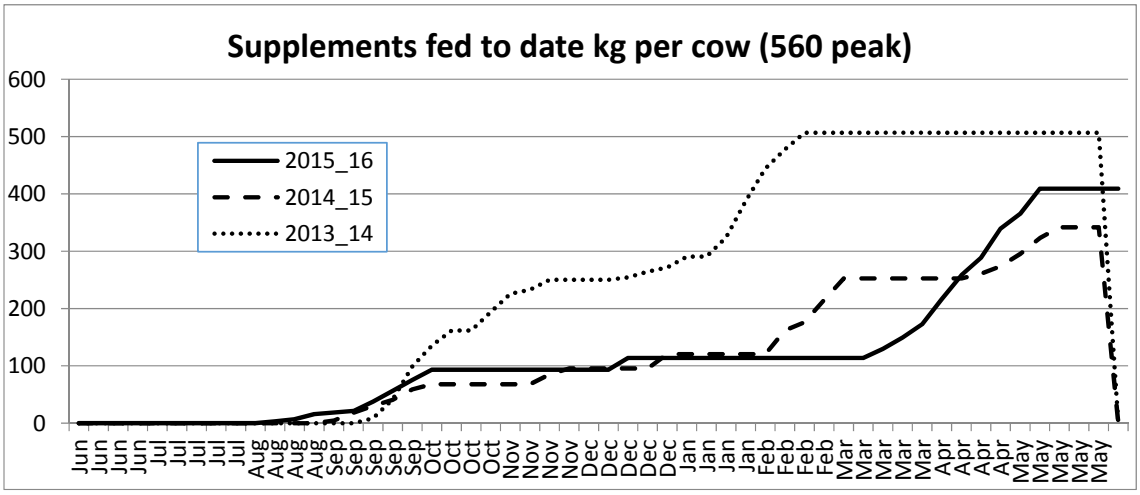


Pre-graze mowing is one of the grass quality management tools available and is used at LUDF to help maintain quality and achieve residuals when small surpluses are available. It is primarily used when the herd would otherwise not achieve low and consistent grazing residuals within a timely manner and when the pasture quality to the base of the sward is still medium to high. Harvesting as silage is the alternative option and used when bigger / more certain surpluses are evident.



The figure above shows the timing and amount of silage harvested from the platform. As explained above, the use of N through summer together with only regrassing 1 paddock allowed for a greater amount of silage to be made from the platform.

This silage was mainly fed to cows through autumn (March-May) which reduced feeding costs over the period. A reasonable match of the farms stocking rate to feed supply coupled with the growing conditions through the season allowed the cows to be well fed on grass from late-September to mid-March (excpet for a small amount fed in mid-December when a lull in pasture growth occured).

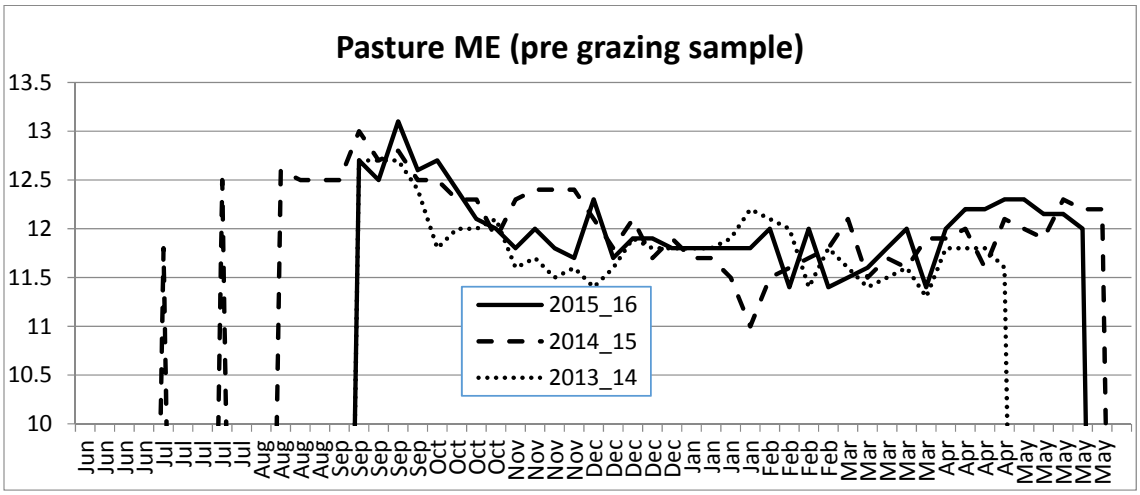


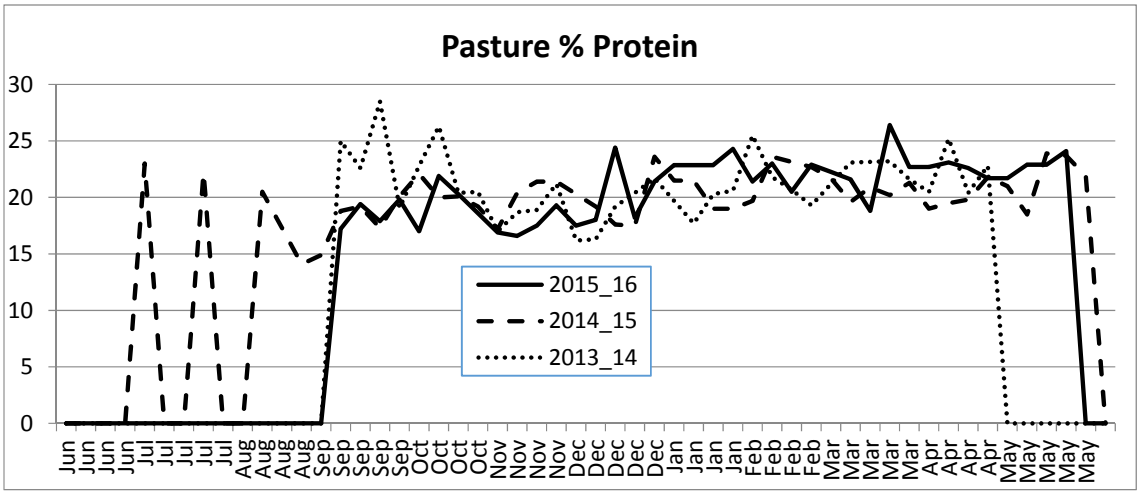
Grazing log – example of using two herds to graze paddocks to desired residual:

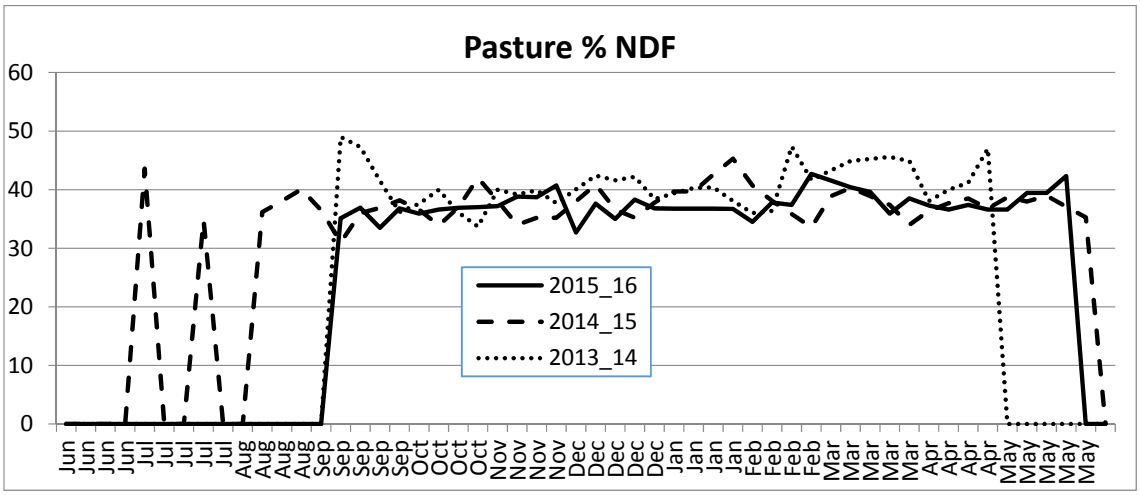
	Small Herd	Main Herd
Saturday 27 September	• Returned to front 1.5 Ha of N-7 after morning milking • At Pm milking went to fresh break in S-1	• Big herd day feed in S-8 • At pm milking returned to S8 until 7.30pm then moved to new break in S-2
Sunday 28 September	• Small herd returned to Front 1.5 Ha of S-1 am grazing • at Pm milking went to 1.6 ha break at the front of N-3	• Day feed in S-2 • at pm milking returned till 7.30pm then went to new break in N-7
Monday 29 September	• Small herd Front 1.5 Ha of N-3 am grazing • at Pm milking returned to fresh break in N-3	• day feed in N-7 • decided at pm milking there was too much grass left to be cleaned up by 8 pm so went to new break in S-1 at milking time
Tuesday 30 September	• Front 1.5 Ha of N-3 am grazing • at Pm milking returned to fresh break in N-3 another 1.5 ha	• N-7 for the day feed • returned there till 7.30 then went to new break in second half of S-1
Wednesday 1 October	• Front 3 Ha of N-3 am grazing • at Pm milking went to 1.6 ha break at the front of N-6	• day feed in S-1 • at pm milking decided there was too much grass left in S-1 to be cleaned up by eight Pm so were put to new break N-3
Thursday 2 October	• back to break in N-6 • at Pm milking went to 1.6 ha break at the front of N-8	• day feed in S-1 • at pm milking returned to clean up N-3 till 8.15 then moved to new break N-6

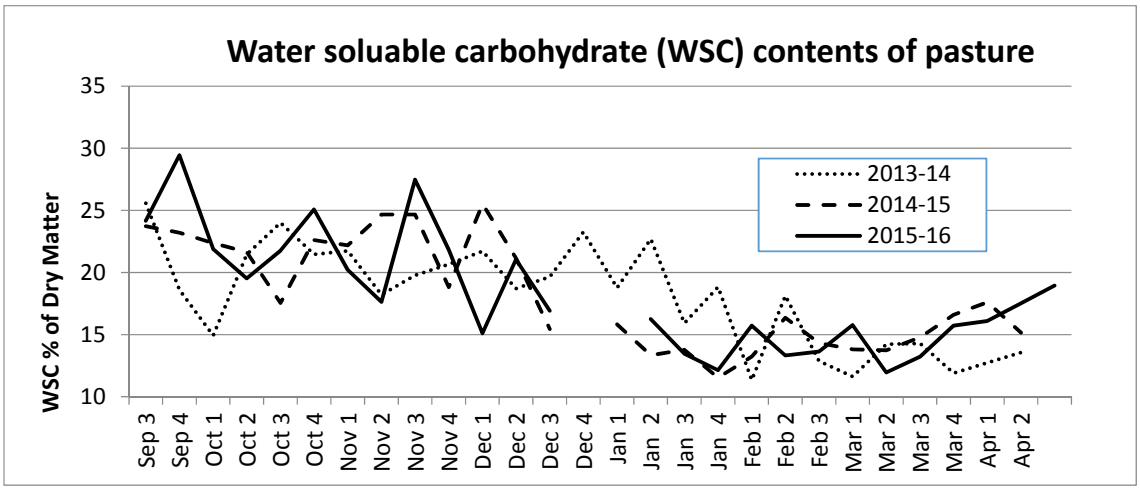
	Small herd	Main herd
Saturday am	N7	S8
Saturday pm	S1	S8 / S2
Sunday am	S1	S2
Sunday pm	N3	S2 / N7
Monday am	N3	N7
Monday pm	N3	S1
Tuesday am	N3	N7
Tuesday pm	N3	N7 / S1
Wednesday am	N3	S1
Wednesday pm	N6	N3
Thursday am	N6	S1
Thursday pm	N8	S1 / N6

Pasture Quality

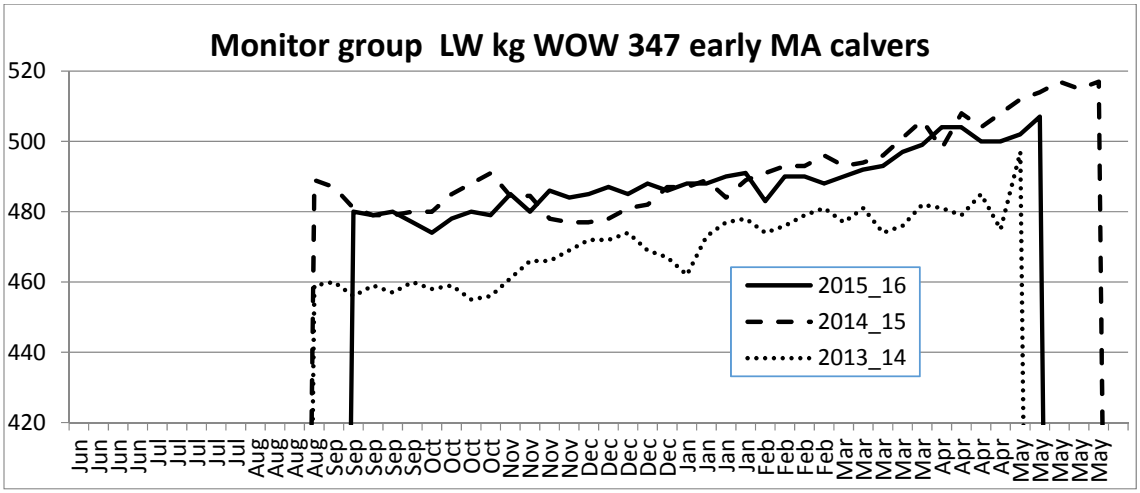








Body Condition Score and Herd Health



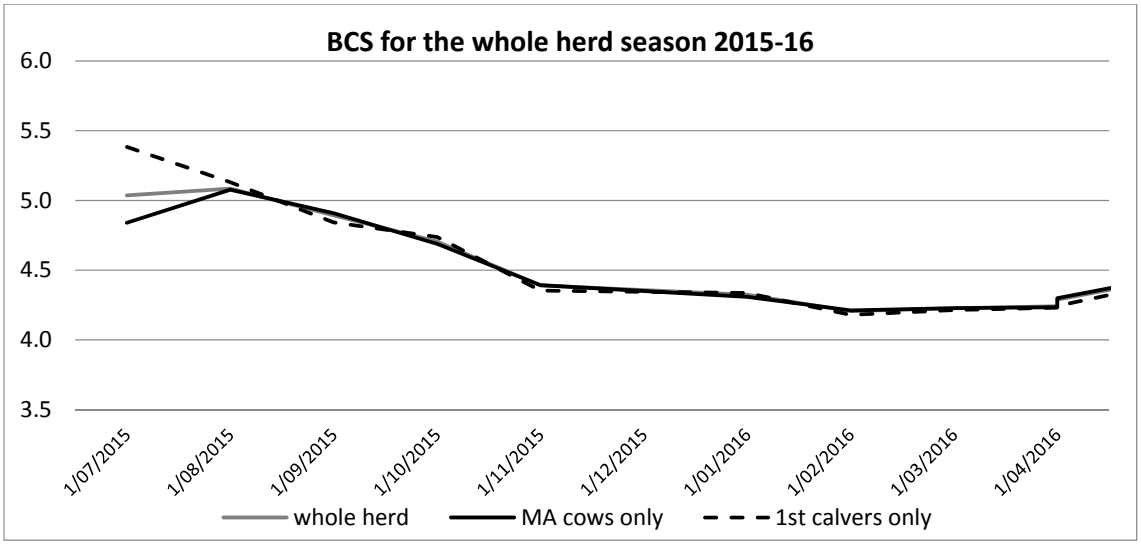
The Walk Over Weighing (WOW) data above shows that the herds average liveweight started to increase late-September /early October, moderately consistent with previous years. They remained heavier than in the previous season till late January when liveweight plateaued for a month this season where as it had continued to climb in prior years.

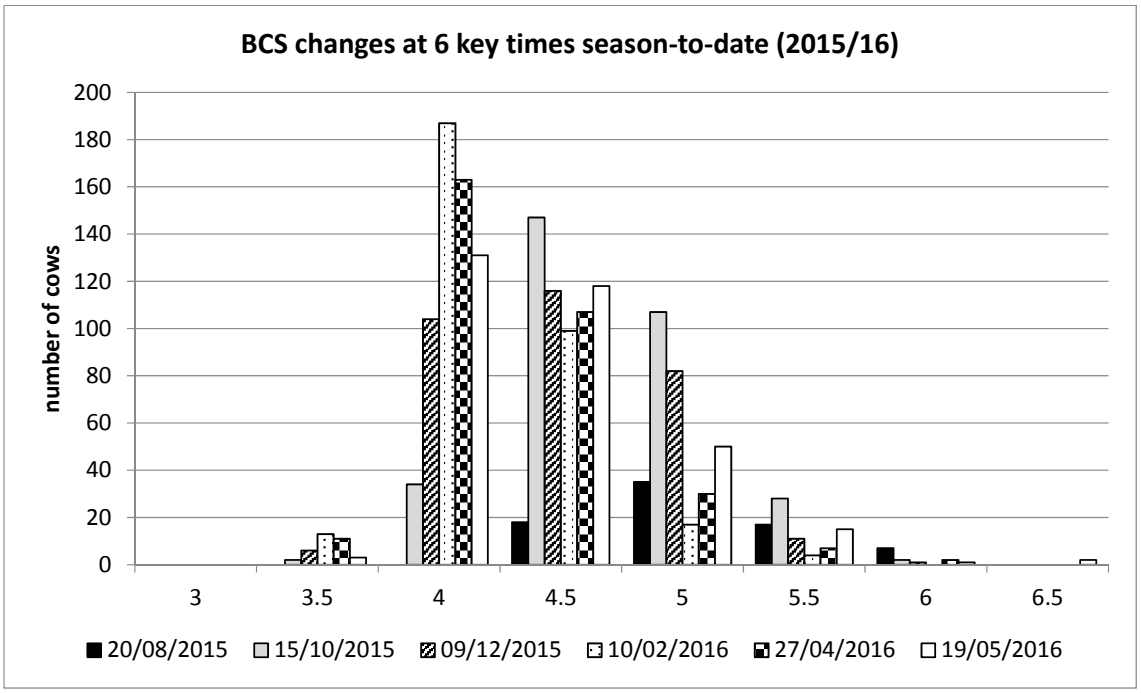
Live weight is highly dependent on gut fill amongst other things, which contributes to explaining how liveweight increased through the spring, while, concurrently, condition score declined (see below). The increase in weight after end-September occurs as the rumen re-develops and cows are eating to their full potential.

Its worth noting WOW remains only an indication of how much an animal weighs at that point in time whereas BCS evaluate cow's energy reserves.

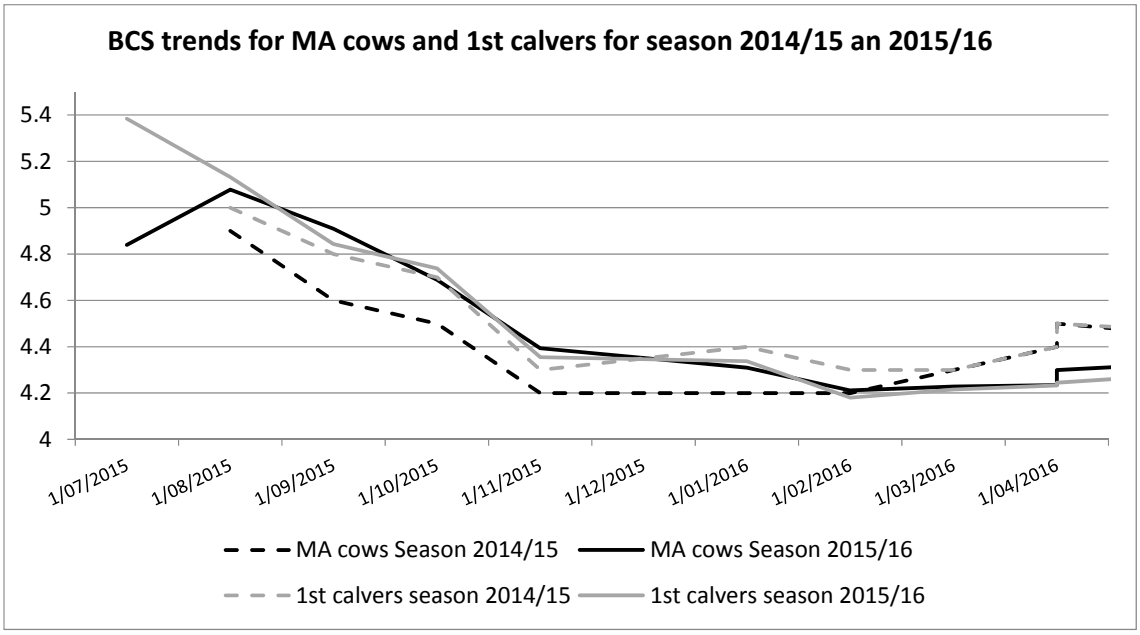
In terms of BCS, the figure below shows the BCS trends for a group of cows that were present at all BCS events through the season, presented as "whole herd", "mixed age cows" and "1st calvers"

It is important to note that the BCS loss happened through the whole season in terms of "herd averages". Our 1st calvers started the season ahead of their mixed age pairs, however, lost that advantage in early lactation and did not recover it again until dry-off. As a whole herd however, the cows started gaining BCS from February onwards.





On an animal basis, the figure above shows the shift in individual BCS in the herd through 6 key periods of the season. Important to note is that there is a shift in the amount of animals improving BCS from February onwards.

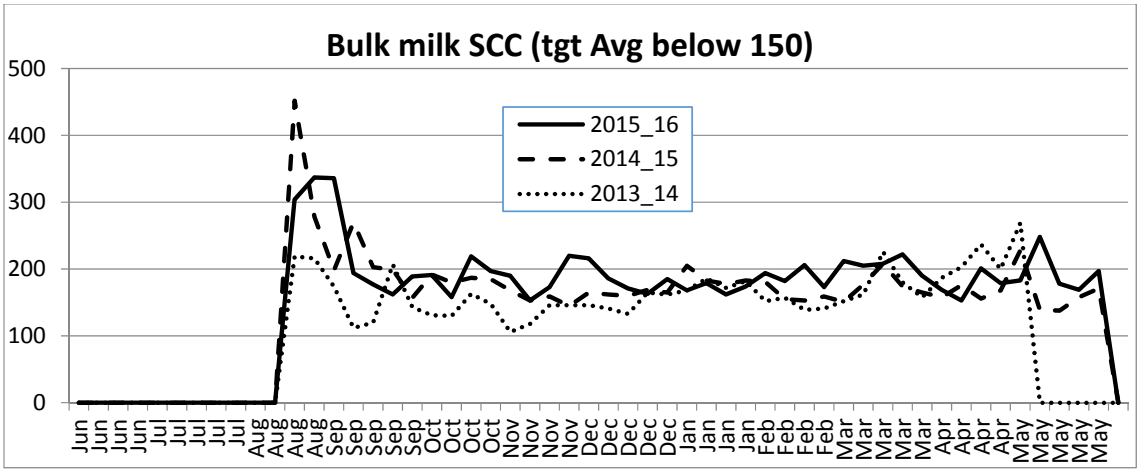


	20-Aug	15-Sep	15-Oct	12-Nov	09-Dec	13-Jan	10-Feb	10-Mar	06-Apr	27-Apr
MA cows Season 2014/15	4.9	4.6	4.5	4.2	4.2	4.2	4.2	4.3	4.4	4.5
1st calvers season 2014/15	5	4.8	4.7	4.3	4.3	4.4	4.3	4.3	4.4	4.5
BCS difference	**0.1**	**0.2**	**0.2**	**0.1**	**0.1**	**0.2**	**0.1**	**0**	**0**	**0**
MA cows Season 2015/16	5.1	4.9	4.7	4.4	4.5	4.3	4.2	4.2	4.2	4.3
1st calvers season 2015/16	5.1	4.8	4.7	4.3	4.5	4.3	4.2	4.2	4.2	4.2
BCS difference	**0.0**	**-0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-0.1**

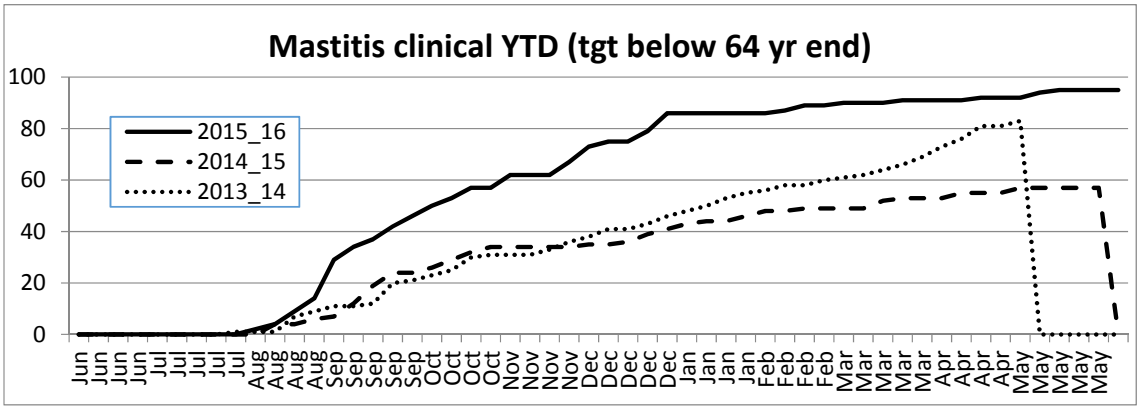
When comparing trends with previous season, it is clear from the figure and table above that, contrary to what happened in season 2014-15, in season 2015-16 our 1st calvers lost the advantage they had in BCS with respect to their mixed-age mate. This advantage was not gained again until cows were dried off.

Cows were dried off based on previously determined rules on CS gains required and days to calving. See the May 2016 focus day notes for this information. Drying off dates are moderated a little based on the winter plan and confidence in condition score gains over the dry period.

Cow Health

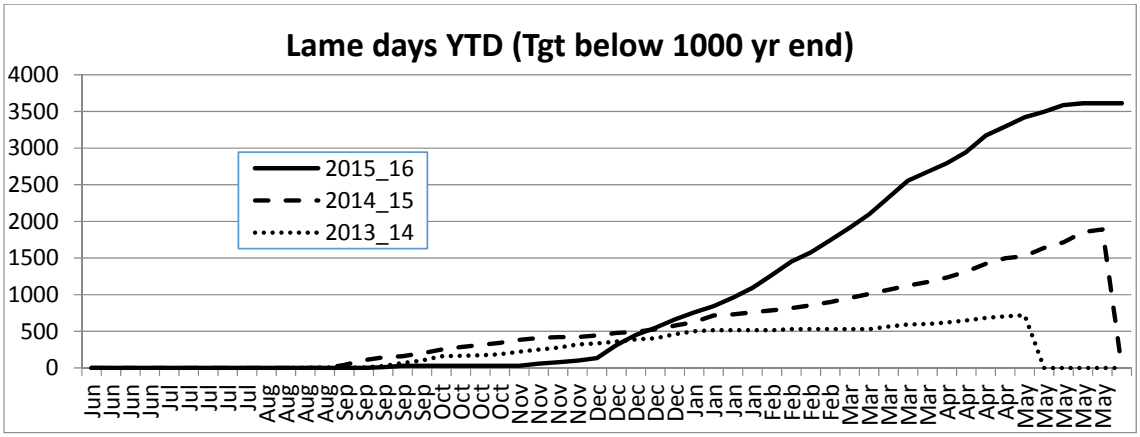


Mastitis

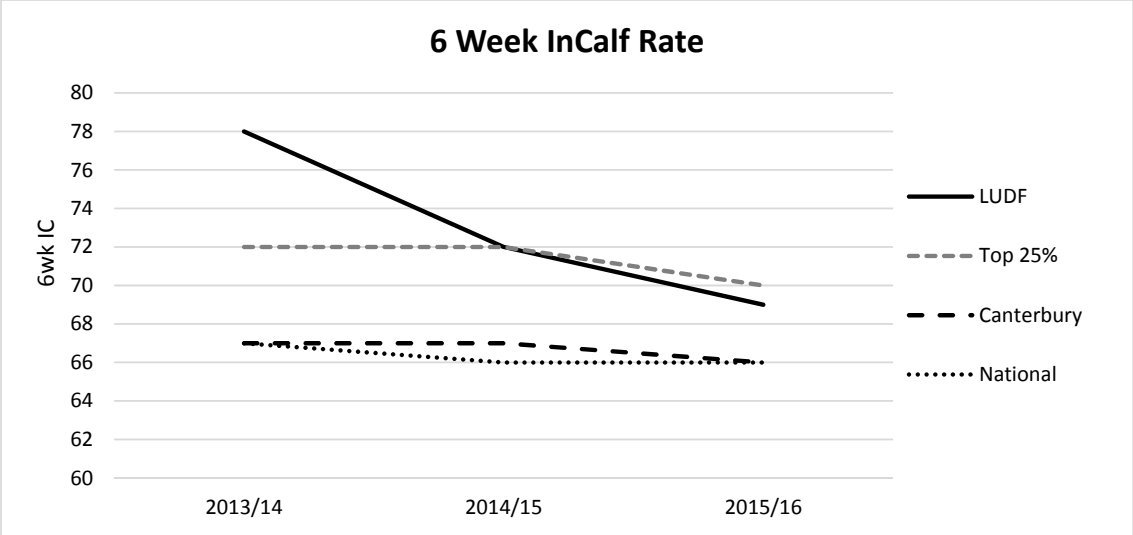


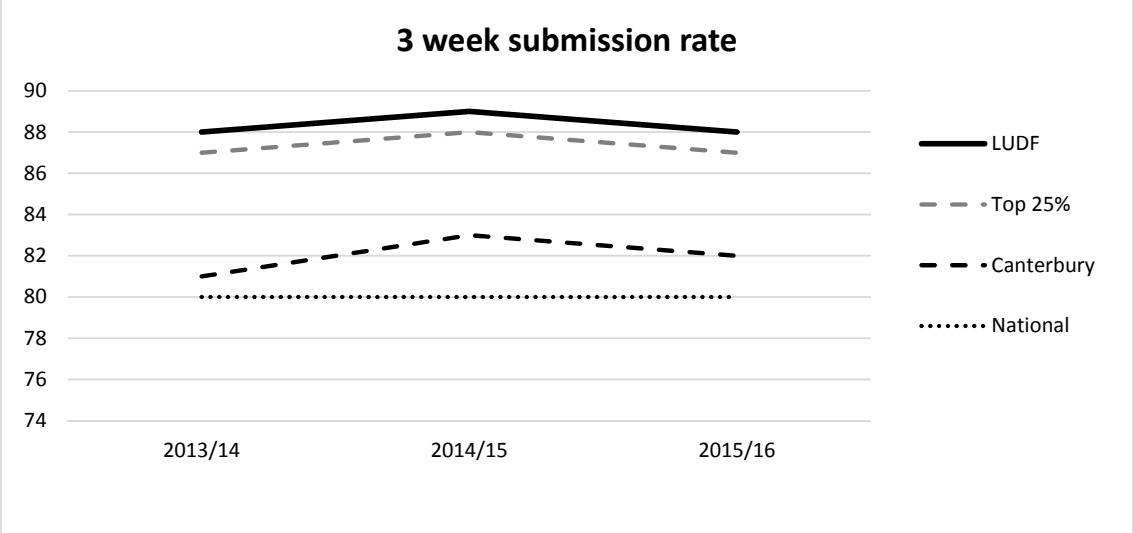
In terms of mastitis, the herd went through an increased occurrence of clinical mastitis through the first half of the season. The shed, milking machine, milking techniques and teat spray were all evaluated resulting in a decrease in vacuum levels and a change in teat spray from Iodine to Chlorhexidine. This stopped the occurrence of clinical mastitis from December onwards. No dramatic increase was observed even through the (wet) January period.

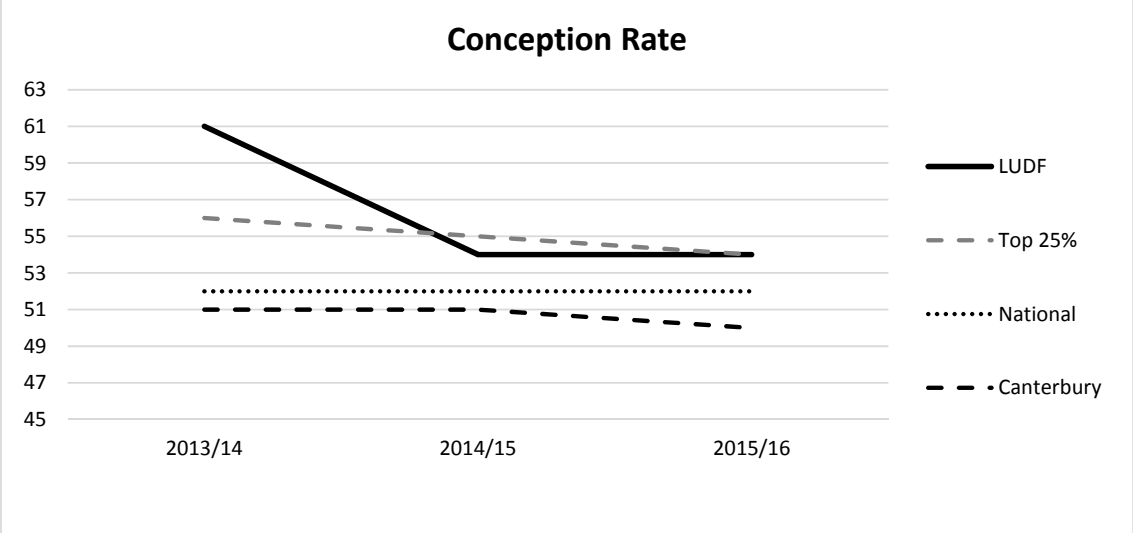
Lameness



6 Week Incalf Results







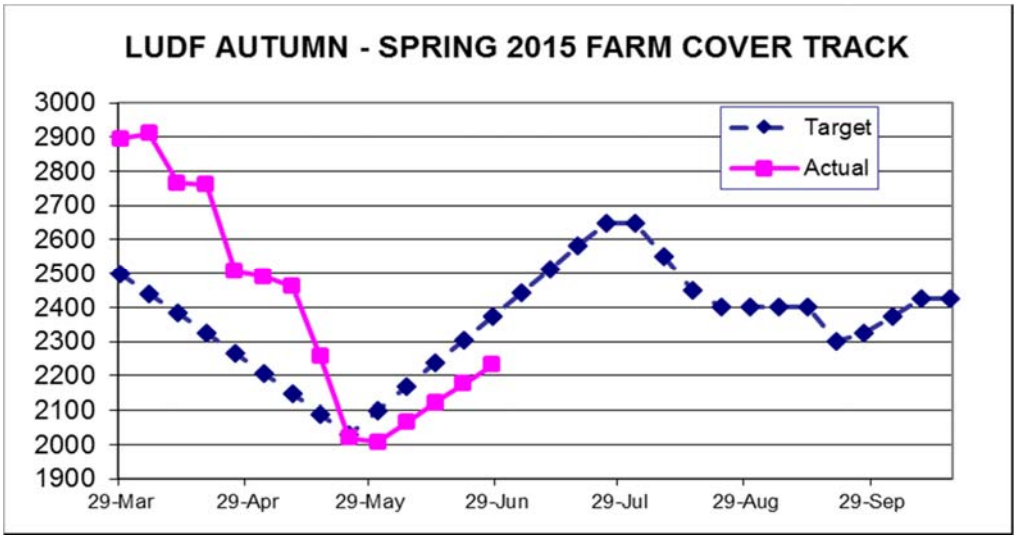
Summary of LUDF Management Practices – Changes over time:

	Historically	Season 2014-15	Season 2015-16
Peak cows	630 (3 season's average)	560	555
Replacement wintered as R2		127 (23%)	102 InCalf (18%) + 40 carry overs purchased
6-weeks InCalf	75% (3 season's average)	72%	69%
Not InCalf rates	12% (3 season average)	13%	13%
Spring Rotation Planner (SRP)	Used as a guideline in conjunction with silage, N, fert, GA. Typically ending mid-September	Proactively managed SRP, holding the first round out to the 23rd September. APC at start of calving actual: 2600 kdDM/ha	Proactively managed SRP, holding till balance date on 29th September. APC at start of calving 2500 kgDM/ha
Rotation length	Average 22 days Sept-Jan 27 days Sept 22 days Oct-Nov 19 days Dec-Jan 22 days Feb 22 days March 33 days April	Average 26 days Sept-Jan 39 days September 23 days Oct-Nov 21 days Dec-Jan 23 days Feb 33 days March 38 days April	Average 29 days Sept-Jan 41 days September 29 days Oct-Nov 22.5 days Dec-Jan 22 days Feb 28 days March 37 days April
	Approx 12.3 grazing rounds	Approx 10.4 grazing rounds (15% fewer grazings)	Approx 10.1 grazing rounds (18% fewer grazings than historically)
Average Pre-grazing covers	3118 kgDM/ha (average Sept-Jan) 3435 kgDM/ha (average Feb-Apr)	3328 kgDM/ha (average Sept-Jan) 3625 kgDM/ha (average Feb-Apr)	3388 kgDM/ha (average Sept-Jan) 3555 kgDM/ha (average Feb-Apr)
Average post-grazing cover	1607 kgDM/ha till end Jan 1690 kgDM/ha Feb-April	1652 kgDM/ha till end Jan 1676 kgDM/ha Feb-April	1625 kgDM/ha till end Jan 1650 kgDM/ha Feb-Apr
Phosphate fertilizer	Maintenance	Maintenance	Below maintenance (cost control)
Nitrogen fertilizer Use	200-350 kgN/ha	143 kgN/ha	179 kgN/ha (intention was to use 160 –

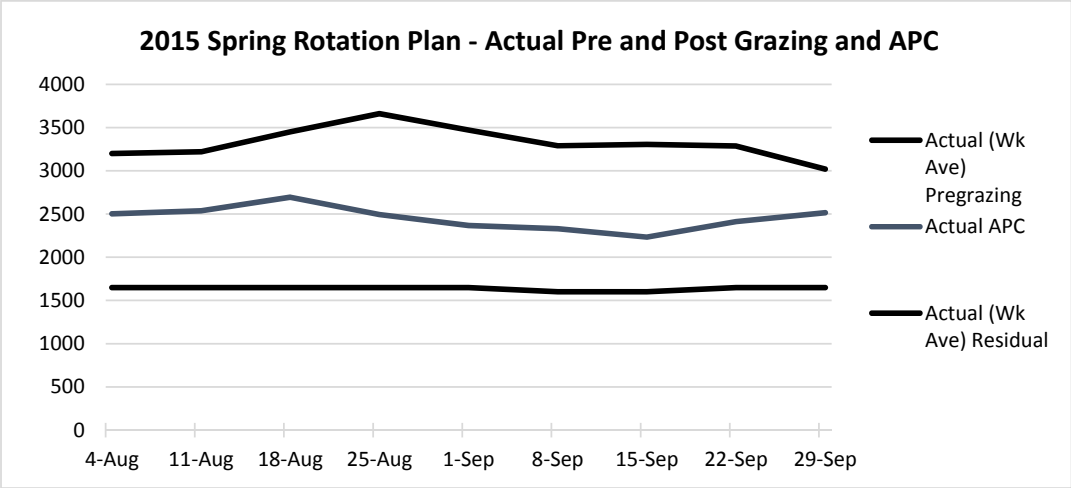
		(intention was no more than 150 kgN/ha)	170kg N/ha while remaining below N Baseline)
Frequency of N-fert application	Before calving on pdks with less than 2200kgDM/ha, then after every grazing, limited use mid-summer	No N pre-calving. Following each grazing till end December, start again end January. Slower grazing rotation means 14% decrease in number of applications	No N pre-calving Following each grazing from start of September through to late March.
Time and amount of N used		95 kgN/ha to end Dec 3 kgN/ha January 21 kgN/ha February 19 kgN/ha March 7 kgN/ha April	103 kgN/ha to end Dec 26 kgN/ha January 29 kgN/ha February 21 kgN/ha March None in April
Last N application	8 May/23 April/ 29 April	14 April	24 March
Application Rates	25-40 kgN/ha/application	25 kgN/ha/application for all applications	25 kgN/ha/application Sept-Feb 20 kgN/application through March
Overseer Est N-loss (Version 6.2.1)	40 kgN	25 kgN	28-30 kgN (mostly due to carrying more cows in autumn)
Regrassing	Typically 3 paddocks (15% of the area)	3 paddocks regrassed (15% of the area)	1 paddock regrassed (5% of the area)
Gibberellic Acid	Apply immediately following grazing from late August till late Sept/early Oct and again in March/April periods based on suitable conditions	As previously used except that slower grazing rotations result in less ability to apply GA in a timely manner following grazing.	Slow first grazing rotation resulted only 1 paddock receiving GA
Area pre-graze mown	534 ha (3.3 times, average 2 seasons)	245 ha (1.5 times)	236 ha (1.5 times)
Supplements harvested from the paltform		22 tDM 40 kgDM/cow 14 ha	154 tDM 280 kgDM/cow 80 ha
Autumn cows in milk **March**		470	546

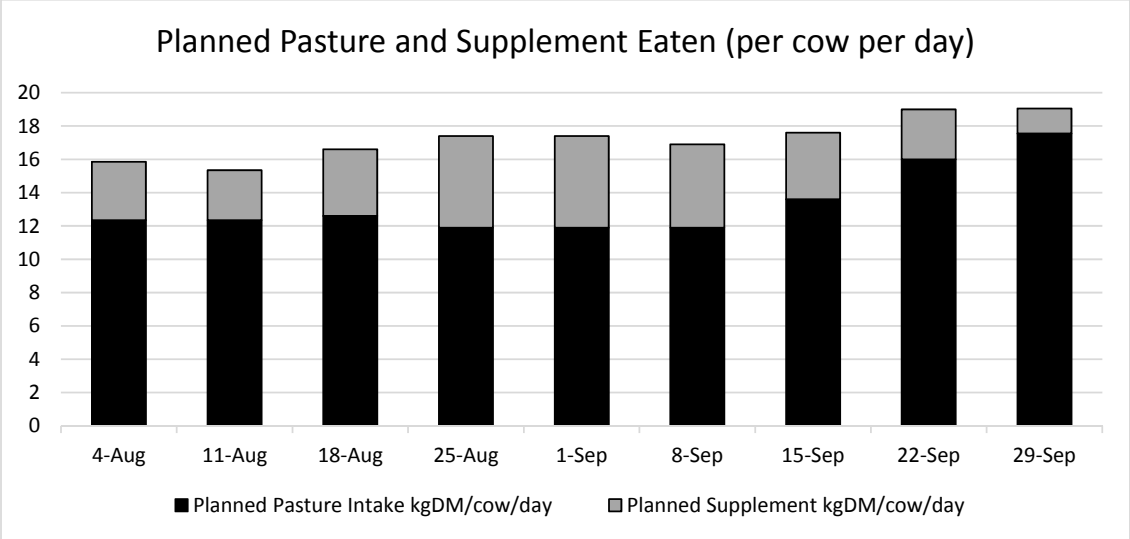
April		468	536
Milk production to end-April	276,570 Average 3 seasons	261,570	276,562
Average production/cow to end April	438 kgMS/cow Average 3 seasons	467 kgMS/cow	498 kgMS/cow
Average milk production/ha to end April	1,728 kgMS/ha Average 3 seasons	1,634 kgM/ha	1,728 kgMS/ha
Tight cost control	Good cost control to keep total expenses low without eroding future profitability of the far. High and efficient production from pasture offsets farm working expenses to produce a lower than average operating cost and a sustainable profit (relative to payout)		Good cost control overall. See budget notes above
Weekly farm walk	Actively measure pasture covers weekly, calculate APC, predict future cover, plan and respond to surplus/deficits		
Pasture allocation	Allocate daily area/cow based on farm walk/feed wedge/APC, milk production, cow response, grazing residual. Move to new break / paddock when grazing residuals achieved.		
Split herd	Split herd based on 1/3-2/3 split with small herd initially comprising heifers and light CS MA cows. Through late spring, some well-conditioned heifers would be moved into the main herd and replaced by low BC MA cows. Following early pregnancy scan and BCS event, the small herd typically becomes all light BCS, early calving cows to assist condition score gains for the following season. The small herd may be merged with the main herd as cow numbers drop through Autumn or become a herd of culls to follow the main herd.		
BCS autumn dry-off rules	Frequent BCS including adhering to BCS targets for drying off based on current CS and days remaining till next calving. Milk production is not/will not be chased at the expense of BCS targets (per individual cow) at calving		
Herd test to identify cows performance and disease risk	Routine herd testing allows identification of low producing cows, particularly important when considering drying off low producing cows		
Heifer mating 2 weeks prior to MA cows	Mating heifers early at LUDF has become part of the reproduction management at LUDF to aid 6weeks InCalf results – this allows the freshly calved heifer more time to cycle and get back in calf in a timely manner.		

Winter Pasture Management



Spring Rotation Plan





Lincoln University Dairy Farm - Farm Walk notes

Tuesday 28th June 2016

LUDF – focus for 2016/17 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 million and Target production of over 500kgMS/cow (>100% liveweight in milk production).

Critical issues for the short term

1. **Monitor cows on wintering for health issues.**
2. **Monitor average pasture cover and shape of the wedge on the milking platform to meet planned cover at end of July (start of calving).**
3. **Watch cow BCS to ensure all cows meet BCS targets at calving (min 5 for MA cows and 5.5 for R2's and R3yr's)**

Key Numbers - week ending Tuesday 28th June 2016

Ave Past Cover	2232 kgDM/ha	Past Growth Rate	18 kgDM/ha/day
Round length	0 (for 160 ha)	Ave Supplement used	0
No Cows on farm	1 (early slip)	Ave Soil Temp (week)	8.8 degrees

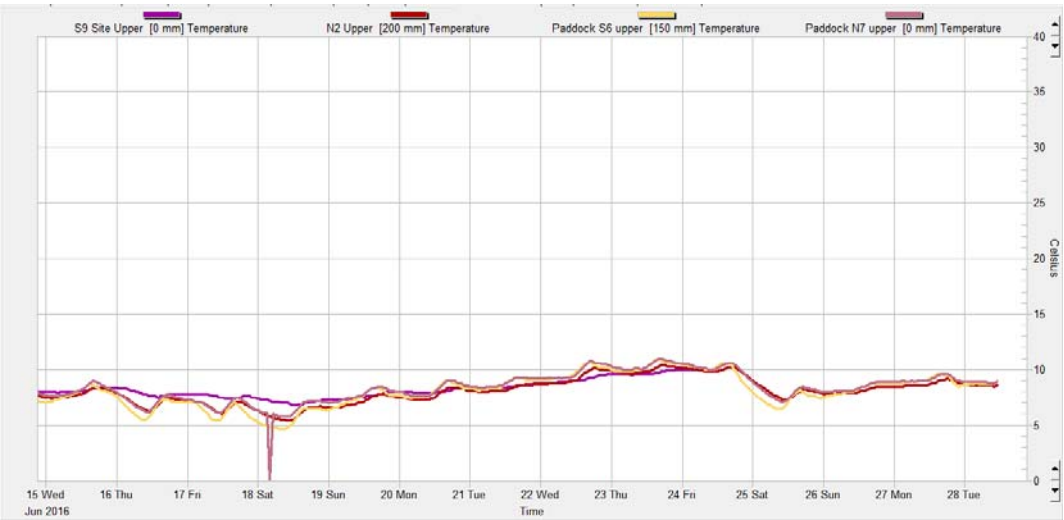
Herd Management

4. 77 late calving cows left for Hororata on Thursday 26th May.
5. 295 early and mid-calving cows left for wintering on 30th May.
6. 15 dry cows (lames) are at the East Block
7. 142 R2 heifers are grazing at Hororata with the 40 bought in heifers.
8. Animal health management of the milking herd before dry-off and wintering:
   a. The milking herd was vaccinated against Leptospira 4 weeks ago.
   b. All cows got a B12 and selenium boost injection before going to wintering blocks.
9. Replacement heifers management:
   a. All R2 heifers were teat sealed on the 20th June, weighed and given a short acting B-12 plus selenium jab
   b. All 2015 born heifer replacements (total 155) are away grazing. They are now grazing in Hororata. They were weighed and received a short acting B-12 plus selenium jab.
   c.

Growing Conditions

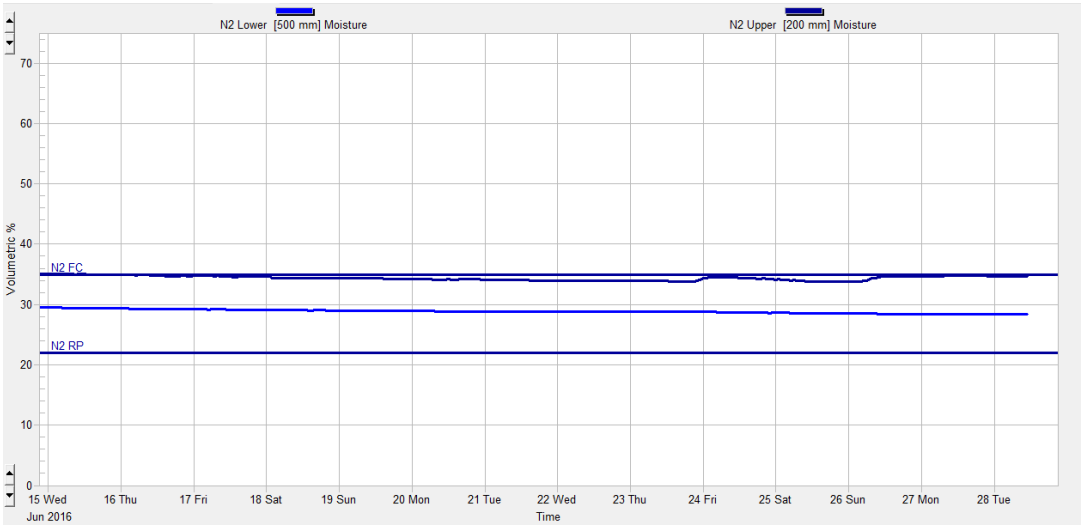
10. The average 9 am soil temperature for the week increased from last week, reaching 8.8°C, up 0.1°C from last week and remains 5.2 degrees warmer than at the same time last season.

Figure 1: Soil temperature history for the last 2 weeks



11. The farm received 11.4 mm of rain through the week. The Aquaflex show that we are close or at field capacity. In general, conditions underfoot remain firm though there are some decidedly wet patches (mainly in the South Block).

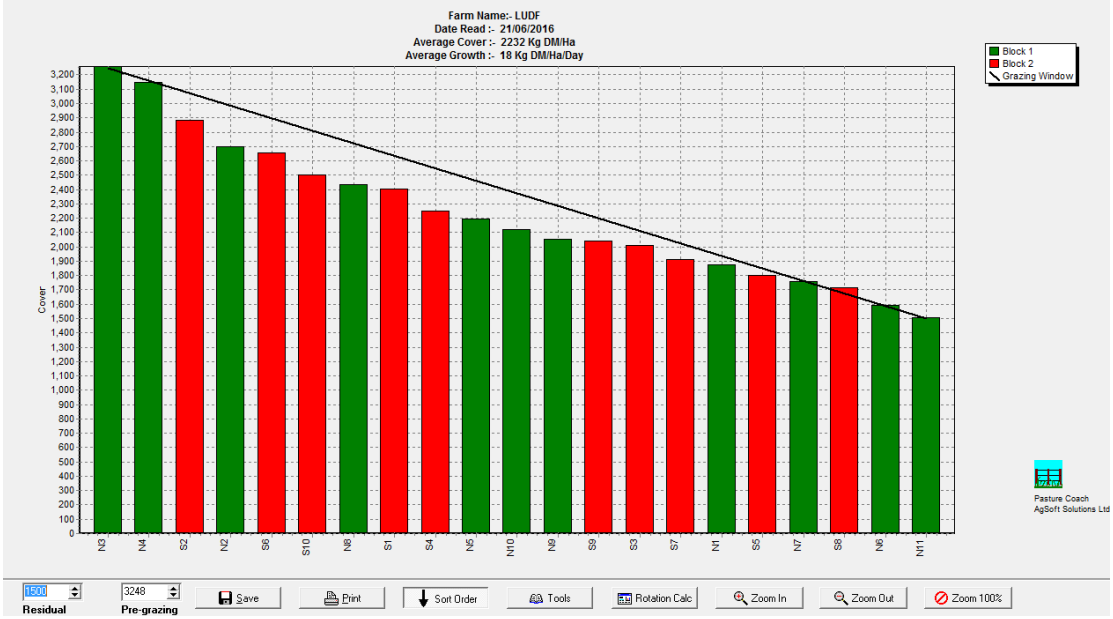
Figure 2: Soil moisture history for the last 2 weeks (Paddock N2).



Pasture and Feed Management

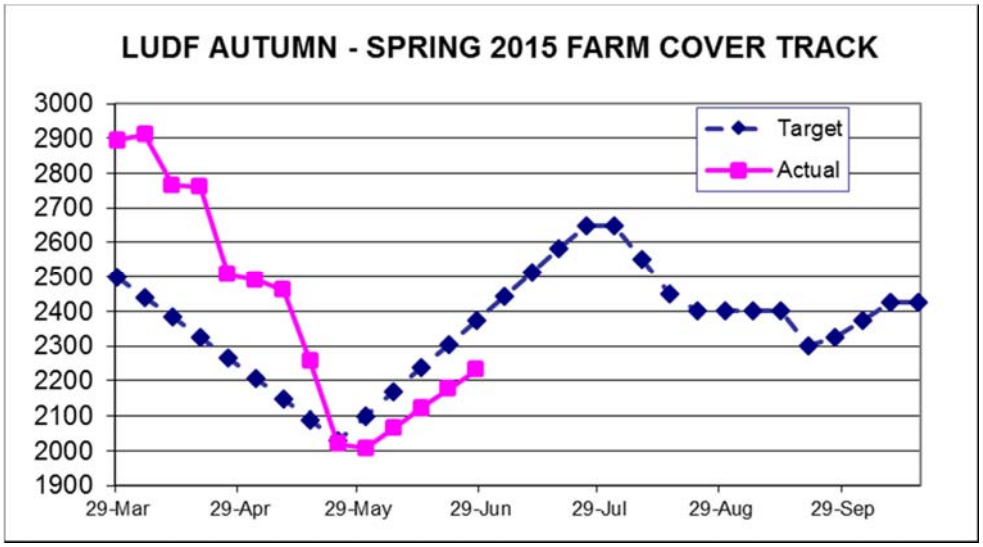
12. Fertility patches remain obvious in a number of paddocks including those not necessarily at the top of the wedge.

Figure 3: This week's feed wedge



13. Based on the full farm area of 160 ha in the grazing round, and with only 1 cow on the platform, there is virtually no demand on the farm at this stage.

14. Below is our autumn/winter pasture cover tracker.



15. At this stage we are about 142 kgDM/ha below target.

16. Our target remains to accumulate pasture cover over the next 30 days to reach target average pasture cover at calving. We are aiming for a minimum APC of 2600 kgDM/ha by planned start of calving, to allow us to effectively set up our spring rotation planner. An average growth rate of 12kgDM/ha/day over the next 30 days will be required for us to achieve our target of 2600kgDM/ha at PSC.

Feeding Management for the coming month

17. For the coming month our aims are to continue to monitor average pasture cover over the coming weeks, particular after the frosty weather forecast from the end of this week.

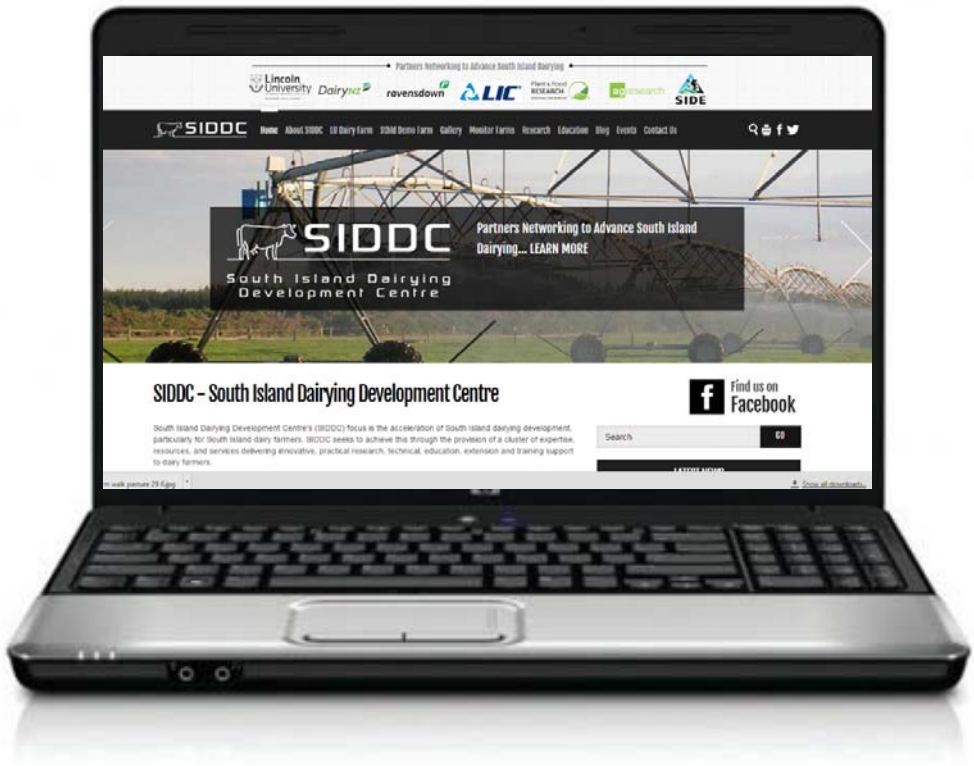
LUDF Weekly report	17-May-16	24-May-16	31-May-16	14-Jun-16	28-Jun-16
Farm grazing ha (available to milkers)	160	160	160	160	160
Dry Cows on farm / East blk /Jackies/other	40/0/0/0	405/0/0/0	67/0/0/373	15/0/52/372	0/15/52/512
Culls (Includes culls put down & empties)	0	0	5	0	0
Culls total to date	118	118	123	0	0
Deaths (Includes cows put down)	1	0	0	0	0
Deaths total to date	13	13	13	0	0
Calved Cows available (Peak Number 560)	405	405	0	0	1
Treatment / Sick mob total	0	0	0	0	0
Mastitis clinical treatment	0	0	0	0	0
Mastitis clinical YTD (tgt below 64 yr end)	95	95	95	0	0
Bulk milk SCC (tgt Avg below 150)	169	197	0	0	0
Lame new cases	0	0	0	0	0
Lame ytd	179	179	179	0	0
Lame days YTD (Tgt below 1000 yr end)	3612	3612	3612	0	0
Other/Colostrum	0	0	0	0	0
Milking twice a day into vat	396	405	0	0	0
Milking once a day into vat	9	0	0	0	0
Small herd	0	0	0	0	0
Main Herd	396	405	0	0	0
MS/cow/day (Actual kg / Cows into vat only)	1.34	1.23	0.00	0.00	0.00
MS/cow to date (total kgs / Peak Cows	516	522	522	0	0
MS/ha/day (total kgs / ha used)	3.39	3.12	0.00	0.0	0.0
Herd Average Cond'n Score	0.00	4.40	0.00	0.00	0.00
Monitor group LW kg WOW early MA calvers	0	0	0	0	0
Soil Temp Avg Aquaflex	11.6	9.1	8.7	8.7	8.8
Growth Rate (kgDM/ha/day)	24	13	22	12	18
Plate meter height - ave half-cms	12.5	10.9	10.8	11.6	12.4
Ave Pasture Cover (x140 + 500)	2256	2020	2007	2123	2232
Surplus/[defict] on feed wedge- tonnes	0	[9.9]	[8.1]	0	0
Pre Grazing cover (ave for week)	3163	2931	2850	2720	0
Post Grazing cover (ave for week)	1600	1500	1500	1500	0
Highest pregrazing cover	3236	2992	2850	2720	0
Area grazed / day (ave for week)	5.63	5.50	1.18	0.25	0.00
Grazing Interval	28	29	136	640	0
Milkers Offered/grazed kg DM pasture	17	17	0.0	0.0	0.0
Estimated intake pasture MJME			0	0	0
Milkers offered kg DM Grass silage	0	0	0	0	0
Silage MJME/cow offered			0	0	0
Estimated intake Silage MJME			0	0	0
Estimated total intake MJME	210		0	0	0
Target MJME Offered/eaten (includes 6% waste)			0	0	0

Pasture ME (pre grazing sample)	12.0		0.0	0.0	0.0
Pasture % Protein	24.1		0.0	0.0	0.0
Pasture % DM - Concern below 16%	14.6		0.0	0.0	0.0
Pasture % NDF Concern < 33	42.3		0.0	0.0	0.0
Mowed pre or post grazing YTD	236.5	236.5	236.5		
Total area mowed YTD	312.3	312.3	312.3		
Supplements fed to date kg per cow (560 peak)	409.2	409.2	409.2	0.0	0.0
Supplements Made Kg DM / ha cumulative	964.35	964.35	964.35	0	0
Units N applied/ha and % of farm	0	0	0	0	0
Kgs N to Date (whole farm)	179	179	179	0	0
Rainfall (mm)	8.2	38.2	37	3.8	11.4
Aquaflex topsoil rel. to fill point target 60 - 80%	50-70	60-90	90-100	90-100	80-100

Next farm walk: 12th July, continuing fortnightly until 1st August 2016, always at 9am. 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 gumboots. Phone SIDDC – 03 423 0022.

Peter Hancox, Farm Manager, Natalia Benquet, Charlotte Westwood.

www. siddc.org.nz



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