SOUTHERN DAIRY HUB

October Field Day 2019

SOUTHERN DAIRY HUB

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0800 336632

RESEARCH DEMONSTRATION & EDUCATION

BBQ Lunch kindly sponsored by:

NEW ZEALAND FARM SOURCE

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SOUTHERN DAIRY DEVELOPMENT TRUST

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Contents

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Visitor Health and Safety Requirements

Entry onto property by permission and appointment only.

Contact either:

General Manager Louise Cook 027 564 5595 or

Farm Manager Charlie McGregor 027 207 6012

All visitors required to sign in and out accepting farm rules

A farm map will be provided showing any general hazards on the farm; the manager will instruct you of any new hazards

General Rules

- Communication – sign in and out
- Children on farm – must be under constant adult supervision and only with express permission of manager
- Reporting – Please notify manager immediately any accidents or near miss events/hazards
- Drive to the conditions – Max speed of 30km/hr 

- Farm bikes – trained operators only, helmet with strap done up **at all times**, never operate if under 16 years' old
- Vehicles – no one to operate farm vehicles without manager's permission
- Water ponds/troughs – Keep a close eye on children around water sources – do not drink from farm taps, troughs, water ways
- In emergency – Please report back to farm manager at Assembly point in front of cowshed
- Fire extinguishers – found in farm houses, dairy shed, vehicles, and woolshed
- No smoking in cowshed, buildings, or vehicles
- Firearms – only with approval of farm manager, must hold current licence

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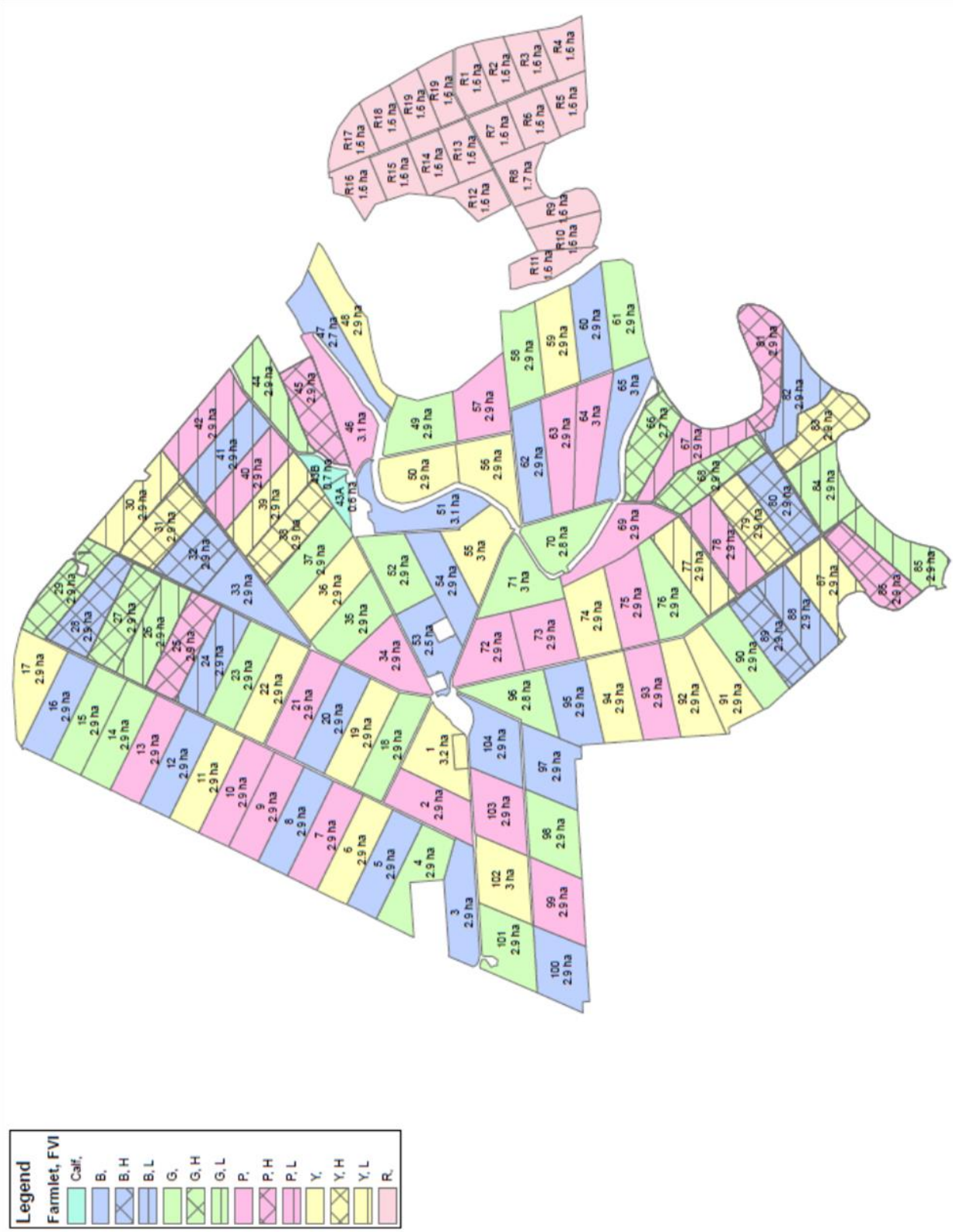
All visitors must comply with the Biosecurity Requirements when visiting the SDH

- All footwear must be disinfected with materials supplied, upon arrival at and departure from the SDH farm site.
- Protective footwear may be borrowed from the SDH upon request, and must be cleaned thoroughly before its return. People wearing inappropriate (or no) footwear will not be allowed onto the SDH premises.
- All visitors are expected to wear clean protective clothing, including wet weather gear if necessary when on the farm(s).
- No farm visits will be allowed, under any circumstances, from anyone within five days of their arrival in New Zealand from Central or South America, any part of Asia or any part of Africa. Further restrictions may be applied at any time, dependent upon international disease status.
- On farm, visiting vehicles must be parked in designated visitor parking areas. Approved vehicles may only access the farm after washing the undercarriage. This may be repeated prior to departure but this is up to the operator concerned.
- SDH retains the right at any time to refuse access to any person or persons deemed not to be complying with these requirements.



Farm Map

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Mission and Strategic Direction - Southern Dairy Hub

Farmers in the Southland region took the initiative to establish the Southern Dairy Development Trust (SDDT) and its fully owned registered trading company, the Southland Demonstration Farm (SDF) in 2007. The Charitable Trust Deed outlines that the purpose of the trust is for "the promotion of dairy farming in Southland and West Otago, and to assist, support and encourage existing dairy farmers and those interested in joining the dairy industry for general educational purposes".

Following the expiry of the lease on the Southland Demonstration Farm at Wallacetown in 2016 SDDT and SDF approached DairyNZ and AgResearch seeking agreement to establish a dedicated Southern Dairy Hub (SDH) to facilitate dairying research and extension in the region. The anticipated benefits are predominantly associated with the ability for farmers, researchers and the industry body DairyNZ to work together to create new solutions for the Southland/Otago and New Zealand Dairy industries.

AgResearch, DairyNZ and SDDT have recognised the current scale and growth potential for dairying in Southland. However, there are significant local issues faced by farmers dealing with wet soils, cold winters and unique environmental issues. The region will require new levels of research and development activity and resourcing to provide solutions that reflect the area's unique climate and soil conditions. Failing to find solutions to address environmental concerns within the context of long-term sustainable farm systems will impact on the ability of the dairy industry to grow in the region.

***SDH Vision**: to be an internationally recognised, innovative and leading centre of excellence for dairy farming, comparative research, and extension*

***SDH Mission**: providing economic, social and environmentally sustainable solutions for the southern South Island dairy farmers and community*

SDH Fundamental aims:

- To improve the performance and protect the viability of existing dairy farms in the southern South Island.
- To help develop and test new options for dairying in the southern South Island.
- To support the responsible and sustainable growth of dairying in the southern South Island.
- To promote the Dairy Industry Strategy.

SDH has leased the farm to the Operating Company (SDRF) for dairy farming and to conduct the research related to dairy farming.

The Research Advisory Committee (RAC) and SDH, together with representatives from the Southern dairy community, then decided the most significant issues facing farmers currently and now we are one year into our first 3-year project. The following section will provide some background on the process taken, what the key outcomes were and the current systems comparison.

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SDH Farm System profit comparison

The Farmlets so far this season are being tracked and compared from a profit point of view.

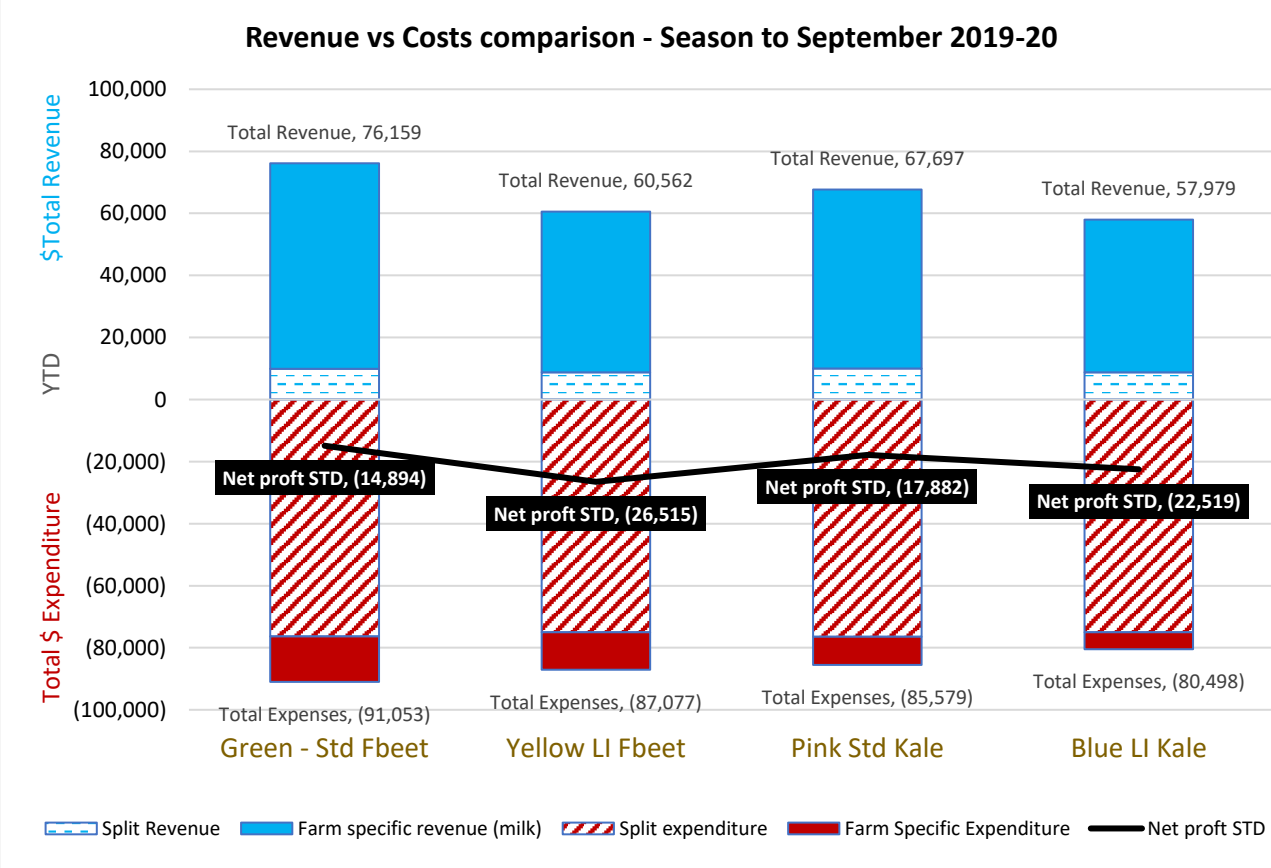
This involves allocation of the generic farm costs (rates, Dairy Shed chemicals and R&M etc.), as well as direct apportionment of the specific costs to a farmlet. Examples of this are – the specific herd test or animal health cost based on numbers of animals in the herd and the treatments required, also phosphate looselick minerals of $6,000 split only between the Green and yellow herds, this is then split unevenly between them based on the two different herd sizes.

We use accrual accounting on the farmlets – meaning we have recorded the total expected revenue ($6.75/kgMS as at 30 September 2019) for all kilos produced season to date.

Season to date the physical numbers summarise as:

	Green - Std Fbeet	Yellow LI Fbeet	Pink Std Kale	Blue LI Kale
Cows in herd	198	166	197	166
Farmlet eff Ha	63.8	63.8	63.8	63.8
kgMS YTD	16,566	12,964	14,838	13,112
kgMS/ha YTD	126	99	114	98

The graph below shows the cumulative total revenue and expenditure season to date on each of these farmlets. Full details behind these numbers are in the table on the next page.



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Profit/Loss STD - September comparison				
Item	**Green Std Fbeet**	**Yellow LI Fbeet**	**Pink Std Kale**	**Blue LI Kale**
Total Milk	66,267	51,743	57,734	49,160
Dairy Cattle Income	6,936	5,863	7,007	5,863
Total Other Income	2,956	2,956	2,956	2,956
Revenue	**76,159**	**60,562**	**67,697**	**57,979**
Administration	4,709	4,709	4,709	4,709
Animal Health	9,756	8,905	7,983	5,140
Breeding	3,897	2,982	3,876	3,068
Calf Rearing	3,419	2,890	3,453	2,890
Electricity	1,797	1,797	1,797	1,797
Farm Working	1,724	1,724	1,724	1,724
Fertiliser	3,421	2,579	3,355	2,282
Freight	14	14	14	14
Insurance	710	710	710	710
Repairs and Maintenance	8,403	8,403	9,751	9,538
Shed Expenses	1,026	1,026	1,026	1,026
Staff Costs	43,655	43,655	39,498	39,498
Supplements and Crops	4,963	4,123	4,123	4,543
Weed and Pest	132	132	132	132
Depreciation	3,428	3,428	3,428	3,428
Total Operating Expenses	**91,053**	**87,077**	**85,579**	**80,498**
Net Profit	**(14,894)**	**(26,515)**	**(17,882)**	**(22,519)**

Revenue and Expenditure exceptions	**Green Std Fbeet**	**Yellow LI Fbeet**	**Pink Std Kale**	**Blue LI Kale**
Split Revenue (stock / other)	9,892	8,819	9,963	8,819
Farmlet specific revenue (milk)	66,267	51,743	57,734	49,160
Split expenditure (General FWE)	(76,392)	(75,047)	(76,482)	(75,047)
Farmlet Specific Expenditure	(14,661)	(12,030)	(9,097)	(5,451)
Net profit STD	**(14,894)**	**(26,515)**	**(17,882)**	**(22,519)**

SDH winter & spring 2019 summary

Key Points

- We struggled to put BCS on the cows wintered on kale this winter with a higher proportion of these herds not achieving pre-calving BCS targets
- Winter and pre-calving supplementation of minerals to the fodder beet cows reduced the incidence of metabolic disease related deaths compared with spring 2018
- Dating heifer pregnancies and better management of mating data is a priority for 2019-20 to provide more robust data for spring 2020 feed budgets and planning
- Supplements in the feed budget that were not required in early spring are now being used to fill the pasture deficits while we wait for balance date to arrive
- Difficult calvings were the main animal health challenge through calving; lameness has been an issue in the last month with wet ground conditions and soft feet. Kale cows are experiencing more front foot lameness compared with fodder beet cows; mastitis incidence has been low
- Milk production has been hovering between 1.8 and 2kg MS/cow for a month with a lot of variation within and between herds on a daily basis
- Bulk milk urea from the vat of the Std and LI FB herds has been lower through the spring

Wintering

All cows dried off by 20th May. Fodder beet herds were offered fodder beet (3 kg DM/day) through late lactation and this continued through the dry off period in preparation for transitioning to their winter fodder beet allocation.

Fodder beet cows all transitioned as one mob and were increased by 0.5 kg DM/day up to 10.5 kg DM/cow with 3.5 kg DM pasture baleage. Loose P supplementation (Ocean Thrift $MgPO_4$) was supplied in bins in the paddock at a rate of 140-180 g/cow/day and the baleage dusted with 50 g DCP/cow/day. Dry cows were on fodder beet until the 3rd October when the late calvers joined the springers.

Kale herds commenced transitioning onto crop 5 days after dry off starting at 2 kg DM/cow/day kale and increasing by 1 kg DM/day up to 11.3 kg DM/cow. Remainder of the diet was pasture baleage throughout the transition and ended at 3.5 kg DM/cow/day for the winter. All kale cows transitioned as one mob. Dry cows were on kale until the 27th August then followed milkers to clean up residuals.
R2 heifers returned to farm on 30th May and after weighing, bleeding and measuring started their transition onto their respective crops.

Once all animals were fully transitioned (14th June) the mobs were resorted for wintering. Each farmlet had 2 wintering mobs:

R2's and lighter MA cows
Remaining mixed age cows

Fodder beet R1's were transitioned onto beet commencing 1st May and once transitioned were offered a diet of 60% beet and 40% baleage (average total DM allocation 8.2 kg DM/animal/day)
Kale R1's were transitioned onto kale commencing 22nd May and once transitioned were offered a diet of 50% kale and 50% baleage (average total DM allocation 8.2 kg DM/animal/day).

Calving

Cows wintered on fodder beet achieved a higher average pre-calving BCS than those wintered on kale. Cows on Kale had a higher proportion of cows below BCS 5 (Figure 1). Average BCS of Herd:

- Std Kale - 5.1
- LI Kale - 5.2
- Std FB - 5.3
- LI FB - 5.4

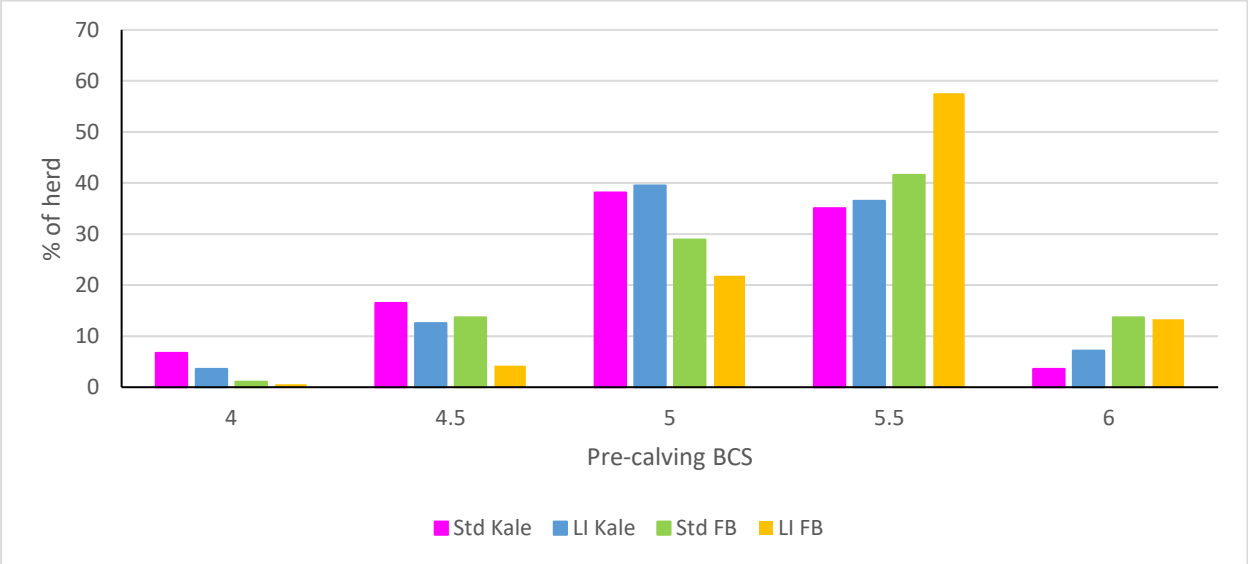

Figure 1: Pre-calving BCS distribution

Springer management

- 2 springer mobs – kale and fodder beet wintered
- Springer drafts 2x per week using expected calving dates and udders
- Aiming for 10-14 days in the springer mob on a diet of 50:50 pasture and pasture silage offered at 10 kg DM/cow
- Fodder beet cows received MgO (50 g/cow/day) and DCP (50 g/cow/day) supplementation dusted onto the pasture break and $MgCl_2$ (70g/cow) in the water.
- Kale cows received MgO supplementation (50 g/cow/day) dusted onto the pasture break and $MgCl_2$ (70g/cow) in the water

Colostrum management

- Milked OAD in the afternoon

- Pasture dusted with MgO (50 g/cow/day), DCP (50 g/cow/day) and limeflour (300 g/cow/day) plus 70 g $MgCl_2$/cow/day through the water
- Only left the colostrum mob following a clear RMT
- Mixed colostrum mob throughout calving, rotated around paddocks from all of the farm systems

Milker Management

- Single milker mob, milked OAD until the 27th August supplemented with MgO (50 g/cow/day) and limeflour (300 g/cow/day) dusted onto the pasture break and 70 g $MgCl_2$/cow/day through the water
- Pasture offered in 12 hour breaks using block allocation rather than offering long narrow breaks
- Split into kale or fodder beet treatments on the 29th August
- Split into individual farmlets on the 4th September

Calving Spread

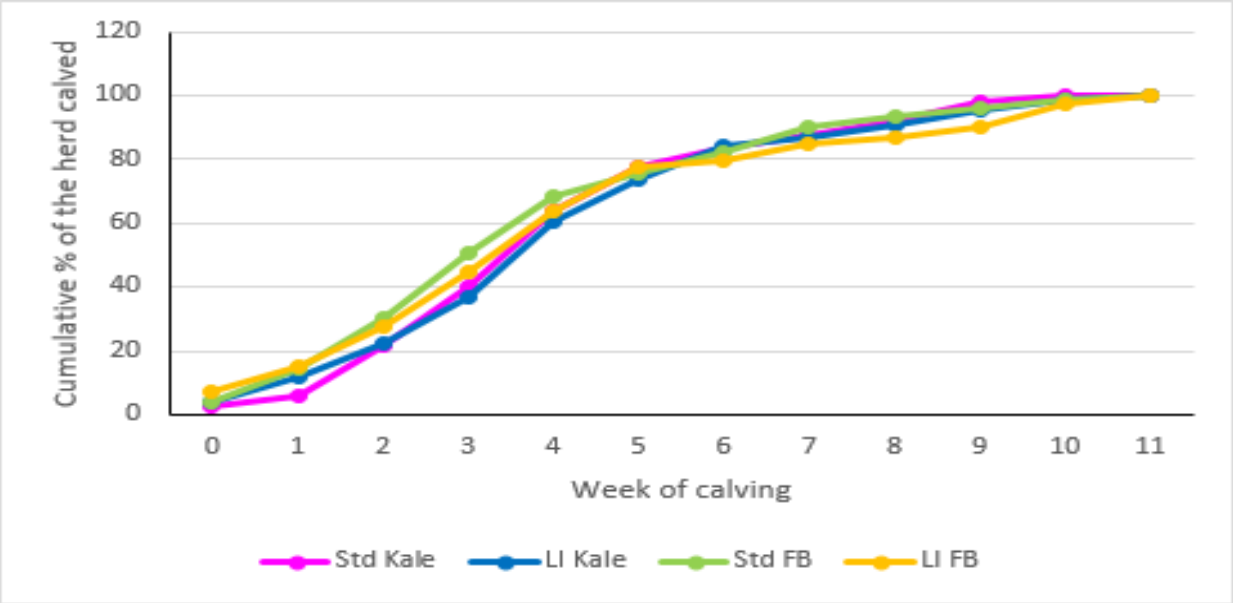

Figure 2: Cumulative calving rate for the four herds during spring 2019

The calving rate for the fodder beet herds was faster for the first 3 weeks of calving but then slowed, allowing the kale herds to catch up by week 6 (Figure 2). The LI FB herd had a very slow period of calving through weeks 6 through 9.

We did not have dated pregnancies for the R2's. For the mixed age cows at least 70% of the Std Kale, LI Kale and Std FB herds calved within 7 days of their predicted calving date, however only 60% of the LI cows calved in this timeframe (Figure 3). Proportionally more of the LI FB cows calved on their due date or more than 21 days outside their due date.

On average cows in all herds spent 14 days off crop prior to calving. A higher percentage of fodder beet cows calved on crop (5 % - Std FB; 3% - LI FB) compared with the kale cows (1.5% Std Kale; <1% - LI Kale) despite the same springer drafting criteria for all herds.

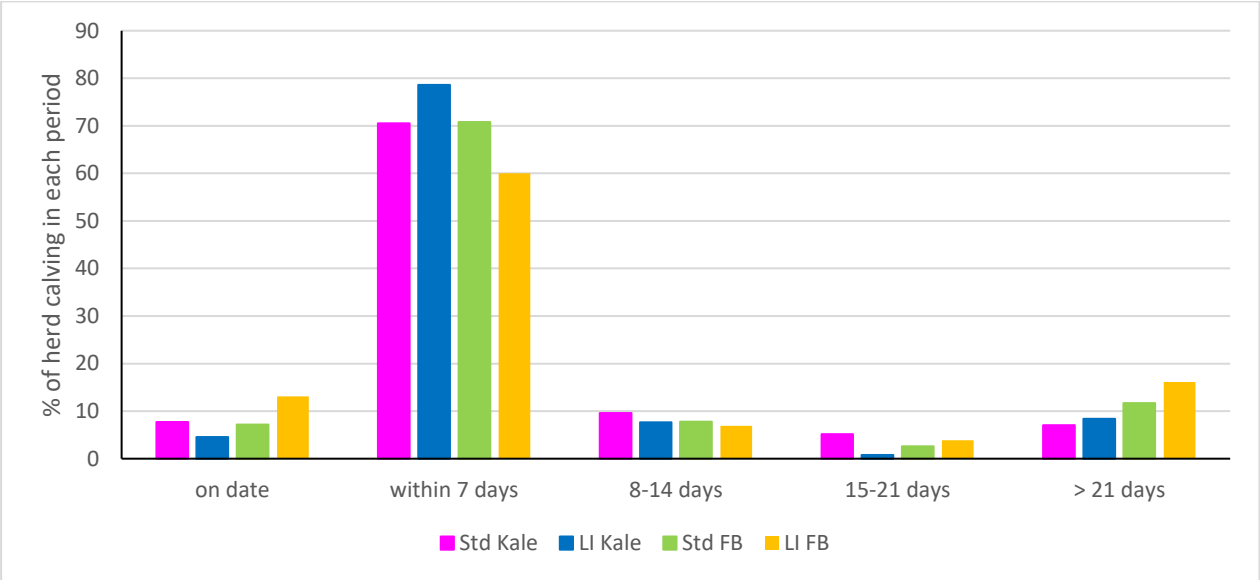

Figure 3: Percentage of cows calving on their due date or within 1, 2, 3 or >3 weeks relative to predicted calving dates

Feed supply and growth rates

Like many farms across the province average pasture cover leading into calving was 2-300 kg DM above the feed budget target (Figure 4). This allowed us to get through until mid-September before we had to start feeding supplement. Supplement 'saved' during late winter/early spring is now being utilized to fill current feed deficits resulting from below average pasture growth rates.

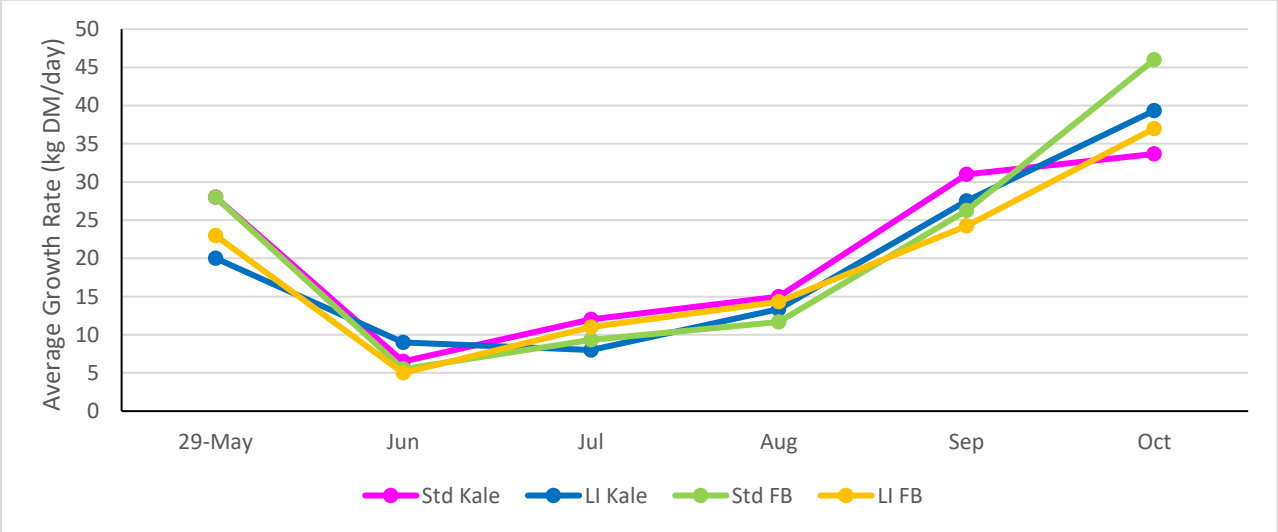

Figure 5: Average monthly growth rates since the 29th May

It took until early September to get on top of the high pre-graze pasture covers and quality was average (ME 11.5 to 12.5; crude protein 14-16%). Dry cows were used behind the milkers in the kale herds to clean up residuals resulting in better quality second round pastures in these farmlets.

Cold, wet conditions have resulted in lower than average growth rates through late September and October (Figure 5). Supplement in the feed budget for earlier in spring has been fed during this period and continues to be fed to fully feed the cows and hold the rotation until growth improves.

Our wet weather and low growth rate management strategies have included

- Holding our round length around 30-32 days to build cover ahead of the cows. Grass grows grass so this allows us to graze at the optimal 2.5-3 leaf regrowth stage.
- Utilising pasture in springer paddocks for milker grazings with additional supplement
- Feeding supplements to fill deficits and using extra baleage to keep cows feeling full and warm during cold, miserable days.
- Using weekly pasture walks and monitoring feed wedges to track our position and update our spring feed budgets.
- Using nitrogen fertiliser proactively and continuing with Ammo31 for the second round applications on the Std Kale and Std FB farmlets
- Targeting residuals and earmarking paddocks that may have been left a bit high for next round or returning to clean up.
- OAD milking lighter cows to reduce pressure leading into mating; lighter kale cows also receive 1 kg DM more in-shed feeding than the remainder of their herd.
- If weather gets really bad there is also always an option to semi stand cows off on springer paddocks that will be going into crop to prevent damaging paddocks across the farm.

Animal Health

Calving difficulties have been the biggest challenge during spring 2019 with a lot of big calves creating difficulties in the R2's and the cows. Metabolic issues and down cow deaths were significantly fewer this season compared with calving 2018.

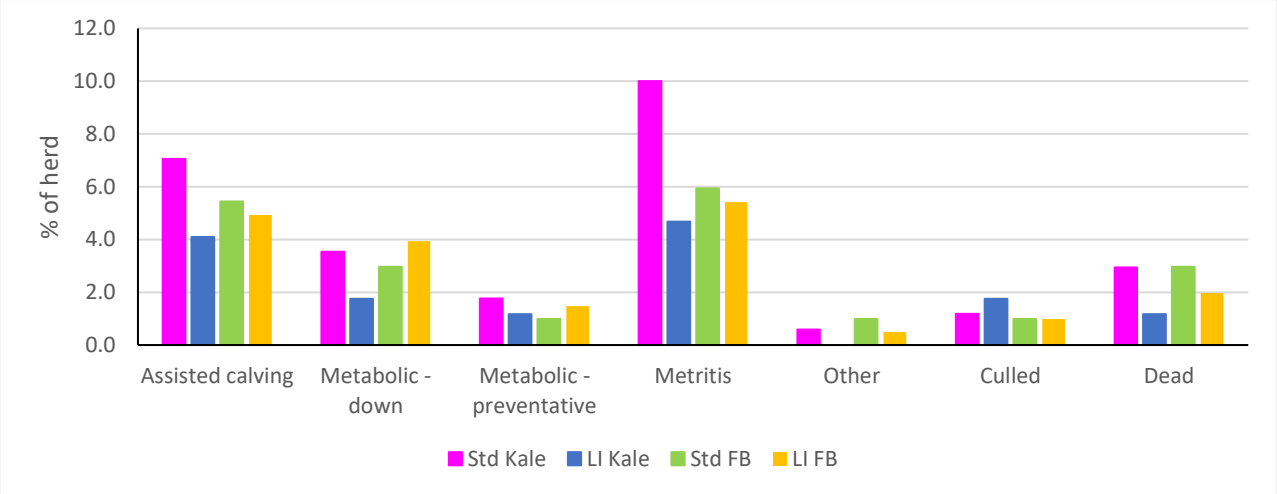

Figure 6: Health incidences related to calving, deaths and culls for the herds during spring 2019.

In Figure 6 the assisted calvings are a combination of vet assisted, calving jack and minor assisted calvings. Most of the culled cows were cows that lost their pregnancies during winter i.e.. they

were scanned in-calf in May but were confirmed empty in September/October with a couple culled due to temperament issues.

Lameness has been an ongoing issue, especially from early September. White line has been the most prevalent cause of this lameness (Figure 7). The kale herds have more lameness cases associated with the front feet (Figure 8) and also a higher incidence of lameness compared with the fodder beet herds.

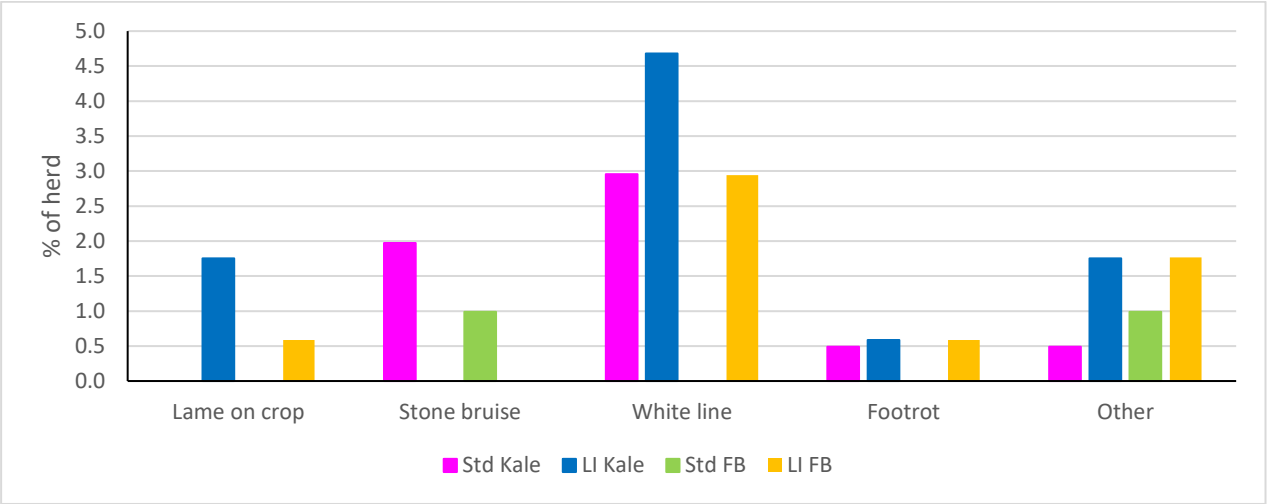

Figure 7: Lameness incidences season to date for each herd

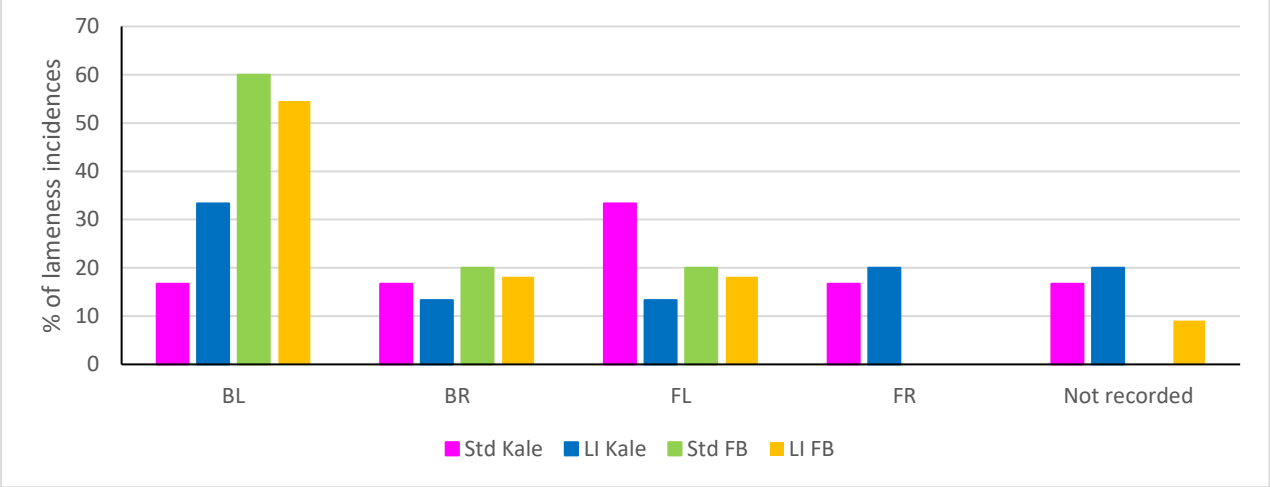

Figure 8: Percentage of lameness cases for each foot (BL – back left; BR – back right; FL – front left; FR – front right)

Milk production and Milk urea

This season daily milk solids production is being estimated using the Delpro volume data and the milk solids supplied to Fonterra (Figure 9). Milk production has been inconsistent across all the farmlets and just when we thought we were heading for a good peak production the wet weather hit and more baleage (only average quality available) was used to fill the feed deficit. Kale cows

have been receiving up to 4 kg DM PKE/barley blend in the shed and fodder beet cows up to 2.5 kg DM lifted fodder beet bulb.

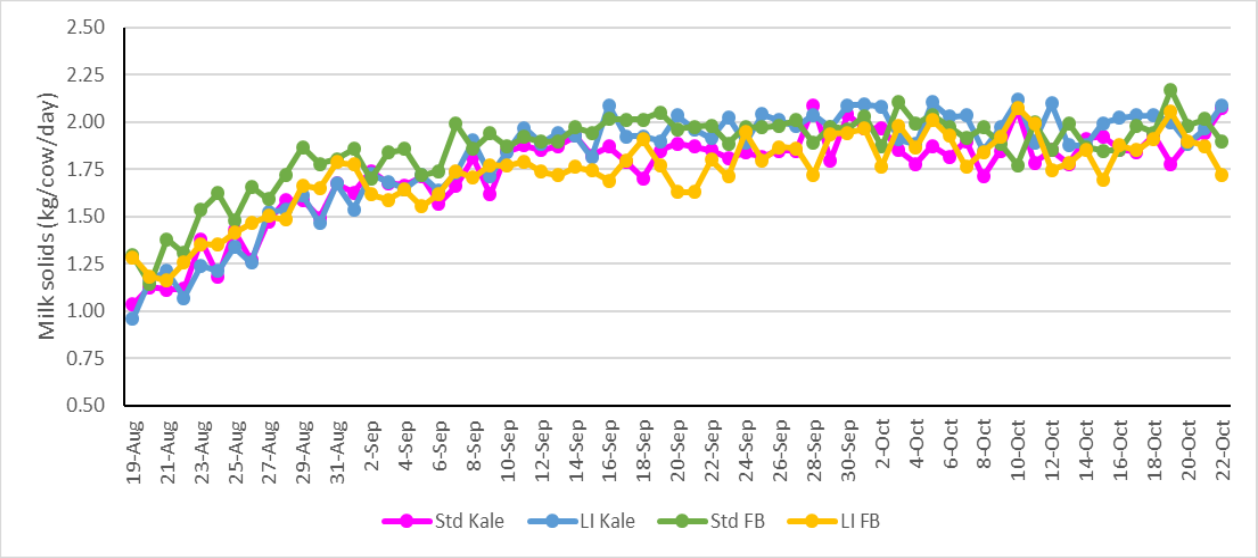

Figure 9: Estimated daily milk solids production for each herd

Differences in milk urea have been observed between the kale and fodder beet herds at different times through spring (Figure 10). The differences have been attributed to differences in the nitrogen intake of the herds, driven primarily by the nitrogen content of the pasture and the difference in the nitrogen content between PKE and fodder beet bulb which have been used as supplements for the kale and fodder beet herds respectively.

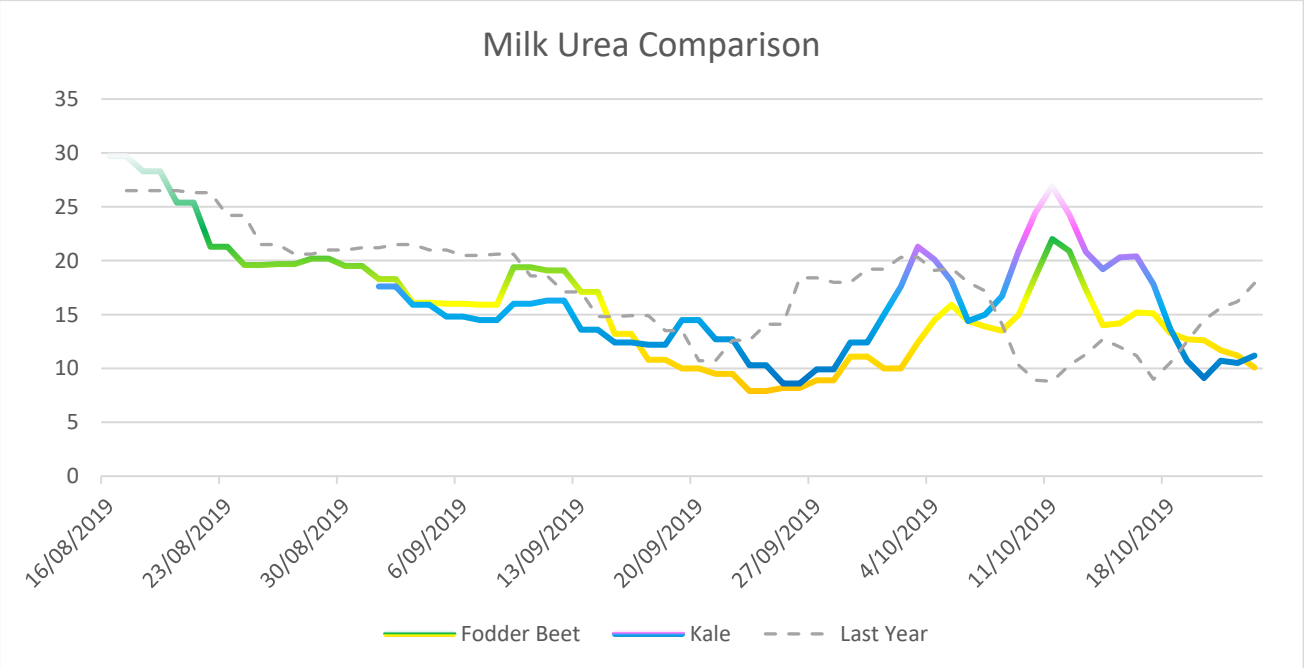

Figure 10: Bulk milk urea concentrations from the kale and fodder beet

The SDH phosphorous (P) supplementation story

Key Points

- In the absence of P supplementation blood P concentrations can decline significantly during winter feeding of fodder beet but this does not always increase the risk of metabolic disease
- Even with 1 or 2 forms of P supplementation provided on bales or as loose licks, up to 48% of animals may still have P concentrations below the lower threshold of 1.3 mmol/l
- Within a herd there is significant variation in blood P concentrations when offered kale or fodder beet
- Feed mineral composition is a major driver on mineral intake and subsequently mineral absorption and blood concentrations. Utilising feed mineral testing to determine what mineral supplements are required for your herd each year.

Background

Earlier research has shown that fodder beet has a different mineral composition to pasture, supplements and other winter forage crops. The biggest difference is in the phosphorous content, particularly in the bulb where P levels are typically in the range of 0.05 to 0.2% compared with pasture and kale at 0.2-0.5%. With bulb making up 15-25% of the crop DM in most situations, fodder beet diets during winter are often low in phosphorus and mineral supplementation may be necessary. Increased incidence of metabolic disorders at calving on some farms feeding fodder beet has questioned the role of phosphorus deficiency in this increase.

Research at SDH over the last 3 winters has enabled us to investigate the role of P supplementation to cows during winter on blood mineral concentrations.

Approach

The P supplementation approach at SDH has evolved over the last 3 winters. In 2017, during the final stages of the farm conversion, no P supplementation was provided to cows wintered on fodderbeet. To minimize the potential risk based on feed test results from winter 2017, DCP was provided at a rate of 50 g/cow/day dusted onto the baleage. Then following a particularly bad spring in 2018 with increased metabolic deaths in the fodder beet herds we opted for a 2 pronged approach in 2019 with cows on fodder beet offered 140-180 grams/cow/day of Ocean Thrift $MgPO_4$ loose lick P supplement in a tub in the paddock as well as 50 g/cow/day DCP dusted onto the baleage.

Blood samples collected in mid-July in all years have enabled us to look at the effect of the different approaches on blood mineral status.

What did we observe?

In winter 2017, in the absence of P supplementation, blood P concentration halved from pre- winter to the mid-winter measurements (Figure1) and 75% of animals had blood P concentrations below 1.3

mmol/l. Despite this observation we had very few cases of metabolic disorders in spring 2017 which we attributed to the majority of the herd being purchased from the north Island and therefore had not eaten fodder beet previously and also the high proportion of 2 and 3 year olds in the herd that year. We also observed differences in blood magnesium mineral concentrations with cows grazing kale having lower average blood magnesium concentration (0.83 vs 0.97 for kale and fodder beet wintered cows respectively).

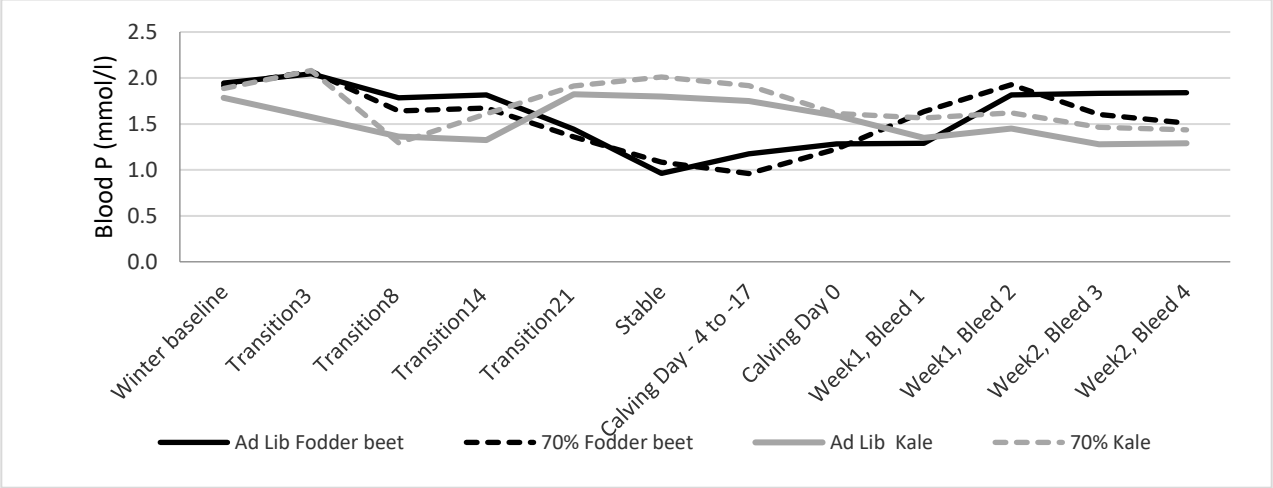

Figure 1: Blood phosphorus concentrations from cows wintered on either kale or fodder beet at 2 different allocations of crop.

Blood samples collected from the Std Kale and Std FB farmlets during winter 2018 indicated significantly lower blood P concentrations in the cows wintered on fodder beet and despite supplementing with DCP (Figure 2) and a herd average of 1.32 mmol/l, 45% of animals had blood P concentrations below 1.3 mmol/l. In spring 2018 we had significantly more metabolic disease and death in the fodder beet herds compared with the kale herds.

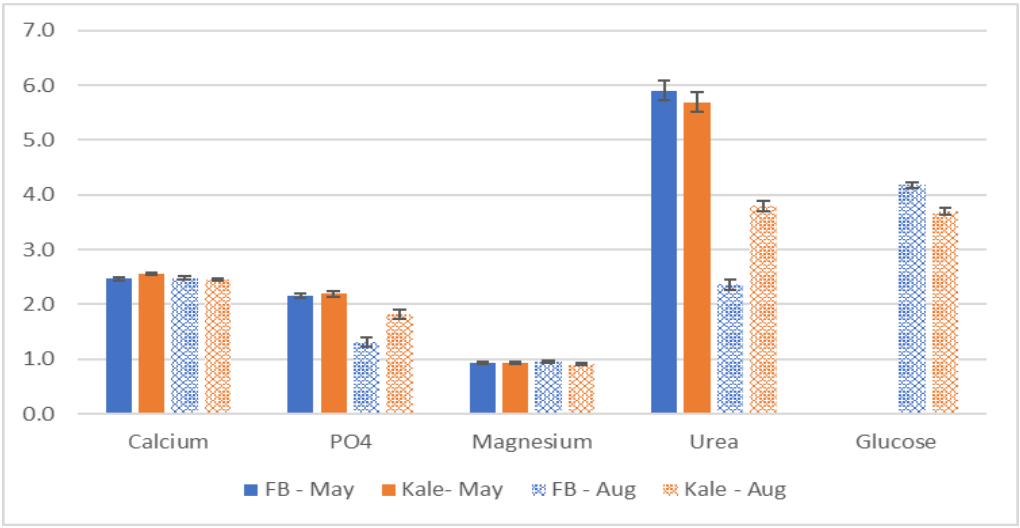

Figure 2: Pre- and mid-winter blood metabolite concentrations from cows offered either fodder beet or kale as their winter crop.

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Preliminary blood results from winter 2019 showed that the proportion of cows below 1.3 mmol/l blood P (48%) was similar to 2018, the average P concentration was only 1.23 mmol/l. An interesting observation which we are still investigating is the low P concentration in the kale cows in 2019 (Table 1).

Table 1: Summary of blood P parameters from cows wintered on either fodder beet or kale in winter 2017, 2018 and 2019

	Fodder beet			Kale		
	2017	2018	2019	2017	2018	2019
Average P concentration mmol/l)	1.08	1.32	1.23	2.01	1.81	1.12
% less than 1.3 mmol/l	75	45	48	0	7	60
Range in P concentration	0.49-2.0	0.59-2.0	0.2-2.44	1.5-2.45	0.94-2.58	0.23-1.99

Blood calcium concentrations have been similar between cows consuming the 2 different crop types for the last 3 years, however blood Mg levels mid winter have consistently been slightly lower in the kale cows, with a higher proportion below 0.8 mmol/l.

Cumulative effects of fodder beet on youngstock

Key Points

- Plasma total protein (proxy for IGG) was similar at birth but lower in fodder beet calves on day 2
- FB calves were 2.5 kg lighter at birth and smaller in stature
- Similar ME intake achieved between R1 groups but the FB diet was deficient in P, Ca and protein. Both diets were marginal for Mg
- R1's grazing fodder beet had higher plasma Ca, Mg & glucose and lower P & urea than R1's grazing kale
- Growth rates of R1's wintered on fodder beet were less than those wintered on kale

Background

Cows wintered on fodder beet often consume a diet low in crude protein, high in soluble sugars and low in phosphorous. We hypothesized that the consumption of diets high in fodder beet during late pregnancy could have negative impacts on the unborn calf.

Approach

Replacement calves from dams wintered in either fodder beet or kale have had the following measurements taken

- Blood sample at birth and 48 hours

- Liveweight, height, length and girth on arrival into the calf pens, fortnightly till weaning, monthly till 12 months and then pre-mating and before entering the herd as R2's

What have we observed?

Calves from cows wintered on fodder beet had lower plasma total protein concentrations than those from cows wintered on kale (Figure 1). Plasma total protein was used as a proxy for IGG concentration. The results suggest that the immune status of the kale born calves was better than the fodder beet calves.

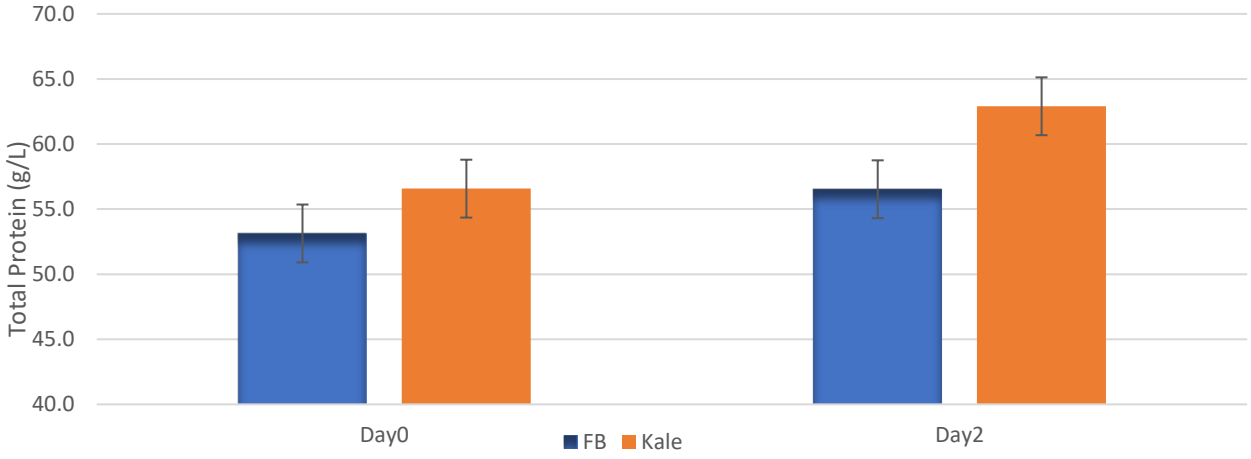


Figure 1: Plasma total protein concentrations from fodder beet and kale born calves on Day 0 and Day 2 of life.

Calves born to cows wintered on fodder beet were 2.5 kg at birth and the absolute difference in liveweight increased with age (Figure 2) but the proportionate difference decreased. At 270 days of age there was still an 8% difference in liveweight. Calves born from fodder beet dams were also smaller in stature (Figure 3).

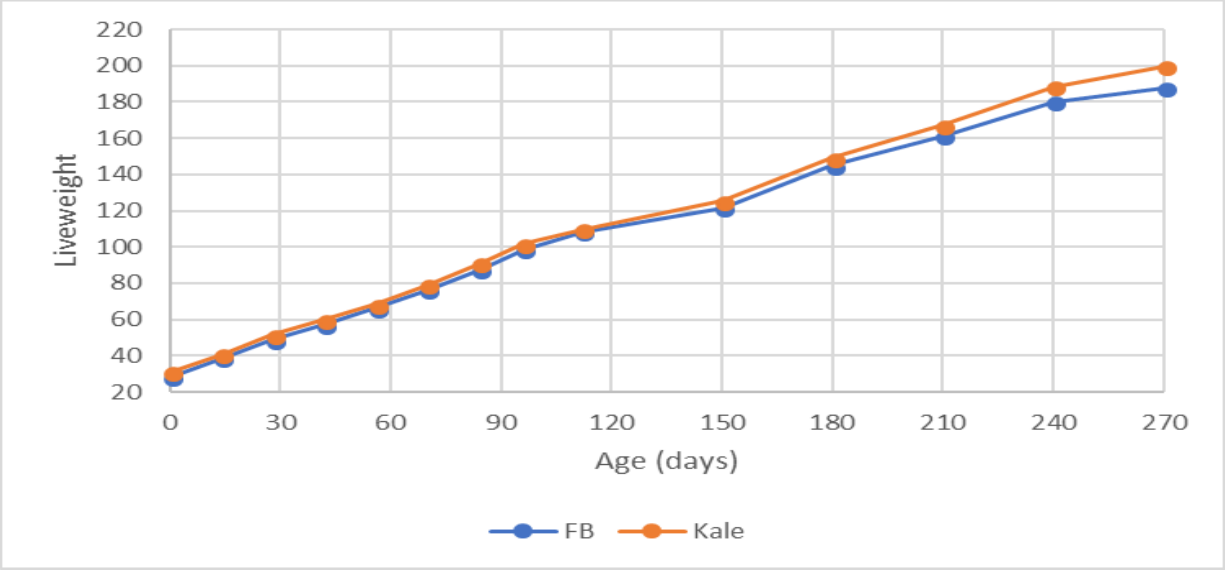


Figure 2: Calf liveweight from birth till 270 days of age

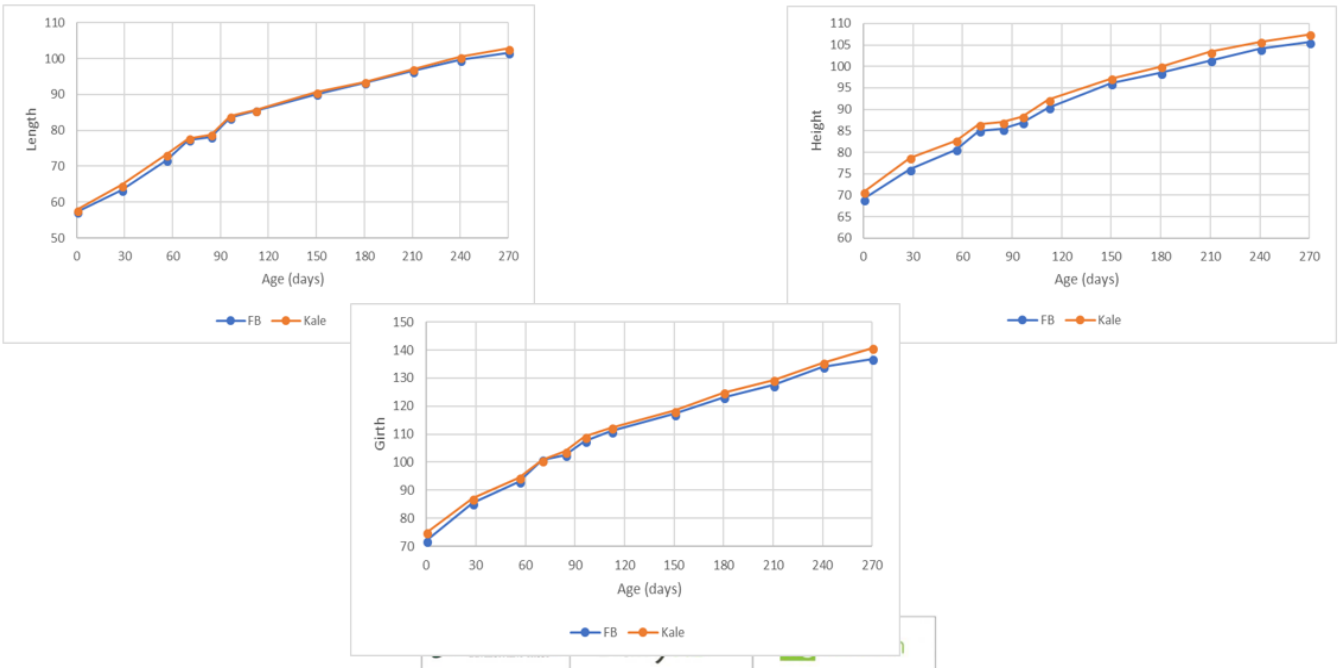


Figure 3: Height, length and girth measurements of calves born from kale or fodder beet dams in spring 2018.

R1's were wintered on either kale or fodder beet. In winter 2018 the fodder beet diet was deficient in P, Ca and crude protein and both diets were marginal for Mg (Table 1). The growth rate of the animals wintered on FB was less than those wintered on kale (Figure 4). The R1's grazing fodder beet had higher plasma Ca, Mg and glucose and lower P and blood urea than R1's grazing kale.

Table 1: Estimated dietary intakes of R1's wintered on either kale or fodder beet

	Estimated dietary intakes				
Crop	Diet CP%	ME intake	Diet P%	Diet Ca%	Diet Mg%
Requirement	15-17%		0.3-0.35%	0.6-0.8%	0.22-0.28%
Kale	15.7%	74	0.31	0.91	0.18
Fodder beet	**11.6%**	73	**0.25**	**0.43**	0.20

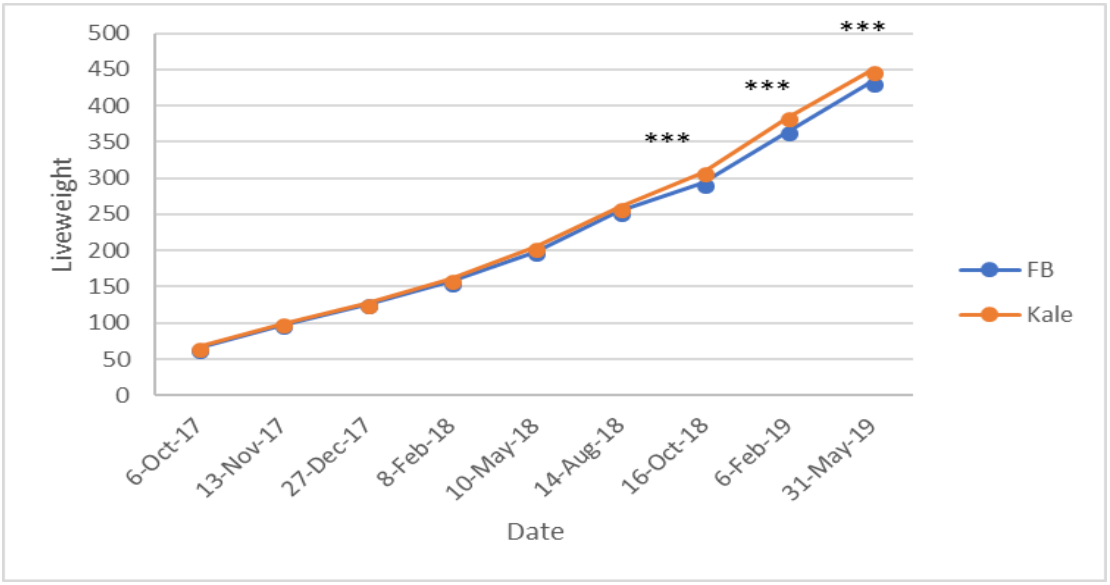


Figure 4: Liveweight gain of R1's wintered on either kale or fodder beet.

Environmental Research

Key Points

- Autumn grazing of FB resulted in a significantly greater N leaching loss than observed for winter-grazed fodder beet. We can probably attribute this to two effects:
  - Timing: removal of plant cover and deposition of urinary N in autumn increases the potential for N removal in subsequent drainage; and
  - Slightly less plant N was consumed by the herd that grazed the winter crop of FB. Urinary N returns would also be reduced.
- Leaching losses from winter-grazed kale were greater than estimated for winter-grazed FB. Although this observation does not represent a statistically significant effect, it is consistent with our overall hypothesis (greater urinary N return and less soil denitrification in the kale treatment)
- Leaching losses of N from autumn-lifted FB were relatively large and similar to losses from autumn-grazed FB. This is a surprising observation and may be due to enhanced soil N mineralisation following the dry summer of 2018.
- Measured losses of N from the pasture paddocks were relatively low and similar to modelled expectations.

1. **Measurement of** nitrate (N) leaching losses from autumn- and winter-grazed crops

Autumn- and winter-grazed fodder beet (FB) crops are key sources of feed in the FB farmlets at the Southern Dairy Hub (SDH). Kale is included in the other two farmlets, although only as a winter feed supply. To increase knowledge of the actual environmental impacts of these grazed forage crops, measurements of N leaching losses commenced in 2018 to provide:

- Quantitative N leaching data for the crops, soils and climate of SDH; and

- N leaching comparisons between:
  - autumn-grazed vs. lifted FB
  - winter-grazed vs. lifted FB
  - winter-grazed kale
  - selected pastures on the milking platform.

These treatments and associated measurements have been repeated in 2019 to allow us to capture at least two years of drainage. The autumn lifting of FB plots occurred on May 1st and grazing was undertaken on May 9th and 10th. The winter grazing of relevant FB and kale treatments occurred on June 26th and 27th. N leaching measurements from these plots will continue through into winter 2020. Below we provide a summary of results-to-date, focussing mainly on findings for the treatments imposed in 2018.

A summary of yields, crop N contents and N losses per cow wintered are shown in Table 1.

Table 1: Crop yields, crop N contents and N leaching losses per cow wintered for the autumn- and winter-grazed fodder beet and winter-grazed kale crop treatments.

	May-grazed FB	July-grazed FB	July-grazed Kale
2018			
Crop yield (t ha^{-1})	24.4	20.4	15.7
Crop N content (kg N ha^{-1})	424	383	422
Mineral N leaching per cow wintered (kg N cow^{-1})		2.4	5.5
2019			
Crop yield (t ha^{-1})	23.4	20.7	8.7[1]
Crop N content (kg N ha^{-1})	400	337	437

Note [1] extra kale was cut and carried to plots to increase yield to 11.8 t ha^{-1} (as measured for other kale paddocks at SDH in 2019).

A summary of N leaching losses from the 2018 treatments are presented in Figure 1 below. Drainage sampling indicated that deposited urinary N was not completely leached from the soil during 2018. Monitoring therefore continued well into 2019. Soil mineral N results are also presented in Figure 1 and show that soil N contents were broadly similar to observed leaching losses.

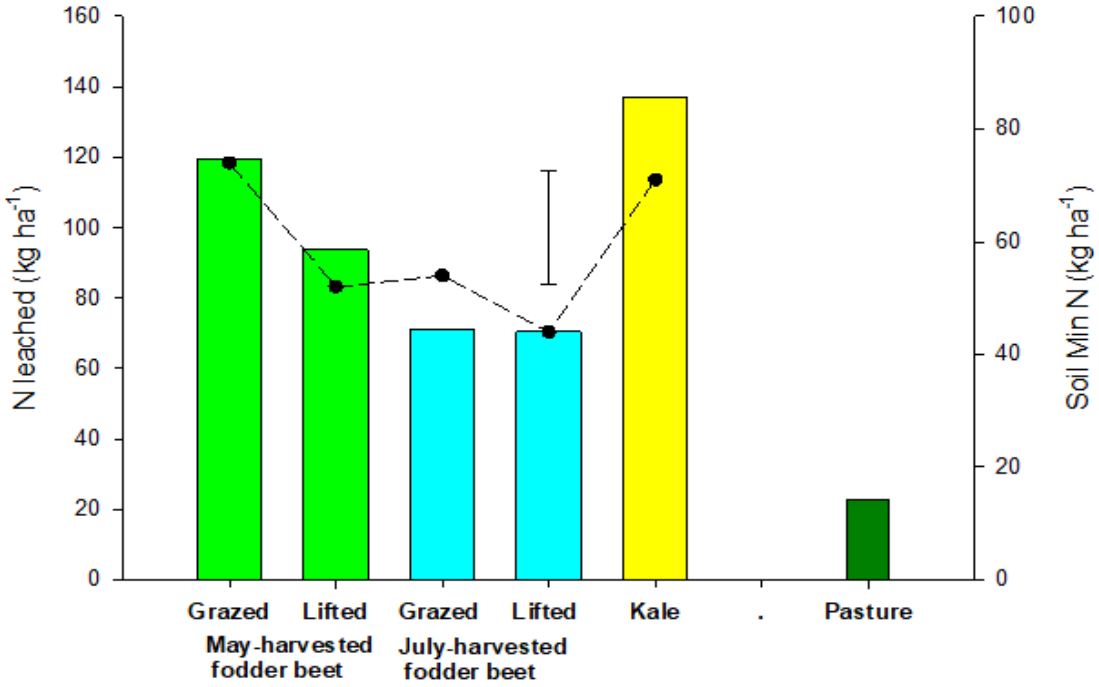


Figure 1. N leaching losses (bars) and soil mineral N contents (●) in crop and pasture treatments imposed in 2018. Bar depicts the LSD value comparing the amount of N leached from the four fodder beet treatments only.

Mineral N leaching from the pasture paddocks grazed over the lactation season averaged only 23 kg N ha^{-1}. This reflects the capacity of the pasture-based grazing system to capture the majority of deposited urine N for pasture production when plants are actively growing. Removing the cows from the pasture over winter is also beneficial and limits urine N returns at times of low pasture growth. However, there was considerable variation in N leaching from the individual paddocks. Some of these differences were likely due to the contrasting grazing pressures applied to each paddock over the summer and autumn period; this aspect will be further looked into.

Southern Dairy Hub Farm Systems Proposal 2018-2021

Background

The Research Advisory Committee (RAC) held a series of meetings and workshops to discuss farm systems options for implementation from 1 June 2018 for 3 lactation seasons. A brainstorming session was used to identify issues facing dairy farmers in Southland and Otago. These issues were collated into 13 themes from which the top 3 were identified.
The top 3 issues were:

1. **Fodder beet**
2. **Nutrient loss reduction**
3. **Wintering**

There is a desire to understand crop vs **off-paddock wintering** and the **impact of infrastructure on whole system performance**, profitability and achieving environmental regulation. Realistically, however, it will be a 2-3 year timeline before this could be considered on the SDH farm due to the current lack of infrastructure and the tight budget situation.

The proposed systems have been designed to better understand crop-based wintering in relation to consequences for environmental impact and profit with the view that the best crop system would be used as the base farm in the next phase of farm systems comparisons (2021 onwards), that might include off paddock infrastructure.

The Process

The Standard kale system was set up as the base model in Farmax Dairy. The results of this were used to generate the key input parameters for the Standard fodder beet system.
Further management changes were considered (reduced N fertiliser, less supplementary feed, reduced stocking rate, dry off date) for each to generate the parameters of the two reduced impact systems.

During the modelling process we identified several physical aspects of the farm and a constraint of OVERSEER that could impede model results being achieved. These are:

1. The pasture growth of the farm (we may have been optimistic on the time to reach potential yield given the early stage of farm conversion).
2. Choice of in-shed supplement and amount that can be consumed during milking
3. The uncertainties associated with N leaching estimates for autumn-grazed fodder beet crops.

System Performance and Input Parameters

Table 2: System performance and input & output parameters

		Crop Type	
	All Systems	5-10 Aug Planned start of calving ≥ 250 days in milk 23% replacement rate No N applied after 10th April or if soil temperature <5 °C in spring Youngstock off	5-10 Aug planned start of calving ≥ 250 days in milk 23 % replacement rate No N applied after 10th April or if soil temperature <5 °C in spring Youngstock off
		Kale	**Fodder beet**
N Input	**Standard Environmental Impact System**	≥1300 kg MS/ha (milking platform) Up to 250 kg N/ha for 2018-19; 200 kg N/ha thereafter; after each grazing Up to 700 kg/cow lactation supplement (home grown first, use driven off pasture deficit) Lactation supplement PKE/grain and pasture silage Winter crop – kale 3.1 cows/ha	≥1300 kg MS/ha (milking platform) Up to 250 kg N/ha for 2018-19 200 kg N/ha thereafter; after each grazing Up to 700 kg/cow lactation supplement (home grown first, use driven off pasture deficit) Lactation supplement fodder beet and pasture silage Winter crop - fodder beet 3.1 cows/ha
	Reduced Environmental Impact System	30% lower N leaching Lactation supplement PKE/grain and pasture silage Up to 75 kg N/ha for 2018-19; 50 kg N/ha thereafter N applications – Sep, Dec, Feb/Mar Winter crop - kale 2.6 cows/ha	30% lower N leaching Lactation supplement fodder beet and pasture silage Up to 75 kg N/ha for 2018-19; 50 kg N/ha thereafter N applications – Sep, Dec, Feb/Mar Winter crop – fodder beet 2.6 cows/ha

Yellow – highlights that this system is the control system

Several mitigations to reduce the environmental impact were also considered in the pre-experimental modelling and farmlet design.

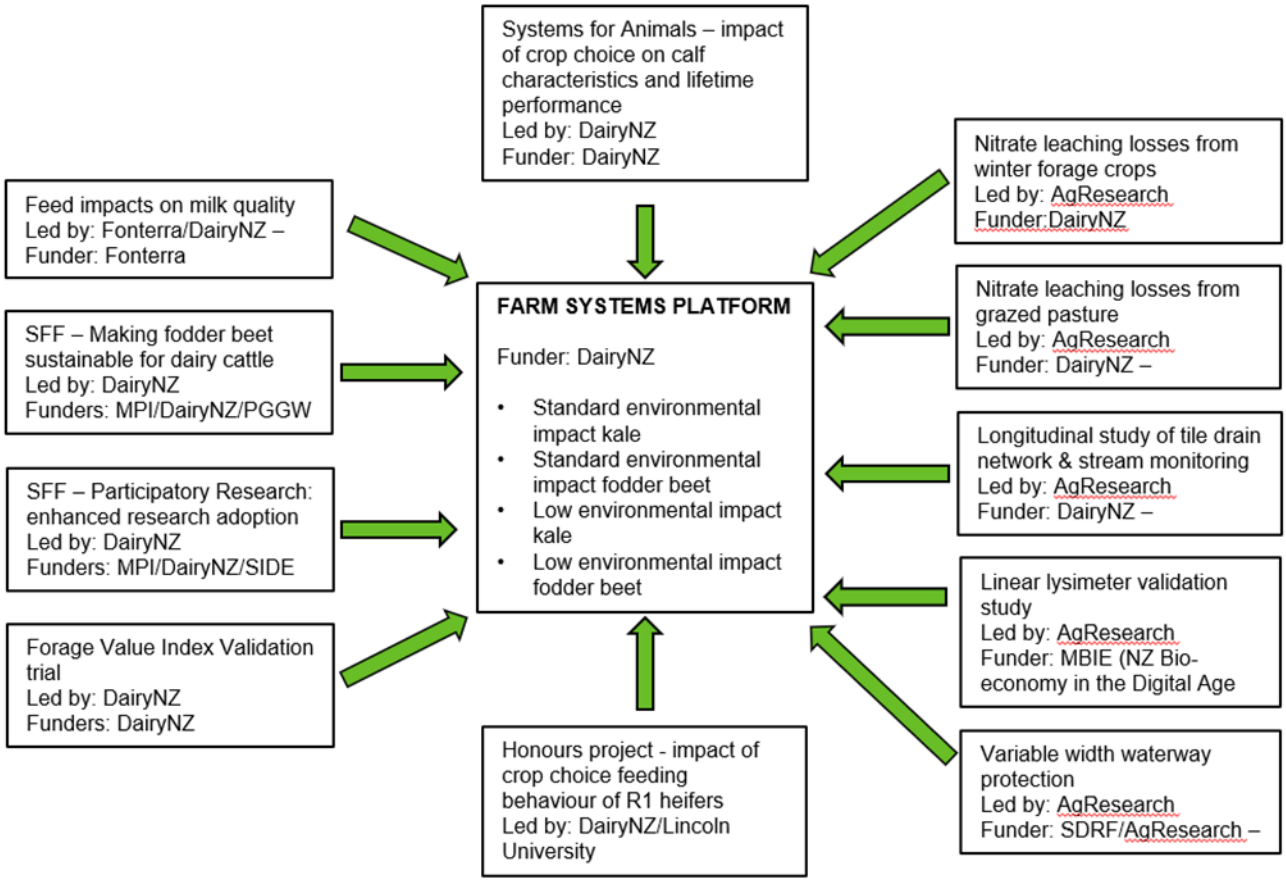
But the RAC opted to only consider system changes where there is high confidence in reducing the environmental impact, with current modelling available.

Current Research Activities at SDH

The farm systems comparison funded by DairyNZ forms the base research platform at the Southern Dairy Hub.

Other research projects led and funded by a number of organisations are using this platform to address key research questions relating to the systems that are being implemented or the issues currently facing dairy farmers in Southern regions.

The current suite of research projects is summarised in the diagram below.



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The Farm

Farm Area

Milking platform: 309 ha
Support Block: 39 ha
Unproductive land: 2 ha

Milking infrastructure

60 bale rotary dairy with DeLaval plant and Delpro Herd Management software
Automatic cup removers and on-platform teat spray, Automatic drafting and weighing
Greenwash on the backing gate

Climate

Mean Annual Maximum Temperature - 17.7 ^{o}C
Mean Annual Minimum Temperature - 5.4 ^{o}C
Average Annual Soil Temperature – 11.0 ^{o}C
Average Annual Rainfall – 785.4 mm

Soil Types

Table 1: Soil types, locations and characteristics on farm

Soil type	Location	Characteristics
Edendale	Top terrace	Well drained, high WHC, seldom dries out
Pukemutu	Through centre of farm	Poorly drained due to sub surface pan between 600 and 900 mm deep. Vulnerable to waterlogging.
Pukemutu/ Makarewa	Bottom terrace	
Makarewa		Poor aeration during wet periods due to poor sub surface drainage and slow permeability. Severely vulnerable to waterlogging in wet periods.

Soil Test Results (Winter 2019)

Data from 38 paddocks (17 support block, 87 milking platform)

Table 2: Soil test results (winter 2019)

	pH	P	K	S	Mg
Milking platform	6.2	21	6	9	14
Support Block	6.0	54	7	11	9

Staffing and management

Roster System – Year round 8 on 2 off, 8 on 3 off
Milking Times – cups on at 5 am / 2.30 pm

Effluent System

Two receiving ponds with weeping walls, leading into a storage pond. Effluent applied by travelling irrigator. Solids cleared out November 2018. Some effluent applied by umbilical system in March 2019. Greenwash on the backing gate

Herd Details – October 2019

Table 3: BW and PW as of September 30th 2019

		BW	PW
Pink – Std Kale	**Cows (194)**	85/44	116/67
Blue – LI Kale	**Cows (164)**	89/44	132/68
Green - Std FB	**Cows (196)**	78/44	101/67
Yellow – LI Kale	**Cows (164)**	90/44	122/67
Grouped	**Youngstock**	125	151

Mating Programme Spring 2019

The Southern Dairy Hub herd will use LIC semen over our herd this year, utilising a combination of the genomically tested bulls in the Forward Pack and the A2:A2 semen to open up options for A@ Research or supply in future years.

Mating Plans:

- Mating for the herd begins November 2nd, for PSC August 10 2020. (this is 1 day later than last year as the coming February is a leap year and therefore we get one extra calendar day of gestation available.
- Our 720 MA cows – will be mated to mostly crossbred semen, some Friesian and a little Jersey as we try to breed to a consistent F10 Crossbred herd.
- Short gestation (SG) Hereford semen used over identified culls.
- After 6 weeks of AB 14 Jersey-Cross bulls with the herd for 6 weeks.
- R2s – Will begin mating October 26th, run with Yearling Jersey Bulls for 9 weeks.

Pastures

220 ha (71%) of the milking platform was resown at conversion in 2017.

Of this 160 ha was fully cultivated, 43 ha direct drilled and 17 ha undersown with annual; ~46.4 ha was sown in 5 star FVI pastures, and ~46.4 ha in 1 star FVI pastures.

The following cultivars were used across the remainder of the farm: Prospect, Excess, Rely and Platform.

Wintering

All mixed age cows and rising 2-yr olds wintered on kale or fodder beet on the milking platform
All rising 1-yr olds wintered on kale or fodder beet on the support block

Crop and Grass 2019

Item	Methods	Cultivars
Winter Kale eaten 2019 Winter	Conventional cultivation	Regal KALE performance bred®
Winter Kale sown for 2020	Direct drilled trial and conventional	Firefly KALE Cleancrop™ Brassica System
Fodder Beet 2019 and 2020 winter	Conventional cultivation	Jamon Fodder Beet
Crop to Grass Spring 2019	Conventional cultivation	Platform PERENNIAL RYEGRASS performance bred®

Next Field Day – March 2019

The Southern Dairy Hub Gratefully acknowledges the donations of our foundation sponsors and pledges, we are here with their support, and to support them in the future.

We would also like to recognise and thank the businesses who continue to support us, specifically:

Proudly supported by: