SOUTHERN DAIRY HUB

October Field Day 2020

SOUTHERN DAIRY HUB

RESEARCH DEMONSTRATION & EDUCATION

info@southerndairyhub.co.nz
0800 336632

BBQ Lunch kindly sponsored by:

NEW ZEALAND FARM SOURCE

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Contents

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DairyNZ

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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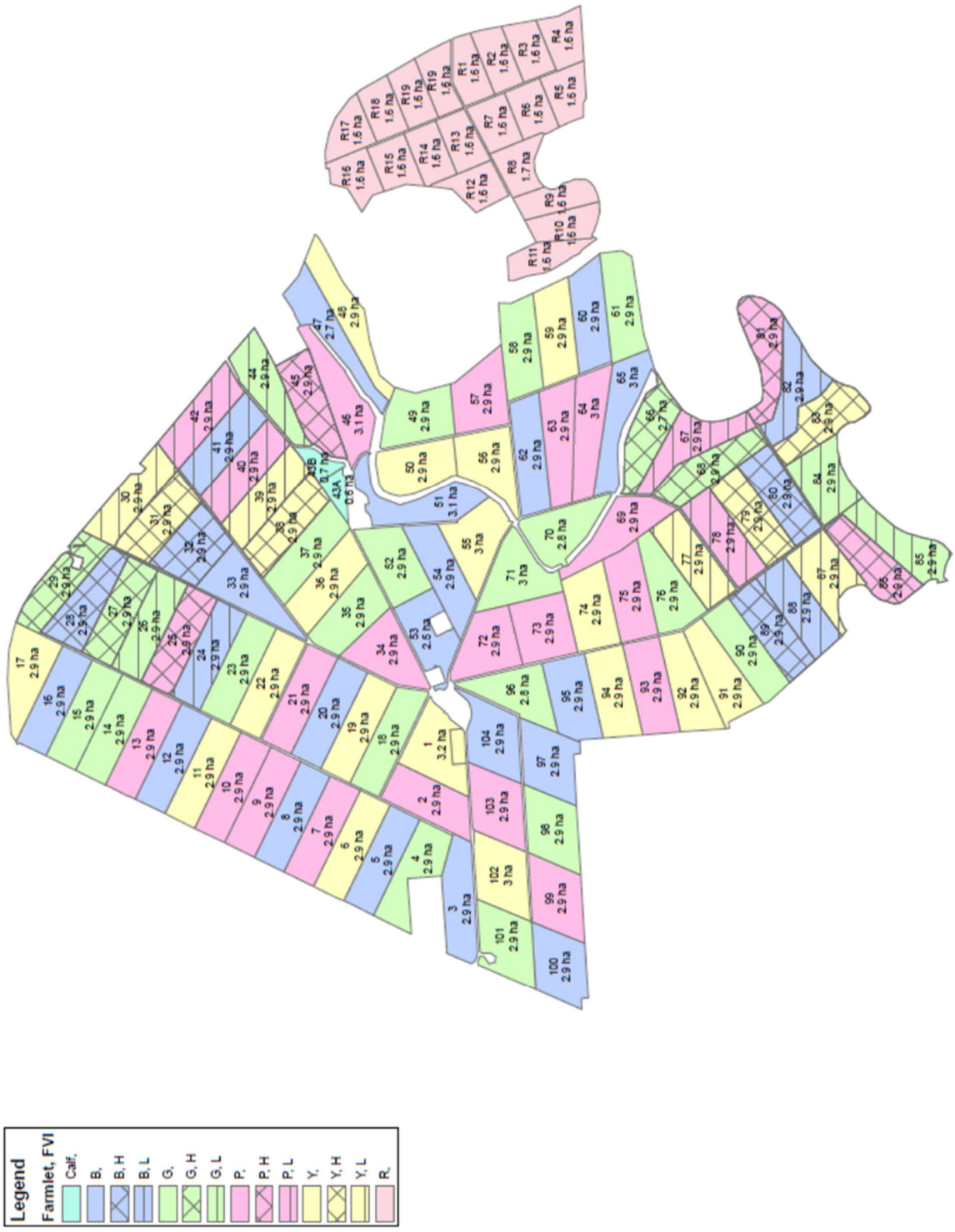
Biosecurity Requirements for Southern Dairy Hub (SDH)

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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Southern Dairy Hub

SDH Purpose: Leading Innovation for Southern Farmers' prosperity

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, owns the farm and buildings and other infrastructure. For simplicity, a second entity (SDRF): The Southern Demonstration & Research Farm leases these assets and carries out the activities of running a commercial size and scale farm, with all commercial expectations whilst delivering farm systems research information for the Research funders.

SDRF is operating a research farm at the hub, and within that there are strict controls on what can and can't be done within each of the four farmlets we are implementing. Demonstration is by way of comparison between research farmlets. In 2017 farmers told us that having systems with reduced nutrient loss was important for the region. SDRF is currently exploring what happens when you change just the Nitrogen Strategy from 200kg/ha to 50kg/ha of Nitrogen per annum to a paddock, alongside comparing the interaction with either Kale or Fodderbeet as a winter crop.

Research farms are a place where industry can take some risk on behalf of farmers and sometimes, as is currently happening at the Hub, we push the boundaries too far. Being a research farm, we can't always address these negative impacts without compromising the research. So, we follow the process through and record all the farm systems impacts including profit, animal performance and environment.

We are pushing the boundaries, so farmers don't have to. This means farmers can use our research as a springboard and can focus on the refinements required to re-stabilise a system.

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

In 2016 when the lease on the Southern Demonstration Farm ended, Southern farmers and Businesses committed an additional 1.2 million dollars towards establishing a dedicated Southern Dairy Hub (SDH) to facilitate dairying research and extension in the region.

With investment from DairyNZ and AgResearch, the 349ha drystock property at Wallacetown was purchased and converted into what is probably the largest pastoral Agricultural Research facility on the planet. The Southern Dairy Hub is owned by the dairy industry and is here for the good of the dairy industry, particularly for Southern Farmers.

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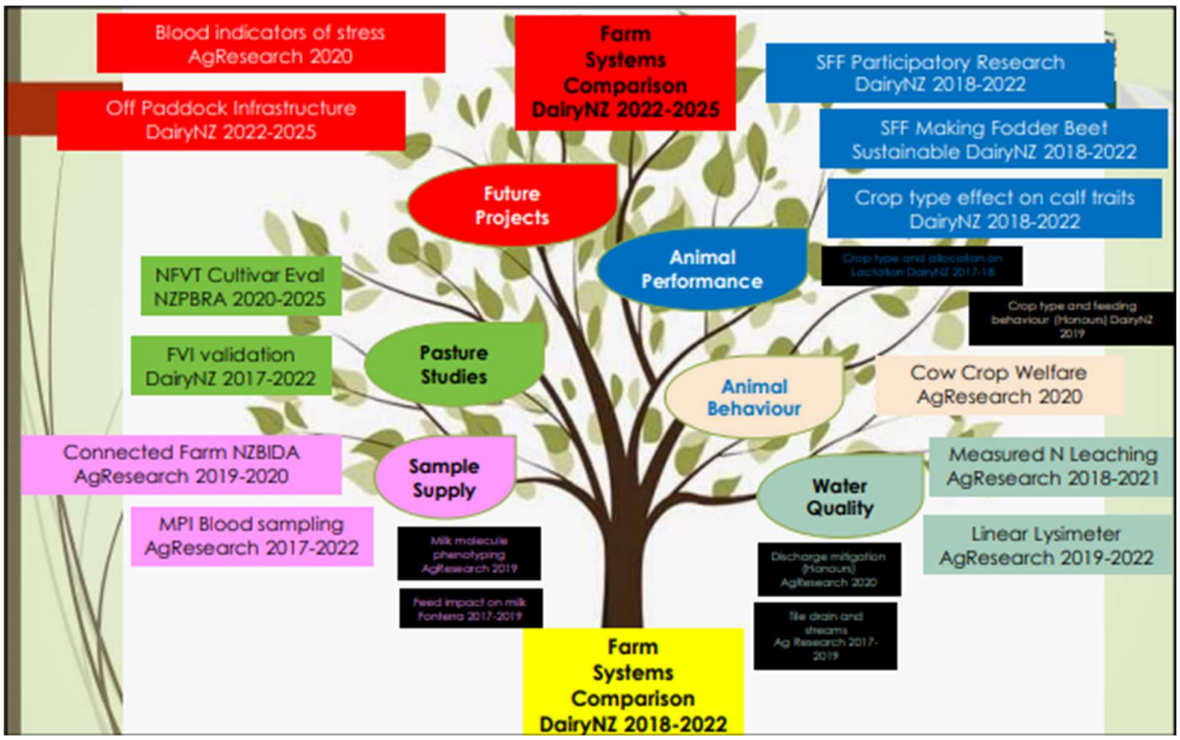
Current Research Activities at SDH

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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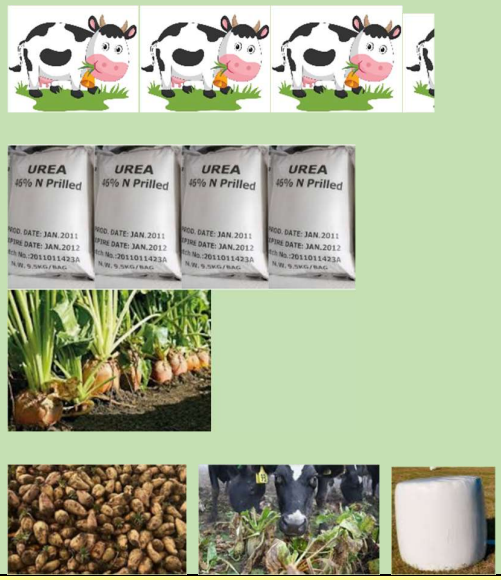
Current Farm Systems Research Comparison

Objective:

1. To test the opportunity for crop choice and nitrogen management to reduce the N footprint 30% and improve profit compared to existing practices.
2. To engage farmers in experimenting on their own farms and building confidence to adapt their management

Table 1: Pictorial representation of the current farm systems comparison at SDH.

Standard Kale	Standard Fodder beet
	
Lower Impact Kale	**Lower Impact Fodder beet**
	

In addition to the farm systems research additional measurements are being taken to investigate the impact of winter diet on growth and performance of replacement stock, the processing characteristics of the milk and changes in pasture quality and composition.

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SDH Farm System profit comparison – 2019-20 recap

Two years on, what have we observed and measured?

- It is harder to put BCS on cows grazing kale over winter than fodder beet
- Meeting crude protein requirements of animals grazing fodder beet in winter is difficult, especially R1's
- Supplementing phosphorus during winter on crop is challenging but is required reliably to meet animal requirements
- Fodder beet systems are more susceptible to poor mineral nutrition management than kale systems
- Fodder beet wintering produces smaller calves
- Gains through pasture breeding have resulted in new ryegrass cultivars being far superior in heading management
- Pasture clover content is responsive to lower N fertilizer inputs
- Fodder beet yield can be highly variable, and it is more susceptible to poor soil preparation and growing conditions and doesn't like wet feet!!
- Nitrate leaching losses are greater from autumn grazed fodder beet than winter grazed fodder beet
- Lifting fodder beet in autumn did not reduce losses
- Nitrate leaching losses are greater from winter grazed kale than winter grazed fodder beet
- Measured nitrate leaching losses from pasture are similar to Overseer predicted losses

Looking at the performance of the systems last season there is no one system that is performing top in all the metrics that we have summarised to date.

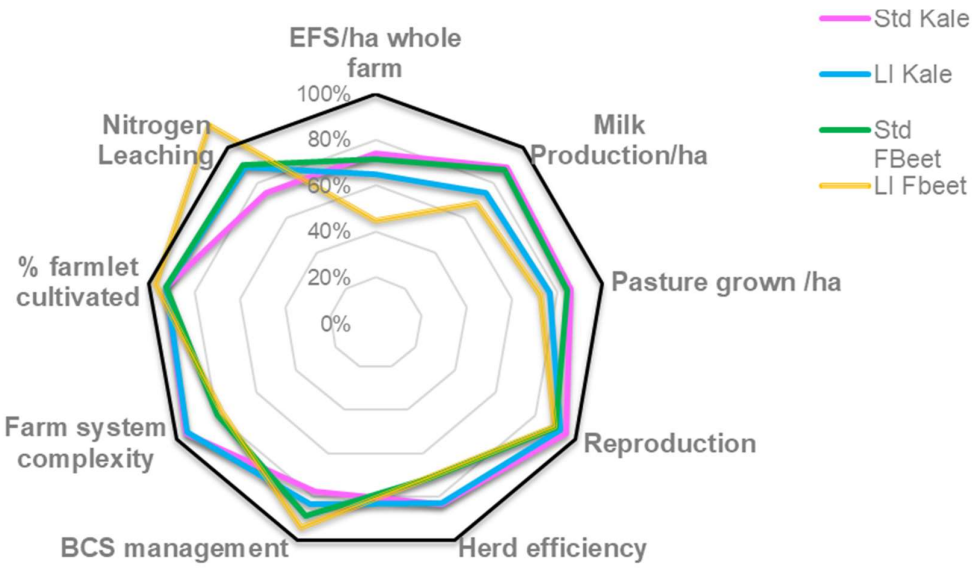

Figure 1. Wagon wheel summary of farm systems performance in 2019-20

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SDH spring 2020 summary

Calving

Springer management

- 2 springer mobs – kale and fodder beet wintered
- Springer drafts 2x per week using expected calving dates and udders
- Aiming for 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
- 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 17th 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 22nd August
- Split into individual farmlets on the 27th August

Calving Spread

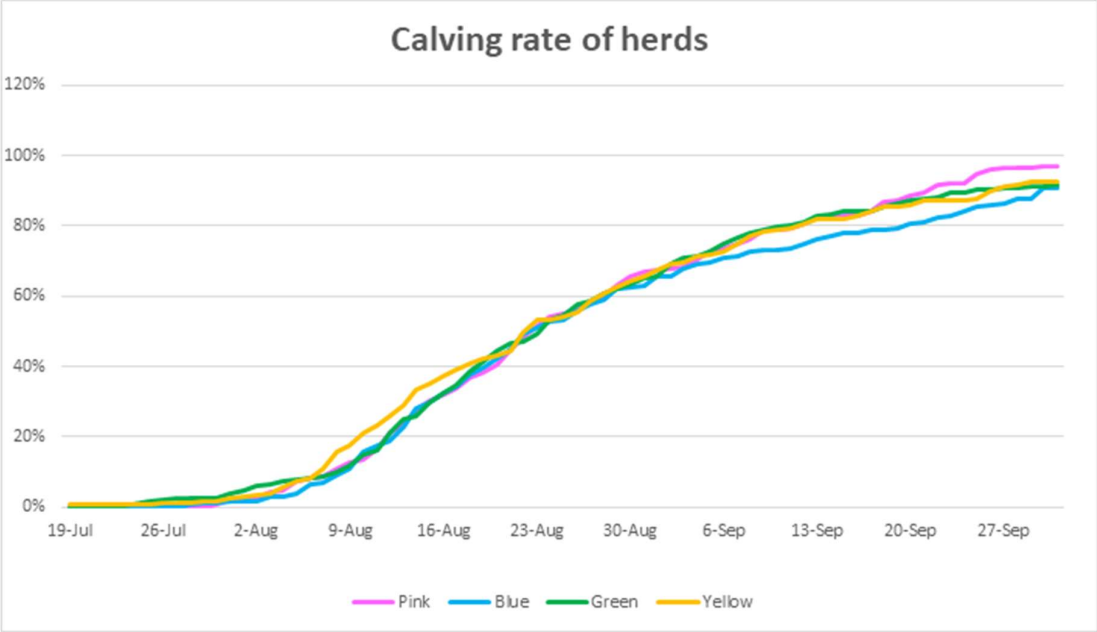

Figure 2: Cumulative calving rate for the four herds during spring 2020

Feed supply and growth rates

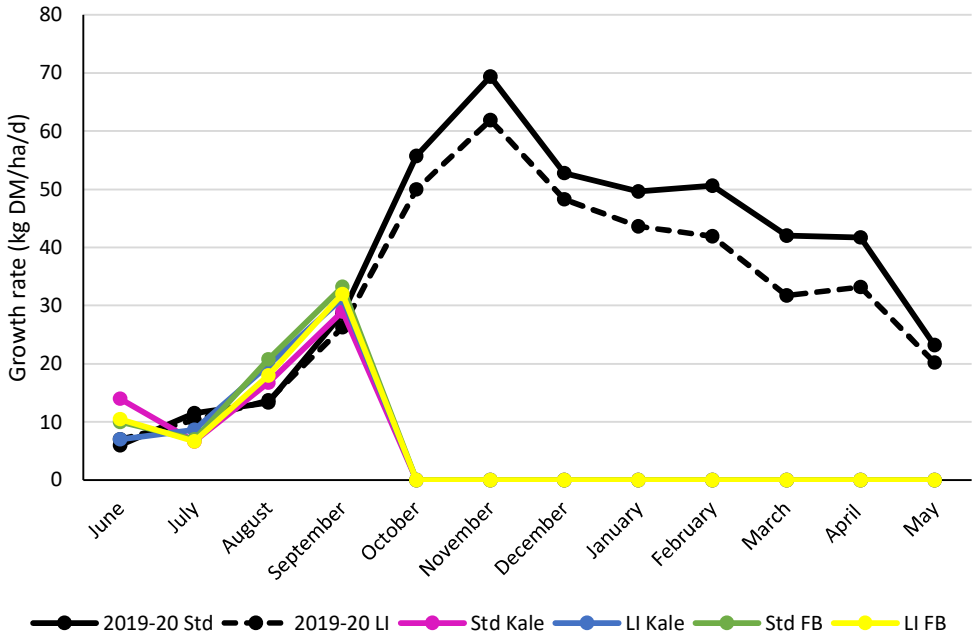

Figure 3: Average monthly growth rates since the 29th May compared with average Standard and LI growth rates from the 2019-20 season

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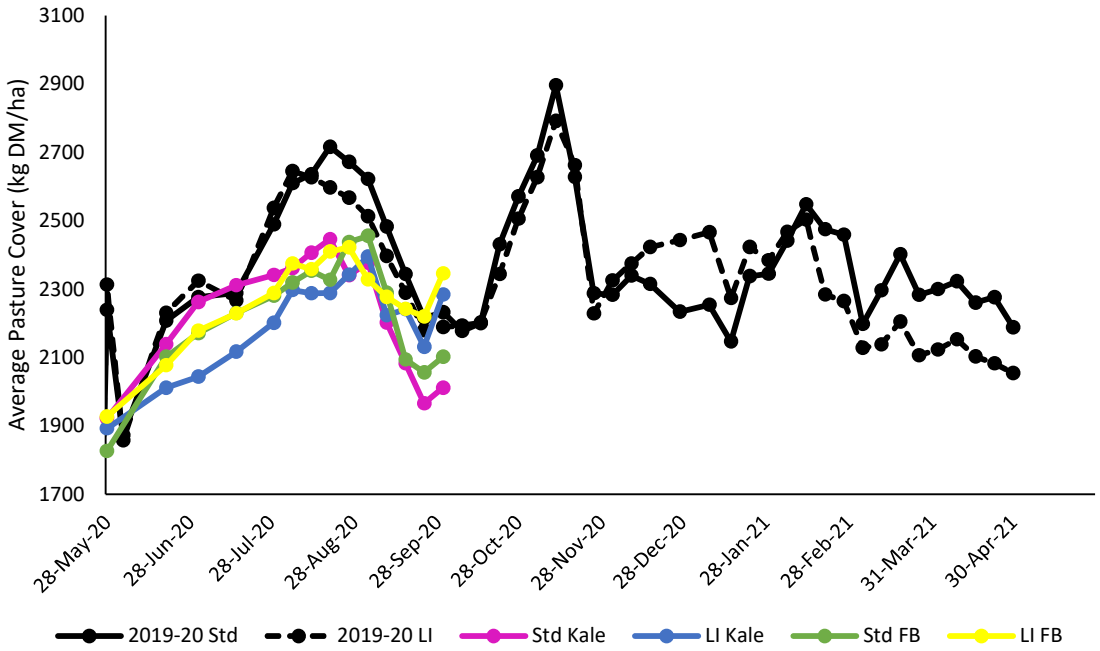

Figure 4: Average pasture cover (kg DM/ha) from 29th May 2020 compared with average Standard and LI growth rates from the 2019-20 season

Average pasture cover at planned start of calving this year was much closer to the target than the 2019-20 season (Figure 2). At the end of September APC was approximately 2000 kg DM/ha for both the Standard herds but around 2300 kg DM/ha for the LI farmlets. Some of the higher APC in the LI farmlet was the result of these farmlets still having 1 springer paddock left to graze. Taking this out of the mix drops APC by approximately 70 kg DM/ha.

After getting caught with high APC early in the season last year our strategy this year was to utilize the spring rotation planner to manage feed allocation and drop out supplementary feed that was budgeted to maintain residuals but not get too fast too early. We have a good supply of milking quality supplement on hand so have dropped to our fastest rotation (22 days) earlier than last year. If pasture gets tight we will increase supplementary feed.

Our wet weather strategies that have been implemented this spring have included:

- 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.
- 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.

Animal Health

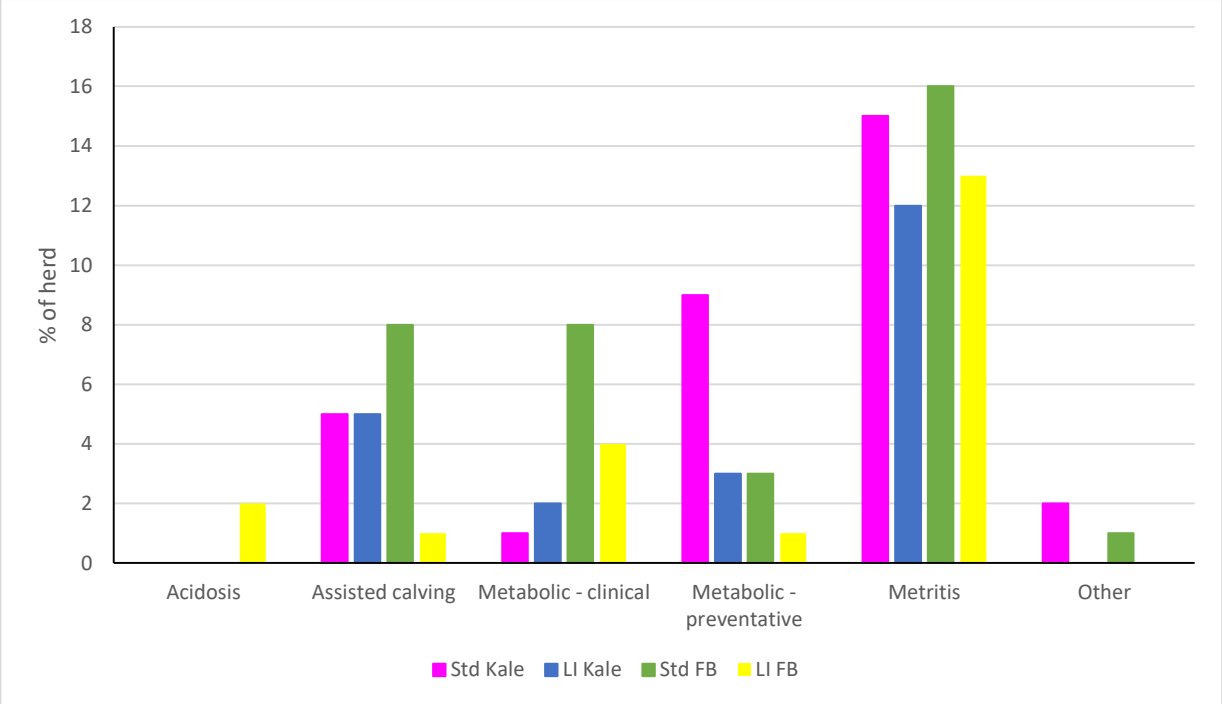

Figure 5: Health incidences related to calving during spring 2020.

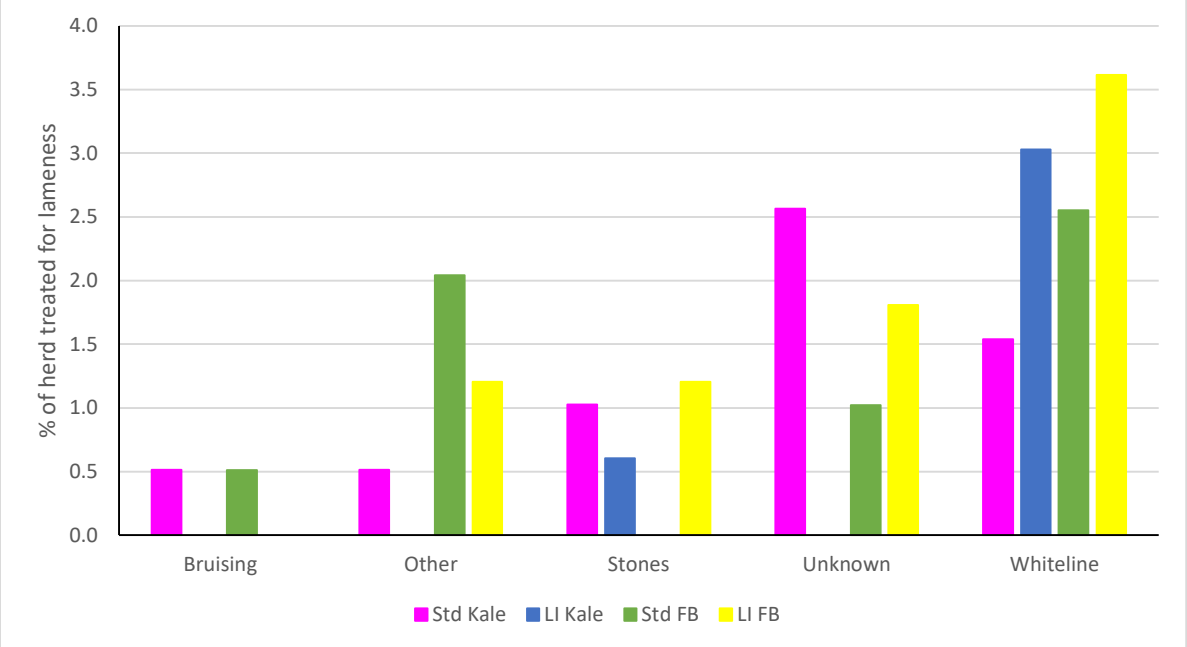

Figure 6: Lameness incidences season to date for each herd

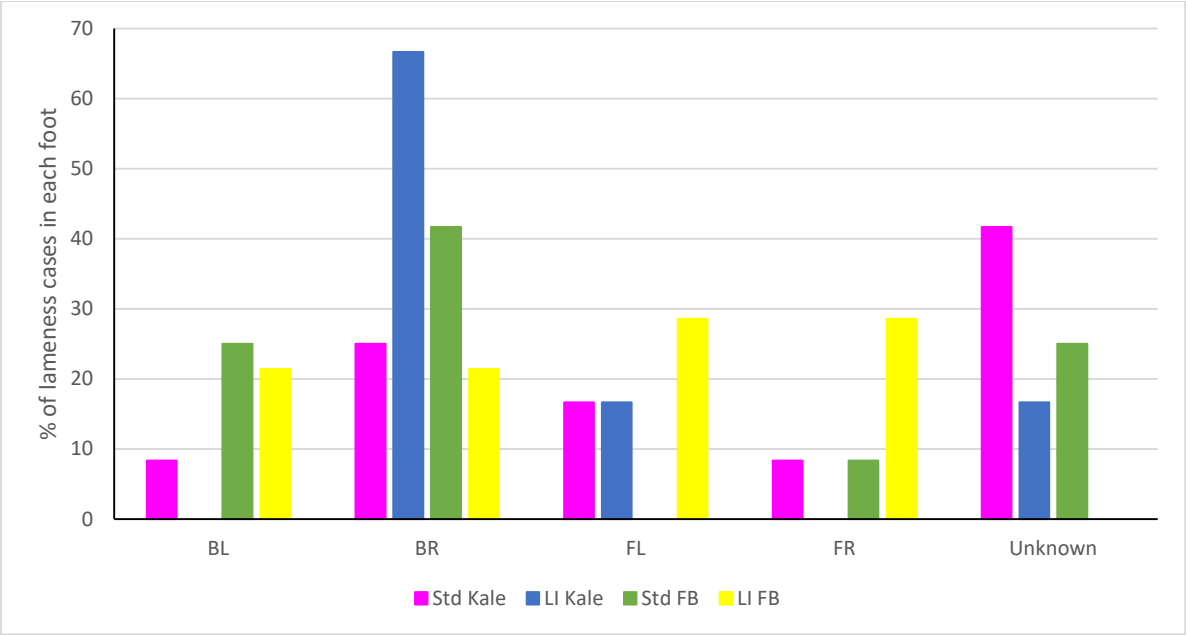

Figure 7: Percentage of lameness cases for each foot (BL – back left; BR – back right; FL – front left; FR – front right)

Milk production

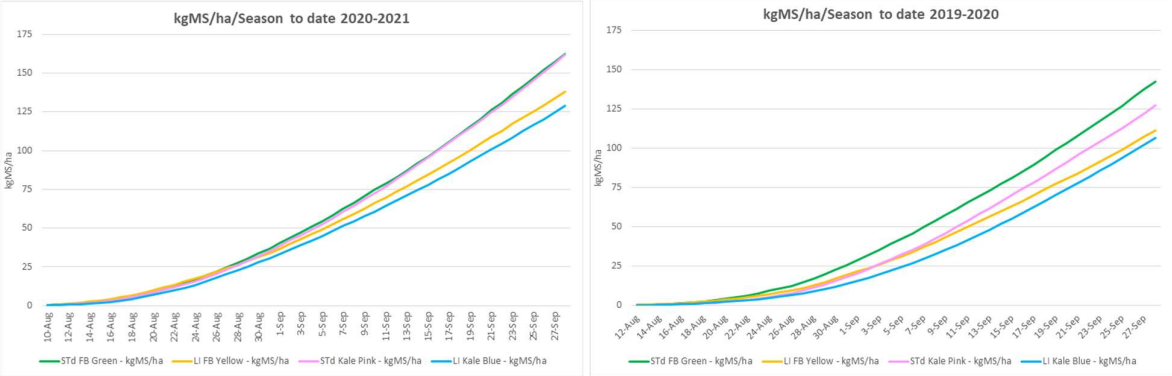

Figure 8: Estimated cumulative milk solids production for each herd in 2020-21 (left) and 2019-20 (right)

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Fodder beet vs kale wintering – are there differences in animal performance? Does feeding rate make a difference?

Project background

Fodder beet and kale forage crops are an important tool for wintering in the south. Fodder beet bulbs are low in crude protein, fibre, phosphorus and calcium and usually make up a large proportion of fodder beet diets meaning recommended daily intake of these nutrients may not be supplied. This can reduce animal production and impair animal health. Increasingly we were hearing that farmers were concerned about poorer than expected performance after calving following fodder beet feeding. Issues included lower than expected milk production based on body condition score (BCS) at calving and levels of feeding in early lactation, the unknown impact of fodder beet feeding on lifetime performance, reproductive performance, and links with metabolic disease.

Figure 9: Cows on kale (top) and fodder beet (bottom)

Question: Would cows fed *ad lib* fodder beet become over conditioned and have poorer animal performance in early lactation?

What we did

To investigate this, in winter 2017 we conducted a winter feeding trial at the Southern Dairy Hub comparing winter diets of fodder beet or kale with baleage, each at two allocation rates: 'target' and 'high' (Figure 2). There were 82 F × J cows assigned to each treatment.

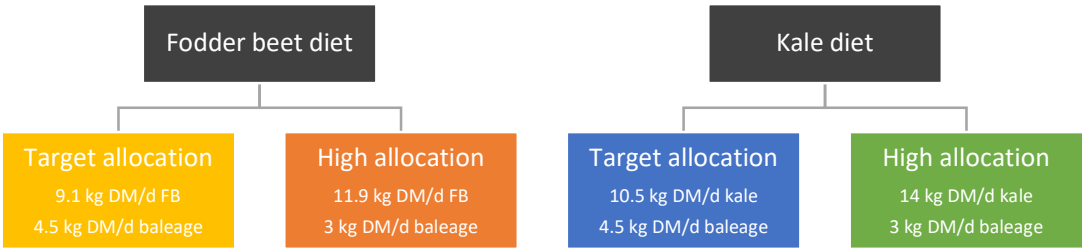

Figure 10: Experimental design

'Target' = offered a maximum of 70% of the diet as crop and used the DairyNZ winter crop allocation calculator to determine feed required to achieve sufficient BCS gain to meet a BCS target at 5 at calving.

'High' = offered at least 80% of the total diet as crop and crop was offered *ad libitum* with baleage.

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Figure 11: Animal sampling as part of the project

Animal measurements: BCS, milk production, reproductive performance, bloods, behaviour
Crop measurements: crop yield, feed quality

Key Findings:

Feed and crop

- Diets with fodder beet were lower in fibre, phosphorus, sulphur and calcium, but had higher metabolizable energy and sugars, compared with kale diets (Table 1).

BCS

- Average body condition score gain before calving was similar for fodder beet and kale cows.

Animal performance

- Crop type (fodder beet vs kale) had a greater impact on cow performance than allocation rate.
- Cows wintered on fodder beet had better reproductive performance (3-week pregnancy rate) and greater average milk solids, fat and protein yield (kg/d) than cows wintered on kale.

Bloods

- Fodder beet cows had lower blood urea and phosphate levels (Figure 4), and higher magnesium levels while on crop and pre-calving, compared to kale cows.

Animal behaviour

- Fodder beet cows spent less time lying and took more daily steps than kale cows (Figure 5).
- Animal behaviour differed in fair and adverse weather conditions. In adverse weather conditions lying time was reduced and steps increased (Table 2).

Table 2: Composition of fodder beet and kale diets offered to cows during winter.

	FB-High	FB-Target	Kale-High	Kale-Target	*SED*[*]	P value crop	P value allocation
Nitrogen (g N/cow/d)	270	247	331	301	*39.6*	0.074	ns
Crude protein (% DM)	12.6	13.0	14.9	14.6	*1.75*	ns	ns
Neutral detergent fibre (% DM)	19.4	25.1	31.8	32.6	*1.44*	<0.001	0.013
Soluble sugars (% DM)	46.4	39.2	20.0	17.7	*2.22*	<0.001	0.016
Metabolizable energy (MJ/kg)	13.2	12.8	11.4	11.6	*0.23*	<0.001	ns
Phosphorus (% DM)	0.19	0.22	0.29	0.31	*0.013*	<0.001	0.042
Sulphur (% DM)	0.14	0.17	0.58	0.62	*0.057*	<0.001	ns
Calcium (% DM)	0.39	0.38	1.32	1.33	*0.087*	<0.001	ns
Magnesium (% DM)	0.21	0.22	0.18	0.21	*0.020*	ns	ns

[*]Standard error of the difference

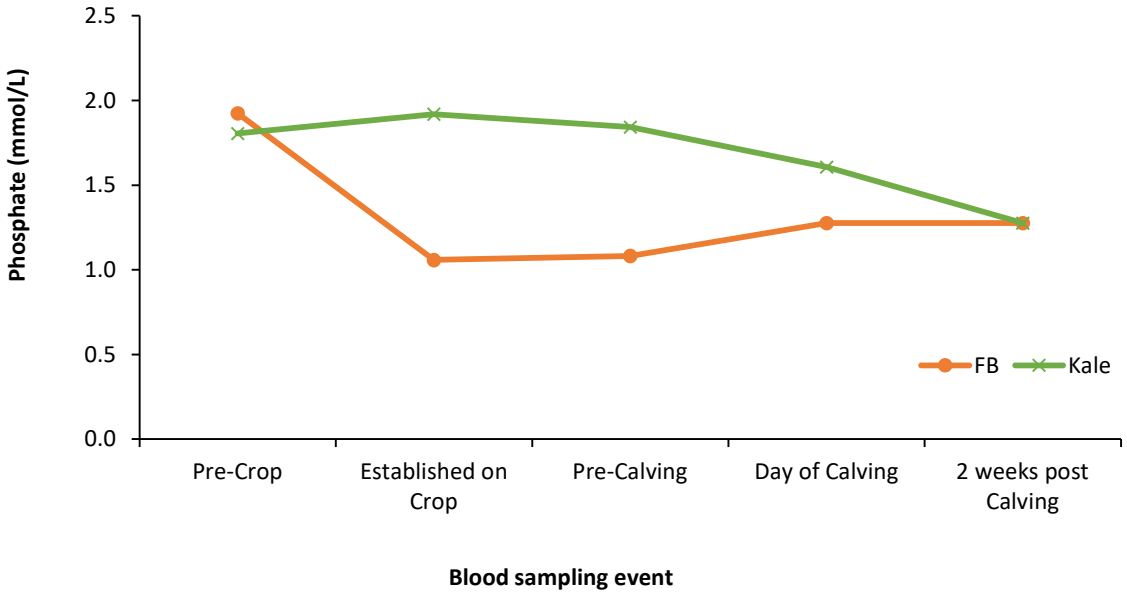

Figure 12: Phosphate levels in blood plasma of cows wintered on fodder beet (FB) or kale.

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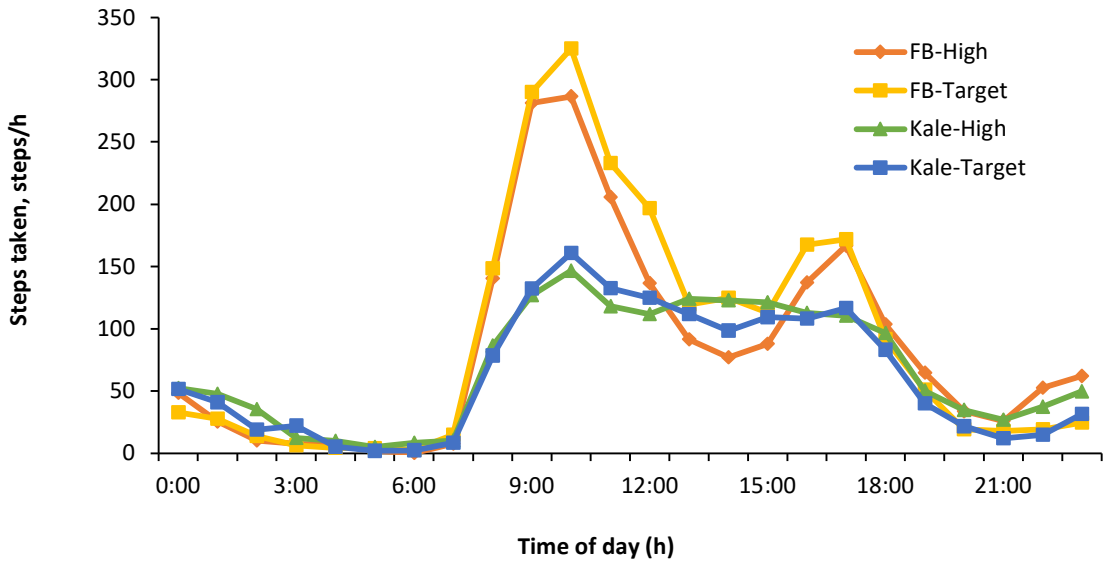

Figure 13: Average steps taken per hour in a day for each treatment.

Table 3: Comparison of activity measures between the fair and adverse weather during the 8-day measurement period.

	Fair Weather			Adverse weather		
	Steps	Lying (h)	% of cows <8h lying	Steps	Lying (h)	% of cows <8h lying
FB-High	1914	11.3	13%	2049	5.4	88%
FB-Target	2222	10.4	24%	1957	5.2	83%
Kale-High	1513	12.4	0%	2647	10	14%
Kale-Target	1515	12.5	0%	1575	5.9	77%
SEM*	*142*	*0.6*		*175*	*0.8*	

*Standard error of the mean

Answer: Winter fodder beet did not reduce cow performance compared with kale. However, the cumulative effects of a fodder beet diet long term are yet to be determined and future research should monitor the impact on longer term animal health.

Acknowledgements

This research is funded by dairy farmers of New Zealand through DairyNZ Inc. (Hamilton, New Zealand), contract RDN1805. We would like to thank W. Ritchie and N. S. Hammond for managing data collection, the farm team at the Southern Dairy Hub for animal management and B. Kuhn-Sherlock for statistical analysis.

How much mud is too much mud?: Identifying farmer friendly visuals linking soil conditions to animal behaviour

Project Background

The 2019 Winter Grazing Task force report listed 7 clear minimum standards which should 'always' or 'never' occur in paddock-wintering systems, one of which stated:

Animals must always have enough comfortable lying space

While many of the minimum standards are self-explanatory and farmers know how to meet them the requirement that animals must always have enough comfortable lying space is creating concern. How do farmers know that the surface in their crop paddock is comfortable and that their animals are achieving the minimum 8 hour per day recommended lying time? The farm systems comparison at the South Dairy Hub provided an ideal site to investigate the relationships between soil surface conditions, weather and lying behaviour on two crop types and two soil types during winter 2020.

Project objective

To determine how soil and weather conditions contribute to the risk of reduced lying time in dairy cows wintered on crop

What we did

Animal measurements

For 5 weeks from the 18th June to the 22nd July 2020 a range of animal and soil-based measurements were implemented. Behaviour monitoring equipment (Cow manager tags and HOBO accelerometers (Figure 1) were attached to 30 animals in each of the four farmlets to measure lying, standing and walking behaviour and rumination and grazing time. Once a week the 120 monitor cows were assessed for dirtiness using the PAACO Dairy Welfare Auditor Scoring system to assess the amount of mud on the belly and thigh (Figure 2).

Figure 14: HOBO accelerometer

Figure 15: Area of focus for assigning a dirtiness score

Proudly supported by:

The area available per cow between the front fence and the back fence each day was standardized at 20 m^2/cow for all mobs throughout the trial period irrespective of crop type or yield.

Soil & climate measurements

Local weather data was extracted from the NIWA weather station at Wallacetown. Each day soil moisture (using a portable soil moisture probe) and Gumboot scores (Figure 3) were measured at 26 sites across the break area by walking a W pattern across the break. Pugging depth was also measured at each site by recording how far a 30 cm plastic ruler could be pushed into the soil before it met resistance. Once a week reference measures of soil moisture were taken at the same time as the portable soil probe measurement to validate the data. Photos of the breaks were taken every day from the same positions in the break.

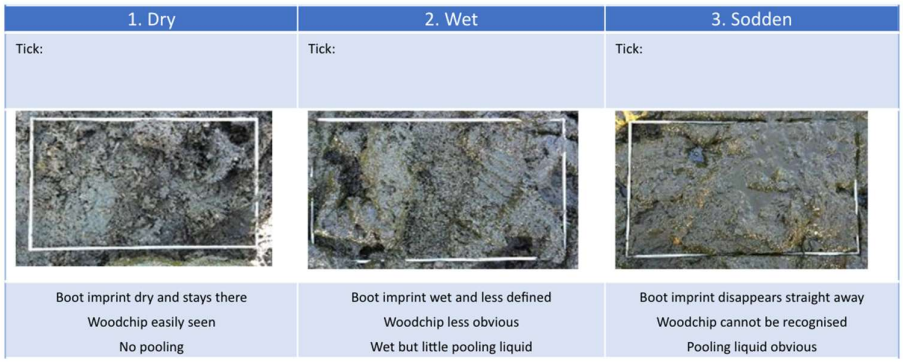

Figure 16: Gumboot score categories (from O'Connor 2016).

Results

Due to the large dataset that was generated we are still extracting all the behaviour data from the devices and summarizing it to put alongside the physical conditions the cows were experiencing. Below is a summary of the weather conditions up until the 13th July plus some photos of the team out doing the measurements and the range of soil conditions that were experienced.

Figure 17: Inquisitive cows checking out what the techs were doing

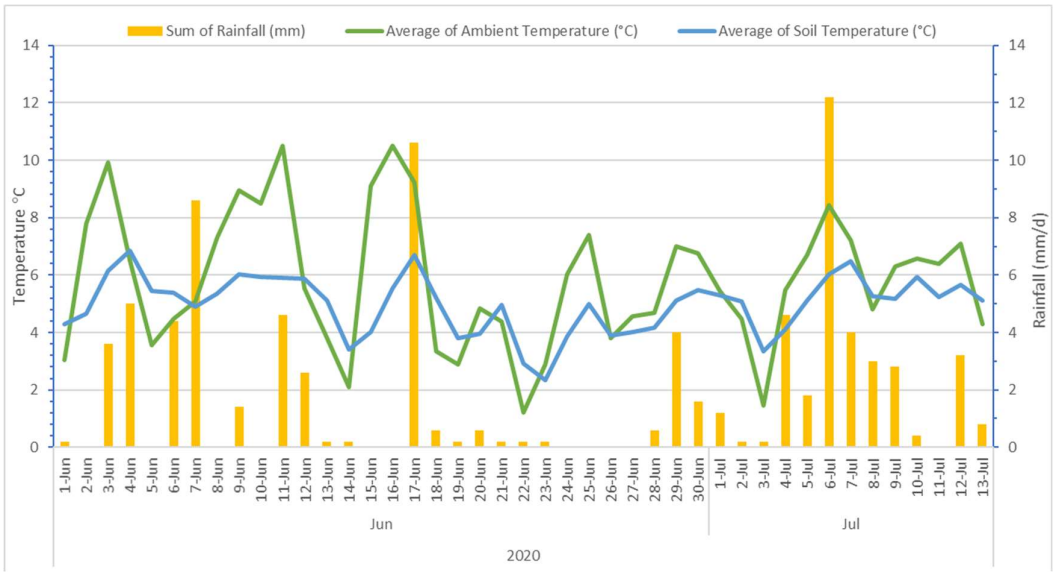

Figure 18: Daily total rainfall and average soil and ambient temperatures.

Figure 19: A range of views of soil conditions experienced during the project.

Acknowledgements

This research is funded by MPI through the Sustainable Food and Fibres Fund, DairyNZ Inc and SIDE. The project team are very grateful to the farmers involved in the project for agreeing to open up their farm businesses for the betterment of others.

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How much N is lost from crops and pasture at SDH?

Autumn- and winter-grazed fodder beet (FB) crops are key to the FB farmlets at the Southern Dairy Hub. Kale is included in the 2 remaining farmlets, although only as a winter feed supply. To increase knowledge of the actual environmental impacts of these grazed forage crops, N leaching losses were being measured in selected treatments during 2018 and 2019 to provide:

- Quantitative N leaching data for the crops, soils and climate of SDH.
- N leaching comparisons between:
  - autumn-grazed v lifted FB
  - winter-grazed kale
  - selected pastures on the milking platform.

These treatments and associated measurements have been repeated in 2020 to allow us to capture three years of drainage. The autumn lifting of FB plots occurred on 19 May 2020 and grazing was undertaken on 20 May 2020. The winter grazing of relevant FB and kale treatments occurred on 23rd and 24th June. N leaching measurements from these plots will continue through into winter 2021.

Average N leaching losses for the first 2 years of measurements are presented in Figure 1 below.

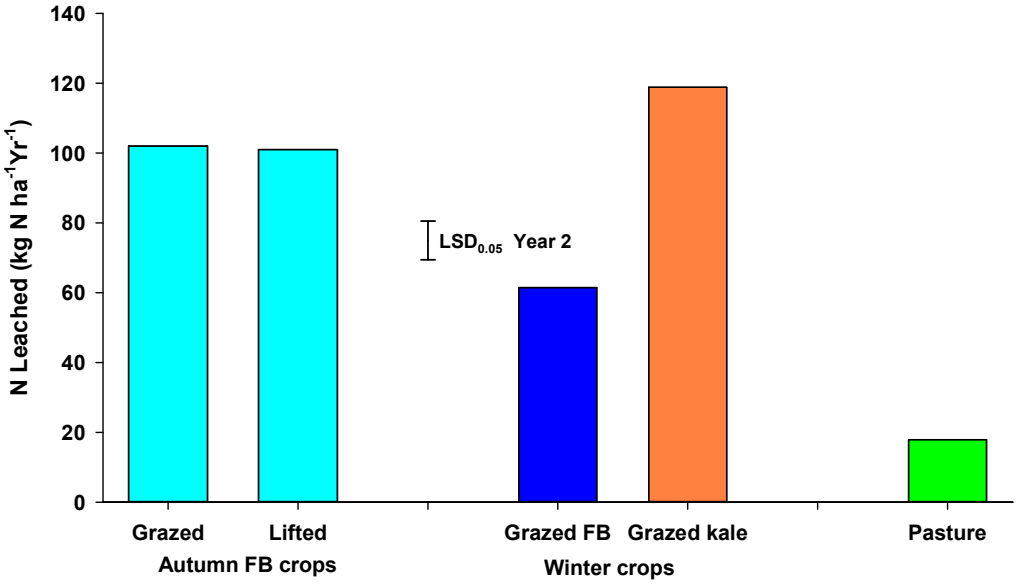

Figure 20: Average annual N leaching losses (2018 & 2019) from autumn-grazed or -lifted FB, and winter-grazed FB or kale treatments. Average N loss from 3 pasture paddocks (Standard farmlet) is also shown (in green).

Initial modelling using yields of FB and kale treatments, and adjusting for areas required, allow calculations of likely N losses per cow wintered - shown in Table 1.

Soil mineral N has been measured 2 weeks after the grazing in May and June each year (Figure 2). In contrast to previous years, soil mineral N contents following the 2020 winter grazing showed little difference between the winter-grazed FB and winter-grazed kale. If the drainage N losses

follow the pattern of the soil mineral N results in 2020, it is possible that there will be no difference in per hectare N leaching losses for the winter 2020 treatments.

Table 4. N leaching losses from winter-grazed crops (average of 2018 & 2019).

	Kale	Fodder beet
N leached kg/ha/year	119	62
N leached kg/cow wintered	5.9	2.3

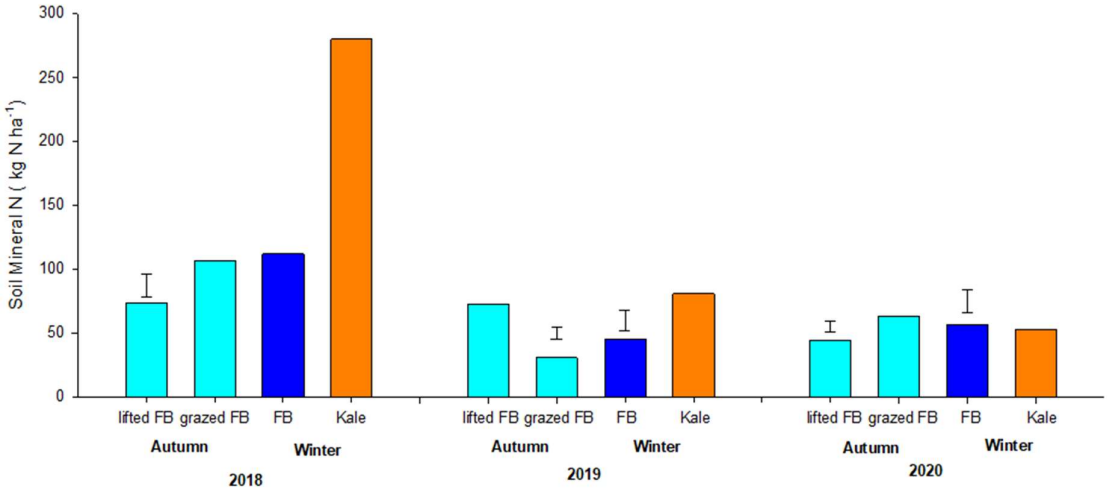

Figure 21: Soil inorganic N (NO3-N + NH4-N) contents for the three years of measurement. Bars show LSD(P<0.05) values for inorganic N in the autumn FB treatments in 2018, and for both autumn and winter treatments in 2019 and 2020.

Summary

- 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 thus also be reduced.
- Leaching losses from winter-grazed kale were greater than estimated for winter-grazed FB.
- 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.

Fodder beet vs kale wintering – impacts on calf stature and bone density.

Project background

Previous research has demonstrated that kale and fodder beet diets differ in many nutrients but in particular phosphorus and nitrogen (crude protein). Also, over recent years it has been suggested that fodder beet feeding may be contributing to increased risk of humeral fractures in rising 2-year old replacements. Since both phosphorus and nitrogen are associated with bone development in utero (i.e. before the calf is born) we were interested in understanding whether the diet cows were wintered on affected calf liveweight and stature at birth and if so were there any differences in bone mineralisation or density.

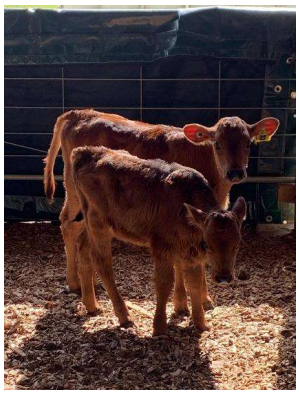

Figure 22: Replacement calves

Questions: Are there differences in liveweight and stature of calves at birth depending on which crop their dam consumed during winter? If differences in stature, did crop type also affect bone structure?

What we did

During spring 2018 and 2019 all replacement heifer calves were weighed on arrival into the calf shed and had their wither height, girth and length measured. These liveweight and stature measures have continued/are continuing until the animals complete their first lactation. In spring 2019 a pilot study was undertaken with bull bobbies to assess bone structure and density.

Key Findings:

Liveweight & Stature

- In both years calves born to dams wintered on fodder beet were 9% lighter at birth and shorter in wither height and length from shoulder to tail than those born to dams wintered on kale

Bone structure

- Differences were observed in some of the bone parameters that were measured in the pilot study, the significance of which requires further investigation

What is next?

During spring 2020 the bone measurements have been repeated in the newborn calves and a cohort will be reared to post puberty and bone health reassessed. The project will also look to investigate non-invasive options for measuring bone density.

Acknowledgements

This research is funded by dairy farmers of New Zealand through DairyNZ Inc. (Hamilton, New Zealand), contract RDN1805 and was a collaboration with Massey University.

Proudly supported by:

Feeding behaviour of R1 heifers on fodder beet or kale

Project background

For colder regions such as in the southern South Island, where forage crops are the predominant feed source for heifers, the extent to which forage type affects feeding behaviour and growth rates is unclear. Many feeding decisions for ruminants over winter are driven by cost and environmental considerations. Despite the perceived cost benefits of feeding fodder beet, there is little known on the impact of a low protein diet on heifer development and subsequent growth characteristics. Given the different physical characteristics of fodder beet and kale we were interested in studying the grazing behaviour and liveweight gain of R1 heifers while grazing crop.

Figure 23: Heifer in the crush to have a cow manager tag applied (left) and repeater station to down load data (right)

Question: Would crop type affect feeding behaviour and growth of replacement dairy heifers during winter?

What we did

In winter 2019, 93 heifers grazed fodder beet from 13 May till 19 August and 98 heifers grazed kale from the 22nd May till 11 August. Liveweight and stature measurements were taken at the start and end of the crop feeding period and grazing behaviour was measured using Cow Manager tags for 2 weeks in July.

Key Findings:

Feed and crop

- Estimated DM intake in July was 7.2 and 6.3 kg DM/head/day for the fodder beet and kale animals respectively.
- Heifers grazing fodder beet consumed a diet of 11.8% crude protein compared with 13.5% for those grazing kale, resulting in similar dietary crude protein intakes.
- ME intake of the fodder beet diet was higher than kale resulting in differences in liveweight gain (Figure 2).

Animal behaviour

- Kale heifers spent 134 more mins/day eating compared to fodder beet heifers (Figure 3).
- Fodder beet heifers spent 83 more mins/day ruminating than kale heifers (Figure 3).
- Idling and activity times did not differ between treatment groups.

Proudly supported by:

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DairyNZ

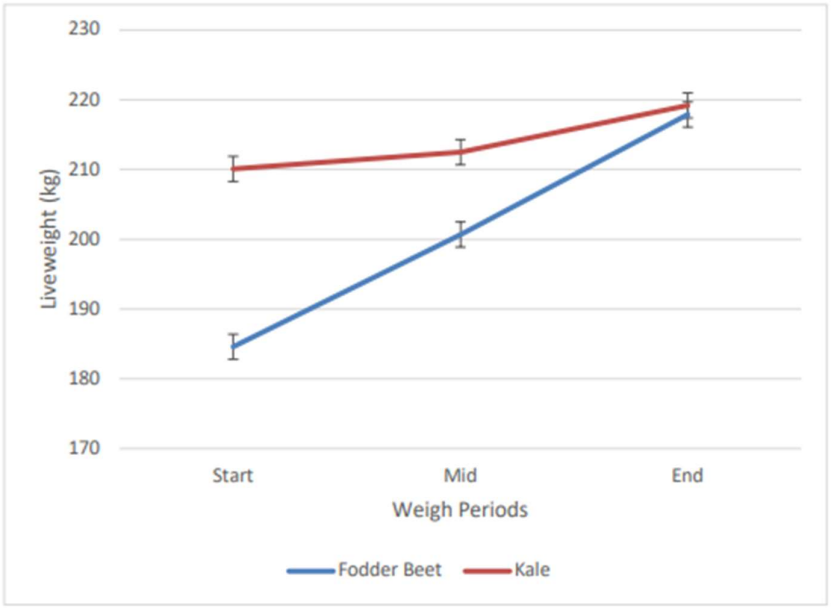

Figure 24: Liveweight gain of R1 heifers wintered on fodder beet or kale. Start = early May, mid = 12 July, End = 20 August.

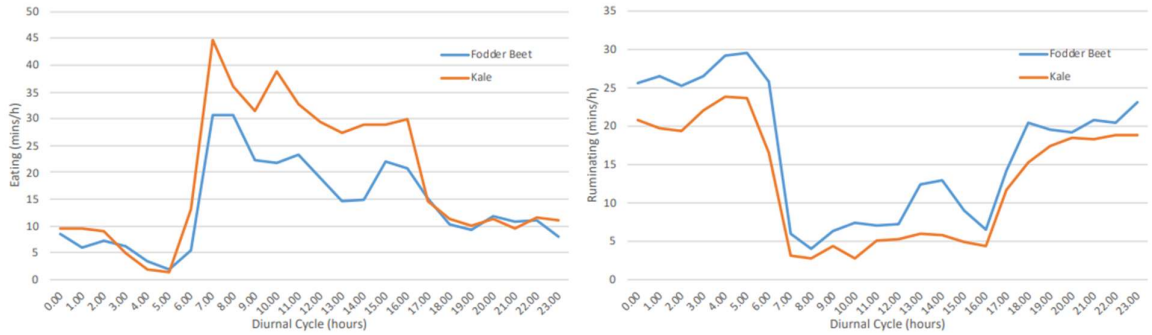

Figure 25: Eating (left) and ruminating (right) behaviour of R1 heifers on fodder beet or kale during winter 2019.

Answer: Heifers wintered on kale spent more time grazing and less time ruminating than those wintered on fodder beet. Higher growth rates were observed on the fodder beet diet, mainly driven by higher metabolisable energy intakes.

Acknowledgements

This research is funded by dairy farmers of New Zealand through DairyNZ Inc. (Hamilton, New Zealand), contract RDN1805. We would like to thank C Crack and Nicole S Hammond for managing data collection, the farm team at the Southern Dairy Hub for animal management. This project was conducted by Paige Harris as part of her Honours Project at Lincoln University.

Proudly supported by:

SDH Participatory research project: Partnering with farmers to increase extension of mitigation options to reduce N, P and sediment losses and greenhouse gas emissions

Project Background

This project aims to support dairy farmers in achieving profitable businesses with a lower environmental footprint by increasing the reach of research from the Southern Dairy Hub and national programmes and utilizing learnings from partnerships with four farms across Southland and South Otago (Figure 1). Farmers and rural professionals will participate in Communities of Practice to identify good management practices and farm system options that will reduce nitrogen, phosphorus and sediment losses, and greenhouse gas emissions. Using this participatory research approach, farmers across the region will have access to research and tools to assist in their decision making.

Figure 26. Diagrammatic representation of the linkages between SDH, the Satellite farms and their proposed locations.

Satellite/Monitor farms

We have partnered with four farms to better understand their environmental and financial performance and identify mitigation options to improve their profitability and reduce environmental losses.

Baseline information (Dairybase) has been collected for all farms and the Farmax and Overseer models set up to model current practice. The modelling results have been sense tested with the farm decision makers and a small group of trusted advisors. The next phase of the project is to expand the group of farmers and rural professionals involved in the Communities of Practice and identify modelling scenarios to move the farms beyond good management practice towards a lower environmental footprint and assess the impact on profitability.

Sediment Loss Risk

The AgResearch sediment loss risk calculator has been set up for each farm, however due to the flat nature of the Northern Southland and Tairei farms this part of the project will focus on the Eastern Southland and West Otago farms due to their topography and crop use.

Greenhouse Gas accounting

To better predict the greenhouse gas footprints of each of the farms and the Southern Dairy Hub farmlets, samples for feed quality (monthly) and weekly feed allocation information is being collected. This information will allow calculation of GHG emissions based on actual feed quality and estimated intake and compare this to the numbers generated from Overseer where default values are used.

Table 5: The farm details for the 2019-20 season for each Satellite farm.

	Pemberton Eastern Southland	**Dingle Northern Southland**	**McLeod West Otago**	**Wells Tairei**
Ownership	Owner operator	Owner operator	50:50	Owner operator
Platform Area	125	220	161	210
Support blocks	107 ha (2 blocks)	100 ha	None	None
Topography	Platform flat, 1 support block rolling	Flat, fully irrigated	Rolling with some irrigation	Flat with drains
Supply	Open Country	Fonterra	Danone	Fonterra
Wintering	Grass & baleage on support block	Fodder beet at home + grazier	Kale at grazier	Fodder beet or kale at grazier
Cows	400	680	480	700
MS kg/cow	560	450	375	460
MS kg/ha	1780	1330	1065	1435
Pasture eaten (t DM)	14.8	13.5	10.9	12.6
Total feed eaten (t DM)	18.2	14.7	12.0	14.7
Imported supplement (%)	19.1%	12.7%	11.0%	14.0%
N fertilizer kg	197	203	127	107
FWE $/kg MS	$4.32	$4.42	$2.77*	$4.32

* Costs don't reflect the full business because of 50:50 sharemilking contract

Key Learnings to Date

It is not easy comparing environmental footprint and profitability relationships across farm businesses that have different resources and management approaches. Key challenges include:

- Fully self-contained vs replacements off vs full or partial wintering off
- Ownership – owner operator vs 50:50 sharemilker and their impact on costs and revenue

The project team are working through a process to estimate the environmental footprint when animals are managed off the milking platform so that valid comparisons can be made between systems.

Acknowledgements

This research is funded by MPI through the Sustainable Food and Fibres Fund, DairyNZ Inc and SIDE. The project team are very grateful to the farmers involved in the project for agreeing to open up their farm businesses for the betterment of others.

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 6: 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.

Proudly supported by:

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 2020

Table 7: BW and PW as of September 30th 2019

		BW	PW
Pink – Std Kale	**Cows (194)**	116	146
Blue – LI Kale	**Cows (164)**	118	148
Green - Std FB	**Cows (196)**	113	129
Yellow – LI Kale	**Cows (164)**	126	158
Grouped	**Youngstock**	156	175

Mating Programme Spring 2020

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 our Research or supply in future years.

Mating Plans:

- Mating for the herd begins November 1st, for PSC August 10 2020.
- 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 2020

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

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: