Leading Innovation for
Southern farmers' propserity

SOUTHERN DAIRY HUB

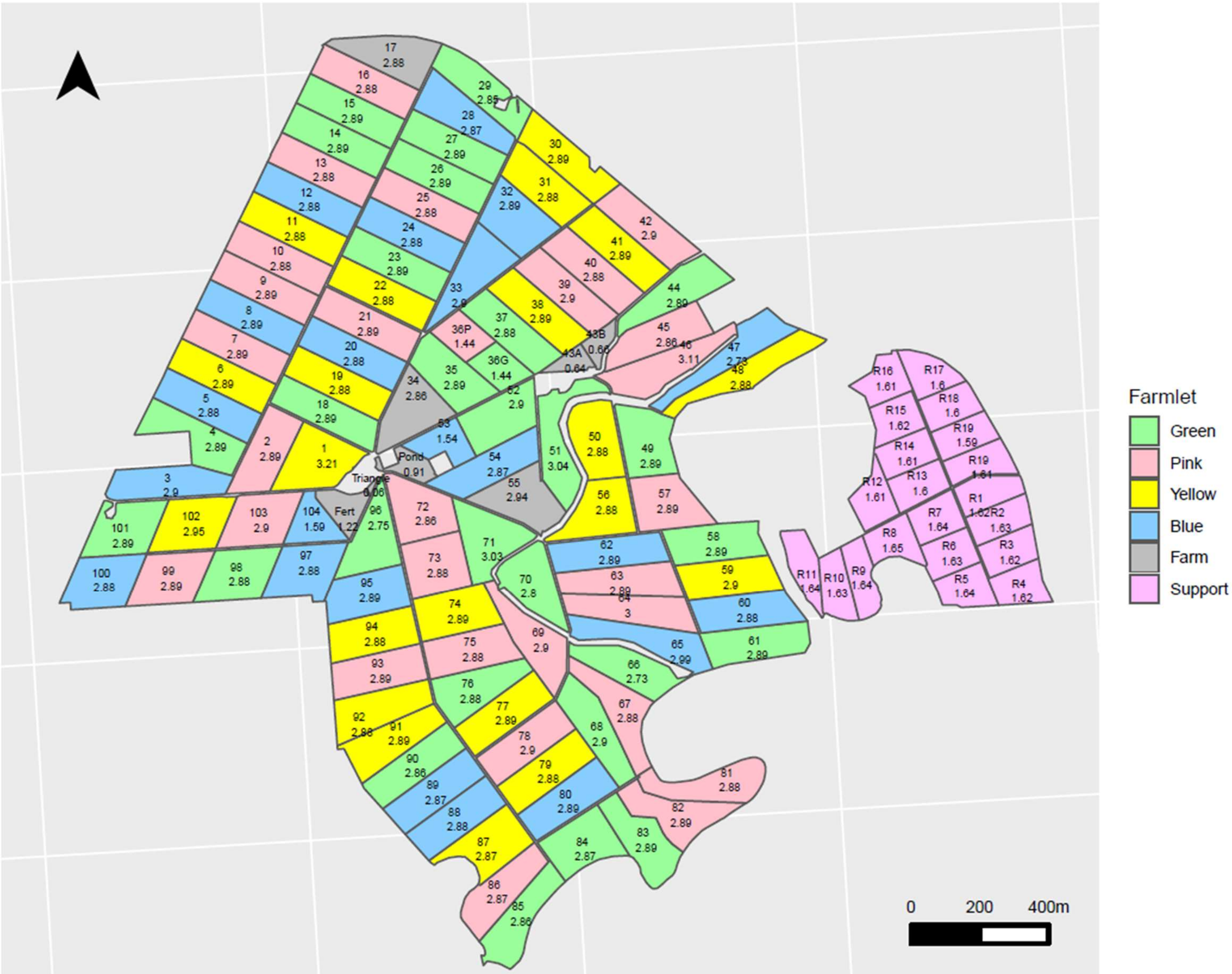
October Field Day 2022

Proudly supported by:

Contents

SOUTHERN DAIRY HUB

Farm Map



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 Billy Singh 021 115 5658

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

- 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 

- 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

Biosecurity Requirements for Southern Dairy Hub (SDH)

<u>All visitors must comply with Biosecurity Requirements when visiting SDH</u>

- All footwear must be disinfected with materials supplied, upon arrival at and departure from the SDH farm site.
- 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, from anyone within five days of their arrival in New Zealand from overseas.
- SDH retains the right at any time to refuse access to any person or persons deemed not to be complying with these requirements.

2022-23 Season to date update

The farm has had a strong start this year, with several years of cumulative work on herd BCS at calving to improve our reproductive performance and calving spread. In addition, the kind spring weather in August and September, good pasture utilisation and quality and access to very high-quality supplements has seen cows milking better on a per-cow basis.

This is shown in two or three key graphs that highlight the farm and farmlet performance season to date.

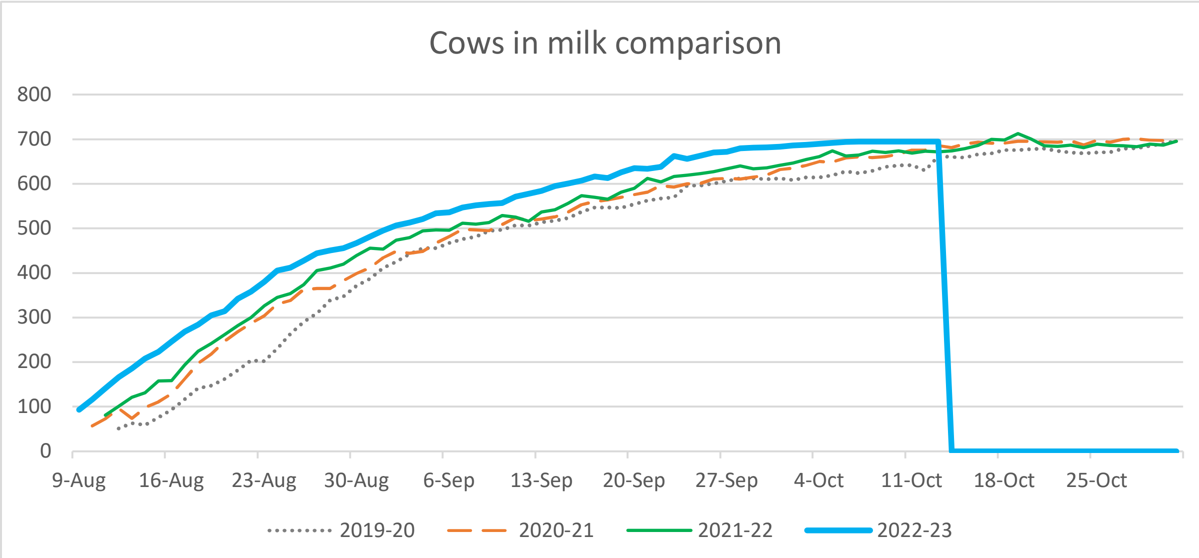


Figure 1: *Cumulative cows in milk for the last 4 seasons*

An interesting phenomenon that that we've seen this year is the accelerated calving spread with cows calving around 4 days earlier than expected based on mating dates. This is due to a genetic shift in gestation length of our herds, similar to the national herd. Younger cows will now be expected to calve after just 279 days of pregnancy not 282. This is awesome, but also affects the spring feed budget, and we know the wonderfully kind spring this year meant we managed to feed these cows well enough, but if this tight calving happened last year we would have been severely compromised.

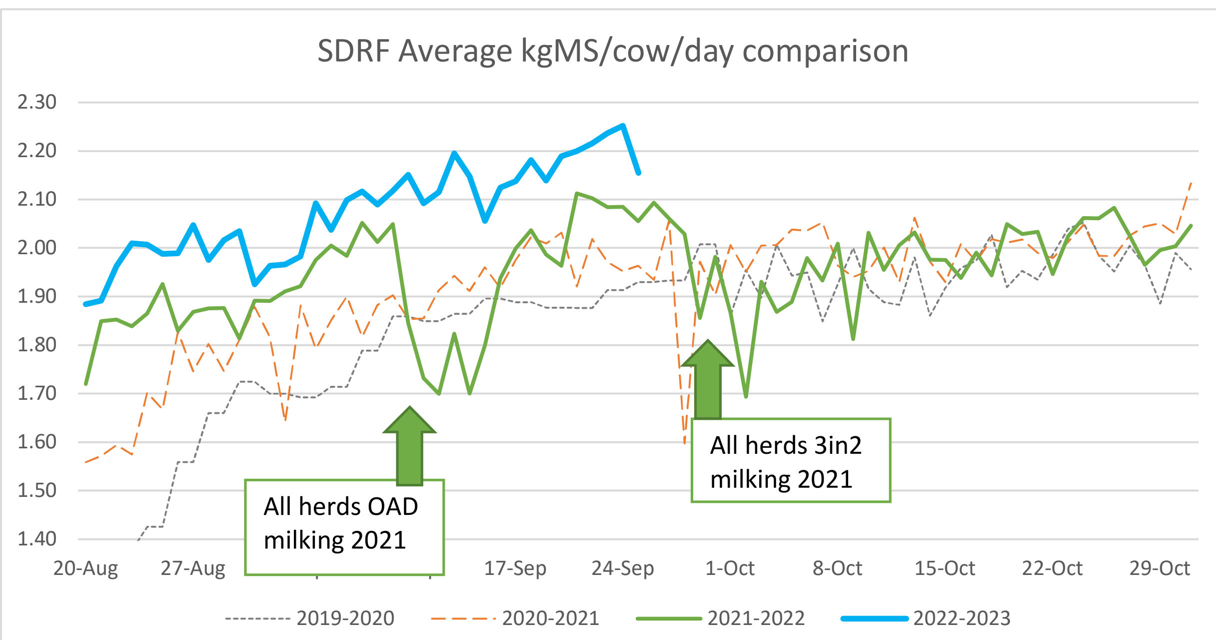
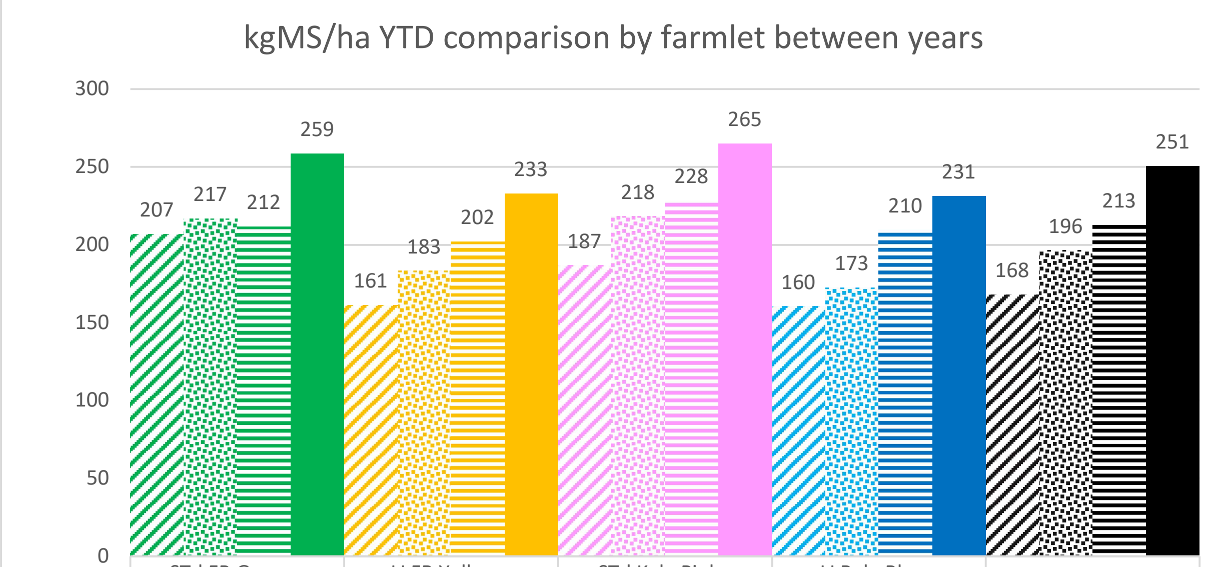


Figure 2: *Whole farm daily per cow milk solids production (kg/cow/day)*

For these reasons we have decided to put our mating date BACK 2 days this season to account for the shorter pregnancy length, to ensure we keep feed supply and cow demand in balance at a PSC of August 10th.



	STd FB Green - kgMS/ha	LI FB Yellow - kgMS/ha	STd Kale Pink - kgMS/ha	LI Bale Blue - kgMS/ha	Farm
2019-20	207	161	187	160	168
2020-21	217	183	218	173	196
2021-22	212	202	228	210	213
2022-23	259	233	265	231	251

Figure 3: *Cumulative season to date milk solids production (kg/ha) for the last 4 seasons*

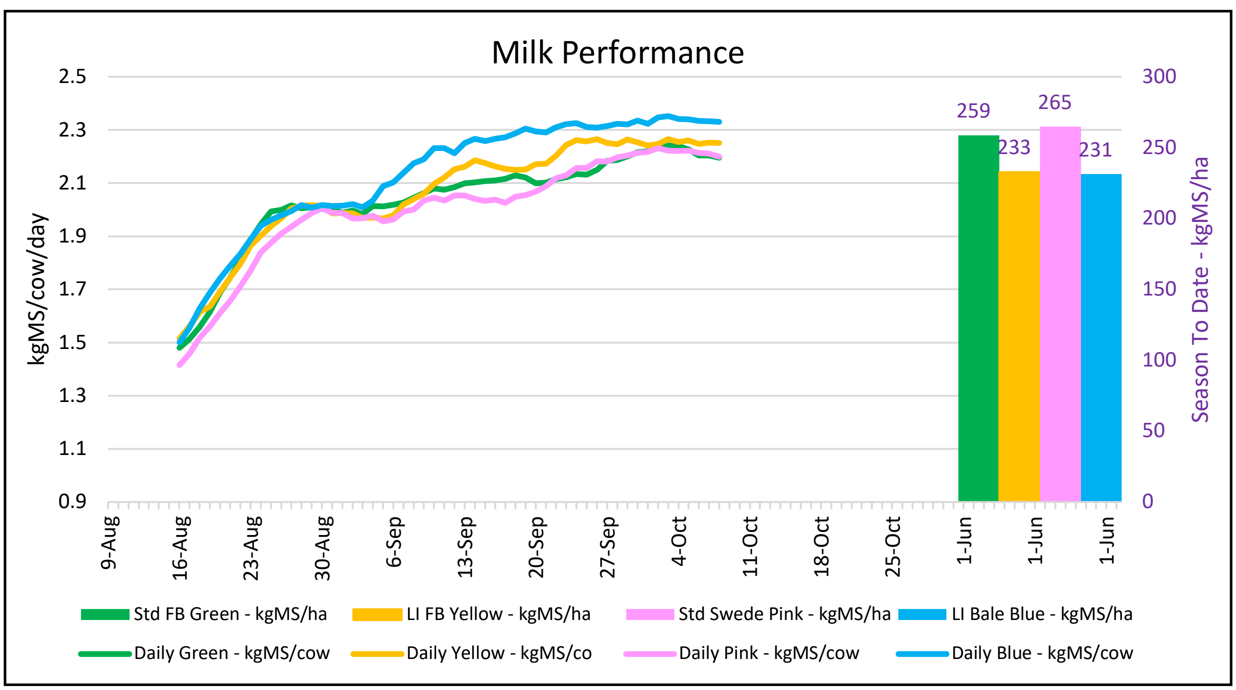


Figure 4: *Average weekly milk solids production (kg/cow/day) and season to date production (kg MS/ha)*

Future proofing paddock-based wintering under proposed new wintering rules

Introduction

Intensive winter grazing (IWG) means the grazing of livestock on annual forage crop at any time in the period that begins 1 May and ends 30 September of the same year. An annual forage crop is a crop that is grazed in the place where it is grown, but does not include –

a. Pasture; or
b. A crop that is grown for arable or horticultural land use

NES Freshwater – IWG rules take effect on 1 November 2022. In addition to the NES rules regional councils may have additional rules in their plans.

Permitted activity conditions include:

1. **Area** – no greater than 50ha or 10% of the farm, whichever is the greater
2. **Slope** – any land under annual forage crop for IWG must be 10 degrees or less (measured over any 20 m distance)
3. **Waterways** – livestock must be kept at least 5 m away from the bed of any river, lake, wetland or drain (regardless of whether there is water in it)
4. **Critical source areas** – must not be grazed, cultivated with annual forage crops and ground cover must be maintained
5. **Pugging** – all reasonably practical steps to minimise adverse effects on freshwater from pugging must be taken
6. **Ground cover** – vegetated ground cover must be established as soon as practicable after livestock grazing is complete

If you cannot comply with the permitted activity conditions a resource consent will be required until the Fresh water farm plan option being developed by the Government is available.

In addition to meeting the environmental requirements of paddock-based wintering there are expectations around the care of the animals in these systems including:

1. We are prepared for all weather conditions
2. Our animals can easily access acceptable drinking water
3. We plan for successful winter feeding
4. Our animals can lie down comfortably
5. We ensure our animals give birth in the right environment

Good management practice & science changes in paddock-based wintering at SDH over the years

1. No winter cropping on the lower terrace due to the flooding risk – grass to grass renovation of paddocks in this zone
2. Dated pregnancy scans for all stock to allow calculation of predicted calving date for springer drafts
3. Late lactation check of pregnancy status to ensure only pregnant animals are wintered
4. Springers drafted off crop at least 14 days before expected calving date (see Figure 5)
5. Back fences moved forward daily
6. Portable water troughs located at the feed face to reduce walking distances
7. Cows grazed into the prevailing weather to protect the drier areas by the feed face when wet
8. Implementation of in-paddock contingency plans based on gumboot scores, current and predicted weather
    a. Increased feed
    b. Access to area behind the back fence
    c. Rolling out straw (Figure 6)
    d. Providing access to pasture breakout zones within the crop paddocks (Figure 7)
9. Transitioning cows off fodder beet 1 month before expected calving date onto a higher protein diet
10. Adopting baleage based wintering for one herd

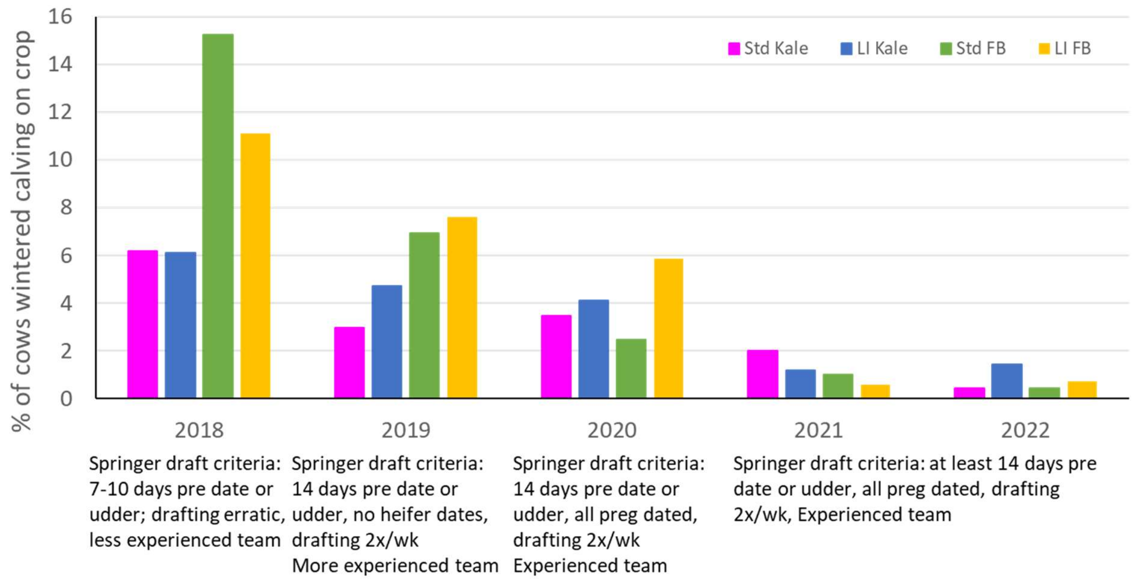


Figure 5: *Proportion of cows calving on crop as winter & springer management has changed*

Figure 6: *Straw for lying when soils are sodden*

Figure 7: *Pasture breakout areas in crop paddocks for when soils are sodden*

Timeline to winter success

8-10 months before sowing crop

- Paddock selected 8-10 months prior to crop establishment. Paddocks for SDH, go via a springer paddock cycle, before ground work begins
- Plan the plants! Soil test paddocks, set fertiliser plan and discuss cultivars with agronomists

Pre-sowing

- Before springer paddock is sprayed out, we plan the layout of the paddock, to account for all of the winter issues!
    - Is the paddock a uniform shape, to make daily break shifts easy? If not, can we square up the paddock by sowing the crop in a uniform shape.
    - What breakout areas do we need in the paddock for the winter? Is the paddock grazing as one continuous break or in two sections?
    - Mark the paddock up in TracMap so all of our contractors, sprayers, spreaders put the right stuff in only the right places
    - Farm Team also physically mark/fence off areas to remain in breakout/grass area
    - Leave a grass strip at the start of a grazing section for cows to rest in during the first day of transition onto crop.
- Complete winter Feed budget before crop is sown, to plan baleage/silage needs

Planting time

- Focus on all ground work being done at the right time (weather permitting), to give plants the best start to life.

Post-Sowing

- Monitor for pest and disease pressure in crop on a weekly basis,
- Apply side dressing of fertiliser in line with your plan
- Harvest surplus pasture from grass areas in paddock to help fill winter demand

Pre-Grazing

- Refresh the written plan, and review with the team: Setup and dividing fences and fence off breakout areas, layout baleage as per plan allowing for extra baleage in transition area, setup portable trough and bale feeders.

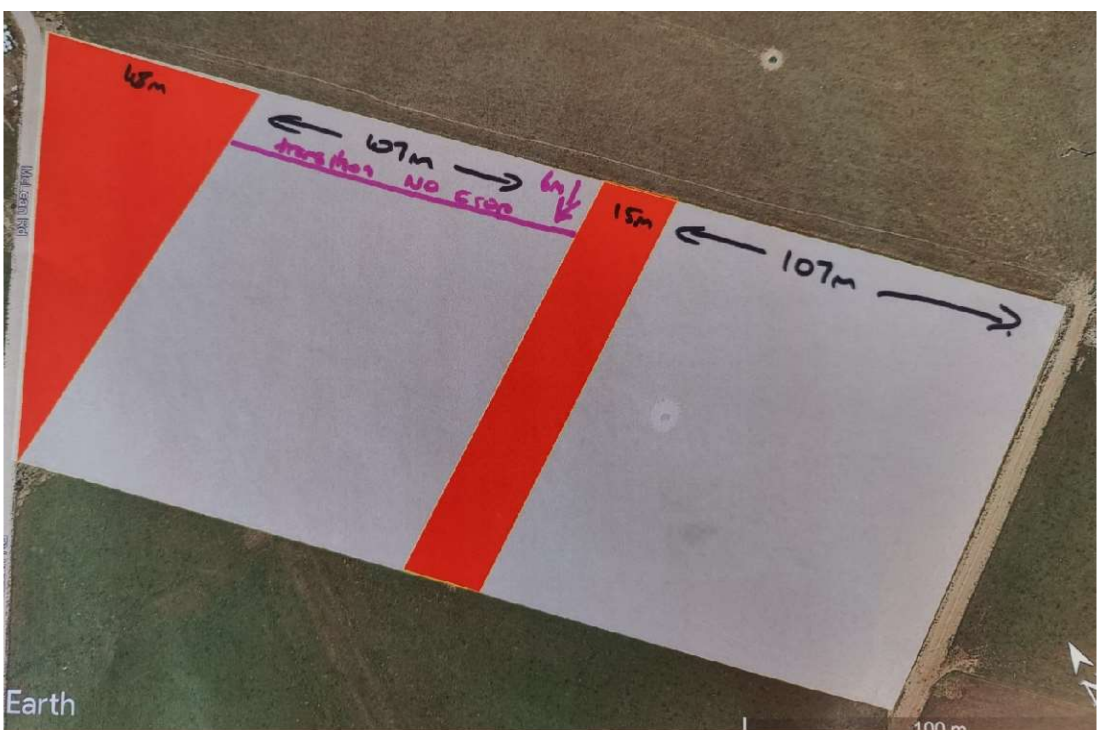


Figure 8: *First stages of a crop paddock plan identifying grass margins and distances*

20+ Research projects completed in 5 years!!

Category	Project Title	Timeline	Project details	Project Objective/Outcome
	Projects researched at SDH			
Multi-year Farm System Evaluations	**4 Year farm system comparison** Kale vs Fodder beet Reducing nitrate leaching by 30%	**2018-2022**	Funding: DairyNZ Lead: DairyNZ Key person: Dawn Dalley	To understand the impact of winter crop choice on environmental loss risk, animal performance and farm profitability Investigating the impact of nitrogen inputs on; environmental outcomes including GHG, animal performance, people, and farm profitability
Multi-year Farm System Evaluations	**3 Year farm system comparison** Off Paddock Infrastructure vs paddock-based wintering Reducing nitrate leaching by 30% with improved profitability	2022-2025	Funding: DairyNZ Lead: DairyNZ Key person: Dawn Dalley/Pierre Beukes	To understand the impact of wintering with; crop, baleage or infrastructure, on environmental loss risk, animal performance and farm profitability Investigating the impact of nitrogen inputs on; environmental outcomes including GHG, animal performance, people, and farm profitability
Multi-year Farm System Evaluations	**SFF Participatory Research**	**2018-2022**	Funding: MPI/DairyNZ/SIDE Lead: DairyNZ Key person: Dawn Dalley	This project will deliver a network of four satellite farms, with associated Communities of Practice (CoP), which are 'research-ready' with demonstrated confidence, capability, and capacity to adopt new farm practices for lower environmental footprint and strong community wellbeing
Impacts of winter crops on animals and performance	**SFF Making fodder beet sustainable**	**2018-2022**	Funding: MPI/DairyNZ/PGGW Seeds Lead: DairyNZ Key person: Roshean Woods	To bring new confidence to FB feeding through mitigating against known risks by: (1) understanding macro nutrient interactions in FB feeding systems, (2) developing decision-support tools to identify when animal health issues may occur, and (3) implementing tools for supplementary feeding strategies.
Impacts of winter crops on animals and performance	Effect of crop type on calf traits	2018-2023	Funding: DairyNZ Lead: DairyNZ Key person: Dawn Dalley	(1) Investigate the relationship between dam winter diet, calf mineral status and on-going growth characteristics (2) Investigate the cumulative effects of winter crop choice on animal performance and welfare
Impacts of winter crops on animals and performance	Crop type & allocation effects on behaviour & lactation performance	2017-2018	Funding: DairyNZ Lead: DairyNZ Key person: Dawn Dalley	(1) To compare BCS gain, nutrient intake, and early lactation milk production of groups of cows offered two feeding levels of winter diets differing in crop type (FB and kale) (2) To establish any effects of winter crop type (FB and kale) on the animal health status, as indicated by blood metabolites and behaviour of mixed-age dairy cows
Impacts of winter crops on animals and performance	Crop type & R1 feeding behaviour	2019	Funding: DairyNZ Lead: DairyNZ Key person: Paige Harris	To compare the growth of rising-one-year-old dairy heifers grazing either kale or FB from May until August and determine if crop type affected grazing behaviour and rumination.
Wintering, Environmental and Animal studies	**Nitrate leaching from winter forage crops**	**2018-2021**	Funding: DairyNZ Lead: AgResearch Key person: Ross Monaghan	To measure N leaching losses from autumn & winter grazed fodder beet, winter grazed kale and selected pasture paddocks to determine and compare the farm system comparison losses of N
Wintering, Environmental and Animal studies	**Crop Establishment for better wintering outcomes**	**2021**	Funding: Thriving Southland Lead: SDH Key person: Louise Cook	Investigate whether utilising strip tillage or direct drilling to establish fodder beet crops and direct drill to establish kale crops maintains soil structure and strength, thereby reducing the occurrence of pugging and improving animal welfare during winter grazing, compared to conventional cultivation
Wintering, Environmental and Animal studies	**Weather & soil effects on animal behaviour**	**2020**	Funding: DairyNZ/AgResearch Lead: AgResearch Key person: Dawn Dalley	To determine how weather and paddock conditions affect the lying behavior of dairy cows managed outdoors in crop paddocks during winter

Pasture	**Forage value index validation**	**2017-2021**	Funding: MBIE/DairyNZ Lead: DairyNZ Key person: Wendy Griffiths	To determine the performance of low and high value FVI cultivars under two nitrogen fertiliser regimes in Southland
Nutrient loss to water studies	Linear lysimeter for nitrate leaching	2019-2022	Funding: MBIE, via AgResearch SSIF funding Lead: AgResearch Key person: Ross Monaghan	To compare N leaching loss estimates from a prototype linear lysimeter that measures drainage and estimates N concentrations in real time to those estimated from a water balance model and suction cup sampling of field leachates.
	Drain discharge mitigation options	2020	Funding: AgResearch Lead: AgResearch Key person: Ross Monaghan	To investigate diversion or mitigation strategies to minimise contaminants entering the stream at the foot of the terrace at SDH.
	Mapping the tile drain and streams at SDH	2017-2019	Funding: AgResearch/DairyNZ Lead: AgResearch Key person: Ross Monaghan	Monitoring of the stream at the foot of the terrace to determine whether it would be a useful catchment to measure the environmental impact of the conversion to dairy.
	Projects hosted at SDH for other Researchers			
Plot trials we host	Catch crops for cleaner water	2020-2023	Funding: SLMACC Lead: Plant and Food Key person: Brendon Malcolm	Lysimeter trial measuring leachate nutrients under plots with varied sowing methods and dates of agricultural catch crops
	Plantain Plot Trial	2022-2024	Funding: SFFF Lead: DairyNZ Key person: Kate Fransen	Plot trial comparing plantain cultivars for plant characteristics that support reduced nitrate leaching.
	Other projects supported by data or samples from SDH			
Information Technology projects	Connected farm NZBIDA	2019-2020	Funding: MBIE Lead: AgResearch Key person: Mark Shepherd	Generate new insights and new research opportunities from a digitally enabled, data rich research farm to improve the performance of existing dairy farms in the southern South Island
	Makarewa Catchment Group Land Scanning	2022-2023	Funding: Thriving Southland Lead: Makarewa -Hedgehope Catchment	
	LIC Space	2018-2022	Lead: LIC Key person: Lorna McNaughton	Testing of algorithms for accurate satellite estimation of pasture cover
Animal investigation	Evaluation of Smaxtec rumen boli	2020-2023	Funding: Fonterra Lead: DairyNZ Key person: Paul Edwards	Determination of the extent of heat stress in dairy cows at SDH and monitoring of water intake during lactation and the dry period.
	Vet South Tail scoring	2022-2023	Funding: Lead: Vet South Key person:	Welfarm project collecting additional data alongside tail scores
Milk composition	Milk molecule phenotyping	2019	Funding: AgResearch Lead: AgResearch Key person: Cameron Craige	Detailed scientific characterisation of the effect of farm system choice on milk composition
	Feed impact on milk composition	2017-2019	Lead: Fonterra	
Blood analysis	Blood indicators of stress	2020	Lead: AgResearch Key person: Heather Neave	Assessing blood telomeres as indicators of cow welfare
	MPI Blood collection	2020	Funding: MPI Lead: SDH	Providing blood samples for use in evaluating new testing methods for M.Bovis

Kale vs Fodder beet Farm System Comparison: 2018-2022

<u>Background</u>

When surveyed during the development of the Southern Dairy Hub in 2017, the top issues that farmers wanted investigated in farm systems comparisons on the farm, with the aim of developing more sustainable production systems were:

1. Fodder beet
2. Nutrient loss reduction to achieve impending ES rules,
3. Wintering, and
4. Infrastructure

In June 2018 a four-year farm systems comparison commenced to address the fodder beet, wintering and nutrient loss reduction priorities identified by farmers (Figure 9). The standard farmlets were designed to represent comparable systems being implemented in Southland at the time with regards N fertiliser inputs, stocking rate, supplementary feed use and wintering practices. Following estimation of the N leaching losses of the Std system the lower impact systems were designed to reduce N leaching by at least 30 % relative to the standard system of the same winter crop type utilising proven N loss mitigations which included N fertiliser inputs, supplementary feed inputs and type and subsequently stocking rate.

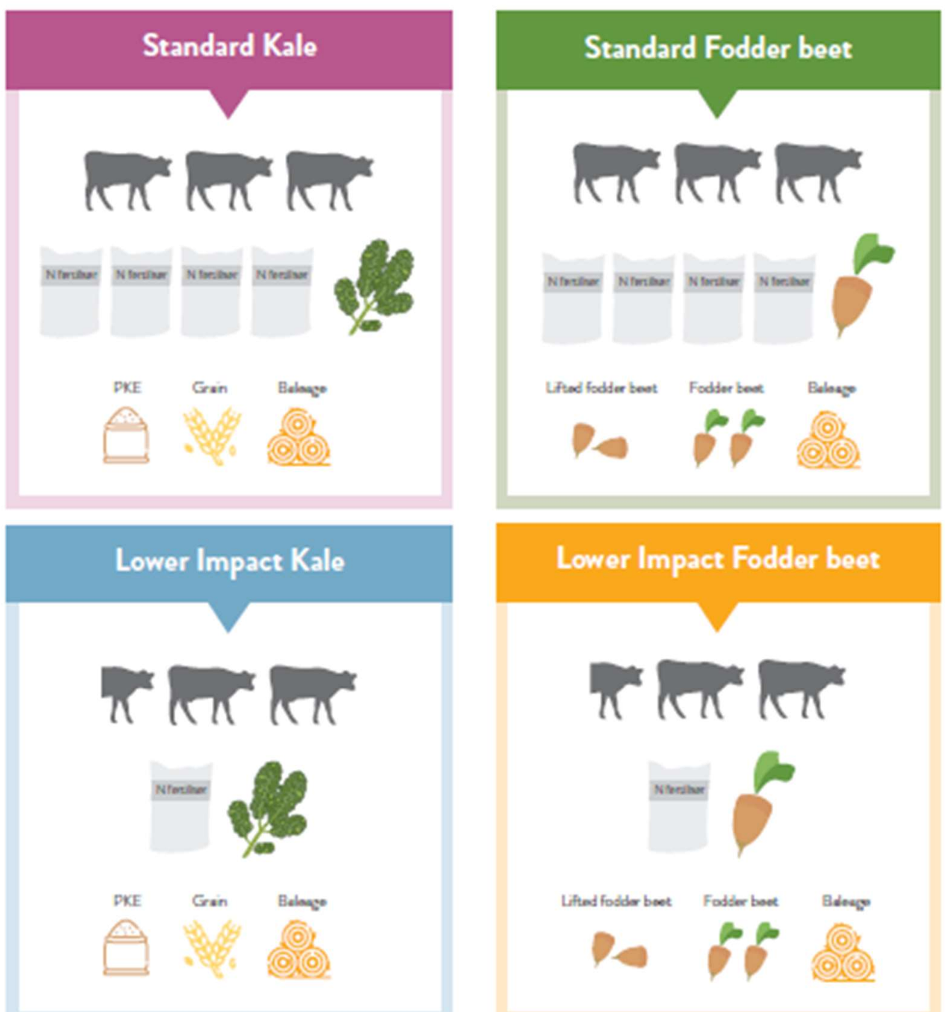


***Figure 9:** 2018-2022 SDH farm system key system features*

Learnings

The "Wagon Wheel" graph allows us to compare all aspects of a farm system in one view. The black outline of the graph is the ideal target, and the coloured farmlet lines show how close each farmlet got to that target (as % achieved of 100%). It's clear that some farmlets deliver well in some areas, and under deliver in others.

When the farmlets were designed, we expected to see a very even profit outcome from all of the farmlets but hoped that some would demonstrate some environmental benefits relative to the others. By the end of year 1, it was very clear that this wasn't the case for profit – a trend which continued throughout the 4 years of the trial.

We look at the graph below and it really puts some perspective on how we define farm success. Profit is an easy measure – but in the changing regulatory landscape the animal welfare, environmental, GHG and people areas of the business, there are undeniably pros and cons with each system that we have run.

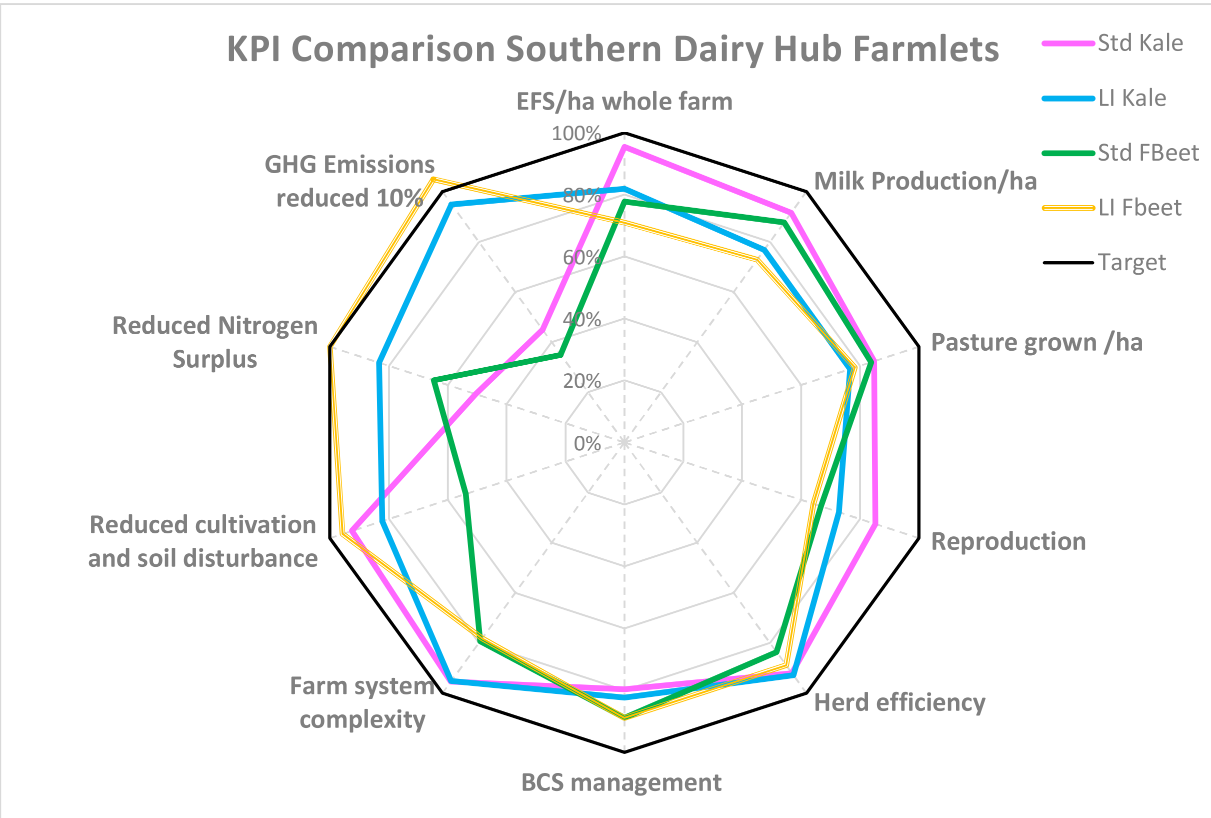


Figure 10: *Wagon wheel KPI comparison of the SDH farmlets (2018-2022)*

Key messages

- Systems to reduce nitrate leaching by 30% reduced profit much more than we expected, but also delivered significant reductions in GHG emissions
- Our fodder beet systems have:
    - cost more to run
    - generally, been more complex to manage
    - have not made the same milk as kale systems, a symptom which starts in early lactation and continues throughout the season
- Focusing on key drivers of reproductive performance eg. BCS at calving, resulted in more predictable reproductive outcomes for the Std kales but less predictable performance for the low impact and Standard FB farmlets (sometimes great, sometimes bad and always unexpected!)
- We are confident we can deliver significant reductions in nitrogen loss and GHG emissions in the lower impact farmlets, due principally to the reduction in total feed eaten and reduced nitrogen surplus
- One year for a system will not tell the whole story. System performance will vary over time and performance (positive or negative) may compound over years.

Key performance summaries that reflect the differences in performance between each of the four farm systems (Summary shows the 2021-22 year, which is representative of the four years of this trial, when looking at the relativity of farmlets to each other

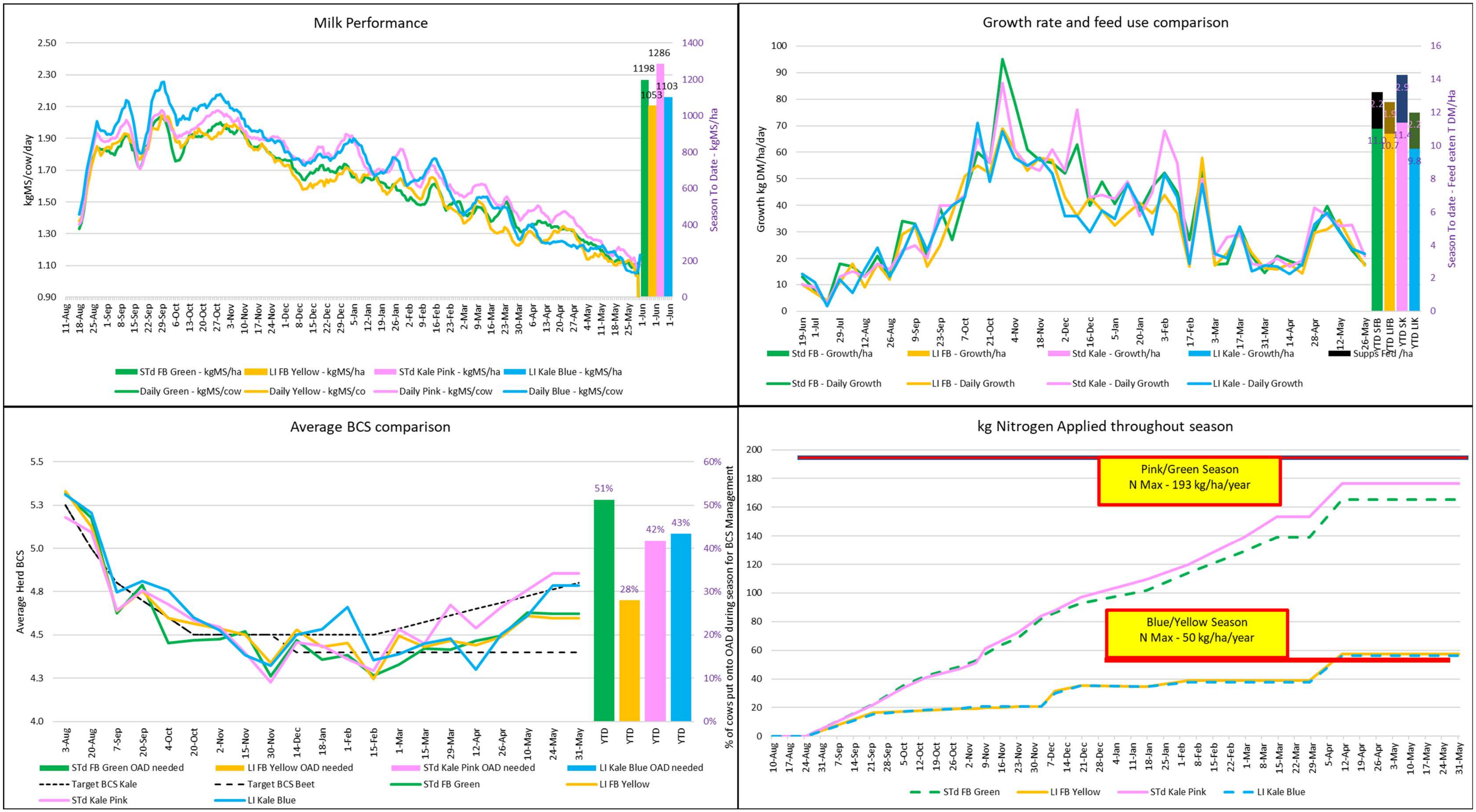


Figure 11 a,b,c,d: *11a weekly MS/cow; 11b Weekly growth rate; 11c fortnightly BCS; 11d annual nitrogen application*

Nitrate leaching from winter forage crops and SDH farm systems

Background

Traditionally, non-lactating in-calf dairy cows have been wintered off pasture on brassica crops. For this reason, autumn- and winter-grazed fodder beet (FB) crops are key to the FB farmlets at the Southern Dairy Hub (SDH), while kale is the winter feed in the other 2 farmlets. To increase knowledge of the environmental impacts of these grazed forage crops, N leaching losses were measured in selected treatments during 2018, 2019 and 2020 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 v winter-grazed FB, and
  - selected pastures on the milking platform.

Average N leaching losses for the 3 years of measurements are presented in Figure 12. N leaching under the winter-grazed fodder beet crops was on average only 50% of that under the winter-grazed kale crops, while the autumn harvested FB leached a similar amount to the winter grazed kale.

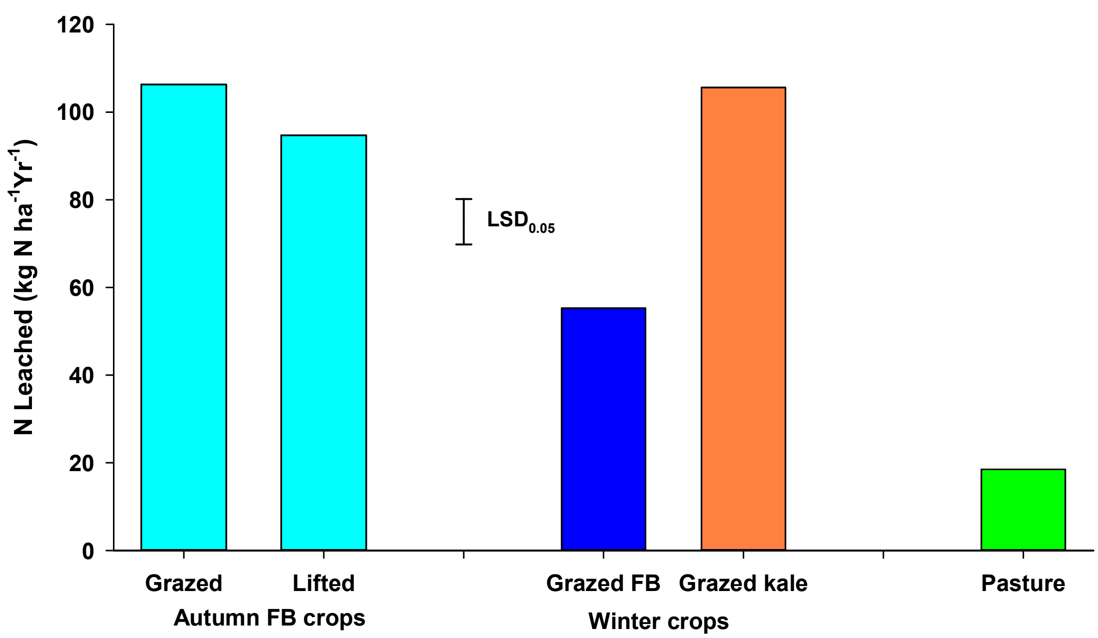


***Figure 12**: Average annual N leaching losses (2018, 2019 and 2020) from autumn-grazed or -lifted FB, and winter-grazed FB or kale treatments. Average N loss from 3 pasture paddocks (Standard farmlet) is also shown (in green). The LSD bar represents a significant difference between the forage crop treatments at a 95% confidence level.*

Likely N losses per cow wintered were calculated using the yields of the FB and kale treatments, cow daily feed allocations and adjusting the areas required for each crop. Using FB as a winter grazing option can reduce nitrate leaching per cow wintered by up to 60% (Table 1).

Table 1. *N leaching losses from winter-grazed crops (average of 3 years of data).*

	Kale	Fodder beet
N leached kg per ha per year	106	55
N leached kg per cow wintered	5.6	2.0

Using losses calculated by Overseer for the pasture areas of the milking platform combined with the measured N losses from the winter crop areas, we have estimated the total N losses from each of the 4 farmlets. These results, presented in Figure 13, indicate that the change in fertiliser N inputs resulted in about 22% less N leached. Similarly changing from kale to fodder beet as the winter crop lowered N leaching losses by about 16%. The lower impact FB (LI FB) treatment leached 34% less than the standard kale farmlet.

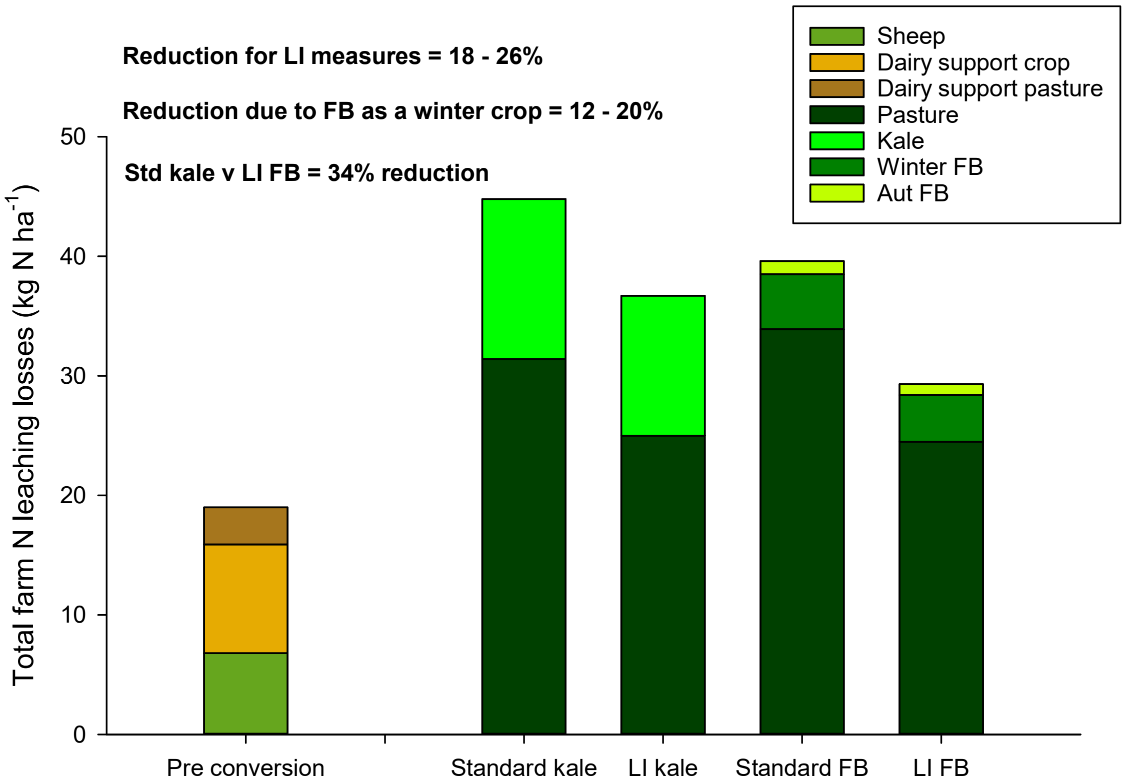


Figure 13: *Comparison of the calculated and measured N losses pre conversion and from the four farmlets. Note that the low impact (LI) treatments indicate lower N inputs.*

<u>Key messages</u>

- If lifting fodder beet in autumn to feed elsewhere or grazing in paddock, aim to replant the paddock as soon as possible to reduce N loss from drainage during the winter period
- Fodder beet offers potential to decrease winter nitrate leaching losses, despite the increase in stocking density required with the higher dry matter yield.
- Measured losses of N from the pasture paddocks were relatively low, and similar to Overseer predicted losses.

Smith LC and Monaghan RM. 2020. Nitrogen leaching losses from fodder beet and kale crops grazed by dairy cows in southern Southland. Journal of New Zealand Grassland 82: 61-71

Weather and soil effects on animal behaviour

Background

Dairy cows are motivated to access dry lying surfaces and will seek protection from wind and rain, but winter conditions may limit these opportunities. The primary aim of this study was to determine the effects of weather and paddock soil conditions on lying behaviour of dairy cows managed outdoors during winter and fed crop in situ. A secondary aim was to characterize eating and ruminating behaviours during winter weather and paddock soil conditions.

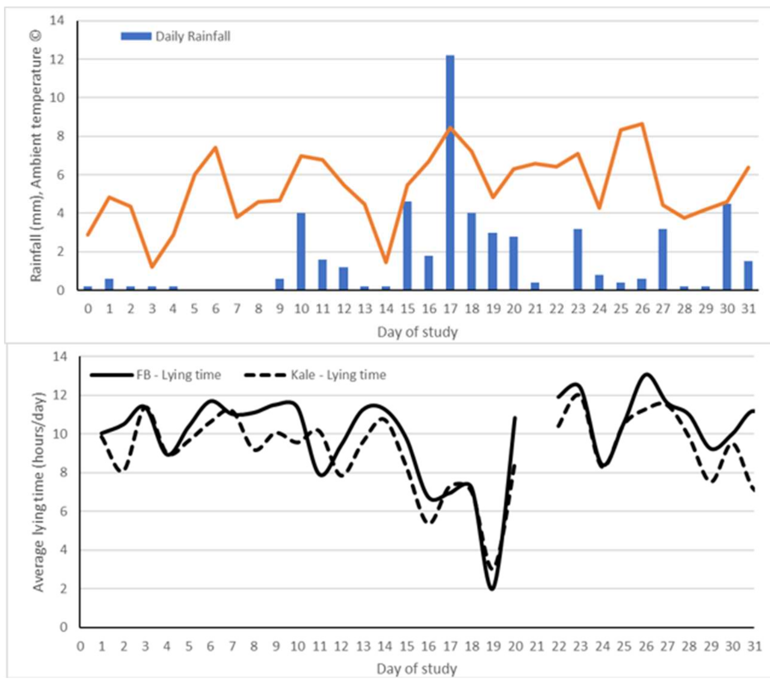


***Figure 14**: Daily rainfall and average lying time for the 30-day behaviour study*

Key messages

- Dairy cattle managed outdoors in winter will experience periods of reduced lying time during inclement weather and sodden soil conditions.
- Prior rainfall and percentage of the available area with surface water pooling are useful measures to determine if lying time, and thus animal welfare, could be compromised
- Pugging depth is not a good indicator of the suitability of the lying surface
- To protect the area closest to the feed face farmers should consider the prevailing weather direction when planning the paddock grazing direction
- Cows are likely to ruminate less with increased surface pooling and fewer suitable spots for lying.
- Farmers should have a contingency plan to provide improved lying conditions when soils become saturated. Options include:
    - Increasing the area available
        - A bigger break or an additional break during the day for brassicas
        - Moving the back fence back to allow access to drier ground previously grazed
    - Rolling out cereal straw
    - Moving to drier, sheltered areas within the paddock that is being grazed
    - Moving to drier, lower risk crop paddocks on the farm
    - Providing access to grass buffer strips in the crop paddock
    - Moving to off paddock infrastructure/yards etc

Neave HW, Schutz KE, Dalley DE. 2022. Behaviour of dairy cows managed outdoors in winter: Effects of weather and paddock soil conditions. Journal of Dairy Science 105(10): 8298-8315

Crop establishment for better wintering outcomes

Background

Maintaining soil structure and strength is one potential way in which pugging could be decreased in intensive winter cropping systems. Conventional cultivation is still commonly used to establish many winter crops, particularly fodder beet, because of the high cost and risk associated with crop failure or lower than expected crop yields.

The aim of the project was to test whether utilising minimum till methods (strip tillage or direct drilling) to establish winter forage crops could maintain soil structure and strength, thereby decreasing pugging and improving animal welfare during winter grazing when compared to conventional cultivation.

Key messages

- For all establishment methods, successful establishment is determined by paddock conditions at the time of planting and follow up agronomic practices such as weed and pest control.
- Although minimum till options may appear to be more environmentally sustainable (from a carbon and soil structure perspective), observations from this study were of lower yields, greater weed burdens, and increased pest pressure. An unintended consequence of minimal till establishment was the increased need for chemical weed and pest control to help achieve more sustainable yields.
- To provide better soil conditions for animals, where practicable, wintering should be undertaken on soils that are more resistant to waterlogging and pugging
- Ensuring that the people implementing the winter plan, i.e., those shifting the breaks and feeding the cows, also understand the plan is critical for better wintering outcomes.
- A tension exists between maximising crop yields and protecting soils. Lower yields result in a lower stocking density and subsequently lower animal grazing days/ha and lower nutrient loading. However, impending rules limiting winter cropping areas are likely to drive higher crop yields and increased stocking density.
- Water pooling is a key indicator for farmers to know when to implement their Plan B or contingency plans such as removing stock from a crop paddock. The firmer soils with minimum till establishment increased the risk of surface water pooling during heavy rainfall events. So, while we may be reducing pugging and keeping cows above ground, the water pooling will impact their lying behaviour.
- **Establishment method is not going to be a silver bullet for poor crop husbandry or lack of attention to detail over the grazing period. Daily management of the stock had the biggest impact on paddock conditions and cow behaviour.**

Based on the observations from this study there are four critical steps for farmers when planning their winter cropping:

1. Good paddock selection, preparation, and agronomic practices to achieve optimum crop yields
2. Involving all the farm team in the planning and implementation process so they understand the 'why'.
3. Implementing good management practices to maximise the time animals spend in better grazing conditions, including use of portable water troughs and back fencing.
4. Having a Plan B that everyone involved with wintering knows when and how to implement.

Detailed results available in the July 2022 Field day handout.

Forage value index validation – Interaction between genetic merit potential of perennial ryegrass cultivars and nitrogen fertiliser in a pastoral grazing system

Background

The DairyNZ Forage Value Index (FVI) was developed to help dairy farm businesses select a suitable ryegrass cultivar-endophyte combination. The FVI value of a cultivar-endophyte combination is given in $/ha/year; this value is an estimate of the expected contribution to the business' operating profit. The FVI $ value and ranking position for a specific cultivar-endophyte combination is calculated using trait performance values from small plot trials, and the expected economic value of differences in these performance traits.

A potential limitation of the performance values is that small-plot trials are managed to a standard that is higher than what could realistically be achieved on a typical farm. The objective of this research was to close the knowledge gap around the validity of the FVI model under different management conditions by testing the performance value traits using large-scale paddocks that are exposed to different management conditions in terms of nitrogen fertiliser and stocking rate.

Results

Pasture production was higher in the high FVI treatment compared with the low FVI treatment 11.6 vs 10.7 t DM/ha/yr with the high FVI cultivars producing more biomass during the summer.

Pasture growth increased under the standard management (180 kg N/ha) compared with the lower impact management (50 kg N/ha/yr) i.e. 11.8 vs 10.4 t DM/ha/yr, with increased DM yield in the standard treatments during summer and autumn

The overall economic advantage to the high FVI treatment was determined to be $109.30/ha/yr; only 22% of the predicted difference of $503/ha/yr

Key messages

- Selecting high FVI cultivars will result in extra pasture DM production in Southland, especially during the summer months.
- For both high and low FVI cultivars total DM production will be determined by the N fertiliser regime of the farm
- The fact the high FVI treatment outgrew the low FVI treatment suggests the FVI model is valid, however the model appears to be overestimating the $ value

Hammond NS. 2021. Interaction between genetic merit potential of perennial ryegrass cultivars and nitrogen fertiliser in a pastoral grazing systems. Master of Agricultural Science Thesis pp. 134

Cumulative effects of fodder beet – SFF Making fodder beet Sustainable

Background

Following the rapid increase in fodder beet use in the mid 2010's, farmers and veterinarians became increasingly concerned about potential negative carryover effects on animal performance. Increased body condition score at calving in cows wintered on FB has resulted in more metabolic disease, e.g. milk fever and liver disfunction at parturition which may affect colostrum quality. Differences in nutrient intake between kale and fodder beet diets in late gestation, as detected by blood mineral status, has the potential to affect calf size at birth, growth of replacement heifers and their subsequent performance

A series of studies have been undertaken at SDH to investigate wider implications of fodder beet feeding to those being investigated in the farm systems study. These include:

1. A comparison of BCS gain, nutrient intake and early lactation milk production of cows offered two feeding levels (ad libitum or targeted for 0.7 BCS gain) of winter diets differing in crop type (FB and kale).
2. Measurement of the health and wellbeing status of cows feed fodder beet or kale at two allocations by testing blood parameters and activity measures during winter
3. Determining if winter crop type and dry matter allocation affected colostrum quality, as measured with Brix, in mixed age cows at their first milking post calving
4. A comparision of the growth of rising one-year-old dairy heifers grazing either kale or fodder beet from May until August and determine if crop type affected grazing behaviour and rumination
5. Investigating any cumulative effects of dam (through en utero effects), on offspring winter diet at 1 and 2 years old (kale or fodder beet) on performance of heifer replacements from birth until the end of their first lactation

Key messages

- Crop type had a greater impact on cow performance than allocation rate
- Cows wintered on fodder beet had better reproductive performance (3-wk pregnancy rate) and greater average milk solids yield than cows wintered on kale.
- Later calving cows are less likely to be pregnant at the end of mating
- Body condition score loss in the first six weeks was not affected by crop type or allocation level
- Feeding fodder beet increased blood magnesium but decreased blood phosphorus (if not supplemented with P), total protein and urea levels compared with cows fed kale.
- Crop type had a bigger effect on blood metabolite concentrations than did the daily allocation of crop (kg DM/cow).
- Achieving recommended dietary protein intake is difficult with fodder beet diets especially in the last 4 weeks of pregnancy and for rising-1-year-olds
- Colostrum quality was not affected by crop type or allocation level but there is significant variation between individual animals and between quarters within an animal most likely linked to colostrum intake by the calf
- Cows wintering on fodder beet walked more and had fewer, longer lying bouts. However, lying time will be affected by the soil conditions in individual paddocks
- Consideration should be given to the diets of heifer replacements in winter to ensure they achieve minimum dietary requirements, particularly of protein and phosphorus
- Dam and heifer diet did not affect milk production for the first lactation, however differences in liveweight, reproduction and blood metabolites indicate possible negative impacts of feeding heifers fodder beet during winter, particularly if the dam is also wintered on fodder beet

Dalley DE, Edwards JP, Woods RR. 2020. Impact of winter fodder beet or kale allocation on body condition score gain and early lactation performance of dairy cows. Journal of New Zealand Grassland 82: 73-81

Dalley DE, Edwards JP, Masterson E, Woods RR. 2021. The effect of winter fodder beet or kale allocation on behaviour and blood metabolite status of non-lactating dairy cows. Journal of New Zealand Grassland 83: 153-162

Dalley DE, Edwards JP, Kay J, Ritchie W, Hammond N. 2018. Effect of winter crop and dry matter allocation on colostrum quality of dairy cattle. Australasian Dairy Science Symposium, Palmerston North, 2018.

Harris P, Dalley DE, Bryant RH. 2021. The effect of feeding fodder beet or kale during winter on growth and behaviour of rising-one-year-old dairy heifers. New Zealand Journal of Animal Science and Production 81: 81-86

Woods RR, Dalley DE, Edwards JP. 2022. Are there cumulative effects on growth and performance of animals from systems feeding either fodder beet or kale to non-lactating dairy cattle in winter? Submitted to Animal Production Science.

SFF Participatory research

Background

Greenhouse gas (GHG) footprints for the farmlet systems were calculated for the 2019-2020 season. The GHG footprints cover all on-farm (milking platform, wintering block), youngstock and pre-farm gate biogenic GHG emissions, including CH_4 from enteric fermentation by ruminants, N_2O and CH_4 emissions from manure management and excreta deposition onto paddocks, and N_2O and CO_2 emissions from urea fertiliser application to land.

The pre-farm gate emissions relate to N fertiliser use for growing purchased supplements (baleage, barley grain and palm kernel expeller (PKE)) and have been included to ensure biological emissions associated with off-farm (and, in the case of PKE, off-country) production of supplements is accounted for in farm-scale footprint assessments.

Because the SDH farmlets include crop type (kale vs. fodder beet) as one of the main treatment effects, separate CH_4 emission factors were used for these two crop types.

Results

Across the four SDH farm systems and the four commercial farms that were studied there was a linear relationship between milk solids production/ha MP and methane (Figure 15) and nitrous oxide emissions

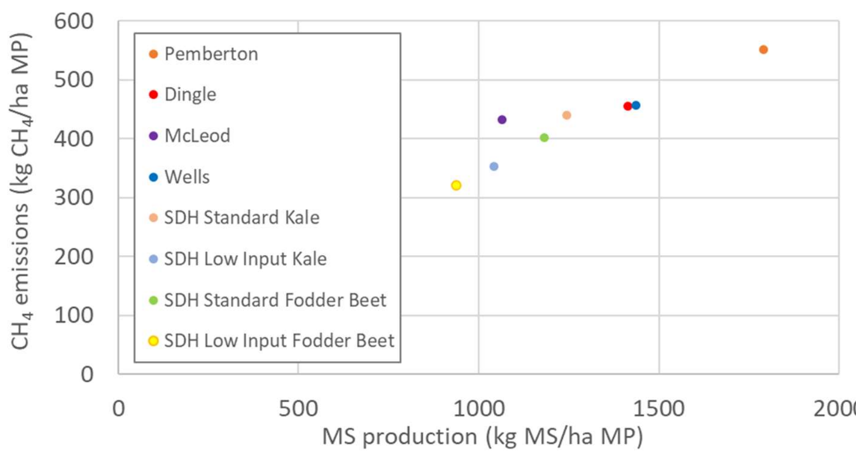


Figure 15: *Relationship between milk solids production and methane emissions for the SDH farmlets & the Satellite Participatory Research farms*

Key messages

- Reducing system intensity (N fertiliser inputs & stocking rate) had a much larger affect on GHG footprints than choice of crop type
    - The LI systems had 20% lower methane footprint and 35% lower long-lived gas footprint than the Standard farmlet systems.
    - The Fodder beet systems had a 9% lower methane footprint and 13% lower long-lived gas footprint than the Kale systems.
    - The reduced N inputs in the LI systems also resulted in a reduction in direct and indirect N2O emissions from fertiliser use and from urine and dung deposition.
- GHG pricing based on the ETS 'back-stop' and the He Waka Eke Noa farm-level split-gas levy across the four farmlets ranged from \$41 to \$61/ha MP assuming a 95% discounted rate with He Waka Eke Noa.

Detailed results available in the March 2022 Field day handout.

The Farm

Farm Area
Milking platform: 299 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 °C
Mean Annual Minimum Temperature - 5.4 °C
Average Annual Soil Temperature – 11.0 °C
Average Annual Rainfall – 785.4 mm

Soil Types
Table 4: 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.
Makarewa	Bottom terrace	Poor aeration during wet periods due to poor sub surface drainage and slow permeability. Severely vulnerable to waterlogging in wet periods.

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
Table 5: BW and PW as of 10 October 2022

		BW	PW
Pink – Std Kale	**Cows (230)**	203	257
Blue – LI Kale	**Cows (141)**	208	258
Green - Std FB	**Cows (230)**	203	249
Yellow – LI Kale	**Cows (141)**	217	274
Grouped	**Yearlings**	278	284

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

Proudly supported by: