DIVERSE PASTURES AND RELEVANCE TO NEW ZEALAND DAIRY FARMING

Diverse Pastures Open Day 2025

www.dairytrusttaranaki.co.nz

Dairy Trust
TARANAKI

AGENDA

10:45 am	**Introduction and H&S**
10:50 am	**Dairy Trust Taranaki trial overview and results**
11:20 am	**Introduction Allan Marx**
11:35 am	**Walk to paddock**
11:45 am	**Allan's Diverse Pasture Outcomes**
12:40 pm	**Walk back to the shed**
12:45 pm	**Summary**
1:00 pm	**Lunch**

This project is funded by MPI through the sustainable food and fibre futures (SFFF) and supported by NZ dairy farmers through DairyNZ.

DISCLAIMER
Please note that the majority of the results presented in this handout are preliminary results that have not yet been statistically analysed.

HEALTH AND SAFETY

- Slippery races when wet
- Vehicles and machinery may be operating
- Electric fences are on
- **No go areas:** effluent sump, chemical storage
- Any accidents or near misses to be reported to DTT or DairyNZ staff
- Meeting point: middle of tanker loop
- First Aid kit available from DairyNZ staff
- First Aid lead: Katie Sievwright (DairyNZ)

TRIAL OBJECTIVE

Dairy Trust Taranaki is conducting a two farmlet study over a 7-year period to assess the economic and environmental impact of diverse pastures as part of the *Regenerating Aotearoa* program. This program investigates the impacts of regenerative farming practices funded by MPI through the *sustainable food and fibre futures* (SFFF) fund.

PROFITABILITY AND PRODUCTION

determine how well diverse pastures perform relative to profit and production from conventional ryegrass-based pastures.

ENVIRONMENTAL

determine whether diverse pastures lead to reduced N leaching and retain or increase soil carbon compared with ryegrass-based pastures.

WELLBEING AND VALUES

determine whether diverse pastures provide farmers and their communities with better outcomes with regards to how the production system is perceived by themselves, consumers and other stakeholders.

TRIAL OVERVIEW

The study involves 2 farmlets (20 paddocks each) at the DTT Waimate West farm investigating a farmlet with conventional ryegrass/clover-based pastures (control farmlet) vs. a farmlet which is transitioned into diverse pastures (trial farmlet) over time. The two farmlets were established in spring 2021. The farmlets were balanced for location, Olsen P, Soil K, effluent use, new grass, previous cropping history and randomised on soil fertility. Initial randomisation of cows took place in January 2022. 120 Jersey & Jersey X cows were randomised on age, BW, PW, calving date, liveweight, condition score and previous milk solids production. Both herds are full autumn calving as the area is traditionally summer dry. At the start of the trial both farmlets were stocked at 3.5 cows/ha. The stocking rate was reduced to 3.0 cow/ha in the second year.

Both farmlets are run as full autumn calving systems, with the dairy season running from February to January the following year.

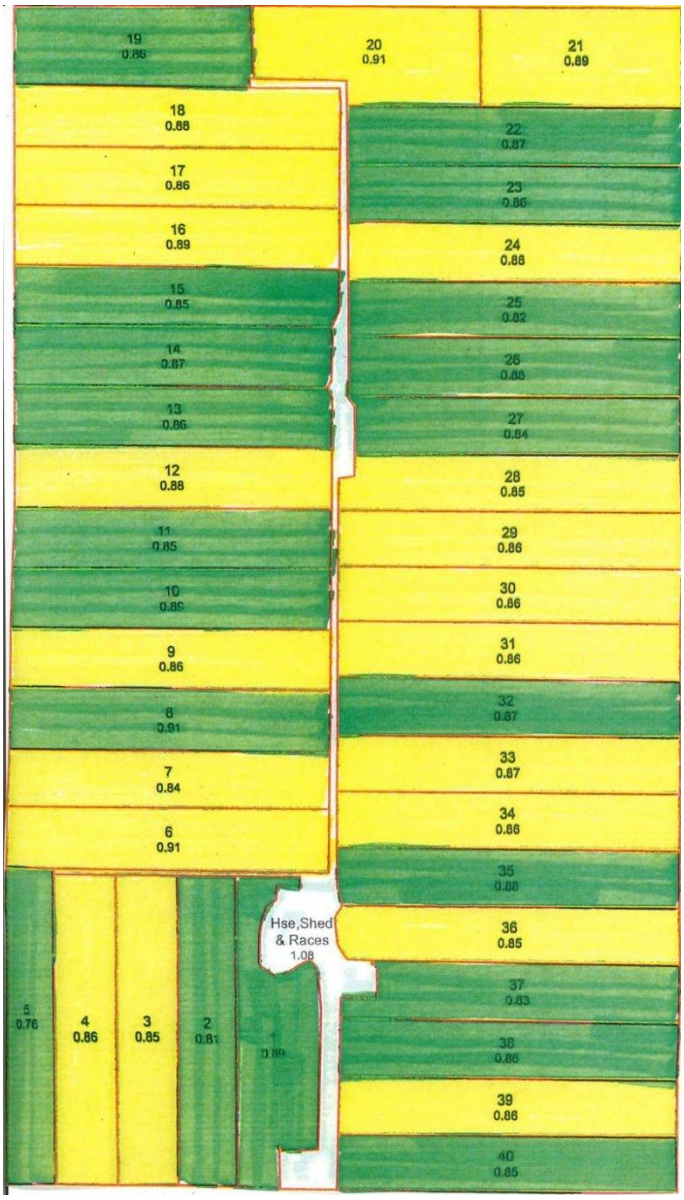


Figure 1 Map of Waimate West Demonstration Farm. Yellow is the diverse farmlet, green is the conventional farmlet.

Farmlets:

Diverse – Initially, 20% of the diverse farmlet were sown in a diverse pasture mix while the remainder of the farmlet was still in conventional ryegrass/clover pastures. An additional 10% of the farmlet was sown into diverse pastures annually following a crop of maize.

Conventional – current system with 'conventional' ryegrass/clover-based pastures. Every time a new area was sown into diverse pastures on the diverse farmlet, the same size area has been resown into standard ryegrass/clover pastures on the conventional farmlet.

The farmlets have gradually been resown over the 3 years of the trial and 60 % of the diverse farmlet has now been sown into diverse pastures. The aim is to have 100 % of the diverse farmlet sown into diverse pastures and 100% of the conventional farmlet resown by the end of year 5 of the trial.

Figure 2 Diverse Pastures species, seed supplied by Barenbrug.

Table 1 Experimental design year 1, 2 and 3 of the trial.

	Year 1 (22/23 season)		**Year 2** (23/24 season)		**Year 3** (24/25 season)	
	Conventional	Diverse	Conventional	Diverse	Conventional	Diverse
effective ha	17.2	17.2	17.2	17.2	17.2	17.2
cows	60	60	53	52	51	51
stocking rate (cows/ha)	3.5	3.5	3.1	3.0	3.0	3.0
nitrogen (kgN/ha)	78	88	114	112	109	112
capital fert	synthetic	Osflo	synthetic	Osflo	synthetic	Osflo
Maize (ha)	1.7	1.7	1.7	1.7	1.7	1.7
pasture species	rye/clover	13 species mix	rye/clover	13 species mix	rye/clover	13 species mix
Area regrassed	30%	30%	40%	40%	60%	60%

MEASUREMENTS

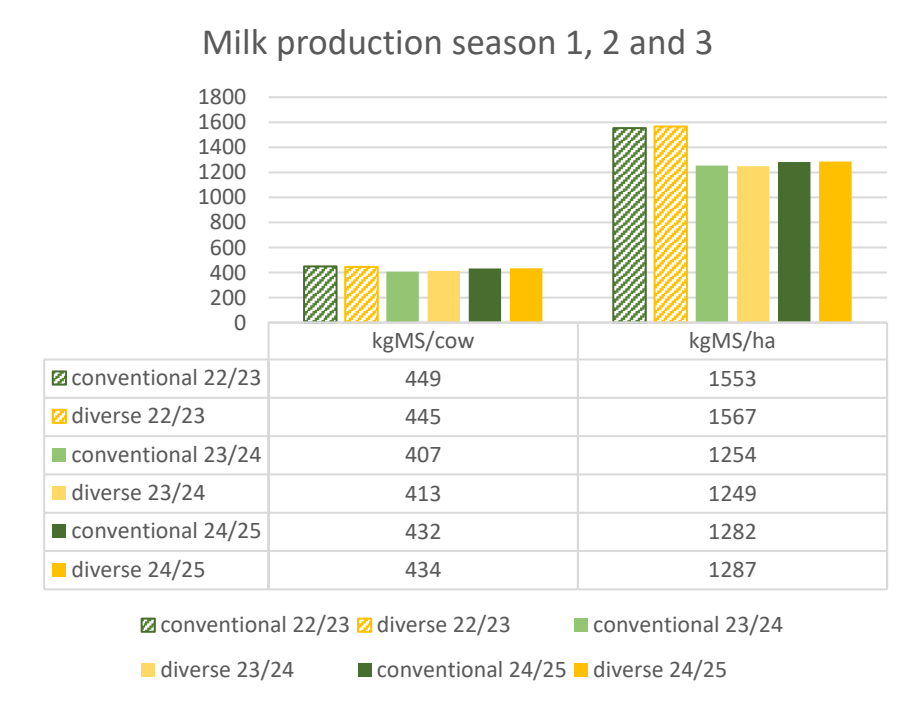
The following parameters are measured throughout the trial:

- Milk production
- Liveweight, BCS and animal health
- Mating and calving information
- Supplements – all supplements harvested and fed
- Soil biology – earthworms, pasture pests and nematodes
- Soil physics – macroporosity and water holding capacity, soil carbon and nitrogen
- N leaching – suction cups and lysimeters
- Pasture composition and pasture quality
- Milk senses and human health benefits testing

YEAR 3 RESULTS

MILK PRODUCTION

The milk production has been very similar so far for the two herds and there were no significant differences between the two herds. The milk production per cow and per hectare was slightly higher in the third season compared to the second season of the trial. Per hectare production was significantly higher in the first season due to the higher stocking rate.



	kgMS/cow	kgMS/ha
conventional 22/23	449	1553
diverse 22/23	445	1567
conventional 23/24	407	1254
diverse 23/24	413	1249
conventional 24/25	432	1282
diverse 24/25	434	1287

Figure 3 Yearly milk production, Kg MS/cow and Kg MS/ha.

SUPPLEMENTARY FEED

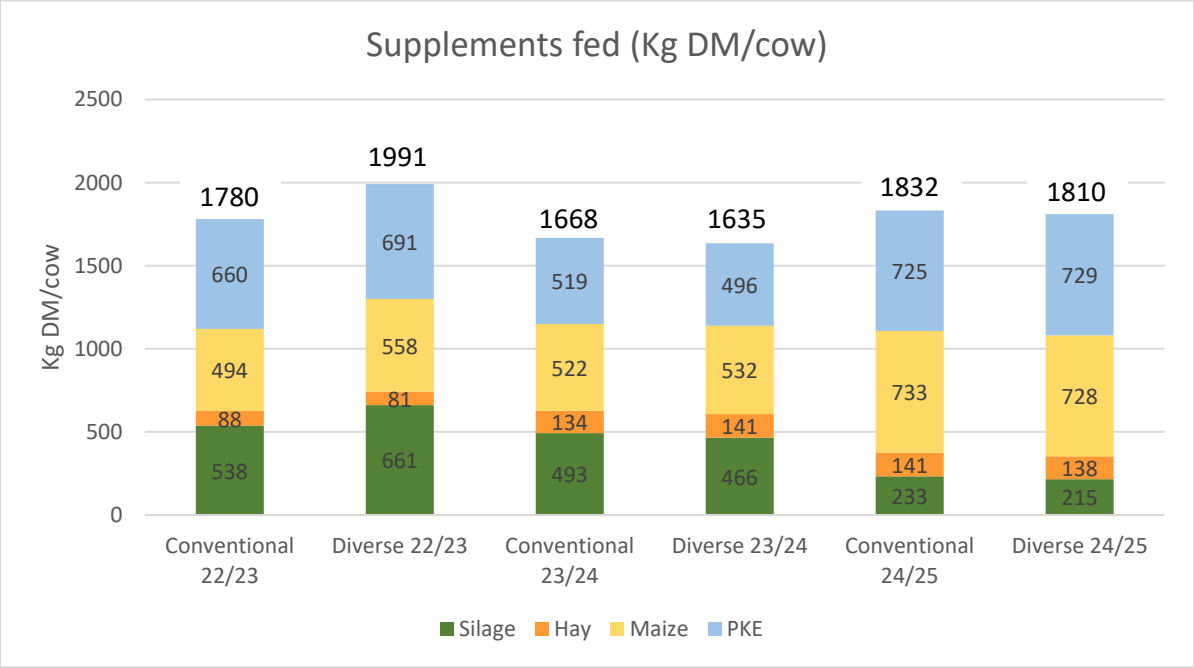


Figure 4 Supplementary feed fed (Kg DM/cow)

Like any autumn calving system both herds required considerable amounts of supplements in all three seasons of the trial (Figure 4). Large amounts of supplement were needed in the first season due to a higher stocking rate. Very dry conditions in summer and autumn 2024 required more supplements to be fed in the third season of the trial compared to the second season. The amounts of additional supplements were very similar on both farmlets in the third season of the trial. All hay and pke was bought in, while the maize and the majority of the silage was homegrown on the respective farmlets.

PASTURE AND CROPS

In Figure 5 below the pasture growth for the third season of the trial on the diverse and conventional farmlet is shown and compared to the two previous seasons of the trial. It was a very dry summer, autumn and winter in 2024 leading to very low pasture growth in February, March and April. Pasture growth increased slightly in May, June and July to levels similar to previous seasons. The lack of rain contributed to minimal pasture damage during winter milking, supporting very good pasture growth on both farmlets, from August to November. The diverse farmlet had a higher average pasture growth than the conventional farmlet in September, October and November due to italian ryegrass, chicory and larger amounts of clovers in the pastures which exhibit strong spring growth. Pasture growth in January was lower than the two previous years of the trial on both farmlets.
Rainfall throughout the last 12 months has only been 55% of normal, resulting in extremely dry conditions this summer.

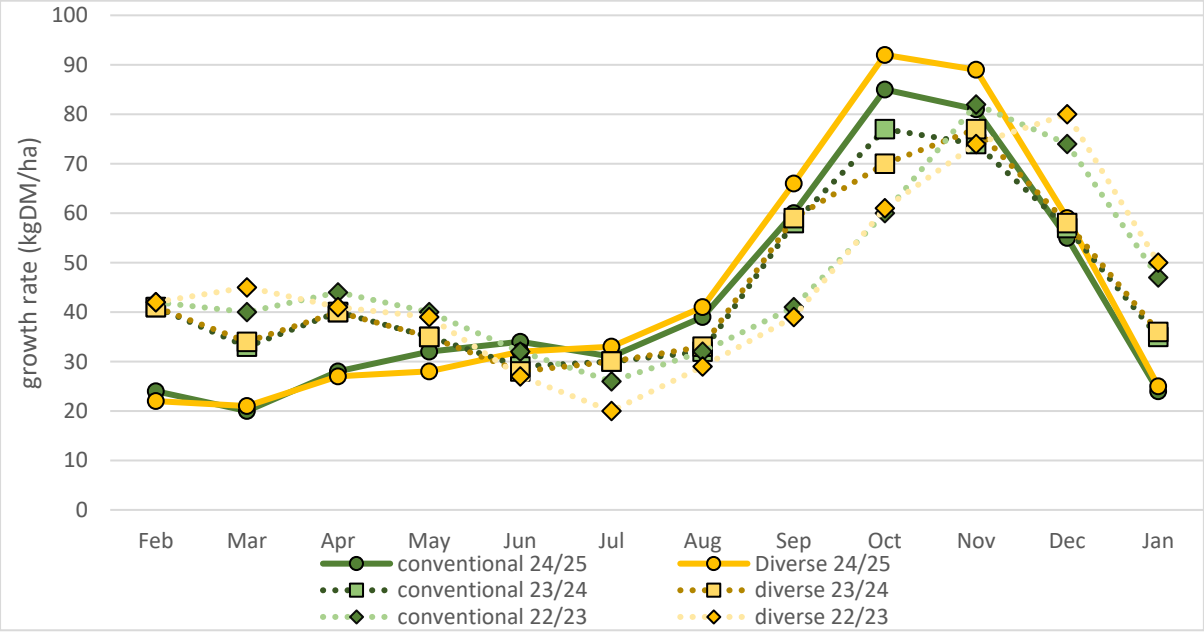


Figure 5 Average monthly growth rates of the conventional (green) and diverse (yellow) farmlets in year 1 – 3 (22/23, 23/24, 24/25 seasons).

In Figure 6 the growth rate of only the paddocks that have been resown into diverse pastures is compared to the growth rates of the whole diverse farmlet and the conventional farmlet. The difference in growth rate between the diverse and conventional pastures in spring was even more pronounced when looking at the diverse pastures only.

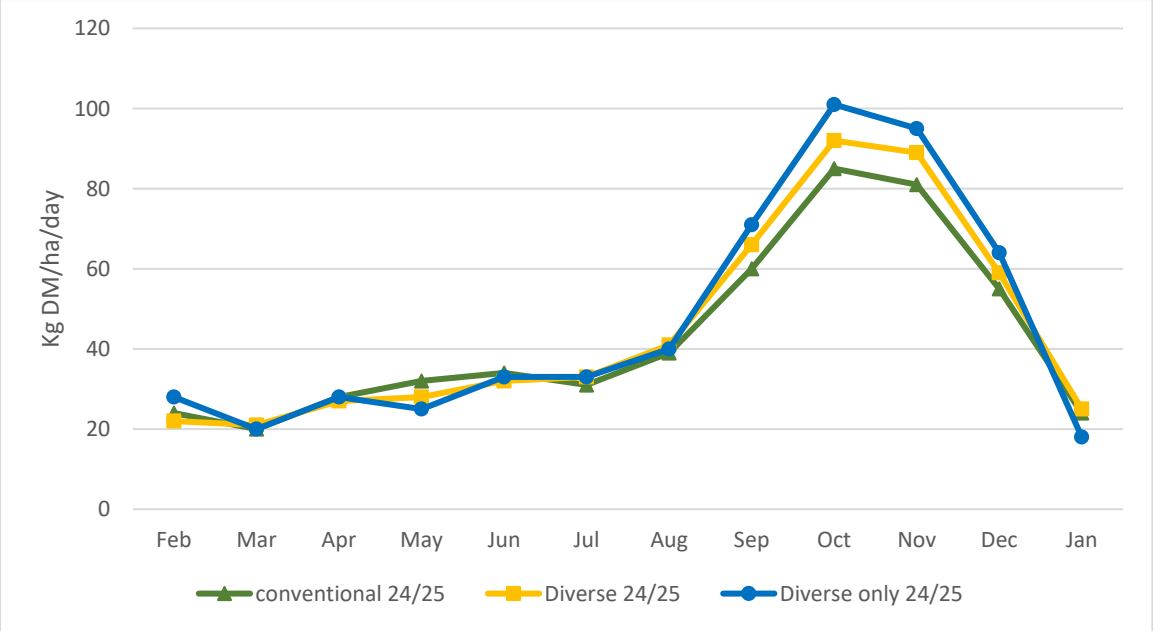


Figure 6 Average monthly growth rates of the conventional (green) and diverse (yellow) farmlets in year 3 (24/25 season) compared with the average monthly growth rates of diverse pastures only (blue).

PROFITABILITY

Both farmlets achieved similar total milk production. The average milk price was $0.03 higher per kgMS on the diverse farmlet, as this farmlet produced slightly more milk during the period of winter milk premium.

However, overall, profitability on the conventional farmlet was 3% higher than on the diverse farmlet. This was due to farm working expenses being $0.10/kgMS higher on the diverse farmlet. This increase was caused by higher costs of fertiliser and regrassing. Osflo fertiliser was used on the diverse farmlet instead of synthetic capital and maize fertiliser. While the cost of the seed was similar for both farmlets, the split seed approach in the establishment of the diverse pastures resulted in extra contracting costs, making the regrassing $100/ha more expensive than on the conventional farmlet.

Income		**Conventional**	**per ha**	**Diverse**	**per ha**
kgMS		22,049	1282	22,136	1287
Milk income	C: $10.27/kgMS, D: $10.30/kgMS	$226,502	$13,169	$228,023	$13,257
Net Stock sales		$13,967	$812	$13,326	$784
Total income		$240,469.13	$13,981	$241,349	$14,197
Total expenses		$166,262	$9,666	$169,186	$9,836
EFS		$74,207	**$4,314**	$72,162	**$4,195**
FWE/kgMS		$7.54		$7.64	

LEARNINGS

ESTABLISHMENT OF DIVERSE PASTURES

Different approaches to the establishment of the diverse pastures have been tested. The first paddocks were sown into the complete Barenbrug diverse pasture seed mix (Figure 2) adding all the seeds at once. Figure 7 below shows how the botanical composition of these pastures has developed over time from summer 2022 until spring 2024. The chicory established very quick and strongly, overshadowing the other species and keeping the proportion of grasses quite low during the first spring. Over time, the proportion of chicory reduced, allowing other species as well as weeds to come through. This also led to opening up of the pastures, resulting in reduced yields. These pastures were therefore undersown in autumn 2024 and topped up with ryegrass, brome and cocksfoot.

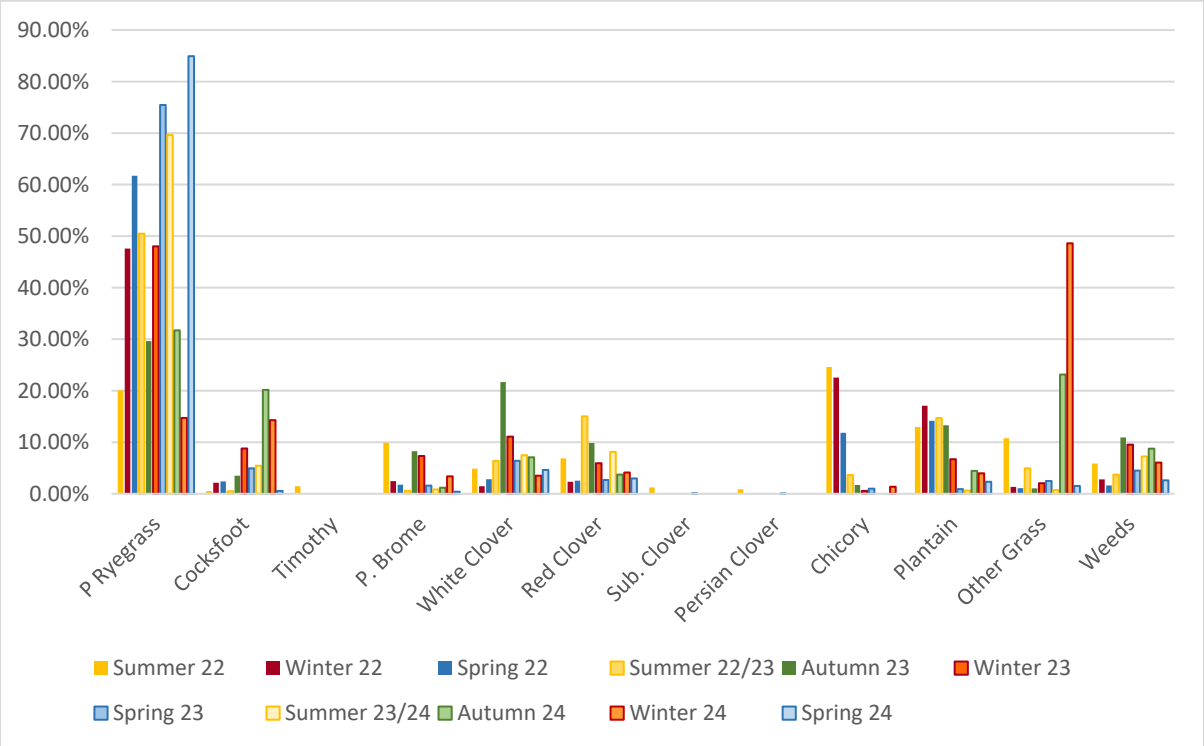


Figure 7 Composition of diverse pastures sown in spring 2021 over time

Ryegrass: The amount of ryegrass present in the pastures varied throughout the season. It was generally higher in winter and spring, and lower in summer and autumn. The ryegrass proportion was particularly low in autumn and winter 2024, when it struggled in the prolonged dry conditions of that season and summer grasses (other grasses) were invading.

Cocksfoot, Brome and Timothy: These species struggled to establish at the start due to the vigorous growth of the chicory. Once the chicory weakened, the cocksfoot and the Brome got stronger. The amount of cocksfoot increased significantly after the paddocks were undersown in autumn 2024 but decreased again in the spring 2024 samples. Timothy did not establish well and did not withstand repeated grazing.

Clovers: The amount of white and red clover varied within and between the seasons, 1 – 22 % for white clover and 1 – 15 % for red clover. Sub clover and persian clover did not seem to establish well and only very small amounts were found in some of the samples with the amounts being highest during the first year, as expected from annual clovers.

Chicory and Plantain: The amount of chicory and plantain was highest in the beginning, up to 24 % for chicory and 17 % for plantain. However, after the first season the amounts of chicory reduced quickly and after spring 2022 there has only been very small amounts of chicory in the pastures (0.6 – 3.6 %). The amount of plantain has also reduced over time and has been below 10% since winter 2023.

Testing new approaches for establishment of the diverse pastures

Split seed approach 1: To try to get a better control over the weeds in the diverse pastures a split seed approach was tested. The paddocks were sown with italian ryegrass, perennial ryegrass and brome in the autumn. Weeds were controlled with post-emergence spray. The following spring cocksfoot and the herbs and legumes were added. However, the high growth of ryegrasses, particularly italian ryegrass, in the spring made it difficult for the herbs and legumes to establish.

Split seed approach 2: To try to improve the establishment of the herbs and legumes, italian ryegrass was excluded from the seed mix as its vigorous growth during spring caused shading, delaying the small seeds that were added in spring from coming through. The italian ryegrass was replaced by Forge, a hybrid tetraploid ryegrass with less vigorous growth in spring. The grasses and perennial clovers were sown in April and then the herbs and annual clovers were added in spring, with stronger establishment of these species compared to approach 1.

Split seed approach 3: In spring 2024 a new approach for the establishment of the diverse pastures was tested where the herbs (chicory and plantain) and annual clovers were sown first in spring and grazed over summer. This crop will be topped up with the grasses (ryegrass, cocksfoot and brome) and perennial clovers in autumn 2025. Sowing herbs and clover first, is opposite to the previous strategies where the grasses were sown first, and it will be interesting to compare the results of the two different approaches.

Figure 8 Pasture of herbs and annual clovers (split seed approach 3).

PASTURE QUALITY

Energy levels of the diverse pastures were the same as of the conventional pastures, with the same changes throughout the seasons, being lowest in March (Figure 9).

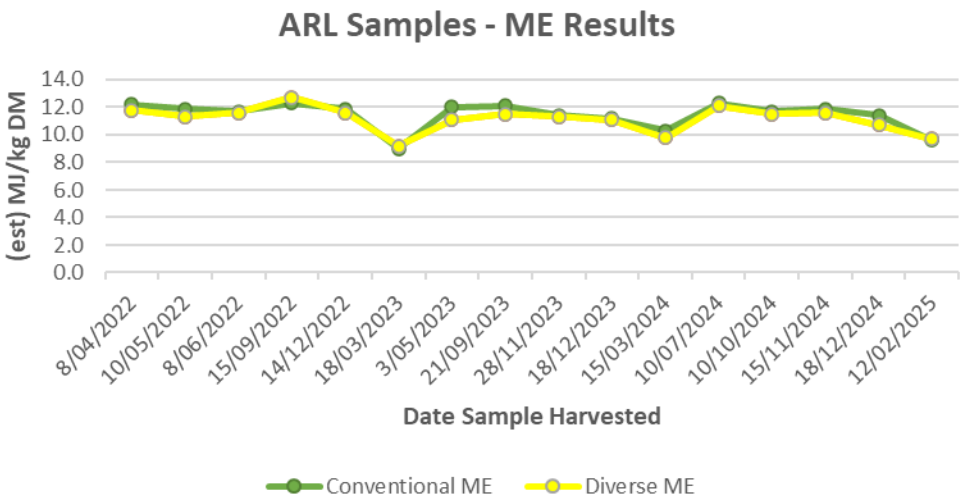


Figure 9 Comparison of energy levels in the conventional and diverse pastures.

Protein levels in the diverse and conventional pastures followed the same trend, with differences in protein content between the pasture types at certain times of the year. The diverse pastures tended to have higher protein content in spring. This is at a time when protein content is traditionally already high in conventional pastures and therefore the extra protein in the diverse pastures is most likely excess to a cows' demand. Apart from one conventional sample in February 2025, all conventional and diverse samples had protein content above levels (18%) where it becomes production restrictive.

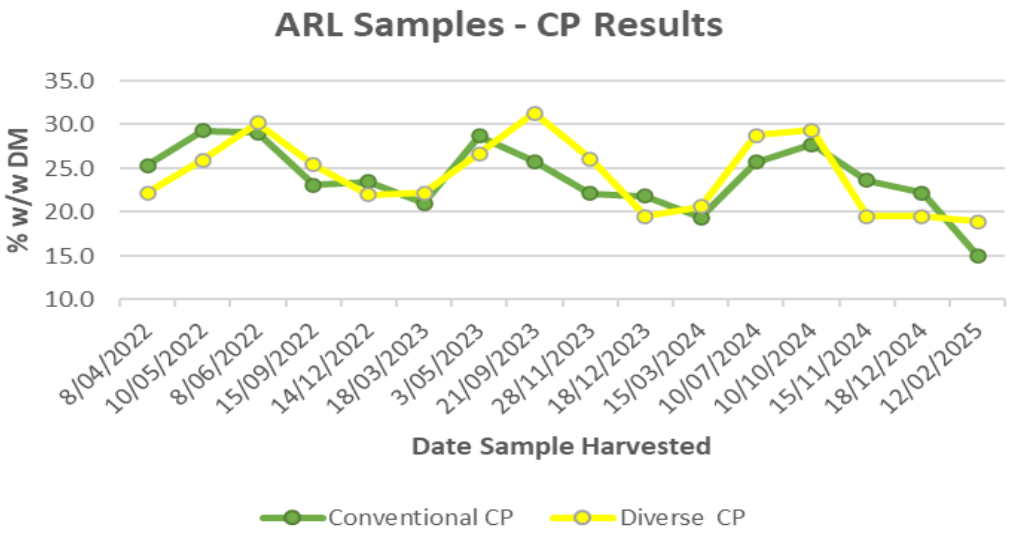


Figure 10 Comparison of protein levels for the conventional and diverse pastures

NDF content was higher in the conventional pastures, with the difference smallest during spring. High fibre content can become restrictive on intakes and therefore production, as cows are only able to eat about 1% of bodyweight in fibre.

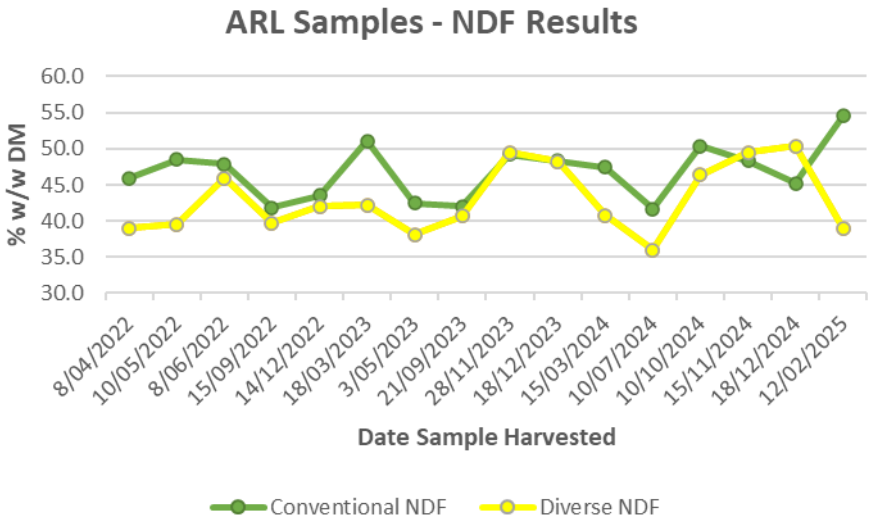


Figure 11 Comparison of NDF levels for the conventional and diverse pastures.

SOIL BIOLOGY

Soil biology is assessed through a combination of measurements, including microbial biomass, microbial respiration, microbial diversity, nematodes, earthworms, and insect pasture pests. The results from samples taken between Spring 2021 and Spring 2024, showed variability in abundance and activity in soil biology between sampling times but no significant differences in the soil biology between the two farmlets. The difference between the two farmlets may be limited so far due to the short time since the establishment of the diverse paddocks.

Figure 12 Soil biology samples are taken twice a year in autumn and spring on both farmlets.

NITROGEN LEACHING

Nitrogen (N) leaching losses are determined by measuring the nitrate and ammonium concentrations in soil water below plant rooting depth by sampling leachate from ceramic suction cups (Figure 13).

Figure 13 Collection of leachate samples from ceramic suction cups.

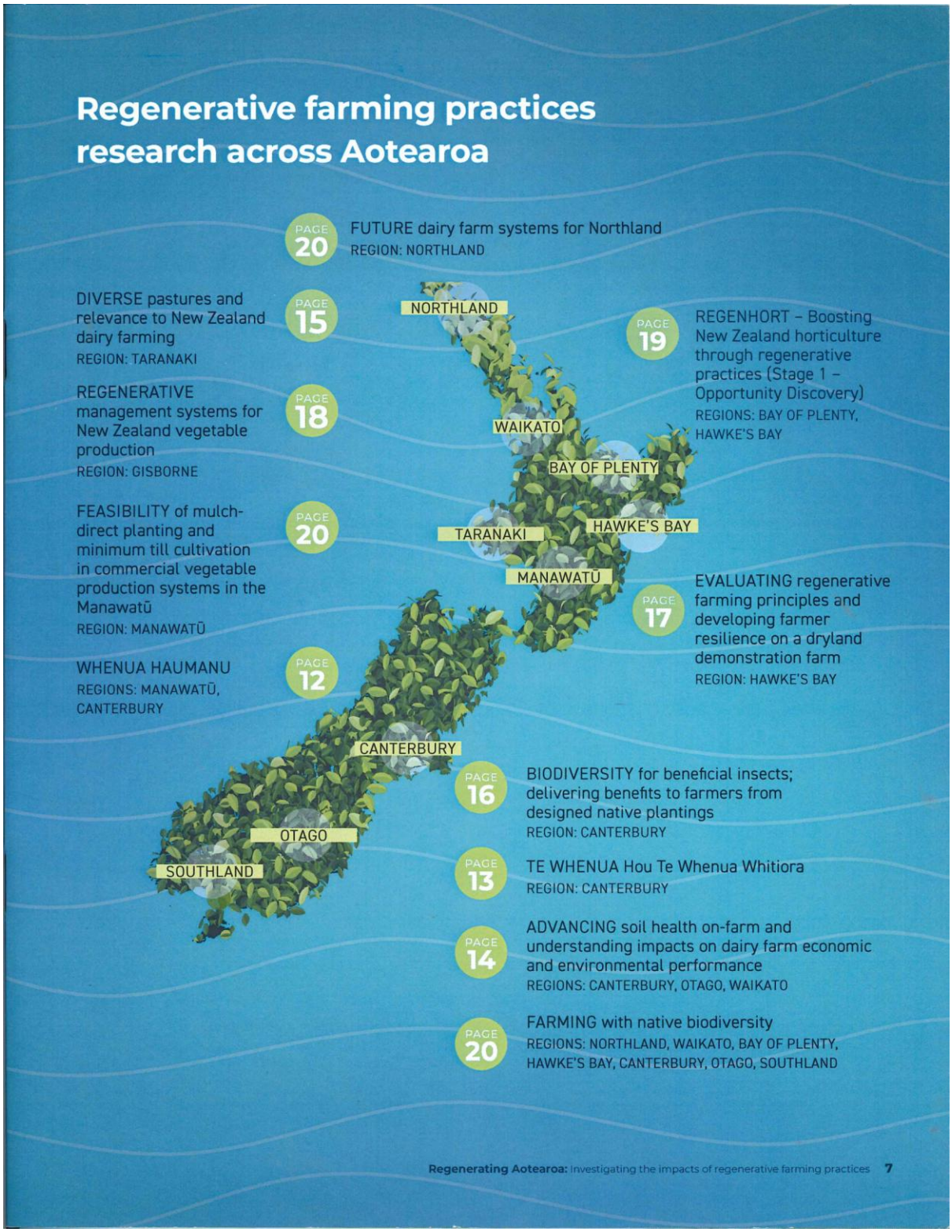
The analyses of the first two years of leachate collections show no statistically significant differences in nitrate-N or ammonium-N concentrations between the two farmlets. There were also no statistically significant differences in the total amount of nitrogen leaching on the farmlets. However, it is still early in the trial as this was only the second year of sampling of the suction cups. The suction cups are at 800 mm depth. Cumulative drainage of over about 400 mm is required before surplus N at the soil surface moves down to 800 mm depth. Due to the very dry conditions in summer, autumn and winter 2024 the amount of drainage was only 187 mm. There could therefore be an initial lag before the effects of the different pastures on the two farmlets will start to become evident.

CONCLUSION

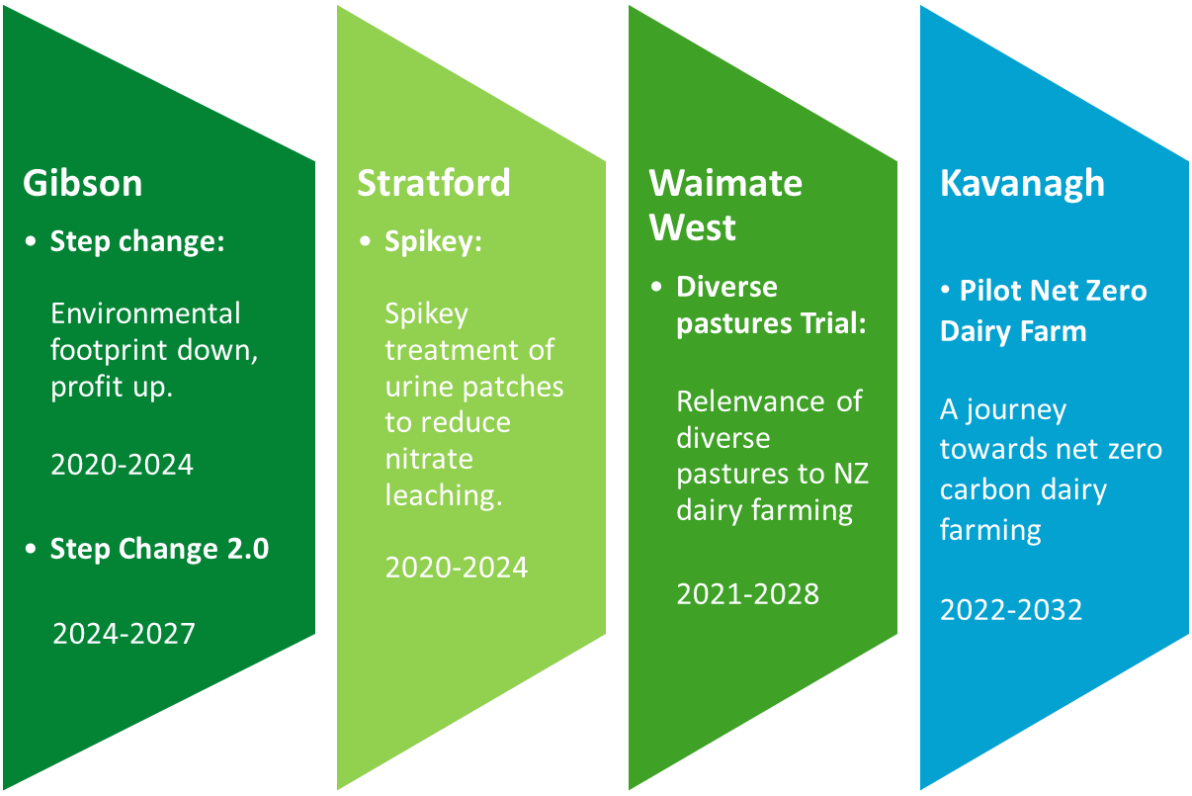
The pasture growth was slightly higher for the diverse pastures in the spring. It was found that the botanical composition of the diverse pastures changes with the seasons and the growing conditions. This aligns with the objective of diverse pastures, where different pasture species thrive under varying growing conditions. This results in more consistent pasture growth and quality compared to conventional pastures that depend on only a few species. Different methods for the establishment of the diverse pastures have been tested.

The cows were in good condition throughout the season and both herds were fully fed at all times with only little difference in feed quality from pasture. Therefore, no significant difference was seen between the two herds in terms of milk production. There was also no significant difference between the two farmlets so far in terms of nitrogen leaching. However, it is still early in the trial and there might be a lag in treatment differences due to the low amount of drainage over the last two years.

MPI - Regenerating Aotearoa: Investigating the impacts of regenerative farming practices (Aug 2022).



For more information on diverse pastures and on the trials that Dairy Trust Taranaki is running on its other three farms sign up to the weekly farm walk notes and follow us across our social media channels.



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