A survey comparing regeneratively and conventionally managed pastures and farm management policies

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Abstract
A pasture and farm management survey was conducted on thirteen geographically paired regenerative and conventional beef and sheep farms in the upper North Island to identify differences in pasture attributes and management practices. Farms were paired by geographical location and livestock type. When compared to conventional pastures, regenerative pastures had a similar number of grass, legume and broadleaf species (averaging 4, 1 and 3 species respectively), three times as much legume (13 compared to 4% content) and 30% less perennial ryegrass in total DM ($P<0.01$) but a similar broadleaf content. There was no difference between pasture types in pre- or post-grazing covers. Compared to conventional pastures, soils sampled from regenerative pastures had a higher pH, and herbage had higher levels of calcium, boron, molybdenum ($P<0.05$) and a trend towards lower Olsen P values ($P=0.052$). There was a divergence between farm types in fertiliser policies, with regenerative farmers generally not using synthetic nitrogen (N) and phosphorus (P) products and applying a wider range of nutrients. Herbicides and pesticides were used across both farm types. Changes in pasture composition (*i.e.*, less perennial ryegrass and more clover) and soil nutrient status were consistent with lower N and P inputs on regenerative farms.

Keywords: Botanical composition, botanical diversity, grazing management, regenerative farming

Introduction
There are many definitions of regenerative agriculture, some are process-focused and others outcome-focused. A recent review of 229 journal articles and 25 practitioner websites, indicated that there is no simple widely accepted definition of regenerative agriculture (Newton et al., 2020). Key elements of regenerative agriculture, however, frequently include a focus on higher pasture covers before grazing and higher residuals after grazing, a longer grazing round, increased botanical diversity and reduced synthetic fertiliser use (Newton et al., 2020). The extent to which these practices have been adopted on farms in New Zealand is unknown, although there is growing interest in the concepts aligned to regenerative farming in New Zealand (Rowarth et al., 2020).

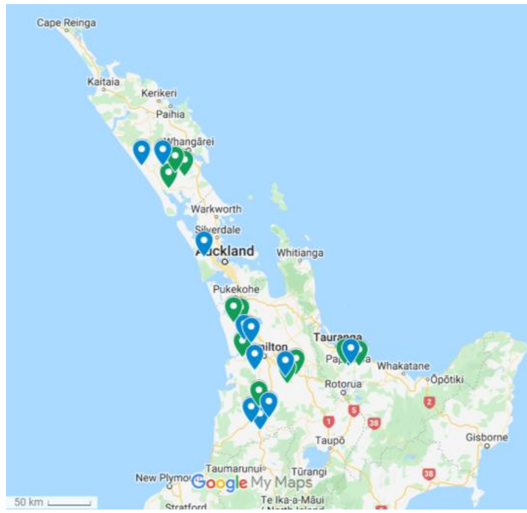

Figure 1 Location of farms in Waikato, Bay of Plenty and Northland included in the survey. Blue points: conventional farms; green points: Regenerative farms.

To obtain clarity regarding how to define regenerative agriculture, and to inform research on how regenerative farming affects the pasture, soils and farm system in a New Zealand context, it is important to identify differences between regenerative and conventional beef and sheep farming in New Zealand. As a first step, a survey was undertaken to identify if there were major differences between farm types, including key pasture attributes, soil attributes and management practices.

Materials and Methods
Farm selection
Thirteen farmers that self-classified as following regenerative agriculture practices for a minimum of two years were identified through industry networks and contacts (*e.g.*, Grandad's Beef, AgFirst, Beef + Lamb New Zealand). There were ten in Waikato-Bay of Plenty and three in Northland (Figure 1). Each of the farms was paired with a nearby farm that had a similar

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livestock type and which was considered by the farm owner to have always been farmed conventionally (*i.e.*, following current industry management practices). Farms were either solely beef or beef and sheep and paired based on being in the same region, and in as close proximity to each other as possible. The average distance between farms within each pair was approximately 25 km, with most within 20 km of each other. Farms in one Northland pair were 86 km apart.

Pasture and soil survey

Paddock selection

A paddock was selected on each farm for pasture and soil measurements based on the following criteria: i) considered by the farmer to be typical for the farm - including the fertiliser program and grazing practices, ii) had not been used for cropping, hay or silage within the last 5 years, iii) less than 15° slope, and iv) ready for grazing within 48 hours. Steep paddocks were avoided as it was considered that topographical and climatic factors would be more important than management in determining the species composition. Management was viewed as playing a greater role in pasture composition on low sloping land. At the same time, an additional paddock was selected using the above criteria, for a post-grazing assessment that had been grazed within the previous 48 hours.

Pasture and soil measurements

Pastures on two Waikato farm pairs were surveyed before the onset of summer moisture deficit in early November and mid-December 2020 respectively, with the remaining eleven pairs surveyed over 5 weeks in late autumn 2021 when pastures were green and vegetative.

Herbage mass, nutritive value and mineral content, botanical composition, and soil nutrient status were assessed prior to grazing, and the residual herbage mass of a pasture after-grazing. Assessments were done on the same day for each of the pairs except one, which was done in the same week.

Herbage mass was estimated using a rising plate meter (Jenquip EC10 plate meter, Feilding, New Zealand), taking a total of 100 readings at 1 m intervals along a 100 m transect.

To assess botanical composition, 30 randomly selected pasture samples were collected using the "toe-cut" method described by Cayley and Bird (1996) at 2-3 m intervals along the herbage mass transect. Samples were bulked, mixed and sub-sampled in the field using the quartering method (Cayley and Bird 1996). To determine the nutrient content of the herbage, sub-samples of the herbage were immediately frozen (-20°C), freeze dried, and ground to a fine power using a 1 mm sieve size (Cyclone Sample Mill, UDY, Fort Collins, USA). Ground samples were sent to Hill Laboratories (Hamilton, New Zealand) to determine the mineral content of the herbage (as detailed in Table 3), crude protein, digestibility and metabolisable energy by near infrared reflectance spectroscopy (NIRS) (Corson et al*.,* 1999).

The remainder of the material was transported chilled to the lab, stored at 4°C and separated into perennial ryegrass (*Lolium perenne* L.), other grasses, legumes, broadleaf species and dead vegetation components within 48 hours of collection. Each component was dried at 65°C to a constant weight to determine its contribution to total dry matter. All species present in the herbage samples were identified.

To determine the soil nutrient status, 30 cores were randomly sampled to a depth of 75 mm at 2 m intervals along the herbage mass transect, bulked, stored in a sealed bag at 4°C and sent to Hill Laboratories (Hamilton, New Zealand) for analyses within 3 weeks of collection.

Farm management survey

A survey covering farm level attributes, such as area, livestock types and classes, pasture renovation/ cropping, pasture management, fertiliser inputs, supplement use, and herbicide/pesticide use was sent to farmers at each of the 26 sites. Each farmer was also asked for their opinion on how regenerative farming compares to conventional farming in relation to the pasture, soil, animal performance and animal health, and regenerative farming future research needs.

The survey was sent electronically, with the farmers having the option to either print and complete the survey by hand, or complete the survey electronically (Human Ethics application #13.21). Two farmers opted to complete the survey over the phone with a member of the project team noting the answers. Surveys were completed by all 13 regenerative farmers and 12 conventional farmers. The survey was semi-qualitative and based on farmers opinions and management practices; therefore, statistical analysis was not performed but key themes were identified.

Statistical analyses

Pasture and soil data from the pasture survey were analysed in Genstat, 20th edition (VSN International, 2020). Firstly, data from the Waikato and Bay of Plenty were analysed together using Analysis of Variance. The blocking effect was the farm pair and the treatment effect was farm type (regenerative or conventional). We assumed that pastures from Waikato and Bay of Plenty would be similar based on previous research (*e.g*. Tozer et al., 2014) but that both would be different to pastures in Northland where kikuyu was more prevalent. Secondly, REML was used to analyse data from all regions. The random effect was farm pair, and the fixed effect was the farm type. Results from the two analyses were similar.

Thus, we have only reported results from the second (all region) analyses. Since all data met the normality assumptions of the analyses, no data transformations were performed. Mean separation was assessed by Fisher's protected Least Significant Difference (LSD).

Results

Pasture and soil survey

Species diversity

There was no difference between the two farm types in the number of grass, legume or broadleaved species (P>0.05). The total number of plant species was greater in regenerative than conventional pastures (averaging 9.4 vs 7.7 species, P<0.05, Table 1).

A total of 40 species were present in the 26 surveyed pastures, although most species (26 out of 40 species) were only present were only present on four occasions (i.e. in under 10% of the surveyed pastures, data not shown). The most frequent species present were perennial ryegrass and white clover (each in 25

Table 1 The number of species present, herbage mass and botanical composition of the surveyed pastures.

Measurement Type	Parameter	Regenerative	Conventional	SED[1]	P value
Number species	Grasses	4.2	3.8	0.60	NS[2]
	Legumes	1.6	1.3	0.32	NS
	Broadleaved	3.6	2.6	0.73	NS
	Total plant species	9.4	7.7	1.06	0.03
Herbage Mass	Pre-grazing (kg DM/ha)	3230	2980	332	NS
	Post-grazing (kg DM/ha)	1790	1660	122	NS
	Difference (pre-post, kg DM/ha)	1440	1320	338	NS
	Difference (% of pre-grazing)	45	44	5.7	NS
Botanical Composition	Perennial ryegrass	27	39	6.0	0.002
(% total DM)	Total grass	56	69	7.3	0.005
	Broadleaved	15	8	5.3	NS
	Legumes	13	4	4.6	0.005
	Dead	16	19	3.4	NS

[1]SED: Standard error of difference.
[2]NS: Not statistically significant (P>0.05).

Table 2 Species present in five or more of the surveyed pastures.

		Number of farms in which a species was present		
Vegetation type	Plant name	Regenerative	Conventional	Total
Grasses	Perennial ryegrass (*Lolium perenne*)	12	13	25
	Annual poa (*Poa anuua*)	13	11	24
	Browntop (*Agrostis capillaris*)	5	8	13
	Yorkshire fog (*Holcus lanatus*)	4	5	9
	Soft brome (*Bromus hordeaceus*)	4	1	5
Legumes	White clover (*Trifolium repens*)	13	12	25
	Red clover (*Trifolium pratense*)	6	3	9
Broadleaved	Plantain (*Plantago lanceolata*)	10	9	19
	Buttercup (*Ranunculus repens*)	9	4	13
	Hawksbeard (*Crepis capillaris*)	6	5	11
	Hawkbit (*Leontodon taraxacoides*)	3	4	7
	Chickweed (*Stellaria media*)	4	3	7
	Fiddle dock (*Rumex pulcher*)	4	3	7
	Yarrow (*Achillea millefolium*)	2	3	5

pastures), annual poa (24), plantain (19), brown top and creeping buttercup (each in 13), hawksbeard (11) and yorkshire fog grass (9) (Table 2).

Pasture covers and botanical composition

There was no difference between farm types in the herbage available before grazing, residual herbage after grazing, or the difference between the pre-grazing and post-grazing herbage mass ($P>0.05$, Table 1).

There was less perennial ryegrass and total grass and more legume in total dry matter in regenerative than conventional pastures ($P<0.01$, Table 1). The percentage of 'other grasses', and of broadleaf species in total dry matter was similar in both pasture types ($P>0.05$).

There was no difference between farm types in the content of crude protein, digestible OM (DOMD) or metabolisable energy of the herbage ($P>0.05$, Table 3). Levels of calcium, boron and molybdenum in the herbage were higher, and manganese lower, when sampled from regenerative rather than conventional farms ($P<0.01$, Table 3).

Soil nutrients

Soil pH ($P<0.01$) and exchange calcium ($P<0.01$), magnesium ($P<0.01$) and sodium ($P<0.05$) were higher in soil sampled from under regenerative than conventional pastures (Table 3). There was a trend towards a lower Olsen P level in regenerative pastures (25 vs 41 mg/g soil) ($P=0.052$).

Table 3 Nutritive values and mineral content of the herbage and the soil nutrient status of the surveyed pastures.

Attribute		**Regenerative**	**Conventional**	**SED[1]**	**P value**
Pasture attributes: (% of total DM unless stated)					
	Crude protein (%)	18.5	17.6	0.78	NS[3]
	DOMD[2] (%)	69.3	68.8	1.36	NS
	Metabolisable energy (MJ/kg DM)	11.1	11.0	0.22	NS
	Phosphorus (%)	0.37	0.41	0.027	NS[3]
	Potassium (%)	3.06	3.12	0.306	NS
	Sulphur (%)	0.30	0.29	0.024	NS
	Calcium (%)	0.63	0.44	0.094	0.010
	Magnesium (%)	0.21	0.21	0.011	NS
	Sodium (%)	0.19	0.17	0.043	NS
	Chloride (%)	1.6	1.6	0.12	NS
	Iron (mg/kg)	550	290	156	NS
	Manganese (mg/kg)	90	123	14.2	0.005
	Zinc (mg/kg)	36	35	3.1	NS
	Copper (mg/kg)	11.1	9.4	0.62	NS
	Boron (mg/kg)	7.6	4.7	1.20	0.002
	Molybdenum (mg/kg)	0.72	0.41	0.117	0.005
	Cobalt (mg/kg)	0.53	0.35	0.083	NS
	Selenium (mg/kg)	0.06	0.04	0.012	NS
Soil attributes	pH	6.0	5.6	0.12	0.002
	Olsen P (mg/L)	25	41	8.79	0.052
	Potassium (MAF QT) [4]	14.9	12.3	1.61	NS
	Calcium (MAF QT)	16.5	9.5	1.76	0.004
	Magnesium (MAF QT)	43.7	27.3	3.78	0.009
	Sodium (MAF QT)	7.7	5.6	0.61	0.016
	Total nitrogen (%)	0.69	0.74	0.069	NS
	Total sulphur (mg/kg)	911	904	99.5	NS
	Total organic carbon (%)	7.7	7.8	0.76	NS

[1]SED: Standard error of difference;
[2]DOMD: digestibility of organic dry matter;
[3]NS: Not statistically significant ($P>0.05$).
[4]MAFQT: MAF Quick Test units (Cornforth, 1980; Cornforth and Sinclair, 1984).

Farm management survey

Farm Area

The average effective area ranged from 28 to 650 ha (average 176 ha) for regenerative farms and from 36 to 900 ha (average 335 ha) for conventional farms (Table 4).

Livestock types and classes

All farms selected for the study had a beef finishing policy to enable meat quality comparisons. Regenerative farms were heavily focused on cattle although fattening bulls did not feature on any regenerative farm (Table 4). Conventional farms had more diverse livestock types and classes – with an average of four on conventional farms and two on regenerative farms.

Re-grassing

Re-grassing was similar for both farm types, with eight regenerative and six conventional farmers undergoing some form of re-grassing each year, including full pasture renewal, over-sowing or under-sowing (Table 4). An average of 5% (4-13%) of the farm area was re-grassed on regenerative farms, and 3% (1-10%) on conventional farms. Both farm types showed a preference for direct drilling, with a small number of farms using cultivation.

Four of the regenerative farmers used a mix of grasses, legumes and herbs comprising up to 20 species. In contrast, conventional farmers used between 2 to 6 species comprising a range of grasses, legumes and herbs.

Supplements

Hay/baleage was commonly used on both regenerative and conventional farms (Table 4). Conventional farmers also used other supplements such as palm kernel expeller (two farms) and pelleted feeds and meals (two farms).

Fertiliser Products

Synthetic fertiliser use was limited by regenerative farmers, with one using DAP at a low rate of 50 kg/ha, another using SurePhos and one using urea at a low rate of 10 kg/ha in a humic acid slurry. Many (>80%) of the regenerative farmers commented that synthetic fertilisers should not be used under regenerative farming practices. Regenerative farmers used macro and micro-nutrients and often a wide range of soil conditioners such as fish hydrolysate and humates. Fertiliser rates, and the numbers of applications per year, varied between farms.

Eleven conventional farms used a form of either diammonium phosphate (DAP) or superphosphate, most with enhanced levels of potassium and sulphur, and to a lesser extent lime, urea and trace elements. Synthetic fertilisers were the products of choice for conventional farms, with a focus on the macro nutrients (nitrogen, phosphorus, potassium, sulphur).

Chemical use

Both farm types used herbicides such as glyphosate, the phenoxy herbicide ‘MCPA’, and Brushkiller (Table 4) for spot spraying or boom spraying of weeds such as gorse, thistles, and blackberry. Use of pesticides was uncommon across both farm types and was limited to control of slugs during pasture renewal or when sowing maize.

Defining Regenerative Farming

Most farmers stated that regenerative farming was about working with nature to enhance soil health. Some farmers also stated that it was defined by no use of synthetic fertilisers, not overgrazing pastures, and increasing diversity of pasture species. Some of the regenerative farmers suggested that this approach would lead to more nutrient-dense pastures, with healthier livestock. Some of the conventional farmers highlighted the need for regenerative farming to be defined with some pointing out that they are also building organic matter, so ‘why are we not classified as farming regeneratively’?

Soils

All regenerative farmers felt there would be improvements, including more microbial activity, and improved soil structure. Some conventional farmers felt that regenerative farming would improve the soil, for example, by increasing microbial activity and organic matter content, while other conventional farmers felt that there would be no difference.

Animals

All regenerative farmers felt that performance would improve through increased growth rates, more contented stock and more nutrient dense meat. Most conventional farmers felt stock performance would be poorer under regenerative systems due to lower fertiliser inputs. Regenerative farmers thought animal health would improve on regenerative farms while conventional farmers thought that animal health would be similar on both farm types.

On changing to regenerative farming

The drivers for the regenerative farmers to switch to regenerative farming practices were to reduce chemical use and synthetic fertiliser inputs, improve soil health, and to lift profitability through reducing inputs. Four conventional farmers felt they were already using regenerative practices but they were unsure how regenerative farming was defined. Two of the conventional farmers were concerned that profitability would be reduced if they switched to regenerative practices while the majority of farmers interviewed did not provide any comments.

Table 4 Farm and management data, of 13 regenerative and 12 conventional farm pairs, including region, effective farm area, years under regenerative farming, livestock types and classes (F: finishing, B: breeding), percentage of total farm area re-grassed per annum, fertiliser products, and supplement, herbicide and pesticide use. Supplements were grown on

Region	Area (ha)	Years regen farming	Livestock types and classes (#)	Area re-grassed (%)	Fertilisers and soil ameliorants
Regenerative farms					
Waikato	94	2.5	Steers, heifers (2)	7	Organibor, Elemental sulphur, Organic selenium chips, Sulphate of potash, Salt, Guano, Cobalt sulphite, Fish hydrolysate, EM Fulvic, Vermicast, Calcimate, Molasses
	60	24	Heifers, ewes (2)	0	Kiwi Fert
	182	10	Steers, heifers (2)	0	RPR, Dolomite, Potassium sulphate, Sulphur bentonite, Boron, Zinc sulphate, Ammonium sulphate, Fish hydrolysate, Greatlands soil conditioner, Clovertone, Bio Phos
	60	3	Steers, heifers, cows, ewes (4)	7	Fish hydrolysate
	400	2	Steers, heifers, dairy beef grazers, cows, ewes, hinds (6)	5	Calci-Life base mix, Elemental sulphur, Ag Salt, DAP (Diammonium phosphate), Zinc sulphate, Selenium chip red, Ag lime, Magnesium oxide, Copper sulphate, RPR (Reactive phosphate rock), Potassium sulphate, Potassium chloride
	30	2.5	Steers, heifers (2)	13	Humic acid, urea, Fish hydrolysate, EM Fulvic
	75	14	Steers, heifers (2)	11	Compost
	36	2	Steers (1)	11	SurePhos 9K + Salt, Copper, Boron, Selenium, Cobolt
	650	2	Steers, heifers (2)	4	Sulphate potash, Granular humic acid, Granulated lime, Guano
	175	9	Steers, heifers, cows (3)	0	Copper, Phosphorus, Potassium, Sulphur, Magnesium, Boron, Cobalt, Zinc, Lime
Northland	28	11	Steers, heifers (2)	0	Lime, EM Enhance, Microbes, Humates, Baleage, hay Sulphate of ammonia
	320	10	Steers, heifers (2)	0	Lime, Dolomite, Potassium sulphate, Borax, Selenium, Cobalt, Humates
	180	25	Steers, heifers (2)	4	None
Mean	*176*	*9*	*2*	*5*	
Conventional farms					
Waikato	36		Steers (1)	10	Surephos 9K, Salt, Copper, Boron, Selenium, Cobalt
	220		Steers, heifers, ewes, dairy grazers (4)	6	DAP, MOP (muriate of potash), Urea
	570		Heifers, ewes (2)	0	DAP, Sulphur super
	420		Steers, heifers, bulls, cows, ewes, nurse cows (6)	0	Superphosphate, Potash, Urea
	48		Steers, heifers, ewes (3)	0	DAP, MOP
	130		Steers, heifers, bulls (3)	4	SurePhos, MOP, Sulphurgain pure, Salt, Copper, Boron, Urea
	370		Steers, heifers, bulls,	2	Pasture mag, Triple super, PhaSedN quick start
	362		Steers, heifers, ewes, cows, rams (5)	0	SustaiN, PhaSedN, DAP, MOP, Dicalcic pastoral, Sulphurgain pure
	480		Heifers (1)	0	MOP
Northland	75		Steers, heifers (2)	10	Superphosphate, DAP, Lime
	900		Steers, heifers, bulls (3)	0	SurePhos, Sustain
	403		Steers, heifers, bulls, ewes, cows, trade lambs (6)	1	Potassic superphosphate, Reverted sulphur super, Ammo 36
Mean	*335*		*4*	*3*	

[1]PKE: palm kernel extract

farm unless other stated. Finishing policies included steers and heifers. Breeding policies included ewes, cows and hinds.

Supplements[2]	Herbicide (H) and pesticide (P) use
Baleage	H
Baleage	H
Baleage, silage	Nil
Baleage purchased	H
Baleage, hay	H, P
None	H
Baleage on farm and purchased	H
Silage	H
Hay, silage	H, P
Hay	H
Hay or Baleage/Hay – fed out as Hay in notes	
Hay	H
None	H
Baleage	H
Baleage, PKE[1] purchased	H, P
Sheep nuts purchased	H
Baleage purchased	H
Baleage	Nil
Baleage on farm and purchased, hay	H
Silage Growup, Fibre gain purchased	H, P
Silage	H
None	H
None	H
Silage, PKE[1] purchased	H
Baleage and silage	H, P

Further research

The effects of regenerative farming practices on (i) soil characteristics including carbon accumulation was the most frequent topic listed on 14 occasions as needing further research, with (ii) economics, and (iii) animal health and performance both listed on 12 occasions as needing further research.

Discussion

Species diversity documented in this study, which averaged eight or nine species depending on the farm type, was similar to that reported for other hill country research. For example, there was an average of 9-12 species in hill country pastures at Whatawhata in the upper North Island, depending on slope and soil fertility (Dodd *et al*., 2003). Tozer et al. (2016) documented an average of 9-11 species, depending on pasture age, in a survey of 171 beef, sheep and dairy pastures in five New Zealand regions. Of the perennial grasses, brown top and Yorkshire fog were the most dominant, as has been found in other surveys of North Island beef and sheep hill country pastures (Cosgrove and Field, 2016).

While regenerative farmers aspired to use more diverse pasture mixtures than currently sown, this did not result in greater diversity of grasses, legumes or broadleaved species within the sampled pastures, which had not been cropped in the last 5 years. To obtain a robust assessment of species diversity, repeat assessments would be required in more paddocks on more farms throughout the year for several years, as different species will be present at different times and in different microenvironments. Despite these limitations, these data do provide a snapshot of diversity on regenerative and conventional farms. If there were major differences between farm types in botanical diversity of grasses, legumes or broadleaved species, it is likely that differences would be detected, as has been observed in pasture surveys of other New Zealand beef and sheep farms in different regions (*e.g*. Cosgrove and Field, 2016; Tozer et al., 2010; Tozer et al., 2016).

The biggest difference between the two farm types was the fertiliser policies. There was a consensus that the use of synthetic fertilisers (e.g., superphosphate, DAP and urea) was not consistent with regenerative farming, although there was no consistent trend about herbicide and chemical use. The general trend towards lower N application on regenerative farms is also consistent with the lower content of ryegrass (Waller and Sale, 2001).

The higher legume content in regenerative pastures also reflects the lower N and P inputs and lower perennial grass content. Grasses compete strongly with legumes so reducing grass dominance can encourage legume growth (Hayes et al., 2019). However, the legume content could decline in the future given that a number of the regenerative farms were not applying phosphorus which is important for legume growth (Haynes, 1980; Hayes et al., 2019). Differences in Olsen P levels were not reflected in differences in the P content of the herbage, indicating that levels in the soil were non-limiting for plant growth in both the regenerative and conventional pastures.

The higher soil pH and exchangeable cations and levels of calcium, boron and molybdenum in herbage sampled from regenerative farms align with the greater focus on adding lime and minerals mixes containing base cations and trace elements documented in the farm survey.

Despite the differences in the fertiliser policies, there were few differences between the farm types in herbage mass. The similar pre-grazing covers and residual biomass on both farm types imply that the grazing pressure was similar on both regenerative and conventional farms at the time that measurements were taken. This was contrary to expectations, as a number of the regenerative farmers had discussed their aspirations to have longer grazing rounds and leave higher residuals after grazing. Given the 2021 summer-early autumn drought, a number of farmers commented that autumn 2021 pasture growth was slower than anticipated. This may have resulted in a higher proportion of the available herbage being grazed than was considered ideal by regenerative farmers. Measurements would need to be done in the same paddock over a longer period to obtain robust data on differences between farm types in grazing intensity. However, it can be inferred that while longer rounds and higher residuals may be an aspiration, they could be difficult to consistently achieve in practice.

Pasture sampling was conducted mainly in late autumn when pastures were vegetative. During these times the proportion of green leaf will be high, regardless of the species or farm type, and there will be smaller proportions of stem and dead material, which have lower digestibility and metabolisable energy values (Burggraaf et al., 2018). At other times of the year, there may be greater differences between farm type in the botanical composition and the proportion of dead vegetation, which may affect pasture quality. Repeat measures at different times of the year would be required to ascertain this.

There was a trend towards cattle only policies on the regenerative farms. This might reflect the smaller size of the regenerative farms which would limit the number of livestock policies. In contrast, the conventional farms were larger and had more livestock policies. There were similarities of many other aspects of management, such as no or limited imported feed, dependence on feed produced on farm (pastures and crops), and reducing or eliminating tillage, all of which are considered defining characteristics of regenerative farming (Newton et al., 2020). Given this, the question needs to be asked as to whether farms in New Zealand deemed to be conventional can be considered as regenerative in many aspects.

Conclusions

The intent of this pasture and farm management survey was to obtain a preliminary snap-shot of pasture and management attributes, such as the botanical composition, pasture covers and soil nutrient status, that may differ between regenerative and conventional farms. Overall, there were many similarities between regenerative and conventionally managed pastures, inferring that conventional farms in New Zealand are regenerative in many aspects. Results suggest that we should focus research on the long-term impacts of regenerative and conventional fertiliser policies and grazing management on: (i) botanical composition (especially the legume content), (ii) pasture performance above and below ground, and (iii) soil quality. Based on the farmer survey, there is also a need to determine the value proposition for regenerative agriculture and its impacts on livestock performance and welfare.

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