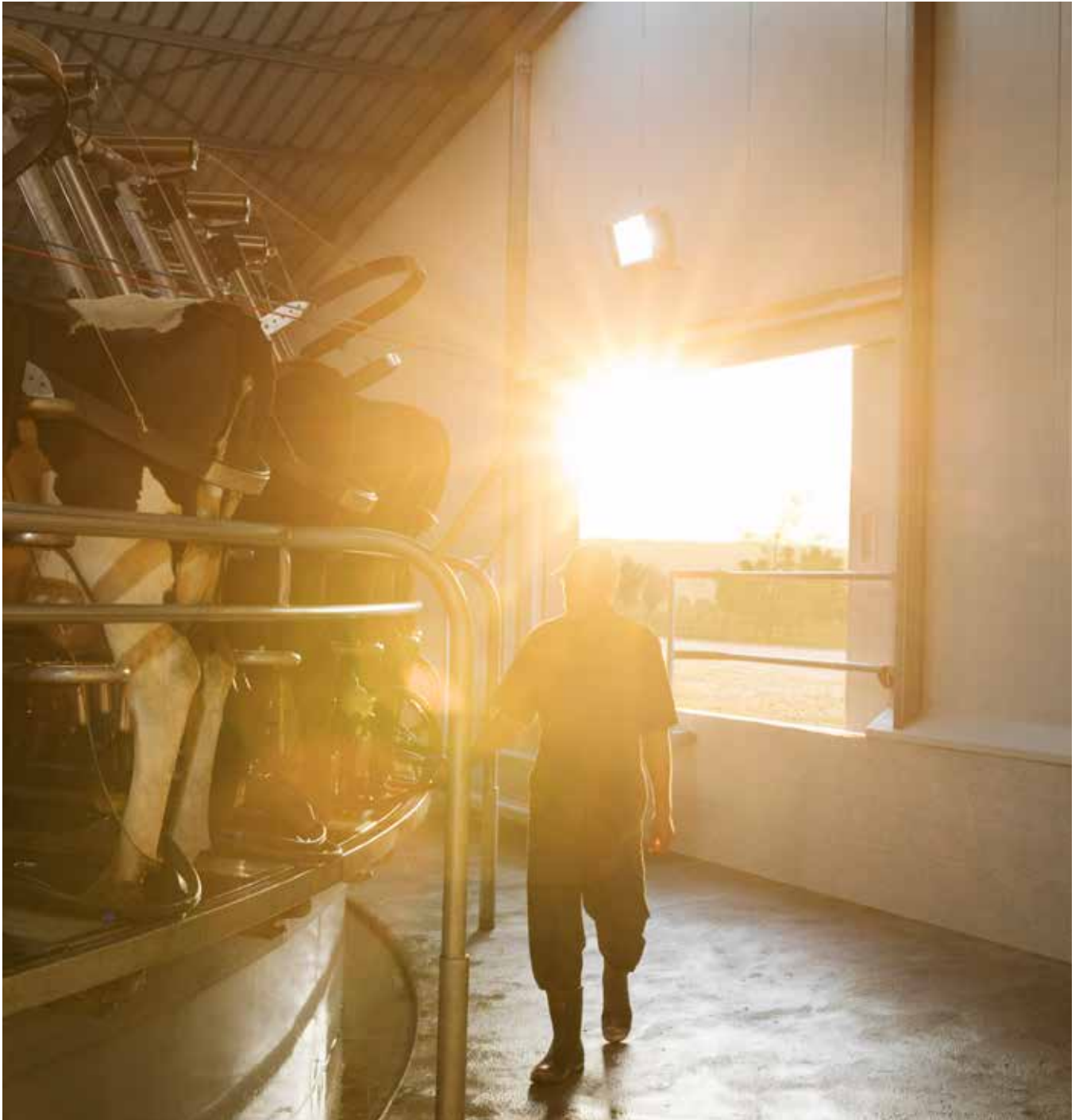


THE

JOURNAL

The Official Publication of The New Zealand Institute of Primary Industry Management Incorporated



INTERNATIONAL COMPETITIVENESS OF NZ DAIRY SECTOR BARRIERS TO LAND USE CHANGE
FUTURE FARM SYSTEMS IN NORTHLAND IRELAND'S GHG JOURNEY AND ORIGIN GREEN BRAND
INFLUENCE OF COW BEHAVIOUR ON THEIR PERFORMANCE FOOD TRENDS – CHANGING CONSUMER BEHAVIOURS
ADVISING CLIENTS ON MILK FUTURES AND OTHER FINANCIAL PRODUCTS



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Sunrise through milking shed door
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The risk of suppressing innovation to improve environmental outcomes



In 2018 the Parliamentary Commissioner for the Environment recommended that a review of Overseer^{FM} be undertaken. An independent Scientific Advisory Panel was subsequently established by the Government to undertake this work.

Within the Panel's report to the Government on Overseer it concluded that, in its current form, it would not have confidence in Overseer's estimates of nitrogen lost from farms. In response to the Panel's findings the Government has decided to put in place one or more of the following options:

- a. the creation of a new risk index tool, potentially using elements of Overseer (including the user interface); and
- b. the development of a next generation Overseer to address the issues raised by the Panel in ensuring that it is fit for purpose as a tool to use in appropriate regulatory settings; and/or
- c. greater use of controls on practices and inputs to manage nitrogen loss (including through amendment to the NES-F); and/or
- d. a completely new approach to understanding and managing diffuse nutrient loss risk. This might include near real-time monitoring of water quality at the local scale or a new nutrient loss tool.

Based on the options listed above it is quite clear that significant changes would be required to Overseer before the Government accepted a revised version of the tool that regional councils can use to effectively manage nutrient discharges off-farm. In charting the options, the Government has signalled its commitment to the next generation Overseer tool that will be able to incorporate innovations that are proven to lead to improved outcomes for fresh water quality.

It is generally acknowledged that the Overseer model is far from perfect, as software modelling tools of farm systems rarely are, but it does provide the farming community with an expanded understanding of nutrient flows at a subsoil level which has helped farmers and their advisers to confidently map out a pathway forward to better manage the application of nutrients to improve environmental outcomes.

Overseer was never intended to be used as a regulatory tool. Nonetheless, for the lack of any other model or tool to estimate the amount of nitrogen and phosphorous leaving the farm system, regional councils have used it in granting resource consents. This has led to the

extended use of Overseer in other areas, including land valuations, bank financing arrangements and to support environmental credentials in marketing our primary products to the world.

It is therefore timely to take stock of what we might lose should Overseer, and potentially other farm systems scenario-based modelling tools, were to be pushed into the background in favour of a more restrictive input and control-based approach that is also listed as an option under consideration by the Government.

While standardising the level of inputs that can be applied on-farm and/or setting controls on certain farm-based activities may have some appeal for policy-makers in meeting environmental targets, this blunt instrument would be counterproductive in encouraging the development and uptake of new and innovative on-farm practices or technologies aimed at providing better environmental outcomes, particularly if farmers are not going to be recognised or rewarded for such efforts.

This could also apply to private and public research organisations when considering their future research priorities. For example, what incentive is there for plant breeders to make long-term investment decisions in researching and developing new plant cultivars with positive environmental benefits if those attributes are not going to be recognised through a nationally endorsed farm systems modelling tool. More so if there is uncertainty around policy settings to adequately recognise new technologies that improve on-farm environmental performance.

Outside of Overseer and Farmax there is a limited range of sophisticated software modelling tools to test the impact of complex farm systems scenarios on water quality and greenhouse gas emissions. These tools have provided the opportunity for farmers and their advisers to develop plans that not only provide better environmental outcomes, but also build sustainable and profitable farming businesses into the future.

It is important that farmers and advisers have confidence in farm systems modelling tools that can robustly test new and innovative farm management practices within the context of the farm system, as well as recognising the latest technologies in providing better environmental outcomes. While Overseer has been mauled by the Panel, the opportunity now exists for the organisation to define its core role within the primary industry and ensure the tool is match fit going forward. **J**

THE INTERNATIONAL COMPETITIVENESS OF THE NEW ZEALAND DAIRY SECTOR

The New Zealand dairy sector primarily exports its produce and so must remain internationally competitive. Mark Neal explores what exactly competitiveness is, and asks who are we competing against, how are we performing against them, and what is the way forward for New Zealand's dairy sector?

What is competitiveness?

Most people will have an intuitive definition of competitiveness. It may come as a surprise (or perhaps not) that even economists have not agreed on a single definition of what it means. In the broadest sense, it is the ability to compete. But who is competing? And for what, and against who? Does historical performance measure competitiveness, or is it forward-looking? At DairyNZ we have developed this definition:

Competitiveness is the ability of the dairy sector to offer products that meet the consumer needs of the local and world markets at competitive prices, and provide adequate returns on the resources employed or consumed in producing them, now and into the foreseeable future.

This definition, while lengthy, covers four key aspects:

- All parts of the value network in the dairy sector are essential. The value chain begins from the farm, through processing, into the markets and on to consumers. It may not always be helpful to consider the farm component alone

- While we primarily export dairy products, the requirements of the New Zealand public are also important
- While the dairy sector competes to get our products into customers' hands, we also compete for land, labour and capital with other farms and businesses
- Finally, while a sector can be competitive now, it needs to forward look towards tomorrow's challenges, such as changing preferences and market shifts.

Who are our competitors?

Considering major competitors for the consumer dairy dollar, we can envision three primary groups:

- Dairy production from more intensive systems, where typically cows are fed in barns on a total mixed ratio (the US is a leading example)
- Other pasture-based milk producers (Ireland is one of the prominent competitors)
- Milk substitutes and alternatives, with established examples like soy and almond-based fluids, and emerging product like proteins brewed in fermentation tanks.

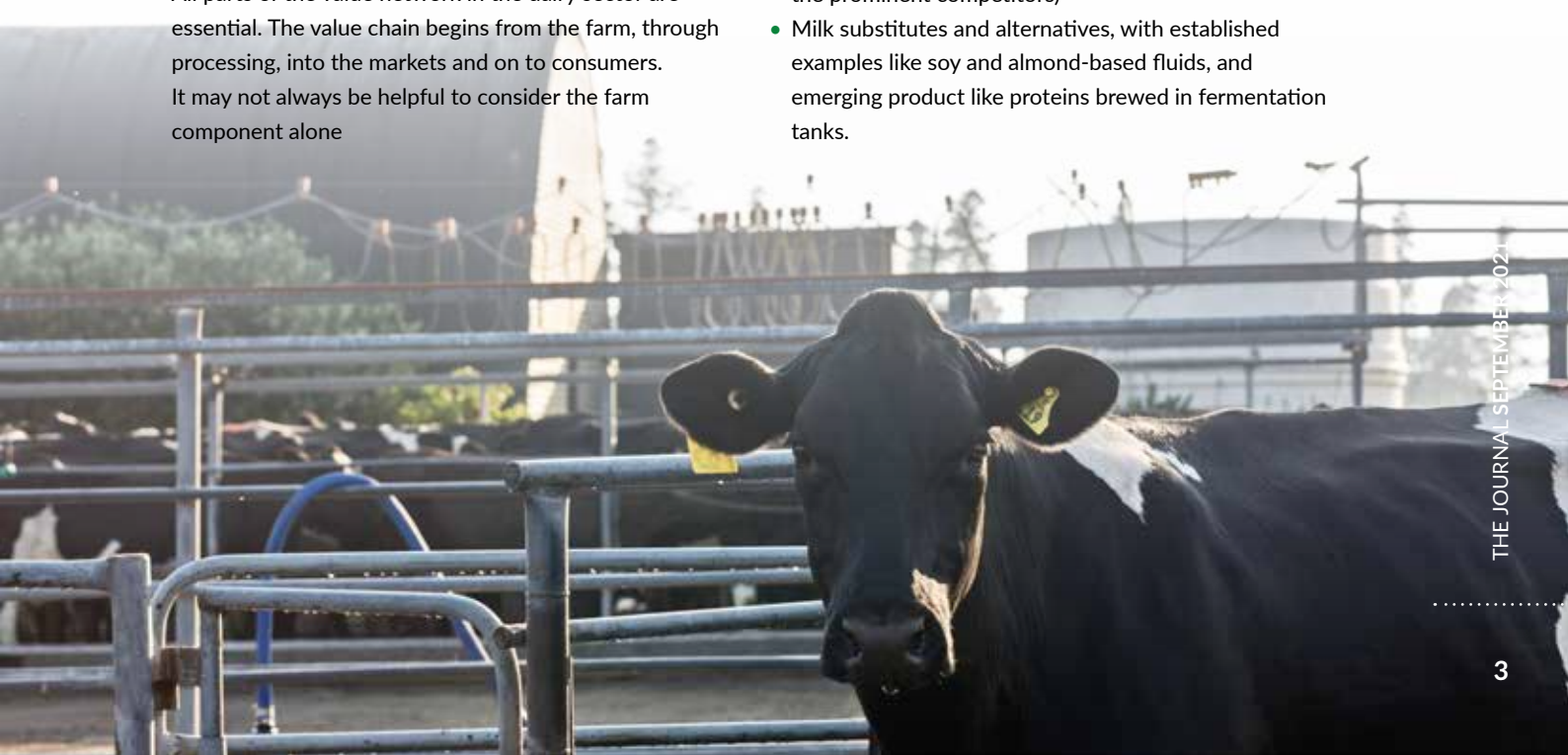


Table 1. Comparison of New Zealand and US dairy sector structures

	NEW ZEALAND	US	FACTOR
Cows per farm	440	300	2/3
Dairy farms	11,000	30,000	*3
Total dairy cows	5M	9M	*2
MS per cow	380	760	*2
Total MS	1.9B	7.2B	*4

Sources: Dairy Statistics (LIC/DairyNZ); USDA ERS (MacDonald et al., 2020, www.ers.usda.gov/publications/pub-details/?pubid=98900)

While this latter category is evolving rapidly, this article does not consider these products in detail. Regardless, the key concerns leading to consumers considering these options, such as perceptions about animal agriculture and greenhouse gas (GHG) emissions, need to be addressed strategically.

The following sections outline the US as an example of a sector with more intensive systems, revisits New Zealand in the context of a sector using grazing systems, and then compares costs across countries.

How is the US performing?

Context

The US has a diverse and rapidly changing dairy sector, so it is helpful to consider the broad context in comparison to New Zealand. While there are some very large US dairy farms (numbers of cows), the average herd in the US is around 300 cows, substantially smaller than the New Zealand average of 440 (Table 1). The US has almost twice as many dairy cows (~9 million) compared to New Zealand. The average US cow produces about 760 kg

MS (milksolids) per year, which is about twice the New Zealand average. So, combining twice as many cows and producing twice as much per cow leads to roughly four times the amount of milk. Also while the US imports some dairy products, they are a net exporter of dairy produce. Indeed, a small increase in production can (if domestic consumption is flat) lead to a much higher increase in the volume of exports.

Trends

Looking at trends over the last two decades, MS production has increased by 41% in the US, much less than the 73% increase for New Zealand. However, there are key differences in how this growth occurred. In the US, dairy cow numbers increased only by about 2%, with MS per cow accounting for most of the change (rising 39%). By comparison, in New Zealand there was a 40% increase in dairy cow numbers, but only a 23% increase in production per cow.

The other key dynamic of the last 20 years is that while average US herd sizes are still smaller than New Zealand, average herd size increased by more than 1.5

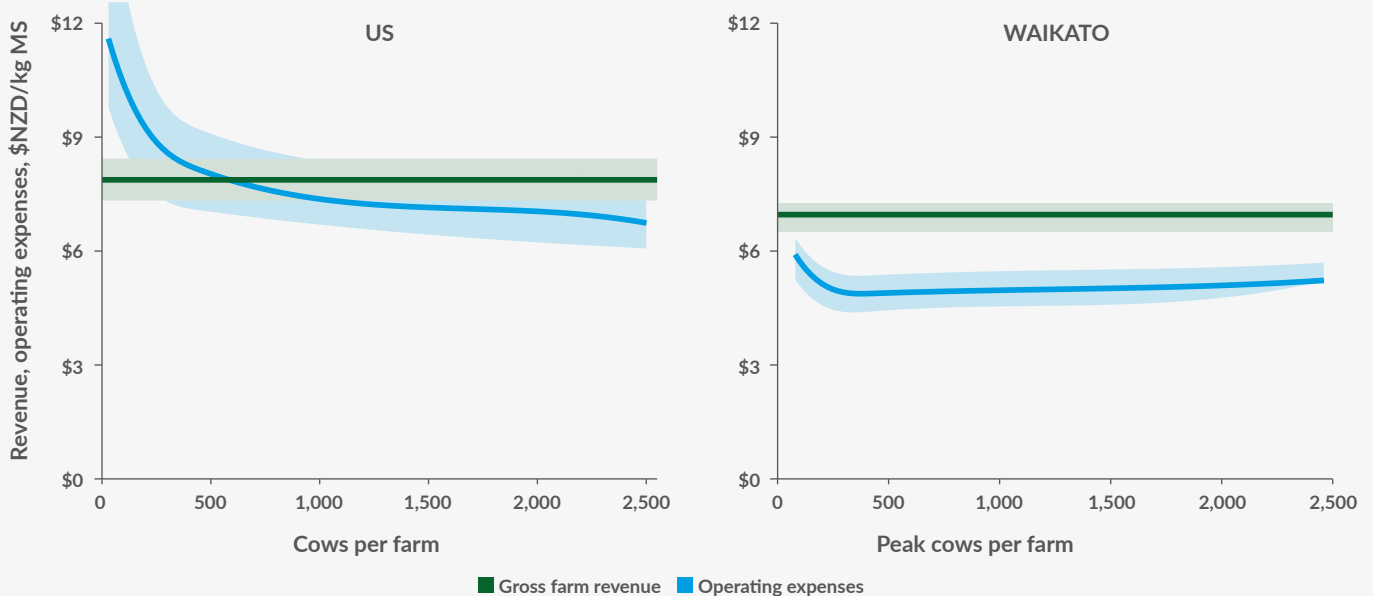


Figure 1: Economies of size for intensive (US) dairy systems compared to Waikato (pasture-based) dairy systems.
Sources: DairyBase (DairyNZ); USDA ERS (MacDonald et al., 2020)

Once farms get to 300 cows the economies of size become insignificant, and there are possibly some diseconomies at very large farm sizes.

times (158%). In comparison, average herd sizes in New Zealand increased by 75%. For the US, this has been due to the creation of more large farms, often in the West or Midwest, while at the same time many smaller farmers in traditional dairy areas (e.g. northeast US) have exited farming. The net effect has been a 60% reduction in the number of farms. In New Zealand, there has been a consolidation of farms in the North Island (although North Island dairy cow numbers were steady), with an increase in farms (and cows) in the South Island. The net effect was a 20% reduction in the number of farms.

Looking forward, we would expect the US to continue a rapid restructuring, while New Zealand is likely to remain more stable, despite competition for land by alternative uses like horticulture in the Bay of Plenty and some changes in land use in other regions (e.g. Lower North Island).

Economies of size

One of the key reasons for the difference in trends between countries is economies of size, which refers to the effect that having a larger business has on the likely cost structure of that business. In the US, many small farms (<250 cows) are unlikely to be profitable (Figure 1), but larger farms have some advantages in that they are

more likely to be profitable (operating expenses below gross farm revenue).

This size effect is a key reason for the continued loss of small farms in the US. Compared with Waikato farms (as an example of pasture-based systems), the different effect of increasing size is stark. Once farms get to 300 cows the economies of size become insignificant, and there are possibly some diseconomies at very large farm sizes.

As an example of US 'mega-dairies', the Fair Oaks Dairy Farm in Indiana has 40,000 dairy cows and houses all of them. It has 450 staff, producing 65 tankers of milk each day. The cow intake is 45 kg/day, and the diet is 80% maize plus 15% grass silage, which makes up 65% of their costs. For perspective, the largest 2,500 dairy farms in the US produce twice as much milk as all of New Zealand's farms.

Pasture-based competitors

How are pasture-based competitors performing?

A recent analysis of more than a decade of data from DairyBase examined the characteristics that were important for financially robust dairy businesses. They concluded that three factors are the most important: high pasture harvest; low costs per kg MS; and prudent use of capital (not over-capitalising).



Fair Oaks Farm, a large US farming enterprise.
Source: Fair Oaks Farm



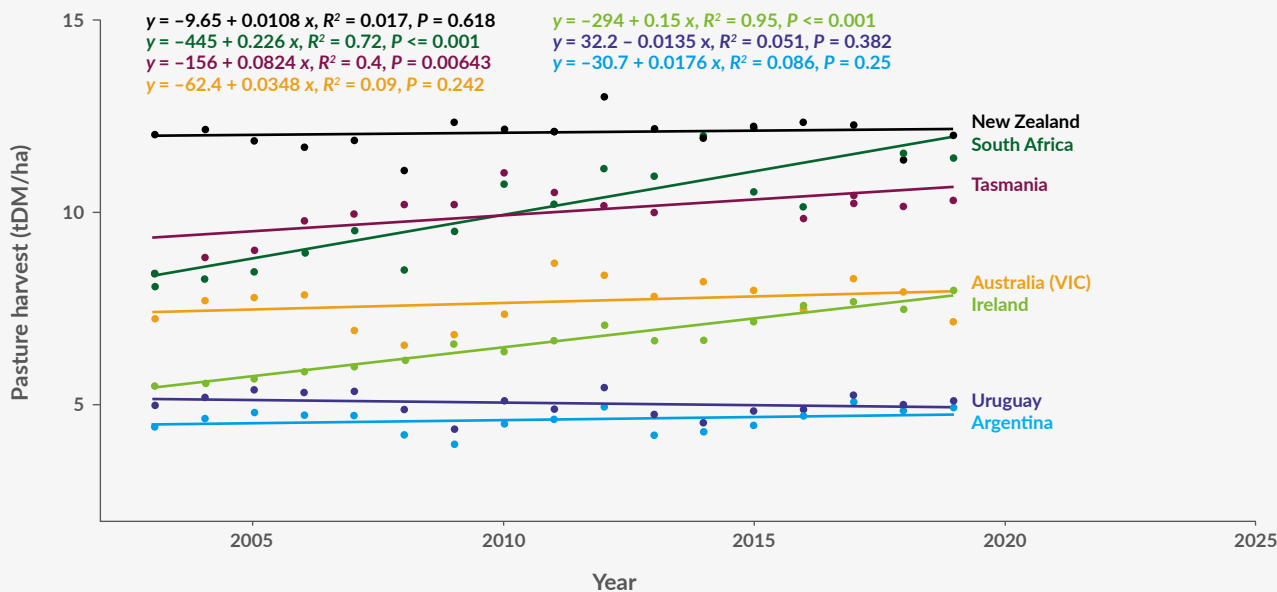


Figure 2: Trends in annual pasture harvest.
Sources: Adapted from Beca (2020, www.tinyurl.com/2020Beca); Shalloo (Pers. comm)

Operating costs, measured in US cents per litre of energy corrected milk, have generally gone up with inflation across countries over the last decade and a half. Costs are low in New Zealand compared to most pasture-based countries.

How is pasture harvest trending?

Looking across countries that could be classified as pasture-based, it is possible to see quite a diverse picture (Figure 2). While New Zealand has a high level of pasture harvest, the trend has been flat. The Resilient Pastures Symposium held in Hamilton in May 2021 brought more attention to the challenges of improving pasture performance and possible actions to confront these issues. One submission for the conference proceedings explored how pasture harvest has been trending for multiple regions within New Zealand. Top and median performance were examined and the conclusion was that positive trends were the exception rather than the rule.

Some other countries have a flattish trend, with low or moderate levels of pasture harvest (Uruguay, Argentina and Victoria in Australia, which represents most Australian production). However, the standout countries for making rapid progress have been South Africa and Ireland, and to a lesser extent Tasmania in Australia. While this rapid progress may reflect that these countries have historically been under-performing compared to their potential, it is only through clear determination to improve that they have started capturing that potential.

Costs

How are costs trending at the country level?

Operating costs, measured in US cents per litre of energy corrected milk, have generally gone up with inflation across countries over the last decade and a half. Costs are low in New Zealand compared to most pasture-based countries, and the rate of increase is lower than in several countries (e.g. Argentina, Uruguay and Australia). South Africa has had increasing costs, but the rate of increase has been less than New Zealand, showing the benefit of rapid increases in pasture harvest with positive signs of cost control. Ireland is the most interesting example, as the costs have tended to be lower, resulting from the cost-effective expansion of dairy farming at the end of the quota system in 2015.

Comparing the use of capital across countries

While operating costs tell part of the story, to be competitive a dairy sector needs to attract and retain capital. In other words, it must cover its opportunity cost of capital, or the return that capital would receive if it were used elsewhere. When you include operating costs and the opportunity cost of capital, the result is an economic cost that can better compare countries. Figure 3 shows an international comparison, which uses lease rates for land and appropriate interest rates for other capital to create an economic cost.



Figure 3. Trends in economic cost, which is operating costs plus the opportunity cost of capital. Sources: Adapted from Beca (2020); Shalloo (Pers. comm)

If research can successfully identify approaches that can ‘break’ the link between feed eaten and methane, farmers will have a more extensive range of options.

The results show that because land in New Zealand is relatively expensive, the gap in economic cost is much narrower than the difference in operating costs. Therefore, a focus on the prudent use of capital is essential to complement a focus on low operating costs. Also, Ireland’s progress to become internationally competitive is impressive and speaks to their level of focus. Finally, while the average US economic cost is higher than in New Zealand, the most efficient US farms are likely on par with the New Zealand average, so complacency is not an option.

Rising competitiveness on farms with increasing environmental requirements

There has been increasing pressure to consider environmental issues like water quality and GHGs. In practice, this may look like decreasing N surplus (linked to N loss to water) and decreasing feed eaten (which links to methane reduction). To what extent do we need to change the emphasis on the three factors for a resilient business mentioned above?

- First, increasing pasture harvest is profitable, but is likely to lead to more methane unless it is used to remove an equivalent amount of supplement. In that case, the farm’s GHG footprint does not increase, but it can still enhance its profitability. To explore if a farm is near its potential, DairyNZ has a handy Pasture Potential tool (www.dairynz.co.nz/pasture-potential)

- Second, for costs, comparison with peer groups or using the DairyBase benchmarks can be helpful (www.dairynz.co.nz/business/dairybase)
- Third, while over-capitalisation (paying too much for land at purchase, adding too much equipment etc) is something to avoid, there may need to be targeted investment to deal with environmental requirements, depending on the situation for each individual business. To prepare farmers for the direction of travel, ‘Know Your Numbers’ events have been offered, to provide context for the opportunities available in their region so they can be more profitable while having a lower footprint (www.dairynz.co.nz/know-your-numbers).

While there are short-term needs (council rules, financial drivers) that farmers will be responding to with current knowledge and options, there is significant R&D taking place to share and enhance the available options and reduce the cost of mitigation. For example, catchment-specific work is happening in the Tararua area (including the use of plantain), and in the Selwyn and Hinds catchments, with a focus on solutions that meet environmental requirements while remaining profitable.

While there are many established and continuing projects in the water quality space, work is also continuing and expanding in the GHG space in collaboration with the

AUSTRALIA A CAUTIONARY TALE

The different economies of size reflect fundamentally different sectors. Although it can be tempting to look at the high production per cow achieved in the US and see an opportunity, is it economically achievable? The Australian situation provides an interesting intermediate position between a traditionally pasture-based system with moderate per cow production (similar to New Zealand) attempting to bridge the gap to high per cow production with a supplement system (closer to the US).

For example, in an article in the 1985 Dairy Production Conference Proceedings (*The Future for Australian Dairying – Alternative Systems of Production*) scientists lamented the gap with US milk production levels. At that time, Australia produced similar per cow production (and total production) to New Zealand. While today Australia produces 20% more MS per cow on average than New Zealand, the sector has been shrinking in farm numbers, cow numbers and total production for the last two decades, and is now half the size of the New Zealand dairy sector. Whether by choice or accident, the strategy of being in the middle has not been useful for Australia's dairy sector.



To contribute to the dairy sector's competitiveness, farmers need to have clarity about the direction of travel.

Pastoral Greenhouse Gas Research Consortium (PGGRC) and the NZ Agricultural Greenhouse Gas Research Centre (NZAGRC). The focus areas include vaccines, inhibitors, animal genetics and forage options, and ensuring these are practical to use on-farm.

If research can successfully identify approaches that can 'break' the link between feed eaten and methane, farmers will have a more extensive range of options. These need to be rapidly adapted for use in pastoral systems to maintain a leading position for emissions efficient dairy production and to meet government targets for reductions in total emissions.

Conclusions

It is clear that the world is changing rapidly and competitiveness cannot be guaranteed when competitors (countries and substitutes) are also evolving. While the US will continue to restructure rapidly, New Zealand has a different source of competitive advantage in pasture, so it cannot copy their approach. The Irish have stretch targets for their sector for pasture harvest, reproduction, emissions intensity and profit that will put them ahead of New Zealand's metrics if we stand still. However, given the similarity of our comparative advantage, there is a significant opportunity for collaboration in the pre-competitive R&D space that will benefit both countries when competing with more intensive systems and substitutes.

To contribute to the dairy sector's competitiveness, farmers need to have clarity about the direction of travel. This direction will be broadly consistent with the Dairy Tomorrow strategy, and initiatives like 'Know Your Numbers' will help identify the challenges and opportunities. The requirements will become clearer arising from the Essential Freshwater reforms and the plans for managing emissions, including *He Waka Eke Noa*, the Primary Sector Climate Action Partnership. Keeping an eye on the R&D solutions and adopting them as they become available will also be critical to maintaining competitiveness.

Further reading

Climate change research at DairyNZ:

www.dairynz.co.nz/environment/dairy-sector-progress/climate-change-research

Farmers Forum – webinars from DairyNZ, including on competitiveness: www.dairynz.co.nz/about-us/event-activity/farmers-forum/

Pasture Summit – videos and conference presentations on profitable and environmentally progressive farm businesses, including Irish perspectives: www.pasturesummit.co.nz

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FUTURE FARM SYSTEMS IN NORTHLAND

AgFirst Consultant and Northland Dairy Development Trust Coordinator Kim Robinson explains how the Northland Dairy Development Trust is starting a new research project comparing how different farm systems respond to the challenges of climate change.

New climate change research project

A research project looking at how farmers can mitigate and adapt to climate change has just begun in Northland. The Northland Dairy Development Trust (NDDT) has been running farm systems research on the Northland Agricultural Research Farm (NARF) for over 15 years. The research is strongly farmer-driven and the latest concerns from farmers about both the effects of climate change and changing farming regulations have led to the current trial.

Northland farms are at the forefront of the effects of a warming climate and demonstrate the challenges that the rest of New Zealand will experience over time. The upper North Island is seeing an increase in C4 grasses, particularly kikuyu and paspalum, as winters become milder and ryegrass performance is decreasing. Previous articles in *The Journal* have mentioned Northland climate/ryegrass risks (December/September 2020 and June 2021). Farmers are beginning to introduce alternative species to ryegrass in an attempt to increase pasture productivity and persistence. There is little known about how this will impact milk production or composition and the grazing management strategies required when these species cover a large proportion of the farm.

At the same time farmers are being given a clear message from the Government that they will need to lower greenhouse gas (GHG) emissions on their farms. There is plenty of modelling information, but farmers are uncertain as to whether the strategies are physically or financially sustainable, particularly the lowering of stocking rate on pastures containing kikuyu.

The new research project addresses these two future issues through trialing two 'future farm' systems with a current profitable farming system. The trials follow on from a three-year farm systems trial that looked at the profitability of feeding supplements over a range of seasonal conditions. The most profitable and resilient of these farms has been used as the 'Current' farm for the new trial.

Farm trial design

The trial will test the effectiveness of three dairy farm systems: one proven resilient system, which is also common to Northland dairy farms; one using pasture species better adapted to a warmer climate; and another designed to achieve future GHG emission targets:



The farmer management group discussing rotation length on new fescue/ cocksfoot pastures

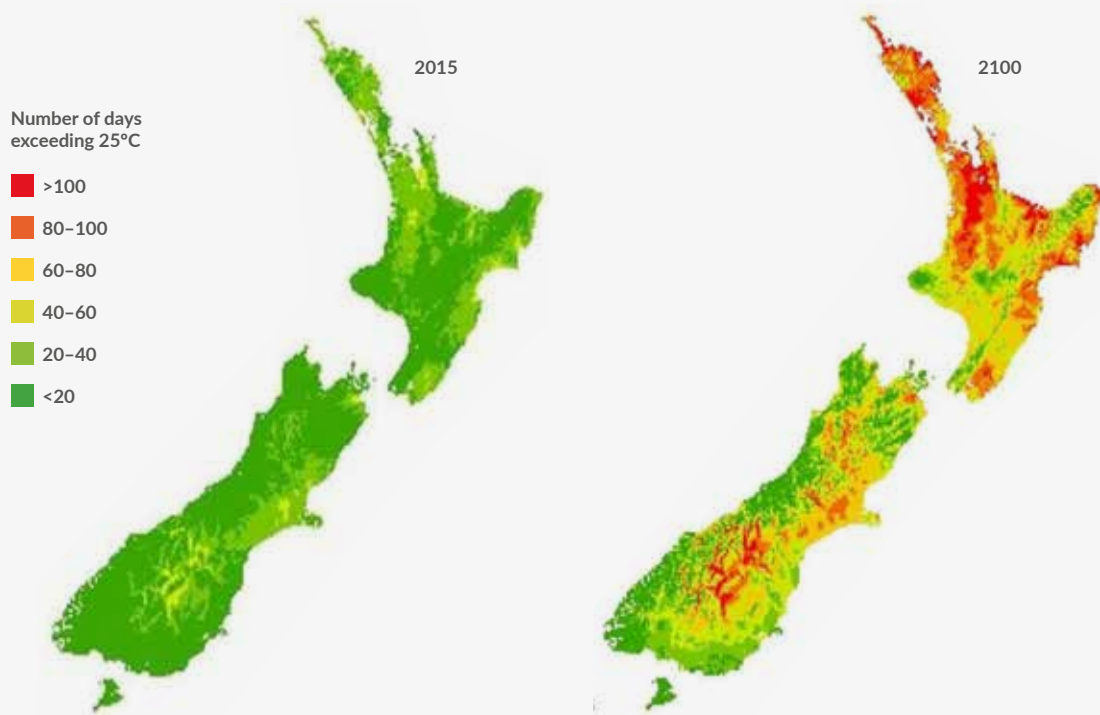


Figure 1: Number of days exceeding 25°C per year 2015–2100

Source: Royal Society of NZ 2016

1. **Current farm (Red)** – existing ryegrass/kikuyu pasture farm with imported feed (mostly PKE) to fill feed deficits. Stocking rate 3.0 cows/ha and up to 190 kg applied N/ha
2. **Alternative Pastures farm (Blue)** – at least 75% of pastures in fescue, cocksfoot and clovers with imported feed (PKE) to fill feed deficits. Stocking rate 3.0 cows/ha and up to 190 kg applied N/ha
3. **Low Emissions farm (Green)** – existing ryegrass/kikuyu pasture farm system that targets a 25% reduction in methane emissions and a 50% reduction in nitrous oxide emissions (compared to the Current farm). Stocking rate 2.1 cows/ha, no nitrogen application, little or no imported feed.

The trial commenced on 1 June 2021 and runs for four years to test these systems under a range of climatic conditions. Pastures on the Alternative Pastures farm had a mix of 15-month-old and three-month-old pastures at the time the trial started. Pasture sowing will continue in future seasons at 10% of the farm per year to maintain over 75% of the farm in these pastures. Other species may be introduced over time if they appear promising on other farms.

Trial measures will capture a large range of data, including pasture and milk production, milk composition, profit and people (labour input and management difficulty) data on the three systems. The NARF farm has the ability to run three independent farmlets, with herds milking into separate vats so any potential changes in milk composition from alternative pasture grazing will be evident. Labour

and machinery hours are recorded on each farm, so this is taken into account when farm costs are analysed.

Animal effects such as heat stress on different pastures will be captured through the use of rumen boli. Management difficulty and the human stress of each system are quantified through the farm manager recording their 'worry score' each fortnight. This system of measuring management stress has been used for the past five years with some intriguing results.

Why alternative species?

Climate modelling shows a significant predicted increase in hot days (over 25°C) by the end of this century (**Figure 1**).

Ryegrass performance under these warm and often dry conditions is relatively poor, and farmers have been frustrated with the lack of persistence in the modern ryegrass cultivars as pastures become open and weedy within a few years of establishment. Rust and pest damage are also increasing and the regression of new pasture to kikuyu often occurs within three years. Kikuyu is productive during summer/autumn, but it can be difficult to manage and has poor winter/spring growth.

In response farmers have begun sowing alternative species to ryegrass (such as tall fescue, cocksfoot, legumes and herbs), and anecdotal evidence indicates they perform better than ryegrass and the re-invasion of kikuyu is much slower. However, these species require different grazing management to traditional ryegrass/clover pastures and farmers have found this challenging when they are familiar with ryegrass management principles. The trial also aims to develop a 'pasture management guide' for farmers using these alternative species.

Pasture introduction and monitoring

To set up the Alternative Pastures farm, 9 ha of new pastures were sown in May 2020. Grass species sown were fescue, or fescue and cocksfoot, with white clover, red clover and Persian clover. Another 11 ha was sown in March 2021 as either fescue, or fescue and cocksfoot, or cocksfoot with white clover, red clover and 1 kg/ha of chicory.

Pasture growth, composition and quality has been compared between the resident kikuyu/Italian ryegrass pastures and the fescue/socksfoot-based pastures since July 2020. **Figure 2** shows the pasture growth differences between these pastures as measured by cutting cages.

The newly sown fescue/socksfoot pastures showed higher pasture growth rates during late winter through to early summer, while the kikuyu-based pastures showed higher growth rates through late summer/early autumn. This monitoring indicates that the fescue/socksfoot-based pastures have produced 1.56 t DM/ha more than the resident pastures from May 2020 sowing to 1 June 2021.

Pasture quality monitoring, as indicated by lab analysis of pasture metabolisable energy (ME) (*see Figure 3*), has shown that the two pasture types had similar pasture quality through late winter and spring. However, the fescue/socksfoot pastures showed higher pasture quality through most of summer and autumn.

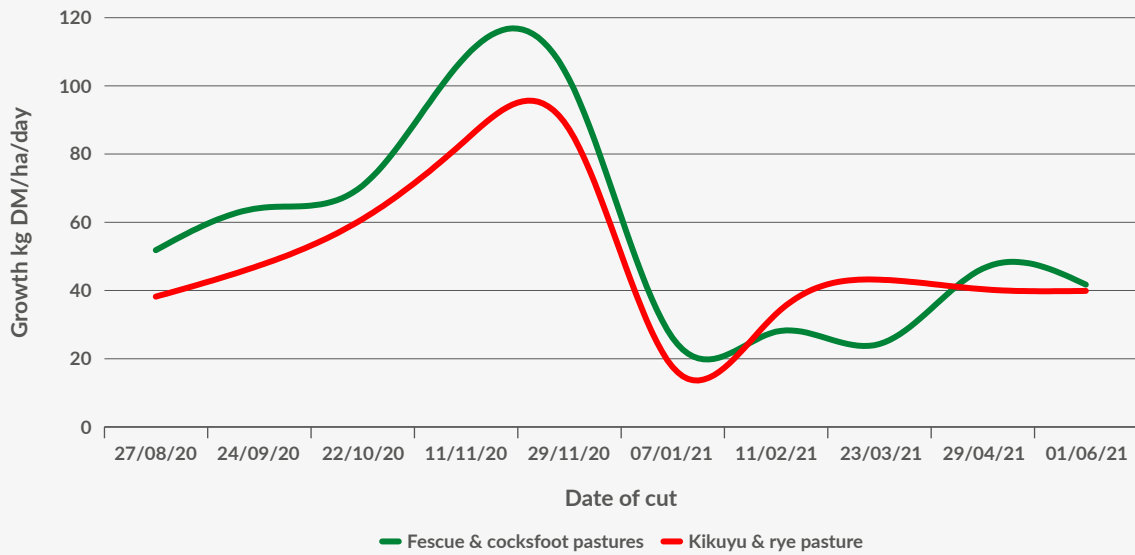


Figure 2: Pasture growth rates as measured by cage cuts

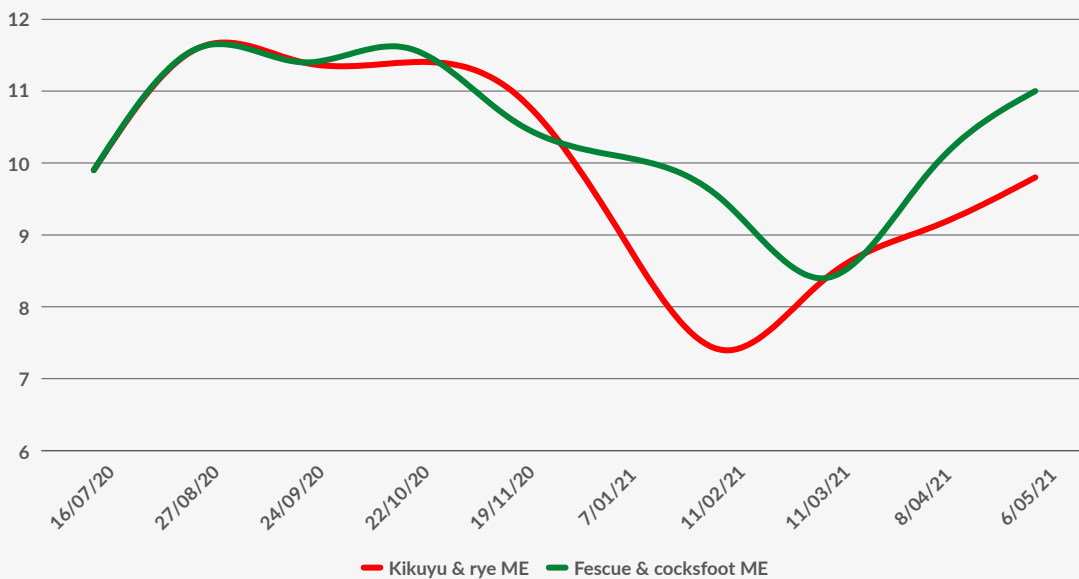


Figure 3: Pasture metabolisable energy content (MJ ME/kg DM)

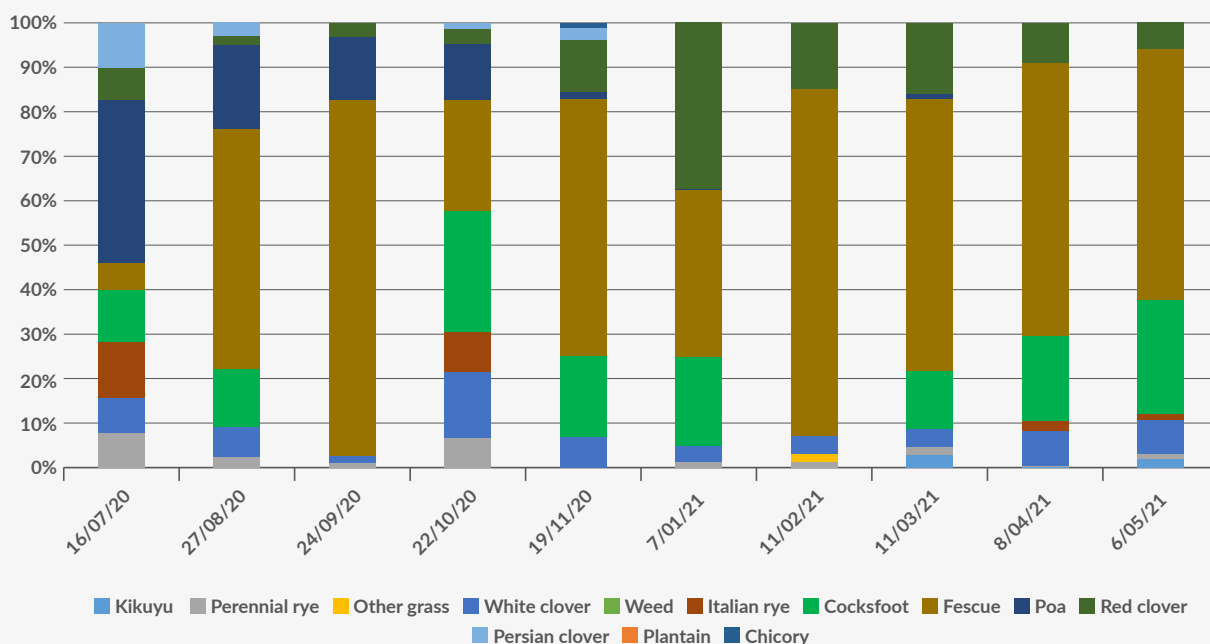


Figure 4: Pasture composition of alternative pastures farm over the 2020/2021 season

All kikuyu paddocks are sown with Italian ryegrass in autumn and the pasture composition from June to December is mainly Italian rye. Kikuyu becomes dominant from January to May and a high proportion of the pasture is stolon with poor digestibility, which leads to significantly lower ME through the summer and autumn months. Kikuyu pastures are managed according to our recognised best practice guide (available on website – www.nddt.nz). They are mulched to ground level between March to May, which removes stolon and encourages leafy growth. Combined with the emergence of Italian ryegrass plants, this leads to an improvement in pasture quality through the winter.

Figures 4 and 5 show the pasture composition changes over the past year. The fescue/cocksfoot pastures were sown in May.

Why low emissions?

Farmers are being given a clear message from the Government and society to lower their GHG emissions in the future. The 2030 industry target is to reduce methane emissions by 10% relative to 2017 levels. The previous three-year supplement trial indicated we could reduce farm-level methane emissions by 15-20%, with a 10-15% drop in profit by removing supplements. All farms used the same amount of applied nitrogen, so nitrous oxide emissions only reduced by 10%.

The 2050 government set industry targets are a 24-47% reduction in methane emissions and nitrous oxide emissions reduced to net zero. This trial has chosen to target a 25% drop in methane and a 50% drop in nitrous

oxide relative to the Current farm, which is very reflective of present-day Northland farm systems, including those in 2017. Nitrous oxide is difficult to reduce to net zero emissions through farm management change alone, so we expect other technologies and offsetting will be used in future farm systems to achieve this target.

Modelling of farm trial systems

Farmax and Overseer^{FM} computer modelling were used to establish stocking rates and management strategies, and to predict production, financial and environmental outputs. Farm systems were tested under three different climatic conditions: an average season, a season with a wet winter, and a season with a dry summer.

Modelling shows that if no nitrogen is applied to the Low Emissions farm, little or no imported supplements are used and the stocking rate is reduced by 26%, then this farm will show a reduction of 24% in methane emissions, 47% in nitrous oxide emissions and 54% in nitrogen leaching compared to the Current farm system. The goal is to maintain production per cow in order to retain product emissions efficiency. Anticipated response rates to nitrogen range from 10:1 to 15:1, depending on the season.

Table 1 shows the predicted milk production under three different climatic conditions: an average season, a dry summer/autumn, and a wet winter/early spring. The Low Emissions farm is predicted to have significantly lower production than the other farms under all climatic conditions.

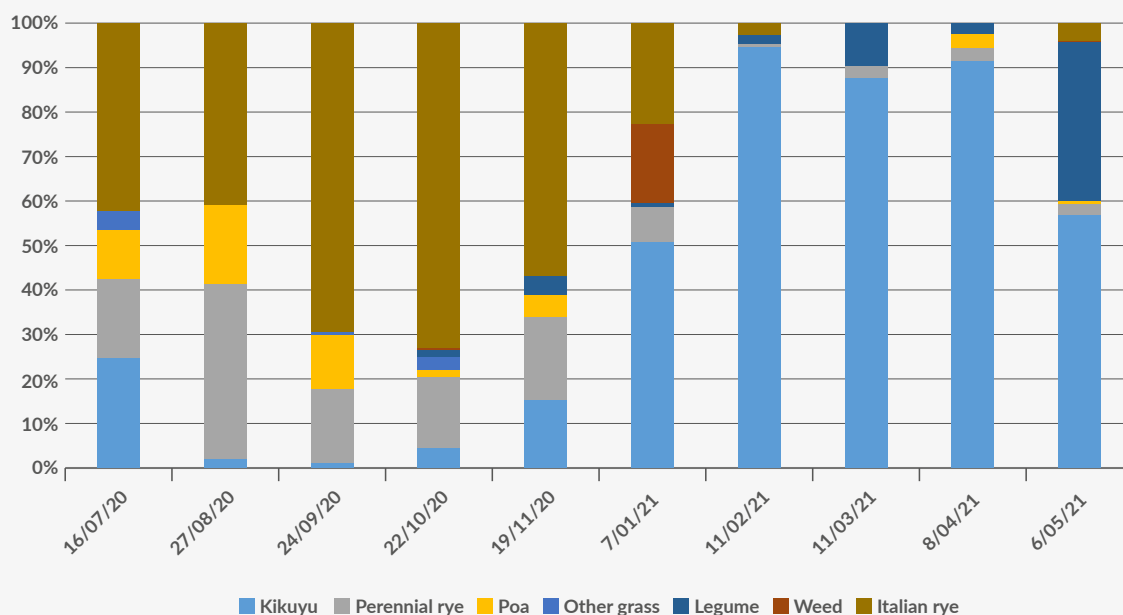


Figure 5: Pasture composition of the existing kikuyu/Italian ryegrass pastures over the 2020/21 season

Table 1: Predicted full season milk production (kg MS/ha) under variable climatic conditions

	TOTAL MILK PRODUCTION/ha		
	Average season	Dry summer	Wet winter
Current farm	1,144	976	1,122
Alternative Pastures farm	1,163	997	1,128
Low Emissions farm	833	659	744

Table 2 shows the predicted GHG emissions for the three farm systems. The Current farm and Alternative Pastures farm are predicted to have similar emissions, while the Low Emissions farm has lower emissions.

Table 2: Predicted GHG emissions - kg CO₂ equivalent/ha and CO₂/kg milk solids for an average climatic season

	METHANE	NITROUS OXIDE	CO ₂ /KG MS
Current farm	8,848	3,196	10.4
Alternative Pastures farm	8,623	3,126	10.0
Low Emissions farm	6,706 (24% reduction)	1,696 (47% reduction)	9.9 (5% reduction)

Farm management, funding and updates

All farms are run by a farm manager in conjunction with a dedicated group of Northland farmers who meet fortnightly to discuss management plans on each farm. There are decision rules for each farm and a Science Manager oversees the farm management strategies to ensure the science is robust. This gives the trial credibility amongst farmers, as the farms are run by farmers making decisions based on their own knowledge and experience within a set of rules.

There is also regular oversight from DairyNZ scientists, and NDDT has been working with NZAGRC, AgResearch and Fonterra to maximise the data and learnings from the project. AgFirst Northland consultants Kim Robinson and Chris Boom are contracted by NDDT to manage the science and extension for their trial work.

The two main funders of the project are the Ministry for Primary Industries (MPI) through its Sustainable Food and Fibre Fund and New Zealand dairy farmers through DairyNZ. Additional support is provided by Fonterra, NDDT and the Hine Rangi Trust. NDDT is also supported by Farm Source, Ballance Agrinutrients, Avoca Lime and FIL.

Fortnightly updates are posted on Facebook and the NDDT website: www.nddt.nz There is also the opportunity to visit the farm or receive fortnightly email updates by registering at: info@nddt.nz

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IRELAND'S AGRICULTURAL GREENHOUSE GAS JOURNEY

Ireland's agricultural sector is dominated by livestock. This article sets out some of the challenges the sector faces in response to more stringent climate targets, focusing in the main on the mitigation of agricultural greenhouse gas (GHG) emissions.

Important sector

Much like New Zealand, agriculture is a very important industry for our rural communities and the Irish economy. Ireland's agri-food sector is dominated by ruminant livestock, with some 4.2 million ha of grassland supporting the production of high-quality meat and milk protein from approximately 7 million cattle and 4 million sheep. The industry employs 164,000 people and accounts for over €8 billion p.a. worth of primary produce at farm gate prices.

Like New Zealand, Ireland is an exporting nation, and food produced on our island to the highest standards of food safety and animal welfare feeds millions of global consumers in 180 different countries annually. These exports are worth a total of €14 billion p.a. to the Irish economy, supporting local communities and local businesses in every part of the country.

GHG reduction

Despite the continuing success story that is Irish agriculture, the sector is coming under increasing pressure to reduce its climate and environmental impact. It is fair to say that the consumer is demanding this change as much as policy is driving it. The same is happening in New Zealand and in most countries all over the world, even if the ambition and pace of change varies from country-to-country.

In the summer of 2020, a new coalition government was formed in Ireland. It was historic in many ways, as our two largest parties (Fianna Fáil and Fine Gael) since the foundation of the state came together for the first time to form a coalition with the Green Party. Within the Programme for Government, there was a commitment to reduce GHG emissions by 51% by 2030, based on 2018 levels. This economy-wide target included all GHGs, with no separate target for biogenic or ruminant methane.

Clearly this is going to create huge challenges for our sector, and we continue to work through these in the context of our Houses of Parliament recently passing a climate law setting out this reduction level. There is an acknowledgement within government that it would not be feasible for agriculture to meet this level of emissions reductions over this decade, and thankfully other sectors such as electricity generation will be able to do more.

Regardless of what final target is agreed, and at the time of writing this is not yet finalised, increased climate ambition will require transformational change on each and every one of Ireland's 140,000 farms. This article sets out the journey our farmers are about to embark on. This decade will be one of change for Irish agriculture, and indeed agriculture globally.

Launch of Ag Climatise

It is important to reflect on where we started this journey from. In 2015, EU milk quotas were abolished and this has had a dramatic impact on milk production in Ireland. Over the last six years, milk production has increased from approximately 5 billion litres to more than 8 billion litres today. This expansion has helped underpin the economic viability of our 18,000 dairy farmers, providing a much needed stimulus for our rural communities.

However, on the back on this expansion some environmental parameters around water quality, air quality via ammonia emissions, and our GHG inventory have gone in the wrong direction. The sector acknowledges these declines and there is a real determination to put this right over the coming years.

It was in this context late last year that Minister McConalogue, Ireland's Minister for Agriculture, Food and the Marine, launched Ag Climatise, a national climate



Dairy calves grazing on newly established multi-species sward

The biggest challenge facing Irish agriculture is reducing the dependence on chemical nitrogen fertiliser.

and air roadmap to 2030. Ag Climatise was the topic of my recent presentation to the New Zealand Agricultural Greenhouse Gas conference earlier in 2021. Ag Climatise contains 29 actions, the achievement of which will take the sector on a journey of sustainability, to ultimately ensure commercial agriculture can operate within the environmental parameters being demanded by consumers.

Chemical fertiliser nitrogen reduction

The biggest challenge facing Irish agriculture is reducing the dependence on chemical nitrogen fertiliser. The EU Farm to Fork strategy has set the policy direction for this and it will be up to the Irish Department of Agriculture, Food and the Marine, working with all stakeholders in a spirit of partnership, to deliver this.

The strategy requires that the losses of nitrogen (via air and water) are reduced by 50% by 2030, which would equate to an approximate 20% reduction in chemical nitrogen fertiliser use over this decade. Chemical nitrogen peaked at 408,000 tonnes in 2018, and the target in Ag Climate is to reduce this to 325,000 tonnes by 2030. This target will be extremely challenging for the industry to achieve, but is something that the sector must do. There are so many environmental benefits to be achieved by cutting chemical nitrogen use: it will reduce emissions of

both nitrous oxide and ammonia, improve water quality and contribute to enhanced biodiversity on farms.

The challenge is clear, so how do we maintain grass productivity and crop yields while at the same time reducing chemical nitrogen inputs? The Ag Climatise roadmap sets out the principal ways that this will be achieved, with the most important actions as follows:

- Optimise delivery of online nutrient management planning to deliver a user-friendly and practical experience for all farmers
- A national liming programme for mineral soils is to be rolled out by industry, which will contribute to improved nitrogen use efficiency for both organic and chemical fertilisers. Liming levels are increasing (currently 1 million tonnes p.a.), but they are still below historic levels (1.7 million tonnes p.a. in the 1980s). Over the course of the next decade, target greater usage of approximately 2 million tonnes p.a.
- Achieve targets of 60% of all slurry spread by low emissions slurry spreading (LESS) equipment by 2022, 80% by 2025 and 90% by 2027. By getting better nitrogen recovery from organic manures, chemical nitrogen demand on-farm will be lower. This action will make a significant contribution towards meeting our ammonia reduction targets



High genetic merit suckler cattle grazing

On the regulatory side in Ireland, a fertiliser register is under consideration to ensure that farmers are only allowed to purchase fertiliser based strictly on crop requirement needs.

- In addition to using LESS, the application of organic manures in the spring, where possible
- From 1 January 2022, require all newly constructed external slurry stores to be covered. All existing external slurry stores should be covered as soon as practically possible, but no later than 31 December 2027. This will reduce ammonia losses from the stores, keeping more of the valuable nitrogen in the slurry, and thereby contribute to the reduction in chemical nitrogen usage
- Require incorporation and maintenance of clover (and mixed species) in all grass re-seeds by 2022, helping a reduction in chemical nitrogen use.

In addition to reducing overall levels of chemical nitrogen, our sector is also committed to adopting protected urea fertiliser as the main source of chemical nitrogen. Essentially, this is a urea-based fertiliser treated with a urease inhibitor, a product that New Zealand farmers are very familiar with.

By 2030, Ag Climatise recommends that 65% of calcium ammonium nitrate, our current main form of chemical nitrogen, is replaced with protected urea. This industry has embraced this change, and while there have been some teething problems in 2021 with the supply of urea-based products, the science is clear. Protected urea will reduce nitrous oxide emissions significantly, while also tackling the issue of ammonia emissions, a win-win for all involved.

If we can implement the actions outlined above, in conjunction with a move to protected urea, we will be a long way down the road to achieving our objectives. In practical terms, a combination of 'the stick and carrot' will be needed to drive the sort of behavioural changes that are needed. Ireland will use the Common Agricultural Policy (CAP) strategic plan to support farmers.

On the regulatory side in Ireland, a fertiliser register is under consideration to ensure that farmers are only allowed to purchase fertiliser based strictly on crop requirement needs. From speaking to and engaging with farmers on a regular basis they are ready for this challenge, and they understand why these changes are being asked of them.

Methane reduction

It is difficult to know where to start with methane or biogenic methane. The issue of methane creates a very different narrative, depending on your perspective. In the context of our roadmap, our objective was to stabilise methane out to 2030, having seen it increase over the most recent decade on the back of dairy expansion. However, as part of our wider Agri-Food Strategy 2030 'Food Vision' report, a 10% reduction based on 2018 levels by 2030 was proposed. This broadly mirrored the New Zealand approach.

The achievement of a 10% reduction in methane will be extremely challenging, but it is a target that the Irish Department of Agriculture, Food and the Marine believe to be both fair and proportionate. With changes in practice at farm level, and advances in technology, the sector is confident that more ambitious reductions in methane will be achievable in the post-2030 period.

Emerging science from the University of Oxford, led by Intergovernmental Panel on Climate Change (IPCC) scientist, Myles Allen, indicates that livestock methane levels would need to fall by 0.3% p.a. to ensure that livestock production systems are not contributing to any additional global warming. Extrapolating further, if methane levels were to reduce at a pace greater than 0.3% p.a. (3% per decade), then the livestock sector would be contributing to global cooling.



Reducing fertiliser use is crucial and has many environmental benefits

Carbon farming is a clear direction of travel and it is something that farmers should embrace.

Essentially, a view is expressed that the livestock sector would be 'bailing out' other carbon dioxide sectors for inaction on their part. Understandably, this is the position that has been adopted by the agricultural industry globally. Nevertheless, there is clearly merit in this argument. There is an overall carbon budget that the globe needs to operate with in order to meet the temperature goals of the Paris Agreement. Ultimately, it will be up to each individual country to decide how it 'uses its share' of the global carbon budget. Science really doesn't inform this debate.

Our new climate legislation will mean that methane needs to be on a declining trajectory, as it accounts for approximately 22% of our total national emissions. It is yet to be determined what level of methane reduction will be required. Ultimately, this is a matter for government approval later this year in the context of our sectoral emissions ceiling.

What is very clear, regardless of any debate around GWP100 versus GWP* (a topic for another day), is that there will be a continued and sustained narrative to reduce livestock methane emissions over this decade and beyond. This is something that livestock production systems all over the world must grapple with. We must not shy away from this challenge; we can all accept that reducing methane is a positive thing to do for our global climate. Financial models are needed to support farmers to do this; after all, it is no different to the principle of paying farmers to sequester carbon by planting trees. Carbon farming is a clear direction of travel and it is something that farmers should embrace.

Animal breeding

Another key component of our roadmap is around animal breeding. Like New Zealand, Ireland is a global leader when it comes to animal breeding. The establishment

of the Irish Cattle Breeding Federation (ICBF) in 1998 has played a key role in this. It was set up as a non-profit organisation to provide cattle breeding information services to the Irish dairy and beef industries. Indeed, a fellow New Zealander, Dr Brian Wickham, played a key role in leading the development of ICBF as its Chief Executive for well over a decade.

Some of the relevant key actions within Ag Climatise are:

- Genotype the entire national herd by 2030 to underpin the development of enhanced dairy and beef breeding programmes that help to achieve a reduction in our overall GHG output
- Transition away from the use of stock bulls as replacements in dairy herds by 2025
- Explore opportunities to better integrate the dairy and beef sectors, particularly focusing on calf-to-beef systems
- Earlier slaughter of beef animals.

It is an ambitious objective to genotype the entire national herd, but it is one that we believe is necessary to accelerate the kind of changes we need to see. There needs to be a re-focus on breeding traits that will lead to a reduction in absolute methane emissions, whether this be feed conversion efficiency or carcass size. Over time, breeding can make a significant contribution to reducing methane emissions.

I was asked at the recent GHG conference in New Zealand about the better integration of our beef and dairy sectors, and what this ultimately meant. With our recent significant dairy expansion, we have surplus calves in the system and many of these could be raised and fattened for beef. However, the genetics of these calves are not always best suited for this purpose. There has been an ongoing debate that the dairy farmer needs to produce a higher

quality calf for the beef farmer to raise. For example, could the genetics of a high-quality beef breed bull be better utilised within our dairy sector? There is merit in this suggestion, and our Ag Climatise roadmap seeks to have a more mature conversation about this issue.

There is also a clear commitment in Ag Climatise to reduce the average age of slaughter of our prime beef animals. Our current average slaughter age is 26.75 months and this needs to be reduced. It is one clear and very obvious way to reduce absolute methane emissions from the beef herd, and both genetics and farm management will underpin this objective.

Research and innovation

What role can research and innovation play in the wider sustainability challenge? Research and innovation underpins much of the economic progress seen in all sectors and agriculture is no different. We have seen the progress made with protected urea fertiliser and significant progress can be made around the development of methane-reducing feed additives and vaccines in the future.

This is where Ireland and New Zealand need to work together to address these issues in a collaborative way. It makes no sense for us to be researching these issues independently of each other. We need to pool our resources, our data sets, and invest in a meaningful way. Significant research collaboration already exists between our countries, but now is the time to really ramp up this level of engagement and lead the way on

this global climate and sustainability agenda. Trial work is already underway around the Dutch-developed feed additive 3NOP, a methane-reducing feed additive that has primarily been developed for confined systems of livestock production.

The challenge now is to develop a delivery mechanism for animals that are out grazing on pasture for large parts of the year. Simply put, if Ireland and New Zealand cannot solve this challenge together, then no countries can. We should not consider ourselves as competitors, as we speak the same language and have strong cultural and historic ties that bind our nations together, so we should maximise these cultural ties for the betterment of our agricultural industries.

Conclusion

While challenges undoubtedly lie ahead, it is an exciting future. The planet needs high-quality meat and milk protein if we are going to feed the globe's expanding population over the decades ahead, and any argument to the contrary is not based in reality. Our countries can produce these products more efficiently than most others in the world, so there is an onus on us to lead the way and climate-proof our livestock agricultural systems and protect the New Zealand and Irish family farm for generations to come.

Dale Crammond is an Agricultural Inspector who has been working in the Irish Department of Agriculture, Food and Marine for 21 years, including 10 years in agri-environmental policy. Email: dale.crammond@agriculture.gov.ie

*Research and innovation
will be key to the future
success of our industry*



IRELAND'S ORIGIN GREEN SUSTAINABILITY BRAND RELEVANCE FOR NEW ZEALAND'S BEEF INDUSTRY



This article reports on a study by the author on Ireland's Origin Green sustainability brand. It looks at what it is, how it is implemented in the Irish beef industry and its relevance to New Zealand. Compared to Ireland, the study found the New Zealand beef industry has been slow to implement important programmes such as the measurement of farm-level carbon footprints, traceability and consistent quality assurance standards.

Bord Bia and Origin Green

Origin Green is Ireland's food and beverage sustainability programme and brand, which claims to be the world's only programme of its type that operates at a national scale. Launched in 2012, it aims to set measurable sustainability targets involving all parts of the supply chain from farmers and processors through to food service and retail.

The programme needs to be understood in the context of the work of Bord Bia (the Irish Food Board). This organisation was established in 1994 from a merger of the Irish Meat and Livestock Board and the food promotional activities of the Irish Trade Board, and later incorporated the horticultural and seafood sectors. Bord Bia's primary function is to promote, assist and develop the marketing of Irish food and beverage products.

Bord Bia receives approximately €70 million in funding, representing about 0.5% of the €14.5 billion value of Irish agri-food exports. The only non-governmental funding is from a statutory farmer levy of €5.9 million. Most of Bord Bia's income is used for marketing and promotions and the remainder is spent on specific projects and operating expenditure. A total of €6.5 million is allocated to the Origin Green quality assurance schemes.

Beef Quality Assurance Schemes and the measurement of carbon footprint

The foundation of the Origin Green certification was the Irish beef quality assurance and traceability schemes, which have a long history in the Irish beef industry. They were originally developed in response to pressure from large retailers, as well as the outbreaks of bovine

Farms that joined the Sustainable Beef & Lamb Assurance Schemes in 2014 saw an average of:

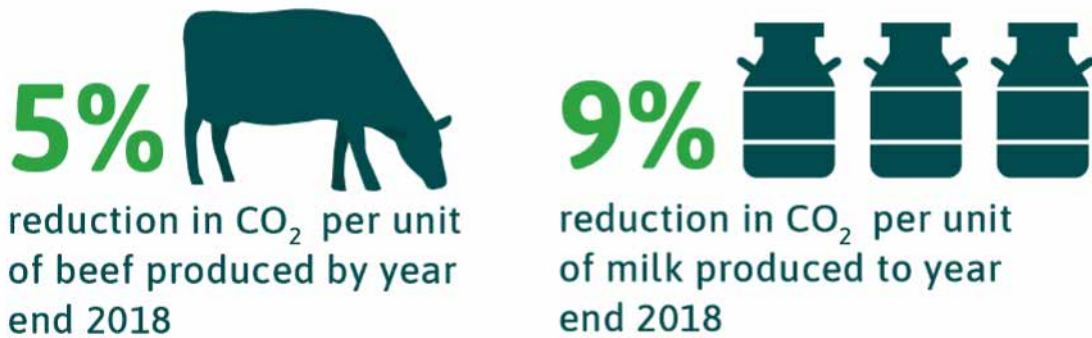


Figure 1: Reductions in on-farm CO₂ emissions 2014-2018
Source: Origin Green Progress Update Report

Following each audit, the farmer receives a sustainability report showing the results and feedback on the farm's performance, with reassessments every 18 months.

spongiform encephalopathy (1984-2008) and foot and mouth disease (2007). They set standards for traceability, food safety, hygiene, health and safety and animal welfare.

The significant change to these quality assurance schemes with the introduction of the Origin Green programme was the addition of a farm-level measure of carbon footprint (Figure 1). Other sustainability measures included are water use efficiency, biodiversity and energy efficiency. This report focuses on the on-farm measurement of carbon footprint.

The addition of a carbon footprint measurement was in response to several published studies on the impact of the livestock sector on greenhouse gas (GHG) emissions that questioned the sustainability credentials of the Irish beef production system. This highlighted the need to develop verifiable industry data to measure GHG emissions and establish a basis for demonstrating progress.

The measurement of a farm-level carbon footprint uses the Carbon Navigator – a tool developed by Teagasc (Agriculture and Food Development Authority). The carbon footprint scheme is certified by the internationally recognised Carbon Trust and utilises methodology aligned to specific standards – GHG Protocol Product Standard PAS 2050 and ISO 14067. These methodologies use a

Life Cycle Assessment (LCA) approach and are based on the Intergovernmental Panel on Climate Change (IPCC) guidelines. Food and drink manufacturers are independently verified by international auditors Mabbett and Associates.

Implementation of the Origin Green carbon footprint measurement

To measure carbon footprint, data is collated from several different sources. This includes the Department of Agriculture's Animal Identification and Movement System (AIMS), the Irish Cattle Breeding Federation (ICBF) database and slaughter weights from the beef processors. Additional data is also collected from Bord Bia's Quality Assurance audit, which requires farmers to record information on all farm inputs and outputs.

Following each audit, the farmer receives a sustainability report showing the results and feedback on the farm's performance, with reassessments every 18 months. This report identifies areas that can improve the carbon footprint of their farms by evaluating key efficiency areas. These include extended grazing, calving rate, daily live weight gain, improved Economic Breeding Index (EBI), nitrogen efficiency, slurry management and energy efficiency.



With increasing environmental regulations there is greater acceptance of the need to record and demonstrate environmental sustainability measures.

Importance of Origin Green in the marketplace

Origin Green aims to be an umbrella for all that the Irish food and beverage industry is doing in the sustainability space. Beef industry leaders have stated that the carbon footprint data is important because it enables the beef industry to measure and demonstrate its environmental credentials. Like New Zealand, Ireland has always traded on its 'green' island environment. However, the Irish beef industry found that this perception is no longer sufficient and they now need to demonstrate this is true. Origin Green is seen as a way of future-proofing the sector and ensuring Irish beef continues to be competitive in a changing environment.

Farmer perceptions of Origin Green

From a market perspective, farmers have said it is difficult to evaluate the impact of the Origin Green brand, especially for returns at the farm gate. They are aware that the Irish industry is dependent on large retail customers such as Tesco and McDonalds and therefore they set the rules. As a result, farmers felt Origin Green has become a standard they require rather than something that provides a premium. Those who are closer to the market through involvement with branded products, such as Hereford or

Angus, are more positive about the benefits. Some farmers are also concerned that all farmers are treated equally and there is no premium for those who have a lower carbon footprint.

Most farmers commented on the significant additional information required for carbon footprint measurements. Many considered this to be time-consuming and not very relevant to their farm business. However, with increasing environmental regulations there is greater acceptance of the need to record and demonstrate environmental sustainability measures. Some highlighted the benefit of the report in identifying areas where they could be more efficient. This seemed to be a more important motivation than specific environmental concerns.

Outcomes for the Irish beef industry

Although Origin Green may not have achieved all of its primary goals, there are several positive outcomes for the Irish beef industry:

- The programme has taken a proactive approach to the environmental impacts of beef production and in particular carbon emissions. Origin Green introduced the farm-level carbon footprint measurement in 2012, which was well ahead of any other beef-producing



Irish grass-based
beef production

Despite some of the challenges in implementing Origin Green, there are significant lessons relevant to New Zealand's efforts to verify and communicate its sustainability credentials.

country. This provided evidence that the industry was taking its environmental impacts seriously and was trying to address its sustainability issues

- It has been able to produce independently verifiable data with which to engage in the debate on the impact of beef production on the environment. Without this, the industry would be vulnerable to data produced from outside the beef industry and would not be able to question the validity of these studies
- It has identified some key areas where farmers can make changes to their production system that improve both environmental outcomes and farm efficiency
- It has helped the industry engage with stakeholders, especially the large retail customers such as Tesco and McDonalds, and supports them with their own sustainability agenda. This has helped keep Irish beef in a competitive position in markets where there is strong competition from local beef.

Relevance to New Zealand

Despite some of the challenges in implementing Origin Green, there are significant lessons relevant to New Zealand's efforts to verify and communicate its sustainability credentials. Bord Bia and the Origin Green programme have enabled the Irish beef industry to be proactive about traceability, quality assurance, measuring GHG emissions and promoting its

sustainability brand. It has also been able to extend this across all its food and beverage exports. In this respect, Ireland is well ahead of New Zealand.

Carbon footprint

New Zealand does not have an equivalent food sustainability programme that includes a farm-level carbon footprint measurement. This is currently under development, but is still several years away from being fully implemented.

For example, the Beef + Lamb New Zealand *Environment Strategy and Implementation Plan* aims to have a system for farm-level accounting and reporting of agricultural emissions in place at the farm level by 2025. Another document that outlines the commitment of primary sector industries to mitigate climate change is *He Waka Eke Noa - Our Future In Our Hands: Primary Sector Climate Change Commitment*, which proposes that all farms will have an emissions reporting system in place by 2025. This highlights how New Zealand tends to respond to government regulation rather taking a proactive approach.

Traceability

Ireland has had animal traceability systems and quality assurance schemes in place since the 1980s. In the Irish scheme any animal can be located through its ear tag. It is a legal requirement that every time an animal moves, farmers are required to enter the new location of the animal in the system.

New Zealand has also been behind Ireland with its quality assurance schemes for beef and lamb.

In contrast, the New Zealand National Animal Identification and Tracing (NAIT) scheme was introduced in 2012. There was considerable opposition from farmers and farmer organisations who saw it as an additional cost on their business for no tangible gain. They were also concerned about the privacy of data and how government agencies might use this. As a result, the Ministry for Primary Industries (MPI) introduced the scheme with no mandatory recording. It was not until the recent incursion of *Mycoplasma bovis* that serious deficiencies in the traceability system were identified. Since then, there has been a major review of NAIT with a number of the recommendations implemented to strengthen the system.

Quality assurance

New Zealand has also been behind Ireland with its quality assurance schemes for beef and lamb. The New Zealand Farm Assurance Programme (NZFAP) introduced in 2017 was the first comprehensive industry-standard farm assurance programme. Before this, farmers had to meet the requirements of multiple farm assurance schemes, depending on the specific processor or customer requirements. Many of these schemes were similar, but often required multiple audits on the one farm.

New Zealand beef industry branding

In contrast to the Irish industry the New Zealand red meat sector has struggled to develop a coordinated

industry strategy or national branding programme that provides verifiable sustainability measures or has the ability to communicate the unique characteristics of our natural production systems. Recent initiatives, such as the Beef + Lamb New Zealand Taste Pure Nature, aim to address this but with limited resources and only in select markets.

Potential for a New Zealand national sustainability brand

Despite the shortcomings of Origin Green, it highlights the opportunity for New Zealand to develop a similar sustainability brand. It also shows the potential to extend this beyond just the beef industry and bring together all New Zealand's food exports. Furthermore, the Irish experience has highlighted the need for an agency or organisation to provide leadership across the food sector to implement change. Without this leadership it is likely that this country will continue to struggle to introduce a unified food strategy or respond to the repeated calls for a New Zealand food sustainability brand.

Acknowledgements

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MUHAMMAD WASIM IQBAL, INA DRAGANOVA,
PATRICK MOREL AND STEVE MORRIS

CAN COW BEHAVIOUR INFLUENCE PERFORMANCE?

This ongoing research is about the validation and application of leading-edge technology to monitor the variations between individual dairy cow's behaviour in a grazing-based system and their contributions to overall herd productivity. So far the research team has compiled two studies (with more to come) and the preliminary results are discussed in this article. Early indications from these results will be of interest to rural professionals as they advise farmers on this topic.

Lifting dairy performance

To ensure the competitiveness of the dairy industry in New Zealand, a consistent focus is required on lifting dairy production by considering it more in terms of quality, not quantity, and value, not volume. An individual animal's performance (productivity) has a key role to play in the overall herd's performance and the profitability of the farm. Having data on an individual's performance can help farmers to adjust feed so their animals produce more or better quality products. It can also highlight the best and worst-performing individuals and aids in decisions about which cows to keep.

Animal performance is influenced by several factors including genetics, feeding regime and type of feed, reproductive status, health and the overall management of the farming system. Animal behaviour is believed to be one of the most important factors contributing to animal performance, and generally includes all the ways they interact with other animals and the physical environment.

Animal behaviour

Knowledge of animals' natural behaviour is essential in creating the right environment for individual animals and herds so they can express themselves naturally. This also helps to manage and care for animals in a better way to keep

them healthy with a high quality of life. This is a fundamental aspect of livestock production, which is supported and promoted by farmers and other rural professionals.

Gaining an understanding of animal behaviour allows us to identify and treat sick animals, respond to immediate challenges, select better animals for breeding, design appropriate housing, and handle herds without creating unnecessary stress. Therefore, farmers, stockpeople and animal handlers should have at least a basic understanding of the behaviour of the animals they work with to adopt best farming practices and to achieve the desired farming efficiency.

Grazing and rumination behaviours

In a grazing-based dairy production system practised in New Zealand, grazing and rumination behaviours are of particular importance:

- Grazing behaviour refers to grass intake and reflects the eating patterns and absence of prolonged hunger. It is influenced by grass type, climatic conditions and the social status of the animals in the herd
- Rumination behaviour indicates an animal's digestive efficiency, fibre intake and health status, and varies depending on grass quality, type and size.



A cow with collar grazing on pasture



PLF tools can supplement the eyes and ears of the farmer through real-time monitoring of behaviour, milk production, temperature, oestrus, and in some cases can predict the onset of disease.

Both intake and digestive efficiency (i.e. grazing and rumination behaviours) substantially affect the animal's performance.

Effect of animal behaviour on dairy cow performance

It is therefore useful to explore the contribution of animal behaviour to dairy cow performance. In New Zealand, average dairy herd size is large (~400 animals) and monitoring individual animal's behaviour using visual observations or camera recording is quite laborious. A lack of tools to measure individual animal behaviour in a commercial grazing-based system has been a hurdle in the past. Advancements in Precision Livestock Farming (PLF) technologies have removed this barrier and paved the way for studies focusing on animal behaviour.

Precision Livestock Farming tools

PLF, also referred to as the 'per-animal approach', uses advanced technologies to optimise the management of individual animals, enhancing the contribution of each one in a herd to improve overall herd performance. PLF tools can supplement the eyes and ears of the farmer through real-time monitoring of behaviour,

milk production, temperature, oestrus, and in some cases can predict the onset of disease. This information can be used by farmers to improve animal welfare by improving feed intake, physical health, reproduction and the overall management of the farming system.

PLF tools can monitor different behaviours in cattle such as eating, ruminating, calving, lying, walking and urinating. The devices that specifically measure behaviour have been tested and used overseas in indoor confined dairy systems, but there is little evidence of their accuracy in outdoor grazing systems like those in New Zealand. This lack of evidence and the system's cost are barriers to the farming community adopting the technology.

Behaviour monitoring cow collar device-based study

A study carried out by the Animal Science section of the School of Agriculture and Environment at Massey University primarily aimed to validate a behaviour monitoring collar device for dairy cows in a grazing-based system in New Zealand. It involved examining individual animal's variations in grazing and rumination behaviour and evaluating whether behaviour can improve performance prediction in dairy cows.



Data collection and PLF tools

The study used a herd of dairy cows from Massey University's Dairy Farm, comprising three breeds (Holstein-Friesian, Jersey and KiwiCross) in different lactation numbers. The data collected comprised of an individual animal's hourly/daily grazing time, hourly/daily rumination time, daily live weight, daily diet, monthly body condition score, monthly milk production and composition of dairy cows during the whole lactation period for three consecutive lactation seasons.

Behaviour data was collected using an automated device called Aficollar, which continuously monitored and recorded daily and hourly grazing time and rumination time on a real-time basis. The collar was fitted around the cow's neck, with the sensor positioned on the right side of the neck. The collar had a triaxial accelerometer sensor, which was fitted in a box.

The sensor could identify specific motion patterns in different behaviour categories, such as grazing and rumination, based on head movements. Built-in generic algorithms processed the collected data and expressed it as hourly and/or daily grazing time and rumination time of the individual cows. The collar wirelessly transmitted the collected data to a base station when the cow was in the range of ~500 m and a wireless internet connection in the farm environment was used to download it.

Analysis and preliminary results

To recap, so far the research team has compiled two studies: one focused on the validation of the PLF tool; and

the second focused on the effects of breed, lactation number, seasonal patterns and stage of lactation on the grazing time. The preliminary results of both studies have already been mentioned and are further discussed in the 'Implications of the study' section of this article. Data for rest of the studies have not been analysed yet.

Data for behaviour and the other variables mentioned above have already been collected for the 2018-2019, 2019-2020 and 2020-2021 lactation seasons. The preliminary statistical modelling to evaluate the difference in grazing and rumination behaviours in different breeds, ages and lactation stages and how the variations in diet types fed throughout the season affected grazing and rumination behaviours will also be evaluated. Statistical modelling was performed to see how grazing and rumination behaviour patterns fluctuate during different seasons and weather patterns.

The study will also provide information on the association of grazing and rumination behaviours with animal performance (milk production and composition), body weight and body condition score, and the extent to which animal behaviour can predict animal performance. The last part of this study will evaluate the variations in behaviour patterns before and during any health-related incidents such as mastitis, lameness, fever etc. The objective of the last part of the study is to examine if the collar device can help to predict the occurrence of any sub-clinical disease, as a dip in grazing and rumination is expected before and during sickness.

Investigations of intra-and inter-animal variations in dairy cow behaviour throughout the lactation period and their effects on performance are expected to contribute to improving the production efficiency of the dairy farming system.

The behaviour monitoring tool used in the study showed consistent results with the visual observations of behaviour performed by a trained observer, which proved the validity of the collar to measure the behaviour of grazing dairy cows. A preliminary analysis of the data collected has revealed that the cows with different breeds and lactation number did not vary in their daily grazing time and rumination time, but Jerseys generally spent more time grazing and less time ruminating compared to Friesians.

Time spent grazing appeared to decrease with an increase in age (lactation number). Time of the year and stage of lactation seemed to have significant effects on grazing time and rumination time. Grazing time varies significantly for different stages of lactation or month of year across the lactation period. Overall variations in grazing time throughout the lactation period had a curve consistent with the lactation curve. The study's next steps include analysing the remaining data, and the outcomes of that analysis will help determine any further investigation.

Implications of the study

Investigations of intra-and inter-animal variations in dairy cow behaviour throughout the lactation period and their effects on performance are expected to contribute to improving the production efficiency of the dairy farming system. This also might help the upcoming studies aimed at selecting more efficient animals for the future.

Daily grazing time of individual cows indicates eating patterns and time spent on grass intake to fulfil satiety needs and it reflects the absence of hunger. Grazing time is expected to be different for healthy and sick animals, and for pregnant and non-pregnant animals. As behaviour data is provided on an individual animal basis, it is easy to notice any fluctuations in the eating patterns of every single animal. Fluctuations in the grazing time of a cow (e.g. a consistently lower grazing time) reflect that the animal might be unhealthy, lame or unwell, so it might be easier to predict and/or identify any health-related issues happening to the animal.

On the other hand, it could be easier to identify those animals with high grazing time but low productivity, and those with low grazing time and high productivity. This might be helpful in developing a future herd consisting of more efficient animals. In turn, the selection of alternative, high-yielding dairy cows with appropriate indices will help to meet future demands for milk volume and quality.

Grazing time patterns for different seasons can help to manage feed resource and pasture availability by preventing feed shortages during extreme weather conditions. Similarly, rumination time also indicates the health status of the animal, so any consistent fluctuations in rumination time would be helpful for identifying if the animal has any physical or physiological problems. Also, grazing time and rumination time in dairy cows differ during oestrus. Behaviour monitoring might help improve on-time oestrus detection, hence improving the conception rate and preventing economic loss to the farmer.

Key messages

- Monitoring animal behaviour should help to improve the welfare status or quality of life for individual cows in the herd
- Monitoring grazing behaviour during different seasons and stages of the lactation period should help manage feed availability and pasture resources, and help to understand the variations in cow feed requirements
- Grazing and rumination behaviour data should help disease prediction in dairy cows to improve their health status
- Monitoring grazing and rumination behaviour during oestrus should help to improve oestrus detection and rate of conception
- Monitoring cow behaviour should help to improve the overall production efficiency of the farming system.

Conclusion

The collar device tested is valid to record individual dairy cow behaviour in a grazing-based dairy production system. This study addresses two perspectives of the grazing-based dairy farming system practised in New Zealand: monitoring dairy cow behaviour at an individual level, not at the herd level; and research that provides knowledge and leads to a pathway for upcoming studies focused on the application of PLF tools in dairy farming systems practice in New Zealand. The knowledge gained about individual animals provides an opportunity to improve health, welfare and performance.

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BARRIERS TO LAND USE CHANGE ISSUES FOR FARMERS

This article discusses the outcome from a project investigating the issues that Waikato farmers encountered when they looked to diversify their land use.



The OLW project

Now more than ever, farmers and growers are facing tighter regulations and pressure to reduce their environmental footprint from traditional dairy and sheep and beef operations. The current focus is on contaminants such as nitrogen (N), phosphorus (P), sediment, *Escherichia coli* (*E. coli*) and greenhouse gases (GHGs). Central government has identified land use change (amongst other strategies) as being a key tool to enable national targets to be met to reduce these contaminants.

AgFirst obtained funding from the National Science Challenge (NSC) Our Land and Water (OLW), administered by the New Zealand Institute of Primary Industry Management (NZIPIM), to carry out a Waikato-based study that sought to understand the challenges a landowner will need to overcome to unlock alternative land use options on their land. AgResearch was engaged as the challenge party, with a role to observe and document the social parameters that farmers faced when

considering land use change. Phillip Weir, the Waikato partner farmer for this project, is actively considering diversification and was relatively well advanced in his due diligence process when the project started.

For land use to progress, better information needs to be provided to individual landowners/managers. Some excellent knowledge, data and tools are available to help make decisions about land use, but there are also some big gaps. This research provided a snapshot into some of the barriers to land use diversification. It is hoped the report will contribute to a vision of identifying a much greater range of suitable land opportunities that may provide the opportunity for a greater diversity of benefits for the New Zealand primary industry sectors.

The OLW project builds upon work completed in 2019 funded by the Waikato Regional Council, which profiled a range of options that might be available for farmers in the Waikato, and work undertaken by AgFirst to identify Barriers to Diversification (2017), a report commissioned by the Ministry for Primary Industries (MPI).



The scope of the OLW project was to recruit and engage with diverse farming operations that would have suitable land and appetite for understanding alternative land use options.

Factors driving land use change

There are a range of factors which drive land use change, which are listed below. All of these factors interact with and influence each other:

- Biophysical factors
- Economic factors
- Technological factors
- Individual factors
- Societal factors
- Regulatory factors.

The scope of the OLW project was to recruit and engage with diverse farming operations that would have suitable land and appetite for understanding alternative land use options. Through the facilitation of workshops, AgFirst provided guidance and technical analysis on how to undertake, at an individual/farmer level, due diligence for their diversification option. Once the participant group was formed a survey was presented to the participants, which enabled benchmarking and recording of individual progress. At a pilot scale, the project aimed to understand the 'real world' challenges to land use change.

Farmer workshops

Three farmer workshops were facilitated to give information on alternative land use options, due diligence requirements, economic analysis, risk criteria, as well as provide expert industry perspectives.

• Workshop One

- Introduction of the participants, the purpose of the project, and their ideas of potential land use change they were investigating (or could)
- A presentation on the work carried out to date on land use change
- Introduce the participant farmers to an action plan involving appropriate due diligence tasks. Participants were provided with a checklist of activities for due diligence
- A presentation on the economic, risk, environmental and human capital issues to consider when looking at land use change

• Workshop Two

- Host farmer discussed his due diligence programme to date (setting up kiwifruit block on a sheep and beef farm) and priorities around business and family life
- Discussion by an invited local farmer on his establishment of an avocado block (3 ha) on his dairy farm
- General discussion by participating farmers as to where they were at with their diversification programmes and issues they had run into
- Presentations from experts/industry people (kiwifruit, sheep milking, hydrologist and GHG/carbon farming)

• **Workshop Three**

- A summary of the project to date
- A review of the due diligence list and where participants were at – what barriers had they faced/ overcome, had they changed their minds on anything?
- A presentation from Fruition Horticulture around land use change into horticulture and associated issues
- A discussion of where to next – having been through the project, what were the participants’ feelings on their next steps and is there enough support to help them progress?

In addition to the workshops, the participants were asked to complete survey questionnaires, which tracked their actions, thoughts and progress throughout the OLW project. The following topics were discussed and reported on from the participants over the length of the project:

- Existing land use enterprise
- Land use options available and considered
- Motivations for land use change

- Access to information and support
- The challenges and barriers participants came up against and how they approached these.

Wide range of current enterprises

Workshop participants had a diverse range of current enterprises ranging from dairy, sheep and beef through to lifestyle enterprises (*Table 1*). Many of the respondents were already farming multi-enterprises, either a combination of dairy and dairy support or dairy support and sheep and beef.

Through discussion with participants, it became apparent that consideration of diversification may be more of a focus for younger farmers as a due diligence exercise, but it is not actually implemented. This was due in part to often needing to navigate a succession arrangement with family (i.e. directing capital into the purchase of land or stock). Increased land values and high levels of capital gain over the last 20 years has placed pressure on these processes, which may result in diversification not being executed.

Table 1: Participants’ current farming operation

PARTICIPANT #	EXISTING ENTERPRISE	TOTAL SIZE (ha)
1	Dairy Dairy support	193
2	Dairy support Sheep and beef	270
3	Dairy Dairy support Lifestyle	165
4	Dairy support Sheep and beef	240
5	Dairy	180
6	Dairy	501
7	Dairy	141
8	Lifestyle	27
9	Sheep and beef	1,020
10	Sheep and beef	16
11	Sheep and beef	225

Table 2: Land use change considered by participants

LAND USE CHANGE CONSIDERED	NUMBER OF RESPONDENTS
Dairy, sheep	4
Vegetable production	4
Maize	2
Blueberries	2
Kiwifruit	3
Dairy, goat	1
Other horticulture (nut trees, citrus, 'anything')	4
Other (forestry, raw milk, meat processing, honey, nursery, native trees, carbon)	8

Some workshop participants noted that they had changed their diversification plans over the course of the workshops, suggesting that the events had sparked new thinking around diversification. By the final workshop, most had either changed their ideas or delayed implementation.

Most participants were considering a combination of diversification enterprises (Table 2). Examples of the combinations mentioned included 'kiwifruit and dairy sheep', 'dairy sheep and blueberries' and 'kiwifruit and vegetable production'.

Overall, farmer participation in the workshops was motivated by a desire to seek information and support (expert advice). In essence, they wanted reassurance that they were on the right track or needed to/should be considering different pathways.

Workshop outcomes

A key message from the workshops was the need for farmers to have good information around the financials (economic analyses) of different diversification options. Farmers wanted reassurance that their investment in one or more new land uses was a sound proposition and they wanted to be able to compare options. In the absence of economic analysis, connecting with others (including consultants and experts) was seen as valuable, especially if everyone is in the same room at the same time. The key motivations ranked by the participants for diversifying are given in Figure 1.

Participants were asked to identify their top supporting partners in progressing their diversification plans. The initial thought about supporting partners saw the banks being rated as having the greatest importance at the start of the project or due diligence process. In effect, the banks were seen as a coverall for finance and therefore if it is not possible to obtain finance the project is dead.

What became apparent is that while this is true, access to capital is not the principal constraint and access to cross-sector information is. The top supporting partners changed throughout the project as shown in Figure 2.

Initially, participants had anticipated that access to capital would be a significant barrier, but this changed through the programme, with physical limitations/resources and production uncertainty being identified as more significant towards the end. A clear message from the workshops is that diversification is multi-faceted and complex. Several participants commented that there was a lot more to sorting through diversification options and implementing these than originally anticipated.

When discussing the 'where to now' at Workshop Three, one of the participants stated that after considerable due diligence: 'There is no silver bullet, information is too hard to come by and the most certainty I will get for financial gain will be to sell my individual titles as large lifestyle blocks.' This unfortunately is the reality of the pressures faced, and more and more we are seeing high class land being lost from productive agricultural land into housing and lifestyle units. The key barriers identified to progressing diversification plans are given in Figure 3.

Participants were asked to identify the disadvantages they felt existed to diversifying. Most participants saw the time involved establishing a new enterprise, increased debt, and pressure to run two or more operations as the key disadvantages to diversification. Figure 4 gives the disadvantages to diversification.

Irrigation issues and other barriers

The barrier that was most discussed during the workshops was water availability for irrigation. There were a number of participants who were working through various stages of their due diligence for obtaining water for irrigation.

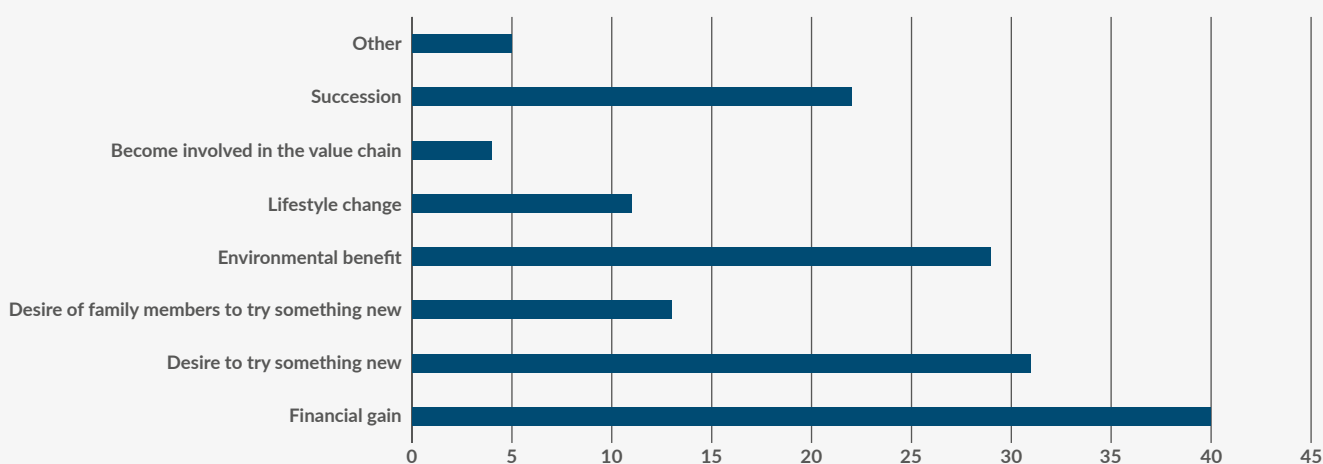


Figure 1: Key motivations of participants

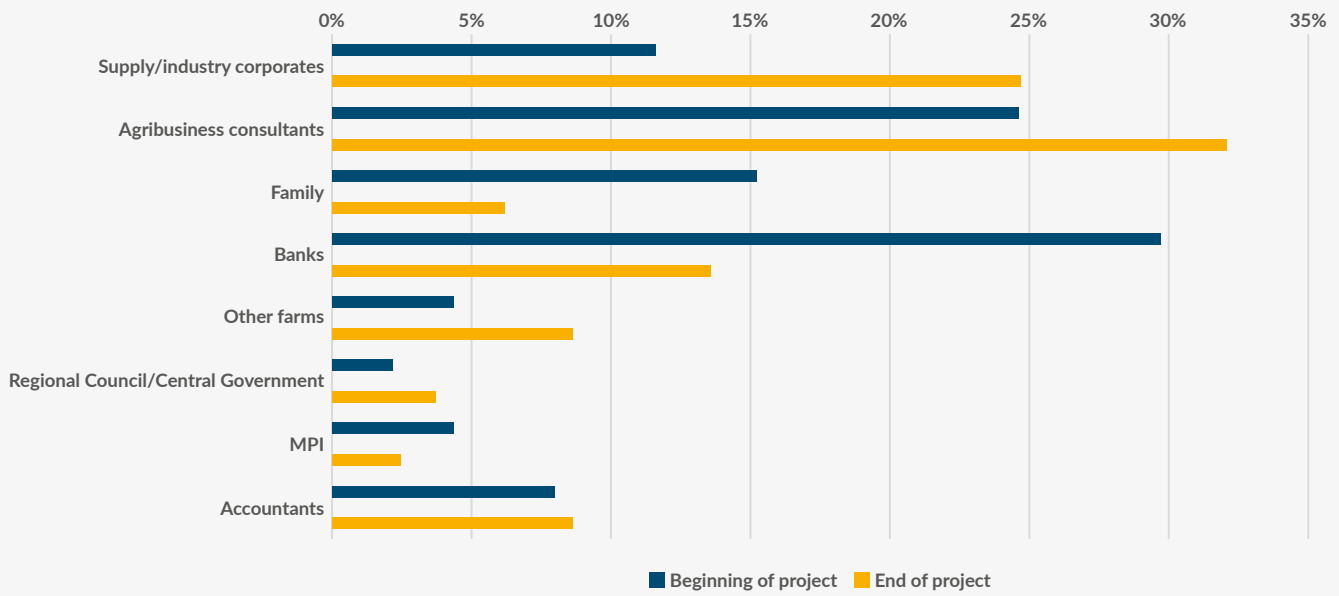


Figure 2: Top supporting partners in land use change decisions

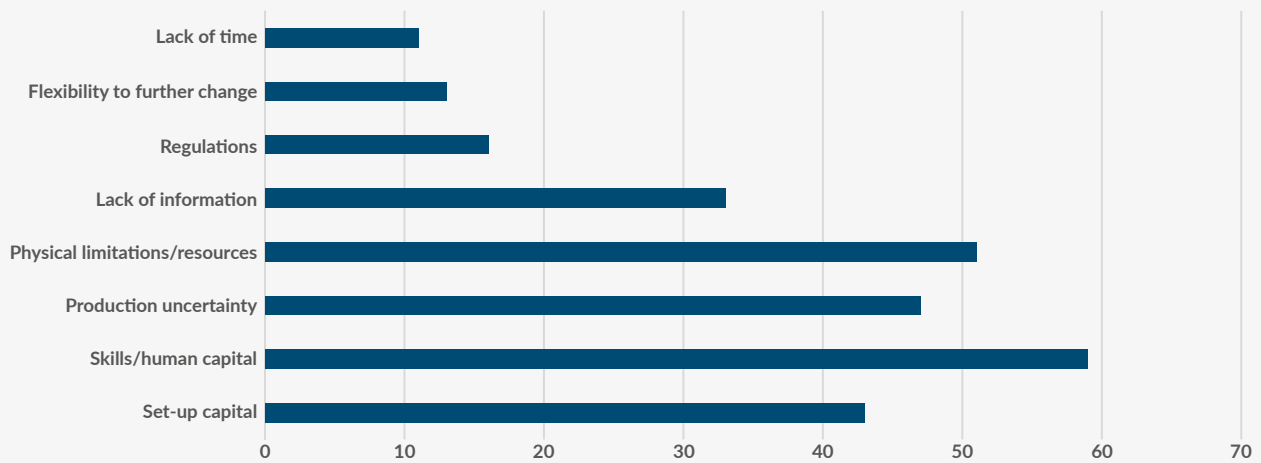


Figure 3: Key barriers to progress diversification options

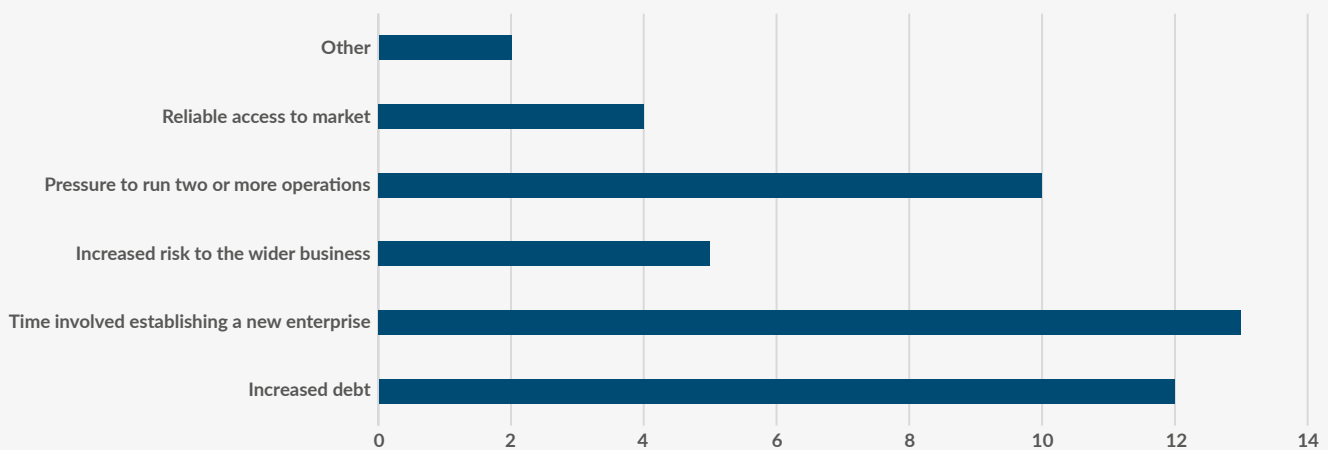


Figure 4: Disadvantages to diversification

At an individual level, the biggest barrier faced was time availability – to continue to run the existing enterprise while doing due diligence on the proposed land use change.

Only one of the participants had progressed to an investigation stage, with the others stalling and often second guessing their diversification options because of uncertainty and difficulty around this topic.

The study area in the Waikato is one that for pastoral land uses has long been considered summer safe, and as centre pivots expanded around New Zealand the need for this infrastructure to support dairying or drystock pastoral within the Waikato has been limited. The challenge then is that farmers in the Waikato are generally only familiar with dealing in volumes of water for stock use that can be readily found from surface features or small bores and is typically low in volume.

When looking at horticultural crops the demand is significant, and despite the soils being of high quality and able to grow most crops the absence of water will ultimately be the restriction. Therefore, from an environmental perspective there could be a requirement to assess the externalities associated with increased water storage and reduced flows versus nutrient and contaminant losses, including GHGs. Practically, there will need to be an easier way to obtain and store water if the economy wants to transition to lower impacting GHGs and water pollutant activities.

Participants also noted frustration around:

- Accessing information on water resources and council regulations
- Costs for investigation and the risk of not finding the quantities required
- The time involvement and cost in obtaining consents
- The abundance of surface water on their farms, with high flows during off-peak periods, but constraints in harvesting and storing this for summer use
- Given the relatively high rainfall in the Waikato catchment, water storage for irrigation could be relatively efficient. Creating the policy settings to support this extra storage is considered a key enabler to allow land use change resulting in lower nutrient and GHG losses.

A key question that perhaps needs to be asked and solved is: 'What is the environmental offset impact of accessing water in an allocated catchment versus reducing on-farm contaminants (nutrients and GHG)?'

Other significant barriers that were commented on by participants include access to financial information. While

there is some financial information available for the major industries, often these are the ones being diversified away from. Information on new crops is extremely rare and difficult to access. Often small growers are focused on the domestic market and are very reluctant to share information. Another barrier relates to market outlook – in a similar vein, obtaining good information on potential markets, and how to access these, is again very scarce.

Recommendations

Some key recommendations from the OLV project are:

- More in-depth analysis of farmers diversifying in a specific region, focusing on both the farmers and their support network
- Case study approach: a focus in on one diversification pathway/option (e.g. dairy cows to dairy sheep or adding kiwifruit to a dairy platform); and tracking farmers' experiences as they progress towards implementation
- Develop Fact Sheets on useful information when considering land use change
- Review government policies and regulations that inhibit land use change, particularly those that result in lower environmental footprints
- The following are considerations that need to be addressed at a regional and national scale:
 - How can we make land use diversification more appealing?
 - What are the steps that can be put in place to enable change to happen?
 - How can we support the industry to provide better information?
 - If access to water is such an issue, how can this be overcome?
 - The easier alternative pathway to diversification is subdivisions/lifestyle blocks.

Conclusion

A clear message from the project is that diversification is multi-faceted and complex. Obtaining good information, particularly economic, on the options under consideration is critical and the lack of this information was a major barrier. Similarly, with information/access to a value chain or to markets.

At an individual level, the biggest barrier faced was time availability – to continue to run the existing enterprise while doing due diligence on the proposed land use change. Physically, the greatest barrier when looking to change land use to a horticultural enterprise was access to water for irrigation and working through the bureaucracy around this. Overall, therefore, while land use change may well be desirable there are significant barriers to achieving this.

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FOOD TRENDS

CHANGING CONSUMER BEHAVIOURS

The food market is changing. Consumers are increasingly transitioning to what market research describes as 'plant-forward' or 'plant-centric' ways of eating. This article looks at how the prevalence of meat in consumer diets is changing and how parties across the food supply chain are evolving to meet changing consumer demand.

Demand and supply side changes

On the demand side, consumers are becoming increasingly concerned about the environmental, ethical and health issues associated with the consumption of meat and other animal products. Spurred on by information shared through social media and Netflix documentaries such as *Game Changers* and *Cowspiracy*, consumers (especially young adults) are shifting their consumption behaviours towards a diet lower in meat and other animal products.

Nationally, this shift is being driven by health concerns, followed by concern for animal welfare and the environment, as well as the lure of increasing numbers of plant-based options in the market. As consumers reduce the prominence of meat in their diets, they are increasingly

seeking plant-based alternatives and retailers and food businesses are working hard to respond.

On the supply side, food service, retail and manufacturing businesses are expanding their meat-free and plant-based product offerings to cater to changing consumer taste. In food service, fast food chains such as Hell's Pizza, Dominoes and Burger Fuel are adding alternative proteins to their menu, adopting both imported and domestically produced products.

Retailing and manufacturing

In retailing, this year both supermarket retailers added plant-based product lines under their own private label brands:





The market for plant-based alternatives has undergone a significant re-branding, with brands actively targeting consumers across vegan, vegetarian, flexitarian and omnivore consumer groups.

- Foodstuffs launched Pam's Plant Based, an extensive line of plant-based meat and dairy substitutes and ready-to-eat meals
- Woolworths launched their Plantitude range across freezer, bakery, grocery, health foods and chiller.

In manufacturing, we have seen a number of new generation domestic brands such as Sunfed and Food Nation join traditional players like Bean Supreme. Where traditional plant-based meats offered convenient plant-based proteins without attempting to taste, look or cook like meat (think bean burgers and veggie sausages), we are now seeing a new generation of plant-based meats sweep the market. These new products are designed specifically with the intention of replicating meat in taste, appearance and cooking experience, such as Beyond Meat and Impossible Foods.

In just a few years the market for plant-based alternatives has undergone a significant re-branding, with brands actively targeting consumers across vegan, vegetarian, flexitarian and omnivore consumer groups.

Flexitarianism and veganism

Many consumers do not see meat reduction as an 'all or nothing' approach. Instead, many are opting for a reduced or 'flexitarian' diet. The German Society for Nutrition has defined flexitarians as those consumers who 'reject factory farming, want to protect the environment, promote

their health and still don't want to give up meat entirely (see www.dge.de/wissenschaft/weitere-publikationen/fachinformationen/flexitarier-die-flexiblen-vegetarier/).

Essentially, flexitarians are flexible vegetarians who eat meat but do not do so daily or regularly. For these consumers, animal welfare and the quality of their food is highly important, as is their health and environmental impact. Therefore, consumers perceive such a diet to reduce their carbon footprint and benefit their health while still enjoying some level of meat consumption.

New Zealand domestic consumers

A 2019 Colmar Brunton study found that one in three New Zealand consumers are reducing their meat consumption, meaning that over 1.5 million Kiwis could be eating less meat. The nationally representative study carried out by Colmar Brunton surveyed over 1,100 New Zealand consumers and showed that growth in flexitarianism is being driven mainly by Generation X and Baby Boomers.

As domestic consumers seek to reduce how much meat they are consuming, they are increasingly seeking plant-based alternatives, with over 60% of Kiwis indicating that they have tried, or are wanting to try, new plant-based meat products. Consequently, this market segment is viewed as a stimulus for demand for plant-based products that have been historically targeted exclusively at vegan and vegetarian consumers. However, that is not to say that vegans and vegetarians are going anywhere. Vegetarian

A 2019 Colmar Brunton study found that one in three New Zealand consumers are reducing their meat consumption, meaning that over 1.5 million Kiwis could be eating less meat.

and vegan consumers are those who have eliminated meat and other animal products from their diets.

The Colmar Brunton study reported that it is millennials who mainly drive veganism and vegetarianism in New Zealand. Similarly, a joint report by Bayer, the NZ Nutrition Foundation and AUT indicates that consumers from 15 to 34 are the biggest age group adopting flexitarian, vegan and vegetarian diets. These trends can be seen elsewhere around the globe because millennials play a prominent role in the global shift in food preferences towards diets low in and void of animal products. Across all markets, younger consumers are overwhelmingly driving these dietary changes.

Global consumers

China

In China, the Government has announced it intends to cut red meat consumption by 50% by 2030. Chinese consumers are increasingly motivated by health, and those in urban centres are shifting to vegan and flexitarian diets in droves, particularly millennials and Gen Z.

Consumers adhering to vegan and flexitarian diets now make up 40% of the population of Hong Kong alone. Consequently, the market for plant-based meat substitutes in China is more extensive than that of the US, coming in at \$910 million in 2018 and with expected annual growth

of 20-25%. This trend poses a particular problem as China represents New Zealand's biggest export market for meat and dairy products.

The US

In the US, a report published by a leading market research firm indicates that American consumers are eating more plant-based foods than ever before. However, while consumption of plant-based meats and dairy alternatives is highest among vegan and vegetarian consumers, the report indicates that flexitarians represent most of the market for these products. Over 40% of US consumers identify as vegan, vegetarian or flexitarian, with flexitarians representing over one-third of the market. More consumers perceive plant-based foods as healthier, better for the environment and for the animals, leading many to question the role of meat in their diets.

Europe

In Europe, research surveying over 2,600 consumers across seven different European countries shows that they are 10 times more likely to identify as flexitarian than vegan and seven times more likely to identify as vegetarian. However, the same study indicates that approximately two-thirds of European flexitarians anticipate transitioning to a completely meat-free diet in the future.



Let us build on our existing reputation as producers of high-quality meat and dairy commodities and use that to market ourselves as producers of high-quality plant-based proteins and value-added products.

What is also interesting is that attitudes towards plant-based diets are also softening among omnivores who are becoming more open-minded and interested in consuming meat alternatives exclusively in the future. Thus, while meat consumption globally is still high, the reality is that the number of consumers making the shift to low and meat-free diets is increasing. Consequently, food businesses across the supply chain need to adapt to serve this growing consumer segment and to take advantage of the opportunities it presents.

Future of food production

These consumption shifts raise a number of questions, but perhaps most significantly what do they mean for the future of food production in New Zealand? As a nation, we seem to have firmly put our eggs in the commodity export basket, especially for meat and dairy. While this has served us to some extent so far, it begs the question of how secure such a position is amongst changing consumer preferences and mounting concern about the role of animal agriculture in climate change. If our export markets continue to institute government mandated meat reduction or taxes on meat and other environmentally costly foods, is it time for us to pivot or diversify our domestic portfolio?

Globally, the alternative protein market poses a significant economic opportunity for those who move quickly. An Australian State of the Industry report shows that investment in plant-based meat in 2020 reached USD 1.4 billion globally, with governments, meat giants and investors moving to make a stake in a market that is forecast to account for 10% of the USD 1.4 trillion global meat market by 2029. Across the ditch, the Australian plant-based meat sector has doubled its domestic manufacturing revenue and jobs in the past year, even amidst a global pandemic.

However, capitalising on this opportunity is not without its challenges. For New Zealand, perhaps our biggest challenges are centred on increasing our yield of suitable plant proteins and investing in processing infrastructure to produce these products domestically. New Zealand farmers and the groups that represent them need to demonstrate leadership to maximise the potential for our primary producers.

With price being one of the most significant barriers to plant-based meats, economies of scale across the supply chain will be important for domestic products to be competitive here and in the international market. Finally, we need investment in R&D to help us ensure we are developing products that are competitive and meeting consumer expectations.

Segmentation in the substitutes market

The market for plant-based meat substitutes is segmented and the product attributes sought and priorities of these segments vary. The products purchased by vegan and vegetarian consumers are often different in their sensory attributes and nutritional profile compared to consumers adhering to flexitarian or omnivorous diets. Consumers also have differing preferences for the companies who are producing these products.

On the one hand, vegan and vegetarian consumers who avoid meat are more likely to prefer purchasing from companies that exclusively make products free from animal-based ingredients. On the other hand, those consumers still consuming some level of meat perceive plant-based meat products produced by meat product manufacturers to be closer to the real deal. However, animal welfare and environmental issues are also raised and need to be addressed.

Perhaps this poses the real opportunity for New Zealand producers. Let us build on our existing reputation as producers of high-quality meat and dairy commodities and use that to market ourselves as producers of high-quality plant-based proteins and value-added products. It is time for New Zealand to leverage our reputation for safe and high-quality food and established relationships with export supply chains to claim our share of this market opportunity.

Summary

Consumer preferences are changing and there is currently no indication that the rate of change is going to slow down any time soon. Rather, projections indicate that consumer shifts towards products that are perceived as better for the environment, human health and animal welfare will continue to increase. While many consumers continue to eat meat, the role of meat in consumer diets is changing. Many are making the shift to low meat diets – and many see plant-based alternatives as a novel and appealing way of achieving this. While some brands may perceive this as a threat, many leaders in foodservice, manufacturing and retailing recognise this for the opportunity that it is – a chance to diversify product portfolios and capitalise on a rapidly growing consumer segment while doing their part for the planet.

Further reading

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ADVISING CLIENTS ON MILK FUTURES AND OTHER FINANCIAL PRODUCTS

WHAT RURAL PROFESSIONALS NEED TO KNOW

New Zealand's new financial advice regime requires any person who provides a regulated financial advice service to retail clients to be licensed by the Financial Markets Authority and to comply with a number of prescriptive requirements. This article takes a helicopter view of the new regime, including who it applies to and what is required, and how it applies to advice given about milk futures and other financial products.

New financial advice regime

Originally scheduled to commence in June 2020, New Zealand's new regulatory regime for financial advice services came into force on 15 March 2021. The new regime is contained in amending legislation called the Financial Services Legislation Amendment Act 2019 (the FSLAA). The FSLAA repealed the previous financial advice regime under the Financial Advisers Act 2008 and in its place inserted a new regime within the Financial Markets Conduct Act 2013 (the FMCA).

We are commonly asked whether the new regime will affect our clients and their advisory business. In short, the answer to that depends on exactly what the business is doing.

Overview of the law

The new financial advice regime contains obligations relating to both financial advice services and broking services (now known as client money or property services), which includes custodial services. This article focuses only on financial advice services.

A person ('P') provides a financial advice service if, in the ordinary course of their business:

- P engages one or more other persons to give regulated financial advice to P's clients on P's behalf (e.g. an advisory business which engages employees to provide advice to its clients), or
- P gives regulated financial advice to P's clients on P's own account (e.g. a self-employed financial adviser giving advice to clients).



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To be caught under the new financial advice regime, a person must be providing 'regulated financial advice', which makes them a financial advice provider or FAP. To determine whether regulated financial advice is given we need to understand whether financial advice is given at all and, if financial advice is given, whether it is regulated under the FMCA.

Difference between financial advice and regulated financial advice

While the new regime is clear about what constitutes financial advice, it can be difficult to determine in practice. The FMCA provides that a person gives financial advice if they:

- a. make a recommendation or give an opinion about acquiring, disposing of or holding a financial advice product; or
- b. make a recommendation or give an opinion about switching funds within a managed investment scheme; or
- c. design an investment plan; or
- d. provide financial planning of a kind prescribed by the Financial Markets Conduct Regulations 2014.

For the most part, people or businesses providing the kind of services described in (b) to (d) are clearly giving financial advice. However, the description of the service in (a) can require more careful analysis and is more likely to capture a broader range of activities that may or may not constitute financial advice. This article focuses only on the activities under (a).

Am I giving financial advice?

Making a recommendation or giving an opinion about acquiring, disposing of or holding a financial advice product requires two elements: you must be giving a recommendation or opinion and it must be about a financial advice product.

Importantly, under the FMCA a person does not give financial advice if that person only:

- a. provides factual information (examples include the cost of a product, or the terms and conditions of a product);
- b. carries out an instruction from a person to acquire, dispose of or hold a financial advice product;
- c. gives a recommendation or opinion about a kind of financial advice product generally rather than a particular financial advice product;

- d. recommends that a client obtain financial advice;
- e. passes on financial advice given by another person (unless they hold that out to be their own advice); or
- f. gives to the client a disclosure document (like a product disclosure statement), information from a register entry or an advertisement for a regulated offer.

'Financial advice products' include:

- a. debt securities (like deposits, bonds and convertible notes);
- b. equity securities (like shares);
- c. managed investment products (like an interest in a KiwiSaver scheme or other managed fund investment);
- d. derivatives (like foreign exchange contracts or milk futures);
- e. a discretionary investment management service (where an adviser decides which financial products to acquire or dispose of on behalf of the client);
- f. contracts of insurance (like life insurance and income protection insurance); and
- g. consumer credit contracts (like residential borrowing or personal loans).

Financial advice does not include, for example, general business advice or advice on the acquisition or disposition of real property (land) or other assets, unless that advice involves one or more of the financial products outlined above.

So, as long as you are not providing a recommendation or opinion about acquiring, disposing of or holding a particular financial advice product you will not be giving financial advice, which means that the new financial advice regime will not apply (assuming you are not undertaking any of the other financial advice activities). We discuss what can be done to ensure that financial advice is not inadvertently given at the end of this article.

I am giving financial advice but is it regulated?

If you are giving financial advice the final consideration is whether it is regulated by the new regime. 'Regulated financial advice' is financial advice that is given in the ordinary course of a business and is not excluded by certain provisions in the FMCA.

It is not possible to examine all of the exclusions in the FMCA in this article and most of them will not, in any event, be relevant to the vast majority of rural professionals or other businesses. For example, there are exclusions relating to advice services offered by persons in professional roles like lawyers and conveyancers, real estate agents, registered valuers, teachers, accountants and tax agents.

There are also exemptions for advice services given by: Crown-related entities and trustee corporations (in certain circumstances); non-financial not-for-profit organisations; lenders to comply with responsible lending obligations to

consumers; and employers to employees about workplace financial products. There is also an exclusion for financial advice given in connection with providing credit, if that credit is an incidental part of a business whose principal activity is not financial services.

The exemption that is most likely to have general application for rural professional businesses is one for a person carrying on a business where financial advice is given as an ancillary part of the business, provided the principal activity of the business is not the provision of 'financial services'. Financial services are defined in the Financial Service Providers (Registration and Dispute Resolution) Act 2008 (the FSPA) and cover a wide variety of services including financial advice, acting as a creditor, investing/administering or managing money or securities for other persons, changing foreign currency, acting as an insurer, operating a money or value transfer service, or providing client money or property services.

Whether you can rely on the ancillary exemption described above will depend entirely on the particulars of your business including what your principal activities are, the nature of the financial advice you are giving (if any), and how frequently any financial advice is given. We recommend that you seek legal advice before determining whether this (or any other) FMCA exemption applies.

To summarise, unless you fall within one of the exemptions in the FMCA, then if you are in the ordinary course of your business making recommendations or giving opinions to any client about acquiring, disposing of or holding a particular financial advice product, you will be providing a regulated financial advice service.

Requirements for giving regulated financial advice

If you are giving regulated financial advice under the new regime, the level of compliance required depends on whether you are providing regulated financial advice to any 'retail' clients.

Retail clients are all clients who are not 'wholesale'. Wholesale clients are defined in the FMCA and include clients who: are financially large (net assets or consolidated turnover of at least \$5 million for the last two financial years); are themselves an 'investment business' (as defined in the FMCA); or have a portfolio of 'specified financial products' of at least \$1 million during the last two years (noting that specified financial products do not include some basic financial products like cooperative company shares, call deposits, bank term deposits and interests in retirement schemes).

Wholesale clients also include 'eligible' clients. Eligible clients are persons who have the necessary experience in acquiring or disposing of financial advice products that allows them to assess the merits of the financial advice services that will be provided to them, their own information needs and the adequacy of the information you

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are giving them. These clients must also understand the consequences of certifying themselves as eligible.

To be able to rely on the eligible client criteria, you must obtain a certificate from the client in the prescribed form, which is verified by an independent professional in the prescribed manner. There is also a prescribed form of self-certification available for use with wholesale clients known as the 'safe harbour' regime, which allows you to rely on the client's own assessment of their wholesale status without looking further. Some qualifications and conditions apply to the use and reliance on safe harbour and eligible client certificates, and you should seek legal advice if you intend to rely on these exclusions to provide regulated financial advice to wholesale clients.

If you are providing regulated financial advice to any retail clients, the new regime requires you to comply with a number of relatively onerous regulatory requirements including:

- Being licensed by the Financial Markets Authority as a FAP
- Complying with all of the requirements for FAPs in the FMCA, including with prescribed conduct/duty requirements (in the FMCA and the Code of Professional Conduct for Financial Advice Services (the Code)), client disclosures, competency/skill requirements and reporting, and
- Registering as a FAP on the Financial Service Providers Register (FSPR) (if this is required under the FSPA).

However, if you are providing regulated financial advice to wholesale clients only, then you are only required to comply with several relatively high-level conduct/duty requirements in the FMCA (not the Code) and to register on the FSPR (if required by the FSPA).

Advising clients about milk futures

For rural professionals, some of the most important and prevalent financial advice products offered in New Zealand are dairy futures and options, a type of financial product known as a derivative. These contracts are commonly traded through NZX's Dairy Derivatives Market, which offers dairy futures and options to market participants like New Zealand farmers.

Because milk futures and options are derivatives, they fall within the definition of a 'financial advice product'. This means that if you are in the ordinary course of your business providing recommendations or giving opinions to a client about acquiring, disposing of, or holding a particular milk future contract, and you are not exempt under any of the prescribed FMCA exemptions, you will be providing regulated financial advice.

If your client is a wholesale client (within the meaning in the FMCA) and you are giving regulated financial advice, you will have some obligations under the new financial advice regime, including relating to conduct and FSPR registration. In this case, you would ideally obtain a safe harbour certificate from the client and, if relying on the eligible client criteria, you must obtain an eligible client certificate in compliance with the FMCA.

If your client is a retail client (by virtue of not being wholesale) and you are giving regulated financial advice, you will be required to comply with the new financial advice regime, including the licensing, conduct/duties, disclosure, competency and registration requirements as noted earlier.

How to avoid giving financial advice entirely

The simplest way to avoid giving financial advice is by ensuring that no recommendations or opinions are given to any client about a particular financial advice product, including a milk future. Recommendations and opinions are easy to spot when they start with a phrase like 'I recommend ...' or 'In my opinion ...', but can also include less obvious recommendations or opinions like 'I would ...' or 'I think you should ...'

Further, it is only considered financial advice where the advice relates to a particular financial advice product. That means you can give an opinion or recommendation





about milk futures generally (such as the role such derivative contracts might play as part of an overall financial strategy) without giving financial advice. However, you cannot give a recommendation about a particular milk futures contract (i.e. a particular contract with dates, prices etc).

In short, to avoid giving financial advice, you should stick to factual information about a particular product, or recommendations or opinions about kinds of products generally. In the case of a milk futures contract, factual information might include an explanation of the terms of the contract (dates, prices etc) and might also include an explanation of the risks associated with milk futures generally. However, you should ultimately avoid recommending that the farmer/client enter into the contract or giving any opinion as to whether the terms of a particular contract are good, bad, suitable or otherwise for them. If your client needs further assistance in making a decision about whether or not to enter into, dispose of or hold a milk futures contract, you should refer them to a registered FAP.

If you are intending not to give financial advice at all, it is recommended that you include appropriate disclaimers or warnings in your client documentation. Further, it is important that you and your staff (if any) understand what constitutes financial advice and, accordingly, what can and cannot be said to clients. Sometimes scripting of frequently asked questions can be helpful. We recommend you have a policy that sets out your understanding and expectations around giving (or not giving) financial advice and that you undertake periodic training for your staff. The systems and processes you put in place to mitigate the risk of any financial advice being given are important in demonstrating to the regulator (if required) that you are taking appropriate steps to avoid any breaches.

If you are giving regulated financial advice only to wholesale clients, we recommend including appropriate disclaimers or disclosures to this effect in your client documentation and that you utilise the safe harbour regime for wholesale clients, where appropriate. All wholesale client certificates, including eligible client certificates, should be safely filed. You should ensure that you (or your business) are appropriately registered on the FSPR to provide regulated financial advice to wholesale clients, and that you and your staff (if any) understand the high-level duties imposed on advisers providing regulated financial advice to wholesale clients. Again, internal policies and procedures are important to ensure you can demonstrate to the regulator (if required) that you and your business are complying with the new financial advice regime.

Conclusion

The new financial advice regime in the FMCA can be complex. If you are concerned that you are, or may be, giving financial advice inadvertently, we recommend that you seek advice as to the appropriate systems and processes you could put in place to help prevent that occurring. Equally, if you are concerned that you are giving regulated financial advice without fully understanding your obligations under the new regime, we suggest you seek legal advice specific to your business as soon as possible.

Disclaimer

The content of this article is general in nature and not intended as a substitute for specific professional legal advice on any matter and should not be relied upon for that purpose.

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WARREN KING

This profile looks at the life and work of Warren King, an NZIPIM member who has been involved in ecology and agronomy research for the past 25 years.

Warren was born in Timaru, and educated at Timaru Boys' High School and Otago University where he graduated with a PhD in Botany (Plant Ecology) in 1996. His thesis focused on the interaction between native and exotic species in a dry grassland near Luggate in Central Otago. This ecological 'lens' – the idea of the pasture as a community of plants in dynamic equilibrium with the biotic and abiotic factors driving it – has informed his research ever since.

Australian agronomy research

Warren accepted a post-doctoral position in Australia and nearly didn't leave, working for the NSW Dept of Agriculture for more than 10 years as a research agronomist. Coming from an ecology discipline background, the title of agronomist did not sit easily at first. It was some time before he realised that ecologists and farmers are kindred spirits – both must understand ecological systems in order to succeed.

Based in Orange in the Central Tablelands of NSW, he worked in perennial pasture systems that were mostly merino sheep grazing diverse native swards. Even in the relatively cool environment in that region (>800 m altitude with around 800 mm rainfall p.a.) ryegrass did not persist, but phalaris and sub-clover were considered 'improved' pastures. Droughts were intense and prolonged, and issues of catchment-scale water use (and accompanying salinity) and biodiversity conservation were starting to become prominent.

Working in Australia taught him how farming is connected to landscapes and communities in many different ways. He misses the sense of scale, the awe of landscapes hundreds of millions of years old and mangoes. He does not miss snakes. With most of his family still in the South Island, and none of them getting any younger, Warren and his family moved back to New Zealand in 2007 for him to work as a Research Scientist with AgResearch.

Current Ruakura research

Based at Ruakura for the last 14 years, he is in the Agro-Ecology Team (formerly Farm Systems) within the Ethical Agriculture Group. Warren's research is focused on the ecology and management of grazed pastures (including pasture establishment, persistence, diversity and production), as well as the effects of the environment.

In his work with the dairy, sheep and beef, and dairy goat industries a key theme has been to bring a systems focus to assessing the many moving parts of a farm system to identify where additional value can be created. This includes consideration of the potential of new technologies and even new industries that may generate potential in a pastoral context.

NZ Grasslands Association work

He was elected to the Executive Committee of the NZ Grassland Association in 2008 and became President in 2019, and he has presided over the organisation

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in especially turbulent times. The mission of NZGA is something Warren believes in strongly: fostering progress in grasslands by holding conferences and publishing great science. For him, this is well aligned with the mission of New Zealand pastoral agriculture as a whole – we must continue to deliver high-quality food and fibre from farming systems that are ‘ethical’ in the broadest sense. This will require the industry to be supported by excellent science, which has become even more important in recent times.

Regenerative agriculture

In his view, there has been a post-modern mistrust of science gaining traction that can only compromise the industry’s ability to rise to the great challenges ahead. Warren has been involved in conversations around regenerative agriculture that highlight this issue. He believes there is some good science to consider alongside some of the benefits claimed for regenerative farming systems, but there are also some science gaps.

It is with some dismay that he has observed a polarisation of public discourse on this topic. It is his belief that the pastoral industry needs to develop a more coherent voice for the difficult national conversations ahead. For instance, what will we do to de-carbonise our economy, to reduce the environmental footprint of everything we do, and to contribute to a future that will be quite different from the present?

Future issues

Warren has been lucky to have been a contributor to several ‘future-visioning’ workshops and to have seen the results of a few more. While the details differ, the general sense is of future landscapes that are more diverse (enterprises, land uses, vegetation types), more connected to the end-users of the products delivered and more connected to the community. He believes that meaningful engagement with Māori stakeholders in pastoral agriculture is critical. There are many Māori concepts about the relationship between people and the land, especially kaitiakitanga/guardianship, that will increasingly be incorporated into how we grow and sell the food and fibre produced in Aotearoa New Zealand.

New Zealand pastoral agriculture has seen some massive challenges in the past. He notes that the upheavals created by the withdrawal of subsidies in the 1980s was painful for many, but the pastoral industry emerged as a more efficient driver of the economy’s engine room and that it was supported in this great challenge by great science. In his opinion, the book of modern dairy farming was written at Ruakura in the 1970s and 1980s.

In addition, world-class technology (such as novel ryegrass endophytes) has helped to drive continued productivity

increases. He sees the challenge ahead as being the same – a withdrawal of the community’s willingness to subsidise the externalities of agricultural systems (such as emissions to the atmosphere and waterways) by ignoring them.

Role of science and consultants

Warren believes that the solutions will be developed by farmers and scientists and the industry working together. This time, however, the science model will be tested. If the visionaries are right and the future is more diverse, then the science needs to be better connected too. Pasture ecologists will need to be involved, as will horticulturists, foresters, apiarists and everyone else associated with busy, working, connected and productive landscapes that people want to live and work and play in. Warren notes that this is not the way that science capability is organised in New Zealand at present. Changes are currently being considered and he is optimistic about this. He feels we must also recognise that science capability relevant to the challenges we face now is less than it was in the 1980s.

The other capability that Warren thinks will be critical in the way that pastoral industries adapt to the future is farm consultancy. He has been a proud member of NZIPIM for many years, recognising that the community of consultants is connected to farmers and farming in ways that scientists cannot be.

Consultants are a key link in the way that new science and technology can be trialled, adapted and ultimately adopted on-farm. He sees that they are also uniquely placed to reflect the realities of farming to scientists, informing thinking and helping to ensure that research is well focused and prioritised. He has developed enduring relationships within the rural professional community, and recognises they have much to teach him about the way farmers think about the challenges on their farms and in their communities and industries.

Family and other interests

Warren asks – how do we encourage our children to see science as not only critical for our future, but as a viable career option? He is married to Cate and they have three boys, but his children are heading in other directions. However, he is proud that they are engaged, socially aware and curious about the world around them. And, who knows, there are many and diverse pathways into agriculture (including via plant ecology) that one of them may take up.

When he is not cheering on the football sidelines or fighting weeds on his gully section, Warren likes to ride bikes – down mountains, on the road and at the velodrome.

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