

Future of Food

Will new and novel proteins
eat New Zealand's
conventional lunch?



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Or is there room
for both traditional
and new and novel
proteins?

As the growth in the consumption of protein increases, the ‘race’ is on to find the next scalable source of sustainable protein. New Zealand needs to take a good hard look at the role it wants to play in this rapidly expanding market.

Threat: New and novel proteins could threaten New Zealand’s traditional strengths in dairy, red meat and seafood. Predicted to be lower in emissions, lighter on water and land, cruelty-free and at industrial scale, new and novel proteins may become the first choice in a climate-constrained world. Can we adapt?

Opportunity: Demand for protein continues to grow, giving New Zealand an opportunity to experiment with new technologies and find ways for new and novel proteins to co-exist with animal proteins. What’s more, Aotearoa’s unique flora and marine environment create opportunities for differentiated proteins and bioactives.

Key points:



The demand for protein continues to grow worldwide.



Rapid rise in new and novel protein, especially dairy, demonstrates consumer appetite for alternatives.



Recent failure of new and novel protein companies shows displacing conventional sources is harder than predicted.



New Zealand is uniquely placed to succeed in some classes and should avoid others.



Four types of new and novel proteins are advantageous for New Zealand and highly competitive on a global scale.

Consumer use of dairy after trying alternatives is mixed

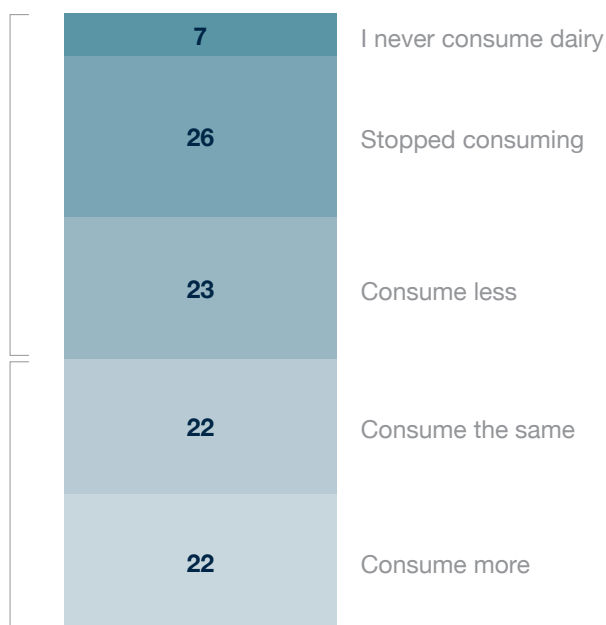
Dairy consumption after trying alternatives, %.

49%

consume **less** or **no** dairy
after trying alternatives

44%

consume **same** or **more**
dairy after trying alternatives



Source: McKinsey Dairy Survey 2022

It wasn't supposed to be like this.

When alternativeⁱ protein business Beyond Meat listed on the New York Stock Exchange in 2019, its stock soared by 163%, buoyed by investor sentiment that new and novel proteins were soon to replace the \$5 billion beef industry. 'Alt protein' was on the march. Sales grew 74%¹ between 2018 and 2021. Non-dairy milks² had already enjoyed spectacular success and grew by 15% over a similar period.

Barclays predicted the new and novel-meat market would hit \$140 billion by 2030³. Boston Consulting Group guessed \$290 billion by 2035⁴.

But then, it all crashed.

In August 2023 Beyond Meat's Ethan Brown reported a decrease in revenues of 31% year-on-year⁵. Its shares fell from a peak of US\$234.90 to US\$7.30 in mid-October.

Overall, sales of plant-based meat fell by 1% in the US in 2022, following a year of zero growth in 2021⁶. In the UK in 2023, vegan brands have scaled back their product ranges⁷ and struggled with their financials⁸. Sunfed Chicken⁹ closed its doors in New Zealand this year, while uptake of plant-based dairy has dropped 10%¹⁰ on Alibaba this year.

The industry has hit the equivalent of a cattle-stop.

Is this the end of the new and novel protein revolution?

ⁱ The terms new and novel and alternative are used interchangeably. Food HQ prefers to use new and novel proteins to describe the non-conventional protein sector.

We simply don't have enough planet to supply protein in conventional ways.

It's spuds, not chips

No, says Dr Victoria Hatton, CEO of FoodHQ and the author of a major report¹¹, published in late 2023 *Unleashing Aotearoa-New Zealand's Next Protein Revolution*.

She says new and novel proteins are experiencing a readjustment, or at least investors are. Data from Sprout Agritech illustrates after the boom in 2021, global VC investment is tracking down, but hasn't come to a dead stop. The sector is being reclassified as food, not tech. More meat and potatoes than silicon and chips.

"When companies like Beyond Meat and Impossible Burger were established, a lot of VC investors had jumped into the plant-based gold rush, thinking they could get fast valuation returns, similar to what they're used to in the virtual world. But these companies are producing more food than tech."

"So I don't think it's about failure. It's about education, and knowing that these companies have a longer, more patient growth story."

Hatton remains hugely optimistic about new and novel proteins.

Why?

Well, global demand for one thing. Growth in protein consumption has outstripped population growth, as countries become wealthier and more urban. It seems the more middle class we become the more protein we want. Year on year, global protein demand grows 8.5%¹². The FAO predicts a 135% increase¹³ in protein consumption by 2050.

"The likes of India, China, Southeast Asia, Africa have this huge protein demand because it's nutritionally dense and it's good for our growth. The world can't produce enough of it at the moment, whether it's

livestock or legumes or dairy. So we have to come up with alternative ways of growing protein that's cheaper and faster," she says.

But herein lies the challenge. We simply don't have enough planet to supply protein in conventional ways. Urbanisation, climate change and concerns about biodiversity are all conspiring against the expansion of agriculture as we know it.

What's more, farming will become more difficult as extreme weather events impact growing conditions.

"Global increased demand for protein won't translate to increased production from New Zealand – new proteins will meet that demand."

The opportunity for New Zealand

When Henry Ford asked farmers what they wanted they typically replied 'a faster horse'. That's the problem with incumbents – it's hard to imagine a radically different future when all you can see is the status quo.

The skeptics of new and novel proteins are no different. New Zealand has been at the forefront of high-quality protein, from grass-fed meat and milk, for many decades, but has taken a backseat in the new and novel protein race. FoodHQ published an initial report¹⁴ in September 2022, showing New Zealand does not have a new and novel protein strategy and that investment in this sector has been limited. Similar themes were highlighted by Te Puna Whakaaronui¹⁵ which wrote that: "We are already 3-5 years behind in some product classes [in the new and novel protein sector] and do not have the resources to compete in many of these categories. Understanding where New Zealand can compete and create long-term value is critical."

...if we can't feed these people then we're effectively saying who do we line up to kill?

Yet the opportunity for new and novel sources of protein as a complementary source has never been better. The potential for New Zealand to add value to its land and traditional protein industries is attractive, exciting even. Being part of the 'race' would enable New Zealand to front foot the risk and enjoy some benefits and prepare for changes to our key food export markets.

A starting point according to Toby Lane, CEO of new and novel protein start-up NXW Nutrition From Water™ (formerly New Fish) is that our vast dairy infrastructure could be converted to create fermented proteins. Speaking at a conference earlier this year he said that precision fermentation could be a massive opportunity for Aotearoa. "Nobody has mastered it [globally]. New Zealand has some of the world's best expertise in the science of food – off the back of dairy. Our opportunity now is to stop using it exclusively for milk and start using it on other things.

Those 'other things' could be microalgae protein, which NXW is pioneering in partnership with the Nelson-based Cawthron Institute. The company was a finalist in three categories at the 2021 New Zealand Food Awards with its world-first Pāua Saucisson—a fermented Blackfoot Pāua (abalone) and Kurobuta Pork salami.

Lane, like Hatton, says the world is at a food production crossroads. On the one hand, the global population is still growing, expected to reach its peak by 2050. "That's hundreds of millions more mouths to feed. The current food system can't handle that, especially if we are to stay within planetary boundaries. But if we can't feed these people then we're effectively saying who do we line up to kill?"

"New Zealand could produce the same amount of food as we do now with 500 times less land and a dramatic drop in water use. It's like having a dairy factory without

a farm. What I say to investors is 'leave the land to do its own thing. We can get out of the way of the land and simply focus on the food'. This new technology gives New Zealand choice and power.

And if we don't pivot and grow what are the risks?

A recent report *Protein futures: future scenarios for land-use in Aotearoa New Zealand*¹⁶, published by the National Science Challenge 'Our Land, Our Water' suggested that precision fermentation will disrupt New Zealand's dairy industry.

Some 95% of our dairy is exported and this contributes \$19bn to our GDP. We contribute about 30% of global dairy exports mainly as dried milk powder to 'big food' companies like Nestlé or countries like China.

But the components of dairy have started to be produced commercially on a small scale through precision fermentation. Pressured by the need to have zero emissions in its food supply chain, Nestlé released Better Whey, a whey protein powder made through precision fermentation in March 2024. Daisy Labs, a New Zealand start-up, is working on producing lactoferrin (a high-value whey protein found in cow milk) using the process.

Many other initiatives are happening globally to produce dairy proteins; for example, rennet, an ingredient used in cheese making, has been made through precision fermentation since 1990. Change Foods¹⁷ harnesses the power of microbes to create real dairy proteins, fats, and flavours through precision fermentation and turns them into cheese that tastes, stretches, and melts just as you'd expect.

We need to be brave enough to challenge the status quo

These all have the potential to remove some part of the value extracted from milk. That is a high risk to our economy at a time when we are looking at ways to double the value of our exports.

“I keep hearing that New Zealand produces enough food for 40 million people. How do we make it 400 million? What can that kind of abundance do for us? Most of what we’ve created in food is in land value. What would happen if we tried to do this without land,” asks Lane.

The jury’s out on whether precision fermentation is a viable option for New Zealand due to the capital investment required, profitability of the product, our regulatory landscape, and the high energy use. But says Hatton, “we need to be brave enough to challenge the status quo, and talk about how we produce food in different ways.”

Four sources for the win

These are bold words. But why not? New Zealand has a proud record of innovation and surprising achievement, and not just in food.

So, if New Zealand is to enter the new and novel protein race, what categories make sense for us? Where could we win?

In her report, Hatton ranked the main new and novel proteins according to market opportunity, regulations, domestic capability, and environmental strengths. The result is a recommendation to focus on four sources of protein where we have a competitive advantage: hemp, leafy greens (rubisco), seaweed and fungi.

“I really believe that we are at the point where New Zealand needs to evaluate the role it plays in the new and novel protein market, consider how best to enter the ‘race’, and understand where investment is best placed to take advantage of our uniqueness,” she says.

	Emerging Protein Source	Competition	Regulations	Natural Resources	Know how	Rating
Lab-Based Sources	Cell Cultured Meat	3	1	1	2	2 Star
	Molecular Farming	4	1	4	4	4 Star
	Precision Fermentation	2	1	1	3	2 Star
Plant-Based Sources	Grass and Leafy Greens	5	2	5	4	4 Star
	Hemp	4	3	5	4	4 Star
	Legumes	2	5	5	4	4 Star
	Oats	2	5	5	4	4 Star
Other Sources	Fungi	4	2	5	2	4 Star
	Insects	3	2	3	2	3 Star
	Seaweed	4	2	5	2	4 Star

We have a competitive advantage in hemp, leafy greens (rubisco), seaweed and fungi.

Here's her rationale.

Hemp: New Zealand's temperate climate is well suited to growing hemp, and it thrives in many regions. Combined with deep expertise in plant science and food production, New Zealand has potential to produce hemp at scale. As a nutrient-rich source of protein, hemp seed has value as a whole food source and a high-value food ingredient. It has a lower water footprint and requires fewer pesticides compared to other crops, while its deep roots contribute to soil health improvement and erosion prevention. This all means it is well positioned to compete alongside soy, pea, and fava bean protein as a major plant-based protein ingredient in a market expected to have rapid growth in the coming years.

Seaweed: New Zealand is committed to growing its aquaculture industry to \$3 billion by 2035 and with a projected tripling in the value of the global seaweed protein industry expected by 2030, it makes sense for New Zealand to consider establishing a seaweed industry. Additional research is needed to further explore how to extract protein from native seaweed species at scale. And a study would be necessary to determine the feasibility of establishing a seaweed protein extraction and processing facility in New Zealand. However, our competitive advantages in this area are considerable.

Fungi: Mycelium-based protein is high quality and closely resembles the texture of meat. It can be produced in an efficient and sustainable manner, whilst requiring fewer resources than many other methods. With the potential to use by-products from other primary industries, this could complement and enhance sustainable resource utilisation and circular food production practices.

Moreover, the market is expected to grow, and international companies have demonstrated success in similar Western markets. However, there is a lack of consumer familiarity with mycoprotein, and challenges may exist surrounding regulation of potentially novel food products. Despite the absence of New Zealand companies currently producing mycelium-based protein, this underexplored yet potentially lucrative sector warrants consideration.

Leafy greens: New Zealand's deep knowledge and experience in cultivating forage crops uniquely positions it as an ideal processor of protein-rich food ingredients derived from grass and leafy greens. Protein extracted from these crops has excellent properties that make it a suitable high-protein ingredient with an array of high-value food applications. It can also help deliver climate outcomes. This gives it the potential to compete with other major plant-based proteins in a rapidly growing market.

Whilst still at an early stage of development, New Zealand has an opportunity to file intellectual property in this area, providing plausible future weightless exports. The feasibility of establishing commercial-scale extraction facilities would need to be considered and incentivisation may be required to encourage repurposing of land for growing these crops.

...‘good for me and good for the planet’.

Future farming

The future farm, according to Hatton, will be different and more diversified. “There’s a place in New Zealand for both traditional and new and novel protein. We have legislation that implies limits on our herd size to reduce methane. I also believe that the global market is shifting. Consumers are demonstrating a preference for food that is ‘good for me and good for the planet’. I think we’ll see a reduction in the demand for livestock-based food because of this.

“I mean look at what’s happening in Singapore, the UAE and Qatar. To meet their food needs they’re looking at indoors, lab-grown and precision fermentation. There’s a huge race to bypass the cow and produce food that is low in emissions, high in protein, that tastes great.”

But it’s a big market and I don’t think there is any risk of a new and novel protein sector displacing our current, traditional farm sector in the short term. It will be a lovely complement as we migrate into the zero-carbon space and a wonderful opportunity for farmers.”

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Glossary of terms

What are new and novel proteins?

Alternatives or new and novel proteins largely fall into four categories:

- **Cell cultured meat**, also referred to as cultivated meat or lab-grown meat, is produced by cultivating animal cells to replicate traditional meat at a cellular level.
- **Precision fermentation**, which uses microorganisms as hosts to produce specific target proteins, or other compounds, in a controlled environment with a refined sugar-based feedstock. This process has been used for decades to produce hormones such as insulin and enzymes involved in food processing. It can be used to produce traditional animal proteins, whey protein for example, without the use of livestock.
- **Plant-based protein** is just as it sounds, protein extracted from plants such as legumes (peas, beans), hemp, oats or leafy greens (see the Leaflet case study). It's probably the one you're most familiar with - brands such as Grater Goods and Plan*t are in most Kiwi supermarkets.
- **Other**, the category for all the rest, includes fungi, insects, seaweed and molecular farming (transgenic GMOs expressing selected proteins).

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Future of Food series

FoodHQ is the New Zealand hub of leading food and food production researchers that advocates for collaboration, food innovation and investment among researchers, industry, and policymakers to tackle challenges to advance the food industry.

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