



Plant-based milks a contested space

# PLANT-BASED ANIMAL PRODUCT ALTERNATIVES AND GLUTEN-FREE MARKETS – opportunities and challenges for New Zealand

This article, based on a project undertaken for Takahuri Whenua (the NZ Agricultural Greenhouse Gas Research Centre Programme), considers emerging opportunities in New Zealand in the plant-based animal product alternative and gluten-free markets. Three exemplar products are considered – peas (could also be fava beans) for protein, oats for oat milk and chestnuts for chestnut flour.

## Peas, oats and chestnuts

New Zealand currently produces oats and peas for domestic markets and export and a small quantity of chestnuts.

Studies have identified significant areas within the country that are suitable for expanding the production of these crops, but they currently struggle against competing land uses. However, they offer non-economic benefits for growers and wider society because they are relatively low carbon compared to our mainly livestock systems, which makes them potentially sustainable crop options.

A higher price could encourage the expansion of these crops with a range of potential benefits, including diversification of land use, rotational benefits (for peas and oats) and alternative income streams for farmers. However, traditional markets for these crops (both in terms of human consumption and animal feeds) do not appear to offer opportunities for a significant shift in profitability and areas grown.

Globally, there has been strong growth in demand for alternative proteins and gluten-free products. Four main

drivers strengthening the overall demand for plant-based products have been identified:

- Consumer preferences (driven by health and lifestyle factors)
- Environmental awareness
- Product research, development and innovation
- Government initiatives.

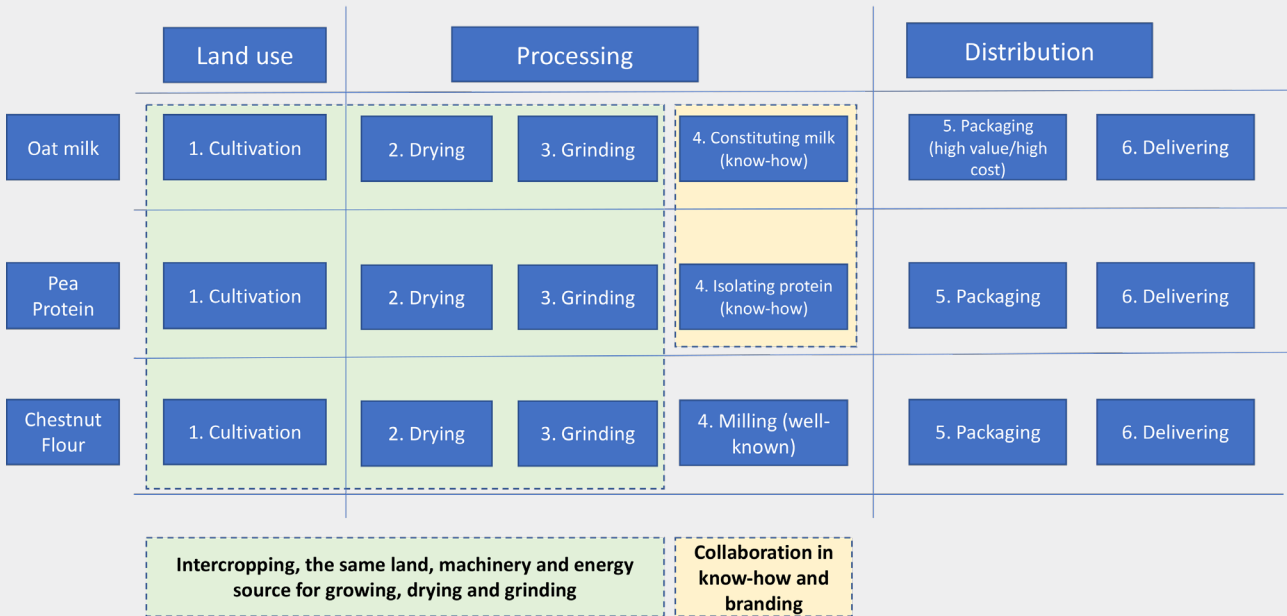
**Table 1** briefly outlines the processes by which these products are produced, some of their properties and examples of end uses.

### Projected demand

More specifically, strong global growth was found in demand for pea proteins and oat milk, with market research companies generally predicting double-digit compound growth rates over the next five to 10 years. The chestnut sector appears to be less dynamic than the oat and pea sectors, but reasonable growth is still forecasted.

**Table 1: Process, properties and uses**

	Pea protein	Oat milk	Chestnut flour
Process	Derived from whole peas through a 'dry' or 'wet' process. Dry extraction is much cheaper and produces 65% protein that is suitable for meat analogues. Wet extraction produces a soluble protein isolate (85% protein), more suitable for dietary supplements and beverages. Three types of pea protein: textured, concentrated and isolated.	Derived from whole oat grains by extracting the plant material with water (often in an enzymatic process)	Chestnuts are slowly dehydrated. When dry, the outer brown shell is removed in a shelling machine. The shelled nuts still have a pellicle around the embryo. To remove this further drying is necessary, which makes the pellicle brittle. When atmospheric conditions are dry, a crushing operation will then shatter the pellicle off. The broken pieces of pellicle, which are very light, are removed by ventilation. Two stages of grinding then follow.
Properties	Pea protein is a rich source of branched-chain amino acids, especially arginine, which improve blood flow and aid in muscle growth. It is easily digestible, vegan, hypoallergenic and can be well absorbed in a variety of diets. Fava beans are higher in protein and also branched-chain amino acids.	Oat milk is vegan, lactose and soy and nut-free. It is 100% wholegrain and can be gluten-free. It is often fortified with B vitamins and minerals. $\beta$ -glucan content may lower blood cholesterol, and is also good for bone health. Can reach up to 36% of the daily recommended calcium intake.	The nutritional profile of chestnuts is unique among nuts. Chestnut flour contains high-quality proteins with essential amino acids (4–7%), a relatively high amount of sugar (20–32%), starch (50–60%), dietary fibre (4–10%) and a low amount of fat (2–4%). It also contains vitamin E, the vitamin B group, potassium, phosphorus and magnesium. It is gluten-free.
Used for	Currently used for dietary supplements (68%), bakery products (17%), meat substitutes (9%) and beverages (4%).	Generally, can be used as a substitute for dairy milk in a range of products. Manufactured in various flavours (e.g. sweetened and unsweetened, vanilla or chocolate).	Generally, can be used as a substitute for wheat flour (in sourdough bread, quick bread, cookies, extruded snacks, gel and cake). Further refinement and additional uses can be developed by chemically, enzymatically and physically modifying chestnut starch to obtain the desired properties. The high sugar content and corresponding sweetness of chestnut flour can be used to create sweet foods without having to add sugar.



**Figure 1: Abstraction of the production and distribution process**

While overall demand for the alternative protein products is strong, market growth for alternative meat products has currently stalled. High food price inflation (leading to a reluctance to pay a premium for alternative products), and increased questioning by consumers of the claimed health and environmental benefits of alternative meat products, have been cited as possible reasons. There is disagreement about the extent that the plateauing of demand represents a fundamental shift for the sector or whether it is just a short-term blip on an otherwise upward trajectory.

Unsurprisingly, the generally strong market signals have attracted interest globally from not only the private sector, but also government agencies and departments tasked with regional and national development. However, when compared to more established agrifood value chains, competition in global markets is relatively fragmented at present, but plant-based protein and milk markets are becoming increasingly contested with many local and international players entering the market.

The international players are also significantly increasing their scale of production. For example, Roquefort’s new facility in Canada is estimated to be able to produce 125,000 tonnes of pea protein a year, while Oatly’s newest factory in the UK will initially produce 300 million litres of oat milk a year (with a planned expansion to 450 million a year).

Even in the face of strong demand, this scaling may lead to the ‘commodification’ of both alternative milk products and protein extracts, which may constrain developments in

New Zealand. The situation is rather different with chestnut flour, although the overall international supply of the raw product is dominated by China.

**Where are we in New Zealand?**

Domestically, New Zealand has a number of emerging oat milk brands. Due to a current lack of processing capacity, with the exception of one brand oat milk is processed offshore. Whether or not New Zealand oats are used also varies across the brands. New Zealand products compete with a range of imported oat milk products, as well as a wide range of alternative milk products.

A small number of New Zealand firms are using imported protein to manufacture diet supplement products and a few more are currently manufacturing plant-based foods. These include Nothing Naughty, Sunfed, Plan’t Foods, Off-Piste and Let’s Eat. They make an array of products containing plant protein as the main ingredient, including plant-based nuggets, burger patties, ‘chicken-free’ chicken, jerky and other meat analogues. There appears to be no commercial chestnut flour production in New Zealand and little evidence of its use in domestic food manufacturing.

Figure 1 provides an abstraction of the production requirements from farm-to-customer. For infrastructure, we produce the raw materials and have the facilities to dry and grind the products (e.g. Harraways’ Southland factory for oats). There are also facilities for packaging the final products and well-developed logistics.

**While overall demand for the alternative protein products is strong, market growth for alternative meat products has currently stalled.**

.....

## **There is no current commercial-scale plant protein extraction occurring in New Zealand and progress in developing a facility has not got beyond the scoping stage.**

.....

The main infrastructural gap lies in the facilities to isolate the proteins and produce oat milk on a commercial scale. For chestnut flour, existing milling infrastructure could (in theory) be used. The situation is about to change for oat milk with the planned opening of the New Zealand Functional Foods (NZFF) factory in Southland, which has an initial stated capacity of 60 million litres per year. Given that this far exceeds the current market size in New Zealand, it does fundamentally alter the viability of other processing plants in this country. There would need to be significant export opportunities to make additional large-scale processing facilities viable.

There is no current commercial-scale plant protein extraction occurring in New Zealand and progress in developing a facility has not got beyond the scoping stage. However, a recent study by PwC did suggest that under certain assumptions a national-scale facility processing 15,000 tonnes a year could be viable. Regarding land use, around 1,800 ha of oats would be required to supply the 60 million litre NZFF factory, and about 4,300 ha of peas would be needed to supply a 15,000 tonne pea protein plant.

### **Opportunities for traditional protein suppliers?**

At first glance it may seem that the development of alternatives to livestock products presents a direct threat to the companies operating in these areas. However, there has been increasing interest in alternative proteins from the traditional dairy and meat sectors as they have witnessed the market grow.

The move into alternative proteins by firms in these sectors is occurring in three main ways:

1. Developing their own plant-based products (e.g. Wunda Pea drink by Nestlé)
2. Engaging in joint ventures with other companies, or
3. Investing in start-ups (e.g. Tyson Food's investment in Beyond Meat).

It is also not necessarily a case of either animal or plant proteins, as a number of companies are developing 'hybrid' products.

Within New Zealand, Fonterra has taken steps into non-dairy products (e.g. in 2019 it took a stake in Motif Ingredients, a US-based food ingredients company developing plant-based or cell-grown animal products,

including milk). More recently it has announced that it is investing in a start-up company with Royal DSM to develop non-dairy proteins using precision fermentation. This approach from Fonterra may well bring value to their farmer shareholders, but it will not lead to opportunities for New Zealand farmers as suppliers.

In 2021, it was reported that Silver Fern Farms, the country's largest meat company, was in the early stages of exploring meat-plant hybrids as it looked to respond to customer demand. Although they recognise the potential dangers of confusing their offering to customers, Silver Fern's strategy opens opportunities for the domestic supply of plant-based protein into these supply chains.

As with international companies, New Zealand companies have established sophisticated post-farmgate supply chains for animal products (both in the dairy and meat sectors), which could also be utilised for plant proteins. Also like their international counterparts, these New Zealand companies could also benefit from the lower environmental footprint for alternative proteins to help reduce their overall emissions profile and improve their social license to operate.

### **Opportunities for growers – the three ceilings**

Establishment of new processing facilities (such as the new NZFF factory), either by specialist plant product producers or through diversification by mainstream livestock product companies, can provide opportunities for New Zealand farmers and growers in the alternative protein space by increasing demand. However, there is still the fundamental question about the extent that this will generate enhanced returns to producers.

This relates to the extent that processors would be willing and able to pay a premium for New Zealand-grown ingredients as opposed to those available in international markets. In turn, this depends upon the extent that provenance is important for these companies (i.e. the extent to which they can monetarise it), and the ability of New Zealand processors to be competitive.

#### **Ceiling 1**

At the most basic level, there could be opportunities for farmers to collaborate with each other to supply processing facilities with raw materials. The collaboration could take a range of forms from loose agreements to more formal business structures. Firms are likely to be keen to secure supply, and if grower groups are able to commit to certain levels of supply over time then this may attract a premium. This premium, however, is likely to be limited by the availability of other supplies (both domestically and internationally) – (Ceiling 1).

The more specialist the supply (i.e. the more skills that are required to grow the product) then the higher the premium is likely to be. The issue is whether the premium will be enough to encourage a sufficient number of growers (or sufficient area) to move into the crops.

AbacusBio highlight the stark reality of the returns to farmers of simply supplying oats, noting:

*Oat supply is only a small part of the oats value chain that farmers represent currently (7 cents out of a retail price of \$4.50), in part due to the large investment required in manufacturing. This highlights the need from a farmer returns perspective to have a larger investment in the value chain rather than remaining a supplier.*

Given the general lack of existing processing capacity identified for the crops under consideration, there would potentially be opportunities for growers to move down the supply chain by becoming involved at the processing stage. Again, this may take a number of forms, either collectively across growers or through some form of joint venture with international or national firms wishing to move into the area. Given the wider perceived benefits of creating strong alternative protein production systems in New Zealand, there may also be the opportunity for public-private initiatives.

### Ceiling 2

While there is likely to be a margin in processing in addition to that in growing, access to this margin will likely require investment by growers, leading to increased risks. A key challenge is that manufacturers are unlikely to pay significantly above international market rates for New Zealand ingredients – (Ceiling 2). Also, if domestic processing cannot attain the same economies of scale as elsewhere there is a real danger it will not be competitive.

With models that involve simply growing or growing/processing, the key weakness is the inability to capture the margin that may be associated with a branded alternative protein product. AbacusBio have also noted that a generic brand could be expected to operate at a relatively slim gross margin of 10-20%. They argue that to elevate products above the commodity level requires either a:

- Strong (brand) story (about the product, its attributes and its provenance), or
- High levels of innovation (in novel products and uses), or
- The development of value-added products using the products as base ingredients.

### Ceiling 3

However, again the value that can be attained from these final products will be constrained by the availability of competitor products in the market – (Ceiling 3). Even with strong branding, Oatly has had difficulty in achieving margins as high as 10-20% over the last year and are struggling for overall profitability.

The fundamental challenge though is returning sufficient value back through the chain to generate returns to growers that stimulate production, as well as compensate for the potential risks associated with investment further down the chain. These challenges are of course not unique to the products considered in this article, but are fundamental to any attempts to diversify away from our livestock orientated agrifood sector.

### International examples

If value cannot be extracted from existing companies for growers, then it is important to consider the alternative options. There are international examples of models where, through their own initiative, farmers have been able to capture the value added in plant-based products.

An example of creating a unique selling point in the increasingly competitive alternative plant-based sector is that of Glebe Farm Foods in the UK. They have focused on producing and developing a market for gluten-free oats made from their own oats. As well as producing their own oat milk product, they also sell their oats to food manufacturers across the world on the basis of its gluten-free status. Through investing in knowledge and on-site facilities, the farmer has become a grower-producer and is able to derive greater margins from their products.

It is likely that New Zealand will struggle to compete with the main competitors in global markets who are taking advantage of economies of scale throughout the supply chain. Differentiation, product innovation and (nation) branding when positioning possible products from New Zealand are crucially important if these alternatives are to be viable.

*Alan Renwick is Professor of Agricultural Economics, Robert Radics is a Senior Lecturer and Julio Botero is a PhD student at Lincoln University. Corresponding author: [alan.renwick@lincoln.ac.nz](mailto:alan.renwick@lincoln.ac.nz)* 



Pea protein at scale – Roquette's 125,000 tonne/year facility in Canada