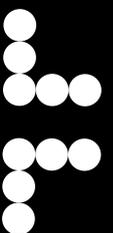




Speciality Grains & Pulses
Report



Contents

1.0	Executive Summary	2
2.0	Background	5
3.0	Evaluation process.....	9
4.0	Filter #1: NZ Based Consumer Insights.....	10
4.1	Implications.....	18
5.0	Filter #2: Import Statistics – define scale and impact of import replacement.....	20
6.0	Filter #3: Biosecurity and Food Safety Risks.....	22
7.0	Filter #4: Assessment of Processor Capability and Value-add.....	25
7.1	Processing Capability – Critical link to Value add	26
8.0	Filter # 5: Existing Knowledge Base.....	27
9.0	Filter #6: Sustainability Evaluation	29
9.1	Information on growing these crops.	30
10.0	Supply Chain Evaluation	31
11.0	Food Authenticity and Provenance Stories.....	31
12.0	Grower Evaluation.....	32
13.0	Stakeholder Engagement.....	34
14.0	Recommendations and Next Steps.....	35
15.0	About Leftfield Innovation Ltd.....	38

Tables:

Table 1: StatsNZ Grain & Pulse Imports 2017 & 2018

Table 2: Major Biosecurity threats to key pulses and grains for the major pathways

Table 3: Processing capability across key raw materials

Table 4: Existing knowledge base

Table 5: Potential environmental impact of crops

Table 6: Growing information

Table 7: Comparing grower group characteristics

Table 8: Preferred pulses and grains – key actions

1.0 Executive Summary

The challenge of identifying a range of sustainable (both economically and environmentally) land uses has challenged NZ growers for years, but increasingly so in the past 10-15 years due to changed environmental legislation, development of irrigation schemes and the volatility of commodity prices.

Farmers are often asked what they “want to grow”. Their response is “you show me the viable business case and I will be keen to look at it”. There are also plenty of stories from distributors saying farmers approach them with production volumes of a specific ‘on-trend or novel’ crop they have grown in the hope they will find a market. Both clearly indicate the disconnect within the value chain between the producer and the customer.

The Specialty Grains and Pulses Study was undertaken to establish land use options that would fit within the “Next Generation Farm Systems” project of the Our Land and Water National Science Challenge. We acknowledge and thank NGFS and OLW for supporting and enabling this work to be completed and next steps identified.

There is often talk of the ‘silver bullet’ that will solve the sustainable land use challenge. Our research indicates that it is very unlikely such an option would emerge. We grow food for consumers, who are all different, different preferences, values etc. - there is no ‘one-size-fits-all’.

We have reviewed a range of specialty grains and pulses through an evaluation process which considered six filters:

- The first filter was the consumer and market insights study. This enabled us to understand if and where the opportunities may exist.
- The second filter looked at Import Data. What are the grains and pulses we currently import and is there an opportunity to replace these with NZ raw materials?
- Thirdly, we looked at the risks to both biosecurity and food safety posed by importing the grains and pulses we were interested in. What are the risks now, and what could emerge with the impacts of climate change from changes in temperature and humidity?
- The fourth filter was to understand the existing processing capability and potential for value-add. This linked back to understanding the food and formats of food the consumers desired.
- Filters five and six looked at the existing knowledge of how to grow the crops and the environmental impact of the crops (N loss, water efficiency, emissions etc).

The resonating message as we look across each of these filters is that it could be any single, or perhaps a combination of more than one of these aspects that could create a barrier to enabling a specific grain or pulse to become a viable land use option in NZ.

Resolving these barriers will require dedicated resource and funding.

Having the ability to look across each of these layers with a high degree of independence and objectivity – no vested interest - is crucial to determining the best opportunities, fit and partnerships to proceed.

Instrumental in LFI's approach and methodology to value capture and creation is being market led. This study has centred around land use options that fit within Phase 1 and 2 of the value transformation process.

Phase 1: Value capture looks at raw material we can grow for domestic and export markets, understanding consumer preferences and market opportunities is critical to ensure we focus on growing plants (and animals) that will provide sustainable land use options in the future.

Phase 2: Transform raw materials into food ingredients and products desired by consumers by partnering with existing processing capability. Focusing on what we can achieve by utilising existing capability enables us to create land use options in the near and mid-term. The challenge is to understand what processing capability exists across the grower regions, and the willingness of processors to partner for new initiatives. There is no aggregated current knowledge base of what processing exists on a region by region basis.

Phase 3: Transforming raw materials to food ingredients and products using methods/technology that does not currently exist in New Zealand. We hear a great deal of discussion about plant-based food concepts that have grown exponentially in the USA such as Beyond Meat and the Impossible Burger. New Zealand has an example - plant-based Sunfed Chicken. All these food products use plant protein extracted from pulses, often sourced from commodity producers in North America. Currently there is no ability to extract protein from plants in New Zealand.

The selection of specialty grains and pulses as 'raw materials' for the near term was very deliberate. In addition to this unprocessed potential, within which we believe we have identified some robust immediate opportunities, it is also recognised that they have a great deal of transformational potential - raw materials into high value food ingredients and plant protein food concepts in the future. Market insights and value proposition development are required before investment in these opportunities could be considered.

While extracted plant protein foods may or may not be an option for New Zealand in the near to mid-term, the key message here is that ***there must be a compelling market led business case*** for any new innovative food concept to attract investment in the associated processing capability required to bring it to reality.

The outcome of this study has identified some key recommendations that once implemented will unlock opportunities for specialty grains and pulses to be grown in New Zealand:

1. **Consumer Insights – Deep Dive** An overarching consumer landscape deep dive into grains and pulses. This piece of work needs to be undertaken to connect with consumers and key influencers (chefs, dietitians & health professionals) and others to understand the drivers and inhibitors to the use of each grain / pulse. Where are the trends now, where are they forecast to be in the future and therefore what will drive consumers future demand, better inform innovation of brands and manufacturers and therefore signal to the farmers the value of planting the crop.
2. **Work with an existing Canterbury based processor: Oats, Quinoa** - expand the opportunities for the established grower group to grow replacements for imports of Oats; work with the same processor and a Quinoa grower to establish import replacement opportunities for the quinoa used in baked goods.
3. **Near-term opportunities for import replacement: Soy, Chickpeas, Buckwheat** – commence a work programme in relation to each grain and pulse to identify the quality provided by different seed varieties. Work with plant breeders to identify and procure seed varieties with attributes that meet consumers expectations are key first steps for a number of these grains and pulses.
4. **Hemp: Consumer insights** – identify gaps and work with key players to address short term gaps.
5. **Grower Region processing capability evaluation** – based on near term opportunities, undertake a deeper study of processing capability in each grower region and engage with processors to determine willingness to partner or toll process.
6. **Consumer Demand for Sustainable Farm Practices** – identify the farm practices that provide the highest impact across the sustainability indicators including emissions, water use, agrichemical use. Work with agri-business experts and CRI's to evaluate the existing tools and their ability to measure impacts. The purpose of this work is to enable growers to have the ability to measure key indicators, capture data and tell an authentic provenance story, underpinned by data, to consumers who care. Gaps identified and solutions are likely to be part of a separate project involving several stakeholders.

Connecting the dots - LFI has the ability to work as an independent informed party across the value chain often in a facilitator and development role. This ability to independently visualise the whole value chain, which often currently operates as a series of silos, has the potential to develop and create sustainable land use options for NZ growers. and new food opportunities for NZ consumers. The teams' deep capability and connections across consumer and markets, agronomy, strategy, food manufacturing, technology, and science enables tangible results delivered for growers and consumers.

2.0 Background

Leftfield Innovation Limited (LFI) was formed in early 2018 to address perceived opportunities in creating more sustainable land and water use in New Zealand food production.

The initial feasibility study – **Near-term Opportunities Feasibility Study for Sustainable Land Use Options**, looked at 5 land uses:

1. Milling Wheat;
2. Speciality Grains & Pulses;
3. Breakfast Cereal Grains, and Animal (Pet) Food made from cereal grains;
4. Plant-based Oils; and
5. Fresh and processed Vegetables.

The objective of this feasibility study was to unlock land use options, within the suite of crops that farmers have the capability to grow, that did not require additional capital investment either on-farm or off farm to make the options viable.

There was a deliberate focus on the ‘low hanging fruit’ to ensure any viable options would provide relatively immediate opportunities for sustainable land use, initially in central Canterbury (where many farmers had already invested significantly in the Central Plains Water Irrigation Scheme), but also in other regions across New Zealand.

A key outcome of this study was the development of Leftfield’s “Future Grains Project” in relation to Milling Wheat.

Through engaging with processors, we determined that there was an opportunity to capture more value from milling wheat by redesigning the relationships between the grower and the processor enabling more value to be shared with the grower.

It was determined by the Grower Group that value was not just about price, but also about certainty and future opportunities for higher-value crops. As a result, an innovative supply agreement was developed that moved the growers from annual contracts to a longer term 5-year supply agreement. Various other benefits were achieved by working with the grower and processor to empower growers to undertake more of the quality control and testing work on-farm, removing the need (and cost) to undertake some of this at the processor end. All these incremental adjustments stacked up to a greater overall benefit to growers; with the key benefit to the processor being quality fit for purpose grain; NZ provenance; and a coordinated group of growers with key representatives managing the operational interface.

Logistics and efficiency of operation were evaluated, a Future Grains Grower Group formed, and a commitment made for approximately 800 hectares or 5000t of milling wheat supplied for Year 1 (2020 Harvest), with more efficient supply structures established, that benefited both the miller and growers involved.

Replacing imported wheat with NZ grown wheat has emerged as a key, with the processor now committed to supplying NZ grown wheat across their product lines where feasible to meet customer demand.

Provenance and developing the ability to capture on-farm data to tell an authentic story is also a key component of the Future Grains Project.

Growers identified early on that their main asset (in addition to the raw material they grow) is farm data. All growers in the group utilise farm management software that enables them to keep substantial records of their farm practices. As a part of this project, LFI have developed a concept for a digital platform that will enable data owned by the growers to be used in a range of ways to communicate their authentic provenance story to the processor and the customer. LFI are in the process of developing the prototype for this transparency technology. Once completed, it will be available to licence to grower groups providing them with the ability to attach the value of origin to the crops they grow, allowing an authentic evidence-based story to be told.

The work undertaken through the Future Grains Project demonstrates that there is an immense opportunity in NZ to look at our agricultural sector with fresh eyes and challenge many of the perceptions and practices that are creating barriers to enabling incremental transformation.

We firmly believe that there is no ‘silver bullet’ for NZ agriculture. Yes, new crops may enter the frame, but the majority of the opportunities lie in front of us and we need to look at how we can do better and do more with what we have; with an unrelenting commitment and focus to understand what consumers want and develop innovative products that match this demand.

The fundamental basis of change lies in building trusted relationships where all parties that share the vision of creating sustainable value for NZ, based on a win-win for the participants and a greater win for NZ.

To support our opportunity evaluation process, LFI has established that there are three broad areas we need to assess as we move from value capture, into value creation.

1. **Start with the raw materials** – seek opportunities for replacing imports with NZ grown; and for those crops where we can demonstrate a point of difference to consumers, look at export opportunities.
2. **Raw materials transformed into food ingredients and products using *existing* processing capability** – enables us to move from commodity into value-add products and including NZ grown ingredients (milled, stone ground, popped, puffed etc) into NZ made branded products with shared values and ethics.
3. **Raw materials (plant and animal) into food ingredients investing in *new* processing capability.** Build a market led business case to attract investment. This builds on and expands the raw materials supply develop as a result of Step 1 and 2.

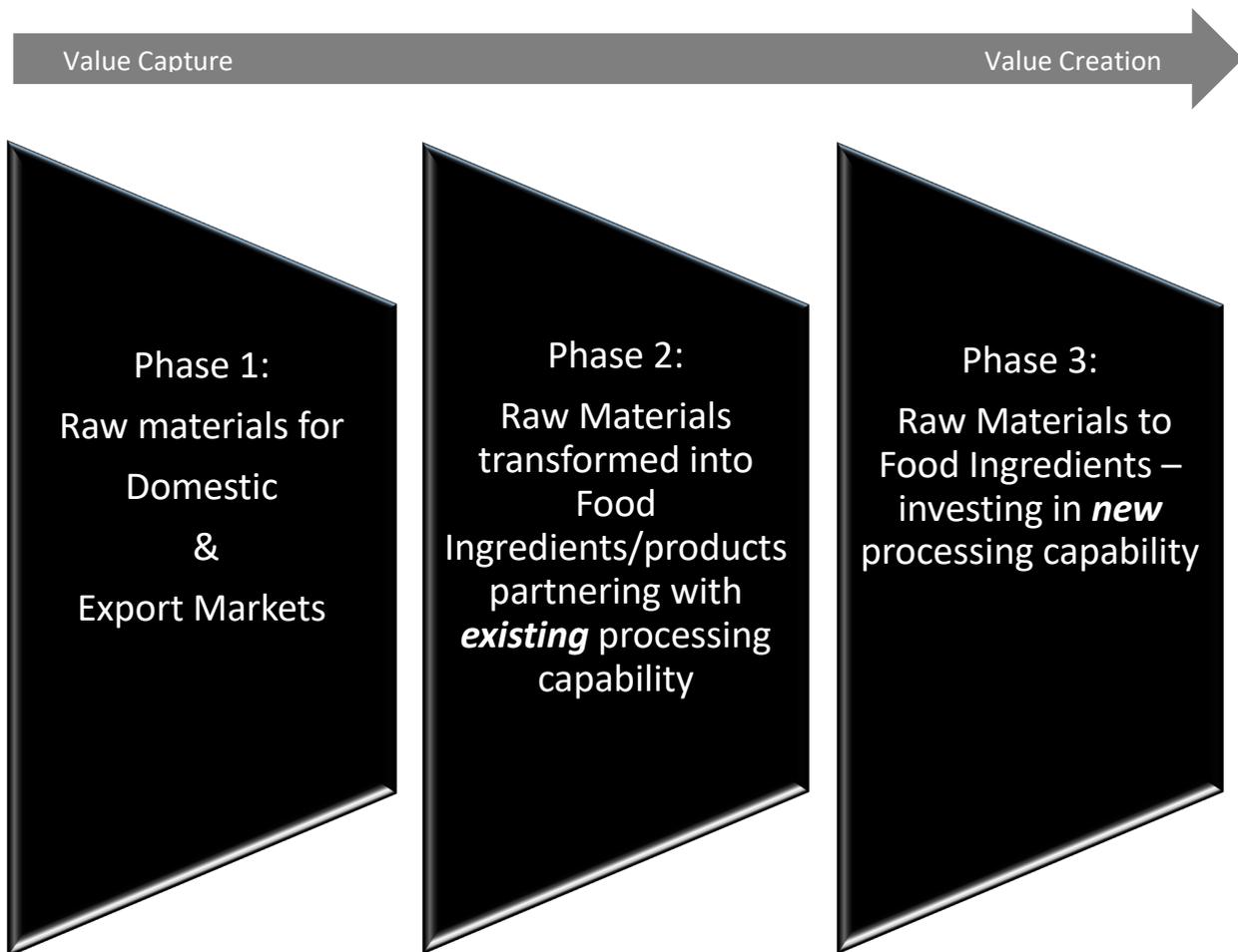


Diagram 1. Value Transformation Phases – raw materials to food ingredients

As a result of the 2018 Feasibility Study, LFI identified potential for several of the near-term land use options, including speciality grains and pulses. Evaluating the potential of each option, through the lens of Phase 1 and Phase 2 above, LFI determined a deeper dive study was appropriate for speciality grains and pulses in order to unlock any existing potential for additional hectares of sustainable land use.

In addition to the increasing demand for New Zealand grown specialty grains and pulses; we learned that there is an increasing challenge importing these raw materials due to New Zealand's strict biosecurity requirements. This constraint, and the biosecurity risks associated with importing pulses that may pose a risk to New Zealand agriculture, was also influencing some importers to consider NZ grown as a preferred option. However, they reported to have been faced with challenges in relation to quality and consistency of supply.

The selection of speciality grains and pulses as 'raw materials' for the near term was very deliberate. In addition to this unprocessed potential, we also recognised that they had a great deal of transformational potential - raw materials into high value food ingredients, particularly plant proteins. While we appreciate that this transformational stage would require further capital investment in new processing capability (e.g. Plant protein extraction), without the foundational elements, such as the correct seed varieties, an understanding of consumer preferences and a grower base, it would be very difficult to build the business case for the future transformational stages of this project.

The Speciality Grains and Pulses Project was identified as an excellent fit with the Next Generation Farm Systems Project of the Our Land and Water National Science Challenge as it was focusing on achieving near-term impact by delivering sustainable land use options for growers across NZ.

We wish to acknowledge and sincerely thank the project funders, Next Generation Farm Systems, Our Land and Water National Science Challenge for supporting and enabling this work to be completed and next steps identified.

3.0 Evaluation process

In order to establish a sound basis for recommendations, we developed an evaluation process that considered key success factors in considering each of the options.

This report has been structured so that each section describes a layer of the evaluation process, with each considered a filter. The objective is to identify those grains and pulses that make it through each filter to establish a shortlist group of raw materials which will have a set of 'next steps' actions identified in order to enable near term land use transformation.

- Filter #1:** Very importantly, we have started with the consumer and market to understand if and where opportunities may exist.
- Filter #2:** Import Data - We are looking at near-term opportunities which we believe may be present in the form of import replacement of raw materials that match consumer demand.
- Filter #3:** Biosecurity and Food Safety Risks – what are the risks to NZ biosecurity and food safety now and in the future from importing these grains and pulses?
- Filter #4:** Processing Capability and Value-add potential – if we were to grow in NZ, do we have the ability to transform the raw materials into a ready to eat product, ingredients and formats of foods that consumers want?
- Filter #5:** Existing Knowledge (Agronomy) – do we understand what is required to grow these crops, where are the gaps and the issues, can we overcome them?
- Filter #6:** Sustainability Evaluation – looking at any land use option through the lens of “can we grow this with minimal impact on the environment” – N loss, water use, Greenhouse Gas emissions etc are a critical step to determining if we should consider growing a crop, regardless of consumer demand.

4.0 Filter #1: NZ Based Consumer Insights

Over the past 12 months LFI have engaged with a range of manufacturers, processors, importers, distributors, consumers and growers.

Understanding the potential opportunities within the New Zealand market for New Zealand grown speciality grains and pulses starts with an understanding of the market trends and consumer preferences.

Frequently we received feedback from importers/distributors and processors that growers look at what they can grow, and then try to find a market. This approach leads to lack of planning around continuity of supply; scale and, most importantly, a lack of understanding as to the form the raw material needs to be in to suit consumer preferences, and integral to this, does the processing and packaging capability exist to produce the consumer offering. Further, the grower's expectation that they can command a higher price compared to the imported equivalent has led to many failures to gain traction.

To expand upon this work, LFI commissioned market and consumer insight specialist firm Pinstriped Leopard, to undertake an independent market screen. While the budget and timeframe for this work was limited, Pinstripe used a stepwise approach so that various stakeholder information could inform subsequent interviews.

The insight summary is based on:

- 1 x importer/distributor interview
- 14 x business to business Interviews (retailers, manufacturers and influencers)
- 1 consumer focus group (pulse and grain purchasers)

“There’s no doubt people are heading toward these types of things. Plant based eating is it.”

Consumer Feedback during Pinstriped Leopard market research.

Summary of insights discussions and interviews

The purpose of this work was to determine if there is a demand for NZ grown speciality grains and pulses?

If so, what grains and pulses are preferred, what formats are preferred, what, if any, are the barriers in NZ to producing these raw materials and food products that match consumer demand? Further, we wished to understand if there was an increasing demand as a result of increase in plant-based eating and proposed a question to all the interviewees about their preference for a high plant-protein low carbohydrate food concept.

We kept this vague but put it in the context of:

'Think fresh Italian pasta with no carbs made in NZ'

Concept Statement:

We envision a product that is made from plants, is as versatile as milling wheat (used to make lots of foods) and is high in protein. This product can be made into a range of foods:

- *Breakfast cereals*
- *Breads*
- *Pasta and noodles*
- *Snack foods*

There are a range of protein sources that can be used in this product:

Hemp protein, pea protein; plant mixed proteins; and a dairy whey powder (if this is desirable). We will use GMO free plants

Many of the plants will be grown in New Zealand with full traceability of origin. Where imported ingredients are used, these will be declared and we will continue to work with partners to develop the processing capability to transform the raw materials into the desired food ingredient here in NZ, that may take time for some of the ingredients but we will have the ability to demonstrate to consumers our progress in this area.

From the insights (summarised below) the larger the retailer and processor, the less interested they are in NZ grown, rather they are commodity focused and price driven.

However, the smaller niche retailers are looking for NZ grown product and raw materials and are very clear about the criteria that matches their values and their consumers' values.

- NZ Grown, traceability (ideal)
- Organic/organic equivalent or spray free
- Sustainable (e.g. not damaging the planet)/socially responsible
- Ethical – does not disadvantage growers or the people of the land, has solid practices that pay people fairly for their effort, fair trade
- Not overly packaged or unpackaged/packaged with natural materials in minimal ways
- Affordable
- Reliable

Further, they are very interested in ensuring that the growers are part of a group or co-operative rather than dealing with small scale individual growers. There was good alignment here with the established Grower Group concept LFI has implemented as part of the Future Grains Project.

Interest in popped, puffed options across a range of the grains and pulses illustrated good opportunities for value-add snack bars and cereals, with natural flavourings.

There was a sense that pulses are steady in demand and slowly increasing:

- Chickpeas are now a staple of many products and increasingly being used as an additional ingredient in soups, snacks, salads, sprouts and ethnic foods etc.
- Beans are showing strong growth with the growing popularity of ethnic cuisines (the growth in Mexican food impacting particularly) – hampered by global shortfalls of product.
- Soybeans are a constant and regular request by customers (increasing with the growing diversity of New Zealand’s population), however import restrictions place pressure on supply.

Grain conversations depend strongly on the grain in question:

- Oats are steady and high volume (there is growth in demand for steel cut)
- Quinoa is high volume, but getting some speed wobbles
- Millet is ‘steady’, but weevils in summer are an issue
- Teff is barely known (exception is areas where there are Ethiopian migrants)
- Amaranth is largely unknown and ‘not an easy grain’ – low demand but pops up now and again if there’s something in the media
- Rye is wanted as flour with good demand
- Spelt is wanted as flour with increasing demand

Taste and ease are the over-riding element to constant use. There is a sense that these products are fundamentally neutral (meaning that flavor needs to be added) however the health benefits make trial desirable. If a lot of work is required to have a consumable product, then the appeal is always lessened.

There is some degree of seasonality with some consumer groups, though where there is an ethnic component then purchasing is typically more stable. Where there is a use component that is traditionally European then there is more seasonal purchasing (e.g. Winter soups, pulses).

Hemp is often described as ‘the next big thing’ – vendors can’t keep up with the demand and can’t get hemp within NZ in the quantities desired. Some are wondering if this is just another fad, however, with hemp mentioned in nearly every interview, several believed that it is ‘the protein of the future’, it is clearly a growth market.

When we hit a ‘NZ interested’ participant then everything fell into place, though there were a surprising number of participants not in the least bit interested in New Zealand grown unless they are offered cheaper AND more easily available. Price trumped provenance with this type of product in many instances.

B2B giving clear advice of knowing your target (with them assuming end consumer) – our sense is that the target is the retailers and manufacturers for whom NZ adds a benefit (and there could be a lot of tail chasing about volume/pricing with the wrong target).

Summary based on each market segment:

Retailers of all types believe that the demand for pulses and grains is steady and growing for two main reasons. Firstly, people are eating more plant-based choices for health reasons, and secondly because they are relatively inexpensive compared to meat.

The implications of the following insights summary are discussed at the end of this section.

Retailer	Feedback highlights
Large and Managed	<ul style="list-style-type: none"> • Generally, feedback from large and managed retailers was not supportive of NZ grown products. • Price competitiveness with imported equivalent featured as strong push back. Further, Buyers/Category Managers don't believe NZ provenance adds 'anything that special', unlike where fresh matters. NZ Grown is nice but not essential. • Supply chain requirements means any new entrant would need to demonstrate better value for the retailer than existing contractual arrangements. • Would need to have relationship with larger volume growers than multiple small growers, which present supply chain management headaches for those managing procurement and distribution. • Would need proof of consumer interest to consider new product option • Proof of concept for any plant protein foods is critical.
Large Franchise	<ul style="list-style-type: none"> • Franchise stores may have some flexibility and be able to work with local suppliers – would need to create relationships with store owner/buyer/category manager for store and work with them to establish requirements and expectations. (Different stores/catchments have different needs). • Puffed and Popped is a great idea if flavoured/packed in appealing ways. Natural and guilt free preferred. • Areas for consideration are cereal replacement for gluten free (largely filled by manufacturers) and snacking – identified as a growth area. • Recommendation – make it suitable for kids but not childlike so adults/parents will eat it too. • Plant protein food products interesting but customers would prefer the end products pre-made. Must be easy to handle and give reliable results.
Gourmet Retail	<ul style="list-style-type: none"> • Each store manages their own ordering from approved sources • Customers prefer convenience, rather than pick and pack options. • Looking for good quality products, highly nutritious with effort removed (grains and pulses can be high effort). • Customers different from weekdays to weekend. Readymade products from pulses and grains during the week, one great dish/item to make from scratch on the weekend – (hard to get volume from one great dish). • Pre-packaged NZ grown product might have some attraction. • NZ grown soy is requested every week and cannot supply. • Customers generally like NZ made/grown, generally will pay a little more for this though if seasonal expect this to be cheaper. • Interest in puffed and popped if value added (e.g. flavours) to make these snacking – need to be packaged and branded. • Interest in products that include plant protein ingredients. • Hemp increasingly being requested.

Retailer	Feedback highlights
Smaller Format Retail	<ul style="list-style-type: none"> • Feedback from smaller format retail was positive. They believe people are looking for ‘better’ and they supply better than the supermarkets (in some way e.g. less packaging, organic etc). • Customers are the higher socio-economic, well-educated consumers with a focus on healthy eating and/or that have specific dietary needs (e.g. gluten free), and/or those that are eating foods from their own culture (immigrants or those of immigrant families). • Customers are informed, influenced by social media and magazines i.e. recipes, but are looking for guidance. • Retailers with price conscious customers will need another reason ‘why’ to help explain cost differences to customers (except for soy, which is in demand). • Strong attraction to the idea of NZ grown product if the price is competitive and if it is pesticide free (minimum)/organic or packaging free depending on the ethos of the retailer. • Some retailers say NZ does have a price premium – quinoa is an example where consumers are willing to pay more for NZ grown product. Others won’t – and if it is not grown in China then it is fine. • Keen on working with a grower representative group or cooperative to ensure steady supply and ensuring that growers get a fair distribution. • Like being freed from issues of international supply – price fluctuations, lack of supply etc., like being able to support local, and being able to tell customers about their engagement with local growers and satisfying customers. • Interested in all the grains and pulses discussed plus buckwheat (ideally popped) and hemp. Spelt and Rye flour preferred. • Puffing and popping options liked plus adding natural flavourings for snack food options – real growth area. • One retailer is about to put mills into their stores – believes that this will have a big impact on people’s purchasing/cooking habits. • Requirements: <ul style="list-style-type: none"> ➤ NZ Grown, traceability (ideal) ➤ Organic/organic equivalent or spray free ➤ Sustainable (e.g. not damaging the planet)/socially responsible ➤ Ethical – does not disadvantage growers or the people of the land, has solid practices that pay people fairly for their effort, fair trade ➤ Not overly packaged or unpackaged/packaged with natural materials in minimal ways ➤ Affordable ➤ Reliable • Support for initiative and desire to be part of future conversations

Manufacturer	Feedback Highlights
Large Manufacturer	<ul style="list-style-type: none"> • Showing little interest in NZ grown product – price and specification focused. • Do not believe that customers are interested in the provenance of grains, more concerned with the provenance of the brand – this earns the trust in the quality of ingredients. • Rigid demands for sustainable farming practices (note - interesting that this isn't connected to the interest in NZ-grown provenance). • Not interested in air mile conversations because this isn't a big thing for NZers. Better and cheaper would be the only way to interest. • Puffing and popping of no interest – that is what they do. • Do believe that NZ can be premium but part of a brand story in well established markets generally. Apart from this it's just 'nice to know' and people don't care that much if they know the product is NZ made.
Mid-size Food Manufacturer	<ul style="list-style-type: none"> • Highly interested in NZ-grown if it comes in at an acceptable price and meets quality standards. • Has had experience of growing soy in NZ in the past – Gisborne (makes for best product), challenges growing in South Island (mould). • Strong appeal to a co-op model/smaller grower collective. – Canada was mentioned as a good example of this model working well. Model fits their values better. • Would need 3 seasons of proof of quality and volume to commit. • Currently exporting a quarter of their product with plans to increase to three quarters in next 10 years. NZ grown product would help their NZ origin story. • Very interested to keep conversation going. • Plant protein product is on trend and is very excited at the thought NZ product would be in stable supply and that someone is pushing the envelope in terms of new product thinking in ways that might work for their brand(s).
Smaller Snack Food Manufacturer #1	<ul style="list-style-type: none"> • Liked the idea of NZ-grown but must meet volume requirements and price point. • Has explored NZ-grown in the past but can't meet both needs at once generally. • Would like more NZ-grown product but dealing with individual growers too hard. • Very supportive of the plant protein food concept – can see how it would appeal and fit trends. • Need for hemp, in high demand. Believes NZ is gearing up for supply because of popularity.
Smaller Snack Food Manufacturer #2	<ul style="list-style-type: none"> • Believes NZ is part of the quality story and that people will buy into it when they understand that it means genuinely good. • Can see value in vegetable-based snacks with minimal processing, natural ingredients/flavours. • Popular with people who think about what they eat and who put quality over quantity – discerning eating.

Influencers	Feedback Highlights
Magazine Editors	<ul style="list-style-type: none"> • Clear on the trend toward plant-based diets and actively work to create content that reflects this, but also advocate for balance, i.e. A plant-based meal is often only once in a week. • Mainstream titles seek to use grains and pulses in ways that reduce meal costs without adding complexity. • Health orientated titles are more likely to use raw products in interesting ways and there is a constant desire to find novel ways of using familiar products. • Gourmet titles are more likely to pick up on trends in restaurants and try to bring these to the consumer market – bringing a pulse or grain that is less commonly used as a high-light product and sometimes this converts into a trend. • What makes a trend is unpredictable. However, having trusted others introduce an unfamiliar product to the consumer, backed by achievable recipes or internet search results in trial. • Where pulses intersect with ethnic cuisine is an ongoing dialogue with the consumer. There is a strong appetite for authentic dishes from other cultures that we can eat at home.
Chefs	<ul style="list-style-type: none"> • Hugely influential in NZ. Frequent dine-outs have experiences they want to replicate – often introduced to new ingredients via a chef looking for ‘innovative’ food. Foodies influenced by this and in turn the magazines influence others. • Generally, love of all things grown in NZ within the ‘influence’ interviews. • Chefs generally love provenance if quality focused.

Distributor	Key Highlights
	<ul style="list-style-type: none"> • Belief that NZ alone won’t be enough – need to consider export. NZ story is important to some overseas markets but still won’t be enough by itself. Price point would need to be competitive. Adding value through organic (desirable in other markets) or trading on Quality (e.g. NZ oats are superior because of our weather conditions) Organic + GM free + appealing price point = success. Cheap + success as well. • Organic is more valued overseas than in NZ or Aus. Organic is growing in terms of popularity though. 30% premium for organic in the Middle East. Organic + NZ story becomes saleable in a different way. • Alignment with others wanting to export products from NZ – NZ grown added into NZ made – has been done successfully. • Contracts with manufacturers overseas have also worked well (e.g. purchase all crop grown). • It is important for growers to understand the consumer and end use prior to growing, rather than growing and trying to find a buyer. NZ growers have tried to sell their product historically but can’t hit the price point needed – growers are wanting too much.

Consumers	Key Highlights
	<ul style="list-style-type: none"> • 2 clear reasons for pulses and grains – health and ethics. (cost effectiveness of these products vs. other options cemented reasons to continue to use.) • Pulses and grains are relatively neutral in flavour and effective at expressing the flavour of other items, making them ideally suited to a wide range of meals / ethnic cuisine. • Consumers were clearly confused as to what a pulse or grain is – they include cous cous and butter beans into the mix showing the knowledge gap retailers discussed quite clearly. The actual knowledge for most wasn't deep – though the long-term vegan in the group impressed as having superior knowledge across the board. Black beans sought after by some. • Consumers said they learned about pulses and grains from the expected sources – media and social media, with dieticians, nutritionists and retailers also being mentioned as information sources. Younger consumers were more likely to mention social media as their primary influence. • Their 'guilt free' status as well as their capacity to suit a wide range of dietary needs (including free from consumers) made them versatile and useful additions to regular eating. Versatility is key – hence pulses and grains that can be used in a variety of ways (as opposed to a single task) are more valued. • Consumers didn't particularly value NZ grown – suggesting that if the product wasn't from China then it was acceptable. Where there is controversy however (e.g. Quinoa being unavailable in the countries where it is traditionally grown because of Western demand) then NZ seems like a 'good' option. NZ grown benefits are not clear to consumers. • Consumers were particularly keen on value-add pulses and grains – popped, puffed, flaked etc. particularly when they could be used as either cereal or snacks. They like the idea of being able to get 'good' snacks into their kids and eat snack foods themselves without guilt. Parameters such as natural flavour and recyclable or environmentally packaging were indicated as essential – these people are clearly conscious consumers in every sense of the word. • The protein concept piqued some interest however it generally felt a little 'processed' in the absence of something tangible. The ability to purchase products readymade seemed to be more acceptable – the notion of gluten free and/or low carb and/or high plant content was 'right' but they needed a real product to evaluate the idea in terms of what mattered most – taste. Pea proteins have disappointed with their flavour profile – hence there is some hesitation for something assumed to be 'expensive' (because it sounds like it will be).

4.1 Implications

The insights gained by LFI as a result of working with a key processor indicates that there are opportunities for replacing imported grains for use in a range of existing end products for the domestic market. This processor is part of a global chain of companies and is interested in novel food products using NZ grown ingredients for global markets. The current barrier to this opportunity is processing capability - dehulling specifically. While this may be an interesting opportunity in the future, it is currently difficult to define in terms of what raw materials and quantity. LFI will continue to work with this processor to develop these options.

Insights from the expert assessment has identified that for raw product conversations *small* is the initial target – small format independent retail environments are keen to have NZ grown product and believe that their customers will value it. They are amenable to further conversation and willing to share information in the pursuit of a successful outcome for all. They individually have modest requirements but collectively could make for a viable opportunity.

The emphasis would be on ethically based brands initially and potentially moving to gourmet brands over time. They prefer strong values / strong ethical and environmental practices because this helps create an overall 'better' impression – their customers come to them precisely for these reasons (and avoid supermarkets often for the same reasons).

This does put a lot of emphasis on *how* crops are grown however – and the two purchase segments (price-conscious and health-conscious) appear to demand different practices. Should export be on the cards then organic should be strongly considered for a good portion of supply.

As the supply for small retail evolves then connection with NZ-based manufacturers should be developed. From initial inquiries the manufacturers that have overseas parent ownership are a step too far. NZ-based manufacturers, with a desire to export, are a prime target and, where sustainability values are incorporated into the operation (as opposed to corporate branding exercises), an alignment with New Zealand supply is desirable. Manufacturers with more of an entrepreneurial mindset therefore take on a special importance. Surprisingly cereal manufacturers did not impress as being a primary target. They seemed to be well entrenched in their current behaviour and saw no benefit to New Zealand origin.

Cost will always be an issue but there is every indication that prices can be agreed prior to growing if quality and supply metrics stack up with the right manufacturers. Organic is a 'no harm' scenario in this instance, though may be cost prohibitive. NZ-grown and GE free is enough for interested manufacturers.

The model favoured is collective / co-operative with an organizing body that makes dealing with multiple smaller growers easy and benefits a larger number financially. This co-op model is apparently effective in Canada and is suggested as a way forward in New Zealand – it is certainly worth further investigation. The co-op model is favoured due to its fairness and ethicality, while the organizing body makes for seamless business practices – this is the ideal in terms of matching brand values and being fit for modern, non-corporate business.

Large retail and large manufacturers have an 'our way' mindset and a cost consciousness that would drive volume though not necessarily value. Their demands are high and NZ-grown would be in constant competition to the volatile international commodity market which would give no certainty/continuity beyond a season by season basis. Some of the franchise-owned stores may be more open to a supply conversation, however there is no real way of being able to create efficiencies with this conversation that is readily apparent – it is a store by store, person by person scenario that may prove costly in terms of long term return for what may be limited loyalty (given staff turnover).

Storage of product requires consideration – neither retailer nor manufacturer has capacity to store all their needs for any more than month by month (sometimes even week by week) period. In this respect a partner that has storage and a distribution chain to supply as needed will be critical.

Consumers are not likely to drive trends in this area – rather others will influence them to create demand. Ensuring NZ grown product is showcased by appropriate publications, chefs and social media touchpoints will be key to driving awareness, consideration and purchase.

Consumers tend to have 2 primary reasons for consumption – general ‘goodness’ (in terms of sustainability / eco friendliness / belief in vegan lifestyle) and health and wellness. That pulses and grains are also cost effective is a budget bonus but not a driver until the behaviour is ‘set’ and then cost consciousness creeps in as standard consumer behaviour.

Their key interest was in raw or partially value-added product (e.g. milled, flaked, puffed), and then flavoured as a snacking scenario. The protein concept impressed as being a step too far for most – they may purchase products made from the plant protein but until they’d tried it in manufactured product would be unlikely to try it themselves (exception would be the avid vegan).

Introducing the benefits of NZ grown would require consideration – now any product that isn’t grown in China is considered acceptable to many. B2B has convincingly put a case for the consumer being the least influential in this conversation – they buy what they buy but are influenced by others and changing existing behaviours and beliefs will require other stakeholders to assist.

This then implies a further value add scenario – NZ grown product included in other, fully formed products, made within NZ by appropriate brands. Initially artisan offers, sold through smaller retailers, would appear to be the opportunity, but this could scale relatively easily to a working in market concept – bread and pasta were suggested by both retailers and consumers as being desirable. There is clearly a market for value added product if the target needs are clearly identified (one retailer said their customers paid \$16 per week for a loaf of bread), and plant protein products speak to several current convergent trends indicating the potential for success.

Plant protein products are on a growth curve and supplying value added product is seen as a ‘winner’ by those that interact with the presumed target (higher-socioeconomic / health-conscious consumers or ethical eaters). There is a hope for products that are flavoured with natural ingredients and are suitable for children as well as adults – sweet (no sugar) and savoury (particularly) are desired.

The end goal concept has interest but there is a lot of ‘it depends’ in responses. There is enough interested people who are willing to engage through development from this initial foray into the market to explore this further. Several participants were extremely excited and have given permission for further contact as the idea evolves.

From raw product to value added product there are several distinct possibilities, however we reiterate that small/mid is the starting point initially. While large (and their volumes) look attractive the price conversation and their extremely high demands (backed by their lack of loyalty) do not make a compelling case. Businesses that know their target markets (and fulfil the needs of the consumer types mentioned within this document) are key to success. We stress, however, the need to have your values in alignment with theirs, and to consider a ‘greater good’ model vs. a standard corporate way of working.

5.0 Filter #2: Import Statistics – define scale and impact of import replacement

This section examines the volume of a range of specialty grains and pulses that are imported into NZ annually. We have indicated the potential impact on land area if these imported raw materials could be replaced with NZ-grown product assuming an estimated yield. This category is the dried pulse, speciality grain and some seed products (dried raw materials) found in Bin Inn, high value health food stores and increasingly supermarket shelves.

A snapshot of the domestic market for grains and pulses in 12 categories is reflected in the following table. Generally smaller amounts of product across each category are used across a range of end products.

Commodity (not for sowing)	Year	Quantity	Value for Duty (excl insurances)	Price/ton	Estimated Hectares required to produce	Approx. tonnes grown in NZ	Can be grown in NZ? Yes/No
Oats – rolled or flaked	2017	6,141t	\$7,204,847	\$1,173	850	6000t	Yes
	2018	Data unavailable	-	-	-		
Millet	2017	86t	\$153,636	\$1,786	23	nil	Yes
	2018	576t	\$430,075	\$746	150		
Quinoa	2017	400t	\$1,587,605	\$3,969	100	100t	Yes
	2018	346t	\$1,402,909	\$4,054	86		
Lentils (shelled)	2017	1,586t	\$2,751,726	\$1,735	500	Small, unable to estimate	Yes
	2018	1732t	2,260,995	\$1,305	577		
Chickpeas	2017	1,985t	\$4,109,335	\$2,070	570	nil	Yes
	2018	2188t	4,261,883	\$1,948	625		
Soybeans	2017	1,903t	2,250,891	\$1,183	500	nil	Yes
	2018	1,921t	2,492,098	\$1,297	500		
Kidney beans (inc. white)	2017	6,637t	\$8,044,990	\$1,212	2500	nil	Yes
	2018	7,003t	7,788,699	\$1,112	2800		
Buckwheat	2017	250t	433,760	\$1,735	70	40t	Yes
	2018	201t	364,403	\$1,813	57		
Sunflower	2017	1,950t	\$2,967,646	\$1,522	350	150t	Yes
	2018	1,570t	\$2,389,337	\$1,522	285		
Hemp	No data	-	-	-	-	100-200t	Yes
Spelt	No Data	-	-	-	-	5t	Yes
Rye	No Data	-	-	-	-	2000t	Yes

Table 1. StatsNZ Grain & Pulse Imports 2017 & 2018

Assessment

Overlaying the feedback from LFI's engagement with Processors, and the consumer insights study, the greatest opportunities in terms of responding to consumer demand, impact on hectares and price per tonne exists with replacing imports of the following grains and pulses:

- Oats,
- Quinoa,
- Chickpeas,
- Soybeans,
- Buckwheat, and
- Hemp

We are aware of another initiative relating to sunflower seeds in New Zealand with a focus on oil and will maintain a watching brief and help where required to advance this opportunity.

We note that the biggest importer of kidney beans is a leading manufacturer of baked beans. We understand that the grower contracts are managed in Australia and this may present challenges for converting to NZ grown. However, LFI will keep kidney beans on our longer list and continue to explore the opportunities for engaging with the manufacturer to understand this opportunity further as ~2500 t is a substantial land use opportunity.

6.0 Filter #3: Biosecurity and Food Safety Risks

Biosecurity and food safety risks for grains and pulses.

The major biosecurity risk from imported grains and pulses will be grain storage pests. The risk of this will vary depending on the country of origin. Although New Zealand already has several storage pests there are some significant pests which are not present in New Zealand. Many of these storage pests are common across the range of imported grains and pulses.

As well as the storage pests there are the food safety risks. Several the grains and pulses are susceptible to infection with mycotoxin-producing fungi and the levels of the fungi or the mycotoxin are rarely considered in importing grains and pulses. The risk of mycotoxins are further enhanced in many imported grains and pulses, compared with New Zealand domestic production, due to the climatic conditions (humid and warm) in many countries of origin, their poor agricultural and post-harvest storage practices and the inability to trace products.

While mycotoxins may be the key risk there are also risks of contamination with agrichemicals, again possibly related to poor agricultural practices in the country of origin or the use of more toxic pesticides and pesticides not registered in New Zealand. While there are risks associated with the range of agrichemicals used in the growing of the crops the highest risks are probably associated with the use of post-harvest insecticides, often organophosphates, to control insect pests.

A further key risk area is the potential to introduce a new disease, weed or pest, to New Zealand. This is possible through the imports of these products as the grain or pulse is often viable and there are many examples of people sowing these grains and pulses in New Zealand for their own use. Pests that infest seeds could be introduced in grains or pulses that are disposed of as they are infested and then, if not completely destroyed, infest a similar species in New Zealand.

Finally, while New Zealand remains GE-free for viable grains, there is a risk of some products, particularly soybean and maize, being GE. We expect readymade food products containing soy will be made with GE soy, unless declared on the packaging.

South America or the USA, the major producers of soybean, have significant production of GE soybeans and securing certified GE-free soybeans could be difficult. Production of these food grade grains in New Zealand would minimise this risk and could also open up some export opportunities.

For these reasons New Zealand should endeavour to produce as many of these grains and pulses as are sustainable in New Zealand. Our freedom from some pests, freedom from GE, our excellent border biosecurity and our good agricultural practices and traceability could even open export opportunities for some of these products as consumers become more discerning.

Crop	Key countries of origin	Key risks
Post-harvest pests of grains and pulses	Asia, India, Middle East, North and South America	Kharpa beetle, Brown Marmorated Stink Bug, Grain Weevil, Warehouse beetle, Larger grain borer, Mexican grain beetle, False wireworm, Long headed flour beetle, Small eyed flour beetle, Depressed flour beetle, American black flour beetle, Dark flour beetle, Casemaking moth, Grain mite.
Chickpea, Adzuki bean, Kidney beans	Asia, India, USA, Turkey, Australia	<i>Callosobruchus spp.</i> - Chick pea beetle, Cow pea beetle, Adzuki bean beetle, <i>Brucidus spp.</i> - seed beetles, <i>Etiella spp.</i> pod borer
Soybean	USA, South America	GE, <i>Callosobruchus spp.</i> - bean bruchid beetle, cow pea beetle
Bean	Europe, Nth America	<i>Brucidus spp.</i> Seed beetles, <i>Callosobruchus spp.</i> , <i>Etiella spp.</i> pod borer
Millet	Europe, Asia, Africa	Ergot, Smuts
Spelt	Europe, USA	Karnal bunt, Smuts, ergot
Oats	Australia	No major oat specific issues
Durum Wheat	Australia, USA	Karnal bunt, Smuts
Buckwheat	USA, China	Lygus bug
Quinoa / Kaniwa	South America	Cassida spp. Lygus spp. (both unlikely)

Table 2: Major Biosecurity threats to key pulses and grains for the major pathways.

The post-harvest pests and the smuts and bunts are the most serious threats to grains and pulses imported for food or food products in New Zealand. Of these probably the most serious are Kharpa beetle, brown marmorated stink bug, karnal bunt and ergot. The presence of ergot in grains could be a food safety risk.

There are a wide range of other diseases and pests of these crops but as they are NOT associated with the seed, hitch hikers with the seed or are seedborne the risks of an incursion occurring as a result of pulse or grain imports is minimal, they have not been discussed in this review.

Origins of grains and pulses in New Zealand

- Lentils – red, green, brown, black – mostly imported from France, some from NZ
- Beans – haricot, kidney, pinto, blackeye – USA. Faba NZ, Adzuki
- Sunflower – Argentina
- Green split peas – Canada
- Chickpeas – Australia, USA, Turkey
- Buckwheat – China
- Coriander & Cumin – India
- Mustard – yellow and brown – USA
- Pumpkin Seed – China
- Caraway Seed – Germany
- Oats – Australia
- Soybean – USA
- Millet – China
- Spelt – Italy
- Quinoa / Kaniwa – Peru
- Hemp - Canada

The list above identifies country of origin of a range of grains and pulses available to New Zealand consumers. Many of the pests, and particularly the storage pests, are associated with warmer climates than New Zealand. With the temperature increases predicted through climate change a 1.5C temperature increase could markedly impact on the ability for a number of these to establish in New Zealand in the future. While pests or disease incursions now may cause little damage, in the future they could cause serious losses in New Zealand.

7.0 Filter #4: Assessment of Processor Capability and Value-add

Assessing the existing capability across NZ was a challenge. There is very little aggregated current knowledge of what processing exists on a region by region basis.

Digging in some areas, we discovered machinery that had been stored and was no longer used. This capability may be required to unlock potential import replacement for the likes of de-hulled grains as limited de-hulling capability exists in NZ. Being able to open opportunities by uncovering latent capability could prove to be very impactful.

We recommend further research be undertaken across key grower regions to identify the existence of processing capability that is currently not used or underutilised.

Processing	Quinoa		Soy		Hemp		Chickpeas		Oats		Buckwheat	
	Nth	Sth	Nth	Sth	Nth	Sth	Nth	Sth	Nth	Sth	Nth	Sth
North Island/South Island												
Harvesting	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cleaning	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Drying	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grading	Y	Y	Y	Y			Y	Y	Y	Y		
Colour Sorting	N	Y	N	Y			N	Y			N	Y
Polishing			N	Y			N	Y	Y	Y		
Metal Detecting	Y	Y	N	N			N	N	N	Y		
De-Hulling			N	N			N	N	N	Y		
Milling	?	Y	?	Y	Y	Y	?	Y	Y	Y	?	Y
Stone Ground		Y								Y		Y
Aspirating	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Roasting/Drying	?	Y							Y	Y		
Sprouting		Y				Y				Y		Y
Splitting								Y				
Pop/Puff	?	Y							?	Y	?	Y
Sieve Grading			Y	Y			Y	Y	Y	Y		
Roll/Press	?	Y							?	Y		
Flaking									N	Y		
Extruding	Y	?							Y	?	Y	?
Steel Cut									N	Y		
Plant Protein Extraction (dry)	N	N	N	N	N	N	N	N				
Plant Protein Extraction (wet)	N	N	N	N	N	N	N	N				

Table 3: Processing Capability across key raw materials (blank = not relevant or not known)

From here onwards in this report only data will be presented for the 6 preferred options. Background information has been collected on the full range of options; and none of the others appear to be fully viable options across the 6 evaluation filters.

7.1 Processing Capability – Critical link to Value add

Processing capability across NZ enables raw materials to be transformed to some extent into food ingredients. However, the processing capability is currently relatively simple in terms of transformation and the resultant complexity of the food ingredient. NZ does not have extractive applications to separate out various parts of the plant, i.e. plant protein.

Protein fractionation would enable NZ to participate in plant protein based novel food product development. Currently any NZ made novel plant protein food product is made from imported ingredients. While this innovation is commendable, it does not provide any direct benefit to NZ land use.

An example is NZ-made Sunfed Chicken, which is made from a range of plant-based ingredients including extracted protein from yellow marrowfat peas grown and processed in Canada. Sunfed Chicken is attracting a great deal of national and international interest and investment; and is scaling up production. However, without the processing capability to transform the raw pea material into a high value ingredient there is no opportunity for NZ growers to participate in this innovative food opportunity that could also transform around 40,000ha of land use in NZ.

Building a protein fractionation factory could cost from \$6M to \$20M depending on type of processing, scale and product purity. However, plant protein is already a commodity and it would be difficult for farmers to capture or create the value, unless we can demonstrate value attributes that are unique to NZ.

While lack of some specialist processing capability is currently a barrier preventing NZ growers from moving from volume to value, opportunities do exist within NZ's processing landscape to extend uses for some existing NZ grown raw materials. Processors that have links to global markets, who have a future focused strategy that recognises the need to respond to changing consumers food preferences and demands are the ideal partners to explore value add, on a win-win basis.

8.0 Filter # 5: Existing Knowledge Base

Growing crops – pulses and grains that could be grown in NZ

The following table evaluates the grains and pulses included in Table 2.

The crops listed in the table below are all crops that can be grown in current pulse and grain growing regions of NZ. Some of the other crops considered require warmer temperatures and may only be grown in the Northern regions where expertise in crop production is currently limited and climatic conditions will make harvest of some crops difficult.

Crop	Where to grow	Potential yield / cultivars	Water needs	Issues / opportunities	End use
Quinoa	Short daylengths and cool temperatures for good growth. -4 to 35C. Southern North Island Canterbury	3-5t/ha Number of varieties and colours. Light colour lower saponins.	375 -450mm Drought reduces plant height and yields	Saponins – bitter taste. Selected for low saponins or remove seed coat (washed) that contains this	High in lysine. High in iron. Good protein. Flour, soups, salads etc
Hemp	Short day plant flowers when daylength is less than 12 hours. Soil temp 7-15C. 100-110 growing days grain. 70-90 growing days fibre. Most areas. Avoid heavy soils.	800-1000kg/ha seed. 3-4 t/ha for fibre. Early sowing for fibre. Later for shorter for seed.	250-300mm water	Harvesting is a problem due to fibrous nature of plant. 12% for grain dry to 9% Less than 16% MC for fibre after retting. Requires 100 -130 kg N/ha.	Seed – oil, flour, beverages Fibre – carpets, insulation
Oats	Spring or autumn sown. Cool conditions through grain fill. Long days to initiate flowering – Canterbury or Southland.	5-8t/ha Limited varieties L5 or Armstrong for grain	450-600mm	Fairly disease tolerant so low fungicide inputs. Lower grain yield so lower N inputs 50kg	High beta glucan High fibre Cereals, muesli bars, porridge, beverages.

Crop	Where to grow	Potential yield / cultivars	Water needs	Issues / opportunities	End use
Buckwheat	Free draining soils can be low pH. Low N requirement less than 50kgN/ha 10C for germination, frost sensitive especially until 2 leaf stage.	1.5-2t/ha Number of varieties but limited breeding. Need to select varieties with quality and suit NZ conditions.	Very drought sensitive. Needs irrigation	Allelopathic to weeds No disease or pest issues low agrichemical input Soil improver High anti-oxidant – Rutin Reduces blood cholesterol	Gluten free Flour – mostly to soba noodles not suitable for bread. Sprouts Honey Nutraceutical High protein 13-15%
Soybean	Soil temperature over 10C for germination. Mature after 140 days Southern North Island, Canterbury	2-5t/ha Huge number of cultivars. Less clear hilum cultivars available for food consumption	Needs irrigation	GM free – any seed imports need a GE test which must be done in Australia. Tolerant to wide range of soils. Harvest around 13% MC lower can shatter Legume fixes N, no N input Susceptible to insects.	Milk Tofu Miso Edamame
Chickpea	Temperate legume average temperature of 15C. Well drained soils – sandy loams. Seedling frost tolerant. October sown. 130 days growing season. Southern North Island, South Island	2- 4t/ha Kabuli type – number of varieties.	Reasonably drought tolerant.	Deep tap root. Susceptible to diseases when wet / waterlogged. Not competitive with weeds. Harvest at 13% - will shatter if too dry. Seed size is important	20% protein deficient in methionine and cystine Kabuli types – wide range of foods and uses humus, salads, falafel, flour etc.

Table 4: Existing knowledge base

Assessment:

There is a relatively robust understanding of the agronomy requirements relating to each of these crops. Many have been assessed and trialled historically through R&D programmes with the likes of Plant & Food Research and the Foundation for Arable Research. Generally, there is a range of geographical locations across NZ which the crops could be grown, which is important for de-risking likelihood of failure as a result of weather events. We can conclude that growing these crops would not be a barrier.

9.0 Filter #6: Sustainability Evaluation

Crop	Nutrient leaching*	Sedimentation	Agrichemical risk	Poor water utilisation	Emissions
Quinoa	Low N input, low loss	Small seed, cultivated sloping land, high risk	Nil input after establishment, low risk	High water use efficiency	Medium per unit of land medium per unit of product
Oats	Average N input, mostly spring sown, Average N loss risk	Mostly cultivated rolling land, high rain risk, Medium risk	Medium inputs after establishment, medium risk	Medium water use efficiency	Medium per unit of land medium per unit of product
Hemp	Low N input, low loss	Small seed, cultivated, flat and sloping land, medium risk	Low input after establishment, low risk	Medium water use efficiency	Medium per unit of land medium per unit of product
Buckwheat	Low N input, low loss	Flat land, minimum tillage, Low risk	Low input after establishment, low risk	Low water use efficiency	Low per unit of land medium per unit of product
Soybean	N fixing	Mostly cultivated rolling land, high rain risk, Medium risk	High inputs after establishment, high risk	Medium water use efficiency	Medium per unit of land medium per unit of product
Chickpea	N fixing	Mostly cultivated flat land, low risk	High inputs after establishment, high risk	Medium water use efficiency	Medium per unit of land medium per unit of product

Table 5: Potential environmental impact of crops

*High N input and output farm system of either cropping or livestock

Assessment:

Any of these crops could be grown in NZ with a minimal environmental footprint and would have the potential to be part of an integrated sustainable farm system.

9.1 Information on growing these crops.

A few of these crops are already grown by farmers in New Zealand, though often in limited quantities. As such, information is readily available from seed companies, FAR and other farmers. Some crops have been grown in limited quantities in trials and information may be available from FAR or seed companies. A few crops will not have been evaluated or data on them is limited in which case overseas information may be the best source.

The following table lists crops availability of cultivars and availability of information.

Crop	Cultivars available	Information sources	Current NZ major uses
Quinoa	Low saponin cultivar and some other selections	Limited – grower and FAR	Breads, salads
Oats	Two main milling cultivars	Seed companies, breeder, FAR, growers	Cereals, snacks, breads, beverages
Hemp	Number of cultivars	Seed companies, farmers	Fibre, oil
Buckwheat	Some may be available	Seed companies, FAR	Flour, noodles - imported
Soybean	Some available but not food types	Seed companies, FAR	Tofu, oil etc, imported
Chickpea	Some cultivars	Overseas information	Humus, flour - imported

Table 6: Growing Information

10.0 Supply Chain Evaluation

While price is a challenge and a deep understanding of the market segment and consumer is required, LFI has established that there are a number of ways more value can be captured for growers by assessing the participants across the entire value chain and redesigning who and how players are involved to ensure erosion of value back to the grower is eliminated.

- Direct relationship between grower and processor; with longer term supply agreements – remove parties that do not add value.
- Ensuring a quality fit for purpose product (i.e. grain); participation by farmers in developing the specifications and quality procedures to make them workable and efficient.
- Grower capability evaluation to establish quality growers in group – shared values and collaborative win-win mindset.
- Use of technology to optimise data capture and sharing to create efficiencies across the supply chain.
- Distribution and storage – work with logistics companies that share the win-win value share mindset; drive efficiencies through effective technological solutions such as delivery scheduling and integrating with their wider delivery network to minimise ‘empty loads’. Identify opportunities where growers can take on storage to reduce costs.
- Collaboration across the value chain to identify problems and work together to resolve.

11.0 Food Authenticity and Provenance Stories

Internationally there is growing concern and awareness regarding the authenticity of food, both from a food safety perspective and consumers becoming more conscious of what they put into their bodies. New Zealand has been fortunate with a justifiable perception that our food standards ensure we are relatively safe from the issues which have occurred offshore, though the increase in low-cost imports and more exposure to less disciplined food production practices have increased the concerns regarding these issues.

As part of our Consumer Insights work, there was clear differentiation between what the large retailers understood were the key purchase considerations (primarily price and consistency of supply), versus the demands of smaller retailers who were seeing increasing consideration of provenance and sustainability considerations.

Over recent years the impact that social media “influencers” have had on younger consumers in particular (millennial and Gen-Z) has driven greater attention to nutrition and natural health, while growing awareness of climate change and social issues has led to more consumers considering environmental impact of food (including water, energy and packaging). This is particularly evident in the growth in niche retail and online purchasing decisions.

The need to have a provenance story is increasingly important. Farmers in New Zealand recognise the importance of not only improved production practices, but also in the value of data on how their food was produced. They are aware that consumers are starting to ask for information regarding emissions, water efficiency, agri-chemical use and animal ethics.

A number of food companies are starting to include provenance as part of their own brand story; however, this is often done at a very high level, without detailed data to back it up. The complexity of the food supply chain means that it is typically only more artisan producers who have control over the complete supply chain who are providing full traceability back to the farmer, whereas most other traceability solutions tend to focus on food safety (recall) processes from the retailer to the manufacturer, which does not necessarily incentivise consumers when making their purchasing decisions.

There is a growing opportunity to ensure that provenance and traceability information accompanies the production of good, healthy food, as the consumers which care about natural health, tend to also be the ones which care about good information. The traceability needs to start with the farm, and progress from there.

12.0 Grower Evaluation

Sustainability focus:

We have learned that the consumer and market opportunities we need to focus on have expectations of ethical and sustainable farming practices. Currently in NZ farm practices and the resulting environmental impacts are generally measured only for regulatory purposes. Flipping the driver for sustainable farming from regulation to consumer and price premium is an incentive for growers to farm well and provide robust data to demonstrate how their crops have been grown.

We need to ensure any growers participating in these opportunities are genuinely committed to sustainability and are willing to continue to modify and evolve their practices over time as new technology and information becomes available to demonstrate areas of improvement; and as consumer preferences evolve.

Working together to achieve scale and certainty of supply:

In order to participate in future opportunities, whether it be supplying the NZ market, or export markets a key challenge for NZ growers is the ability to produce a consistent supply, volume and quality to match demand.

Achieving this ambition requires farmers to work together. The Consumer's interest in provenance and traceability adds another layer to ensuring any grower group has shared values that align with the consumers they are producing food for. The ability to tell a compelling story and engage with consumers will be more successful if the foundation principles of the group align from the outset.

The consumer insights work undertaken for this study gave a strong signal that a co-operative type business model was preferred for a range of reasons. Firstly for the easy of doing business – a single entity and point of contact rather than a number of individual growers; and secondly, consumers prefer to support individual growers who produce quality, healthy food that can communicate provenance, so a co-operative/group enables them to do so at a greater more cost effective scale.

LFI has experience in forming grower groups, which to date have been successful. However, starting small enabled LFI to select the top performing farmers based on our experience and knowledge of everyone track record. As these groups expand to meet demand, it is recognised that it is not possible to know all farmers capability and their mindset/willingness to work together to achieve a win-win for growers, processors and consumers.

To ensure a more robust process is in place to manage expansion, and formation of new grower groups, LFI has developed a values-based on-line farmer questionnaire.

Questionnaire - Key themes include:

- A clear purpose and values for their business
- Meet quality standards consistently
- Willing to seek advice when need help
- Willingness to act as a mentor for less experienced farmers
- Engaged in discussion groups and forums and keep up to date with new regulations
- Taking care of the environment is part of their sense self-identify
- focuses on best practice and committed to continual improvement
- Willing to invest money to make changes to business even if benefits are not realised for some time
- Willingness to collaborate with other farmers for mutual benefit – share skills, machinery, transport etc
- Connected to farming community and interested to learn about what other farmers are doing

Grower Group Characteristics – points of difference

Redesigning the working relationship between grower and processor requires a different approach, one that is based on a shared vision and a set of shared values. Establishing win-win outcomes for each party requires a move away from the characteristics seen in various historical grower groups that have been unsuccessful. Characteristics of Grower Groups established by LFI include:

LFI established Group Characteristics	Characteristics of various groups historically
Value	Volume
Shared values	Company or individual values
Partnership	Relationship / Contract
Quality	Price
Long term	Medium term or annual
Grain mark	No brand
Farmer managed	Company and/or farmer managed
Number of products (in time)	One product
Consumer focussed	Production focussed
Sustainable benchmarks	No benchmarks
Invited to participate and need to meet standards	Invited to participate – a few standards

Table 7: Comparing grower group characteristics

13.0 Stakeholder Engagement

To achieve the insights that have led to the identification of some potential near-term land use opportunities, it was necessary to engage with a range of stakeholders to ensure that we had perspectives from different stakeholder types and ensured that those interviewed had a level of expertise that provided valid input.

- Ministry of Primary Industries – provides perspective on strategy at a national level, with understanding of key initiatives that are already underway.
- Crown Research Institutes – has the science and in-depth insights of the crop opportunities and challenges. Has technical resource and knows the realities of resource constraints to undertake further research and science.
- Growers / Farmers – understand land use and economics of farming, and have trusted relationships built over long periods of time.
- Processors – awareness of processing capability, supply-chain structures and latent potential. Has a degree of market insight based upon requests from those further in the supply-chain.
- Distributors – integrated within the supply chain which provides an understanding of differing market dynamics and logistic issues, including international competition.
- Retailers (large and specialised) – can provide insights on consumer purchasing behaviour, economics, market size and trends.
- Consumers – it is difficult to obtain a truly informed sample of consumer preferences without undertaking a large-scale study to achieve appropriate sample size (for which we did not have budget), however a small group was tested to provide some input.

While there were some varied perspectives among the different stakeholders, it was clear that the current demand for more sustainable food production of natural, healthy products was relatively niche currently, there was an emerging trend towards this, being led by specialised retail and younger, more aware consumers. It was generally accepted that this will continue to grow over time and given the need for some significant changes in food production that adaptation should start now.

14.0 Recommendations and Next Steps

Reviewing the opportunities for specialty grains and pulses through the six filters highlights that in most cases the challenge is not can we grow them. The challenge to enabling either expansion or introduction of some of these grains and pulses lies in understanding consumer demand, and the availability of processing capability to transform the raw materials into desired food products to match that demand.

Instrumental in LFI's approach and methodology to value capture and creation is being market led. We have identified that there is potential within the six grain/pulse categories we have shortlisted, however there are actions and **further steps that need to be resourced and funded** in order for the opportunities to be enabled and realised on the ground.

These next steps include:

Consumer Insights – Deep Dive - critical next step is an overarching consumer landscape deep dive into grains and pulses. This piece of work needs to be undertaken to connect with consumers and key influencers (chefs, dieticians & health professionals) and others to understand the drivers and inhibitors to the use of each grain / pulse. Where are the trends now, where are they forecast to be in the future and therefore what will drive consumers future demand, better inform innovation of brands and manufacturers and therefore signal to the farmers the value of planting the crop. This research is a high priority as the sooner it can be done the more powerful it will be to influence decision making across the value chain.

Work with existing Canterbury based processor: Oats, Quinoa - expand the opportunities for the established grower group to grow replacements for imports of Oats; work with the same processor and a Quinoa grower to establish import replacement opportunities for the quinoa used in baked goods.

Near-term opportunities for import replacement: Soy, Chickpeas, Buckwheat– commence a work programme in relation to each grain and pulse to identify the quality provided by different seed varieties. Work with plant breeders to identify and procure seed varieties with attributes that meet consumers expectations are key first steps for a number of these grains and pulses.

Hemp: Consumer insights – identify gaps and work with key players to address short term gaps.

Grower Region processing capability evaluation – based on near term opportunities, undertake a deeper study of processing capability in each grower region and engage with processors to determine willingness to partner or toll process.

Consumer Demand for Sustainable Farm Practices – identify the farm practices that provide the highest impact across the sustainability indicators including emissions, water use, agrichemical use. Work with agri-business experts and CRI's to evaluate the existing tools and their ability to measure impacts. The purpose of this work is to enable growers to have the ability to measure key indicators, capture data and tell an authentic provenance story, underpinned by data, to consumers who care. Gaps identified and solutions are likely to be part of a separate project involving several stakeholders.

Grain/Pulse	Short (6months -1yr)	Med (1yr-2yr)	Longer (2yr-3yr)
Soy	Work with Plant Breeder to procure suitable seed varieties Test for GM free (Australia); (white Hilum, fast cooking times); establish quality standards.	Selection programme in NZ to identify varieties suited to NZ conditions and producing quality Trials and seed multiplication Establish NZ Grower group(s) in best locations.	Implement sustainability measures and digital traceability licence Establish relationship with processing capability NZ grown crop Seed and seed/growers for NZ and export Link with key processors and food brands for inclusion in products New Product Development
Hemp	Identify opportunities not already being evaluated by key players. Identify gaps in key players programme and develop plan.	Work with key players to address short term gaps Implement sustainability measures and digital traceability licence	Link with key processors and food brands for inclusion in products New Product Development
Chickpeas	Work with plant breeder to identify selections suited to NZ.	Establish NZ Grower group(s) and a relationship with the customer / processor. Cultivar evaluation programme to select best material. Implement sustainability measures and digital traceability licence Establish first commercial production.	Link with key processors and food brands for inclusion in products New Product Development
Oats	Work with existing processor currently identified to have an import replacement opportunity for flaked oats Unlock existing barrier of de-hulling by developing relationship with local owner of de-hulling machine. Contract volumes to match processor demand. Establish grower group (expand existing) to include	Implement sustainability measures and digital traceability licence Work with plant breeder to select plant material to supply for key end uses Market Insight's for Oat based products export opportunities.	Link with key processors and food brands for inclusion in products New Product Development

Grain/Pulse	Short (6months -1yr)	Med (1yr-2yr)	Longer (2yr-3yr)
	<p>oats for 2021 harvest. Supply Agreement in place.</p> <p>Work with processors to develop quality assurance and traceability programme</p> <p>Work with Oat Product manufacturer to identify where further support is required (market insights, processing and/or packaging capability) to support expansion of oat-based beverage opportunities</p>		
Buckwheat	<p>Insight work to understand customer quality standards and form of raw or processed grain</p> <p>Procure suitable seed and commence trials</p> <p>Work with New Zealand and international party to develop production systems to deliver quality grain. Cost assessment for export.</p>	<p>Import replacement for NZ processor of pre-mix for baked goods</p> <p>Establish grower group (expand existing) to include buckwheat for 2021 harvest. Supply Agreement in place</p> <p>Implement sustainability measures and digital traceability licence</p> <p>Cultivar evaluation programme to select best material</p>	<p>Expand production to meet export requirements.</p> <p>Link with key processors and food brands for inclusion in products</p> <p>New Product Development</p>
Quinoa	<p>Work with established Quinoa grower and processor to add value to raw material (popping, puffing and flours) to replace imported Quinoa in processors existing product range. This may result in expanding volume grown in the near term. Supply Agreement in place.</p> <p>Undertake market insights work to identify further opportunities to partner – raw material and food ingredient:</p>	<p>Establish Grower group to scale up hectares of production across North and South Island.</p> <p>Implement sustainability measures and digital traceability licence(?)</p> <p>Lock in supply contracts</p> <p>Cultivar evaluation programme to select best material</p>	<p>Increase production of value-add forms of product ingredients and branded goods.</p> <p>Link with key processors and food brands for inclusion in products</p> <p>New Product Development</p>

Table 8: Preferred pulses and grains – key actions

15.0 About Leftfield Innovation Ltd

Enabling transformation requires deep understanding. We each have on average 25 years of leadership in our respective domains.



Nick Pyke
Land use and Agronomy



Susan Goodfellow
Strategy and Sustainability



John Morgan
Food innovation and processing



Ed Butler
Science and Plant Proteins



Patrice Feary
Consumer and Market Insights



Andrew Plimmer
Digital Innovation

