

SPROUTED

**THE PLANT INGREDIENT OPPORTUNITY
TAKING ROOT ON THE PRAIRIES**

CANADA WEST FOUNDATION

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EXECUTIVE SUMMARY

Plant ingredients present the type of opportunity that only comes once in a generation.

Around the world, a growing middle class with more money to spend on food has an appetite for more and better options. Consumers in North America and Europe want green and sustainable food choices. Demand for protein, including plant-based protein, and other plant-based ingredients, is sky-rocketing.

The good news is that Canada's Prairie provinces already grow many of the crops, including lentils, peas and beans, that are in demand to be processed into plant ingredient components, such as protein, fibre and starch. The even better news is that we are well-placed not only to enter the non-soy plant ingredient processing sector – and take advantage of the value-added possibilities that entails – but to dominate it.

In addition to food and beverages, plant-based ingredients are in high demand for use in nutraceuticals, pharmaceuticals, cosmetics, pet food and animal feed. They are also incredibly high in value. The demand for plant-based protein alone is already valued at more than US\$8 billion and growing rapidly, and this is only one of the ingredients that can be extracted from crops.

Together, the Prairies have the capacity to dominate the non-soy plant ingredient market, and should combine resources to do so. Manitoba, Saskatchewan and Alberta already grow large volumes of well-suited crops and have had successful early investments into processing facilities. They house the plant-science research and development required to commercialize new varieties with the right ingredient characteristics. Good transportation and logistics infrastructure, a sound regulatory system and a global reputation as a reliable supplier are also strengths.

The region's preferential access to the United States, the largest existing market for plant-based ingredients, is another advantage our competitors lack.

Plant ingredient processing is a global opportunity with global competition. Provinces can choose to compete against each other, or they can collaborate and compete against the rest of the world. This collaboration involves all actors – government, researchers and industry players. Plant ingredient processing offers a realistic path for export growth and diversification for the Prairie economy. Agricultural exports are already a western strength. Diversifying from this strength makes sense.

To pursue this opportunity, we recommend

The provinces, federal government and industry:

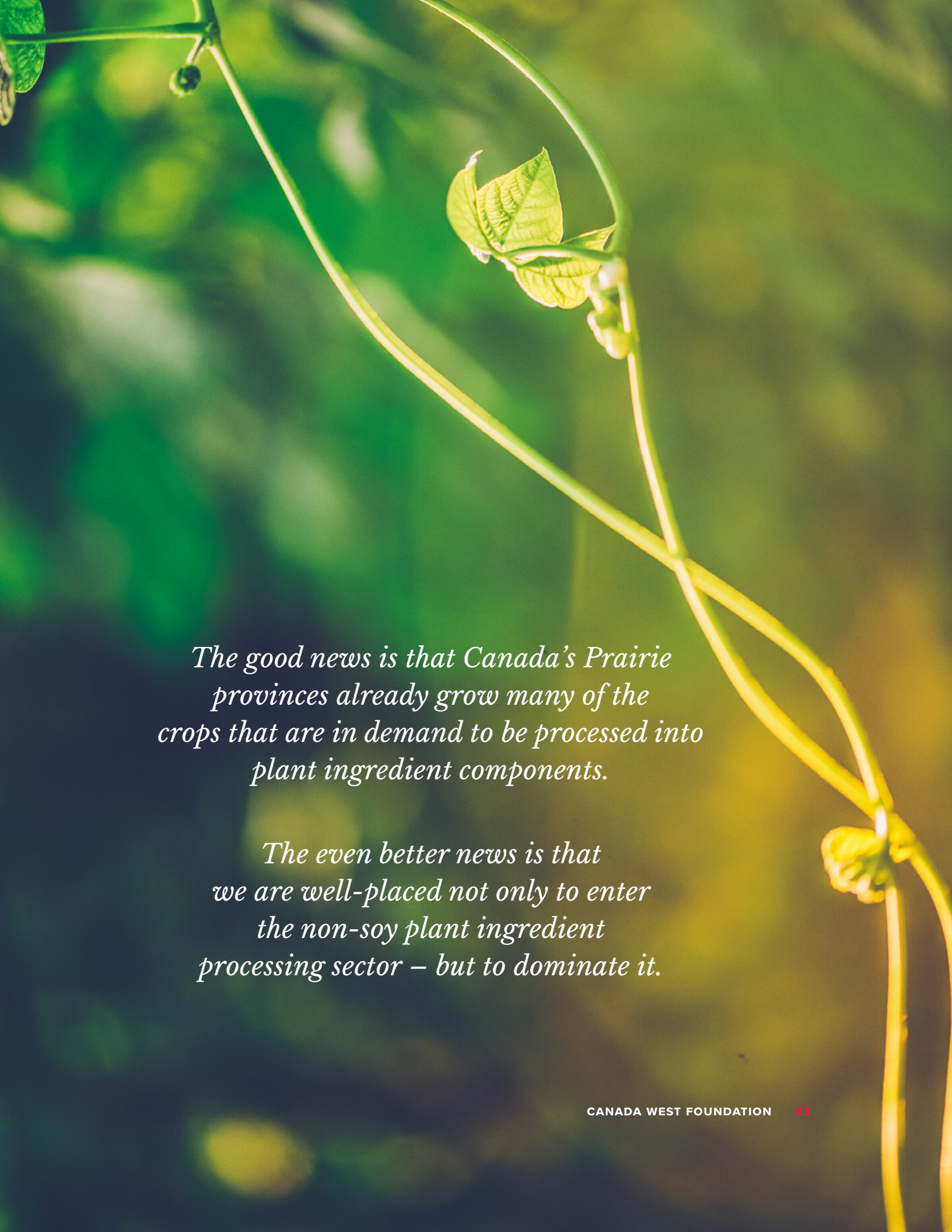
- Prioritize the plant-based ingredients sector.
- Continue support for research, particularly commercialization.
- Leverage publicly funded Intellectual Property (IP).

The Prairie provinces:

- Pursue the opportunity as pan-Prairie.
- Establish a regional “one-stop shop” with information and value chain co-ordination.
- Improve access to capital.

The federal government:

- Protect access to the U.S. market.
- Improve transportation for exporting ingredients.



The good news is that Canada's Prairie provinces already grow many of the crops that are in demand to be processed into plant ingredient components.

The even better news is that we are well-placed not only to enter the non-soy plant ingredient processing sector – but to dominate it.

INTRODUCTION

Western Canada grows a variety and large volume of crops but one key opportunity has not yet been fully harvested: processing those crops into ingredients. Many of the crops already grown on the Prairies, such as pulses and lentils, can be processed into ingredients such as concentrates and isolates – raw material that is not only in high demand for use in food and beverages, nutraceuticals, pharmaceuticals, cosmetics, pet food and animal feed, but is also incredibly high in value.

If the Prairie provinces seize this plant processing opportunity, we can be part of an entirely different supply chain – an innovative shift from the bulk commodities we typically sell.

Becoming a global leader in plant-based ingredients can benefit western Canada's economy in three ways:

01

It will allow western Canada to choose which opportunities to pursue amid new demand created by the rise of the global middle class. It is crucial that the western provinces approach this strategically and build capacity for the long term, rather than taking the first, easiest or cheapest option on the table. As global demand rises and shifts, the upfront costs to produce plant-based ingredients in leading crops such as canola and peas can be leveraged to pursue other plant-based ingredient opportunities.

02

Potential returns to producers will be greater by processing closer to home. If they do not have to absorb costs of shipping to distant markets and if their products feed into other higher value-added products for which there are few substitutes, then producers' farm receipts will rise.

03

It will create more jobs that pay well. High-tech jobs in research and production of high-value ingredients are more Silicon Valley than local grain elevator. Automated clean manufacturing, for example, creates jobs for mechatronic and process engineers and technicians. The processing facilities themselves typically will be built close to the crops used as inputs, bringing jobs to rural areas.

Agricultural opportunities for value-added processing may never replace existing economic engines like the energy sector dollar for dollar in the West, but they do offer a realistic path for export growth and diversification. Agricultural exports are already a western strength. Diversifying from this strength makes sense.

Two features of the plant-based protein and ingredient opportunity for the Prairies stand out.

First, it is primarily a business-to-business opportunity (B2B), rather than a business-to-consumer (B2C) opportunity. Being positioned upstream in the supply chain has disadvantages – margins are lower and it is necessary to invest in continuing research and development to avoid commoditization of both plant product and processed ingredients. On the other hand, if producers provide ingredients to large food processors, the costs and risks of doing business are lower because they can take advantage of their developed consumer channels.

Second, it is a business where processing closer to source material makes sense. Plant fractionation significantly reduces the volume of the material, and multiple products are sold to different markets. Processing close to the source is crucial to ensure access to crops, which reduces supply chain risks

and costs. It also reduces shipping and transshipping costs. The industry here can create and adopt the latest technology to leapfrog much older soy processors to produce higher-quality, differentiated products at lower cost.

These two factors create a unique opportunity for western Canada where distance to large consumer markets is normally seen as a barrier to the region's development of a larger food processing industry. The industry can supply the growing Canadian consumer food processors across the country, as well as international markets.

International firms have already shown faith in the region's potential by investing hundreds of millions of dollars in facilities and equipment in western Canada. One example is Roquette's \$400 million pea protein facility being built in Portage la Prairie, Man. But without a plan, the potential of the plant-based protein and ingredient opportunity could easily be lost. Long-term thinking, a strategy and investment of time and resources are needed from both government and industry.

To compete against the rest of the world, the provinces must first collaborate. Robust intellectual property policies are necessary to build and keep a technology advantage; commercialization can help exploit the range of plants that can be processed, as well as co-products like fibre and starch.

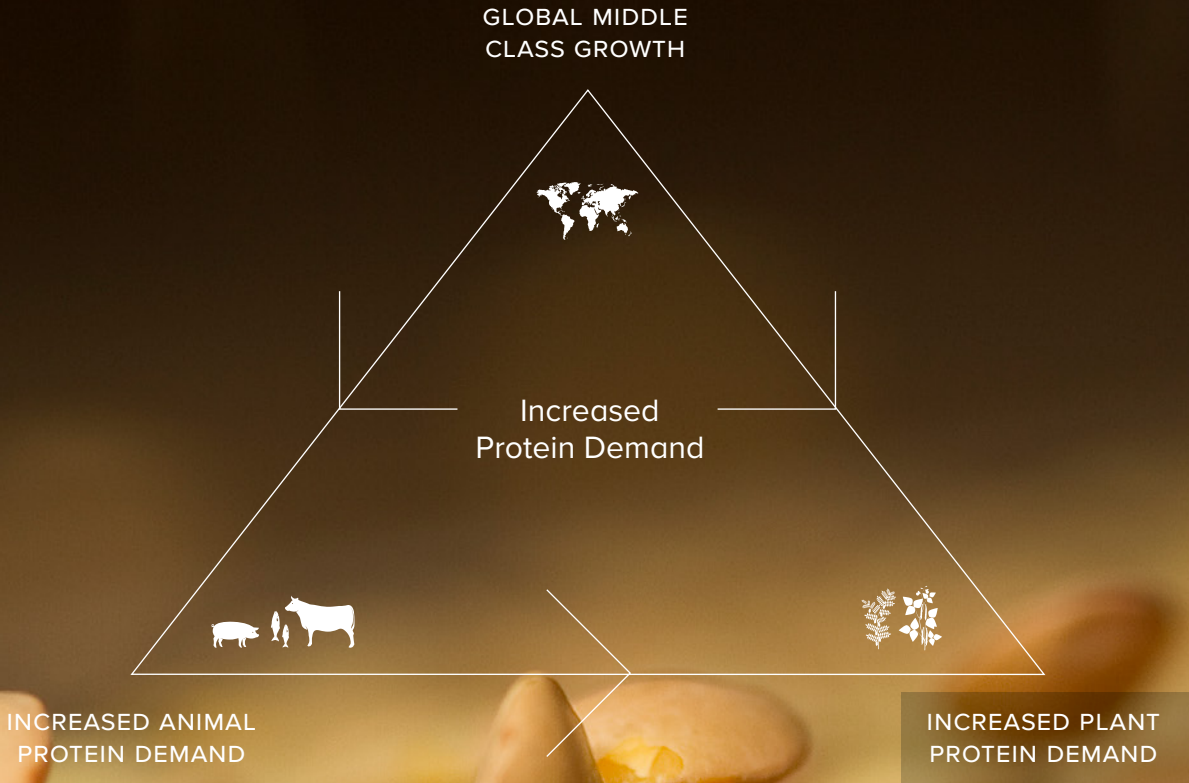


*Without a plan, the potential of
the plant-based protein
and ingredient opportunity
could easily be lost.*

*Long-term thinking, a strategy
and investment of time and resources
are needed from both government
and industry.*

*This paper is an introduction to the opportunity that
plant ingredient processing holds for the Prairies.
While we offer recommendations, more work needs
to be done to iron out solutions to some of the
challenges that go hand-in-hand with the opportunity.*

FIGURE 1: VISUALIZING PROTEIN DEMAND



There is an opportunity in the growing

GLOBAL DEMAND FOR PLANT-BASED INGREDIENTS

The growth in demand for plant-based ingredients starts with global population growth – more people bring more demand for food. The characteristics of the population increase shape the types of food demanded. As illustrated in Figure 1, as consumers demand more protein, plant-based protein demand increases. As consumers demand more animal-based protein, demand for plant-based protein for use in animal feedstocks also rises.

The global population is increasing...

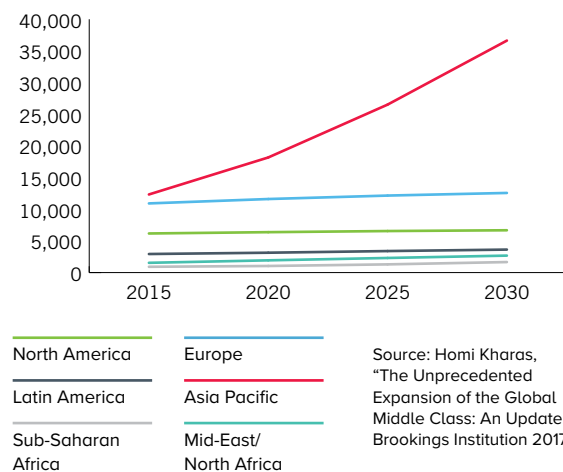
Current estimates put the world population at 7.6 billion. The global population is projected to reach 9.8 billion in 2050, with most growth coming from developing countries.¹

...and so is the global middle class

Not only is the global population growing, it is also getting richer: there will be a greater proportion who are considered middle class. The global middle class (GMC) consisted of 3.2 billion people in 2016, or 43 per cent of the world's population. This is almost 500 million more people than previously thought.

Further, 160 million people are projected to join the global middle class *annually* for the next five years.² Middle-class consumption accounts for more than one-third of the global economy, or about US\$35 trillion dollars, and it is growing by close to four per cent annually in real terms.

FIGURE 2: GLOBAL MIDDLE CLASS SPENDING
PURCHASING POWER PARITY (PPP), CONSTANT 2011
(BILLION \$)



¹ United Nations Department of Economic and Social Affairs, World Population Prospects: The 2017 Revision, June 2017, <https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html>.

² Homi Kharas, "The Unprecedented Expansion of the Global Middle Class: An Update," Brookings Institution, February 2017.

Human food demand

According to the United Nations Food and Agricultural Organization (FAO), agricultural production will need to double in developing countries by 2050 to feed the growing world population. This equates to producing an additional one billion tons of cereals and 200 million tons of meat per year over what is produced now. Consumption of fish is also projected to increase by more than 30 million tons annually by 2030.³

The growing number of middle-class consumers will drive demand not only for more food but for higher quality and types of food. One of the biggest challenges will be meeting the rise in demand for protein.

Demand for plant-based protein is increasing

The current size of the global plant-based protein market is estimated at more than US\$8 billion and is expected to reach US\$14.8 billion by 2023 with a compound annual growth rate (CAGR) of 5.9 per cent from 2017-2022.⁴ By 2054, plant-based protein is expected to be one-third of the global protein market.⁵ Between 2017 and 2023, human consumption of plant-based protein is expected to nearly *double*.⁶

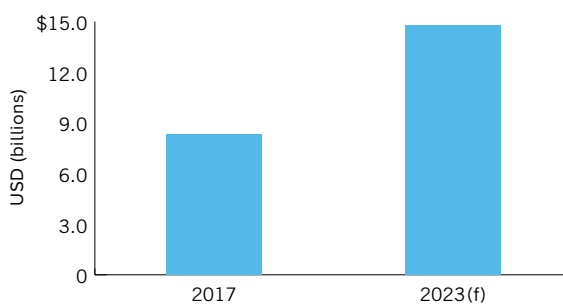
North America is the largest market for plant protein ingredients, making up 35 per cent of total global demand in 2015, followed closely by Europe.⁷

The Asia-Pacific market is smaller, but expected to register the fastest growth moving forward. Other regions, including Latin America, the Middle East and Africa, comprise a small fraction of global demand.

Of the 247 kilotonnes of plant protein demand in North America in 2015, nearly 80 per cent (195 kilotonnes) came from the U.S. Being located next to the largest consumer of plant protein ingredients gives western Canadian processors an advantage over competitors. In 2015, Germany's plant protein ingredients demand was 55 kilotonnes, the United Kingdom's (UK) was 27 kilotonnes, China's was nearly 70 kilotonnes, and India demanded less than 20 kilotonnes.

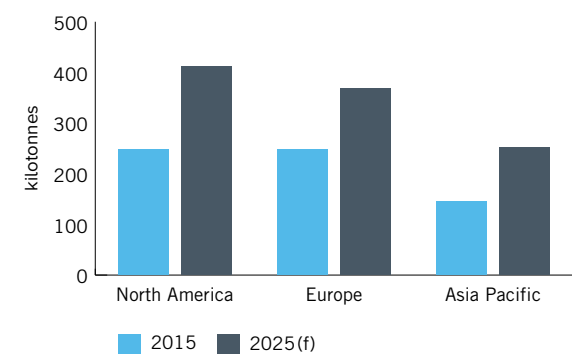
Canada, the U.S., the European Union (EU) and other countries such as Japan and Australia have all approved the use of plant-based protein ingredients in food processing.⁸ The crops grown in western Canada are ideally suited for the many uses for plant-based ingredients in food manufacturing. New products with plant-based proteins grew nearly 15 per cent in 2014, double the rate of growth of animal-protein based new products (7.5 per cent in 2014).⁹

FIGURE 3: GLOBAL PLANT PROTEIN DEMAND GROWTH



Source: Mordor Intelligence

FIGURE 4: PLANT PROTEIN INGREDIENTS DEMAND (VOLUME)



Source: Grand View Research

³ World Bank, "Fish to 2030: Prospects for Fisheries and Aquaculture," December 2013, <http://documents.worldbank.org/curated/en/458631468152376668/Fish-to-2030-prospects-for-fisheries-and-aquaculture>.

⁴ Mordor Intelligence, "Global Plant Protein Market," <https://www.mordorintelligence.com/industry-reports/plant-protein-market>, November 2017.

⁵ Lux Research, "WhooPea: Plant Sources Are Changing the Protein Landscape," Dec 2014, <http://members.luxresearchinc.com/research/report/16091>.

⁶ Mordor Intelligence, "Plant Protein Market (2017 - 2022) | Size | Share | Forecasts". Web excerpt. The plant-based protein market is estimated to be US\$8345 million as is expected to reach US\$14,800 million by 2023.

⁷ Grand View Research, "Plant Protein Ingredients Market," November 2017.

⁸ Ibid.

⁹ Plant Based Foods Association, <https://plantbasedfoods.org/why-plant-based/>.

While there is no way of knowing what exactly protein consumption will look like in the future, we know that protein consumption will increase because of population growth and/or increased wealth. It is estimated that the global population will grow by 2.2 billion by 2050. If these people consume protein at the same rate as a country with average protein consumption (Vietnam or Peru, for example), we would require a roughly 32 per cent increase in total world protein production. As the world increases in overall wealth, protein consumption around the world could increase to the level that currently wealthy countries occupy. For example, if the world were to consume protein at the same level that the U.S. does, by 2050, global protein production would need to increase by 78 per cent.¹¹

Animal protein demand is changing

Animal protein consists primarily of meat and dairy derivatives such as whey or casein. While meat consumption is on the rise in much of the developing world, it is falling in advanced economies. In Western Europe, meat consumption fell nine per cent from 1990 to 2009, according to the FAO. This is part of a larger dietary transition in advanced economies. This entails either less consumption of animal proteins, as seen in some countries in Europe, or increased consumption of plant-based proteins. The latter has been the case in North America, where demand for vegetable oil has also fallen as part of this dietary transition. The developing world, especially sub-Saharan and North Africa,

HOW PLANT-BASED INGREDIENTS ARE USED IN FOOD MANUFACTURING

In North America, Europe and China, health and nutrition foods are key markets for ingredients such as protein and fibre derived from pulses. Pea protein, for example, is used in granola and energy bars, high-protein pasta, baby food, veggie burgers and even beverages and smoothies. Pulse fractions are also used in processing to stabilize viscosity in sauces and dressings; add crispiness in breaded products by reducing oil absorption; and retain moisture in meat products. Beta-glucan from barley and oats are good for heart health and help manage diabetes but humans would have to consume massive amounts of these cereals to receive the benefits. An Alberta company, GrainFrac, developed technology to concentrate beta-glucan so food manufacturers can include it in products like pasta, granola bars and drinks.¹⁰ Lentil protein can be used as a foaming agent in baking as an egg white replacement, and a U.S. company is making mayonnaise from pea protein instead of eggs. As consumer demand grows for more and wider taste experiences, the sensory properties like taste and texture demanded of these ingredients by consumers will evolve and there will be a need for a wider array of crops – many of which are produced on the Prairies.



¹⁰ GrainFrac, "GrainFrac," <http://www.grainfrac.com/> accessed Oct. 30, 2017.

¹¹ Henchion and et al, "Future Protein Supply and Demand: Strategies and Factors Influencing a Sustainable Equilibrium," 2017

the Middle East and India are at the other end of the dietary transition characterized by a shift toward more protein consumption, initially from plant sources and then from animal sources – particularly meat and an increase in demand for oils.

In North America, which will be the largest market for plant ingredients processed in western Canada, environmentally conscious consumers want eco-friendly, sustainable food products. Pulses, for example, are a low-fat source of protein. By incorporating pulse fractions into their products, food manufacturers can help agri-food processors meet sustainability goals. Pulses use about half the non-renewable energy other crops require, have a low-carbon footprint and require small amounts of nitrogen fertilizer.¹⁴

Aquaculture feed protein demand

Production of fish and seafood, meanwhile, is expected to grow by more than 30 million tonnes from 2011 to 2030.¹⁵ This has the potential to increase the demand for plant protein-based aquafeed significantly.

It is estimated that the share of fish and seafood that is farmed will expand to the point where it will be responsible for half the total supply, and will supply more than 60 per cent of fish consumed by humans.¹⁶ More production of farmed seafood will lead to an

increase in demand for feed. Fishmeal from aquatic sources is declining due to a combination of a drop in the annual catch and rising human consumption of traditional sources of fishmeal feedstock. These traditional sources such as sardines and anchovies compete with human consumption especially among the lower-income brackets of the rising global middle class. For example, whole small fish like sardines are sold in markets in Nigeria for between US\$0.20 to US\$0.40 per kg versus US\$4.3 per kg for beef. The decline in availability of fished feedstock has partially been offset by the introduction of processed fish byproducts like leftovers from producing ready-to-serve fillets for higher-income consumers. But the introduction of processing byproducts has only blunted, not reversed, the decline in availability of aquatic fishmeal. Rising use of processing byproducts for pet food, mostly for the higher-income global middle class, will further reduce the ability of processed byproducts to compensate for dwindling fished feedstock.

Plants alone are not a good substitute as feed for fish as the nutritional profile is not a good match. For fish such as salmon, the lack of oils in plant substitutes makes them less useful, and potentially even harmful. However, plant-based ingredients that have a higher protein concentration and are designed to replace fished feedstock are a better substitution. The rising cost of fished feedstock due

THE IMPOSSIBLE BURGER

Impossible Foods, a U.S.-based food science company, has created something not quite impossible, but something thought to be impossible – a vegetarian burger that looks, tastes, and smells like beef. It even bleeds! They have created this success by investing significant resources in product development, including experimenting with 3000 plants to arrive at the formula for the impossible burger,¹² underlining the importance of developing a wide range of plant ingredients for processed foods as demand grows and more products are needed to meet a wider array of tastes in the U.S. and other markets. The Impossible Burger was launched in July 2016, and is now offered in 225 locations across the United States.¹³



photo: www.impossiblefoods.com

¹² Mary Ellen Kuhn, "A New Crop of Plant Protein Pioneers," Institute of Food Technologists, December 2014, http://www.ift.org//media/food%20technology/pdf/2014/12/1214_feat_1_plantprotein.pdf?fullsite=true.

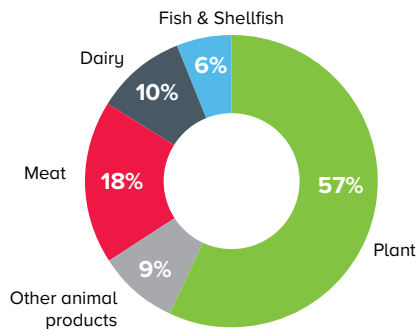
¹³ Impossible Foods, "The Impossible Burger," <https://www.impossiblefoods.com/burger/>.

¹⁴ The Economic Development Alliance of Southeast Alberta, "Opportunities in Pulse Processing Feasibility Study," August 2013, <http://edalliance.ca/wp-content/uploads/2016/04/Opportunities-in-Pulse-Processing-Feasibility-Study-in-Southeast-Alberta.pdf>, p. 8.

¹⁵ World Bank, "Fish to 2030: Prospects for Fisheries and Aquaculture."

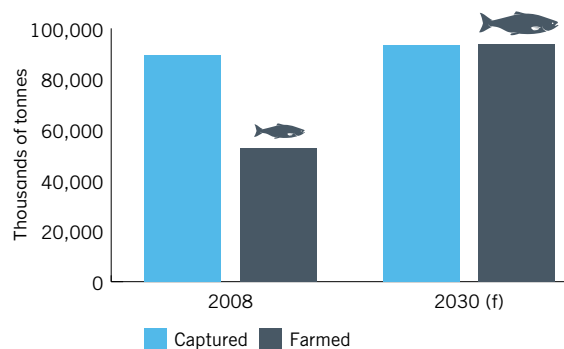
¹⁶ Ibid.

FIGURE 5: GLOBAL SOURCES OF PROTEIN FOR HUMAN CONSUMPTION, 2010



Source: Henchion and et al, "Future Protein Supply and Demand: Strategies and Factors Influencing a Sustainable Equilibrium," 2017

FIGURE 6: SOURCE OF FISH FOR HUMAN CONSUMPTION



Source: World Bank Agriculture and Environmental Services, 2013

to dwindling supplies and competing uses makes fractionated and engineered plant-based feedstocks more competitive. Though these plant-based feedstocks will still lack some critical elements needed for fish feed, when used in combination with other ingredients, they can play a significant role in meeting global demand.

Extracting protein from insects is another feasible substitute for aquaculture feed; the EU approved the use of insect protein in fish feed earlier this year.

Pet food

Demand for plant-based protein sources in pet food is also on the rise. The global pet food industry,

already valued at nearly US\$50 billion, is growing by more than five per cent annually.¹⁷ Pet obesity is one driver of the search for new input sources in diet pet food. Traditional diet food for pets is high in fibre, which can cause other complications such as decreased nutrient digestibility.¹⁸

Canadian research is already underway in this area. For example, in 2014 the Alberta Crop Industry Development Fund completed a project with Edmonton-based Champion Petfoods Ltd. and Alberta Agriculture that incorporated field pea and white flower faba bean in diet food for dogs.

In short, demand for protein is exhibiting strong growth across a variety of uses.


Nutreco, headquartered in the Netherlands with a subsidiary in Canada, is the largest global producer of fish feed. It has developed a new salmon feed containing a mixture of soybeans, rapeseed and ground chicken to replace traditional wild catch sources of feed like anchovies. The company, working with scientists in Norway, is working on phasing out the use of chicken to make the new fish feed completely vegetarian. While the use of plant-based fish feed is not expected to lower costs of farming fish, Nutreco notes vegetarian feed is more sustainable and will be seen as a higher standard product.¹⁹



¹⁷ J.M. Bond, "Extrusion Characteristics, Palatability, and health Implications of Pea Fractions in Dog Food," Pulse Canada, 2013, <http://www.bestcookingpulses.com/documents/Pulses%20for%20Pet%20Food%20-%20White%20Paper.pdf>, p. 1.

¹⁸ Ibid, p. 3.

¹⁹ "Caged Salmon Go Vegetarian as Nutreco Cooks Up Bean, Seed Diet," May 2009, <https://en.engormix.com/MA-aquaculture/news/caged-salmon-vegetarian-nutreco-t15023/p0.htm>.



The Prairies do not need to become a major soy producer to get into the plant ingredient market. As demand for non-soy plant ingredients grows, the large and varied crop receipts in Canada will help us dominate.

Western Canada has resources and research to

DOMINATE THE NON-SOY PLANT INGREDIENT MARKET

Western Canada has a combination of advantages that make it extremely well-positioned to seize the opportunity to meet demand for non-soy plant-based ingredients. Markets with strong demand growth are especially attractive. New entrants can succeed without stealing shares of the existing market from entrenched incumbents that can lead to retaliation.

The non-soy ingredients market, where demand is growing for use in human food and beverages, animal and fish feed, and pet food, presents an opportunity. As demand for plant-based protein increases, so too does demand for more variety of feedstocks. Soy currently dominates the sector, but allergy, hormone and genetically modified food concerns, as well as broader nutritional and taste benefits, mean consumers are hungry for a wider

range of plant-based ingredients. New products based on non-soy ingredients are in demand to satisfy the increasingly sophisticated consumer appetite. This is good news for the Prairies – one of the world's leading producer of crops such as peas, beans, lentils, wheat, oats, and canola that are well-suited for producing plant-based proteins and ingredients.

Leadership of the global plant ingredient market should be Canada's goal. Continued market domination yields higher returns and creates positive feedback throughout the system. As a market leader, Canada would become the source of choice for product, processing facility location, investment and research, stimulating the economy further and creating even more jobs.

The Canada West Foundation conducted more than 20 interviews with key informants working in companies, associations, and research in the plant ingredient space, as well as officials from the governments of Alberta, Saskatchewan and Manitoba. These interviews helped inform our research into the opportunities and challenges the Prairies face in the plant ingredient processing sector.

Market leadership will take work. For some of the required steps we are primed and ready – like our ability to produce in-demand crops. There are also challenges, like transportation, that need work to build upon what we have. Others, like commercialization capacity, will require significant new investments to build out existing capabilities.

Canadian research and development is turning commodities into high value ingredients

Fractionation, a relatively new processing technology that breaks plants into protein, starch and fibre fractions for use as ingredients in food processing, is the basis of this opportunity.

Cost-effective processing to fractionate crop components can produce pure ingredients, extracts, and isolates from a wide range of western Canada-based crops. Western Canadian crops can be at the beginning of an entirely different supply chain, an innovative shift from the bulk commodities we typically sell.

Early investments demonstrate feasibility

In the past year, plans for new pulse fractionation facilities have been announced in each of the Prairie provinces: Bowden, Alta; Moose Jaw and Vanscoy, Sask; and Portage la Prairie, Man. Three are investments by international companies (German, American and French) – validation that others also see the opportunity for ingredient processing in the Canadian Prairies.

Besides these recent investments, there are already several ingredient processing facilities operating in Saskatchewan and Manitoba. There is also a strong base of crop processing (like cleaning and bagging, and canola crushing) facilities in the Prairies. For a list of facilities, refer to Appendix A (p. 29).

Canada produces large quantities and varieties of relevant crops

One of the ways Canada is uniquely positioned to take advantage of the growing demand for plant-based ingredients is the ability of Canadian farmers to grow large quantities of in-demand crops *and* niche crops which also have market potential.

In the short-term, Canada's biggest opportunity in plant ingredient processing is using the crops we already grow in large volume. Canada is the largest producer of canola, contributing more than a quarter of global production. We account for nearly 35 per cent of global production of dry peas.²⁰

On the Prairies, millions of acres of canola, wheat, barley and pulses are each seeded each year. In B.C., the dominant crops are peas and canola. The Maritimes mainly produce corn, wheat and soybeans. In central Canada, the predominant crops are corn, wheat, soybeans and beans.

Currently, the global plant ingredient market is dominated by soy. Between 1961 and 2009, worldwide soy production grew by nearly 10 times. In 2012, 270 million tonnes of soy were produced.²¹ Canada represents only a small part of this market, and this is not likely to change.²² *We do not need to become a major soy producer to get into the plant ingredient market. As demand for non-soy plant ingredients grows, the large and varied crop receipts in Canada will help us dominate.*

Growing high volumes of multiple crops gives Canadian processors a strong base of crops from which to work. For example, as new technology is developed for pulse or canola ingredients, processors can easily source the crops they need from current production levels. At the same time, the variety of crops in Figure 7 (p. 15) shows that many different crops with different soil, light, and moisture requirements can be grown in Canada. Therefore, if a niche crop (such as flax or lupins) grows in importance, we will be able to grow it here.

²⁰ Grand View Research, "Plant Protein Ingredients Market," November 2017.

²¹ World Wildlife Fund, "Soy is Everywhere," http://wwf.panda.org/what_we_do/footprint/agriculture/soy/facts/.

²² Ibid. In 2011, 85% of soy was produced by four countries: China, Argentina, the US, and Brazil.

FIGURE 7: MAJOR CROP PRODUCTION BY REGION IN MEGATONNES (2017)



Source: Canada West Foundation and institution websites

It makes sense to process plant ingredients close to production

For some products, like crude oil, it makes more economic sense to process in large refineries close to where it will be sold as a final product to achieve both scale economies and meet differentiated market requirements. For example, refined petroleum products must be tailored to meet climate and regulatory requirements of the jurisdictions in which they are consumed.²³ Similar scenarios exist for many processed foods. Western Canada produces high volumes of wheat, but ships the majority to eastern Canada to be milled into flour and then baked into bread because consumers are concentrated in eastern Canada and the U.S. If we shipped bread baked in western Canada to these consumers, they would be buying and eating stale bread. We also do not ship bread into western Canada from the East; we bake enough here to supply the local market.

It is the opposite for plant ingredients. Canola provides a clear illustration of why this is the case. Producers can sell their canola to a primary elevator for export or to a canola crushing plant. Farmers earn a higher price by trucking their product directly to the crush pad rather than to the primary elevator because of the difference in the freight costs borne by producers for processed and unprocessed seed. When farmers sell to a primary elevator, they pay a handling fee to the elevator and are charged freight costs to ship their product from the elevator to the West Coast ports. When farmers sell to a processing facility like a crush pad, if they truck the grain themselves to the plant, they only pay a handling fee to unload their canola at the plant. The shipping costs for the final product are borne by the end purchaser instead of by the farmer. Recent savings for farmers in northwest Saskatchewan run from \$48 a tonne for peas to \$53 a tonne for canola.²⁴ This same scenario of the end user, not the producer, paying shipping costs is also true for processed plant ingredients.

Canola crushing facilities close to production benefit from shorter supply chains. For example, there are two canola crushing plants in Yorkton, Sask. within trucking distance of the high volumes of canola produced in northern Saskatchewan and northwestern Manitoba. As demand for ingredients from crops like pulses continue to grow, processing facilities will generally be established close to the source of production if new processing technologies are efficient. The advantage will be greater for more complex, greater value-added processing which reduces the weight and volume of the product for shipment significantly, reducing shipping costs to markets outside the West. If processors can also use the byproducts to create other valuable products depending on global demand, then shipping costs will determine their competitiveness in local and global markets. Since 98 per cent of dry peas, more than 50 per cent of beans and all lentil and chickpea crops seeded in Canada are in the West, there would be a critical mass of supply for processing plants established in the region.

Being close to the farms that produce feedstock is critical for companies to establish first-person relationships to ensure supply and avoid costly interruptions in facilities that need to run continuously. Direct relationships also allow manufacturers to avoid the cost of paying intermediaries to manage these relationships. Being located close to farmers means having to stockpile less feedstock at the production facility, saving on storage costs, which would also be lower to begin with in rural less-populated areas than in larger urban metropolises. Of course, urban metropolises have some advantages such as better and more robust infrastructure, particularly related to water.

Using the whole plant

Plants contain multiple different components, all of which can be processed into separate ingredients that feed into multiple supply chains. For example, peas contain starch, protein, fibre, fat, sugars, and other components.²⁵ A consumer goods processor

²³ House of Commons Standing Committee on Natural Resources, "Current and future state of oil and gas pipelines and refining capacity in Canada," May 2012, <https://www.ourcommons.ca/DocumentViewer/en/41-1/RNRR/report-3/>, p. 21-22.

²⁴ Quorum Corporation, 2015-2016 Annual Report, Tables 6A-3C and 6A-3D

²⁵ Mehmet C. Tulbek, "Pulse-milling: Wet and dry fractionation applications of peas, lentils, and chickpeas in gluten-free foods," *Pulse Canada*, 2010, <http://www.pulsecanada.com/uploads/78/61/786198e3f71bdda9847150ab5d561bfe/Gluten-free-Pulse-milling-Wet-and-Dry-Fractionation-Applications-of-Peas-Lentils-and-Chickpeas-in-Gluten-free-Foods.pdf>.

interested in using pea protein powder will buy the protein from a processor, rather than process the entire peas and have so many co-products left over for which it has no use and will either have to pay to ship back or throw away. In addition, given the longer shelf life of ingredients and the smaller volume, significant transportation savings should also be realized in shipping feedstock shorter distances to plants and then shipping finished product to end users at multiple locations.

Although Canada produces many crops used in plant ingredient processing, we mostly export in bulk form. Canada is a relatively small player on the processed food stage, and the processed food Canada does export has minimal added value. Most of the grain, seed and pulse production from the Prairies are sold as bulk commodities that are simply cleaned and sorted. Some is crushed for oil or milled into flour. *Canada is selling itself short.* When crops are processed here, it means companies, jobs, and capital are being kept in Canada. When crops are processed significantly, as opposed to just cleaning and bagging, it is more labour intensive, creating more jobs and economic stimulus. Before research breakthroughs, it made sense to ship unprocessed grains abroad, receiving a low, but stable, economic return. Now, however, Canadian crops can be worth much more to the Canadian economy, *if* they are processed domestically and then exported. If Canada commits to this higher-value plant ingredient opportunity, it will provide tangible economic benefits.

Research capacity in the Prairies

Research related to plant ingredients in the Prairies can be divided into: crop science, which is the research done before the crop goes into the ground; and food processing research and development (R&D), which focuses on commercialization.

The Prairies have long been the breadbasket of Canada, but in the past few decades, significant achievements in crop science and food science R&D is turning the breadbasket into a food basket.

Crop science

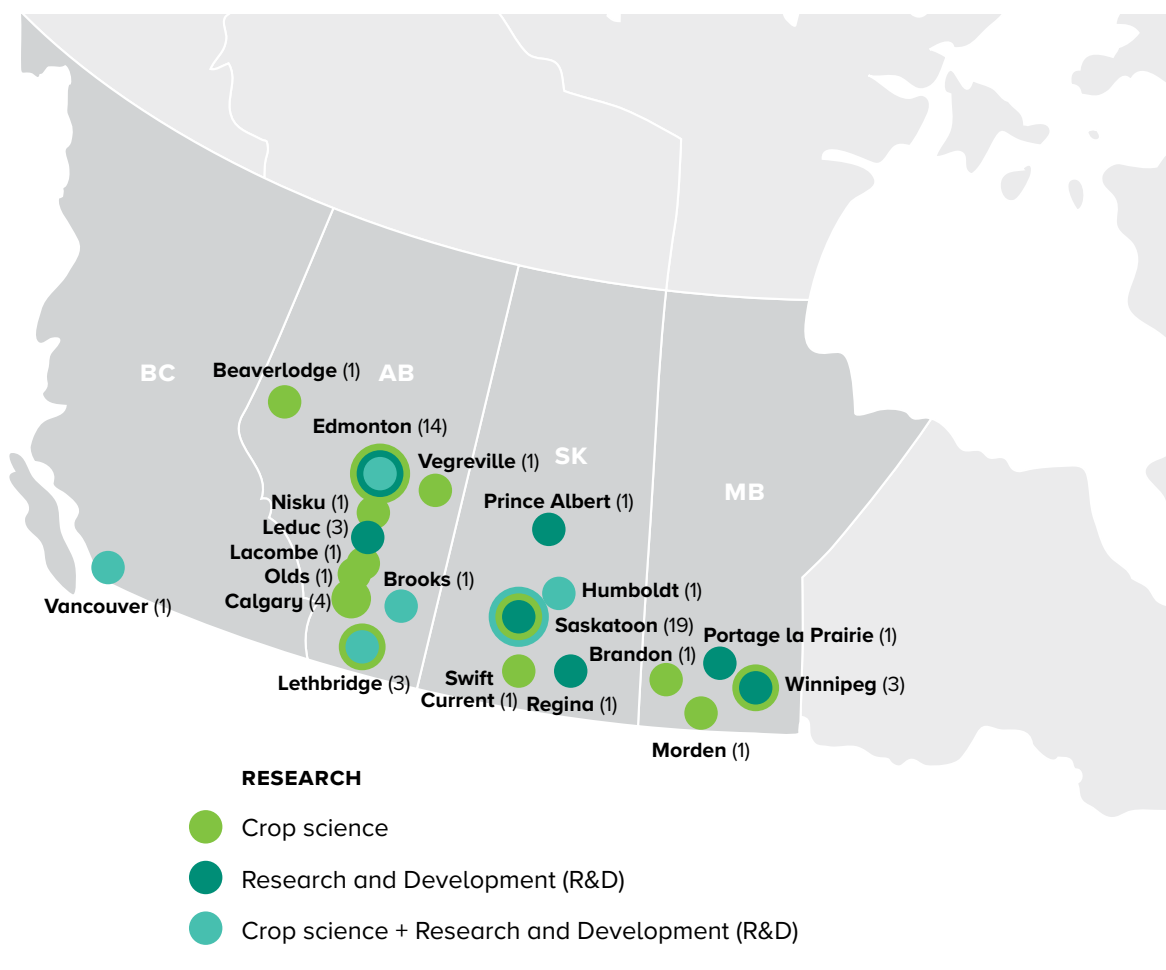
Crop science has flourished in the Prairies for decades, as evidenced by the development of canola in the 1970s. Each Prairie province is home to crop science centres, including federal research centres (such as the Lethbridge, Alta. research centre with 45 scientific staff); crop associations (such as the Saskatchewan Canola Development Commission with more than 70 active research projects; 18 new ones announced in 2015/16 alone valued at nearly \$5 million²⁶); numerous colleges and universities; and for-profit agricultural science companies (for example, Dow Dupont has several locations in Alberta). The general goal of crop science is to make a crop more productive and suitable to both farmers and end users. This involves increasing yields and diminishing the effects of disease and pests, among other research goals. These institutions share information with each other and work with the private sector. Hence, public-sector investments have also led to increased private-sector investments. Co-operation between these groups is especially important for smaller crops, like canola, on a global scale.

Research and Development

The Prairies benefit from strong R&D organizations as well. These institutions focus on how to better extract ingredients from plants, and how to use these ingredients more effectively in processed food. Like crop science, R&D facilities are spread across the Prairies and exist in most major cities and several towns. They vary from for-profit institutes (like PAMI in Humboldt and Saskatoon, Sask., and Winnipeg, Man.) to provincially funded institutes (like the Food Processing Development Centre in Leduc, Alta. and the Food Development Centre in Portage la Prairie, Man.).

²⁶ Saskatchewan Canola Development Commission, "2015/16 Annual Report," http://www.saskcanola.com/quadrant/media/files/about/pdfs/SaskCanola_2015-16_AR_web.pdf, p. 7.

FIGURE 8: CROP & INGREDIENT RESEARCH INSTITUTIONS IN WESTERN CANADA (2017)



*See appendix B for full list of research institutes
Source: Canada West Foundation and institution websites

There are several clusters of crop science and R&D throughout the Prairie provinces. Notable centres include central Alberta (Edmonton, Nisku, and Leduc) and Saskatoon, which is home to 19 crop and R&D centres. Even outside these centres, research institutions in the Prairies are interconnected and can collaborate and learn from one another. As Figure 8

indicates, the concentrated number of facilities in the Prairies creates a web that in turn leads to more research than if these institutions worked alone. The expertise in western Canada is something international investors are aware of, and an advantage we have over other jurisdictions. For a list of the institutions in Figure 8, refer to Appendix B (p. 31).

Canada is politically stable

While political stability is something Canadians tend to take for granted, it is essential for establishing large, profitable markets. This is key in attracting investors, as they want to know that their investment will not be affected by unstable political factors. This gives Canada an edge over less-stable jurisdictions to attract investment for plant-based ingredients. Canada also has a reputation as a reliable supplier of bulk commodities to international customers – a reputation that will carry over to processed commodities like plant ingredients.

Trade agreements give us preferential access to North American, Asian and European markets

Canada has trade agreements with 44 countries – preferential market access to close to 16 per cent of the global population (about 1.2 billion). Both North American Free Trade Agreement (NAFTA) and proximity give Canada preferential access to the U.S. market, where the majority of demand for plant-based proteins exists. While the future of NAFTA is uncertain, our geographic location and our entrenchment in the U.S. market will give Canada some form of preferential access to that market compared to other, more distant, countries. Canada should be doing all it can to work this to our advantage, by pushing for further agriculture regulatory harmonization in the current NAFTA renegotiation talks. We cannot avoid the risk of the U.S. throwing up non-tariff barriers or imposing countervailing or anti-dumping duties on Canadian exports, but harmonization can reduce these risks.

Canada's trade agreement with Europe, the Comprehensive Economic and Trade Agreement (CETA), entered into force earlier this year. The U.S. does not have free trade with Europe, nor is it anywhere close to achieving a similar deal. This gives Canada an obvious advantage in trade, but also in investment and manufacturing. For example, with a steady supply of inputs and easy and preferential access to the U.S. market, western Canada is an attractive jurisdiction for European plant ingredient manufacturers looking to supply the U.S. to set up shop.

Besides NAFTA, Canada is participating in two other active trade negotiations. The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) between 11 countries is moving forward despite U.S. withdrawal from the original pact. Joining the CPTPP would take us from having one trade deal with an Asian country (with Korea) to eight. Canada recently became an associate member of the Pacific Alliance trade integration bloc made up of Chile, Columbia, Mexico and Peru, and is negotiating a trade deal with the bloc. Like western Canada, the Pacific Alliance's focus is on becoming more competitive to increase trade with Asia. Completing both trade negotiations will give Canada better access to Asia-Pacific markets where future plant-based protein demand is projected to occur.

Western Canada's Research Prowess

THE STORY OF CANOLA

To grasp the Prairies' research and development capacity, consider canola. Prairie scientists developed the crop in the 1970s, and by 1978, it was officially named, "Can" for Canada, and "ola" for oil.²⁷ Since then, with many scientific milestones (such as improving the healthfulness, profitability, and processing techniques) along the way,²⁸ canola has become a cornerstone of Canada's agriculture economy. Today, the crop is an economic powerhouse that creates more than a quarter million jobs and more than \$26 billion for the economy. The three Prairie provinces see most of this economic benefit: in recent years, Manitoba has received approximately more than \$4 billion in economic benefits, Alberta more than \$7 billion, and Saskatchewan more than \$12 billion.²⁹

TODAY, CANOLA IS AN ECONOMIC POWERHOUSE THAT CREATES MORE THAN A QUARTER MILLION JOBS AND MORE THAN

\$26 B

FOR THE ECONOMY.

²⁷ Canola Council of Canada, "Canola History Timeline," <https://canolahistory.ca/>.

²⁸ Ibid.

²⁹ Canola Council of Canada, "Economic Impact of the Canola Industry," 2016, <https://www.canolacouncil.org/markets-stats/industry-overview/economic-impact-of-the-canola-industry/>.

Seizing this opportunity will
BENEFIT WESTERN CANADA

Attracting additional plant ingredient processing facilities to the Prairies will bring opportunities in the form of jobs, economic growth, new market opportunities for farmers and increased crop production.

Ingredient facilities will lead to jobs and economic growth

The establishment of value-added facilities to process plant fractions and ingredients will bring jobs and investment into the Prairie provinces. For example, the Roquette pea protein facility slated to open in Portage la Prairie, Man. in 2019 will bring 150 permanent jobs with an annual payroll of \$9 million to the community, not to mention about 300 construction jobs to build the plant.³⁰

These facilities often bring jobs to rural areas. Since companies want to establish facilities close to the inputs (crops), rural municipalities open to economic development have an opportunity to work with companies to set up shop in their jurisdiction.

The site for the organic pea protein facility planned by Verdient Foods – backed by Hollywood director James Cameron and his wife – is in Vanscoy, Sask. The village's population is less than 350 people and the municipality is home to about 2,700.

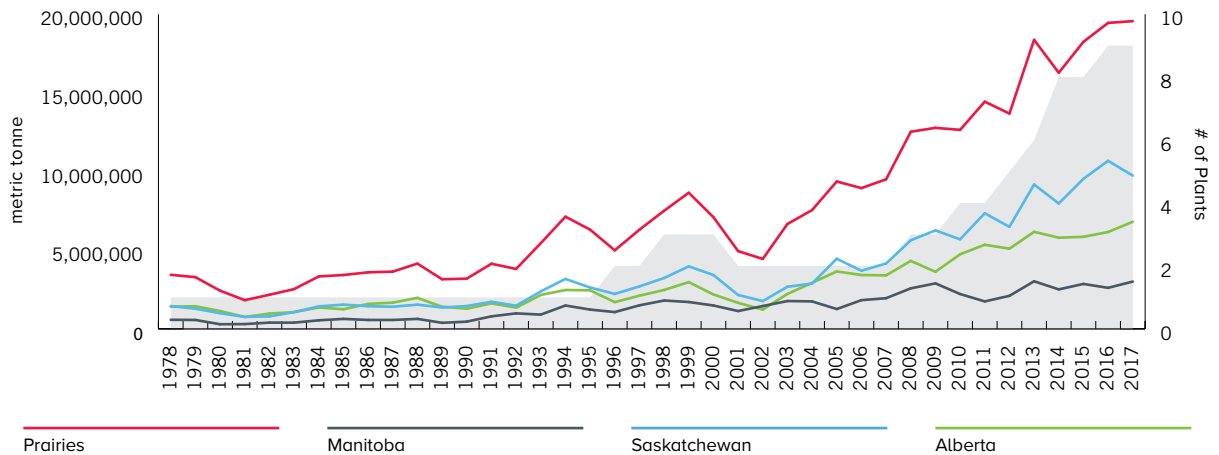
Ingredient facilities will provide new market opportunities for farmers

Farmers are always looking for new market opportunities. More ingredient processing on the Prairies will give western farmers that produce the inputs the facilities need the opportunity to supply a plant if it is located within the radius of where they can truck their production. As noted, farmers can earn a higher price by selling their crop directly to a processing facility rather than to a primary elevator. This type of opportunity to provide a consistent supply and earn a steady income can make a huge impact to a farm and its ability to reinvest. Ingredient processing companies may also offer farmers premium prices for higher quality crops.³¹

³⁰ Western Producer, "France's Roquette bets on pea protein with Manitoba factory," January 18, 2017. <http://www.producer.com/2017/01/frances-roquette-bets-on-pea-protein-with-manitoba-factory/>.

³¹ Alberta Farmer, "Customers can't wait for new pulse plant to open," June 6, 2017.

FIGURE 9: CANOLA PRODUCTION AND PROCESSING PLANTS IN WESTERN CANADA, 1979-2017



Source: Statistics Canada, CANSIM Table 001-0010

With more ingredient facilities, more crops may follow


Experience shows that when processing capacity increases, so does production of the crops being processed. For example, between 1978 and 1996, there were two canola processing plants in western Canada. In this timeframe, canola production grew to 4.9 million tonnes from 3.4 million tonnes, an increase of 45 per cent in 18 years. In comparison, during the next two decades, 11 additional plants were opened, and canola production rose to 19.5 million tonnes, an astonishing 290 per cent increase.³² As shown in Figure 9, there is a correlation between the massive growth of canola production and the growing number of canola processing plants in the Prairies.

Production of crops such as pulses have been steadily increasing in western Canada. The canola success story may encourage those looking to enter the plant ingredient processing sector.

Ingredient facilities make the west more attractive for food manufacturers

The establishment of more ingredient processing in western Canada may also make the region – and the country – more attractive for food manufacturers. As ingredient facilities are established in the Prairies, attention will need to be paid to who is buying the processed fractions and ingredients and whether there is an opportunity to attract some of these food manufacturing companies to set up shop in western Canada.

³² Statistics Canada, CANSIM Table 001-0010



*Alberta has strong research and finance experience,
but no operating fractionation plants;
Saskatchewan has high volumes of pulse production,
research and operating plants, but a smaller
financial base; Manitoba will be home to the world's
largest pea protein facility, but has a smaller,
although significant, research profile.*

How Canada can **DOMINATE THE NON-SOY PLANT INGREDIENT MARKET**

There are steps both Ottawa and the Prairie provinces can take to tackle challenges and ensure we become *the* dominant player in the non-soy plant ingredient market.

All levels of government should:

MAKE IT A PRIORITY

Canada must make domination of the non-soy plant-based ingredient market an agriculture priority. Signaling this is important: to foreign investors, to other levels of government, and to the farmers who produce the inputs. This will take a real, visible and vocal commitment of resources and support.

CONTINUE SUPPORT FOR RESEARCH, PARTICULARLY COMMERCIALIZATION

Technological advancements and product innovation will be key drivers of growth in the plant ingredients market.³³ Western Canada's existing network of crop and food science expertise will help attract investment in plant ingredient facilities in the Prairies.

There is already some commercialization research taking place, for example, how to make plant ingredients market-ready. There are other aspects of research on the commercialization side that, if ironed out in western Canada, would go a long way to help us dominate the sector. These include:

→ **More efficient processing:** Current dry and wet fractionation technology can extract around 70-75 per cent and 80-85 per cent protein concentrate from pulses. Wet fractionation obtains a higher purity of product than dry (air classification), but requires large volumes of water and is more expensive. For other crops like oats and canola, it is still challenging to extract protein. Ideally, processing would be able to capture all or most of the protein concentrate for the crops grown in large volumes in western Canada because higher value products will fetch higher prices.

³³ Grand View Research, "Plant Protein Ingredients Market," November 2017.

→ **Uses for co-products:** While the current commercial focus is on plant protein, splitting out protein fractions also produces co-products such as fibre and starch. The remaining starch and fibre fractions are often so heavily milled for crops, it is difficult to find uses for them. For canola and pulses, work is needed to develop additional uses for co-products. Creating products using co-products will allow value to be obtained from all parts of the plant. Considering starch is the largest part of the seed for most plants (for example, peas are composed of 20-27 per cent protein, 42-49 per cent starch, 15-16 per cent fibre and less than two per cent fat),³⁴ finding uses and markets for *all* the components will have a significant impact on revenue. For example, there are several initiatives in western Canada looking at how to use pea starch as an alternative to corn and potato starch.

Both the federal and provincial governments have funding programs and facilities for research. A special emphasis on commercialization research for plant ingredient processing should be considered.

LEVERAGE PUBLICLY FUNDED INTELLECTUAL PROPERTY

We need to ensure investments in crop and plant science and commercialization research pay returns for western Canada. This means owning or controlling intellectual property (IP) that is created with government funding. IP that is created entirely with government funding could be rented to companies for use in Canada; IP that is financed jointly with the private sector needs to have restrictions that ensure the benefits do not benefit other jurisdictions at the expense of western Canada.

The other side of the issue is that research supported by public funds is often inaccessible. For example, a company may work with a government food development centre or university to come up with a new plant fraction extraction technology or ingredient functionality but not move forward with commercialization. While public money went into that research, it is often dropped and the research duplicated down the road by another company. Some

mechanism to foster commercialization in cases like these where public money has been spent is needed, but is beyond the scope of this paper.

A major value proposition for Canada in the plant-based protein and ingredient opportunity relies on being able to realize value from all inputs. This includes using the value of all the plant components, from protein to fibre to starch. It also means capturing the full value from investments in marketing, crop science and commercialization. The goal is to sell not just products, but knowledge and technology, too.

Opportunities for the Prairie provinces to realize the plant-based ingredient opportunity

PURSUE THE OPPORTUNITY AS PAN-PAIRIE

Canadian provinces do not always have the best record on co-operation. Inter-provincial trade disputes abound, and there is often a sense of “me-too” in terms of federal funding – what one province receives, others want as well. Plant ingredient processing is a global opportunity with global competition. Provinces can choose to compete against each other or they can collaborate and compete against the rest of the world.

The New West Partnership Agreement, which created a single economic region covering the four western provinces, is an attractive selling point for large firms investing on a global scale. By co-ordinating resources in the plant ingredient sector, provinces will be able to generate more economic prosperity than they would ever be able to on their own. While each of the Prairie provinces could independently create a small plant ingredient industry, a joint industry could dominate the global market. Each province has strengths and weaknesses that can be supplemented by the others. Alberta has strong research and finance experience, but no operating fractionation plants; Saskatchewan has high volumes of pulse production, research and operating plants, but a smaller financial base; Manitoba will be home to the world’s largest pea protein facility, but has a smaller, although significant, research profile.

³⁴ Pulse Canada, “Pulse Fractions: Protein, Fiber, Starch Food Applications,” 2013, <http://www.pulsecanada.com/uploads/fa/74/fa74411c141da899c2a44efa10c43796/2-T-Der-Pulse-Fractions.pdf>.

ESTABLISH A REGIONAL “ONE-STOP SHOP” WITH ACCESSIBLE INFORMATION AND VALUE CHAIN CO-ORDINATION

There is some inter-provincial co-operation occurring in western Canada, mostly in research. There are strong research capabilities in all the Prairie provinces in crop and food science and technical processes, and researchers have a good understanding of what colleagues in other provinces are working on. Companies in one province will work with researchers in another province if their area of expertise better matches the crop or technology the company is using.³⁵

The Prairie provinces and U.S. states in the Midwest/Great Plains region have a Protein Highway initiative to enhance cross-border collaboration to help the agriculture sector meet the growing demand for plant-based proteins. While working with the U.S. region most like the Prairies to enhance the global competitiveness of the region makes sense, the provinces must also be careful to ensure that international investment opportunities are not poached by U.S. jurisdictions, something we have seen happen before in other sectors.

For both domestic and international companies, finding resources, including the right researchers and government contacts, is challenging and time-consuming.

A pan-Prairie, one-stop shop that is the first point of contact for both domestic and international companies would provide information including:

- **Research expertise:** what is being done and where (universities, food development centres, Agriculture Canada research labs, etc.) and who is conducting it;
- **Government contacts:** it can be difficult in western provinces to simultaneously meet with different government departments. The West can look to the Atlantic provinces, particularly PEI and New Brunswick, for examples of co-ordination

on the part of government to bring officials from all relevant provincial and federal departments into one room to meet with companies interested in establishing processing plants in the province;

- **Value chain co-ordination:** between the companies located in the Prairies that are creating plant-based products, prototypes and gathering market intelligence;
- **Industry associations:** for different crops as well as food processing associations; and
- **Finance options:** lending, research funding, and government grant programs and tax incentives.

IMPROVE ACCESS TO CAPITAL

Access to capital to start up processing plants is a challenge for Canadian companies. One reason is that many banks do not understand these types of ventures. One interviewee remarked that though it has banked with the same institution for years, the bank still does not understand the agri-processing business. Banks are also less likely to take the investment risks in agriculture as they are in other sectors like oil and gas. Venture capital firms will take on higher amounts of risk, but charge higher interest rates.

There are federal and provincial government programs that can provide some funding to companies establishing ingredient processing plants. However, rigid timeframes in terms of when money needs to be spent means if there are any delays, companies are disqualified from funding or are required to pay funding back. While governments must be fiscally responsible and have rules in place for funding programs, government should work with companies to ensure that delays – often beyond their control – do not prevent them from qualifying for program funding they otherwise could have received.

³⁵ Stakeholder interviews.

Opportunities for the federal government to help:

PROTECT ACCESS TO THE U.S. MARKET

Plant-based protein consumption is dominated by the North American market. To dominate as a supplier of non-soy plant-based ingredients, Canada must maintain preferential access to the U.S. market. We already have an advantage over competitors due to our geographic location and tariff-free trade of plant fractions through NAFTA. Regulatory harmonization is the next step. Agriculture regulatory harmonization has been on the agenda for the binational Canada-U.S. Regulatory Cooperation Council (RCC), but it is unclear if anything has been achieved or even discussed. Canada should push for rules harmonization in this area in both the NAFTA renegotiations and at the RCC. As Canada becomes a larger producer of plant-based ingredients and exports larger volumes of these ingredients into the U.S., regulatory harmonization can help prevent non-tariff barriers from impeding our access to the largest global plant-based ingredient consumer.

IMPROVE TRANSPORTATION FOR EXPORTING INGREDIENTS

The World Bank's Logistics Performance Index, which ranks countries on several trade standards, ranks Canada as ninth overall in quality of trade infrastructure.³⁶ However, there is room for improvement. We heard during interviews that while there are few issues shipping inputs to domestic processing plants, shipping can be prohibitively expensive and difficult when exporting plant ingredients.

Shipping issues are particularly concerning for high value-added plant ingredients. The volume of exports in this sector is much smaller than unprocessed grains, and more handling is usually required to prevent products from being damaged.³⁷ In our interviews, we heard from plant ingredient processors that rail companies are often uninterested in shipping their product, because the volume is too small (it does not fill an entire unit train) and requires too much special care. Access to shipping containers can also be difficult depending on location; it is less of an issue for regional hubs like Calgary, Edmonton and Regina, but is an issue in smaller hubs such as Winnipeg.

This is far from being a uniquely Canadian problem; many other countries with sound transportation infrastructure struggle with these same problems.³⁸ It is not even a problem unique to plant ingredients, as many commodities experience export transportation frustrations, particularly with railway shipping in western Canada. However, if Canada wants to dominate the non-soy plant ingredient market, these transportation issues need to be addressed.

³⁶ The World Bank, "Full LPI dataset," 2016, <https://lpi.worldbank.org/>.

³⁷ The Economic Development Alliance of Southeast Alberta, "Opportunities in Pulse Processing Feasibility Study," p. 74.

³⁸ The Economic Development Alliance of Southeast Alberta, "Opportunities in Pulse Processing Feasibility Study," p. 14.

CONCLUSION

With global demand set to sky-rocket, plant-based ingredients are a major growth opportunity. Western Canada already has the components to become the dominant player in this market. We produce large volumes of crops suited to making ingredients; there is a network of crop and food science R&D, including on the commercialization side that can be expanded; we have transportation and logistics infrastructure that will allow for the export of plant ingredients and we are a stable jurisdiction which will both help attract companies looking to set up plant ingredient facilities and customers looking for stable suppliers.

But success will not happen without a strategy. The federal and provincial governments, industry and producers must act immediately to seize this opportunity.

APPENDIX A

EXISTING AND PLANNED INGREDIENT AND CROP PROCESSING FACILITIES IN THE PRAIRIES

There already some ingredient processing facilities in the Prairies, and more are planned. These are listed in Figure A1.

FIGURE A1: EXISTING AND PLANNED INGREDIENT PROCESSING FACILITIES IN THE PRAIRIES

LOCATION	COMPANY	SUMMARY	STATUS
Bowden, AB	W.A. Grain and Pulse Solutions	Dry and wet fractionation lines	Planned
Saskatoon, SK	Parrheim Foods	Dry fractionation of starch, fibre and protein concentrates from bean, barley and pea	Operating (est. 1989)
Arborfield, SK	Can Pro Ingredients Ltd.	Canola protein concentrate	Operating (est. 2007)
Moose Jaw, SK	Canadian Protein Innovation	Green pea fractionation, mainly for protein	Planned
Vanscoy, SK	Verdient Foods	Organic pea processing (protein, starch and fibre)	Planned
Portage la Prairie, MB	Nutri-pea	Wet milling and extraction (pea protein, starch and fibre)	Operating
Portage la Prairie, MB	Roquette	Will be the largest global pea protein processing plant	Planned (start date 2019)
Portage la Prairie, MB	Best Cooking Pulses	Milling, pulse flours and pea hull fibre	Operating
Glenboro, MB	Prairie Fava	Milling protein content from faba beans	Operating (est. 2017)

Source: Company websites and Canada West Foundation interviews

The Prairies are also home to a variety of crop processing facilities, from canola crushing to splitting, bagging and cleaning pulses and cereals, to producing hemp protein. Figure A2 lists processing facilities for crops that have the potential to be utilized for plant-based ingredients.

FIGURE A2: CROP PROCESSING FACILITIES IN THE PRAIRIES

LOCATION	COMPANY	CROP
Bow Island, AB	Viterra, Alberta Bean Division	Beans
Kinderstey & Zealandia, SK	Canpulse Foods	Canary seed, lentils, coriander, peas, beans, chickpeas and flax
Lethbridge, AB	Richardson Oilseed	Canola
Yorkton, SK	Richardson Oilseed	Canola
Lloydminster, AB	ADM	Canola
Clavet, SK	Cargill	Canola
Nipawin, SK	Bunge Canada	Canola
Altona, MB	Bunge Canada	Canola
Yorkton, SK	Dreyfus	Canola

Table continues

St. Agathe, MB	Viterra	Canola
Edmonton, AB	GrainFrac	Cereals
Broxburn and Brooks AB	CB Constantini Ltd	Cereals, oilseeds and legumes
Saskatoon, SK	InfraReady Products	Cereals, pulses and oilseeds
Winkler, MB	Schweitzer-Mauduit	Flax
Portage la Prairie, MB	Prairie Flax Products	Flax
Brooks, AB	Nature's Nutraceuticals Inc.	Flax and hemp
Calgary, AB	All Impacts Food Ltd.	Flaxseed and yellow pea
MacGregor, MB	Hempco	Hemp
St. Agathe, MB and Winnipeg, MB	Hemp Oil Canada	Hemp
Winnipeg, MB	Manitoba Harvest	Hemp
Nisku, AB	Hempco	Hemp
Emerson, MB	Emerson Hemp Distribution Company	Hemp
Gilbert Plains, MB	Plains Hemp	Hemp
Calgary, AB	Canadian Greenfield Technologies Corp.	Hemp
Portage la Prairie, MB	Better Hemp Company	Hemp
Saskatoon, SK	Hemp Production Services	Hemp
Pitt Meadows, BC	Naturally Splendid	Hemp
Barrhead, AB	GFR Ingredients	Hemp (and custom processing)
Vauxhall, AB	Columbia Seed Co. Ltd	Legumes, peas, faba and broad beans and mustard seed
Lethbridge, AB	Viterra, Special Crops	Mustard seed, dry beans, dry peas, chickpeas, lentils, specialty oats and canary seed
Yorkton, SK	Grain Millers	Oats
Barrhead, AB	Richardson Milling	Oats
Portage la Prairie, MB	Richardson Milling	Oats
Martensville, SK	Richardson Milling	Oats
Sturgeon County, AB	Canadian Oats Milling Ltd.	Oats
Camrose, AB	Viterra Camrose Specialty Oat	Oats
Saskatoon, SK	Ardent Mills Saskatoon Flour	Oats
Regina, SK	Avena Foods	Oats
Emerson, MB	Emerson Milling Inc.	Oats
Edmonton, AB	Ceapro Inc.	Oats
Grande Prairie, AB	Champion Oat Processors (division of Hi-Pro Feeds)	Oats
Sexsmith, AB	Peace Country Milling and Grain	Oats and wheat
Fort Saskatchewan, AB	Royal Commodities Limited	Oats, oilseeds and grains
Duck Lake, SK	Belle Pulses	Peas (green)
Bellevue, SK	Belle Pulses	Peas (yellow)
Regina, SK	AGT Food & Ingredients	Peas, chickpeas, and lentils
Estevan, SK	Southland Pulse Inc	Peas, lentils, chickpeas, canary seed
Vancouver, B.C. & Winnipeg, MB	Burcon NutraScience Corporation	Peas, soy and canola
Elbow, SK	Diefenbaker Spice & Pulse	Pulses
Lethbridge, AB	L.A. Grain Ltd.	Pulses

Table continues

Calgary, AB	Socoular	Pulses, cereals and oilseeds
Innisfail, AB	W.A. Grain and Pulse Solutions	Pulses, cereals and oilseeds
Moose Jaw, SK	Agrocorp Processing Ltd.	Pulses, legumes and cereals
Cut Knife, SK	Agrocorp Processing Ltd.	Pulses, legumes and cereals
Innisfail, AB	Agrocorp Processing Ltd.	Pulses, legumes and cereals
Falher, AB	Agrocorp Processing Ltd.	Pulses, legumes and cereals
Lethbridge, AB	Bayer Crop Science Canada	Seed
Moose Jaw & Swift Current, SK	Simpson Seeds Inc.	Special crops
Saskatoon, SK	Scouler Special Crops	Special crops (sunflower seed, flax, and canary seed) and pulses

Source: Company websites

APPENDIX B

RESEARCH CAPACITY IN THE PRAIRIES

Figure B1 lists the names and locations of the crop science and research institutions related to ingredient processing research referred to in Figure 8 (p. 18).

FIGURE B1: CROP SCIENCE & INGREDIENT PROCESSING RESEARCH CAPACITY IN WESTERN CANADA

Institute	Location	Type
University of British Columbia, Food Science Group	Vancouver, B.C.	Crop Science, R&D
University of Alberta Cereal Protein and Cellulose Program	Edmonton, AB	Crop Science
University of Alberta Agri-Food Discovery Place	Edmonton, AB	Crop Science, R&D
University of Alberta, Department of Agriculture, Food & Nutritional Science: Food Science and Bioresource Technology research	Edmonton, AB	Crop Science, R&D
University of Alberta, Department of Agriculture, Food & Nutritional Science: Plant Biosystems research	Edmonton, AB	Crop Science
University of Alberta, Department of Agriculture, Food & Nutritional Science: Economics of Agriculture, Food & Agribusiness	Edmonton, AB	Crop Science
University of Alberta Lipid Chemistry Group	Edmonton, AB	R&D
University of Alberta Agricultural Genomics and Proteomics Unit	Edmonton, AB	Crop Science
Alberta Innovates Phytola centre at the University of Alberta	Edmonton, AB	Crop Science
Alberta Innovates Food Innovation	Edmonton, AB	R&D
The Metabolomics Innovation Centre	Edmonton, AB	Crop Science
National Institute for Nanotechnology	Edmonton, AB	Crop Science
Alberta Glycomics Centre (U of A, Department of Chemistry)	Edmonton, AB	Crop Science
InnoTech Alberta	Edmonton, Calgary & Vegreville, AB	Crop Science
Government of Alberta Agrivalue Processing Business Incubator	Leduc, AB	R&D
Government of Alberta Food Processing Development Centre	Leduc, AB	R&D
Government of Alberta Food Science and Technology Centre	Brooks, AB	Crop Science, R&D
Government of Alberta Sensory Evaluation Program	Leduc and Edmonton, AB	R&D
20/20 Seed Labs Inc.	Nisku, AB	Crop Science

Table continues

Agriculture & Agri-Food Canada, Lacombe Research and Development Centre	Lacombe, AB	Crop Science
Olds College	Olds, AB	Crop Science
SAIT	Calgary, AB	Crop Science
University of Calgary, Department of Biological Sciences	Calgary, AB	Crop Science
University of Lethbridge	Lethbridge, AB	Crop Science
Lethbridge College Centre for Applied Research and Innovation	Lethbridge, AB	Crop Science, R&D
Agriculture & Agri-Food Canada, Lethbridge Research and Development Centre	Lethbridge, AB	Crop Science
Dow AgroSciences	Calgary, AB (HQ); Saskatoon, SK (canola research centre)	Crop Science
Beaverlodge Agriculture Research Station	Beaverlodge, AB	Crop Science
Prairie Agricultural Machinery Institute (PAMI)	Humboldt, SK	Crop Science, R&D
Saskatchewan Research Council	Saskatoon, SK	Crop Science, R&D
POS Bio-Sciences	Saskatoon, SK	R&D
Agriculture & Agri-Food Canada, Saskatoon Research and Development Centre	Saskatoon, SK	Crop Science
Saskatchewan Polytechnic BioScience Applied Research Centre	Saskatoon, SK	R&D
Agriculture & Agri-Food Canada, Swift Current Research and Development Centre	Swift Current, SK	Crop Science
University of Saskatchewan, College of Agriculture and Bioresources, Department of Food and Bioproduct Sciences	Saskatoon, SK	R&D
Feeds Innovation Institute, University of Saskatchewan	Saskatoon, SK	Crop Science, R&D
Innovation Enterprise, University of Saskatchewan	Saskatoon, SK	Crop Science, R&D
Saskatchewan Structural Sciences Centre, University of Saskatchewan	Saskatoon, SK	Crop Science, R&D
Global Institute for Food Security, University of Saskatchewan	Saskatoon, SK	Crop Science, R&D
University of Saskatchewan Crop Development Centre	Saskatoon, SK	Crop Science
Innovation Place	Saskatoon, Regina & Prince Albert, SK	R&D
Saskatchewan Flax Development Commission	Saskatoon, SK	Crop Science, R&D
Canadian Light Source	Saskatoon, SK	Crop Science, R&D
Contango Strategies	Saskatoon, SK	R&D
Maxxam Analytics	Saskatoon, SK	Crop Science, R&D
Saskatchewan Food Industry Development Centre Inc.	Saskatoon, SK	R&D
DuPont Pioneer	Saskatoon, SK	Crop Science
Genome Prairie	Saskatoon, SK & Winnipeg, MB	Crop Science
Agriculture & Agri-Food Canada, Brandon Research and Development Centre	Brandon, MB	Crop Science
Agriculture & Agri-Food Canada, Morden Research and Development Centre	Morden, MB	Crop Science
Richardson Centre for Functional Foods and Nutraceuticals, University of Manitoba	Winnipeg, MB	R&D
University of Manitoba	Winnipeg, MB	Crop Science
Manitoba Agriculture Food Development Centre	Portage la Prairie, MB	R&D

Source: Institution websites

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