

National Pulse Research Strategy

National Pulse Research Strategy Committee

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“A special acknowledgement to Dr. Valerio Hoyos-Villegas at McGill University who was invited to participate on the Committee and provide a perspective from Eastern Canada in the development of the strategy for future research opportunities in the pulse sector.”

Introduction

Canada is a world-leader in the production of high-quality pulse crops, including lentils, dry peas, dry beans, chickpeas, and faba beans. In 2020, pulse crops in Canada were worth over \$3B in farm gate value which represents 7.6% of total crop receipts.¹ In 2019, Canada was the largest exporter of lentils and dry peas in the world (> 2.1 and 3.6 million tonnes, respectively) and was also in the top ten global exporters for dry beans, chickpeas and faba beans.²

In 2017, Pulse Canada set a target for “25 by 25”: 25% of the Canadian pulse industry’s production capacity will go to diversified, new end uses by the year 2025. The main strategy to reach this target is to find new efficiencies in the trade environment and create new opportunities for pulse consumption and utilization.³

The outlook for Canadian pulse crops is bright for several reasons:

- **Value-added and food processing opportunities:** With the growing shift towards plant-based proteins, pulse crops have the potential to play a key role in meeting Canada’s target to capture more value from agricultural products through value-added processing. Increased ingredient processing capacity will also contribute to domestic food security and establish Canada as a front runner in supplying pulses to high value, stable markets.
- **Health and nutrition:** Pulse crops pack a nutritional punch and are a valuable source of protein, fibre, starch, and other nutrients for human and animal diets. Plant-based diets are expected to slow the progress of chronic diseases.
- **Environmental sustainability:** Cultivation of pulse crops in rotations has benefits at several levels, including (a) on-farm benefits to pulses in rotation, (b) agro-ecosystem benefits at the landscape level, and (c) contributions to national efforts to reduce agricultural green house gas emissions.

“Greater emphasis on the production of sustainable crops, such as peas, lentils, canola, hemp and cereals, will reduce agriculture’s carbon footprint and add organic matter and carbon to the soil.”

Protein Industries Canada – The Road to \$25 Billion

Developing a National Pulse Research Strategy

In 2021, pulse sector representatives from across Canada⁴ gathered to develop a national research strategy to coordinate and guide pulse research investments. Research and innovation will be key for Canada to remain competitive as a world leader in pulse production and take advantage of new markets and opportunities. The process to develop this strategy took place over several months and included interviews and a virtual strategy workshop in September 2021. Articulating a national vision for pulse research is an important step in the coordination of research funding and programming to maximize efficiency, increase capacity and improve the ability to adopt new innovative technologies.

¹ Statistics Canada. Table 32-10-0045-01: Farm cash receipts.

² FAOSTAT: Export of Pulses by Country.

³ <https://pulsecanada.com/about/what-we-do>

⁴ See Appendix C for a list of the National Pulse Research Strategy Committee members



The scope of this strategy is high-level and all-encompassing for the pulse sector across the spectrum from discovery to applied research. Certain funding organizations, such as producer groups, may primarily wish to fund more downstream or applied research areas. Conversely, other funding groups such as AAFC, may wish to fund earlier stage and discovery level research. It is anticipated that provincial organizations will continue to have individual strategies to address crop-specific and local or regional research needs.

Purpose and Vision of the National Pulse Research Strategy

Purpose

The goal of this National Pulse Research Strategy is to identify a medium- to long-term research strategy, including national research priorities. This strategy will be used by the sector in the pursuit of research funding and will guide research investments.

Our Vision

- Pulses are a foundational choice for Canadian farms, human health, animal nutrition, and environmental sustainability.
- Pulse research in Canada is on the forefront of new technology; it is nationally coordinated, collaborative, and accelerates progress towards three strategic outcomes.

The following pages describe the three **strategic outcomes** that are the basis of this strategy. For each outcome, we list the **key drivers** that we anticipate will be crucial in leading the progress towards the strategic outcomes. Following that section, the high-level **research priorities** are listed for each of the three strategic outcomes. The final section describes **enabling activities** that will accelerate research progress and the uptake of innovation along the value chain.



Strategic Outcomes

Outcomes	Key Drivers
<p>1 Pulses are a profitable component of diverse crop rotations that enhance farm sustainability.</p>	<ul style="list-style-type: none"> Innovation drives step-change in yield gains & productivity <ul style="list-style-type: none"> • Yield, quality, sustainable production practices and costs of production contribute to profitable margins for growers Pulse crop production is recognized as a key opportunity to meet Canada’s environmental sustainability goals <ul style="list-style-type: none"> • Pulses add to the sustainability of crop rotations through reducing carbon footprints, lowering GHG and increasing water use efficiency • Pulses add value to crop rotations through positive influence on following crops
<p>2 Growers produce a safe, reliable and consistent supply of Canadian pulses to meet growing demand.</p>	<ul style="list-style-type: none"> Stable and consistent yields of pulse crops adapted to biotic and abiotic stresses <ul style="list-style-type: none"> • Root disease has minimal impact on realized yields and on yield stability • Integrated Pest Management practices and biotic stress resilience mitigate the risks of weeds, diseases and insects • Climate change adaptation and abiotic stress resilience support yield stability along with the expansion of pulse crop areas and crop options • Canadian growers have reliable access to high quality seed supply Innovative products and sustainable management practises ensure a safe supply of pulses <ul style="list-style-type: none"> • Pest management options are safe and effective and include alternatives such as biologicals, variety resistance and new advancements • Continuous improvement in management practises and variety development enhances the harvestability of pulse crops
<p>3 Pulse crops achieve desirable end use quality for domestic and global customers.</p>	<ul style="list-style-type: none"> Quality Canadian pulses fulfill the value-added strategy for whole pulse, processing, flour and fractionation uses for domestic and export markets <ul style="list-style-type: none"> • Desired quality attributes for pulses are clearly defined, along with standardized analysis methods • Quality program is established in Canada for pulses with publicly available data to ensure growers can make informed decisions on varieties and production practises that influence quality • Varieties are developed that target the desired food safety, crop composition and end-use quality characteristics that are fit for purpose, supported by the management practices that optimize these characteristics • Growers receive value for the products produced • Research supports the pulse sector market strategy for human health, animal feed, and processing objectives



Research Priorities

1. Pulses are a profitable component of diverse crop rotations that enhance farm sustainability.

Key drivers:

- Innovation drives step-change in yield & productivity
- Pulse crop production is recognized as a key opportunity to meet Canada's environmental sustainability goals

1A. Increase yield potential and profitability through variety development and the adoption of breeding innovations, with particular focus on high yielding varieties with appropriate crop quality and development of traits that reduce cost of production (e.g., nitrogen fixation, pest resistance).

1B. Expand the adaptability of pulse crops to ensure there are sustainable pulse crop options for every hectare of crop production nationally. Specific targets for increasing adaptability and resilience to climate change include:

- Yield stability under variable climatic conditions (e.g., understanding variety-specific genetics by environment (GxE) impacts) for all pulses
- Drought tolerance in peas, dry beans and chickpeas
- Excess moisture stress resilience in peas, lentils, and dry beans on rainfed eastern prairies, without yield penalty in the absence of stress
- Faba bean adaptation to rain-fed areas, heat tolerance, maturity and post-harvest quality (e.g., staining damage)
- Cold tolerance and early maturity in dry beans

1C. Investigate new crop opportunities to increase the options for pulse crops in diverse and sustainable rotations.

- Conduct feasibility assessments of alternative pulses to determine new pulse crop options in Canada's changing climate, including crop adaptability and marketability

1D. Quantify and increase the sustainability profile of pulse crops, including:

- Develop and evaluate novel technologies to increase the sustainability of pulse crops (e.g., nitrogen fixation technologies, fertility management, no-till practices, cover crop options)
- Quantify the value of pulse crops in rotation, including beneficial impacts on following crops in the rotation
- Demonstrate and update the sustainability profile for pulse crops
- Establish the role of pulses in reducing GHG emissions across crop rotations, particularly with regards to fertilizer use patterns

1E. Quantify the potential yields, actual yields, and yield gaps for Canadian pulses as well as identify the environmental and/or management factors contributing to yield gaps. Use this GxExM⁵ information to establish agronomic management practices to close the gaps, as well as to target traits of interest for genetic improvement.

⁵ GxExM is a systems approach using the concept that yield is a function of genetics, environment and management

2. Growers produce a safe and reliable supply of Canadian pulses to meet growing demand.

Key drivers:

- Stable and consistent yields of pulse crops adapted to biotic and abiotic stresses
- Innovative products and sustainable management practises ensure a safe supply of pulses

2A. Prevent and/or mitigate damage from **root rot** diseases through a national, coordinated and focussed approach. Specific priorities include:

- Genetic resistance to root rot complexes
 - For peas and lentils: *Aphanomyces*, *Fusarium sp.*,
 - For dry beans: *Fusarium sp.*, *Pythium*, *Rhizoctonia*, *Chalara*)
- Development of diagnostic and prediction tools for root rot infection in peas and lentils, with priority on *Aphanomyces* and *Fusarium*
- Development of new technologies to mitigate yield losses caused by root rots (e.g., new chemical or biological control products, land management strategies that reduce oospore loads, agronomic practices and rotations that mitigate disease pressure)

2B. Develop genetic resistance, herbicide tolerance, and/or Integrated Pest Management (IPM) strategies for control of priority diseases, weeds and insects, listed in [Appendix A](#).

2C. Improve the harvestability of pulse crops, specifically:

- New management strategies and technologies to reduce reliance on preharvest products, including improved genetics for early maturity and uniform maturity
- Improve standability and reduce lodging in peas, faba beans
- Improve canopy and root architecture, increase pod height in dry bean
Improved canopy architecture and agronomic performance of large seeded pulse crops (e.g. chickpeas, kidney beans)

2D. Advance the security of a domestic seed supply through resistance and/or management strategies to control seed-borne disease, including common bacterial blight and anthracnose (with a focus on dry bean seed production).

2E. Take a proactive approach to pest management through developing models for prediction, national coordinated monitoring systems, and investigation of potential new threats (new insects, viruses).

2F. Identify alternative control options for pests that reduce reliance on pesticides and/or develop pesticides/pest control products that minimize non-target effects and are environmentally safe.

2G. Develop management strategies for pulse health to enhance ability to withstand abiotic and biotic stress

- Macro- and micro-nutrient impacts on plant health and ability to withstand stress
- Pulse nutrient management, with particular interest in P management, and N management for new areas of adaptability



3. Pulse crops achieve desirable end use quality for domestic and global customers

Key driver:

- Canadian pulses fulfill the value-added strategy for whole pulse, processing, flour and fractionation uses for domestic and export markets

3A. Develop a quality testing system and market-specific quality goals for pulse crops nationally

- Determine the quality traits needed for current and emerging pulse ingredient uses
- Develop point-of-need diagnostic tests for quality traits
- Implement quality testing in the breeding process

3B. Determine the direct effects of pulses and pulse quality (including the GxExM impacts) in order to support the marketing of pulses for use in feed, fractionation, food ingredients, human health, nutrition, and processing sectors (as shown in [Appendix B](#)).

3C. Food safety contaminants are monitored and managed to meet quality targets and maintain market access (e.g., low cadmium in peas, monitor aflatoxins, other heavy metals).



Enabling Activities

In addition to the research priorities, four topic areas have been identified as critical areas to accelerate research progress. These are intended to be new and specific actions that the sector will take during the course of this strategy. These actions are designed to achieve the following:

- Place Canada’s pulse industry at the forefront of pulse innovation
- Enhance the efficiency of Canada’s pulse research programs
- Capture maximum value from pulse research investment

I. Embrace New Technology & Innovation

To remain competitive in global markets, actions must be taken to rapidly adopt new technologies, such as genomics technologies and AI/machine learning, that can inform the development of new varieties, increase productivity, enhance sustainability and enable decision-making.

Enabling Actions:

- Explore breeding tools and new technologies to identify those that are best positioned to drive advancements in yield gains, including genomics, phenomics and other novel approaches.
- Enable and encourage development of alternative pest management products (i.e., RNAi, biologicals, etc.).
- Strengthen weed science research capacity to develop solutions for pulse crop weed control and harvest management.
- Develop point-of-need pest diagnostic tools to enable timely decision-making.
- Develop national monitoring and surveying program for insects, disease, and weeds

II. Attract New Investment

To realize the full potential of pulses and adapt to changes in funding programs, the sector needs to attract new research investment and develop new funding models that will strengthen and diversify research programming.

Enabling Actions:

- Develop an environment that encourages and attracts new research investment, including piloting new models for pulse variety commercialization
- Explore public-private partnerships to gain faster access to new technology
- Enable technology transfer and entrepreneurship for faster adoption of research outcomes
- Develop partnerships to increase diagnostic capacity for pulse pests and quality traits
- Foster a regulatory and policy environment that attracts new investment (e.g., predictable and effective regulatory approval pathways, value capture for new technologies, protection of existing tools)
- Support and foster a regulatory and policy environment that recognizes the unique contribution of pulse crops to Canada’s sustainability targets
- Coordinate and leverage research with new research funding partners, based on the potential for pulses to contribute to Canada’s environmental and economic goals (e.g., ECCC, ISED, PIC, Genome Canada, NSERC, and provincial sources (ADF, AFC, etc.))
- Leverage consumer trends and the value proposition of pulses to align with the business objectives of industry to facilitate funding partnerships



III. Enhance Research Coordination

To enhance research efficiency and maximize the value of outcomes, research needs to be coordinated across geographies and, in some cases, across cropping systems.

Enabling Actions:

- Establish inter-provincial and/or national coordination to maximize efficiency, increase capacity and optimize funding for innovation. Priorities include:
 - Ensure root rot research is coordinated with other initiatives (e.g. AAFC, WGRF) to encourage efficient cross-agency and inter-disciplinary research
 - Coordinate pulse breeding programs across Canada to increase capacity and enable the adoption of innovative processes
 - Establish a standard quality assessment and evaluation platform across breeding programs in Canada
- Enable collaborations between research organizations (federal, institutional, private), such as:
 - Explore areas of intersection with Protein Industries Canada (e.g., milling research capacity) and other ISED initiatives
 - Coordinate with ALS-Living Labs to layer experiments and data collection, maximize the value of research trials
 - Coordination with the Integrated Agronomy Cluster (WGRF) and the CFCRA cluster soybean activities
 - Farm-scale validation of small-plot research outcomes and recommendations
- Encourage multi-disciplinary teams to work together, as needed, to solve problems (e.g., food scientists, engineers and computer scientists, geneticists and breeders, biochemists, pathologists, agronomists and microbiologists, nutritionists, etc.)
- Human health, animal feed and processing objectives need to be coordinated through a national approach (i.e., Pulse Canada 25 by 2025).

IV. Strengthen Communication

Formalized communication networks will strengthen the competitiveness of the pulse value chain and increase research efficiency.

Enabling Actions:

- Foster stronger relationships between researchers, industry, agronomists, growers, and processors. The pulse sector relies on public researchers and the expectations between these groups needs to be affirmed. Such as:
 - Establish a consistent communication path to transfer customer/end-user experiences back to researchers
 - Host networking events to foster communication between university, government, and private researchers
- Coordinate extension efforts across regions to deliver consistent messaging for crop beneficial management practices and outcomes of research projects to growers and agronomists, supported by accessible and up-to-date resources
- Establish knowledge transfer (KT) pathways to communicate new information to growers and end-users, including equipping agronomists with the knowledge and training to successfully implement new or alternative practices or varieties on the farm
- More frequent connection and collaboration with Bean Improvement Cooperative (BIC), North American Pulse Improvement Association (NAPIA) and other pulse research groups/organizations to access global technologies for the improvement of pulse crops



Appendix A: Pest Priorities

This table lists priority pests for the development of genetic resistance and/or pest management strategies.

Pest Priorities	
Lentils	
Insects	Aphids, grasshoppers, wireworm/cutworm
Disease	<i>Aphanomyces</i> & <i>Fusarium</i> root rots, <i>Anthracnose</i> (fungicide resistant), <i>Stemphylium</i> , <i>Botrytis</i> , <i>Sclerotinia</i> , <i>Ascochyta</i>
Weeds	Kochia, Group 2 resistant weeds, wild mustard, v. canola, NLWB, sow thistle, cleavers, develop genetic herbicide tolerance traits for lentil; wild mustard, Lamb's-quarters,
Field Peas	
Insects	Pea aphid, cutworm, wireworm, pea leaf weevil (hot spots), cutworm, wireworms, grasshoppers
Disease	<i>Aphanomyces</i> & <i>Fusarium</i> , <i>Ascochyta</i> complex (foot rot), <i>Mycosphaerella</i> blight, bacterial blight
Weeds	Group 2 resistant weeds, cleavers & kochia, narrow leaf hawksbead, white cockel, v. canola, tall waterhemp, Canada thistle
Dry Bean	
Insects	Potato leaf hopper, western bean cutworm. Green clover worm, cutworm, seed corn maggot, wireworm; aphids (as vectors), Lygus, spider mites; Storage pests (bruchids and bean weevils)
Disease	Bacterial blight, <i>Fusarium</i> root rot, <i>Sclerotinia</i> , soybean cyst nematode, White mold; <i>Anthracnose</i> ; Common Bacterial Blight; Bean Common Mosaic Virus; Bacterial brown spot; Rusts; Green Patch
Weeds	Herbicide-tolerant weeds, including Canada fleabane, Kochia, Group 2 resistant broadleaf weeds; tall waterhemp; hairy nightshade
Chickpeas	
Insects	Grasshoppers, wireworm
Disease	<i>Aschocyta</i> , root rot complexes, rusts
Weeds	Group 2 resistant weeds, kochia, v. canola, general broadleaf weed management
Faba Bean	
Insects	Aphids, lygus bug, pea leaf weevil, blister beetle, bertha army worm
Disease	Chocolate spot, <i>Alternaria</i> , <i>Stemphylium</i> , vascular wilt monitoring. <i>Botrytis</i> , rusts
Weeds	Cleavers, v. canola, Group 2 resistant weeds, Canada thistle, general broadleaf weeds



THE CANADIAN PULSE INDUSTRY’S ‘25 BY 25’ STRATEGY

THE ‘25 BY 25’ STRATEGY

Globally, Canada is the largest exporter of pulses and biggest producer of peas and lentils. Although Canadian pulses are exported to over 130 countries, the vast majority of Canadian pulses are exported to a relatively small number of international commodity markets. Reliance on only a few commodity markets can present risk for the Canadian pulse sector and stifle penetration of Canadian-sourced pulse ingredients into the food industry. To diversify markets and grow the value of the Canadian pulse sector, the Canadian pulse industry embarked on a ‘25 by 25’ strategic target in 2017. The overall objective is for 25% of Canadian pulses to be used in non-traditional markets and use categories by 2025. Based on domestic production, the following tonnage targets for incremental use in non-traditional markets/applications were set:

- Peas: 1,100,000 tonnes
- Lentils: 625,000 tonnes
- Beans: 75,000 tonnes
- Faba beans: 100,000 tonnes
- Chickpeas: 100,000 tonnes

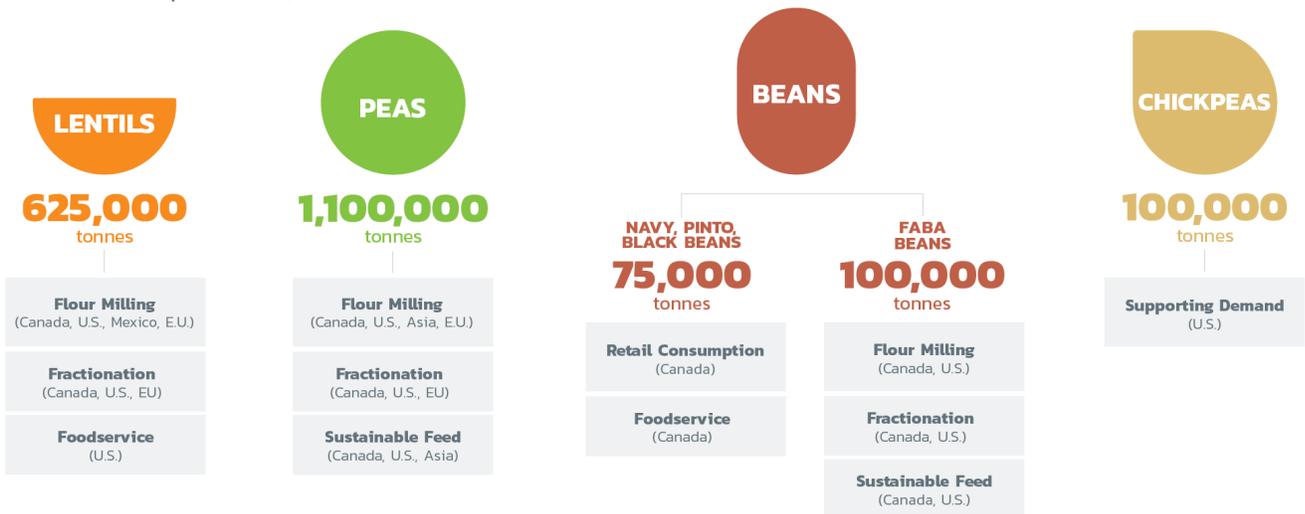


Figure 1. 25 by 2025 crop targets.

These tonnage targets were used to guide the development of crop-specific strategies that would achieve high volume incremental use in line with the target based on modelling. Consideration was given to typical inclusion rates for different pulse formats in end-use applications, global volume consumption of these products, and Canada’s position in export markets. Using reasonable assumptions on possible market penetration for new products using pulses/pulses ingredients, the crop-specific strategies have identified the formats, end-use applications, and regions/target audiences that would have greatest potential to achieve the tonnage targets (see Figure 1). In the case of chickpeas, forecasted growth in demand suggests that we’re on track to meet the 2025 target without needing a focused market development strategy. Therefore, the current emphasis for chickpeas is on addressing Canadian production issues.





Pulse Canada and its member associations (Alberta Pulse Growers, Saskatchewan Pulse Growers, Manitoba Pulse and Soybean Growers, Ontario Bean Growers, and the Canadian Special Crops Association) are working collaboratively to successfully meet the objectives of the 25-by-25 strategy. This requires a combination of marketing and research activities.

RESEARCH NEEDS TO SUPPORT THE GROWTH OF THE SECTOR

NEED FOR PRE-COMPETITIVE, OPEN ACCESS RESEARCH TO SUPPORT GROWTH IN THE PROCESSING AND END-USE MANUFACTURING SECTOR

Although the private sector will conduct their own R&D in house, they will largely focus on research that provides them with a competitive advantage for their products, and will not share broadly with the sector. There are however, areas of “public-good” or pre-competitive research that are critical for the success and growth of the broader “category” of pulses/pulse ingredients. In many cases, these types of projects are challenging for any one company or stakeholder group to justify investing in on their own because it will not provide them with any competitive advantage but rather benefits the whole sector. Feedback from the private sector has emphasized a role for industry associations and government in leading this type of research, citing the specific need for credible, unbiased information on the health benefits of pulses/pulse ingredients, early exploration work that companies can launch off from, projects to explore new ideas about pulse ingredients and substitution potential for other ingredients, as well as foundational research that can be put into a public library or database of basic information on various pulse ingredient formats, their quality, functionality, uses, and benefits. There is value to this work being “open-access” as it can be shared by all players in the sector. In some cases, there are companies who do not have the resources to do research in-house who will benefit from this work, and it also helps larger companies by providing a credible knowledge foundation that they can build from to do proprietary work.

In 2020, representatives from 10 pulse ingredient processing ingredient companies in North America came together to prioritize areas for pre-competitive research that would build demand for pulse ingredients. Nine areas for potential collaboration were identified by the group which included Pet Food, Human Health & Nutrition, Sustainability, Standards, Processing for Functionality, Valorization of By-Products, Allergens, Aqua-Feed, and Alternative Energy. Following a prioritization exercise, the two topics identified as the highest priority areas for the group were “human health & nutrition” (specifically to develop health claims for pulse ingredients). The second area was “standards” (specifically to develop and promulgate a common language for terms used to describe various aspects of pulses). These two areas were ranked much higher than others by the group, but were of equal importance.

In 2017, 30 pulse ingredient processors and food manufacturers were consulted on the value of different market areas of research related to new markets/non-traditional utilization. “Facilitating pre-competitive research on pulse nutrition, health, sustainability, processing and utilization” was cited by the majority of respondents as the most valuable activity (77% of respondents cited this as “extremely valuable”).

- “Scientists working in academia will have very different ideas of what is important for research and will advocate for their own area of research. When you consider the perspectives of end users, particularly those that are closest to the consumer, you will get very different ideas.” – Food Manufacturer
- “We need to continue work to build the science and foundation for health claims. This could be an anchor point that positions pulses as something really good for consumers.” – Food Manufacturer
- “There is a need to demonstrate and communicate human health benefits of pulses and pulse ingredients.” – Pulse Ingredient Processor



- “Research funded by companies or done for promotional reasons is viewed as biased or not credible.” – Food Manufacturer
- “It would be helpful to have a library of information on whole pulses, pea protein, pea starch etc. on functionality, uses, benefits.” – Pulse Ingredient Processor
- “A database with all nutrition, quality information is very important and there is a lot of very basic knowledge we don’t have.” – Pulse Ingredient Processor
- “We have done a lot of things in-house for R&D that you aren’t aware of, industry associations and government should focus on early exploration work that companies can launch off from.” – Food Manufacturer
- “Pre-competitive research projects to explore new ideas about pulse ingredients, substitution potential for other ingredients, is very helpful” – Pulse Ingredient Processor

HOW OTHER PLAYERS ARE SUPPORTING THE PLANT-BASED SECTOR WITH RESEARCH

Other associations in the plant-based ingredient space are leading efforts related to research that has relevance to the broader Canadian pulse processing sector, however their focus is not exclusive to pulses. In particular, **Protein Industries Canada** is leading work to increase plant-protein ingredient processing in Canada which will benefit the growth of ingredients derived from Canadian pulses. Although their emphasis to date has been on proprietary industry collaborations where results are not “open-access” for the entire eco-system, their recently released sector strategy emphasizes increasing investment and international partnerships into diversified plant-based food innovation, better alignment of public research with private sector needs, development of a regulatory system that enables innovation and commercialization, gaining recognition for Canada’s agri-food system as a global leader in sustainability for plant-based foods and ingredients, and increasing commercialization of Canadian research. PIC’s sector strategy has been positioned as a roadmap that all industry organizations can find themselves within, as no one organization or business can execute on it alone.

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The **Good Food Institute** (GFI) is a global non-profit organization that supports the alternative proteins sector (including cultivated meat, plant-based products, and fermentation) by advancing foundational, open-access research and creating a thriving research and training ecosystem around these game-changing fields. GFI also works to secure government support for alternative protein research and advocates for public policy that places all proteins on a level playing field.

HOW PULSE CANADA IS SUPPORTING THE INGREDIENT PROCESSING AND PLANT-BASED SECTOR

Unique areas of work for Pulse Canada include a dedicated focus in marketing and research activities to a) grow consumption of whole pulses, b) increase demand for pulse flours, c) grow value-added processing of Canadian pulses in global markets, and d) increase demand for pulse-based ingredients including co-products in end-use applications globally, and outside of the plant-based foods market. Pulse Canada’s marketing efforts rely heavily on the development of commercially relevant information on pulses to address key knowledge gaps and priorities that align with processor, food industry and consumer needs. This type of information is created through research projects funded by Pulse Canada, or in collaboration with member associations, government, or other stakeholder groups.



25 BY 2025 MARKETING AND RESEARCH STRATEGIES TAILORED TO INDIVIDUAL CROPS AND INGREDIENT-STREAMS

LEVERAGING PLANT-BASED PROTEIN INGREDIENT DEMAND TO GROW PROCESSING OF CANADIAN PEAS, LENTILS AND FABA BEANS

Although soy currently dominates the plant-based protein market due to its high protein concentration, low cost, reliability of supply chain and superior functionalities (highly soluble, foaming and gelling), its less favourable image associated with GMO, estrogenic and allergenic effects and deforestation in Amazon basin is expected to allow for the rise of other grains including pulses. Plant-based food manufacturers will be increasingly looking to diversify away from soy. According to a 2021 Ernst & Young report, the projected global demand for peas resulting from plant-based meats will be between 10 and 17,000,000 MT by 2035. Global demand for lentil in plant-based meats will be between 1.5 and 2.5 million MT by 2035 whereas other pulses like chickpea, lupin and faba bean have an expected demand between 4.7 and 7.7 million MT by 2035 in this category. Capturing 10% of global demand for Canadian pulses in plant-based meats by 2035 based on Ernst & Young's projections is estimated to be between 1 and 1.7 million MT for peas, 476,000 - 773,400 MT for other pulses (chickpeas, lupin, faba beans), and 153,000 – 248,100 MT for lentils.

Historically, China has and continues to process the largest volume of Canadian peas for the production of pea ingredients. However, other regions have significantly increased their capacity to fractionate peas. Notwithstanding COVID-19, the demand for plant protein continues to rise. This is demonstrated by new food product launches and menu offering in both the retail and commercial foodservice, respectively, that use fractionated pulse ingredients. In Canada alone, current and planned infrastructure development will fractionate an estimated 700,000 tonnes of peas. The US and EU will also provide additional processing capacity.

Given Canada's production capabilities, the '25 by 25' strategy aims to position Canada as the primary supplier of peas to the fractionation industry, particularly in North America and the EU. These are regions where quality, reliability, consistency and sustainability are important criteria in supply chains, which offers tremendous potential for higher value to be delivered back to the farm gate. The significant pea fractionation processing capacity that will be available in both North America and the EU, also provides an opportunity to encourage fractionation processing of other Canadian pulses like lentils and faba beans as additional value-added plant-based protein alternatives. Highlighting the quality advantages of Canadian pulses for ingredient processing, food quality, and sustainability will be key to positioning Canada as the leading supplier of peas and other pulses for fractionation.

BUILDING DEMAND FOR FRACTIONATED INGREDIENTS MADE FROM CANADIAN PEAS AND OTHER PULSES

Although demand for plant-proteins is growing for meat and dairy alternative applications in particular, the plant-based foods sector is at risk for unintentionally increasing undesirable nutrients while reducing the overall nutrient density of the diet when ultra processed plant-based substitutes are selected over whole, minimally processed plant-based foods. The impact of plant-based alternative food products on the environment with regard to production, processing, packaging and water use is also being questioned. Marketing the quality, nutrition, functionality attributes and sustainability advantages of ingredients derived from Canadian pulses is needed to continue growing their use by the fractionation and end-use food manufacturing industry. The Canadian pulse sector has more sustainability data than any other



country. The advancements in practices adopted by Canadian producers, our production and research capacity, as well as climate change resilience all position Canada with the potential to be a leading supplier of high quality, nutritious and sustainability protein ingredients for the future.

Targeted marketing and outreach activities to food industry will leverage attributes of pulse proteins that deliver on functionality and resonate with consumers. The sustainability profiles in particular are one of the advantages that could set Canadian pulse protein ingredients apart from others in the protein space. Marketing the co-products of protein fractionation will also ensure the success and profitability of the Canadian pulse industry. The functionality, nutrition benefits, and “clean label” advantage of pea fibre will be marketed to manufacturers of meat and bakery products. Significant volumes of starch are generated by the fractionation of peas. However, use of pea starch is limited by industry compared to starches from corn, tapioca and potato starch. Given the competitive nature of the food starch market, the strategy to build demand for pea starch is focused on exploring alternative uses in industrial applications. Because of the increase in domestic processing capacity, the Canadian pulse industry will have a surplus of starch. Finding markets for this starch will provide farmers and the industry with increased demand and a predictable revenue stream on a by-product that is presently seen as a loss leader. The end result is creating value throughout the supply chain.

INCREASING VALUE-ADDED PROCESSING OF CANADIAN PULSE FLOURS AND UTILIZATION IN THE GLOBAL PACKAGED FOOD MARKET

Food manufacturers across all categories are looking to leverage the plant-based trend, enhance nutrition and sustainability profiles of product offerings. Whole pulse flours can offer nutritional, marketing, and economic benefits over fractionated ingredients because they are nutrient dense, less processed, and of lower cost. The flour market currently emphasizes wheat and cereal grain flours, however there is growing interest in this sector for alternative flour ingredients, particularly those relevant to plant protein. Pulse flours align with consumer trends for plant-based, nutrition density, clean label, minimally processed, and sustainability. Pulse flours have potential to boost nutrition and protein quality in particular for cereal-based foods, and offer functional advantages across a range of product applications. According to Euromonitor, all pulse flour types are expected to register strong growth in the US packaged food and pet food markets to 2023, whereas wheat and other flours are expected to have very low growth or declines in use. Building global demand for pulse flours in food applications and expanding pulse flour processing capacity for Canadian pulses will support diversification, especially for pulses like lentils that do not lend themselves to fractionation as easily as peas and faba beans.

Since there is significant flour milling capacity already installed in global markets, this strategy aims to encourage traditional flour millers in North America, Mexico, the EU and Asia, to explore lentil, pea and faba bean flour milling by highlighting the advantages that ingredients made from Canadian peas/lentil/faba beans provide. Pulse Canada also intends to work with food manufacturers to demonstrate to millers that there is increasing interest in the use of pulse flours. The nutritional and functional advantages in particular of using pulse flours in cereal-based and meat blends will be marketed to manufacturers of batters/breading, snacks, cereals, pasta, noodles, bakery, and processed meat.

INCREASING USE OF CANADIAN PEAS AND FAB A BEANS AS A FEED INGREDIENT FOR SUSTAINABLE MEAT

A substantial amount of Canadian peas have historically been used in domestic livestock markets, with faba bean use for feed also increasing. As interest in plant-protein and sustainability continues to grow, there is an opportunity to leverage the sustainability advantages of Canadian peas and faba beans for



producing value-added sustainable meat products. Other product quality advantages and potential animal health/performance advantages of utilizing peas/faba beans in feed applications will also be highlighted. The strategy will also leverage the current use of peas for feed in China to explore diversification opportunities to nearby countries in SE Asia and East Asia.

OPPORTUNITIES FOR WHOLE PULSES TO ADDRESS CONCERNS AROUND PROCESSED PLANT-BASED FOODS

Consumers following a plant-based diet now have a wide variety of processed plant-based food products available to choose from, however questions are being raised as to whether plant-based alternative food products carry the same established nutrition and health benefits as traditional plant-based diets based on whole, unprocessed pulses, legumes and vegetables. The impact of plant-based alternative food products on the environment is also being questioned. With scrutiny growing towards processed plant-based foods, minimally processed whole, shelf-stable pulses offer the same plant-protein benefits with a “whole food” advantage. Plant-based food manufacturers are looking to enhance the nutrient profile and diversify the format of future plant-based foods so they can be marketed as healthy, sustainable alternatives to animal-based products. Pulses like lentils, beans and chickpeas, easily lend themselves to consumption and utilization in whole formats. Whole pulses, have greater potential to substantiate health benefits compared to processed ingredients and plant-based food products, which can create unique consumer pull opportunities. In addition to sustainability advantages from production, whole pulses are shelf-stable, nutrient-dense foods.

INCREASING DOMESTIC USE OF CANADIAN GROWN BEANS

A recent market insights study commissioned by Pulse Canada identified an opportunity to increase domestic use of Canadian grown beans by highlighting them as a product of Canada. This is particularly relevant to consumers today, who are interested in purchasing locally/domestically produced products and supporting the Canadian economy. During COVID-19, consumers purchased significantly higher rates of canned, shelf-stable bean products. Since dry and canned beans are already in the pantries of Canadians, marketing efforts will aim to enhance the consumer experience with bean products to drive repeat purchase behaviours. Beans are closely aligned with consumer trends around whole foods, plant protein, nutrition, health, clean labels, local, and the increasing importance of sustainability. The strategy will emphasize marketing and technical support to shelf-stable bean processors, a direct-to-consumer and retail-focused plan to leverage these attributes of beans.

INCREASING WHOLE LENTIL USE IN USA FOODSERVICE

Increasing demand and use of whole lentils in the foodservice market remains as an opportunity. Lentils offer several advantages including nutrition, versatility, sustainability (carbon, water, waste, soil health, bio-diversity), and are an affordable source of plant protein. The foodservice sectors interest in the advantages that lentils offer is growing. Given the high amount of lentil production in Canada, an increase in domestic usage is unlikely to yield significant results because of the relative size of the population and foodservice sector in Canada. For this reason, the lentil foodservice strategy is focused on the US market. The foodservice strategy focuses on two menu applications for lentils: Power Bowls and Meat Blends. Target audiences include commercial (restaurant chains) and non-commercial (institutional) foodservice operators as well as manufacturers of value-add foodservice products in the US, and suppliers of Canadian lentils to manufacturers or distributors of foodservice products.

Appendix C: National Pulse Research Strategy Committee (NPRSC) Members

The following NPRSC members participated in the development of this strategy:

Daryl Domitruk	Executive Director	Manitoba Pulse and Soybean Growers
Leanne Fischbuch	Executive Director	Alberta Pulse Growers Commission
Valerio Hoyos-Villegas	Assistant Professor of Plant Breeding & Genetics	McGill University
Chris Marinangeli	Senior Director, Research & Regulatory Affairs	Pulse Canada
Jennifer Mitchell	Project Manager	Ontario Bean Growers
Sherrilyn Phelps	Director of Research & Development	Saskatchewan Pulse Growers
Carl Potts	Executive Director	Saskatchewan Pulse Growers
Jenn Walker	Research & Extension Manager	Alberta Pulse Growers Commission

