PULSE CANADA

Canadian Pulse Industry Looking Ahead to 2025

Addressing innovation and collaboration

25 by 2025: A Collaborative National Strategy

LENTILS

625,000
tonnes

- **Flour Milling** (Canada, U.S., Mexico, E.U.)
- **Fractionation** (Canada, U.S., EU)
- **Foodservice** (U.S.)

PEAS

1,100,000
tonnes

- **Flour Milling** (Canada, U.S., Asia, E.U.)
- **Fractionation** (Canada, U.S., EU)
- **Sustainable Feed** (Canada, U.S., Asia)

BEANS

NAVY, PINTO, BLACK BEANS

75,000
tonnes

- **Retail Consumption** (Canada)
- **Foodservice** (Canada)

FABA BEANS

100,000
tonnes

- **Flour Milling** (Canada, U.S.)
- **Fractionation** (Canada, U.S.)
- **Sustainable Feed** (Canada, U.S.)

CHICKPEAS

100,000
tonnes

- **Supporting Demand** (U.S.)

Pulse Canada's Research Streams

What is needed to build demand and support sector growth

1) Address industry challenges (technical, regulatory, marketing)
2) Build data on the quality and performance (functionality, nutrition, sustainability) of (Canadian) pulses and pulse ingredients
3) Demonstrate alignment of pulses with global nutrition, health, sustainability, economic goals

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Address industry technical challenges

Pulse flour as a percent of total flour (2020 tonnes, % share)

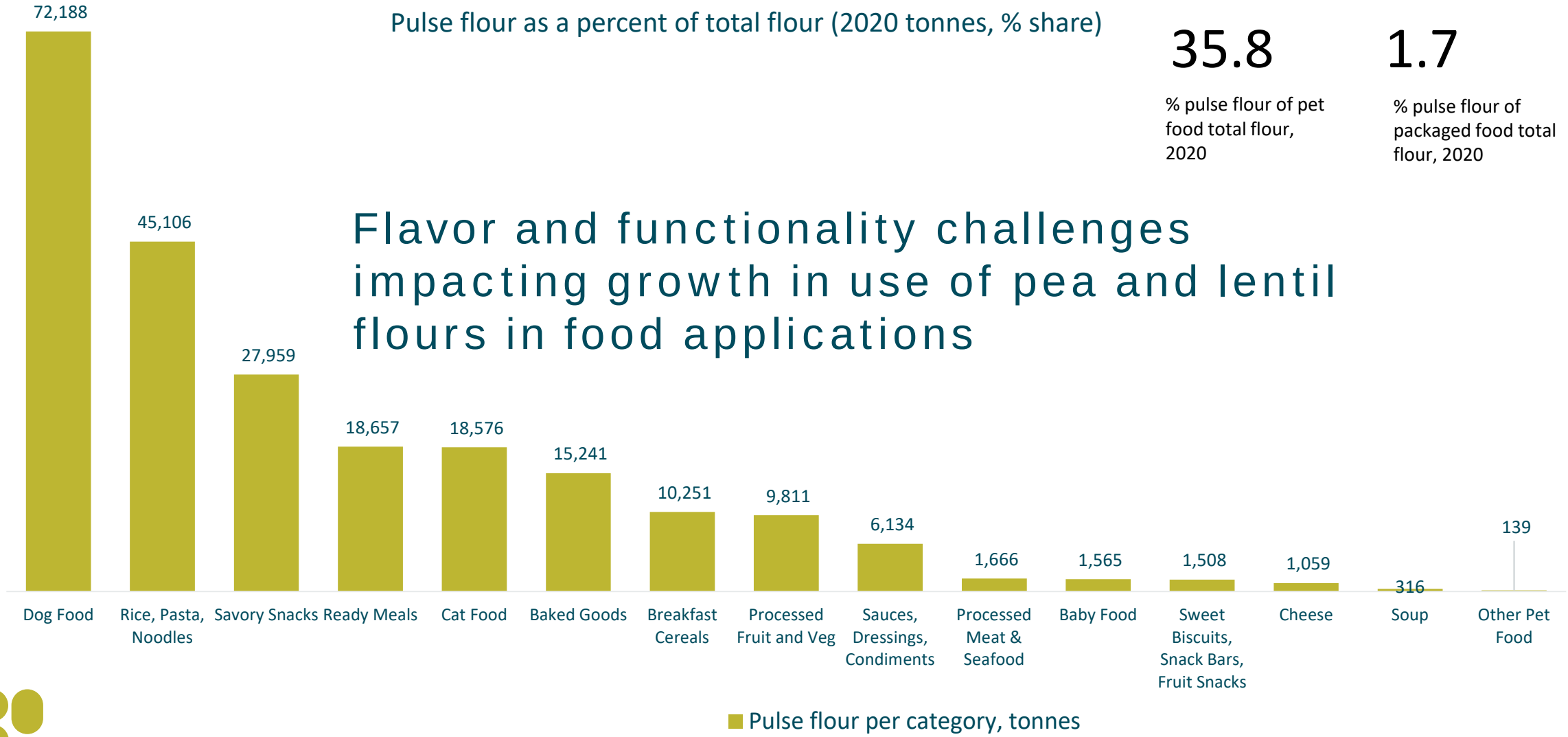
35.8

% pulse flour of pet food total flour, 2020

1.7

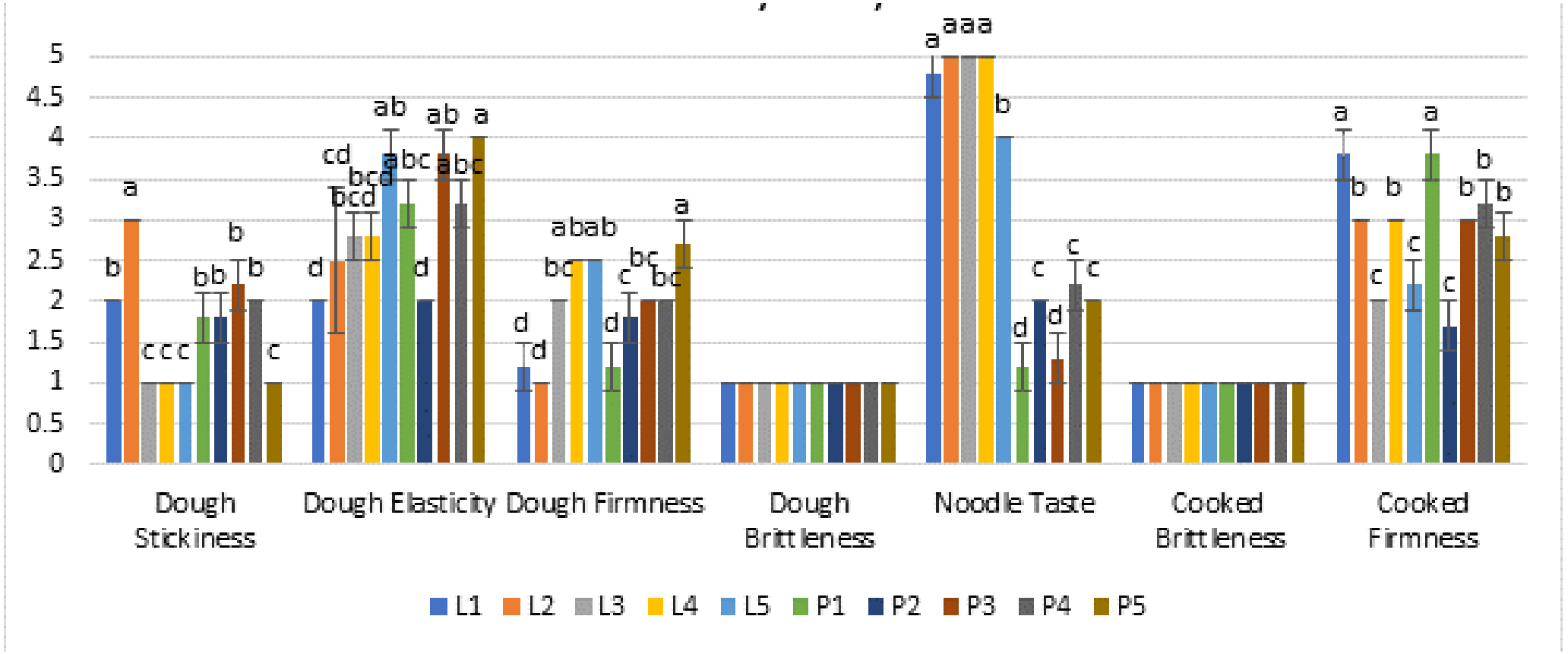
% pulse flour of packaged food total flour, 2020

Flavor and functionality challenges impacting growth in use of pea and lentil flours in food applications



Address industry technical challenges

Testing the impact of different milling strategies on performance of pea and lentil flours with varying protein content, starch damage and particle size



Address industry regulatory challenges

Protein Claims for Labelling and Marketing in North America are Based on Quantity and Quality

"Good/ Source of Protein“
“Excellent Source of Protein”
“High Protein”

Protein Quality	PDCAAS
Milk Proteins (casein, whey)	1
Soy Protein	1
Mycoprotein	0.996
Potato	0.99
Soy	0.91
Pea Protein Concentrate	**0.89**
Vegetables	0.73
Peas	**0.7**

Address industry regulatory challenges

Regulatory challenge with making protein content claims on plant-based foods

- Build data on the impact of increasing plant-protein intake on protein quality of diets in Canada and the US to encourage regulatory modernization

Loblaws

PULSE CANADA

General Mills

UNIVERSITY OF TORONTO

University of Manitoba

HF Helderleigh Foundation

APNM-2020-1027.R1

The effect of increasing intakes of plant protein on the protein quality of Canadian diets

Christopher P.F. Marinangeli[1], Hrvoje Fabek[2], Mavra Ahmed[2,3], Diana Sanchez-Hernandez[2], Samara Foisy[4], James D. House[5]

Protein Intake	Proportion of plant protein (%)			
	Quartile 1 0-24.9% (n=1942)	**Quartile 2 25-49.9% (n=3328)**	**Quartile 3 50-74.9% (n=1009)**	**Quartile 4 75-100% (n=219)***
Total Day Absolute Protein Intake (g/day)	110.31 ± 5.3***	84.68 ± 1.1	69.41 ± 1.45***	57.14 ± 2.34***
Total Day Absolute Protein Intake (g/kg BW/day)	1.44 ± 0.07***	1.13 ± 0.03	0.97 ± 0.02***	0.82 ± 0.03***
Total Day Absolute Protein (% energy)	20.24 ± 0.79***	15.72 ± 0.18	13.03 ± 0.15***	11.41 ± 0.38***
Aggregated Total Day Corrected Protein†				
PDCAAS	0.99 ± 0.001***	0.96 ± 0.004	0.87 ± 0.006***	0.71 ± 0.018***
Corrected protein (g)	107.96 ± 5.29***	80.60 ± 1.21	58.16 ± 1.46***	37.13 ± 1.88***
Corrected Protein by body weight (g/kg BW)	1.41 ± 0.07***	1.07 ± 0.03	0.81 ± 0.02***	0.54 ± 0.03***
Proportion of energy from corrected protein (%)	19.93 ± 0.8***	15.21 ± 0.21	11.2 ± 0.19***	7.73 ± 0.45***
Sum of Time Intervals Total Day Corrected Protein (g/day) †§				

Abbreviations: BW, body weight; PDCAAS, protein digestibility corrected amino acid score

Mean ± SEM value was significantly different from quartile 2 (25-49.9% plant protein): * P<0.05, ** P<0.01, *** P<0.0001.

*21 Adults (0.32%) consumed 100% protein from plants on any given day

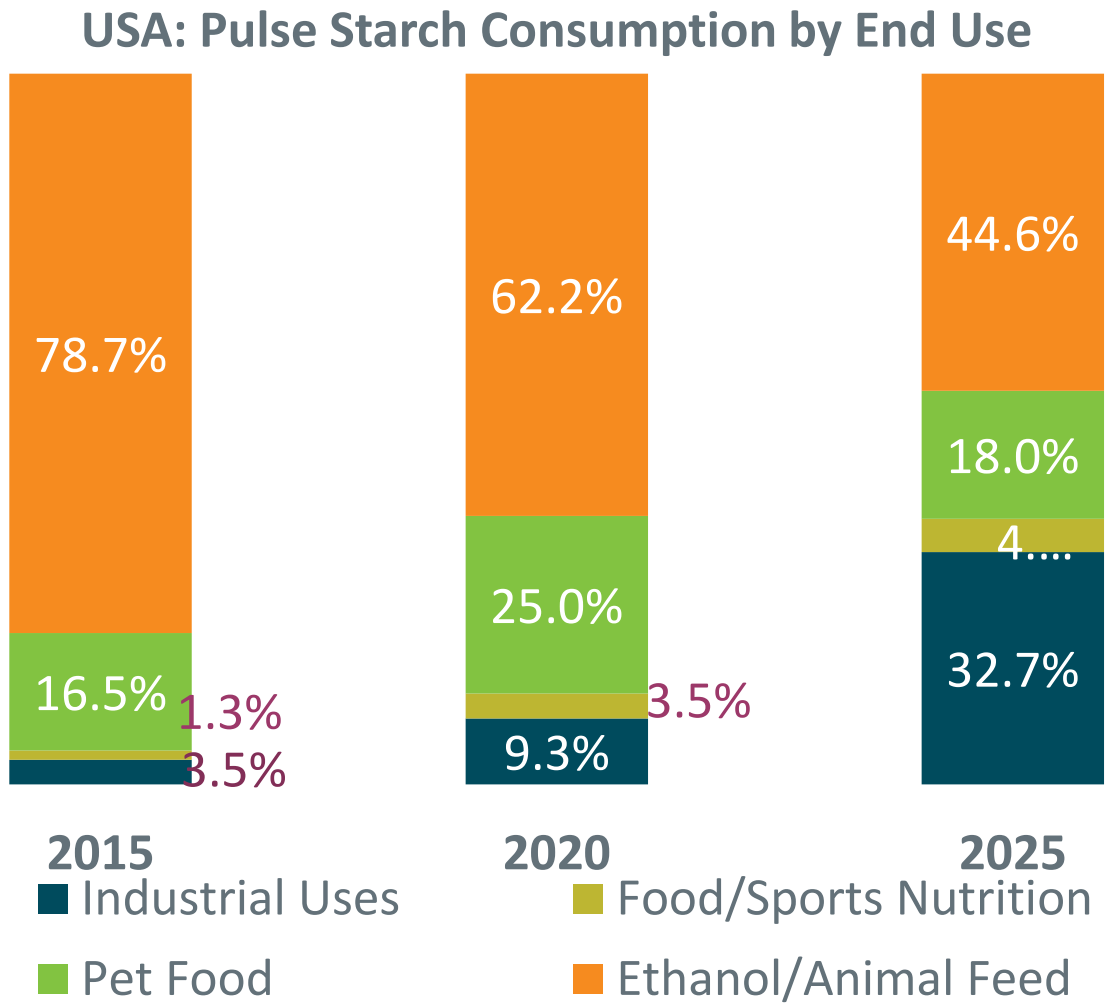
†Assumed total N digestibility coefficient of 0.8 for all protein foods

§ Total day corrected protein was sum of corrected protein consumed across the time intervals. Corrected protein intake was calculated for protein consumed within six – four-hour eating intervals (Interval 1: 00:00-03:59; Interval 2: 04:00-07:59; Interval 3: 08:00-11:59; Interval 4: 12:00-15:59; Interval 5: 16:00-19:59; and Interval 6: 20:00-23:59).

Reference: Marinangeli et al. 2021. APNM.

Address industry marketing challenges

Need more high value usage for pea starch



Innovation over substitution takes time and resources, but builds competitive barriers

1

Horizon 1: Generic Substitution

No unique functionality, but large volumes are easily obtainable with minimal investment into capabilities or awareness. Starch here is highly commoditized and competition focuses on price and the ability to supply adequate volumes.

2

Horizon 2: Valorized Substitution

Some unique functionality or modifications may be needed to enter the market. Moderate awareness must be communicated so manufacturers incorporate pulse starch into their formulations. In some instances, pulse starch can be used to replace non-starch ingredients (*i.e., pectin, gelatin, casein, etc.*).

3

Horizon 3: Innovative and Specialized Usage

Innovative/novel usage requires substantial R&D for modifications or achieving suitable levels of purity (*i.e., Roquette in Pharmaceuticals*). New markets must be created, so awareness generation will be essential.

Animal Feed / Aquafeed | Ethanol | Pet Care | Oil / Mining /Drilling | Food / Sports Nutrition | Paper/Packaging (Modified)

Bioplastics | Paper/Packaging (Modified) | Sweeteners | Pharmaceuticals/Nutraceuticals | Food / Sports Nutrition (Modified)

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Examples of Commercially Available Pea Protein Products	
Protein Composition (dry basis)	**Product Description**
44%	Yellow Field Pea
50%	Pea Protein Concentrate
>50%	Pea Protein Texturized
>55%	Pea Protein
56%	Pea Protein Concentrate
80%	Pea Protein
>80%	Pea Protein
>80%	Pea Protein
>80%	Pea Protein
82%	Pea Protein Isolate
82%	Pea Protein Isolate
>83%	Pea Protein
86–88%	Pea Protein Isolate
>90%	Pea Protein

Build Data on Pulse Protein Performance

Functionality Performance of Commercial Pulse Proteins

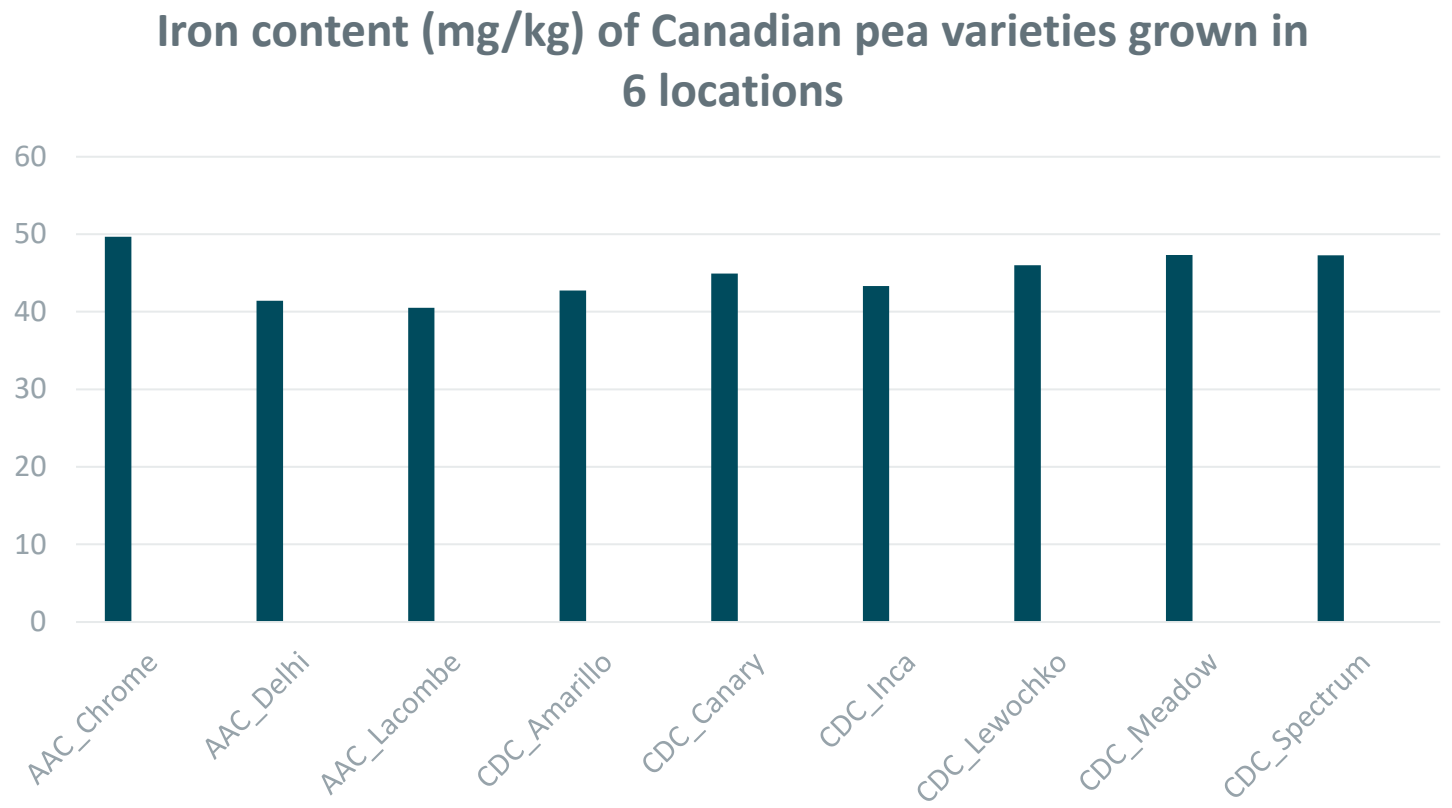
- Building Public Data on Performance of Pulse and Soy Protein Ingredients for End-Users
- Establish comparative rankings for functional performance of undisclosed commercial samples of protein isolates and concentrates from multiple varieties of pea, lentil, faba and soy protein isolates.
- Functional properties include: solubility, foaming properties, emulsification, gelling, WHC, OHC at pH 3, 5, 7.

NRC·CNRC

UNIVERSITY OF SASKATCHEWAN

Build Data on Canadian Pulse Quality

Exploring functionality and nutrition advantages of Canadian pulses for processing



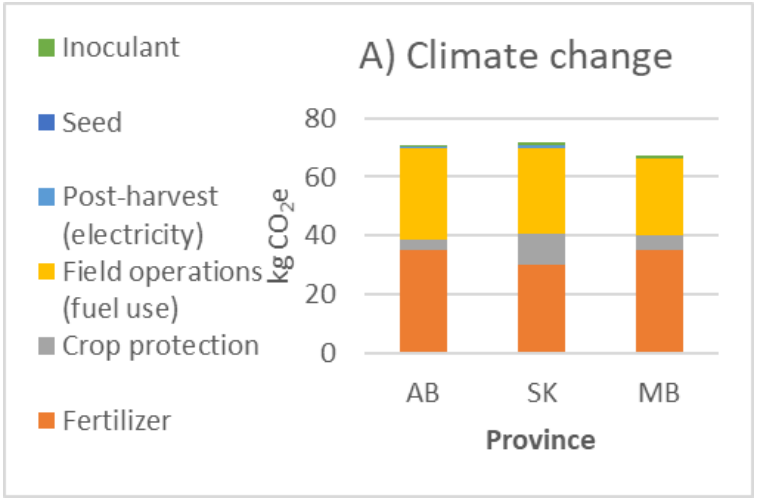
ALBERTA PULSE GROWERS

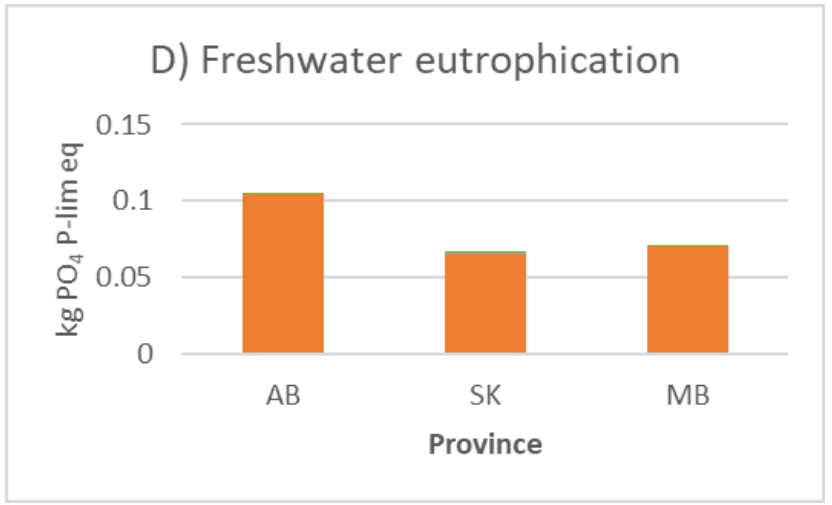
SASKATCHEWAN pulse Growers

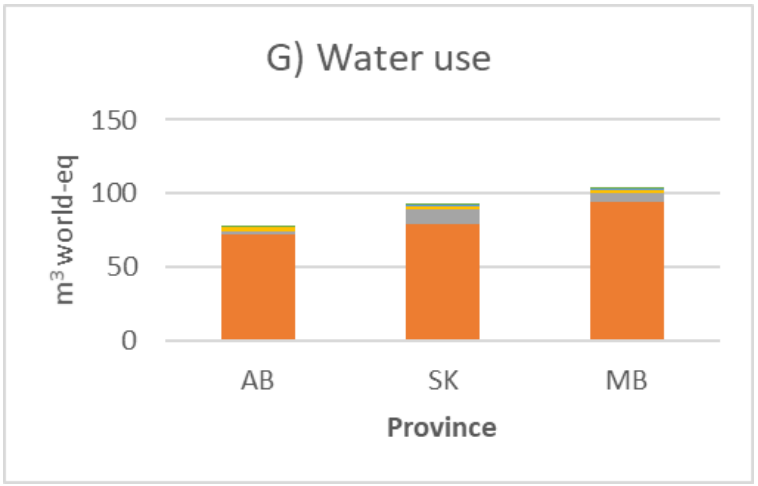
MANITOBA Pulse Soybean GROWERS

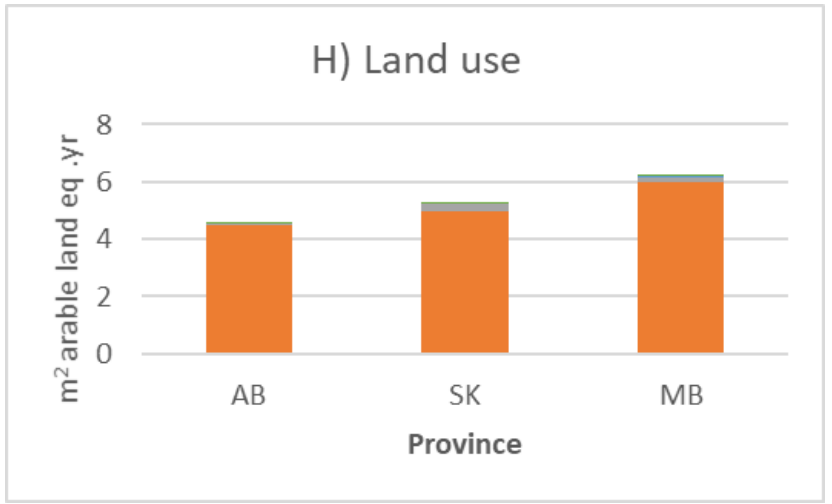
Build Data on Canadian Pulse Sustainability

n = 269 pea producers
5.7 % of total production









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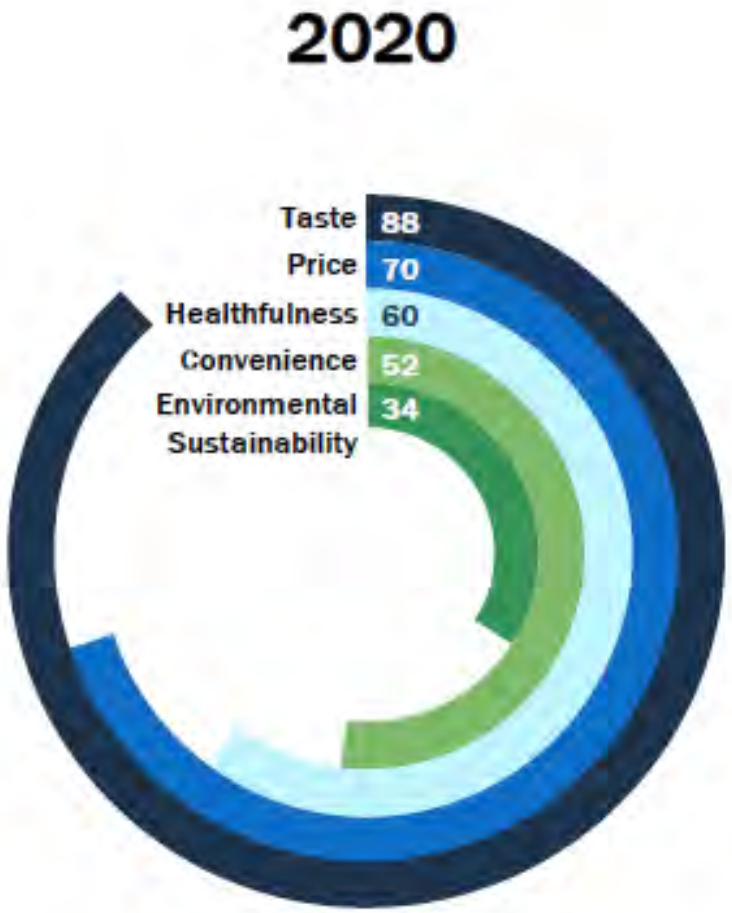
Demonstrate alignment of pulses with global nutrition, health, sustainability, economic goals

How much of an impact do the following have on your decision to buy foods and beverages? (n=1,011)



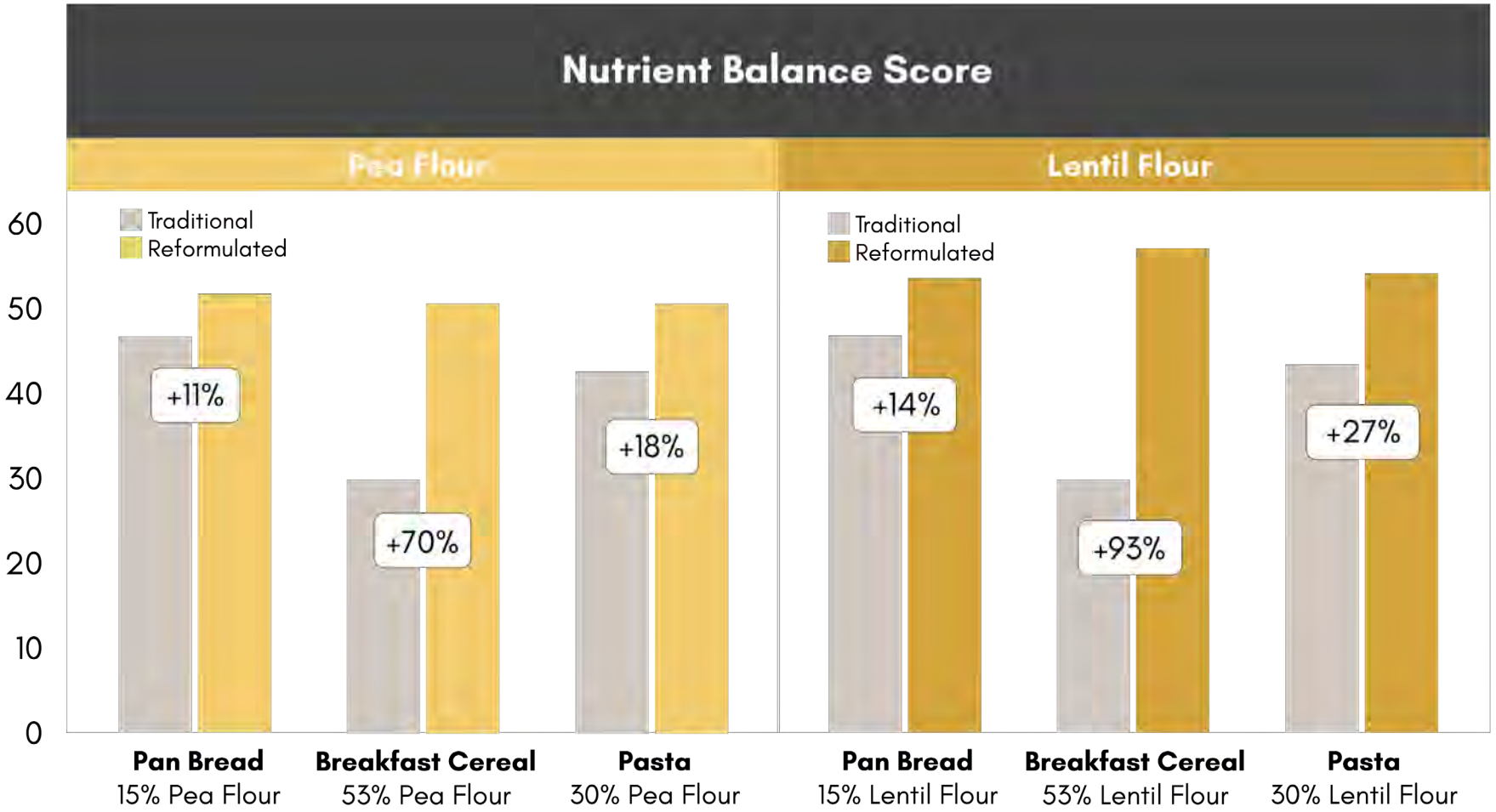
International Food Information Council

Sources of Protein Across Quartiles

Proportion of Plant Protein (%)								
Quartile 1 0-24.9%			Quartile 2 25-49.9%			Quartile 3 50-74.9%			Quartile 4 75-100%		
Source of Protein	Mean (%)	SEM	Source of Protein	Mean (%)	SEM	Source of Protein	Mean (%)	SEM	Source of protein	Mean (%)	SEM
Meat & poultry	51.94	1.44	Meat & poultry	33.63	0.60	Dairy	17.11	1.57	Breads, rolls, crackers	23.38	4.51
Dairy	17.50	1.18	Dairy	19.48	0.56	Breads, rolls, crackers	16.93	1.63	Grains	15.61	2.64
Fish	7.14	0.74	Breads, rolls, crackers	12.00	0.52	Meat & poultry	16.01	1.12	Nuts	10.59	2.80
Breads, rolls, crackers	5.61	0.20	Grains	8.51	0.25	Grains	12.53	1.30	Vegetables	7.87	1.03
Eggs	5.09	0.52	Fish	4.98	0.45	Nuts	9.52	1.79	Dairy	7.47	0.99
Grains	4.19	0.30	Eggs	4.97	0.44	Vegetables	6.06	0.32	Legumes (non-soy)	7.46	2.70
Vegetables	2.14	0.15	Vegetables	3.74	0.13	Eggs	3.87	0.76	Soy	7.14	2.79
Potatoes	1.71	0.12	Nuts	3.23	0.20	Legumes (non-soy)	3.22	0.59	Breakfast cereals	4.55	1.25
Fruit	0.95	0.10	Potatoes	2.17	0.11	Breakfast cereals	2.99	0.32	Fruit	3.93	0.63
Breakfast cereals	0.93	0.10	Breakfast cereals	2.04	0.17	Fish	2.54	0.58	Baked Goods	3.49	0.89
Baked Goods	0.92	0.10	Fruit	1.74	0.07	Fruit	2.49	0.14	Meat & poultry	2.63	0.56
Frozen dairy	0.79	0.14	Baked Goods	1.34	0.16	Potatoes	1.89	0.21	Potatoes	2.59	1.95
Nuts	0.69	0.24	Legumes (non-soy)	1.01	0.12	Baked Goods	1.88	0.26	Eggs	1.58	0.56
Legumes (non-soy)	0.23	0.08	Frozen dairy	0.79	0.13	Soy	1.35	0.43	Meat alternatives	0.91	1.66
Sprouted legumes (non-soy)	0.07	0.02	Soy	0.18	0.04	Frozen dairy	1.23	0.48	Frozen dairy	0.88	0.59
Soy	0.07	0.03	Plant-based dairy alternatives	0.17	0.03	Meat alternatives	0.46	0.19	Plant-based dairy alternatives	0.59	0.17
Plant-based dairy alternatives	0.04	0.01	Meat alternatives	0.04	0.11	Plant-based dairy alternatives	0.38	0.11	Fish	0.18	0.08
Meat alternatives	0.01	0.01	Sprouted legumes (non-soy)	0.03	0.01	Sprouted legumes (non-soy)	0.02	0.01	Sprouted legumes (non-soy)	0.04	0.02
Sprouted soy	0.00	0.01	Sprouted soy	0.02	0.01	Sprouted soy	0.00	0.00	Sprouted soy	0.00	0.00

Marinangeli et al. 2021. APNM. In Press

Effect of Reformulation: Nutrition



*The Nutrient Balance Score considers both qualifying nutrients (e.g. protein, fiber, vitamins and minerals) and disqualifying nutrients (e.g. salt, fat and cholesterol). Further details can be found in: Fern et al. 2015. *PLoS One*. 10(7):e0130491

Chaudhary et al. Nutrients 2018, 10, 490

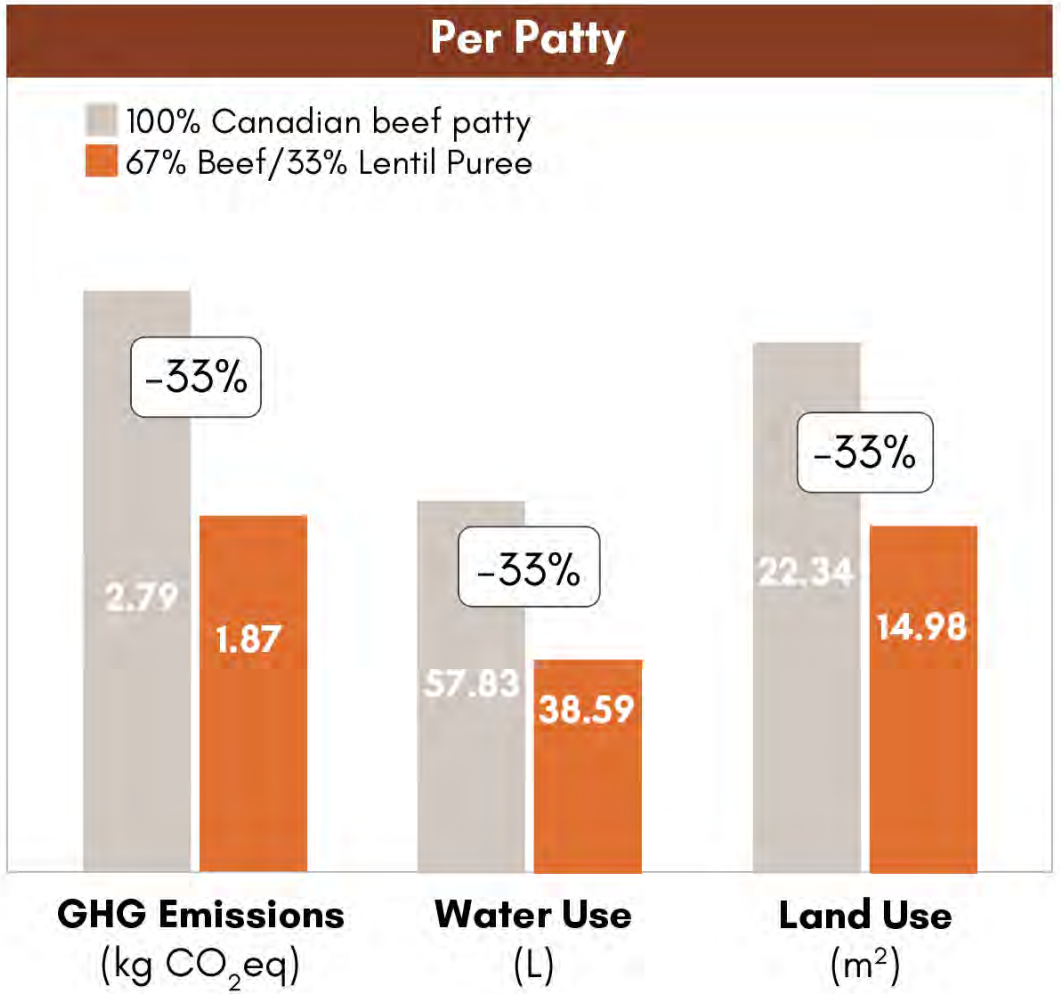
Blended Beef/Lentil Burger

Using 33% Lentil Puree:

- 32% ↓ in saturated fat
- 33% ↓ in cholesterol
- 50x ↑ in fibre
- 127% ↑ in folate

Chaudhary, A. & Tremorin, D. 2020.

Blended Beef/Lentil Burger



Chaudhary, A. & Tremorin, D. 2020.

LCA of Pork/Eggs: impact of peas in feed

Impacts of peas in feed

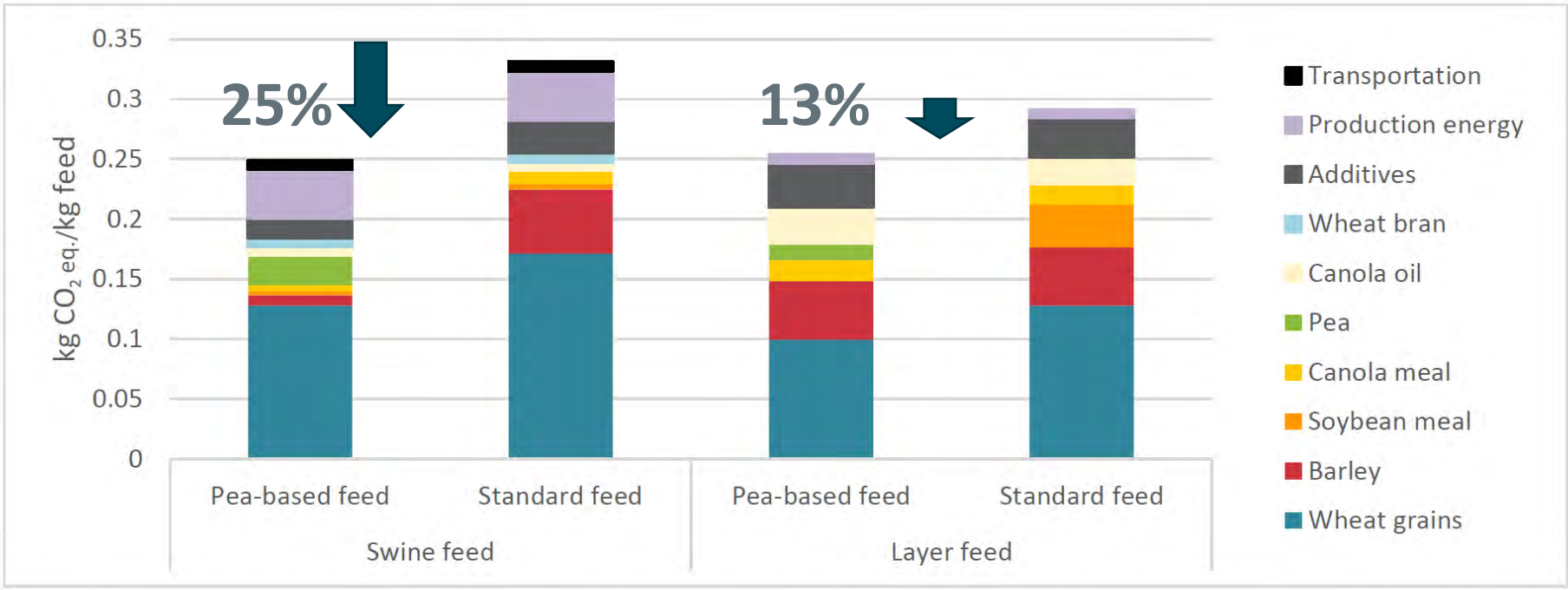


Figure 5-1: Contribution of feed ingredients to the Climate Change Impact (IPCC 2013 Method) of the animal feed production system, per 1 kg of feed.

Canadian Pulse Industry 25 by 2025

Innovation and Collaboration to

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Thank You