PULSE CANADA

CANADIAN FEED PEAS

LIFE CYCLE ASSESSMENT SUMMARY REPORT

CANADIAN PEAS FOR SUSTAINABLE FEED & LIVESTOCK PRODUCTS

As climate change and other environmental issues have become a concern of global nature, food and agricultural systems have been highlighted as a significant contributor to greenhouse gas emissions, water use, and biodiversity loss. Livestock production has been noted as having large impacts within the food system, including impacts on greenhouse gas emissions, water use, water quality and land use. At the same time, there are many opportunities to reduce the environmental impact of livestock production at every stage of the production system.

Canadian pulses are recognized for their environmental and agronomic benefits within cropping systems. The agronomic benefits of pulses are driven by the nitrogen-fixing capacity of pulses, as well as the soil health benefits of including pulses in rotations. These agronomic benefits have been well-documented within Western Canadian crop production systems and also translate into environmental benefits. In particular, pulses reduce greenhouse gas emissions from cropping systems, as their nitrogen-fixing capacity reduces the requirement for nitrogen fertilizers.

As feed production is a major contributor to the environmental footprint of livestock production, the low environmental impact of pulses can contribute to lowering the impact of livestock production. The environmental benefit of including pulses in livestock feed has been demonstrated through multiple research studies in North America and Europe (Alberta Agriculture, 2009).

Including pulses within livestock diets presents an opportunity to reduce the environmental footprint of pork and egg production systems. This also creates the potential to develop and market livestock products with low environmental footprints (e.g. low carbon pork).

In order to better quantify the benefit Canadian pulses can provide to both feed and livestock products, Pulse Canada commissioned a life cycle assessment investigating the impact of including Canadian peas into animal feed rations for Western Canadian pork and egg production.

METHODOLOGY

Three functions were covered by the analysis: 1) to produce animal feed, 2) to produce pork, and 3) to produce eggs. Impacts were calculated and are presented for the following functional units:

- **1 kg of animal ration (layer or swine), produced in Western Canada in 2020.**
- **One dozen eggs produced in Alberta in 2020, at the grading gate.**
- **1 kg of pork, carcass weight, raised in Saskatchewan in 2020, at the meat processor gate.**

The life cycle assessment (LCA) was guided by the International Organization for Standardization (ISO 14040/14044). System boundaries were set for each analysis. The animal feed production system includes crop (seed, fertilizer, pesticide, machinery use, water and land use) and additive production, and feed transformation. The egg production system includes processes related to the production of a dozen Alberta eggs, from feed production up to the washing and grading station gate. The pork production system includes all processes related to the production of 1 kg of Saskatchewan-raised pork carcass weight, from the feed production up to the abattoir gate.

Standard and pea-based rations were provided by animal nutrition experts from the University of Alberta and the University of Saskatchewan (Tables 1 and 2). Canadian pea production was modelled by Bamber et al. (2020), and their environmental impact results per kilogram of peas were used in this study. Canadian crop production (excluding pulses) and additives were modelled using the Global Feed LCA Institute (GFLI) and AGRIBALYSE database. Crop yield values were modified based on Statistics Canada's data for the years 2017 to 2019, on a dry matter basis.

For the egg production system, hatchery, farm operation and washing and grading life cycle inventories (LCI) were modelled in this study. The "Environmental Footprint of Egg", published by Alberta Agriculture and Rural Development (AARD, 2014), was used as the data source. For the pork production system, farm operations and meat production LCI were not modelled in this study. The "Environmental LCA of Canadian Pork Production", published by the Pork Value Chain Roundtable (2018) was the main data source, and direct climate change impact results were extracted from it.

Table 1: Average layer feed composition, excluding additives

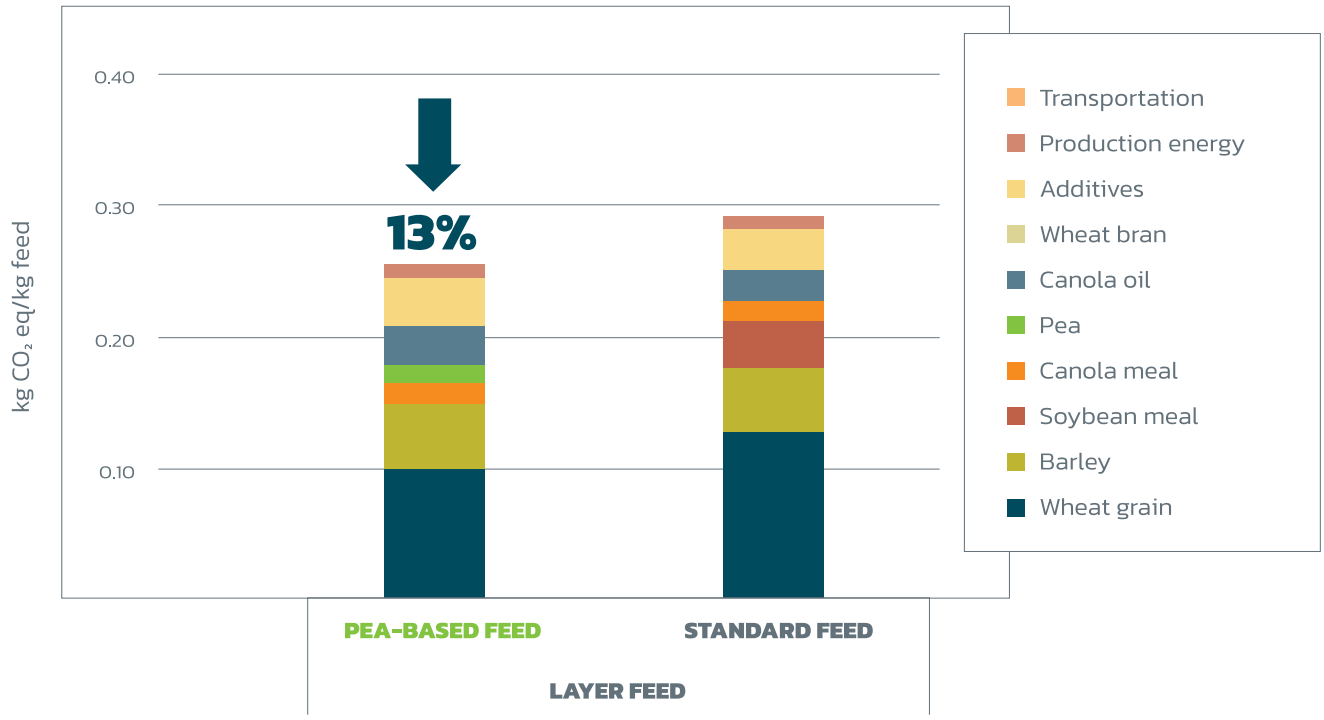
Ingredients	Standard layer feed	Pea-based layer feed	Origin for Alberta (AB) users	LCI Data source
	in g/day			
Wheat, broken	50.04	38.95	Western Canada*	GFLI Database, modified with AGECO internal data
Barley, ground	15	15	Western Canada	
Soybean meal	10	-	Soybeans Midwest, USA Soymeal processed in AB	Ecoinvent process adapted for AB
Canola meal	10	10	West. Canada (AB)	GFLI, modified with AGECO internal data
Field pea	-	20	Western Canada	Bamber et al., 2020
Canola oil	2.65	3.60	Western Canada	GFLI, modified with AGECO internal data

Table 2: Average swine feed composition, excluding additives

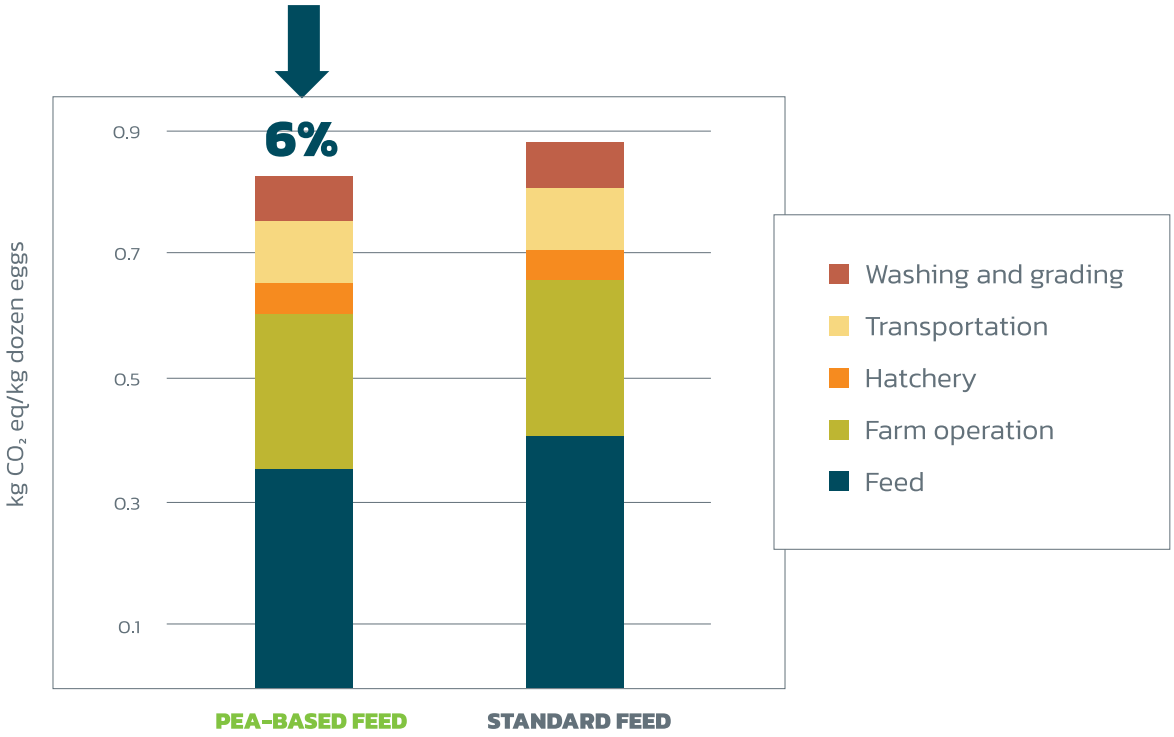
Ingredients	Standard swine feed (in kg total, over the animal life cycle)	Pea-based swine feed (in kg total, over the animal life cycle)	LCI Data source
Crops			
Wheat	85	75	GFU, modified with AGECO internal data
Soybean meal (47%)	32	8	Ecoinvent process, adapted for AB
Canola meal	34	19	GFLI, modified with AGECO internal data
Wheat bran	13	36	Modified ecoinvent process
Peas	0	129	Bamber et al, 2020
Canola oil	3	2	GFLI, modified with AGECO internal data

RESULTS

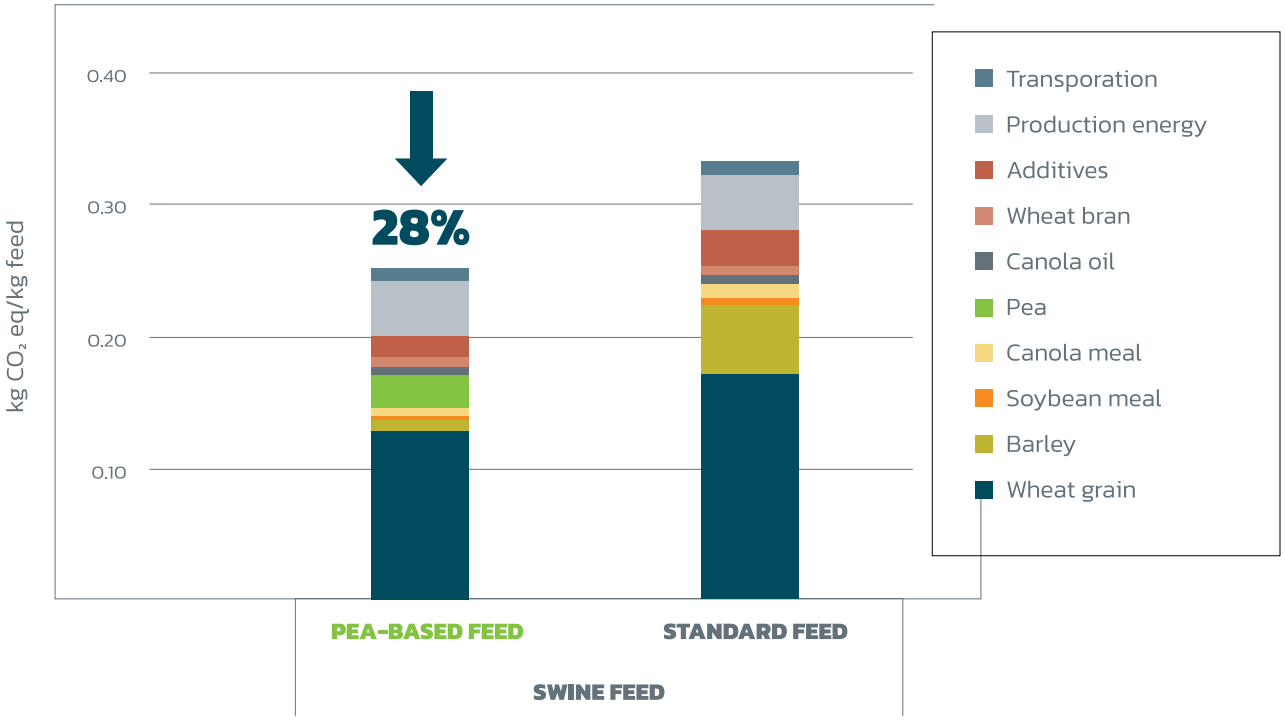
Contribution of feed ingredients to the Climate change impact (IPCC 2013 Method) of the layer feed production system, per 1kg of feed.



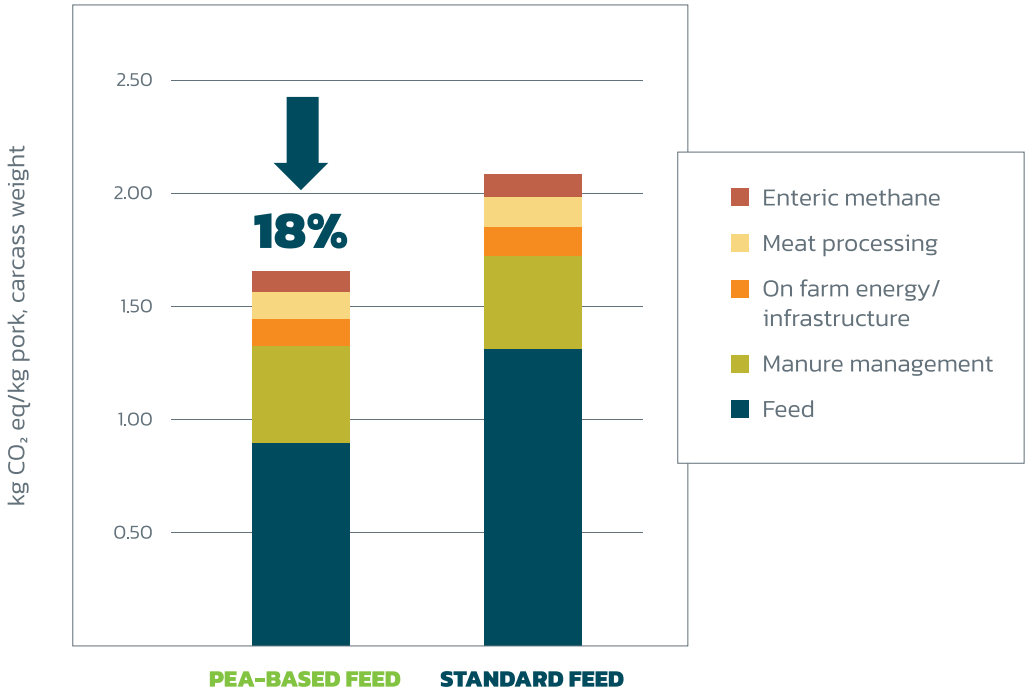
Contribution of life cycle stages to the Climate change impact (IPCC 2013 Method) of the egg production system, per dozen eggs.



Contribution of Life cycle stages to the Climate change impact (IPCC 2013 Method) of the pork production system, per kg of swine feed.



Contribution of life cycle stages to the Climate change impact (IPCC 2013 Method) of the pork production system, per kg of pork carcass weight.



CONCLUSION

This study demonstrates that the inclusion of Canadian peas into Western Canadian hog and egg rations has a strong potential to reduce the life cycle greenhouse gas emissions from pork production. This reduction is largely driven by using pea to replace feed ingredients with a higher carbon footprint (e.g. wheat, barley, canola meal, soybean meal). The greenhouse gas reduction benefit of utilizing pea in an egg production system is less pronounced, but remains significant.

As the global food system continues to explore how to reduce environmental impacts of food production, pulses have been shown to be a potential solution-provider, with benefits from both their production and consumption. In the case of livestock production, the inclusion of peas and other pulses should be considered as a potential strategy in reducing the greenhouse gas impacts of livestock production.

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Questions? We're ready to help.

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