

SUSTAINABILITY — CONTINUOUS IMPROVEMENT

Building on the a life cycle assessment (LCA) results, Egg Farmers of Alberta (EFA) in cooperation with Alberta Agriculture and Forestry (AAF) is developing a Multi-Criteria Decision Analysis (MCDA) model to assist producers in reducing their feed costs and carbon footprint.

EFA completed a LCA in cooperation with AAF to quantify the environmental impacts of egg production in Alberta and to identify potential areas for improvement in environmental performance. The LCA evaluated environmental impacts of egg production, from cradle to the graded and washed stage: growing and transporting feed, hatchery outputs, the farm operation including utilities, egg washing and grading, and transportation. According to the LCA results, feed production accounted for about 70% of the greenhouse gas emissions (also known as carbon footprint).

The MCDA is a modeling exercise that can be used to determine an optimal feed ration that meets both the nutritional requirements of laying hens at the lowest possible cost while assessing the carbon footprint of the feed ration. Traditionally, feed ingredients are chosen based on nutritional value, cost and availability. Carbon footprints of feed ingredients have not normally been a consideration in determining feed rations. The MCDA includes carbon footprints of each feed ingredient for making feed ration decisions.

Reducing carbon footprint in feed rations

According to MCDA results, the carbon footprint of feed formulation could be reduced using lower impact feed ingredients while satisfying nutritional requirement of laying hens. But, there were trade-offs between the costs and carbon footprints of feed formulation. Barley, canola meal, faba bean and peas were lower impact feed ingredients. Inclusion of these lower impact ingredients in the feed formulation could lead to a reduction of the carbon footprint of feed production in Alberta for laying hens.

Replacing some of the wheat with the lower impact feed ingredients resulted in a significant reduction of the carbon footprint of the feed ration as measured by carbon dioxide equivalent ($\text{CO}_2\text{e}/\text{tonne}$). The carbon footprint of wheat was significantly higher than those of the lower impact ingredients (see Fig.1). However, environmental benefits of including low-carbon feed ingredients needs to be balanced against additional costs of adding them into the feed formulation because prices vary significantly depending on feed ingredients (see Fig.1). It is also important to note that nutritional quality of feed formulation should be monitored when any changes in the feed formulation are made.

How much of the carbon footprint can be reduced by increasing low-impact feed ingredients in feed rations?

For egg production over one cycle in a layer flock of 10,000 hens with a feed conversion ratio of 2.2, 396 tonnes of feed is estimated to be required. Potential reduction of carbon footprints by substituting lower carbon feed ingredients (5% and 10%) for wheat is illustrated with an equivalency of driving a small car in Figure 2. Faba beans would reduce the highest amount of greenhouse gas emissions, followed by canola meal, barley and peas. Particularly, legume crops such as peas and faba beans provide additional benefits of residual nitrogen for subsequent crops which reduce nitrogen fertilizer requirement of the subsequent crops, resulting in a significant reduction of carbon footprint of feed crop production.

Low-cost and low-carbon feed rations

On farm feed management is important to enhance feed efficiency. In practice, a wide variation in the nutrient content of raw feed ingredients is a challenge to maintaining a consistent and accurate nutritional content of diets. For next steps, further investigations of the performance of low-cost and low-carbon feed rations should be conducted using feed trials to demonstrate that the low-cost and low-carbon feed rations provide profitability, productivity and egg quality, leading to gaining confidence in farmers and nutritionists to implement a practice change. Therefore, along with on farm best feed management practices, low-cost and low-carbon feed rations for laying hens could be achieved by adjusting the inclusion of low-carbon feed ingredients such as peas in feed rations considering price, nutritional value and the carbon footprint.

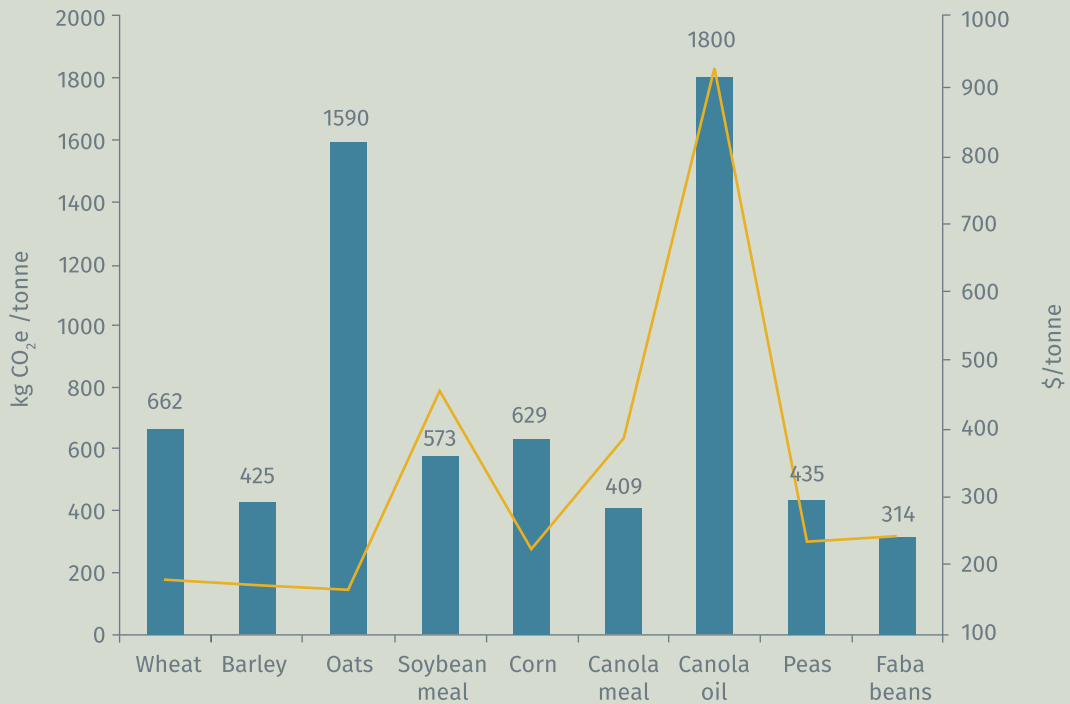


Fig.1 Prices and carbon footprints of feed ingredients ^a
^aPrices are an average of 2014 market value.

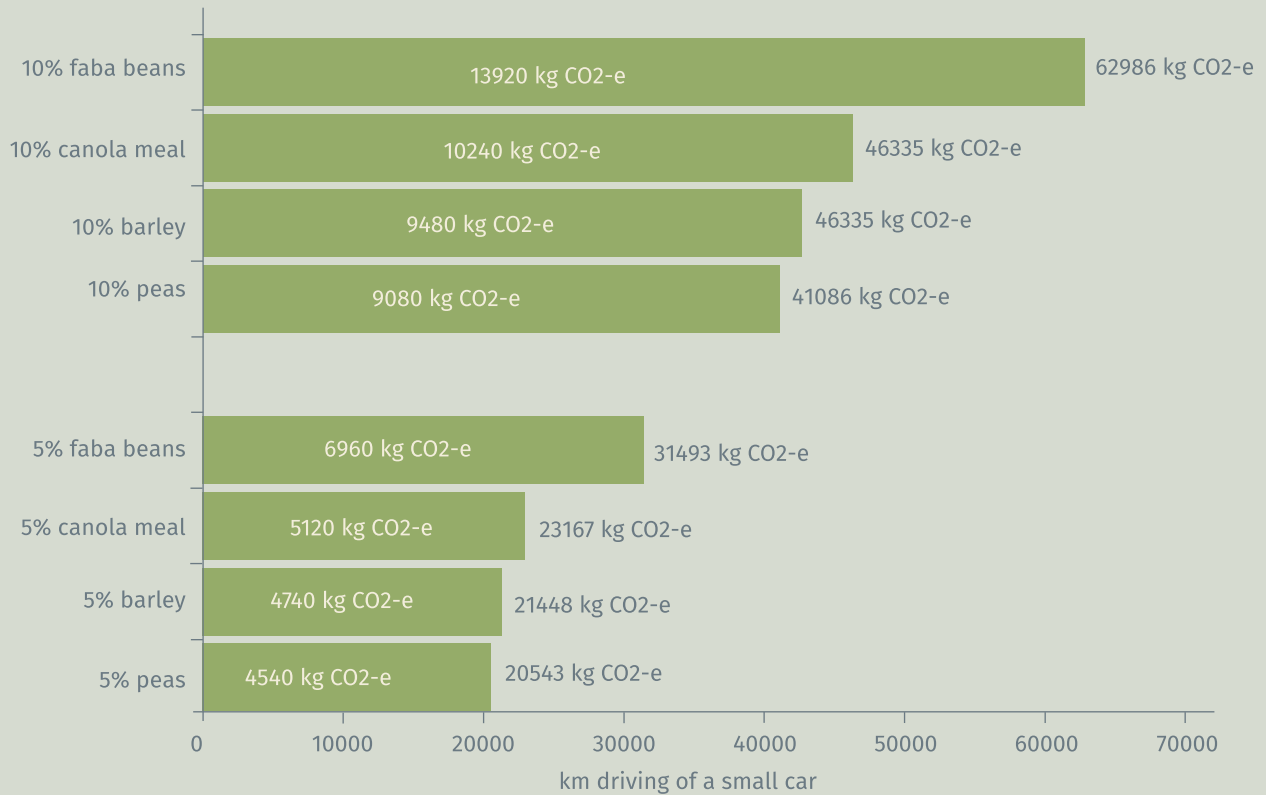


Fig.2 Potential reduction of carbon footprint by inclusion of low carbon feed ingredients in rations ^a
^a Assuming that 396 tonnes of feed is required for egg production in a flock of 10000 laying hens with a feed conversion ratio of 2.2.