



# Dietary approaches to reducing the carbon intensity of table egg production: A more aggressive approach

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## Summary

The overall carbon intensity of table egg production can be measurably reduced through incorporating a wider array of locally available ingredients in laying hen diets. This can be done without jeopardizing egg quality or profitability.

## The Problem

Food systems are under pressure to reduce their carbon footprint so as to contribute to societal efforts to address climate change.

A life cycle analysis (LCA) of the Alberta egg industry conducted by Alberta Agriculture suggests that 65% of the overall carbon footprint of table egg production is directly related to carbon intensity of feedstuffs. As such, any reduction in carbon intensity of layer rations should translate into measurable reductions in the carbon intensity of the resulting eggs.

It is widely assumed that striving for greater feed efficiency will have a beneficial impact on the environmental footprint of poultry production.

## Our Approach

A standard Alberta layer ration was formulated based on the survey data collected by Alberta Agriculture as part of the LCA project for the AB egg industry. Six diets were then formulated using locally available AB feedstuffs (no inclusion restrictions) to 95%, 100% or 105% of recommended nutrient density to either minimize cost or minimize carbon intensity (**Table 1**).

Carbon intensity values for each feedstuff/ingredient were drawn from an international database of LCA-based values. Ingredient prices used to formulate diets were reflective of those in Central AB at the time of the study.

Test diets were fed to Lohmann LSL-Lite hens housed in conventional battery cages for a 16-week experiment.

**Table 1.** Ingredient composition, AME value, diet cost and carbon intensity of test diets.

Ingredient	Alberta Standard (Control)	Minimal cost			Minimal carbon intensity		
		95% density	100% density	105% density	95% density	100% density	105% density
Wheat	48.75	15.59	50.05	36.89	-	-	26.29
Corn	10.00	33.88	-	7.18	19.36	24.68	13.68
Barley	5.00	-	-	-	26.14	13.18	-
Faba bean	-	20.22	25.33	21.30	16.40	16.59	20.00
Canola seed	-	7.76	0.35	7.66	15.37	17.47	12.49
Soybean meal	11.71	-	0.76	6.14	-	-	4.43
Canola meal	5.00	9.45	4.42	-	9.50	11.98	3.13
Canola oil	4.62	-	5.00	6.00	-	2.27	5.25
Limestone	11.37	10.81	11.49	12.13	10.84	11.42	12.10
Dicalcium phosphate	1.11	0.65	0.83	0.89	0.71	0.73	0.85
Choline premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Vitamin mineral premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Salt	0.51	0.40	0.40	0.40	0.41	0.41	0.40
L-Lysine	0.12	-	-	-	-	-	-
D,L-Methionine	0.20	0.20	0.25	0.28	0.18	0.19	0.26
L-Threonine	0.56	0.01	0.08	0.08	0.04	0.03	0.06
Enzyme	0.05	0.05	0.05	0.05	0.05	0.05	0.05
AME, Mcal/kg	<b>2.80</b>	<b>2.65</b>	<b>2.80</b>	<b>2.95</b>	<b>2.65</b>	<b>2.80</b>	<b>2.95</b>
Cost, \$CDN/T	<b>327.70</b>	<b>275.96</b>	<b>287.56</b>	<b>337.02</b>	<b>292.93</b>	<b>327.00</b>	<b>345.40</b>
Carbon intensity, kg CO <sub>2</sub> eq/T	<b>626</b>	<b>477</b>	<b>546</b>	<b>566</b>	<b>427</b>	<b>469</b>	<b>548</b>

## Our Observations

Feed efficiency was inversely related to energy density of the diet, indicating that hens adjusted feed intake to compensate for differences in dietary nutrient density (**Table 2**).

**Table 2.** Effect of altering nutrient density and formulation objective of diets fed to laying hens on productivity, egg attributes, economic indicators and feed-attributable carbon intensity of eggs.

	AB Standard (Control)	Minimize cost			Minimize carbon intensity		
		95%	100%	105%	95%	100%	105%
<b>Hen productivity</b>							
Feed disappearance, g/hen•day	117.1	111.1↓	113.1↓	106.4↓	115.4	110.5↓	106.2↓
Lay percent, eggs/100 hen•days	95.61	92.71↓	94.09↓	93.75↓	95.01	94.97	93.17↓
Egg mass production, g/hen•day	58.52	54.37↓	55.00↓	56.28↓	56.30↓	55.37↓	55.38↓
Egg:feed ratio	0.504	0.490↓	0.488↓	0.530↑	0.486↓	0.500	0.520↑
<b>Egg attributes</b>							
Average egg weight, g	61.70	58.69↓	58.42↓	60.27↓	59.18↓	58.76↓	59.39↓
Albumen, % of egg weight	54.71	55.18	54.42	55.43	54.36	54.96	54.80
Shell, % of egg weight	14.24	14.54	14.39	14.31	14.59	14.47	14.45
Yolk, % of egg weight	30.84	30.28	31.19	30.15↓	30.97	30.50	30.84
Egg shell thickness, mm	0.478	0.476	0.466↓	0.467	0.469	0.455↓	0.461↓
Specific gravity	1.088	1.087	1.086↓	1.087↓	1.087↓	1.086↓	1.086↓
Haugh units, HU	86.2	81.0	78.2	77.2	86.3	82.4	87.1
<b>Economic indicators</b>							
Feed cost, ¢/hen•day	3.85	3.07↓	3.25↓	3.55↓	3.38↓	3.61↓	3.67↓
Income over feed cost, ¢/hen•day	12.81	12.89	12.86	12.72	13.01	12.68	12.43↓
<b>Carbon intensity, feed-attributable</b>							
g CO <sub>2</sub> eq/kg egg mass produced	1242	975↓	1124↓	1061↓	880↓	941↓	1060↓
kg CO <sub>2</sub> eq/30 doz case (L eggs)	25.93	20.37↓	23.47↓	22.15↓	18.38↓	19.65↓	22.12↓

↓ ↑ Denotes statistically significant (P < 0.05) reductions or increases compared with control.

There was little difference in either egg quality or profitability (income over feed cost) among treatments.

All six test diets reduced the carbon intensity of egg production compared with control. A maximum reduction of **29%** (25.93 vs 18.38 kg CO<sub>2</sub> eq/case L eggs) was observed for the low-density diet formulated to minimize carbon intensity.

## What this means

Substantial reductions in feed-attributable carbon intensity are possible through utilizing a wider array of local ingredients (e.g., faba beans, canola seed, barley). Our results suggest that this can be implemented without compromising egg quality or profitability.

Our study further demonstrates that increasing feed efficiency (in a broad sense) does not reduce the environmental footprint or enhance the profitability of table egg production.

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