Nutrient digestibility in Canadian-grown pulse crops compared to soybean meal for growing broilers at 15- and 29-d of age

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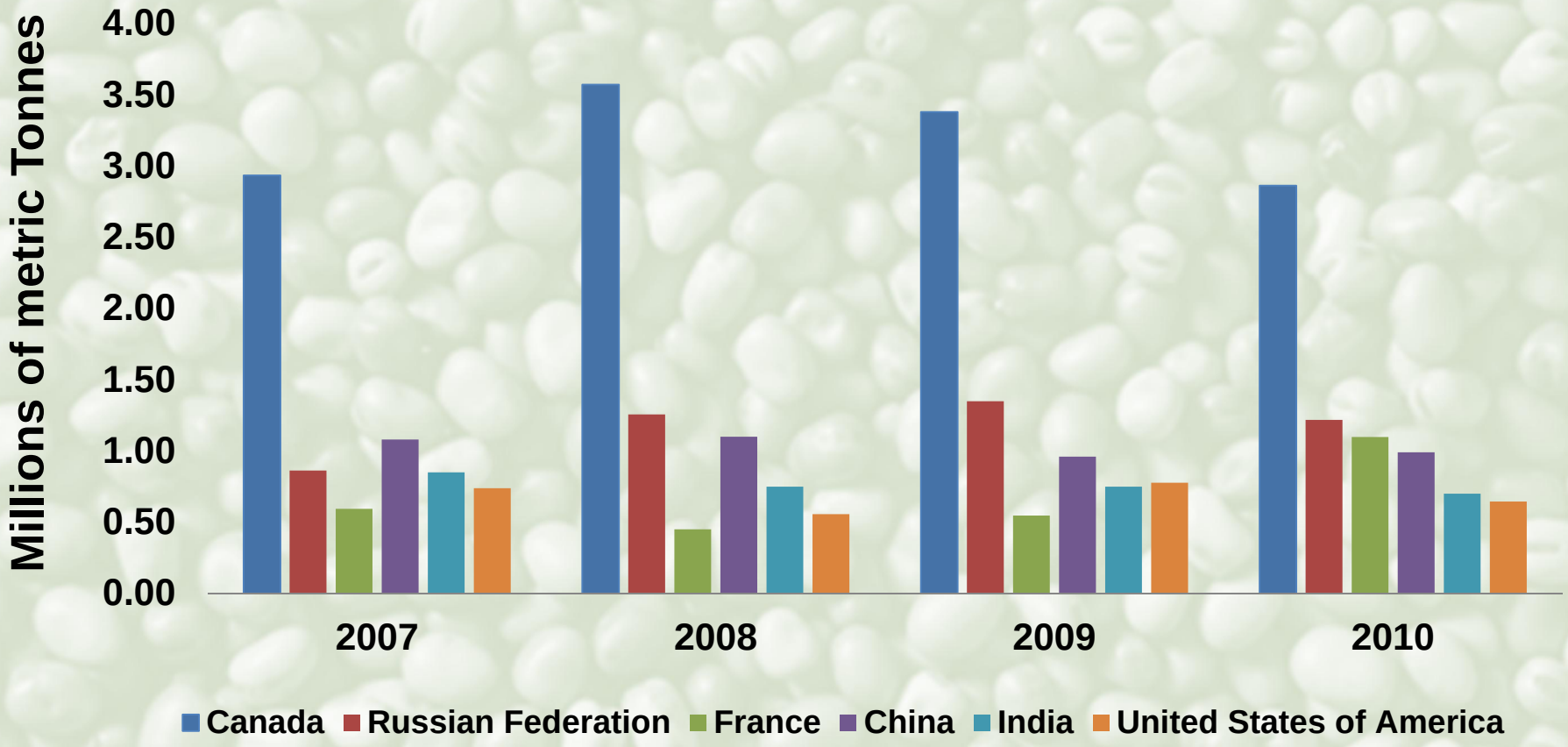
Background

- **Western Canada is one of the largest producers of pulse crops in the world**
  - Primarily field pea and lentil
  - Province of Saskatchewan alone would be in the top 4 globally

Figure 1. **Dry pea production, by country 2007-2010**



Source: FAO (2012)

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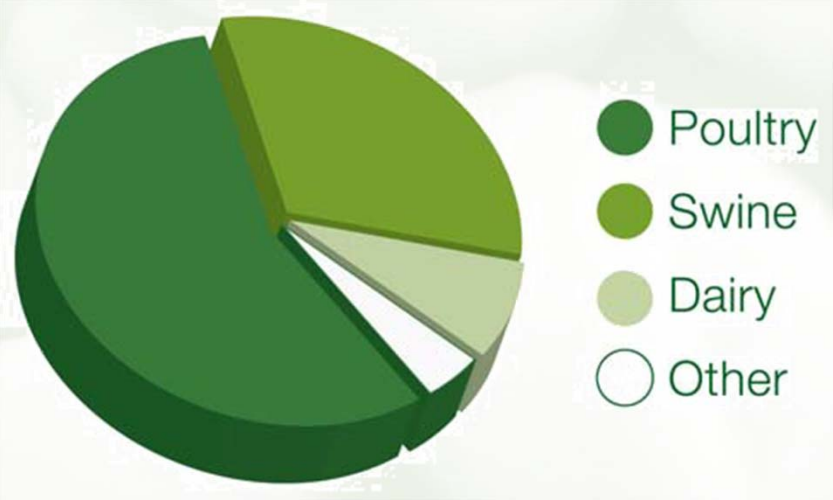
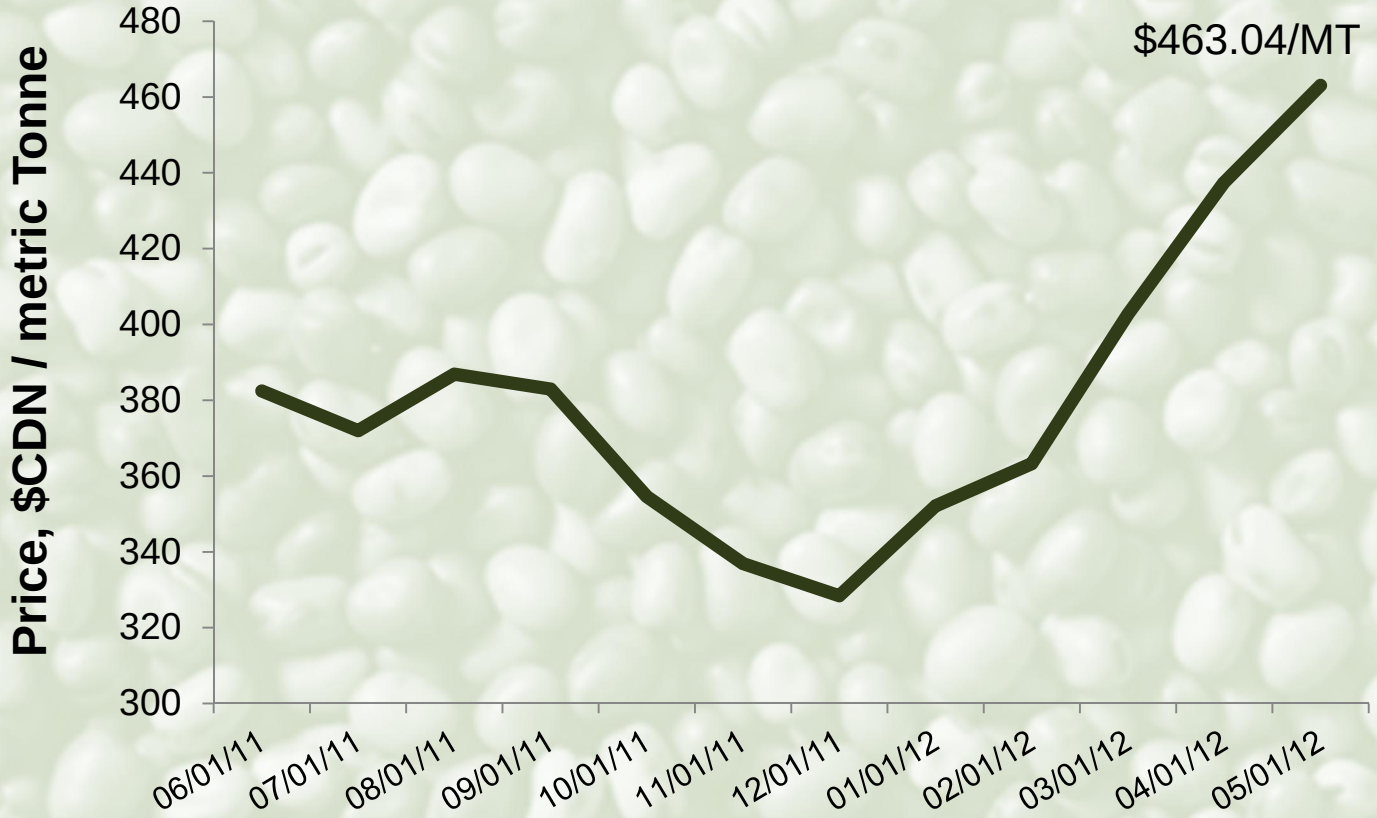
Background (cont'd)

- **Canada imports about half of the soybean meal it uses annually**
  - Works out to 1.2 million metric T
  - Majority is used for poultry feeding



Source: Agriculture and Agri-Food Canada

Figure 2. **Trend in soybean meal prices over the past year in Canada**



Source: CME

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Objectives

1. **Compare nutrient digestibility of:**
   - Lupin *var.* ‘Arabela’
   - Field pea *var.* ‘Cooper’
   - Zero-tannin faba bean *var.* ‘Snowbird’
   - Soybean meal (generic imported)
2. **Digestibility in 15- vs. 29-day old broiler chicks**

METHODS & MATERIALS

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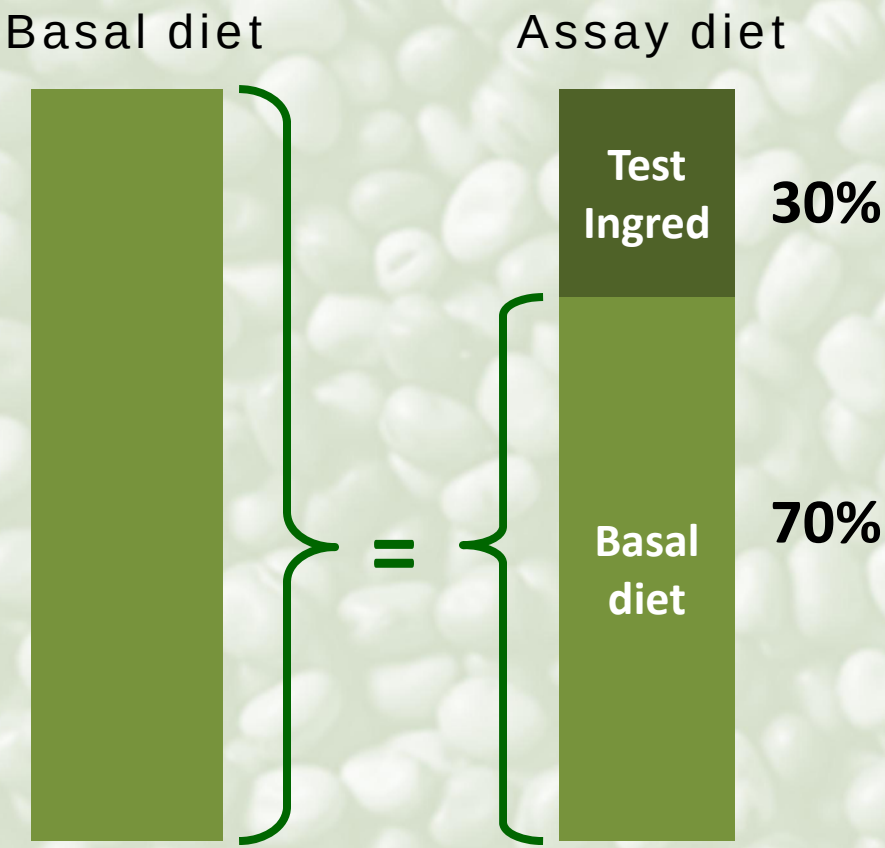
Methods & materials



$$D_{test} = \frac{\left(D_{assay} - D_{basal} \times RC_{basal}\right)}{RC_{test}}$$

D_x = digestibility
RC_x = relative contribution

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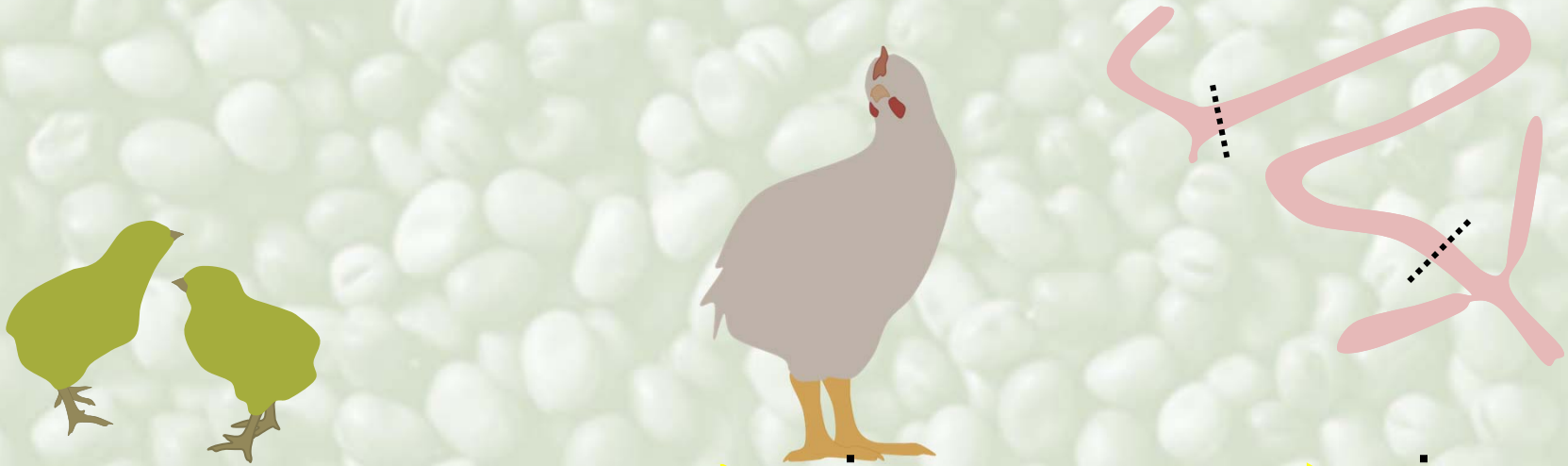
Table 1. **Ingredient composition of basal diets**

Ingredient	d 15 Basal	d 29 basal
Wheat	66.55	66.22
Corn	15.91	15.19
Canola Oil	6.63	8.81
Fish Meal	3.68	3.67
Dicalcium Phosphate	1.54	1.27
Limestone	1.28	0.93
Vitamin Mineral Premix	1.30	1.30
Salt (NaCl)	0.25	0.25
Celite	2.00	2.00
L-Lysine HCl	0.37	0.02
D, L - Methionine	0.31	0.28
L - Threonine	0.12	
Enzyme	0.05	0.05

Table 2. **Analyzed composition of test ingredients**

Nutrient	Soybean meal	ZT Faba bean	De-hulled lupin	Field pea
Dry matter, %	89.41	90.23	91.06	90.27
Crude protein, %	48.15	33.92	35.45	26.12
Crude fibre, %		7.84	4.70	4.22
Lysine, %	2.92	1.93	1.68	1.80
Methionine, %	0.66	0.32	0.27	0.29
Met + Cys, %	1.24	0.71	0.58	0.62
Arginine, %	3.36	2.94	3.07	2.11
Threonine, %	1.81	1.15	1.28	1.12

Methods & materials (cont'd)



Methods & materials (cont'd)

- **Test diets and basal diet fed to cages of 13 male Ross 308 broilers**
  - 8 replicate cages per treatment in a RCB design
- **Digesta/excreta pooled to yield 1 sample of each per test cage**

Methods & materials (cont'd)

- **Digestibility coefficients in test ingredients were then compared using PROC MIXED of SAS (9.1)**
  - Pulse, age and 2-way interaction as fixed effects
  - Feed intake as a covariate (excluded unless significant)
  - Block as random term

RESULTS

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Table 3. **Effect of pulse x age on apparent total tract digestibility of dry matter and gross energy.**

	Soybean meal		ZT Faba bean		De-hulled lupin		Field pea	
	15d	29d	15d	29d	15d	29d	15d	29d
Dry matter	72.12^{b}	77.76^{b}	73.20^{b}	62.64^{c}	54.02^{d}	59.31^{cd}	59.56^{cd}	87.71^{a}
Gross Energy	72.32^{b}	83.96^{a}	73.10^{b}	67.67^{bc}	54.65^{e}	63.29^{cd}	59.60^{de}	89.63^{a}

Table 4. **Apparent ileal digestibility (%) of crude protein and essential amino acids in soybean meal and selected pulse crops.**

	Test ingredients					*P* - value
	Soybean Meal	Faba Bean	Lupin	Field Pea	SEM	Ingr
Crude protein	79.8^{a}	79.5^{a}	81.4^{a}	69.2^{b}	1.3	**0.001**
Arginine	83.8^{b}	87.3^{a}	87.7^{a}	76.9^{c}	1.2	**0.001**
Histidine	82.0^{a}	81.4^{ab}	77.5^{b}	65.8^{c}	1.5	**0.001**
Isoleucine	79.2^{a}	75.5^{ab}	71.5^{b}	58.3^{c}	2.2	**0.001**
Leucine	78.8^{a}	78.3^{a}	78.1^{a}	62.6^{b}	1.7	**0.001**
Lysine	82.9^{a}	82.5^{ab}	78.7^{bc}	76.0^{c}	1.4	**0.003**
Methionine	72.9^{a}	52.3^{b}	41.2^{c}	42.0^{c}	3.2	**0.001**
Met + Cys	47.4	47.1	40.8	36.7	4.0	0.161
Phenylalanine	82.4^{a}	80.6^{a}	79.2^{a}	68.8^{b}	1.5	**0.001**
Threonine	72.1^{a}	67.4^{a}	68.6^{a}	56.8^{b}	1.9	**0.001**
Valine	77.2^{a}	74.0^{ab}	69.5^{b}	57.1^{c}	2.1	**0.001**

Table 4. **Apparent ileal digestibility of crude protein and essential amino acids in broilers at 15 and 29 d of age.**

	Age			*P* - value
	d 15	d 29	SEM	Age
Crude protein	79.5[a]	75.4[b]	1.0	**0.004**
Arginine	84.3	83.6	0.8	0.588
Histidine	77.8	75.6	1.0	0.145
Isoleucine	71.0	71.2	1.6	0.912
Leucine	73.7	75.2	1.2	0.345
Lysine	82.1[a]	78.0[b]	1.0	**0.006**
Methionine	54.6	49.7	2.2	0.129
Met + Cys	46.3	39.7	2.9	0.099
Phenylalanine	77.9	77.6	1.1	0.858
Threonine	62.8[b]	69.7[a]	1.3	**0.001**
Valine	67.6	71.3	1.5	0.091

Conclusions

- **Faba bean and lupin appear to have good AA digestibility for all ages of bird**
  - Similar AID coefficients for most AA as SBM
  - Peas ranked lower for AID of nearly all AAs
  - Sulphur AA's are problematic in pulse crops

Conclusions

- **ATTD coefficients for GE and DM in these ingredients is influenced by age**
  - ATTD of GE higher in older birds except in faba beans
  - Difference was most dramatic for peas

Acknowledgements

Pulse Canada

SASKATCHEWAN pulse Growers

Alberta Pulse Growers

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