

the feed pea FOCUS



PEA OUTLOOK FOR 2007

The pea production outlook for 2007 is optimistic in light of the pressure that biofuel production is putting on the price, and in turn acreage estimates, for canola and other crops. StatsCan estimates¹ 2007-8 field pea production will be 2.8 MMT which, combined with 0.25MMT carry-in, will total a supply of 3.05MMT in western Canada for the coming year. Feed pea price is predicted to increase by \$5/MT to total \$145/MT in '07-'08.

FEED PEA AND FABIA BEAN COMPOSITION FOR DAIRY CATTLE

Feed peas are an excellent quality feedstuff, resulting from an oversupply of edible peas for export markets and from downgrading due to weathering. Zero-tannin faba beans are being developed specifically for use in livestock diets, with the expectation they will provide nutritional improvements over the high-tannin beans studied to date⁴. The nutrient content of these pulses relative to canola meal, soybean meal and rumen microbes is shown in Table 1. The Canadian Grain Commission analyzed 24 pea samples (21.5 - 25.4% CP, DM basis, resp.) and determined the following nutrient means and ranges (% DM basis): crude fat 1.35% (1.0-1.7), ash 2.9% (1.3-3.4), ADF 7.6% (6.5-8.7), NDF 10.0% (9.0-11.2), starch 44.9% (41.6-47.5), lysine 7.7% of CP (7.2-8.2), methionine 1.1 % of CP (0.9-1.4), isoleucine 4.9 % of CP (4.6-5.4), Ca 0.08% (0.06-0.11), and P 0.49% (0.27-0.95)².

¹ http://www.agr.gc.ca/mad-dam/index_e.php?s1=pubs&s2=spec&s3=php&page=spec_2007-02-06

² Wang, N. and Daun, J.K. 2004. Effect of variety and crude protein content on nutrients and certain antinutrients in field peas. *J Sci Food Agric* 84:10211029.

³ Christensen, D. 2006. Milk Rivers Conference. Dairy Production Innovation Technologies. Dnepropetrovsk. Agro-soyuz Corporation. Ukraine.

⁴ Yu, P., Goelema, J.O., Leury, B.J., Tamminga, S. and Egan, A.R. 2002. An analysis of the nutritive value of heat processed legume seeds for animal production using the DVE/OEB model: a review. *Anim. Feed Sci. Technol.* 99:141-176.

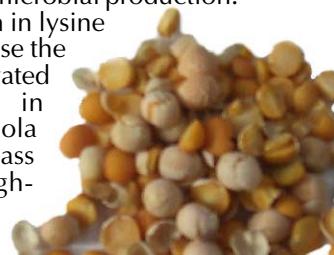
⁵ Lopetinsky et al, 2004. Zero-tannin faba bean nutrient assessment and swine performance trials for Alberta. Project # NIF-2003-031.

⁶ Goelema, J.O. 1999. In: Yu, P. et al. 2002. Ref #4 (above).

Table 1. Chemical composition of field peas, faba beans, canola meal and soybean meal (DM basis)³.

	Peas	Faba Beans ⁴	Canola Meal	Soybean Meal	Rumen Microbes
Crude protein (%)	25.1	30.6	38.9	53.4	62.5
Ether extract (%)	1.5	1.2	3.9	3.4	12.0
Ash (%)	3.7	-	6.8	6.5	4.4
ADF (%)	9.1	11.2	19.1	6.1	-
NDF (%)	18.5	15.2	23.6	10.0	-
Lignin (%)	0.94	0.3	5.7	0.8	-
Starch (%)	52.0	39.3 ⁵	5.8	-	-
Lysine (% of CP)	7.4	4.9	5.77	6.35	7.90
Methionine (% of CP)	1.19	0.7 ⁵	2.20	1.41	2.60
Isoleucine (% of CP)	4.87	4.1 ⁵	4.63	4.55	5.70
Undegraded Protein (% of CP)	22	17.3 ⁶	35	35	-
Calcium (%)	0.12	0.12	0.70	0.38	-
Phosphorus (%)	0.46	0.44	1.20	0.78	-
ME, Mcal/kg	3.42	3.20	2.94	3.42	3.42
NEI, Mcal/kg	2.01	-	1.76	2.01	2.20

In order to support the high performance levels of dairy cows, lactation diets must maximize microbial nutrient synthesis from structural carbohydrates, and meet any outstanding requirements by supplying bypass nutrients directly to the small intestine. Pea and faba bean starch degrades slowly, at a rate similar to starch in corn³, stabilizing rumen pH and promoting a rumen environment favorable to fibre breakdown. Pea and faba bean protein degrades rapidly in the rumen, providing the soluble nitrogen required to maximize rumen microbial production. However, peas and faba beans are rich in lysine and isoleucine and, if treated to increase the bypass potential of the protein, elevated levels of pulses could be used in combination with methionine-rich canola meal (see Table 1) to also meet the bypass amino acid requirements of high-producing dairy cows.



PERFORMANCE TRIALS

Canadian dairy performance trials have shown that peas support excellent levels of production over a wide range of inclusion levels and processing techniques (Table 2). The palatability of peas was excellent, and inclusion did not reduce intake in any of the trials. Researchers indicated that peas supported excellent performance, if diets were formulated to meet bypass protein requirements by including a complimentary source of less soluble protein (Christensen, 2006). A combination of cereal and protein sources were replaced in the control rations (see Table 2), due to the starch that peas contained.

Table 2. Fat-corrected milk performance from dairy trials utilizing peas processed using various techniques.

Author (Control ration)	Dietary Peas (%)	FCM Prodn (kg/d)	Pea Processing
Corbett et al (1995) ⁷	0	27.4	N/A
(Barley/CM/SBM)	25*	27.8	Pelleted
Petit et al (1997) ⁸	0	31.1	N/A
(Corn/soy)	20.2	30.6	Cracked
	20.2	30.0	Ground, extruded
Jackman (2001) ⁹	0	43.1	N/A
(Barley/soy)	10.6	43.3	Coarse rolled
	10.6	41.8	Micronized (125°C 60s)

* 25% of ration concentrate for this trial only.

HEAT TREATING TO INCREASE BYPASS PROTEIN AND STARCH

Rumen degradable protein supplied in excess of that required by rumen microbes will be lost to the environment through deamination and excretion. This limits the inclusion level of rapidly degradable pulses in dairy cow rations. However, work in Europe⁶ and Australia^{10, 11}, has shown that peas and faba beans can be heat treated to increase their rumen bypass protein and starch values, making them suitable for inclusion at higher levels in dairy rations. Results from pressure toasting work involving peas, faba beans and full fat soybeans are outlined in Table 3.

Table 3. Rumen undegradable protein and starch characteristics of pulses following toasting for various times and temperatures (particle size=3mm)^{8, 11}.

Toasting (OC/min)	Rumen Undegradable Protein (%)			Rumen Undegradable Starch (%)	
	Pea	Fababean	FFSB*	Pea	Fababean
0/0	21	17.3	27.7	11.5	8.1
100/7	24.3	17.5	34.2	10	6.2
136/3	44.4	40.6	40.8	25.4	10.7
136/7	49.6	46.7	42.9	28.5	12.4
136/15	53.7	53.4	43.3	39	15.3

* Full - fat soybeans.

Dry roasters, used to reduce the trypsin inhibitor content of fullfat soybeans in southern Manitoba, commonly treat seed at 146°C for 40 minutes¹². These conditions are similar to those used by Yu (1999)¹⁰, where dry roasting for 45 minutes at 150°C resulted in 43% of the protein becoming ruminally undegradable, a significant increase from 11% of protein bypassing the rumen in raw faba beans. There is no data available on dry roasting peas.

CAN PARTICLE SIZE AFFECT BYPASS VALUE?

Studies suggest that particle size may affect the bypass potential and total tract digestibility of pulses. Rolled peas, lupins and faba beans (3.2, 3.9 and 4.25mm roll gap, resp.), blended in a 1:1:1 ratio, had a large particle diameter with bypass protein and starch contents exceeding the 21-25% (resp.) of total content previously reported (Table 4).^{6,10} Pelleting of the blended pulses significantly reduced the particle size, as well as the bypass protein and starch content of this mixture (P<0.001).

Table 4. Effects of particle size on the bypass protein and starch content of pulse seeds¹³.

	Process	Particle Diameter	Bypass Protein	Bypass Starch
Goelema ¹³	Rolled	89%>2.5mm ^a	64.7 ^a	78.4 ^a
	Rolled, pelleted	57%>2.5mm ^b	28.9 ^b	37.9 ^b

^{a, b} Means in the same column with different superscripts differ (P<0.001).

⁷Corbett, R.R., Okine, E.K. and Goonewardene, L.A. 1995. Effects of feeding peas to high-producing dairy cow. *Can. J. Anim. Sci.* 75:625-629.

⁸Petit, H.V., Rioux, R. and Ouellet, D.R. 1997. Milk production and intake of lactating cows fed raw or extruded peas. *J. Dairy Sci.* 80:3377-3385.

⁹Jackman, J. A., 2001. Processing of feed protein sources to improve milk yield and composition in dairy cows. M.Sc. Thesis. 103pp. University of Saskatchewan, Saskatoon, Canada.

¹⁰Yu, P. 1999. PhD. Thesis. In: Yu, P. et al. 2002. Ref #4 (above).

¹¹Yu, P. 1995. MSc. Thesis. In: Yu, P. et al. 2002. Reference #4, above.

¹²BBF Enterprises, personal communication.

¹³Goelema et al 1999 Effects of pressure toasting expander treatment and pelleting on in vitro and in situ parameters of protein and starch in a mixture of broken peas, lupins and faba beans. *Anim. Feed Sci. Technol.* 78:109-126.



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