Alberta Dairy Management
PREPARED FOR AND DISTRIBUTED BY THE DAIRY EXTENSION ADVISORY GROUP

Feeding Peas to Lactating Cows

Peas have not been widely used in diets for dairy cattle, partly because of cost and partly because of lack of information on the their nutritive attributes. Recent Alberta feeding trials and research on the rumen degradability of peas have shed more light on their potential use in lactating rations.

University of Alberta trial

Pea protein has been successfully substituted for soybean protein in diets fed to late lactation cows in a study conducted at the University of Alberta. The soybean meal diet was formulated to satisfy the nutrient requirements of a Holstein cow weighing 600 kg and producing 22 kg of 3.5% fat milk at 200 days in lactation. A TMR consisting of 25% alfalfa silage, 25% brome grass silage and 50% concentrate was fed ad libitum twice daily. Four different 18.6% crude protein concentrates were used in which pea protein replaced soybean protein at 0, 33, 67 and 100%. Barley was the major grain source. Daily milk production, 4% fat corrected milk (FCM) production and dry matter intake were not affected as the level of peas was increased (table 1).

	PEA PROTEIN %			
	0	33	67	100
	---------- kg/day ----------			
Milk Yield	20.7	22.0	21.4	21.7
4% FCM	20.2	21.8	21.9	20.7
DM Intake	21.2	21.5	21.9	21.6

Table 1 : Effect of substitution of pea protein for soymeal protein on milk production and dry matter (DM) intake in late lactation cows.

Field trial

A field trial was initiated in Alberta in a high producing herd to see if practical rations could be formulated using peas as a protein source while maintaining peak milk yield as well as average production. Two 18.5% crude protein concentrates were formulated to contain similar amounts of bypass protein using meat meal and distillers grains. Soybean meal and canola meal were used in the control ration while the test ration contained 25% peas. Barley was the grain used in both mixes. The concentrates were fed through a computer controlled feeder according to level of milk production. A 50% alfalfa silage, 50% whole plant barley silage mixture was fed free choice along with 2.3 kg of alfalfa hay per cow daily.

Average production for the herd ranged between 32 and 34 kg for the 6 month duration of this experiment. Milk yield peaked at approximately 60 days and did not appear to differ between the two concentrate groups (figure 1). Persistency of milk production did not appear to be affected by concentrate source. There was a tendency for higher butter fat content in the milk of animals fed peas. This tendency for higher fat test may be due to changes in ruminal volatile fatty acid concentrations associated with feeding peas. Both test groups contained 40% or more first lactation animals. The results of this trial indicate that peas can be used in properly balanced rations in fed to high producing animals. In high producing dairy cows, the use of peas should be limited only by the cost of providing adequate bypass protein.

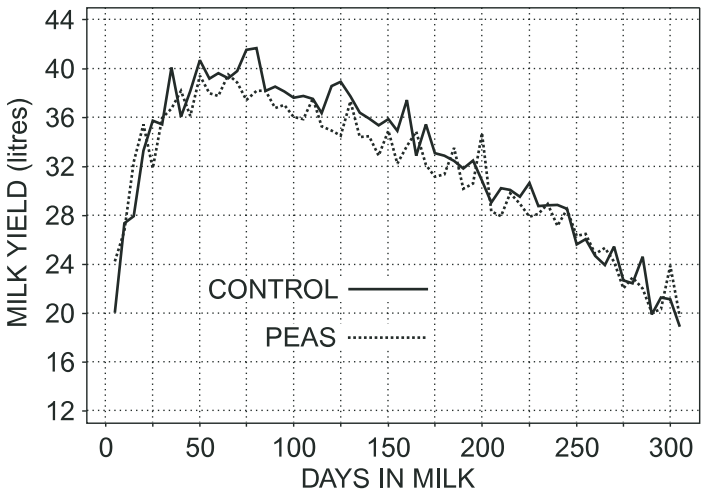

Figure 1 : Milk production of cows fed a pea based concentrate compared with control cows fed a canola/soymeal based concentrate.

Rumen Degradability

Peas, like other legume seeds, are characterized by their highly degradable protein and slowly degradable starch. The protein in peas is completely digested by ruminant animals. Pea protein is highly soluble with a low rumen escape or bypass protein content. NRC assigns a bypass protein content of 22% of crude protein (CP), based on 4 measurements. This appears to be reasonable, based on work at Agriculture Canada's Lethbridge Research Centre and the University of Alberta. Approximately 40% of the CP in peas is soluble.

Since pea protein is completely degraded by ruminants, this suggests that the non-soluble, slowly degradable fraction represents about 38% of CP. The initial degradation rate of the slowly degradable protein fraction appears to be much slower than for soybean meal. The pea protein disappearance rate was approximately 1.6% per hour compared to 4.5% for soybean meal after 6 hours of rumen incubation time. This relatively slow rate of degradation has been observed in other studies. Degradation rate from 6 to 12 hours appears to be similar to soybean meal. This may be advantageous in providing a more sustained release of nitrogen for rumen microbial growth.

The energy content of peas is similar to corn and wheat (see table 2). The starch content of peas ranges from 41 to 54% of the dry matter with approximately 50% of this being soluble. The non-soluble, rumen degradable fraction is characterized by its slow degradation rate. In high concentrate diets, the ruminal degradation rate of pea starch is similar to corn and much slower than wheat, oats or barley. A slow starch degradation rate would help control rumen pH especially in animals that are fed large amounts of grain. Fibre digestion is depressed at a rumen pH below 6.0 which contributes to reduced dry matter intake, butterfat depression and increased digestive disturbances. This may also explain why high producing cows fed high grain diets tended to have higher butterfat percentage in their milk when peas comprised a significant proportion of the concentrate.

COMPONENT	TYPICAL VALUE	
Bushel Weight	64	lbs/bushel
Dry Matter	10.0	% of wet feed
Crude Protein	23.4	% of Dry Matter
Soluble Protein	40.0	% of Crude Protein
Bypass Protein	22.0	% of Crude Protein
Acid Detergent Fibre	8.2	% of Dry Matter
Neutral Detergent Fibre	17.7	% of Dry Matter
Starch	54.0	% of Dry Matter
Net Energy for Lactation	1.81	Mcal/kg Dry Matter
Fat	1.3	% of Dry Matter
Ash	3.3	% of Dry Matter
Calcium	0.11	% of Dry Matter
Phosphorus	0.41	% of Dry Matter
Potassium	1.01	% of Dry Matter
Magnesium	0.12	% of Dry Matter

Table 2 : Typical composition and nutrient values for high bushel weight feed peas.

Processing

No research has been reported in the scientific literature on the effect of processing on the nutritive quality of peas for ruminant animals. Given the large kernel size of peas, it is questionable whether peas require processing before being fed. In spite of this lack of information, it would seem reasonable that peas be processed and that processing methods which minimize particle size reduction be used. Coarse grinding or rolling are the most common processing methods currently employed.

Peas are usually ground before incorporation into pelleted feeds. Inclusion of peas in pelleted concentrates generally improves pellet quality, resulting in more durable pellets with less fines produced with mechanical handling. Steam flaking of peas has been shown to have no effect on degradability of protein or on gelatinization of starch. Steam processing of cereal grains usually causes the starch to gelatinize resulting in increased extent and rate of starch degradation in the rumen. Extrusion of peas has resulted in gelatinization of the starch with resulting increases in the rate and extent of its ruminal degradation. Extrusion has also resulted in a 50 to 75% reduction in protein solubility, and ruminal degradation rate. An extrusion temperature of 140 ˚C appears to be adequate as higher temperatures failed to result in further improvements in protein degradation characteristics. Total tract digestibility of pea protein was not changed by extrusion.

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