Dairy Research Summary

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Faba Bean (Rolled or Ground) Inclusion in Dairy Cow Diets: Effect on Digestion and Milk Performance

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Why is this important?

Soybean meal (SBM) is one of the main protein sources in the diet of high-producing dairy cows due to its high protein concentration and balanced amino acid profile. However, demands for alternatives to SBM are increasing due to high feed prices and lack of availability in some areas. Legume seeds may be a good alternative to SBM (as a protein source) and cereal grains (as an energy source) due to their relatively high protein and starch content. Faba bean offers the potential to be a practical alternative to SBM as a protein source and also contains a substantial amount of starch, which makes it an excellent source of energy and offering the potential to replace cereal grains, such as corn or barley in dairy cow diets. As particle size greatly impacts the degradability and availability of protein or starch, it stands that rolling or grinding faba beans may positively impact nutrient availability.

The objective of this study was to determine the effect of replacing SBM with ground or rolled faba bean in the diet of lactating cows on digestion, milk performance (production and composition), and methane emissions.

What did we do?

Nine multiparous Holstein cows were used in this study. The cows averaged 121 DIM at the start of the experiment and had a milk yield of 41 kg/d. Cows were fed a TMR consisting of 59% forages (alfalfa silage, corn silage, and timothy hay) and 41% concentrate. Soybean meal and corn grain were either completely or partially replaced with either rolled or ground faba bean. The diets were formulated to contain the same levels of protein and energy, regardless of the feedstuff used. Rolled faba bean was processed using a roller mill, while ground faba bean was processed using a hammer mill.

Cows were milked 2x/d and milk samples were taken for further analysis. Feed intake, digestibility, nitrogen excretion, milk production, milk composition, rumen fermentation characteristics, and methane production were measured.

Table 1. Ingredient composition of the experimental diets.

Ingredient (% of DM)	Control	Ground FB	Rolled FB
Alfalfa silage	35.4	35.3	35.3
Corn silage	20.2	20.2	20.2
Corn grain, ground	24.0	16.2	16.2
Soybean meal	9.2	0	0
Ground FB	0	17.1	0
Rolled FB	0	0	17.1
Beet pulp	3.73	3.72	3.72
Timothy hay	3.50	3.50	3.50
Corn gluten feed	1.88	1.87	1.87
Min/vit supplement	1.65	1.65	1.65
Calcium carbonate	0.51	0.51	0.51

[1]FB = faba bean

What did we find?

It is worth noting that faba bean is lower in protein compared to SBM (30.2 vs. 52.0%) and starch concentration is lower in FB than in corn grain (30.7 vs. 70.2%). That said, intake of dry matter (25.8 kg/d), protein, fibre, starch, and gross energy were similar between the experimental diets. Likewise, digestibility was not affected by the dietary treatment. However, digestibility of protein was higher for cows fed ground faba bean compared to rolled faba bean. There was a very slight reduction in ruminal pH in cows fed rolled faba bean vs. those fed the control diet (6.20 vs. 6.09; *P*=0.07).

Table 2. Milk yield and composition of cows fed diets with or without ground or rolled faba bean (FB).

	Control	Ground FB	Rolled FB
Yield (kg/cow/d)	36.5	35.8	36.0
Milk composition			
Fat (%)[4]	3.92	3.90	3.90
Protein (%)[5]	3.42	3.40	3.39
Lactose (%)[6]	4.50	4.52	4.49

As seen in Table 2, dietary treatment had no effect on milk production and milk composition. Feed efficiency was similar between cows for all dietary treatments (1.41 kg of milk / kg of DMI). The amount of nitrogen excreted in feces or urine was not different between cows fed faba bean and those fed the control diet.

The amount of methane emitted daily by cows averaged 539 g/d and was not affected by the experimental diet.

What does it mean?

This study demonstrated that rolled or ground faba bean may be successfully used in dairy cattle rations as an alternative to soybean meal and as a partial replacement for corn grain (with potential to replace other cereals, such as barley). The researchers found no negative impacts of using faba bean in dairy cattle rations on feed intake, milk production, nitrogen excretion, and methane emissions. In an age where environmental impact of a dairy operation and the contribution to greenhouse gas emissions are on the radar, these latter two results are positive.

Producers should consider diversifying their crop rotations (if producing their own feed) in an effort to improve soil and crop health and reduce crop disease. Including legumes, such as faba bean, in the rotation plan can further aid soil health through its ability to fix nitrogen in the soil.

Finally, studies have found that faba bean can be used in dairy cattle rations as a grain (such as this study) or as whole plant silage, offering producers variety of use for this crop in addition to the environmental benefits. Depending on feed availability and pricing in a given area, this may offer further benefit to a producer's bottom line, as utilizing faba bean as a grain or a silage could reduce feed costs.

Summary Points

- Producers in Canada often use soybean meal as a protein source and corn grain as an energy source in their dairy cattle rations.
- Faba bean, either rolled or ground, offers an alternative to these other sources with excellent protein and starch levels.
- Inclusion of either rolled or ground faba bean in dairy cattle diets resulted in no negative impact on feed intake, digestibility, milk production or composition, nitrogen excretion, or methane emissions.
- Introducing faba bean into crop rotations allows producers to take advantage of attractive pricing and the nitrogen-fixing capability of legumes to improve soil and crop health.

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