Alfalfa Leaf Meal: Evaluation as a Hay Replacement in Dairy Diets

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Introduction

Alfalfa leaf meal (ALM) is a new feed ingredient that may become available to the dairy industry in the near future. A farmer cooperative has been organized in southwest Minnesota to produce alfalfa hay for use in a biomass electricity project. The concept is to produce electricity by gasification of the stems from alfalfa hay. The leaves will be separated from the hay prior to combustion to reduce nitrous oxide pollution and provide another source of revenue to the project. The ALM may be a valuable feedstuff for inclusion in dairy diets. Because the initial batches of ALM were relatively low in protein and high in fiber, a trial was conducted investigating partial replacement of forage in lactating cow diets with ALM. The advantage of replacing alfalfa hay with ALM might be the assurance of consistency in the quality of the product and ease of handling when incorporated in TMR diets. But because the particle size of ALM is inherently fine in comparison with long or chopped hay, it was not known what effect replacing hay with ALM would have on rumen function and, thus, on milk yield and composition. A study was conducted to evaluate the effect of partial substitution of good quality chopped alfalfa hay with ALM pellets of similar composition on milk yield, milk composition, and rumen function.

Materials and Methods

Eighteen multiparous cows were used in a replicated 3 x 3 Latin square design. Treatments consisted of diets in which ALM partially replaced chopped alfalfa hay. Alfalfa leaf meal used in this study was in the form of pellets and contained 23.6% crude protein (CP) and 44.5% neutral detergent fiber (NDF). The alfalfa hay contained 22.0% CP and 43.9% NDF. Treatment diets contained 0, 8 or 16% ALM pellets. Diets were fed twice a day, ad libitum. The study consisted of 3 experimental periods with 11 to 14 d for adaptation to dietary treatments and 5 to 7 d for data collection. Feed intake and digestibility, and milk yield and composition were measured. The impact of feeding ALM pellets on rumen function was assessed by monitoring eating and chewing activities of cows for 24 h at the end of each experimental period.

Results and Discussion

Chemical composition of the diets was similar across treatments (Table 1). Dry matter (DM) intake of cows fed a diet containing ALM pellets at 8% of the diet DM were similar to those of cows fed no ALM pellets (Table 2). However, when cows were fed ALM pellets at 16% of the DM, dry matter intake tended to decrease compared with cows fed no ALM pellets, and was significantly reduced compared with cows fed ALM pellets at 8% (Table 2). Digestibility of diet DM and fiber was not significantly affected by treatment (Table 2), suggesting that partial substitution of ALM pellets for hay did not affect rumen fermentation. Also, feeding ALM pellets in partial replacement of good quality hay had no effect on milk yield or milk composition (Table 3). Replacing alfalfa hay with ALM pellets did not affect the time cows spent eating (Table 4). However, the time cows spent ruminating decreased as the amount of ALM pellets in the diet increased. Conversely, the time spent resting (not eating or ruminating) increased as the proportion of ALM pellets in the diet increased. This observation could be interpreted to suggest that ALM pellets may not be equivalent to chopped alfalfa hay for stimulation of rumination. However, in this experiment, DM and NDF digestion were not affected by treatment (Table 2) and milk fat test was not different across treatments (Table 3). In addition, pH measurements indicated that regardless of the diet fed, rumen pH did not drop below 6 (data not shown) and stayed within the range of values where fiber digestion is not greatly compromised. Also, total volatile fatty acid production and the ratio of acetate plus butyrate to propionate did not decrease when two rumen cannulated cows were fed the diets containing ALM (data not shown).

Conclusion

The results of this study suggest ALM pellets can be included in the diets of dairy cows up to 16% of the

DM in replacement of an equivalent amount of high quality alfalfa hay without compromising production or rumen health. However, these results should not be interpreted to suggest ALM could totally replace all hay in dairy cow diets. It is not known if ALM in the form of meal rather than pellets could partially replace alfalfa hay and, because this was a short trial, the impact of extended ALM feeding in replacement of hay on rumen function, body condition, and milk production is still unknown. However, it does appear that ALM may have a role in dairy rations as a partial replacement for alfalfa hay.

Table 1. Composition of experimental diets.

	Alfalfa leaf meal, % of diet DM		
Item	0	8	16
Ingredient Composition:	- - - - % of diet DM - - - -		
Corn silage	25.8	26.0	26.0
Alfalfa hay, chopped	25.9	18.5	11.2
ALM pellets	—	7.9	15.8
Grain mix	48.3	47.6	47.0
Chemical composition[1]			
CP	18.8	18.7	18.6
NDF	31.2	31.4	31.7
ADF	16.8	17.1	17.4
EE	3.4	3.4	3.5
NFC	37.4	37.0	36.5

[1]CP (crude protein), NDF (neutral detergent fiber), ADF (acid detergent fiber), EE (ether extract), and NFC (non-fiber carbohydrates).

Table 2. Effects of feeding alfalfa leaf meal on intake, and dry matter and fiber digestibility.

	Alfalfa leaf meal, % of diet DM				
Item	0	8	16	SE	*P*
Dry matter intake, kg/d	27.9[ab]	29.3[a]	26.7[b]	0.60	0.04
DM digestibility, %	66.4	65.8	65.0	0.95	0.57
NDF digestibility, %	51.0	52.3	52.7	1.52	0.72

[a, b]Means in the same rows not sharing a superscript differ at $P \leq 0.05$.

Table 3. Yield and composition of milk from cows fed alfalfa leaf meal in partial replacement of alfalfa hay.

	Alfalfa leaf meal, % of diet DM				
Item	0	8	16	SE	*P*
Milk, kg/d	38.8	39.7	39.5	0.66	0.56
Fat, %	3.69	3.49	3.64	0.08	0.34
Protein, %	3.10	3.03	3.07	0.03	0.47
Lactose, %	4.77	4.72	4.75	0.06	0.78

Table 4. Eating and chewing activities of cows fed diets containing alfalfa leaf meal pellets partially replacing chopped alfalfa hay.

	Alfalfa leaf meal, % of diet DM				
Item	0	8	16	SE	*P*
Time spent eating, min.	208	213	203	5.5	0.49
Time spent chewing, min.	448[a]	425[a]	381[b]	9.0	< 0.01
Time spent resting, min.	646[b]	659[b]	719[a]	9.0	< 0.01

[a, b]Means in the same row not sharing a superscript differ at $P \leq 0.05$.