Comparing Forage Sources in Dairy Rations Containing Similar Neutral Detergent Fiber Concentrations

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Introduction

The NDF-Energy Intake System indicates that differences among forages will have little impact on intake and milk production when dairy rations are formulated to contain the same NDF concentration. This system implies that differences in forage quality can be compensated by changes in the forage to concentrate (F:C) ratio of the ration. Although NDF can differ in rate and extent of digestion, the NDF-Energy Intake System predicts that these effects are insignificant in relation to the ratio of fiber to nonfiber that is present in the ration. In effect, the system replaces fiber in the forage with nonfiber from concentrates to maintain a constant NDF intake when forage quality varies. It assumes that differences between fiber and nonfiber are critical and that differences within fiber or nonfibrous carbohydrates among sources are less important.

The system predicts that, if forage quality is different among forages and rations are formulated for a constant F:C ratio, rations with lower NDF will yield greater performance than those with higher NDF concentrations. Conversely, it predicts that, if F:C ratios are varied so that rations are formulated to contain the similar NDF concentrations, they will result in equivalent milk production irrespective of forage source. This study was designed to test this hypothesis.

Methods

Sixty Holstein cows, averaging 90 days in lactation and 35.1 kg milk/d, were blocked by parity and initial milk production and assigned to rations containing sorghum x sudan hybrid (SS), orchardgrass (OS), alfalfa (AS), wheat (WS), or corn (CS) silage. Cows were fed a covariate ration containing a mixture of all silages for 2 weeks followed by their assigned ration for 12 weeks. Total mixed rations contained approximately 8% roasted soybeans to insure that protein quality and quantity were not limiting production. They were formulated to have 31% aNDF and 18% crude protein (CP) using high moisture corn and soybean meal and contained between 30.3 and 31.4% aNDF and 17.7 to 19.1% CP based on analysis (Table 1). Samples of forage were taken daily and composited weekly for analysis. Dry matter (DM) was determined by oven drying at 55°C for 48 h, which approximates dry matter determined by toluene distillation, for measuring DM intake or oven drying at 105°C for expressing chemical composition. Crude protein was determined by the Kjeldahl method and NDF was determined using sodium sulfite and heat-stable amylase, and after ashing of residues (aNDF).

Results and Discussion

There were no differences in milk production ($P < .90$) among forage sources over the entire trial (Table 2), although there was a week by source interaction (corn silage resulted in higher production initially and orchardgrass resulted in higher production later in the trial). Because cows were blocked by milk production and parity, there were differences in milk composition and intake among treatment groups during the covariate period. Thus, milk composition ($P < .10$) and average intake ($P < .40$) did not differ among treatments (Table 2). Intake of concentrates varied from 8.0 kg/d for the corn silage ration to 12.8 kg/d for the wheat silage ration with no difference in milk production. This indicates that concentrates can be substituted for forages in rations to adjust diets for differences in forage quality

Conclusion

It appears that forages of differing qualities can result in equal performance if fed in rations that are formulated to contain similar NDF. Rather than feeding a fixed F:C ratio, it is recommended that dairy rations be balanced for NDF concentration to adjust for differences in forage quality. Optimum production of 4% fat-corrected milk can be achieved when feeding a variety of forage sources by balancing rations to obtain an aNDF intake of 1.1 to 1.2% of body weight per day.

Table 1. Chemical composition of the different forage sources.

Component	Sorg x Sudan silage	Orchardgrass silage	Alfalfa silage	Wheat silage	Corn silage
Forages:					
Dry matter	40.2	44.8	57.9	51.7	42.1
Crude protein	12.8	15.5	17.2	10.2	8.3
aNDF[1]	54.8	48.4	45.2	54.4	41.6
Rations:					
Dry matter	55.0	57.4	64.9	64.2	57.6
Crude protein	18.5	17.7	17.7	19.0	19.1
aNDF[1]	31.0	31.1	31.4	30.3	30.5
Forage (% DM)	44.2	51.5	57.2	43.6	63.6

[1]Amylase treated, ash-free, neutral detergent fiber

Table 2. Production responses of dairy cows fed rations containing similar neutral detergent fiber (aNDF) from different forage sources.

Variable	SorgXSudan silage	Orchardgrass silage	Alfalfa silage	Wheat silage	Corn silage
Body weight (kg)	586.4	609.1	592.7	625.1	608.5
Dry matter intake (kg/d)	22.0	23.3	23.6	22.7	22.0
Milk production (kg/d)	32.4	33.7	33.6	33.5	34.6
Milk fat (%)	3.6	3.8	3.6	3.4	3.5
Milk protein (%)	3.1	3.1	3.0	3.0	3.1
Body weight change (kg/d)	.14	.09	.24	.10	.16