Comparison of Ground Shelled Corn and High Moisture Ear Corn of Two Particle Sizes for Their Effects on Milk Production and Rumen Fermentation When Cows Are Fed Green Chopped Grass-Legume Forage

F. San Emeterio, R.B. Reis, L.D. Satter and D.K. Combs

Introduction

Supplemental feed is required to achieve maximum profitability under most grazing conditions in the United States. Relatively little research has been done to identify optimum supplements for feeding programs based on green chopped or grazed forages. The objective of this study was to evaluate the effect of moisture and particle size of supplemental corn on milk production, milk composition, dry matter intake, and rumen fermentation when green chopped forage was fed.

Materials and Methods

Six primiparous and three multiparous Holstein cows averaging 120 and 180 days in milk, respectively, at the beginning of the trial were fitted with rumen cannulas and arranged in a 3 x 3 Latin square design replicated three times. Periods were 21 days, 15 days for adaptation and 7 days for sampling. Cows were fed 4x daily at 6 hr intervals. Feed bunks were cleaned prior to each feeding. The forage was green chopped from a mixed grass-legume pasture managed similar to an intensive rotational grazing situation. Green chop rather than grazed forage was used so an accurate measure of feed intake could be made. Pasture was chopped daily, hauled to the barn where the animals were located and divided in four parts. One part was fed to the cows immediately, and the other three parts were stored at 4 ^{o}C in individual mesh bags for the next three feedings. Average forage composition throughout the experiment was: DM-22.5%; CP-21.8%; NDF-35.4%; and ADF-24.1%.

The corn based concentrate was fed four times daily, about 30 min after the forage was offered. A total of 10 kg of concentrate DM was fed daily. The grain mix contained (DM basis) 92% corn, 6.5% soybean meal, and 1.5% of a vitamin-mineral mix. Chemical composition of the grain mix (DM basis) was CP-12.0%; NDF-10.7%; and ADF-2.7%. The ratio of forage:grain in the feed consumed was approximately 53:47.

The treatments were dry ground shelled corn (mean particle size of 1.25 mm) (DC); coarsely ground high moisture ear corn (mean particle size of 3.14 mm) (HC); and medium ground high moisture ear corn (mean particle size of 2.22 mm) (HM). Measurements made were dry matter intake, milk production and composition, and ruminal pH, NH_3, and volatile fatty acid concentration. Blood allantoin was measured and used as an indicator of rumen microbial protein synthesis. Ytterbium chloride, cobalt EDTA and chromium mordanted fiber were used as external markers to evaluate rate of digesta passage and starch digestibility.

Results and Discussion

Dry matter intake was not affected by moisture level or particle size of the corn in the supplement. Though not significant, there was a trend toward increased milk yield and milk protein percentage as the particle size of supplemental corn was reduced. Ammonia and total amino acid (TAA) concentration in rumen fluid tended to be higher with the coarsely ground high moisture ear corn than for the other two treatments. Fine grinding of high moisture ear corn improved overall starch digestibility ($P < .001$).

Conclusions

Grinding of corn is a relatively simple and inexpensive procedure that can be effective for increasing starch digestibility. The difference in mean particle size between the two high moisture ear corn treatments in this experiment (3.14 mm and 2.22 mm) may not have been enough to cause sufficient difference in rumen fermentation. Finer grinding may be necessary to see consistent changes in rumen fermentation and milk production measurements.

Table 1. Animal performance, rumen environment, blood allantoin and fecal starch concentration for cows fed green chopped grass-legume forage supplemented with ground shelled corn, or high moisture ear corn of two particle sizes.

	Treatments			
	DC	HC	HM	SEM
Dry matter intake, kg/d	21.4	20.2	20.8	0.46
Milk yield, kg/d	27.5	25.9	26.1	0.83
Milk fat, %	3.45	3.47	3.35	0.07
Milk protein, %	3.52	3.50	3.60	0.03
Ruminal pH	5.84	5.85	5.87	0.03
Ruminal NH_3, mmol	8.46[a]	10.3[b]	8.85[ab]	0.46
Ruminal TAA, mmol	1.31[a]	1.55[b]	1.37[ab]	0.07
Blood allantoin, mg/dl	53.2	57.9	57.3	3.11
Fecal starch, % DM	13.1[c]	14.0[c]	9.42[d]	0.53

[a,b]Means within the same row with different superscripts differ ($P < .05$)
[c,d]Means within the same row with different superscripts differ ($P < .001$)