

Effect of Corn Silage Chop Length on Intake, Milk Production, and Rumen Function in Lactating Dairy Cows

C.S. Kuehn, J.G. Linn and H.G. Jung

Introduction

Particle length of forages is important in the diets of lactating dairy cows because it can impact numerous aspects of rumen function. A minimal amount of long particles is important in the diet to insure proper rumen health by promoting rumination and salivation. Diets with small particles may spend less time in the rumen, resulting in less microbial digestion, but may result in increased dry matter (DM) intake. A reduced chop length of corn silage may improve its digestibility because of increased attachment sites for the microbes. In addition, cracked corn kernels may be rendered more digestible because the starch might be more accessible. The objective of this study was to determine the effects of corn silage chop length on DM intake, milk production, rumen fermentation, and nutrient digestion in mid-lactation dairy cows.

Material and Methods

A 92 to 96 d relative maturity hybrid corn was harvested at a theoretical chop length of .87 cm (L) or .32 cm (S). Approximately five and one-half metric tons of each chop length were packed into a 25 cu m steel refuse container lined with plastic. Corn was allowed to ferment for 28 d before feeding. The Penn State Forage Particle Separator (NASCO, Fort Atkinson, WI) was used to evaluate particle length. Mesh sizes of the top and middle screens were 1.9 and .8 cm, respectively. Smaller material passed through the screens to the collection box. This experiment was conducted as a 2 x 2 Latin square (2 periods and 2 treatments) replicated across 4 blocks. Eight mid-lactation Holstein cows were assigned to blocks according to days in milk and milk production. The DM content of the L and S silages were similar (33.9 vs. 34.7 %, respectively). Chemical composition of the two silages was similar and averaged 9.0, 48.1, and 24.3% for crude protein, neutral detergent fiber (NDF), and acid detergent fiber, respectively. Diets were formulated to contain 40.0 % L or S silage, 37.8% grain mix, 9.9% chopped alfalfa hay, 8.8 %

protein mix, and 3.5% soyhulls on a DM basis. Adaptation periods were 5 to 7 d, followed by 4 d sample and data collections. Chewing activity was monitored at 5 min intervals for a 24 hr period during each period. Two rumen fistulated cows were fed the L diet during period 1 and the S diet during period 2. Rumen fluid samples were taken to observe pH changes after feeding.

Results and Discussion

Particle size distribution of the L silage was 16.5, 57.3, and 26.2% (wet basis) on the top, middle and bottom screens, respectively. The S silage particle size distribution was skewed toward smaller particles (14.5, 37.9, and 47.7% on the top, middle, and bottom screens, respectively). Intake, milk yield, and milk composition did not differ between the L and S silage diets (Table 1), although intake did trend higher for cows fed the S silage diet. Rumen pH of the fistulated cows declined during the first 2-h post-feeding for cows fed both silage chop lengths, but the S silage treatment continued this decline in pH until 4-h post-feeding whereas the L silage treatment cows had already stabilized at 2-h post-feeding (Fig. 1). The ratio of volatile fatty acids (acetate plus butyrate to propionate) showed the same pattern as pH with time after feeding. These rumen measurements suggest that the S silage treatment may have resulted in less rumination and saliva flow to maintain rumen pH at optimal levels. Observations on all cows indicated trends toward less time spent ruminating (431 vs. 427 min/d) for L and S silage treatments, respectively. Similar trends were observed in rumination time per kg of DM and NDF consumed (data not shown); however, rumination times were not statistically different. Digestibility of DM and NDF also tended to be lower on the S silage treatment (76.1 and 68.7% vs. 73.8 and 65.9%, for L and S silages, respectively), but these differences were also not significant.

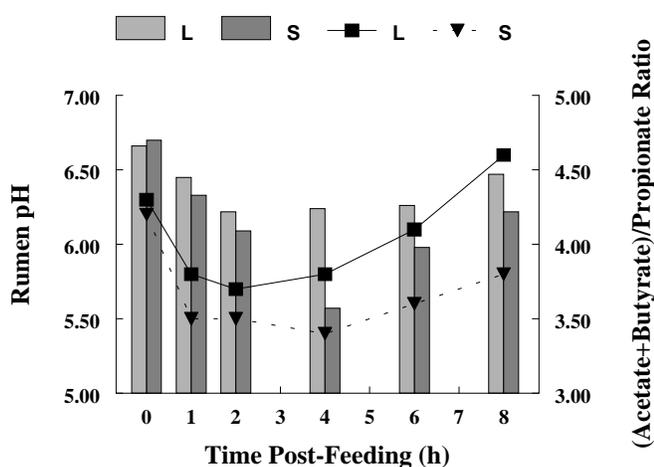


Figure 1. Rumen pH (bars) and volatile fatty acid ratio (lines) for fistulated cows fed long (L) or short (S) chop-length corn silage.

Conclusion

Trends for higher intakes and lower pH in the S diet, as well as higher digestibilities for the L diet, suggest that differences in the chop length of corn silage affects intake and feed digestibility by lactating cows. The short sampling period of 4 d, in addition to low cow numbers, limited the power of this study to detect differences in cow performance and behavior. Further research on corn silage chop length using longer collection periods and more cows is warranted.

Table 1. Dry matter intake, and production of milk, fat, and protein of cows fed long or short chopped corn silages.

Item	Silage Chop Length		Probability
	Long	Short	
	---- kg/d ----		
Dry Matter Intake	26.1	26.8	.14
Milk	29.6	29.1	.25
Fat	1.21	1.20	.91
Protein	1.04	1.02	.45
Lactose	1.42	1.36	.12