



Improving Alfalfa Fiber Digestion Through Extreme Mechanical Processing

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RATIONALE & OBJECTIVES

- Our previous research had shown that intensive mechanical processing of alfalfa haylage increased the rate and extent of dry matter and fiber digestibility.

Objectives:

Develop an impact-shredding processor that was capable of processing wilted alfalfa to a processing level index (PLI) of at least 70%.

Examine the effects of mechanical processing (MP) wilted alfalfa on the lactation performance of dairy cows.

Estimate the economic potential of the MP system through partial budget analysis.

STUDY DESCRIPTION

- Intensive MP ruptures cells and increases surface area for microbial attachment in the rumen, facilitating greater fiber digestion. A lactation study was conducted using 36 Holstein cows assigned to one of two diets in a randomized complete block design with a 2-wk common feeding period, followed by a 6-wk experimental period. The two diets were identical, except for alfalfa harvest technique. Both diets contained 30% alfalfa haylage, 30% corn silage, and 40% concentrate (DM basis). Alfalfa in the control (CON) diet was conventionally harvested while the MP alfalfa was processed using the impact-shredding processor developed for this research. The PLI of the MP alfalfa was 74%. Forage particle-size, animal feeding behavior, feed intake, and lactation performance were quantified.

RESULTS

- A screenless hammermill was developed that processed alfalfa haylage by impact and shredding. The target PLI of greater than 70% was achieved. Alfalfa stems were shredded and fiberized by the MP system (Figure 1).
- Processing reduced fiber length, so the MP material was chopped at 22 mm compared to 10 mm for the CON alfalfa. Final alfalfa particle-size for the MP material was similar to the CON treatment (8.3 vs. 9.1 mm, $P = 0.052$).
- Cows fed the MP diet tended to have less dry matter intake (DMI) (60.1 vs 61.6 lb/day; $P=0.09$) than cows fed the CON diet. Chewing, eating and rumination time was similar for both diets.
- Milk yield was not significantly different between treatments (101.5 (CON) vs. 103.1 (MP) lb/day; $P=0.22$), however, milk fat percentage for cows fed the MP diet was greater than cows fed the CON diet (3.94% vs 3.81% fat; $P=0.02$).

Figure 1. Example of chopped material (right) and processed material (left). Note that processing shreds and fiberizes the stems.



- Because of greater fat percentage, fat-corrected milk (FCM) for cows fed the MP diet was greater than cows fed the CON diet (101.7 vs. 98.7 lb/day, P=0.03). Feed conversion efficiency, defined as FCM/DMI was greater for cows fed the MP diet compared to cows fed the CON diet (1.69 vs 1.60, P=0.003).
- Processing wilted alfalfa is energy intensive, so cost of harvest was estimated to increase by 22% to 45% compared to conventional harvesting.
- Income over feed costs (IOFC) was insensitive to added cost to harvest alfalfa haylage. The IOFC of the MP diet was approximately 1.04 times that for CON diet. As a result, a 500-cow herd would have \$45,500 to \$48,900 greater annual IOFC (Figure 2).

Figure 2. Income over feed costs as impacted by harvest costs for herd fed a diet using conventional (red) or mechanically processed (blue) alfalfa haylage.

