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.

Rationale & Objectives

• 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.