PASTURE AND FORAGES SYMPOSIUM
Forage Processing for Ruminants

17 Processing, mixing, and particle size reduction. A. J. Heinrichs, B. P. Lammers, and D. R. Buckmaster, *The Pennsylvania State University*, College Park.

Adequate forage amounts in both physical and chemical forms are necessary for proper rumen function in the dairy cow. Under conditions where total amount of forage or particle size of the forage is reduced, cows will spend less time ruminating and will have a decreased amount of a more buoyant feed mass in the rumen. These factors reduce saliva production which allows rumen pH to fall below 6.0, depressing cellulolytic bacteria and causing more prolonged period of lower rumen pH level. Insufficient particle size in the diet decreases rumen acetate to propionate ratio and reduces rumen pH. While a reduction in forage particle size increases dry matter intake, it decreases digestibility by decreasing retention time of solids in the rumen. The mean particle size of the diet, the variation in particle size, and the amount of chemical fiber are all important nutritionally for the dairy cow. Defining a fiber amount and distribution are important factors in balancing dairy cattle diets. Since particle size of the diet plays such an important role in digestion and animal performances, it must be an important consideration from harvest through feeding. Forage and TMR particles sizes are potentially reduced in size by all phases of harvesting, storing, taking out of storage, mixing, and deliver of feed to the dairy cow. Forages should not be reduced in particle size beyond what is necessary to achieve minimal storage losses and be accommodated by existing equipment. Forage and TMR particle size as fed to the cows should be periodically monitored to maintain adequate nutrition for the dairy cow.

18 Pre- and post-ensiled processing of corn and sorghum silages. J. H. Harrison[1]*, L. Johnson[1], C. Hunt[2], K. K. Bolsen[3], M. A. Young[3], and K. Shinners[4], *[1]Washington State University Dairy Forage Facility, Puyallup, [2]University of Idaho, Moscow, [3]Kansas State University, Manhattan, and [4]University of Wisconsin, Madison.*

Mechanical processing of whole plant corn or grain sorghum silages can be achieved either pre- or post-ensiling. Common methods of mechanical processing are: 1) an on-board kernel processor mounted on a forage harvester, 2) a recutter screen on a forage harvester, and 3) a stationary roller mill. Processing of corn silage can increase the rate of the ensiling process and reduce dry matter losses during ensiling. Processing corn silage has been shown to improve starch digestion as a result of fracturing the corn kernels, and improve fiber digestion as a result of crushing and shearing of stover and cobs. Improvements in milk production have ranged from .9 to 1.3 kg per d when cows were fed mechanically processed corn silage. The response to processing grain sorghum silage for growing cattle has been dependent on stage of kernel maturity at harvest. Cattle fed post-ensiled processed grain sorghum silages harvested at late-dough or hard grain stages of maturity have had improved rates and efficiencies of gain. In addition, digestibility of starch has been higher compared to unprocessed silages. Fiber digestibilities of grain sorghum silages have not been affected by processing at any stage of maturity. With the advent of mechanical processors, alternative strategies are evident for corn silage and grain sorghum management. A longer harvest window is possible and intentionally harvesting at or near physiological maturity may be desirable.

Key Words: Corn silage, Sorghum silage, Ensiling

19 Mechanical maceration of forages. R. W. Hintz*, R. G. Koegel, and T. J. Kraus, *W-L Research, Inc., Evansville, WI and U.S. Dairy Forage Research Center, Madison, WI.*

Mechanical conditioning of forages has been used for many years to reduce drying time, and decrease the risk of forage quality loss due to rain. Research has shown that high intensity conditioning not only reduces drying time compared to standard conditioning treatments, but can also increase digestibility, feed efficiency and bypass protein concentration of the conditioned forage. High intensity conditioning, also called maceration, splits forage stems longitudinally into long, thin strips, thus increasing the surface area available for evaporation and for attachment by rumen micro-organisms. Various methods of macerating forage are being evaluated by equipment manufacturers for possible commercialization. Because these methods vary in their intensity of conditioning, they will also differ in the extent to which they improve drying rate and increase animal performance. Various methods of maceration and their effects on drying rate and increased digestibility will be discussed. A technique for quantifying the intensity of maceration and prediction of digestibility changes will be presented.

Key Words: Mechanical conditioning, Maceration, Digestibility

20 Economics of forage processing. C. A. Rotz, *USDA Agricultural Research Service, East Lansing.*

Processing to increase the digestibility and available energy from alfalfa, grass, and corn silage forages has received much interest in recent years. An important consideration in the development and adoption of new processing technologies is their potential economic benefit to producers. Many factors must be considered to evaluate the economics of these new processes. Added equipment cost is the most obvious. Processing equipment is intricate, increasing initial costs by $15,000 or more. This intricate equipment also increases repair and maintenance costs. Processing requires more power; thus a larger engine or tractor and more fuel are used. Harvest operations are often slowed which leads to less timely harvest and more labor use. In addition, forage processing interacts with other parts of the farm. Economic benefits are very dependent upon the animals consuming the forage, their diet, and thus their ability to benefit from increased forage digestibility. Crop variety and maturity also affect the improvement in digestibility received. Processing is further influenced by weather, storage methods, and the timeliness of other farm operations. All these factors and their interactions are best evaluated by simulating farms over many years of weather with a computer model called DAFOSYM, the Dairy Forage System Model. Simulation analyses show that improved animal performance attained with maceration and mat processing of alfalfa can return up to $4 for every dollar of increased costs. Preliminary analysis of corn silage processing indicates that the cost of processing can be returned through improved grain digestion in years when corn becomes too mature at harvest. Greater fiber digestibility and dry matter recovery during ensiling further improve animal performance and economic return. Forage processing thus shows potential for improving the profit of animal production systems, but the benefit received is affected by farm size and production methods.

Key Words: Forage, Economics, Simulation