WHY FORAGE FIBER QUALITY IS IMPORTANT

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ABSTRACT

Forages provide the majority of total dry matter fed to dairy cattle, with fiber making up most of weight/volume of the forage. Many of the problems observed in dairy herds are related to inadequate forage intake and/or low quality forage. What is fiber and how is it measured are discussed. The factor that affects quality and yields most of any forage is the stage of maturity at harvest. Fiber level in the ration plays a key role in regulating feed intake and milk production.

Key Words: forage fiber, hay quality

INTRODUCTION

Forages provide approximately 65 percent of the total dry matter fed to dairy cows and 80 percent of that consumed by young dairy stock. As a result, the importance of forage in feeding dairy cattle cannot be overemphasized. Many problems encountered in dairy herd are related to inadequate forage intake and/or low-quality forage. Forage quality refers to how well animals consume forage and how efficiently the nutrients in the forage are converted into animal products.

Fiber is the structural part of a plant that gives form and rigidity. Although technically not a nutrient like protein or energy, fiber is required in ruminant rations to stimulate rumen function.

WHAT IS FIBER?

Fiber is the slowly digested or indigestible material in feeds. Typically, fiber measures the plant cell wall (the structural portions of the plant that give it support). Fiber components of the cell wall, including cellulose, hemicellulose, and lignin, as well as pectin, are digested only by the process of microbial fermentation. In the rumen of dairy cows a thriving population of bacteria, protozoa, and fungi produce enzymes that break the very complex components of the cell wall into smaller molecules such as glucose.

Fiber is the portion of the feedstuff that can limit digestion, requires cud chewing, or rumination for particle size reduction, and occupies space in the rumen because of bulkiness, thus limiting intake. Maintaining normal rumination by feeding adequate levels of fiber in dairy cows' diets avoids low milk fat test, off-feed problems, rumen acidosis, and sore feet. The capacity of the cow's gut for feed places an obvious limit upon how much she will be able to consume, and the higher the content of forage or other fibrous feeds in the diet, the sooner she will approach this limit.

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MEASUREMENT OF FIBER LEVEL IN FEEDS

The three methods used for commonly measuring fiber in feedstuffs include Crude Fiber (CF); Acid Detergent Fiber (ADF); and Neutral Detergent Fiber (NDF). Each of these measurements is found on various feed tags and forage analysis reports. Although they all measure fiber, each method gives different fiber values for one feedstuff. Much confusion can be avoided by knowing exactly which cell wall component is being measured by which method.

Crude Fiber is the oldest method of measuring fiber content and does not accurately measure cellulose, hemicellulose or lignin. The acid in the process dissolves hemicellulose, while the alkali dissolves lignin. The number obtained for CF will not reflect the actual amount of digestible or indigestible fiber in the feed.

The Van Soest System of fiber analysis (Acid Detergent Fiber and Neutral Detergent Fiber) is a much better estimator of the nutritionally important fractions of a feedstuff. The neutral detergent solubles are composed of proteins, non-protein nitrogen, fats, starch, sugars, pectin, and soluble minerals. This fraction is readily available to an animal and approaches 100% digestible. NDF contains both indigestible and digestible components consisting of proteins, hemicellulose, cellulose, and lignin. ADF contains all of these except hemicellulose.

NDF is typically the largest fiber value for a feedstuff, with ADF being next largest and CF the smallest. See Table 1.

Table 1. Typical fiber content of forages as measured by three common techniques (% DM)

Forage	Crude Fiber	Acid Detergent Fiber	Neutral Detergent Fiber
Alfalfa hay/silage	22	29	40
Ladino Clover	21	32	36
Corn Silage	24	28	51
Bromegrass hay	30	35	65

Source: National Research Council, Nutrient Requirements of Dairy Cattle. 1989.

FACTORS AFFECTING FORAGE QUALITY

Many different factors have been shown to influence the feeding value of alfalfa. For a given year, the factor that affects quality and yields most is the stage of maturity at harvest.

Dry matter yield increases constantly from immaturity to about mid-bloom. Dry matter from stems increases at a constant rate throughout the growing stage, but leaf dry matter yield increases through the early bloom stage with little dry matter increase after that stage. The nutritive qualities of the leafy portion are known to be superior to the stems of plants because leaves have the highest concentration of protein and energy.

The feed value of alfalfa decreases with maturity, not only because of leaf loss but because the digestible energy and crude protein decreases with maturity. Digestible energy in the leaves varies very little, whereas the digestible energy of stems decreases considerably. Leaves and stems decrease in protein at similar rates, but leaves contain about twice as much protein as

stems. These declines in protein and energy are accompanied by corresponding increases in indigestible lignin and low digestible cellulose. Therefore, it is important that the producer harvests any hay mixtures at early maturity and preserves leaves in order to have high quality forage.

FIBROUS FEEDS AND DAIRY COW PERFORMANCE

Adequate fiber content of proper physical form in the diet of lactating dairy cows assures normal chewing activity and rumen function. All feeds or forages have a certain *roughage value.* Roughage value measures a feed's ability to stimulate chewing, specifically chewing during rumination. This concept considers not only the fiber content of the feed, but its texture or particle size, as well.

High-fiber byproduct feeds such as soybean hulls or corn gluten feed may be quite high in fiber level, but the fiber typically has small particle size and low effective fiber level or roughage value. An important point to remember is that both fiber level and fiber coarseness affects the "roughage value" of a feed.

Unlike many nutrients, the dairy cow requires a fairly narrow range of fiber for maximum milk production response. This reflects the fact the fiber has two distinct effects upon the cow. First, by increasing the fiber in the diet from none toward the optimal level, the roughage value of the fiber stimulates more rumination and maintains normal rumen function. As more fiber is added to the diet beyond the optimal level for a given production level, fiber begins to assert its second distinctive effect: limiting intake and digestibility of the diet.

CONCLUSIONS

Fiber level in the ration plays a key role in regulating feed intake and milk production. To formulate a diet that provides adequate effective fiber, a dairy producer must understand what fiber is, what measurements of fiber are used, and what role physical fiber plays in maintaining normal rumen function. Formulating diets for optimal levels of fiber should provide maximum forage intake and maximum milk production.

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