

What is forage quality?

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Perhaps the most often requested meeting topic I receive for cattleman's meetings is "How to Produce Quality Hay". Even though the basic guidelines for producing, storing and feeding quality hay are simple, this can be a confusing topic. Actually defining forage quality can be even more difficult. Quality varies according to plant species, variety, fertility and (most importantly) stage of maturity. To further complicate the situation, forage quality requirements of animals change depending on their physiological status. Accurate determination of forage quality using laboratory procedures can also be difficult. This article will discuss (1) variables that define forage quality, (2) how forage needs change with animal type and (3) practical reasons for testing hay.

What determines forage quality?

Forage quality is an ambiguous term whose meaning varies from farm to farm. A dairy producer may consider hay that contains 15% crude protein and 68% TDN a marginal forage while a beef producer would consider this an excellent crop. Likewise, one beef producer may be content with 8% crude protein bermudagrass hay while another would consider this mulch. Still others believe that quality has nothing to do with protein or energy and is directly related to color or "weediness". For the purpose of this article, we'll focus on the two most important laboratory derived nutrient values of hay: crude protein and energy content.

Crude protein content in forage is easily predicted by measuring plant nitrogen content and multiplying this by 6.25 (the average nitrogen content of protein). Because crude protein is directly related to nitrogen content, it is not surprising that heavily fertilized forages will normally contain high crude protein content. Legumes also contain higher levels of nitrogen and crude protein than grasses. Plant maturity at harvest has a large impact on crude protein content. Mature forages have fewer leaves and more stems than younger forages. Leaves contain soluble proteins like chlorophyll whereas stems are high in fiber and low in protein.

Energy is far more difficult to predict in forages than crude protein. Energy content depends on the digestibility of various chemical fractions of forages. The most common method of predicting forage energy content is based on amount of fiber. Plants that contain large amounts of fiber are generally less digestible. Fiber is more variable in digestibility than other soluble fractions of the plant (for example, sugars) and is currently the most accurate predictor of forage energy content.

There are many factors that influence energy content and scientists have spent careers trying to define and influence these factors. Dr. Gary Hill in Tifton has found that different chemical linkages among fiber types can drastically alter the digestibility of grasses. This is one reason that Tifton 85 bermudagrass is more digestible than other bermudagrass hybrids even though fiber content of Tifton 85 is normally high. This

finding should ultimately aid plant breeders in developing even more digestible forages in the future.

There are several controllable factors that influence energy content of forages. The most often discussed is variety selection . Many forages like alfalfa, brown midrib sorghum and corn silage have been successfully selected for improved forage quality. We have already discussed that Tifton 85 has a higher digestibility (about 10%) than other hybrid bermudagrasses when harvested at the same maturity. *In general* variety plays a relatively small role in determining the energy content of a forage crop but variety certainly can play a role when all other management practices are similar.

Plant type greatly affects forage quality. Legumes generally have higher quality than cool season grasses and cool season grasses normally have higher quality than warm season grasses. Within warm and cool season categories, there are differences between species. Bahiagrass will normally have lower hay quality than bermudagrass because of stem and seedhead production.

Maturity at harvest plays the largest role in determining forage quality. Forages should be harvested in a timely manner. Think back to the spring months when rye pastures go from a lush green vegetative state to a brown low quality reproductive state in a matter of a few weeks. The same process occurs in bermudagrass and tall fescue pastures even though it is not as visually obvious.

Forages that possess high crude protein or digestibility values still do not guarantee good animal performance. Two other hurdles must be cleared. First, animals must consume enough of the forage to meet their maintenance and production requirements. Hay containing 15% crude protein and 70% TDN still will not provide enough nutrients for a mature cow if she is only allowed to eat 5 pounds per day. Antiquality factors also impact animal performance. Mold or toxic alkaloids (like those found in most tall fescue) can greatly decrease performance of animals consuming what appears to be high quality hay.

Animal factors influencing forage requirements.

Proteins are the building blocks of muscle and tissues and are also required by rumen microbes. Animal muscle grows and is constantly “rebuilding” within animals so crude protein must be constantly supplied to meet tissue growth demands. This is the main reason that replacement heifers and young calves have higher crude protein requirements than mature cows or herd sires. Even in mature cows, the rumen microbes require about 8% dietary crude protein to adequately digest fibrous feedstuffs. If microbes are only supplied with 5% crude protein, fiber digestion is inhibited, feed intake declines and animal performance suffers.

Energy is needed for all animal maintenance functions including breathing, heartbeat, and temperature regulation. Walking, milk production, muscle growth and fat deposition also all require energy. Energy is used relatively efficiently for functions like maintenance or milk production, but is less efficiently utilized for growth or fat production. The exact quality of hay needed by cows varies depending on their particular physiological stage.

Dry animals that are not gaining weight will have relatively low energy requirements while lactating or growing animals (like replacement heifers or stocker calves) will have higher requirements.

How do I know if the desired quality is being supplied?

The ultimate proof of quality forage is determined by animal performance. As long as animals perform at the desired level, the required quality of forage is likely being supplied. Many producers use this excuse (at least on a subconscious level) and refuse to test hay because animals appear to be performing well. This is actually an economically foolish practice. By the time producers realize that hay quality is inadequate, losses in animal gain, conception rates or milk production have already occurred and money has been needlessly lost. Hay color, smell, texture, field history and time of cutting can *help* indicate hay quality; but are far from foolproof. The only way to determine the type and amount of supplement required is to submit forage for testing. The UGA forage testing lab offers an excellent upgraded service that provides results in 24-48 hrs after sample receipt. This service provides results in a relatively easy to interpret format. New equipment upgrades have decreased testing fees from \$28 to \$10 per sample. New digestibility equations are under development for warm season species like bermudagrass and bahiagrass to further improve accuracy of the testing laboratory.

The Georgia Department of Agriculture also provides a hay testing service that is free of charge and supplies crude protein, crude fiber, nitrates and moisture content. These values can be difficult to interpret and must be used in combination with an equation to estimate energy content. This requires more effort and interpretation by the county agent and producer, but reasonable estimates of diet quality are possible. It may take a few weeks to receive results from GDA during busy periods of the year.

Why test?

Even though many cattlemen are interested in listening or reading about producing quality hay, few are willing to invest \$10 to determine how much supplement should be fed. All rained-on hay is not bad, and hay cured during sunny weather is certainly not always good quality.

Testing monitors hay operations even under ideal growing conditions. Even if well fertilized forages are cut at the appropriate maturity forage quality can vary significantly due to improper raking, tedding, baling or storage. Hay cuttings that test low in quality can be fed to dry cows. High quality hay can be fed to lactating cows or replacement heifers. Begin to work with your county agent to design a hay testing program and supplementation program. Often hay quality is adequate and supplementation can be decreased or eliminated. Saving two bags of supplemental feed will pay for the testing service. Improving calving percentage or weaning weights will offset testing fees for years.