



Hay Quality and Testing

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Factors Influencing Forage Quality

Many Louisiana producers may overestimate the quality of their hay because they don't recognize the reasons hay quality varies. Most realize that the presence of weeds causes reduced quality and that rain on hay after it has dried in the field can also reduce quality. The influences of fertilization practices and stage of maturity are frequently overlooked.

Nitrogen application at recommended rates increases the protein level in grasses and can have a somewhat smaller impact on energy level or TDN. It also increases growth rate so that forage can be harvested more frequently. Fertilization and liming to keep forage crops growing rapidly are important for making high quality hay.

Of all the factors that affect hay quality, the growth stage when it is harvested generally has the largest effect. This is especially true for warm-season perennial grasses such as bermudagrass, and bahiagrass which are commonly harvested for hay in Louisiana. Past research by the LSU AgCenter has shown that digestibility and protein levels in Coastal bermudagrass are much higher if the grass has grown for only 4 weeks than if it has been allowed to grow for 8 weeks between harvests. Other grasses also lose quality as they age. Clearly then, the first requirement for making high quality grass hay is to harvest it at a young growth stage. Bermudagrass should be harvested after 4 weeks of growth for high quality. Bahiagrass and dallisgrass should be cut after a similar growing period

or at a boot to early heading stage, whichever comes first. Johnsongrass, pearl millet or sorghum-sudangrass hybrids should be harvested at an early boot stage or a height of about 40 inches, whichever comes first. Most clovers should be cut at an early flowering stage.

Leaves contain more nonstructural carbohydrates and protein than stems. The nonstructural carbohydrates, which include plant sugars and starches, are highly digestible. When forage plants mature, the amount of stem material increases. Thus, forages with a greater amount of leaves are more likely to be of higher quality. Harvesting at an early maturity stage will help to insure that there will be more leaf material on the plant.

Forage crops decrease in nonstructural carbohydrate concentration and digestible dry matter percentage during the curing process because of plant respiration. Decreases in digestible dry matter can also occur from the leaching of soluble nutrients during rainfall and the physical loss of leaves at harvest. Management techniques that minimize curing time (use of a mower-conditioner, tedder, etc.) can minimize digestible dry matter loss. Just as plant respiration reduces forage quality during curing, similar activity can cause quality changes during storage. If hay with excessive moisture is packaged and stored, mold may develop. Mold-producing organisms generate heat through respiration; the mold and heat reduce consumption as well as protein and dry matter digestibility.

Diseases, insects, and some weeds have been responsible for reduced forage quality. Particularly noteworthy pests are leaf diseases and high populations of fall armyworms.

Traditional Hay Selection Criteria

When cattlemen are asked for a definition of good hay, they often list factors such as:

- The hay must be green.
- There should be no dust or mold.
- There must be fine stems and lots of leaves.
- There can be no weeds.
- The hay cannot be rained upon.

The above list contains factors that are subjective in nature, and while important, they generally do not adequately assess the nutrient composition of the forage. In addition to looking at these subjective factors, cattlemen should also have their hay tested to determine nutrient content. Forage testing identifies the nutritionally strong and weak points of a particular forage, so that proper protein and energy supplementation can be planned.

Forage Sampling Procedures

Each “lot” of hay should be sampled separately. A lot of hay is hay cut from one field at a given stage of maturity, cut at the same time, all of the same variety, fertilized alike and harvested and stored alike if it is already in storage.

Care should be taken to take a

representative sample of the hay. The following steps should be used:

- A tube-type hay probe should be used. Grab samples are not representative.
- The probe tip must be sharp.
- Sample square bales from the end with cores being taken near the center of the end.
- Sample a minimum of 10 small square bales per lot and combine the cores into one composite sample. Sampling 20 bales would be better.
- Sample large round bales from the side with the probe inserted toward the center of the bale.
- Sample at least two areas for each large round bale and a minimum of five bales per lot and combine the cores into a composite sample.

Place the composite sample for a lot into a plastic ziplock bag and seal tightly, excluding as much air as possible. Fill out all of the information on the sample entry form such as name and address, forage type, etc. Samples should be taken to the local parish Extension office. The Extension agent will send the samples to the LSU AgCenter Forage Testing Laboratory located near Franklinton, LA. There is no charge for the analysis. You should receive your test results within one to two weeks.

Definitions of Common Forage Testing Terms

Dry matter (DM) is the percentage of the forage that is not water. Nutrient needs of animals are expressed on a DM basis.

Crude protein (CP) is the total amount of nitrogen contained in a forage, percent nitrogen is multiplied by 6.25 to obtain crude protein. Crude protein is a mixture of true protein and nonprotein nitrogen; it indicates the ability of the forage to meet an animal's protein needs. It is expressed as a percentage of dry matter and includes both nutritionally available and unavailable nitrogen. Generally, the higher the CP percentage the greater the forage quality.

Total digestible nutrients (TDN) is the sum total of all digestible organic nutrients (protein and energy) of a forage that are available to the animal, usually expressed as a percentage of DM.

Acid detergent fiber (ADF) is the percentage of highly indigestible plant material in a forage; it is comprised of cellulose, lignin, cutin, silica, pectin, and unavailable protein. It is negatively correlated to digestibility and therefore can be used to calculate dry matter digestibility, digestible energy, and total digestible nutrients. A low ADF value indicates greater digestibility.

Neutral detergent fiber (NDF) is the percentage of cell wall material in a forage. Partially available to animals, it is comprised of cellulose, hemicellulose, lignin, cutin, and unavailable protein. It is considered an indication of plant maturity and therefore related to intake. A low NDF indicates greater forage intake by livestock.

Application of Forage Testing Results

One of the most common factors influencing forage quality is plant maturity. Forage testing allows producers to see how nutrient composition changes as the crop matures. This is accomplished by

comparing the test results of a forage cut at a very mature stage to a similar forage harvested on a more timely basis. Forage testing could also help the producer better assess the need to renovate existing fields or establish new forage stands.

In the past, producers have formulated rations from "book values". While book values do predict average nutrient composition, they do not take into account many factors that affect nutrient availability and intake. Only forage testing can precisely evaluate the composition.

Using forage testing to formulate livestock rations takes into account two basic goals: development of nutritionally balanced rations and development of least-cost rations. Forage testing provides information that helps determine the best use of a forage and what supplements, if any, are needed to achieve desired levels of animal performance. It is important to keep in mind that different livestock classes have different nutritional requirements which must be met by the ration. Livestock classes are generally separated by intended purposes of production, production levels, body weight and condition score, and frame size.

While not commonly practiced in Louisiana, forage testing makes marketing hay on the basis of feeding value possible. This practice aids the seller in pricing hay and provides valuable information to the buyer about how to use a forage most effectively in a livestock feeding program. Forage test results can be used as a tool for negotiating the price of hay.