Understanding Forage Analysis Important To Livestock Producers

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Forage testing measures the nutrient content of hay or pasture. Comparing the forage's nutrient content with the animal's nutrient requirements enables a producer to see if supplements are needed to improve animal performance or health. A forage analysis report contains information on such attributes as moisture, fiber, digestibility, protein, and mineral content.

Moisture

Moisture content is an indication of how well the forage was dried before storage. Hay should be baled when the moisture content is less than 18 percent; high-density, large, round bales need a moisture content below 16 percent. Haylage should be made when the moisture content is 50-60 percent. Most hays will cure to about 10 percent moisture during storage, but round bales may be higher in moisture if stored outside.

Fiber

Forages vary widely in fiber content. Fiber content tells us how digestible the forage is and how much of it the animal will eat. Well managed pasture or hay can be low in fiber and highly digestible. Late-cut hay is usually high in fiber and low in digestibility and intake.

Acid detergent fiber (ADF) is the less-digestible cellulose and lignin or "woody" fiber in the plant. ADF is an indicator of digestibility across different species of grasses and legumes. As ADF increases, digestibility decreases.

Neutral detergent fiber (NDF) is an estimate of the plant's cell wall content and includes the ADF and hemicellulose. Some of the NDF is highly digestible. Forage NDF is the best indicator of how much forage a high-producing animal will eat. A high-producing dairy cow can eat about 1.1 percent of her body weight in NDF. For example, a 1,300-pound cow is able to eat about 29 pounds of grass hay containing 50 percent NDF (1300 x 0.011/0.50=28.6). She could eat 36 pounds of a grass-legume hay containing 40 percent NDF. Livestock eat more legume than grass hay because legumes are lower in NDF than grasses.

Energy

Energy available from the forage may be expressed in different units of measure. These include total digestible nutrients (TDN), net energy lactation (NEL), net energy maintenance (NEM), and net energy gain (NEG). Forage TDN content is calculated from fiber, non-fiber carbohydrates, protein, and ash fractions measured in the forage sample. Different labs may use different equations. Typically, net energy is then calculated from TDN.

Nonfiber carbohydrates

Non-fiber carbohydrates include pectin, starch, and sugar, which are nearly 100 percent digestible in the rumen. The rumen bacteria need these carbohydrates for energy to grow.

Crude protein

Crude protein (CP) is the non-protein nitrogen and amino acid nitrogen in feeds. The animal's rumen bacteria use this nitrogen to make bacterial protein as they digest forage. After they digest the forage for their growth, the bacteria are digested in the animal's true stomach. The animal uses the amino acids for growth and milk production. Many laboratories measure available and unavailable protein. When a feed is heated, some of the protein becomes unavailable because it is tied up with other compounds. This happens when damp hay is baled, causing it to heat, or when silage is stored without all the air being removed, which allows excessive heating.

In ration formulation, CP is divided into classes based on how fast it is degraded in the rumen.

These classes are termed soluble, degraded, and undegraded intake protein. Newer ration balancing literature calls them rumen degradable protein and rumen undegradable protein.

Soluble intake protein is rapidly degraded to ammonia in the rumen. Some of this rapidly available protein is needed by the rumen bacteria when their growth rate is high. However, excess soluble protein will degrade to ammonia and will be lost from the animal in urine.

Degraded intake protein is all the protein that is degraded in the rumen. Rumen bacteria use degradable protein for growth as they digest fiber and non-fiber carbohydrates. If the ration contains too much degradable protein compared with the rumen digestible carbohydrates, it is converted to ammonia, lost from the rumen, converted to urea, and excreted in urine. The protein is wasted. This process increases the animal's energy requirement. In extreme cases, this can result in lower milk production or lower rate of gain in growing animals. Degradable protein is less likely to be wasted if adequate digestible fiber or non-fiber carbohydrate sources are available to the rumen bacteria. Undegraded intake protein is not degraded in the rumen, but may be digested in the intestinal tract.

The goal of balancing a ration is to ensure that there is enough CP and that the proportion of degradable and undegradable protein meets the needs of the rumen bacteria and the animal. Perennial forage crops vary in protein content. Forages having higher legume content are usually higher in crude protein at the same stage of maturity. Dry hay tends to have less protein than

silage and well-managed pasture. Because of fermentation, much of the protein in silages is readily degradable. The CP content of well-managed pasture usually exceeds the needs of high-producing livestock and results in lower daily gains than would be expected from the energy content in the pasture.

Minerals

Basic forage tests usually include the major minerals (calcium, phosphorus, magnesium, potassium, sodium, and sulfur). For an additional charge the forage can be tested for trace minerals (iron, zinc, copper, manganese, and molybdenum). Often, the tests do not include other minerals (cobalt, selenium, and iodine) needed by livestock. The mineral content of forages varies, depending primarily on plant maturity, plant species, and soil fertility. Fertilizing and liming may change the botanical composition of the stand, thereby changing the mineral levels in the forage. For example, phosphorus fertilization and liming may increase the legume growth in a pasture, which increases the calcium and magnesium content of the forage.

Conclusion

Forage testing is a cost-effective way of identifying the nutritional quality of hay and pasture. When the nutrient analysis is compared to animal nutritional requirement, managers can determine if purchased supplements are needed and if feeding them will be profitable. As a general rule, test your forage crops prior to purchasing any supplemental feeds.