Ridin' Herd

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Understanding a forage analysis

Livestock are most productive when fed a ration balanced according to their nutrient needs. Unfortunately, many rations are balanced using average values for each feedstuff. These so-called "book values" often result in over- or underfeeding certain nutrients. More economical and better balanced diets can be formulated using nutrient concentrations determined from feed analysis.

Methods of feed testing

Once a feed sample has been collected properly, it can be analyzed for nutrients. Most commercial laboratories offer standard feed tests for forages, grains or total mixed rations (TMRs). Analyzing feeds for moisture, protein and energy is recommended when designing diets for beef cattle.

Typically, results are reported on an as-is and dry-matter (DM) basis. Dietary nutrients should always be balanced on a DM basis because nutrient requirements for beef are reported on a DM basis. Values reported on a DM basis can be converted to an as-is basis using the moisture content of the feed to determine the actual amount of feed (as-is) that should be fed or delivered.

Sight, smell and touch are useful, although frequently misleading, indicators of feed value. Stage of maturity at harvest, foreign material or pests, color and leafiness can be detected visually and provide some limited information on the nutritional value of feed. Musty and foul odors can indicate lower quality due to deterioration in storage. Physical evaluations alone rarely are sufficient for predicting eventual animal performance, partly because of the lack of a good means of measuring such qualities as color and leafiness.

Nutrient analyses most commonly are done by chemically reacting or extracting important compounds in a laboratory and determining their amount in the feed. When representative feed samples are tested chemically, accurate predictions of animal performance usually can be made because the nutrient requirements also were determined using chemically tested feeds.

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Near-infrared reflectance (NIR) spectroscopy is a rapid, reliable, low-cost, computerized method to analyze feeds for their nutrient content. It uses near-infrared light rather than chemicals to identify important compounds and measure their amount in a sample. Feeds can be analyzed in less than 15 minutes using NIR, compared to hours or days for chemical methods. This rapid turnaround and the resulting cost savings in labor make NIR an attractive method of analysis.

When sending a sample in to be tested using NIR, it is important to identify the type of feed/forage being submitted so as to make sure that the right feed library is used. This method will not accurately evaluate a full mineral profile of a sample. However, NIR does appear to fairly accurately determine calcium (Ca) and phosphorus (P).

NIR does not do an adequate job of measuring the energy (TDN; total digestible nutrients) content of the distillers' grains that are feed byproducts from the ethanol industry. In an NIR analysis, TDN is estimated using acid detergent fiber (ADF). ADF measures cell wall content of a feed. Distillers' grains are high in fat; therefore, NIR will underestimate their energy content. NIR will adequately measure moisture, percent crude protein (CP), calcium and phosphorus in distillers' grains.

(Continued on page 66)

Ridin' Herd *(from page 64)*

Nutrients of primary concern in developing diets for beef cows are moisture content, percent CP and percent TDN. Relative feed value (RFV) is important for dairy cattle because RFV and relative feed quality (RFQ) are indicators of forage digestibility and, therefore, forage intake. For beef cattle, RFV and RFQ are not used in ration formulation.

Interpreting test results

Interpretation of test results is important in designing diets for beef cows. Here are some pointers.

Dry matter is the moisture-free content of the sample. Because moisture dilutes the concentration of nutrients but does not have a major influence on intake, it is important to always balance and evaluate rations on a DM basis.

Crude protein measures the proportion of nitrogen (N) in a feedstuff multiplied by 6.25, and this includes both true protein and nonprotein nitrogen. In ruminants, evaluation of the fraction that is degradable in the rumen (degradable intake protein, DIP) vs. the rumen-undegradable fraction (undegradable intake protein, UIP, or bypass protein) is also important.

However, the rumen degradability of protein is not measured in most commercial labs. Therefore, it is recommended that rations be formulated using analyzed CP values and average values for DIP and UIP that can be found in the 1996 National Research Council (NRC) *Nutrient Requirements of Beef Cattle*.

Nitrogen that has become chemically linked to carbohydrates and thus does not contribute to either DIP or UIP supply is called heat-damaged protein or insoluble crude protein (ICP). This linkage is mainly due to overheating when hay is baled or stacked with greater than 20% moisture, or when silage is harvested at less than 65% moisture.

Feedstuffs with high ICP are often discolored and have distinctly sweet odors in many cases. When the ratio of ICP:CP is 0.1 or greater, meaning more than 10% of the CP is unavailable, the CP value is adjusted. Adjusted crude protein (ACP; see below) values should be used for ration formulation.

ACP is the crude protein corrected for ICP. In most nutrient analysis reports, when ACP is greater than 10% of CP, the adjusted value is reported. This value should be used in formulating rations when ICP:CP is greater than 0.1.

TDN is the sum of the digestible fiber, protein, lipid and carbohydrate components of a feedstuff or diet. TDN is directly related to digestible energy and is often calculated based on ADF. TDN is useful for beef cow rations that are primarily forage. TDN values tend to underestimate the feeding value of concentrate relative to forage.

The NIR analysis method does not estimate the TDN content to wet (WDGS) or dry (DDGS) distillers' grains plus solubles very well. Our data suggest that WGDS and DDGS are 125% the energy value of corn in forage diets. Therefore, if corn is 90% TDN on a DM basis, then WDGS is 112.5% TDN (90%×1.25)

RFV is a prediction of feeding value that combines estimated intake (NDF) and estimated digestibility (ADF) into a single index. RFV is used to evaluate legume hay. RFV is often used as a benchmark of quality when buying or selling alfalfa hay. RFV of feedstuffs other than alfalfa is not relevant. RFV is not used for ration formulation.

Final thoughts

Sampling forages and understanding a forage analysis will result in supplementation strategies that meet the cows' nutrient requirements, but also will affect profit potential of the enterprise. Oversupplementation results in increased input costs without increases in animal performance.