MANAGEMENT

Ridin' Herd

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Understanding a feed analysis — part 2

In the last Ridin' Herd, we discussed entries reported in a forage/feed analysis. Forages especially can vary a lot in nutrient content based on their maturity at harvest. With this in mind, high-quality forage is less mature at harvest. However, as maturity at harvest increases, yield increases. For a commercial cow-calf operation, forage quality must be balanced with forage yield.

Last time we discussed moisture and protein. The following is a continuation of our review of terminology often found on a forage/feed analysis.

Fiber

Crude fiber (CF): Crude fiber is a traditional measure of fiber content in feeds. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) are more useful measures of feeding value and should be used to evaluate forages.

Neutral detergent fiber (NDF): This is a measure of the structural components of the plant, specifically the cell wall. NDF is a predictor of voluntary intake, because it provides bulk or fill. In general, low NDF values are desired, because NDF increases as forages mature.

Acid detergent fiber (ADF): This is a measure of the least digestible plant components, including cellulose and lignin. ADF values are inversely related to digestibility, so forages with low ADF concentrations are usually higher in energy. In near infrared reflectance (NIR) analysis, ADF is used to estimate the percentage of total digestible nutrients (TDN) of a feed.

Energy

Total digestible nutrients (TDN): This measurement 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 balancing energy in beef cow diets.

Net energy (NE): This measurement is mainly referred to as net energy for maintenance (NE_m), net energy for gain (NE_g) and net energy for lactation (NE_l). The net energy system separates the energy requirements into their fractional components used for tissue maintenance, tissue gain and lactation. Accurate use of the NE system relies on careful prediction of feed intake. In general, NE_g overestimates the energy value of concentrates relative to roughages.

Fat

Ether extract (EE): This is the crude fat content of a feedstuff. Fat is an energy source with 2.25 times the energy density of carbohydrates.

Relative values

Relative feed value (RFV): This measurement 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 is not used for ration formulation. Also, RFV should only be used to compare alfalfas and should not be used to compare alfalfa against grass hays, because the scale was developed using alfalfa.

Relative forage quality (RFQ): Like RFV, RFQ combines predicted intake (NDF) and digestibility (ADF). However, RFQ differs from RFV, because it is based on estimates of forage intake and digestibility determined by incubating the feedstuff with rumen microorganisms in a simulated digestion. Therefore, it is a more accurate predictor of forage value than RFV. Neither RFV nor RFQ are used in ration formulation.

Using the analysis

Instead, use dry-matter (DM) composition for ration formulation. Fig. 1 provides an example forage/feed analysis, showing the hay sample is 14.4% moisture and 85.6% DM. The DM composition can be found by dividing as-is value by the percent DM. Remember, for ration formulation you should always use the dry-matter composition.

For example, crude protein (CP) in Fig. 1 is 19.8%. Therefore, 19.8% CP (as-is) ÷ 0.856 = 23.2% CP on a DM basis.

Because the heat-damaged protein is not 10% or more of the CP, the available crude protein is the same as CP. Available protein estimates are generally only reduced when heat-damaged (unavailable) protein accounts for greater than 10% of CP.

Let's assume you are supplementing late-gestation cows with a 38% protein cake. If you feed 2 pounds (lb.) per head, then the amount of CP supplemented is 2 lb. per head × 0.38 CP = 0.76 lb. per head CP.

In another context, National Research Council (NRC) tables indicate that one month after calving a 1,200-lb. cow with moderate milk production requires a diet that is about 10% CP. This same cow should have a DM intake of about 27 lb. per day. If she is consuming low-quality forage that is only 5% CP, how much of this first cutting

Fig. 1: Client sample of first-cutting alfalfa

	Analysis	
	As-received basis	Dry matter basis
Moisture, %	14.4	0.0
Dry matter, %	85.6	100.0
Crude protein, %	19.8	23.2
Heat-damaged protein, %	0.8	0.9
Available protein, %	19.8	23.2
Digestible protein estimate, %	13.7	16.1
Acid detergent fiber, %	27.0	31.5
Neutral detergent fiber, %	31.1	36.4
TDN estimate, %	55.6	64.9
Relative feed value	164.4	

of alfalfa do you need to provide to meet her CP requirement? Consider the following:

- ► 27 lb. per day intake × 0.10 CP requirement = 2.7 lb. per day CP requirement
- ► 27 lb. low-quality forage × 0.05 CP = 1.35 lb. per day CP from forage
- ► 2.7 lb. per day CP required – 1.35 lb. per day CP from forage = 1.35 lb. per day CP needed from alfalfa
- ► 1.35 lb. per day CP needed ÷ 0.232 CP in alfalfa = 5.8 lb. supplemental alfalfa per day to meet protein requirement

Formulating rations

Do not use digestible protein for ration formulation. For formulating beef cow rations, ADF and NDF are of limited usefulness. Instead, use TDN, which is calculated from ADF but is easier to use.

Fig. 1 shows a relatively high-quality hay with a high TDN value. In the protein example above, we calculated that we should supplement 5.8 lb. of this hay to meet the protein requirements of our hypothetical cow.

Remember, this cow calved one month ago, weighs 1,200 lb. and has moderate genetic potential for milk. At 27 lb. per day DM intake, she needs a diet that is about 58% TDN to meet her energy requirements. Will 5.8 lb. per day of this alfalfa meet her energy needs if the low-quality forage she consumes is only 50% TDN?

- ► 27 lb. DM intake × 0.58 TDN required = 15.7 lb. per day TDN required
- ► 22.2 lb. low-quality forage × 0.50 TDN = 11.1 lb. per day TDN from low-quality forage
- ► 5.8 lb. alfalfa × 0.649 TDN = 3.75 lb. TDN from alfalfa
- ► 11.1 lb. per day TDN from low-quality forage + 3.75 lb. per day TDN from alfalfa = 14.85 lb. per day TDN

Therefore, we can see that this cow will lose some body condition even when fed supplemental alfalfa.

Again, do not use RFV for formulating rations; TDN is much more useful.

Near infrared reflectance

NIR 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.

NIR does not do an adequate job of measuring the energy (TDN) content of the distillers' grains (DG) or distillers' solubles. In an NIR analysis, TDN is estimated using ADF. ADF measures the cell wall content of a feed, which is related to fiber content. Distillers' grains and solubles are high in fat; therefore, NIR will underestimate their energy content.

NIR will adequately measure moisture, percent CP, calcium (Ca) and phosphorus (P) in distillers' grains.

Final thoughts

Test forages for quality, as there can be wide swings in quality. Use the analysis to design economical feeding programs. Also, use the analysis to determine if other feeds are needed to balance the diet for the class of livestock you are feeding.

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Editor's Note: *"Ridin' Herd" is a monthly column written by Rick Rasby, professor of animal science at the University of Nebraska. The column focuses on beef nutrition and its effects on performance and profitability.*