Evaluating Feeds

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Robert Pawelek and Shelby Filley

As discussed in the previous chapter, nutrient content of feeds varies not only among different feed types, but also among batches of the same type of feed (hay lots, grain shipments, growth stage of pasture, etc.). The objective of sampling forages and concentrates is to obtain representative samples for laboratory analysis to estimate the value of feed for livestock.

Rapid feeding and turnover of grains and supplements may reduce the value of analyses compared to analyzing larger batches fed over a longer period of time. However, analyses completed even after the ration is consumed can detect seasonal differences that may influence future use.

Sampling feeds

Forages may be sampled as hay or standing pasture. Sampling methods include mechanical coring of bales with a hay probe, pulling hand-grab samples from bales or windrows, pulling hand-grab samples from standing forage, and clipping standing forage samples.

Accuracy depends largely on sampling method and lab technique. Having dependable samples can prevent unwelcome surprises. It is important to identify the sample by date, cutting, forage or concentrate type, pasture location, and owner before shipping it to the lab.

Remember: the key to accurate sampling of feed is to sample consistently and mix the samples thoroughly, especially if you plan to divide them.

Baled hay

There are several methods for sampling baled hay. The best technique is to use a mechanical coring probe made specifically for this purpose. Place the serrated edge on the side of the hay bale that is most resistant to puncture (usually the round side of a round bale or the small end of a square bale) and obtain a sample by drilling with a brace.

The sample should be as representative of the composition of the bales as possible. Repeat the process on several hay bales within the sampling lot. Sample hay from different fields or cutting times separately.

An older traditional method of obtaining forage samples is the hand-grab technique. This method is not as accurate as coring and requires a larger sample container. Hand samples do not provide consistently reliable results.

Pasture forage

Standing forage may be sampled by the hand-grab or clipping technique. Collect 20 subsamples and combine a sufficient amount to fill a 1-gallon reclosable plastic bag. In a pasture having a pure stand of forage, take samples randomly from different locations. If the pasture is a mixed stand of forages, it is important to sample only plants that animals will graze. Clip forage no shorter than 1 inch to avoid contaminating samples with soil. You can use scissors or a knife. Unlike hay, pasture forage is not normally dry when sampled. To avoid spoiling, air dry moist samples before shipping.

Grain

Grade of grain, along with protein and energy content, can vary widely. Periodically analyze the major feed grains for lactating and finishing diets. You also can request a lab analysis from the supplier. To sample, use a grain probe if available; otherwise, hand sampling is acceptable. It is best to take grain samples while the material is being off-loaded from the delivery truck. However, you can take five samples from different locations in the pile, bunk, bin, or truck. Combine all samples and ship in a clean, dry container.

Other feeds

Bagged or block products require several separate samples. A general guideline is to take samples from 10 percent of the bags or blocks in question. Take at least one handful per bag. Sample blocks by slicing or chiseling a chunk from each block.

Choosing a laboratory

A List of Analytical Laboratories Serving Oregon (EM 8677) is available in your county Extension office or on the Internet (http://eesc.oregonstate.edu/agcomwebfile/edmat/html/em/em8677/em8677.html). It contains contact information for labs that analyze forage samples. Prices and sample submission guidelines may differ among laboratories. Call the lab prior to taking the sample. Lab fees start at around $30.00 per sample and increase depending on analyses requested.

Analyses (lab tests to request)

There are many possible tests to perform on forages. Results for moisture, protein, and energy are the most important. Ask the lab to run the required analyses to give you this basic information. Standard analyses include percent dry matter (DM), percent crude protein (CP), percent acid detergent fiber (ADF), and percent neutral detergent fiber (NDF). Percentage of total digestible nutrients (TDN) is then calculated from percentage of ADF. Periodic analysis for basic mineral content also is helpful. Other analyses are nitrate nitrogen and trace mineral composition. Because nonstandard analyses can be costly, request them only when needed.

Laboratory method

Wet chemistry uses chemical solutions to directly measure plant components in feed. This method is a well recognized and accepted way to measure the components of feed.

Near Infrared Reflectance Spectroscopy (NIRS) uses light transmitted through the sample to estimate the components of the feed. The estimates are made using mathematical equations based on previous wet chemistry data. Large amounts of data from many reference samples are required in order to create accurate equations for estimating feed components in this manner. While some forages lend themselves well to NIRS, and some laboratories have compiled the necessary data for accuracy, this is not always the case.

Be sure to discuss the use of wet chemistry versus NIRS with your county Extension faculty, nutrition consultant, or analytical lab before you decide which method to use. NIRS usually is less expensive and may be available overnight. Some labs can run wet chemistry samples overnight, while others take longer.

Lab report definitions

Acid detergent fiber (ADF)—A measure of cellulose and lignin. ADF is negatively correlated with overall digestibility (high ADF = low digestibility).

Adjusted crude protein—The crude protein adjusted for availability to the animal. Some proteins can be bound with fiber and are unavailable, especially in heat-damaged forages.

As-fed basis—A way to express percentage of nutrients in a feed, including moisture. As-fed will equal as-sampled or as-received, if the feed is not altered between sampling, testing, and feeding time.

Crude fat—Fat and other ether extractable compounds. Fat is an energy-dense nutrient and contains 2.25 times the energy found in carbohydrates and proteins.

Crude protein (CP)—An estimate of the protein content of the feed. Laboratories measure the nitrogen (N) content of the forage and then calculate crude protein using the formula CP = %N x 6.25.

Dry matter (DM)—The dry portion of the forage (not including the water).

Dry matter basis—A way to express percentage of nutrients in a feed, without the moisture. At some point in the calculations, DM must be converted to as-fed basis for the final mixing and feeding (see Chapter 5).

Minerals and vitamins—See Chapter 4.

Moisture—The water portion of a sample.

Net energy (NE)—An estimate of the energy in a feed that is available to the animal after allowing for energy lost during digestion and metabolism. Estimates for NE are divided into NE for maintenance (NEm) and NE for gain (NEg) and are more precise than TDN.

NEm is the energy value of a feed to maintain animal tissue without gain or loss of weight.

NEg is the energy value of a feed used for body weight gain above that required for maintenance.

Neutral detergent fiber (NDF)—A measure of hemicellulose, cellulose, and lignin, representing the fibrous bulk of the forage. NDF is negatively correlated with intake (high NDF = low intake).

Nonstructural carbohydrates (NSC)—Starches and sugars inside the cell that serve as energy sources for the animal.

Relative feed value (RFV)—A way to rank feed based on digestibility (ADF) and intake (NDF) potential. An RFV of 100 is considered the average score and represents an alfalfa hay containing 41 percent ADF and 53 percent NDF on a dry matter basis. The higher the RFV, the better the forage quality. RFV is used in feed marketing, not in balancing a ration for animals.

Total digestible nutrients (TDN)—A rough estimate of the feed energy available to the animal. It often is calculated from ADF.

References

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Worksheet 3.1
Sampling Plan for Your Forages

Each year, analyze new lots of hay or batches of grain (or other supplements) prior to the intended feeding period. You then can make and follow a plan for using this feed in an efficient manner. List the feeds you need to have analyzed.

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2. _____

3. _____

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