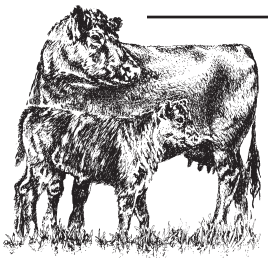

Western Beef Resource Committee

Cattle Producer's Library

Nutrition Section CL305

Common Sense Feed Analysis and Interpreting Forage Analysis

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The best use of any feed, whether range grass, grain, or supplement, begins with an understanding of nutrient content and quality. Water quality can affect the health and performance of cattle. New water sources or unusual health or production problems may require water analysis. Unfortunately, in many instances, the process stops once a sample is taken.

Interpreting the information provided in the report of analysis and converting those figures to feeding and management plans are the ultimate goals. A simple example of the use of feed analysis follows: a 1,100-pound cow, with superior milking ability, nursing her calf requires 22.3 pounds of dry matter, 2.6 pounds of crude protein, and 14.5 pounds of TDN daily (source: CL 300).

Two hays are available. The lab test shows:

Identification	% dry matter	% TDN		% crude protein	
		as fed	dry	as fed	dry
Field 1	88	54.6	62	20	22.7
Field 2	88	47.5	54	13.2	15

Feeding 26.5 pounds of hay from Field 1 hay meets the cow's needs; however, 30.5 pounds of hay from Field 2 hay would be required. A 4 pounds-per-cow daily saving would be made if hay from Field 1 were fed. Such a saving would pay for feed analysis many times over!

Lab Analysis

Selecting a feed laboratory is quite important. The lab selected should routinely analyze the type of feedstuff that will be submitted. Most labs testing hay and forage are certified by the National Forage Testing Association. Their analysis is routinely checked against reference standards. Recommendations on choosing a laboratory can be obtained from livestock extension educators, university nutritionists, consulting nutritionists, feed company personnel, and veterinarians whose practice includes cattle.

Forage analysis should also include visual appraisal. A lab test cannot identify lack of color, musty or moldy smell, presence of weeds, and many other factors that would make a feed unacceptable, even though analytically it would appear to be high quality forage.

Feed analysis begins with sampling. Because of the wide variety of feedstuffs fed to cattle, several different methods of sampling are necessary.

Hay Sampling

Hay should be sampled with a probe or hollow tube that takes cores from baled hay. A handful or slice of hay is quite unsatisfactory because it tends to over- or underestimate the quality of the hay. Several commercial models of hay probes are available. Here are several:

1. Hay Chec Sampler. 12- or 14-inch probe. Hodge Products, Inc., P.O. Box 1326, El Cajon, CA 92022 phone: 619/444-3147
2. Penn State Forage Sampler. 18-inch probe. Nasco Farm and Ranch Catalog, Nasco West, 1524 Princeton Ave., Modesto, CA 95354 phone: 800/558-9595
3. Forageurs Hay Probe. 14- or 24-inch probe. Forageurs Corp., P.O. Box 564, Lakeville, MN 55044 phone: 612/469-2596
4. Oakfield Hay Sampler. 18-inch probe. Oakfield Apparatus, Inc., P.O. Box 65, Oakfield, WS 53065 phone: 414/583-4114

Many livestock extension educators have a hay probe that may be borrowed. A homemade hay probe can be made by sharpening the end of a 16-inch section of golf club shaft. The inside diameter should be a least 3/8-inch. Probes are designed to be run by hand or power drill. Hay bales are sampled so that the probe is driven or augured in at a right angle to the stems.

Stab the unit as far into the baled hay as possible. Sample small bales of hay from the end. Sample large, rectangular bales from the top, middle, and bottom to allow for sifting of leaves. Sample round bales from the side. Take several core samples from each round bale to increase the chance of obtaining a representative sample.

Hay put up in a large stack, such as bunch raked grass hay, may be sampled by withdrawing handfuls from different parts of the stack. Taking 20 different samples from a single cutting, particular field, or haystack is preferred.

Each core sampled should be collected and placed with others in a bag or other container. Identify the sample with name of crop, owner or location, cutting, if appropriate, and date of sampling. Keep the sample cool, clean, and dry before delivery or mailing to the laboratory. Always send the entire sample. Have the hay analyzed for dry matter, crude protein, acid detergent fiber, calcium, phosphorus, potassium, and TDN calculation.

Some laboratories calculate an RFV (relative feed value). This is **only valid** for comparing alfalfa hay samples. RFV 100 is standard, and all samples are compared with that value. This reference value is 100 percent dry matter basis, crude protein 18.5 percent, acid detergent fiber 32.0 percent, and TDN 58.6 percent.

If you sent in two or more samples of grass hay, grain hay, or some other similar kind of hay, an RFV could be calculated to assist you in comparing those samples. For example, if oat hay #1 had an RFV of 110 and oat hay #2 had an RFV of 95, and they were priced the same, oat hay #1 would be a better buy as it has 15 percent greater feeding value.

Sampling Silage, Haylage, and High Moisture Grain

Sampling should be done after the product has been ensiled for 30 days. Taking fresh samples before ensiling may lead to erroneous results. High moisture feeds are usually sampled by grabbing handfuls from at least 10 different locations in the pit or bunker, or by taking samples directly from the feed bunk as it is being fed. If the silage comes from a silo that has a mechanical unloader, allow the equipment to run for a short while before taking the sample to assure fresh product.

Forage or grain stored in heavy-duty plastic bags requires cutting a small hole in the side of the bag and digging into the material several inches to obtain a sample. Six to eight samples would be satisfactory from large bags, while two to four samples would suffice from small bags. The hole in the bag should be closed and taped shut immediately after the sample is withdrawn. This will allow sampling with only minimal damage to the contents.

Place high moisture samples in a plastic bag or other container and label with crop identification, owner and location, and date sampled. If available, place the sample in a freezer immediately, if not cool immediately, until refrigeration or freezing is available. This prevents spoilage of the sample. If shipping long distance that will require over 2 days in transit, place a freezer pack like one that accompanies vaccines into the shipping carton to assure the product arrives in good condition. Schedule shipping so that sample delivery is not delayed over a weekend.

Silage and haylage should be analyzed for dry matter, crude protein, acid detergent fiber, acid detergent insoluble nitrogen, calcium, phosphorus, potassium, and TDN calculation. High moisture grain should be analyzed for dry matter, crude protein, crude fiber, ash, ether extract, and TDN calculation. Table 1 shows a lab analysis for a sample of straw.

Some laboratories do not report dry matter. However, dry matter is the difference between 100 percent and the moisture reported. In Table 1, 100 minus 9 equals 91 percent dry matter. Dry matter is quite important because it represents the portion of the feed that the animal can use for maintenance or production. Excessive moisture in dry feeds such as hay or grain will allow those feeds to spoil, mold, or heat to the point where they ignite.

Generally, hay or grain should have no more than 15 percent moisture to store safely. Haylage and silage must have sufficient moisture to allow fermentation to proceed. Haylage moisture is normally 40 to 60 percent; while corn silage moisture is 65 to 75 percent.

Crude protein is determined by measuring the amount of nitrogen found in the sample. Most proteins contain 16 percent nitrogen, so percent protein is calculated by multiplying the amount of nitrogen times 6.25 (100% divided by 16% = 6.25). In Table 1, the the actual nitrogen found was 0.48 percent of the straw dry matter.

Table 1. Example of laboratory analysis of a straw sample.

	As fed	Dry matter
Moisture, %	9.0	——
Crude protein, %	2.73	3.0
Acid detergent fiber, %	52.78	58.0
TDN, %	40.04	44.0
Calcium, %	0.15	0.16
Phosphorus, %	0.046	0.05
Potassium, %	1.18	1.30

Acid detergent fiber is a measure of the lignin, cellulose, and silica. ADF is related to digestibility of the plant by cattle. The higher the ADF content, in general, the less digestible forage will be. ADF is used by many laboratories to calculate the TDN (Total Digestible Nutrients) value. It is a system that rates the energy content of any feed.

Energy is the fuel that powers the animal's body to grow or produce milk. Other terms used to describe energy are calories, therms, or net or metabolizable energy.

The higher the TDN value the more capacity a feed has to promote weight gain or produce milk. Calcium, phosphorus, and potassium are mineral elements that are important to health and performance of livestock. The amounts of these minerals vary quite a bit in roughage. It is important to know if they are present in adequate quantity.

In many instances phosphorus and potassium are deficient in mature or low quality forages. One way to use a lab analysis is to compare the results with a table that lists the nutrient requirements. (Note: CL 300 has complete tables of these values.) Table 2 is a comparison of the straw sample described in Table 1 with the nutrient requirements of a 1,200-pound cow during the middle third of pregnancy.

Every nutrient tested, other than potassium, is less than the needs of the cow. This means that some additional nutrients must be fed. This can be in the form of grass, hay, silage, pellet, block, liquid, or meal. The choice depends on cost coupled with the cattle producer's labor, facilities, equipment, and land. CL 303 and 304 discuss selection of supplemental nutrients.

Sampling Range and Pasture Forages

Range and pasture forages are by far the most difficult feed to sample because grazing cattle select certain plants. Studies have shown that they are able to select plants that are higher in protein and energy than the average forage in the pasture.

In a pasture having a pure stand of forage, sampling 20 different locations from different sites around the pasture is sufficient. Plants can be cut with scissors or a knife. On range or pasture that is a mixed stand of forages it is important to include all the species grazed by livestock, while avoiding rank forage that will not be consumed. The more types of forage and location that can be included in this type of sample, the greater the chance that the sample will reflect the nutrient content of the range.

Table 2. Comparison of nutrient requirements and nutrients provided by straw.

	Nutrient requirement	Straw sample
	(% in diet dry datter)	(% dry matter)
Crude protein	6.9	3.0
TDN	48.8	44.0
Calcium	0.19	0.16
Phosphorus	0.19	0.05
Potassium*	0.6	1.3

*From Clanton, D. C. 1980. Applied potassium nutrition of beef cattle. Third International Minerals Conference.

Quite important is that a sample height be a minimum of 1 inch above the ground and that no soil contaminate the sample. Samples with soil contamination will yield false mineral analysis. Sample quantity should be sufficient to fill a 1-gallon container.

Once collected the sample should be identified as to owner and location, forage type (for example, orchard grass or native range), and date sampled. The sample should be cooled after collection and stored refrigerated or frozen until shipped or delivered to the lab. The entire sample should be shipped.

Pasture and range forage samples should be analyzed for dry matter, crude protein, acid detergent fiber, neutral detergent fiber, calcium, phosphorus, potassium, and TDN calculation. Trace minerals may be added if a more complete forage picture is desired.

Sampling Grain, Concentrates, or Supplements

Sampling grain or meals is best done using a grain probe. However, grabbing samples by hand is also acceptable. Pellets, cubes, or cake may also be sampled by grabbing handfuls.

Products delivered in bulk should be sampled from five different locations in the pile, feed bunk, or as it is delivered from the truck. All samples should be combined and stored in a clean, dry, container before delivery to the lab. Identify the product, owner, sample location, and date.

Bagged or block products require that several containers be opened and sampled. A working figure is to sample 10 percent of the bags or blocks in question. Take at least one handful from each bag. Sample blocks by slicing or chiseling a chunk from each block.

Once again, identify and store in a clean container. Grain, or grain substitutes such as grain screenings, millrun, or beet pulp might be analyzed for dry matter, crude protein, crude fiber, ash, ether extract, TDN calculation, calcium, phosphorus, and potassium.

Supplement analysis may vary quite a bit depending on the nature of the product. Before sampling a supplement or concentrate it is extremely important to determine why the analysis will be made, what nutrients will be tested, and how the information will be used. In most instances this requires the services of an extension educator or professional nutritionist.

Interpreting the analysis of these types of products is quite complex. A protein supplement might be checked for dry matter, crude protein, crude protein from

non-protein nitrogen, salt, and phosphorus. This would depend on the guarantee and your reason for checking. A mineral supplement might be checked for dry matter, salt, calcium, phosphorus, magnesium, zinc, copper, iron, and manganese.

A concentrate made of mixed ingredients designed to replace grain might be checked for dry matter crude protein, acid detergent fiber, fat, calcium, phosphorus, and potassium. A TDN or energy calculation is quite inaccurate without knowledge of an accurate description and amount of each ingredient in the formula.

Although selenium is an important part of many supplements, due to deficiency in some areas, it is not routinely analyzed at feed testing laboratories. Some university labs have the capability. Olson Biochem Lab, P.O. Box 533, South Dakota State University, Brookings, SD 57007, performs selenium analysis routinely on many different forages, feed ingredients, and supplements. Results are reliable and service is excellent.

Liquid supplements are best sampled by placing a clean 1-quart container under the stream as it is delivered from the truck. The sample should be made up of product near the beginning, middle, and end of the delivery. Identify and store in a cool location.

Liquid supplements and molasses blocks may be analyzed for solids (or dry matter), crude protein, crude protein from non-protein nitrogen, phosphorus, and total-sugars invert. Special liquid supplements known as suspension supplements may include significant amounts of calcium, salt, and fat. These may be included in an analysis if desired.

References

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