



Forage

Hay Quality

Many livestock species use forages as their primary source of nutrition. Therefore, it is important to provide animals with the best quality forage available. By paying close attention to the quality of forages, you ensure healthy animals and minimize the costs of purchasing concentrate feeds.

Forage quality refers to a forage's potential to meet the nutritional needs of a particular animal. A hay that meets all the nutritional needs of a pleasure horse would not meet those of a lactating dairy cow. Make sure to keep the needs of your animal in mind when reviewing the different ways of evaluating forage quality.

Factors that affect quality

The stage of maturity at harvest plays a major role in determining the quality of a forage. Early in the growing season, forage plants move into their vegetative stage, characterized by leafy growth containing high concentrations of starches, sugars, proteins, and minerals. As the growing season progresses, plants enter the reproductive stages, characterized by elongated stems and developing seed heads. The dry matter in these mature plants has a lower proportion of nutrients and a higher proportion of plant fiber. The greater the fiber content of a hay, the less digestible it is, and the less an animal will consume before it fills its stomach. Therefore, the best hays contain a high proportion of leaves and few seed heads or stems.

Hay quality will also depend on how the hay was harvested, handled, and stored. Ideally, to preserve nutrients, hay should cure in dry, sunny weather as quickly as possible. Once it's at the proper moisture content (15 %-18%), it should be taken from the field and stored in a dry, well-ventilated area. Hay not harvested and stored under these conditions may lose nutrients or get moldy, both of which dramatically lower quality.

Weeds often have poor feed value, and some species are toxic to livestock. High quality hay comes from healthy forage stands with few or no weeds. Hay balers occasionally pick up stray foreign objects, such as trash or broken machinery parts. These pose a real threat to animal health, so high quality hay must be free of foreign material.

Hay quality can vary with forage species. Orchardgrass matures very early in the growing season, and the first cutting may be too coarse by the time ideal harvesting conditions prevail. Timothy and brome grass mature later, so there's a better chance that hay made from these species will be harvested at the right stage of maturity. There is little stem or seed head development in most grasses in second or third cuttings, and these generally make very high quality hay.

Legumes are generally more difficult to dry than grasses because of their coarse, thick stems. Leaving legume hay in the field long enough for the stems to dry risks overdrying the nutritious leaves to the point

where they shatter from the stem. This lowers the hay's quality, since the shattered leaves don't make it into the bale.

Evaluating hay quality

When purchasing hay, you can get a general sense of its quality with a visual evaluation. Look for the following characteristics:

- *Maturity* - High quality hay will have a high proportion of leaves in the bale, with few or no coarse stems or seed heads.
- *Condition* - High quality hay will contain little dust or mold.
- *Color & odor* - High quality hay generally has a bright green color and a sweet, fresh odor. Brown coloration, a bleached appearance, or musty odors denote low quality.
- *Foreign material* - The hay should be free of foreign objects (trash, sticks, tree leaves), and weeds. Be on the lookout for poisonous plant species in the bale. (For more information, see the UNH Cooperative Extension fact sheet *Poisonous Plants in Pastures*.)

While a visual appraisal will help you identify poor quality hay, it won't help you assess its feed value. For an accurate measurement of nutrient content, you need a laboratory forage analysis. (See below for information on taking a sample.) When purchasing hay, most reputable dealers will have feed analyses available, or will be willing to submit a sample for analysis. The most important information for small-scale livestock owners in a forage analysis report:

- *Dry matter* - Everything in the sample other than water, including protein, fiber, fat, minerals, etc. The dry matter of a forage contains all of the nutrients.
- *Crude protein (CP)* - an estimate of the plant protein in the feed based on its total nitrogen content. Expressed as a percentage of dry matter.
- *Neutral detergent fiber (NDF)* - total plant fiber in the feed, comprised of hemicellulose, cellulose, and lignin and expressed as a percentage of dry matter. The higher the NDF, the less an animal will eat before its stomach is full. Ruminant animals (cows, sheep, and goats) have the ability to digest some plant fiber as a source of energy.
- *Total digestible nutrients (TDN)* - The sum of digestible protein, starches, sugars, fiber, and fat, expressed as a percentage of dry matter.
- *Net energy values*, expressed as megacalories of energy per pound of dry matter (Mcal/lb.) are important to producers raising livestock for meat or milk:
 - √ *Net energy of maintenance (NEM)* refers to the fraction of a forage's energy content available to keep animals alive.
 - √ *Net energy of gain (NEg)* refers to the fraction of energy available for animals to gain weight.
 - √ *Net energy of lactation (NEl)* refers to energy available for milk production.
- *Relative Feed Value (RFV)* - an index for ranking forages based on their digestibility and intake potential. Generally, the higher the score, the higher the quality, but a score of 85-90 is still high quality for animals fed for maintenance or light production.
- *Minerals* - Expressed as percentages of dry matter, or in the case of microminerals, parts per million, the content of various minerals in a forage will vary with soil fertility and crop management. Because mineral excesses or deficiencies can cause health problems in livestock, you need to know the mineral content of your hay when planning a feeding program.

Table 1. Average nutrient values for selected forages (DM basis)*

	Grass hay	Alfalfa hay	Legume/grass haylage	Grass/clover Pasture
% Crude protein	11	21	15	19
% NDF	63	38	56	52
%TDN	57	60	57	62
NE _m , Mcal / lb.	0.50	0.57	0.52	0.66
NE _g , Mcal / lb.	0.25	0.31	0.27	0.34
NE _l , Mcal / lb.	0.49	0.63	0.54	0.61
Relative Feed Value	88	162	99	122

* averages of all feed samples submitted to DairyOne Forage Laboratory from May 1, 2002 - April 30, 2003

Taking an accurate forage sample

Proper sampling is necessary to provide an accurate representation of a hay. When you submit a sample for analysis, follow these guidelines:

- Submit a separate sample for each 'lot' (quantity of hay from a particular field or cutting) of hay.
- Use a probe that takes a core from a hay bale; "grab samples" or single flakes of hay are not acceptable.
- Take random samples to ensure the sample represents the entire lot, not just the first few bales you see.
- Take 20 cores, each from a separate bale of hay, for a composite sample. If you have a small lot of large bales (e.g. round bales), take two or three cores from each bale.
- Insert the probe 12-24 inches into the bale at a 90° angle. For small square bales, insert the probe at the end of the bale so that it takes hay from several flakes. For large round bales, insert the probe in the side of the bale, angled toward its center.
- Seal the sample in a plastic bag and keep it in a cool, dry place until you're ready to send it. Keep haylage or baleage samples in the freezer until you're ready to send them out.
- Avoid sending samples late in the week, since they may arrive at the laboratory over the weekend and spoil before someone arrives to take care of them. Instead, send them early in the week so they can be processed upon arrival.

Contact your Extension county educator (see list on next page) for information on where and how to send your hay samples for analysis.

Sources

Dairy One Forage Laboratory fact sheet - [Understanding My Forage Analysis](#)

Putnam, Dan and Steve Orloff. 2003. Ten tips to ensure an accurate hay sample. Hoards's Dairyman vol.148 no.7

UNH Cooperative Extension County Office Telephone Numbers

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