



United States Department of Agriculture
Natural Resources Conservation Service

“Forage Quality Terms and Definitions”

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In general, forage quality is defined in terms of livestock nutrient requirements. It is often described by protein and energy using the definitions below.

There are several ways to test forage quality. Forage analysis is the most commonly used. By sampling forages for laboratory analysis, an estimate can be made of the forage quality consumed by livestock. Such information improves management by better matching of forage quality with animal needs. Laboratories use either chemical (wet) procedures or Near Infrared Reflectance Spectroscopy (NIR). When properly calibrated, both methods give reliable results.

Another method is fecal sampling. Fresh manure samples are submitted to Texas A&M for analysis. One advantage is that the procedure tests actual animal consumption.

SAMPLING

Care must be taken when sampling to ensure accurate results for the forage being sampled. For hay, the sample should be a consolidation of cores taken from 15 to 20 bales. For pasture, take enough samples to adequately reflect the condition. Fecal samples should number 6 to 10.

TERMS

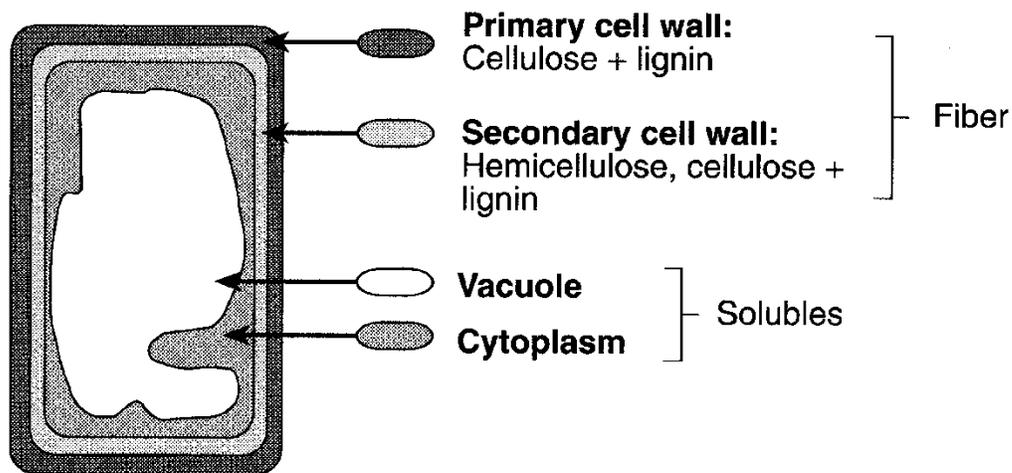
Crude Protein (CP) - the total amount of protein, some of which is insoluble or non-degradable. Crude protein is measured in the laboratory by first measuring nitrogen and then multiplying by 6.25.

Neutral Detergent Fiber (NDF) - an estimate of the portion of a forage sample that is walls of plant cells. It is measured by boiling a forage sample in a neutral detergent and weighing the residue. Boiling removes the soluble components of the cell - most of the sugars, fats, starches, and proteins. The remaining residue is composed of cell walls made up of cellulose, hemicellulose, and lignin. The amount of NDF residue is inversely related to forage intake. That is, high quality forages have low amounts of NDF.

Acid Detergent Fiber (ADF) - the indigestible portion of a forage sample. It is measured much like NDF except that a forage sample is boiled in an acidic detergent. The boiling removes sugars, fats, starches, proteins, and hemicellulose. The amount of ADF residue is inversely related to energy so high quality forages have low amounts of ADF.

Total Digestible Nutrients (TDN) - an estimate of digestible forage. TDN is not measured directly but is calculated from ADF. TDN is used by many beef producers to balance rations.

Figure 1. Plant Cell With Forage Quality Components of the Cell Wall ^{1/}



^{1/} Missouri Grazing Manual, Jim Gerrish et al., published by MU Extension, University of Missouri, 1999, page 33.

Net Energy (NE) - calculated from ADF. Net energy estimates are used largely by dairy producers in ration balancing for maintenance (NE_m), gain (NE_g), and lactation (NE_l).

Relative Feed Value (RFV) - an estimate of hay quality. It is calculated from NDF, ADF, and crude protein with emphasis on NDF. The RFV grading system assumes that full bloom alfalfa has a value of 100. Immature alfalfa has a higher RFV and stemmy alfalfa has a lower RFV.

Digestible Dry Matter (DDM) - digestibility estimated from ADF. The higher the ADF, the lower the digestibility.

Dry Matter (DM) - the percent of the forage that is not water.

Dry matter Intake (DMI) - although it can be determined from feeding trials, it is usually estimated from NDF. The higher the NDF, the lower the intake.

Anti-quality Components - compounds like alkaloids, tannins, and other toxic compounds that cause problems in animal health and performance. Even though often present in small amounts, they can override the nutritional value of forage, even when testing high for CP and TDN. Tall fescue endophyte contains a major anti-quality component. Sericea lespedeza is high in tannins, especially when mature.

Three main factors affecting forage quality are plant type, part, and maturity. Legumes are often higher in crude protein than grasses and add some energy. Harvesting forages at the proper maturity is an important management tool for improving quality.

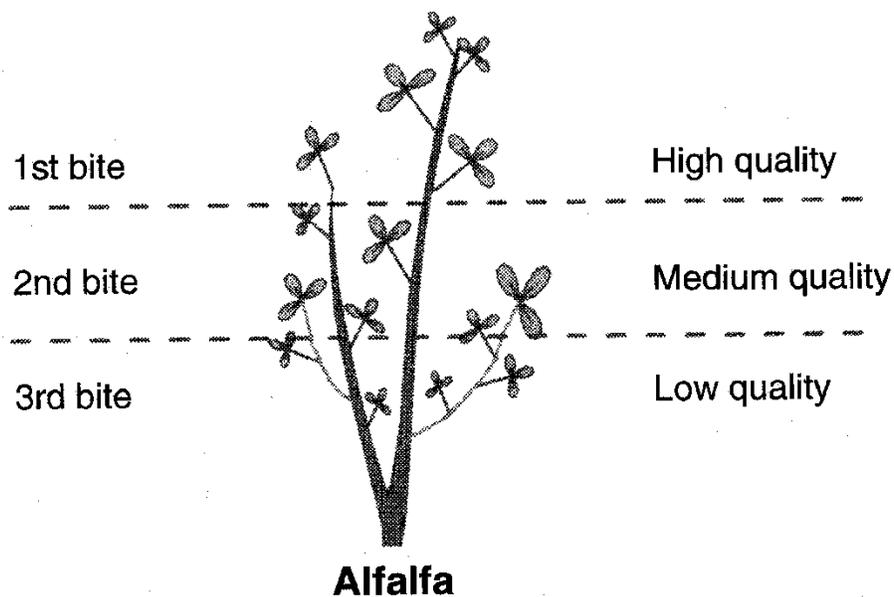
Table 1. Effect of Maturity at Harvest for Orchardgrass and Red Clover, 1998 ^{2/}

Stage of Harvest/Utilization	% Dry matter	%CP	%TDN
Growing Forage - April 10	19.0	27.1	73.0
Growing Forage - May 1	21.0	22.3	68.2
Growing Forage - May 20	21.0	15.6	62.4
Hay Harvest - May 30	85.0	11.4	58.9
Hay Harvest - June 15	86.0	9.2	52.7
Hay Harvest - July 1	85.0	8.1	43.4

^{2/} Understanding Forage Analyses by Richard White, extension agent, animal science, Pulaski, VA. (paper for Cow-Calf School), 2000.

Plant part grazed affects quality. The top part of a vegetative plant is higher in quality than the lower, more stemmy part. This a key factor in grazing two herds through a field with different nutrient needs (lactating cows, dry cows, etc.)

Figure 3. Alfalfa Leaves have Higher Forage Quality than Stems ^{3/}



^{3/} Missouri Grazing Manual, Jim Gerrish et al., published by MU extension, University of Missouri, 1999.

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