ALFALFA FORAGE QUALITY TERMINOLOGY

- Understanding the basic terminology and meaning of alfalfa quality terms helps in the evaluation of a forage's ability to produce a desired level of animal performance when it is consumed.
- Interpretation of alfalfa forage quality laboratory results may seem complicated, but can be simplified by focusing on the items of primary interest: protein, fiber, and total digestible nutrients.

Alfalfa Forage Quality

Forage quality measures the potential of a forage to produce a desired animal response.[1] The quality of a forage can be influenced by its palatability (desirability to be eaten by an animal), intake (how much an animal will eat), digestibility (how much an animal can digest), and ultimate nutrient content.

The maturity at harvest is important in determining alfalfa forage quality. Leaves are higher in quality and digestibility than stems, and the proportion of leaves in an alfalfa forage declines as the plant matures.[2] When alfalfa is in vegetative growth, the proportion of leaves to stems is highest, which helps to maximize forage quality. Leaf yield increases up until first flower and remains unchanged after that. Stem yield continues to increase as alfalfa matures, decreasing forage digestibility and quality. Not only will the stems make up a greater proportion of the total yield as alfalfa matures, the digestibility of the stem material also declines with advancing alfalfa maturity. The fiber content of the stems increases, especially the lignin content which is the least digestible fraction of the fiber.

Harvesting and storage effects can also influence alfalfa forage quality. Leaf shatter, plant respiration, and leaching by rainfall during field drying of hay can reduce forage quality, even after cutting if not processed in a timely manner. Losses can also occur due to weathering and microbial activity during storage.

Forage Quality Terminology

Laboratory analyses can be used to determine the nutritive value of forages and provide information needed to formulate animal rations.[3,4,5,6] Important terms when interpreting alfalfa forage quality are as follows:

Dry Matter (DM) - The portion (weight) of the forage other than water is DM which is used in formulating rations. Hay with moisture content less than 10% can be lower in palatability, but more than 15% may indicate a risk of mold.

Crude Protein (CP) - An indicator of the protein content in the forage which is a mixture of true protein and non-protein nitrogen. CP content indicates the capacity of the feed to meet an animal's protein needs. Typical CP content in alfalfa is in the range of 18 to 25%. Alfalfa cut early or with a high percentage of leaves has a high CP content. Animals meet protein needs by breaking down plant and microbial (from the rumen) protein and reassembling as animal protein. Other terms include Rumen Digestible Protein (RDP) which is that portion of total protein that is degraded in the rumen, and Rumen Undegraded Protein (RUP) which is that portion of the protein not degraded in the rumen. NDFCP is neutral detergent fiber crude protein.

Acid Detergent Fiber (ADF) - The percentage of highly indigestible and slowly digestible material in a forage. This includes the cell wall portions of the forage which are made up of cellulose and lignin. Lower ADF indicates a more digestible forage, and ADF values less than 35% are desirable for an alfalfa forage. ADF can be an indicator of the energy content of a forage and is used in digestibility calculations. Acid Detergent Lignin (ADL) analysis can be performed sequentially on ADF residue. Lignin is

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the major factor influencing the digestibility of plant cell wall material. As lignin increases, the digestibility, intake, and animal performance usually decreases. ADF values will be higher as lignin increases in a forage, or as alfalfa maturity increases.

Neutral Detergent Fiber (NDF) - The percentage of cell walls or fiber in a forage that is digested in a specified time, comprised of the ADF fraction plus hemicelluloses. NDF values reflect the amount of forage the animal can consume. They are inversely related to animal intake potential, with lower percentages indicating greater animal consumption. NDF content less than 45% is generally desirable for an alfalfa forage. Low NDF is better as long as there is a certain minimum fiber level in the ration to meet an animal's needs.

Neutral Detergent Fiber Digestibility (NDFD) - A newer term which is the percentage of the NDF that is digested by animals at a specified level of feed intake. NDFD is inversely related to animal intake and the energy that an animal can derive from a forage. This value can be used to rank alfalfa forages on potential fiber digestibility and in energy calculations.

Total Digestible Nutrients (TDN) - This can be an estimate of the digestible energy of a forage, representing the digestible fiber, protein, lipid and carbohydrate components. TDN in conjunction with protein and ADF can be instrumental in determining the overall quality and rations of the forage material when making feeding recommendations. Typical TDN values for alfalfa can be in the range of 60 to 70%. Other net energy values often calculated from TDN values are:

- Net Energy of Maintenance (NEM) - an estimate of the energy value of a forage used to keep an animal in equilibrium (neither gaining or losing weight).
- Net Energy of Lactation (NEL) - an estimate of the energy value of aforage used for maintenance plus milk production during lactation.
- Net Energy for Gain (NEG) - an estimate of the energy value of a forage used for body weight gain above that required for maintenance.

Nonfibrous Carbohydrate (NFC) - An estimate of the rapidly available carbohydrates in a forage which is primarily starch and sugars.

Ash - A measure of the total mineral content in a forage. Values greater than 14% for legumes usually indicate soil contamination of forage.

Ether Extract (EE) - Used to measure the crude fat content of a forage.

Relative Feed Value (RFV) - An index for ranking forages based on combining digestibility and intake potential, calculated from ADF and NDF values. An index representing forage quality and one of the systems used by forage testing laboratories for many years. RFV uses NDF and ADF as predictors of forage quality. The NDF content is correlated with intake, and ADF is correlated with digestibility. RFV values are relative to a value of 100 which is the indicator of quality that can be equated to alfalfa at full bloom. For example, when alfalfa is at pre-bloom, it would have higher nutritive value with an RFV greater than 100. Values less than 100 indicate mature alfalfa at post bloom. Some growers raising or buying alfalfa will use RFV to evaluate or compare alfalfa quality when buying or selling the hay. It provides the producer or buyer with a simple means of comparing the performance potential any given forage has with other available like forages.

Relative Forage Quality (RFQ) - Another index used to rank forages by potential intake of digestible matter where 150 is considered milking dairy quality feed and lower indices are needed for other categories of animals. RFQ can be a better predictor of animal performance than RFV.

Milk 2016 - Milk per acre and milk per ton estimates can be calculated using this spreadsheet developed as an alfalfa/grass evaluation system at the University of Wisconsin.[7]

https://fyi.extension.wisc.edu/forage/milk2016-combining-yield-and-quality-into-a-single-term/

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The spreadsheet utilizes laboratory analysis values for CP, ADF, NDF, NDFD, NDFCP, ash, and ether extract along with yield measured in the field to calculate these estimates. The spreadsheet also calculates NFC, TDN, RVQ, and RFV for alfalfa and grass forages.

Summary

Factors having the greatest impact on alfalfa forage quality are stage of maturity at harvest and the harvesting and storage techniques. Alfalfa leaves are higher in quality than stems, and young stems are higher in quality than old stems. The more mature and fibrous an alfalfa forage, the longer it can take to be digested and the less an animal may consume. The ultimate measure of forage quality is animal performance. Good animal performance results when animals consume forage that is high in nutrients and low in fiber. The numbers provided on a forage test report are valuable but not absolute, Sampling technique and good laboratory procedures are important for obtaining useful forage quality results.

Sources

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Web sources verified 1/29/21.

Legals

Performance may vary, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields.