

Forage Testing¹

J. M. Vendramini, M. S. Silveira, J. D. Arthington, and A. R. Blount²

Why Test Forage?

Forage testing provides useful information about the nutritive value of forage. This information can be used to adjust the amount and composition of nutritional supplements offered to livestock consuming forage. The correct adjustments can reduce costs of forage production and optimize the amount of nutrients imported to the property.

Where to Send Forage Samples and What Testing Results Will Be Provided

The UF/IFAS Forage Extension Laboratory is located at the Range Cattle Research and Education Center in Ona, Florida. The laboratory provides forage testing for Florida's livestock producers and forage producers. Results of the tests include crude protein (CP) and total digestible nutrients (TDN).

Mail samples to Forage Extension Laboratory, UF/IFAS, Range Cattle REC, 3401 Experiment Station, Ona, FL, 33865.

Beyond understanding the nutrient quality of your forage, it is also valuable to understand how your forage samples compare with other such samples submitted to

the laboratory. On an annual basis, the Forage Extension Laboratory publishes the average forage nutritive values by forage species (Table 1).

Nutritive-Value Parameters and Definitions

The nutritive-value parameters reported by the Forage Extension Laboratory are as follows:

1) Dry matter (DM): DM refers to the portion of the forage after water is excluded. All nutritive-value parameters are reported on a "dry matter basis," thus results of samples with different DM concentrations can be compared. Dry matter concentration is important for conserved forage — such as hay, haylage, and silage — because this measure indicates how the conservation process may impact forage nutritive value. Dry matter concentration for hay should be approximately 85%–92%, haylage 40%–60%, and silage 30%–40%.

2) Crude protein (CP): CP is the nitrogen and amino acids in feeds. An estimate of forage total crude protein is obtained by multiplying total nitrogen concentration by a constant of 6.25. Adequate CP concentrations in the forage are dependent on forage species and animal requirements. For more information, see EDIS Publication AN190, *Basic*

1. This document is SS-AGR-63, one of a series of the *Florida Forage Handbook*, Agronomy Department, UF/IFAS Extension. Original publication date April 2001. Revised June 2015 and July 2018. Visit the EDIS website at <http://edis.ifas.ufl.edu>.

2. J. M. Vendramini, associate professor, Agronomy Department, Range Cattle Research and Education Center, Ona, FL; M. S. Silveira, associate professor, Soil and Water Science Department, Range Cattle REC; J. D. Arthington, professor, Agronomy Department, and director, Range Cattle REC; and A. R. Blount, professor, Agronomy Department, North Florida REC, Marianna, FL; UF/IFAS Extension, Gainesville, FL 32611.

The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication do not signify our approval to the exclusion of other products of suitable composition.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For more information on obtaining other UF/IFAS Extension publications, contact your county's UF/IFAS Extension office. U.S. Department of Agriculture, UF/IFAS Extension Service, University of Florida, IFAS, Florida A & M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Nick T. Place, dean for UF/IFAS Extension.

Nutrient Requirements of Beef Cows (<http://edis.ifas.ufl.edu/an190>).

3) Total digestible nutrients (TDN): TDN represents the energy concentration in the forage, the sum of digestible fiber, starch, sugars, protein, and fat in the forage. Energy is the nutrient required by cattle in the greatest amount and usually accounts for the largest proportion of feed costs.

4) Neutral detergent fiber (NDF): NDF represents plant cell wall components (hemicelluloses, cellulose, lignin), which are more or less degradable, depending on the stage of maturity and degree of lignification of the forage. In general, as NDF increases, voluntary forage intake is reduced.

5) Acid detergent fiber (ADF): The ADF component of forage is determined when either the NDF residue or an intact forage sample is processed in a detergent solution primarily containing sulfuric acid. The remaining fiber residue, mostly cellulose and lignin, is called ADF. In general, as ADF increases, forage digestibility is reduced.

How to Collect a Sample

Properly collecting and identifying a sample is very important. A sampling device or tool is needed for collecting hay samples. Several commercial types are available. These tools usually consist of a tube — with a cutting edge on one end and a shank on the other — that is fastened in the chuck of an electric drill or hand brace. The sampler is driven into the end of a rectangular bale or the rounded side of the round bale. Collect a single core sample from each of 12 bales for a particular lot of hay. To ensure the sample is representative, combine the 12 cores into one sample. The outer layer of weathered round bales should be pulled away before sampling. Each hay cutting, type of hay, etc., should be sampled and analyzed separately. Each hay cutting or lot should be identified and stored separately.

Silage samples can be collected from the face of a bunker silo as it is being fed and from the unloader of an upright silo. Bagged silage can be sampled by cutting small slits along the side of the bag and penetrating the hay sampler to collect the material. Producers must reseal the slit with waterproof tape after collection.

Collect silage from five or six places along the bag, mix well, and extract a single sample to send to the laboratory. Immediately place the sample in a plastic bag and seal it. If the sample is not mailed right away, place the sample in a refrigerator or freezer.

Pasture samples can be collected and analyzed by plucking the forage with your fingers at the height the animals are grazing it. However, keep in mind that, when adequate pasture forage is available, cattle may select forage with a better nutritive value than the forage sampled by hand plucking. One practical example of selection can be found in limpgrass pastures with good forage availability. In this example, cattle will typically select leaves that have greater nutritive value than hand-plucked samples collected with leaves and stems. In this case, forage testing results may suggest that cattle would respond to protein supplementation. However, in fact, the animals are already consuming adequate amounts of protein from forage selection and may not respond to supplementation.

Scissors or some other cutting device also can be used. If possible, these samples should be dried before sending to the laboratory. If drying is not possible, mail the sample immediately after it is harvested. Your results are only as good as your sample!

Additional Information and Testing Procedures

Nutritive value results (Table 1) are reported by forage species. Forage species not included in this publication were not received by the laboratory in sufficient numbers to be included in this annual report. Crude protein and TDN were analyzed in all samples. Dry matter (DM), NDF, and ADF were analyzed in selected samples submitted by dairy producers participating in the Southeast Dairy, Inc., Check-Off Program.

The UF/IFAS Forage Extension Laboratory sample processing and analyses are as follows:

- Forage samples are dried at 55°C in a forced-air oven for DM determination.
- Total digestible nutrients (TDN) are estimated using the “in vitro” dry matter digestibility (IVDDM) procedure described by Goering and Van Soest (1970). (USDA-ARS Agric. Handb. 379. U.S. Gov. Print. Office, Washington, DC). modified for the Ankom Daisy II In Vitro Digester (Ankom Technol. Corp., Fairport, NY).
- Crude protein was calculated by multiplying nitrogen concentration by 6.25.
- Nitrogen is determined by combustion using the Flash EA 1112 Series (Thermo Electron Corporation, Waltham, MA).

- Neutral detergent fiber (NDF) and acid detergent fiber (ADF) are analyzed using an Ankom 2000 Fiber Analyzer (Ankom Technology Corp., Fairport, NY).

Many laboratories provide forage testing results based on the NIRS procedure. The NIRS procedure is often valid, depending upon the set of forage samples originally used to establish the procedure's equations. In general, wet chemistry procedures are more accurate.

If you do not know how to interpret the results, contact your County Agricultural Extension Office, or the UF/IFAS Forage Extension Laboratory at jv@ufl.edu.

The authors sincerely thank the Dairy Check-Off Program for sponsoring forage testing for the Southeast Dairy, Inc. producer samples.

References

Ankom Technology Corporation. 1998. "Method for Determining Acid Detergent Fiber, Neutral Detergent Fiber and Crude Fiber, Using the Ankom Fiber Analyser." Ankom Technology Corporation, 14 Turk Hill Park, Fairport, New York 14450, USA.

Goering, H.K., and P.J. Van Soest. 1970. "Forage fiber analysis (apparatus, reagents, procedures, and some applications)." *USDA Agric. Handb.* 379. U.S. Gov. Print. Office, Washington, DC.

Hersom, Matt. 2007. *Basic Nutrient Requirements of Beef Cows*. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <http://edis.ifas.ufl.edu/an190>.

Table 1. Dry matter (DM), crude protein (CP), total digestible nutrients (TDN), acid detergent fiber (ADF), and neutral detergent fiber (NDF) of forage samples submitted to the Forage Extension Laboratory at the Range Cattle Research and Education Center – Ona, FL (October 2006 to December 2017)

Forage Species	Number of Samples	CP	TDN	ADF	NDF
Bahiagrass ^a	598	6.3 ± 3.0	50 ± 4	--	--
Bermudagrass	1012	11.7 ± 3.8	53 ± 2	41 ± 3	74 ± 3
Stargrass	379	8.9 ± 3.4	52 ± 7	47 ± 9	70 ± 15
Limpograss	873	4.1 ± 2.7	53 ± 9	41 ± 4	70 ± 6
Corn Silage	112	8.2 ± 2.2	76 ± 8	30 ± 3	41 ± 9

^aADF and NDF analysis performed only on samples submitted by dairy producers. Bahiagrass was not analyzed for these nutrient constituents.