By Rachel Endecott, Beef Cattle Specialist

Cow Sense Chronicle

October 2015

Analyzing Forages for Winter Feeding

Last month, Dr. Van Emon wrote about forage sampling techniques. This month, I'm going to follow up with a brief overview of interpreting the forage analyses received from a laboratory. Many of you have heard me say that it's hard to manage if you don't measure first. This is especially true in this case. An understanding of forage quality is a critical first step in developing least-cost rations for wintering beef cattle. Below is a grass hay sample that also includes a mineral analysis. Definitions and important terms are found on the next page.

Sample ID: FL 2698
Feedstuff: GRASS HAY

ANALYSIS RESULTS		
Component	As Sent	Dry Wt.
Moisture (%)	12.58	///////
Dry Matter (%)	87.42	///////
Crude Protein (%)	6.92	7.92
Acid Detergent Fiber (%)	35.3	40.4
Total digestible nutrients (%)	49.4	56.5
Net energy-lactation (Mcal/lb)	0.50	0.57
Net energy-maint. (Mcal/lb)	0.48	0.55
Net energy-gain (Mcal/lb)	0.28	0.32
Sulfur (%)	0.13	0.15
Phosphorus (%)	0.18	0.20
Potassium (%)	1.55	1.77
Magnesium (%)	0.15	0.18
Calcium (%)	0.36	0.42
Sodium (%)	0.06	0.07
Iron (ppm)	443	507
Manganese (ppm)	50	58
Copper (ppm)	6	6
Zinc (ppm)	17	20

Important Forage Analysis Terms

Moisture

As Fed – Values in the "As Fed" or "As Received" column include the moisture contained in the submitted sample. Because of the dilution effect of the water, values in this column will be smaller than the Dry Matter column.

Dry Matter – Values in the "Dry Matter" column give nutrient information with the water removed. To accurately compare forages of differing water content, they must be compared on a dry matter basis.

Protein

Protein (or Crude Protein) – A measure of the amount of nitrogen in the feedstuff. Laboratories measure the nitrogen in a sample, then multiply by a factor of 6.25 to get the crude protein value.

Fiber

Acid Detergent Fiber (ADF) – Refers to the cellulose and lignin components of the forage cell wall, and relates to the ability of an animal to digest the forage. As ADF increases, digestibility of a forage usually decreases.

Neutral Detergent Fiber (NDF) – Refers to the total cell wall – cellulose, hemicelluloses and lignin. NDF values reflect the amount of forage an animal can consume. As NDF increases, dry matter intake will generally decrease. Labs often analyze for ADF but may not include NDF values unless specifically requested.

Energy

Total Digestible Nutrients (TDN) – An estimate of the digestibility of the forage and one measure of the energy content of a feedstuff. The higher the TDN value of a forage, the more energy it contains.

Net Energy for Maintenance (NEm) – The net energy system is an alternative way to assign energy values to feedstuffs, based on how the energy is partitioned for different uses. NEm describes the ability of a forage to meet the maintenance energy requirements of an animal.

Net Energy for Growth (NEg) – NEg describes the amount of energy in a forage available for growth after the maintenance needs have been met.

Net Energy for Lactation (NEl) – NEl describes the ability of a forage to meet the energy requirements of lactation.

The table below summarizes energy and protein requirements for a 1400-lb cow (1996 Beef NRC)

	Diet Nutrient Density		Daily Nutrients per Animal	
Physiological Stage	TDN (% DM)	CP (% DM)	TDN (lbs)	CP (lbs)
20-lb peak milk				
Early Lactation	58.0	9.9	17.6	3.00
Late Lactation	54.2	8.3	16.0	2.45
Post-Weaning	47.4	6.6	12.2	1.68
Late gestation	52.3	7.9	14.4	2.15
30-lb peak milk				
Early Lactation	60.9	11.3	20.1	3.38
Late Lactation	56.3	9.3	17.4	2.88
Post-Weaning	47.4	6.6	12.2	1.68
Late gestation	52.3	7.9	14.4	2.15

The next question is, "***Does the hay meet cow requirements?***" Example calculations are shown below. Note that the hay meets both TDN and CP requirements during mid– and late gestation, but does not meet requirements for early lactation for either 20 or 30 pounds of peak milk yield.

ENERGY:
1400-lb cow, dry matter intake (DMI) of 2% of body weight = 28 lb
Intake x % TDN = lb TDN provided
28 lb x 0.565 = 15.82 lb TDN provided
Mid-gestation requirement = 12.2 lb TDN
Late gestation requirement = 14.4 lb TDN
Early lactation requirement = 17.6-20.1 lb TDN

PROTEIN:
1400-lb cow, DMI of 2% of body weight = 28 lb
Intake x % CP = lb CP provided
28 lb x 0.0792 = 2.22 lb TDN provided
Mid-gestation requirement = 1.68 lb CP
Late gestation requirement = 2.15 lb CP
Early lactation requirement = 3.00-3.38 lb CP

NITRATE TOXICITY CONCERNS
Finally, a brief note on forage testing for nitrate concentration. Several plant species are of concern for nitrate accumulation, especially during drought conditions. These include annual small grain crops, corn, and plants in the sorghum/sudangrass family. Weeds can also accumulate nitrate; some examples include redroot pigweed, common lambsquarters, kochia, wild sunflower, Russian thistle, witchgrass, Canadian thistle, and black nightshade. The highest concentration of nitrate will be found in the stalk of the plant, particularly in the lower portion. Nitrate uptake is a normal part of plant metabolism, where the plant converts nitrate to nitrite and then to ammonia. Ammonia serves as a main building block for protein synthesis. The conversion pathway from nitrate to ammonia is the same in the rumen of a cow. At high intakes of nitrate, the conversion pathway becomes overwhelmed at the nitrite-to-ammonia step and nitrite accumulates. Nitrite competes with oxygen for red blood cells, and converts hemoglobin to methemoglobin, which is incapable of oxygen transport. The table below gives some guidelines for nitrate-containing feedstuffs.

Reported on 100% dry matter basis as:		**Comment**
NO3-N (ppm)	**NO3 (ppm)**	
< 350	< 1500	Generally safe for all conditions and livestock.
350-1130	1500-5000	Generally safe for non-pregnant livestock. Potential early-term abortions or reduced breeding performance. Limit use to bred animals to 50% of the total ration.
1130-2260	5000-10000	Limit feed to 25-50% of ration for non-pregnant livestock. **DO NOT FEED TO PREGNANT ANIMALS**, may cause abortions, weak calves, and reduced milk production.
> 2260	> 10000	**DO NOT FEED**. Acute symptoms and death.

Questions for Rachel?
rachel.endecott@montana.edu
406-994-3747