

**The Importance of a Forage Feed Analysis** - Murray Feist, M.Sc., P.Ag. Ruminant Nutritionist  
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Feed testing is an important component to any bison feeding program. By testing feeds for their nutrient content, producers can gain key information about that feed that will assist them in planning a feeding program for the upcoming fall and winter months. Feed testing also provides an opportunity to test for anti-nutritional factors such as molds, toxins, nitrates, and prussic acid.

The feeding of bison revolves around a forage based diet and therefore any forage to be used in the feeding program should be tested. Forages contain varying amounts of protein, energy and minerals depending on stage of growth when harvested, growing environment, harvesting conditions, and variety (i.e.: legume, grass or straw). As shown in Table 1, the nutrient content alfalfa is different from brome grass which is different from barley straw.

**Table 1. Average forage feed values (100% dry matter)**

Forage	Crude Protein (% dry matter)	Total Digestible Nutrients (% dry matter)
Alfalfa hay, early	18	59
Alfalfa hay, late	16	53
Brome grass hay	10	55
Barley straw	3	46

Source: Bodycote Testing Group, Adapted from NRC Nutrient Requirements for Dairy Cattle, 1993.

When sampling feeds for testing and nutrient analysis, it is important to take a representative sample from the feed source. Table 2 indicates how many sub-samples need to be taken.

**Table 2. Sampling Procedures**

Sample	Procedure
Grains	<ol style="list-style-type: none"> <li>1. 3 samples/truck load</li> <li>2. 10-12 probes per bin</li> </ol>
Silage	<ol style="list-style-type: none"> <li>1. Probed 15-20 locations in silo/pit</li> <li>2. Grab Sample: 5-6/feeding for 3 feedings. Collected samples should be kept refrigerated or frozen in air tight bags.</li> </ol>
Hay/Forages	<ol style="list-style-type: none"> <li>1. 15-20 locations in stack</li> <li>2. Greater than 20 bales: sample 10% of number of bales</li> <li>3. Less than 20 bales: sample all bales.</li> <li>4. Combine all samples into a final sample volume the size of bread and submit for testing.</li> </ol>

## **Feed Testing Results – What am I Looking For?**

### **Moisture**

When interpreting a feed test and planning a feeding program for bison, producers first want to note the moisture content of the feed (measured in percent) and secondly the nutrient values in the 100% dry matter column. Identifying the moisture content is important as it not only provides a way to compare the quality of similar feeds on an equal basis (i.e. is a barley hay as good as a barley silage), but also allows a producer to utilize the nutrients of the feed on a dry matter basis. Once the nutrients in the ration are balanced to the nutrient needs of the bison, the moisture content of each feed is then used to compute how much of that feed should be fed on an as fed basis.

### **The Top 4**

Once the moisture percentage and dry matter column has been identified, producers should look for the top four critical nutrients in the feed: crude protein, energy values (often reported as Digestible Energy, Net Energy, and Total Digestible Nutrients), calcium and phosphorus. These are the first four primary nutrients of importance when formulating rations for bison. The protein and energy are required in large amounts (measured as a percentage) and are the first two essential nutrients necessary to not only meet maintenance requirements but also to meet production requirements for growth and lactation. Calcium and phosphorus are the next two nutrients of importance to look for in the feed as both play important roles in the function of milk production, muscle contraction, bone structure and development as well as reproduction.

### **What About Fibre?**

In the case of forages that are harvested well into maturity and past normal cutting, total fibre of the plant should be analyzed. There are two fibre values that are measured for forages. The first analysis that is conducted on all forages samples is the acid detergent fibre or ADF. The ADF content is the indigestible portion of the forage comprised of lignin and cellulose that rumen microbes cannot easily utilize to create energy for the bison. When ADF content increases there is a decrease in energy and TDN available to the bison. As an example, a mid-bloom alfalfa hay could have an ADF content of 41 percent (dry matter basis) reflecting an energy or TDN content of 56 percent; while a barley straw could have an ADF content of 55 percent resulting in an estimated energy content of 46 percent. There is an inverse relationship between ADF and the energy content of the feed.

A second analysis for fibre is neutral detergent fibre or NDF. The NDF is an indication of the total fibre content of the plant. This number will be higher than the measured ADF content. The difference between NDF and ADF is the portion of fibre in the plant that is available to rumen microbes for digestion. This portion of fibre contains pectin's and cellulose structures that rumen microbes absorb and create energy. In the case of over mature forages or forages exposed to extreme weathering during harvest, the NDF can become so high that it will limit feed intake in bison. Excessive NDF in forages will reduce daily feed intake resulting in a deficiency in protein, energy and minerals consumed. Under these circumstances, if a forage contains greater than 60% NDF and is the only feed in the diet, there will be a loss of animal condition and performance unless supplemental feed is provided.

### **Macro and Micro Minerals**

Finally, other macro minerals (measured as a percentage) such as magnesium, potassium and sodium can be analyzed and used in a balanced feed diet. As well, the micro or trace minerals such as copper, zinc, molybdenum, manganese, iron, iodine and selenium can be requested for analysis.

While only measured in units as small as parts per million (or milligrams per kilogram, mg/kg), these micro minerals play an important role in body functions. Most often producers will benefit from a standard mineral supplementation program. However, it is useful to conduct a trace mineral analysis in feeds to establish mineral levels being provided. As well, if mineral deficiencies or toxicities are suspected, a trace mineral analysis of the feed is the first step toward identifying the deficiency and plan for corrective feeding.

### **Other Tests**

Situations that would warrant other feed tests could also include tests for crude fat, sulphur, nitrates and prussic acid. Often, forage crops that have been impacted by adverse environmental conditions such as frost increase the risk of adverse feed complications. For example, frost and drought can result in the accumulation of nitrates in cereal forage crops and in flax, high levels of prussic acid (a chemical related to cyanide). A feed analysis is the only method that producers and nutritionists can use to determine if the forage has toxic levels of nitrates or prussic acid.

### **Feed Grains and By-product Feeds**

Usually, there is not an urgent need to conduct a feed analysis on parent feed grains such as barley and oats because these feed grains are relatively consistent in their nutrient contents. Weathered or poorly stored grains tend to be depleted in nutrients and may require a feed analysis to determine the extent of nutrient degradation.

By-product feeds such as distiller grains with solubles and canola meal also may tend to have somewhat inconsistent nutrient levels. Should a by-product feed be considered as part of the feeding program, producers should investigate the average nutrient levels for that feed and when in doubt feed test and consult a nutritionist.

Another feed source to be tested would be raw grain screenings. Each year, grains are cleaned providing a mixture of chaff, hulls, weed seeds and fibres left behind. While screenings can successfully be fed to bison, producers should be looking to feed test these sources for nutrient content due to the variability of “ingredients” in the mixture.

### **Conclusion**

Feed tests are an important part of animal health and husbandry. As forages are harvested and stored for winter feed, a feed analysis should be conducted to a) identify the quality of feed on hand and b) allow for targeted and timely supplementation of these forages to balance rations to meet nutrient needs and the production schedules of the bison. Using average values often results in average results. In this case, knowledge is power and can be effective in providing smart feeding choices, eliminate unwanted costs, and increase performance and production.