Practical Forage Evaluation: Laboratory and Barnyard

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Forages provide the foundation upon which productive and economical dairy rations are built. However, there are a variety of forage types, harvesting, storage and feeding systems utilized on dairy farms.

A key component in the evaluation of a feeding program is an index of forage "quality." The term quality covers a broad spectrum of characteristics including visual appraisal, smell and chemical characteristics. All of these must be integrated into an overall framework to determine whether or not the forage is of acceptable quality and palatability to support the desired levels of productivity.

How can forage "quality" be monitored? What type of tests or analyses can be done? What can be done at the farm versus in the lab? How can the results be interpreted? This paper will attempt to address some of these questions.

A. *Laboratory analyses*—The primary use of laboratory analysis data is to provide an index of nutrient content and potential feeding value. Most forage testing labs have a number of analyses available. These may be priced as either individual analysis or as part of a package of multiple analyses. The exact analyses to be requested will depend upon the question being asked at the farm and the costs involved. Are you doing a preliminary overview of the situation or an in-depth problem solving evaluation? The following package may be useful:
   1. Basic (minimum) package—Dry matter, total crude protein, ADF (or NDF). In addition, most labs will estimate the TDN or NE_l value of the feed from the ADF value.
   2. Middle level package—Basic package listed above plus some macrominerals (such as Ca, P, K, Mg, Na).
   3. In-depth analysis package—Packages 1 and 2 listed above plus some trace minerals (such as Fe, Zn, Cu, Mn).

In addition to these analyses, there are a number of other analyses which may be useful in specific situations. These include:

pH—Highly desirable for silage samples (as an alternative this may be done on the farm).

ADF-N—A measure of heat-damaged or bound protein. An ADF-N value in excess of 5-10% of the total crude protein indicates the presence of heat-damaged nitrogen. If excessive heat-damaged nitrogen is present, the total crude protein content of the feed should be adjusted for ration formulation purposes. This analysis is most applicable to silages or other feedstuffs which have undergone a fermentation or heating process. There is probably little reason to have this analysis on hay, pasture or greenchop samples.

Soluble-N—Another special measure of nitrogen content. This analysis would be advisable in situations in which a potential imbalance of protein fractions is suspected. Silages will have a large range in soluble-N content depending upon the moisture content and degree of fermentaion which has occurred.

Ammonia-N—This analysis may be useful as an index of the quality of silage being fed. Values less than 8-10% of the total protein generally indicate a good, stable fermentation.

Nitrates—May be useful or indicated in very specific situations. Examples are drought-stressed forages or forages grown on soils with high levels of manure or nitrogen fertilizer application.

Molds (Mycotoxins)—Again, may be useful in specific situations. These analyses may be quite expensive if quantitative results are desired.

   4. Wet chemistry versus NIR—Wet chemistry is more expensive and slower than NIR. If a properly calibrated NIR unit is used, it can be used for dry matter, protein and fiber analyses. NIR does not directly measure minerals. Mineral estimates obtained with NIR are determined through the use of a correlation matrix. They may be reasonable "ballpark" values but should not be relied upon in in-depth troubleshooting or evaluation situations.

B. *Farm evaluations*—There are a variety of observations which can be made on the farm with little or no equipment. Your senses of sight, smell and touch will be the key monitoring tools.
   1. Hay samples—Basically, you are looking for color, stem to leaf ratio, coarseness of stems and the presence of weeds or other foreign materials. In some samples, mold may be visible. However, a musty smell may also be an index of slightly wet or spoiled hay. Hay should not be warm or

hot to the touch.

2. Silages—Most of your on-farm forage evaluation will probably be spent on these samples. The exact characteristics to look for will depend upon the actual crop ensiled and the type of storage structure used. The following guidelines may be useful in the evaluation process:
   a. Sight— The key evaluation component here is particle size. The silage should contain a mixture of particle sizes. For haycrop silage samples, approximately 20-25% of the total particles should be 1-1½ inches in length. Corn silage samples should have some visible pieces of cob in addition to a variety of particle sizes of the husk, leaf and stalk fractions. You should also examine the silage in the storage structure if possible. The uniformity of color throughout the silo is the key. Look for the amount of top spoilage and the presence of mold or spoilage pockets in the silo.
   b. Smell—The silage should have a good lactic acid smell which is indicative of a good, stable fermentation. Acetic acid (vinegar), butyric acid or ammonia smells are indexes of a less than desirable fermentation. These types of silage may also not be very stable especially during the feedout process.
   c. Touch—The objective here is a cool silage. If the silage is warm or hot to the touch, it is another index of a poor fermentation. Special attention should be paid to silage which has been disturbed and may be subject to aerobic deterioration or secondary fermentation. You should also squeeze the silage to get an index of moisture content.
   d. Evaluation- There are a number of simple tools which may be useful in refining the above observations. A scale and tarp is useful for determining weights of feeds fed and refused. A moisture tester will provide a more accurate measure of dry matter content. A pocket pH meter or test strip is useful for monitoring pH as an index of fermentation. Most silages should have a pH of 4.5 or less if they have undergone a normal, stable fermentation.

C. Feedbunk observations-

The final set of evaluations should be conducted at the feedbunk. Does the feed heat while it sits in the feedbunk? Are the cows separating out and consuming different particle sizes? Are they leaving only the longer, coarser pieces of the forages?

Summary

The evaluation of forage quality includes a combination of factors. A combination of laboratory analysis and on-farm evaluations will permit you to put together a picture of overall forage quality. By using the guidelines listed above, you should be able to determine the potential of alterations in forage quality and their impact on animal performance. These measures should be considered as an integral part of a total nutrition evaluation package.