Forage Quality Analysis

Randy Wiedmeier
Regional Livestock Specialist, Southcentral Area

In case you have not noticed, it’s Fall again and I am observing the filling of hay yards and barns. For many years the extension service has promoted and encouraged the testing of hay and other stored feeds for nutrient content. Although I believe the testing of forages is on the increase, I would venture a guess that most of our hay is probably bought, sold, and fed without a laboratory analysis for nutrient content. In this article, I would like to address some of my observations and opinions regarding the analyzing of forages such as hay for nutrient content.

1. Most of the errors associated with analyzing forages for nutrient content do not occur in the laboratory. Most errors are associated with improperly sampling the forage. It is important to use an approved sampling devise like a tube-type core sampler (18 inches long, one half inch cutting diameter). Most MU extension offices have samplers you can borrow. Although the more bales you can sample the better, there are practical limits, e.g., 10 to 15 bales from each lot or field, etc. Try to avoid sampling bales from only one area in a field. For example, if you sample only bales laying along a gravel road, errors could result because of dust from the road settling on the forage in that particular portion of the field. Also, variations in soils, etc., can affect the nutrient content of forages. If possible, it is best to sample bales three to four weeks after baling, especially if the moisture content is above 15%.

2. There are two methods normally used to analyze forages for nutrient content, wet chemistry and near infrared spectroscopy (NIRS). The procedures used for wet chemistry are time consuming and sometimes require the use of expensive and hazardous chemicals. However, most of these procedures have been used since the 1860s and are accurate and repeatable. NIRS is a relatively recent innovation. Forage samples are bombarded with near infrared light and a reflectance pattern specific to various nutrient concentrations is emitted. The reflectance pattern is then interpreted by comparing it to forages with similar patterns that have known nutrient concentrations determined by wet chemistry. The accuracy of NIRS depends on the accompanying computer model having an extremely large array of reflectance patterns from forages of varying nutrient concentrations. NIRS has the advantages of being relatively rapid, not requiring the use of hazardous and expensive chemicals (once the computer model has been developed), and the sample is not destroyed in the procedure. Over time, most of the NIRS computer models have become quite accurate. NIRS is functional with nutrients of higher concentration in forages such as fiber, protein, fat and some macro-minerals. However NIRS is probably not of adequate accuracy with nutrients of lower concentration such as micro-minerals.
3. Two problems that can result from NOT sampling and testing your hay are: not being able to estimate the market value of the hay and not knowing how well the nutrient content of the hay matches the nutrient requirements of your livestock. Although there are many variables affecting the local market value of hay, one method that can be used is the cost per unit of energy (NEm) with corn grain as a basis.

\[
\begin{array}{|c|c|c|c|c|}
\hline
$/\text{ton Corn DM}$ & NEm/lb. Corn DM & $$/\text{unit of NEm}$ & NEm/lb. Hay DM & $$/\text{ton Hay DM} \\
\hline
160.00 & ÷ & .9909 & = & 161.47 & x & .5800 & = & 93.65 \\
\hline
\end{array}
\]

If this hay was in the form of an 800 lb. round bale, it would contain about 720 lbs. of DM. So based on the table above, the round bale would be worth $(93.65 \times 720) \$33.71.

If a lactating beef cow was able to consume 26 lbs. of DM from this hay, would its energy (NEm) requirement be met?

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{DM Intake, lbs./day} & \text{NEm/lb. Hay DM} & \text{NEm Provided} & \text{NEm Required} \\
\hline
26.00 & x & .5800 & = & 15.08 & 15.00 & \text{OK} \\
\hline
\end{array}
\]

Without having a good estimate of the energy (NEm) content of this hay, neither an accurate assessment of its market value nor a determination of animal nutrient adequacy can be made.

4. There are two major livestock ramifications that can result from NOT sampling and testing your hay: the productivity of your livestock could suffer because they should have been supplemented but were not. Or, the profitability of your livestock operation could suffer because they were supplemented and it was not required or necessary.

\[
\begin{array}{|c|c|c|c|c|c|c|}
\hline
\text{DM Intake, lbs./day} & \text{NEm /lb.} & \text{NEm Intake} & \text{NEm Required} & \text{NEm Status} & \text{Calving Interval, days} & \text{Profit/Cow, $/year} \\
\hline
23.00 & x & .5200 & = & 11.96 & - & 15.00 & = & -3.04 & 400 & \$-50 \\
26.00 & x & .5800 & = & 15.08 & - & 15.00 & = & + .08 & 360 & \$+25 \\
\hline
\end{array}
\]

The cows being fed the .5200 NEm hay were receiving only about 80% of their energy (NEm) requirement and as a result were weaning a calf every 400 days instead every 365 days as needed, which resulted in an economic loss. These cows should have been supplemented or received a better quality hay.

\[
\begin{array}{|c|c|c|c|c|c|c|}
\hline
\text{DM Intake, Hay + Supplement, lbs./day} & \text{NEm /lb.} & \text{NEm Intake} & \text{NEm Required} & \text{NEm Status} & \text{Calving Interval, days} & \text{Profit/Cow, $/year} \\
\hline
26.00 +0 & x & .5800 & = & 15.08 & - & 15.00 & = & + .08 & 360 & \$+25 \\
26.00+3.00 & x & .6200 & = & 17.98 & - & 15.00 & = & +2.98 & 360 & \$-50 \\
\hline
\end{array}
\]

The cows fed the 3.0 lbs. of supplement/day were receiving about 120% of their energy (NEm) requirement and weaned a calf every 360 days similar to cows fed the .5800 NEm hay without supplementation. These cows probably simply gain body weight without improving performance, so the cost of the supplement was counted against the cow’s profitability. They should have received NO supplemental energy.

5. Most laboratory analyses of hay and other livestock feeds cost $20 to $50/sample depending on the extent of the analysis. Although it can be kind of a hassle to take the samples and send them to the lab, the investment in time and money usually always results in improved returns.