Dairy One News from Dairy One - Where Information Creates Opportunity. July 1988, No. 4 Forage Laboratory

## RELATIVE FEED VALUE

Historically speaking, forages have been marketed (particularly hay) based upon visual and physical appearances. Green, leafy, fine-stemmed hay that smells fresh will bring a higher price than coarse, stalky hay that shows evidence of having been rained on. This is a good system. Good quality hay could definitely be distinguished from poor hay, but establishing which of the good hays was the best was not always easy. The advent of forage analysis enabled us to take forage evaluation one-step further by quantifying the nutrient content of the forage. Now we can tell how much protein, fiber and minerals the forage could potentially provide. Anytime that you can assign a numerical value to something, it makes it much easier to evaluate its worth.

The Hay Marketing Task Force of the American Forage and Grasslands Council has endorsed the use of **Relative Feed Value** (RFV) as a measure of forage quality. RFV is calculated by combining the digestibility and intake potential of a forage into one number. **Acid Detergent Fiber** (ADF) is negatively correlated with digestibility and **Neutral Detergent Fiber** (NDF) is negatively correlated with intake. Thus, a forage with a high ADF and high NDF will have a low RFV because the ability of the animal to meet its nutrient needs from the forage is lessened.

RFV has been around for several years. Therein lies the problem. The RFV prediction equations have been continually modified and not always with 100% agreement. Thus, several equations are now in use that do not necessarily generate the same RFV on the same forage. The Northeast DHIA Forage Lab has adopted the equation currently endorsed by the Minnesota and Wisconsin Cooperative Extension Services. It is our hope that the use of these equations by 3 of the 4 largest dairy states will lead to unification throughout the industry. These equations are the most up-to-date. In the past, equations were based on sheep data and extrapolated to dairy cows. The new equation is directly applicable to dairy cows. Crude protein has been deleted from the equation because it is not highly correlated to digestibility or intake. Crude protein is also more easily substituted for than either digestibility (energy) or maximizing forage intake.

The reference hay contains 41% ADF and 53% NDF and corresponds to an RFV of 100. TABLE 1. outlines the hay grades proposed by the Hay Marketing Task Force. As RFV increases, so does the value of the hay.

RFV is applicable only to legume, legume-grass mixes and grass hay or haylages. It is provided on those analyses that contain both **ADF** and **NDF**. Thus, if you need the RFV, be sure the NDF is provided with the analysis that you choose or request NDF as a supplemental analysis.

RFV is a useful and accepted measure for evaluating hay crop quality. A DHIA analysis provides the assurance that the most up-to-date and accepted value of RFV is reported.

**TABLE 1. Legume, Grass and Legume-Grass Mixture Quality Standards**

| Quallity standard [a] | CP | ADF % of DM | NDF | RFV[b] New |
|---|---|---|---|---|
| Prime | >19 | <31 | <40 | >151 |
| 1 | 17 - 19 | 31 - 35 | 40 - 46 | 151 - 125 |
| 2 | 14 - 16 | 36 - 40 | 47 - 53 | 124 - 103 |
| 3 | 11 - 13 | 41 - 42 | 54 - 60 | 102 - 87 |
| 4 | 8 - 10 | 43 - 45 | 61 - 65 | 86 - 75 |
| 5 | <8 | >45 | >65 | <75 |

**a** Standard assigned by Hay Market Task Force of AFGC.

**b** Relative Feed Value (RFV) - Reference hay of 100 RFV contains 41% ADF and 53% NDF.

## HAVE ANY OF YOUR CUSTOMERS ENTERED THE 1988 NORTHEAST FORAGE QUALITY CONTEST?

The Forage Quality Contest is well underway. Any one of your customers that produces hay or haylage that tests 19% or better has a good chance of winning. Prizes are awarded to the first 10 place finishers in both the hay and haylage divisions. This year's sponsors have been very generous and there are a wealth of prizes available.

You all know who your best forage producers are. Give them the chance for recognition and big prizes for all their hard work. An entry form is attached. Please feel free to reproduce it as often as you like or call Northeast DHIA or "The Northeast Improver" for more entry forms.

As a special bonus, the first 50 entrants will receive a coupon for a free NIR analysis.

Entrants can be from any cutting. Samples must be received by September 2, 1988. Show your customers that they're winners by entering them in the 1988 Northeast Forage Quality Contest.

**NIR CONFERENCE** — In May, two forage lab staff members attended a 3-day short course on NIR technology and its application. The conference held in St. Louis, MO attracted NIR users from across the country. It was a diverse crowd and uses of NIR included the following; breakfast cereal, pizza dough, candy, beer, blood, petroleum, synthetic fibers and other organic polymers. The DHIA Forage Lab group was the only one present analyzing forages.

The course presenters included experts from private industry and the USDA. Karl Norris, one of the founding fathers of the NIR analysis, of the USDA was quite interesting and had some great stories about the diversity of materials that he has developed calibrations for. One handy hint that he did pass on is that when trying to analyze solid rocket propellant, be mindful of the intensity of your light source. Failure to do so may result in your instrument becoming the "second" NIR instrument to obtain a geosynchronous orbit about the planet.

We were honored to have Dr. Norris visit our lab about a week later. We were able to discuss in greater detail our particular applications and got some good ideas to help us in calibration development.

The course reminded us of the strengths and limitations of NIR analyses. Limitations include the following:

1. **Instrument requirements** — instrumentation is expensive. Repairs are costly, not only in terms of expense, but down time. DHIA uses the Pacific Scientific Full Scanning Monochromator. It is superior to the more common filter instruments in that it scans the entire near infrared spectrum as opposed to only the discrete segments scanned by filter instruments. This provides much greater flexibility for calibration development.

2. **Dependence on calibration procedures** — time-consuming, sophisticated mathematical and statistical treatments must be applied to spectral data to develop meaningful results. This is coupled to wet chemistry results run in duplicate or triplicate. The calibration process is costly in terms of time and money.

3. **Complexity in the choice of data treatment** — selection and interpretation of math treatments and statistics is challenging. Continuing advancements in computer software are helping to reduce the complexity of this task.

4. **Lack of sensitivity for minor nutrients** — the NIR is best at determining the organic components of feeds. Mineral values are relative estimates that tend to shadow the protein and fiber components of feeds. Forages that have high protein and low fiber contents, generally have higher mineral contents. This is reflected in NIR analysis. These values are useful for routine feed programming, but we recommend using ICP mineral analysis for problem or exceptional herds that require intensive feed programming.

The strengths of NIR include:

1. **Sample preparation** — sample requires only drying and grinding. Drying time is the limiting factor varying from 5 minutes in a microwave to 12 hours in ovens.

2. **Speed** — once a sample is dried, the typical scan time is 70 seconds. Results can be turned out faster and more can be done in a day.

3. **Multiplicity of analyses with one operation** — all the nutrients on an NIR analysis can typically be determined in one scan. This eliminates the need for several different analytical procedures.

4. **Non-consumption of sample** — once the sample is scanned; it can be saved and rescanned at a later time or run through another procedure. Wet chemistry procedures destroy the sample.

5. **Safety** — eliminates the use of hazardous chemicals.

The use, understanding and acceptance of NIR technology continues to grow. The calibration process is time-consuming and expensive but has undergone considerable refinement and is becoming less complex. But no matter how good your calibration is, there are still samples that fall outside the limits of the calibration and require further testing.

In summary, NIR is used for a wide variety of analyses ranging from food to petroleum. As with any analytical procedure, it has its strengths and weaknesses. It is a simple, safe, rapid, economical method for ascertaining forage quality. This year, DHIA analyzed 5 times as many samples via NIR as it did two years ago. The use of a full scanning monochromator, continued calibration refinement, technical expertise, and wet chemistry backup have all contributed to the growth of DHIA NIR analysis.