by Steve Martin

Understanding feed fiber measures

A FEW years ago I had the opportunity to judge the hay show at the Wyoming State Fair. High altitude, fertile soil and ample irrigation make much of the state a perfect place to grow great hay.

With forage analysis papers in hand, I walked slowly through the bales arranged in a big tent as if they were compliant wethers in a class of market lambs. The information on the papers, plus visual assessment of the bales made for easy work.

Why did they ask a dairy nutritionist to judge a hay show? It is because dairy producers and nutritionists spend much time and effort looking at forage and ingredient analysis reports and visually evaluating forages?

As we grow, buy, formulate and feed things like forages, by-products and even primary grain ingredients, we need to know some key information about their content. We in the dairy industry take the blue ribbon in this skill.

In an effort that is similar to a well-informed, cautious grocery store shopper pausing to consider a food label, we take time to routinely sample and evaluate many of the feeds we include in diets. Some things have very little potential variation, while others are literally all over the board. No matter if it is variety and growing conditions for a forage or milling conditions for a by-product ingredient, the nutrients we need to correctly build a diet are constantly changing.

For this discussion I want to focus on the fiber portion of feed ingredients. In non-ruminant and even human diets, fiber can mostly be lumped into one category. But in dairy diets we must sort them out with much more precision.

Let's first remind ourselves about the difference between roughage and fiber as well as between feed tags and feed analysis.

Roughage versus fiber

Fiber is a chemical term and a chemical measurement. It describes the portion of the carbohydrates in plant material that come from the cell wall. Although sugar and starch are also carbohydrates found in plant matter, the carbon arrangements in fiber renders it indigestible to mammalian enzymes. Thus is the beauty of the ruminant animal. Microbial effort in the rumen of a cow does have the tools necessary to unlock the nutrients in plant fiber and supply energy for the cow.

Roughage is not really the same as fiber. The definition of roughage intersects and overlaps with fiber, but roughage is more general and has a physical component. On a feed tag you may see the term "roughage components" or something similar. The term is really trying to describe more about the type of ingredients found in the feed blend and not so much about the fiber level, nor the physical particle size of the ingredients being described.

From a nutrition sense, roughage means much more. Things like percent roughage in a diet or the results of a shaker-box analysis speak to what we are trying to do with roughage. These measures relate mostly to cow health, butterfat production and other things that remind us that cows were designed to eat things like grass and weeds, not corn and soybean meal.

I recently received a feed analysis for a potential roughage replacement ingredient to evaluate. In times of drought when hay and silage are like gold, the feed industry works hard at finding and building things that can replace true forages in rations.

The fiber measure supplied by the company from their lab analysis was crude fiber. The word crude should give you pause and make you think about what you were doing in 1975! I think the ingredient analysis industry, along with state feed control officials that regulate what goes on feed tags, should agree to put this measurement out to pasture.

For many years now crude fiber has been outpaced in descriptive value by ADF (acid detergent fiber) and NDF (neutral detergent fiber). These two measures are much more useful for describing the true value of a potential ingredient and are well understood by the dairy industry.

It is in these numbers where we can start to sort out the digestibility of fiber. They are the sole source of information needed for an even better known measure: RFV (relative feed value). Of the two, NDF is more valuable in building dairy diets.

In recent years, however, we have made new strides that are making ADF/NDF feel obsolete. The new information digs deeper into how much fiber is truly digested by the cow, as well as the portion that is not. We are using these new measurements as the base of much of our diet formulation.

These measures are NDF digestibility (NDFd) and undigested NDF (uNDF). It would seem that you wouldn't need both of them if you had one or the other. But it is the different time stamp at which they are measured that matters. This month I will dig into how using NDFd can help us grow and buy better forages and eventually build a better diet. Next month I will look at how uNDF can help us better understand and dial-in how the rumen is working to digest all feeds and, at the same time, keep the cow healthy.

NDFd is simply a measure of the amount of NDF that is digestible in the rumen. It is more intuitive and follows right along with how a dairy producer already thinks about the quality of a forage.

If a hay or silage crop is less mature, softer, and generally better in every visual assessment, it usually follows with the NDFd being higher. This is good. Another good example is the NDFd of brown midrib (BMR) forages is higher than regular forages. This is why it supports more milk through higher digestibility.

What about lignin?

It is important to mention how lignin fits into this. Measuring lignin in forages is something that some in the industry became comfortable with, but it never caught on nearly as well as ADF and NDF. But it is central to this discussion.

To put it simply, fiber is the good guy that is necessary for good ruminant health and digestion. Lignin is the bad guy – the corrupting component in fiber that can render portions of NDF unavailable for digestion. NDFd and uNDF describe the extent to which lignin negatively influences fiber digestibility by cows.

There are several time stamps at which NDFd is measured. You might see a "NDFd 24 hr" or "NDFd 30 hr" time stamp. All of these are valuable and relate to the amount of time the forage will spend in the rumen being subject to the rumen's microbial digestive enzymes. It basically tells you how good the forage is for making milk.

One of the best examples of understanding NDFd is to apply math and science to why BMR forages can support more milk. Simply, more of the fiber is available to be digested before it leaves the rumen. Similarly, NDFd is the measuring stick to show how much better grass or alfalfa hay is when you reduce days between cutting, or how and why pre-boot wheat silage is better than when it is fully headed at chopping time.

Forages do have energy

Once again, these are principles that every good dairy producer already knows. But if we can lean more on NDFd we can definitively calculate how much better it is. Although we don't think of forages as energy suppliers to a diet, they do have energy values. The higher the NDFd of the forage in question, the higher its energy value.

What about fiber in by-products? Can NDFd help us better sort out all of these choices we have in various hulls, skins, shells, etc.? The answer is a strong yes and is best described in the difference between two popular but very different hulls.

Cottonseed hulls and soybean hulls are often grouped together by dairy producers. These hulls are like two brothers with the same last name, but that's the full extent of their similarity. The differences between them serve as the best teaching opportunity for using NDFd as well as the difference between fiber and roughage.

Cottonseed hulls have a very low NDFd. They also have a strong roughage component. This is not a surprise when handling them. Soybean hulls, however, have little or no roughage characteristics and are very high in NDFd. The energy levels of the two follow accordingly.

Thus, cottonseed hulls are competing for space in the ration with things like hay, straw or silage. Soybean hulls are more likely to replace high-energy corn or other principle grains. All the while, they are both high fiber ingredients.

In next month's column I will discuss how uNDF, the inverse of NDFd, is used for a different purpose when building rations. It has more to do with formulation, cow health and feed efficiency than it does sorting out which alfalfa hay bale wins the contest at the state fair.

As we have moved on from crude fiber to ADF/NDF and now to NDFd/uNDF, we are truly getting better at feeding for the bottom line. *WEST*

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