Building solid forage testing protocols (part 2)

by Steve Martin

In LAST month's column I talked about the importance of having a solid plan and consistent protocols in place for ingredient analysis. In order for a nutritionist to build good rations to support good cow performance, correct information about feed ingredients is a must, because variability in the nutrient content of rations will produce disappointing results.

Advancements in technology have offered better tools with which to build rations. But as with many things related to advancements in technology, the process has become more complicated. In years past, if we knew protein content and a fiber measure or two we were ready to build rations. Thanks to the growing knowledge base in dairy nutrition, agronomy and analytics, we can easily fill a full page with meaningful forage test result values.

As you stand back and look at a correctly formulated TMR in a bunk, one of the first steps behind that finished product was a correctly completed lab analysis submission form. When a producer gains an understanding of some nutrients and what feeding value they best describe, the process becomes less daunting.

One of the best ways to better understand something is to break it into different parts. To do this with dairy feed ingredients we need a quick lesson in plant science. As a place to start, let's think about plants being made up of protein, carbohydrates, fat and ash. They are the building blocks of plant tissue that bring nutrients to the dairy diet.

When an analytical lab is using different assays to look into the details of a feed ingredient, the basic approach is to measure the varying amounts of those building blocks. Since nearly every part of a dairy diet is either a whole plant or part of a plant, understanding a little plant physiology is also helpful.

The overall goal of a modern forage analysis is not only to quantify the amount of a nutrient, but also estimate its usability by animals. So no matter whether the analysis is of alfalfa hay that is "whole-plant" material or soybean meal that is part of the plant, the approach is the same.

The best example of this detail is to look at the nutrient that is probably best understood by dairy producers: protein. In a full nutrient analysis the lab will not only determine the amount of protein, but also provide details about how much of the protein is bound to fiber and how much is soluble in the rumen. Knowing this information helps a formulator know how the protein will behave in the rumen and intestines and how it can be converted to milk.

Carbohydrates are also familiar to most dairy producers. It may be starch in corn silage or fiber in straw, but in either case the lab can quantify them.

Other familiar nutrients like starch and sugar have much to do with the energy content of a feed ingredient. The lab can measure the amount of starch in various feed ingredients and this information can be further enhanced by an estimation of starch fermentation rate. Starch content has been used for many years, but contemplation of how fast it might be fermented in the rumen is a more recent advancement.

Much of the energy of some ingredients depends upon starch content, but let's don't forget that the amount and digestibility of fiber measures like acid detergent fiber (ADF) and neutral netergent fiber (NDF) are also important. These portions of the plant have been used for many years to help nutritionists meet the roughage requirements of cows to support butterfat production and good cow health. In recent years this effort has been greatly enhanced by not only reporting the amount of these various fibers, but also better describing their potential digestibility.

One example is reporting the amount of NDF, along with an estimate of how much will be digested in the rumen (NDFd). Some labs have further enhanced this by describing the amount that is essentially 100 percent indigestible.

Knowing this number helps a formulator build diets that can either increase or decrease voluntary intake. By calculating how this lowest quality carbohydrate will impact rumen fill and rumen outflow rates, estimations can be made about a cow's appetite and intake potential.

Fats and minerals are a little more straightforward in their reporting. Some byproducts like dried distiller's grains, wet brewer's grains, and hominy need to be analyzed for fat content, primarily because the unsaturated fat in them can have a negative impact on milk fat synthesis.

All fats in plant material have this potential risk and should be quantified. It is most likely a problem, though, in byproducts from which some or all starch has been removed, thus concentrating the fat.

Mineral analysis is often completed by wet chemistry methods. These results are useful in assisting the nutritionist in balancing a ration that builds upon minerals already in various feeds by adding the right amount of supplementation to meet animal requirements. Macro-minerals like calcium, phosphorus, magnesium and potassium are good choices for routine analysis.

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Consider trace minerals

Adding trace minerals to the analytical package may be helpful when looking for potential antagonistic risks. One of the most common mineral analysis efforts relates to balancing dietary cation-anion difference (DCAD) diets in close-up rations to reduce the risk of milk fever. Adding chloride and sulfur to the list of macro-minerals completes the math in DCAD equations.

We should remember that the biggest opportunity to gain milk production and overall cow health is to sample routinely and then choose the right analysis that addresses the key nutrients from various ingredients. Even more importantly, ingredients with the widest variability need to be assessed the most often.

Corn silage, for example, is probably the most frequently tested feed in dairy diets. There are a couple of reasons why. One is the often high feed rate of corn silage, making up as much as 40 percent of ration dry matter in some cases. Variability in this one ingredient can result in big variations in the final ration.

In addition, there are two main nutrients supplied by corn silage that both have significant potential variations in content and availability. Corn silage brings starch to a diet, but the amount is highly variable and can range from 15 to 45 percent. Differences in plant genetics and growing conditions can also greatly influence the rate and availability of that starch.

The non-starch portion of corn silage, namely stalk/cobs/etc. has a very wide range of potential fiber digestibility. So when sending a corn silage sample to the lab there is much to be learned. Not only do we need to know the starch and fiber content, we also need starch rate and fiber digestibility. Only then can we fully describe the corn silage to the computer ration formulation model.

One more topic to explore is lab analysis of the final TMR. Although I have been mostly cool on this idea for much of my career, a new client has changed my mind a little and I now look forward to reviewing these results. But does this step wrap a bow on the whole ration making process?

If the nutrients in a TMR analysis report are close to targets, then yes, it is a very positive data point that the whole process is intact. The problem comes when nutrient levels in the TMR don't agree with formulated values. What do you do then?

There are several realities that could be in place for that particular load. It could be as simple as poor sample gathering, as it is difficult at best to hand-grab a 100 percent representative TMR sample from a bunk. Or it could be feeder error. The feeder may have loaded one ingredient instead of another. Scooping up a bucket of canola pellets instead of corn gluten pellets at 5:30 a.m. is certainly a possibility. And lastly, it could be that the ingredient analysis in the formulating computer was not up to date with the nutrient content of feeds mixed that day.

With all of the science available in a modern forage lab, lack of knowledge about nutrient content and predicated availability of nutrients should never be a limiting factor in feeding for profitable milk production. Having a smart sampling protocol and knowing what nutrients to pick for the various classes of ingredients will be a great help to the formulating nutritionist.

At the end of the day, though, it is the cow that is the final arbiter, and offering her a ration with finely tuned nutrients based on solid forage and ingredient analysis will help insure that you are truly feeding for the bottom line.

The author is the founder of Dairy Nutrition and Management Consulting LLC, which works with dairies and heifer growers in Texas, New Mexico, Kansas, Colorado, Washington and California.