Straight to the Bottom Line

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10/1/13 Title- "Developing a Sound Feed Ingredient Analysis Plan, Part II"

In last month's column, we discussed the importance of forage and ingredient analysis in a sound dairy nutrition program. Due to the high forage inclusion required for sound cow health and the frequent use of by-products, nutrient variability at the bunk is a real risk. Regularly scheduled sampling and further analysis of the forages and byproducts is necessary to reduce potential variability and subsequent production issues. So, with a justified need for a good sampling and lab analysis program, how is a dairy to be sure this process is completed in the best way to have the most positive impact? In this month's column, we will discuss differences between wet chemistry and NIR analysis.

As science progressed over the past 150 years, the body of knowledge regarding what comprised things in nature grew rapidly. Things that had always before been viewed as a whole were being broken into parts. Scientists were interested in what things in nature were made of at a molecular level. Instead of looking at a soybean and seeing it as a soybean, scientists developed techniques to determine the building blocks of that bean and to quantify the parts. Some of this discovery was related to new microscopic techniques while others to chemical methods used to separate the different parts. Much of this history was likely detailed in your middle school science class. Many of the scientist's names that you memorized in the 8th grade were of people that discovered the nutrients you see on a forage analysis of today.

As these techniques were being developed, a new nomenclature was needed to classify and name these parts. It was discovered that things in nature were comprised of protein, carbohydrates, fats and minerals. To that point, these substances had not even been contemplated. Now, they had techniques to cleave out and quantify them. In a somewhat separate effort, scientist had to begin to figure out what the meaning was for these new discoveries. This effort was the beginnings of the science of nutrition and it attempted to match up these discoveries to the details of feeding people and animals.

As you can imagine, lab techniques in place in the 1800's were rudimentary at best and very unsafe. These procedures used caustic chemicals and were apt for fire and even explosions. Speed forward a hundred years and many of the issues with caustic chemicals and risk of explosion were the same though science had learned from its mistakes and safer procedures had been standardized.

In a modern feed lab, much of the same basic science is employed to determine nutrient levels. In some cases, the same caustic chemicals are still used. There have been advances in the techniques and mechanization of the process. The result has been an improvement in safety and efficiency. But, a basic chemical process is usually in place to determine results. This process is commonly referred to as "wet chemistry". In most labs, these procedures take 24 to 48 hours to complete. In many cases, a separate

lab prep set up is necessary for each nutrient of interest. This adds to the time and the cost of the process but the result is a direct measure of the nutrients.

Due to the obvious complications related to the process of wet chemistry the quest for a more simple process began. The result of this quest is what we now call NIR or near-infrared spectroscopy. NIR technology was first reported in the scientific literature in the 1930's. By the late 1960's, agricultural scientists began to develop NIR techniques for use in feed analysis. Over the following 30 years, NIR technology improved vastly and is now qualified to determine a vast number of nutrients. NIR technology uses readings on the way a feed material reflects light and compares that to standards in a data base. The standards were set using wet chemistry. So, the NIR results are only as good as the original information used to build the data base and the similarity of the tested material to the material used in the calibration.

The beauty of NIR analysis is the savings in both time and money. A page full of nutrients can be generated in few minutes compared to several days with wet chemistry. However, it is not as simple as it may sound due to requirements to recalibrate the system. As with wet chemistry methods, check samples are run frequently to validate results. Certifications are also available for outside verification.

Both systems have their value and application to dairy nutrition. If speed and volume of samples is the goal, then NIR might be the best fit. If a limited number of samples are needed and the number of nutrients is not great, wet chemistry might be the better choice. In next month's column, we will discuss what nutrients are key variables for common ingredients used in dairy rations.