RAPID ON-FARM FORAGE ANALYSIS OFFERS REAL-TIME BENEFITS

Technology is putting more management tools in the hands of dairy producers, enabling them to make real-time decisions.

By Alberto Barbi

Near infra-red (NIR) dairy feed nutrient analysis has been used for decades. Mostly confined to laboratories, some university Extension systems began taking mobile NIR vans directly to dairy farms and hay auctions in the 1980s.

Now, new portable NIR feed nutrient analyzers – the size of a small suitcase – will allow producers and nutritionists to take the analyzer to the feed. That access promises rapid calculation of forage dry matter (DM) and fiber, starch and protein, when and where it's needed. In turn, producers will have the opportunity to improve the way they feed cows, precisely adjusting rations to match their nutritionists' feeding recommendations, on-site, every day.

Goal is TMR consistency

Evaluating forages more consistently and frequently means more consistent TMRs, said Tom Oelberg, Regional Sales Manager, Diamond V. "I would envision sampling the TMR 10 times for each load if needed."

TMR audits are another use. "When we make changes from a TMR audit to improve consistency, we're seeing a 1- to 3-lb. increase in milk production, and a point or two improvement in milk components," Oelberg said. "It can have a huge economic impact, especially in the larger operations."

Kurt Ruppel, Cargill Technology Leader, agreed. "If a change in a major ingredient is varying a half a percent, it can mean 20¢ per cow per day," he said. "If a major ingredient is varying a lot, we want to know why. Constantly changing the nutrients delivered to the cow creates inconsistent production and reduced feed efficiency."

According to a 2012 Ohio State University study, substantial day-to-day variability in DM, NDF, CP and starch in corn silage and hay silage is large, often as great as month-to-month variation. Day-to-day variation for specific nutrients, such as starch, did not follow any discernable pattern. Because diets are formulated on a DM basis, but delivered on an as-fed basis, a deviation of DM could substantially alter the diet composition in just one day.

The study concluded single samples should not be relied on to provide an accurate description of the feed, and substantial changes in diet formulation should not be done on results from a single sample. Duplicate samples taken on a single day reduced day-to-day variation, but the costs of sending multiple samples to a lab for analysis on a daily basis would not justify the added expense.

With an on-farm NIR feed analysis unit, it is more feasible and cost effective to do daily multiple feed samples. The nutritional variances in certain feeds can be identified and corrected immediately.

After loading feedstuffs and programming the AgriNIR to measure the defined feedstuff versus calibrated values, the unit provides a printout of results.

Methods compared

A study at the University of Wisconsin-Madison evaluated new portable NIR technology. The study's objective was to evaluate the use of NIR spectroscopy for on-farm measurement of forage DM content, according to Dr. Randy Shaver, UW-Madison dairy scientist.

The research was conducted using an AgriNIR™ Portable Analyzer for Forages from dinamica generale US, Inc. The 11-week study measured 94 corn silage samples from six silo bags and two bunkers, and 20 alfalfa silage samples from one bunker, using the oven method and the NIRS. It was used to measure

MANAGEMENT BY ANALYSIS

On-farm NIR feed analysis can improve dairy nutrition management decisions, allowing producers and their nutritionists to:

- test forage samples taken by hand directly from the bunker or silo, or when chopping hay in the field to adjust chop length as needed.
- get real-time, immediate feed test results in under 60 seconds.
- test more often, as many times per day as desired, at no extra cost.
- spot-test forage samples from different bunker or bag locations; get an average dry matter reading for mixing forages lots at the TMR.
- make diet changes proactively, rather than reactively.
- track DM and nutrient changes to predict future feeding programs and plan supplement use.
- monitor the quality of off-farm purchased hay and by-products.
- same-day testing after a major rainfall measures changes in DM content, opening the door for DM adjustment at the TMR, and avoiding dips in production that can take days or weeks for the cow to recover.

The end result is greater feeding-to-feeding ration consistency, resulting in improved overall cow health, and more milk and milk components.

Depending on features, the price of a portable analyzer can range between $28,000-$32,000. Due to the benefits listed above, payback for a portable NIR analyzer in larger dairy operations can be as short as 3 to 6 months. It also creates additional NIR analysis business opportunity for nutritionists serving serveral dairies.

protein, neutral detergent fiber (NDF), acid detergent fiber (ADF), starch, ash and fat, but only compared DM content to results from an oven method. Overall, the on-farm NIRS measured DM content comparable to the oven method, the study concluded.

Shaver's graduate student, Matt Akins, presented a paper "Evaluation of On-Farm Forage Dry Matter Determined by Near Infrared Spectroscopy" at the 2012 American Dairy Science Association conference.

"If I was a feed consultant or nutritionist I'd be excited about the opportunity to have one of these," said Shaver. "The reason we were interested in on-farm NIR was measuring the DM content of silages coming out of the bunker. We've been trying to do a better job keeping rations consistent on a day-to-day basis.

"DM content changes as you go through the bunker, and when you have rainfalls, that can really affect DM content," Shaver said. "That's how most people initially will use this technology, to do more frequent measurement of DM content. Rain events can affect DM and depress milk production, so knowing moisture content allows ration adjustments accordingly.

Rapid analysis for multiple samplings

The portable unit measures DM, crude protein, starch, ADF, NDF, crude fat and ash in under 60 seconds. The compact unit is easy to carry or throw into a tractor or pickup. There is virtually no sample prep – hand-grab some feed and place it into the sample cup, then insert it into the analyzer. Results can be printed or transferred to a personal computer.

The more times test samples are replicated, the more precision is possible, Shaver said. The instrument comes preloaded with NIR calibration curves for seven crop families – corn silage, hay, high moisture corn, alfalfa hay, grass silage, TMR and soybean flour.

System software support can develop new calibration curves on request. Analysis results can be imported directly into TMR management software for an immediate TMR recipe adjustment and historical statistical reports.

Nutrition companies have also developed proprietary calibration curves that can be loaded to the portable NIR analyzer. Cargill calls its version the "N-Box."

"One of the challenges is creating and maintaining calibrations for all of the ingredients that are of value to the dairy operation," said Mike Jerred, Global Dairy Leader at Cargill, which has developed and validated calibrations for forages (hays, silages and fresh forages), grains, and other key commodities.

"The (technology) helps us do a better job teaching our feeders bunker face management," Jerred added. "Likewise, there may be cases where forages are coming to one farm from various locations. We can test incoming hay for DM, protein and NDF digestibility as it arrives and target specific lots to specific diets. Our consultants and feeders have more time for face management, pre-mixing, and overall TMR consistency.

"We aim to optimize nutrient flow to our cows at optimum cost," he continued. "Anything that can help us get a better handle on nutrient variation is going to help us apply that system better."

Other technology

The model tested by Shaver can be mounted in a payloader bucket to measure feed as it is moved from a concrete bunker or plastic storage bag.

This NIR technology can be incorporated into a full feeding management system to aid dairy producers and their nutritionists. In addition to the NIR Analyzer unit, other pieces of the complete system includes a fully computerized feeding system that reads DM and nutrient values of forages, automatically adjusting rations on the fly at the TMR; professional feed management software; and a remote control, high-tech weighing controller that wirelessly receives data from the NIR Analyzer. ❐

FYI

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■ To read the Ohio State University study, "Within Farm Variation in Nutrient Composition of Feeds," visit http://tristatedairy.osu.edu/Proceedings%202012/William%20Weiss.pdf

■ A University of Wisconsin-Madison study, "Evaluation of on-farm forage dry matter determined by near infrared spectroscopy," was presented as a poster at the 2012 Joint Annual Meeting of ADSA/AMPA/ASAS/CSAS/WSASAS, July 15-19, in Phoenix, Ariz.