Evaluate rations to get the most IOFC with higher-priced corn

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Using ration modeling programs that evaluate multiple carbohydrate fractions and their digestibility enables us to increase income over feed cost (IOFC). Corn prices are over $6 per bu and predicted to be steady to higher. Traditionally, corn has supplied the major source of energy from fermentable carbohydrate (primarily starch) in most dairy rations.

However, there are a number of other carbohydrate fractions and sources that should be evaluated in ration formulation. In ration modeling programs like CPM (and CNCPS, NDS, etc.), neutral detergent fiber (NDF), soluble fiber, starch and sugar all are monitored and contribute to total and fermentable energy needs.

Ration and feed evaluation

CPM guidelines target over 40 percent for total fermentable carbohydrates. Typically, fermentable starch has provided most of that; however, there is flexibility in how much that fraction contributes. Dann et. al. at the Miner Institute in 2008 reported no significant difference in milk production (94 to 97 lbs), components (3.5 percent BF, 3.1 percent TP) or feed efficiency (1.65:1) when cows were fed 18 percent, 21 percent or 25 percent total starch (3 percent, 10 percent or 17 percent corn in ration DM). Beet pulp and wheat midds were effectively substituted to increase digestible NDF, soluble fiber and sugar to meet total fermentable carbohydrate needs in that research trial.

We evaluate alternative carbohydrate ingredients considering starch content and fermentability, along with soluble fiber, sugar and digestible NDF using CPM. Some ingredients to consider are: corn gluten feed, hominy, bakery, cereal or candy byproduct, rice cakes, granola, potatoes, chips, pretzels, feed wheat, barley, grain screenings (without contaminants), beet or citrus pulp, pomace, sprouts, soy hulls, almond hulls, molasses, wheat midds, whey, sugar byproduct, etc. Current pricing and analyses are required for evaluation.

For accurate evaluation of these carbohydrate fractions, feedstuffs should be appropriately analyzed at a reputable laboratory. Those labs affiliated with the National Forage Testing Association and/or the NIR Consortium participate in ongoing third-party forage analysis quality assurance programs. Our consultants typically work with one of three labs, depending on geography. We see that some analysis procedures and results differ between labs, so it's best to choose one lab and stay with it. Analyses for total NDF, starch and sugar are readily available. Soluble fiber is usually calculated by difference. NDF digestibility (NDFD) has been offered for a number of years and there is still some procedural variation. Our consultants use 30-hour and/or 24-hour NDFD time points to select forages used for highest production.

Starch digestibility analyses are newer and there is less consensus on preferred analytical procedures. Estimates of starch fermentability can be made from in vitro 7-hour, 2-hour enzymatic, in situ 12-hour, degree of starch analysis, prolamin (UW grain evaluation), corn silage processing score and fecal starch analysis. These can provide useful info, particularly if calibrated to actual herd performance. More discussion of these procedures will follow in subsequent articles.

Crop, ingredient and herd management also have an impact

Forages can supply the majority of fermentable carbohydrates if they are high quality. Varieties should be selected for highly digestible fiber and fermentable starch. Seed companies provide corn hybrid rankings and many states (Pennsylvania, Wisconsin, New York and others) provide independent head-to-head comparisons. When comparing, recognize that the best varieties are often not significantly different in digestibility. Therefore, yield, agronomics and traits can be selected to meet your needs from within the most nutritionally superior group of varieties.

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it typically provides the most digestible carbohydrates per acre from fermentable NDF and starch. Consider BMR CS for higher NDF fermentability and good starch levels. Harvest CS at 32 to 36 percent dry matter (DM). Research has shown starch content increases but degradability can decline at higher DM (closer to black layer) as more prolamin protein encloses starch granules. If that happens, feeding the drier silage last, after it has had longer time to ferment, would be the best option.

Recent research at the University of Delaware, Penn State, our own comparisons and labs elsewhere has shown that starch fermentability increases with time ensiled. This also applies to high-moisture (HM) corn. Increased forage carryover from the previous year facilitates more extensive starch fermentation and can minimize the "fall slump" seen when feeding new corn silage. This can be particularly helpful with BMR silage to increase starch fermentability. More fermentable starch from silage and HM corn means you can feed less of it, typically resulting in lower ration costs.

Get the most out of corn or other grain you do feed. Grind finer (>75 percent passing through a flour sifter), steam flake corn to 26 to 28 lb bushel wt and barley to 66 to 75 percent of original weight. Ensile HM corn at 28 to 30 percent moisture for three months or longer before feeding. The dark yellow, vitreous (glassy) portion of the kernels is degraded more slowly than the white, floury portion and takes longer to become available during ensiling. The vitreous portion also is denser, resulting in heavier bushel weight (>60 lbs) and this corn typically needs more extensive processing in order to improve its starch fermentability.

Grass and alfalfa harvested at earlier maturities can provide highly digestible NDF and soluble fiber. Baled hay maintains more soluble fiber and sugars for fermentability in the rumen. Forage analysis and selection based on relative forage quality (RFQ), which incorporates NDF digestibility, instead of relative feed value (RFV), will assign more accurate feeding values to these forages. If ensiled, ensure intense packing, complete/rapid covering and rapid pH drop to minimize carbohydrate loss during initial fermentation and feedout. Consider an inoculant with both upfront and feedout research-proven effectiveness to maximize recovery of the carbohydrates grown and harvested.

Ration additives can improve utilization of starch and other carbohydrates. Monensin improves rumen propionate yield and milk production efficiency, providing more return for lower cost. Monensin and Lasalocid are approved for use in heifers also. Yeast and derivatives and several direct-fed microbials (DFMs) improve carbohydrate (fiber) digestion; ask for research when deciding. Less information is available on enzymes and essential oils; some positive research and field experience exists.

Segregate forages and group cows and feed the most fermentable feedstuffs, especially starch, to high-producing cows. The concepts explained in the hepatic oxidation theory (H.O.T.) of Dr. Allen at Michigan State University support feeding lower total and fermentable starch and more fermentable fiber and sugar to the post-fresh and late-lactation cows. High levels of fermentable starch post-fresh can limit intake by generating high levels of rumen propionate, indicating to the cow that her energy needs are being met. High levels of fermentable starch later in lactation direct energy to body fat deposition instead of milk production via propionate, glucose, and insulin interactions.

Formulating rations with consideration for multiple carbohydrate fractions can result in higher income over feed cost. Managing crops, storage, cows and commodities will give greater benefits to ration balancing efforts and improve dairy profitability. **PD**

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