by Chris Hallada

Why new corn silage doesn't feed as well

THE air is brisk, the fields are tilled, and another year's corn silage harvest is tucked away and fermented in the silo. As the new silage is opened, the corn smells well fermented and tests well. Yet, immediately upon switching from last year's corn silage to "new" corn silage milk production drops. Despite your best efforts, the cows fail to come back to previous production levels for a couple months. Sound all too familiar?

Based on these observations, nutritionists, herd managers, and owners have suggested the quantity of digestible nutrients in corn silage must be changing with time ensiled. Yet, clear research to support these observations has been lacking. To test the hypothesis that corn silage nutrients, in particular starch and fiber digestibility, change over time, we designed a study to pin down what happens.

To take out the effect of field, location in the storage unit or hybrid variation, we used two commercial corn silage hybrids from two dairies in southeastern Minnesota. We took forage from a single load after it was harvested with a self-propelled forage harvester. We vacuum sealed the samples in plastic bags, fermented them, and kept them in an environmentally controlled room. Every 30 days, bags were removed and frozen until analyzed at the end of the trial. The study took place over a period of 11 months.

At the end of the year, we analyzed all samples for dry matter digestibility (12 and 30 hour), NDF digestibility (12 and 30 hour), and starch digestibility (12 and 30 hour), plus total tract starch digestibility via in-vitro methods.

The cows knew . . .

The study proved the ultimate judge of forage quality and energy, the cow, is right. All digestibility measures improved with time ensiled. (See the table.) Most changes in these values appeared to plateau after six months of ensiling, although NDF digestibility continued to improve until the end of the trial.

So what does this mean to cow performance and ultimately your farm's margin? Clearly, the amount of available energy to the cow is limited early in the ensiling period. With today's high-producing cows and tightly formulated rations, it is not feasible or practical to expect we can make up the energy limitations entirely through ration formulation.

Depending on the stage of lactation the cow is in, one of two things can happen. If the cow is early in lactation, high in milk production and limited by gut fill, we often see a drop in milk production because of the poor digestibility associated with shortly fermented forage. Cows lower in production or late in lactation may be able to compensate for some of the reduced digestibility by eating more and improving energy intake. Either way, potential income is lost either due to lost milk or higher feed cost.

Effective ration formulation depends on optimizing rumen microbial growth and microbial protein production. Diets that are poorly fermented in the rumen can result in reduced rumen function and microbial yield. This can lower milk production and ration efficiency. However, as ruminal starch digestibility goes up, excessive fermentability can result in lowered ruminal pH, feed intake, diet digestibility, and microbial protein production. This not only negatively affects milk production if diets are not adjusted but can have implications on cow health.

Experienced nutritionists and herd managers often watch cow performance, intake, and manure to make adjustments in the diet. Having a more complete understanding of how nutrients change over time ensiled may help achieve the best ration formulation and, thus, farm margins.

Your choices are . . .

So what can be done to reduce this effect of "new" corn silage? The most obvious is to ensile the corn silage and wait three to six months before feeding. While this adds to storage and inventory cost, it is offset by greater milk income. However, extra storage space and the economic reality of inventorying excess feed is something many dairymen are unable or unwilling to invest in.

Of course, you can make up some energy by simply substituting an energy source such as corn or concentrate for forage. But this usually results in greater cost and may negatively affect rumen function.

Some nutritionists formulate for less corn silage and more haylage during this period until the forage is adequately fermented and more digestible. But this option means more ration adjustments and inconsistencies. If this is done, it is preferable to make changes gradually over time. Proper processing will help improve starch digestibility but cannot overcome the effect of fermentation.

Hybrids do differ . . .

Recent research by Pat Hoffman and others at the University of Wisconsin suggests that hybrid differences may alleviate some of the lower starch digestibility seen early in the fermentation of corn silage. Proteins called prolamins encapsulate starch granules and appear to vary among hybrids. Since this prolamin is insoluble in water or rumen fluid, it inhibits starch digestion. Some hybrids naturally have less of this protein matrix.

Average changes in digestibility values after ensiling

Time (mo.)	DMD12	DMD30	NDFD30	STRD12	ttSTRD
0	37.4%	42.5%	29.2%	69.3%	91.6%
1	37.9%	43.2%	30.9%	70.6%	92.5%
3	38.8%	44.3%	34.6%	72.5%	94.1%
5	39.5%	45.1%	36.6%	73.5%	95.3%
7	40.0%	45.6%	37.4%	73.6%	96.1%
9	40.4%	45.9%	38.6%	73.9%	96.4%
11	40.5%	46.4%	39.2%	73.9%	96.9%
Monthly change (0-6 mo.)	0.50%	0.70%	1.20%	0.60%	1.80%

DMD = dry matter digestibility at 12 or 30 hours
NDFD30 = digestibility of NDF fraction at 30 hours
STRD12 = starch digestibility at 12 hours
ttSTRD = total tract starch digestibility

Eventually, as time ensiled passes, this protein dissolves due to fermentation acids, and endosperm becomes more soluble (digestible). Thus, with time ensiled, we see changes in starch digestibility.

Hybrids containing less prolamin may have better digestibility in the early months of ensiling versus hybrids that contain more prolamin that needs to be solubilized. But because prolamins disappear with fermentation, differences between hybrids may disappear after several months of ensiling. A test developed by Pat Hoffman that includes prolamin measurement as part of a grain quality index recently has become commercially available.

With some of this new information, we now have a clearer understanding of how dry matter, starch, and fiber digestibility vary with length of ensiling. This will help nutritionists formulate rations that maximize energy intake, diet efficiency, milk production, and herd health.

The author is Vita Plus forage program manager, dairy nutritionist.The author would like to gratefully acknowledge the financial and technical assistance of Don Sapienza and Dave Taysom of Sapienza Analytica, LLC and Dairyland Laboratories, Inc., respectively.