Is corn silage the magic forage?

Heavy corn silage diets are becoming more common. Avoid problems by paying attention to quality factors.

By Corwin Holtz

Producers, nutritionists, veterinarians and others understand the value of high quality forage. It can

- Control purchased feed costs.
- Maximize rumen and cow health through effective fiber from forage.
- Maximize energy intake from forages.
- Maximize milk output.
- Maximize milk income over total feed costs.

In the Northeast, and other U.S. regions, corn silage has become – or is fast becoming – the forage of choice for many dairy producers and their nutritionists. It brings many attributes to the nutritional table. At the same time, producers must understand the challenges of "heavy" corn silage diets.

Heavy corn silage diets are those where corn silage makes up more than 50% of the dry matter (DM) of the forage portion. In the Northeast, corn silage levels commonly range from 60 to 80% of forage DM. In a few cases, corn silage is pushed as high as 90 to 100% of forage DM. This makes corn silage 30 to 50% of total ration DM in rations that are 50% DM forage and 50% DM concentrates.

When one forage comprises such a large part of the diet, its quality is critical.

What is quality?

The quality of corn silage has been a major area of research during the past five to 10 years. Until this surge of research, most of us accepted the notion that "all corn silage is created equal."

What a mistake! Corn silage can vary greatly in two broad quality categories – quantitative quality and qualitative quality.

Quantitative quality. This includes such things as crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), fat, minerals and a calculated energy value. These numbers have value, but they don't tell the complete story of corn silage's true nutritional value.

Two key components of corn silage – starch content and NDF digestibility (NDFd) – must be accounted for. If they're not known and regularly used in diet formulation, then we're assuming all corn silage is created equal.

1. Starch content. Evaluation of the amount and type of starch contained in corn grain is an area of research and corn breeding. Starch that is more vitreous (glassy), compared to a floury type starch, is less digestible and, thus, less available to the rumen.

2. NDFd. "Controversy" in the field centers on the length of time used to evaluate digestibility. Most historical data is based on a 48-hour digestibility. In my opinion, 20- or 24-hour digestibility values more closely reflect the actual rumen retention time of corn silage, and should be used.

Starch content and NDFd can vary greatly within and across seasons, across varieties and even from field to field. The combination of variety selection (for NDF digestibility characteristics) and growing/agronomic conditions can lead to tremendous differences. (Table 1)

A couple tips: Use a single forage laboratory for your digestibility work so you can make comparisons across samples. Comparing digestibility numbers from different labs is rather meaningless as procedures differ enough. Ask your nutritionist to look at these numbers and use this information, if the person isn't already, to ensure proper use of corn silage within your ration formulation.

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Table 1. Quantitative values for 2002 crop year corn silage samples

Parameter	Mean 1	Mean 2	Range 1	Range 2
NDF (% of DM)	44.2	42.5	38.3-50.0*	30.7-69.7
NDF digestibility (% of NDF)**	37.9	54.5	31.0-44.9*	41-71
Starch (% of DM)	30.8	29.3	23.3-38.3*	12.8-45.2

Mean 1 and Range 1 = *Dairy One, Ithaca, NY*
** Normal range = +/- one standard deviation*
Mean 2 and Range 2 = *Cumberland Valley Labs, Maugansville, MD*
***** Mean 1 and Range 1 =*** *24h NDF digestibility*
Mean 2 and Range 2 = *30h NDF digestibility*

FYI

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Qualitative quality. This refers to the quality of the fermentation process silage has undergone. Qualitative quality is primarily an evaluation of the volatile fatty acids (VFA) that are produced in the fermentation process. It also includes a few other key numbers that can clarify the chemistry of the fermentation process. As with quantitative values, qualitative numbers can vary across corn silage samples. (Table 2)

Qualitative values give insight into palatability and potential consumption, potential spoilage and mold conditions, and the integrity of protein fractions within the forage.

Check that your nutritionist is evaluating these numbers from time to time. If some qualitative numbers don't look "right," conduct an analysis of moisture content, packing, covering and other silage management practices to discover holes in your harvest and storage processes.

Celebrate consistency

Why should we look at heavier corn silage diets? Consistency. Cows, and more importantly rumens, function most efficiently when a diet is consistent from day to day. Sound "cow people" know that the more consistent they make things – cow comfort, milking routine, feeding management – the better cows respond to what we want: rumen and cow health, reproductive activity and, of course, milk output.

High quality corn silage, fed at 30 to 50% of ration DM, can bring a high level of consistency to a herd's day-to-day diet.

Nutritionally, high quality corn silage brings two key components required for maximizing the growth of ruminal bacteria, which have the "perfect" amino acid makeup, compared to other protein sources. (The more bacteria we can make, the better the amino acid profile is for cows and the less that has to come from bypass protein sources.)

1. Fermentable carbohydrate (starch).

2. Fermentable fiber (NDF).

Research at Michigan State University (Oba and Allen, 1999) shows that for every 1% increase in NDFd, there is a corresponding increase of .33 pounds of dry matter intake (DMI) and .53 pounds of 4% fat corrected milk (FCM). Increasing overall rumen fermentation and efficiency most likely produce these results.

Starch and fermentable NDF, combined with the correct levels and types of degradable protein sources (urea, soybean meal, canola meal), are ideal nutrients for ruminal bacteria growth. When you maximize rumen microbial growth, you can buy less of the more expensive rumen undegradable protein sources: blood meal, extruded soy products, fish meal, protected amino acids and corn gluten meal. This can potentially reduce purchased feed costs.

Table 2. Qualitative values for 2002 crop year corn silage samples

Parameter	Mean 1	Mean 2	Range 1	Range 2
Lactic Acid (% of DM)	5.2	5.3	3.0-7.5*	.1-11.1
Acetic Acid (% of DM)	2.65	3.08	1.0-4.2*	.11-10.67
Total VFA (% of DM)	8.27	9.41	5.3-11.2*	.3-20.3
Ammonia N %	.71	.74	.384-1.03*	.09-1.42

***Mean 1 and Range 1** = Dairy One, Ithaca, NY*
** Normal range = +/- one standard deviation*
***Mean 2 and Range 2** = Cumberland Valley Analytical Services, Maugansville, MD*

As the informal survey of nutritionists shows (See What nutritionists say), having enough of the right kind of effective fiber sources can be one of the primary challenges with heavy corn silage diets. Processing corn silage produces, in most cases, longer chop length vs. non-processed corn silage. This can add to the diet's effective fiber component. As corn silage levels increase, many dairies increase the amount of high NDF hay or straw. No controlled research has looked at this practice. But field experience points to positive results from including .5 to 2 pounds of high NDF grass hay or straw into heavy corn silage diets. To be effective, grass or straw particles need to be 1 to 3 inches long to prevent sorting and to ensure effective fiber is consumed.

Corn silage is definitely becoming the forage of choice for many nutritionists and producers. If a heavier corn silage diet fits into your agronomic program, it might be time to consider moving in that direction. Talk with your nutritionist. ▮

What nutritionists say

In a recent informal survey, some Northeast and Midwest dairy nutritionists had this to say about heavier use of corn silage in dairy diets:

POSITIVES

- More consistent rations
- More palatable rations
- More Mcal of energy per acre than hay crops
- Generally an easier crop to manage than multiple cuttings of hay
- Can plan and lock in protein purchases
- Corn ground can handle heavy levels of manure and thus benefit CAFO plans.

CHALLENGES

- Increased purchased proteins
- May require dry hay or straw for proper effective fiber
- Particle size can be important. Processed corn silage has definite advantages over unprocessed corn silage.
- Eggs are in "one basket" to a great degree. That's good if you harvest high quality corn silage but bad if corn silage digestibility is low.
- Need to have two to three months of additional inventory. Corn silage fermented less than two months doesn't perform as well as fully fermented corn silage.
- Greater risk of acidosis if effective fiber is not managed properly.