## **HOARD'S DAIRYMAN**



## **Does hybrid or processing matter more?**

Carbohydrates are the largest individual energy contributor to a cow's diet and maximizing its value matters more than ever.

by Alvaro Garcia

ORN silage enhances the diet's energy density while supplying effective fiber, provided particle size is adequate. This energy is influenced by the digestibility of both structural (fiber) and nonstructural (mainly starch) carbohydrates. To assess the contribution of each carbohydrate fraction, we looked at the results of more than 200,000 corn silage samples analyzed by the Dairy One Forage Laboratory between 2004 and 2020.

Out of 215,203 samples, average acid detergent fiber (ADF) was 25.4% dry matter (DM). Ranging from 21.5% to 29.3%, it had almost an 8-percentage unit spread (see table). The average neutral detergent fiber (NDF) of 212,887 samples was 43%, ranging from 37.3% to 48.7%. That's a 11.4-percentage unit spread! What is important to know is how much of that NDF is digestible.

Current research considers 24, 30, or sometimes even 48 hours in vitro NDF digestibility (NDFD) as better predictors of forage digestibility than lignin. Since high-producing cows eat more, and their feed passage rate is accelerated, NDFD at 30 or even 24 hours has been suggested as more adequate to describe the energy available to the cow than 48-hours digestibility.

The average NDFD at 24, 30, and 48 hours was 41.7%, 52.7%, and 62.0%, respectively. The ranges on a dry matter basis were:

- 35.1% to 48.4% for 24 hours
- 47.1% to 58.4% for 30 hours
- 56.5% to 67.5% for 48 hours

Since the spread is larger between NDFD24 (13.3 percentage points) compared to NDF30 (11.3 percentage points) and NDF48 (11 percentage points), and the latter two have almost identical NDFD, we suggest using NDFD30 as a more accurate predictor of digestibility and energy of corn silage in high-producing and/or early lactation dairy cows. This is an important concept since the energy

to assign to corn silage for the same cow varies between early and late lactation.

## **Unlocking starch's value**

Out of 208,975 samples, the average starch concentration was 32.4%. The range was from 25.2% to 39.5%, making the spread in carbohydrate content 14.3 percentage points.

To better understand its energy contribution to the diet, we need to consider the digestibility of each corn silage sample. If 100 grams of silage has 43 grams NDF and 32 grams of starch, each with an average digestibility of 52.7% and 69.8%, respectively, as shown in the table, then these provide 22.6 grams (43 grams x 0.527) of digestible NDF and 22.3 grams (32 grams x 0.698) of digestible starch, and almost the same amounts of digestible carbohydrates.

The key is to unlock the energy in corn starch with either a silage processor or to allow for more prolonged fermentation in the silo. Out of 53,870 silage samples, the average starch digestibility was 69.8%. The range was from 48.8% to 90.9% (see table).

Each 100 grams of silage, with average NDF of 43% and maximum NDFD30 of 58.4%, supplies 43 grams x 0.584 = 25 grams of digestible carbohydrates. A conventional silage, with average starch of 32.4% but processed to improve its digestibility to 90.5%, provides slightly more digestible carbohydrates (32.4 grams x 90.5 = 29.3 grams).

In addition, disrupting the plant cell walls enhances fiber digestibility, and as a result, cows **TO MAXIMIZE RETURNS** from corn silage, consider your options between hybrid selection and running a silage processor on that corn at harvest.

fed processed silage can outperform those fed an unprocessed, highly digestible silage hybrid. The average milk per ton for unprocessed silage was 3,523 pounds of milk. Meanwhile, the average for processed corn was 3,620 pounds.

## **Corn silage economics**

Researchers Masahito Oba and Michael Allen evaluated the relationship of NDFD with cow performance and estimated that one-unit gain in forage NDFD resulted in 0.37 pounds per day of dry matter intake, 0.50 pounds per day of milk yield, and 0.55 pounds per day of 4% fat-corrected milk.

Improving NDFD from 47.1% to 58.4% would mean 4.2 pounds of improved feed intake and 5.7 pounds of additional milk per cow daily. Dairy producers need to strive for corn silage with NDFD30 as close to 60% as possible either through hybrid selection or processing.

One measure of profitability for dairy farms is income over feed costs (IOFC) measured in dollars per cow per day: IOFC = (Milk price (\$ per cwt.) x daily average milk production)/100 - daily feed costs (dollars per cow per day). Here are a few examples:

**Double purpose "conventional" silage**: (\$16 per cwt. x 80 pounds per cow per day)/100 - \$6 feed costs per cow daily = \$6.80

**High NDFD hybrid**: (\$16 per cwt. x 82.9 pounds per cow per day)/100 - \$6 feed costs per cow daily = \$7.26

When choosing a higher NDFD30 silage hybrid, fiber digestibility can improve from an NDFD30 of 52.7% to 58.4%. This 5.7 percentage points gain in NDFD, according to Oba and Allen's work above, would result in 2.9 pounds more milk (0.50 x 5.7 = 2.9 pounds). From the high NDFD hybrid equation above, the IOFC will be \$7.26 per cow daily. This will result in an additional 46 cents per cow per day. This additional revenue will go a long way toward buying premium seed and still leave plenty of money in your pocket.

Another approach is to estimate the changes in IOFC by using a silage processor. From the table, we can estimate the additional pounds of milk produced per ton of processed silage fed. To be clear, this is an index ranking and represents a projection. The difference between a processed and unprocessed ton of silage is 3,620 (processed) minus 3,523 (unprocessed), which equals 97 pounds of milk per ton of silage.

A cow fed 57 pounds of TMR on a dry matter basis with 40% corn silage will eat roughly 23 pounds of silage on a dry matter basis. One ton of silage contains roughly 700 pounds of dry weight; if fed at 23 pounds per cow, it will feed 30 cows. Then, 97 pounds of additional milk per ton divided by 30 cows equals an additional 3.2 pounds of milk per cow. This figure is again like the one above of 2.9 pounds additional milk with highly digestible silage.

The response from selecting hybrids with higher digestibility produces similar results compared to a silage processor. Discuss with your nutritionist the approach that fits your farm to maximize returns from corn silage.

Acid detergent fiber, neutral detergent fiber, and starch in over 200,000 corn silage samples				
	Samples	Minimum	Maximum	Average
ADF, % DM	215,203	21.5%	29.3%	25.4%
NDF, % DM	212,887	37.3%	48.7%	43.0%
NDF Digestibility 30 h, % NDF	4,274	47.1%	58.4%	52.7%
Starch, % DM	208,975	25.2%	39.5%	32.4%
Starch Digestibility 7 h, % Starch	53,870	48.8%	90.9%	69.8%
Milk (lbs.)/ton unprocessed	3,343	3,241	3,806	3,523
Milk/ton (lbs.) processed	3,343	3,352	3,888	3,620

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