# NDFd in dried distillers grains with solubles: Should we care?



**Kevin Herrick, Fernando Diaz-Royon** and **Paul Kononoff** for *Progressive Dairyman*

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Most livestock nutritionists recognize dried distillers grains with solubles (DDGS) as a source of fat and protein. As a result, researchers have devoted a significant amount of time and resources to better characterize the fat and amino acid components of DDGS. However, we often overlook that a significant amount of DDGS is comprised of fiber. In fact, fat content (8 percent dry matter [DM]) is much less than the fiber component, while typical crude protein concentrations (31 percent DM) are similar to the concentration of the ash-free neutral detergent fiber (aNDFom) fraction (31 percent DM; **Table 1**).

### Fiber terms and variability

A challenge with any fiber discussion is accurately defining the fiber terms being compared. Components such as acid detergent fiber (ADF), neutral detergent fiber (NDF), crude fiber, total dietary fiber and soluble dietary fiber are commonly used, and each term reflects a different part of the fiber component. The fiber measures used most often in the dairy industry to describe DDGS include ADF and NDF. Generally speaking, the ADF fraction includes cellulose and the lignin component while NDF includes ADF plus the hemicellulose fraction.

We can also consider the digestibility of these fractions to evaluate fiber quality in DDGS. Methods to determine digestibility estimates have traditionally been obtained through in vivo or in situ studies. These were time-consuming, expensive and highly variable – and, as a result, very few nutritionists saw value in trying to determine fiber digestibility of DDGS. However, in vitro systems have evolved to better predict response in the animal and, as a result, nutritionists now have the option of submitting DDGS samples to determine digestibility.

We recently analyzed samples of DDGS from six different ethanol

**TABLE 1** Typical distillers grains with solubles nutrient composition

| Item | DDGS |
|---|---|
| | Percent of DM |
| Dry matter | 88 |
| Crude protein | 31 |
| Fat | 8 |
| ADF | 12 |
| aNDFom | 31 |

**TABLE 2** Fiber components and digestibility of six dried distillers grains with solubles samples[1]

| Item | 1 | 2 | 3 | 4 | 5 | 6 | Avg. |
|---|---|---|---|---|---|---|---|
| ADF (percent DM) | 12.2 | 10.8 | 11.1 | 10.1 | 12.0 | 13.1 | 11.5 |
| aNDFom (percent DM) | 31.3 | 28.9 | 29.9 | 29.2 | 30.3 | 32.2 | 30.3 |
| NDFd 30 (percent DM)[2] | 21.8 | 20.3 | 21.3 | 21.1 | 20.0 | 19.2 | 20.6 |
| NDFd 30 (percent of aNDFom)[2] | 69.6 | 70.0 | 71.3 | 72.3 | 66.1 | 59.6 | 68.1 |
| uNDFd 30 (percent of DM)[3] | 9.4 | 8.6 | 8.5 | 8.0 | 10.2 | 12.7 | 9.6 |
| Hemicellulose (percent DM) | 19.1 | 18.1 | 18.7 | 19.0 | 18.2 | 19.1 | 18.7 |
| ADF ( percent of aNDFom) | 38.9 | 37.3 | 37.2 | 34.6 | 39.8 | 40.7 | 38.2 |

[1]Samples collected from 10 different biorefineries and sent to Dairyland Labs for analysis.
[2]NDFd 30 = 30-hour NDF digestibility as determined by in vitro degradation
[3]uNDFd 30 = Undegraded NDF component after a 30-hour in vitro degradation

bio-refineries located in South Dakota and Nebraska in order to better characterize DDGS fiber quality. All the bio-refineries were dry-grind, and all used corn as the only source of grain. Samples of DDGS were sent to a commercial laboratory for proximate analysis and 30-hour NDF digestibility (NDFd) (**Table 2**).

The ADF and aNDFom values for our small sample size had minimal variability. However, there was considerably more variability in digestibility estimates. The greatest NDFd at 30 hours was 72.3 percent of aNDFom for sample No. 4, while the least digestible was sample No. 6 which had an estimate of 59.6 percent of aNDFom.

We can speculate on why there are differences in fiber values among DDGS. First, corn varieties or growing conditions that affect the nutrient content of corn can affect many components of DDGS quality. Secondly, the ethanol process affects the fiber variability of DDGS. The dry-grind ethanol process is complex and involves many steps and variables. Enzymes, fermentation time and temperature, drying temperature and throughput are just a few factors with the potential of changing the fiber concentration or quality.

## Fiber degradation rate

Concentration of fiber and amount degraded at a certain time point are not the only important measures of fiber quality. Degradation rate of the fiber is also important when trying to determine the effect of fiber quality on animal performance. In order to better understand NDFd in DDGS, we estimated NDF digestibility at 24, 30, 48 and 240 hours for the same six DDGS sources as our previous exercise (**Figure 1**, page 132).

Although several of the DDGS samples had very similar patterns of NDFd, there was a source that exhibited significant variability. The majority of this variability is evident at the earlier digestibility time points, with later time points having

Continued on page 132

**FIGURE 1** Digestibility of NDF over four time points for six sources of DDGS

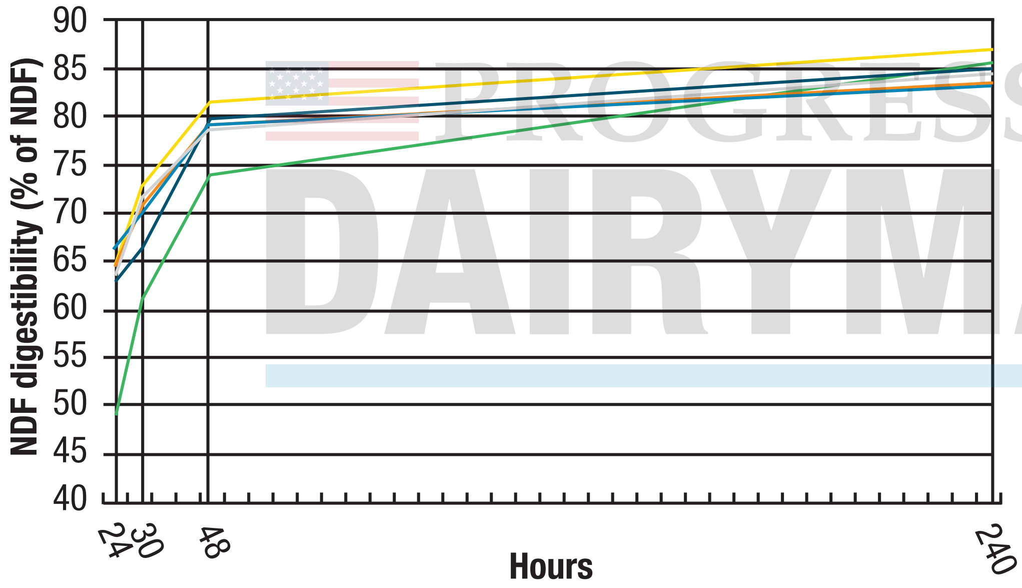


**TABLE 3** Inputs and predicted milk performance based on DDGS NDF digestibility

| Item | Low-NDF digestibility DDGS | Mid-NDF digestibility DDGS | High-NDF digestibility DDGS |
|---|---|---|---|
| NDFd (percent of NDF) | 50.0 | 62.0 | 67.0 |
| NDFd hours | 24 | 24 | 24 |
| NDFd kd (percent/hr)[1] | 6.7 | 12.2 | 21.8 |
| ME allowable milk (lbs/hd/day)[1] | 98.45 | 99.63 | 100.58 |
| MP allowable milk (lbs/hd/day)[1] | 97.46 | 99.14 | 100.52 |

[1]Estimated by AMTS software

**NDFd in dried distillers grains with solubles,** cont'd from page 131

similar NDFd among all samples.

## Ration implications

Utilizing predictive models of the dairy formulation software provides another option to quantify the potential effects of distillers NDFd on performance. The Agricultural Modeling and Training Systems (AMTS; Groton, New York) formulation software includes an option to estimate undigested NDF of ingredients based on the digestible NDF at certain time points.

To begin with, we created three different DDGS feeds in the AMTS library. The NDFd at 24 hours for each DDGS was changed to reflect the least (50 percent of NDF), average (62 percent of NDF) and greatest (67 percent of NDF) digestibility estimate we observed for the six samples we previously described. All values for DDGS nutrients were left unchanged from the AMTS default library value except for NDFd. We then used AMTS to formulate a high-group lactation diet to support approximately 100 pounds of milk per head per day. Forage sources included corn silage and alfalfa hay, and DDGS was locked in at 10 pounds (8.8 pounds DM) per head per day or approximately 16.38

**Kevin Herrick**
Technical Service
Director of Nutrition
Poet Nutrition
*kevin.herrick@poet.com*

percent of diet DM. The DDGS feed with the average NDFd was used to formulate the initial diet.

The metabolizable energy and metabolizable protein allowable milk estimate for all formulations are shown in **Table 3**. The metabolizable energy allowable milk ranged from 98.45 to 100.58 pounds per head per day between the low- and high-NDF digestible DDGS sources. Similarly, the metabolizable protein allowable milk ranged from 97.46 to 100.52 pounds per head per day among the same DDGS sources. We recognize many variables can affect these predictions. Type of animal, stage of lactation, other ingredients and DDGS inclusion would all have an effect. However, it is an interesting exercise to demonstrate the differences DDGS NDFd may have on animal performance.

### Conclusions

Fiber is often overlooked as a factor when discussing DDGS quality. However, fiber represents a large component of DDGS and, as a result, even small changes in quality of fiber can have a significant effect on animal performance. Although our sample size was relatively small, we still observed variability for both DDGS fiber content and digestibility, which we feel is representative of the industry. We also demonstrated the magnitude of change we observed can have a significant impact on potential milk production.

*Fernando Diaz-Royon, DVM, Ph.D., is a dairy nutrition and management consultant at Rosecrans Dairy Consulting, LLC.*

*Paul Kononoff, Ph.D., is an associate professor of dairy nutrition/dairy nutrition specialist at the University of Nebraska – Lincoln.*

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