HOARD'S DAIRYMAN

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Some commodity feeds require regular testing

ACCORDING to the Renewable Fuels Association, the ethanol industry in the United States produced an estimated 40 million metric tons of distillers grains (wet, dried, and modified) in 2015, of which 32 percent were used on dairy farms. Distillers grains are a source of energy and nonrumen degradable protein for dairy cattle diets and are generally an appealing ingredient for Midwest dairy farmers because of the lower price and availability in the market compared to other feedstuffs. However, nutrient content variability (inconsistency) of the product within and among plants is frequently mentioned as a constraint by dairy producers and nutrition consultants.

In a survey conducted among local dairy producers by the Dairy Science Department at South Dakota State University in 2011, dairy producers were asked the degree of importance of several distillers grains issues (1 = none; 2 = low; 3 = average; and 4 = high). "Variability between batches" was the issue with the highest degree of importance (3.8), followed by protein content (3.5), and fat content (3.4).

Similarly, results from another survey published by the National Agricultural Statistics Service in 2007 showed that consistency was a concern to dairy producers. On a scale of 1 to 4 (similar to the aforementioned study), the average was 3.8 for consistent protein, 3.6 for consistent moisture and fat, and 3.5 for consistent fiber.

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Looking for a standard

Three university studies have reported the nutrient composition of a large number of distillers dried grains with solubles (DDGS; see table). University of Minnesota researchers (2002) evaluated the nutrient content and variability of 118 DDGS samples from 10 ethanol plants located in Minnesota and South Dakota. Average protein content and fat content values were 30.2 and 10.9 percent, respectively, with coefficients of variation of 6.4 and 7.8 percent.

A University of Missouri study (2004) reported the composition of DDGS samples collected over five years from an ethanol plant located in Minnesota. All parameters were significantly affected by year. The mean concentrations of protein and fat were 31.3 and 11.9 percent on a dry matter basis, respectively. Actual variation (highest minus lowest value) in protein was 5.0 percentage units, whereas coefficients of variation were 4.7 percent. Likewise, actual variation in fat content was 1.6 percentage units and coefficients of variation were 6.5 percent.

Sources of variation in the composition of DDGS samples were evaluated by University of Missouri researchers in 2010. A total of 108 samples of corn and DDGS were obtained from each season (fall, winter, spring, and summer) during each of three successive weeks from nine ethanol plants located in the Upper Midwest.

Composition of distillers dried grains with solubles (percent dry matter basis)

	University of Minnesota (2002)	University of Missouri (2004)	University of Missouri (2010)	Dairy One Lab (2015/16)
Number of samples	**118**	**235**	**49**	*
Dry matter, % as fed	88.9	–	89.2	88.1
Protein, %	30.2	31.3	32.0	31.2
Fiber (NDF), %	42.1	–	58.9	33.9
Ash, %	5.8	4.6	3.9	6.6
Fat, %	10.9	11.9	11.5	10.3

*Crop year: May 1, 2015 to April 30, 2016; number of samples ranged by nutrient, from 280 to 504.

Protein concentration ranged from 26 to 38 percent on a dry matter basis, with a mean of 32 percent. Fat concentration ranged from about 5.0 percent to about 15.0 percent dry matter, averaging 11.5 percent. Protein and fat concentrations were not different among plants. However, season affected nutrient composition; protein was highest in winter and lowest in summer, and fat was greatest in fall and lowest in winter. In addition, the authors indicated that fermentation batches were more important sources of variation than ethanol plants or season.

DDGS samples (504) analyzed recently (May 1, 2015 to April 30, 2016) by the New York State Dairy One Lab showed an average fat content in DDGS of 10.3 percent on a dry matter basis (see table; with a range of values from 7.7 to 12.9 percent) and protein content of 31.2 percent (range 27.5 to 34.3 percent).

Most of the variation in the nutrient content of distillers grains is likely a result of the corn crop, percent of condensed distillers solubles (syrup) added back to DDGS, and completeness or duration of the fermentation process . . . which affects the degree of starch removal.

Diving deeper into variation

One study conducted in Indiana showed that product variability of DDGS was primarily due to the levels of syrup added during the drying process. The semisolid and syrup streams produced after corn fermentation have different chemical properties. As a result, boosting syrup concentrations in the drying process progressively resulted in DDGS with reduced levels of protein, acid, and neutral detergent fiber, while ash and oil contents in distillers grains went up. An obvious strategy for controlling product consistency in distillers grains lies in adding a consistent level of syrup to distillers grains during the drying process.

In addition, nutrient differences among corn hybrids and the geographic location where the crop is grown will be amplified in the resultant co-products.

As of recent times, ethanol biorefineries have started to extract a portion of the oil from distillers grains. The majority of the extraction methods are based on physical separation techniques, using different separation columns or centrifuges, and they are capable of extracting between 30 percent and 70 percent of the oil contained in the co-product.

When part of the oil is removed, the rest of the nutrients are proportionately concentrated. One exception is energy, which is diluted proportionally to the fat extraction.

The fat in distillers grains is mainly composed of unsaturated fatty acids. Linoleic and oleic are the most abundant fatty acids, with an average of 50 percent and 25 percent of the total fatty acids, respectively. The high concentration of unsaturated fatty acids in distillers grains can sometimes lead to milkfat depression in dairy cattle fed diets that include high levels of co-products and less than 50 percent of forage.

In order to get nutritionally balanced diets, routinely conduct chemical analysis of distillers grains.