

Distiller's Grains: Focusing On Quality Control

A tremendous amount of research has been conducted in a short period of time to determine the suitability of distillers dried grains plus solubles (DDGS) for poultry feeds

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During the past several years, distiller's dried grains plus solubles (DDGS) has become a major feed ingredient in North America. Dozens of fermentation plants have been established in the mid-western United States where corn is fermented to produce alcohol to be mixed with petroleum. While it is sometimes debated whether this produces a net gain in fuel, there is no question that millions of tons of fermentation residues are now available to the feed industry. As might be expected, a tremendous amount of research has been conducted in a short period of time to determine the suitability of DDGS for poultry and animal feeds. Much of this research can be found at In studies conducted at the University of Georgia, it was found that broilers and laying hens can easily utilize 10% DDGS, although somewhat lower levels are recommended for the starter period. There are no inherent problems with DDGS, as might be the case with gossypol in cottonseed meal or trypsin inhibitors in underprocessed soy. Instead, any problems to be encountered with the use of DDGS are probably due to simple variations in quality.

The process by which DDGS is produced is quite easy to understand. First, corn is ground and moistened, and an enzyme is added to convert starch to sugars. The material is then heated to eliminate unwanted microbes, and then a yeast is added to convert the sugars to alcohol. After fermentation, alcohol is removed by distillation and the remaining components are dried. As grain is composed of approximately 2/3 starch, which is consumed during fermentation, the process effectively triples the concentration of oil, fiber, and other minerals. The level of protein in DDGS is slightly more than triple that in the original corn, as the final product also contains yeast residues. Studies on DDGS at the University of Georgia found typical nutrient levels to approximate those in Table 1. Nutritionists and quality control specialists will need to focus on several additional areas to maximize the efficiency of DDGS use in their feeds.

Variations in Proximate Composition

For reasons which are not completely clear, the protein content of DDGS can vary from 24-29%.

Table 1. Nutritional profile of distillers grains plus solubles (90% DM)

Protein (%)	27.0
Oil (%)	9.5
Crude fiber (%)	9.0
Calcium (%)	0.33
Phosphorus, total (%)	0.75
Phosphorus, available (%)	0.49
Sodium (%)	0.10-0.45*
Metabolizable energy (kcal/kg)	2810

*Significant variation seen between suppliers.

There can also be significant variations in fiber, while oil content generally is less variable. Thus, whenever receiving a new shipment of DDGS it is highly advisable to evaluate at least the crude protein content prior to incorporating the material into poultry feeds.

Amino Acids

Once crude protein has been determined, the area of amino acid availability is one which should be of prime concern to nutritionists. In general, we have found the availability of amino acids in DDGS to be extremely satisfactory, and only slightly lower than that of corn itself. Some decrease would be expected due to the effect of drying on the availability of amino acids such as lysine. Typical total and available amino acids in DDGS are presented in Table 2. What concerns most nutritionists, however, is the possibility of decreased amino acid availability in samples of darker color. This concern is completely understandable, as lysine availability is sharply reduced in overprocessed soybean meal. Fourteen samples of DDGS have been evaluated for total and available amino acids at this laboratory. In addition, we have attempted to relate the darkness of a sample to its amino acid availability.

Our studies clearly indicate that dark DDGS samples have lower amino acid availability than lighter samples. In the photograph, three samples of DDGS are shown. Sample 1 is of light color, typical of that produced by many new DDGS plants. Sample 2 is intermediate, while Sample 3 is dark (all samples were taken from commercial shipments). In Table 2,

Table 2. Amino acid composition and availability of several distillers grains plus solubles samples differing in color (90% DM)

	Light (#1)		Intermediate (#2)		Dark (#3)	
	Total A.A.(%)	Availability (%)	Total A.A.(%)	Availability (%)	Total A.A.(%)	Availability (%)
Lysine	0.84	75	0.69	65	0.39	46
Methionine	0.55	86	0.53	85	0.46	82
Cystine	0.60	72	0.56	71	0.52	68
Threonine	0.98	74	0.94	70	0.85	69
Tryptophan	0.24	81	0.20	81	0.14	80
Arginine	1.20	80	1.03	81	0.75	73
Isoleucine	1.00	80	0.97	85	0.89	78
Valine	1.40	79	1.27	77	1.24	77
Leucine	3.05	88	3.11	87	2.87	87

the light sample (#1) is seen to have satisfactory levels of total and available amino acids. The intermediate sample (#2) had somewhat reduced levels of available amino acids, especially lysine, but this decrease was not severe. However, the dark sample (#3) had extremely low levels of both total lysine and lysine availability. This indicates that a significant amount of the lysine had been destroyed during processing. In addition, we see that much of the lysine that was not destroyed had become biologically unavailable. Thus, the level of available lysine in sample #3 was only 1/3 that in the light colored sample (#1). As is the case with soybean meal, other amino acids were not as severely affected as lysine by the excessive heating.

Metabolizable Energy

Metabolizable energy (ME) has been determined on more than 25 samples of DDGS, using the TME_n assay with Leghorn roosters. While samples with higher fiber content understandably have lower energy, a value of 2800 kcal/kg is appropriate for feed formulation. We have seen no indication that color of sample affects its ME.

Available Phosphorus

Many nutritionists have been surprised by the high level of available phosphorus in DDGS (see Table 1). As with other components, the level of total phosphorus is three times higher in DDGS than in corn. During the fermentation process, it is presumed that modest amounts of phytase are produced by



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yeast, thus converting phytin phosphorus to more available forms. We have found the phosphorus in DDGS to be approximately 65% available for poultry.

Mycotoxins

Just as levels of nutrients are tripled in DDGS as compared to

the original grain, this also applies to concentration of mycotoxins, which are not destroyed by fermentation. However, while mycotoxins may occur, this is considered by the alcohol industry to be relatively unlikely. The profit from corn fermentation is clearly in the efficient production of alcohol. Corn which has been improperly stored and has developed aflatoxin or other mycotoxins may not give the same efficiency of alcohol production as higher quality corn. Thus, while the possibility of mycotoxin contamination of DDGS cannot be ruled out, at present toxin contamination is not considered likely. EI

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