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Use of Dry Distillers' Grains with Solubles by Poultry

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Introduction

The rapid emergence of ethanol plants in Indiana will result in a large quantity of corn co-products that could be used to feed poultry. The primary co-product available is fed as dried distillers' grains with solubles (DDGS); however, the quantity that may be fed may be limited because there are numerous issues affecting use of DDGS in poultry rations.

Issues to Be Addressed

Whether large amounts of DDGS can be fed on poultry farms depends upon how well the ethanol industry can overcome the main obstacles in feeding DDGS to poultry. There are a number of issues that should be addressed.

Product Variability Within and Between Plants

The DDGS drying process often results in heat-damaged protein, thus DDGS are feared to be quite variable in their quality and composition. Plant-to-plant variation tends to be larger than within-plant variation, but there is still variability (sometimes due in part to fermentation time or efficiency) and possible heat damage to proteins as a result of the drying process. Additional inconsistency can come in the quantity of distillers' solubles being added back to the grains before drying.

Variability in Digestibility of Amino Acids

As mentioned previously, the drying process of grain can result in damaged proteins that greatly reduce the digestibility of certain amino acids such as lysine. For example, lysine digestibility can range from 59 to 84% (Parsons et al., 2006). Also, the amino acid profile of the diet will shift by including a larger percentage of dietary protein from DDGS. A diet including DDGS will likely increase the amount of synthetic lysine added to the diet to account for this imbalance and for the reduced digestibility.

Variability in Available Energy

Most DDGS contain more oil than in corn grain. Therefore, including DDGS in poultry diets will likely shift the amount and composition of fat in the diet. The ramification of this shift in fat type is unknown at present. Additionally, the energy content of DDGS can be variable due in part

to caramelization of starch during the drying process. For example, the metabolizable energy (ME) can range between 1185 to 1388 kcal/lb. (Parsons et al., 2006)

Variability in Availability of Phosphorus

Phosphorus in DDGS can range from 0.62 to 0.77% (versus that of corn at 0.3%; Parsons et al., 2006). The bioavailability (versus potassium mono-phosphate), however, is at least two to three times greater than that of corn and can range between 62 and 100% (Parsons et al., 2006). Incorporation of DDGS into diets should account for the additional total and available phosphorus. If this adjustment is made, increases in manure phosphorus concentrations can be avoided.

Variability in Sodium Content

Sodium chloride (salt) is often added to DDGS to aid in the desiccation/drying process. Sodium is an essential element, but if included at greater levels than needed by the bird, can lead to increased water consumption and wet litter or manure. Wet litter and/or manure can also cause additional bacterial growth, which can predispose a flock to an increased susceptibility to intestinal infections. Parsons et al. (2006) noted considerable variation in the sodium content of DDGS samples ranging from 0.05 to 0.17%, which is considerably greater than the sodium content of corn (0.02%). Therefore, sodium content of DDGS should be monitored closely for poultry.

Problems with Pelleting and Pellet Quality

If the temperature of the distillers' grains is not suitable when the solubles are added back, there is a tendency for "molasses balls" to develop. These subsequently can cause substantial problems with throughput through the pellet mill and gumming of dies. If DDGS are used at more than 5% of the diet, pellet durability can be greatly reduced due to the springiness of the fiber within the co-product.

Mycotoxins

If mycotoxins (aflatoxins, zearalenone, vomitoxin) are present within the corn prior to fermentation, the DDGS will contain three to four times the concentration of mycotoxins in corn.

Other Issues

Often corn is finely ground prior to fermentation to maximize the efficiency of conversion to ethanol. If the average particle size of the resultant DDGS is 300 microns or smaller, bridging and flowability of the DDGS during shipping and storage can become burdensome. If particle size of the DDGS is overly fine (i.e., 300-400 microns), much of the DDGS may pass more quickly through the gizzard of the bird, reducing its exposure to proteolytic digestion. This could result in a lowered nutrient digestibility in the bird.

Rapid tests are available for assessing nutrient composition and nutrient availability. Two of these include near Infra-Red Reflectance analysis for total amino acids and rapid enzyme in vitro analyses for amino acid digestibility. Utilization of these rapid tests will allow for more precise diet formulation to make certain the productive needs of the bird are met.

Table 1. *Estimation of Distillers' Dry Grains plus Solubles (DDGS) Used by the Indiana Poultry Industry.*

	Total Consumption	Theoretical DDGS Use (tons)		
Bird Category	Feed (tons)	5% of Diet	7.5% of Diet	10% of Diet
Broiler	222,640	11,132	16,698	22,264
Turkey male	368,280	18,414	27,621	36,828
Turkey female (light)	60,915	3,046	4,569	6,092
Turkey female (heavy)	32,185	1,609	2,414	3,219
Duck	72,774	3,639	5,458	7,277
Pullet to 13 wk	94,152	4,708	7,061	9,415
Pullet 13 to 20	31,911	1,596	2,393	3,191
Laying hen	892,178	44,609	66,913	89,218
Total per year	1,775,034	88,752	133,128	177,503
Total per week		1,707	2,560	3,414
Total per day		243	365	486

Current Industry Utilization and Future Use

An informal survey across the Indiana poultry industry revealed typical use of 5 to 7% DDGS in poultry diets (high being 10 to 11%), with several companies not utilizing any. Depending on economics and comfort with DDGS nutrient variability as indicated previously, the industry could expand its use to 10% or more. Table 1 estimates the theoretical utilization of DDGS by the poultry industry in Indiana.

Conclusions

The question one has to answer before including DDGS in poultry diets, therefore, is one of cost versus nutritional benefit. For example, if one were to compare two DDGS sources with similar crude protein contents, the inherent nutritional value of a DDGS with 1300 kcal/lb and 82% lysine digestibility would obviously be greater than a DDGS with 1190 kcal/lb and 60% lysine digestibility. Often, however, ingredient-purchasing decisions are not always straightforward. They are complicated by other limitations, including availability, storage capacity, hauling distance, and total diet inclusion limits (e.g., by sodium concentration of the DDGS). Therefore, pricing and buying decisions must be done on an individual situational basis.

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