FACTSHEET

Livestock Marketing Information Center

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Feeding Distiller Grains to Hogs

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The continuing rapid expansion in the number of dry-mill ethanol plants means there will be an expanding supply of distiller grains on the market. Ethanol plants both consume feed and produce feed. For each bushel of corn processed through a dry-mill ethanol facility, 17 pounds of dried distiller grains with solubles (DDGS) are produced. In 2000, approximately 250 million bushels of corn was processed in dry-mill plants resulting in 4.25 billion pounds of DDGS. In 2006, 1.5 billion bushels of corn is expected to be processed yielding 25.5 billion pounds of DDGS. By 2010, 2.5 billion bushels of corn is forecast to be dry milled for ethanol production resulting in 42.5 billion pounds of DDGS. To put this quantity into perspective, U.S. hogs consume approximately 82 billion pounds of feed annually. Since using corn to produce ethanol drives up corn prices, it behooves hog producers to figure out how to effectively utilize this burgeoning new feed ingredient.

Wet verses Dry Distiller Grains

Ethanol plants use large amounts of corn and water. Finely ground corn flour is mixed with water, enzymes, yeast and other additives then heated for liquefaction before moving on to fermentation. After fermentation and distillation is complete, the corn mash is centrifuged to separate the "thin stillage" from the "wet grains." The thin stillage is put through an evaporator to produce condensed distiller solubles (CDS). The CDS may be sold or added to the wet grains to produce wet distiller grains with solubles (WDGS). More commonly, the CDS is added back to the wet grains which are heat dried to yield dry distiller grains with solubles (DDGS). DDGS is a more concentrated nutrient source than WDGS. However, the dry down process is costly and can destroy some of the nutritional value of the distiller grains.

Although nutritionally more valuable and lower cost to produce, the high water content of WDGS (typically 65-70%) makes it costly to transport and gives WDGS a short shelf life, especially during hot weather. As a general rule, during the summer don't plan to store WDGS more than 7 days. DDGS can be stored for a month or so during the summer. Storage time can triple for distiller grains during winter months. Despite its short shelf life and high cost of shipping, WDGS can be a very competitively priced feed ingredient for livestock operations that are located close to ethanol plants.

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Because corn is finely ground during the initial step in the dry milling process, DDGS tends to pack tightly and often presents handling problems for users. Flow ability can also be a problem for processed feed containing DDGS.

Nutritional Value

The process of producing ethanol in a dry-mill plant converts the starch within the corn first to sugar then to ethanol while leaving the other components of the grain pretty well unaltered. The removal of the corn starch concentrates the non starch components of corn approximately three fold in the DGS. Nutritionally, DGS is quite different than corn. Table 1 presents average nutritional values for soybean meal, whole corn, dry distiller grains and wet distiller grains. The variation in nutritional content of DGS is much greater than for corn or soybean meal.

Table 1. Nutrient Content of Soybean Meal, Corn, DDGS and WDGS

Nutrient	Soy Meal	Whole Corn	Dry DGS	Wet DGS
Dry Matter	90%	87%	88-92%	30-35%
Fat	3%	4%	9-10%	8-12%
Fiber	10-11%	2-3%	8-9%	13%
Crude Protein	48%	8-9%	29-30%	29-31%
lysine	3%	0.3%	0.6-0.9%	0.7-1.0%
Minerals				
Calcium	0.3%	0.03%	0.1-0.3%	0.1-0.3%
Phosphorus	0.7%	0.3%	0.8-1.0%	0.8-1.0%
Energy (kcal/lb)	1782	1551	1700	1750

Nutritional Quality

There are no quality standards for distiller grains with solubles (DGS). Because of differences in the design and operation of ethanol plants (types of enzymes and yeast used, length of fermentation, drying temperatures, etc.) compounded by the differences in the grain used, there is considerable variation in the nutrient content of DGS. This variation presents a major challenge to livestock feeders. It is advisable to test each load of DGS before feeding. As a general rule, livestock feeders should look for DDGS that are light golden in color. Distiller grain that is dark red in color sometimes indicates that the mash was overheated in the dry down process. Overheating makes the nutrients in DDGS less available to the animals eating it.

Protein Quality

The crude protein content of DGS is high, typically close to 30%. However, the mix of amino acids that makeup this protein is not particularly well suited for monogastric animals such as pigs. For swine rations that contain more than 20% DDGS, it will be necessary to add synthetic lysine in order to balance the ration. For rations with 30% or more DDGS, it will be necessary to add synthetic lysine, threonine and tryptophan in order to adequately meet the pig's amino acid needs.

Minerals

The content of phosphorus and calcium is higher in distiller grain than corn. The phosphorus in DGS is 80-90% digestible by the pig whereas the phosphorus in corn is only 14% digestible.

Micotoxins

The fermentation of corn to produce ethanol does not destroy any micotoxins (e.g. aflatoxin, vomatoxin, etc.) which might have been present in the corn. These toxins will be much more concentrated in the DGS than they were in the corn. Since micotoxins in feed can present serious problems for livestock, it is advisable to only purchase DGS made from corn that has been screened for micotoxins.

Potential Health Benefits

There is some indication that DGS may have some therapeutic benefits for swine. There is inconclusive evidence that feeding DDGS may reduce the incidence of illeitus, acidosis, laminitis, and liver abscesses and increase the number of pigs per litter.

Pork Quality

Because distiller grains are high in oil, the quality of the fat in pork tends to be negatively impacted by feeding DGS. This is generally not a concern when low levels of DGS are fed , but can become a carcass value problem when a high level of DGS is included in the swine ration.

Hog Growth

There are three key issues when formulating swine rations with DGS as a replacement for corn: nutritional formulation, ration palatability, and impact on pork quality. It is possible to formulate nutritionally balanced swine rations with fairly high DGS content. However, ration palatability tends to decline as DGS content increases, resulting in reduced feed intake and slower rates of gain.

Table 2 summarizes feeding trials performed by the University of Missouri. These studies indicate no change in feed conversion as the DDGS content of swine grow-finish diets is increased from 0% to 30%, but a decline in average daily feed intake (ADFI) and average daily gain (ADG) resulting in reduced carcass weights (Car Wt). Feeding trials performed by Kansas State University indicate that hogs prefer to consume diets without DDGS.

Table 2. Hog Growth Performance (63-268 pounds)

DDGS	F/G	ADFI	ADG	Car Wt
	ratio	*----------pounds---------*		
0%	2.47	5.63	2.28	208.86
10%	2.51	5.59	2.23	202.67
20%	2.46	5.38	2.18	202.14
30%	2.47	5.32	2.15	199.22

Source: Marcia Shannon, University of Missouri-Columbia

Relative Feed Value

As a general rule of thumb, in swine rations, 200 pounds of DDGS plus 3 pounds of limestone replaces 177 pound of corn plus 20 pounds of 44% soybean meal plus 6 pounds of dicalcium phosphate. Since DDGS substitutes primarily for corn and soybean meal, it is possible to develop a formula to calculate the feed value of DDGS based upon the market price of corn and soybean meal. Tables 3 and 4 estimate the feed value of DDGS based on various prices for corn and soybean meal. Table 3 assumes no reduction in animal performance from feeding DDGS. Table 4 assumes a 2% reduction in average daily gain.

Table 3. Comparative Economic Value of DDGS in Swine Finishing Rations (10% inclusion and no reduction in animal performance)

	Soybean Meal ($/ton)						
Corn	150	175	200	225	250	275	300
$/bu	*Value of DDGS, $/ton*						
2.00	89	92	94	97	99	102	104
2.25	97	100	102	105	107	110	112
2.50	105	108	110	113	115	118	120
2.75	113	116	118	121	123	126	128
3.00	121	123	126	128	131	133	136
3.25	129	131	134	136	139	141	144
3.50	137	139	142	144	147	149	152
3.75	145	147	150	152	155	157	160
4.00	152	155	157	160	162	165	167

Table 4. Comparative Economic Value of DDGS in Swine Finishing Rations (10% inclusion and 2% reduction in average daily gain)

	Soybean Meal ($/ton)						
Corn	150	175	200	225	250	275	300
$/bu	*Value of DDGS, $/ton*						
2.00	83	86	89	91	94	96	99
2.25	91	94	97	99	102	104	107
2.50	100	102	105	107	110	112	115
2.75	108	110	113	115	118	120	123
3.00	116	118	121	123	126	128	131
3.25	122	126	129	131	134	136	139
3.50	132	134	137	139	142	144	147
3.75	140	142	145	147	150	152	155
4.00	148	150	153	155	158	160	163

In the fall of 2006, DDGS were below the values shown in Table 3 and 4, making DDGS an attractive substitute for some of the corn and soybean meal typically used in swine rations.

Feeding Recommendations

Including low levels of DDGS in swine rations offers the opportunity to reduce ration cost without sacrificing animal performance. Table 5 shows University of Missouri recommendations on inclusion rates for various swine rations. The column headed "Easy" represents a DDGS inclusion rate that should result in animal performance that is not significantly different from typical corn-soy diets. The column headed "Max" gives inclusion rates that are likely to result in reduced feed intake and growth rates.

Table 5. Swine Feeding Recommendations for DGS

	Easy	Max
	--percent of ration's dry matter—	
Nursery Pigs	5%	25%
Grow-Finish Hogs	10%	20%
Gestating Sows	20%	50%
Lactating Sows	5%	20%
Boars	20%	50%

Source: Marsha Shannon, University of Missouri

Summary

Unless crude oil prices fall dramatically, ethanol production will continue to expand resulting in higher corn prices and large quantities of distiller grains. It appears likely that the price of DGS will be below its calculated nutrient value relative to corn and soybean meal, especially for areas close to dry milled ethanol plants. The bulk of the distiller grains will be fed to cattle, which are better able to utilize the high fiber content of DGS. However, distiller grains can be an attractive feed ingredient in swine rations. In swine rations, 200 pounds of DDGS plus 3 pounds of limestone replaces 177 pound of corn plus 20 pounds of 44% soybean meal plus 6 pounds of dicalcium phosphate. The high fiber and oil content of DGS limit its use to a minor portion of swine rations.

References

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