Rethinking Ethanol Coproducts

By Troy Lohrmann
Vice President of Animal Health and Nutrition
Quality Technology International

Ethanol production is expanding at an unprecedented rate. Most of this growth is through dry-grind ethanol production. Besides carbon dioxide, the coproducts remaining from fermentation are distillers grains and solubles—generally combined and dried to make distillers dried grains with solubles (DDGS). Like ethanol, the amount of DDGS in the marketplace is increasing rapidly, with a majority of it being consumed in the U.S. animal feed market. Today, with the ethanol growth boom, the price of DDGS is beginning to show signs of "oversupply" economics in many areas. Classic economics would suggest that when supply increases beyond demand, price erosion begins.

Today DDGS prices are beginning to show this behavior. Case in point: DDGS has gone from being priced at a premium to corn in ruminant markets to selling at a larger discount to corn. The volume of new dry-grind ethanol plants coming on line in the next five years will help ensure that DDGS will not likely increase in value relative to corn. Hence, to provide a better model of dry-grind ethanol profitability, it may not be advisable to use average historical DDGS prices for new construction ethanol plant cash flows. Therefore, the situation forming in the ethanol industry creates the need for new technologies, which increases revenue options and hedge against high corn prices, low ethanol prices and low coproduct prices.

On the nutritional side, distillers grains has a number of beneficial characteristics. Some of the attributes include a concentrated source of digestible neutral detergent fiber (NDF), a high proportion of phosphorus in the nonphytate form, a source of rumen undegraded protein and a digestible source of energy from vegetable oil. However, not every animal species needs all of these in the same proportion as found in DDGS. For example, some species, such as poultry, don't benefit from the higher NDF levels in DDGS since it dilutes energy. Beef producers would be able to include higher-level DDGS in rations if the coproduct's phosphorus levels were reduced by 50%. Dairy nutritionists have found they need to limit the inclusion in the ration of lactating cows due to the high amounts of "free," unsaturated vegetable oil in DDGS. Some, but not all, swine producers have limitations on DDGS since higher levels of vegetable oil in the ration has been shown in research to increase carcass fat iodine levels and the incidence of soft belly fat. The feeding value and dietary use of the DDGS is therefore limited, and subsequently, increasing the levels in animal diets won't be a means to lower the building inventories.

Distillers Grains at Badger State Ethanol

One way to increase the value of coproducts from ethanol processing would be to separate the non-fermentable fractions of corn into basic components. For example, a majority of the oil in corn grain is found in the germ. Wet-mill technology has been in place for decades, allowing for the efficient, clean removal of the germ in corn. There are requirements, however, for germ removal to be successful in ethanol processing: minimize starch loss (germ purity) and maintain the integrity (intactness) of the germ for human food processing. From an economics perspective, it's no secret that the value of corn oil is significantly higher for human food versus animal feed.

Another benefit of fractionating corn using wet-mill technology is the efficient separation of bran from starch. Only wet fractionation technology allows for a clean separation of starch from pericarp. With the clean and efficient removal of germ and pericarp, prior to fermentation, more starch is fermented per bushel when compared to other fractionation systems. By cleanly removing the germ and fiber

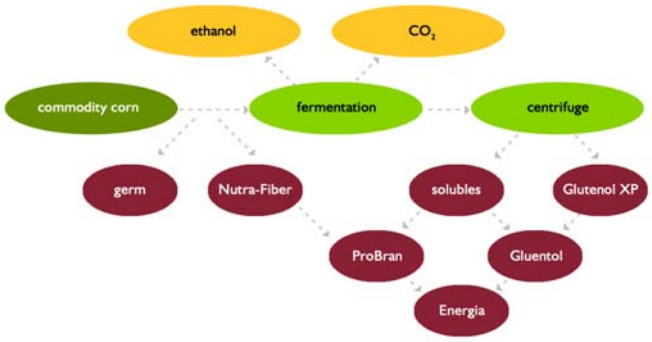

Figure 1. HydroMilling Phase II

Table 1

	NeutraGerm	Neutra-Fiber	ProBran	Glutenol	Energia	Common DDGS
Dry matter, %	97.0	90.0	90.0	90.0	90.0	90.0
Crude protein, %	17.5	6.8	9.5	45.0	30.0	26.4
Fat, %	45.0	1.5	2.0	3.3	2.5	8.8
Fiber, %	6.0	17.1	16.6	3.8	8.2	8.3
Starch, %	8.1	6.8	6.0	1.5	3.8	nr
Ash, %	1.9	0.6	1.0	4.0	2.5	4.4

prior to fermentation, the amount of non-fermentables is reduced by at least 7.5 pounds per bushel of corn. This year, a novel, modified wet-mill process, trademarked HydroMilling, was introduced to the ethanol industry. There are two unique features that differentiate HydroMilling from traditional wet-milling processes. First, the HydroMilling process does not use supplemental sulfur dioxide (SO_2). People and some animals can detect the SO_2. Therefore, HydroMill products will have a much wider market appeal and interest. Secondly, SO_2 is corrosive, and traditional wet milling and germ processing plants are expensive to construct due to the need for high-grade stainless steel. HydroMilling is very cost-efficient due to the absence of SO_2 from the process.

The HydroMilling process allows ethanol producers to keep the corn fractions separate for marketing purposes. From a livestock feed perspective, the specialized HydroMilling product streams can have greater value when each is marketed to different species. This is dictated by the market assessment prior to equipment installation. The primary products from HydroMilling are corn bran, corn germ, solubles and corn gluten meal. These products are marketed under the trademarked Solaris brand.

Solaris' trademarked NeutraGerm is the intact, clean corn germ; Solaris' trademarked NeutraFiber is the corn bran fraction; and Solaris' trademarked Glutenol XP is a product similar to corn gluten meal. Depending on the markets and market assessment, the HydroMilling process is customized to maximize profits by optimizing products with markets. For example, Glutenol XP is combined with the solubles to create a novel product called Solaris Glutenol. This product has a protein content similar to high-protein soybean meal, but a digestible energy—or "apparent metabolizable energy"—similar to corn since the bran was removed early in the process. Compared to high-protein soybean meal, Glutenol XP is low in potassium, non-allergenic and low in non-starch polysaccharides. For poultry and aquaculture, corn is a source of pigmentation. Like corn gluten meal, Glutenol XP is a superb source of pigmentation.

A majority of the oil in the corn kernel is located in the germ. NeutraGerm is a premium coproduct that is sold to corn oil processors. A significant amount of the kernel phosphorus is also located in the germ. From an animal feed perspective, removal of the germ would have benefits in animal species that have issues with high levels of vegetable oil and phosphorus in the diet. Excess phosphorus builds up in the soil and runs off into streams or leaches into groundwater. Therefore, the amount of DDGS in beef cattle rations can be limited when phosphorus is beyond requirements. In mid-August, whole-corn germ for oil processing was valued at approximately $225 to $235 per ton, whereas DDGS had a market value of $70 to $75 per ton. For a 100 MMgy ethanol plant, this would be an annual revenue difference of $10 million. Another benefit of removing the oil (germ) is handling. DDGS today can not be pelleted and has handling limitations. Depending on the market, the HydroMilling process can also make a low-fat DDGS product, trademarked Solaris Energia. Since it is low-fat and high in protein, Energia is made into a high-quality pellet for certain domestic and international markets.

Another unique product from HydroMilling is Solaris' trademarked ProBran, which, for ruminants, is a cost-effective substitute for higher-cost fiber sources such as citrus and beet pulp. Both of these premium fiber sources have market values exceeding that of distillers grains on a per-ton basis. Like Energia, the attributes of ProBran allow it to be pelleted for logistic efficiencies and handling ease.

Based on discussions with commercial dairy nutritionists, DDGS is commonly fed at the rate of four to six pounds per head per day. Glutenol XP and ProBran allow ethanol producers to market more per head since usage rate of four to five pounds and four to six pounds per cow per day, respectively, can be fed. Thus, twice as much product is fed per animal compared to DDGS, and the product value is greater with Solaris products compared to DDGS.

The products discussed above are being commercialized today. Other options exist in the future for bran conversion to cellulosic ethanol, food fiber and cogeneration burning as a plant fuel source. Other options include corn germ proteins, which are unique in that they are non-allergenic and may have applications beyond animal feed.

Overall, the HydroMilling process offers ethanol producers market flexibility today and in the future. In addition, since coproduct revenues should be at least double that of DDGS, the ethanol operation will be situated to be competitive in the long term. When prices for ethanol are high, HydroMilling increases profitability. When ethanol prices are low or corn prices are high, however, the HydroMilling process offers a hedge that protects plant profitability and long-term viability. Dry-grind ethanol and DDGS may not offer this hedge in the long term. DGQ

AUTHOR Troy Lohrmann is vice president of animal health and nutrition at Quality Technology International. Reach him at troyl@qtitech.com or (847) 649-9300, ext. 25.

Distillers Grains Quarterly

This article was printed in the 2006 Fourth Quarter issue of *Distillers Grains Quarterly*.