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Steady Supplies or Stockpiles? Dried Distillers Grains and U.S. Beef Production

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Rapid expansion in U.S. corn-based ethanol production has created concern that large surpluses of distillers grains will occur. Expected production levels are indeed high. Using a relatively conservative set of assumptions, a recent CARD study projects that the U.S. ethanol industry will produce nearly 15 billion gallons of ethanol and 40 million metric tons of distillers grains (dry matter basis) per year by 2011. Under a much more aggressive set of assumptions, the CARD study projects that ethanol production could reach nearly 30 billion gallons annually by 2016, generating more than 88 million metric tons of distillers grains per year. (See “Emerging Biofuels: Outlook of Effects on U.S. Grain, Oilseed, and Livestock Markets,” available at www.card.iastate.edu.)

Some U.S. distillers grains are exported, but the primary users are the domestic livestock and poultry industries, especially beef and dairy cattle because ruminants are better able to accept the high fiber levels in conventional distillers grains. Estimates vary on how much distillers grains can be used in rations, but recommended rates for beef rations are frequently reported at 30 to 40 percent, with the maximum inclusion rate generally considered to be 50 percent (dry matter basis). By comparison, recommended inclusion rates are 20 to 25 percent for dairy cattle, 20 percent for growing and finishing hogs, and 10 to 15 percent for poultry.

Given the higher inclusion rates for beef rations, the beef industry has excellent potential to use more distillers grains as the ethanol industry expands. However, the level of distillers grains that must be consumed to prevent surpluses—especially at the higher production level projected in the CARD study—raises questions about how much the U.S. beef industry can use and whether increased use will affect beef quality.

Cost will be the primary factor in producer decisions about using distillers grains. However, product availability and form, animal nutrition, carcass and meat quality, and environmental issues will also factor into distillers grains use in beef production.

Increasing total distillers grains consumption can be accomplished in two ways: increasing the number of producers who use distillers grains (adoption rate) and increasing the amount of distillers grains used in rations (inclusion rate). A recent USDA survey showed that in 2006, 36 percent of respondents with beef-feeding operations were using co-products and 34 percent were considering doing so. Thirteen percent of respondents running beef cattle operations were feeding co-products and 30 percent were considering doing so. Among respondents who did not use co-products, the most common reasons were availability (35 percent) and infrastructure and handling (22 percent). These results indicate significant opportunities to increase distillers grains adoption rates if transportation, handling, and storage problems can be resolved to make distillers grains available to all producers in a useful form. Some feedlots are co-locating with ethanol plants to eliminate the cost of drying distillers grains and to minimize transportation costs. However, given projected distillers grains production, most of it will be dried for efficient and economical transportation, and drying will help increase distillers grains availability to remote feedlots of all sizes.

Nutrient Concentration and Variability
For beef cattle, distillers grains can provide a viable source of supplemental protein, replace some corn as an energy source, and improve average daily gain and feed conversion, depending on how much distillers grains is included in the ration. However, feeding distillers grains creates some nutrition management challenges, in part because most of the nutrients in corn become three times more concentrated in distillers grains. Nutrients such as sulfur are often added during ethanol...
production and can occur at even higher concentrations. Formulating rations to accommodate the nutrient composition of distillers grains is further complicated by the significant variation in nutrient content that has been shown to occur between ethanol facilities and even between batches from the same facility. These nutrient issues can limit or even prohibit distillers grains use in some feeding situations.

Sulfur is the most likely nutrient to limit distillers grains use in beef production. Sulfur is a required macrominerals for cattle, but ingesting too much can result in sulfur toxicity and reduce feed and water intake, and may cause polioencephalomalacia, a potentially fatal neurologic disease. Numerous analyses have shown that the sulfur content of distillers grains is generally four to seven times greater than that of corn. Further, the sulfur content of condensed distillers solubles, another ethanol co-product often mixed with distillers grains, can be up to 10 times that of corn. These high sulfur levels are especially problematic in areas with high sulfa levels in the water cattle drink and during seasons when water consumption is higher because of higher temperatures.

A second nutrient that can limit distillers grains use is fat. Distillers grains are an excellent source of energy for cattle, but too much total fat in rations can depress fiber intake and digestion. The fat levels reported for conventional distillers grains (8 to 13 percent) will generally limit distillers grains inclusion to about 50 percent to achieve acceptable growth performance.

A third nutrient of interest is phosphorus, which must be managed for both nutritional and environmental reasons. The nutritional concern is ensuring an appropriate ratio of calcium to phosphorus in rations. Because this ratio can be achieved by supplementing calcium, phosphorus generally is not considered a nutritionally limiting factor for distillers grains inclusion. The environmental concern is that higher phosphorus intake by cattle fed distillers grains results in greater phosphorus excretion, which may increase phosphorus run-off from feedlots and harm streams and rivers. In much of Iowa and other Corn Belt states that raise both corn and cattle, higher phosphorus excretion can be managed through appropriate manure distribution. However, phosphorus may be a limiting factor in feedlots in corn-importing regions with different soils types and environmental concerns.

Animal Performance and Beef Quality
As more data from feedings trials have become available, an understanding of the effects of feeding distillers grains at high (40 percent or more) inclusion levels has begun to emerge. A number of studies show significant improvement in several live-animal performance and carcass quality measures using distillers grains inclusion rates of up to 50 percent, compared to feeding traditional corn-based rations. Optimum performance and carcass quality generally are achieved at moderate (15 to 30 percent) inclusion rates, and most improvements decline and eventually disappear as inclusion rates increase.

Far fewer studies have been conducted to measure effects on quality and sensory evaluation of beef cuts. Moderate inclusion rates of distillers grains have been shown to improve marbling and overall meat quality, and consumer panels have not detected significant reductions in beef tenderness, juiciness, and flavor. However, feeding distillers grains appears to have detrimental effects on shelf life. Recent studies at the University of Nebraska indicate that feeding moderate levels of wet distillers grains alters the fatty acid profile of beef, resulting in higher levels of polyunsaturated fatty acids that can speed oxidation, reduce color stability, and shorten shelf life. Other studies have shown more rapid discoloration in beef as inclusion levels of distillers grains approach 50 percent, and beef from cattle fed distillers grains at any inclusion level has been shown to become rancid more quickly.

How Much Is Too Much?
More scientific feeding trials are needed, and data are needed from feeding situations in which each animal is marketed at an optimum finish rather than the all-in–all-out system used for most scientific trials. More beef quality and sensory evaluations are needed. However, a common theme from the research to date is that 50 percent is the maximum practical inclusion rate in most feeding situations and that exceeding 50 percent may cause adverse health, performance, and/or carcass and meat quality effects. Economic incentives would encourage many producers to feed above optimal rates and some producers to feed above the maximum rate.

Returning to the CARD study, U.S. beef rations would have to include an average of 48 percent distillers grains under the conservative assumptions and 62 percent under the aggressive consumptions, if the beef industry is to use its projected share of distillers grains. Both scenarios exceed optimal inclusion rates, and
the aggressive projection exceeds the current maximum practical rate. Under either scenario, adoption and inclusion rates must both increase significantly. An alternative to increasing inclusion rates to such a high level is for the United States to develop export markets for distillers grains, an effort which will be facilitated by high feed grain prices.

Significant technological and management changes will be required to greatly increase adoption rates and push the maximum inclusion rate above 50 percent for most producers. Economic incentives in both ethanol and beef production will determine whether changes are made. Given the federal mandate to increase both corn-based and cellulosic ethanol production under the new Energy Independence and Security Act, much new research will be performed and many new technologies will be developed during the period covered by the CARD study. Researchers are working to resolve transportation, storage, and shelf-life problems. As competition increases, the ethanol industry is expected to have a strong incentive to increase the number and value of co-products, such as improving the nutritional value and consistency of distillers grains as a feed ingredient. New processes that modify distillers grains by lowering fat and/or fiber content may increase its use by other livestock sectors, and co-product blending may help mitigate nutritional issues. A combination of such changes will be needed to assure steady, consistent supplies and to take greater advantage of distillers grains in the beef industry.

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