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Dried Corn Distillers Grains in Dairy Cattle Feeding
Part 1 – Conventional and New Distillers Products

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With crude oil prices high, and certain to head even higher as conventional oil reserves are depleted, the world (especially the developed world) is reaching out for renewable fuels. One of those fuels will certainly be ethanol and, although it will not likely exceed 10% of total automobile 'gasoline' in the foreseeable future in most countries, it will impact what dairy cows in developing countries will be eating in the next decade. This is because the overwhelming majority of motor fuel ethanol in most developed countries will be fermented from corn grain, and about $^{1}/_{3}$ of the dry weight of corn grain received by ethanol distillation facilities becomes a corn distillers byproduct of some kind.

Over the past 10 years, there have been about 90 ethanol distillation plants built throughout the US Midwest, and by far the bulk of them use corn grain as the feedstock. The fermentation process uses microorganisms to ferment starch (about 67% of the dry weight of corn grain) to create ethanol, a clean burning fuel which can be blended with gasoline at various proportions up to 85% ('E85'), although levels of 10% ('E10') are more common in most parts of the world, including the USA.

Corn grain based ethanol production in the US Midwest started in a big way in the 1990's, mainly with the objective of providing an alternative market for corn grain, then at historically low prices, in order to alleviate the fiscal woes of corn and soybean farmers in that region, many of whom were being forced out of business. In some ways, the ethanol was almost a by-product of the real objective, which was to keep farmers in the US Midwest in business. However as time passed, and prices of crude oil stayed high, the objective slowly shifted towards the actual production of ethanol as a motor fuel in order to create a lower need for imported fuels. However the currently very high demand for corn grain as a feedstock for ethanol production, and the severe 2012 drought in the US Midwest, have created a near crisis for animal farmers worldwide who are faced with historically high prices for corn and soybeans, as well as potential corn and soybean shortages through 2013.

Distillers Grains – A Traditional Feed for Dairy Cattle

Distillers grains from the potable alcohol distillation industry have long been used as cattle feed. However their quality was often variable due to mixing of grain types prior to the fermentation process in order to impart desirable flavors to the alcoholic beverage produced, and because the value of the spent grains to the distilleries was often trivial in comparison to the value of the beverage. This could often be observed in distillers grains delivered to farms by variable, often dark, coloration of the product, which was partly the result of use of grains such as wheat, rye or barley. However often poor control during drying of wet distillers grains, which resulted in over-drying, caused a reduction in digestibility of protein and neutral detergent fiber (NDF) which, combined, make up about 60% of the dry weight of distillers dried grains with solubles (DDGS).

However most new generation ethanol production facilities depend upon the value of the ethanol, which is sold as a motor fuel additive, as well as the spent grains to be profitable. This, combined with the more consistent feed stock (i.e., virtually 100% of a single grain within production facility, which varies regionally) and more consistent control during drying creates a much more consistent DDGS product with a generally higher nutritive value for food animals.

Distillers Grains – The New Generation Products of Motor Fuel Distillation

There are a number of 'new generation' corn based DDG products which have entered feed markets as a result of expansion of the motor fuel distillation industry, as well as the need to tailor the characteristics of the DDG by-products to meet the nutritional needs of specific classes of food animals. These vary widely by production facility, production process and the quality of the grain used in the fermentation process. However corn based DDG products generally fall into one of the following categories:

Conventional distillers dried grains with solubles (DDGS) is the DDGS which has been available as an animal feed since the advent of the motor fuel distillation industry. It is the by-product of a conventional ethanol production process which uses ground corn grain which is cooked using an external heat source prior to fermentation. This product has generally excellent flowability, and bridging is uncommon. Its dry nature also makes it ideal for long distance transport by rail or ship as transportation costs are minimized per ton of dry matter (DM). Many companies have created branded DDGS products with high quality control.

An option to DDGS is wet DGS (WDGS) which is theoretically simply the DDGS without the final drying step. However it seems that quality control of WDGS, primarily consistent return of solubles, is often erratic leading to a somewhat more variable product. However WDGS has found substantial markets in situations where food animal production facilities are sited near the ethanol distillation facilities since WDGS has high transportation costs per ton of DM and its short shelf life means that its delivery to farms must be a frequent (*e.g.,* bi-daily) event to prevent spoilage and excess DM losses.

High protein distillers dried grains (HPDDGS) is a specific purpose DDG which is the by-product of fermentation of corn grain which has undergone a preliminary process to remove much of the seed coat fiber, and continuous grinding to remove corn germ, prior to fermentation. Thus, the resulting DDG has a much higher level of protein due to lower levels of fiber and fat. In contrast to DDGS, where the solubles are blended with the wet fermentation residue prior to drying, this process blends the solubles with the corn fiber removed in the preliminary step to create a fibre/solubles product which is generally sold locally as a wet feedstuff, or dried and pelleted for shipment to markets further away. Overall, HPDDGS has a proximate chemical profile which is much closer to competing protein meals (especially solvent extracted canola meal) than does DDGS, and it is generally classed as a protein meal.

Low fat distillers dried grains (LFDDGS) is a specific purpose DDG which is the by-product of fermentation of corn grain that has undergone a preliminary grinding process to remove much of the corn germ prior to fermentation. Thus the resulting DDG has a much lower level of fat, about half that of DDGS, but levels of other nutrients are minimally impacted. In contrast to HPDDGS, where the solubles are not blended with the wet fermentation residue prior to drying, this process blends the solubles with the wet fermentation residue. The lower fat level of DDGS makes it attractive to dairy farmers already feeding high levels of unsaturated oils in lactation diets which can suppress milk fat synthesis.

When grains other than corn are used as the starch source in the ethanol fermentation procedure, the DDG products differ. However corn based DDG products constitute the bulk of DDG products used as animal feeds in the USA.

Conclusions

The rapid increase in the use of grains for ethanol production since 2001 in the Midwestern USA, and other parts of the world, has created the need to utilize vast quantities of ethanol fermentation by-products in food animal production worldwide. While it seems that ethanol production is stabilizing, at least in the USA, the potential for further increases exist. However the industry has introduced several new generation DDG products in recent years based upon different production methods. In the next issue, I will examine the nutrient profiles, and their variability, of some of the DDG products.

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