# THE IMPACT OF THE BIOFUELS INDUSTRY ON THE POULTRY INDUSTRY

**Jerry C. Weigel, Manager, Nutrition**
**BASF Plant Science**
**Research Triangle Park, NC 27709**
**November 14, 2007**

The welcome sign is out for the steady rising supply of Corn Distillers Grains w/Solubles (DDGS) in some sectors of the feed industry, while others see it as a potential threat to the stability of the soybean meal sector.

Implementation of the Renewable Fuels Standard in the U. S. stimulated rapid growth in the corn dry milling production of fuel ethanol. The fuel ethanol industry has gone from 40% of the production from dry milling in 2000 to over 80% in 2007. As a consequence, output of DDGS the co-product of the dry grind has risen to over 14 million metric tons surpassing Corn Gluten Feed, the co-product from the wet milling of corn for starch to a number of primary products. If you put this on a tonnage replacement it represents 9% of the corn fed. If one believes what the government experts say that by 2020 the supple of DDGS will exceed 34 million metric tons or 23% of the corn tonnage equivalent.

So what is the issue on feeding DDGS to poultry today in the U.S.? According to many Nutritionists around the U. S. feel that is it is product inconsistency. Why? They number many, and they include;

- Initial Grain Source
- Variation in the Nutrient Content of the Grain (3x factor)
- Variability of Production
- Grind Size
- Lab Methods
- Feed Streams Bleed
- Efficiency of Fermentation
- Misc. Factors (???)

In a very nice review article by Johathan Goodson from DeGussa Corp. (*Jonathon.goodson@degussa.com)* he reviews over 1300 samples since 2002 and concluded the DDGS is a quite variable in nutrient content.

Amy Batel, Univ. of Georgia has also conducted a number of experiments evaluating the consistency of DDGS from a number of different plants. The federal government has offered some GIPSA standards for review by the industy as far as trading specification.

The American Feed Industry Association (AFIA), Richard Sellers, AFIA, (*rsellers@afia.org)* is also involved in trying to find ways to standardize lab methods with some excellent results.

In a review paper by Carl Parsons and others, **Nutritional Value of Conventional and Modified DDGS for Poultry,** 2006 Multi-State Poultry Nutrition and Feeding Conference the authors did a very good job at looking at a number of analytes and evaluating their quality in feeding poultry.

So what are the various co-products from the dry milling of grain for fuel ethanol (potable as well)? The proper definition of each of the co-products can be obtained by the American Assn of Feed Control Officials (AAFCO).

There products include, but certainly not limited to;

- Distillers Grains
- Distillers Dried Grains (P)
- Distillers Dried Grains with Solubles (P)
- Condensed Distillers Soluble
- Distillers Dried Solubles (P)
- Distillers Wet Grains
- Modified Wet Distillers Grains (P) if dry
- Thin Sillage

Several these are offered to the market as wet feeds towards the ruminant feed market. The products that could find their place into poultry feeds are marked with a (P).

It is important to remember that co-products from the dry milling of grain for ethanol are all called (something) distillers. If the co-product has a (something) gluten, i.e., Corn Gluten Feed or Meal, these co-products are from the wet milling industry. It is also very important to remember that for the most part Corn Gluten Feed is pelleted and if you order it and call it meal…the product will be a 60% bright yellow product. If you want the co-product non-pelleted, you need to call it, loose. The same is for the Distillers products, be sure you know the texture of the product and not get pellets with you expect a loose product.

It is also important to understand the mass balance of a dry milling fuel ethanol plant. This mass balance is;

18 pounds of Fuel Ethanol
18 pounds of DDGS
18 pounds of Carbon Dioxide

This is based on the following;

56 pounds of corn/bushel

32 pounds of starch/bushel
1.8 pounds of corn oil
14.2 pounds of gluten products
8 pounds of water (bound, not added)
For ease in calculating the production of ethanol from corn the yields today are 2.80 gallons (10.6 L) of ethanol per bushel of corn.

In the conventional dry grind process, corn is ground and mixed with water to produce slurry. This slurry is cooked and then liquifed, saccharified and fermented t produce ethanol. The remaining nonfermentables (germ (which contains some protein and all the oil), fiber, and protein (zein) are recovered at the end of the process and becomes a blend to make DDGS.

At the outset of the process the kernels are ground and as mentioned above mixed with hot water and cooked with regulated pressurized steam to break down the starch matrix. Alpha amylase is added to break the starch polymers down to short chain molecules, called dextrins. The mash is cooled to 32 C and moved to the fermentation vessel, some call this a reactor. Glucoamylase and yeast are added for simultaneous saccharfication and fermentation (SSF) which takes from 48 to 72 hours. The resultant product is called beer from the well. From the beer well the beer is moved to a stripper of rectifier column to remove the ethanol. The overflow is ethanol and water mix and is then sent to the distillation column (s) and molecular sieves to further remove excess water. The stream from this is called wet stillage and it is spun to produce thin stillage and it is then blended with the fiber and oil at a 20/80% blend and dried to produce DDGS.

Over the past several years there have been several new procedures and procedure modifications to the dry milling process and these are;

*Enzymatic Dry Grind….*this involves an enzyme and fractionization of corn to recover the germ, pericarp fiber and endosperm fiber. It involves a short soaking and course grinding followed by an incubation with a protease and starch degrading enzyme cocktail. The enzymes increase the specific gravity allowing for ease in separation. The germ and pericarp fiber are recovered by hydroclones and purified by screening. The benefit from this system is many, but for the animal feeder is concentrates the protein and can reach crude protein levels of 55% with less fiber. This system will also let you recover some of the oil.

*Dry Degermming/Defibering…*this is a system that tempers the corn and then breaks the kernel into small pieces in what is called a degerminator, which separates the germ and pericarp. A density table separates the endosperm starch (grits) by air aspiration.

*Elusieve Process…*this is a simple separation process whereas the fiber is taken from the DDGS. When the fiber is removed it concentrates the protein and oil. The engineering behind this is called elutriation or separation of lighter from heavier particles and is a very low cost method.

There are other processes being evaluated in several labs, but in the lab of Vijay Singh, University of Illinois seems to be doing much of this early work. There are several commercial dry milling facilities testing these new recovery systems. It is understood that some of this research on processing could and would improve the quality and consistency of corn dry milling co-products, but it will also improve or increase the plant capacity and allow the recovery of corn oil and or pericarp fiber and constituents of the fiber, like hull oil.

What is the future of DDGS? We will continue to produce ethanol from corn, but over the next 10 years we will see more and more ethanol production from other sources. There is no doubt that energy demand is increasing while petroleum supplies shrink, which as led to a boom in biofuels as substitutes to fossil based energy sources. Corn grain conversion to ethanol dominates the biofuel production in the U. S. However, concerns of recent have been raised about the impact of grain ethanol production on grain prices and availability of corn for traditional feed and food uses. Also, much larger biofuel production goals have been set for the future will require much more feedstock than corn can provide. Ethanol from cellulosic feedstock's including, corn stover, straw, certain grasses, forestry products and wastes and even urban wastes (grass trimmings). The magic question is what percentage of the ethanol production will be cellulosic, well that is the question? Just to "wet the whistle" if we follow the 25 x ' 25 ruling we in 2025 we would need 800,000,000 metric tons of dry cellulose and in 2030 with 30 x '30 we would need 1 billion tons of dry matter.

What this means to the feed industry is that there could be significantly less ethanol co-products available for the poultry sector.

Proper formulation fundamentals are important and critical when utilizing DDGS or any corn processing co-product (s). It is important that you know what you are getting before you formulate poultry feeds. It is very important to do the following;

- Set up a set of inbound specifications for the co-product
- Be sure your vendor or supplier knows these specifications
- If anything is novel about the ingredient that your plant requires write it in the contract
- Ask the supplier for historical analytical data, both physical and chemically
- Visit the facility, learn their process
- Limit origination sources
- Follow a strict sampling program and let the supplier know you are checking every load
- Be sure you understand the definition of the co-product
- Ask the expert (s)

The recommended feeding recommendations based on Jerry Weigel;

**FEEDING LEVELS AS PERCENTAGE OF TOTAL FEED**

| Bird | % of Feed |
|---|---|
| Broiler Chicks | Up to 2.50% |
| Broiler Grow/Finish | Up to 5.00% |
| Layers | Up to 15.00% |
| Breeders | Up to 20.00% |
| Pullets | Up to 5.00% |
| Turkey Poults | Up to 2.50% |
| Turkey Grow/finish | Up to 7.50% |
| Ducks | Up to 5.00% |
| Game Birds | up to 5.00% |

Before ending this paper, I think it is important for the poultry industry to realize that we will not run of corn. There are forecasters and biotech scientists saying that by 2030 we could have a corn trend line of 300 bushels per acrd (boa), as compared with number of 153 today. The new biotech traits that are being researched today will insure that these massive yields of corn will come to existence.

There is also lots of research going on that is suggesting increase ethanol yields from 2.8 gallons per bushel (gpb) to 3.2 gpb, thus producing more ethanol on less corn. As we improve the efficiency of production we will be reducing the volume of DDGS and hopefully reducing the variation in this very important co-product.