

ethanol

coproducts

for cattle

Wet Distillers Feeds for Feedlot Cattle

Distillers by-products have a long and nearly as colorful history as the distilling industry itself. The Bourbon Beef Association established the Bourbon Beef Show in Louisville, Ky. shortly after World War II to showcase prize beef animals raised on distillers wet grains. Prize money was sizable, even by today's standards. Iowa State College research in 1936-37 showed a \$7.92 per head advantage to distillers grain fed cattle compared to soybean meal fed cattle, including the hogs that followed the cattle (Distillers Feed Research Council, 1951).

Distillers Grains

Using distillers grains in beef cattle rations was studied extensively in the 1970s and 80s. Research emphasized distillers dried grains with and without solubles and wet feeds generated from farm scale stills.

Distillers dried grains and distillers dried grains with solubles are a "rumen bypass" or rumen undegradable protein source. This characteristic may be important for some production situations with cattle and lambs. For example, when soybean meal is fed, approximately 75 percent of the soy protein is degraded to ammonia in the rumen. This ammonia can be assimilated in bacteria protein by the rumen microorganisms and eventually used by the animal if sufficient energy is present. The remaining 25 percent of the soy protein is not degraded in the rumen and is directly absorbed by the animal. In light calves and lambs where energy intake is insufficient or lactating dairy cows with greater protein demands, a higher bypass protein source may be beneficial. Studies estimate distillers grains are about 50 percent degraded by the rumen bacteria, 180 to 200 percent less than soybean meal. Therefore, distillers grains allow a lower protein diet to meet animal requirements or more urea to be fed to lower ration costs, compared to soybean meal for ruminants.

Distillers Wet Grains

In the late 1970s and 80s, several studies were conducted to evaluate the feeding value of wet distillers grains generated from farm scale stills. These studies generally concluded that distillers wet grains have a similar energy value to corn grain, but cattle performance may be limited by the ration's moisture, particularly at high levels. Distillers grains from these smaller stills was typically strained but not pressed; therefore, average moisture content was approximately 80 percent. In 1993, University of Nebraska researchers conducted finishing trials with calves and yearlings over a two-year period. Wet distillers grains and the thin stillage produced were added to the rations at 5.2 percent, 12.6 percent, and 40 percent of the ration dry matter. Thin stillage was poured on the 5.6 percent and 12.6 percent rations and added as the drinking water source for the 40 percent ration. The composite wet grains/thin stillage feeds were approximately 10 percent ethanol on a dry matter basis. All levels of distillers grains improved cattle efficiency. Researchers calculated the wet distillers/thin stillage feed had 150 to 180 percent of the energy value in corn for yearlings and 120 to 130 percent of the energy value of corn for calves.

A follow-up study compared the wet distillers grains/thin stillage composite added at 40 percent of the ration dry matter to dried distillers grains and dry rolled corn in five finishing beef trials. In this study, cattle fed the wet distillers were more efficient than those fed distillers dried grains or dry rolled corn. Distillers grains were calculated to have 120 to 140 percent of the energy value of corn. Possible reasons for the different feeding value between wet and dry distillers grains include:

- High ethanol content of wet grains produced from the Nebraska still,
- Moisture content,
- A reduction in subacute acidosis in the cattle, and
- Heat damage during the drying process for wet grains.

In an effort to explain the reasons for the higher-than-expected feeding value of wet distillers grains, two Nebraska finishing studies were conducted in 1996, using both lambs and cattle. In these studies, the nutrient composition of wet distillers grains was duplicated with other ingredients. In the first lamb trial, a composite of 47.9 percent wet corn gluten feed, 11.9 percent condensed distillers solubles, 30.5 percent corn gluten meal, and 9.7 percent tallow was added to the diet at 40 percent. This composite was compared to distillers wet grains or dry rolled corn. The composite or distillers wet grains improved lamb efficiency 12 percent. In a second trial with cattle, a composite of 65.8 percent wet corn gluten feed, 26.3 percent corn gluten meal, and 7.9 percent tallow was compared to dry rolled corn, corn gluten feed, the composite without added tallow, and the composite without added corn gluten meal. Composites and corn gluten feed were each added at 40 percent of the ration dry matter. The composite treatment and the dry rolled corn treatment were more efficient than cattle fed wet corn gluten feed. Removing corn gluten meal or fat from the composite had no effect on performance. This suggests the distillers solubles portion of wet distillers product may be the ingredient contributing to the higher-than-expected feeding value.

The previous studies were based on farm-sized or small research stills. In 1995, Nebraska researchers published a study evaluating wet distillers grains, wet distillers grains with solubles, and dried distillers grains with solubles from a commercial-scale plant in Nebraska. Based on a cattle finishing trial, the energy value of the products relative to corn grain were 96

percent, 102 percent and 80 percent for wet distillers grains, wet distillers grains with solubles, and dried distillers grains. The plant used 80 percent sorghum grain and 20 percent corn as the raw material for fermentation. In a follow-up digestibility study with lambs, distillers grains from sorghum were poorer in organic matter and protein digestibility than distillers grains based on corn.

Iowa State University (ISU) conducted one of the first studies comparing the feeding value of wet distillers grains with solubles from a commercial ethanol plant for feedlot cattle in 1995. Sixteen percent distillers dried grains with solubles and 16 percent, 28 percent, and 40 percent wet distillers grains with solubles were compared to urea or soybean meal controls. The calculated net energy value of wet and dry distillers grains with solubles were 150 percent and 92 percent of corn grain, respectively.

In 1997, two trials were conducted at ISU evaluating the feeding value of wet distillers grains and condensed distillers soluble from a commercial ethanol facility. The wet distillers grains in these studies were from the same facility as the 1996 study, and did contain some solubles. In the first experiment, 20 percent wet distillers grains improved daily gains 10 percent, and 40 percent wet distillers reduced feed intake and maintained daily gain. Net energy of the distillers grains ranged from 140 to 180 percent of corn, with the higher value being at the 20 percent level. In the second study, cattle were fed 16 percent, 28 percent and 40 percent of the ration dry matter. Again, calculated energy values based on the performance of the cattle ranged from 130 to 180 percent of corn, with the higher values at the lower inclusion levels. Table 1 summarizes the recent studies evaluating the energy value of wet distillers grains with solubles.

Based on the ISU research, the suggested energy value for distillers grains with solubles is at least 125 percent of corn. Previous research suggests wet distillers grains without solubles appear to have an energy value similar to corn. A logical conclusion is that the difference in feeding value is related to the solubles portion of the wet feeds.

Distillers Solubles

Thin stillage is the liquid portion of the distillers fermentation by-product. This may be condensed to produce condensed distillers solubles (CDS) or dried to produce distillers dried solubles. University of Minnesota researchers used thin stillage to replace drinking water for

Table 1. Energy of Wet Distillers Grains Compared to Corn

Reference	Location	% of Corn Energy
Larson, et al (1993)	Nebraska	120 - 130
Larson, et al (1993)	Nebraska	150 - 180
Ham, et al (1994)	Nebraska	120 - 140
Lodge, et al (1995)	Nebraska	96 - 102
Trenkle (1996)	Iowa State	150
Trenkle (1997)	Iowa State	150 - 180
Trenkle (1997)	Iowa State	150
Fanning, et al (1999)	Nebraska	134

finishing steers. In three experiments involving 300 animals, cattle that were allowed access to thin stillage as their only water source gained weight 5.7 percent faster, consumed 5.8 percent less feed and were 11 percent more efficient than those with access to only water. In University of Michigan studies, CDS were evaluated as an energy source by adding or replacing the drinking water for Holstein steers. They calculated an energy value that exceeded that of published values for dried distillers solubles.

Several characteristics of CDS may relate to its unique nutritional properties. In the mid-1970s, Purdue University researchers evaluated CDS as a potential ingredient for liquid cattle supplements. They reported the addition of CDS improved both fiber digestion and urea utilization. More recently, Nebraska researchers evaluated the effects of CDS on rumen microbiology and metabolism. They found that CDS increased the counts of starch degrading and lactic acid utilizing bacteria. This led to a twofold increase in the rate of lactic acid fermentation. The research implies CDS may affect rumen microbial populations in a way that enhances starch digestion and reduces acidosis.

A 1997 ISU study of CDS added at 6.5 percent of the ration dry matter improved daily gain and feed conversion compared to urea or soybean meal supplemented heifers. The calculated energy value of the CDS was 1.9 times the energy in corn. This data contrasts a 1996 South Dakota State University study where 0 percent, 5 percent, 10 percent, or 20 percent CDS were fed to yearling steers. Gains improved approximately 7 percent, efficiency was not effected, and rumen fluid pH increased.

An ISU study conducted in 2001 found 4 percent CDS improved daily gain 3 percent and feed efficiency 5 percent. At an inclusion rate of 8 percent, daily gain declined 6 percent, due mostly to intake reduction. Part of the explanation for the feed intake reduction was a variation in dry matter in the wet distillers solubles. The loads of material delivered ranged from approximately 15 to 30 percent dry matter. This differs from the 1997 study in which loads ranged in dry matter from approximately 25 to 40 percent.

The exact energy value of CDS remains unclear. CDS are higher in fat and lower in fiber than wet distillers grains. Therefore, it is logical that CDS are higher in energy. It appears that level of feeding and perhaps the moisture level of the material are important factors in determining the ultimate value as a cattle feed.

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