
Ron Torrell

Back to Basics

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Feeding ethanol coproducts to beef cattle

Most of us have heard the phrase "When you're handed lemons, make lemonade." Such is the case with the wake-up call for cattle producers when the rapidly growing ethanol industry revealed its hunger for corn.

So, how can we make lemonade out of this? The answer is by using the coproducts of ethanol production, such as distillers' dried grains, which are becoming increasingly available and are usually an extremely cost-effective feed ingredient. In this column we will be discussing the nutritional value of ethanol coproducts (see Table 1).

There are currently two types of milling processes used to produce ethanol. Fig. 1 illustrates the wet-milling process, while Fig. 2 ilustrates dry milling. The majority of ethanol results from dry milling.

Dry milling

Distillers' grains are the primary coproduct of the dry-milling process. They can be sold as a wet or dry product. However, due to the large quantity of distillers' grains being produced and limited livestock availability near ethanol plants, dried distillers' grains with solubles (DDGS) is the ethanol coproduct most available to cattle producers in the Pacific Northwest.

Distillers' grains normally contain 30%-35% crude protein (CP) and 10%-12% fat. Also, research has shown that dried distillers' grains can contain 20% more available energy than dry-rolled corn (based on feedlot performance). However, it can have high levels of phosphorus (P) and sulfur (S).

The increased phosphorus is normally a benefit to cow-calf producers because most pasture- or hay-fed cattle are at least marginally deficient in phosphorus. In contrast, the potentially high sulfur content can affect copper (Cu) status and potentially cause polio in beef cattle if proper nutritional management is not followed.

Fig. 1: Flowchart of the corn wet-milling industry

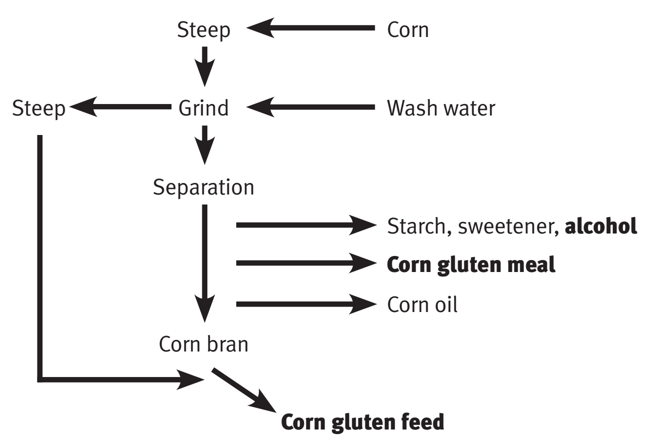

Fig. 2: Flowchart of the corn dry-milling industry.

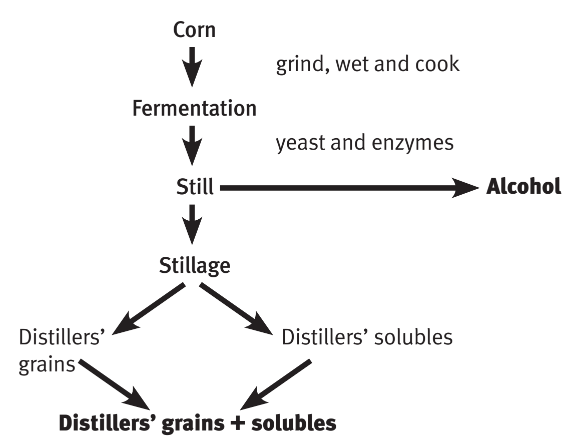

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Table 1: Nutrient content (%) of ethanol co-products

Item	Ethanol co-product		
	Dried distillers' grains + solubles	Corn gluten feed	Corn gluten meal
DM, %	90	90	90
CP, %	30-35	20	65
TDN, %	90	80	86
Fat, %	10-12	2.8	2.2
Calcium, %	0.17-0.26	0.07	0.08
Phosphorus, %	0.78-0.83	1.1	0.53
Sulfur, %	0.37-0.44	0.33	0.72

Distillers' grains for heifer development

Heifer development programs can be a major expense for the cow-calf enterprise. Heifer development costs will depend on when the potential replacements are weaned and the feeding strategy used to develop the heifers. Because the replacement heifer enterprise does not generate income, or very little income from cull replacements, costs for this enterprise are borne by the cow-calf enterprise.

Our data suggest replacement heifer costs from the time the replacement heifer is weaned until the beginning of her first calving season can add $69-$88 to annual cow costs. The more economical the replacement heifer program, the greater the profit potential of the cow-calf enterprise — as long as reproductive performance of the heifers is not compromised.

Byproducts from the production of ethanol are becoming more available to cow-calf producers. How these byproducts fit into a heifer development program has the potential to affect the bottom line.

There is limited data available on the use of distillers' grains in heifer development programs. Research trials already conducted indicate that distillers' grains are higher in energy than corn. Research also indicates there are no negative interactions on forage digestion when distillers' grains are included in high-forage diets. These findings make distillers' grains a prime candidate to use in a heifer development program.

Heifer development programs require quality feeds that allow for a targeted gain. Dried distillers' grains (DDGs) are about 30% crude protein (CP) and are a good source of bypass protein. Of the 30% CP, 35% is degraded intake protein (DIP) used by the rumen microorganisms to make their own protein, and 65% is undegraded intake protein (UIP) or bypass protein.

Heifers are still growing during the developmental phase and have a requirement for some bypass protein in the diet. This is another good reason why DDGs should work in a heifer development program.

Reproductive performance

The nutrient attributes of DDGs in a heifer development program sound too good to be true; so, now for the potential concern. There are data to suggest diets that supply a lot of UIP can have a negative effect on reproductive performance. These data were generated using feedstuffs other than DDGs that were high in bypass protein. One set of data indicates that diets high in UIP fed to replacement heifers increased weight at puberty in addition to increasing age at puberty. Another set of data indicated supplementing postpubertal heifers with diets high in UIP resulted in decreased serum concentrations of follicle-stimulating hormone (FSH). These relationships are not good for a heifer development program.

We designed an experiment to examine the effect of high UIP in a heifer development program on reproductive performance. We used 316 crossbred heifers divided evenly into two groups — a treatment group and a control group. All heifers were treated alike, except the diet for the treatment heifers included DDGs.

Because DDGs have a high amount of UIP, treatment heifers had a much higher daily consumption of UIP compared to the control heifers. Minerals and vitamins were balanced in each diet. The remainder of the diets consisted of grass hay that ranged between 8.4% and 11.0% CP and about 54% total digestible nutrients (TDN).

Heifers used in this experiment were born in the spring and weaned in the fall. Heifers were weighed throughout the trial, and diets were adjusted to achieve similar average daily gains (ADG). In addition, blood samples were collected throughout the experiment to determine when puberty occurred.

Heifers were synchronized for estrus using two shots of prostaglandin (PGF) given 14 days apart. For five days after the last shot of PGF, the number of heifers responding to synchronization and the time (hours after the second PGF shot) heat occurred were recorded. Heifers that exhibited heat during the five-day time frame were artificially inseminated (AIed) using the same bull. We waited 10 days, then turned in cleanup bulls for a breeding season of 45 days total.

Forty-five days after the AI period, heifers were scanned by ultrasound to determine if pregnancy occurred during the AI period.

The percent pubertal prior to PGF and age at puberty were not different between groups. Weight at puberty was different in favor of the DDG-fed heifers. The weight difference was due to a 0.24-pound (lb.) ADG difference in the second year.

Time to estrus after the second PGF injection was not different between groups. The AI conception rate, the percentage of heifers conceiving to AI following a detected heat after the second PGF injection, was significantly greater in the DDG-fed heifers. This corresponded to a greater AI pregnancy rate in the DDG-fed group.

Overall pregnancy rate, using a 45-day breeding season, was not different between groups. These data clearly demonstrate that diets using DDGs that may result in high bypass protein [average UIP intake, 253 grams (g) per day; maximum UIP intake, 351 g per day in our experiment] does not have a negative effect on reproductive performance in replacement heifer development programs.

The DDGs were supplemented at 0.57% of heifer body weight on a dry-matter (DM) basis. Heifer weights and average body weight was determined throughout the experiment. If the average weight of the heifers was 700 lb., they were fed 4 lb. per head per day of DDGs on a DM basis (4.5 lb. per head per day if the distillers' were 90% DM).

If heifers are consuming 2.5% of their body weight on a DM basis daily, their total DM intake would be about 17.5 lb. per head per day. Of the 17.5-lb.-per-head-per-day intake, 4 lb. per head per day would be DDGs. DDGs at this level calculates to 23% [(4 lb. per head per day DDGs ÷ 17.5 lb. per head per day intake) × 100 = 22.9%] of the diet on a DM basis. This amount of DDGs is well within my recommendation for the inclusion of DDGs in the diet, which is not feeding more than one-third of the diet on a DM basis as DDGs.

As with any diet that is developed using DDGs, because DDGs are high in phosphorus, it is important to make sure the calcium-to-phosphorus ratio is within the range for growing cattle. In addition, make sure there is plenty of bunk space or eating space so that each animal gets its fair share. Make sure the ration is mixed uniformly to avoid any complication with sulfur in the DDGs. Finally, total fat in the diet should not exceed 5% to eliminate the negative effect of fat on forage digestion in the rumen.

Final thoughts

As the ethanol industry expands in the United States, especially in the Great Plains, there will be a greater opportunity to feed distillers' grains in the wet or dried form. If DDGs are priced economically, these data suggest they will fit into heifer development programs and reproductive performance will not be compromised. In these diets, DDGs are an excellent energy source. In addition, other protein and phosphorus sources will not need to be supplemented.

— by **Rick Rasby**

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Research has shown that beef cattle can be successfully fed as much as 40% of their diet as distillers' grains. Current recommendations for forage-based diets, however, are to not feed more than 5 or 6 pounds (lb.) per day to mature beef cows. For backgrounding or growing diets, calves can be fed up to 20% of their diet, roughly 3-5 lb., as distillers' grains. Distillers' grains can be an economical, and effective, protein and energy supplement for cattle producers.

Most CGF is fed within 100 miles of a processing plant as a wet product; however, dry CGF is also available and is often marketed as a pelleted product.

Wet milling

Corn gluten feed (CGF) is a popular protein and energy source for feedlot cattle because it is rich in highly digestible fiber and moderate in crude protein. It is the largest coproduct of the wet-milling process.

Contrary to its name, CGF does not contain gluten, but rather a mixture of corn bran and condensed "steep" solubles. Most CGF is fed within 100 miles of a processing plant as a wet product; however, dry CGF is also available and is often marketed as a pelleted product.

Research with feedlot cattle has suggested that the energy value of CGF is approximately 92%-100% of the energy value of shelled corn. Another positive aspect of CGF is that it can be fed to cattle in very large amounts (up to 50% of the diet) and still maintain acceptable performance. It should be noted that CGF can be variable in nutrient composition both within and between processing plants. This is because the ratio of corn bran to condensed distillers' solubles will vary depending on the markets available.

Corn gluten meal (CGM) is golden yellow and is mainly gluten, the protein part of the corn kernel. As a result, it is used primarily in the swine and poultry industries as a protein supplement. However, it is a good source of rumen nondegradable or "escape" protein that is sometimes used in the diets of rapidly growing calves or high-producing dairy cows.

Summary

A coproduct of ethanol production, specifically dried distillers' grains, can be an economical feedstuff for cow-calf producers and can be successfully used in heifer development programs (see "Distillers' grains for heifer development"). It is an excellent source of protein, energy and phosphorus for cows and growing calves. Hopefully you have found a little "lemonade" in this information.

If you have questions regarding feeding dried distillers' grains, Dave Bohnert, co-author of this article, will discuss feeding dried distillers' grains to beef cattle in more detail at the University of Nevada Cooperative Extension's annual Cattlemen's Update programs scheduled for the first full week of January 2008 in a Nevada community near you. You may contact Bohnert at the Eastern Oregon Agricultural Research Center at 541-573-8910 or dave.bohnert@oregonstate.edu.

If you would like to discuss this article or simply would like to talk cows, do not hesitate to contact me at 775-738-1721 or torellr@unce.unr.edu.

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