Proceedings, The Range Beef Cow Symposium XX
December 11, 12 and 13, 2007 Fort Collins, Colorado

# USING BYPRODUCT FEEDS IN COW/CALF PROGRAMS

Ivan G. Rush
Beef Specialist
Panhandle Research & Extension Center
University of Nebraska – Lincoln

## INTRODUCTION

The topic of byproduct feeds can be a very long list from well known oil seed meals to corn byproducts from the distilling industry to potato waste to orange peels. In addition, people feed chocolate candy, Keebler's cookies and the list can go on and on. This paper will focus primarily on byproducts from the alcohol and oil industry. Even though byproducts from the oil industry, such as cottonseed meal and soybean meal, have been available for many years, the tremendous growth into the bio-fuels industry has increased the quantity of byproducts available for cattle feed. Historically, we have looked at the higher protein byproducts as a protein supplement for cattle consuming low quality roughages; however, today in many cases, we are looking at the byproducts from the alcohol industry as both a protein and energy source. In some cases, it may be more economical to overfeed protein to meet the cattle energy needs
.

## TEST FEEDS

To be able to balance the most economical ration, the composition of the ration ingredients must be determined accurately. This is very important when feeding all harvested feeds and dealing with feeds that can have a lot of variability. Often times, byproducts can vary considerably from processing plant to plant, sometimes based on feedstuff used or variation in processing methods. Even when byproducts are used as a supplement in grazing situations, it is still very important to know the quantity of major nutrients, such as protein and energy, but at times, mineral levels can be very important too. In some cases, minerals that are present in very high levels can limit how much a byproduct can be fed. A good example of this is the level of sulfur in byproducts from the ethanol industry.

Perhaps the most obvious analysis, but often overlooked, is the level of water or moisture in the byproduct. This is very important because the true feeding value can change dramatically by just varying the moisture level 5-10%. All feeds should be priced on a dry matter basis (zero moisture in feed), but this is more critical in feeds that carry considerable moisture. For example, if a byproduct feed that contains 50% moisture is priced at $45/ton, the price for a ton of dry matter would be $90/ton. Let's assume the next load of feed contains 60% moisture and is still priced at $45/ton. The cost per ton of dry matter in this load would be $112.50/ton or a 20% increase on a dry matter basis. If the feed was priced on a dry matter basis, the second load with 60% moisture should be priced at $36/ton. Again, this may seem very obvious, but is often the largest factor in determining feeding value of feeds that are relative high in moisture, whether it is wet distillers grains, wet beet pulp, corn silages, or liquid supplements.

Further analysis for protein is important. Crude protein is what is offered on the tag and in commercial laboratory analysis; however, the quality of protein and the amount of the protein that is digested in the rumen is important. Consulting with nutritionists would aid in determining true value of the crude protein. The level of energy in the feedstuff is also important; however, it is also the most difficult to estimate. The majority of commercial laboratories use acid detergent fiber (ADF) to predict energy (TDN and net energy), but this can be very misleading for many byproduct feeds, depending primarily on the extent of digestibility of the fiber in the ADF fraction. For example, the fiber level in distillers grains and beet pulp can be fairly high, but has a very high level of digestibility that is utilized for energy in the diet.

Mineral analysis can also be important but is often not needed as frequently as the other nutrients. Perhaps the one of most concern is the level of sulfur in corn byproduct feeds. High levels of sulfur can cause polioencephalomalacia, often called "brainer" disease. In many cases, this limits the level that can be safely fed. In some byproduct feeds, oil or fat can be relative high and may limit the amount fed.

## DISTILLERS BYPRODUCTS

Corn byproducts can fit in almost any diet in growing cattle, developing heifers and cow diets. They can serve as excellent sources of protein, energy and phosphorus. When fed in high roughage diets, they do not appear to lower forage digestibility, as is the case when feeds that are high in starch such as corn and barley are fed. Because of the lack of negative associative effects on forage digestibility higher levels can be fed when more energy is needed or when supplements are used for a substitute of forage. This was an important consideration when many producers were in a drought situation.

Many of the plants are being constructed in areas where corn production is very high and yet large numbers of cattle are fed in relative close proximity of the corn processing plants. Because of the cost of drying it is more economical to feed the byproduct wet; however, because of limited cattle in close proximity of the plants plus often feedlots have fewer cattle on feed during the summer, it is necessary to dry the byproducts and this become available in range country as a commodity.

Distillers grains are an excellent source of UIP or bypass protein. The importance of this will depend on the type of cattle fed and other ration components. In some cases with lactating two-year old heifers some research has indicated an improvement in rebreeding performance when the UIP requirements are met. In a large study on a Nebraska ranch, a number of heifers were fed some harvested hay and a conventional protein supplement while a second group grazed winter forage and were supplemented with corn gluten feed. Little differences were noted in the heifers gain or breeding performance; however, the grazed heifers with corn gluten feed had $6.71/head less developmental cost. Some questions have been raised whether degradable intake protein (DIP) requirements must be met when high levels of distillers grain are fed that are relative high in UIP and low in DIP. When UIP is in excess, the metabolizable protein will usually be in excess. It appears a portion of this excess metabolizable protein is recycled to the rumen in the

form of urea to meet the DIP requirement and therefore sources of DIP, such as urea, will not need to be added to the supplement.

The main reason corn byproducts have increased in popularity is they are often priced very competitive with other supplements, especially during the summer months when cattle numbers in feedlots are lower than in fall and winter. One of the major problems with the dry commodity products coming from the processing plant is that they are in either meal form or in some cases, a relatively soft, small pellet. The qualities of the corn byproducts is such that it is very difficult to make a quality range cube, so the feed industry must add other feed ingredients such as sunflower meal or wheat mids and this increases the cost.

Some producers feed the pellets on the ground and report a very small loss. Some producers that feed the meal on the ground feel that even though some waste is experienced, it is not great enough to offset the added cost of cubing. Unfortunately, there is no data to accurately estimate the loss when either pellets or meal is fed on the ground. Obviously, the level of waste would depend greatly on the condition of the ground, i.e. mud, softness, height of grass, etc. Some producers feed in bunks, which of course eliminates waste, but the cost and management of bunks must be considered. Calculations by one producer were that he could pay for bunks in less than five years through the savings of purchasing the byproducts directly from the processing plant.

Distillers solubles or syrup from the ethanol industry (Table 1-CCDS) is often used in liquid supplements; however, some is fed in large quantities directly to cattle. The water content of the syrup is relative high (65% for CCDS), so the cost of transportation can be relative high, plus storage for liquids must be available. As stated previously, there is considerable variation in water content from plant to plant. Syrup from some plants may contain closer to 80% water, while in others it may be 60%. Solubles have about the same level of bypass or UIP protein and energy as distillers grains (on dry basis), but is somewhat higher in phosphorus. Some have offered solubles free choice in tubs, but the consumption is extrememly high, which would raise concerns with high sulfur levels.

Klopfenstein and others at UNL have compared feeding distillers dried grains and corn gluten feed either daily, or an equivalent amount, three times a week. In general, gain was improved slightly when fed daily; however, feed efficiency was not affected.

In summary, corn byproducts can be quite variable depending on their source, but offer an excellent source of desirable supplemental nutrients, especially energy, protein, and phosphorus. Because of the tremendous growth in the ethanol industry, more byproducts will be available in the future and at times can be a very economical source of supplements. They offer the advantage of high energy that can be fed at relatively high levels without adversely affecting forage digestibility. They may have some advantage in bypass protein that may show some advantages in some cattle rations.

**Table 1.** Nutrient composition of selected corn milling byproducts

| Feedstuff:[a] | DRC | WCGF- | WCGF- | DDGS | WDGS | CCDS | MWDGS | Steep |
|---|---|---|---|---|---|---|---|---|
| DM | 90 | 44.7 | 60.0 | 90.4 | 34.9 | 35.5 | 45-50 | 49.4 |
| CP, % of | 9.8 | 19.5 | 24.0 | 33.9 | 31.0 | 23.8 | 30.6 | 35.1 |
| UIP, % of | 60.0 | 20.0 | 20.0 | 65.0 | 65.0 | 65.0 | 65.0 | 20.0 |
| P, % of | 0.32 | 0.66 | 0.99 | 0.51 | 0.84 | 1.72 | 84.0 | 1.92 |
| TDN, % | 90.0 | 90.0 | 94.5 | 101.0 | 112.0 | 112.0 | 112.0 | 113.0 |
| Neg, | 0.70 | 0.70 | 0.74 | 0.78 | 0.87 | 0.87 | 0.87 | 0.88 |

[a]DRC=dry rolled corn with NRC (1996) values, WCGF=wet corn gluten feed from two plants, DDGS= dried distillers grains + solubles, WDGS = wet distillers grains + solubles, CCDS+condensed corn distillers solubles (corn syrup), MWDGS=modified wet

Source: Utilization of corn co-products in the Beef Industry. August 2007. UNL &

## OIL SEED BYPRODUCTS

As stated earlier, many byproducts from the oil seed industry have been available for years. Cottonseed “cake” was fed as a protein supplement to cattle in the early 1900’s. The term “cake” was used because the oil was extracted by a hydraulic high pressure press leaving slabs of pressed cottonseed hulls. This was often shipped into the northern range country in rail cars and was fed to cows in diner plate sized pieces, hence the name “cake.” Cottonseed meal remains one of the best sources of protein supplements for range cows, but because of distance from cotton gins, it is often not as economical as in past years because of other, lower cost, sources and the reduction of cotton acres has reduced the supply.

Soybean meal probably provides the highest level of quality protein as any oil byproduct feeds. Because of the high quality protein, it is used in poultry, swine, and young calf rations, so it often demands a relatively high price in cattle supplements. It is very high in palatability.

Sunflower meal has become much more plentiful and is currently utilized in many commercial range cubes. Sunflower meal tends to be more variable depending somewhat on the level of hulls in the supplement and the manner of extraction of oil, which varies considerably. Table 1 shows the variation that occurs with the various levels of hulls in the sunflower meal. The hulls are high in indigestible fiber, which lowers energy in the sunflower meal. In some processing plants, the hulls are removed before the oil extraction process, but then a portion is added back to the meal.

**Table 2.** Effect of level of hulls on protein and energy (TDN)

| | No Hulls Removed | Partially De-hulled | De-hulled |
|---|---|---|---|
| Crude protein % | 28.0 | 34.0 | 41.0 |
| Fiber % | 24.0 | 21.0 | 14.0 |
| TDN % | 45.0 | 55.0 | 70.0 |

Source: Anderson, North Dakota State University and National Sunflower Association

The following table shows the specification for sunflower meal from various plants.

**Table 3.** Specification set for 4 sunflower processing plants

| Location | Protein % | Fat % | Fiber % |
|---|---|---|---|
| ADM (Enderlin, ND) | 35.0 | 1.0 | 18.0 |
| Cargill (W. Fargo, ND) | 32.0 | 0.5 | 21.0 |
| ADM (Goodland, KS) | 32.0 | 1.25 | 21.5 |
| Colorado Mills (Lamar, CO) | 29.5 | 13.3 | 23.9 |

Source: National Sunflower Association (www.sunflowernsa.com)

Sunflower meal is often used to improve range cube quality. The protein quality is usually not as high as in other oil seed byproducts, unless all of the hulls have been removed, and has a relatively high level of rumen degradable protein (26% DIP). Some feed industries utilize a combination of sunflower meal and dried distillers grains to manufacture range cubes. The main purpose of the sunflower meal is to allow maximum use of distillers grain (approximately 75%) and yet make an excellent cube.

## WHEAT BYPRODUCTS

The most popular and most utlized wheat byproduct in range cubes is wheat middlings, often referred to as wheat mids. As can be noted in Table 4, wheat mids are lower in protein than the oil seed byproducts, but are very palatable and make a high quality cube.

Wheat bran is not used a great amount, but because of the readily digestible fiber, it is sometimes used in creep feeds and in calf rations.

## SUGAR BYPRODUCTS

The byproducts from the sugar beet industry serve as excellent sources of energy for the cattle industry (Table 4). Wet beet pulp is utilized in calf diets as a ration ingredient and conditioner in finishing diets, as well as in cow herds that are relative close to the beet processing plants. In past years, considerable dry pulp was available; however, because of drying cost, most plants only have wet pulp available, which limits how far it can be transported and still be an economical feed. As can be noted in the table, beet pulp will contain close to 10% crude protein on a dry matter basis and approximately 74% TDN. The energy level is debatable as it may vary with the level in the ration and the type of cattle fed. Research at the University of Nebraska has found that when fed in growing rations and compared to corn silage, it had approximately 33% more value (on a dry matter basis) when it replaced up to 20% of the corn silage in the ration. In general, over all rations, beet pulp appears to have at least 80% the value of corn on a dry basis. Just as with distillers grains, the fiber in the beet pulp serves as a fiber friendly feed, because of the complimentary effect on ration digestion. It does not lower the digestibility of other forages in the ration as does corn or other starch containing feeds. Wet beet pulp can also be a great ration conditioner. Rations that consist of primarily ground hay and cracked corn can be very dusty; however, 25% wet beet pulp on an as-is basis can markedly improve ration quality, which can increase intake and reduce waste. Research and experience has shown that wet pulp can be fed up to 50% of the ration dry matter, but usually most nutritionists prefer to limit wet beet pulp up to 25-30% of the ration dry matter.

Wet pulp can be stored for a prolonged period of time with some waste as the mold cap develops (3-8”) and some dry matter lost. Research at the University of Nebraska found a 13% loss of dry matter when wet beet pulp was stored in a bunker silo for about six months.

Molasses is used as a major ingredient in liquid supplements. Because the level of protein in molasses is relatively low, urea is usually added to provide a higher level of protein in supplements. Western Sugar recycles the majority of molasses to extract additional sugar (TDN is approximately 71% on DM basis or 44% with 38% moisture).

## BREWER’S GRAINS

Brewer’s grains are a byproduct of the beer industry, which utilizes malt barley. As can be seen in Table 4, brewer’s grains are moderate in protein (29.5%), but are relative high in bypass protein and relative high in protein quality. The level of energy is lower than soybean meal and distillers grains due primarily to the lowered digestibility of the barley hulls. Currently, much of the brewer’s grains are sold wet to the dairy industry, which makes an excellent feed for dairy cows, so less is available for the beef industry, especially in the dried form. Brewer’s grains are very high in palatability and are often used in getting early weaned calves on feed as a ration ingredient.

**Table 4.** Average Nutrient Content of Byproduct Feeds (DM basis), NRC 1996

| Byproducts: | Crude Protein % | UIP % | Fiber ADF % | TDN % |
|---|---|---|---|---|
| Oil Seed: | | | | |
| Cottonseed meal | 46.1 | 43.0 | 17.9 | 75.0 |
| Soybean meal | 51.8 | 34.0 | 7.0 | 84.0 |
| Sunflower meal | 26.0 | 26.0 | 30.0 | 65.0 |
| Soy hulls | 12.2 | 25.0 | 49.0 | 77.0 |
| Canola meal | 40.9 | 28.0 | 17.0 | 69.0 |
| Wheat: | | | | |
| Wheat mids | 18.7 | 21.0 | 11.7 | 69.0 |
| Bran | 17.4 | 20.0 | 14.0 | 70.0 |
| Sugar Beet: | | | | |
| Pulp | 9.8 | 45.0 | 44.6 | 74.0 |
| Molasses | 14.6 | 20.0 | 0 | 80.0 |
| Desugarized solubles | 18.3 | 20.0 | 0 | 71.0 |
| Barley: | | | | |
| Brewer's grain | 29.5 | 50.0 | 31.2 | 66.0 |

## STORAGE OF DISTILLERS GRAINS

Because wet distillers grains are more plentiful during the summer months when cows and yearlings are on pasture and cattle on feed is often lower, wet distillers grains are often priced lower. This is tempting by many cattle producers; however, the traditional wet distillers tend to spread out while maintaining about two feet of depth, making it difficult to store large quantities. Recent research by Erickson and Klopfenstein at UNL has looked at adding various levels of roughage, as an addition to wet distillers grains, so it may be piled and packed just the same as silages. The following table gives the levels of different roughages that can be added to store in pit silos or oxygen free bags.

**Table 5.** Levels of roughage mixed with wet distillers grain when stored in oxygen limiting bag or bunker silo

| | Bag[a] | | Bunker | |
|---|---|---|---|---|
| | lb/ton added to wet feed | % of final mix | lb/ton added to wet feed | % of final mix |
| Grass hay % | 140 | 15.0 (6.5) | 30-40 (17) | 30-40 (17) |
| Wheat straw % | 110 | 12.5 (5.5) | 25-32 (13) | 25-32 (13) |
| Alfalfa hay % | 225 | 22.5 (10.2) | 45-55 (28) | 45-55 (28) |
| Dry distillers grains | 775 | 50.0 (28) | --- | --- |

[a]300 PSI
Wet distillers grains at 35% dry matter 65% moisture
Numbers in parentheses is % of forage on wet basis

## SUMMARY

Byproduct feeds may provide opportunities to lower feed costs. Many different types of byproducts are available, so to determine value, the nutrient content must be known, which some times requires analyzing a sample and perhaps consulting with a nutritionist. Level of moisture is very important in determining value and should be the first consideration when dealing with wet byproducts. The oil seed meals have been utilized for many years; however, more sunflower meal is currently available in many parts of range country. The corn byproducts from the distilling industry have changed the supplementation programs in many areas, as more is available and sometimes can be purchased very reasonable. When priced relative low, corn byproducts are then used for an energy source.