

ethanol co-products for cattle

Distillers Grains for Beef Cows

Iowa's ethanol industry is alive, vibrant and currently producing large volumes of feed co-products. Based on surveys conducted by the California Ethanol Commission, ethanol production capacity is expected to double from just less than 3 billion gallons in 2002 to nearly 6 billion gallons by 2006. Much of this added growth is expected to occur in Iowa and the upper Midwest, now the center of ethanol production from corn. During 2005 and 2006 ethanol fuel production capacity in Iowa is expected to double.

Expansion in ethanol production is highly significant to the livestock industry. Why? Each bushel of corn processed produces 2.65 gallons of ethanol and 17 air dry pounds of distillers grains. Therefore, an expansion of 2 billion gallons of ethanol, requiring almost 755 million bushels of corn, would produce 17 million tons of distillers grains.

Distillers Feeds

Many Iowa producers have experience with corn gluten feed, but not distillers grains. In general distillers grains are higher in nutrient concentration. Distillers grains contain approximately 30% protein compared to approximately 20% in corn gluten feed (dry matter basis). Also distillers grains are higher in energy partly due to the high fat content. Fat content of distillers feeds have been reported in a range from 9 to 14% (IBC-18, dry matter basis). Similar to corn gluten feed (CGF), distillers grains are high in digestible fiber, but low in starch. Due to these characteristics distillers grains may have some unique benefits as a supplement in certain production situations for the cow-calf producer. As always, economics will dictate whether these products fit into a particular ration. Furthermore, storage and handling may be more challenging with wet distillers grains (WDG) because of shorter storage life and consistency. Some variation exists between products and plants. South Dakota State University recently completed a study comparing product variation within and between plants, in feed analyses

of corn co-products from dry-mill ethanol plants. For instance, in distillers dried grain with solubles they found the crude protein content to have a standard deviation of 2.78 percent from the average of 33.3 percent. Fiber, fat and mineral content was also variable. So it is important to contact a supplier for detailed analyses.



Wet Distillers Grains

Distillers Grains for Beef Cows

Little research has been conducted to specifically evaluate distillers grains in beef cow rations. However, extensive research with growing-finishing cattle as well as lactating

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dairy cows gives some insight into when and where distillers grains may fit for beef cows. These situations include feeding as a protein source, particularly for low quality forages (replace CGF or soybean meal), as a low starch-high fiber energy source (replace CGF or soy hulls), and as a source of supplemental fat (soybean replacement)

Distillers grains can be fed as an excellent source of supplemental un-degraded or “bypass” protein for high producing dairy cows. Up to 20% of the ration dry matter can be fed in these situations (Schingoethe, 2001). Beef cows need less supplemental protein than dairy cows, but in many production systems they are fed poor-quality, low-protein forages. In these situations distillers grains fit well as a supplemental protein source. For an extreme example, in native winter range in the West, Colorado researchers found that distillers dried grains (DDG) compared favorably with alfalfa hay or cull navy beans as a supplement to provide 0.4 lbs of protein per day to beef cows grazing native winter range (Smith et al. 1999).

When corn gluten feed or distillers dried grain were compared by Illinois researchers as supplements to ground alfalfa hay for lactating Simmental cows, distillers dried grain fed cows gained more weight per day, but corn gluten feed fed cows produced more milk (Shike et al. 2004). Calf weights and rebreeding performance were similar.



Combining Corn Stalks and Distillers Solubles while Tub Grinding

In subsequent feeding trials, Illinois workers compared supplementing ground cornstalks with either dried distillers grains with solubles or corn gluten feed in lactating beef cows. Both 114 Simmental and 88 Angus cows nursing calves were used in the two experiments where limit-fed, total mixed rations were offered. There was no significant difference due to type of co-product used, as both products resulted in similar milk production and calf weight gains (see table 1).

Table 1. Performance of Simmental and Angus cows on Ground Cornstalks supplemented with Corn Gluten Feed or Dried Distillers Grains with Solubles.¹

	Corn Gluten Feed	Dried Distillers Grains with Solubles
Dry Matter Intake (lbs/day)		
Simmental	22.8	21.2
Angus	19.8	19.1
% Co-product in ration		
Simmental	77	76
Angus	55	53
Milk Production (lbs/day)		
Simmental	22.9	20.9
Angus	21.2	19.2
Calf ADG		
Simmental	2.2	2.2
Angus	1.8	2.0

¹Faulkner, et.al. (2005)

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Because distillers grains, like corn gluten feed, are low in starch and may be more effective as an energy supplement with poor quality forages. An example of this is shown in Table 2. Note that both corn gluten feed and distillers dried grains were superior supplements to straight corn grain in the corn stover diets, but not the alfalfa diets. Corn stover intake was significantly increased with supplementation and both gluten and distillers grain

improved dry matter digestibility. On the other hand with the higher quality alfalfa forage, corn proved to be the superior supplement, yet all three types were excellent in dry matter digestibility. However, it is important to note that when alfalfa was the forage the supplements replaced the forage in the total intake, thus lowering alfalfa intake. That was not the case with corn stover.

Distillers grains can be one of the best supplements for

Table 2. Digestibility of low and high quality forages supplemented with CGF or DDGS^{1,2}

	Stover	Stover + Corn	Stover + CGF	Stover + DDG	Alfalfa	Alfalfa + Corn	Alfalfa + CGF	Alfalfa + DDG
Dry Matter Intake, %BW	.75	1.58	1.67	1.40	1.66	2.08	2.15	2.06
Forage Intake, lbs/day	5.67 ^a	6.68 ^{ab}	6.97 ^b	6.39 ^{ab}	13.80 ^d	10.01 ^c	10.12 ^c	10.30 ^c
Digestibility, % of Dry Matter	39.1 ^a	53.7 ^b	58.9 ^c	59.4 ^c	55.8 ^b	66.1 ^d	60.1 ^c	61.8 ^c

¹Supplements are 50% of diet, significance P<.05

²Summer and Trenkle (1998)

corn stalk based beef cow feeding programs. Corn stalks are low in protein, energy and minerals, but are abundant and low in cost. Table 3 shows typical protein and energy requirements of medium frame cows at various stages of production. Also shown are corn stalk and distillers grain combinations that will meet those requirements. What is the bottom line of these calculations?

1. For average cows in good condition for the last 1/3 of gestation, 3-5 lb. of distillers dried grain or 8-15 lb. of wet distillers grain per day will meet their protein and energy requirements when fed as a supplement to corn stalks.
2. For average cows in good condition for early lactation, 6-8 lb. of distillers dried grain or 20-23 lb. of wet distillers grain will meet their protein and energy requirements when fed as a supplement for corn stalks.
3. These rations should be fine-tuned for the specific cow size, stage of production, condition score and weight gain

requirements, environmental conditions, feed analyses and operational goals. Additionally, vitamin and mineral ration concentrations need to be evaluated. Ration analysis programs like BRANDS may be a helpful tool for this purpose (visit www.iowabeefcenter.org for more information).

Distillers Dried Grains as a source of supplemental fat

Recently, there has been considerable interest in supplementing fat to beef cow rations as a way of improving reproduction. In a recent review of this literature, Strohbahn (2002) made the following observations:

1. In six studies, supplementing fat improved pregnancy rate 6.2% when the pregnancy rate of controls was 81%. Supplementation was required in most of these studies.
2. Expect less benefit if your current pregnancy rates are 90% or better.

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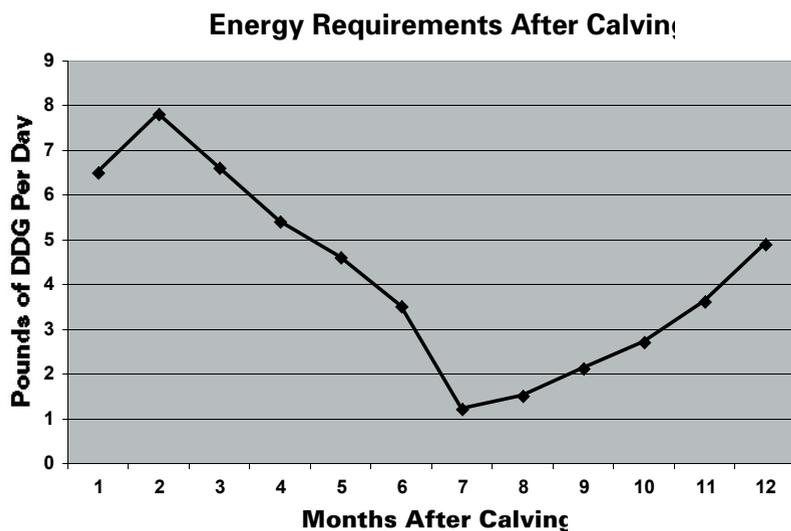
Table 3 . Approximate beef cow protein and energy requirements by month and distillers dried grain supplementation of corn stalks.

Distillers Dried Grains Supplement with Corn Stalks

Month after Calving	Total Digestible Energy Req. ^{1,2}	Crude Protein Req. ^{1,2}	Dry Matter Intake ^{1,2}	% of Dry Matter Intake	Lbs. per day
1	58.0	9.76	29.5	20	6.5
2	59.1	10.31	30.5	23	7.8
3	56.8	9.56	31.3	19	6.6
4	55.5	8.94	30.3	16	5.4
5	54.1	8.29	29.4	14	4.6
6	53.0	7.73	28.6	11	3.5
7	45.0	6.00	27.2	4	1.2
8	45.8	6.20	27.0	5	1.5
9	47.3	6.53	26.9	7	2.1
10	49.5	7.04	26.8	9	2.7
11	52.6	7.80	27.0	12	3.6
12	56.6	8.88	27.6	16	4.9

¹NRC(1996) Appendix Table 23, 1400 lb. cows, medium milk.

²Assumes nutrient analysis of corn stalks as 85% DM, 50% TDN and 5% CP (DM basis). Assumes nutrient analysis of distillers dried grain as 90% DM, 90% TDN and 30% CP (DM basis).



3. Fat supplementation works best with lower quality forages where protein and/or energy supplementation is already necessary.

The successful fat sources used in those six studies included sunflower meal, safflower meal, rice bran, whole soybeans and whole cottonseed. Since these products contain a similar fatty acid profile to corn oil, it is expected that distillers dried grain fed at the same rates of fat supplementation might give similar responses.

Distillers Feeds for Heifers

Distillers dried grain is well known as a good source of “bypass” protein. About twice as much protein from distillers dried grain bypasses the rumen as compared to soybean meal. Because of this, distillers dried grain works well as a protein source

distillers grains for beef cows

for classes of cattle that have a high protein requirement relative to their feed intake, such as young calves. It is unknown if wet distillers grain has the same “bypass” characteristics. The proteins in distillers dried grain may become less rumen degradable due to the heat of the drying process.

As an energy source, distillers dried grain has a similar feeding value to corn grain. However, recent work with finishing cattle has indicated that wet distillers grain and condensed distillers solubles may have up to 125% of the energy in corn. This varies based on the feeding level and the base ingredients. For more information on feeding distillers grains to finishing cattle, see Loy and Miller (2002b).

Nebraska researchers have completed an interesting study involving replacement heifers grazing brome grass (MacDonald and Klopfenstein, 2004). In this study, heifers were fed distillers dried grain at rates of 0, 1, 2, 3 or 4 lb. per day. For each pound of distillers dried grain that was fed; forage consumption decreased by 1.72 lb. and average daily gain increased by .06. This direct substitution allows the economics of supplementation to be calculated easily. Based on a 10-year average, Nebraska pasture cost of \$21.65 per animal unit month, distillers dried grain had a value of about \$175 per ton in this study. Beef Cow Business Records data from Iowa beef cow producers indicates that our animal unit month costs are significantly lower than in Nebraska, thus their calculated value would be high for most Iowa producers.

Storage and Preservation

Wet distillers grain can deteriorate rapidly when exposed to air. Preservatives added at the processing plant can extend storage life, however, usually not enough for a small cow-calf operation using limited quantities per day. In these cases, it may be more desirable to look at long term storage methods such as ensiling. Ensiling as an option has been successfully demonstrated at South Dakota State University (Garcia and Kalscheur, 2004). Wet distillers has been successfully preserved alone or in combination with soyhulls, beet pulp or corn silage. Because wet distillers grain has a very low initial pH (<4), the fermentation is not a classic ensiling process. However, this acid level does aid in preservation. A current demonstration at Iowa State University (ISU) is evaluating the preservation of condensed distillers solubles combined with ground corn stover.

Ration Costs

Profit in the beef cow enterprise is driven by product output value and cost of that production. The ISU Beef



Ensiled Corn Stalks and Distillers Solubles

Cow Business Record for the last 10 years shows that feed costs account for 62 percent of the annual financial cost to maintain a cow-calf unit in Iowa, which averages \$324 per unit. Further analysis shows that stored feed cost for winter time rations average \$1.01 per day.

Can distillers grain rations be formulated that will give lower costs? This, of course, is very dependent on ingredient costs and the cost of mixing and delivering a ration to a bunk feeding system. As indicated earlier, distillers grains fit well with cornstalks in a complete, mixed and bunk-delivered ration (see Table 3). It is likely that other feeding methods will work, but no research or demonstration projects to date have been done to prove this.

Based on baled or stacked cornstalks done with Iowa custom rate charges; the cost per ton of harvested and ground cornstalks ranges from \$17 to \$25 per ton. Using this range in price for ground cornstalks and dried distillers grains with solubles at \$70 per ton, the last three months of gestation would have an average ration cost of \$.38 to \$.51 per cow daily. This range does not include vitamin and mineral supplementation cost. The first three months of lactation would have an average ration cost ranging from \$.57 to \$.72 per cow daily. Keep in mind no storage or feeding losses have been included in these cost estimates, but it is readily apparent that distillers grains in combination with cornstalks hold great potential for lowering winter ration costs in Iowa.

Conclusions

Distillers grains can be an excellent source of nutrients for beef rations. In young growing cattle, distillers dried grain can provide a source of bypass protein and energy. While in adult beef cows, distillers grains have proven themselves to be an excellent source of protein, energy and fat supplementation. Challenges do exist relative to storage and shelf life issues with the wet products for small beef cow herds. The ultimate decision as to whether these or any feeds are feasible comes down to economics—the cost of the feed ingredient compared to the value of the feeds it replaces.

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