Distillers Grains for Beef Cattle

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Distillers byproducts are excellent feed resources for feedlot cattle. Distillers byproducts are normally available for use in feedlot finishing diets in two forms, dried distillers and wet distillers byproducts (WDB). In general, there are two nutritional philosophies regarding their use in feedlot finishing diets. Distillers byproducts can be fed at 6 to 15% of the diet dry matter, serving primarily as a source of supplemental protein. When fed at higher levels (greater than 15% of the diet dry matter), the byproduct's primary role is a source of energy replacing corn grain. Other than dry matter content (wet distillers, 35-45%; dried distillers, 90-95%), the chemical composition of the two distillers byproducts is similar. Distillers byproducts contains 10-15% fat (oil), 40-45% neutral detergent fiber, 30-35% crude protein and 5% ash (NRC, 1996).

Dried distillers byproduct is routinely fed as a supplemental protein source, however, the drying process appears to reduce the energy value of the distillers byproduct. Ham et al. (1994) demonstrated a 9% improvement in feed efficiency when dried distillers byproduct replaced 40% of the dry-rolled corn in finishing diets (Table 1). However, this improvement was only 50% of that observed when wet distillers byproduct replaced a similar amount of dry-rolled corn. Drying cost significantly increases the commodity price for the distillers byproduct. The dried distillers byproduct is routinely priced relative to other supplemental protein sources like soybean meal. Therefore, when priced on an energy basis (relative to corn), the expected improvement in animal performance is not large enough to offset the increased ration cost associated with higher inclusion levels.

Wet distillers byproducts are commonly fed at higher levels in the diet to supply both protein and energy to the animal. There are numerous advantages to using wet distillers byproducts. For the dry-milling plant, the energy cost associated with drying the product can be significantly reduced or eliminated. This should allow for an overall increased energy yield for each bushel of corn processed. The major downside of using wet distillers byproducts is transportation costs associated with the movement of water.

Experiments evaluating the use of wet distillers byproducts in ruminant diets are available (DeHaan et al, 1983; Farlin, 1983; Firkins et al., 1985; Ham et al., 1994; Fanning et al., 1999; Larson et al., 1993; Lodge et al., 1997; Trenkle, 1997 a; Trenkle, 1997 b). In the experiments with finishing cattle, the replacement of corn grain with wet distillers byproduct consistently improved feed efficiency. Larson et al. (1993) replaced dry-rolled corn with 5.2, 12.6 or 40% (dry matter basis) wet distillers byproduct (Table 2). With the first two levels of byproduct (5.2 and 12.6), these researchers observed a 7% increase in feed efficiency above the basal dry-rolled corn diet. But, when the inclusion level was increased to 40% of the diet dry matter, the improvement in feed efficiency was 20% above the dry-rolled corn diet. In other published experiments (Ham et al., 1994; Fanning et al., 1999; Lodge et al., 1997) the inclusion level of the wet distillers byproduct has been 30 to 40% of the diet dry matter. These experiments consistently suggest a 15 to 25% improvement in feed efficiency when 30 to 40% of the corn grain is replaced with wet distillers byproduct.

Distillers grains made from sorghum and corn were compared at 30% of the diet dry matter. Statistically the byproducts had similar feeding values (Table 3) although the corn derived grains were numerically, slightly better.

Eleven experiments were summarized where WDB was compared to corn as an energy source for finishing cattle (Table 4). The WDB replaced 12.6 to 50% of the diet (corn). The data were summarized into three situations. First is the control diet based on dry rolled corn. Second is when WDB replaced corn at a low level in the diet (12.6 to 28%). The third situation is where WDB replaced corn in the diet at 30 to 50% of diet dry matter.

At the low level (ave. 17.4%) of WDB feeding, the energy value was 152% that of corn. At the high level of feeding, the value decreased to 136% the value of corn. We can then calculate the value of the WDB as 124% the value of corn when fed between 17.4 and 40% of the diet.

We believe there are very good explanations for the change in relative feeding values as WDB increases in the diet. We believe the first increments fed (up to 17.4%), supply nutrients such as protein that may be of value to the cattle but more importantly reduce the acidosis that occurs in the control diet. The WDB contains protein and fat which supply energy to the animal but it does not contain the starch that leads to acidosis. Further, the fiber (hull) in the WDB is highly digestible but adds fiber to the diet and reduces acidosis. So the very high value of the WDB (152%) at low level feeding is probably due to factors other than the strict energy value of the nutrients contained therein.

The value when fed above 17.4% of the diet is probably due to the high fat content of the WDB and the high content of bypass protein. Fat has about three times the energy value of starch for cattle and bypass protein has about 30% more energy than starch. The value from feeding trials was determined to be 124% the value of corn. By calculating the theoretical energy value based on the bypass protein and fat contents, we estimate the energy value of WDB to be 120% the value of corn. This calculation gives confidence in the value obtained from feeding trials.

Typical feedlot diets contain about 85% corn. The starch in the corn is the energy source used by the cattle. However, the starch is rapidly fermented by the rumen microorganisms to organic acids. The overproduction of the organic acids causes acidosis followed by reduced feed intake and reduced gains (Stock and Britton, 1993; Stock et al., 1995). Distillers byproducts have essentially all of the starch removed leaving protein, highly digestible fiber and fat. The feeding of the byproducts appears to reduce acidosis and enhances feed efficiency.

The previous research indicates that wet corn byproducts (distillers grains and thin stillage) are higher in net energy than corn grain; however, wet corn gluten feed (WCGF) is similar in net energy to corn. Potential differences between wet distillers byproducts and WCGF include lipid content, escape protein level, and NDF level.

A finishing trial using 60 individually fed yearling crossbred steers (600 lb) was conducted. Treatments consisted of a dry rolled corn, WCGF, wet distillers byproducts composite (COMP2), (WCGF, corn gluten meal, tallow), COMP2 minus tallow (-FAT) and COMP2 minus corn gluten meal (-CGM). The tallow and corn gluten meal were replaced with wet corn gluten feed. The COMP2 was formulated (DM basis) to contain 12.5% degradable protein, 12.5% undegradable protein, 13.1% lipid, and 32.7% NDF and consisted of 65.8% WCGF, 26.3% CGM, and 7.9% tallow (DM basis). All diets contained (DM basis) 79.1% dry rolled corn or dry rolled corn plus 40% corn byproducts, 5% corn silage, 5% alfalfa, 5.9% molasses based supplement, and 5% dry supplement.

Steers consuming the COMP2, -CGM, and dry rolled corn diets were more efficient (P<.10) than the steers fed dry rolled corn or WCGF diets (Table 4). No difference in ADG was observed among treatments (P>.10). Steers fed the COMP2 diet consumed less (P<.10) feed than steers fed the dry rolled corn diet with the steers fed WCGF, -FAT, and -CGM being intermediate (P>.10) to these treatments.

A composite of feeds can be formulated that improves efficiency of gain compared with WCGF. However, it is not clear what level of fat, fiber, or escape protein or how the interactions of these ingredients may contribute to the increases in feeding value observed with distillers byproducts. These results indicate that the lipid fraction of the distillers byproducts may be responsible for the largest increase in efficiency.

There are at least three factors involved in the higher feeding value for distillers byproducts (protein, energy, acidosis). Based on the limited data available regarding the level of wet distillers byproduct in the diet, the economic value of the byproduct varies as the level fed in the diet changes. Also, as the level fed increases, more is fed per animal per day and more total byproduct would be fed. The precise relationship between level of byproduct in the diet and both the feeding value and economic value remains elusive.

Distillers Grains for Stocker Cattle, Heifers and Cows

Beef calves from weaning until they enter feedlots, developing heifers and beef cows are fed primarily forage diets. Especially in the winter, forages are low in protein and phosphorus and need to be supplemented. Further, the protein in forages is highly degraded in the rumen and the cattle should be supplemented with undegraded (bypass) protein to meet metabolizable protein requirements. Distillers grains (wet or dry) is an excellent source of undegraded protein and phosphorus. The values obtained from feeding trials for undegraded protein are shown in Table 5. Wet grains were compared to dry grains and the value of the protein was similar (Table 6). This suggests that the high escape protein value of distillers grains is due to the innate characteristics of the protein and not to drying or moisture control.

Stocker calves, developing heifers and cows may need energy supplement in addition to supplemental protein and phosphorus. It is advantageous if the same commodity can be used for supplemental energy as well as protein. We previously stated that distillers grains should have 120%

the energy value of corn grain. For example, corn at $2/bu is $79/ton (90% dry matter). That means dried distillers grains would be worth at least $95/ton as an energy source. Additional advantages for distillers grains are that it contains very little starch and therefore should not depress fiber digestion.

The value of distillers grains as a protein supplement is illustrated in Table 7. We have shown the formulation and cost of a soybean meal based supplement and a distillers grains based supplement. They should have equal feeding value but the distillers grains supplement is less expensive because of the high escape value of the protein. Less expensive midds and urea can then be used in the supplement. This illustrates just how economical distillers grains can be as a supplement to stockers, heifers and cows.

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Table 1. Energy Value of Wet vs Dry Grains

	Control	Wet	Low[a]	Medium[a]	High[a]
Daily feed, lb	24.2[bc]	23.5[b]	25.3[c]	25.0[c]	25.9[c]
Daily gain, lb	3.23[b]	3.71[c]	3.66[c]	3.71[c]	3.76[c]
Feed/gain	7.69[b]	6.33[c]	6.94[d]	6.76[d]	6.90[d]
Improvement:					
Diet		21.5		11.9 (ave.)	
Distillers vs corn		53.8		29.8	

[a]Level of ADIN, 9.7, 17.5 and 28.8%.
[b,c,d]Means in same row with different superscripts differ (P<.05).

Table 2. Effect of Wet Distillers Byproduct Level on Finishing Performance of Yearlings and Calves

	Byproduct level, % of diet DM[a]			
Item0	5.2	12.6	40.0	
Daily feed, lb				
Yearlings[b]	25.21	24.64	24.05	21.30
Calves[b]	18.52	19.23	18.55	17.40
Daily gain, lb				
Yearlings[c]	3.61	3.76	3.85	3.85
Calves[b]	2.86	3.06	3.08	3.21
Feed/gain				
Yearlings[e]	6.94	6.62	6.33	5.78
Calves[b]	6.45	6.33	6.10	5.65

[a]Wet grains:thin stillage (fed ratio), yearlings = 1.67:1; calves = 1.81:1, DM basis.
[b]Byproduct level, linear (P<.01).
[c]Byproduct level, linear (P<.10); quadratic (P<.10).
[d]Feed/gain analyzed as gain/feed. Feed/gain is reciprocal of gain/feed.
[e]Byproduct level, linear (P<.10).

Table 3. Corn vs Sorghum Distillers Byproducts

	Diets[a]		
Item	DRC	CORN	SORG
Initial weight, lb	791	790	792
DMI, lb/day	23.5	22.9	25.4
ADG, lb	3.64	3.95	4.11
Feed/gain	6.48	5.81	5.97
Yield grade	2.32	2.65	2.56
Choice	95	70	74

[a]DRC = dry-rolled corn (control), CORN = corn distillers grains, SORG = sorghum distillers grains.

Table 4. Influence of Level in Diet on Value of Wet Grains Plus Solubles in Feedlot Diets

Experiment	WDB level in diet dry matter		
	0	12.6 - 28%	30 - 50%
Trenkle, 1997a	.154[a]	.183 (20)[a] 194%[c]	.176 (40) 137%
Trenkle, 1997a	.154		.176 (40) 136%
Trenkle, 1997b	.164	.207 (16) 126%	.168 (40) 102%
Trenkle, 1997b	.164	.171 (28) 114%	
Firkins et al., 1985	.155	.156 (25) 101%	.171 (50) 121%
Larson et al., 1993	.144	.158 (12.6) 177%	.173 (40) 150%
Larson et al., 1993	.155	.164 (12.6) 164%	.177 (40) 135%
Ham et al., 1994	.133		.158 (40) 147%
Fanning et al., 1999	.154		.172 (30) 147%
Means		152% (17.4)	136% (40)
Value 17.4 to 40			124%

[a]Feed efficiency.
[b]Level in diet dry matter.
[c]Value relative to corn.

Table 5. Escape Protein Values

Source	% protein escape
Soybean meal	30
Wet distillers grains	60-70
Dried distillers grains	60-70
Distillers solubles	30

Table 6. Wet and Dry Grains for Calves

Supplement	ADG	Protein efficency[a]	ADIN[b]
Urea	1.00	--	--
WG	1.46	2.6	--
DDGS	1.42	2.0	9.7
DDGS	1.47	1.8	17.5
DDGS	1.54	2.5	28.8

[a]Pounds gain/lb supplemental protein.
[b]Acid detergent insoluble nitrogen, measure of amount of heating.

Table 7. Value of Distillers Grains — 40% Supplement

	SBM	DDG
SBM	78.7%	---
DG—	60%	
Midds	20.3	32.8
Urea	---	6.2
Minerals	1.0	1.0
Ingredient cost	$153	$95

Prices: SBM, $161; DDG, $95; Midds, $61; Urea, $280 (corn $75).