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Evaluation of Wet Distillers Grains for Finishing Cattle

Allen Trenkle
Iowa State University

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Abstract

A feeding trial was conducted with 870-lb steers fed 137 days to evaluate replacing cracked corn with dry and wet distillers grains with solubles (DGS) as feed for finishing cattle. Dry DGS was evaluated at 16% of diet dry matter. Wet DGS (WDGS) was evaluated at 14.6%, 26.2%, and 37.5% of diet dry matter. Control diets were supplemented with urea or a combination of urea and soybean meal. Feeding 16% dry DGS or 14.6% wet DGS increased rate of gain and tended to increase carcass fatness. Increasing the amount of wet DGS in the diet decreased feed intake, reduced gain, and improved feed conversion. The calculated net energy for gain values for dry and wet DGS were .92 and 1.5 times the energy value of corn grain. Economic returns declined slightly as the percentage of wet DGS increased in the diet, but remained above the two diets without DGS. The average benefits from feeding wet DGS averaged $25, $21, and $19 per head for steers fed 14.6%, 26.2%, and 35.7%, respectively, based on a formula price for wet DGS related to price of corn and including a charge for transportation of the wet feed.

Keywords

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Disciplines

Animal Sciences

Evaluation of Wet Distillers Grains for Finishing Cattle

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Allen Trenkle, professor of animal science

Summary

A feeding trial was conducted with 870-lb steers fed 137 days to evaluate replacing cracked corn with dry and wet distillers grains with solubles (DGS) as feed for finishing cattle. Dry DGS was evaluated at 16% of diet dry matter. Wet DGS (WDGS) was evaluated at 14.6%, 26.2%, and 37.5% of diet dry matter. Control diets were supplemented with urea or a combination of urea and soybean meal. Feeding 16% dry DGS or 14.6% wet DGS increased rate of gain and tended to increase carcass fatness. Increasing the amount of wet DGS in the diet decreased feed intake, reduced gain, and improved feed conversion. The calculated net energy for gain values for dry and wet DGS were .92 and 1.5 times the energy value of corn grain. Economic returns declined slightly as the percentage of wet DGS increased in the diet, but remained above the two diets without DGS. The average benefits from feeding wet DGS averaged $25, $21, and $19 per head for steers fed 14.6%, 26.2%, and 35.7%, respectively, based on a formula price for wet DGS related to price of corn and including a charge for transportation of the wet feed.

Introduction

Production of fuel alcohol from corn in dry-mill plants when integrated with cattle feeding has been shown to benefit economic development in agricultural communities. Integration with cattle feeding is an important component of this system. Past studies conducted to evaluate dried distillers grains with solubles (DDGS) indicated feeding values equal to or greater than corn grain when fed to finishing cattle as a source of supplemental protein and energy (North Central Regional Research Publication No. 297, 1984). Recent studies at the University of Nebraska indicated that wet DGS (WDGS) had considerably more energy than corn grain when fed to finishing cattle (1993 Nebraska Beef Cattle Report). In the Nebraska studies the cattle were fed WDGS without solubles from an experimental still that did not remove all the ethanol from the feed, and the cattle were forced to drink the solubles. Studies were conducted with feeding WDG to finishing cattle at the University of Illinois (1983 Illinois Beef Cattle Report),

Table 1. Composition of diets (dry basis).

Ingredient	Diet					
	1.07% Urea	10.0% SBM	16% DDGS	16% WDGS	28% WDGS	40% WDGS
Crude protein, %	12.0	14.0	14.0	14.0	14.5	16.9
Dehydrated alfalfa	12.00	12.00	12.00	12.00	12.00	12.00
Cracked corn	83.63	74.74	68.36	68.55	57.40	45.50
Cane molasses	2.00	2.00	2.00	1.67	1.43	1.19
Soybean meal		10.00				
Dry distillers grains			16.00			
Wet distillers grains				16.00	28.00	40.00
Urea	1.07	.34	.54	.66		
Dicalcium PO_4	.14					
Limestone	.48	.48	.51	.51	.57	.70
NaCl	.30	.30	.30	.30	.30	.30
KCl	.22		.16	.19	.18	.18
Elemental sulfur	.039	.012	.017	.021		
Trace minerals	.024	.024	.024	.024	.024	.024
Vitamin A[a]	.08	.08	.08	.08	.08	.08
Rumensin®[b]	.0175	.0175	.0175	.0175	.0175	.0175

[a]Provided 1,400 IU of vitamin A per pound of dry matter.
[b]Provided 14.4 mg sodium monensin per pound of dry matter.

but the material was ensiled with corn before feeding. No experiments have been reported in which WDG from a commercial dry-mill ethanol plant using corn have been fed to cattle. The objective of this experiment was to evaluate wet and dry DGS WDGS from a commercial dry-mill ethanol plant in a cattle feeding experiment.

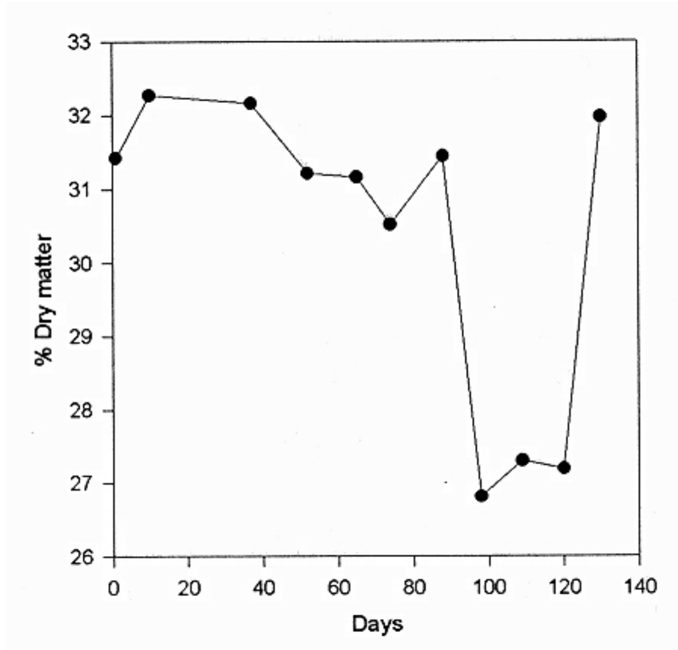
Materials and Methods

One-hundred-fifty-four 10- to 11-month-old steers with an average weight of 870 pounds were purchased at an Iowa auction. They were predominantly Continental-crossbred steers (Charolais and Simmental) that had been backgrounded during the winter. The steers had been preconditioned but were given booster immunizations and treated for internal and external parasites before beginning the test in March. Six steers were allotted at random from weight-outcome groups to each of 24 pens. Four pens were allotted at random to each of six diets containing on a dry basis: (1) 1.07% urea, (2) 10% soybean meal and urea, (3) 16% dried distillers grains with solubles and urea, (4) 16% wet distillers grains with solubles and urea, (5) 28% wet distillers grains with solubles and urea, and (6) 40% wet distillers grains with solubles and urea. The composition of the diets is shown in Table 1. Wet and dry DGS were purchased from a commercial dry-mill ethanol plant using corn with an annual 15-million-gallon production. The dry DGS was purchased as one lot of material at the start of the experiment. Wet DGS was delivered at 10- to 14-day intervals and stored in a small bunker silo. The grain mix of the diets was prepared separately from the wet distillers grains. Wet distillers grains and grain mix were weighed separately and given to the cattle twice daily.

All steers were implanted with Revalor®-S on Day 1. The cattle were housed in an open-front shed with feed bunks under the roof of the shed. The steers were weighed individually in the morning, before feeding, on two consecutive days at start and end of the experiment, and at approximately 28-day intervals throughout. The cattle were started on the diets described in Table 1, but intake was limited for the first four weeks while they adjusted to the grain. The experiment was started in late March and the steers were fed for 137 days. All the cattle were sold at a commercial beef-packing plant. Weights of hot carcasses were taken after slaughter, and measurements on the carcasses were obtained after 24 hours in the cooler. Yield grades from individual carcasses were calculated from measurements on the carcasses using the standard yield grade equation.

The net energy values for DGS were calculated from the performance of the cattle using the net-energy equation from Nutrient Requirements of Beef Cattle, 1994 NRC ($ADG = 15.54\ NEg^{.9116} W^{-.6837}$). This equation needed some modification to fit the type of cattle and implant program used in this experiment (see Discussion).

Figure 1. Dry matter content of wet DGS delivered to research farm starting on March 28. Decreased dry matter occurred during July.

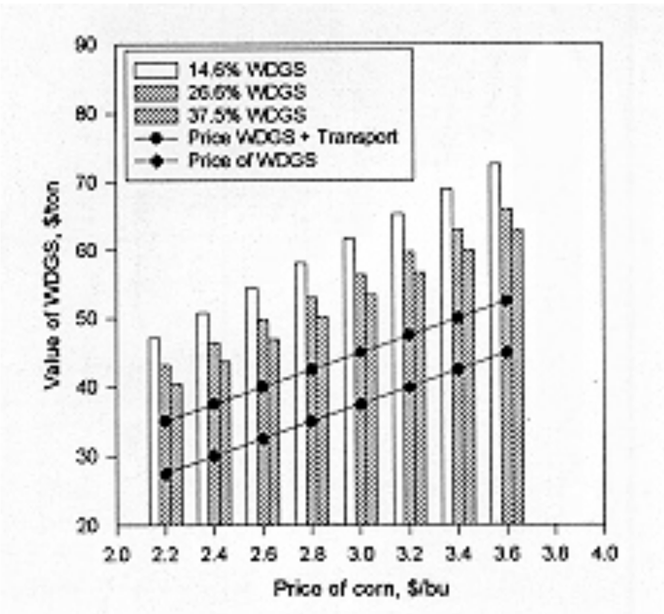


Pen means were used as the experimental unit in the statistical analysis. Data were analyzed by analysis of variance. Standard error of the means and least significant difference ($p < .05$) between means also were calculated.

Results and Discussion

The WDGS had a shelf life of up to 14 days, which is somewhat longer than observed with storage of wet corn gluten feed in earlier experiments. The dry matter contents of the 11 loads of WDGS delivered to the research farm are shown in Figure 1. The dry matter concentration in WDGS was very consistent until the three loads delivered in July, which contained 4.5 points more moisture. The protein concentration in WDGS was very consistent among loads and averaged 29.4% on a dry basis. The load of DDGS averaged 91.8% dry matter and 28.9% protein. Concentrations of NDF and ADF averaged 45.5 and 16.5 in WDGS. Concentrations of ether extract (fat) averaged 8.79% in WDGS. The corn grain fed in this experiment averaged 87.8% dry matter and 8.6% protein. Because of slightly greater moisture concentration in WDGS than anticipated, the actual percentages of diet dry matter consumed by the cattle as WDGS were 14.6, 26.2, and 37.5 for the diets formulated to contain 16%, 28%, and 40% in Table 1.

Figure 2. Value of wet DGS as a feed for cattle over range of corn prices from $2.20 to $3.60 per bushel. Calculated values of DGS shown as bars in the graph are prices that would result in the same cost of gain as for the control steers fed the urea- supplemented diet. The two lines show the price of wet DGS at the plant and plant price plus $7.50-per-ton transportation cost.



During the first 56 days, feeding additional supplemental protein as soybean meal increased gain and improved feed conversion 16% and 12% respectively, compared with steers fed urea alone (Table 2). Substituting dried or wet DGS at 16% or 14.6% of diet dry matter improved gains and feed conversion 8% and 4% for DDGS and 3% and 9% for WDGS compared with steers fed urea. During this period, none of the steers fed wet or dry DGS performed as well as the steers supplemented with soybean meal. One reason for poorer performance was that all groups of steers fed WDGS consumed less feed than steers fed the dry diets. In other experiments, we have consistently seen superior response to feeding soybean meal in cattle similar to those used in this study. During the second period, however, all the groups fed DGS gained faster than steers fed soybean meal. Compared with control steers fed the urea diet, steers fed WDGS had the greatest improvements in feed conversion during the second period. Steers fed WDGS averaged 9% higher efficiency than those fed the urea-supplemented diet. Over the total feeding period, steers fed 14.6 WDGS gained 11% faster and were 7% more efficient than steers fed the urea-supplemented diet.

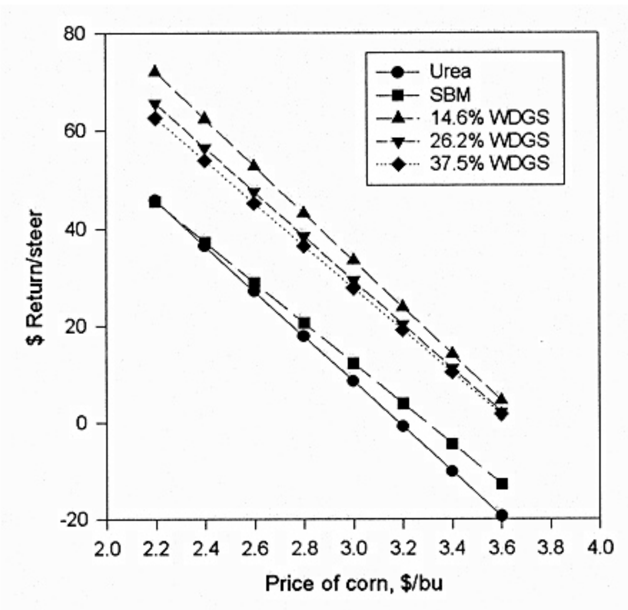
Increasing the quantity of WDGS fed decreased feed intake, tended to decrease rate of gain, and improved feed conversion.

The greater gains of steers fed soybean meal or DGS were reflected in heavier carcasses (Table 3). There were no differences among the diets in dressing percentage, area of ribeye, or quality grades. Calculated yield grades were lower for steers fed soybean meal or 37.5% WDGS compared to steers fed 16% DDGS. Feeding increasing levels of WDGS resulted in lower yield grades. Steers fed the lower level of DGS tended to have greater fat thickness, and more kidney-heart-pelvic fat. Overall, however, carcasses of these steers were not greatly affected by feeding WDGS.

Net energy for gain of DGS was calculated using the NRC net energy equation; however, use of $15.54\ NEg^{.9116}W^{-.6837} = ADG$ did not estimate gain of the urea-fed steers. To estimate the gain of these steers, $18.91\ NEg^{.9116}W^{-.6837} = ADG$ had to be used. This adjustment seemed reasonable based upon the type of cattle and the implant program used in this experiment. Use of this modified equation estimated the NEg. of WDGS to be 1.07 Mcal/lb (2.35 Mcal/kg) of dry matter or 1.5 times the NEg of corn grain. These estimates were somewhat lower than those for finishing steers observed in the Nebraska experiments. The explanation for the higher apparent net energy of the WDGS is not clear. It is unlikely this feed can have that much more energy. The greater concentration of fat in WDGS contributes more energy than corn grain, but cannot account for all the difference. Feeding WDGS with corn might result in greater utilization of the starch in corn. Greater protein intake might have contributed to a greater energy value, because the modified net energy equation underestimated the gain of the steers fed soybean meal. Use of the modified equation estimated soybean meal to have a net energy value 77% greater than its table value, which is unlikely. It may be that feeding more protein nutrition improves digestion or improve utilization of absorbed nutrients. The calculated NEg of DDGS was .65 Mcal/lb (1.42 Mcal/kg) or 92% that of corn grain. This estimate is similar to earlier estimates from cattle feeding experiments with DDGS (North Central Regional Research Publication No. 297, 1984). The enhanced value of DGS seems to be lost with drying.

The economic value of WDGS was estimated by calculating how much one could pay for WDGS to maintain the same cost of gain as found for the steers fed the urea-supplemented diet. These values are compared with different prices for corn in Figure 2. These values for WDGS have to include the costs of WDGS at the plant and transporting the wet feed to the cattle. The price of corn should also include all costs of transportation and processing before feeding to the cattle.

Figure 3. Economic returns per steer from feeding wet DGS or dry feeds over range of corn prices from $2.20 to $3.60 per bushel. Feed prices were: pelleted alfalfa, $110/ton; molasses, $110/ton; soybean meal, $200/ton; urea, $250/ton; and other ingredients in supplement, $250/ton. Purchase and selling prices of steers were $68/cwt and $63/cwt, respectively. Nonfeed costs were $.35/day and $20/head for processing and transportation. Returns were calculated from the performance of the cattle shown in Table 2.



The plant producing the DGS used in this study sells WDGS at the plant based on the following formula: cost of WDGS ($/ton) = cost of corn ($/bu) x 12.5. Using this cost, plus $7.50 per ton for transportation, resulted in economic returns to the feedlot summarized in Figure 3. Economic returns declined slightly as the percentage of WDGS increased in the diet, but remained above the two diets without WDGS. The average benefits from feeding WDGS over the range of corn prices shown in Figure 3 were $25, $21, and $19 for 14.6%, 26.2%, and 37.5% WDGS, respectively. The economic benefits from feeding soybean meal compared with urea increased as the price of corn increased. The impact of transportation costs on the price of WDGS is shown by the two lines in Figure 2.

Implications

The results of this experiment confirmed other studies indicating that wet distillers grains have greater energy value than corn grain for finishing cattle. There were minimal effects on carcass quality from feeding up to 37.5% of diet dry matter as WDGS. Based on a pricing equation used at one commercial ethanol plant, there were positive economic returns from including wet distillers grains in the diet of finishing cattle. These results support the concept that integrating cattle feeding with an ethanol plant will improve economic returns to the total system.

Acknowledgments

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Table 2. Feedlot performance of steers fed soybean meal (SBM), dry distillers grains with soluble (DDGS), or wet distillers grains with solubles (WDGS).

Ingredient	Diet							
	1.07% Urea	10.0% SBM	16% DDGS	16% WDGS	28% WDGS	40% WDGS	SE[a]	LSD[b]
No. steers	24	24	24	24	24	24		
Starting weight, lbs	877	873	874	873	867	873	2.37	7.03
Final weight, lbs	1345	1364	1384	1394	1367	1365	13.2	39.3
<u>0 to 56 days</u>								
Daily gain, lbs	3.60	4.17	3.89	3.69	3.80	3.84	.11	.32
Feed, lb. DM lbs	16.3	16.6	16.9	15.3	15.0	14.9	.11	.34
Feed/gain	4.54	3.99	4.36	4.15	3.95	3.88	.12	.36
<u>57-137 days</u>								
Daily gain, lbs	3.28	3.18	3.61	3.88	3.51	3.42	.14	.50
Feed, lb DM lbs	21.9	21.7	23.9	23.9	21.7	20.8	.43	1.27
Feed/gain	6.74	6.86	6.62	6.15	6.18	6.08	.24	.71
<u>0-137 days</u>								
Daily gain, lbs	3.41	3.58	3.72	3.80	3.64	3.59	.09	.27
Feed, lb, DM lbs	19.6	19.6	21.0	20.3	19.0	18.4	.27	.79
Feed/gain	5.74	5.49	5.65	5.35	5.23	5.12	.12	.36
Liver abscesses	6	1	4	6	2	6		

[a]Standard error of the mean.
[b]Least significant difference among means ($p < .05$).

Table 3. Carcass data.

Ingredient	Diet							
	1.07% Urea	10.0% SBM	16% DDGS	16% WDGS	28% WDGS	40% WDGS	SE[a]	LSD[b]
Carcass wt, lb	819.6	833.0	860.5	854.3	845.4	831.5	6.45	19.2
Dressing %	61.0	61.1	62.1	61.1	61.8	60.9	.31	.93
Ribeye area, in^2	14.0	14.6	14.5	14.1	14.3	14.7	.24	.73
Fat cover, in	.32	.25	.37	.42	.33	.29	.04	.11
KHP fat, %	1.7	1.7	2.1	2.0	1.9	1.8	.08	.23
% Choice	41.7	33.3	29.2	37.5	33.3	25.0	10.3	30.6
No. choice	10	8	7	9	8	6		
No select	14	16	17	15	16	18		
Yield grade								
1	10	13	6	2	8	11		
2	10	9	14	15	11	9		
3	3	2	2	5	3	3		
4	1		2	1				
Calculated yield	2.26	1.97	2.49	2.69	2.34	2.06	.14	.41

[a]Standard error of the mean.
[b]Least significant difference among means ($p < .05$).