Value of Wet Distillers Grains in a Cattle Diet without Corn

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Summary

The potential of finishing cattle without grain was evaluated by comparing steers fed tub-ground grass hay and wet distillers grains (DGS) with steers fed a corn-based diet without DGS or the corn-based diet containing 40% DGS. The experiment was done with 24 head of 840 lb Angus steers fed each diet. The replacement of corn and protein supplement in the control diet with 40% wet DGS reduced feed intake and daily gain. The carcasses from steers fed DGS had reduced marbling and tended to have fewer Choice carcasses and lower carcass value determined with a marketing grid based on quality and yield grade. Substituting DGS for a portion of the corn and protein supplement in a corn-based diet resulted in reduced feed costs at all prices of corn evaluated ($2 to $4/bu). However the reduced feed cost of gain was more than offset by the decrease in carcass value. There was economic advantage of feeding the diet containing 40% DGS when corn price was greater then $3.50/bu and DGS was priced at 70% the cost of corn on a dry basis. Steers fed the hay and DGS diet gained less, had poorer feed conversion and required an additional 62 days to reach the same end live weight. These steers had acceptable grading carcasses (62% Choice) but less than carcasses from steers fed the control diet. Though feed costs and feed cost of gain were less for the steers fed hay and DGS, the cattle were not more profitable than either group of steers fed the corn-based diets at any price of corn ($2 to $4/bu) or wet DGS (1, 0.85 or 0.70 times the price of corn on a dry matter basis).

Introduction

Rising prices of crude oil since 2004 have provided incentives for increasing production of fuel ethanol from corn grain and thereby creating a new demand for corn and an increase in price of corn. It has been estimated that $60 per barrel crude oil price will result in $3.50 per bushel corn price compared with an average of $2.40 per bushel prior to 2004. An increase of $1.00 per bushel in corn price results in an increase of about $9.50 in feed cost/cwt gain. When distillers grains (DGS) are priced equal to corn on a dry matter basis, adding up to 20% of the diet dry matter as DGS to replace corn and protein supplement results in improved economic returns to cattle feeding, but at higher levels of inclusion the price of DGS should be less than corn to maintain economic returns. Based on its chemical composition, DGS is a nearly ideal supplement for lower quality roughages. Because starch is removed from corn during the fermentation to make ethanol it is not present in DGS to cause negative associative effects often observed when corn grain is used as supplement for roughages. Cattle feeding experiments are being conducted to determine if cattle can be finished without corn grain. Last year the results of two experiments in which modified wet DGS was used to supplement chopped grass hay or corn stalks were reported (AS Leaflet R2184, 2007). The objective of this study was to further evaluate wet DGS as a feed for supplementing lower quality grass hay when fed to steers with genetic potential for quality grade.

Materials and Methods

Angus steers with genetic potential for high quality grade were fed high-roughage diets to support gains of about 2 lbs/d for 100 days before this study. Seventy two steers with an average weight of 840 lbs were randomly allotted to12 pens for this experiment. Four pens were then randomly allotted to each diet. The steers were not implanted for the initial 100-d study or during this experiment.

The concentrate portion of each diet shown in Table 1 was prepared as a separate mix. The concentrate mixture, corn silage, tub-ground grass hay or wet DGS were weighed and mixed in a mixer wagon prior to delivery to the cattle. The starting weight of each steer was the average of two weights taken early in the morning on two consecutive days prior to feeding but with access to water. The cattle were fed twice per day and the amount of feed offered the cattle was gradually increased until their appetite was satisfied after which they were fed according to appetite. If the amount of feed consumed decreased, they were offered less feed and feed that accumulated in the bunks was removed and sampled for determination of dry matter. The mixed concentrate portion of the diets, corn silage, ground hay and wet distillers grains were periodically sampled for chemical analysis. Average dry matter of the DGS was 33.3%. Feed costs were calculated based on performance of the cattle and representative feed costs at the time the data were summarized (See footnote to Table 4).

The final weight of each steer was the average of weights taken before the morning feeding on two consecutive days. Daily gain for each steer was calculated from beginning and ending weights and the average daily gain calculated for each pen. Steers fed the corn-based diets were fed 142 days and those fed hay + DGS were fed 204 days. Weights of hot carcasses were taken after slaughter, and measurements on the carcasses were obtained following a 24-hr postmortem chill. Trained personnel called marbling score; percentage of kidney, pelvic and heart fat (KPH) and yield grade prior to the federal grader in the packing plant. Ribeye area (REA) and fat thickness over the ribeye between the 12^{th} and 13^{th} ribs on the left side of each carcass were measured.

Pen means were used as the experimental unit in the statistical analysis. Data were analyzed by analysis of variance. Main effects in the statistical analysis were diets. Differences were considered to be statistically significant at $P < .05$. Treatment means and probabilities of difference due to diet are presented.

Results and Discussion

Performance of the steers is summarized in Table 2. Feeding finishing steers 40% wet DGS replacing corn and protein supplement resulted in decreased feed intake and slower rates of gain. In previous experiments feeding 40% wet DGS has resulted in similar or reduced gain compared with cattle not fed DGS. Feeding hay and DGS resulted in slower rates of gain and poorer feed conversion compared with steers fed the corn-based diets with or without DGS.

The final live weights of the steers fed hay and DGS after they were fed an additional 62 days were not different from the steers fed the control corn-based diet. Though the steers fed hay + DGS had similar final live weight, carcass weights were less because of lower dressing percentage (Table 3). Average fat cover, REA and yield grades were similar among all three groups of steers. The genetic potential of these steers for quality grade was expressed, notably in the control steers which graded 100% low Choice or higher. Carcasses from steers fed DGS in the corn-based diet had less marbling compared with the control steers and lower average carcass grade (77% Choice). Marbling in carcasses from steers fed hay + DGS was not different from the steers fed DGS in the corn-based diet. Average values of the carcasses were $1.58, 1.56 and 1.54/lb for the steers fed the corn, corn + DGS and hay + DGS diets, respectively.

Feed costs ($/cwt of dry matter), total feed costs ($/steer) and feed cost of gain ($/cwt of gain) are summarized in Tables 4, 5 and 6, respectively. If wet DGS was priced equal to corn grain on a dry basis, feed costs were lower for steers fed the corn-based diet with wet DGS resulting in lower feed cost/cwt of gain. Cost of the hay + DGS diet was the lowest of the three diets, but feed cost of gain was highest for steers fed the hay + DGS diet when DGS was priced equal to corn. Feed cost of gain for steers fed the hay + DGS diet was never less than that for the steers fed corn + DGS at all prices evaluated. Compared with the control diet the cost of gain of the steers fed hay + DGS was less when corn cost $3.50 or more per bushel with DGS priced at 85% of corn and when corn cost more than $2.50 or more per bushel with DGS priced at 70% of corn.

At higher corn prices there were potential advantages of feeding DGS to decrease feed cost of gain. However the average carcass value of steers fed 40% wet DGS in the corn-based diet was $62.60 less than carcasses from the steers not fed DGS. The economic advantage of feeding this relatively high level of DGS in a corn-based diet occurred when corn price was $3.50 or higher per bushel and wet DGS was priced 70% of corn price. The lower carcass value and longer time in the feedlot negated any economic advantage of feeding the hay + DGS diet at all prices evaluated in this study.

Table 1. Formulated composition of diets (Dry basis).

	Diets		
	Corn	Corn + DGS	Hay + DGS
Dry rolled corn	80.79	46.85	2.30
Corn silage	8.00	8.00	
Ground hay	3.00	3.00	48.00
Cane molasses	0.67	0.37	0.03
Distillers grains		40.00	48.00
Urea	0.96		
Soybean meal	5.00		
Limestone	1.02	1.36	1.25
Sodium chloride	0.30	0.30	0.30
Potassium chloride	0.14		
Vitamin A premix[1]	0.08	0.08	0.08
Trace mineral premix	0.024	0.024	0.024
Rumensin premix[2]	0.0195	0.0195	0.0195

[1]Provided 1,400 IU of vitamin A activity per pound of diet dry matter.

[2]Provided 15.6 mg sodium monensin per pound of dry matter.

Implications

As price of corn increases, substituting relatively high levels of wet DGS for corn grain has potential to improve net returns to cattle feeding, but the cost of DGS on a dry basis should be less than the cost of corn. Based on results of this experiment it appears that no-grain diets based on grass hay and wet DGS can be fed to cattle to produce adequately grading carcasses, but feedlot performance and carcass value are sufficiently reduced to result in reduced returns to cattle feeding.

Acknowledgments

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Table 2. Performance of steers fed a conventional finishing diet with and without wet distillers grains compared with a diet without corn containing wet distillers grains and chopped grass hay.

	Diets			P[1]
	Corn	Corn + DGS	Hay + DGS	
Beginning wt, lbs	842	839	842	0.50
Ending wt, lbs	1268[a]	1216[bc]	1243[ac]	0.03
Days fed	142	142	204	
Gain, lbs/d	3.00[a]	2.65[b]	1.98[c]	0.001
Feed intake, lbs DM/d	21.4[a]	19.2[b]	20.1[b]	0.02
Feed/gain	7.16[a]	7.25[ab]	10.21[c]	0.001

[1]P is probability of a statistical difference.
[ab]Differences between means that do not have a common superscript are statistically significant (P < .05).

Table 3. Carcass measurement of steers fed corn-based diet with and without wet distillers grains compared with a diet without corn containing wet distillers grains and chopped grass hay.

	Diets			P[1]
	Corn	Corn + DGS	Hay + DGS	
Carcass wt, lbs	779.6[a]	753.8[ab]	735.9[b]	0.02
Dressing %	61.5[a]	62.0[a]	59.2[b]	0.001
Back fat, in	0.46	0.46	0.40	0.08
Ribeye area, sq in	12.6	12.3	13.1	0.08
KPH, %	2.4[a]	2.1[b]	2.0[b]	0.003
Marbling score[2]	617[a]	553[b]	530[b]	0.008
Avg called yield grade	2.67	2.68	2.67	0.99
Quality grades[3]				
Prime			1	
Choice +	1			
Choice	18	7		
Choice -	5	11	14	
Select		5	9	
% USDA Choice	100	76.7	62.5	0.04
Yield grades				
1		1		
2	10	5	8	
3	12	17	16	
4	2			
Carcass value[4], $	1234.89[a]	1172.29[ab]	1129.90[b]	0.009

[1]P is probability of a statistical difference.
[2]Marbling score, 400 = Slight[0], 500 = Small[0], 600 = Moderate[0].
[3]Percentages of carcasses eligible for CAB were 79.2, 30.4 and 0 for corn, corn + DGS, and hay + DGS, respectively.
[4]Grid: $154/Cwt for USDA Choice- YG 3; quality grade: Prime +$19, CAB +$5.46, Select -$5.80; and yield grade: YG 1 +$6.5, YG 2 +$2.5, YG 4 -$15.
[ab]Differences between means that do not have a common superscript are statistically significant (P < .05).

Table 4. Feed costs in relation to cost of corn and price of distillers grains.

Corn, $/bu	Price distillers grains[1]	Diets		
		Corn	Corn + DGS	Hay + DGS
		Feed cost[2], $/cwt of diet dry matter		
2.00		5.04	4.28	4.23
2.50		5.91	5.20	4.74
3.00	1.0	6.77	6.13	5.25
3.50		7.63	7.05	5.76
4.00		8.49	7.97	6.27
2.00		5.04	4.03	3.94
2.50		5.91	4.90	4.38
3.00	0.85	6.77	5.76	4.81
3.50		7.63	6.62	5.25
4.00		8.49	7.49	5.69
2.00		5.04	3.79	3.65
2.50		5.91	4.59	4.01
3.00	0.70	6.77	5.40	4.38
3.50		7.63	6.20	4.74
4.00		8.49	7.00	5.10

[1]Price of distillers grains on a dry basis expressed as 1.0, 0.85 or 0.70 times the cost of corn on a dry basis. The calculated cost of wet DGS (33% DM) compared with corn (88% DM) at $3, 3.50 and 4.00/bu were $40.18, 46.88 and 53.57 (1 x cost of corn), $34.15, 39.84 and 45.54 (0.85 x cost of corn) and $28.13, 32.81 and 37.50 (0.7 x cost of corn).

[2]Feed costs other than corn and DGS were as follows: corn silage, 8 x cost corn ($/bu) + 5; tub-ground hay, $70/ton; soybean meal, $300/ton; urea, $375/ton; molasses, $175/ton; minerals and other supplemental ingredients, $400/ton.

Table 5. Feed cost per steer in relation to cost of corn and price of distillers grains.

Corn, $/bu	Price distillers grains[1]	Diets		
		Corn	Corn + DGS	Hay + DGS
		Feed cost[2], $/head		
2.00		153.53	116.69	173.69
2.50		179.81	141.92	194.64
3.00	1.0	206.08	167.14	215.58
3.50		232.36	192.37	236.53
4.00		258.63	217.59	257.47
2.00		153.53	110.05	161.70
2.50		179.81	133.61	179.65
3.00	0.85	206.08	197.59	218.30
3.50		232.36	180.74	215.54
4.00		258.63	204.30	233.49
2.00		153.53	103.41	149.71
2.50		179.81	125.31	164.66
3.00	0.70	206.08	147.21	179.61
3.50		232.36	169.11	194.55
4.00		258.63	191.01	209.50

[1]Price of distillers grains on a dry basis expressed as 1.0, 0.85 or 0.70 times the cost of corn on a dry basis.
[2]Feed costs other than corn and DGS are given in Table 4.

Table 6. Feed cost of gain in relation to cost of corn and price of distillers grains.

Corn, $/bu	Price distillers grains[1]	Diets		
		Corn	Corn + DGS	Hay + DGS
		Feed cost[2], $/cwt gain		
2.00		36.09	31.01	43.19
2.50		42.27	37.72	48.40
3.00	1.0	48.45	44.42	53.61
3.50		54.62	51.12	58.82
4.00		60.80	57.83	64.03
2.00		36.09	29.25	40.21
2.50		42.27	35.51	44.67
3.00	0.75	48.45	41.77	49.14
3.50		54.62	48.03	53.60
4.00		60.80	54.30	58.06
2.00		36.09	27.48	37.23
2.50		42.27	33.30	40.94
3.00	0.50	48.45	39.12	44.66
3.50		54.62	44.94	48.38
4.00		60.80	50.77	52.10

[1]Price of distillers grains on a dry basis expressed as 1.0, 0.85 or 0.70 times the cost of corn on a dry basis.
[2]Feed costs other than corn and DGS are given in Table 4.