

Relative Feeding Value of Wet Corn Steep Liquor When Fed to Finishing Cattle

A.S. Leaflet R1773

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Summary

Corn steep liquor is a liquid by-product containing condensed steep water and condensed distillers solubles from a wet corn milling plant. Finishing steers weighing nine hundred and seventy-five pounds were fed corn-based finishing diets containing 0%, 6%, or 12% corn steep liquor for 84 days. Feeding corn steep liquor did not affect performance of the steers or carcass characteristics. Based on value of feeds replaced in the diet, steep liquor had a value of \$55 to \$60/ton (50% dry matter) when used to replace corn and supplemental protein in a corn-based finishing diet.

Introduction

Corn steep liquor is a liquid by-product containing condensed steep water and condensed distillers solubles from a wet corn milling plant. This feed typically contains about 50% solids and 20% crude protein, so it has potential value as a livestock feed. In a previous experiment, feeding 10% of diet dry matter as steep liquor in a corn-based diet containing alfalfa pellets as roughage resulted in about a 5% improvement in feed efficiency, with no significant effects on carcass value (A.S. Leaflet R1630, 1999). The purpose of this experiment was to confirm the earlier observations and to study the response to feeding lower and higher levels of steep liquor in a corn-based diet with corn silage and chopped hay as roughage.

Materials and Methods

Seventy-two crossbred steers, predominantly black and black-white face, with an average weight of 850 lbs. each were divided into weight outcome groups and randomly allotted from these groups to 12 pens of 6 steers each. Four pens of cattle were randomly allotted to each of 3 diets shown in Table 1. The 3 dietary treatments were the control diet, 6.0% steep liquor, and 12.0% steep liquor. The corn was processed in a roller mill to break or crack a majority of the kernels. The mixed-grass hay was ground through a 2-in. screen. The concentrate portion of the diets was prepared as a mix in a stationary horizontal mixer and weighed in a mixer wagon separately from the corn silage and ground hay. After mixing, total mixed diets were fed to the cattle twice per day. Periodically the mixed diet, corn silage, hay, and steep liquor were sampled to determine dry matter and crude protein. Feed removed from the bunks was sampled to determine dry matter. After all the cattle

had been fed the control diet for 42 days, steep liquor was added to the feed. At this time, the average weight of the steers was 975 lbs. The steers had been implanted, mostly with Ralgro[®], prior to purchase and were implanted with Component TE-S[®] with Tylan 21 days prior to feeding of steep liquor.

The steers were sold in 2 groups 5 days apart to facilitate collection of carcass data. The 3 diet treatments were equally represented in each sale group. The steers were fed an average of 126 days, having been fed steep liquor 84 days. Weights of hot carcasses were taken after slaughter, and measurements on the carcasses were obtained after 24-hr. postmortem chill. The federal grader called marbling and yield grades. Ribeyes between the 12th and 13th ribs on the left side of the carcass were photographed with a digital camera, and fat thickness and muscle area measured using a calibrated computer software program.

The economic value of steep liquor was established by calculating the monetary value of the feeds replaced by addition of steep liquor to the control diet. The cost of each ingredient was calculated on an individual steer basis by the following equation: Average gain (lbs.) x feed/gain x percentage of ingredient in the diet (% of dry matter) x cost of ingredient (\$/lb. dry matter). The sum of the costs of individual ingredients equaled the total feed cost for a steer. The difference in total feed cost between the control and the experimental diets divided by the quantity of steep liquor fed to finish the average steer equaled the value of steep liquor on a dry basis. Average gain used in this calculation was the average gain of all the steers. Feed/gain used in the calculation was the average for each diet. Feed costs for the primary ingredients were corn, \$2.00/bu.; corn silage, \$25/ton; hay, \$75/ton; molasses \$100/ton; and urea, \$288/ton.

Pen means were used as the experimental unit in the statistical analysis. Data were analyzed as a completely randomized design, with 4 replications (pens) per treatment, by analysis of variance and standard errors of the means calculated.

Results and Discussion

Addition of steep liquor to the diets had no significant effects on feedlot performance of the steers (Table 2). The average daily gain, feed dry matter intake, and feed required per pound of gain for all the steers were, respectively, 3.56, 22.6, and 6.37 for the 84-day period steep liquor was fed. There were no differences in performance of steers fed 6% or 12% steep liquor. Feeding steep liquor to these steers did not significantly affect carcass weight or carcass characteristics (Table 3). Steers fed steep liquor had fewer

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USDA average Choice carcasses but somewhat improved yield grades compared with those fed the control diet.

The calculated replacement value of steep liquor as a feed ingredient at 6% and 12% of the dry matter in the finishing diet was \$52.50 and \$59.30/ton of material containing 50% dry matter. This is a break-even cost compared to the control diet and would have to include cost of shipping, storage, and handling. In order to realize this

value when fed to cattle, adjustments in the diets (Table 1) must be made so steep liquor is replacing energy (corn and molasses) and supplemental nitrogen (urea). Steep liquor replaced cane molasses, some corn, and some urea in the diets in this experiment. Frequently there are benefits from addition of wet feeds to dry diets for beef cattle. There may be increased value of steep liquor if compared to a dry control diet.

Table 1. Rations for corn steep liquor study (dry matter basis).

Ingredient	Rations		
	Control	6% steep liquor	12% steep liquor
		----- % of DM -----	
Cracked corn	81.39	76.88	71.26
Steep liquor		6.0	12.0
Corn silage	10.0	10.0	10.0
Chopped hay	5.0	5.0	5.0
Molasses	0.75		
Urea	0.86	0.31	
Limestone	0.92	1.23	1.32
Dicalcium Phosphate	0.63	0.16	0
Salt	0.30	0.30	0.30
Vitamin A ^a	0.08	0.08	0.08
Trace minerals	0.024	0.024	0.024
Rumensin ^{®b}	0.0195	0.0195	0.0195
Elemental sulfur	0.0276		

^aProvided 1,400 IU of vitamin A activity per pound of dry matter.

^bProvided 15.6 mg sodium monensin per pound of dry matter.

Table 2. Performance of yearling steers fed corn steep liquor.

Item	Rations			SEM
	Control	6% steep liquor	12% steep liquor	
Starting wt., lbs.	980	974	974	21.1
Ending wt., lbs.	1286	1266	1272	32.5
Days fed	84	84	84	
Daily gain, lbs.	3.64	3.48	3.55	0.163
Feed DM per day, lbs.	23.1	22.4	22.2	0.66
Feed/gain	6.37	6.47	6.26	0.170

^aStandard error of mean. Differences in performance were not statistically significant ($P > .05$).

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Table 3. Effects of feeding corn steep liquor on carcass measurements of yearling steers.

Item	Rations			SEM ^a
	Control	6% steep liquor	12% steep liquor	
Carcass wt., lbs.	779.6	773.2	771.2	18.06
Dressing percent	60.5	61.4	60.6	0.29
Fat thickness, in	0.35	0.34	0.34	0.025
Ribeye area, sq in	13.3	13.3	13.5	0.325
Marbling ^b	530	504	510	25.5
Carcass grades				
Percent Choice	23.8	12.5	12.5	
Percent Choice -	33.3	41.7	37.5	
Percent Select	42.9	45.8	50.0	
Percent Yield Grade 1	9.5	20.8	29.2	
Percent Yield Grade 2	71.4	58.3	62.5	
Percent Yield Grade 3	14.3	20.8	8.3	
Percent Yield Grade 4	4.8			
Called yield grade	2.17	2.00	1.79	0.15

^aStandard error of mean. Differences in carcass measurements were not statistically significant ($P > .05$).

^b500 = Small⁰, 400 = Slight⁰.

Implications

The results of this study suggest that corn steep liquor has value to replace a portion of the corn and supplemental nitrogen in finishing diets for beef cattle and can be fed to replace up to 12% of diet dry matter without affecting performance or carcass value.

Acknowledgments

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