

Effects of Replacing Corn Grain and Urea With Condensed Corn Distillers Solubles on Performance and Carcass Value of Finishing Steers

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Summary

Ninety-six yearling steers weighing 850 lbs were used in a study to evaluate condensed distillers solubles (CDS) for a dry mill corn processing plant as a replacement for a portion of the corn grain and supplemental nitrogen in a finishing ration supplemented with urea. Condensed distillers solubles were fed at 0%, 4%, 8% and 12% of ration dry matter in a 109-day experiment. Feeding CDS at these levels had no effect on performance of the cattle, carcass measurements or carcass value in a value-based grid. The calculated replacement value of CDS in this study was considerably less than observed in two previous experiments, likely due to experimental variation or possibly variability of CDS among processing plants. Based on the results of the three experiments, CDS has value as a feed for finishing cattle and its relative energy value is equal to or greater than corn grain. When justified based on cost of CDS compared with corn and protein supplement, CDS can be fed to finishing cattle without reducing performance or carcass value.

Introduction

New dry mill corn processing plants are being built to increase production of fuel ethanol. The coproducts of ethanol production from corn grain have been shown to be excellent feeds for cattle and swine. Condensed distillers solubles (CDS) is a coproduct derived from condensing thin stillage, which remains after removing the ethanol and wet grain fraction from the fermentation of grain. A portion of CDS is added back to the wet grains to produce distillers grains with solubles. Many plants have excess CDS. Condensed distillers solubles contains about 30% dry matter but is a liquid product. Based on nutrient composition, CDS would be considered as a source of energy and protein in a beef ration. In a previous study feeding 6.5% of the ration dry matter as distillers solubles resulted in improved gain and feed efficiency of finishing heifers (A.S. Leaflet 1451, 1997). In another study with finishing steers, feeding 4% of ration dry matter as CDS improved feed efficiency 5%, but feeding 8% CDS resulted in decreased feed intake and gain (A.S. Leaflet 1772, 2002). The purpose of this study was to conduct another study to establish the feeding value of CDS for finishing steers. If CDS has value as a feed for cattle, it

could be marketed as an ingredient distinct from distillers grains with solubles.

Materials and Methods

Ninety-six Charolais crossbred and Angus steers weighing 850 lbs were divided into six weight outcome groups. Steers were randomly allotted from the weight outcome groups to sixteen pens of six steers each. Four pens of cattle were allotted to each of four experimental treatments. The average of two weights taken on consecutive days was used as the starting weight. Two weights taken on consecutive days at the end of the trial were averaged and used as the final end weight. The steers were implanted with Component TE-S on the first day of the study. Five steers had to be removed from the study for reasons not related to the experiment. Not more than one steer was removed from a pen. The steers were fed 109 days.

The four experimental treatments were 0%, 4%, 8% and 12% CDS. The control ration was supplemented with urea. 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 grain, supplement and a portion of the CDS was prepared as a mix and weighed separately from the corn silage, ground hay and the remainder of the CDS in a mixer wagon. After mixing, total mixed rations were fed to the cattle twice per day. Periodic samples of the mixed portion of the ration, corn silage, hay and CDS were sampled for determination of dry matter. Feed removed from the bunks was sampled for determination of dry matter.

The steers were sold in one group to a commercial beef packing plant. Weights of hot carcasses were taken after slaughter, and grades of the carcasses were obtained after 24-hr postmortem chill. A federal beef grader called marbling and yield grades. Dressing percents were calculated using hot carcass weights and the final live weights taken at the research farm. Carcass value was based on the following pricing grid (\$/cwt of carcass): \$127.79 for Low Choice; yield grade 3 with premiums of \$14.50 for Prime; \$10.00 for average Choice and Choice⁺; \$6.50 for yield grade 1; \$2.50 for yield grade 2, and discounts of -\$13.45 for Select and -\$15.00 for yield grade 4.

The economic value of wet distillers solubles was established by calculating on an individual steer basis the value of the feeds replaced by addition of distillers solubles to the control ration. The cost of each ingredient to finish the steer was calculated by the following equation: Average gain (lbs) x feed/gain x percentage of ingredient in the ration (% of dry matter) x cost of ingredient (cost/lb dry

matter). The sum of the costs for individual ingredients equaled the total feed cost for the average steer. The difference in total feed costs between control and the experimental rations divided by the quantity of dry distillers solubles fed to finish the average steer equaled the value of distillers solubles on a dry basis. Weight gain used in this calculation was the average gain of the steers fed a

particular ration. Feed/gain used in the calculation was the average for each ration. Feed costs for the primary ingredients were: corn, \$2.30/bu; corn silage, \$22/ton (35% DM); hay, \$65/ton; molasses, \$100/ton; and urea, \$350/ton.

Pen means were used as the experimental unit in the statistical analysis. Data were analyzed by analysis of variance and standard error of the means calculated.

Table 1. Rations for wet distillers solubles study (Dry Matter Basis)

	Rations, % Condensed distillers solubles			
	0	4	8	12
		----- % of DM -----		
Rolled corn	86.23	83.33	79.74	76.13
Distillers solubles		4.00	8.00	12.00
Corn silage	5.00	5.00	5.00	5.00
Chopped hay	5.00	5.00	5.00	5.00
Molasses	0.75			
Urea	1.36	1.05	0.75	0.45
Limestone	1.00	1.00	1.00	0.97
Salt	0.30	0.30	0.30	0.30
Potassium chloride	0.21	0.15	0.05	
Trace minerals ^a	0.024	0.024	0.024	0.24
Vitamin A ^b	0.08	0.08	0.08	0.08
Rumensin ^c	0.0195	0.0195	0.0195	0.0195
Elemental sulfur	0.0437	0.0338	0.0241	0.0145

^aThe trace mineral premix contained: (%) Ca 13.2, Co 0.10, Cu⁺⁺ 1.5, Fe⁺⁺ 10.0, Fe⁺⁺⁺ 0.44, I 0.20, Mn⁺⁺ 8.0, S 5.0, and Zn 12.0.

^bThe premix contained 3.85 million IU of vitamin A (as retinyl palmitate) per kg, providing 1,400 IU of vitamin A per pound of dry matter in the ration.

^cThe premix contained 176.2 g sodium monensin per kg, providing 15.6 mg of sodium monensin per pound of dry matter in the ration.

Results and Discussion

Feedlot performance of the steers is summarized in Table 2. Replacing a portion of the corn grain and urea in the control ration with CDS did not significantly change feed intake, average daily gain or feed efficiency. The steers had excellent gains, averaging 3.9 lbs/d with a feed conversion of 5.4 lbs of feed dry matter per pound of gain. Feed cost per hundred pounds of gain were \$25.10, \$25.50, \$25.70 and \$24.20 for 0%, 4%, 8% and 12% CDS (Pricing CDS at \$25/ton with 30% DM), respectively.

Carcass weights, dressing percentage, marbling and distribution of carcass quality grades and yield grades were not affected by feeding CDS at 4%, 8% or 12% of rations dry matter. The average quality grade of all steers was 89% Choice⁺ or better (Small⁰ or more marbling) and 70% yield grades 1 and 2.

The calculated replacement value for CDS (30% moisture) were -\$1.15, \$14.82 and \$27.12 per ton when fed at 4%, 8% and 12% of ration dry matter, respectively. These replacement values were considerably less than observed in

previous experiments designed to evaluate the value of CDS as a cattle feed. Using the same feed prices, replacement value of CDS was \$88.00/ton when fed at 6.5% of ration dry matter (A.S. Leaflet 1451, 1997) and \$54.90 and \$67.90/ton when fed at 4% and 8% of ration dry matter (A.S. Leaflet 1772, 2002). We suspect that the value of CDS in cattle finishing rations was overestimated in the first experiment (A.S. Leaflet 1451, 1997) and underestimated in this experiment. Our three studies have been conducted with different sources of CDS. There might be some variation in CDS among dry mill corn processing plants depending on centrifuges and condensing temperatures. Never the less, CDS has been found to have relative energy values equal to or greater than dry rolled corn in the three studies. Another advantage of feeding CDS might be the addition of moisture to reduce dust and to condition dry rations.

Over all three experiments, carcass measurement and grades were not affected by feeding CDS to finishing cattle. Cattle feeders should be confident that carcass value in pricing grids would not be affected by feeding CDS.

Table 2. Performance of yearling steers fed condensed distillers solubles.

Item	Rations, % Condensed distillers solubles				SEM ^a
	0	4.0	8.0	12.0	
Starting wt, lbs	849	850	861	858	4.0
Ending wt, lbs	1269	1278	1283	1289	14.8
Days fed	109	109	109	109	
Daily gain, lbs	3.86	3.92	3.87	3.95	0.124
Feed DM per day, lbs	20.0	21.1	21.3	20.8	0.31
Feed/gain	5.21	5.40	5.51	5.27	0.109

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

Table 3. Effects of feeding wet distillers solubles on carcass measurements of yearling steers.

Item	Rations, % Condensed distillers solubles				SEM ^a
	0	4	8	12	
Number carcasses	22	23	22	24	
Carcass wt, lbs	770	767	780	774	7.6
Dressing percent	60.6	60.1	60.8	60.1	0.37
Marbling ^b	585	546	587	563	22.9
Carcass grades					
Percent Choice ⁺	9.1	4.3	13.6	16.7	
Percent Choice	22.7	4.3	22.7	8.3	
Percent Choice -	50.0	78.3	50.0	58.3	
Percent Select	18.2	13.0	13.6	16.7	
Percent Yield grade 1	4.6	4.3			
Percent Yield grade 2	63.6	69.6	68.2	70.8	
Percent Yield grade 3	31.8	26.1	31.8	29.2	
Called yield grade	2.28	2.20	2.32	2.29	0.12
Carcass value, \$	1005.70	990.00	1002.66	1023.64	14.58

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

^b500 = Small⁰, 400 = Slight⁰.

Implications

The results of this study suggest that corn distillers solubles can replace a portion of the corn and supplemental nitrogen in finishing rations for beef cattle without affecting performance or carcass value.

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