Impact of Feeding Alkaline-Treated Corn Stover at Elevated Amounts in Commercial Feedlot Cattle

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Summary

*A commercial trial was conducted to compare feeding 20% alkaline treated corn stalks (**TRT**) in place of 14% dry-rolled corn and 6% native stalks (**CON**). Both diets contained dry-rolled corn (40 or 54%), 35% wet distillers grains plus solubles, and 5.17% supplement. Alkaline treatment was performed by adding 5% calcium oxide to 95% ground corn stalks (DM basis) and water to equal 50% DM. Cattle fed TRT had lower ADG and poorer F:G with equal DMI. The changes in gain were due to lower live and carcass weights. Carcass quality was impacted subtly, and reflects the lower gain with equal days fed between the two treatments.*

Introduction

Alkaline treatment of forages improves fiber digestibility by disrupting bonds. Treating crop residues was researched heavily in the 1970s to improve forage quality and cost effectiveness. With recent increases in commodity prices, there is renewed interest in applying this to feedlot diets today that include wet distillers grains plus solubles. In four of five controlled UNL feedlot trials, performance was similar between feeding 20% treated stalks and 5 to 10% untreated roughage in diets with 40% distillers grains (*2013 Nebraska Beef Cattle Report*, pp. 70-73; *2012 Nebraska Beef Cattle Report*, pp. 106-107; *2012 Nebraska Beef Cattle Report*, pp. 108-109; *2014 Nebraska Beef Cattle Report*, pp. 72-74). However, in one yearling study, a significant 6.7% increase in F:G was observed when compared to a 5% untreated stalk control (*2013 Nebraska Beef Cattle Report*, pp. 70-73). Treatment process in all of these university trials included 5% CaO (Mississippi Lime, StoverCalO, granulated quicklime) with 95% corn stalks (DM basis) and then mixed with enough water to produce a final mix that was 50% DM. No data are available using commercial treatment technologies and mixing and storing for seven days prior to feeding. Likewise, no data are available on commercial feedlot performance using alkaline treated stalks in place of a portion of corn. Therefore, the objective was to evaluate feedlot performance and carcass characteristics when 20% treated stalks were fed compared to a conventional control ration.

Procedure

This study was completed at a commercial feedlot in Northeast Colorado (Timmerman Feeding Co., Sterling, Colo.). Steers were received and processed in two separate groups and blocked by source. Block 1 consisted of 513 yearling steers originating from the Northern Plains, weighing 805 lb across eight pens. Block 1 steers were started on June 6, 2012, and fed 141 days to Oct. 24, 2012. Block 2 steers were yearling steers of Mexican origin weighing 750 lb across eight pens. Block 2 steers were started on June 13, 2012, and fed 153 days to Nov. 11, 2012. Steers in both blocks were fed a common distillers grains-based grower ration until the respective day of treatment initiation, upon which steers were removed from pens and alley-sorted two steers each way until pen replicates were filled. Steers were then uniquely identified with numbered tags, vaccinated with Pyramid® 5 (Zoetis Animal Health) and treated for internal and external parasites with an injection of Cydectin® (Zoetis Animal Health) and an oral dose of Safe-Guard® (Merck Animal Health). Steers were also given a Revalor-XS implant (Merck Animal Health). Following processing, steers were pen weighed and these weights served as initial weight for each pen replicate. Initial weights were assumed to be shrunk, so no pencil shrink was assigned to initial pen weights.

Two treatments were evaluated in this study with eight pen replicates per treatment, four within each block. The study design was a randomized block design with 16 total pens, two blocks with four replications per block, and eight total replications per treatment. Diets included a control (CON) with 6% stalks, 35% wet distillers grains plus solubles, dry-rolled corn and supplement compared to a diet with 20% alkaline treated corn stalks, 35% wet distillers grains plus solubles, dry-rolled corn and supplement (TRT; Table 1). Treated stalks replaced untreated stalks and dry-rolled corn. The only other difference between the two diets was that limestone was not included in the supplement for TRT, as calcium was provided by the alkaline-treated corn stalks.

Alkaline-treated stalks were provided by a nearby commercial feedlot that was treating stalks on a weekly basis. The treatment process utilized a Roto Grind (Burrows Enterprises, Greeley, Colo.) where ground corn stalks (4 inch tub ground) were added to the Roto Grind. During grinding, water and calcium oxide (Stover CalO, Mississippi Lime, St. Louis, Mo.) were added using a continuous flow system developed by Performance Plus Liquids (Palmer, Neb.). This system targets adding water to reach a final DM of 50% in the treated stalks and 5% calcium oxide on a DM basis. The calcium oxide product, Stover CalO, is granular, pure, reactive calcium oxide or quicklime that has particles

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less than ¼ inch. Following treatment and grinding, stalks were stored in a loosely packed pile for 7 to 14 days prior to feeding.

Both finishing diets included similar feed additives added via a micro nutrient machine. Targeted consumptions for Rumensin® (340 mg/steer), Tylan® (80 mg/steer), vitamin A (30,000 IU/steer), vitamin D (3,000 IU/steer), and vitamin E (100 IU/steer) were equal across treatments.

After initial BW were collected, steers were adapted to finishing diets. Grain adaption was slightly different between the two treatments due to a greater amount of stalks included in TRT. For the CON treatment, steers were fed three grain adaptation diets prior to the finishing diet, containing 45 and 33% alfalfa hay for steps 1 and 2, respectively. Step 3 contained 14% alfalfa hay and 5% untreated stalks, whereas the CON finishing ration contained 6% untreated stalks, all on a DM basis. The TRT fed cattle were adapted using two adaptation diets prior to the finishing ration. Alfalfa hay was fed at 25, 13, and 0% while treated stalks were kept constant at 20% inclusion in all steps. For both treatments, each adaptation diet was fed five full days followed by 1-3 days of transition between steps. As a result, cattle fed TRT were adapted to their final diet eight days faster than CON and using less alfalfa hay.

When visually appraised as being finished across treatments within a block, steers were removed from pens, weighed live at the pen scale and shrunk 4%, and shipped by entire blocks for slaughter (Cargill Meat Solutions, Fort Morgan, Colo.). On day of slaughter, hot carcass weights were collected. Following a 24-hour chill, fat depth, *Longissimus* muscle area, called USDA Quality Grade, and called USDA Yield Grade were collected on a pen basis.

Table 1. Diets fed to finishing steers comparing 6% stover (CON) to 20% alkaline-treated stover (TRT).

Ingredient	CON	TRT
Dry-rolled corn	53.83	39.83
Wet distillers grains plus solubles	35.0	35.0
Corn stalks, ground	6	—
Treated stalks, ground	—	20.0
Liquid supplement	5.17	5.17
Nutrient composition, formulated (actual)		
DM	50.88 (49.5)	47.03 (47.9)
CP	16.3 (18.5)	15.8 (18.0)
Ca	0.67 (0.72)	0.87 (1.08)
P	0.44 (0.53)	0.41 (0.50)
K	0.79 (1.00)	0.96 (1.15)
S	0.37 (0.37)	0.38 (0.36)

Table 2. Performance and carcass characteristics of commercial feedlot steers fed either alkaline treated corn stover at 20% of diet DM (TRT) or a conventional control with 6% stover (CON) blocked by two different types of steers and arrival date.

				P-values[1]		
	CON	**TRT**	SEM	Diet	Block	Int.
Performance						
Initial no., n	593	595	—	—	—	—
Slaughter no., n	592	594	—	—	—	—
Pens, n	6	6	—	—	—	—
Days of Feed	147	147	—	—	—	—
Initial BW, lb	780	775	8	0.70	<0.01	0.98
DMI, lb/day	23.36	23.58	0.23	0.53	<0.01	0.44
Live						
Final BW, lb	1372	1353	10	0.19	<0.01	0.52
ADG, lb	4.04	3.94	0.03	0.06	<0.01	0.24
F:G	5.79	5.99	0.05	0.01	<0.01	0.97
Carcass-adjusted						
Final BW, lb	1401	1370	10	0.04	<0.01	0.25
ADG, lb	4.25	4.05	0.04	<0.01	<0.01	0.05
block 1	*4.68*	*4.36*	*0.06*			
block 2	*3.81*	*3.75*				
F:G	5.53	5.83	0.05	<0.01	<0.01	0.37
Total Gain, lb	622	594	6	<0.01	<0.01	0.07
block 1	*660*	*616*	*8*			
block 2	*584*	*573*				
Carcass Characteristics						
Hot Carcass Weight	882.8	862.9	6.3	0.04	<0.01	0.25
Dressing %	64.35	63.78	0.09	<0.01	0.05	0.03
block 1	*64.65*	*63.75*	*0.13*			
block 2	*64.05*	*63.80*				
Fat Depth	0.513	0.488	0.009	0.07	<0.01	0.19
Ribeye Area	13.33	13.08	0.10	0.11	0.32	0.73
Yield Grade	3.29	3.21	0.05	0.29	<0.01	0.29
Quality Grade Distribution						
% Prime	0.45	0.30	0.16	0.53	<0.01	0.53
% Choice	57.94	51.74	1.70	0.02	0.03	0.17
% Select	38.66	42.64	1.53	0.09	<0.01	0.64
% < Standard	2.95	5.33	1.07	0.14	0.04	0.15

[1]*P*-values for effect of diet (CON vs TRT), block, and interaction (Int.) between block and diet.

Results

Cattle performance and carcass characteristics are provided in Table 2. Steers had similar (P =0.98) initial BW as expected when assigned in sorting alleys. Steers had similar DMI between treatments ($P = 0.23$) and consumed approximately 2.14% of BW for CON steers and 2.20% of BW for TRT using average of initial and carcass-adjusted final BW. On a live basis, steers fed TRT were 19 lb numerically lighter ($P = 0.19$) in shrunk live BW at the end of the feeding period compared to CON. As a result, ADG was decreased by feeding TRT compared to CON ($P = 0.06$) and cattle were less efficient ($P = 0.01$), with a 0.20 increase in F:G.

Carcass weights were 20 lb lighter ($P = 0.04$) for TRT fed steers compared to CON. Therefore, when performance was adjusted for 63% dress final BW, ADG was decreased ($P < 0.01$) by 0.20 lb/day for TRT compared to CON. Less gain resulted in poorer F:G for TRT steers compared to CON ($P < 0.01$). There was a significant block by treatment interaction for carcass-adjusted ADG, which was tested due to four replications per block. Feeding TRT decreased ADG by 0.32 lb/day in block 1 (northern cattle) whereas ADG only decreased by 0.06 lb/day in block 2 (Mexican cattle) compared to CON.

Similar to carcass-adjusted ADG, there was a decrease in dressing percentage caused by feeding TRT; however, there was an interaction between block and dietary treatment. Dressing percentage for steers in block 1 were impacted by dietary treatment more than steers in block 2, with a 0.9 percentage unit decrease by feeding TRT compared to CON for block 1 and only a 0.25 percentage unit decrease in dressing percentage for block 2. Other carcass characteristics reflect the performance results. In general, feeding TRT tended to decrease fat depth ($P = 0.07$) and LM area ($P = 0.11$), and decreased percent USDA Choice grade ($P = 0.02$) compared to CON. These data likely reflect the lower ADG observed with feeding TRT as all cattle were slaughtered at one time point within blocks and were equal across dietary treatment.

As a general rule, feeding TRT resulted in lighter carcasses, and lower dressing percentage. With no change in intake, the decrease in ADG resulted in poorer feed conversions and some subtle impacts on carcass quality, which reflect poorer ADG.

It is unclear the cause of the depression in ADG observed in this commercial study relative to previous research. One of the five experiments conducted at UNL matches these results where feeding 20% treated stalks did not result in similar performance. Interestingly, similar to the current study, that particular study (*2013 Nebraska Beef Cattle Report*, pp. 70-73) was conducted with yearlings fed in the summer and resulted in a 6.7% increase in F:G for steers fed 20% treated stalks. For comparison, in the current study we observed a 5.4% increase in F:G when steers were fed TRT compared to CON. It is unclear if cattle type, season, or some other variable impacts cattle performance when replacing corn with alkaline treated stalks.

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