Alkaline Treated Wheat Straw or Corn Stover Fed to Growing Calves

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Summary

Four hundred sixty steer calves were fed CaO treated (5% of DM) or untreated wheat straw and corn stover with wet distillers grains plus solubles (WDGS) during a 69-day growing study. An interaction between crop residue and alkaline treatment was observed for ending BW and ADG. The relative response in ADG and ending BW due to alkaline treatment was greater for wheat straw compared to corn stover. Steers fed wheat straw diets had greater DMI and improved F:G compared to corn stover diets. Alkaline treatment increased DMI and improved F:G, although the F:G response was small. Growing calves on untreated residue diets may be more economical.

Introduction

Utilizing crop residues for growing calves has the potential to be economical when fed with distillers grains. Previous research with wheat straw (*2009 Nebraska Beef Cattle Report*, pp. 35-36) and corn stover (*2009 Nebraska Beef Cattle Report*, pp. 30-32) found increased ADG and improved F:G when inclusion levels of WDGS increased in growing calf diets. Another option to increase ADG and improve F:G may be growing cattle on alkaline treated residue. The objective of this trial was to evaluate treated wheat straw or corn stover in growing calf diets.

Procedure

This experiment utilized 460 steers (initial BW: 729 ± 44 lb). Steers were received during the fall of 2011 and grazed corn stalks from late November until start of the experiment (Feb. 23, 2012). Corn stover was treated using CaO (standard quicklime; Mississippi Lime Company, Kansas City, Mo) and carried out using a patented process with successive tub grinders (Performance Plus Liquids, Inc., Palmer, Neb). Wheat straw was treated with CaO every two weeks similar to as described in previous reports (*2012 Nebraska Beef Cattle Report*, pp. 106-107; pp. 108-109). In both corn stover and wheat straw treatments, the mixture was calculated to be 50% DM with calcium oxide added at 5% of the total DM. Treated corn stover and treated wheat straw DM averaged 57.6 and 49.6%, respectively. Treated corn stover and wheat straw were stored anaerobically in silage bags throughout the trial. The authors recognize that methodology to apply alkaline treatment is a critical factor to be considered. Correspondingly, since two types of processes were used to treat corn stover and wheat straw, this could potentially influence the response to treatment and results. Steers were limit-fed a mix of 47.5% alfalfa hay, 47.5% wet corn gluten feed, and 5.0% supplement at 2% of BW for five days prior to trial initiation and five days following to equalize gut fill. Steers were weighed two consecutive days following five days of limit-feeding at initiation and at the end of the trial. This trial was designed as 2 x 2 factorial with factors consisting of alkaline treatment (CaO+ H_2O vs. none) and residue (corn stover vs. wheat straw). There were three initial weight blocks, six replications per treatment, and 19 steers per pen. Diets (Table 1) were offered *ad libitum* to steers once daily. Treated diets contained sufficient Ca (3.35% from CaO treatment) and supplement was included at 1.0%. Untreated diets had supplement inclusion of 3.0% and limestone was added (1.58% of diet DM) to maintain a Ca:P of 1.2:1. Monensin was included in both supplements and formulated to supply 200 mg/steer daily. Monthly composite samples were assayed for

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Table 1. Dry matter and nutrient composition of diets fed to growing steers.

	Corn Stover		Wheat Straw	
Ingredient, % of DM	Treated	Untreated	Treated	Untreated
Treated stover/straw				
Untreated stover/straw	69.0	—	69.0	—
WDGS	—	67.0	—	67.0
Supplement	30.0	30.0	30.0	30.0
Fine ground corn	0.8228	1.2388	0.8228	1.2388
Limestone	—	1.5840	—	1.5840
Tallow	0.1000	0.1000	0.1000	0.1000
Trace mineral	0.0500	0.0500	0.0500	0.0500
Vitamin A-D-E	0.0150	0.0150	0.0150	0.0150
Rumensin[1]	0.0122	0.0122	0.0122	0.0122
Crop Residue				
DM, %	57.6	86.8	49.6	86.7
IVDMD, %[2]	39.6	38.6	43.1	36.1

[1]Formulated to provide 200 mg per steer/daily.
[2]*in vitro* DM disappearance of crop residue, 48 hour incubation time.

Table 2. Effect of crop residue and alkaline treatment on growing steer performance.

	Corn stover		Wheat straw					
Item	Treated	Untreated	Treated	Untreated	SEM	CaO[1]	Residue[2]	CaO x Residue
Initial BW, lb	729	729	728	727	0.64	0.59	0.43	0.19
Ending BW, lb	844[b]	834[c]	868[a]	841[b]	2.60	<0.01	<0.01	<0.01
DMI, lb/day	16.7	15.7	18.7	16.4	0.43	<0.01	<0.01	0.15
ADG, lb	1.67[b]	1.52[c]	2.02[a]	1.63[bc]	0.04	<0.01	<0.01	<0.01
F:G	10.00	10.32	9.25	10.06	—	0.06	0.07	0.18
$/head[3]	-15.01	0.00	-6.80	0.00	—	—	—	—

[1]Main effect of CaO + water or none.
[2]Main effect of residue type (corn stover or wheat straw).
[3]Average profit/head relative to untreated crop residue.
[abc]Within a row, means lacking common superscripts differ, when interaction $P < 0.05$.

in vitro DM disappearance (IVDMD). Inoculum for IVDMD was obtained by collecting a mixture of rumen fluid (strained through four layers of cheesecloth) from two steers consuming a 30% concentrate-70% roughage diet. Inoculum was mixed with McDougall's buffer at a 1:1 ratio along with 1 gram of urea/L of rumen fluid. A 0.5 gram sample was added to a 200 mL test tube and 50 mL of inoculum was added. Test tubes were placed in a water bath at 39°C for 48 hours. Fermentation was ended by adding 6 mL of 20% HCl per test tube. Residue was filtered, dried at 100°C, and weighed to determine IVDMD. A partial budget analysis was constructed to estimate profitability of steers fed diets in this study. Assumptions included: untreated ground wheat straw or corn stover cost at $100/DM ton, alkaline treatment cost of $50/DM ton, WDGS priced 95% of corn ($6.50/bu), initial purchase price of $1.50/lb and $0.042 slide. Data were analyzed using the MIXED procedure of SAS (SAS Institute, Inc., Cary, N.C.) with block as a fixed effect. Main effects of chemical treatment and residue, as well the interaction were tested. If an interaction was significant ($P \leq 0.05$), simple effect means were separated with a t-test using the pDiff option.

Results

An interaction ($P < 0.01$) between crop residue and alkaline treatment (Table 2) was observed for ending BW and ADG; therefore, simple effects are presented. The magnitude of response on ADG and ending BW due to alkaline treatment was greater in wheat straw diets compared to corn stover diets. Steers fed treated corn stover had increases of 1.9% for ADG and 3.2% for ending BW compared to untreated corn stover. However, steers fed treated wheat straw diets had increases of 23.9% for ADG and 9.8% for ending BW compared to untreated wheat straw. The observed ADG and ending BW differences of steers fed treated and untreated crop residues are also supported by IVDMD of treated and untreated corn stover (39.6% vs. 38.6%) and wheat straw (43.1 vs. 36.1%). No interaction was observed for F:G ($P = 0.18$) or DMI ($P = 0.15$) between crop residue and alkaline treatment. Steers fed treated wheat straw diets had greater DMI ($P < 0.01$) and tended ($P = 0.07$) to have improved F:G compared to corn stover diets. Alkaline treatment tended ($P = 0.06$) to improve F:G and increased DMI ($P < 0.01$) compared to untreated. Given the economic assumptions applied to this study, feeding steers treated corn stover and wheat straw diets resulted in lower net return ($/head) compared untreated residue diets. This estimated lost in profitability is related to the increase in diet cost from alkaline treatment, increased DMI of steers fed alkaline treated diets compared to untreated, and the small improvement in BW gain of steers fed alkaline treated diets compared to untreated. The results of this study indicate that response to CaO treatment on growing calf performance is dependent on crop residue source. Calcium oxide treated crop residues fed with distillers grains did improve growing calf ADG and F:G. However, the response to alkaline treatment in growing calf diets is much lower than observed in finishing cattle work when used as a corn replacement. Given the small improvement in performance identified in this study, growing calves with untreated crop residues maybe just as economical.

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