University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Nebraska Beef Cattle Reports

Animal Science Department

2012

Reducing Particle Size Enhances Chemical Treatment in Finishing Diets

Adam L. Shreck
University of Nebraska-Lincoln

Brandon L. Nuttelman
University of Nebraska-Lincoln

William A. Griffin Griffin
University of Nebraska -Lincoln, wgriffin2@unl.edu

Galen E. Erickson
University of Nebraska-Lincoln, gerickson4@unl.edu

Terry J. Klopfenstein
University of Nebraska-Lincoln, tklopfenstein1@unl.edu

See next page for additional authors

Authors

Adam L. Shreck, Brandon L. Nuttelman, William A. Griffin Griffin, Galen E. Erickson, Terry J. Klopfenstein, and Michael J. Cecava

Reducing Particle Size Enhances Chemical Treatment in Finishing Diets

Adam L. Shreck
Brandon L. Nuttelman
William A. Griffin
Galen E. Erickson
Terry J. Klopfenstein
Michael J. Cecava[1]

Summary

Three hundred-sixty calf-fed steers were fed either treated or untreated corn stover that was previously ground through a 1-in or 3–in screen. Treated stover diets improved ADG and F:G compared to untreated. Reducing particle size improved ADG and F:G but did not influence DMI. Compared to a control diet with 5% roughage and 15 percentage units more corn, diets with 20% treated corn stover had similar F:G, ADG, DMI, and carcass quality. Up to 15% additional corn can be replaced with treated corn stover when diets contain wet distillers grains, and may be further enhanced by reducing particle size before chemical treatment.

Introduction

A previous study (*2012 Nebraska Beef Cattle Report,* pp. ??-??) has demonstrated the potential to replace corn with corn stover that has been treated with 5% calcium oxide, with no reduction in performance or carcass characteristics compared to a diet that would be commonly fed in Nebraska. The focus of this experiment was to further investigate ways to enhance this feeding strategy, as corn stover and distillers grains are abundant in Nebraska. We hypothesized that reducing particle size may increase the extent of digestibility during the treatment process, leading to better performance.

Procedure

The experiment used 360 calf-fed steers (30 pens, 12 steers/pen) (initial BW: 822 ± 9.9 lb). The experiment had two weight blocks (three replications per block), five diets (six replications per treatment) and was designed as a randomized complete block design. Main factors included corn stover, which was ground through a 1-in or 3–in screen, and then alkaline treated with 5% calcium oxide at 50% moisture or not treated. Corn stover replaced a 50:50 blend (DM basis) of HMC and DRC and was fed at 20% diet DM (Table 1). The control contained a higher amount of corn (51 vs. 36%) and lower roughage (5%, untreated corn stover ground through 3-in screen). All diets contained 40% modified distillers grains plus solubles (MDGS; 59.3% DM). Chemical treatment consisted of water, calcium oxide, and ground corn stover weighed and mixed into Roto-Mix feed trucks. Feed trucks dispensed treated corn stover into a silage bag which was packed with a pressure setting of 400 psi, and this equated to a density of approximately 8 lb DM/ ft^3. Chemical treatment was considered completed with a minimum of seven days prior to feeding. Untreated corn stover was ground and stored under roof (no added moisture or chemical). Orts were assessed weekly and were only observed on 3-in untreated stalks diets. However, this amount was small (< 0.5% of total DM offered). Calcium oxide replaced limestone in treated diets. Cattle were fed once daily for 151 days. Data were analyzed in the MIXED procedure of SAS (SAS Inst., Inc., Cary, N.C.). Pen was the experimental unit. Block was included as a fixed effect. The factorial was analyzed separately with main factors of roughage source and treatment, as well as the interaction, included in the model. To compare treated and untreated diets to the control, means were separated by the pDIFF option with a protected F-test. Percentage of choice carcasses and above were analyzed in GLIMMIX assuming a binomial distribution.

Table 1. Dietary treatments.

		1" Grindsize		3" Grindsize	
Ingredient, % of DM	Control	Treated	Untreated	Treated	Untreated
HMC	25.5	18.0	18.0	18.0	18.0
DRC	25.5	18.0	18.0	18.0	18.0
Corn Stover—treated[1]	—	20.0	—	20.0	—
Corn Stover—not treated	5.0	—	20.0	—	20.0
MDGS	40.0	40.0	40.0	40.0	40.0
Supplement[2]	4.0	4.0	4.0	4.0	4.0
Composition of Corn Stover					
NDF, %		56.0	76.5	56.8	81.1
IVNDFD, %[3]		58.0	36.0	51.0	36.0

[1]Treated with 5% CaO and water added to 50% DM and ground through 1-in or 3-in screen.
[2]Formulated to provide 360 mg/steer daily Rumensin® and 90 mg/steer daily Tylan®.
[3]*In vitro* NDF digestibility, 48 hour incubation time.

Table 2. Performance and carcass characteristics.

Item	Control	1" Grindsize Treated	1" Grindsize Untreated	3" Grindsize Treated	3" Grindsize Untreated	SE	F-test	Factorial *P*-value Grind[1]	Factorial *P*-value Trt[2]	Factorial *P*-value GxT[3]
Steer performance										
Initial BW	823	822	823	821	825	9.9	0.99	0.94	0.80	0.88
Final BW[5]	1378[a]	1385[a]	1319[bc]	1362[ab]	1309[c]	14.8	<0.01	0.24	<0.01	0.60
ADG, lb[9]	3.67[a]	3.73[a]	3.28[b]	3.58[a]	3.21[b]	0.050	<0.01	0.02	<0.01	0.40
DMI, lb	24.01[abc]	23.60[bc]	24.50[ab]	23.45[c]	24.78[a]	0.33	0.04	0.87	<0.01	0.53
F:G[7]	6.54[ab]	6.32[a]	7.47[c]	6.55[b]	7.72[b]	0.087	<0.01	0.01	<0.01	0.90
Final BW[6]	1419[a]	1372[ab]	1339[b]	1360[ab]	1333[b]	21.0	0.05	0.52	0.03	0.83
Dressing %[8]	61.39	63.63	62.06	63.10	61.89	0.007	0.26	0.08	<0.01	0.37
Carcass characteristics										
HCW, lb	868[a]	873[a]	831b	858[a]	825[b]	9.4	<0.01	0.26	<0.01	0.63
12th rib fat, in	0.57	0.55	0.51	0.56	0.52	0.023	0.24	0.51	0.07	0.96
LM area, in^2	13.26	13.28	13.16	13.26	12.82	0.175	0.32	0.30	0.13	0.36
Marbling[4]	595	568	546	590	579	13.4	0.11	0.07	0.27	0.69
% Choice	86.1[a]	77.5[ab]	67.6[b]	81.4[a]	76.4[ab]		0.08	0.13	0.08	0.85
Calc. YG	3.48	3.43	3.21	3.41	3.32	0.102	0.38	0.63	0.13	0.50

[1]Fixed effect of grind size (1" vs 3").
[2]Fixed effect of chemical treatment.
[3]Grind size x chemical treatment interaction.
[4]500 = Small, 600 = Modest.
[5]Calculated as HCW/common dress (63%).
[6]Pen weight taken before slaughter.
[7]Analyzed as G:F, reciprocal of F:G.
[8]Calculated as HCW/Final live BW.
[9]Caculated from carcass adjusted final BW.
[abc]Within a row, values lacking common superscripts, differ, when F-test is significant ($P < 0.05$).

Results

There were no particle size x chemical treatment interactions noted in this trial. Chemical treatment was effective in solubilizing approximately 30% of the corn stover NDF (Table 1) and this led to increases ($P < 0.01$) in ADG (12.6%) and improved F:G (17.4%) relative to untreated corn stover. Dry matter intake was lower for chemically treated stover compared to untreated ($P < 0.01$), which is reflective of energy density being diluted. Reducing particle size of the stover from 1 inch to 3 inch also improved ($P < 0.01$) ADG (3.2%) and F:G (3.5%). Compared to control, treated stover was not different for ADG, F:G, adjusted final BW or final BW measured before slaughter, marbling score, 12th rib fat, YG, or percentage choice and prime. Grind size tended to reduce marbling score ($P = 0.07$). Chemical treatment tended ($P = 0.07$) to increase 12th rib fat; however, this difference was small numerically. Reducing particle size improves the feeding value of feeding chemically treated corn stover in byproduct diets.

[1]Adam L. Shreck, research technician; Brandon L. Nuttelman, research technician; William A. Griffin, research technician; Galen E. Erickson, professor; Terry J. Klopfenstein, professor, University of Nebraska–Lincoln Department of Animal Science, Lincoln, Neb.; Michael J. Cecava, Archer Daniels Midland Company Research Division, Decatur, Ill.