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Summary

A digestion study was conducted to evaluate diets containing calcium oxide treated corn residue in combination with de-oiled distillers grains in forage based growing diets. Chemical treatment did not affect digestibility of DM, OM, or NDF. However, concentration of distillers grains did improve DM and OM digestibility. The use of chemically treated residue in combination with distillers grains in growing diets may not impact diet digestibility.

Introduction

Previously completed trials (*2014 Nebraska Beef Cattle Report*, pp. 62-63, 67-68) indicated that calcium oxide (CaO) treated corn residue in growing diets increased DMI and ADG when compared to untreated corn residue. However, only a minimal F:G response was observed with CaO treatment. Both of these studies implied that the expense of chemical treatment might increase the cost per unit of energy of the corn residue when compared to untreated corn residue. Therefore, the objective of this trial was to compare digestibility of treated and untreated crop residues in diets containing de-oiled distillers grains diets.

Procedure

This experiment utilized 12 ruminally fistulated steers, of which six were yearlings and six were calves. Treatments were set up in a 2 x 2 factorial with factors including chemical treatment (treated or untreated) and de-oiled MDGS inclusion (20 or 40% of diet DM). Steers were assigned randomly and acclimated to each diet for four, 21-day periods, with a 14-day adaptation period and a seven-day collection period. Chemical treatment consisted of water, CaO (Standard Quicklime, Mississippi Lime Co., Kansas City, Mo.), and ground residue. Calcium oxide was added at 5% of residue DM, and the mixture was hydrated to a final targeted DM of 50%. The mixture was weighed and mixed in Roto-Mix feed trucks, dispensed into concrete bunkers, and subsequently covered with plastic. The treatment process was completed at least seven days prior to being fed, and was repeated throughout the duration of the study. Untreated residue was only ground and fed without chemical or water addition. All residue used for this study was ground through a 1-inch screen. De-oiled MDGS were fed at either 20 or 40% of the diet DM (Table 1), with residue inclusion at 76 or 56%. All diets contained a 4% dry meal supplement formulated to provide similar dietary Ca (1.19% DM basis) in untreated diets as treated residue diets did not contain limestone. Steers were fed 200 mg/steer of monensin daily. Diets were mixed twice each week and stored in a cooler (32°F) until used to ensure fresh feed throughout the experiment.

All steers were ruminally dosed with 7.5 g of TiO_2 twice daily at 0800 and 1600 hours. Fecal grab samples were collected at 0800, 1200, and 1600 hours from day 15 to day 21. All fecal samples collected in a day were composited on a wet basis into a daily composite, then freeze-dried. From daily composites, a steer within period fecal composite sample was made and analyzed for NDF, OM, and Ti percentage. Ruminal pH was recorded every minute using pH probes (Dascor, Inc., Escondido, Calif.) from day 15 to 21. Analysis of feeds offered and feed refusals were completed for DM, OM, and NDF

Table 1. Ingredient composition of diets fed to yearlings and calves.

	20 MDGS[1]		40 MDGS[1]	
	Untreated	Treated	Untreated	Treated
MDGS	20	20	40	40
Treated residue[2,3]	—	76	—	56
Untreated residue[3]	76	—	56	—
Supplement[1]	4	4	4	4
Fine ground corn	1.6794	1.8734	3.4124	1.8734
Limestone	1.1940	—	1.1110	—
Salt	0.3000	0.3000	0.3000	0.3000
Tallow	0.1000	0.1000	0.1000	0.1000
Urea	1.6500	1.6500	—	—
Rumensin®[4]	0.0116	0.0116	0.0116	0.0116
Trace mineral	0.0500	0.0500	0.0500	0.0500
Vitamin A-D-E	0.0150	0.0150	0.01500	0.0150
Nutrient composition, %				
CP	67.77	61.40	59.59	54.92
NDF	10.49	10.53	16.29	16.31
Ca	0.38	2.49	0.30	1.85
P	0.27	0.28	0.45	0.46

[1]MDGS = modified distillers grains plus solubles.
[2]Chemical treatment consisted of hydration with water to 50% DM and addition of 5% CaO (DM).
[3]All residue originated from the same source.
[4]Formulated to provide 200 mg/steer daily monensin.

Table 2. Effects of CaO treatment and MDGS on digestibility and lab analysis of forage NDF.

	20		40			*P*-values		
	Trt	Unt	Trt	Unt	SE	Dist[1]	Trt[2]	DxT[3]
DM								
Intake, lb	12.7	12.7	17.9	17.3	1.4	<0.01	0.79	0.82
Digestibility, %	45.6	49.8	58.7	60.6	0.1	0.02	0.46	0.79
OM								
Intake, lb	11.1	11.5	15.9	15.8	1.3	<0.01	0.92	0.81
Digestibility, %	52.7	55.6	61.6	64.0	0.1	0.05	0.49	0.96
NDF								
Intake, lb	7.3	8.7	9.2	10.2	0.9	0.05	0.11	0.77
Digestibility, %	48.1	54.9	54.3	56.6	0.1	0.48	0.37	0.67

[1]Fixed effect of 20 vs. 40% MDGS.
[2]Fixed effect of treated vs. untreated corn residue.
[3]Interaction of distillers inclusion x CaO treatment.

Table 3. Ruminal pH of steers fed 20 or 40% MDGS with CaO treated or untreated corn residue.

	20 MDGS[1]		40 MDGS[1]			*P*-values		
Item	Trt[2]	Unt	Trt[2]	Unt	SEM	Dist[3]	Trt[4]	TxD[5]
Maximum pH	6.94[b]	7.47[a]	7.04[ab]	6.97[ab]	0.30	0.56	0.10	<0.01
Average pH	6.65[b]	7.13[a]	6.80[ab]	6.70[b]	0.20	0.56	0.01	<0.01
Minimum pH	6.45[b]	6.80[a]	6.54[ab]	6.38[b]	0.13	0.26	0.33	<0.01

[1]MDGS = modified distillers grains plus solubles
[2]Chemical treatment consisted of hydration with water to 50% DM and addition of 5% CaO (DM).
[3]Fixed effect of MDGS level.
[4]Fixed effect of chemical treatment.
[5]Interaction of chemical treatment x MDGS level.

percentage. Dry matter was determined using a forced air oven set at 60°C for 48 hours. Digestibility data were analyzed using the MIXED procedure of SAS (SAS Institute, Inc., Cary, N.C.) with steer and period as fixed effects. Ruminal pH was analyzed as a repeated measure using the GLIMMIX procedure with day as the repeated measure. Main effects of chemical treatment, MDGS inclusion, and age of steer were tested as well as the interactions. Factors were deemed significant at $P < 0.10$.

Results

There were no chemical treatment x distillers level interactions ($P > 0.15$) observed for intakes or digestibilites. Chemical treatment did not impact ($P > 0.37$) DM, OM, or NDF digestibilities (Table 2), which was unexpected when compared to previous data (*2011 Nebraska Beef Cattle Report,* pp. 35-36). Additionally, a tendency for decreased ($P = 0.11$) NDF intake was observed for treated diets (8.26 vs. 9.49 lb/day). This suggests that treatment with CaO partly solubilized NDF and, therefore, decreased NDF intake. Lab analysis of forage indicated that CaO solubilized NDF by approximately 10 percentage units relative to the untreated residue (NDF content of 76.0 and 66.6 for untreated and treated residues, respectively). Presumably treatment with CaO partially solubilized NDF, thereby decreasing NDF intake.

Overall, greater DM and OM digestibilities were noted with 40 MDGS inclusion ($P \leq 0.05$) compared with 20 MDGS. Increased distillers inclusion also improved DM, OM, and NDF intakes ($P \leq 0.05$). Interactions were noted for maximum, average, and minimum ruminal pH ($P < 0.01$; Table 3) as untreated residue had greater maximum and average pH within 20 MDGS ($P \leq 0.10$) and treated residue had greater pH values within 40 MDGS. Minimum pH data tended to change in the same manner. Results suggest that increased de-oiled MDGS inclusion will increase dietary DM and OM digestibility as well as DM, OM, and NDF intake levels. However, residue treatment with CaO did not affect dietary digestibility. Treated residue inclusion in growing diets may not improve diet digestibility over untreated residues.

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