Use of Treated Corn Residues in Growing Diets

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Summary

A growing study compared the effects of pelleting corn residue and treating with calcium oxide or calcium hydroxide. All diets contained 60% corn residue, 36% distillers products, and 4% supplement (DM basis). Steers consuming pelleted diets had increased DMI, greater ending BW, but poorer F:G compared to non-pelleted treatments. Diets containing the chemically treated corn stover had increased ADG and lower F:G compared to the non-treated diets. While both pelleting and chemical treatment with CaO increased DMI, and ADG, only the use of CaO improved feed efficiency.

Introduction

Treatment of corn stover with 5% calcium oxide (*CaO)* increases forage digestibility and can result in acceptable finishing performance when fed in combination with distillers grains (*2012 Nebraska Beef Cattle Report*, pp.106-107). Additionally, reducing particle size prior to calcium oxide addition may further increase the benefits of this type of treatment (*2012 Nebraska Beef Cattle Report,* pp. 108-109). A recent receiving study (*2014 Nebraska Beef Cattle Report*, pp. 64-66*)* evaluated a complete pelleted feed compared to a standard control diet and determined that pelleted rations may be a viable way to feed newly received cattle. Little work has been done evaluating calcium oxide treatment of corn residue in combination with distillers grains in growing diets; therefore, the objective of this study was to evaluate the effects of calcium oxide treatment of corn residue and pelleting in growing diets containing distillers grains.

Procedure

Experiment

An 80 day growing study was conducted using 480 yearling crossbred steers (BW = 688 ± 17 lb). Steers were limit-fed a diet of 50% forage and 50% byproduct for five days prior to the study at an estimated 2% of BW in order to minimize gut fill differences. Initial weights were collected on individuals two consecutive days. Steers were sorted into four weight blocks, stratified by BW within block, and assigned randomly to pens. Pens were assigned randomly to one of four treatments, with seven pens per treatment and 16 or 24 steers per pen. Pen served as the experimental unit. During processing, steers were implanted with Ralgro®. Ending BW were collected similar to initial BW, where steers were limit-fed for five days the same diet at an estimated 2% of BW and weighed two consecutive days prior to feeding.

Treatments were arranged in a 2 x 2 factorial with factors including corn residue with and without calcium oxide treatment, and diets that were either mixed or pelleted (pellets processed and provided by Iowa Agricultural Bio Fiber, Harlan, Iowa). Unpelleted diets contained modified distillers grains plus solubles, whereas the pelleted diets contained dry distillers grains plus solubles. Corn residue used in all diets originated from the same source (i.e., same fields and split two ways). All diets contained 60% baled corn residue, 36% distillers grains, and 4% supplement, which was formulated to provide 200 mg/steer daily of Rumensin.

Chemical treatment of non-pelleted residue consisted of CaO (Standard Quicklime, Mississippi Lime Co., Kansas City, Mo.), ground residue (3-inch screen), and water weighed and mixed into Roto-Mix® feed trucks. The mixture was calculated to be 50% DM with calcium oxide added at 5% of the forage DM. Feed trucks dispensed treated residue into a bunker and was subsequently covered with plastic. This process was completed every two weeks continuously throughout the trial so that residue treatment occurred for at least seven days prior to feeding. The pelleted residue was treated with 6.6% calcium hydroxide [$Ca(OH)_2$] in place of CaO which provided the same hydroxide units as 5% CaO. Approximately 50% of this residue was treated with a moisture content of 35% before being blended with the remainder of the residue and pelleted.

Statistical Analysis

Performance data (BW, DMI, ADG, G:F) were analyzed using the MIXED procedure of SAS (SAS Institute, Inc., Cary, N.C.) as a generalized randomized block design with pen as the experimental unit. The model included block, effects of pelleting, chemical treatment, and interaction of pellet and chemical treatment.

Results

There were no pellet x treatment interactions observed for this trial. Ending BW, DMI, and ADG were increased due to pelleting ($P < 0.01$, Table 1). However, the relative increase in ADG was smaller than the increase in DMI resulting in poorer F:G for the pelleted diets. The large increase in DMI due to pelleting may be related to increased passage rate from reduced particle size in the pellet. In this situation, steers are consuming feed to gut fill; therefore, reducing particle size by pelleting likely increased passage rate. This, in turn, allowed for increased DMI. The

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Table 1. Effects of pelleting and chemical treatment on cattle performance.

	Pelleted		Not Pelleted			*P*-values		
Item	Untreated	$Ca(OH)_2$	Untreated	CaO	SEM	Pellet[1]	T[2]	PxT[3]
Initial BW, lb	688	689	688	688	1	0.49	0.49	0.82
Ending BW, lb	926	954	907	927	5	<0.01	<0.01	0.47
ADG, lb	2.97	3.31	2.74	2.99	0.06	<0.01	<0.01	0.44
DMI, lb/day	26.1	27.4	20.7	22.2	0.2	<0.01	<0.01	0.58
Feed:Gain[4]	8.80	8.29	7.55	7.46	—	<0.01	0.05	0.18

[1]Fixed effect of pelleting.
[2]Fixed effect of CaO or $Ca(OH)_2$ treatment.
[3]Pellet x CaO/$Ca(OH)_2$ treatment interaction.
[4]Statistics calculated on Gain:Feed.

increased passage rate and DMI presumably decreased digestibility.

Chemical treatment of residue with CaO or $Ca(OH)_2$ increased ending BW, DMI, and ADG ($P < 0.01$) and improved feed conversions ($P < 0.05$). While there was no interaction between pelleting and chemical treatment ($P = 0.18$), the improvement in feed conversion due to chemical treatment was 6% in pelleted diets and 1% in unpelleted diets.

Chemically treated forages are known to have increased digestibility compared to untreated forages (*2011 Nebraska Beef Report*, pp.35-36). In finishing diets, treatment of residues with CaO is profitable when they replace corn (*2012 Nebraska Beef Report*, pp.106-107). However, in growing diets the expense of chemical treatment may increase the cost per unit of energy of the corn residue compared to untreated corn residue because the improvement in feed conversion was small. Chemical treatment appeared to have a larger numeric impact on F:G in the pelleted diet, although the interaction was not significant ($P = 0.18$) . Additionally, while the pelleted diets showed a desirable increase in ending BW, ADG, and DMI, pelleting did not positively impact feed conversion compared to the unpelleted diets. Using a pelleted ration for growing calves could be a feasible option to achieve additional gain if the diet is favorably priced.

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