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Optimum Inclusion of Alkaline-Treated Cornstalks and Distillers Grains Fed to Calf-fed Steers

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Summary

A finishing study evaluated the effects of adding 10, 20 or 30% CaO treated cornstalks to diets containing either 20 or 40% (DM basis) modified distillers grains (MDGS). Steers fed a diet containing 40% MDGS responded quadratically with 10 and 20% (DM basis) treated residue having equal and better F:G than feeding 30% treated stalks. However, cattle fed 20% MDGS did not respond as well to treated cornstalks with 10% treated stalks having the lowest F:G, but poorer than the control diet with 5% stalks and 20% MDGS.

Introduction

A previous study determined that a 3:1 ratio of distillers to treated stalks along with a maximum of 20% treated residue and at least 25% corn (DM basis) are required to maintain feed efficiency when compared to a 56% corn, 5% roughage control diet (*2013 Nebraska Beef Cattle Report,* pp. 56-57). Numerous studies have illustrated that cattle perform similarly when fed 20% alkaline treated stalks compared to a control diet with 5% stalks, thus allowing for 15% corn to be replaced (*2012 Nebraska Beef Cattle Report*, pp.108-109*; 2012 Nebraska Beef Cattle Report*, pp. 106-107*; 2013 Nebraska Beef Cattle Report,* pp. 70-73). However, all of these studies provided 40% wet or modified distillers grains plus solubles along with treated residue. With variable inclusions of wet or modified distillers grains possible under different economic scenarios, producers need to know whether inclusion of distillers grains plus solubles impact how alkaline treated stalks perform in finishing diets. Therefore, the objective was to identify the maximum amount of treated forage in combination with varying levels of MDGS on cattle performance and carcass characteristics.

Procedure

Experiment

A 180-day finishing study was conducted using crossbred steer calves (n = 378; BW = 705±15 lb) to evaluate inclusion levels of treated stalks in combination with MDGS. Calves were received for approximately 30 days prior to the study. Following receiving, steers were limit-fed at an estimated 2% of BW a 50% forage, 50% byproduct diet for five days prior to weighing. Initial weights were collected on two consecutive days to reduce gut fill effects. Based on first day weights, steers were separated into two weight blocks, stratified by BW within block, and assigned randomly to pens. Pens were assigned randomly to one of seven treatments, with six pens per treatment and nine steers per pen.

The seven treatments were set up in a 2x3 plus 1 factorial design including a dry-rolled corn (DRC), modified distillers grains with solubles (MDGS) and 5% untreated stalks control (CON). The 2x3 factorial diets contained either 20 or 40% MDGS with 10, 20, or 30% alkaline treated stalks (Table 1). All diets on the study contained 4% dry meal supplement, which was formulated to provide 330 mg/steer daily Rumensin® and 90 mg/steer daily of Tylan®.

Chemical treatment consisted of adding 5% CaO (standard quicklime; Mississippi Lime, Co., Kansas City, Mo.), ground cornstalks (1-inch screen), and water weighed and mixed into Roto-Mix feed trucks. The mixture was targeted to be 50% DM with calcium oxide added at 5% of the forage DM. Feed trucks dispensed treated residue into a bunker and were covered with plastic. This treatment process was completed every two weeks continuously throughout the trial, allowing for residue to be exposed for at least one week prior to feeding, at a minimum.

During initial processing, steers were vaccinated with Vision 7® and Vista 5®, and were implanted with Revalor®-XS. One day prior to slaughter, steers were weighed using a pen scale in the afternoon after being fed 50% of the previous day's intake that morning. Following weighing, steers

Table 1. Diet composition for diets containing 20% or 40% MDGS and 10%, 20%, or 30% treated stalks.[1,2]

	20 MDGS				40 MDGS		
Item	CON	10	20	30	10	20	30
Ingredient							
DRC	71	66	56	46	46	36	26
MDGS	20	20	20	20	40	40	40
Treated stalks[3]	—	10	20	30	10	20	30
Stalks	5	—	—	—	—	—	—
Supplement[4]	4	4	4	4	4	4	4

[1]Values presented on a DM basis.
[2]MDGS = modified distillers grain with solubles; DRC = dry-rolled corn.
[3]Treated with 5% CaO and water added to 50% DM.
[4]Supplements formulated to provide: 330 mg/steer daily Rumensin and 90 mg/steer daily Tylan.

Table 2. Performance of finishing cattle comparing the simple effects of 10, 20, or 30% alkaline treated stalks with either 20 or 40% MDGS along with the control diet that included 5% untreated stalks and 20% MDGS.

		20 MDGS					40 MDGS						*P*-values	
Item	Control	10	20	30	Lin[1]	Quad[2]	10	20	30	Lin[3]	Quad[4]	SEM	F-Test[5]	DxT[6]
Performance														
Initial BW, lb	704	704	706	707	0.12	0.84	705	705	705	1.00	0.92	1	0.74	0.45
Final BW, lb[7]	1440^{ab}	1409^{bc}	1377^{cd}	1308^{e}	<0.01	0.24	1437^{ab}	1452^{a}	1361^{d}	<0.01	<0.01	14	<0.01	0.26
DMI, lb/d	23.5	23.5	23.8	23.1	0.51	0.25	23.8	24.2	24.3	0.34	0.70	0.32	0.18	0.47
ADG, lb[8]	4.07^{ab}	3.90^{bc}	3.71^{cd}	3.32^{e}	<0.01	0.23	4.05^{ab}	4.13^{a}	3.63^{d}	<0.01	<0.01	0.07	<0.01	0.21
F:G[8]	5.79^{a}	6.02^{b}	6.40^{c}	6.98^{d}	<0.01	0.54	5.89^{ab}	5.88^{ab}	6.70^{d}	<0.01	<0.01	—	<0.01	0.07
Live BW, lb[9]	1407^{abc}	1394^{bcd}	1376^{cde}	1347^{e}	0.01	0.69	1413^{ab}	1433^{a}	1372de	0.02	0.01	12.64	<0.01	0.29
Carcass Characteristics														
HCW, lb	907^{ab}	888^{bc}	868^{cd}	824^{e}	<0.01	0.24	905^{ab}	915^{a}	858^{d}	<0.01	<0.01	9	<0.01	0.26
Dressing, %	64.4^{a}	63.7^{bc}	63.1^{cd}	61.2^{e}	<0.01	0.05	64.1^{ab}	63.8^{ab}	62.5^{d}	<0.01	0.11	0.3	<0.01	0.21
LM area, in^2	14.4	14.0	14.2	13.8	0.54	0.23	14.1	14.5	14.0	0.67	0.10	0.18	0.18	0.93
12th Rib fat, in	0.58^{a}	0.53^{a}	0.46^{b}	0.39^{c}	<0.01	0.98	0.59^{a}	0.53^{a}	0.43^{bc}	<0.01	0.45	0.02	<0.01	0.74
Marbling[10]	459	488	488	470	0.30	0.53	476	462	463	0.44	0.62	13	0.42	0.31

^{abcde}From the F-test, means lacking common superscripts, differ $P < 0.05$.
[1] Linear contrast for treated stalks within 20% MDGS inclusion.
[2] Quadratic contrast for treated stalks within 20% MDGS inclusion.
[3] Linear contrast for treated stalks within 40% MDGS inclusion.
[4] Quadratic contrast for treated stalks within 40% MDGS inclusion.
[5] Overall F-test statistic comparing the Control to all other treatments.
[6] DxT is the distillers inclusion by alkaline treated stalks inclusion interaction.
[7] Calculated as HCW/common dress (63%).
[8] Calculated from carcass-adjusted final BW and statistics performed on G:F, the reciprocal of F:G.
[9] Pen weight before slaughter shrunk 4%.
[10] Marbling score where 400 = Small^0.

were loaded and shipped to the abattoir. The following morning (day 182), steers were slaughtered at Greater Omaha Pack (Omaha, Neb.), at which time hot carcass weights (HCW) and liver scores were recorded. Following a 48-hour chill, fat thickness, rib eye area (REA), USDA marbling score were measured. Final BW, ADG, and F:G were calculated using HCW adjusted to a common (63%) dressing percentage. However, live final BW and dressing percentages were analyzed assuming a 4% shrink on final live BW collected the day of shipping.

Performance and carcass data were analyzed as a 2 x 3 plus 1 factorial using the Mixed procedures of SAS (SAS Institute, Inc., Cary, N.C.) as a randomized block design with pen as the experimental unit. Weight block was included as a fixed effect. Orthogonal linear and quadratic contrasts were used to determine the response curve for alkaline treated forage within MDGS inclusion.

Results

Performance

Intakes were not impacted by treatment ($P > 0.18$) and no differences were observed across different treated stalks inclusion (Table 2). For the factorial design, no significant interaction ($P = 0.21$) was observed between treated stalks and distillers inclusion on ADG. However, the simple effect responses were different depending on whether treated stalks were fed with 20 or 40% MDGS. As treated stalks increased in diets with 20% MDGS, ADG decreased linearly. However, ADG decreased quadratically when treated stalks were added to 40% MDGS diets with ADG equivalent between 10 and 20% treated stalks and decreasing at 30% inclusion. There was a distillers inclusion by treated stalks interaction for both carcass adjusted F:G ($P < 0.10$) and F:G based on final live BW ($P < 0.05$; data not shown). Similar to ADG, F:G increased linearly when treated stalks were increased from 10 to 30% in diets with 20% MDGS, but increased quadratically when treated stalks increased in diets with 40% MDGS (Table 2). No difference was observed between 10 or 20% treated stalks with 40% MDGS but increased at 30% which caused the quadratic response. The control diet contained 20% MDGS with 5% untreated stalks which resulted in better ADG and F:G compared to 10% treated stalks with 20% MDGS suggesting that with only 20% MDGS in the diet, even feeding 10% treated stalks will not result in equal performance to cattle fed 5% untreated stalks as a roughage source. Unfortunately, a control diet with 40% MDGS and 5% untreated stalks was not included in the treatment design. These data suggest that the impact of increasing treated stalks in feedlot diets on F:G (and likely ADG) depends on inclusion of distillers grains.

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For performance variables besides F:G, no interaction was observed between MDGS inclusion and treated stalks. Table 3 presents the main effects of increasing treated stalks in finishing diets across both inclusions of MDGS. Final BW, ADG, and live BW all decreased quadratically as treated stalks increased in the diet from 10 to 30%. These data suggest that feeding 10 or 20% treated stalks gives comparable performance whereas increasing to 30% inclusion decreases BW and ADG.

Table 3. Main effect of alkaline treated stalks inclusion at 10, 20, or 30% of diet DM on performance and carcass characteristics

	Stalks inclusion					
Item	10	20	30	SEM	Linear	Quadratic
Performance						
Initial BW, lb	704	705	706	0.82	0.21	0.81
Final BW, lb[1]	1423	1415	1335	10	<0.01	0.01
DMI, lb/day	23.7	24.0	23.7	0.23	0.84	0.29
ADG, lb[2]	3.97	3.92	3.47	0.05	<0.01	<0.01
F:G[8]	5.95	6.13	6.80	—	<0.01	<0.01
Live BW, lb[3]	1403	1404	1359	9	<0.01	0.04
Live F:G, lb[8]	6.13	6.21	6.58	—	<0.01	0.08
Carcass Characteristics						
HCW	897	891	841	6	<0.01	0.01
Dressing, %[4]	63.9	63.4	61.9	0.2	<0.01	0.02
REA, in	14.0	14.3	13.9	0.1	0.43	0.04
12th Rib fat, in	0.56	0.49	0.41	0.02	<0.01	0.60
Marbling[5]	482	475	467	9	0.23	0.93

[1]Calculated as HCW/common dress (63%).
[2]Calculated from carcass-adjusted final BW.
[3]Pen weight before slaughter.
[4]Calculated as HCW/Live BW.
[5]400 = Small.
[6]Main effects of 20 vs. 40 MDGS.
[7]Interaction of distillers x chemical treatment.
[8]Statistics calculated on G:F.

Carcass Characteristics

Cattle fed elevated amounts of roughage tend to maintain live BW, but have decreased dressing percentage. Thus, evaluating treatments on a carcass-adjusted basis is critical for accurate conclusions. Dressing percentage decreased linearly when treated stalks were included in the 40% MDGS and decreased quadratically when fed with 20% MDGS (Table 2). The greatest dressing percentage was for the control and 40% MDGS with 10% treated residue suggesting increased fill for the other treatments. Fat thickness generally reflected changes in ADG with cattle that gained less being leaner at slaughter with linear decreases in fat depth as treated stalks increased in both 20 and 40% MDGS based diets (Table 2). The fattest cattle were on the control, as well as the 10% and 20% treated stalks with 40% MDGS diets. These data suggest that if 10 or 20% alkaline treated stalks are fed, then 40% distillers included in the diet in addition to the treated residue is important to maintain F:G, carcass finish, and likely ADG.

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