Effect of Corn Processing on Steer Performance and Fecal Starch Content

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Summary with Implications

Processing corn as high-moisture corn increases starch digestion and improves cattle efficiency when fed blended with dry-rolled corn in finishing rations. A finishing study evaluated the effect of corn processing method (dry-rolled corn or 2:1 high-moisture corn to dry-rolled corn blend) on performance of calf-fed steers. Corn processing method did not affect average daily gain; however, steers fed a high-moisture corn and dry-rolled corn blend consumed 1.1 lb/day less than steers fed a dry-rolled corn diet. Feeding high-moisture corn and dry-rolled corn blend diets improved feed efficiency by 5.2% compared to steers fed dry-rolled corn. Fecal starch content decreased by 31.3% when comparing cattle fed the high-moisture corn and dry rolled corn blend diet to cattle fed a dry-rolled corn diet.

Introduction

Increasing the extent of starch digestion in finishing rations can improve feed conversion and cattle performance. Processing corn as high-moisture corn increases ruminal starch digestibility by up to 37% in comparison to corn processed as dry-rolled corn (*2006 Nebraska Beef Cattle Report*, pp. 38–39). Due to increased starch degradation, feeding high-moisture corn improves finishing cattle performance by decreasing dry-matter intake and improving feed conversion when compared to dry-rolled corn (*2008 Nebraska Beef Cattle Report*, pp. 54–56). Feeding blends of high-moisture corn and dry-rolled corn improves feed conversion, with a 3:1 ratio of high-moisture corn to dry rolled corn optimizing feed conversion in finishing steers. The objective of this experiment was to evaluate the effect of feeding finishing diets containing either dry-rolled corn or a high-moisture corn and dry-rolled corn blend on steer performance, carcass characteristics, and fecal starch content during the finishing period.

Procedure

A finishing study was conducted utilizing 800 crossbred steers (666 ± 38 lb) fed for an average of 192 days. Prior to trial, steers were limit-fed at approximately 2% of body weight for five days to equalize gut fill. The limit-fed diet was comprised of 50% alfalfa hay and 50% Sweet Bran (Cargill Wet Milling; Blair, NE). Steers were divided into two starting blocks, and each block of steers were weighed for two consecutive days (d-2 and d-1 for the first half, d0 and d1 for second half). Individual weights were averaged to establish initial weight (666 lb. ± 38 lb). Steers were stratified by first day weights and blocked. Cattle were assigned randomly to pens within weight block and pens were assigned randomly to treatment. The adaption period of 25 days consisted of decreasing alfalfa haylage while increasing corn inclusion. Treatment diets consisted of either 70% dry-rolled corn (DRC) or a blend of 46.67% high-moisture corn and 23.33% DRC (HMC:DRC) (Table 1). Each treatment consisted of five weight blocks and 20 replications per treatment. Pens contained 20 steers and pen served as the experimental unit.

Steers were implanted with Revalor IS (Merck Animal Health) on days -1 and 1 (based on initial weighing). Cattle were reimplanted with Revalor 200 (Merck Animal Health) on days 70 and 71. Cattle were harvested one week apart at 188 and 195 days on feed. Steers were slaughtered at Greater Omaha. Hot carcass weight (HCW) and liver abscess scores were collected on the day of slaughter. After a 48-hour chill, USDA marbling score, longissimus muscle (LM) area, and 12th rib fat depth were recorded. Carcass adjusted final body weight (BW), average daily gain (ADG), and feed efficiency were calculated from final BW based on HCW adjusted to a 63% dress. Feed efficiency (G:F) were analyzed, but data are reported as feed conversion (F:G).

The MIXED procedure of SAS was used to analyze animal performance and carcass characteristics with pen as the experimental unit. Block was treated as a fixed effect.

Fecal samples were collected from the pen floor on days 47, 90, 135, and 181 while on finishing diets. Composites were dried for 48 hours in a 60°C forced air oven. Concentration of fecal starch was determined using the Megazyme total starch assay procedure utilizing the amyloglucosidase and α-amylase method. The GLIMMIX procedure of SAS was used to analyze fecal starch content as a repeated measure with pen as the experimental unit. Effects of corn processing method and time on fecal starch content were analyzed over both the entire feeding period and while steers were fed the finishing ration only.

High moisture corn and dry rolled corn samples were collected monthly to evaluate particle size using the sieve method.

Results

Regardless of treatment, cattle finished with a HCW of 853 lb ($P = 0.96$; Table 2). Steers fed HMC:DRC consumed 1.1 lb/day less than steers fed the DRC diet ($P < 0.01$). Average daily gain of steers fed DRC was not significantly different than ADG of steers consuming a HMC:DRC blend ($P = 0.91$). Feeding HMC:DRC improved feed efficiency by 5.2% ($P < 0.01$) compared to feeding DRC due to lower DMI and similar ADG overall for HMC:DRC. Corn processing did not impact marbling or LM area ($P > 0.58$). Steers fed HMC:DRC were slightly fatter at slaughter than steers fed DRC ($P = 0.04$; Table 2).

In the finishing period, a 31.3% reduc-

Table 1. Dietary treatment composition (DM basis) fed to finishing steers.

Ingredient	DRC[1]	HMC:DRC[2]
Dry-rolled corn	70.0	23.33
High-moisture corn	-	46.67
Sweet Bran	20.0	20.0
Wheat Straw	5.0	5.0
Supplement[3]	5.0	5.0

[1]DRC included in the diet on a DM basis at 70%

[2]HMC:DRC had HMC included at 46.47% and DRC included in the diet at 23.33% on a DM basis

[3] Supplement consisted of Rumensin (Elanco Animal Health) at 30g/ton of DM, Tylan (Elanco Animal Health) at 8.8 g/ton of DM, 0.65% urea, and a trace mineral + vitamin package

Table 2. Effect of corn processing on performance and carcass characteristics

Item	DRC[1]	HMC:DRC[2]	SEM	*P*-value
Pens	20	20		
Performance				
Initial BW, lb	673	673	0.4	0.73
Final BW, lb[3]	1354	1354	5.1	0.95
DMI, lb/d[3]	23.8	22.7	0.1	< 0.01
ADG, lb[3]	3.54	3.55	0.03	0.91
Feed:Gain[3 4]	6.72	6.39	-	< 0.01
Carcass Characteristics				
HCW, lb	853	853	3.21	0.96
Marbling[5]	524	523	5.05	0.83
LM area	13.8	13.9	0.08	0.58
12th Rib Fat	0.54	0.56	0.008	0.04

[1]DRC included in the diet on a DM basis at 70%

[2]HMC:DRC had HMC included at 46.47% and DRC included in the diet at 23.33% on a DM basis

[3]Calculated using hot carcass weight with a 63% dressing percentage adjustment

[4] Analyzed as Gain:Feed, reciprocal of Feed:Gain

[5]Marbling Score 500=Modest00, 600=Moderate00

Table 3. Effect of corn processing method on percent fecal starch during finishing period

Days on Feed	47	90	135	181	*P*-value
DRC[1]	18.76	24.46	20.91	24.96	<0.01
HMC:DRC[2]	15.03	16.56	13.19	16.44	

[1]DRC included in the diet on a DM basis at 70%

[2]HMC:DRC had HMC included at 46.47% and DRC included in the diet at 23.33% on a DM basis

Table 4. Corn particle size distribution of DRC and HMC with geometric mean diameter (GMD) and geometric standard deviation (GSD)

	DRC[1]		HMC[2]	
Screen Size, µm	Percent Retained	CV	Percent Retained	CV
6300	1.77	69.75	14.31	36.49
4750	25.94	20.22	37.87	5.75
3350	47.51	27.25	22.44	9.74
1700	17.11	39.93	11.92	16.48
1410	2.47	165.91	1.84	18.80
850	1.87	56.46	4.25	20.92
600	0.86	51.62	2.45	31.83
<600	1.99	54.25	4.92	21.61
GMD, µm	3486	-	2809	-

[1]DRC included in the diet on a DM basis at 70%

[2]HMC:DRC had HMC included at 46.47% and DRC included in the diet at 23.33% on a DM basis

tion in fecal starch content was observed when HMC:DRC was fed compared to the DRC diet ($P < 0.01$; Table 3). When evaluating corn particle size, high-moisture corn retained 12.54% more particles than DRC on the top screen (6300µm; whole corn) (Table 4). Corn processed as DRC had a numerically greater geometric mean diameter than HMC, with DRC having more particles retained on screens above 1700µm. These data suggest that HMC contained a greater proportion of whole kernels and fine particles than DRC.

Conclusion

Finishing steers on a HMC:DRC blend diet resulted in a 31.3% reduction in fecal starch compared to steers finished on a DRC diet. Feeding a HMC:DRC blend decreased intake and maintained similar gains, resulting in a 5.2% improvement in feed conversion when compared to steers fed DRC.

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