Interaction of Sweet Bran Inclusion and Corn Processing Method in Beef Finishing Diets

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Summary with Implications

The effects of corn processing method and Sweet Bran concentration on finishing cattle performance and carcass characteristics were evaluated in steam-flaked corn or a blend of high-moisture and dry-rolled corn-based diets. Sweet Bran was included at 0, 20, or 40% of diet dry matter. When cattle were fed 0% Sweet Bran, feeding steam-flaked corn resulted in a 11.7% improvement in feed conversion and heavier hot-carcass weight compared to feeding high-moisture/dry-rolled corn. As Sweet Bran increased in the diet, there was a linear improvement in feed conversion for high-moisture/dry-rolled corn-fed steers and no change in feed conversion for steam-flaked corn-fed cattle. Accordingly, in diets with 40% Sweet Bran, the improvement in feed conversion due to feeding steam-flaked corn narrowed to 3.7%. These data suggest concentrations up to 40% Sweet Bran (dry-matter basis) can be fed with steam-flaked corn diets without affecting performance and the optimal level of Sweet Bran for high-moisture/dry-rolled corn-based finishing diets is 40%.

Introduction

Feeding Sweet Bran replaces starch with highly digestible fiber in finishing diets, which improves intake (DMI) and average daily gain (ADG). Depending on the corn processing method employed, feeding Sweet Bran may maintain or improve feed efficiency while simultaneously reducing the occurrence and severity of acidosis.

Previous research suggests concentrations up to 35% Sweet Bran can be fed with steam-flaked corn (SFC) based diets (*2003 Nebraska Beef Cattle Report*, pp.24–25). Final weights, ADG, and feed conversion were similar across treatments (0, 10, 20, 25, 30, and 35% Sweet Bran). Previous research evaluated high-moisture corn/dry-rolled corn (HMC/DRC) based finishing diets comparing 0% Sweet Bran to only one other Sweet Bran concentration (*2001 Nebraska Beef Cattle Report*, pp. 59–63; *2005 Nebraska Beef Cattle Report*, pp. 37–38). In the current experiment, increasing concentrations of Sweet Bran were fed and the interaction between Sweet Bran concentration and corn processing method were evaluated. Therefore, the objective of this research was to determine the optimal level of Sweet Bran in SFC and HMC/DRC based finishing diets.

Procedure

A feedlot performance study conducted at the University of Nebraska–Lincoln Eastern Nebraska Research and Extension Center near Mead, NE utilized 480 crossbred yearling steers [initial body weight (BW) = 799 ± 33.3 lb.] Steers were sorted into 3 BW blocks, stratified by BW within block, and assigned randomly to one of 48 pens (10 steers/pen). The light block included 4 replicates, while the medium block included 3 replicates, and the heavy block included 1 replicate. All steers were weighed for two consecutive days after limit feeding a common diet of 50% alfalfa and 50% Sweet Bran at 2% of BW for 5 days to minimize gut fill.

Treatments were arranged as a 2 × 3 factorial, that consisted of two corn processing methods (SFC or a 2/3 HMC 1/3 DRC blend) and three inclusions of Sweet Bran (0, 20, or 40% of diet DM). Steam-flaked corn was processed to a flake density of 28.6 lb/bushel at a commercial feedlot (Raikes Feedyard, Memphis, NE) and delivered to the research feedlot on a weekly basis. High-moisture corn was harvested at approximately 73% moisture , processed through a roller mill, and stored in a concrete bunker for approximately 250 d. Treatment diets are provided in Table 1. All steers were fed monensin (Rumensin, Elanco Animal Health, Greenfield, IN) at 30 g/ton and tylosin (Tylan, Elanco Animal Health) was included at 8.8 g/ton (DM basis). Ractopamine (Optaflexx, Elanco Animal Health) was fed the last 28 (heavy and middle blocks) or 42 (light block) days on feed to target 300 mg/steer daily followed by a one-day withdrawal prior to slaughter. Feed was delivered once daily between 7 and 10 am.

Steers were implanted with 80 mg of trenbolone acetate and 16 mg estradiol (Revalor-IS, Merck Animal Health, De Soto, KS) on d -2 and then reimplanted with 200 mg trenbolone acetate and 20 mg of estradiol (Revalor-200, Merck Animal Health) on d 75 for the light block and d 76 for the medium and heavy blocks. The medium and heavy blocks were on feed for 154 days. The light block was shipped 2 weeks later and on feed for 168 days to achieve a similar 12th rib fat thickness as the medium and heavy blocks.

Cattle were harvested at a commercial abattoir (Greater Omaha; Omaha, NE). On the day of harvest, hot carcass weight (HCW) was recorded, and carcass-adjusted final BW was calculated using a 63% dressing percentage. Carcass-adjusted final BW was used to determine average daily gain (ADG) and feed conversion (Feed:Gain). On the day of harvest, liver abscess scores were recorded immediately after evisceration. Following a 48 h-chill, marbling score, 12th rib fatness, and longissimus muscle (LM) area were measured.

Data were analyzed using the MIXED procedure of SAS as a generalized randomized block design with pen as the experimental unit and block as a fixed effect. The experiment was analyzed as a 2 × 3 factorial with two corn processing methods (steam-flaked corn or high-moisture/dry rolled

Table 1. Dietary treatment composition (DM basis) for finishing steers fed high-moisture and dry-rolled corn or steam-flaked corn with 0, 20, or 40% Sweet Bran

	Treatment[1]					
	SFC	SFC	SFC	HMC/DRC	HMC/DRC	HMC/DRC
Ingredient	0	20	40	0	20	40
Steam-flaked corn	80	60	40	-	-	-
High-moisture corn	-	-	-	53.33	40	26.67
Dry-rolled corn	-	-	-	26.67	20	13.33
Sweet Bran	0	20	40	0	20	40
Corn Silage	15	15	15	15	15	15
Supplement[2]						
Fine Ground Corn	1.32	2.39	2.96	1.32	2.39	2.96
Limestone	1.66	1.59	1.52	1.66	1.59	1.52
Tallow	0.125	0.125	0.125	0.125	0.125	0.125
Urea	1.5	0.5	0	1.5	0.5	0
Salt	0.3	0.3	0.3	0.3	0.3	0.3
Vitamin A-D-E Premix	0.015	0.015	0.015	0.015	0.015	0.015
Beef Trace Premix	0.05	0.05	0.05	0.05	0.05	0.05
Rumensin Premix[3]	0.17	0.17	0.17	0.17	0.17	0.17
Tylan Premix[4]	0.009	0.009	0.009	0.009	0.009	0.009
Analyzed Nutrient Composition, % of DM						
Organic Matter	96.19	94.91	93.70	95.57	94.44	93.26
Neutral Detergent Fiber	11.86	17.19	22.47	13.52	18.43	23.39
Acid Detergent Fiber	5.76	7.21	8.65	6.05	7.43	8.80
Crude Protein	12.15	12.49	14.55	12.63	12.95	14.79
Calcium	0.796	0.793	0.791	0.772	0.775	0.779
Phosphorus	0.194	0.395	0.535	0.292	0.439	0.584

[1]Treatments included SFC 0: steam-flaked corn with 0% Sweet Bran, SFC 20: steam-flaked corn with 20% Sweet Bran, SFC 40: steam-flaked corn with 40% Sweet Bran, HMC/DRC 0: high-moisture corn/dry-rolled corn with 0% Sweet Bran, HMC/DRC 20: high-moisture corn/dry-rolled corn with 20% Sweet Bran, and HMC/DRC 40: high-moisture corn/dry-rolled corn with 40% Sweet Bran.

[2]Supplement fed at 5% of dietary DM for all treatments.

[3]Formulated to supply Rumensin-90 (Elanco Animal Health) at 30 g/ton DM.

[4]Formulated to supply Tylan-40 (Elanco Animal Health) at 90 mg per steer daily.

corn) and three inclusions of Sweet Bran (0, 20, or 40%). Linear and quadratic interactions between treatment factors were tested using covariate regression. If no interaction was observed, then main effects of corn processing and Sweet Bran inclusion were evaluated. If an interaction was observed, then simple effects of Sweet Bran inclusion were evaluated within each corn processing method. Liver abscesses were analyzed using the MIXED procedure of SAS as a binomial evaluating the presence or absence of liver abscesses. Arithmetic means are presented due to unbalanced blocking.

Results

Interaction of Sweet Bran and Corn Processing

There were no quadratic interactions or quadratic effects of Sweet Bran ($P > 0.22$). There was a linear interaction of corn pro-

Table 2. Carcass adjusted performance of cattle fed a combination of high-moisture and dry rolled corn or steam-flaked corn with 0, 20, or 40% Sweet Bran[1]

	Treatment							*P*-value[2]		
	SFC	SFC	SFC	HMC/DRC	HMC/DRC	HMC/DRC				
Item	0	20	40	0	20	40	SEM	Corn × SB Linear	Corn	SB Linear
Days on feed, n	161	161	161	161	161	161	-	-	-	-
Performance										
Initial BW, lb	799	799	799	799	799	799	11.6	0.77	0.81	0.34
Final BW[3], lb	1562	1578	1593	1473	1522	1570	10.9	< 0.01	< 0.01	< 0.01
DMI, lb/d	26.7	27.5	28.3	26.4	27.5	28.6	0.30	0.41	0.89	< 0.01
ADG, lb	4.81	4.91	5.01	4.25	4.56	4.87	0.07	<0.01	< 0.01	< 0.01
Feed:Gain[4]	5.56	5.61	5.67	6.21	6.04	5.88	-	< 0.01	< 0.01	0.24
Carcass Characteristics[c]										
HCW, lb	984	994	1004	928	959	989	6.8	< 0.01	< 0.01	< 0.01
LM area, in^2	15.0	15.1	15.2	14.5	14.7	14.9	0.16	0.60	<0.01	0.07
12th rib fat, in	0.61	0.63	0.66	0.58	0.61	0.63	0.02	0.92	0.10	0.02
Marbling[5]	512	520	528	486	488	490	11.3	0.60	< 0.01	0.42
Calculated Yield Grade[6]	3.45	3.51	3.57	3.31	3.43	3.54	0.08	0.57	0.27	0.05
Liver abscesses, %[7]	41.56	29.11	43.59	58.75	55.0	48.75	0.056	0.17	< 0.02	0.33

[1]Arithemtic means are reported

[2]Corn×SB= P-value for linear interaction between corn processing method (a combination of high-moisture corn and dry rolled corn or steam-flaked corn) and Sweet Bran inclusion (0, 20, or 40%); corn=*P*-value for main effect of corn processing method; SB= *P*-value for linear main effect of SB inclusion

[3]Calculated on a carcass-adjusted basis using a common dressing percentage (63%).

[4]Statistics based on Gain:Feed

[5]Marbling score 300=slight, 400=small, 500=modest, etc.

[6]Calculated as 2.5 + (2.5 x 12th rib fat, in) + (0.02 x 2.0 [KPH, %]) + (0.0038 x HCW, lb)—(0.32 x LM area, in^2).

[7]Calculated as a percent of total steers; dead steers removed

cessing method and Sweet Bran inclusion for ADG ($P < 0.01$; Table 2; Figure 1). In both SFC and HMC/DRC diets, ADG increased linearly from 0 to 40% Sweet Bran inclusion ($P < 0.05$). The SFC diet had greater ADG than HMC/DRC diet at 0% Sweet Bran, but as Sweet Bran increased in the diet, the ADG for HMC/DRC increased at a greater rate compared to SFC resulting in similar ADG at 40% Sweet Bran. There was also a linear interaction for F:G ($P < 0.01$). As Sweet Bran increased in the diet, there was no improvement in F:G for SFC diets ($P = 0.19$) but a linear improvement in F:G in HMC/DRC diets ($P < 0.01$). At 0% Sweet Bran, there was a 11.7% improvement in F:G when feeding SFC compared to HMC/DRC, which is consistent with previous research. While the F:G for SFC remained better than HMC/DRC when 40% Sweet Bran was fed ($P = 0.04$), the improvement in F:G was only 3.7% when 40% Sweet Bran was fed compared to 11.7% when no Sweet Bran was fed. Additionally, there was an interaction for HCW and carcass-adjusted final BW ($P < 0.01$). At 0% Sweet Bran, the SFC diet had greater HCW and carcass-adjusted final BW than the HMC/DRC diet. As Sweet Bran inclusion increased, there was a tendency for an increase in HCW and carcass-adjusted final BW for SFC diets ($P = 0.06$) and a significant increase for HMC/DRC diets ($P < 0.01$) resulting in similar HCW and carcass-adjusted final BW between the two corn processing methods fed with 40% SB.

There were no interactions for DMI, LM area, 12th rib fat, marbling, calculated yield grade, or liver abscesses ($P > 0.92$), so main effects of corn processing method or Sweet Bran inclusion will be discussed.

Corn Processing

There was a tendency for steers fed SFC to have greater fat depth than steers fed HMC/DRC ($P = 0.10$). Accordingly, steers fed SFC had a greater degree of marbling compared to steers fed HMC/DRC ($P < 0.01$). Steers fed SFC had a larger LM area than steers fed HMC/DRC ($P <$

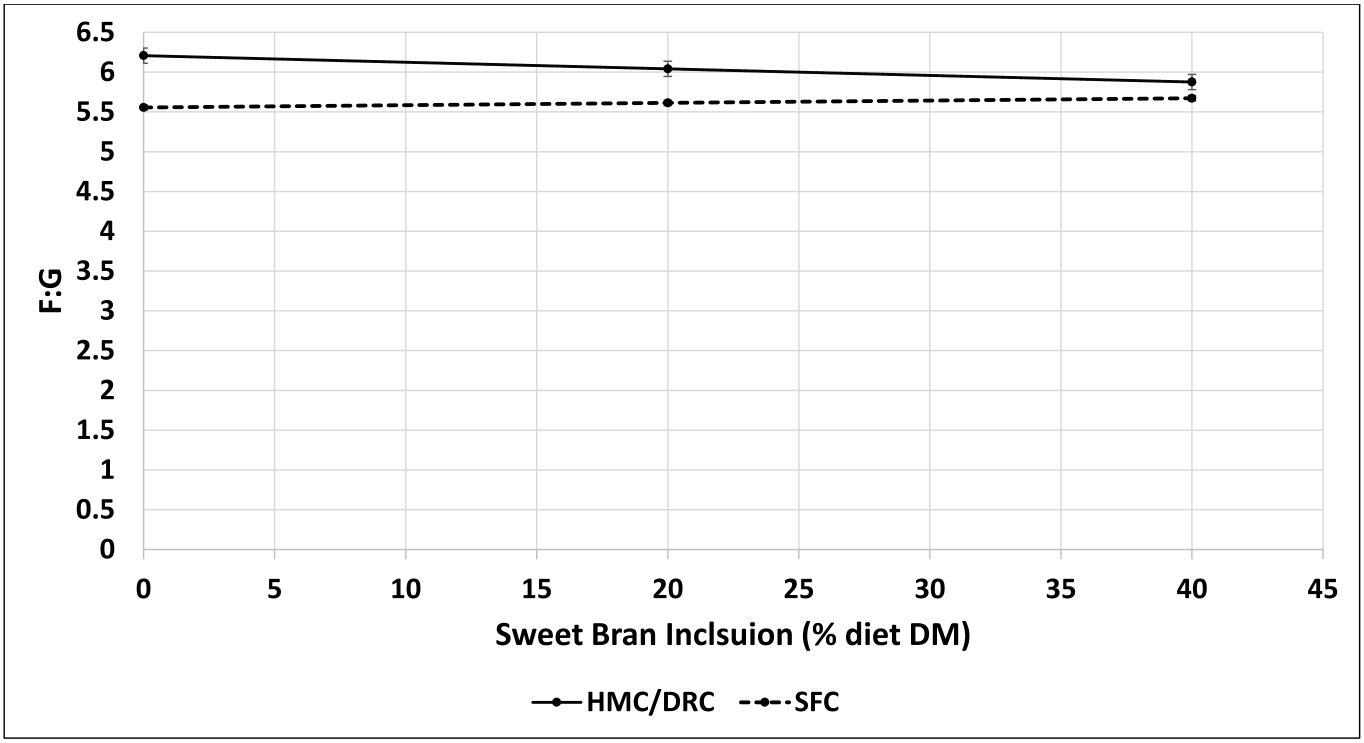

Figure 1. Effect of corn processing method and Sweet Bran inclusion on feed to gain ratio. Corn processing methods include steam-flaking (SFC) or a blend of 2/3 high-moisture corn and 1/3 dry-rolled corn (HMC/DRC). The linear interaction of corn processing and Sweet Bran was analyzed as Gain:Feed and was significant ($P < 0.01$).

0.01). Impacts on carcass traits likely reflect changes in performance as cattle fed SFC generally gained better. Lastly, there was an effect of corn processing on liver abscesses with steers fed HMC/DRC having a greater prevalence of liver abscesses compared to steers fed SFC ($P < 0.02$). It is unclear why abscess rates were abnormally high as all steers were fed tylosin in this study.

Sweet Bran

There was a linear increase in DMI as Sweet Bran increased in the diet regardless of corn processing method ($P < 0.01$). There was also an increase of 12th rib fat with fat increasing as Sweet Bran increased in the diet ($P = 0.02$), which lead to a linear increase in calculated yield grade as Sweet Bran increased in the diet ($P = 0.05$). As Sweet Bran increased in the diet, LM area also tended to increase ($P = 0.07$).

Conclusions

These data suggest that up to 40% Sweet Bran can be fed with SFC without affecting feed conversion and the optimal level of Sweet Bran for HMC/DRC based finishing diets is 40%. Therefore, feeding Sweet Bran in HMC/DRC based finishing diets makes HMC/DRC diets more competitive with SFC-based finishing diets allowing producers without steam-flaking capabilities to achieve similar gains and conversions.

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