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Effect of Corn Processing and Reconstitution in High Grain Diets on Feedlot Performance and Carcass Characteristics of Steers and Heifers

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Summary

A 167-day feedlot trial was conducted to examine the effects of corn processing and reconstitution on growth performance and carcass characteristics of feedlot cattle. Initial weights of the continental cross steers (n=95) and heifers (n=63) were 690 and 680 lb, respectively. Diets were 84.5% corn, 7.0% ground grass hay, 4.9% soybean meal, and 3.6% liquid supplement. The grain component of the diet was either dry whole corn (WC), dry rolled corn (RC), corn reconstituted at least 12 h before rolling (RRC), or corn reconstituted with a commercial surfactant[3] at least 12 hours before rolling (CRC). Monensin and tylosin were included at 26.9 and 11.0 g/ton, respectively. Dry matter content of the WC, RC, RRC, and CRC diets were 85.62, 85.03, 80.98, and 80.96%, respectively. Dietary treatment had no effect on the feedlot performance of the steers or heifers. Yield grade (YG) was lower (P=.05) for CRC than for RRC cattle (2.96 vs 3.27). Kidney pelvic and heart fat (KPH) was lower (P<.05) for RC (2.30%) and CRC (2.29%) than for WC (2.48%) and RRC (2.56%) cattle. KPH and YG were the only measured variable affected by dietary treatment indicating little advantage to any of the corn processing methods tested.

Key Words: Beef, Grain Processing, Feedlot Performance

Introduction

This trial is the second part of a research project to evaluate the effects of corn grain processing and reconstitution in high grain diets. The first trial evaluated treatment effects on nutrient digestibility and processed corn grain particle size distribution. Data from the digestibility trial indicated no differences in nutrient digestibility due to processing, reconstitution or treatment with a surfactant. Gain, feed efficiency, and carcass data were not measured in the digestibility trial due to constant handling of the cattle and the low number of experimental units (n=12). The purpose of this trial was to examine the effects of corn grain processing and reconstitution on growth performance and carcass characteristics of feedlot cattle.

Materials and Methods

Ninety-five steers and 63 heifers of crossbred continental ancestry were allotted by gender into 20 pens (8 head/pen) to examine the effects of corn processing and reconstitution on growth performance and carcass characteristics of feedlot cattle. All but three of the steers and heifers were purchased from one ranch. Initial weights of the steers and heifers were 690 and 680 lb, respectively. Diets were 84.5% corn, 7.0% ground grass hay (2 in. screen), 4.9% soybean meal (SBM), and 3.6% liquid supplement (Table 1). The grain component of the diet was either dry whole corn (WC), dry rolled corn (RC), corn reconstituted at least 12 hours before rolling (RRC), or corn reconstituted with a commercial surfactant at least 12 hours before rolling (CRC). The same lot of corn was used to prepare all treatments for a week or more depending on the size of the

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[3]E-Z Flake 4, Loveland Industries, Greeley, CO.

Table 1. Diet composition

Ingredient	(DMB)
Corn, %	84.50
Grass hay, %	7.00
Soybean meal, %	4.90
Liquid supplement, %	3.60
Crude protein, %	12.03
Calcium, %	.532
Phosphorus, %	.317
Potassium, %	.894
NE_m (Mcal/cwt)	95.66
NE_g (Mcal/cwt)	65.54
Monensin (g/ton)	26.9
Tylosin (g/ton)	11.0

lot. Monensin and tylosin were included at 26.9 and 11.0 g/ton, respectively.

Cattle were fed once daily (a.m.) in outside concrete floored pens that are 25 ft.^{2} with an automatic waterer and 25 feet of fence-line feed bunk. Bedding was supplied equally to all pens as environmental conditions dictated. Steers were implanted with Synovex-S[4] on day 1 and Revalor[5] on day 65. Heifers were implanted with Synovex-H[4] on day 1 followed by Synovex-H and Finaplix-H[5] on day 65. All cattle were weighed in the morning at 0, 23, 44, 65, 93, 121, 149, and 167 days on feed. At 107 days on feed the source of grass hay changed and .4% urea was added to the diet to maintain crude protein levels. Cattle were slaughtered on two consecutive days. Carcass data collected included hot carcass weight (HCW), rib eye area (REA), rib fat thickness (RF), kidney pelvic and heart fat (KPH), and marbling score.

Reconstituted treatments (RRC and CRC) were prepared by adding 7% water to the whole corn grain in a horizontal ribbon-type mixer. The corn was left in the mixer overnight and rolled in the morning. The same roller with the same distance between the rolls was used for all grain processing. Two batches of RRC and CRC were prepared each week and stored in gravity flow bulk bins.

Data were analyzed with the GLM procedure of SAS (1985) appropriate for a randomized complete block design. Least squares means were separated with the PDIFF option at the .05 level. Pen means were used as the experimental unit for feedlot performance data. There were three pens of steers and two pens of heifers assigned to each diet. Animal was the experimental unit for carcass data.

Results and Discussion

An addition of 7% water by weight increased ($P<.001$) the moisture of the RRC and CRC corn by an average of 5.5%, while dry rolling increased ($P<.01$) the moisture content of the RC by .7%. Excess reconstituted grain carry-over in the bulk bins was not a problem in the colder months (January through April). When daytime temperatures exceeded 70 °F, reconstituted corn would begin to get warm after 4 days. During warmer weather, care was taken to match the supply of reconstituted corn to consumption in order to empty bins once weekly. Even though reconstituted corn occasionally became warm, it did not produce a offensive smell and had cooled by the time it was delivered to the feed bunk. Corn processing had no effect on cumulative feedlot performance (Table 2). Orthogonal contrasts showed that the increase in dry matter intake of the RRC and CRC over the RC diets neared significance ($P=.06$). During the first half of the trial, feed deliveries were not managed to reduce the accumulation of fines in the bunk giving a rather high mean (.24 ± .03 lb per head per day) for diet refusal. Diet refusal was not affected by dietary treatment. Steers exhibited greater ($P<.05$) ADG and dry matter intake than heifers (Table 3). Steers tended ($P=.09$) to be more efficient than heifers.

[4]Syntex Animal Health, Des Moines, IA.
[5]Hoechst Roussel, Somerville, NJ.

Table 2. Diet analysis, cumulative feedlot performance, diet refusals, and carcass characteristics by treatment

Variable	Treatment				SE
	WC	RC	RRC	CRC	
Corn dry matter, %	86.35[a]	85.65[b]	80.81[c]	80.78[c]	.11
Diet dry matter, %	85.62[a]	85.03[b]	80.98[c]	80.96[c]	.09
Crude protein, %	11.67	11.76	11.81	11.78	.06
Neutral detergent fiber, %	12.53	12.56	12.57	12.56	.004
Acid detergent fiber, %	5.45	5.47	5.47	5.47	.003
Ash, %	3.75	3.90	3.93	3.94	.03
NE_m, Mcal/cwt	92.63	92.54	92.57	92.57	.02
NE_g, Mcal/cwt	63.29	63.26	63.25	63.25	.006
Feedlot Performance					
Initial wt., lb	686	685	686	684	2.8
Final wt., lb	1240	1246	1242	1240	15.1
Average daily gain, lb	3.28	3.30	3.30	3.31	.09
Dry matter intake, lb	20.40	20.19	20.79	20.83	.23
Feed/gain	6.24	6.14	6.31	6.31	.14
Diet refusals, lb/head/day	.26	.25	.27	.21	.03
Carcass Characteristics					
Hot carcass wt, lb	753	756	751	751	9.0
Dressing percent	61.1	61.1	60.7	60.7	.21
Yield grade	3.10[ab]	3.03[ab]	3.27[a]	2.96[b]	.10
Kidney, pelvic, heart fat, %	2.48[ab]	2.30[b]	2.56[a]	2.29[b]	.07
Quality grade[d]	5.14	5.07	5.10	5.03	.12

[a,b,c]Unlike superscripts differ ($P<.05$).
[d]5.0 = low choice.

Hot carcass weight was not influenced by diet. KPH was lower ($P=.03$) for RC (2.30%) and CRC (2.29%) than for WC (2.48%) and RRC (2.56%) cattle. Yield grade (YG) was lower ($P=.05$) for CRC than for RRC cattle (2.96 vs 3.27). YG was lower ($P<.001$) for heifers than for steers (2.37 vs 2.85). REA was larger ($P<.001$) for heifers than for steers (13.4 vs 12.5 in.^{2}). RF (.56 in.) and dressing percentage (60.9%) were not affected by diet or gender. Average quality grade (5.0 = low choice) was lower ($P<.01$) for heifers than for steers (4.91 vs 5.26). Heifers and steers graded 41.3 and 68.4% choice, respectively. It was noted upon palpating the implant sites that of the Revalor and Finaplix-H implants only 60% were normal. Cattle were wet when the implanting was performed and a less than ideal implant placement was necessary due to ear conditions. The heifers also received a Synovex-H implant (right ear) which had a much higher normal rate (90%). This may explain the larger rib eyes and lower quality grades of the heifers.

Table 3. Feedlot and carcass data by gender

Variable	Heifers	Steers	Root MSE
Number[a]	63	95	--
Initial wt	680	690	52.9
Final wt	1207	1264	84.5
Average daily gain, lb[c]	3.15	3.44	.198
Dry matter intake, lb[c]	20.10	21.00	.518
Feed/gain	6.38	6.12	.313
Diet refusals, lb/head/day	.26	.23	.069
Carcass Characteristics			
Hot carcass wt, lb	737.8	768.4	56.64
Rib eye area, $in.^{2}$[c]	13.4	12.5	1.22
Rib fat, in.	.54	.57	.16
Yield grade[c]	2.84	3.34	.66
Kidney, pelvic, heart fat, %	2.37	2.45	.47
Quality grade[bc]	4.91	5.26	.74
Dressing percent	61.0	60.8	1.32

[a]n = 62 for heifer carcass data.
[b]5.0 = low choice.
[c]Gender effect ($P<.05$).

Conclusions

Cold rolling and reconstitution of whole shelled corn offered no advantages in feedlot performance or carcass characteristics. The addition of the conditioner to the reconstituted diets lowered yield grade. Although feed refusals were reduced by reconstitution in the digestion trial, no differences were noted in this feedlot trial. Reconstituted treatments showed the highest dry matter intake in the feedlot trial and the lowest dry matter intake in the digestion trial. CRC diets showed the least diet refusals in both trials. Processed grain treatments did not increase utilization or performance enough to cover the cost of processing. Reconstitution does reduce the fines and dust associated with processed grains. This is an advantage that could not be measured by animal performance.