EFFECTS OF PROCESSING METHOD AND ADDING MOISTURE ON THE FEEDING VALUE OF HIGH MOISTURE CORN FOR FEEDLOT STEERS

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Story in Brief

The effect of adding water and method of processing high moisture corn on feedlot cattle performance was studied. Limousin crossbred steers (741 lb; n=96) blocked by weight were assigned randomly to one of three treatments. Corn grain (70% DM) was ground through a commercial tub grinder or rolled either without or following the addition of water (64.5% DM) and ensiled. Steers were given ad libitum access to high moisture corn in 92% concentrate diets with chopped alfalfa (8%) included as a roughage. Feed intake and ADG during the 135 d trial were not significantly different between ground and rolled grains. However, ground grain improved efficiency (4.46 vs. 4.60). Wet grain tended to decrease intake (16.8 v. 17.9 lb. DM) with no effect on ADG. Consequently, wet grain improved both live and carcass adjusted efficiency. At slaughter, cattle fed ground grain tended to have a higher dressing percentage and more backfat than rolled grain. Cattle fed rolled wet grain tended to have more external fat and more carcasses grade choice than rolled grain. The addition of water to high moisture corn before ensiling appeared to slightly increase efficiency and fat deposition of feedlot steers. Compared with cattle fed corn in the rolled form, cattle fed ground high moisture corn had an improved feed efficiency. Ideal particle size represents a balance between digestion and acidosis. For maximum digestion, large particles should be avoided, but to reduce acidosis, small particles should be avoided. To minimize diversity in particle size, rolling should be preferable to grinding, but the ideal particle size and distribution for high moisture rolled corn remains to be determined.

(Key Words: Ground Grain, Rolled Grain, Digestibility.)

Introduction

High moisture corn is the staple of millions of feedlot cattle. Most corn preserved in this manner is ensiled at approximately 30% moisture following rolling or grinding. Processing method has been shown to influence cattle

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performance (Van Koevering et al., 1994). Corn moisture level at processing is an important factor in subsequent cattle performance (Owens and Secrist, 1994). Water added to corn at processing may improve feedlot performance. The objective of this study was to investigate the effects of water added before processing and processing method on the feeding value of high moisture corn.

Materials and Methods

Animals: Limousin crossbred yearling steers (n=96) from Oklahoma were hauled to Guymon, OK on January 12, 1994. The cattle were vaccinated with a MLV 4-way respiratory vaccine and implanted with Revalor-S®. On January 27, 1994 (d 0) the cattle were transported 15 miles to the Panhandle State University research facility at Goodwell, OK. The cattle were weighed, stratified by weight into two weight blocks (heavy and light) and assigned randomly to one of three treatments. High moisture corn was either ground through a commercial tub grinder rolled or rolled with water sprayed on while still in the truck before processing. The steers were housed (eight calves/pen) in twelve outside pens with covered feed bunks. Each treatment had four pens (two heavy reps and two light reps).

Diets. Isonitrogenous and isocaloric diets (Table 1) were available free choice. The basal ingredients (corn and alfalfa hay) were analyzed in a commercial laboratory for dry matter, crude protein, calcium, phosphorus and potassium. The diets differed only in corn processing method and/or moisture content.

Data Collection. The calves were weighed on d 28, 63, 121 and 138. Feed samples were taken at each weighing. Cottonseed hull based pellets containing chromic oxide were fed d 89 to 99 to provide each animal with 10 g chromic oxide per d. Fecal samples were collected from all pens on d 97 (PM), 98 (AM and PM) and 99 (AM). Fecal samples were analyzed for starch, protein and chromium content. Total tract digestibilities of crude protein and starch digestibility were calculated. The heavy replicate group was killed at Monfort, Dumas, TX on d 128. Carcass data were collected after a 24 hr chill. The light replicate group was killed at Excel, Dodge City, KS on d 144. Carcass data were collected and rib sections were obtained for further study after a 48 hr chill. Statistical analysis were completed by orthogonal contrasts of SAS comparing rolled vs. ground and rolled wet vs. rolled.

Results and Discussion

Cattle Performance. Performance data are summarized in Table 2. Average daily gain was calculated both on a liveweight and a carcass adjusted (common dressing percentage) basis. Differences between these values are due to

differences observed in dressing percentage. Rate of gain was not affected by added moisture or processing method at any time during the trial. Wetted corn tended to decrease intake in the last half of the feeding period (P=.10) and overall (P=.13). Consequently, efficiency was improved (P=.02) late in the finishing phase and overall (P=.003). Processing method did not affect intake. However, efficiency was superior (P=.02) for ground corn when calculated on a carcass adjusted basis. This is consistent with previous research at this station in which ground corn was found to have superior feeding value (Van Koevering et al. 1994). Maximum efficiency is attained when digestion is maximized without causing acidosis. Ground corn typically is finer than rolled corn, thereby increasing both rate and extent of digestion and possibly predisposing animals to acidosis. Optimum particle size, to allow for maximum digestion without digestive upset, has not yet been determined. Similarly, increased moisture may lead to enhanced ruminal digestion of corn. Rumen microbes may digest wetter particles more quickly due to faster access to the wetter material. These performance results were supported by the digestibility results.

Carcass Characteristics. Carcass data are summarized in Table 3. No differences were noted in carcass characteristics due to corn processing. Dressing percentage was not affected by moisture level, but steers fed ground grain tended (P=.09) to have a higher dress. Backfat (P=.12) and pelvic fat tended to be increased with added moisture. More of the animals fed wetted grain graded choice (P=.15). These data are consistent with the performance data.

Digestibility. Digestibility data are summarized in Table 4. Though not significant, wetting the grain produced higher dry matter, starch and protein digestibilities. These data further support the idea that adding moisture before ensiling may enhance animal performance Ground grain tended to produce higher starch digestibility (P=.28), but dry matter and protein digestibility did not differ.

Literature Cited

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Table 1. Diet and calculated nutrient composition (% of DM) for high moisture corn diets.

Ingredient	Rolled/wet	Rolled	Ground
Dry matter	67.88	72.55	74.57
High moisture corn	83.16	84.10	84.6
Alfalfa hay	8.00	8.00	8.00
Cottonseed meal	3.00	3.00	3.00
Soybean meal	3.80	2.88	2.20
Urea	.5	.50	.50
Salt	.3	.30	.30
Limestone	.95	.85	.85
Dical	.19	.19	.25
Potassium chloride	.15	.21	.25
Copper sulfate	.0012	.0012	.0012
Zinc oxide	.0014	.0015	.0015
Vitamin A 30	.011	.011	.011
Rumensin 80	.017	.017	.017
Tylan 40	.0125	.0125	.0125
Calculated nutrient composition. dry matter basis			
NEm, Mcal/cwt	94.94	96.14	96.13
NEg, Mcal/cwt	62.09	62.19	62.17
Crude Protein, %	13.00	13.00	13.00
Potassium, %	.70	.70	.69
Calcium, %	.61	.60	.59
Phosphorous, %	.34	.34	.34
Magnesium, %	.17	.17	.167
Cobalt, ppm	.12	.12	.12
Copper, ppm	8.3	8.1	8.0
Iron, ppm	105.6	103.2	110.5
Manganese, ppm	40.3	40.4	40.4
Selenium, ppm	.17	.17	.16
Zinc, ppm	30.5	30.7	30.4

Table 2. Effects of corn processing and added water on feedlot performance.

Item	Rolled/wet	Rolled	Ground	Wet v. Dry P=	Rld v. Grd[c] P=
Liveweight, lb[a]					
Initial	740	737	740		
Final	1269	1279	1272	.73	.57
DMI, lb					
Day 0 to day 61	17.1	17.9	17.9	.25	.98
Day 61 to finish	16.6	17.9	17.4	.10	.49
Total	16.8	17.9	17.7	.13	.68
ADG, lb[a]					
Day 0 to day 61	4.27	4.51	4.62	.31	.64
Day 61 to finish	3.85	3.78	3.77	.63	.96
Total (live)	4.09	4.20	4.13	.50	.67
Total (carcass)[b]	3.84	3.91	3.97	.60	.66
Feed /gain					
Day 0 to day 61	4.01	3.98	3.88	.71	.25
Day 61 to finish	4.36	4.82	4.65	.02	.27
Total (live)[a]	4.13	4.27	4.29	.03	.75
Total (carcass)b	4.40	4.60	4.46	.003	.02

[a]Weight based on unshrunk live-weight.

[b]Calculated using carcass weight and the average dressing percentage.

[c]Compares corn with different processing method and a similar moisture content

Table 3. Effects on grain processing on carcass characteristics.

Item	Rolled/wet	Rolled	Ground	Wet v. Dry P=	Rld v. Grd P=
Dress, %	63.4	63.2	64.1	.58	.09
Hot carcass weight, lb	804.8	808.4	814.8	.76	.60
Marbling score	343.8	331.9	341.3	.53	.62
Backfat, inches	.46	.40	.43	.12	.48
KPH, %	1.94	1.82	2.07	.53	.21
Yeild grade	1.81	1.81	1.91	1.00	.60
Rib eye area, inches^2	16.0	15.5	16.1	.43	.32
Choice, %	25.00	6.25	18.75	.15	.33
Select, %	56.25	75.00	56.25	.28	.28
Standard, %	18.75	18.75	25.00	1.00	.67

Table 4. Effects of grain processing on diet dry matter digestibility.

Item	Rolled/wet	Rolled	Ground	Wet v. Dry P=	Rld v. Grd P=
Digestibility, %					
Dry matter	85.4	84.8	84.5	.89	.83
Starch	98.0	97.8	98.0	.27	.28
Protein	78.8	78.3	78.0	.67	.83
Fecal concentration of DM, %					
Starch	10.6	10.7	9.3	.98	.26
Protein	17.2	17.9	17.9	.09	.79