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High Moisture and Dry-Rolled High-Oil Corn for Finishing Feedlot Steers

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> When fed in the dry rolled form, high-oil corn improved feed efficiency over normal corn. However, high-oil corn did not improve efficiency over normal corn when fed in the high moisture form.

Summary

Finishing steers fed diets containing dry-rolled high-oil corn had a 2.5% reduction in dry matter intake and 4.2% better feed efficiency than steers fed diets containing dry-rolled normal corn. Hot carcass weight, dressing percent, liver abscess score, rib fat thickness, marbling score and yield grade did not differ among treatments. Steers fed high-moisture high-oil corn had larger ribeye area and greater percent kidney, pelvic and heart fat than steers fed high moisture normal corn. No differences in performance or efficiency were detected from substituting high-oil high moisture corn for normal high moisture corn.

Introduction

Nutritionally modified grain varieties, such as "high-oil" (HO) corn, have been developed that may improve efficiency of livestock production. Higher oil content of grain increases energy density of the diet and aids in dust control. However, the ideal management systems (processing method; fat, ionophore, mineral supplementation) for nutritionally modified grains may differ from those ideal for normal grain. For example, South Dakota State University researchers detected a processing by corn type interaction between normal and high-oil corn. Dry matter intakes and gains were 5 to 10% greater for steers fed rolled HO corn than steers fed whole HO corn. These results indicate that HO corn may need to be processed prior to feeding to finishing beef cattle. To date, no information has been published on HO corn harvested, stored and fed as high moisture grain to feedlot cattle. The objective of this study was to evaluate high-oil corn versus normal corn when fed as dry-rolled or high moisture grain to finishing feedlot steers.

Procedure

In separate locations, normal (N) and high-oil (HO) corn varieties were planted at the University of Nebraska, Northeast Research and Extension Center in Concord, Neb. Varieties were harvested as both high-moisture (HM) and as dry corn. At harvest each load of corn was sampled and analyzed for DM content. High-oil and normal high moisture corn were harvested at 28 % DM. Corn harvested as HM grain was rolled and stored in two separate bunker silos. Dry corn (D) was coarsely rolled prior to feeding.

Three hundred eighty British x continental crossbred steers were purchased in early November 1998 and were processed in mid- to late November. Processing included: weighing, implanting, tagging, vaccinating, and deworming. Weights at processing were used to divide the steers into light (LWG) and heavy (HWG) weight groups. On Dec. 7, the LWG again was weighed and sorted by weight into additional groups and placed into their respective trial pens on Dec. 8. Initial weight for the LWG was an average of full live weights taken on Dec. 7 and Dec. 8. The HWG was treated the same as the LWG, with full live weights taken

(Continued on next page)

Table 1. Percentage of grain from each grain type and form in each diet.

	Treatment			
Grain type	1	2	3	4
Normal				
Dry-rolled	50	0	0	50
High moisture	50	0	50	0
High-oil				
Dry-rolled	0	50	50	0
High moisture	0	50	0	50

on Dec. 9 and Dec. 10. Fifteen steers were excluded from the research pool for the following reasons: too heavy, too light, or lame.

The LWG included 200 steers with 10 steers/pen in 20 pens (five weight groups with four treatments in each weight group). The HWG included 160 steers with 10 steers/pen (four weight groups with four treatments in each weight group). Pens were assigned randomly within each weight group to one of four treatments. Each diet contained equal amounts of DM corn from D and HM. This made the four different combinations of N and HO corn in the D and HM form: (1) ND plus NHM, (2) HOD plus HOHM, (3) HOD plus NHM, and (4) ND plus HOHM as shown in Table 1.

On a DM basis, the finishing diets contained 84% corn, 7.5% alfalfa hay, 4.5% liquid supplement, 2.0% soybean meal, and 2.0% Rumensin®, Tylan®, thiamine supplement. Diet ingredients and feedbunk samples were obtained every second week and analyzed for DM content. Corn samples were also analyzed for CP, pepsin insoluble nitrogen and crude fat. High-moisture corn was also analyzed for pH, ethanol and selected volatile fatty acids. Feedbunk samples were analyzed for nitrogen, calcium and phosphorus. Fecal samples were collected from two steers/pen and four pens/treatment and analyzed for pH, crude fat, and starch content.

The LWG and HWG were harvested after 92 and 81 days on feed, respectively. On day of harvest, liver abscess scores and hot carcass weights were recorded. After a 24-hour chill, rib eye area (REA), rib fat thickness (RF), USDA quality grade, USDA yield grade and percent kidney, pelvic and heart fat (% KPH) were recorded. Tissue samples were removed from the neck region of a sub-sample of carcasses (mean of 20 carcasses/treatment) of the HWG on the day carcass data was collected. Lipid extracted from both the lean and fat tissue were analyzed for following fatty acids: myristic, myristoleic, palmitic, palmitoleic, stearic, oleic, linoleic, linolenic, arachidic, ecosenoic, and summed to calculate total saturated, and mono-, di-, and tri-unsaturated.

Table 2. Corn analysis, Dry Matter Basis.

	Normal	High-oil	P < .10
High Moisture Corn			
Dry matter at harvest, %	71.6	71.8	
Dry matter at feeding, %	66.8	68.8	.028
Crude fat, %	5.00	8.12	.0001
pH	4.04	4.14	
Crude protein, %	8.45	8.87	.045
Pepsin insoluble nitrogen, %	10.43	10.72	NS
Ethanol, %	1.97	1.88	NS
Lactate, %	3.97	4.18	.063
Acetate, %	1.40	1.25	NS
Propionate, %	.20	.17	NS
Dry-Rolled Corn			
Dry matter, %	86.4	86.4	NS
Crude fat, %	4.48	6.98	.0001
Pepsin insoluble nitrogen, %	26.77	26.30	NS

Table 3. Summary of steer performance, intake and efficiency comparing high moisture and dry-rolled high-oil corn over approximately 90 day feeding period.

	Treatment			
Item	1	2	3	4
No. head	90	90	90	90
No. pens	9	9	9	9
Initial weight, lb	900	898	900	900
Average daily gain, lb/day[a]	4.16	4.18	4.18	4.07
DM intake (DMI), lb/day[b]	26.07	25.50	25.28	25.98
Feed efficiency, DMI/gain[c]	6.28	6.09	6.07	6.38
Final weight, lb	1261	1263	1261	1254

[a]Adjusted to a common dress of 63%.
[b]Treatments 1 plus 4 vs 2 plus 3 differ ($P < .10$).
[c]Treatments 1 plus 4 vs 2 plus 3 differ ($P < .05$).

Table 4. Summary of steer carcass data comparing high moisture and dry-rolled high-oil corn in feedlot diets.

	Treatment			
Item	1	2	3	4
Hot carcass weight, lb	794	795	794	790
Actual dress, %	62.6	62.5	63.1	62.7
KPH fat, % of carcass[a]	2.29	2.36	2.30	2.34
Ribeye area, sq in	13.73	13.91	13.65	13.94
Estimated fat, in	.42	.43	.42	.43
Marbling score[b]	537	531	504	530
USDA yield grade	2.51	2.43	2.48	2.39
Final yield grade[c]	2.64	2.62	2.66	2.58
Liver abscesses, %	3.33	5.56	7.78	10.00

[a]Treatments 1 plus 3 vs 2 plus 4 differ ($P < .05$).
[b]Marbling score of 400 = Traces, 500 = Small, 600 = Modest, 700 = Moderate.
[c]Final yield grade = 2.50 + (2.50 x estimated fat thickness) + (.20 x percent KPH) + (.0038 x hot carcass weight) – (.32 x ribeye area).

Results

Even though HOHM corn and NHM corn were harvested at the same moisture content, HOHM corn had a higher ($P < .05$) DM content (based on oven

DM determinations) than NHM corn after fermentation (Table 2). The CP content was greater (*P* < .10) for HO corn than N corn as is typical for high-oil corn (Table 2).

Based on analysis of feces from these steers, no differences (P > .05) in fecal starch content were detected among treatments. However, crude fat content of feces was 5.04%, 7.96%, 6.85%, and 6.31% for treatments 1, 2, 3 and 4 respectively. Thus steers fed HODR corn (treatments 2 and 3) had more (*P* < .05) of their fecal DM as crude fat than steers fed NDR corn (treatments 1 and 4).

When compared with steers fed diets containing dry-rolled normal corn, (mean of treatments 1 and 4) steers fed diets containing HODR corn (mean of treatments 2 and 3) tended to have lower (*P* < .10) dry matter intakes but had improved (*P* < .05) feed conversions. No differences (*P* > .10) were detected in feed intake, gain and efficiency between steer groups fed high-moisture normal corn (mean of treatments 1 and 3) vs high-moisture high-oil corn (mean of treatments 2 and 4; Table 3).

No differences (*P* > .05) in saturation of fatty acid from lean or fat tissue among treatments were detected. However, steers fed high-oil corn tended to have greater (*P* < .10) percentages of arachidic acid (C20:0) in both meat (.66 vs .59) and fat (.92 vs .86) samples. Steers fed high-oil high-moisture grain had greater (*P* < .05) internal (KPH) fat than steers fed normal high moisture grain (2.35 vs 2.30). Feeding a mixture of high-oil grain with normal corn grain (mean of treatments 3 and 4) tended to slightly increase (*P* < .10) the incidence of liver abscesses when compared to steers fed either grain form alone (average of treatments 1 and 2; Table 4).

Results from this study indicate that substituting dry high-oil corn for a portion of the dry corn with normal oil content in diets for feedlot steers can decrease dry matter intake and improve feed conversion. Although no problems with fermentation of high-moisture high-oil corn were encountered, no performance advantage from substituting high-moisture high-oil corn for high-moisture corn with normal oil content was detected.

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