Value of High-Oil and High-Protein Corn Grains for Finishing Cattle

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Summary

Three specialty corns, high oil, high protein and high oil with high protein, were compared with control corn in a 113-day steer feeding trial. During the first 63 days of the study, steers fed the corns containing more oil had slower gain and poorer feed conversion compared with the control corn. At the end of the trial there were no statistically significant differences in performance of steers fed the different corns. Steers fed the high protein corn tended to have higher grading carcasses compared with those fed the control corn. Otherwise there were no differences in carcass measurements due to source of corn fed the steers. Feed cost of gain was reduced with the high-protein corn and the corn with high fat and high protein compared with the control corn because of similar feed conversions and the reduced amount of soybean meal needed to supplement the specialty corns.

Introduction

Plant breeders have modified corn to enhance its nutritional value for livestock. One modification has been to increase the energy concentration in the grain by increasing the oil content. Another modification has been to increase the protein content of the grain. Still another modification has been combining the increase in oil and protein into one variety. The purpose of this study was to evaluate a high-oil variety, a high-protein variety and a high-oil and high-protein variety in comparison with a control corn as feeds for finishing steers.

Materials and Methods

One hundred forty-four yearling Angus steers (average initial weight 860 lb.) were purchased from one ranch. The steers had been weaned and were being fed a backgrounding ration containing 11% hay, 28% corn silage, 55% corn and 6% liquid supplement. The steers were purchased in February and started on experiment in early March. Six steers were allotted to each of 24 pens at random from outcome groups based on frame score (calculated from hip height and age) and backfat as measured by ultrasound. Six pens were assigned at random to each of the four diets shown in Table 1. The steers were fed Rumensin® (28 gm/ton at 90% dry matter) and implanted with Revalor®-S 21 days after the experiment was started. Steers were weighed in the mornings before feeding, on two consecutive days at the beginning and end of the study and at 32-day intervals throughout.

The four treatments compared in the 113-day experiment were control corn (Wilson 1664), high-oil corn (Wilson 6605 ED), high-protein corn (Wilson 1785) and corn containing high oil and high protein (Wilson 1650 HV). The dry matter contents of the four respective corns were 88.8%, 89.6%, 91.0% and 91.2%. The protein and ether extract concentrations were 8.05 & 3.65; 8.01 & 6.39; 8.89 & 4.16 and 9.67 & 6.35 as a percent of dry matter for the control, high-oil, high-protein and high-oil with high-protein, respectively. The corns were processed in a roller mill to break or crack a majority of the kernels. Because the initial analysis indicated the grains contained different quantities of protein, additional soybean meal was fed with the control corn to make the rations isonitrogenous with respect to plant sources of protein (Table 1). However, analysis of later samples indicated the high-oil corn did not contain more protein. The concentrate portion of the diet was prepared as a mix and weighed separately from the silage. The two feeds were mixed before being placed in the bunks. The steers were started on the finishing rations shown in Table 1 by limiting intake. Feed offered the steers was gradually increased until they were being fed to appetite. The steers were fed two times per day. The corns were sampled during the trial for analysis of dry matter, protein and oil. Periodic samples of the mixed feeds and silage were taken for determination of dry matter. Feed removed from the bunks was weighed and sampled for determination of dry matter. Dry matter was determined by drying in a convection oven at 85 ^{0}C. Total nitrogen in the corns was measured by the Kjeldahl method and multiplied by 6.25 to obtain crude protein. Oil content of the corns was measured by extracting with ether and weighing ether soluble materials extracted.

The steers were sold one load at a time so each carcass could be processed into retail cuts for evaluation of sires. All the steers within a pen were sold together. The steers fed the corn containing high oil and high protein were fed an average of two additional days compared with the other corns. Weights of hot carcasses were taken after slaughter, and measurements on the carcasses were obtained after a 48-hour postmortem chill. One federal grader called marbling, yield grade, and percentage of kidney, pelvic, and heart fat (KPH) for all the carcasses. Ribeyes were individually traced on sheets of acetate paper that were later used to measure fat thickness and muscle area using a beef carcass grid. Ribeye area and fat thickness measurements were made between the 12th and 13th ribs on the left side. Yield grade was calculated from carcass measurements using the standard yield grade equation.

Pen means were used as the experimental unit in the statistical analysis. Data were analyzed by analysis of variance. Treatment means and probabilities of difference due to rations are presented.

Results and Discussion

Steer performance is shown in Table 2. Steers fed high-oil corn gained less (32 lbs.) during the first 63 days of the experiment but recovered 10 lbs. of this difference during the remainder of the study. During the first 63 days of the trial, the corn with high oil and high protein numerically reduced gain compared with the high protein corn similar to the results obtained with the high oil corn compared with the control. During the last part of the finishing period the steers fed the corn with high oil and high protein recovered 90% of the difference in weight gain at the end of 63 days. Over the 113 days of the study, there were no statistically significant differences in performance of steers feed the different specialty corns.

Carcass measurements indicated that steers fed corn with greater oil content tended to have fatter carcasses (Table 3). Carcasses from steers fed the high oil corn had numerically greater thickness of backfat, higher percent of KPH fat, increased marbling and higher calculated yield grades. However, there were no statistically significant differences in carcass measurements of steers fed the different specialty corns. Carcasses from steers fed the high protein corn tended to have increased marbling and a greater number of prime quality grades.

The lesser performance of the steers fed high-oil corn during the early portion of the experiment is similar to the response of steers fed high-oil corn in the experiment conducted last year. In another study with steers the digestion of dry matter and protein was less in diets containing high-oil corn compared with diets containing control corn. Most of the reduction in digestibility seemed to occur throughout the digestive tract rather than in the rumen. Digestion of fat in the intestines as a percentage of fat entering the duodenum was reduced, but there was more total fat being digested in steers fed high-oil corn. The flow of feed nitrogen to the duodenum and the loss of fecal nitrogen tended to be greater in steers fed high-oil corn suggesting the protein in high oil corn might have been less available. So the reduction in gain of steers fed high-oil corn could be the result of reduced availability of metabolizable protein during the early phase of the finishing period when the steers had high rates of gain.

With feed costs of corn, $2/bu; soybean meal, $200/ton; corn silage, $25/ton; urea, $153/ton; and supplemental ingredients, $200/ton; the feed costs of gain ($/cwt. of gain) were $30.78, 31.18, 29.71 and 28.55 for control, high-oil, high-protein and corn with high oil and high protein, respectively. The reduction in feed costs for the two high-protein corns were the result of a reduction in the amount of soybean meal required to supplement these corns (Table 1). The reduced amount of soybean meal needed to supplement the high-oil corn was not great enough to make up for the reduction in performance of the steers.

Based on the results of this study, high-oil corn did not have greater value than the control corn when fed to cattle. Because less soybean meal was used to supplement the high-protein corns, the feed cost of gain was reduced. In this experiment, steers fed the high-protein corn had more prime carcasses, which would add value to the grain. However steers fed the corn with high oil and high protein did not have higher grading carcasses than those fed the control corn. Therefore the observed improvement in carcass grades of steers fed high-protein corn needs to be confirmed before giving additional value to the grain due to carcass value. The lowest cost of gain was achieved with the corn containing high oil and high protein. This benefit was the result of equal efficiency of feed utilization and less required protein supplement compared with the control corn. The results of this study indicated that high-oil corn had feeding value similar to control corn, but corns containing more protein have increased value for feeding cattle.

Table 1. Ration composition (% of dry matter).

	Ration			
Ingredient	Control	High-oil	High-protein	High-oil & high-protein
Rolled corn	76.47	78.07	78.97	80.86
Corn silage	12.00	12.00	12.00	12.00
Molasses	0.75	0.75	0.75	0.75
Soybean meal	8.00	6.30	5.35	3.40
Urea	0.87	0.87	0.87	0.87
Potassium chloride	0.24	0.30	0.34	0.39
Limestone	1.22	1.26	1.27	1.28
Sodium chloride	0.30	0.30	0.30	0.30
Trace minerals	0.024	0.024	0.024	0.024
Vitamin A premix[a]	0.08	0.08	0.08	0.08
Rumensin® premix[b]	0.0195	0.0195	0.0195	0.0195
Elemental sulfur	0.0278	0.0278	0.0278	0.0278

[a]Provided 1,400 IU of vitamin A activity per pound of dry matter.
[b]Provided 15.6 mg sodium monensin per pound of dry matter.

Implications

The increased energy in high-oil corn was not utilized by finishing steers to reduce feed required per unit of liveweight gain. The additional protein in high-protein corns seemed to be available to cattle and resulted in similar feedlot performance with less supplemental protein.

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Table 2. Results of feeding specialty corn grains on feedlot performance of yearling steers.

	Ration				
Item	Control	High-oil	High-protein	High-oil & high-protein	Probability[a]
Starting weight, lbs	860	863	861	858	0.63
Ending weight, lbs	1223	1206	1215	1209	0.46
0 to 63 days					
Gain, lbs/d	3.94	3.43	3.78	3.50	0.36
Feed intake, lbs DM/d	20.6	19.5	19.8	19.0	0.17
Feed/gain	5.26	5.75	5.22	5.43	0.34
0 to finish					
Days fed	113	113	113	115	
Gain, lbs/d	3.22	3.02	3.12	3.05	0.46
Feed intake, lbs DM/d	21.5	20.8	20.8	20.3	0.36
Feed/gain	6.68	6.94	6.71	6.65	0.84

[a]Probability that treatment means are different. Statistical difference is achieved when the probability is 0.05 or less.

Table 3. Effects of feeding specialty corns on carcass measurements of yearling steers.

	Ration				
Item	Control	High-oil	High-protein	High-oil & high-protein	Probability[a]
Carcass weight, lbs	788	773	773	773	0.47
Dressing percentage	64.4	64.1	63.6	64.0	0.70
REA, sq in	12.5	12.3	12.2	12.0	0.38
Back fat, in	0.56	0.60	0.55	0.56	0.58
KPH, %	2.1	2.5	2.0	2.3	0.09
Marbling[b]	563	575	627	545	0.11
Quality grades					
Prime	5	7	13	3	
Choice	30	25	19	30	
Select	1	3	2	2	
Yield grades					
1	0	0	0	1	
2	12	5	9	6	
3	20	24	23	23	
4	4	6	2	4	
Avg calculated YG	3.31	3.50	3.30	3.43	0.37

[a]Probability that treatment means are different. Statistical difference is achieved when the probability is 0.05 or less.
[b]Marbling score of 300 = Small^0, 400 = Modest^0, etc.