Effects of Whole or Rolled Corn with 20 or 40 Percent Grass Hay on Finishing Performance of Yearling Steers

Chanda Engel, Anna Taylor, Chris Schauer, Rob Maddock, and Ken Olson

Introduction

Corn included in growing and finishing feedlot diets typically is processed by dry rolling, grinding or steam flaking. Corn processing research trials have had mixed results through the years, with some reporting processed corn increasing digestibility and improving the performance of feedlot cattle and others showing no difference between processed and whole corn. The topic of how much processing and when to process still is debated among producers and nutritionists. Forage level and moisture content of dietary ingredients, as well as other unknown factors, may interact with the processing level and contribute to the variability in animal response.

Experimental Procedures

One hundred-eight black crossbred yearling steers were used to evaluate feeding whole or dry-rolled corn in diets with 20 or 40 percent of the diet dry matter included from grass hay. Steers were assigned randomly to one of 12 pens (nine animals/pen) at the NDSU Carrington Research Extension Center. Each pen was assigned randomly to one of four treatments: 1) 55 percent whole corn with 20 percent grass hay, 2) 55 percent dry-rolled corn with 20 percent grass hay, 3) 35 percent whole corn with 40 percent grass hay or 4) 35 percent dry-rolled corn with 40 percent grass hay (Table 1). Diets were formulated to be similar in crude protein and meet or exceed the National Research Council (NRC) recommendations. Each corn type was analyzed for particle size following the procedures of Behnke (1985). Mean particle size for whole and dry-rolled corn was 5,516 ± 1.15 millimeters (mm) and 2,824 ± 1.45 mm, respectively. Steers were weighed and implanted with 120 milligrams (mg) trembelone acetate and 24 mg estradiol (Revalor S; Merck Animal Health) at the start of the trial (day 0). Steers were weighed every 28 d throughout the 141 d on feed. Cattle on all treatments were harvested as one group at Tyson Fresh Meats, Dakota City, Neb. The carcass attributes were evaluated by a trained grader after a 24-hour chill. Data were analyzed using the GLM procedure of SAS (SAS Inst. Inc., Cary, N.C.) and pen was the experimental unit.

Table 1. Formulation and nutrient composition of diets for yearling steers fed whole or dry-rolled corn and 20 or 40 percent grass hay.

Ingredients, Dry-matter Basis	40% Forage Whole Corn	40% Forage Rolled Corn	20% Forage Whole Corn	20% Forage Rolled Corn
Corn, %[1]	32.54	33.48	51.47	52.39
MDGS, %[2]	25.67	25.27	25.65	25.07
Hay, %	39.75	39.15	20.73	20.32
Supplement, %[3]	2.04	2.1	2.2	2.21
Nutrient Composition				
CP, %	14.29	14.07	14.51	14.17
NEg, Mcal/lb	0.47	0.48	0.56	0.56
DM, %	74.1	73.02	72.91	74.59
Diet concentrate, %	60.25	60.85	79.27	79.68
Diet forage, %	39.75	39.15	20.73	20.32

[1]Mean particle size for the whole and dry-rolled corn was 5,516 ± 1.15 mm and 2,824 ± 1.45 mm, respectively.

[2]Modified corn distillers grains, 52 percent dry matter.

[3]Supplement included vitamins, minerals and an ionophore.

Results

During the 141-day feeding period, corn type (whole or dry-rolled) did not influence ($P \geq 0.21$) performance across the two forage levels, thus data is presented as main effects of whole corn vs. rolled corn and 20 percent forage vs. 40 percent forage (Table 2). Weights at the start and across all five weigh periods were similar for whole and rolled corn treatments ($P \geq 0.47$; Table 2). Overall average daily gain (ADG) was similar ($P \geq 0.25$) across all weigh periods, with the exception of days 28 to 56, when the steers on the rolled corn treatment gained 4.31 pounds/head/day, compared with those on the whole corn gaining 3.56 pounds/head/day ($P = 0.03$). Dry matter intake (DMI) was similar for both corn types ($P \geq 0.0.42$). Feed to gain followed a similar pattern to ADG. All carcass attributes were similar between whole corn and rolled corn diets ($P \geq 0.11$; Table 3).

Table 2. Performance of yearling steers fed diets with whole or rolled corn and 20 or 40 percent grass hay.

Variable	Rolled Corn	Whole Corn	20% Forage	40% Forage	SEM	Corn Trt *P*-value	Forage Trt *P*-value	Corn x forage level *P*-value
Experimental unit, pen	6	6	6	6	--	--	--	--
Weight, lb.								
Weight, day 0	920	916.17	916.83	919.33	2.49	0.31	0.5	0.96
Weight, day 28	1,085.50	1,079.17	1,092.83	1,071.83	7.86	0.58	0.1	0.69
Weight, day 56	1,202.00	1,175.17	1,207.50	1,169.67	10.16	0.10	0.03	0.5
Weight, day 85	1,325.50	1,293.50	1,340.83	1,278.17	12.11	0.10	0.01	0.47
Weight, day 113	1,422.83	1,390.17	1,441.83	1,371.17	14.07	0.14	0.01	0.57
Weight, day 141	1,531.83	1,495.50	1,549.50	1,477.83	18.49	0.20	0.03	0.77
Average daily gain, lb/hd/d								
ADG, days 0-28	5.91	5.82	6.29	5.45	0.3	0.84	0.08	0.69
ADG, days 28-56	4.31	3.56	4.25	3.62	0.21	0.03	0.07	0.51
ADG, days 56-85	4.26	4.08	4.6	3.74	0.13	0.35	0.002	0.6
ADG, days 85-113	3.48	3.45	3.61	3.32	0.29	0.96	0.51	0.91
ADG, days 113-141	3.89	3.76	3.85	3.81	0.22	0.68	0.91	0.68
ADG, days 0-141	4.17	3.94	4.31	3.8	0.13	0.25	0.02	0.76
Dry-matter intake, lb/hd/d								
DMI, days 0-28	26.56	26.86	26.76	26.66	0.58	0.72	0.91	0.68
DMI, days 28-56	30.44	31.68	31.03	31.09	1.04	0.42	0.97	0.21
DMI, days 56-85	28.57	28.96	28.79	28.75	1.29	0.84	0.98	0.22
DMI, days 85-113	28.39	27.82	27.57	28.63	1.07	0.72	0.5	0.48
DMI, days 113-141	30.98	29.89	29.07	31.8	1.36	0.59	0.2	0.4
DMI, days 0-141	28.77	28.82	28.43	29.16	0.96	0.97	0.6	0.56
Feed:Gain, lb:lb								
Feed:Gain, days 0-28	4.54	4.67	4.3	4.92	0.16	0.60	0.03	0.68
Feed:gain, days 28-56	7.13	9.04	7.46	8.7	0.33	0.00	0.03	0.42
Feed:gain, days 56-85	6.77	7.19	6.28	7.68	0.26	0.29	0.01	0.2
Feed:gain, days 85-113	8.19	8.58	7.74	9.03	0.85	0.76	0.31	0.54
Feed:gain, days 113-141	8.01	8.01	7.65	8.38	0.42	1.00	0.25	0.66
Feed:gain, days 0-141	6.93	7.35	6.61	7.67	0.15	0.09	0.001	0.48

Table 3. Carcass performance of yearling steers fed diets with whole or rolled corn and 20 and 40 percent grass hay.

Variable	Rolled Corn	Whole Corn	20% Forage	40% Forage	SEM	Corn *P*-value	Forage *P*-value	Corn by forage level interaction *P*-value
Hot carcass weight, lb.	906.99	888.01	908.86	886.15	10.41	0.23	0.16	0.07
Yield grade[1]	3.80	3.71	3.87	3.65	0.07	0.39	0.06	0.17
Ribeye area, sq. in.	12.31	12.16	12.19	12.27	0.18	0.57	0.78	0.58
Marbling score[2]	457.58	439.8	440.9	456.48	6.89	0.11	0.14	0.85
Back fat, in.	0.52	0.51	0.53	0.5	0.02	0.62	0.33	0.22
KPH, %	1.74	1.78	1.74	1.77	0.02	0.26	0.39	0.14

[1]Yield grade is a composite calculation of fat to lean yield in a carcass based on a relationship of hot carcass weight, ribeye area, fat thickness and KPH; low values = lean carcasses.

[2]USDA Quality grades based on scores of 300-399 = select, 400-499 = low choice, 500-599 = average choice, 600-699 = high choice, 700+ = prime.

Body weight was similar ($P \geq 0.69$) in steers fed the two forage levels at the start and through day 56; however, at each subsequent period from day 56 through market, body weights were greater ($P \leq 0.03$) for 20 percent forage. Average daily gains were greater for the 20 percent forage for the first three periods and overall (days 0 to 141; Table 2). DMI was similar ($P \geq 0.20$) for steers fed 20 and 40 percent forage treatments across all periods and thus for the whole 141-day feeding period. The feed-to-gain ratio followed a similar pattern as ADG. The 20 percent forage-fed cattle used less feed to gain a pound of body weight for the first three trial periods and overall, compared with 40 percent forage-fed cattle ($P \leq 0.03$).

Conclusions and Implications

These results indicate that when feeding grass hay above 20 percent of the diet dry matter, corn type (whole or rolled) does not interact differently with forage level. Feeding diets with 20 percent forage had higher calculated energy values and, as expected, resulted in improved feed efficiency and overall ADG. However, hot carcass weight and carcass quality grade were similar for the two forage levels. Feeding dry-rolled corn provides a slight advantage over whole corn, as indicated by improved feed efficiency. However, whole-corn and rolled corn diets produced carcasses with similar carcass characteristics at harvest. It appears that when the cost to roll corn exceeds the production benefits or rolling is not available, feeding whole corn is a viable option for finishing yearling steers.

Acknowledgements

The authors thank NDSU Carrington Research Extension Center livestock program technicians Dale Burr, Tim Schroeder and Tyler Ingebretson for their contributions and diligence to this project and the program. We also thank the Hettinger Research Extension Center for providing the cattle and partial funding for this project.