Effects of Replacing Dry Rolled Corn with Dry Rolled Wheat on Feedlot Performance and Carcass Merit

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Story in Brief

The objective of these experiments was to determine the effects of replacing a portion of dry-rolled corn with dry-rolled wheat on feedlot performance and carcass merit. Two trials were conducted where 25% (DM basis) of the dry-rolled corn was replaced with dry-rolled wheat and fed throughout the finishing phase. Performance and carcass data showed no significant differences between those cattle fed corn only vs. those fed corn and wheat. The only numerical difference was in the marbling and quality grades of the two treatment groups. Steers fed the corn finishing diet had slightly more marbling and higher quality grades than cattle finished on corn and wheat. These results showed that wheat had no significant impact on feedlot performance or carcass merit when replacing 25% of dry-rolled corn.

Key Words: Carcass Merit, Feedlot Cattle, Grain Source, Performance

Introduction

The selection of a grain source to be used in feedlot finishing diets is influenced by many factors such as availability, cost, and effects on performance and carcass merit. Site and extent of starch digestion are influenced by grain source and grain processing, with the primary goal of grain processing being to increase starch (energy) availability. In addition, grain sources can be characterized by their rate of ruminal starch fermentation. The greatest rate of ruminal starch fermentation occurs with wheat. Combinations of grains can be used to spread starch digestion throughout the digestive tract, and also to decrease the incidence of ruminal acidosis (Bock et al., 1991).

Zinn et al. (2002) reported that steam flaking increased the NE_m of corn by 14% and NE_g by 19% compared with dry-rolled or whole corn. In part, this is a result of greater ruminal and total tract starch digestibility of steam-flaked compared with dry-rolled corn, resulting in a positive effect on ADG, feed efficiency, and final live weight (Huck et al., 1998). Due to the greater ruminal starch digestibility of wheat grain, we hypothesized that replacing dry-rolled corn with dry-rolled wheat would improve performance of finishing cattle. The objective of this study was to determine the effect of replacing 25% of corn grain (DM basis) with wheat on performance and carcass merit of yearlings and calves.

Materials and Methods

Two experiments were conducted at the Willard Sparks Beef Research Center. Experiment 1 utilized 71 crossbred yearling steers (avg initial BW = 822 ± 66 lbs). On arrival (July 17, 2003), steers were individually weighed and ear tagged. On July 22, 2003, steers were weighed, horn tipped as needed, vaccinated subcutaneously with 2 mL of Titanium 5 (Intervet Inc., Millsboro, DE), dewormed with 7 mL Ivomec-Plus injectable (Merial, Duluth, GA), and implanted with Revalor-S (Hoechst Roussel Vet, Clinton, NJ). Steers were sorted by initial body

weight and randomly allocated to one of 12 pens (6 pens/treatment, 6 steers/pen). Steers were fed for 140 d (July 30, 2003 – December 16, 2003).

Treatment diets are shown in Table 1. Diets were formulated to meet or exceed NRC (1996) nutrient requirements, and contained monensin (30 g/ton of DM) and tylosin (10 g/ton of DM). Steers were gradually adapted to their final treatment diet by offering 55, 65, 75, and 85% concentrate diets for seven d each. Feed refused was weighed every 28 d. In addition, diet samples were collected, and DM content of the diets and dietary ingredients was determined. Diet and ingredient samples were composited by 28-d periods, dried in a forced-air oven, and ground in a Wiley mill to pass a 1-mm screen. Interim unshrunk BW was determined at 28-d intervals. Steers were harvested at a commercial facility. Hot carcass weight, external fat, internal fat, longissimus muscle area, marbling score, yield grade, and quality grade were determined.

Data for BW, dry matter intake, average daily gain, feed efficiency, hot carcass weight (HCW), carcass-adjusted variables (calculated using carcass-adjusted final weight, which was calculated as HCW/average dressing percent), and normally distributed carcass characteristics were analyzed as a complete randomized design using the Proc Mixed procedure of SAS Release 8.02 (SAS Institute Inc., Cary, NC). Non-parametric USDA quality grade data were analyzed and transformed using Friedman's test by listing the percentage of Choice and Select for each pen within a block and then analyzed as normally distributed data as above (Elam et al., 2003). Pen was the experimental unit.

Experiment 2 utilized 87 steer calves (avg initial BW = 498 ± 72 lbs). On arrival (October 2, 2003), calves were individually weighed and ear tagged, vaccinated for Bovine Rhinotracheitis and Bovine Viral Syncytial Virus with 2 mL of Bovishield FP4+Lepto (Pfizer, New York, NY), dewormed with 4.5 mL Ivomec Plus, and implanted with Component E-S (Intervet Inc., Millsboro, DE). On December 18, 2003, steers were re-implanted with Revalor-S (Hoechst Roussel Vet, Clinton, NJ). Steers were blocked by previous cow supplementation treatment (Banta et al., 2004) and randomly allocated within block to one of the nine pens (9 pens/treatment, 4 or 5 steers/pen). Pens were randomly allotted to treatments (Table 1). Steers were fed for 189 days (October 24, 2003 – April 20, 2004).

Steers were gradually adapted to their final treatment diet by offering 55, 65, 75 and 85% concentrate diets for seven d each. All data collections were the same as for Exp. 1. Data were analyzed as a randomized complete block design using the Proc Mixed procedure of SAS. Pen was the experimental unit. The model statement included treatment, and the random statement included block.

Table 1: Feedstuff composition of diets (%DM)

	Wheat Finisher	Corn Finisher
Rolled corn	58.5	77.5
Rolled wheat	19.5	-

Alfalfa hay	10.0	10.0
Cane molasses	4.0	4.0
Yellow grease	2.0	2.0
Wheat midds	1.48	.56
Soymeal 47.7	1.56	3.0
Cottonseed meal	.52	1.0
Vitamin A-30,000	.011	.011
Limestone 38%	.85	.85
Salt	.20	.20
Urea	.80	.80
Dical	.50	.50
Manganous oxide	.003	.004
Zinc sulfate	.009	.0114
Availa Zinc 100	.029	.029
Rumensin 80	.019	.019
Tylan 40	.013	.013
Availa Copper 100	.0011	.0015
Selenium 600	-	.0040

Table 2: Calculated nutrient composition of experimental diets

	Wheat Finisher	Corn Finisher
NE_m Mcal/CWT	95.82	96.58

NE_g Mcal/CWT	62.10	62.71
Fat	5.08	5.47
ADF	6.4	6.2
NDF	12.9	12.0
Crude Protein %	13.6	13.6
Potassium %	.74	.76
Calcium %	.66	.66
Phosphorus %	.40	.39

Results and Discussion

Feedlot performance for Exp. 1 is presented in Table 3. Body weight was not affected (P=.39 to .82) by treatment. Similarly, there was no difference in dry matter intake from d 1-27 (P=.93) or d 1-139 (P=.45). From day 1-27, steers fed wheat had numerically (P=.14) greater average daily gain; however, treatment groups were similar (P=.50) from d 1-139. Feed to gain ratio was numerically improved (P=.12) for steers fed wheat during the first 27 d. However, across the finishing phase, feed:gain did not differ (P=.98) among treatments. Carcass adjusted performance did not differ among treatments (Table 3).

Table 3. Performance data, Exp. 1

	Wheat	Corn	SEM	P-Value
Body Weight				
Day 1	809	835	28	.53
Day 28	926	936	32	.82
Finish, d 140	1321	1358	34	.45
Adj. final BW[a]	1319	1358	31	.39
DMI				
Day 1-27	22.9	22.8	.31	.93
Day 1-139	24.3	24.9	.54	.45
ADG				

Day 1-27	4.3	3.8	.34	.14
Day 1-139	3.7	3.8	.09	.50
Adj. ADG[a]	3.7	3.8	.09	.46
Feed:Gain				
Day 1-27	5.4	6.2	.36	.12
Day 1-139	6.6	6.6	.14	.98
Adj. F:G[a]	6.6	6.6	.17	.94

[a]Adjusted final BW was calculated as hot carcass weight/average dress of 0.6335. Adjusted daily gain was calculated as (adjusted final BW − initial BW)/days on feed. Adjusted feed:gain was the ratio of adjusted daily gain and daily DMI

Performance data for Exp. 2 is presented in Table 4. Initial weights for calves fed corn were greater (P<.03) compared with calves fed wheat; therefore initial BW was used as a covariate for all subsequent statistical analyses. Final weights were not different (P=.22) among treatments. Across the finishing phase, average daily gain did not differ (P=.23) among treatment groups. Overall dry matter intake tended (P<.10) to be lower for cattle fed wheat; however, overall feed:gain was very similar (P=.48) among treatment groups. Feed:gain was improved (P=.03) for calves fed wheat from d 1-83. Similar to Exp. 1, carcass adjusted performance did not differ among treatments (Table 4).

Table 4. Performance data, Exp. 2

	Wheat	Corn	SEM	P-Value
Body Weight				
Day 1	509	524	11	.03
Day 28	664	663	5	.88
Day 83	874	874	9	.97
Day 149	1065	1079	8	.13
Final, d 169	1160	1173	9	.22
Adj. final BW[a]	1165	1174	8	.30
ADG				
Day 1-28	5.3	5.3	.18	.88
Day 1-83	4.3	4.3	.11	.97

Day 1-finish	3.8	3.9	.05	.23
Adj. ADG[a]	4.4	4.5	.05	.30
DMI				
Day 1-28	14.7	15.3	.43	.24
Day 1-83	16.3	18.3	1.7	.36
Day 1- finish	19.2	19.6	.22	.10
Feed:Gain				
Day 1-28	2.8	2.9	.09	.32
Day 1-83	4.2	4.4	.05	.03
Day 1-finish	5.1	5.2	.07	.48
Adjusted F:G[a]	4.2	4.3	.08	.15
[a]Adjusted final BW was calculated as hot carcass weight/average dress of 0.63. Adjusted daily gain was calculated as (adjusted final BW − initial BW)/days on feed. Adjusted gain:feed was the ratio of adjusted daily gain and daily DMI				

Carcass data for Exp. 1 is shown in Table 5. There were generally no differences in carcass merit among treatment groups. Steers fed corn tended (P<.09) to have greater ribeye area than steers fed wheat and corn. Yield grades for steers fed corn were numerically greater (P=.12) compared with steers fed wheat.

Table 5. Carcass data, Exp. 1

	Wheat	Corn	SEM	P-value
HCW, lb.	836	861	19.4	.38
DP, %	63.3	63.4	.54	.91
Ribeye area, in^2	13.2	13.8	.25	.09
12th-rib fat, in.	.60	.64	.03	.38
KPH, %	2.7	2.9	.17	.59
Marbling[a]	382	393	13.4	.55

Yield Grade	3.02	3.26	.19	.12
% Choice	36.1	43.3	6.5	.45
[a]Marbling score: SL = 300, SM = 400				

Carcass data for Exp. 2 is shown in Table 6. No differences in hot carcass weight, dressing percentage, ribeye area, 12th-rib fat thickness, or kidney-pelvic-heart fat, yield grade, or percent Choice were observed among treatments. Steers on the corn diet had greater (P<.01) marbling scores than steers fed wheat. Steers fed corn had 81.6% choice carcasses compared with 69.6% choice for steers fed wheat (P=.21).

Table 6. Carcass data, Exp. 2

	Wheat	Corn	SEM	P-value
HCW	734	739	5.3	.30
DP, %	63.2	63.0	.24	.58
Ribeye area, in^2	12.1	12.2	.18	.58
12th-rib fat, in.	.66	.66	.03	.93
KPH, %	2.5	2.6	.15	.56
Marbling[a]	411	449	8.2	.01
Yield Grade	3.6	3.6	.11	.97
% Choice	69.6	81.6	6.7	.21
[a]Marbling score: SL = 300, SM = 400				

Implications

For calves and yearlings, 25% of dry-rolled corn can be replaced with dry-rolled wheat with minimal impact on performance or carcass merit. The tendency for decreased marbling scores and quality grades by steer calves fed wheat supports a previous research summary by Owens and Gardner (2000) that showed lesser marbling and quality grades in steers fed grains processed for a greater degree of ruminal starch fermentation.

Literature Cited

Banta, J.P. et al. 2004. Okla. Agr. Exp. Sta. Res. Rep.

Bock, B.J. et al. 1991. J. Anim. Sci. 69:2703.

Elam, N.A. et al. 2003. J. Anim. Sci. 81:2686.

Huck, G.L. et al. 1998. J. Anim. Sc. 76:2984.

NRC. 1996. Nutrient Requirements of Beef Cattle. (7th Ed.). National Academy Press, Washington D.C.

Owens, F.N., and B.A. Gardner. 2000. http://www.asas.org/JAS/symposia/proceedings/0940.pdf. Accessed June 27, 2004.

Zinn, R.A. et al. 2002. J. Anim. Sci. 80:1145.

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