METABOLIZABLE ENERGY OF STEAM FLAKED AND ROLLED WHEAT AND CORN IN FEEDLOT RATIONS

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Story in Brief

Crossbred implanted yearling steers (240) averaging 331 kg were fed diets with 81 to 82% dry rolled hard red winter wheat, steam flaked hard red winter wheat, dry rolled corn, and steam flaked corn for 138 to 149 days. Diets contained monensin (30 g/ton), tylosin (90 mg/hd/d) and 12% roughage. Daily gains and quality grades were lower for cattle fed rolled wheat than for those fed flaked wheat, flaked corn or rolled corn. Fat thickness, KPH and yield grade were lowest for cattle fed wheat diets. Flaking grain reduced feed consumption by 3.8 and 5.9% and improved feed/gain by 7.2 and 2.9% for diets with wheat and corn, respectively. Calculated metabolizable energy from grain alone, as estimated from animal performance by running the net energy equations backward, tended to be only slightly greater for flaked than rolled grain, and tended to be very slightly greater for corn than wheat.

(Key Words: Grain Processing, Wheat, Corn, Metabolizable Energy, Steers)

Introduction

Low prices for hard red winter wheat have renewed interest in replacing other grains with wheat in diets for finishing beef cattle. Martin et al. (1985) demonstrated that the metabolizable energy of a feedlot finishing diet with rolled corn (RC) was increased by replacing 50% or 75% of the rolled corn with rolled wheat (RW). This advantage for wheat conflicts with the tabular values (NRC, 1984) which indicate that dry corn grain has approximately 102% the metabolizable energy content of wheat. Gill et al. (1981), using corn based diets, indicated that both rate and efficiency of gain of finishing cattle can be improved by lowering roughage levels to 12% or below. Proper types of grain and roughage, methods of processing, and use of ionophores may permit use of roughage levels lower than 12% in finishing cattle diets. Ionophores decrease problems with bloat and acidosis (Bartley et al., 1983), and method of grain processing alters ration consumption and performance of feedlot animals (Ramirez et al., 1985). This trial was conducted to determine the relative metabolizable energy values of finishing diets with wheat or corn grains in dry rolled or steam flaked forms.

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Materials and Methods

Hereford, Angus, and crossbred steers (240) were amassed from auction barns in Guymon and Texhoma, Oklahoma and Amarillo, Texas. Steers were trucked to Panhandle State University, Goodwell, Oklahoma, placed in a drylot and maintained on hay until the trial was initiated. One week was required to purchase all animals of the weight and quality needed. Animals were weighed individually, received routine feedlot vaccinations, wormed with injectable Tramisol, ear tagged and implanted with Synovex-S. A second Synovex-S implant was administered 56 days later.

Initial shrunk weight averaged 730 pounds. Steers were blocked by weight into four groups (793, 744, 715 and 669 lb) and randomly allocated within block to four treatments. A total of 16 pens (4 per treatment) with 15 animals per pen were used in this experiment. The composition of the finishing diets is shown in Table 1. Animals were gradually switched from the initial diet (40% roughage) to the finishing diet (12% roughage) during the first 21 days of the study by a stepwise decrease in the level of cottonseed hulls in the diet. Roughage was 7% cottonseed hulls and 2.5% pelleted alfalfa, and 2.5% roughage was in the supplement. Cracked grains were cracked with a roller mill at Panhandle State University. Steam flaked wheat (FW) was trucked approximately 10 miles from the Freeman Feedlot, Texhoma, Texas each evening, and steam flaked corn (FC) was trucked from the Texas County Feedlot, Guymon, Oklahoma each morning. Initial weights were shrunk and animals were weighed full on days 28, 56, 84 and 118 and shrunk weights were calculated by subtracting 4% to calculate weight gain. Final shrunk weight was calculated from hot carcass weight assuming that dressing percentage was 62%.

After being fed for 138 days (two heavy replicates) or 149 days (two light replicates), cattle were trucked to Booker Custom Pack, Booker, Texas for slaughter. Hot carcass weights, fat thickness at the 12th rib, marbling score, yield grade, rib eye area and incidence and severity of liver abscesses were recorded.

Results and Discussion

Steer weight gain calculated from carcass weight was greater for the corn than wheat diets by 4.3% and 10.7% for flaked and rolled forms of grain, respectively (Table 2). Steers fed the CW ration had lower gains than cattle fed other diets. These data agree with performance data of Martin et al. (1985), though differences in that study were not significant. Average daily feed consumption was reduced by flaking and lower for wheat than corn diets ($P<.05$). Feed/gain ratios favored flaked grains ($P<.10$).

Rib eye area was smaller ($P<.05$) for steers fed cracked corn. No explanation for this effect is apparent. Quality grade reflected performance data. Steers fed corn produced carcasses with a higher ($P<.05$) quality grade than animals fed wheat.

Fat thickness at the 12th rib, KPH and yield grade was greater for cattle fed corn than wheat. Steers which received the FW ration had a significantly better yield grade ($P<.05$) and less fat cover ($P<.05$) and KHP percent ($P<.01$) than cattle fed FC or CC.

There were no significant ($P<.05$) differences between the treatment groups in the incidence of liver abscesses. Steers on the CW ration had the highest rate of abscessed livers, while the CC treatment

Table 1. Diet composition, as fed basis.

	Diet			
	FW	FC	CW	CC
Ingredients				
Wheat, steam-flaked	82.45			
Wheat, cracked			82.45	
Corn, steam-flaked		80.50		
Corn, cracked				80.50
Cottonseed hulls	7.00	7.00	7.00	7.00
Alfalfa pellets	2.55	2.50	2.55	2.50
Molasses	3.00	3.00	3.00	3.00
Supplement	5.00	7.00	5.00	7.00
Ration Composition, % of dry matter				
Dry matter, %	87.55	85.86	88.30	87.73
Crude protein, %	12.70	11.73	12.70	11.70
Calcium, %	.45	.50	.45	.50
Phosphorus, %	.35	.35	.35	.35
Potassium, %	.75	.75	.75	.75
ME, mcal/kg dry matter	2.97	2.96	2.97	2.96

	Wheat Diets	Corn Diets
Supplement composition, %		
Cottonseed meal	10.35	55.60
Wheat midds	0.00	3.60
Alfalfa meal	59.25	0.00
Calcium carbonate	15.55	12.85
Potassium chloride	0.00	8.55
Dicalcium phosphate	0.00	3.90
Urea	7.70	11.00
Salt	5.75	3.60
Monensin 60	0.47	0.29
Tylosin 40	0.23	0.14
Vitamin A&D[1]	0.32	0.18
Trace mineral[2]	0.40	0.30

[1]Vitamin A 10M I.U./lb; Vitamin D 1M I.U./lb.
[2]Trace Minerals, Percent of TM mix: Mn 7.45; Fe 14.5; Cu 3.74; Co 0.23; Zn 17.60; S 16.15;and I_2 0.23.

had the lowest incidence (Table 2). Steers with abscessed livers generally were higher performing animals. Without an ionophore and an antibiotic in the diet, a higher incidence of liver abscesses would be expected.

The primary goal of this trial was to determine the relative metabolizable energy (ME) values of steam flaked and dry rolled wheat and

Table 2. Effect of grain type and processing method on performance and carcass characteristics.

	Diet			
	FW	FC	CW	CC
No. steers	60	60	60	60
Pens	4	4	4	4
Weight, lb				
Initial	729[b]	731[a]	732[ab]	728[a]
56 days	911[b]	918[a]	914[ab]	932[a]
Final	1175[ab]	1200[ab]	1166[b]	1212[a]
Carcass	728[ab]	744[ab]	723[b]	751[a]
Average daily gain, lb	3.11[a]	3.25[a]	3.00[b]	3.36[a]
Average daily feed, lb				
0-56	19.1[b]	18.9[b]	19.8[b]	22.0[b]
57-end	20.6[b]	21.6[a]	21.5[a]	21.8[a]
Total	20.0[c]	20.6[bc]	20.8[b]	21.9[a]
Feed/gain				
0-56	5.88	5.68	6.11	6.03
57-end	6.82[ab]	6.69[a]	7.50[b]	6.81[ab]
0-end	6.43[ab]	6.29[a]	6.93[b]	6.48[ab]
NEg, Mcal/cwt	60.7	61.8	57.0	59.8
Calculated metabolizable energy, Mcal/kg diet dry matter	3.05	3.09	2.93	3.02
Average ribeye area, sq in	12.9[a]	13.1[a]	13.1[a]	12.4[b]
Fat thickness, in	.53[ab]	.60[a]	.51[b]	.64[a]
KPH,%[d]	1.89[c]	2.06[b]	1.83[c]	2.09[a]
Yield grade	2.8[b]	3.0[ab]	2.7[b]	3.4[a]
Yield 4 and 5, %	3	15	2	23
Quality grade	11.03[a]	11.32[a]	10.32[b]	11.38[a]
Percent choice	30	15	3	20
Liver abscesses				
Score	.25	.20	.22	.07
Incidence	13	10	15	7
Feed cost of gain, $/cwt	41.70	44.16	43.18	44.36

[ab]Means within a row with different superscripts differ (P<.05).
[c]10 = Good plus; 11 = Choice minus.

Table 3. Energy calculations.

	Diet				
	FW	FC	CW	CC	Average
Diet ME, mcal/kg	3.05	3.09	2.93	3.02	----
Diet, relative ME	.987	1.000	.951	.977	----
Grain, % of diet	82	81	82	81	----
Grain, relative ME	.984	1.00	.940	.972	----
Flaking effect, %	+4.7	+2.9	---	---	+3.8
Grain effect, %	---	+1.6	---	+3.4	+2.5
Estimated grain ME[a]	3.31	3.44	3.16	3.35	
Values from NRC (1984)	3.22	3.44	3.22	3.25	

[a]Calculated by subtracting ME values for other dietary ingredients.

corn. The ME values for diet dry matter were calculated as described by the following equations:

E = 2.54 NEm + 2.4178 feed in kg;
F = NEg - 2.54 feed in kg;
G = 2.4178 NEm;

where NEg = (.04871 gain in kg + .00629 gain in kg * gain in kg)

* weight in $kg^{3/4}$;

NEm = .0705 * weight in $kg^{3/4}$

then:

NEm of diet = $[-E - (E^2 - 4FG)]^{.5} / 2F$;
and ME of diet = [2.2577 - log 10 (77/NEm of feed)] / .2213

The FW and FC rations had ME values 4.1 and 2.3% higher than CW and CC, respectively, suggesting that flaking was slightly beneficial to both grains. On the average, wheat diets had 98% the energy value of corn diets. Per unit of grain, these advantages for flaking over rolling and corn over wheat are 4.7 and 2.9%, respectively (Table 3). Consequently, for energy, wheat and corn were essentially equal in feeding value for these rations which contained 12.0% roughage with the major roughage source being cottonseed hulls. Different roughage sources and levels may alter the efficiency of energy utilization. Calculated energy values (Table 3) were almost identical to those listed by the NRC (1984).

The feed cost of gain based on corn at $3.36 per bushel and wheat at $3.33 per bushel was $41.70, $44.16, $43.18, and $44.36 for FW, FC, CW and CC, respectively. Wheat, irrespective of processing method, produced gains for $1.82/cwt less than corn. FW produced gains for $2.46/cwt less than FC, while CW cost $1.18/cwt less to feed. Though efficiency of gain and feed cost were improved by flaking, flaking of wheat would be justified only if the flaking cost was under 4.7% of the cost of wheat. For corn, the breakeven cost of flaking would be 3.4% of the cost of corn.

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