

FINAL REPORT
EFFECTS OF GRAIN PROCESSING AND CALCIUM SOURCES
ON PERFORMANCE OF FINISHING STEERS

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Summary

A 134 day finishing experiment was conducted to determine the efficiency of energy utilization as affected by grain processing methods. In addition, the effects of calcium source and level on performance was determined. Steers consuming steam-flaked corn and steamflaked milo gained similarly and numerically faster than steers consuming whole shelled corn or dry rolled corn. Calcium source and level did not significantly affect gains or feed efficiency, however, in the more severely processed grains the 1% Holly Sugar calcium tended to depress gains. Steers demonstrated similar feed efficiency. Steers consuming the steamflaked corn and steamflaked milo were more efficient numerically than the steers consuming whole shelled corn and dry rolled corn. The steers consuming steamflaked corn with .5% calcium tended to be slightly more efficient than steers consuming steamflaked milo with .5% calcium. The two steam-flaked grains with the 1% calcium were fairly similar in performance. There were no differences in carcass characteristics.

Introduction

Rations fed to finishing cattle in the high plains area commonly contain a high percentage of grain. It is widely accepted that these grains must undergo some form of physical processing before they are offered to the animals. Grain processing breaks the hard, outer seed coat of the grain as well as altering the starch matrix inside the grain, making the starch more readily available to the animals. Over the past several years steam flaking has been the most widely accepted grain processing method. Rapidly increasing energy costs have dictated a question concerning the feasibility of the steam flaking process. The possibility exists that a less severe physical process, which requires a lesser amount of natural energy utilization might be substituted for steam flaking to produce a more economical product to the retail counter.

Another method being closely scrutinized by researchers for increasing starch availability to the animal is the use of buffers in ruminant rations. Some research using calcium carbonate as a buffer has shown improved feedlot performance. Calcium carbonate combined with sodium bicarbonate in the rations may shift the site of starch digestion from the rumen to the small intestine and possibly increase starch digestibility. Digestion of starch by the ruminant consuming high concentrate rations may be reduced because of the low roughage consumption, which causes reduced flow of saliva, which in turn reduces the amount of bicarbonate and phosphate buffers that neutralize acid in the rumen. High acid content in the rumen may cause a high outflow of acids to the lower digestive tract which reduces the ability of enzymes to digest starch in that section of the digestive tract. With these facts in mind, it is obvious that the use of buffers to improve starch digestibility of feedlot rations and steer performance would be dependent on the type of grain and the type of grain processing used for that ration. Therefore, in order to maximize the usefulness of the information obtained, the following experiment was designed to investigate calcium carbonate buffers of various sources and various levels in combination with various grain processing methods.

Experimental Procedure

A preliminary experiment was conducted at the Texas A & M University Research Center at Bushland, Texas. Three sources of calcium carbonate were used (common calcium carbonate, Iowa soft limestone and Holly Sugar calcium carbonate). This ex-

periment was designed to determine the optimal source and level of calcium carbonate. At the end of the 56 day feeding period it was determined that calcium at 1% from the Holly Sugar calcium carbonate produced the most desirable performance.

At the Texas Tech University Research Center at Pantex, Texas, 200 head of steers, averaging 650 pounds were allotted to a randomized block design in a 4 x 2 factorial arrangement. The steers were obtained from a pre-conditioning feedyard, transferred to the Texas Tech Center and allowed adequate time for adjustment to the high concentrate ration (table 1). Upon arrival the steers were given the normal feedlot processing, ear tagged, weighed and allotted to the eight treatments (5 replications per treatment) according to weight, frame size and muscle score. Fresh feed was provided daily and the steers were provided clean water in in-line water troughs shared by adjacent pens. Rations were mixed in a one ton ribbon mixer and distributed from feed trucks equipped with electronic scales. The grain processes were whole shelled corn (WSC), dry rolled corn (DRC), steamflaked corn (SFC), and steamflaked milo (SFM). Starch gelatinization was determined on the processed grains by a commercial laboratory (table 2). The calcium sources were common calcium carbonate and Holly Sugar calcium carbonate, both providing calcium at .5 and 1% of the diet on an air dry basis. Figure 1 shows the experimental design. Criteria for evaluation were average daily gain, feed consumption, feed efficiency and carcass characteristics. Data were analyzed by analysis of variance.

Results

The feedlot performance and carcass characteristics of the total feeding period are shown in table 3. There were no significant differences in steer performance due to calcium source or level. However, on steamflaked corn and steamflaked milo, gains tended to be depressed by the high level of Holly Sugar calcium. Steers consuming steamflaked corn and steamflaked milo demonstrated similar ADG and were numerically greater in gains than steers consuming whole shelled corn and dry rolled corn for the total feeding period. Feed efficiency was again not significantly different between treatments, however, the steers consuming steamflaked corn with the low level of calcium tended to be more efficient than the other steers. The data at 62 days into the experiment appeared somewhat different than the final results. At this point in the experiment there was no difference due to calcium source or level, however, steers consuming whole shelled corn performed numerically greater than steers consuming steamflaked corn or dry rolled corn. This was evident both in average daily gain and feed efficiency. The steers consuming the whole shelled corn and steamflaked milo demonstrated similar performance.

As shown in table 3, there were no differences in carcass characteristics between treatments. The rather high number of liver abscesses was indicative of the 8% roughage ration being consumed. Numerically the steers consuming the steamflaked corn and steamflaked milo with the low levels of common calcium carbonate demonstrated much higher percentage of liver abscesses than did the steers on the steamflaked grains with the high level of Holly Sugar calcium carbonate. Generally the more severe the process, the greater the number of abscesses. This is possibly due to the increased energy availability of the grains.

Figure 1. EXPERIMENTAL ARRANGEMENT

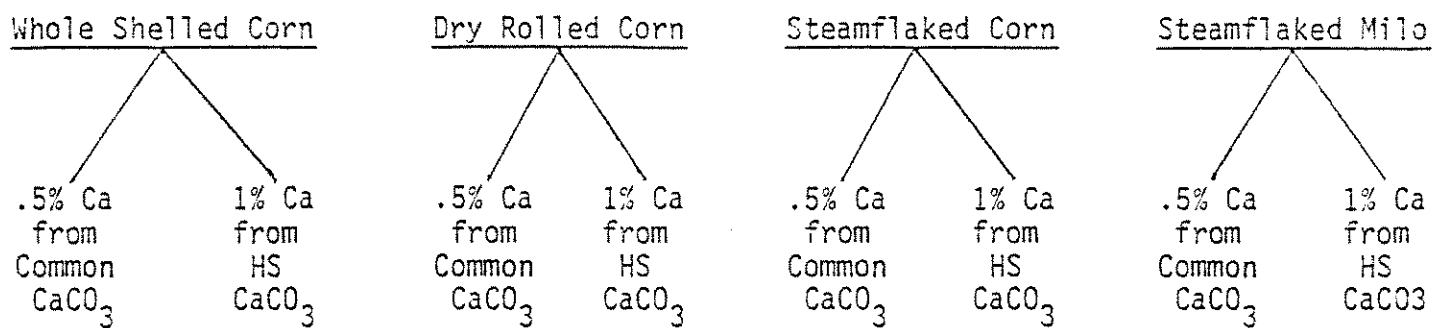


Table 2. STARCH GELATINIZATION OF GRAIN

Grain	% Moisture	% Starch Gelatinization
Steamflaked corn	16.0	46.0
Steamflaked milo	17.7	57.7
Dry rolled corn	12.9	17.0

Table 3. 134 DAY FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS.

	Treatments																									
	A			B			C			D			E			F			G			H				
	WSC	.5% Ca	Common CaCO ₃	WSC	1% Ca	HS CaCO ₃	SFC	.5% Ca	Common CaCO ₃	SFC	1% Ca	HS CaCO ₃	DRC	.5% Ca	Common CaCO ₃	DRC	1% Ca	HS CaCO ₃	SFM	.5% Ca	Common CaCO ₃	SFM	1% Ca	HS CaCO ₃		
<u>ot Performance</u>	23	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
Initial wt., lbs.	721.5	730.1	731.1	731.1	731.1	731.1	729.6	729.6	729.6	729.6	729.6	729.6	726.1	726.1	726.1	726.1	726.1	726.1	726.1	732.8	732.8	732.8	732.8	732.8	733.0	
Final wt., lbs.	1044.5	1062.1	1074.3	1074.3	1074.3	1074.3	1062.7	1062.7	1062.7	1062.7	1062.7	1062.7	1047.8	1047.8	1047.8	1047.8	1042.3	1042.3	1042.3	1079.1	1079.1	1079.1	1079.1	1079.1	1082.7	
Lys on feed	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	
WG, lbs.	2.41	2.48	2.56	2.56	2.56	2.56	2.48	2.48	2.48	2.48	2.48	2.48	2.40	2.40	2.40	2.40	2.34	2.34	2.34	2.58	2.58	2.58	2.58	2.58	2.61	
Feed/head/day, lbs.	23.39	23.32	22.83	22.83	22.83	22.83	22.46	22.46	22.46	22.46	22.46	22.46	23.24	23.24	23.24	23.00	23.00	23.00	23.90	23.90	23.90	23.90	23.90	23.90	23.44	
Feed/gain	9.71	9.40	8.92	8.92	8.92	8.92	9.06	9.06	9.06	9.06	9.06	9.06	9.68	9.68	9.68	9.83	9.83	9.83	9.26	9.26	9.26	9.26	9.26	9.26	8.98	
<u>Carass Characteristics</u>	645.3	649.0	651.3	651.3	651.3	651.3	643.2	643.2	643.2	643.2	643.2	643.2	648.8	648.8	648.8	648.8	640.2	640.2	640.2	653.4	653.4	653.4	653.4	653.4	653.7	
Hot carcass wt., lbs.	61.8	61.1	60.6	60.6	60.6	60.6	60.5	60.5	60.5	60.5	60.5	60.5	61.9	61.9	61.9	61.9	61.4	61.4	61.4	60.5	60.5	60.5	60.5	60.5	60.4	
Dressing %	4.6	4.6	4.6	4.6	4.6	4.6	4.4	4.4	4.4	4.4	4.4	4.4	4.8	4.8	4.8	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.6	
Marbling	3.1	3.0	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1	2.9	
Yield grade	10.8	11.1	11.1	11.1	11.1	11.1	10.6	10.6	10.6	10.6	10.6	10.6	11.4	11.4	11.4	11.4	11.1	11.1	11.1	11.6	11.6	11.6	11.6	11.6	11.1	
Quality grade	11.1	11.4	11.4	11.4	11.4	11.4	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.1	11.1	11.1	11.2	11.2	11.2	11.2	11.2	11.3	
Pin eye area, sq in.	.50	.54	.54	.54	.54	.54	.52	.52	.52	.52	.52	.52	.51	.51	.51	.51	.48	.48	.48	.53	.53	.53	.53	.53	.48	
Back fat, in	2.3	2.3	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	
P.H. fat, %	17.0	20.0	24.0	24.0	24.0	24.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	30.0	30.0	30.0	28.0	28.0	28.0	28.0	28.0	21.0	
Liver abscesses, %																										

Marbling numerical scores.

Yield grade 2 = 52.3% of carcass weight in boneless, closely trimmed cuts from round, loin, rib and chuck; yield grade 3 = 50%.

Good (thirds) = 9, 10, 11. Choice (thirds) = 12, 13, 14.

Table 4. 62 DAY FEEDLOT PERFORMANCE.

	A WSC .5% Ca Common CaCO ₃	B WSC 1% Ca HS CaCO ₃	C SFC .5% Ca Common CaCO ₃	D SFC 1% Ca HS CaCO ₃	E DRC .5% Ca Common CaCO ₃	F DRC 1% Ca HS CaCO ₃	G SFM .5% Ca Common CaCO ₃	H SFM 1% Ca HS CaCO ₃
DG, lbs.	3.10	3.09	2.84	2.79	2.85	2.88	3.06	2.99
feed/head/day, lbs.	23.25	23.66	23.16	22.32	23.32	22.69	24.06	23.91
feed/gain	7.49	7.73	8.20	8.03	8.20	7.98	7.92	8.03

Table 5. Close Out

Head purchased	200	
Total weight*	135,000	
Average weight	675	
Cost per cwt*	76.00 ✓	
Total cost	102,600.00	<i>110,000.00</i>
Processing	700.00	
Medicine & Vet	80.00	
Total feed cost	53,007.50	
Total cost	156,387.50	
Railer sold 1	331.58	
Total Sold (195 head)	\$118,487.19	
Total Income	\$118,818.77	
Total Loss	<\$37,568.73>	< >
Loss per head sold	<\$191.68>	< >

*This was from my recollection not from sale weights.
This should be on TCFA files.