Limestone and Potassium for Feedlot Steers

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Story in Brief

A high moisture corn diet was supplemented with limestone to increase calcium content to 1 percent of dry matter in two trials and with potassium chloride to increase potassium to 1 percent of the ration in one trial with feedlot steers. In the first trial, calcium supplementation decreased feed intake by 10 percent and rate of gain by 13 percent. But in the second trial, gain was increased by 9 percent with addition of the same level of calcium from the same source, largely due to a 4 percent increase in feed intake. Results indicate that if calcium supplementation increases feed intake, it will increase animal performance and vice versa. Review of experiments from across the United States reveals that only one location has reported consistent benefit from calcium supplementation while little or no benefit has been reported from other locations. Potassium supplementation increased dry matter digestibility and live weight gain, but carcass gain was changed little.

Introduction

Calcium supplementation of feedlot rations has increased rate of gain and efficiency of feed use in some feedlot studies. Lack of response has been attributed by some workers to low solubility and large particle size of the limestone. Previous studies with cannulated steers have shown that digestion of starch and fiber may be increased with added limestone. Previous studies with cannulated steers have shown that digestion of starch and fiber may be increased with added limestone, but digestibility of starch in the small intestine has not increased (Zinn and Owens, 1980). Similarly, added potassium may increase digestion in the rumen due either to buffering properties or more frequent and smaller meals. The objectives of these studies were to determine the influence of supplemental calcium and potassium on performance of feedlot steers.

Materials and Methods

Ninety-six steers were allocated to 12 pens in each trial with four pens (32 steers) receiving each treatment. The first trial used 717 lb steers in a 121-day trial. In the second trial, steers weighed 613 lb initially and were fed for 147 days. Rations used in both trials were similar (Table 1), consisting of high moisture corn and corn silage. The first trial began in April. One source of calcium, obtained from Texas, was added to the diet to increase dietary calcium to 1 percent of dry matter. Potassium chloride was added in a second treatment to produce a dietary K level of 1 percent. The second trial started in November to double check results of the first trial. For the second trial, two sources of calcium — the same relatively low solubility limestone as used in trial 1 as well as a "high reactivity" form from Carthage, Missouri — were used.

Table 1. Ration composition

Ingredient	Percentage[a]
Corn, high moisture	81.0
Corn silage	8.0
Alfalfa, chopped	4.0
Soybean meal	2.4
Cottonseed meal	2.6
Limestone	.8 – 2.5
Urea	.35
Dicalcium phosphate	.20
KCl	.15 – 1.00
Salt	.30

[a]Vitamin A, Tylan and Rumensin also included.

Results and Discussion

Added limestone in the first trial reduced feed intake by 10 percent, gains by 13 percent and efficiency of feed use by 4 percent, calculated on a carcass weight basis (Table 2). These results indicate that extra calcium supplementation may depress feed intake and reduce gains of rapidly growing steers under some conditions. This suggests some type of toxicity of the added limestone. However, in the second trial, using identical diets, addition of limestone from the same source increased gains of steers that were gaining less rapidly. Limestone used in the second trial had smaller particle size than in the first study. Carcass measurements were not consistently changed by limestone (Table 3).

The "more reactive" limestone in the second trial produced performance equal to that of the less soluble limestone, suggesting that solubility or reactivity alone was not responsible for the difference. Results from these trials indicate that when the limestone reduced feed intake, it had a deleterious effect on steer performance, but when it increased feed intake, it improved performance. These effects are probably due to extent of ruminal fermentation, clearance of fiber from the rumen, or levels of specific acids produced in the rumen.

Potassium supplementation increased feed intake and live weight gain slightly. When corrected for the slight difference in dressing percentage, gains and efficiencies were influenced very little by added potassium. Potassium may have increased fluid intake and retention. Some of the benefit attributed to high potassium levels for newly received cattle may be due to increased intake and retention of fluids.

Response to supplemental calcium from trials in the literature is summarized in Table 4. Though overall, favorable effects are noted, consistently favorable responses come from one location only. Calcium supplementation has not consistently improved performance at other locations. Calculations from that location indicate that the unsupplemented corn-corn silage diet they have used has a

Table 2. Feeding trial results

	Trial 1			Trial 2		
Calcium level	**0.46**	**1.00**	**0.46**	**0.46**	**1.00**	**1.00**
Calcium source	**—**	**TX**	**—**	**—**	**TX**	**MO**
Potassium level	**0.65**	**0.65**	**1.00**	**0.65**	**0.65**	**0.65**
Weights						
Initial	715	716	720	608	606	626
57-62 days	991	970	1008	834	876	880
121-147 days	1148[a]	1093[b]	1161[a]	1014	1055	1068
Daily gain, lb						
Early	3.82[ab]	3.46[b]	4.00[a]	2.60	3.36	3.08
Late	2.75	2.52	2.90	2.86	2.86	2.96
Total	3.30[a]	3.00[b]	3.46[a]	2.76	3.05	3.01
Total[d]	3.58[a]	3.11[b]	3.65[a]	2.65	2.90	2.82
Daily feed, lb						
Early	19.9[a]	18.2[b]	20.4[a]	14.0	14.9	14.9
Late	19.4[ab]	17.8[b]	19.6[a]	17.4	18.1	17.8
Total	19.9[a]	18.0[b]	19.9[a]	16.1	16.9	16.7
Feed/gain						
Early	5.22	5.26	5.13	5.38[a]	4.45[c]	4.84[b]
Late	7.14	7.11	6.75	6.08[ab]	6.33[a]	6.02[b]
Total[a]	5.55	5.78	5.47	6.00	5.83	5.96
ME, mcal/kg	3.28	3.22	3.30	3.01	3.06	3.06
Fecal pH	5.6[ab]	5.8[a]	5.5[b]			
Digestibility, %						
Dry matter	73[b]	70[a]	74[b]			
Starch	92	91	91			
Nitrogen	61	57	60			

[abc]Means within a trial with different superscripts differ ($P < .05$).
[d]Based on carcass weights.

much lower net energy value than expected, and supplementation increased the value of their ration to a point equal to what would be expected from their ration. Though responses have been inconsistent, calcium does not increase energy value of feeds beyond table values. Some of the differences in response to limestone sources from trials may be due to toxic effects of some sources rather than unidentified benefits from the "better" limestone sources.

Table 3. Carcass measurements

	Trial 1			Trial 2		
Calcium level	0.46	1.00	0.46	0.46	1.00	1.00
Calcium source	—	TX	—	—	TX	MO
Potassium level	0.65	0.65	1.00	0.65	0.65	0.65
Carcass weight	712[a]	678[b]	720[a]	618	641	645
Dressing percent	61.3	60.3	60.7	60.9	60.7	60.4
Rib eye area						
Sq. inches	12.2	11.9	12.1	12.6	12.9	13.1
in.²/cwt	1.72	1.76	1.69	2.05	2.04	2.02
Fat thickness, in.	.54	.50	.60	.29	.31	.31
KHP, %	3.08[a]	2.75[b]	3.00[a]	2.36	2.52	2.33
Marbling score[c]	13.7	13.0	13.0	9.9	10.6	10.2
Federal grade[d]	12.9	12.6	12.6	11.7	12.0	11.9
Percent choice	81	62	67	—	—	—
Cutability, %	49.7[a]	49.2[ab]	48.8[b]	52.1	52.0	52.2
Cooler shrink, %	1.7	1.5	2.0	—	—	—

[ab]Means in a row within a trial with different superscripts differ significantly ($P<.05$).
[c]Slight minus=10; slight average=11.
[d]High good=12; low choice=13.

Table 4. Influence of calcium on feedlot performance — literature summary

		Change, percent for every 1% added Ca		
Location	Trials	Gain	Feed intake	Feed/gain
All	39	+3.1	− .1	+ 3.4
One	19	+7.5	−3.9	+12.3
Others	20	+ .5	+2.3	− 1.8

Literature Cited

Zinn, R. A. and F. N. Owens. 1980. Okla. Agri. Exp. Sta. Res. Rep. MP-107:131.