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L.H. Harbers

R.D. Teague

Jack G. Riley

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Calcium Sources Compared in Liquid Feed Supplements For Finishing Steers

L. H. Harbers, R. D. Teague, and J. G. Riley

Summary

When calcium chloride was added to a mixture of minerals and urea in molasses, the minerals had not settled after the mixture was shipped 350 miles and stored 4 weeks. Calcium carbonate added to a similar supplement caused all minerals tested except sodium, potassium, and copper to precipitate.

Using a 112-day, steer-feeding trial, we found that animals performed similarly when their liquid feed supplement contained either calcium chloride or resuspended calcium carbonate.

Introduction

Limited information is available on calcium chloride as a potential calcium source for practical ruminant rations. The true digestibility of the chloride form does not differ from those of other inorganic calcium sources. When calcium chloride was added to beef finishing rations as a urolithiasis preventative, growth rate and feed efficiency were not impaired.

Because it is soluble, calcium chloride should have an advantage over other inorganic sources (i.e., carbonate) in liquid supplements. Reported here are results from a beef finishing trial that compared chloride and carbonate calcium sources in a liquid feed supplement.

Experimental Procedure

Forty-two steers (797 lb.) were divided by weight into six lots of seven animals. Three randomly selected lots received a liquid feed supplement containing calcium carbonate; the other three lots, a supplement containing calcium chloride* (table 18.1). Each animal was allowed 2 lb. of the specific liquid feed supplement daily plus a starter ration of 60% roughage. The liquid feed supplements were stored in 5 gal. buckets to facilitate complete mixing. The animals were changed gradually to a high concentrate ration during 28 days and maintained on that ration 84 days (table 18.2). Animals were slaughtered at a commercial plant that allowed appropriate data to be collected and kidneys to be sampled.

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*Dowflake®, The Dow Chemical Company, Midland, Mich.

Barrels containing 55 gal. of either calcium carbonate or calcium chloride were sampled at the top and bottom of liquid layers without disturbing precipitated residues when the barrels arrived, then 2 and 4 weeks later. Samples were analyzed for N, P, Ca, Na, K, Mg, Fe, Mn, Zn, and Cu. Residues in the 5 gal. buckets were determined at various times during the experimental period.

Results and Discussion

A summary of animal performance and carcass information is given in table 18.3. During the 112-day period, animals receiving $CaCO_3$ gained 2.39 lb. daily and those fed $CaCl_2$ supplement, 2.37 lb. daily. Calcium source did not influence gain. Steers fed $CaCO_3$ ate slightly more dry matter (19.3 lb. vs. 18.3) but those fed $CaCl_2$ were slightly more efficient (7.71 vs. 8.08). No disease or gastric-disturbance differences were apparent.

Carcass data (table 18.3) favor the $CaCO_3$ fed groups, but not significantly. Slight differences in carcass data probably reflect the heavier weight of the carbonate cattle. More livers were condemned from animals fed $CaCO_3$ (15.8%) than those fed $CaCl_2$ (5.0%). All observed kidneys were normal.

Changes in the protein supplements with time are summarized in tables .4-.5. Neither supplement fermented during the feeding period, but residue (table 18.4) in $CaCO_3$-containing buckets (3-4%) was difficult to resuspend. One bucket was used in each of three feedings, so residual losses would not bias growth data. Residue in the calcium chloride supplemented liquid varied from ½ to 1%. It was easily mixed before adding the supplement to the other feed ingredients. The pH of the chloride supplement was at least one unit below that of the carbonate supplement.

The mineral analyses of the 55-gal. barrels taken at 0, 2, and 4 weeks did not include residue but only minerals remaining in the liquid--the minerals most likely used under practical conditions using bulk tanks. Analyses are summarized in table 18.5. In the $CaCO_3$ supplement calcium, phosphorous, and magnesium in the top layer upon arrival were lost by week 2. Concomitant increases were noted in the bottom portion (not in the solid residue, but in that portion capable of being siphoned via a glass tube). Sodium and potassium were not affected. In the supplement containing calcium chloride as the calcium source, no differences between top and bottom were found after 4 weeks. Zinc, iron, and manganese were drastically reduced in the top portion of the calcium carbonate liquid supplement. No changes were evident in the calcium chloride liquid supplement. Copper remained suspended in both supplements.

Table 18.1. Compositions of Liquid Feed Supplements Used To Compare Sources of Calcium.

Ingredients	Control ($CaCO_3$)	Treatment ($CaCl_2$)
	%	%
Water	5.00	5.00
Minugel clay	1.50	--
Urea, 50% solution	18.50	18.50
Powdered limestone	6.10	--
Calcium chloride[a]	--	8.34
$(NH_4)_2SO_4$	1.80	1.80
NaCl	2.00	2.00
Trace minerals	0.40	0.40
Vitamins A-D-E[b]	0.02	0.02
Ammonium polyphosphate (10-34-0)	3.40	3.40
Cane molasses	61.25	61.00

[a]Dowflake®, Dow Chemical Co., Midland, Mich.

[b]Pound of supplement: 30,000 I.U. vitamin A; 3.000 U.S.P. units vitamin D; 4 U.S.P. units vitamin E.

Table 18.2. Average Composition of Feed Fed to Steers the Last 84 Days.

Ingredient	Daily amount, lb.	Moisture, %
Cracked sorghum grain	22.0	13
Corn silage	7.1	67
Liquid feed supplement	2.0	21

Table 18.3. Feedlot Performance and Carcass Data from Animals Used to Test Indicated Sources of Calcium.

Item	$CaCO_3$	$CaCl_2$
No. of animals fed	21	21
Initial weight, lb.	820	774
Final weight, lb.	1285	1048
Daily gain, lb.	2.39	2.37
Dry matter intake, lb.	19.3	18.3
Feed efficiency, feed/gain	8.08	7.71
No. of animals slaughtered	19	20
Hot carcass weight, lb.	642	622
Condemned livers, %	15.8	5.0
Grade[a]	3.4	3.7
Yield grade[b]	2.91	2.75
Loin-eye area, in.^{2}	11.64	11.62
Backfat, in.	.45	.42
Kidney knob, %	2.76	2.78

[a] 1= High choice; 6 = low good.

[b] 1 = Most desirable; 5 = least desirable.

Table 18.4. Residue and pH of Liquid Feed Supplements Maintained in 5 gal. Containers.

	$CaCO_3$		$CaCl_2$	
Time, weeks	% residue	pH	% residue	pH
0	3.65	5.22	0.48	4.15
2	3.56	5.20	0.51	4.15
4	3.08	5.30	0.50	4.30
8	4.07	5.30	1.02	4.55

Table 18.5. Mineral Concentrations in Undisturbed Liquid Feed Supplements Containing Either $CaCO_3$ or $CaCl_2$ (55 gal. containers).

Supplement	Time, wks.	Ca, % top	Ca, % bottom	P, % top	P, % bottom	Na, % top	Na, % bottom	K, % top	K, % bottom	Mg, % top	Mg, % bottom
$CaCO_3$	0	1.37	1.67	.54	.57	2.02	2.04	.10	.09	.15	.14
	2	0.17	2.29	.21	.58	1.97	1.99	.09	.10	.06	.16
	4	0.18	2.63	.23	.64	2.03	2.05	.10	.12	.07	.19
$CaCl_2$	0	2.40	2.26	.45	.56	1.60	1.59	.12	.12	.09	.10
	2	2.56	2.53	.49	.50	1.59	1.52	.12	.12	.08	.09
	4	2.46	2.32	.49	.48	1.54	1.55	.12	.12	.10	.09

Supplement	Time, wks.	Mn, ppm top	Mn, ppm bottom	Fe, ppm top	Fe, ppm bottom	Zn, ppm top	Zn, ppm bottom	Cu, ppm top	Cu, ppm bottom
$CaCO_3$	0	123	138	705	714	285	314	53	68
	2	6	145	58	830	45	320	48	56
	4	7	164	67	900	50	348	44	57
$CaCl_2$	0	133	141	495	470	320	314	53	58
	2	124	133	445	439	271	292	46	51
	4	127	126	444	411	309	297	52	55