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Effects of protein level, calcium:phosphorous ratio and monensin on performance of finishing steers

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Abstract

Ration crude protein levels of 10.4% and 12.0% were fed with or without monensin and with calcium-to-phosphorous ratios (Ca:P) of 1:2, 2:1, or 1:1. Steers fed 10.4% crude protein, a 1:1 Ca:P, and Monensin had highest average daily gains and were most efficient. Extra protein in the 12% ration or the extra calcium in the 2:1 ration produced no benefits. Phosphorous in the 1:2 Ca:P apparently was excessive, as indicated by depressed daily gain and poorer efficiency. Monensin significantly increased average daily gain and improved feed efficiency.

Keywords

Cattlemen's Day, 1981; Report of progress (Kansas State University. Agricultural Experiment Station); 394; Beef; Protein; Calcium:phosphorous ratio; Monensin; Performance; Steers

Effects of Protein Level, Calcium:Phosphorous Ratio and Monensin[1] on Performance of Finishing Steers

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Summary

Ration crude protein levels of 10.4% and 12.0% were fed with or without monensin and with calcium-to-phosphorous ratios (Ca:P) of 1:2, 2:1, or 1:1. Steers fed 10.4% crude protein, a 1:1 Ca:P, and Monensin had highest average daily gains and were most efficient. Extra protein in the 12% ration or the extra calcium in the 2:1 ration produced no benefits. Phosphorous in the 1:2 Ca:P apparently was excessive, as indicated by depressed daily gain and poorer efficiency. Monensin significantly increased average daily gain and improved feed efficiency.

Introduction

Monensin may have a "protein-sparing" effect while improving feed efficiency. Other research has suggested that when fecal pH is near neutral, less starch is lost in feces, and performance improves. But, when calcium is used to buffer gut pH, the Ca:P ratio may be excessive. We conducted this study to examine these problems.

Procedure

We used two protein levels, 10.4% (1.96 lb. protein/day) and 12% (2.38 lb. protein/day), and three Ca:P ratios (1:2, 1:1, 2:1); each with and without Monensin. Rations were 75-82% corn, 15% corn silage, and 4-10% supplement (dry matter basis). Protein was adjusted by altering soybean meal. Ca:P ratios were adjusted by altering limestone, monosodium phosphate, and dicalcium phosphate. Monensin was initially fed at 200 mg/steer/day, then increased after 37 days to 300 mg. Rations were fed ad lib twice daily. Initial and final individual shrunk weights were taken after animals had no feed or water for 15 hours. Rumen samples and interim weights were taken 4 hours after morning feeding. Fecal samples were collected at 10-day intervals, with pH determined before samples were frozen. Average daily gain, feed consumption, and feed efficiency by pens, feed and fecal starch content, and fecal pH were measured.

Results and Discussion

Increasing crude protein from 10.4% to 12% improved neither rate nor efficiency of gain. There was no interaction between protein and monensin, perhaps because 10.4% protein was not low enough to cause protein stress that might have been overcome by Monensin's protein-sparing activity.

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[1]Monensin, trademark Rumensin, is a product of Elanco Division, Eli Lilly and Co., Indianapolis, IN.

Adding calcium to provide a 2:1 Ca:P ratio affected neither gain nor efficiency. Extra phosphorous in the 1:2 ratio may have been detrimental, as shown by animals receiving it having poorest gain and efficiency (table 4.2).

Monensin significantly improved gain and efficiency (table 4.3).

Steers fed 10.4% protein and a 1:1 calcium-to-phosphorous ratio had the fastest and most efficient gains. There were no interactions between monensin and protein level or monensin and calcium-to-phosphorous ratio.

Fecal starch (range 7.4-35.2) with any treatment did not differ significantly. Correlations between fecal starch and fecal pH were low ($r = -.08$), indicating a poor relationship between the two.

Table 4.1. Effect of ration crude protein level and daily protein intake.

Protein level, %	10.4	12
Daily protein intake/steer, lb.	1.96	2.38
No. steers	30	30
Initial wt., lb.	767	781
Final wt., lb.	976	964
Avg. daily gain, lb.	2.32[a]	2.35[b]
Avg. daily feed, lb.	18.90[a]	19.89[b]
Feed eff., lbs., feed/lb. gain	8.15	8.46

[a,b]Means in the same row with different superscripts differ significantly ($P<.10$).

Table 4.2. Effect of calcium:phosphorous ratio on steer performance.

Ca:phos ratio	1:1	2:1	1:2
No. steers	20	20	20
Initial wt., lb.	776	773	772
Final wt., lb.	990	969	951
Avg. daily gain, lb.	2.54	2.33	2.13
Avg. daily feed, lb.	19.55[a]	19.68[a,b]	18.96[b]
Feed eff., lbs. feed/lb. gain	7.70[a]	8.45[a,b]	8.90[b]

[a,b]Means in the same row with different superscripts differ significantly ($P<.05$).

Table 4.3. Effect of Monensin on steer performance.

Treatment	Monensin	No Monensin
No. steers	30	30
Initial wt., lb.	772	776
Final wt., lb.	978	962
Avg. daily gain, lb.	2.46[a]	2.21[b]
Avg. daily feed, lb.	19.14[c]	19.66[d]
Feed eff., lbs. feed/lb. gain	7.78	8.90

[a,b]Means in the same row with different superscripts differ significantly (P<.10).

[c,d]Means in the same row with different superscripts differ significantly (P<.05).

Table 4.4. Effect of calcium:phosphorous ratio and protein level on steer performance.

Calcium:Phosphorous	1:1		1:2		2:1	
Protein level	10.4	12	10.4	12	10.4	12
No. steers	10	10	10	10	10	10
Initial wt., lbs.	784	769	779	765	779	767
Final wt., lbs.	1005	975	936	966	987	951
Avg. daily gain, lb.	2.63[a]	2.45[a,b]	1.87[c]	2.40[a,b]	2.47[a,b]	2.20[b,c]
Avg. daily feed, lb.	19.00	20.10	17.91	20.02	19.80	19.57
Feed eff., lbs. feed/lb.	7.22[a]	8.20[a,b]	9.58[c]	8.34[b]	8.02[a,b]	8.90[b,c]

[a,b,c]Means in the same row with different superscripts differ significantly (P<.10).