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Abstract

Eighty-eight medium-framed crossbred steers (731 lb) were used to identify the optimal level of urea in finishing diets for growth and carcass traits. Diets contained no urea or .5, 1.0, or 1.5% urea (dry matter basis) and no other supplemental protein. Feed efficiency and gain were improved substantially by the first increment of urea (.5%), with little or no improvement from subsequent urea additions. Pooled across level, urea improved feed efficiency by 5.6% and gain by 8.9%, whereas dry matter intake declined 3.3% compared to controls. Regression analysis indicated that the optimal level of urea for gain and feed efficiency was .91% of dietary dry matter. Dressing percentage and hot carcass weight responded quadratically, being higher for steers receiving .5 or 1.0% urea. Fat thickness, yield grade, and KPH fat increased linearly with level of urea. Percentage choice carcasses tended to increase, although no differences in marbling score were observed with increased urea. Because of increased carcass weight and finish, with no increase in loineye area, these data suggest that adding urea increased energy utilization (diet digestibility) rather than metabolizable protein supply to the small intestine.

Keywords

Cattlemen's Day, 1994; Kansas Agricultural Experiment Station contribution; no. 94-373-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 704; Beef; Finishing steers; Urea; Performance; Metabolizable protein

LEVEL OF UREA IN HIGH GRAIN DIETS: FINISHING STEER PERFORMANCE

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Summary

Eighty-eight medium-framed crossbred steers (731 lb) were used to identify the optimal level of urea in finishing diets for growth and carcass traits. Diets contained no urea or .5, 1.0, or 1.5% urea (dry matter basis) and no other supplemental protein. Feed efficiency and gain were improved substantially by the first increment of urea (.5%), with little or no improvement from subsequent urea additions. Pooled across level, urea improved feed efficiency by 5.6% and gain by 8.9%, whereas dry matter intake declined 3.3% compared to controls. Regression analysis indicated that the optimal level of urea for gain and feed efficiency was .91% of dietary dry matter. Dressing percentage and hot carcass weight responded quadratically, being higher for steers receiving .5 or 1.0% urea. Fat thickness, yield grade, and KPH fat increased linearly with level of urea. Percentage choice carcasses tended to increase, although no differences in marbling score were observed with increased urea. Because of increased carcass weight and finish, with no increase in loineye area, these data suggest that adding urea increased energy utilization (diet digestibility) rather than metabolizable protein supply to the small intestine.

(Key Words: Finishing Steers, Urea, Performance, Metabolizable Protein.)

Introduction

Current information concerning requirements of finishing cattle for rumen degradable protein and metabolizable protein is limited. In order to establish metabolizable or net protein systems, a requirement for ruminal degradable protein needs to be established. Urea is a common source of rumen degradable nitrogen in finishing diets and, therefore, our objective was to identify the optimal level of urea for performance and carcass traits of finishing yearling steers.

Experimental Procedures

Eighty-eight medium-framed crossbred steers (731 lb) were received from Flint Hills grass in July 1993. A single initial weight was taken following a 3-day equalized intake period of prairie hay and protein supplement. Steers were stratified into three weight blocks; implanted with Revalor®; and stepped up to the final ration without urea or containing .5, 1.0, or 1.5% urea (dry matter basis). The step-up period of 14 days began on the day initial weights were taken. Diets (Table 1) contained no supplemental protein other than urea. All diets were formulated to contain .7% Ca, .35% P, .7% K, 25 g/ton Rumensin®, and 10 g/ton Tylosin®. Steers were fed experimental diets for an average of 131 days. The two largest weight blocks were slaughtered following 119 days on feed, but the smallest weight block required an additional 35 days on feed to reach a desirable finished weight. Hot carcass weights and a 62% dressing percent were used to determine final weight for calculation of gain and feed efficiency. Steers were slaughtered at a commercial plant, and carcass data were obtained following a 24-hour chill.

Results and Discussion

Dry matter intake responded cubically ($P<.10$) to the addition of urea, being lower

for steers supplemented with .5 or 1.5% urea. The reduction in intake was probably associated with an increased starch fermentation rate. Daily gain (P=.10) and feed efficiency (P<.02) responded quadratically to the addition of urea. Both daily gain and feed efficiency were increased substantially by the first increment of urea (.5%), with little or no improvement from subsequent urea additions. Pooled across level, urea supplementation improved daily gain 5.6% and feed efficiency 8.9% and reduced dry matter intake 3.3% compared to the control diet. As dietary urea increased, dressing percentage responded quadratically (P<.01). A quadratic trend (P=.16) also was observed for hot carcass weights. Fat thickness (12th rib) increased (P<.04) and KPH fat tended (P=.14) to increase linearly with level of urea. Loin eye area and incidence of liver abscesses were not affected by dietary level of urea. Calculated yield grade increased linearly (P<.10) with level of urea as a result of increased 12th rib fat and KPH fat. Percentage of carcasses grading Choice tended (P=.17) to increase as dietary level of urea increased, although urea level had little effect on marbling scores. Predicted crude protein requirements of steers in this study (1.88 lb/day) were met by the control diet. Improvements in performance and increased carcass weight and finish, with no improvement in loineye area, suggest that urea enhanced energy utilization (diet digestibility) by the animal, rather than metabolizable protein supply to the small intestine. The Iowa State metabolizable protein system predicted the urea fermentation potential for the basal diet in this study to be 1.09%. Regression analysis (model $Y = \text{urea} + \text{urea}^2$) showed the optimal level of urea for gain (r^2=.31) and feed efficiency (r^2=.40) to be .91% of dietary dry matter.

Table 1. Diet Composition [a]

	Treatment (% Urea, dry matter basis)			
Ingredient	Control	.5	1.0	1.5
Rolled corn	76.9	77.0	77.2	77.2
Prairie hay	10.0	10.0	10.0	10.0
Supplement 1 [b]	10.6	7.1	3.5	--
Supplement 2 [c]	--	3.4	6.8	10.3
Molasses	2.5	2.5	2.5	2.5
% Crude protein (dry matter basis)	7.7	9.0	10.3	11.6

[a]Dry matter basis. Formulated to contain .7% Ca, .35% P, .7% K, 25 g/ton Rumensin, and 10 g/ton Tylosin. Elemental sulfur was supplied to maintain a N:S ratio of 10:1 across treatments.
[b]Supplement supplied no urea.
[c]Supplement supplied 1.5% urea (dry matter basis) in 1.5 treatment.

Table 2. Effect of Dietary Urea Level on Performance and Carcass Traits of Steers

Item	Treatment (% Urea dry matter basis)				SEM
	Control	.5	1.0	1.5	
No. pens	3	3	3	3	
No. steers	22	22	22	22	
Initial wt., lb	735	731	729	730	4.8
Final wt.[a], lb	1170	1193	1201	1184	12.6
Daily feed[b], lb	24.37	23.12	24.00	23.56	.38
Daily gain[c], lb	3.35	3.53	3.64	3.49	.09
Feed/gain[d]	7.29	6.54	6.62	6.76	.13
Hot carcass wt., lb	726	740	745	734	7.8
Dressing %[e]	62.04	63.13	63.09	62.11	.18
KPH, %	1.58	1.73	1.84	2.00	.18
Loin eye area, in^2	13.5	13.7	13.4	13.4	.35
Fat 12th rib[f], in	.31	.36	.46	.50	.05
Yield grade[g]	2.02	2.16	2.57	2.64	.25
Marbling score[h]	5.32	5.01	5.28	5.64	.32
Pct Choice	41	41	59	68	
Liver abscesses, %	5	5	0	5	

[a]Calculated as hot carcass weight/.62.
[b]Cubic (P<.10).
[c]Quadratic (P=.10).
[d]Quadratic (P<.02).
[e]Quadratic (P<.01).
[f]Linear (P<.04).
[g]Linear (P<.10).
[h]4= slight, 5= small, 6= modest.