COMBINATIONS OF RUMINALLY DEGRADABLE AND ESCAPE PROTEIN FOR IMPLANTED FINISHING STEERS

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Summary

One hundred forty-four crossbred medium framed steers (738 lb) were used to compare urea and soybean meal as basal supplemental nitrogen sources and sources of high (blood meal:corn gluten meal; BMCG) or low (soybean meal; SBM) ruminal escape proteins as additional protein supplementation. Basal diets were formulated to contain 10.8% crude protein (CP) and were supplemented with either urea or SBM (.91% and 5.55% of DM, respectively). An additional 2 percentage units of CP were either provided or not provided as SBM or as a 50:50 combination (protein basis) of BMCG. Steers were implanted with Revalor-S® and fed experimental diets for 113 days. Steers fed urea diets consumed 3.9% more feed than those fed SBM as the basal N source. Average daily gain was unaffected by treatment. Soybean meal improved feed efficiency 3.8% compared to urea as a basal nitrogen source. Supplying additional CP from SBM increased feed efficiency 4.4% compared to BMCG. Hot carcass weight and dressing percentage were not affected by treatment. Supplementing basal diets with 2 percentage units of CP increased percentage of carcasses grading choice, KPH fat, and yield grade. High dry matter intakes resulted in metabolizable protein intakes above the predicted requirements (760 g/d) for steers in this experiment, which may have precluded a response to supplemental protein.

(Key Words: Degradable Protein, Escape Protein, Finishing Steers, Performance.)

Introduction

Finishing steers receiving growth promotants, especially the combination of estradiol and trenbolone acetate, have enhanced growth rates, which may increase their requirements for metabolizable protein. Protein presented to the small intestine can be increased by using protein sources such as blood meal and corn gluten meal, which escape rumen degradation, whereas the rumen nitrogen requirement can be met with sources susceptible to degradation.

Previous studies (Cattlemen's Day, 1994) demonstrated that supplementing high grain diets with urea enhances rumen organic matter digestion with little or no improvement in microbial protein production. A source of natural, ruminally degradable protein may be required to increase microbial protein presented to the small intestine and subsequently increase animal performance. Those reports suggested that, in corn-based finishing diets, the level of urea for optimal rate and efficiency of growth is .91% of dietary dry matter. In this study, our objectives were to compare urea (non-protein nitrogen) versus soybean meal (natural, degradable protein source) as basal, supplemental nitrogen (N) sources and evaluate additional N supplementation from high- versus low-escape proteins on performance and carcass characteristics of implanted, finishing steers.

Experimental Procedures

One hundred forty-four crossbred, medium-framed steers (738 lb) were allotted to one of four weight replicates and stratified into one of six pens within each replicate in a 2 × 3 factorially arranged experiment. Basal diets (90% concentrate, 10.8% CP; Table 1) contained either .91% urea or an equivalent amount of N as SBM (5.55% of diet DM). An additional two percentage units of CP were either provided or not provided by a 50:50 combination (protein basis) of BMCG (high escape) or SBM (low escape). All diets were formulated to contain .7% Ca, .35% P, and .7% K. Steers were fed 275 mg Rumensin® and 90 mg Tylosin® per head daily. Steers were stepped up to an 80% concentrate diet prior to the start of the experiment. Initial weights were the average of two consecutive early morning weights taken before feeding. Steers were implanted with Revalor-S® and fed experimental diets for 113 days. Final weights were computed from hot carcass weights, assuming a dressing percentage of 62 for calculation of daily gain and feed efficiency. Steers were slaughtered at a commercial plant, and carcass data were obtained following a 24-hour chill. Statistical analysis allowed comparisons of: 1) basal supplemental N source, 2) basal versus additional supplemental protein (i.e., 10.8 vs 12.8% CP diets), 3) additional N supplementation in the form of high (BMGG) or low (SBM) escape protein, and 4) interaction between basal and additional N sources.

Results and Discussion

Steers fed urea diets consumed 3.9% more feed (P<.07) than those fed SBM as the basal N source (Table 2). Average daily gain was not affected by treatment. Steers supplemented with SBM as the basal N source were 3.8% more efficient (P<.05) than those supplemented with urea; additional N supplementation from SBM improved feed efficiency 4.4% (P<.09) versus BMCG. The improvement in feed efficiency from SBM suggests that provision of natural, degradable protein to rumen microorganisms improved fermentation. Hot carcass weight and dressing percentage (62.6%) were unaffected (P>.2) by treatment. A basal × additional N source interaction (P<.02) was observed for 12th rib fat thickness. When steers were fed the urea basal diet, fat thickness was increased by additional BMCG, whereas fat thickness of steers fed the SBM basal diet was decreased by additional BMCG. Loin eye area (LEA) was decreased (P<.05) by the addition of supplemental N to the basal diets, and this depression in LEA was more severe when steers received additional N from BMCG than from SBM. Observed differences in LEA may be somewhat trivial because of the small differences noted across treatments. Percentage of carcasses grading choice, KPH fat, and calculated yield grade were increased (P<.09) when additional N was provided to the basal diets. Metabolizable protein requirements for steers in this experiment were calculated to be approximately 760 g/d. High dry matter intakes resulted in metabolizable protein intakes ranging from 949 to 1112 g/d, which may have precluded responses to basal and supplemental N sources in this study.

Table 1. Diet Composition (% of Dry Matter)

	Treatment [a]					
	Urea			SBM		
Item	0	BMCG	SBM	0	BMCG	SBM
Rolled corn	85.5	82.6	81.0	81.2	78.3	76.6
Prairie hay	8.0	8.0	8.0	8.0	8.0	8.0
Urea	.91	.91	.91	--	--	--
Soybean meal	--	--	4.54	5.55	5.55	10.1
Blood meal	--	1.19	--	--	1.19	--
Corn gluten meal	--	1.71	--	--	1.71	--
Vitamins/minerals [b]	3.09	3.09	3.05	2.75	2.75	2.80
Molasses	2.5	2.5	2.5	2.5	2.5	2.5
% Crude protein	10.8	12.8	12.8	10.8	12.8	12.8

[a]Dietary tre atments (basal N source/supplemental N source). SBM= soybean meal; 0= no supplemental protein; BMCG=blood meal:corn gluten meal . [b]Provided dietary levels of 1500 IU/lb Vitamin A, 20 IU/lb Vitamin E, .7% Ca, .35% P, and .7% K.

Table 2. Effect of Basal and Supplemental Nitrogen S o urce on Performance and Carcass Traits of Implanted Finishing Steers

	Treatment						
	Urea		SBM				
Item	0	BMCG	SBM	0	BMCG	SBM	SEM
No. pens	4	4	4	4	4	4	
No. steers	24	24	24	24	24	24	
Initial wt, lb	741	742	745	744	743	741	1.4
Final wt[a], lb	1156	1156	1178	1167	1162	1165	13.7
Daily fee d[b], lb	25.47	24.51	24.87	23.92	24.36	23.61	.61
Daily gain, lb	3.72	3.70	3.88	3.79	3.71	3.79	.12
Feed/Gain [c,d,e]	6.86	6.64	6.41	6.32	6.56	6.25	.14
Carcass Traits							
Hot carcass wt, lb	717	717	731	724	721	722	8.5
Fat 12th ri b[f], in	.45[g]	.55[h]	.48[gi]	.51[hi]	.46[g]	.53[hi]	.02
KPH[j], %	2.05	2.09	2.25	2.13	1.98	2.13	.06
Loineye are a[e,j], sq in	12.8	12.1	12.4	12.3	12.1	12.4	.15
Marbling score [k]	4.77	5.21	5.12	4.98	4.85	5.06	.16
Yield grade	2.73	3.08	2.96	3.02	2.93	3.02	.08
Pct. Choice [j]	37.5	75.0	66.7	45.8	54.2	66.7	
Metabolizable protein intake, g/d	983	1112	1076	840	1029	949	

[a]Hot carcass weight/.62.

[b]Urea vs SBM (P<.07).

[c]Feed/gain was analyzed as gain/feed and reported as the reciprocal.

[d]Urea vs SBM (P<.05).

[e]SBM vs BMCG (P<.09).

[f]Basal by additional N source interaction (P<.02).

[ghi]Means in the same row with different superscripts differ (P<.10).

[j]Supplemental vs no supplemental protein (P<.08).

[k]4 = slight, 5 = small, 6 = modest.