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NATURAL DEGRADABLE PROTEIN AND ROUGHAGE TYPE FOR IMPLANTED FINISHING STEERS FED DRY-ROLLED CORN DIETS

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Summary

Three hundred eighty-four crossbred, yearling steers (810 lb) were used to evaluate soybean meal (SBM), sunflower meal (SFM), and combinations of the two as protein supplements and supplemental protein effects in diets containing silage or alfalfa as dietary roughage. All diets contained 1.0% urea (dry matter basis). An additional 2 percentage units of crude protein were either not provided or provided as SBM, SFM, or a 50:50 combination (protein basis) of SBM and SFM. Steers were implanted with Revalor-S and fed experimental diets for 126 days. No interactions between protein supplementation and roughage source were observed. Daily feed intake and feed efficiency were unaffected by additional supplemental protein compared to urea alone. Averaged across both roughage sources, provision of supplemental SBM tended to increase daily gain. Dressing percentage decreased when supplemental SBM was provided and increased when alfalfa was fed as the roughage source. Based on carcass-adjusted performance, feeding alfalfa as the dietary roughage source improved daily gain by 3.9% and feed efficiency by 4.8% compared to sorghum silage. Carcass finish, marbling score, and carcasses grading Choice were unaffected by treatment. Carcass-adjusted growth rate and conversion efficiency were enhanced when alfalfa was fed independent of dietary crude protein concentration.

(Key Words: Sunflower Meal, Soybean Meal, Urea, Finishing Steers.)

Introduction

The goal of protein supplementation of feedlot diets is to provide amino acids (metabolizable protein) to the animal and to optimize ruminal fermentation. Urea in high grain diets has been demonstrated to enhance ruminal digestion, but not to increase metabolizable protein supply. Natural, degradable protein sources such as soybean meal (SBM) contain both a degradable and a ruminal escape protein fraction. Recent research conducted at Kansas State University demonstrated that yearling steers consuming dry-rolled corn finishing diets supplemented with 1% urea responded to supplementation with a natural, rumen degradable protein source. Sunflower meal (SFM) is degraded readily in the rumen. However, information on its usefulness in finishing diets is limited. Because of its relatively low crude protein content and low energy density, the resulting reduction in dietary NEg concentration when SFM is fed could alter feedlot performance.

Roughage sources can vary dramatically in crude protein concentration and degradability and, therefore, also can affect responses to supplemental protein. Alfalfa hay and sorghum silage are two roughage sources commonly used in finishing diets and differ in their protein concentration. Our objectives were: 1) to compare SBM, SFM, and a combination of the two as supplemental proteins in diets already containing 1% urea and 2) to examine the potential interaction between roughage source and supplemental protein in corn-based diets fed to implanted, finishing, yearling steers.

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Experimental Procedures

Three hundred eighty-four crossbred yearling steers (810 lb) were allotted to one of five weight replicates and stratified to one of six pens within each replicate. Steers were stepped up to an 80% concentrate ration prior to beginning the experiment. All diets (Table 1) contained 1.0% urea and 10% roughage as either sorghum silage or alfalfa hay and were formulated to contain .72% Ca, .36% P, .7% K, and a 10:1 nitrogen: sulfur ratio (dry matter basis). An additional 2 percentage units of crude protein were either not provided or provided by SBM, SFM, or by a 50:50 combination (protein basis) of the two in diets containing sorghum silage as roughage. To address the possible interaction between additional supplemental protein and roughage source, 2 percentage units of crude protein were either not provided or provided as SBM in diets containing alfalfa as the roughage source. Steers were fed 275 mg Rumensinfi and 90 mg Tylanfi per head daily. Initial and final weights were the averages of two consecutive early morning weights. Steers were implanted with Revalor-Sfi and fed experimental diets for an average of 126 days. The two heaviest replicates were slaughtered following 114 days on feed, and the remaining three replicates at 133 days. Steers were slaughtered at a commercial plant, and carcass data were obtained following a 24-hour chill. Statistical analyses allowed comparisons of: 1) urea alone versus additional supplemental protein, 2) SBM versus SFM as additional supplemental protein, 3) urea versus additional SBM supplementation, 4) interaction between roughage source and protein supplementation, and 5) effect of roughage source.

Results and Discussion

Steer performance and carcass traits are reported in Table 2. Interactions between roughage source and protein supplementation were not evident. Daily feed intake and feed efficiency were unaffected by treatment. Averaged across roughage source, steers supplemented with SBM tended (P=.15) to gain faster than those fed only urea. However, daily gains of steers supplemented with SFM or the combination of SBM and SFM were similar to those of steers supplemented with urea alone. Dressing percentage was decreased (P<.10) when steers were supplemented with SBM and increased (P=.05) when steers were fed alfalfa as the dietary roughage source.

Because treatment affected dressing percentage, daily gain and feed efficiency also were determined using final weights calculated from hot carcass weights and a 63% dressing percentage. Based on that carcass-adjusted performance, daily gain and feed efficiency were unaffected by supplemental protein. When steers were fed alfalfa as the dietary roughage source, carcass-adjusted daily gain increased by 3.9% (P<.10) and feed efficiency was improved by 4.8% (P<.07) compared to steers fed sorghum silage. Marbling score, carcass finish, and percentage of carcasses grading USDA Choice were unaffected by treatment. The provision of supplemental SBM increased (P<.10) ribeye area and tended (P=.17) to improve yield grade.

The lack of a larger response in animal performance to the provision of natural, degradable protein is inconsistent with previous reports. Based on actual live weights, SBM supplementation tended (P=.15) to improve gain relative to either no supplementation, SFM supplementation, or supplementation with a combination of SBM and SFM. However, when based on carcass weights, no difference existed between protein sources. Lack of a significant response to supplemental protein limits the conclusions that can be drawn about the relative value of these protein sources. Based on carcass-adjusted final weights, increased daily gain and improved feed efficiency when alfalfa was fed suggests a roughage response independent of dietary crude protein concentration.

Table 1. Diet Composition (% of Dry Matter)

	Treatment[a]					
	Sorghum Silage				Alfalfa Hay	
Item	None	SBM	SFM	SFM/SBM	None	SBM
Rolled corn	83.6	79.5	76.0	77.7	84.0	79.9
Sorghum silage	10.0	10.0	10.0	10.0	--	--
Alfalfa hay	--	--	--	--	10.0	10.0
Urea	1.0	1.0	1.0	1.0	1.0	1.0
Soybean meal	--	4.4	--	2.2	--	4.4
Sunflower meal	--	--	7.9	4.0	--	--
Vitamins/minerals[b]	2.9	2.6	2.6	2.6	2.5	2.2
Molasses	2.5	2.5	2.5	2.5	2.5	2.5
% Crude protein	10.8	12.8	12.8	12.8	11.9	13.9

[a]None= no additional supplemental protein; SBM= soybean meal; SFM= sunflower meal. [b]Formulated to provide dietary levels of 1500 IU/lb vitamin A, 15 IU/lb vitamin E, .72% Ca, .36% P, and .7% K.

Table 2. Effects of Supplemental Protein Source and Roughage Type on Performance and Carcass Traits of Steers Fed a Dry-Rolled Corn-Based Diet

	Treatment						
	Sorghum Silage				Alfalfa Hay		
Item	None	SBM	SFM	SFM/SBM	None	SBM	SEM
No. pens	5	5	5	5	5	5	
No. steers	64	64	64	64	64	64	
Initial wt, lb	812	810	809	809	809	810	3.7
Final wt[a], lb	1251	1266	1259	1245	1257	1266	9.1
Daily feed, lb	24.01	24.59	23.88	24.04	24.31	23.82	.40
Daily gain[b], lb	3.52	3.66	3.52	3.49	3.58	3.64	.07
Gain/feed	.147	.149	.148	.145	.148	.153	.003
Carcass Traits							
Hot carcass wt[c], lb	793	790	787	787	800	805	6.3
Dressing %[d,e]	63.35	62.30	62.94	63.23	63.59	63.49	.31
Fat 12th rib, in	.43	.40	.44	.41	.42	.43	.02
KPH, %	2.47	2.51	2.40	2.44	2.48	2.53	.03
Ribeye area[f], sq in	12.9	13.3	12.9	13.2	13.1	13.4	.17
Marbling score[g]	5.09	4.95	5.17	4.90	5.04	5.09	.10
Yield grade[h]	2.95	2.77	2.96	2.78	2.90	2.83	.09
Percent Choice	70.3	60.9	68.8	65.6	71.9	59.4	
Carcass Adjusted Performance[i]							
Daily gain[j], lb	3.56	3.56	3.52	3.53	3.68	3.73	.08
Gain/feed[j]	.149	.145	.148	.147	.152	.156	.004

[a]Final weight pencil shrunk 4%. [b]Urea vs additional SBM (P= .15). [c]Silage vs alfalfa (P= .11). [d]Silage vs alfalfa (P= .05). [e]Urea vs additional SBM (P<.10). [f]Urea vs additional SBM (P<.05). [g]4= slight; 5=small; 6=modest. [h]Urea vs additional SBM (P=.17). [i]Daily gain and conversion calculated using final weights= hot carcass wt/.63. [j]Silage vs alfalfa (P<.10).