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Effects of supplementation of limit-fed growing diets with either soybean meal or nonenzymatically browned soybean meal on steer performance

Abstract

Seventy two individually fed Angus x Hereford steers (642 lb) were used to evaluate the effects of supplementing limit-fed, growing diets with either soybean meal (SBM) or nonenzymatically browned soybean meal (NSBM). Eight steers were allotted to a control diet composed of 39.1% high-moisture corn, 42% cottonseed hulls, 10.4% ground corn, 5% cane molasses 2.25% urea, and 1.5% vitamins and minerals (dry basis). The remaining steers were allotted to diets that derived 100, 80, 60, or 40% of their supplemental protein from SBM or 60, 45, 30, or 15% of their supplemental protein from NSBM. The balance of supplemental protein came from urea. All diets were formulated to contain 13.0% crude protein (dry basis). Steers were fed once daily for 80 days at 2.25% of BW. Average daily gain and efficiency did not differ ($P>.05$) between sources ($ADG=1.932 + .103 \times (\% \text{ CP from SBM}) + .097 \times (\% \text{ CP from NSBM})$); $gain:feed=.140 + .0058 \times (\% \text{ CP from SBM}) + .0051 \times (\% \text{ CP from NSBM})$). The lack of response to NBSBM supplementation above that for SBM suggests that either degradable intake protein was limiting in the basal diet or a large proportion of the amino acids in the NSBM were unavailable due to overprocessing.

Keywords

Cattlemen's Day, 2000; Kansas Agricultural Experiment Station contribution; no. 00-287-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 850; Beef; Growing cattle; Nonenzymatically browned soybean meal; Undegraded intake protein

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EFFECTS OF SUPPLEMENTATION OF LIMIT-FED GROWING DIETS WITH EITHER SOYBEAN MEAL OR NONENZYMATICALLY BROWNEED SOYBEAN MEAL ON STEER PERFORMANCE

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Summary

Seventy two individually fed Angus × Hereford steers (642 lb) were used to evaluate the effects of supplementing limit-fed, growing diets with either soybean meal (SBM) or non-enzymatically browned soybean meal (NSBM). Eight steers were allotted to a control diet composed of 39.1% high-moisture corn, 42% cottonseed hulls, 10.4% ground corn, 5% cane molasses 2.25% urea, and 1.5% vitamins and minerals (dry basis). The remaining steers were allotted to diets that derived 100, 80, 60, or 40% of their supplemental protein from SBM or 60, 45, 30, or 15% of their supplemental protein from NSBM. The balance of supplemental protein came from urea. All diets were formulated to contain 13.0% crude protein (dry basis). Steers were fed once daily for 80 days at 2.25% of BW. Average daily gain and efficiency did not differ ($P > .05$) between sources ($ADG = 1.932 + .103 \times (\% \text{ CP from SBM}) + .097 \times (\% \text{ CP from NSBM})$; $\text{gain:feed} = .140 + .0058 \times (\% \text{ CP from SBM}) + .0051 \times (\% \text{ CP from NSBM})$). The lack of response to NSBM supplementation above that for SBM suggests that either degradable intake protein was limiting in the basal diet or a large proportion of the amino acids in the NSBM were unavailable due to overprocessing.

(Key Words: Growing Cattle, Nonenzymatically Browned Soybean Meal, Undegraded Intake Protein.)

Introduction

Previous research at KSU has demonstrated that supplementation with non-enzymatically browned soybean meal (NSBM) improved performance of growing steers fed restricted amounts of wheat middling-based diets. Energy sources like high-moisture corn are characterized by relatively high levels of degradable intake protein and also might benefit from supplementation with NSBM.

The content of bypass protein is higher in NSBM than in untreated commercial soybean meal (SBM). Our objective was to compare the effects of supplementing limit-fed growing diets composed predominantly of high-moisture corn and cottonseed hulls with either SBM (28% bypass protein) or NSBM (82% bypass protein).

Experimental Procedures

Seventy two individually fed Angus × Hereford steers (642 lb) were stratified by weight and allotted randomly, within strata, to one of nine treatments. Eight steers were allotted to a control diet (Table 1), and the remaining steers were allotted to one of four soybean protein levels within each SBM source. Levels of SBM were 100 (6.5% CP), 80 (4.9% CP), 60 (3.2% CP), and 40% (1.6% CP) of supplemental CP with the balance as urea. Levels of NSBM were 60 (3.9% CP), 45 (2.9% CP), 30 (1.9% CP), and 15% (1% CP) of supplemental CP with the balance as

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urea. All diets were formulated to contain 13.0% crude protein (dry basis). Steers were fed once daily for 80 days at 2.25% of BW. Data were analyzed by regression using supplementation level as a continuous variable nested within supplement source (SBM or NSBM).

Results and Discussion

Gain (Figure 1) and efficiency (Figure 2) did not differ ($P > .05$) among sources:

$$\text{ADG (lb/day)} = 1.932 + .103 \times (\% \text{CP from SBM}) + .097 \times (\% \text{CP from NSBM})$$

$$\text{Gain to feed} = .140 + .0058 \times (\% \text{CP from SBM}) + .0051 \times (\% \text{CP from NSBM}).$$

In our model, we formulated the control diet to contain excess degradable intake protein (120% of requirement according to level 1 of the 1996 NRC) and, therefore, expected little response to SBM supplementation. However, the observed response to SBM supplementation suggests that the basal diet was still deficient in degradable protein.

Supplementing limit-fed growing diets based on high-moisture corn and cottonseed hulls with NSBM improve animal performance above that seen with SBM supplementation. This suggests that either degradable intake protein was limiting in the basal diet or that a large proportion of the amino acids in the NSBM were unavailable due to overprocessing.

Table 1. Compositions of Experimental Diets (dry basis)

Item	Control	SBM ¹	SBM	SBM	SBM	NSBM ²	NSBM	NSBM	NSBM
		40	60	80	100	15	30	45	60
----- % of supplemental protein -----									
High-moisture corn	39.10	39.10	39.10	39.10	39.10	39.10	39.10	39.10	39.10
Cottonseed hulls	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00
Molasses	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
SBM ¹	-	4.90	7.40	9.90	12.40	-	-	-	-
NSBM ²	-	-	-	-	-	1.80	3.80	5.60	7.40
Ground corn	10.40	6.00	4.00	2.00	-	8.90	7.30	5.70	4.10
Calcium phosphate	.23	.23	.23	.23	.23	.23	.23	.23	.23
Salt	.25	.25	.25	.25	.25	.25	.25	.25	.25
Limestone	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Urea	2.25	-	.52	1.04	1.56	.85	1.15	1.46	1.77
Vitamin/mineral mix ^a	.06	.06	.06	.06	.06	.06	.06	.06	.06

^aContains 8 ppm Cu, .04 ppm Co, .5 ppm I, .13 ppm Fe, 48 ppm Mn, .2 ppm Se, 47 ppm Zn, 1330 IU/lb vitamin A. Rumensin[®] and Tylan[®] were added at 30 g/ton and 10 g/ton of diet, respectively.

¹SBM = soybean meal.

²NSBM = nonenzymatically browned soybean meal.

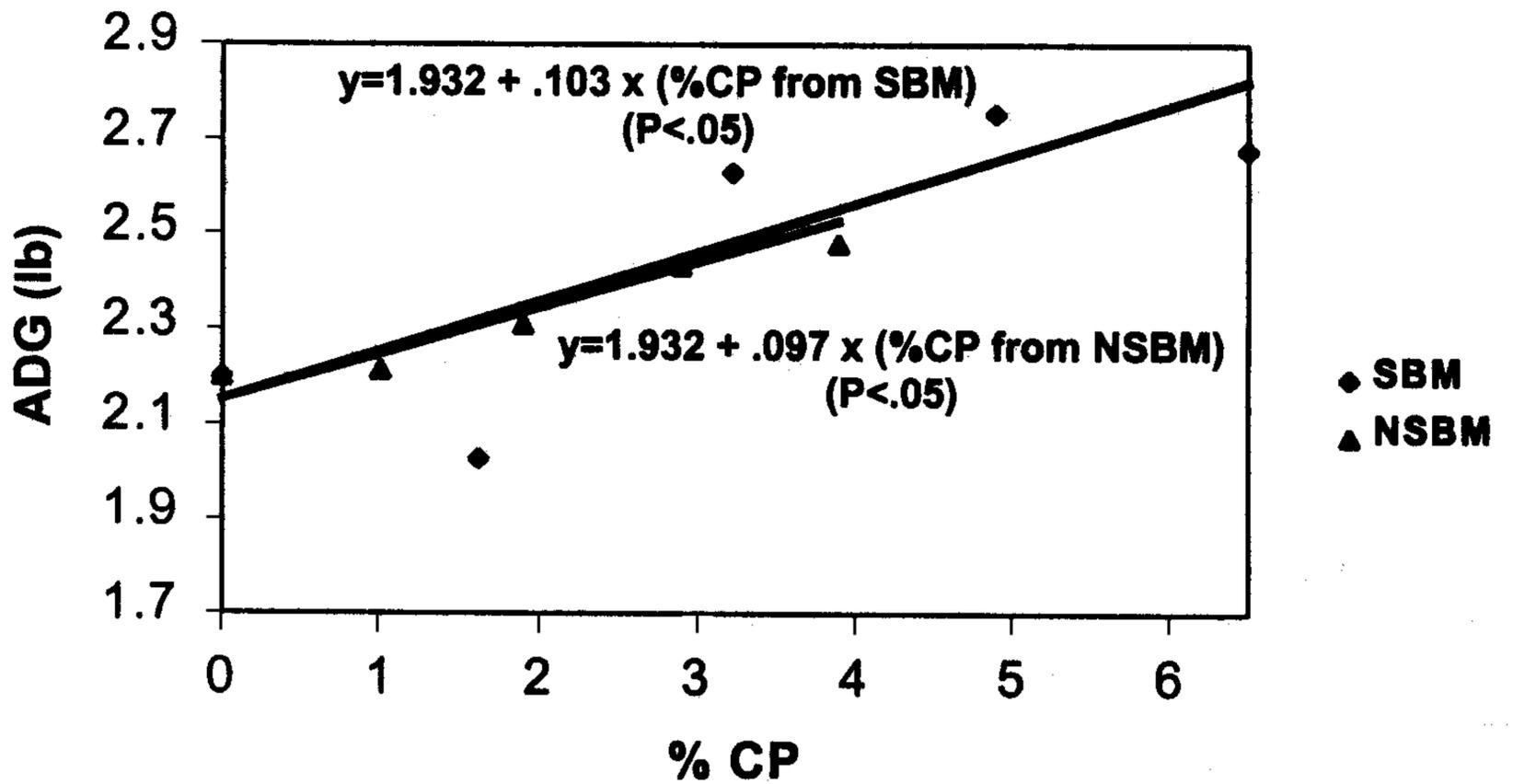


Figure 1. Effects of Supplementing Limit-Fed Growing Diets with Soybean Meal (SBM) or Nonenzymatically Browninged Soybean Meal (NSBM) on Average Daily Gain (ADG)

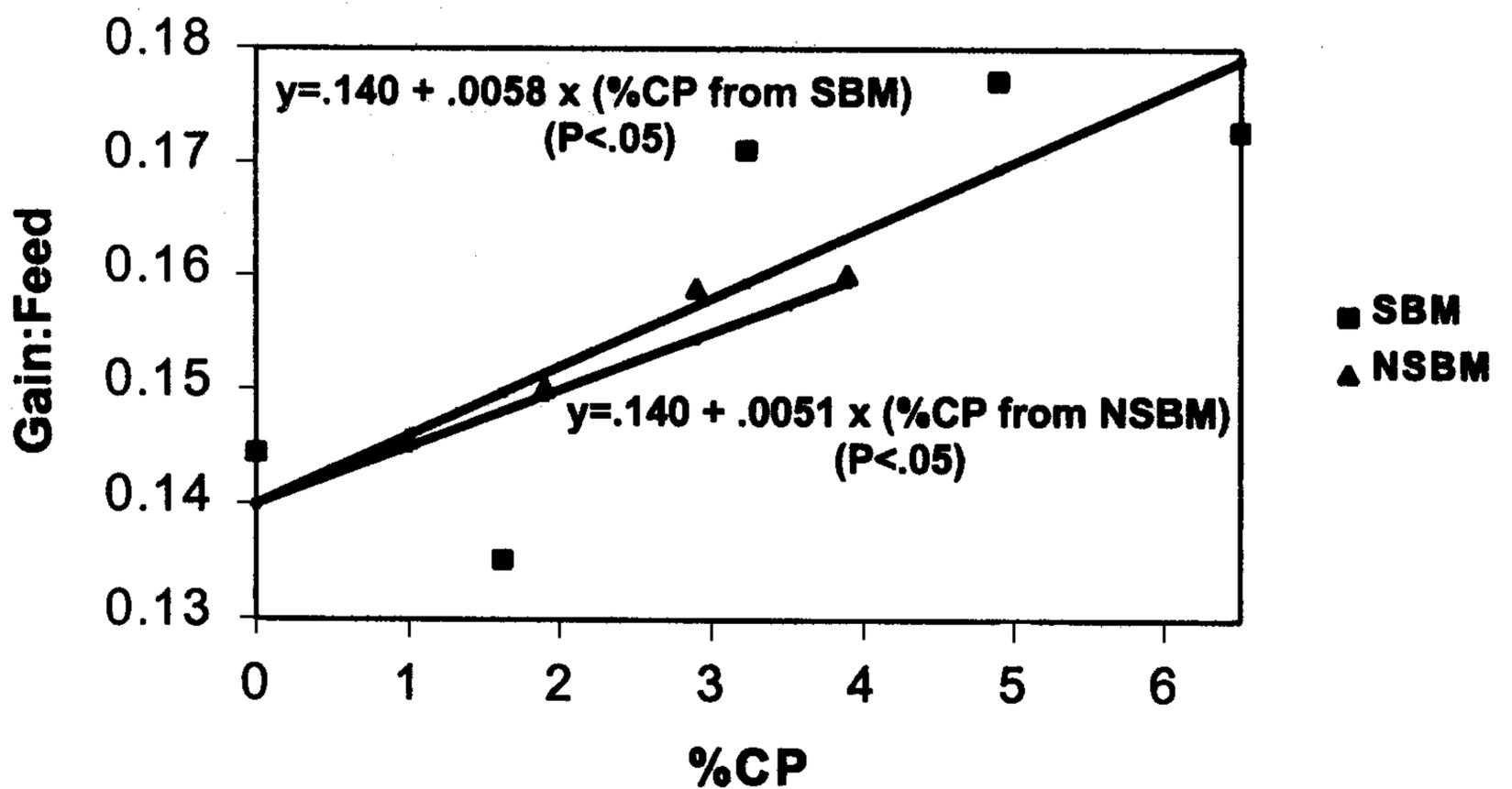


Figure 2. Effects of Supplementing Limit-Fed Growing Diets with Soybean Meal (SBM) or Nonenzymatically Browninged Soybean Meal (NSBM) on Feed Efficiency (gain:feed)