Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 1 *Cattleman's Day (1993-2014)*

Article 966

1987

Raw soybeans as a protein source for growing cattle

S. Anderson

Robert T. Brandt Jr.

Raw soybeans as a protein source for growing cattle

Abstract
A 60-day growth trial with 170 exotic crossbred steers (avg. wt. 626 lbs) was conducted to assess the value of raw soybeans in silage-based diets. Protein supplements were based on 1) urea, 2) urea plus soybean oil (SBO), 3) soybean meal (SBM), 4) SBM plus SBO, 5) rolled (RSB), and 6) whole (WSB) soybeans. Soybean oil was added to treatments 2 and 4 in amounts equivalent to that contributed from raw soybeans. Total diets were 11.5% crude protein. Steers fed SBM gained faster (P<.05) and consumed more feed than those fed RSB or WSB. However, SBO added back to the SBM diet resulted in performance similar to that of steers fed RSB or WSB (P=.47). This suggests that the protein value of SBM and raw soybeans was similar, but that small increments (less than 2% of diet dry matter) of soybean lipid inhibited ruminal diet digestion and(or} utilization. There was no advantage for rolling raw soybeans vs. feeding them whole (P=.45). Costs of gain were urea < raw soybeans < soybean meal.

Keywords
Cattlemen's Day, 1987; Kansas Agricultural Experiment Station contribution; no. 87-309-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 514; Beef; Raw soybeans; Protein; Growing cattle

Raw Soybeans as a Protein Source for Growing Cattle

Scott Anderson[1] and Robert T. Brandt, Jr.[2]

Summary

A 60-day growth trial with 170 exotic crossbred steers (avg. wt. 626 lbs) was conducted to assess the value of raw soybeans in silage-based diets. Protein supplements were based on 1) urea, 2) urea plus soybean oil (SBO), 3) soybean meal (SBM), 4) SBM plus SBO, 5) rolled (RSB), and 6) whole (WSB) soybeans. Soybean oil was added to treatments 2 and 4 in amounts equivalent to that contributed from raw soybeans. Total diets were 11.5% crude protein. Steers fed SBM gained faster ($P<.05$) and consumed more feed than those fed RSB or WSB. However, SBO added back to the SBM diet resulted in performance similar to that of steers fed RSB or WSB ($P=.47$). This suggests that the protein value of SBM and raw soybeans was similar, but that small increments (less than 2% of diet dry matter) of soybean lipid inhibited ruminal diet digestion and(or) utilization. There was no advantage for rolling raw soybeans vs. feeding them whole ($P=.45$). Costs of gain were urea < raw soybeans < soybean meal.

Introduction

Economic pressures have renewed interest in the feeding value of raw soybeans for cattle. Limited data exist on their value for growing calves. Additionally, comparisons have not separated protein from fat responses. Our study measured 1) the protein value of raw soybeans, 2) potential interactions between protein and lipid in raw beans, and 3) the influence of rolling raw soybeans.

Experimental Procedures

One hundred-seventy, mixed, exotic, crossbred steer calves (avg. wt. 626 lbs) were blocked by initial weight to four replicates for a 60-day growth trial (October 30 to December 29, 1986). All steers had received routine vaccinations, were dewormed (Ivomec®), ear-tagged, and implanted (Compudose 200®).

[1]Research assistant, Southwest Kansas Branch Experiment Station, Garden City.
[2]Research animal scientist, Southwest Kansas Branch Experiment Station, Garden City.

Steers were full-fed a silage diet for 2 weeks before the experimental diets were started. Six dietary treatments (four pens per treatment) were: 1) urea, 2) urea plus soybean oil (SBO), 3) soybean meal (SBM), 4) SBM plus SBO, 5) rolled (RSB), and 6) whole raw soybeans (WSB). Diets (Table 5.1) were 83% corn silage and were formulated to contain (dry basis) 11.5% crude protein, .40% calcium, .25% phosphorus, 1.1% potassium, 70 ppm zinc, .2% ammonium sulfate, and .25% salt. Soybean oil was added to the urea and SBM basal diets in amounts equal to that supplied by the raw soybeans. All diets contained 71% TDN (calculated). RSB and WSB diets contained 10.47% raw soybeans (dry basis). Dry ingredients were incorporated into supplements and blended with silage, molasses, soybeans, and(or) soybean oil at feeding time. RSB were rolled to break each soybean seed.

Steers were fed once daily from a truck-mounted mixer-feeder. Initial and final weights were the average of weights on two consecutive days before feeding.

Results and Discussion

During the first 26 days of the trial, steers fed SBM gained faster and more efficiently ($P<.05$) than those fed urea (Table 5.2). Gains and feed conversions for cattle fed RSB or WSB were intermediate to those for cattle fed urea and SBM. Feed consumptions were similar ($P>.05$) in this period, although adding only 1.87% soybean oil to the SBM diet reduced intake by 4.5%.

For the entire feeding period, steers fed SBM gained faster ($P<.05$) and consumed more dry matter than those fed RSB or WSB. However, SBO addition to the SBM diet resulted in daily gains and feed conversions similar to RSB or WSB ($P>.05$).

Soybean oil addition reduced gain 4.2 and 6.3% for steers fed urea and SBM, respectively. Similarly, SBO reduced feed consumption of urea and SBM diets by 2.4 and 4.4%. Greater percentage reductions in performance for SBM vs. urea diets from SBO addition suggest a toxic effect on ruminal microorganisms, rather than a physical inhibition of feed substrate attachment.

No apparent benefit resulted from rolling raw soybeans. Dry matter intake was numerically lower, yet feed conversion was slightly higher for WSB vs. RSB. Feed efficiency data suggest no antinutritional factors in raw soybeans for cattle beyond potential inhibition of ruminal diet digestion by the lipid fraction.

We noted that whole soybeans swelled when they were mixed with silage. When raw soybeans were placed in tap water, they swelled to 3 to 4 times their original size. Thus, the reduced consumption of WSB diets may be related to increased physical fill.

Table 5.1. Composition of Diets[1]

Ingredient	Treatment				
	Urea	Urea + SBO	SBM	SBM + SBO	RSB or WSB
	%				
Corn silage	83.00	83.00	83.00	83.00	83.00
Urea	1.27	1.27	-	-	-
Soybean meal	-	-	8.56	8.56	-
Raw soybeans	-	-	-	-	10.47
Cane molasses	4.00	2.00	4.00	2.13	4.00
Soybean oil	-	2.00	-	1.87	-
Ground corn	10.57	10.57	3.55	3.55	1.66
Dicalcium phosphate	.29	.29	.09	.09	.01
Limestone	.17	.17	.27	.27	.33
Salt	.25	.25	.25	.25	.25
Ammonium sulfate	.20	.20	.20	.20	.20
Potassium chloride	.17	.17	-	-	-
Vit. A, D, E premix	.03	.03	.03	.03	.03
Trace mineral premix	.05	.05	.05	.05	.05
Ration cost[2]					
$ per ton, as fed	27.76	30.20	31.72	34.02	29.00

[1]Dry basis.
[2]Based on $20/ton corn silage, $4.60/bushel soybeans and $165/ton soybean meal.

Table 5.2. Performance and Cost of Gain for Growing Steers Fed Different Protein Sources

Item	Urea	Urea SBO	SBM	SBM + SBO	RSB	WSB	SE[a]
Number steers	28	28	29	28	29	28	
Initial wt, lb	625	628	625	626	627	624	1
Final wt, lb	780	778	791	782	776	775	7
Daily gain, lb							
0 - 26 days	2.78^{f}	2.76^{f}	3.20^{d}	3.11^{de}	2.88^{ef}	2.86^{ef}	.12
27 - 60 days	2.37^{gh}	2.21^{h}	2.36^{g}	2.14^{gh}	2.12^{h}	2.19^{h}	.14
0 - 60 days	2.55^{gh}	2.44^{h}	2.72^{g}	2.55^{gh}	2.45^{h}	2.47^{h}	.10
Daily feed, lb[b]							
0 - 26 days	16.60^{d}	16.53^{de}	17.10^{d}	16.33^{de}	16.48^{de}	15.92^{e}	.34
27 - 60 days	17.18^{d}	16.45^{de}	17.35^{d}	16.58^{de}	16.35^{de}	15.87^{e}	.40
0 - 60 days	16.90^{d}	16.50^{de}	17.23^{d}	16.48^{de}	16.40^{de}	15.88^{e}	.32
Feed/gain							
0 - 26 days	6.03^{e}	6.02^{e}	5.35^{d}	5.26^{d}	5.72^{de}	5.57^{de}	.22
27 - 60 days	7.25	7.59	7.43	7.81	7.66	7.30	.41
0 - 60 days	6.65	6.80	6.35	6.47	6.68	6.43	.24
Cost of gain[c]							
$ per lb of gain	.237	.263	.259	.282	.249	.240	

[a]Standard error.
[b]Dry matter.
[c]Feed costs.
[def]Means in a row with unlike superscripts differ (P<.05).
[gh]Means in a row with unlike superscripts differ (P<.10).