Evaluation of Condensed Porcine Solubles as a Source of Supplemental Nitrogen in Corn-Based Finishing Diets for Yearling Steers

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Summary

A feeding trial was conducted with 860-lb yearling steers fed 121 days to evaluate Condensed Porcine Solubles (Porcine Solubles) as a source of supplemental nitrogen for finishing cattle. Diets containing 5% soybean meal, 1.46% urea, and 2% or 4% Porcine Solubles were compared. When first offered, cattle did not want to consume feed containing the Porcine Solubles. Following adaptation, feed containing up to 4% Porcine Solubles was readily consumed. During the first 56 days, steers fed soybean meal gained faster and were more efficient than steers fed urea or Porcine Solubles. At the end of the trial there were no differences among the nitrogen supplements in feed intake, gain, or feed conversion. There were no significant differences in carcass weight or measures of carcass quality.

Introduction

Condensed Porcine Solubles (Porcine Solubles) is a coproduct resulting from the extraction of heparin from porcine intestines. The coproduct is a liquid rich in soluble peptides and amino acids with significant levels of fat. The objective of this experiment was to evaluate Porcine Solubles as a source of supplemental nitrogen for finishing steers fed high-corn diets.

Materials and Methods

Ninety-six 17- to 18-month-old steers with an average weight of 860 pounds were selected from a group of 113 steers purchased at an Iowa auction. They were crossbred steers being black, red, and white in color that had been grazing during the summer. The steers were purchased in late September and started on experiment in October, 1996. Six steers were allotted to each of 16 pens at random from outcome groups based on initial weight. Four pens were allotted at random to each of four diets shown in Table 1. The diets were prepared as total mixed rations. The cattle were fed twice daily.

All steers were implanted with Revalor S® after they had been on feed two months. The steers were housed in an open-front shed with feed bunks under the roof of the shed. The steers were weighed individually in the morning, before feeding, on two consecutive days at start, as well as when the cattle were sold, and at approximately 28-day intervals throughout. The cattle were started on the diets shown in Table 1. The nutrient composition of the diets is reported in Table 2. When first offered feed, steers given 4% Porcine Solubles refused to consume the feed and those given 2% Porcine Solubles did not readily consume the feed the first day. To get these cattle on feed they were fed the urea diet the following day, then fed a diet containing 1% Porcine Solubles for 5 days, and then changed to 2% Porcine Solubles for 8 days before changing the steers to be fed 4% solubles to 3% Porcine Solubles for two days before making the final change to 4%. Intake of all steers was limited for the first four weeks while they adjusted to the grain. After this period each pen of cattle was offered feed according to appetite. If bunks were clean for two days, the amount of feed offered was increased. If significant quantities of feed remained in the bunk, the amount of feed offered was reduced. The length of the trial was 121 days.

All the steers were sold at the same time at a commercial beef-packing plant. Weights of hot carcasses were taken after slaughter, and measurements on the carcasses were obtained after 24 hours in the cooler. Marbling, yield grade, and percentage of kidney, pelvic, and heart fat (KPH) were called by the federal grader. Ribeyes were traced on acetate paper and then area determined using a beef carcass grid. Ribeye area and fat thickness measurements were made between the 12^{th} and 13^{th} ribs on the left side. Feed removed from the bunks was weighed and sampled for determination of dry matter. Periodic samples of the mixed feeds were taken for determination of dry matter. Dry matter was determined by drying in a convection oven at 85 ^{0}C. Sulfate concentrations in the well water at the research farm were determined using a sulfate test kit (Hach Company, Loveland, Colorado).

Pen means were used as the experimental unit in the statistical analysis. Data were analyzed by analysis of variance. Treatment means and standard error of the means are presented. The experiment was started October 15, 1996, and the cattle were slaughtered February 18, 1997 at the IBP beef plant in Denison Iowa. The period over which gains were measured was 121 days.

Results and Discussion

The results of replacing urea or soybean meal with 2% or 4% of diet dry matter with Porcine Solubles are summarized in Tables 3 and 4. At 56 days, steers fed soybean meal or urea tended to consume more feed than those fed 4% solubles (Table 3). Steers fed soybean meal or urea gained more weight than those fed 4% solubles ($P < .05$). Only steers fed soybean meal were more efficienct ($P < .05$) than those fed 4% solubles. At the end of the 121-day trial, no production or carcass measurements were significantly ($P > 0.05$) affected by the source of supplemental protein. Steers fed 4% Porcine Solubles tended

to consume about one pound less feed and gain slightly less. The steers fed 4% solubles, however, were not less efficient. Dry matter concentrations in the diets were 88.3, 88.2, 86.4, and 84.6% for the urea, soybean meal, 2%, and 4% diets, respectively. The average dry matter concentration of the Porcine Solubles was 46.3 ± 0.8%. Carcass grades were excellent for each of the sources of supplemental nitrogen.

The feed intake and gain by period are shown in Figures 1 and 2. Steers fed soybean meal tended to consume more feed during the first 84 days of the trial and then decline somewhat. Steers fed 4% solubles tended to consume less feed dry matter during the first 84 days and then increase. Even though the steers did not want to consume feed containing Porcine Solubles when first offered, they seemed to have adjusted and consumed feed in a normal manner. Steers fed soybean meal gained weight more rapidly during the first two periods and then the rate tended to decline. Steers fed 4% solubles gained weight more slowly during the first two periods and then increased during the third period before declining.

One steer in each of two pens fed 4% Porcine Solubles became afflicted with what was diagnosed as polioencephalomalacia by veterinarians from the University Veterinary Clinic at 11 and 14 days after the trial started (this occurred while the steers were being brought up to the 4% solubles). The steers were removed from the pens and not returned. One steer was blind when removed from the pen. Both steers were administered thiamin and gradually recovered. The calculated sulfur concentration of this diet was .35% (Table 2), which should not have been a deleterious level. The concentration of sulfates in the water at the research farm were analyzed to be 85 ppm.

Implications

The results of this experiment indicated that Condensed Porcine Solubles could be used to supply a portion of the supplemental protein, potassium, and phosphorus for finishing steers. When mixed in the total diet, Porcine Solubles initially were not readily consumed by cattle. However, after two weeks, steers readily consumed the diets containing Porcine Solubles. The steers perhaps could have been moved to the 4% diet more rapidly than was done in this study. It may be that Porcine Solubles could be placed in the supplement, especially a liquid supplement and not have affected the steers' initial response to the feed. Because Porcine Solubles contain high concentrations of sulfur, it is important not to have significant quantities of sulfur intake from other components in the diet or the water. There were no effects of feeding Porcine Solubles on beef carcasses. Based on the results of this study, it seems that Condensed Porcine Solubles could be used to furnish a portion of the supplemental nitrogen for finishing steers fed high-corn diets.

Acknowledgments

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Table 1. Composition of diets (% diet dry matter).

Ingredient	Diet			
	1.46% Urea	5% SBM	2% CPS	4% CPS
Cracked corn	82.96	79.02	81.65	79.99
Dehydrated alfalfa	12.00	12.00	12.00	12.00
Cane molasses	2.00	2.00	2.00	2.00
Soybean meal		5.00		
Urea	1.46	.72	1.66	.88
Porcine solubles			2.00	4.00
Dicalcium PO_4	.15		.10	.06
Limestone	.77	.82	.80	.82
NaCl	.30	.30	.30	.30
KCl	.19		.16	.18
Elemental sulfur	.046	.023		
Trace minerals	.024	.024	.024	.024
Vitamin A[a]	.08	.08	.08	.08
Rumensin®[b]	.0195	.0195	.0195	.0195

[a]Provided 1,400 IU of vitamin A per pound of dry matter.
[b]Provided 15.6 mg sodium monensin per pound of dry matter.

Figure 1. Feed dry matter intake by period. Average dry matter intakes for each individual period are shown in the graph.

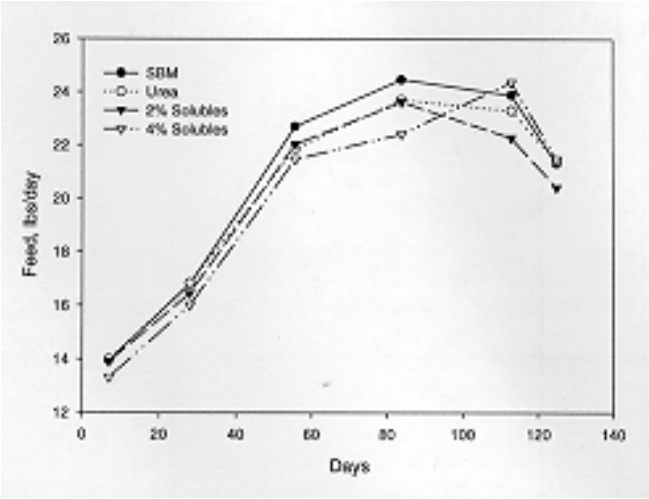

Figure 2. Rate of gain by period. The average daily gains for each individual period are shown in the graph.

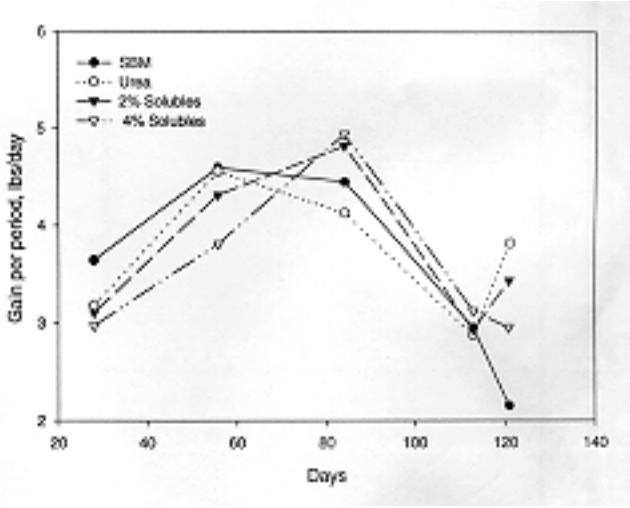

Table 2. Nutrient composition of diets (% diet dry matter)[a].

Nutrient	Diet			
	1.46% Urea	5% SBM	2% CPS	4% CPS
Crude protein	13.0	13.0	13.0	13.0
Ca	.50	.50	.50	.50
P	.35	.35	.35	.35
K	.75	.74	.75	.75
Na	.15	.15	.19	.35
S	.206	.200	.268	.378

[a]Calculated from nutrient tables (1984 Beef NRC).

Table 3. Mean feedlot performance of steers fed Condensed Porcine Solubles during the first 56 days of the trial.

Item	Diets				
	1.46% Urea	5% SBM	2% CPS	4% CPS	SE[a]
No. steers	24	24	24	22	
Daily gain, lbs.	3.87	4.12	3.71	3.39	.09
Feed, lbs. DM	19.0	19.4	18.9	18.4	.11
Feed/gain	4.95	4.72	5.10	5.43	.09

[a]Standard error of the mean.

Table 4. Mean feedlot performance and carcass data from steers fed Condensed Porcine Solubles during the 121-day trial.

Item	Diets				
	1.46% Urea	1.46% Urea	2% CPS	4% CPS	SE[a]
No. steers	24	24	24	22[b]	
Starting weight, lbs.	860.7	860.7	860.4	865.0	1.2
Ending weight, lbs.	1306.6	1318.6	1315.4	1307.4	8.7
Avg no. days	121	121	121	121	
Feedlot					
Daily gain, lbs.	3.69	3.78	3.76	3.66	.07
Feed, lbs. DM	21.3	21.8	21.8	21.0	.25
Feed/gain	5.81	5.76	5.82	5.75	.07
Gain/feed	.173	.174	.172	.174	.002
Carcass					
Carcass wt, lbs.	784.9	792.6	799.6	798.5	6.2
Dressing %	60.1	60.1	60.8	61.0	.28
Ribeye area, in.^{2}	13.8	13.4	13.4	13.6	.13
Fat cover, in.	.22	.29	.31	.29	.018
KHP fat, %	1.9	2.1	2.1	2.1	.06
% Choice	62.5	91.7	87.0	77.3	5.0
No. Choice	15	22	20[c]	17	
No. Select	8	2	3	4	
No. Standard	1			1	
Yield grades					
1	6	2	2	2	
2	17	21	17	20	
3	1	1	4		
Avg. yield grade	1.79	1.96	2.08	1.90	.05

[a]Standard error of the mean.

[b]One steer removed from each of two pens because of diagnosed polioencephalomalacia.

[c]One stag carcass in pen 14 fed 2% Porcine Solubles is not included in this average