Corn Gluten Meal Plus Urea For

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Story in Brief

Steer calves lost more weight than heifer calves during assembly and processing. Substituting corn gluten meal plus urea for soybean meal resulted in lower feed intake and weight gain initially, but during the second 28-day period, performance of the steer calves fed the corn gluten meal plus urea diet was slightly superior to those fed the soybean meal diet. When urea provided 10 percent of the total dietary nitrogen, and corn gluten meal was the supplemental protein source, calves ate less feed but gained as much weight as calves consuming a higher level of urea or no urea.

Introduction

During assembly and transportation of stocker calves from the farm of origin to the next production point, periods of starvation and refeeding are encountered. During these periods, the stressed calf will mobilize body reserves of protein and energy to meet metabolic needs. At the same time, rumen function may cease due to infrequent feeding, stress, and diet changes. Since the ruminant depends upon the microorganisms of the rumen for conversion of various nitrogen sources into protein, protein supply is reduced, forcing the calf to draw upon body reserves further. Diets rich in energy and protein are needed following the stress of assembly and transit both to meet current needs and to replace body reserves quickly and efficiently. When protein needs of the calf are high, and microbial protein production is low, special supplementation may prove helpful. To increase the amount and type of protein reaching the intestinal tract for absorption, protein which bypasses ruminal fermentation can be fed. Some nitrogen available to the ruminal microorganism also must be provided so that rumen function is not depressed. The objective of this experiment was to measure the effect which the composition of the protein supplement in the receiving diet of stressed calves has on feed intake, health and performance.

Materials and Methods

Seventy-two crossbred calves (33 heifers and 39 steers) were weighed, weaned from their dams and subjected to a 24-hr fast without feed and water to simulate the first phase of assembly (movement from the farm of origin and through the auction barn). Next, the calves were moved several miles by trailer to another assembly point and provided hay and water for the next 24 hr. A second period of fasting was then imposed for 24 hr to simulate the transit. Calves were then divided into six pens. One pen of steers and one pen of heifers were fed each of the diets shown in Table 1.

USDA, Agricultural Research Service, Southern Region in Cooperation with the Oklahoma Agricultural Experiment Station.

Table 1. Composition of receiving rations[a]

Ingredients	Diets		
	Control	U-10	U-20
Corn, ground	55.0	61.0	62.6
Cottonseed hulls	25.9	23.4	24.1
Soybean meal	11.1	—	—
Corn gluten meal	—	6.6	4.0
Molasses	5.0	5.0	5.0
Urea	—	.45	.9
Minerals	3.0	3.6	3.4
Nutrient composition[a]			
Crude protein	12.5	12.5	12.5
Net energy-Maint., Mcal	.84	.85	.85
Net energy-Gain, Mcal	.49	.50	.50

[a]Percent of dry matter.
[b]Net energy as Mcal per pound of dry matter.

Diets differed only in the source of the supplemental protein. The control diet (C) contained soybean meal as the supplemental protein source while the other two diets contained corn gluten meal plus urea. Urea provided either 10 percent (U-10) or 20 percent (U-20) of the total dietary nitrogen in these two rations. Corn gluten meal, a by-product of the corn milling industry, has a crude protein content of 60 percent. Much of this protein source supposedly bypasses ruminal digestion and is digested and absorbed postruminally. Urea provides a readily available nitrogen for rumen microorganisms.

All diets provided equal amounts of crude protein and energy, and calves had free access to diets for 56 days. Feed consumption and body weight changes were measured each week. Body weights were taken prior to the morning feeding and after a 16-hr period without water in order to reduce gut fill. Data were analyzed statistically as a randomized block design. The sex of the calf was the block, and the stress diets were the treatments within each block.

Results

The average weight of the calves at weaning was 357 lb with steer calves weighing more than the heifer calves (Table 2). During the first 24-hr fast, the

Table 2. The effect of sex of the calf on weight changes during assembly, fasting and refeeding

	Heifer	Steer	Mean
No. of calves	33	39	
Weaning weight, lb	334.3	376.1	356.9
First fast weight, lb	299.3	335.1	318.7
Weight lost, lb	35.0	41.0	38.2
Weight lost[a], %	10.5	10.9	10.7
Refed weight, lb	320.8	364.1	344.3
Refed weight, %	95.9	96.8	96.4
Second fast weight	302.7	339.2	322.5

[a]Percentage of weaning weight.

steer calves lost 41 lb, and heifer calves lost 35 lb. Expressed as a percentage of the weaning weight, weight losses were 10.5 vs 10.9 percent for steers and heifers. During the subsequent refeeding period, both groups were visibly distressed but regained over 60 percent of their weight loss. Steer calves regained 29 lb and weighed 96.8 percent of their weaning weight while the heifer calves regained 22 lb to weigh 95.9 percent of their weaning weight. During the second fasting period, steer calves again lost more weight than heifer calves. When all losses and gains over the assembly period (fast-refeed-fast) had been totaled, the steer calves had lost 37 lb and weighed 90.2 percent of their weaning weight while heifer calves had lost 32 lb and weighed 90.5 percent of weaning weight. Although steer calves changed weight more rapidly, both groups entered at the feedlot with the same percentage of the original weaning weight.

Few health problems were encountered, and no calves were treated for bovine respiratory disease. No comparison of the effects of diet on health were possible. The steer calves gained more weight than the heifer calves; both groups responded similarly to the three diets (Table 3).

During the first 28 days of the trial, the corn gluten meal and urea rations produced slower rates of gain than the soybean meal ration. The opposite effect was noted during the second 28-day period with greater gain with the U-10. Overall, rates of gain during the 56-day feeding period for calves fed the three different rations were not significantly different.

No difference in feed consumption attributable to diet or sex of the calves was apparent, but slightly less of the U-10 and U-20 diets was consumed, especially during the first 28 days. Lower intake may explain the poor performance noted for both steer and heifer calves during the initial 28-day period. For the 56-day feeding period, intake of the U-10 diet was 10.3 percent less than the soybean diet. Since animal gains were equal, feed efficiency data favored the U-10 diet.

Table 3. The effect of diet on the average daily gain and feed consumption

	Heifers			Steers		
Items	C	U-10	U-20	C	U-10	U-20
Average daily gain[a], lb						
0-28 days	2.15[c]	1.75[cd]	1.72[d]	2.71[c]	2.08[d]	2.31[cd]
29-56 days	2.52[c]	3.04[d]	2.58[cd]	2.66[c]	3.05[d]	2.92[cd]
0-56 days	2.34	2.39	2.15	2.68	2.57	2.62
Feed consumption[b]						
0-28 days	11.76	9.56	10.05	12.64	11.07	12.05
29-56 days	17.33	16.40	16.92	18.68	17.09	18.09
0-56 days	14.54	12.98[c]	13.49[cd]	15.64[c]	14.08[d]	15.06[c]
Feed efficiency						
0-28 days	5.47	5.46	5.84	4.66	5.32	5.22
29-56 days	6.88[c]	5.39[d]	6.56[cd]	7.02[c]	5.60[d]	6.20[cd]
0-56 days	6.21	5.43	6.27	5.84	5.48	5.75
Crude protein intake						
0-28 days	1.61	1.43	1.45	1.69	1.47	1.54
29-56 days	1.87	2.33	1.94	1.96[c]	2.42[d]	2.07[c]
0-56 days	1.74	1.87	1.69	1.83	1.96	1.78

[a]Pounds/head/day.
[b]Pounds of 90% dry matter feed consumed per head per day.
[c,d]Means in the same row within one sex with different superscripts are different ($P<.05$).

Analysis of the weekly feed samples revealed that diets were similar in protein content during the first 4 weeks of the experiment. On week 6 for reasons unknown, the protein content of the U-10 was 16.6 percent (dry matter basis) whereas the other two diets remained at 12.5 percent. Protein intake of calves tended to be lower for diets containing corn gluten meal plus urea during the first 28-day period, but during the second 28-day period, crude protein intake of the U-10 diet increased dramatically due to the increased protein content of the diet. Whether the gain response to U-10 during the second 28-day period was due to protein source or the protein intake is uncertain. Additional research is needed concerning the source and concentration of protein needed for stressed calves.

Corn gluten meal is used primarily in the poultry industry, and the supply and price can fluctuate, depending upon local demand. At the time of this experiment, the costs of protein from corn gluten meal and soybean meal were similar. Cost per ton of ration was slightly less for the corn gluten meal and urea diets than for the soybean meal diet. Cost of gain for the 56-day trial was 8 cents per pound lower for calves receiving the U-10 diet than calves fed the soybean meal diet. Net gain over weaning weight was lower for the U-10 and U-20 rations during the first 28-day period and resulted in a higher cost per pound of gain than for the C ration. During the second 28-day period the calves receiving the corn gluten meal and urea rations ate slightly less feed than the calves receiving the C ration but gained more weight. This resulted in a lower cost of gain especially for those calves receiving the U-10 ration. Results suggest that corn gluten meal plus urea is a useful protein source for stressed calves. Although initial intake and gain may be reduced, later performance should compensate and decrease the cost of gain. Further study of long-term and health effects of rations containing high bypass protein is needed.

Table 4. Weight changes and cost of gain of steer and heifer calves fed three different diets

	Heifers			Steers		
Items	C	U-10	U-20	C	U-10	U-20
Feed cost, $[a]						
0-28 days	26.60	21.02	21.48	28.23	24.33	25.76
29-56 days	38.71	36.06	36.16	41.72	37.58	38.67
0-56 days	64.97	57.08	57.64	69.95	61.91	64.43
Gain over weaning[b]						
0-28 days	27.4	19.1	15.7	36.2	22.8	28.3
29-56 days	70.7	85.1	72.3	74.5	84.6	76.6
0-56 days	98.1	104.2	88.0	110.7	107.4	104.9
Cost per pound of gain over weaning[c] weight						
0-28 days	95.84	110.05	136.82	77.98	106.71	91.02
29-56 days	54.75	42.37	50.00	56.00	44.42	50.48
0-56 days	66.23	54.78	65.50	63.19	57.64	61.42

[a]Cost 1 ton C = $159.53, U-10 = $157.05 and U-20 = $152.67.
[b]Total pounds of gain that period.
[c]Cost as cents per pound of gain over weaning weight.