1987

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BEEF REPORT

UREA, CORN GLUTEN MEAL OR SOYBEAN MEAL AS SUPPLEMENTAL CRUDE PROTEIN SOURCES FOR FEEDLOT STEERS LIMIT-FED HIGH ENERGY GROWING DIETS

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CATTLE 87-5

Summary

Urea, corn gluten meal and soybean meal were compared as supplemental crude protein sources for growing steers fed limited amounts of a high energy diet. Interactions between level of urea and natural protein source were not significant, indicating that source of natural protein did not influence urea utilization. Level of urea and source of natural protein did not affect average daily gain. These data indicate that up to 1% of diet dry matter as urea can be effectively utilized by limit-fed cattle.

(Key Words: Limit Feeding, Urea, Corn Gluten Meal, Soybean Meal.)

Introduction

Calves are traditionally grown on low energy, high roughage diets. Low energy availability in the rumen prevents urea from being effectively utilized.

Limit feeding high concentrate diets alters rumen conditions and function. Greater available energy in the rumen may support greater utilization of urea. In addition, rate of passage of material through the rumen may be slowed. This may result in increased ruminal degradation of dietary protein, reducing the flow of protein from the rumen to the lower digestive system.

Corn gluten meal is a by-product of the corn milling industry. As a protein source, it has been shown to undergo less ruminal degradation than soybean meal. About 65% of the protein in corn gluten meal escapes ruminal degradation compared to 35% of the protein in soybean meal. Cattle fed corn gluten meal as a source of supplemental protein may be capable of effectively utilizing more urea than cattle fed soybean meal because of the reduced rumen degradable nitrogen component. Ultimately, combinations of corn gluten meal and urea may reduce the total supplemental protein required by limit-fed cattle.

The objectives of this research were to determine if urea could be effectively utilized by cattle that were limit-fed high energy diets and to compare corn gluten meal and soybean meal as sources of supplemental natural protein in limit-fed diets.

Materials and Methods

One hundred twenty-eight Angus steers that had been on a 28-day receiving program were limit-fed a high energy diet (table 1) for 91 days. Cattle were all fed the same amount of dry matter. Daily feed allotment was designed to allow 2.25 lb average daily gain.

Protein percentage of the diet was 12.01% (table 2). Average daily dry matter intake by the cattle was 13.53 lb. Total protein intake by the cattle was 1.62 lb. Daily protein required by medium framed steer calves gaining at 2.25 lb per head per day is 1.70 lb per head per day (NRC, 1984). By feeding a level of protein lower than that required, differences in cattle performance should reflect differences in protein utilization.

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TABLE 1. DIET FED TO STEERS

Ingredient	Amount[a]
High moisture corn	52.85
Corn silage	35.00
Supplement	12.15

[a] Percentage, dry matter basis.

TABLE 2. NUTRIENT COMPOSITION OF DIET FED TO STEERS

Item	Amount
Net energy gain[a]	57.50
Crude protein[b]	12.01
Calcium[b]	.67
Phosphorus[b]	.47
Vitamin A[c]	2700

[a] Mcal per cwt dry matter.
[b] Percentage of dry matter.
[c] IU per lb of dry matter.

Cattle were fed combinations of five protein supplements (table 3). Supplements contained various amounts of soybean meal, corn gluten meal and urea. All supplements were formulated to contain equal crude protein, calcium and phosphorus (table 4). Supplements were fed in an arrangement that provided four levels of urea, 0, .33, .67 and 1.00% of dry matter corresponding to 0, 24.49, 48.99 and 73.47% of supplemental crude protein from urea, respectively (table 5). Corn gluten meal provided from 0 to 93.44% of supplemental crude protein and soybean meal provided from 0 to 98.85% of supplemental crude protein. The combinations of corn gluten meal and soybean meal were such that approximately 0, 33, 67 and 100% of the supplemental natural crude protein was from soybean meal and the balance was from corn and corn gluten meal.

TABLE 3. SUPPLEMENTS FED TO STEERS[a]

Ingredient	Supplement 1	2	3	4	5
Corn gluten meal[b]	--	19.09	37.89	56.84	--
Soybean meal	80.18	53.74	26.77	--	--
Ground corn	--	7.08	15.07	22.65	70.06
Urea	--	--	--	--	9.50
Dicalcium phosphate	6.17	6.58	7.00	7.25	7.83
Limestone	7.40	7.41	7.17	7.17	6.73
Trace mineral salt[c]	2.47	2.47	2.47	2.47	2.47
Beet molasses	3.45	3.29	3.29	3.29	3.00
Rumensin 60	.16	.16	.16	.16	.16
Vitamin A-30	.16	.16	.16	.16	.16

[a] Percentage of supplement dry matter.
[b] Corn gluten meal was 60% crude protein on a dry matter basis.
[c] Composition, minimum percentage, NaCl 96.0, Zn .350, Mn .209, Fe .200, Mg .150, Cu .030, I .007, Co .005.

TABLE 4. NUTRIENT COMPOSITION OF SUPPLEMENTS

Item	Amount
Net energy gain[a]	51.00
Crude protein[b]	36.50
Calcium[b]	4.60
Phosphorus[b]	1.70

[a] Mcal per cwt supplement dry matter.
[b] Percentage of supplement dry matter.

Data were analyzed as a completely randomized design with a 4 x 4 factorial arrangement of treatments. Each treatment combination consisted of eight steers. Individual steers were used as the experimental units. All steers were assumed to consume the same amount of feed. Cumulative net energy for gain intake was used as a co-variate in the analysis. This was intended to compensate for potential growth differences due to treatments. If the imposed treatments resulted in different growth rates, the faster gaining cattle would have a higher maintenance requirement and would have been fed less energy for gain than slower gaining cattle.

TABLE 5. TREATMENT ARRANGEMENT[a]

Supplement[c]	Protein source[d]	Level of urea[b] 0	.33	.67	1.00
1	Urea	0	24.49	48.99	73.47
	Corn	0	6.27	12.54	18.81
	CGM	0	0	0	0
	SBM	98.85	65.08	33.49	1.91
2	Urea	0	24.49	48.99	73.47
	Corn	1.94	7.58	13.21	18.85
	CGM	31.38	21.13	10.87	.62
	SBM	66.25	43.62	22.45	1.28
3	Urea	0	24.49	48.99	73.47
	Corn	4.13	9.05	13.97	18.89
	CGM	62.28	41.94	21.58	1.23
	SBM	33.00	21.73	11.18	.64
4	Urea	0	24.49	48.99	73.47
	Corn	6.21	10.45	14.69	18.93
	CGM	93.44	62.91	32.38	1.85
	SBM	0	0	0	0

[a] Percentage of supplemental protein.
[b] Percentage of dry matter.
[c] From table 3.
[d] CGM = Corn gluten meal, SBM = Soybean meal.

Results and Discussion

No interactions between level of urea and natural protein source were evident, indicating that source of natural protein did not influence the utilization of urea. Therefore, only main effects of level of urea and protein supplement are shown (tables 6 and 7).

Level of urea did not influence average daily gain at 28 days or for the entire trial. Average daily gain tended to be higher for cattle fed supplements containing both soybean meal and corn gluten meal (supplements 2 and 3). These differences were not statistically significant, however.

Performance by all cattle was significantly greater than the projected 2.25 lb per head per day. An extremely mild winter may have contributed to this outstanding performance.

Limit-fed cattle appear capable of utilizing urea up to 1% of diet dry matter. Replacing soybean meal with corn gluten meal did not improve performance of steers, indicating no advantage to feeding a high "escape" protein.

TABLE 6. EFFECT OF UREA LEVEL ON PERFORMANCE

Item[b]	Urea[a] 0	.33	.67	1.00	SEM[c]
Initial wt, lb	585	599	580	576	12.89
ADG 28	2.51	2.45	2.61	2.33	.14
ADG	2.75	2.70	2.79	2.72	.09
F/G 28	4.87	4.96	4.72	5.23	.33
F/G	4.91	4.95	4.87	4.93	.20

[a] Percentage of diet dry matter.
[b] ADG = average daily gain, F/G = feed/gain.
[c] Standard error of the mean.

TABLE 7. EFFECT OF NATURAL PROTEIN SOURCE ON PERFORMANCE

Item[b]	Supplement[a] 100	67	33	0	SEM[c]
Initial wt, lb	597	581	573	589	12.89
ADG 28	2.20	2.72	2.60	2.37	.14
ADG	2.58	2.79	2.91	2.68	.09
F/G 28	5.48	4.48	4.61	5.22	.33
F/G	5.20	4.82	4.62	5.00	.20

[a] Percentage of supplemental natural crude protein from soybean meal. Remaining supplemental natural protein provided by corn gluten meal and corn.
[b] ADG = average daily gain, F/G = feed/gain.
[c] Standard error of the mean.