Protein Levels and Rumensin for Feedlot Cattle[1]

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Story in Brief

One-hundred sixty yearling steers were fed whole shelled corn rations for 155 days at Panhandle State University, Goodwell, Oklahoma. Cattle initially averaged 574 pounds, and were fed rations with soybean meal added to provide 9.5, 10.3, 11.2, and 12.3 percent crude protein with or without added rumensin. As protein levels increased, rate of gain during the trial increased by 7 percent, and feed efficiency improved by 5 percent. Gains were increased by higher protein levels only for steers under 850 pounds. Rumensin did not effect rate of gain, but reduced feed intake by 4 percent, and improved feed efficiency by 5 percent. An interaction of rumensin and protein level was apparent, with rumensin depressing feed intake and rate of gain most at the higher protein levels. Feed efficiency advantage with rumensin feeding was greatest with low protein rations. Backfat thickness and yield grade were slightly higher with higher protein levels. Liver abscess incidence was higher with added rumensin. Results suggest that rumensin may spare protein.

Introduction

To compensate for decreased feed intake when rumensin is fed, a higher protein level might be needed. But work in 1975 (Martin, *et al.*) suggested that protein level for steers may not need to be increased with rumensin. Review of the literature (Elanco, 1977) suggests that rumensin may be more beneficial at lower protein levels.

The objective of this work was to determine the optimal protein levels for growing steers fed corn grain-soybean meal rations with and without rumensin added.

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[1]Experiment conducted at Panhandle State University, Goodwell.
[2]Oklahoma State University, Stillwater.
[3]Panhandle State University, Goodwell.

Materials and Methods

One-hundred sixty Hereford, Angus, and exotic crossbred steers were allocated by weight and breed to 20 pens of eight head each. Cattle had grazed wheat pasture, then were maintained for four days on a 40 percent silage ration prior to the beginning of the experiment. Cattle were shrunk overnight and weighed at the start of the trial. Interval weights were obtained while on full feed at 28 to 30-day intervals. Final weight was calculated from hot carcass weight assuming a constant dressing percentage of 62 percent.

Routine feedlot vaccinations, and 30 mg. DES implants were administered four days before the starting date. All steers were implanted with Synovex S on day 84 of the experiment. Rations used are listed in Table 1. All rations provided 0.45 percent calcium, 0.3 percent phosphorous, and 0.60 percent potassium. No antibiotic was fed.

Rumen fluid samples were collected for volatile fatty acid and ammonia analysis on days 56 and 114 of the experiment. At slaughter, livers were scored and carcass parameters measured. Statistics were calculated on pen means except for the comparison of rate of gain to steer weight, which was calculated from interval gains with steers grouped into 100 pound increments of average body weight with a 5 percent pencil shrink.

Results and Discussions

Protein Effects

Daily gains were depressed at the lower protein level, especially early in the experiment (Table 2). Gain response to the highest protein level was apparent early in the trial. Up to 750 pounds, (Figure 1) higher protein levels produced more rapid gains. Above this weight, steers in the lower protein groups made some "compensatory" weight gains. But this compensation was

Table 1. Ration composition (dry matter basis)

	Rations			
Ingredient	**9.5**	**10.3**	**11.2**	**12.3**
Corn, whole shelled, %	92.3	89.8	87.3	84.0
Cottonseed hulls, %	5.0	5.0	5.0	5.0
Alfalfa, dehy grnd, %	1.0	1.0	1.0	1.0
Soybean meal, %	---	2.61	5.15	8.58
Poly phos, %	0.04	---	---	---
Calcium carbonate, %	1.05	1.05	1.03	1.00
Potassium chloride, %	0.33	0.24	0.15	0.03
Salt, %	0.30	0.30	0.30	0.30
Trace mineral, ppm	125	125	125	125
Vitamin A, 10,000 Iu/g, ppm	150	150	150	150
Crude Protein (determined)	9.46	10.33	11.23	12.34
Monensin (assay) ppm	0/31	0/31	1/52	3/34

Table 2. Performance and carcass characteristics across protein levels

Item	Ration protein 9.5	10.3	11.2	12.3
Daily gain, lb.				
0-30 days	3.38	3.56	4.42	4.62
0-155 days	3.16[a]	3.29[b]	3.27[b]	3.38[b]
Daily feed, lb.				
0-155 days	17. [ab]	18.1[a]	17.5[b]	17.9[ab]
Feed/gain				
0-155 days	5.61[a]	5.52[ab]	5.34[b]	5.30[b]
Carcass weight, lb.	661	671	661	684
Liver score[1]	0.25	0.47	0.50	0.50
Kidney, heart, pelvic fat, %	2.9	2.9	3.0	2.9
Marbling score[2]	15.8	16.8	17.0	16.9
Backfat, inches	0.61	0.62	0.66	0.63
Ribeye area	12.1	12.4	12.3	12.0
Yield grade[3]	3.3[a]	3.3[a]	3.4[ab]	3.6[b]
Rumen ammonia, mg/dl	4.8	7.3	7.9	12.7
Rumen acetate, molar %	51.0	48.0	47.4	49.8
Rumen propionate, molar %	42.0	45.3	47.2	44.2
Total, m moles/ml.	82.3	80.7	82.2	84.2

[1]0 = none, 1 = one small abscess, 2 = two or three small abscesses and 3 = many small or one or more large abscess.
[2]15 = small+, 16 = modest-, 17 = modest, 18 = modest+, etc.
[a,b]Means with different superscripts differ statistically (P<.10).

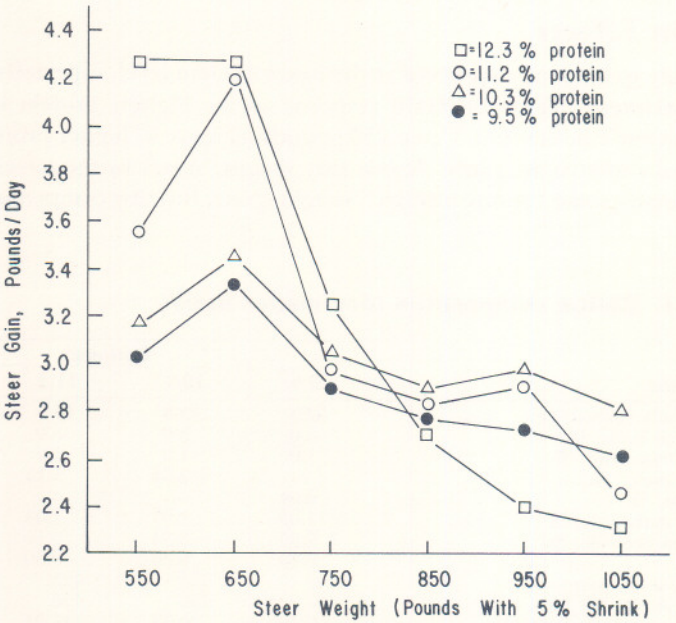

Figure 1. Steer gains at different weights.

limited with the lowest protein ration. Results suggest that steer weight and background may influence response to protein. Young calves will readily respond to protein levels up to 12 percent in whole shelled corn rations. Above 850 pounds, background matters. If steers are to make compensatory gain, moderate protein levels (10.3 in this trial) are needed. If steers are well fed below 700 pounds, no supplemental protein with corn gain (9.5 percent protein) may be needed.

Steers fed higher protein levels tended to have greater marbling, thicker backfat, and higher yield grades. Rumen ammonia concentrations increased with protein level as did propionate to acetate ratio. This suggests that higher protein levels may alter ruminal acid ratios in a manner similar to added rumensin.

Rumensin Effects

Gains (Table 3) were not altered by rumensin addition, but feed intake was decreased by about 0.7 pounds per day which improved feed efficiency by 5 percent. Incidence of liver abscesses was more than doubled by rumensin feeding, and yield grade was depressed slightly. Rumen ammonia was slightly lower with added rumensin, possibly reflecting decreased protein loss in the rumen. Decreased acetate, increased propionate, and slightly lower total acid levels were noted with added rumensin, as is commonly observed.

Rumensin by Protein Interaction

At lower protein levels, rumensin had little affect on feed intake, but improved rate of gain and feed efficiency. At higher protein levels, feed intake and gains were both reduced with added rumensin (Figure 2). So overall feed efficiency improvement due to rumensin decreased as protein levels increased. Improvements in feed efficiency with rumensin were four, ten, five and -two percent at protein levels of 9.5, 10.3, 11.2, and 12.3 percent. Metabolizable

Table 3. Rumensin influence on steer performance

Item	Control	Rumensin
Daily gain, lb.		
0-30 days	3.97	4.02
0-155 days	3.26	3.29
Daily feed, lb.	18.2[a]	17.5[b]
Feed/gain	5.58[a]	5.31[b]
Carcass weight	673	670
Liver score	0.21[a]	0.59[b]
Yield grade	3.55[a]	3.42[b]
Rumen ammonia, mg./dl	9.4	7.9
Rumen acetate, molar %	50.2	48.8
Rumen propionate, molar%	42.8	45.1
Total, mmoles/ml.	84.2	80.4

[a,b]Means with different superscripts differ statistically (P<.05).

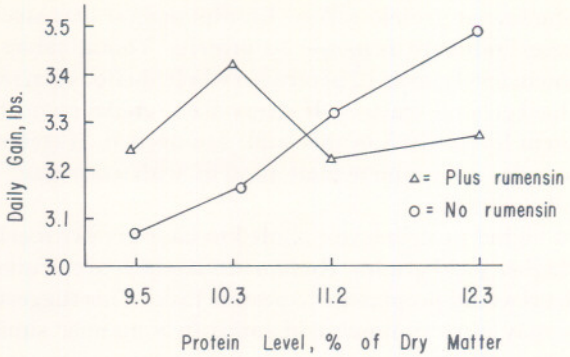

Figure 2. Steer gains with different protein levels with or without rumensin.

energy, calculated from the California Net Energy equation for the four protein and two rumensin levels, are shown in Figure 3. Energy availability was improved as protein level increased without rumensin feeding, but energy availability remained unaffected by protein level when rumensin was added.

Rates of gain were increased most by rumensin when intestinal protein was marginally deficient, during the compensatory gain phase (900-1000 pounds) with the 9.5 percent protein cattle, and the earlier growth period (from 600 to 900 pounds) for the 10.3 percent protein cattle. At the 12.3 percent level, added rumensin reduced rate of gain for steers from 700 to 1100 pounds. Highly elevated protein levels have been shown to depress intakes and gains of steers. Overall, rumensin may spare protein and appears most effective at marginal protein levels.

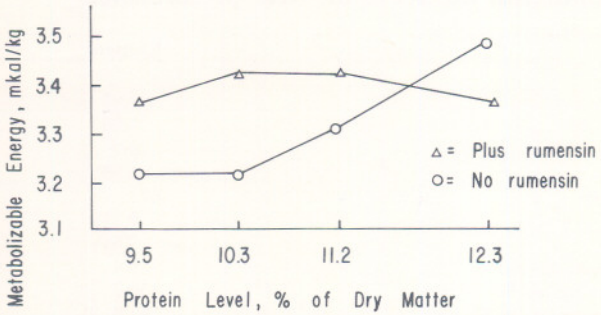

Figure 3. Energy value of ration fed at 4 protein levels with or without rumensin.

References:

1. Martin, Jerry, *et al.* 1976. Okla. Ag. Exp. Sta. Res. Rept-96, p. 87.
2. Elanco, 1977. Rumensin-Protein Seminar, Jan 12, 1977, Indianapolis, Ind.

Protein Sources and Rumensin for Feedlot Steers[1]

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Story in Brief

Thirty-two steers initially weighing 564 pounds were fed whole shelled corn rations containing 11.3 percent protein with all supplemental protein from either soybean meal or urea, and with or without rumensin added. After 155 days, steers were slaughtered and carcasses were evaluated. Daily gains and feed intakes were both five percent higher for urea-fed steers, so feed efficiencies did not differ. Rumensin reduced gain by about two percent and intake by five percent, improving feed efficiency by five percent. Carcasses from steers fed urea were slightly heavier, and yield grades were slightly higher than from steers fed soybean meal.

Introduction

Least cost formulation of feedlot rations often includes urea when soybean meal prices are expensive relative to cereal grains, but urea levels above 0.75 percent of the ration are commonly avoided, especially with high moisture feeds. Animal performance from rations having more urea is often substandard. The advent of rumensin as a feed additive improving feed efficiency and possibly sparing protein suggests that rumensin may prove more beneficial with urea based rations.

The objective of this experiment was to examine the influence and interactions of protein sources (urea vs. soybean meal), and rumensin on steer growth and performance with an 11.3 percent protein shelled-corn ration.

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