

# Protein Sources with Steam Flaked Corn Diets for Finishing Steers

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## Story in Brief

Soybean meal, urea, casein and no additional protein supplements were fed with steam flaked corn to 48 finishing steers (701 lb) for 139 days. Gain and feed efficiency increased with added protein. Gains, ruminal ammonia and blood urea levels were low for steers not receiving supplemental protein. Protein was added to their ration on day 89. Refeeding protein to the deficient group for 49 days restored efficiency but not rate of gain equal to that of other steers. Gains and feed efficiency favored urea over the soybean meal supplement by 11 and 3 percent, primarily due to greater feed intake of the urea supplemented diet. Steers fed casein consumed less feed and had gains similar to steers fed soybean meal. Efficiency of feed use was best for steers fed casein, with apparent metabolizable energy being about 7 percent superior to other diets.

## Introduction

Protein needs for cattle over 700 pounds have been widely debated. Some researchers have recommended protein withdrawal while others have suggested that soybean meal is more useful than urea due to the amino acids it provides for ruminal digestion and the potential protein bypass. Two lines of evidence suggest that ammonia concentrations in the rumen of steers fed high levels of high concentrate rations may be deficient for bacteria to thrive. First, ruminal ammonia concentrations are sometimes low. Secondly, in a trial by Zinn with intestinally cannulated steers, efficiency of microbial protein synthesis in the rumen decreased when feed intake was increased from 1.8 to 2.1 percent of body weight, which might be due to inadequate amounts of ammonia in the rumen.

If ruminal ammonia is inadequate, deficits of postruminal protein could be alleviated by feeding either 1) more protein to bypass the rumen or 2) more urea to increase the production of microbial protein in the rumen which is flushed to the small intestine. When steers get heavier, and postruminal protein needs decline, it is unclear whether an ammonia deficiency reduces steer performance if postruminal protein needs are met. The objective of this trial was to determine the relative value of supplementing a steam flaked ration with soybean meal, urea or casein. Only about 30 percent of soybean protein may be degraded to amino acids and subsequently to ammonia in the rumen when fed with a high concentrate ration at high feed intake levels. Urea should be entirely degraded to ammonia within the rumen. Casein also should be extensively degraded to ammonia in the rumen but will provide amino acids for microbial use, which has been suggested by California workers to be beneficial. The zero supplementation treatment was included to check that the ration without supplementation was deficient for growth of these steers.

## Materials and Methods

Forty-eight steers (701 lb) were allotted to eight pens at Panhandle State University, Goodwell, OK, and fed steam flaked corn rations without added protein or with added soybean meal, urea or casein (Table 1). The trial lasted 139 days, but after 89 days on feed, steers in the two pens fed no supplemental protein were switched to rations containing a protein supplement. One pen of steers received supplemental soybean meal while the other pen received a soybean meal-urea supplement for the remaining 49 days of the trial.

**Table 1. Ration composition (% of dry matter)<sup>a</sup>**

Ingredient	Supplemental protein		
	Soybean meal	Urea	None <sup>b</sup>
Corn, steam flaked	82.1	87.3	87.6
Corn silage	6.4	6.4	6.4
Alfalfa, chopped	3.6	3.6	3.6
Soybean meal	5.84	0	0
Limestone	.86	.82	.82
Urea	0	.87	0
Ammonium sulfate	.15	.15	.15
KCl	.23	.43	.43
Salt	.38	.38	.38

<sup>a</sup>Crude protein of negative control was 9.4% and of other rations, 11.8% of dry matter. All rations contained .7% K, .5% Ca and .34% P plus rumensin (30 g/ton), Tylan (90 mg/head daily) and vitamin A (30,000 IU/head daily).

<sup>b</sup>Casein-supplemented steers received a mixture of 50% "urea" supplement and 50% of the "none," plus 100 g of casein per steer twice daily.

## Results and Discussion

Results are presented in Table 2. Performance and efficiency of feed use were very poor for steers fed no supplemental protein for 89 days. Ruminal ammonia and blood urea levels were much lower for these steers but not below the level indicated by some workers as required (5 mg/dl). Performance and efficiency indicate that protein was deficient for these steers. When protein was fed to these deficient steers, they responded well in gain and efficiency even though they weighed 864 pounds at that time. Feed intakes did not recover completely, but feed efficiency for the total trial was surprisingly good despite the long period of protein depletion and reduced gain. Results indicate that efficiency of gain of nutritionally deprived cattle can be very good.

Responses in gain and efficiency were greater with urea than with soybean meal supplementation. This same effect was apparent when the protein depleted steers were returned to soybean meal or urea plus soybean meal supplements. Greater gain response with urea than with soybean meal supplementation might be expected if the level of ruminal ammonia normally is low with soybean meal. Steam flaking of the grain may emphasize this effect since heat treatment usually reduces ruminal breakdown of protein to ammonia. This would make urea more useful with flaked corn diets than with high moisture corn diets as discussed in a 1980 review (Martin et al., 1980). However, ruminal ammonia on day 89 was almost equal for these two treatments. Possibly, buffering of rumen contents from

**Table 2. Steer performance**

	Supplement				Recovery Period <sup>d</sup>	
	SBM	Urea	Casein	None <sup>d</sup>	SBM	SBM + Urea
Pens	2	2	2	2	1	1
Steers	12	12	12	12	6	6
Daily gain, lb						
0-89 day	2.56 <sup>ab</sup>	2.65 <sup>a</sup>	2.40 <sup>b</sup>	1.84 <sup>c</sup>	—	—
90-139 day	2.83 <sup>ab</sup>	3.46 <sup>a</sup>	3.17 <sup>ab</sup>	3.25 <sup>ab</sup>	2.84	3.66
0-139 day	2.66 <sup>b</sup>	2.94 <sup>a</sup>	2.68 <sup>b</sup>	2.35 <sup>c</sup>	—	—
Daily feed, lb						
0-89 day	15.7 <sup>ab</sup>	16.1 <sup>ab</sup>	14.1 <sup>bc</sup>	13.6 <sup>c</sup>	—	—
90-139 day	15.1 <sup>bc</sup>	17.6 <sup>a</sup>	14.0 <sup>c</sup>	13.9 <sup>c</sup>	13.2	14.6
0-139 day	15.5 <sup>bc</sup>	16.7 <sup>ab</sup>	14.2 <sup>cd</sup>	13.8 <sup>d</sup>	—	—
Feed/gain						
0-89 day	6.15 <sup>b</sup>	6.06 <sup>b</sup>	5.92 <sup>b</sup>	7.39 <sup>a</sup>	—	—
90-139 day	5.32 <sup>b</sup>	5.16 <sup>b</sup>	4.40 <sup>b</sup>	4.32 <sup>b</sup>	4.7	4.0
0-139 day	5.84 <sup>ab</sup>	5.69 <sup>ab</sup>	5.29 <sup>b</sup>	5.87 <sup>ab</sup>	—	—
Metabolizable energy, mcal/kg	3.46 <sup>b</sup>	3.49 <sup>b</sup>	3.71 <sup>a</sup>	3.49 <sup>b</sup>	—	—
Ruminal ammonia <sup>e</sup> N, mg/dl	24.6	22.9	27.5	10.0	—	—
Blood urea <sup>e</sup> N, mg/dl	15.8	16.8	20.9	10.3	—	—

<sup>abc</sup>Means with different superscripts differ ( $P < .05$ ).

<sup>d</sup>Protein readded on day 89, and recovery period is subdivided by type of protein fed during recovery.

<sup>e</sup>Measurements obtained on day 89 of the trial.

urea or saliva may have been greater with the urea diet which speeded fiber digestion and clearance from the rumen. Alternatively, production of end products in the rumen which are signals of food intake control may have differed with the two supplements.

Feed intake and gains were lower with casein than urea as a source of dietary nitrogen. This suggests that amino acid release in the rumen, one of the proposed benefits of soybean meal as a protein supplement, is probably not useful to increase gain of growing steers. Feed efficiency, however, in steers receiving supplemental casein was considerably superior (7 percent) to efficiency of steers fed other diets. Factors responsible are under study. With casein priced at \$2 per pound, this efficiency advantage will not be pursued with feedlot steers.

### Literature Cited

Martin, J. J. et al. 1980. Okla. Agr. Exp. Sta. Res. Rep. MP-107:114.