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**EFFECT OF LEVEL OF NON-ENZYMATICALLY  
BROWNEED SOYBEAN MEAL IN LIMIT-FED, GRAIN  
SORGHUM DIETS FOR GROWING HEIFERS**

*R. D. Hunter, J. S. Drouillard, and E. C. Titgemeyer*

**Summary**

Grain sorghum-based diets were fed in a limit-feeding trial involving 72 heifers for 100 days. Heifers were fed one of four diets designed to provide 12.5%, 14.9%, 17.3%, and 19.6% crude protein. Protein levels in the diets were altered by providing up to 20% of the diet as non-enzymatically browned soybean meal (Soypass<sup>®</sup>) at the expense of dry-rolled grain sorghum. Performance of heifers (gain and feed efficiency) tended ( $P=.15$ ) to improve linearly as protein concentration of the diets was increased. The greatest improvements were observed at concentrations up to 17.3%.

(Key Words: Bypass Protein, Limit Feeding.)

**Introduction**

Restricted feeding is gaining popularity among cattle feeders; traditional roughage-based growing diets fed ad libitum are replaced by high grain diets fed at restricted intake. Restricting intake of high concentrate rations has several advantages. Concentrates are usually less expensive sources of energy than roughages, and digestibility of grains is high in comparison to roughages, thereby reducing manure production.

Given the lower levels of intake with limit-fed diets, concentrations of protein, vitamins, and minerals in the diet must all be increased in order to satisfy daily nutrient requirements. Utilization of protein may be less than optimal if fed in excess of

requirements or when provided by sources that are highly fermentable. This occurs because rumen microbes may not be able to utilize the nitrogen as rapidly as it becomes available. Degradable protein that the bacteria cannot utilize for formation of microbial protein is lost as ammonia. This represents an important economic loss for cattle producers and may contribute to contamination of watersheds. Recent work at Kansas State University with limit-fed corn diets indicated a linear increase in average daily gain as protein level increased from 14 to 20% of the diet. This experiment was designed to measure performance of cattle fed grain sorghum-based diets containing from 12.5 to 19.6% crude protein.

**Experimental Procedures**

Seventy-two crossbred heifers of southern origin weighing approximately 660 lb were used in a randomized block design experiment. The heifers were stratified into three weight blocks and assigned to 12 pens of six head each. Diets were formulated to provide energy for weight gains of approximately 2 lb/day. The heifers were weighed every 14 days. The feed offerings were adjusted at that time to 2.2% (dry matter basis) of body weight. The limit-fed grain sorghum diets contained 12.5, 14.9, 17.3, or 19.6% crude protein. The protein levels were achieved by adding increasing amounts of Soypass, which is a non-enzymatically browned soybean meal containing a high proportion of bypass protein (Table 1). Cattle were fed once daily for a total of 100 days.

## Results and Discussion

Increasing the level of Soypass in limit-fed grain sorghum diets did not affect weight gain or feed efficiency significantly. However, there were linear trends for feed intake ( $P=.15$ ) and daily gain ( $P=.15$ ) to increase and for gain efficiency ( $P=.15$ ) to improve with addition of Soypass to the diet (Table 2). The greatest improvements were observed up to a dietary crude protein concentration of 17.3%.

In this experiment, protein level was confounded with the substitution of Soypass for grain sorghum. In using this approach to assess protein requirements, we made the assumption that grain sorghum and Soypass are energetically equal. If Soypass contains more energy than the grain sorghum, the responses could have been due to changes of dietary energy rather than of dietary protein.

**Table 1. Experimental Diets (% of Dry Matter)**

Ingredient	Protein Level			
	12.5%	14.9%	17.3%	19.6%
Dry-rolled grain sorghum	79.3	72.7	66.2	59.6
Chopped alfalfa hay	12.0	12.0	12.0	12.0
Soypass <sup>1</sup>		6.7	13.3	20.0
Cane molasses	4.0	4.0	4.0	4.0
Soybean meal	1.4	1.4	1.4	1.4
Urea	0.9	0.9	0.9	0.9
Limestone	1.0	1.0	1.0	1.0
Calcium phosphate	0.6	0.5	0.4	0.3
Salt	0.3	0.3	0.3	0.3
Ammonium sulfate	0.2	0.2	0.2	0.2
Magnesium oxide	0.1	0.1	0.1	0.1
Potassium chloride	0.1	0.1	0.1	0.1
Vitamins/minerals <sup>2</sup>	0.1	0.1	0.1	0.1

<sup>1</sup>Soypass<sup>®</sup> is a registered trade name for non-enzymatically browned soybean meal (Lignotech USA).

<sup>2</sup>Formulated to add to the diets (dry basis): 1220 IU/lb vitamin A, 600 IU/lb vitamin D, 0.05 ppm Co, 10 ppm Cu, 0.6 ppm I, 0.8 ppm Fe, 60 ppm Mn, 0.25 ppm Se, 60 ppm Zn, 30 g/ton monensin, and 10 g/ton tylosin.

**Table 2. Effect of Protein Level on Performance of Heifers Fed Diets Based on Dry-Rolled Grain Sorghum**

Item	Protein Level				SEM
	12.5%	14.9%	17.3%	19.6%	
Daily gain, lb <sup>a</sup>	1.59	1.68	1.87	1.89	0.15
Dry matter intake, lb/day <sup>a</sup>	15.2	15.4	15.4	15.4	0.11
Feed/gain <sup>a</sup>	9.52	9.09	8.33	8.13	0.70

<sup>a</sup>Linear trend ( $P=.15$ ).