Evaluation of a nonprotein nitrogen byproduct as an ingredient in diets for growing beef cattle.

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Introduction

Proteferm is a byproduct of the fermentative production of glutamic acid (monosodium glutamate). It contains about 40% crude protein (as is) and the crude protein consists of 20% protein/peptide, 20% free amino acids (mainly glutamic acid) and 60% non-protein nitrogen, mainly in the form of ammonium chloride. Proteferm is also a rich source of some other minerals, particularly sodium and potassium. There are several reasons that Proteferm may have value as a feed ingredient in diets of beef cattle: 1)Beef cattle can utilize significant levels of NPN as a source of dietary protein; 2) Residual monosodium glutamate in Proteferm may serve to enhance flavor of the diet and stimulate increased feed intake; and 3) Addition of higher moisture feeds often facilitates diet mixing and promotes improved feed intakes. Given these possibilities, a feeding trial was conducted with growing heifer calves to evaluate the potential of Proteferm as a feed ingredient. The objectives of this study were: 1) to evaluate the effect of Proteferm as on palatability (feed intake) and performance of growing beef cattle, and 2) to compare Proteferm as a source of NPN and energy to isonitrogenous mixtures of molasses and urea in beef cattle diets.

Materials and Methods

Ninety Angus –cross growing heifers with an average initial body weight of 244 kg were used. Heifers were vaccinated for IBR, PI3, blacklag, malignant edema an Hemophilus. They were dewormed and treated for grubs and lice. Heifers were weighed and allotted to 15 pens (6 heifers/pen). Three pens were then randomly allotted to each of five experimental diets.

Diets (Table 1) were based on corn silage and medium-quality grass hay and were formulated to contain 2.40 and to 2.50 Mcal ME/kg of dry matter (DM). The remainder of the diets consisted of ground corn and supplemental sources of protein, minerals and vitamins. Soybean meal provided supplemental protein (preformed amino acids) to the control diet. In the Proteferm diets (i.e., 3% Prot and 5% Prot), Proteferm was added at 3 and 5% of dietary DM respectively. The 3 and 5% Proteferm levels provided, respectively, 22 and 33% of total dietary CP and NPN and were selected because they fall within the recommended levels of NPN supplementation of beef cattle diets (NRC 1984). The 5% Proteferm level was included to evaluate any additional effects of a higher level of Proteferm on feed intake. No additional response to NPN itself was anticipated. The molasses-urea mixture diets (i.e., 3% Mol-U and 5% Mol-U) contained 3 and 5%, respectively, of a molasses-urea mixture formulated to be isonitrogenous to Proteferm. Three diets, (i.e., control, 3% Prot, and 3% Mol-U) were formulated for 11.5% CP on a DM basis. This is slightly less than the requirements (NRC 1984) for these cattle and allowed for more sensitive evaluation of differences in performance due to source of dietary CP. The remaining diets (i.e., 5% Prot and 5% Mol-U) provided 12.8% CP on a DM basis.

Heifers were weighed at the beginning of the trial and interim weights were taken every 28 days. At the end of an 84-day feeding trial, heifers were weighed on two consecutive days to help reduce variation created by variation in

gut fill. Feed intake was monitored daily and adjusted to maintain *ad libitum* intakes while minimizing feed refusals. After the completion of the trial average daily gain (ADG), daily DM intake, and gain/feed ratio were calculated for each pen. Performance data were analyzed by analysis of variance (SAS, 1985) for a completely randomized design with pen as the experimental unit. Planned treatment comparisons included the following orthogonal contrasts: 1)control vs. 3% Prot, 3% Mol-U, % Prot, and 5% Mol-U (e.g., control vs. NPN supplementation), 2) control vs. 3% Prot and 3% Mol-U (e.g., control bs. NPN at same dietary CP level), 3) 3% Prot and 3% Mol-U vs. 5% Prot and 5% Mol-U (e.g., 3% level vs. 5% level) and 4) 3% Prot and 5% Prot vs. 3% Mol-U and 5% Mol-U (e.g., Proteferm vs. molasses-urea).

Results and Discussion

Neither interim (data not shown) nor cumulative (Table 2) performance of heifers was affected ($P > 0.10$) by CP level or source in the diet. Therefore, planned treatment comparisons were not made. For the entire 84 day trial (Table 2), there were no differences ($P > 0.10$) between diets in any of the performance parameters evaluated (i.e. ADG, daily DM intake and gain/feed ratio). Mean values for all treatments were almost identical. Average balues across diets for ADG (kg), daily DM intake (kg) and gain/feed ratio were 0.91, 6.69 and 0.136, respectively. Rates of gain were very near to those that would be predicted for this type of animal fed a diet with an energy content similar to that estimated for the control diet.

Results indicate that Proteferm, when fed at these levels, did not have any stimulatory effect on feed intake nor did it provide any other apparent advantages in comparison to an isonitrogenous mixture of molasses and urea. It may be that higher levels of Proteferm are necessary to provide a stimulatory effect on feed intake. One reason that it probably has limited potential for enhancing performance is its negligible value as an energy source. The gross energy value of Proteferm was 2.55 kcal/g DM (by bomb calorimetry) and most of this probably accounted for by the heat of combustion of the ammonia in the Proteferm. It is concluded from our results that, for growing cattle, Proteferm can be fed at 3 to 5% of the dietary DM without any negative effects on feed intake or Performance.

References

NRC 1984. Nutrient Requirements of Beef Cattle (6th Rev. Ed.). National Acamey Press, Washington, DC.

SAS. 1985. SAS User's Guide: Statistics. SAS Inst. Inc., Cary, NC.

Table 1. Composition of diets fed to growing heifers.

	Diet[a]				
Ingredient	Control	3% Prot	3% Mol-U	5% Prot	5% Mol-U
	-----% of DM ----				
Corn silage	56.0	59.1	59.1	57.9	57.9
Grass hay	34.0	30.9	30.9	30.1	30.1
Ground corn	3.78	4.92	4.92	4.92	4.92
Soybean meal	4.14	--	--	--	--
Rumensin mix[b]	2.08	2.08	2.08	2.08	2.08
Proteferm	--	3.0	--	5.0	--
Molasses	--	--	2.28	--	3.8
Urea	--	--	0.72	--	1.2
Nutrient Profile[c]					
ME, Mcal/kg	2.53	2.44	2.50	2.39	2.50
CP, %	11.5	11.5	11.5	12.8	12.8
Ca, %	0.85	0.83	0.85	0.83	0.86
P, %	0.39	0.36	0.36	0.36	0.35
K, %	1.82	1.74	1.75	1.75	1.76

[a]Prot = Proteferm, Mol-U = a mixture of molasses and urea that is isonitrogenous to Proteferm; Proteferm or the molasses-urea were added at 3 or 5% of dietary dry matter (DM).
[b]Provided 25mg monensin/ton of DM and also provided supplemental calcium, phosphorous and vitamins A, D and E.
[c]On a DM basis.

Table 2. Feedlot performance of growing heifers as affected by dietary protein source and level.

	Diet[ab]					
Item	Control	3% Prot	3% Mol-U	5% Prot	5% Mol-U	SEM[c]
No. of heifers	18	18	18	18	18	
Initial wt. kg	241	247	242	243	247	1.6
ADG[d], kg	0.91	0.92	0.93	0.92	0.89	0.038
DM intake, kg	6.61	6.68	6.66	6.65	6.91	0.219
Gain/feed	.138	.138	.140	.138	.128	.006

[a]Prot = Proteferm, Mol-U = a mixture of molasses and urea that is isonitrogenous to Proteferm; Proteferm or the molasses-urea were added at 3 or 5% of dietary dry matter (DM).
[b]Treatment effects were similar (P > 0.10) for all measurements evaluated.
[c]Standard error of the mean.
[d]ADG = average daily gain.