EFFECT OF UREA ON VOLUNTARY INTAKE AND METABOLIC PARAMETERS IN BULLS FED SUGAR CANE AND MOLASSES

H. Losada, E Aranda, J Ruiz[1] and R Alderete

Colegio Superior de Agricultura Tropical, Apdo Postal 24, Cardenas, Tabasco, Mexico

Molasses containing 0, 7,-14, or 21% Urea was fed free choice as a supplement to chopped mature whole sugar cane, which also was freely available. The design was a 4 x 4 Latin Square with 4 Zebu x Swiss bulls of about 280 kg live weight. Each animal received I kg/d of rice polishings. Each experimental period lasted 14 days for adaptation and a further 14 days for the collection of tata. Intake of sugar cane ant of total DM, ammonia in rumen fluid and in blood increased as the amount of urea in the molasses was increased. Consumption of the molasses mixtures was inversely relates to urea concentarions.

Key words: Cattle, molasses, sugar cane, urea, voluntary intake, ammonia

In the system of cattle feeding based on the utilization of sugar cane as am energy source (Preston et al 1976) urea is an important supplement. Trials have been carried out to decide the appropriate level of urea (Alvarez and Preston 1976; Ferreiro et al 1977) and the method of incorporating it in the diet (Alvarez et al 1976).

Giving a concentrated solution of urea in molasses and feeding this mixture on a free choice basis (Silvestre et al 1977;Ferreiro & Preston 1976), has advantages from a management standpoint. The following trials were carried out to furnish more information in this area.

Materials and Methods

Experiment 1: Four Zebu Swiss bulls with an average liveweight of 280 kg were fed a basal diet of sugar cane and molasses. The treatments in a 4 x 4 Latin Square design were concentrations of urea in the molasses of 0, 7, 14, and 21%. The animals were housed in concrete floored individual pens in an open-sided building. The mature (12-14 months)whole sugar cane of the variety 94362 was chopped and given free choice in two feeds at 8:00 and 12:00 hr, Rice polishings was fed at 1 kg/d. Water and minerals(48% salt, 48% bone meal trace minerals)were freely available. The mixtures of molasses/urea were prepared by diluting the urea in equivalent amounts of water and completing the mixtures with final molasses. They were fed on a free choice basis.

The experimental periods were 28 d; 14 for adaptation and an equal time for the collection of data.

Experiment 2: Four Swiss x Zebu bulls with a liveweight of 240 kg were used. The diets and the treatments were similar to those described in the first experiment. The adaptation period was for 45 days followed by a period of 15 d for the collection of data. At the end of each collection period samples were taken of rumen fluid and jugular blood 2 hr after giving the sugar cane and rice polishings. The blood samples

---

[1]Present address: Escuela de Agricultura, Universidad de Guadalajara, Mexico

were taken first, using heparin as anticoagulant while rumen fluid was obtained with a stomach tube. It was filtered in muslin and the pH taken immediately using a glass electrode. Total VFA were determined by distillation according to the method of Pennington (1952). Ammonia in rumen fluid and in blood was determined by the method of Seligson and Hirahara (1957). The laboratory analyses were carried out in duplicate and the values obtained were analysed by regression.

Results and Discussion

Mean values for intakes of the dietary components are shown in table 1, There was an obvious response in voluntary intake of sugar cane and of total diet DM as urea concentration in molasses was raised. m e intakes of the molasses mixtures showed the reverse trend, The relationships between the concentration of urea in molasses and the different measurements of voluntary intake (figure 1) appeared to be linear.

Table1:
Mean values for feed intake of bulls given chopped sugar cane and molasses with different urea concentrations

	Urea concentration, g/kg				
	0	7	14	21	SEx (Prob)[1]
Live weight, kg	280	281	278	278	
Intake of DM, kg/d					
Sugar cane	3.32	4.55	5.67	6.15	±0.80 (.001)
Molasses/urea	1.40	1.75	.967	.967	±0.81 (.001)
Rice polishings	.918	.918	.918	.918	
Urea		.123	.136	.231	
Total	5.64	7.09	7.55	8.03	±.83 (.001)
Cane, % of total	58	62	75	78	±6.2 (.001)
Molasses/urea, % of total	24	24	13	10	±5.2 (.001)

[1]SE of mean and probability of F test in analysis of variance

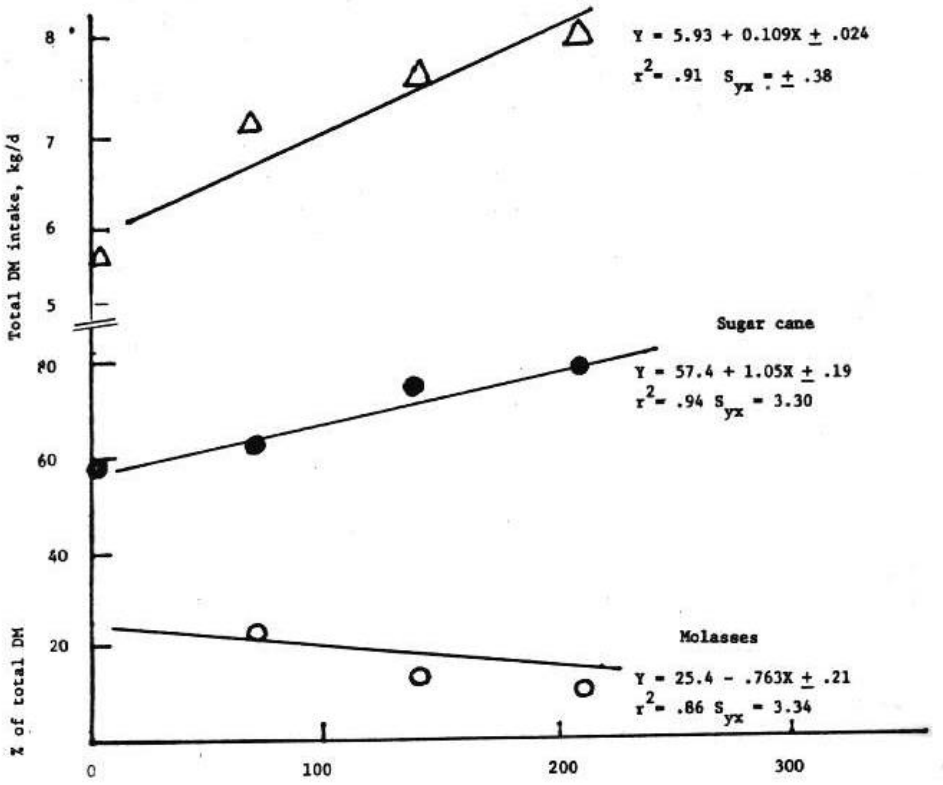
Values for pH, and ammonia in rumen fluid and blood, in experiment 2, are given in table 2. Ruminal pH showed a quadratic tendency according to the increase in concentration of urea in molasses. The response in total VFA appeared to be linear. Values for ammonia in rumen fluid and blood showed increases parallel to the increases of urea in the molasses.

The results of voluntary intake are broadly in agreement with those reported by Silvestre et al (1977), Ferreiro et al (1977) and Alvarez and Preston (1976) they can be interpreted as reflecting the needs of the rumen microorganisms for fermentable N, leading in turn to increased flows of microbial protein to the duodenum with a positive feedback on total DM intake (Preston and Leng 1979).

Table 2:
Mean values for rumen and blood metabolites in bulls given free access to molasses/urea and sugar cane.

	Urea concentration, g/kg				SEx
	0	7	14	21	
Rumen pH					
1000 hr	7.0	7.5	8.5	7.6	±0.4
1400 hr	7.0	7.5	7.0	6.5	
Rumen VFA, m-mol/litre					
1000 hr	71	72	63	72	±12
1400 hr	70	76	96	110	
Rumen NH_3, mg/100ml					
1000 hr	10.7	14.4	23.7	61.4	±13
1400 hr	3.3	8.9	13.0	38.1	
Blood NH_3, mg/100ml					
1000 hr	6.0	10.7	11.0	19.0	±16
1400 hr	6.0	12.6	16.3	26.4	

Figure 1: Effect of urea content of molasses on total and related intakes of molasses/urea and sugar cane when both feeds were offered free choice



With temperate climate feeds, composed of grains and dry roughages, the inclusion of urea in the diet has frequently led to a reduction in voluntary intake (Schaadt et al 1966; Wilson et al 1975), This has been attributed to the bitter taste of the urea, a factor which presumably led to the reduction in intake of the molasses/urea mixtures when the urea concentration exceeded 7% in the present experiments. However, in our experiment although the urea depressed the intake of the molasses in which it was dissolved, the daily intake of urea actually increased as did total DM intake. This would indicate that conditions for rumen microbial growth were more favourable on our sugar cane/molasses diet than on the temperate feeds used by the North American researchers.

The reduction in rumen Ammonia levels after feeding, probably reflects the intake of this nutrient by the rapidly growing microbial population, stimulated by the consumption of the rapidly fermentable sugars in the sugar cane and the molasses.

References

Alvarez F J, Alpuche O, Preston R T 1978 Leucaena leucocephala as a protein supplement for sugar cane based diets: effects on rumen fermentation and turnover rate Tropical Animal Production 3:40-44

Elliott R, Ferreriro H M & Priego A 1978a An estimate of the quantity of feet protein escaping degradation in the rumen of steers fed chopped sugar cane, molasses/urea supplemented with varying quantities of rice polishings Tropical Animal Production 3:36-39

Ffoulkes D y Preston T R 1978 Cassava or sweet potato forage as combined sources of protein and roughage in molasses based diets: effect of supplementation with soybean meal Tropical Animal Production 3:186-192

Hulman B, Owen E & Preston T R 1978 Comparison of Leucaena leucocephala and groundnut cake as protein sources for beef cattle fed ad libitum molasses/urea in Mauritius Tropical Animal Production 3:1-8

Preston T R 1972 Molasses as a feed for cattle world Review Nutrition Dietetics (ed G 11 Bourne) Karger Basle

Rowe J B, Loughnan Marian L, Nolan J V & Leng R A 1979 Secondary fermentation in the rumen of a sheep given a diet based on molasses British Journal of Nutrition 41: 393-397

Salais FJ, Sutherland T M & Wilson A 1977 Effect on animal performance of different sources of forage in diets based on molasses and urea Tropical Animal Production 2:158-162

Stouthamer A H & Bettenhaussen C 1973 Utilization of energy for growth and maintenance in continuous and batch cultures of microorganisms Biochimica et Biophysica Acta 301:53

Received 10 June 1979