EFFECT OF AN ANTI-PROTOZOAL AGENT ON PERFORMANCE OF GROWING CALVES FED A MOLASSES BASED DIET[1]

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Groups of between 12 and 14 Holstein cross calves weighing about 90 kg were fed molasses/urea of libitum, 4 kg/d chopped sugar cane and 150 g fish meal daily plus minerals. The molasses was supplemented with zero, 1, 2 or 3 g of an anti-protozoal agent (Teric GN9; ICI (Australia) Ltd) per kg of molasses. Liveweight gains over a 70 day period were significantly (P 4.03) higher for the group given 1 g Teric/kg molasses (224g/d) than for the controls (122 g/d) or those given the higher levels of Teric (115 and 177 g/d for 2 and 3 g Teric/kg molasses) (SEx ± 34). Numbers of protozoa in rumen fluid increased over the experimental period on the control treatment but decreased for the Teric treatments. The differences were significant for the samples after 71 days on trial (8.1, 6.4, 6.0 and 4.8 x 10^4/ ml; SEx ± .85; P < .02) for control and increasing levels of Taric respectively.

Key words: Cattle, molasses/urea, protozoa, anti-protozoal agents

Bird and Leng (1978) reported that administration in a single dose (100 ml) of an anti-protozoal agent (Teric GN9; ICI (Australia) Ltd) to cattle kept in isolated groups and fed a molasses based diet significantly increased the growth rate and promoted better feed conversion. This compound eliminated completely the protozoa from the rumens of the treated animals and they remained free of these micro-organisms throughout the trial.

Teric GN9 is a toxic material and care must be taken in dosing animals with it. The method chosen by Bird and Leng (1978) of using a stomach tube is not really suitable for commercial operations, particularly with Zebu type cattle in tropical environments, which is the situation where this type of additive is likely to be most applicable.

The objective of this trial was to examine the effect of continuous feeding of the additive at low levels in the liquid molasses fed as a major component of the diet of growing calves.

Materials and Methods

Treatments, Design and Animals: The treatments were an untreated control and three levels of Teric GN9 of 1, 2 and 3 g/kg of the molasses/urea mixture. There were between 12 and 14 animals in each treatment group and these were made up of Holstein and their crosses with Sahiwal, Simmental and Creole. Each treatment group

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was housed in a single pen in a partially slatted floor feedlot with concrete dividing walls. Physical contact between animals in adjacent pens was possible and these animals also used a common water trough, thus facilitating the transmission of protozoa between treatment groups.

Procedure: The Teric GN9 was first added to water and the aqueous solution then distributed in the molasses when this was replenished at intervals of approximately 1 week. The molasses contained 2.5% urea and was fed on a free choice basis. The animals also had restricted quantities of chopped whole sugar cane (4 kg/d) and 150 g/d of a bypass protein in the form of locally produced fish meal. Phosphorus-rich minerals were also available. After 61 days the levels of Teric GN9 in the molasses were doubled. The experiment had to be terminated 12 days later due to lack of further supplies of additive giving a total of 73 days for the experiment.

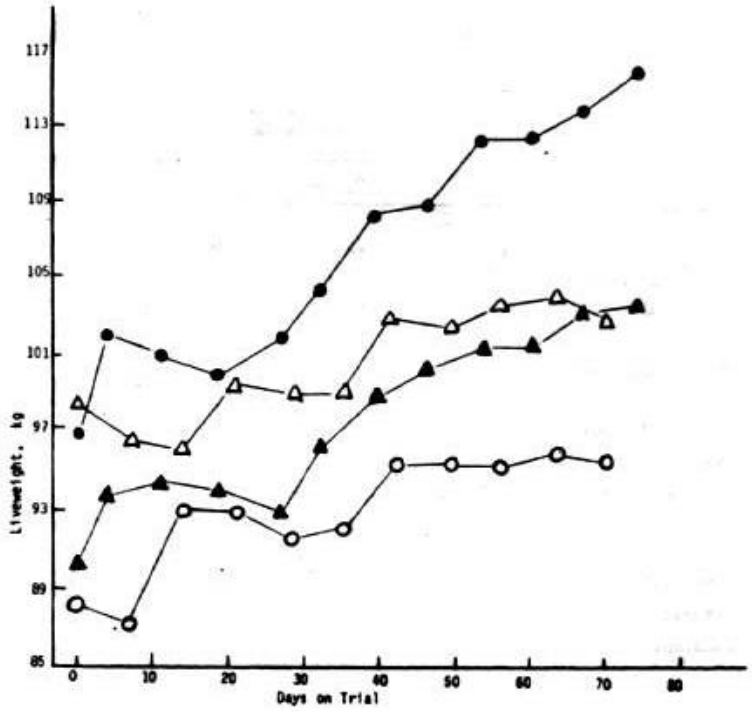
Determination of Protozoa in the Rumen Fluid: Samples of rumen fluid were taken by stomach tube after 3.5 to 4.5 hr after feeding the forage on days 16, 51 and 71 of the experiment. On the first sampling day all of the control animals were sampled and 5 in each of the Teric treatment groups. On the subsequent sampling dates all animals were sampled. The rumen fluid (5 ml) was preserved with formal saline (20 ml) (10% (v/v) formalin solution (40% formaldehyde) and 0.9% (w/v) NaCl made up with water). The counting chamber (Hawksley, England; Crystalite BS748) was 0.2 deep. The total number of protozoa (Holotrichs and Entodina) were recorded by the method of Warner (1962). Other samples of rumen fluid were preserved with acid for analysis of short chain fatty acids (to be reported in a subsequent paper).

Measurements: The calves were weighed weekly and liveweight gain determined by the regression of liveweight on time. Feed intakes were recorded and samples taken for analysis for nitrogen and dry matter (see Table 1).

Table 1
Composition of Feeds

	Brix	Dry Matter %	% in DM			
			N	Fibre	Ash	Fat
Sugar cane		27.9+1.0	.58+.021	28.6+.76	4.6+.46	1.06 +.11
Molasses	80.5 +.3	70.0 +.6				
Fishmeal		92.2+.38	7.28+.14	.51+.21		8.9+.83

Figure 1:
Growth curves of groups of calves fed ad libitum molasses/urea, 4 kg/d of sugar cane and 150 g/d of fish meal, and supplemented with zero (○), 1g (●), 2 g (△) or 3 g (▲) Teric GN9 per kg of molasses



Results

The growth curves for the 4 treatment groups are shown in Figure 1. Table 2 summarizes the data on liveweight change, feed intake and feed conversion. Mean protozoal counts are in Table 3.

The calves were relatively small (approximately 100 kg liveweight at the beginning of the experiment) and had not previously been accustomed to receiving molasses. A period of adaptation was therefore expected, and the growth curves confirm that there was little or no gain in weight during the first 3 weeks. After this point, it was obvious that the group receiving the low level of Teric was gaining in weight at a faster rate than the controls and the other groups receiving 2 or 3 g of Teric/kg of molasses. An analysis of variance, using within group variance as the error term, showed a significantly higher gain for the low level Teric treatment compared with the other treatments; this was true for the overall trial period ($P < .03$) and for the period 16 to 71 days, following adaptation ($P < .015$). Regression analysis using the mean weekly liveweights of the group as the dependent, and days as the independent variables, also showed that the slope of the line (rate of change in liveweight) of the low level Teric treatment was significantly greater than the slopes for any of the other three treatments.

Molasses intake appeared to be higher on the treatment receiving the low level of Teric and there was a close relationship (r=.85) between molasses intake and liveweight gain.

Table 2:
Mean values for liveweight gain and feed intake of groups of calves given ad libitum molasses containing 0,1,2 or 3 g Teric GN9/kg molasses, restricted forage and protein supplement

	Level of Teric, g/kg molasses					
	0	1	2	3	SEx	P[4]
No of calves	13	12	14	13		
Liveweight, kg						
Initial	87	95	99	91		
Final	96	116	104	105		
Daily weight gain, g						
0 to 72 days	122	244	115	177	±34	.03
16 to 72 days[1]	78	290	126	198	±37	.002
Feed intakes, kg/d						
Molasses/urea	2.4	3.1	2.4	2.6		
Chopped sugar cane	4.0	4.0	4.0	4.0		
Fish meal	0.15	0.15	0.15	0.15		
Minerals	0.05	0.05	0.05	0.05		
Total DM	2.98	3.44	2.95	3.09		
Consumption index[2]	3.26	3.26	2.90	3.15		
Feed conversion[3]	24.4	14.1	29.1	17.5		

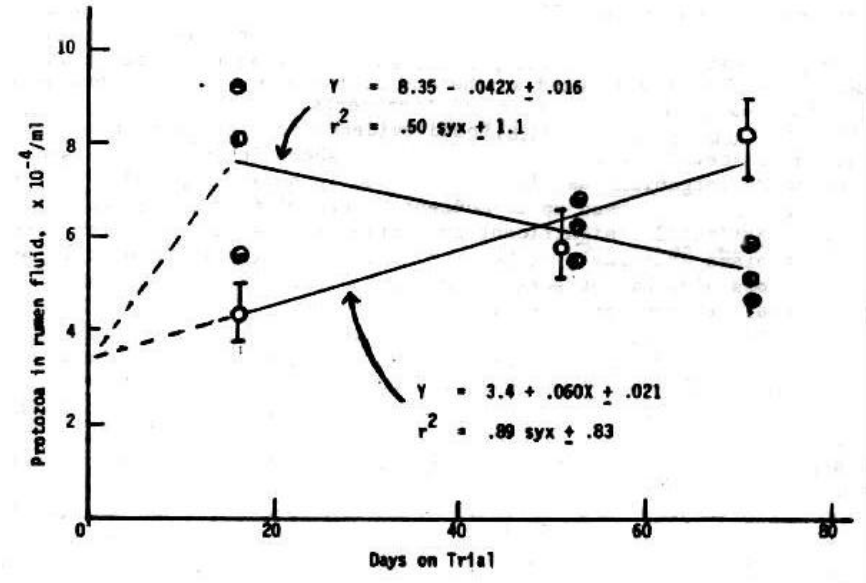
[1] After period of adaptation
[2] Intake of DM/100 kg liveweight
[3] Intake of DM/gain in liveweight
[4] Probability of F Test in analysis of variance

Table 3:
Protozoal numbers in rumen fluid of Holstein cross calves given a molasses based diet and 0, 1,2 or 3g Teric GN9/kg molasses (13 observations/treatment, except for the first sample when there were 13 observations on control and 5 on the remainder)

	Level of Teric, g/kg molasses				SEx	P[1]
	0	1	2	3		
Days from beginning of the experiment	----------x10^{-4}/ml----------					
16	4.6	8.1	5.6	9.2	1.9	.38
51	5.8	5.4	5.9	6.9	0.85	.55
71	8.1	6.4	6.0	4.8	0.85	.02

[1] Probability of “F” test in analysis of variance

Figure 2:
Changes in protozoal concentration in rumen fluid in calves fed high levels of molasses supplemented with zero (○), 1 g (•) 2 g () or 3 g () Teric GN9 per kg of molasses



There were indications (although only with 5 animals sampled per treatment the variation was high) that protozoal numbers in the treated groups were stimulated at the start of the trial, at least by the low level of Teric treatment. There were no significant differences in the protozoal population between the treatment groups at either the first or the second sampling times. In the final sample, however, the protozoal populations in all treated groups had fallen to values significantly lower than that recorded on the control treatment without the Teric additive ($P < .02$).

Discussion

No samples were taken for protozoa estimation before initiating the treatment but as the animals were selected at random from a common source there is no reason to suppose that there were differences between the groups at the start in their protozoal populations. The control group showed an increase in the protozoal population density for the duration of the trial ($r = .94$; see Figure 2). This fact, coupled with the age of the animals, suggests that at the commencement of the trial, the protozoal population density in all animals may have been low. Since the samples for estimating the protozoal population density were taken by stomach tube, there may have been contamination with saliva which would result in an underestimation of protozoal numbers.

The results cannot be interpreted in a completely conclusive manner owing to the fact that there was no replication of treatment groups and therefore treatment effects were confounded with pen effects. However the pens were of identical construction and situated in one row facing in the same direction. It therefore seems likely that the differences could moat probably be attributed to the effect of the Teric GN9 additive.

In the trials of Bird et al (1978) and Bird and Leng (1978) with sheep and cattle, the beneficial effects of the Teric compound were attributed to its effect in eliminating protozoa from the treated animals. This cannot have been the explanation in the present experiment as protozoal numbers, although significantly reduced at the end of the experiment, were nevertheless similar but low in all animals on all treatments.

Recently Rowe et al (1978a,b) found evidence for secondary fermentation (oxidation of acetate to CO_2) in the rumen of sheep fed molasses-based diets. Methanosarcian (organisms usually encountered in sewage and mud) were present in the rumen of these sheep up to concentrations of 6 x 10 /ml indicating that they constituted a significant proportion of the biomass in the rumen. As such organisms are likely to be sensitive to a detergent such the Teric GN9, it is possible that effects of the Teric seen in this study are due to the control of these organisms.

The continuous feeding of Teric GN9 in the diet, at low levels, appears to have led to an increased intake; this is contrary to the findings of Bird and Leng (1978) where Teric was given as a single dose at the beginning of the trial and where there were no effects on intake. Since feed intake is stimulated on these diets by extra dietary bypass protein (Preston, 1972) it is suggested that extra protein was made available from rumen fermentation where 1g Teric/kg molasses was given. However at the higher rates of Teric although growth rates were increased the feed intake was not increased. This indicates a greater availability of energy nutrients to the animal.

Further trials are planned to examine low levels of Teric administration.

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