EFFECT OF PRE-FERMENTATION, LEVEL OF WHEAT BRAN AND ACCESS OR NO TO MOLASSES CONTAINING 10% UREA ON PERFORMANCE OF ZEBU BULLS FED A SUGAR CANE BASAL DIET[1]

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Two experiments were carried out in order to compare chopped whole sugar cane fed immediately after chopping, and the same sugar cane fed 24 hr after chopping. In the first experiment (112 days) which was carried out during the rainy season, the other comparison was level of wheat bran (1000 or 500 g/d). However, in the second experiment (63 days) carried out in the dry season, the additional comparison was access or no to a mixture of molasses containing 10% urea. The experiments were carried out with 24 Zebu bulls and the design was a 2 x 2 factorial with two replications (3 bulls per group) in each of the two experiments.

There were no significant differences which could be attributed to the affect of pre-fermenting the sugar cane in either part of the experiment (320 vs 291 g.d in the first part; and 414 vs 411 g/d in the second part, for fresh and pre-fermented cane respectively). The results showed no significant differences in the first part of the experiment due to the level of wheat bran (296 vs 314 g/d for 500 and 1000 g/d of wheat bran respectively); however, there was a significant increase due to the molasses/urea both in liveweight gain (557 vs 267 g/d; P <.002) and in conversion (9.95 vs 19.7 kg/kg of growth; P <.001). The respective voluntary intakes were sugar cane 14.2 and molasses .93 kg/d; and sugar cane 15.7 kg/d for the treatment without molasses.

It was concluded that pre-fermentation of the sugar cane had no effect on animal performance under the conditions in which this experiment was carried out, but that there was a highly significant improvement when the animals also had access to molasses containing 10% urea.

Key Words: Cattle, sugar cane, pre-fermentation, molasses, urea, wheat bran, seasonal effects

When sugar-cane is chopped it immediately begins to ferment and this leads to a reduction in pH and in Brix reading (soluble sugars), with production of organic acids and alcohol (Gonzalez and MacLeod 1976). These changes are principally due to the fermentation of the soluble sugars by yeasts and this can give rise eventually to the transformation of up to half of the sugars as occurs in ensiled sugar cane to which no additives have been added (Preston et al 1976b).

It is known that the rate of animal growth on sugar cane ensiled without additives is reduced by half, in comparison with the use of fresh sugar cane and that this is related to an important reduction in voluntary feed intake (James 1973). It is therefore to be expected that a partial fermentation, which often takes place when sugar cane is fed to cattle, would also affect animal performance, as it is not always possible to ensure that in such situations the sugar cane is fed fresh immediately after chopping.

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The objectives of this experiment were to determine the effect on animal performance of fermenting sugar cane for 24 hr (this representing the maximum period of fermentation likely to occur in practice), and at the same time investigate the effect of different levels of a supplement of wheat bran (Experiment 1) and of enriching the ration with molasses/urea (Experiment 2).

Materials and Methods

Treatments and Design: The two experiments were carried out with the same animals; the first during the wet season and the second during the dry season. In both experiments the principal treatment was the use of freshly chopped sugar cane or chopped sugar cane pre-fermented for 24 hr. In Experiment 1, the additional treatment was 500 or 1000 g/d of wheat bran. In Experiment 2, the level of wheat bran was fixed at 1000 g/d and a new treatment was introduced: the presence or absence of a molasses mixture containing 10% urea. In both experiments, the design was a factorial 2 x 2 with 2 replications.

Animals: Zebu bulls were used of one to two years of age. They weighed between 186 and 198 kg at the beginning of Experiment 1 and between 234 and 258 kg at the beginning of Experiment 2. There were 3 animals in each treatment group giving a total of 24 in the experiment.

Procedure: The sugar cane used was the variety 980. Its characteristics during the two experiments are summarised in Table 1. In both experiments, the sugar cane was offered ad libitum in one single feed in the morning. The fresh cane was chopped with a maize harvester (Gehl 600). For the pre-fermentation, the chopped cane was placed in open hessian sacks for a period of 24 hr before feeding. Both the fresh and the pre-fermented sugar cane were put in the feed trough before adding an aqueous solution of urea and sulphate of ammonia at the rate of 50 g/kg, The solution contained 77% water, 18% urea and 5% ammonium sulphate (w/w). The wheat bran was given in the afternoon and placed on top of the sugar cane in the feed trough, In Experiment 2, the molasses/urea (80% molasses, 10% water and 10% urea, w/w) was given on a free choice basis in a separate feeder.

Table 1 :
Characteristics the of the sugar cane used in Experiments 1 and 2

Season	Wet		Dry	
Sugar cane	Fresh	Pre-fermented	Fresh	Pre-fermented
Brix°	11.7	10.8	13.6	12.9
Dry matter, %	25.0	25.3	27.0	27.6
pH	4.7	3.2	4.7	3.5

The animals were housed in pens on a cement floor (3.5 metres / animal) in a building open at the sides.

Measurements: The animals were weighed individually at the beginning of the experiments and subsequently at intervals of 2 weeks. Rate of liveweight gain was determined by regression of liveweight on time on experiment. Feed intake wee recorded daily and consumption of DM calculated on the basis of analyses of samples taken daily of the fresh and fermented cane. The DM content of the wheat bran wee determined periodically.

Results

Composition of the Sugar Cane: Both in the wet and dry season, the changes in the composition of the sugar cane due to the pre-fermentation were relatively small. The Brix fell by 1° in the wet season, and by 0.7° in the dry season. There was a more marked change in pH which fell from 4.7 to 3.2 in the wet season, and from 4.9 to 3.5 in the dry season. In general, both Brix and DM content of the cane showed higher values in the dry season as compared with the wet season, which was to be expected. However, the values recorded in the dry season were still relatively low, indicating that the cane wee of inferior quality.

Animal Performance: In Experiment 1, there were no significant changes in the parameters of animal performance due to treatments. Overall rate of liveweight gain was relatively low in the range 270 to 320 g/d.

In Experiment 2, the most notable effect was the highly significant (P <.002) increase in the rate of liveweight gain when molasses containing 10% urea was given as a supplement to the sugar cane. The rate of growth was doubled from 267 to 557 g/d. There was a slight increase in voluntary intake (of 12%) on the molasses treatment, but feed conversion was improved very significantly (P <.001) from 19.7 to 9.95 kg DM/gain in liveweight. As in the first experiment, there was no effect of the pre-fermentation of the sugar cane on any of the animal performance parameters.

Discussion

Based on the results observed, we can conclude that under the conditions in which the experiments were carried out, there were no differences between using fresh or pre-fermented sugar cane. These data are not in agreement with those reported by Preston et al (1976b) where the use of sugar cane pre-ferment ed for 24 hr led to a reduction in liveweight gain from 792 g/d for fresh cane to 580 g/d for pre-fermented cane. Part of the explanation may relate to the inferior value of the sugar cane utilised in our experiment. To a certain point, it is logical to think that the lower the Brix of the fresh cane, then the less will be the effect of pre-fermentation. In fact, the changes in the composition of the sugar cane (Table 1) support the idea that sugar cane of this quality is little affected by pre-fermentation, at least in terms of its content of soluble sugars.

The deficiency in the quality of the fresh sugar cane was clearly indicated by the very marked effect on animal performance brought about by allowing free access to a mixture of molasses containing 10% urea. In fact, the quantity of molasses consumed was not high (approximately I kg/d), however, the effect on animal performance was very notable. The beneficial effect of the molasses was the same with fresh sugar cane as with prefermented sugar cane, underlining therefore the idea that the fermentation treatment in this experiment had little effect on the nutritive value of the sugar cane used.

Table 2:
Mean values for feed intake, growth rate and feed conversion in Zebu bulls fed fresh or pre-fermented sugar cane with or without wheat bran (Experiment 1)

Sugar cane	Fresh		Pre-fermented		SE (P)[1]
Wheat bran	500	1000	500	1000	
Feed intake, kg/d					
Sugar cane	16.4	15.1	16.1	14.1	-
Wheat bran	0.5	1.0	0.5	1.0	-
Urea	.148	.136	.145	.130	-
Ammonium	.082	.076	.081	.072	-
Minerals	.070	.070	.070	.070	-
Total DM	4.84	4.88	4.84	4.77	-
Initial liveweight, kg	193.4	189.8	197.6	185.8	-
Daily gain, g	320	319	272	310	± 35 (.75)
Consumption Index[2]	2.28	2.09	2.30	2.34	± .19 (.80)
Conversion[3]	15.3	15.5	18.4	15.5	± 2.24 (.73)

[1] Standard Error of means (Probability of "F" test)
[2] kg DM intake/100 kg LW/d
[3] DM intake/gain in liveweight

Table 3:
Animal performance parameters on basal diets of fresh or fermented sugar cane with two levels of wheat bran (comparison of main treatment intakes; Experiment 1)

	Wheat bran, g/d		P[1]	Sugar cane		P[1]	SEx
	500	1000		Fresh	Pre-fermented		
Liveweight gain, g/d	296	314	.99	320	291	.85	±24
Consumption Index[2]	2.29	2.22	.96	2.19	2.32	.89	±13
Conversion[3]	16.8	15.5	.79	15.4	16.9	.71	±1.58

[1] Standard error of means (Probability of "F" test)
[2] kg DM intake/100 kg LW/d
[3] DM intake/gain in liveweight

Table 4:
Mean values for feed intake, growth rate and feed conversion in Zebu bulls fed fresh or fermented sugar cane with or without access to molasses/urea (Experiment 2)

Sugar cane	Fresh		Prefermented		SEx(P)[1]
Molasses/urea (10%)	With	Without	With	Without	
Feed intake, kg/d					
Sugar cane	14.7	15.5	13.8	15.9	-
Wheat bran	1.0	1.0	1.0	1.0	-
Urea	.243	.140	.247	.143	-
Ammonium sulphate	.037	.038	.035	.040	-
Molasses	.888	-	.980	-	-
Minerals	.070	.070	.070	.070	-
Total DM	5.51	5.14	5.49	5.39	-
Initial liveweight, kg	234	238	238	258	-
Daily gain, g	570	257	545	277	± 47 (.02)
consumption Index[2]	2.17	1.83	2.15	2.04	± .10 (.20)
Conversion[3]	9.79	19.8	10.1	19.6	± .79 (.001)

[1] Standard Error of means (Probability of "F" test)
[2] kg DM intake/100 kg LW/d
[3] DM intake/gain in liveweight

Conclusions

Apparently in sugar cane of moderate quality (Brix 11 to 13°), a period of pre-fermentation of 24 hr has no effect on animal performance which in any event was poor even with the fresh sugar cane (250-280 g/d). Furthermore, improving the nutritive value of the ration by providing access to molasses containing 10% urea was also not affected by the fermentation treatment, animal performance being improved equally on fresh cane (570 g/d) as on pre-fermented cane (545 g/d). The fact that animal performance was not reduced by the fermentation treatment does not necessarily indicate that the same will occur with sugar cane of higher quality; in the experiment of Preston et al (1976b), for example, with high Brix cane supplemented with rice polishings, the reduction in performance was from 792 to 580 g/d.

Table 5:
Animal performance on basal diets of fresh or fermented sugar cane with or without access to molasses/urea (Experiment 2)

	Molasses/urea(10 %)		P[1]	Sugar cane		P[1]	SEx
	With	Without		Fresh	Pre-fermented		
Liveweight gain, g/d	557	267	.002	414	411	1.00	± 33
Consumption index[2]							
Total DM	2.16	1.93	.07	2.00	2.09	.51	±.07
Fresh cane	5.54	5.62	.69	5.60	5.76	.92	± 27
Conversion[3]	9.95	17.7	.001	14.8	14.9	1.00	±.56

[1] Probability of "F" test
[2] Daily intake/100 kg liveweight
[3] DM intake/gain in liveweight

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