THE VOLUNTARY INTAKE BY CATTLE OF CHOPPED SUGAR CANE TREATED WITH SODIUM HYDROXIDE

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Four Swiss x Zebu bulls of approximately 229 kg liveweight were used in a 4 r 4 Latin square design. The treatments were four levels of sodium hydroxide: 0, 2, 4 and 6% of cane dry matter (DM). The animals were housed in individual pens and had free access to chopped whole sugar cane and a concentrated solution (21% w/w) of urea in molasses, supplied in different troughs, and salt and water. Rice polishings (I kg/d) was also given. The sodium hydroxide (commercial grade) was diluted in water at the rate of 4:1 and was mixed with the sugar cane. The treated material was stored for 24 hr before being given to the animals. During the experimental phase, samples were taken of the sugar cane offered and of the residue, for determination of pH. The experiment lasted 112 d, divided into 4 periods, each of 21 d. There was a linear response in voluntary intake according to the level of sodium hydroxide (6.82, 7.66, 7.80 and 8.12 kg DM/d for 0, 2, 4 and 6% of sodium hydroxide). The pH in the feed that was offered was 3.0, 8.1, 9.8 and 11.2 for the increasing levels of sodium hydroxide, and 2.9, 4.9, 7.9 and 9.2 in the uneaten residue 24 hr later. It is considered that the effect of the sodium hydroxide is probably related to the solubilisation of the cell wall components which, in turn, would be expected to increase rumen en microbial synthesis efficiency and flow rate out of the rumen, which in turn should give rice to a greater voluntary intake.

Key Words: Sugar cane, sodium hydroxide, voluntary intake, pre-fermentation

In a cattle feeding system based on the use of sugar cane as an energy source (Preston 1977), one of the principal problems appears to be the low voluntary intake when sugar cane is supplemented only with urea. One of the reasons for this low intake is thought to be the low degradability of the fibre in sugar cane (Ravelo et al 1978). Another possibility is that the fermentation of the sugar cane which begins immediately the sugar cane is chopped, may result in a reduction in voluntary intake and low growth rates (Alvarez et al 1979).

A possible procedure for resolving some of the problems associated with the high content of fibre in sugar cane and the rapid fermentation when it is chopped, could be the addition of sodium hydroxide.

The objective of this experiment was to study the effect of different levels of sodium hydroxide on the voluntary intake of cattle fed a basal diet of ground whole sugar cane.

Materials and Methods

Treatments, Animals and Design: Four Swiss x Zebu bulls of approximately 229 kg liveweight were allocated to four treatments of 0, 20, 40 and 60 g of sodium hydroxide per kg sugar cane (DM basis). The design was a 4 x 4 Latin square with experimental periods of 28 d.

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Procedure: The animals were housed in individual pens with a solid concrete floor, in a building open at the sides. Mature sugar cane (12-14 months) of the Variety B4382 was used. It was finely chopped and fed on a free choice basis. The animals also had free access to a urea/molasses mixture (21% urea w/w), water and mineral salts. In addition, each animal received 1 kg/d of rice polishings. Commercial grade sodium hydroxide was diluted (20% w/v) before being spread over the sugar cane mixture. The mixture was stored in jute sacks for 24 hr before being offered to the animals.

Measurements: The first 14 d of each period were considered as an adaptation time for the animals to the treatment, and the experimental recordings were made over the last 14 d. In this recording phase, samples were taken of the sugar cane mixtures offered, and also of the feed refusals, for the determination of pH. A sample was obtained by shaking 20 g of the mixture with 100 ml of distilled water and then determining pH with a glass electrode.

Results and Discussion

The DM intakes of the different components of the diet are summarised in Table 1. In examining the effect of sodium hydroxide treatment of the sugar cane on

Table 1:
Effect of sodium hydroxide treatment of sugar cane on voluntary intake and pH (means for 4 animals)

	Level of NaOH, %of DM				
	0	2	4	6	SE(P)
DM intake, kg/d					
Sugar cane	6.82	7.66	7.80	8.12	.19 (.01)
Rice polishings	.92	.92	.92	.92	
Molasses /urea	1.15	1.05	.99	1.12	.17 (> .5)
Total	8.89	9.63	9.71	10.16	.14 (.01)
pH of the sugar cane					
Offered[1]	3.0	8.1	9.8	11.2	
Refusals[2]	2.9	4.9	7.9	9.2	

[1] After being stored in sacks for 24 hr
[2] Recovered from the feed trough 24 hr after being offered to the animal

voluntary intake, it must be remembered that the control treatment bad in fact been subjected to a period of spontaneous fermentation of 24 hr. Therefore, it is possible that the improvement in voluntary intake of sugar cane DM estimated at the highest level of the sodium hydroxide treatment may be largely due to the negative effect of the pre-fermentation of the control ration. In fact, Alvarez et al (1979) reported a reduction of 10% in the intake of sugar cane due to the effect of allowing it to ferment spontaneously for 24 hr. It can be concluded, therefore, that there was a positive

effect due to the sodium hydroxide, equivalent to about a 10% increase in voluntary intake. When the data in Table 1 are compared on a metabolic body weight bests with the voluntary intake of sugar cane by similar animals fed the same cane used in this experiment but given it immediately after chopping (Table 2), then the differences due to spontaneous fermentation and to the addition of sodium hydroxide are in agreement with what was predicted from the experiment of Alvarez et al (1979).

Table 2:
Voluntary intake (per unit metabolic body weight) of sugar cane fed fresh, fermented for 24 hr, or treated with sodium hydroxid for 24 hr

	Fermented[1]	Fresh[3]	Treated with NaOH[2]
DM intake of sugar cane, $DM/W^{.75}/d$	.095	.106	.115
Increase over fermented cane, %		10	21
Increase over fresh cane, %			8

[1] This experiment: fermented for 24 hr
[2] This experiment NaOH at 6% of 1111 for 24 hr
[3] Results for different (but similar) animals fed the same sugar cane immediately after chopping

The effect of the alkali on voluntary intake could possibly be mediated through the inhibition of fermentation. However, this toes not seem likely as the effect of the alkali was linear over the range that was studied. Another possibility is that the effect of the alkali was related to its effect on the pH of the sugar cane, since a close relationship (r^2 =.99) was observed between voluntary intake and the pH of sugar cane offered.

A third possibility is that the effect of the sodium hydroxide was to solubilise some of the cell wall material. This in turn could be expected to increase rumen microbial synthesis and decrease the retention time of the digesta in the rumen; both of these effects would be expected to give rise to an increase in voluntary intake (Preston and Leng 1979).

Further experiments are required in order to determine the exact action of the sodium hydroxide on the chemical and physical condition of the sugar cane and to ascertain if the increase in voluntary intake will result in better animal performance.

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