

DIGESTIBILITY AND VOLUNTARY INTAKE ON SUGAR CANE DIETS: EFFECTS OF CHOPPING THE CANE STALK IN PARTICLES OF DIFFERENT SIZES:¹

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Two experiments were carried out using Swiss X Zebu steers of 180 kg live weight. In the first experiment the design was a 3 x 3 latin square with two replications the treatments being cane stalk chopped with a machete in large particles (20 mm) or by machine to produce either fine (2 to 5 mm) or coarse (5 to 10 mm) particles. The diets were given ad libitum and were made isonitrogenous (2X of N in DM) by adding a solution of molasses/urea (220 g/litre at the rate of 50 ml/kg of sugar cane). 40 g/d of a mineral mixture were also given. In the second experiment two treatments (chopping with a machete or fine grinding by machine) were compared in a changeover design with 8 animals. In this experiment 500 g/d of rice polishings was also given. There were no differences in digestibility or in Voluntary intake which could be attributed to the different methods of processing. Digestibility coefficients were the same in both experiments but voluntary intake was almost twice as high in the second experiment when rice polishings was given.

Key words: Sugar cane, cattle, digestibility, processing

It is well known that in the case of the traditional forages used in temperate countries, the degree of grinding results in changes in animal performance. When the particle size is reduced by fine grinding, or by pelleting, the retention time in the rumen is reduced and as a consequence there is an increase in voluntary intake and a reduction in digestibility (Blaxter 1966).

In the experiment reported by Preston et al (1976) where derinded sugar cane was compared with a simple process of grinding in a forage chopper, the aim in the latter treatment was to produce a particle size as small as possible, in order that it should be comparable with the product resulting from the derinding of the stalk, which had a consistency similar to damp sawdust.

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The objective of the experiment described here was to study the effect on digestibility and voluntary intake of processing sugar cane stalk into large particles (with a machete) or fine particles. In the first experiment, the diet was sugar cane stalk, urea and minerals, while in the second rice polishings was given as a protein supplement in view of its marked effects on animal performance as reported by Preston et al (1976) and Lopez et al (1976)

Materials and Methods

Experiment 1:

Treatment and Design: 6 Swiss x Zebu steers of average initial weight 180 kg were used in a 3 x 3 latin square design with two replications to compare the following treatments (A) cane stalk chopped with a machete to give a particle size of approximately 20 mm diameter; (B) stalk ground in a high speed forage chopper to give large particles (5 to 10mm); (C) cane stalk ground finely in the forage chopper (2 to 5 mm).

Procedure: For treatments (b) and (c) the Chetumal grinder was used (see Preston et al 1976 for the description of this machine). The large particles were produced by forcing the cane stalk through the machine as rapidly as possible, while fine particles were obtained by restraining the rate at which the stalk entered the machine. Only the stalk was fed, the tops being rejected. The experimental periods were for 14 days of which the first 9 served for adaptation while the last 5 days were for total collection of faeces. The rations were made isonitrogenous at the level of 2% of nitrogen in dry matter by adding a solution of urea in final molasses (220 g urea/litre) at the rate of 50 ml/kg of fresh cane stalk. All the animals received 40 g/d of a mixture of salt (50%) rock phosphate (47%) and trace minerals (3%). The general procedure has been described by Montpellier and Preston (1977).

Brix in cane juice was determined daily and each week the percent of dry matter was estimated from bulked samples taken daily. Feeding was always ad libitum; the residues were collected daily and kept until the end of the period for determination of dry matter.

Experiment 2:

Treatment and Design: The two extreme treatments used in experiment 1 were selected, i.e. chopping with machete or fine grinding by machine. The design was a single change-over with 4 animals on each treatment.

Procedure: The experimental plan was similar to that described in experiment 1 except that 500 g/d of rice polishings was included in the ration.

Results and Discussion

Mean Values for digestibility and voluntary consumption index for the two experiments are given in table 1. The characteristics of the cane stalk in terms of Brix in the juice and the content of dry matter are given in table 2.

Table 1:
Mean value for voluntary consumption index and dry matter digestibility

	Machete	Chopping		SE
		Coarse	Fine	
Expt 1				
Volunt. consumption index ¹	1.64	1.55	1.61	±.076
Digest of DM, %	66.7	68.2	67.2	± 1.45
Expt 2				
Volunt consumption index ¹	3.19	-	3.20	±.050
Digest of DM, %	68.7	-	67.3	±.86

¹ Daily intake of DM (kg)/100 kg LW

In neither experiment, was there any indication of significant differences in digestibility or voluntary intake which could be attributed to the method of processing. It is obviously impossible to make a statistical comparison between the two trials, nevertheless it is interesting to note that voluntary consumption index was almost twice as high in experiment 2 as in experiment 1. This could be related to the presence of rice polishings in experiment 2, since a stimulatory effect of rice polishings on voluntary intake of sugar cane diets was reported by both Preston et al (1976) and Lopez et al (1976). It was surprising that there were no significant effects on digestibility or voluntary intake due to processing. In this respect, the results are different from what normally would be obtained with traditional forages (Blaxter 1966). The principal difference between sugar cane and forages typically used in temperate countries, is the high content of sugar in the former and its virtual absence in the latter. Sugar cane consists of soluble sugars and cell wall material in approximately equal proportions. In fact, in this experiment, if the Brix reading is considered to be an estimation of soluble sugars then expressing this on a dry matter basis indicates that there were approximately 60% of soluble sugars in the ration dry matter.

In other experiments (Montpellier and Preston, unpublished data), it was noted that the effect of the size of the particle of sugar cane on the rate of diffusion of the sugars into water was insignificant, even comparing the two extreme methods of processing used in experiment 2. Is therefore to be expected that particle size is unlikely to affect utilization of the sugars in cane stalk, at least in terms of digestibility. The contribution

of the fibre to the overall nutritive value of the ration is also very low (Valdez and Leng 1976), thus even if there were some effects of processing on digestibility of the cane fraction it is probable that the effect on the overall value of the diet will be insignificant in view of the small contribution of the fibre to total digestible dry matter.

Table 2:
Mean values ($X \pm SEx$) for Brix $^{\circ}$ and dry matter in the sugar cane stalk during the two experiments

	Brix $^{\circ}$ in juice	Dry matter (%)
Expt 1		
Repl 1	19.1 \pm .90	27.4 \pm 1.38
Repl 2	18.5 \pm 1.04	28.0 \pm 1.38
Expt 2		
Repl 1	21.8 \pm .80	29.2 \pm .50
Repl 2	22.3 \pm .75	31.2 \pm 1.3

Conclusion

The results of this experiment show clearly that the degree of processing the sugar cane stalk in terms of the size of the final particles, does not play an important role in terms of digestibility and voluntary intake. However, it is not possible to extend this conclusion to the overall nutritive value of the ration, without knowledge of the effect of processing on the utilization of the final products of digestion. This aspect will be reported in a subsequent paper.

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