

DIGESTIBILITY OF TOPS, RIND, DERINDED STALK AND THE ENTIRE PLANT OF SUGAR CANE¹

F A Montpellier² and T R Preston³

*Centro de Investigación y Experimentación Ganadera
Chetumal, Mexico*

8 Brown Swiss x Zebu steers of 180 kg live weight were used in two replications of a 4 x 4 latin square design to determine dry matter digestibility and consumption index of rations based on rind, tops, derinded stalk or whole sugar cane. The diets were balanced with a urea/molasses mixture (283 g urea/litre) at the rate of 50 ml/kg of fresh cane. In addition the animals received 500 g daily of rice polishings and minerals. DM digestibility was significantly higher with derinded stalk (71.3%) than with the chopped whole sugar cane (60.3), rind (59.6) or tops (61.5). Voluntary consumption index, was highest for tops (2.78 kg/100 kg of live weight), followed by the whole cane (2.3) with lowest values for derinded stalk (1.98) and rind (1.86).

Key words: sugar cane, cattle, processing, digestibility

The first reports on the digestibility of sugar cane came from the trials carried out by Donefer and his colleagues in Barbados (CIDA 1973). Using sheep they reported dry matter digestibility coefficients of 70% for derinded cane stalk and 79% for derinded stalk with chopped tops mixed together in the ratio 75:25. They gave no information on voluntary intake, nor was it apparent whether these values were obtained under conditions of ad libitum or restricted feeding.

In the first trial carried out in this Center with sugar cane (Preston et al 1976) it was reported that there were no significant differences in live weight gain between chopped whole or derinded sugar cane. In fact, there was a tendency for results to be better with the whole rather than the derinded cane.

As the rind is obviously the most lignified component of the sugar cane stalk., it would be expected that its removal (as in the derinding process) would result in increased digestibility and, therefore, better animal performance.

The objective of this experiment was to test this hypothesis as far as effects on digestibility and voluntary intake.

¹ This work was financed in part by funds from the International Development Research Centre of Canada

² Present address: Banco de Crédito Rural Peninsular, Chetumal QR, Mexico

³ Scientific Adviser to CIEG

Materials and Methods

Animals: 8 Brown Swiss x Zebu steers of 180 kg live weight were used.

Treatments and Design: The experimental treatments consisted of the following fractions of the sugar cane plant: (A) rind; (B) derinded stalk; (C) tops; and (D) the whole plant. The experimental design was two replications of a 4 x 4 latin square.

Procedure: The period on each ration was 14 days of which the first 9 were for adaptation and the last 5 for total collection of faeces in metabolic cages. Preparation of the derinded stalk, rind and the chopped whole cane was according to the procedure described by Preston et al (1976). The rind was chopped into particles of approximately 10 to 20 mm before feeding. The tops were processed in a similar way. These feeds were mixed with a solution of urea in molasses (283 g urea/litre of mixture) at the rate of 50 ml /kg of fresh cane.

Collection of faeces was made daily. The total amount was determined by weighing and a 5% aliquot was retained daily and stored at 3°. Samples of feed were also taken daily for storage at 3° and for determination of Brix using a hand refractometer. At the end of the collection period, the samples of faeces and feeds were bulked, mixed and determinations made of dry matter by drying at 60° during 48 hr.

Table 1:
Mean values for digestibility and voluntary intake

	Rind	Derinded stalk	Tops	Whole cane	SE _x	Level of significance
Intake of fresh cane, kg/d						
Rep 1	7.12	11.0	15.7	12.8		
Rep 2	8.24	12.0	16.4	12.8		
Digestibility of DM, %						
Rep 1	60.3 ^b	71.4 ^a	60.2 ^b	60.2 ^b	±1.46	P<.003
Rep 2	58.86 ^b	71.2 ^a	62.8 ^b	60.4 ^b	±1.86	P<.01
Consumption index						
Rep 1	1.98 ^c	2.10 ^c	2.97 ^a	2.64 ^b	±.09	P<.001
Rep 2	1.73 ^c	1.86 ^{bc}	2.5 ^a	1.99 ^b	±.09	P<.001

¹ Daily intake of DM (kg)/100 kg live weight

^{abc} Means in the same row without common superscript differ at P <.05

Results and Discussion

Data on DM digestibility and voluntary consumption index are given in table 1. Digestibility was highest for derinded sugar cane, but did not differ between the treatment of whole sugar cane, and the separate fractions of rind and tops (range from 59 to 61%). Voluntary consumption index was highest for tops (2.78), followed by the whole sugar cane (2.31) with lowest values for derinded stalk (1.98) and rind (1.86).

The different cane fractions differed significantly in dry matter content (highest for rind) and in the Brix of the juice which was highest in rind and lowest in the tops (table 2).

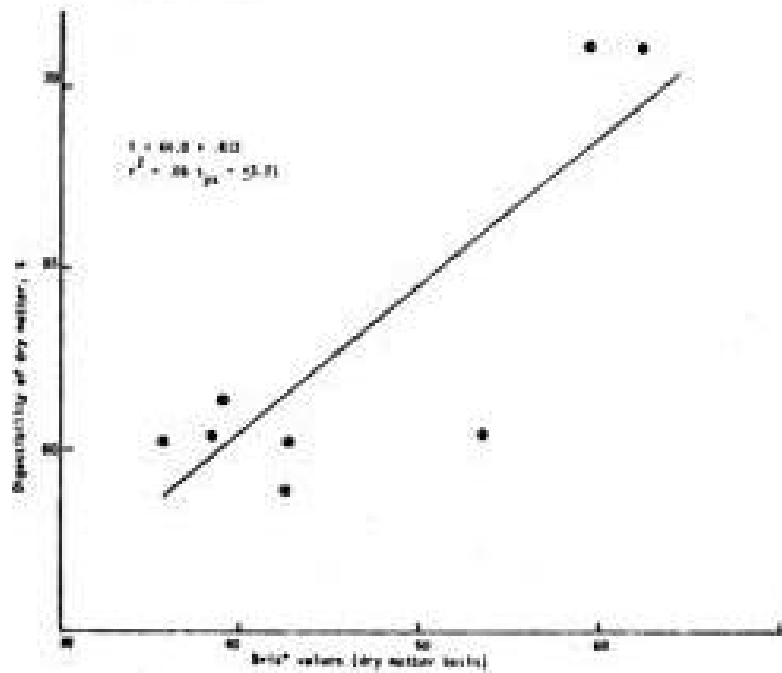
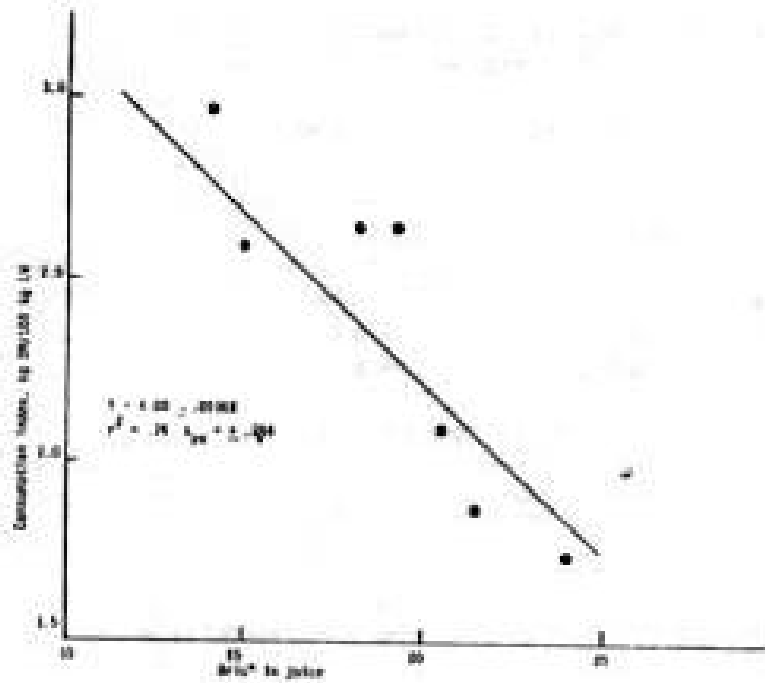
Table 9:
Mean values for dry matter and Brix

	Rind	Derinded Stalk	Tops	Whole cane	SE _x
DM%					
Rep 1	90.52	25.73	27.77	30.12	±1.33
Rep 2	38.15	25.55	28.05	26.58	±1.10
Brix °in juice					
Rep 1	25.65	20.49	14.82	18.12	±1.40
Rep 2	24.00	21.29	14.88	19.20	±0.850
Brix ° DM basis					
Rep 1	38.28	59.32	35.74	42.71	± 3.7
Rep 2	42.41	62.11	39.04	53.51	± 3.81

It was to be expected that DM digestibility would be highest for the derinded sugar cane stalk, however it was surprising that the digestibility of the rind was similar to that recorded for the tops and the whole sugar cane. The unexpected findings were in relation to voluntary feed intake, which was similar for rind and the pith (i.e. derinded stalk), two fractions which differ considerably in physical characteristics and composition.

The results stress the importance of making digestibility measurements under conditions of ad libitum feeding in order to obtain realistic values as to the nutritional potential of feeds of this type. The first parameter determining the nutritive value of a specific ration is the amount of digestible dry matter that is consumed. In this experiment, the highest daily intake of digestible dry matter (kg/100 kg live weight) was on the diet of tops (1.71) followed by derinded stalk (1.41) and whole cane (1.39) with the lowest values for rind (1.11).

Figure 1:
Relation between Brix° values and digestibility and voluntary index



Although one tends to associate the rind of sugar cane with low nutritive value considering it to be a highly lignified material, in fact the content of sugars (Brix) in the juice was higher in this fraction, than in any of the other components of the sugar cane plant. This almost certainly accounted for the relatively high digestibility recorded in this experiment.

The significantly higher voluntary intake on sugar cane tops than on whole sugar cane or derinded stalk is in agreement with the findings of Ferreiro and Preston (1976) and Ferreiro and Preston (1977).

As was reported by Ferreiro and Preston (1977); there was a significant negative relationship ($r = -.86$) between Brix in juice and voluntary intake and a positive relationship ($r = .81$) between Brix (dry matter basis) and digestibility (figure 1).

The findings of this experiment go some way to explaining why performance on derinded sugar cane is below expectation. Removing the rind from the stalk certainly increases the dry matter digestibility; in fact, by 18% compared with whole cane. That this is not reflected in superior animal performance is because voluntary intake is less by almost the same proportion, thus intake of digestible dry matter is practically the same for whole cane (1.39 kg/100 kg LW) as for the derinded stalk (1.41).

References

CIDA 1973 Sugar cane as livestock feed proceedings CIDA Seminar Barbados 30-31 January 1973

Ferreiro H M & Preston T R 1976 Fattening cattle with sugar cane: the effect of different proportions of stalk and tops *Trop Anim Prod* 1:178-185

Ferreiro H M & Preston T R 1977 Digestibility and voluntary intake of chopped or derinded sugarcane stalk, with and without addition of cane tops *Trop Anim Prod* 2:

Preston T R, Carcaño C, Alvarez F J and Gutierrez D G 1976 Rice polishings as a supplement in a sugar cane diet: effect of level of rice polishings and of processing the sugar cane by derinding *Trop Anim Prod* 1:150 -161