FATTENING CATTLE WITH SUGAR CANE: THE EFFECT OF DIFFERENT PROPORTIONS OF STALK AND TOPS[3]

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60 commercial Zebu steers of 235 kg live weight were allocated to 6 treatment groups in a production function design. These were proportions of sugar cane stalk and tops of (percent of tops fresh basis) 0, 20, 40, 60, 80 and 100. These mixtures were supplemented with a solution of molasses/urea (283 g urea/litre of solution) at the rate of 50 ml/kg of fresh sugar cane. ID edition, all animals received 1 kg daily of rice polishings given An a single feed at 7 a.m. before the sugar cane was fed. During the 98 day experiment there were significant positive relationships between the parameters voluntary consumption index, and live weight gain and the treatment variable proportion of tops.

In contrast, feed conversion became worse as the proportion of tops in the ration increased. The regression equations describing these relationships (X = % tops in the forage component of the diet) were: voluntary consumption index (kg DM/100 kg live weight) = 1.74.164X -.00009X^2; daily gain (g/d) = 593 + 2.51X; feed conversion (kg DM/kg gain) = 7.71 +.0134X. The content of dry matter and of Brix in the juice both of tops and stalk increased during the progress of the trial. The voluntary consumption index also decreased with time on experiment, this effect being more noticeable for the diets with higher proportion of stalk. There was a negative relationship between voluntary consumption index and Brix in juice for the 100% stalk ration (b = -.134 ±.054), this tendency being less marked with the 100% tops ration (b = -.0024 ±.058).

Key words: Sugarcane, cattle, stalk-top ratio

Sugar cane consists of two principal fractions; the stalks and the tops, which differ both in chemical composition and digestibility. For example, data from the literature indicate that the tops contain more nitrogen 5.6 vs 3.2 g/kg DM) and

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more crude fibre (320 vs 262 g/kg DM) (Anon 1974a), less total sugars (270 vs 443 g/kg DM) (Anon 1974b) and lower DM digestibility (61.5 vs 67.1%) (Montppellier and Preston 1976a,b). According to these data, the stalk should support a higher level of animal performance than the tops.

On the contrary, in trials carried out in Barbados, the addition of 30% of tops to a diet of derinded sugar cane stalk led to greater voluntary intake and faster live weight gain, however, feed conversion was poorer (James 1973).

The objective of this experiment was to quantify the effect on animal performance of a wider range of proportions of tops and stalk in sugar cane diet supplemented with urea, final molasses and rice polishings.

Materials and Methods

Treatments and Design: The treatments consisted of varying proportions of tops and stalk of 100:0, 80:20, 60:40,40:60 20:80 and 0:100 (fresh basis). These were evaluated in a production function design with one group of 10 animals on each treatment.

Animals: A total of 60 bulls principally Zebu, but with some crossbreds were used. They were approximately 2 years old and weighed 235 kg on average at the start of the trial. They had previously been on pasture in different areas of the State. They were stratified in order of weight into 6 groups, which were then allocated at random to the different treatments.

Diets: The stalk and the tops of the sugar cane were chopped separately, and then recombined in the feed trough according to the proportions laid down in the treatments. A solution of urea/molasses (283 g urea, 208 g water, and 581 g of final molasses/litre of solution) was sprayed over the feed at the rate of 50 ml/kg of fresh cane. In addition, rice polishings was given at the rate of 1 kg daily per animal in a single feed at 7 a.m. before giving the sugar cane. The daily ration of sugar cane was given in two feeds at approximately 9 a.m. and 3 p.m. The cattle also had free access to water and a mixture of salt and minerals (500 g common salt, 470 g rock phosphate and 30 g of trace minerals[1].

Measurements: The cattle were weighed individually every 14 days and rate of live weight gain calculated by regression of weight on time. Feed intake was recorded daily and measurements made of dry matter and Brix in the fractions of stalk and tops at 14 day intervals during the experiment.

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[1] Contains (g/kg): Mn 190 Fe 40, Cu 4, I 2.4, Co.4, Zn.2, $CaCO_3$ 833.

Results

Health: One animal on the 20% tops treatment was cut badly after 56 days in the trial and was slaughtered. The data for this animal were eliminated from the analysis.

Animal Performance: There was a wide range in live weight of the animals at the beginning of the experiment and because of this it was decided to have maximum uniformity within groups in order to reduce competition. As a result there were differences in initial live weight between the different treatment groups. In spite of this, statistical analysis showed no relationship between initial live weight and daily gain during the experiment.

Table 1:
Mean values for live weight feed maize and conversion (ten animal per treatment group)

	Tops:stalk (fresh basis)					
	0:100	20:80	40:60	60:40	80:20	100:00
Live weight, kg						
Initial	237	185	280	211	250	257
Final	296	245	348	287	327	339
Daily gain[1]	.605	.614	.699	.76	.788	.839
Intake, kg/d						
Fresh cane	11.37	14.5	16.62	16.29	15.5	18.64
Molasses	.739	.204	1.08	1.05	1.00	1.211
Urea	.160	.204	.234	.227	.216	.262
Rice polishings	1	1	1	1	1	1
Minerals	.06	.06	.06	.06	.06	.06
Total DM	4.52	4.66	6.49	6.4	6.76	7.5
Consumption index[2]	1.7	2.2	2.1	2.6	2.3	2.6
Conversion[3]	7.47	7.59	9.28	8.35	8.57	8.94

[1] Data determined by regression of live weight on time
[2] Intake of DM/100 kg LW/day
[3] DM/daily gain

Selecting the extreme treatments of 100% stalk and 100% tops, and relating voluntary consumption with Brix in the juice (table 4), it was found that the values for the slope (negative) of the regression the correlation coefficient and the level of significance of the slope, were greater for the treatment of 100% stalk than 100% tops. There was no significant relationship between voluntary consumption index and Brix on a dry matter basis.

Mean values for feed intake, conversion and change in live weight during the experiment are given in table 1. Both intake and rate of gain in live weight increased as the proportion of tops in the sugar cane feed was increased. In contrast, feed conversion became worse (figure 1).

Figure 1:
Relation between tops/stalk ratio and animal performance

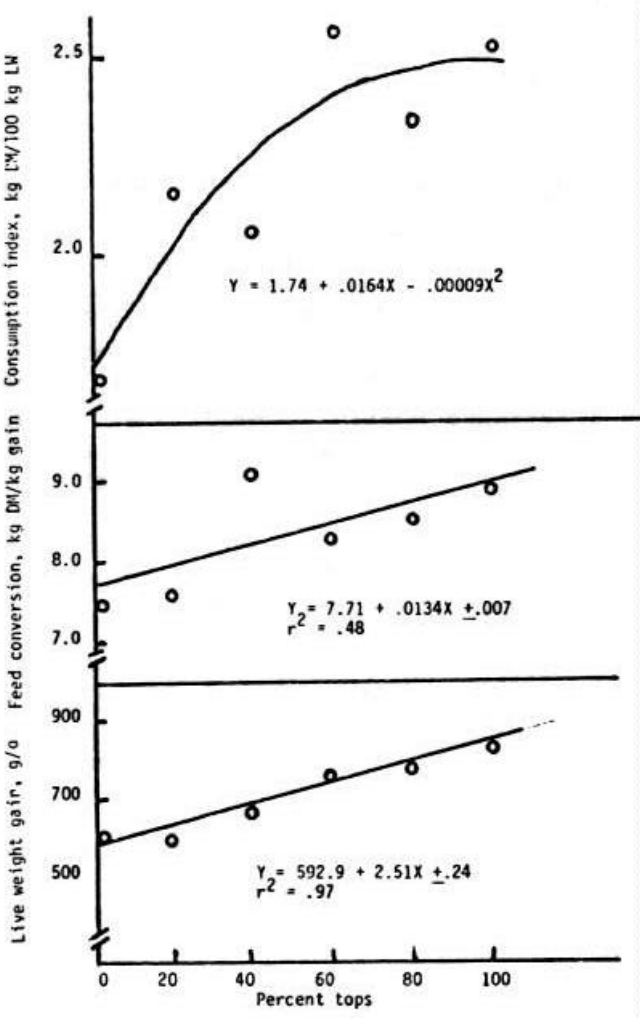


Table 2:
Mean values for dry wet content and Brix in juice and dry matter

	Dry Matter[2]		Brix in Juice[3]		Brix, Dry Basis[1]	
Days	Stalk	Tops	Stalk	Tops	Stalk	Tops
0 - 14	26.50	30.69	17.9 ±.21	7.85 ±.53	49.6	17.7
15 - 28	26.58	30.70	18.6 ±.37	10.34 ±.5	51.47	23.3
29 - 42	26.7	30.70	20.7 ±+.27	12.5 ±.89	56.8	28.2
43 - 56	26.9	28.84	20.6 ±.5	11.6 ±.51	56.0	28.7
57 - 70	29.9	31.76	21.37±.52	13.8 ±1.22	49.9	29.6
71 - 84	28.86	26.01	21.17±.48	10.8 ± 1.11	51.9	30.8
85 - 98	28.87	34.75	21.7 ±.70	13.6 ± 1.14	53.5	25.6

[1]Brix in DM = $\frac{(100 - DM\ \%)}{DM\ \%}$ Brix in juice
[2] One sample every 14 days
[3] Means and SE for daily samples

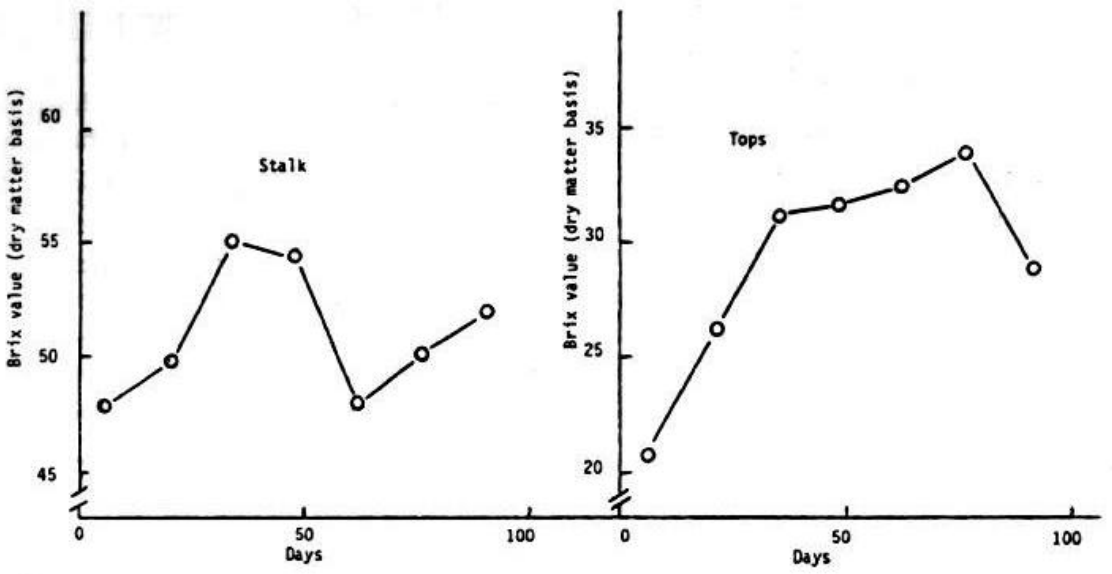
Composition of Sugar cane: Mean values for dry matter, Brix in juice and in DM for the tow sugar cane fractions are given in table 2. Both percent DM and Brix in juice showed a tendency to increase as the experiment progressed, however on a DM basis the pattern of Brix values was different (figure 2), with highest values recorded after 20 days (24 February) and 50 days (26 May) for tops and stalk, respectively.

There were significant relationships between time on experiment and the voluntary consumption index, although this effect was only significant for the treatments with highest proportions of stalk.

Table 3:
Relation between voluntary consumption index (Y) and time on trial (x= days)

% Tops	Regression coefficient (b ± SE)	Correlation coefficient (r)	Significance of regression coefficient
0	-.0070 ±.0023	-.81	P<.03
20	-.0062 ±.0029	-.69	P<.09
40	-.0037 ±.0020	-.63	P <.13
60	-.0052 ±.0024	-.70	P <.08
80	-.0070 ±.0045	-.57	P <.18
100	-.0036 ±.0036	-.40	P <.37

Figure 2:
Changes in Brix (dry matter basis) in stalk and tops during the trial



Discussion

James (1973) reported that the addition of 30% of chopped tops to derinded sugar cane stalk led to increased intake and live weight gain, but to a deterioration in feed conversion. However, live used only one level of tops (30%) and the stalk was derinded. In our experiment the whole stalk was used, nevertheless the tendency in animal performance was similar. The beneficial

effect of the tops can be attributed principally to its stimulating effect on voluntary intake.

The fact that feed conversion was poorer with tops than with stalks (and normally when live weight gain is increased there is a concomitant improvement in feed conversion) suggests that the nutritive value of the tops is less than that of the stalk (as a greater quantity was required to produce the same rate of live weight gain). This is in agreement with the findings of Montppellier and Preston (1976a,b) of a lower digestibility for tops than for stalk.

It is more difficult to explain why the tops should have a stimulating effect on voluntary intake. The tops contain more true protein and this could be expected to give rise to an increase in voluntary intake (see Leng and Preston 1976).

Table 4:
Relation between voluntary consumption index (Y) and Brix (x) in juice or corrected to dry matter for the 100% stalk and 100% tops treatments

Treatment measurement	Regression coefficient	Correlation coefficient	Range of values of Brix during the trial
Brix in juice			
100% stalk	-.134 ±.054	-.74	17.7 to 21.7
100% tops	-.0024 ±.058	-.02	7.85 to 13.8
Brix, DM Basis			
100% stalk	-.023 ±.009	-.25	49.6 to 56.8
100% tops	-.021±.011	-.35	17.7 to 30.8

The chopping of tops results in particles of a larger size than when the stalk is chopped or derinded, and this could give rise to a more rapid turnover of rumen digesta and, as a result, a greater feed intakes In this respect, Coombe and Briggs (1974), working with semi-purified diets based on waste paper reported increased intake and live weight gain in sheep when alfalfa hay was added to the basal ration. The paper had a higher organic matter digestibility (55%) than had the hay (50%), a situation similar to that encountered as between stalk and tops of sugar cane.

The reduction in voluntary intake on all the treatments as the trial progressed coincided with the increasing severity of the dry season. However, it is interesting to record that the effect was much more marked for the diets with the highest content of stalk. A typical characteristic associated with the advance of

the dry season is that the sucrose in the cane juice becomes more concentrated. It is therefore logical to think that the reduction in intake could also be associated with this increase in sugar concentration in the juice. The fact that there was a closer relationship (r), and higher values for the regression coefficient (b) between voluntary intake and Brix in juice on the diet of 100% stalk (r = -.74; b = -.134 ±.054) than on the diet with 100% tops (r =.02 ; b =.0024 ±.058), supports this hypothesis. The fact that there was no relationship between Brix values (dry matter basis) and voluntary intake, indicates that the effect of the sugars is physical rather than chemical. In other words, their possible properties, in terms of affecting voluntary intake, may be related to their being dissolved in the sugar cane juice. In this respect, the effect is similar to what has been encountered with liquid diets based on final molasses, in which it is considered that the phenomenon of osmosis may play an important role in determining voluntary intake (Benavides and Rodriguez 1971 Benavides and Preston 1971).

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