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*SHORT NOTE*

# THE NUTRITIVE VALUE OF SUGAR CANE (*SACCHARUM OFFICINARUM*) TOPS

C. DEVENDRA*

*Keywords:* Sugar cane tops, Nutritive value, Metabolisable energy, Urea

## RINGKASAN

Nilai pemakanan keratan ke atas pucuk tebu (SCT) iaitu satu bahan sampingan dari tanaman tebu telah ditentukan dari kajian-kajian imbangan dengan menggunakan kambing biri-biri tempatan. Di dalam perlakuan 1, SCT telah diberi makanan secara *ad libitum* sementara dalam perlakuan 2, SCT telah dicampurkan dengan 10 peratus gula merah dan 2.9 peratus urea. Terdapat perbezaan yang berkesan antara perlakuan di dalam pengambilan bahan basah dan kering ($P<0.05$) dan di dalam keboleh hadaman yang ketara ke atas protein kasar sahaja ($P<0.05$), yang mana dengan penambahan urea telah mencapai 41.0 peratus. Retensi N ialah 17.8 peratus. Imbangan Ca dan P, kecuali Mg adalah positif. Nilai pemakanan SCT ialah 0.7 peratus dari protein kasar yang dihadzamkan (DCP), 55.8 peratus ialah jumlah zat makanan yang dihadzam (TDN), 10.29 MJ/Mg tenaga hadzaman (DE) dan 8.44 MJ/Kg tenaga ungkaibina (ME).

## INTRODUCTION

The sugar cane plant possesses enormous potential for capturing solar energy, and it is known that along with other tropical grasses, the plant possesses an additional enzyme system which enables efficient conversion of this energy into carbohydrate (HATCH and SLACK, 1966). This reason, coupled with a relatively high yield potential of sugar cane and a variety of by-products, makes the plant particularly attractive for animal feeding.

Thus the whole plant and the various by-products from it have been extensively utilised for feeding various farm animals. Indeed it can be said that of the crops that are potentially valuable for animal feeding in the tropics, sugar cane is probably the most versatile. Molasses for example is used extremely widely, in both temperate and tropical countries as an energy source, to improve palatability and as a perfect substrate for non-protein nitrogen (NPN) source. The reports on utilisation are notably extensive and include for example, derinded 'comfith' whole plant (CIDA, 1973), intact whole plant (PRESTON *et al.*, 1976), sugar cane tops (COLEMENARES, 1960; CHAUDHARY *et al.*, 1972); bagasse (RANDEL, CARRERA and VALENCIA, 1970; DEVENDRA, 1979; MARTIN, 1981), molasses (TILLMAN, *et al.*, 1951; PRESTON, 1973; DEVENDRA, 1976) and filter cake mud (PEREZ, TZVETANOV and LAMAZARE, 1982).

The principal by-products from sugar cane cultivation are cane tops, final (blackstrap) molasses and bagasse, with extraction rates of about 30, 3–4 and 25 per cent respectively, relative to the whole plant. In terms of the area under the crop in Malaysia, the approximate total availability of sugar cane tops (SCT) alone is estimated to be about 262 x $10^3$m tons. Currently, most of the tops are burned to facilitate harvesting the cane for sugar production and also to reduce problems of pests. However, it is also possible that if the SCT can be shown to be useful for animal feeding, especially in the vicinity of sugar cane growing areas such as Perlis, then effective use can be made by ruminants to convert the roughage resources to useful product such as meat. As a first step in this approach, an initial study was undertaken to determine intake and the nutritive value of the material: this paper reports the results of this study.

*Feed Resources and Animal Nutrition Branch, MARDI, Serdang, Selangor.

## MATERIALS AND METHODS

The techniques used for the balance trial, sampling of feed and chemical analyses of faeces and urine were as previously described (DEVENDRA, 1975). The residual feeds were also analysed for chemical constituents and compared with the feed given; no differences were detected. A 10 per cent sample of both faeces and urine were bulked and used in the analyses.

The SCT were cut fresh during sugar cane harvesting in Perlis during May 1982, collected and transported by lorry to MARDI, Serdang, where they were chopped into 3–5 cm length for feeding. A single load was sufficient for the trial. The feed was stored air dry in open pens during the feeding period.

One balance trial (21 days duration: 14 days adaptation and 7 days collection) was completed, in which chopped SCT was fed to sheep *ad libitum* or SCT supplemented with 10 per cent molasses and 2.9 per cent urea (feed grade, 281 per cent crude protein). The inclusion of the latter increased the crude protein content of SCT from 3.8 to 11.9 per cent.

A total of eight adult indigenous sheep (approximate live weight 23 – 24 kg) were used for the trial, four per treatment. The animals were in good condition and were routinely drenched with Nilverm for stomach worms. Clean drinking water was provided *ad libitum*.

## RESULTS AND DISCUSSION

### (1) Chemical Composition

*Table 1* presents the chemical composition and mineral content of the SCT. The most conspicuous aspects are the low crude protein, high crude fibre and low P contents in the forage. The gross energy content was relatively high.

### (2) Intake

*Table 2* sets out the pattern of the feed intake. The intake of SCT was increased significantly ($P<0.05$) with molasses/urea supplementation, but the dry matter intake (DMI) and DMI as percentage of mean live weight were not significantly different between treatments. The increased DMI is due to the availability of increased dietary protein which is essential to stimulate intake above the critical minimum level of 6 per cent (MILFORD and MINSON, 1968; DEVENDRA, 1978).

### (3) Digestibility

The apparent digestibility of SCT and SCT + molasses/urea showed that there were only significant differences ($P<0.05$) for crude protein *(Table 3)*. The apparent digestibility of dry matter of 51.1 per cent is comparable to values of 43.3 to 49.6 per cent for *in vitro* studies (CHAUDHARY *et al.*, 1972). In GUADELOUPE, GEOFFROY and VIVIER (1975) have reported higher dry matter digestibilities of 54 to 60.1% also *in vitro*.

### (4) Nitrogen and mineral balance

Data on nitrogen (N) balance indicated *(Table 4)* that the effect of the supplementation was to increase N retention significantly ($P<0.05$). This was associated with a marked increase in N retention (17.8 per cent) compared to a negative N balance with SCT alone. Data for Ca, P and Mg balances indicated that except for Mg, Ca and P were consistently negative.

Although N digestibility and retention was improved, it is conceivable that the situation could have been further improved in the presence of some pre-formed proteins. In this respect, the use of for example, proteins from *Leucaena leucocephala* forage may have been advantageous. Thus PEPITO (1966) fed sugar cane tops with supplemental concentrates and ipil-ipil in the Philippines and recorded 0.41 to 0.51 kg/day live weight

TABLE 1: THE CHEMICAL COMPOSITION OF SUGAR CANE TOPS (SCT) AND SCT SUPPLEMENTED WITH MOLASSES/UREA

(% dry matter basis)

| Constituent | SCT | SCT + Molasses/Urea |
|---|---|---|
| Crude protein (N x 6.25) | 3.8 | 9.0 |
| Crude fibre | 38.0 | 34.7 |
| Ether extract | 1.8 | 1.6 |
| Ash | 4.9 | 6.4 |
| Nitrogen-free extract | 51.5 | 48.3 |
| Energy (MJ/Kg) | 20.15 | 19.92 |
| Ca | 0.18 | 0.25 |
| P | 0.02 | 0.01 |
| Mg | 0.18 | 0.11 |

TABLE 2: THE VOLUNTARY FEED INTAKE OF SHEEP FED CHOPPED SUGAR CANE TOPS (SCT) OR WITH MOLASSES UREA (SMU) ADDED

(Each value is the mean of 4 sheep)

| Parameter | Treatments | | L.S.D* P = 0.05 |
|---|---|---|---|
| | SCT++ | SMU+++ | |
| Fresh intake (g/day) | 391.8 | 452.0 | 26.8 |
| Dry matter intake (DMI/day/g) | 351.0 | 382.5 | 17.4 |
| DMI/Kg$^{0.75}$ (g/day) | 33.3 | 35.8 | N.S. |
| Relative intake (%)+ | 41.4 | 44.7 | N.S. |
| DMI as % of mean live weight (%) | 1.5 | 1.6 | N.S. |

+Relative intake = $\frac{\text{Observed intake}}{80\text{x kg}^{0.75}} \times 100$

++Sugar cane tops (SCT)
+++SCT + Molasses + Urea
*Least significant difference (P = 0.05)

gain in bulls. In Mexico, the dry matter digestibility of immature stalks, immature tops, mature stalk and mature tops fed to bulls together with molasses/urea and rice polishings were 65.6, 62.2, 61.1 and 55.6 per cent respectively (FERREIRO, PRESTON and SUTHERLAND, 1977).

**(5) Nutritive value**

The determination of digestibility enabled an assessment of nutritive value of SCT *(Table 5)*. The DCP value of 0.7 per cent is somewhat higher than the values of 0.2 – 0.5 per cent reported for sheep, goats and cattle by MCDOWELL *et al.*, (1974). However, the DE values of 10.29 MJ/Kg and ME value of 8.44 MJ/Kg are within the range of the DE values of 10.17 – 10.62 MJ/Kg and ME values of 8.37 – 8.70 also reported by MCDOWELL *et al.*, (1974). Similarly, the TDN value of 55.8 per cent determined in

TABLE 3: APPARENT DIGESTIBILITY OF SUGAR CANE TOPS (SCT) AND SCT SUPPLEMENTED WITH MOLASSES/UREA (%)
(Each value is the mean of 4 sheep)

| Constituent | SCT | SCT + Molasses/ Urea | t-value |
|---|---|---|---|
| Dry matter | 40.7 | 40.1 | N.S.+ |
| Organic matter | 43.0 | 41.9 | N.S |
| Grude protein (N x 6.25) | 17.2 | 40.7 | ** |
| Crude fibre | 50.8 | 47.0 | N.S |
| Ether extract | 17.6 | 10.6 | N.S |
| Ash | –ve | 2.5 | – |
| Nitrogen-free extract | 40.4 | 39.7 | N.S |
| Energy | 51.1 | 47.2 | N.S |
| Ca | –ve | –ve | – |
| P | –ve | –ve | – |
| Mg | 27.0 | 10.2 | 8.4 |

+ Not statistically significant
** $P<0.01$

TABLE 4: NITROGEN BALANCE
(Each value is the mean of 4 sheep)

| Parameter | Sugar cane tops (SCT) | SCT + molasses/ Urea | 't'-value |
|---|---|---|---|
| Nitrogen intake (g/day) | 2.35 | 4.37 | ** |
| Nitrogen in faeces (g/day) | 1.99 | 2.58 | ** |
| Nitrogen in urine (g/day) | 2.14 | 1.01 | * |
| Balance (g/day) | –1.78 | 0.78 | – |
| Apparent digestibility (%) | – | 41.0 | – |
| N retention as percentage of intake (%) | – | 17.8 | – |

this study is also comparable to the value of 55.2 per cent reported by McDowell *et al.*, (1974).

The net energy for fattening (NEF) was also calculated using the Rostock equation (Schiemann *et. al.*, 1971): $Y = 1.82 X_1 + 8.39 X_2 + 1.90 X_3 + 1.90 X_4$ where Y = NEF, $X_1$ = DCP (g), $X_2$ = digestible crude fat (g), $X_3$ = digestible crude fibre (g) and $X_4$ digestible nitrogen – free extract (g). The NEF of sugar cane tops was found to be 1.17 MJ/Kg.

**(6) Practical implications**

The practical implications of this study are that while SCT are potentially useful for

TABLE 5: NUTRITIVE VALUE OF SUGAR CANE LEAVES

| Constituent | Value |
|---|---|
| Digestible crude protein (%) | 0.7 |
| Total digestible nutrients (TDN, %) | 55.8 |
| Digestible energy (MJ/Kg) | 10.29 |
| Metabolisable energy (MJ/Kg) | 8.44 |
| Net energy for fattening (MJ/Kg)* | 1.17 |

*Calculated from the Rostock equations published by Shiemann *et al.* (1971)

ruminants, their effective utilisation can only be brought about by supplementation with molasses to mainly increase palatability and urea to promote increase intake. Effective feeding systems involving SCT would need also to ensure that the material is chopped, well mixed with molasses/urea and possibly also supplemented with less degradable proteins in the rumen such as *L. leucocephala* forage.


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## SUMMARY


The nutritive value of sugar cane tops (SCT), one of the by-products from sugar cane cultivation was determined from balance studies using indigenous sheep. In treatment 1, SCT was fed *ad libitum* and treatment 2 involved feeding SCT supplemented with 10 per cent molasses and 2.9 per cent of feed grade urea. There were statistically significant differences ($P<0.05$) in the intake of fresh and dry matter ($P<0.05$) and in the apparent digestibility of crude protein ($P<0.05$) which with urea supplementation, reached 41.0 per cent. The corresponding N retention was 17.8 per cent. Except for Mg, Ca and P were in negative balance. The nutritive value of SCT was 0.7 per cent digestible crude protein (DCP), 55.8 total digestible nutrients (TDN), 10.29 MJ/Kg digestible energy (DE) and 8.44 metabolisable energy MJ/Kg (ME).


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