# DIGESTIBILITY OF STALK AND TOPS OF MATURE AND IMMATURE SUGAR CANE

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Eight crossbred Zebu steers of mean initial weight 190 kg were used in a 4 x 4 latin square design with 2 replications to determine DM digestibility and voluntary intake of rations based on stalk or tops of mature or immature sugar cane. The criterion for maturity was the number of internodes and the Brix of the juice. Means for repeated estimates during the trial were: internodes 7.3 and 19 for immature and mature cane while the Brix vales were 9.63, 6.61, 15.2 and 7.22 (SE ± .49) for immature stalk, immature tops, mature stalk and mature tops respectively. Feeding was ad libitum. The stalk and tops were processed in a high speed chopper to give particle sizes of approximately 5 mm for stalk and 20 mm for tops. To each fraction of cane a solution of molasses/urea (220 g urea/litre) was added at the rate of 50 ml/kg of fresh cane. Each animal also received 500 g/d of rice polishings and 40 g/d of minerals. Each period lasted 18 days, a total collection of faeces being made during the last 5. Digestibility of DM was 65.6, 62.2, 62.1 and 55.6 for immature stalk, immature tops, mature stalk and mature tops respectively. There were significant differences in favour of stalk compared with tops and the immature as compared with the mature plant. Voluntary consumption index (kg DM/100 kg of live weight) was 2.06, 2.3, 2.0 and 2.16 for the different treatments according to the order previously described.

*Key words: Sugar cane, cattle, cane maturity*

When sugar cane is grown for sugar production, harvesting is performed at maturity which coincides with the dry season. For cane grown for animal feeding it would be useful if it could be harvested at other times of the year. Alvarez and Preston (1976) found that young cane significantly decreased growth performance when compared with mature cane as components of similar diets.

The present experiment was carried out to test whether there are major differences in digestibility between mature and immature cane, which might explain thin effect.

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## Materials and Methods

*Treatment and Design*: Eight crossbred Zebu steers of average weight 206 kg were used in two balanced latin square patterns of diets in which the principal energy sources were : (A) immature cane stalk (7 nodes);(B) immature cane tops, (C) mature cane stalk (19 nodes), (D) mature cane tops. The animals were 18 days on each treatment, spending the final 9 days in digestibility cages.

*Diets*: The cane factions were chopped, mixed with urea/molasses (220 g urea/litre) at 50 ml/kg of cane and fed ad libitum. 40 g/day of minerals were also given the mineral mix consisted of 50% sodium chloride, 47% rock phosphate and 3% trace minerals. The cane was given at 8:00 a.m. and 2:00 p.m. Rice polishings (0.5 kg/d) was offered at 7:00 a.m; water was freely available.

*Procedure*: Consumption was measured daily and 200 g samples of the diet collected daily were pooled for DM determination. Faeces were weighed at 9:00 a.m. daily, and 5% samples stored and pooled for DM determination. Faeces collections were begun 48 hr after placing the animals in the cages. Animals were weighed at the beginning and end of each period. Stomach tube samples of rumen fluid were taken at the end of each treatment for the determination of volatile fatty acid proportions by gas chromatography (Gonzalez and MacLeod 1976). Brix on juice and proximate analyses were made by standard methods, the former on daily samples the latter on pooled samples from each of the treatments.

## Results

Brix values, dry matter digestibilities and consumption indices are shown in table 1.

*Table 1:*
*Mean values for digestibility, voluntary intake and Brix °*

| | Immature | | Mature | | Significance level |
|---|---|---|---|---|---|
| | Stalk | Tops | Stalk | Tops | |
| Brix ° in juice | 3.63[b] | 5.61[d] | 15.23[a] | 7.22[c] | P <.001 |
| Digestibility of DM,% | 65.65[a] | 62.15[ab] | 62.14[ab] | 55.64[b] | P <.05 |
| Consumption index[1] | 2.06 | 2.30 | 2.00 | 2.16 | NS |

[1] Daily intake of DM (kg)/100 kg LW
[abcd] Means without superscript in common differ at P <.05

Despite the marked differences in sugar content reflected in the Brix of the cane juice, the only significant difference in digestibility was found between immature stalk and mature tops. Consumption of DM was similar on all four treatments with a slightly higher value (P<.01) on immature tops compared with mature stalks. Intake of digestible DM did not differ between treatments.

*Table 2:*
*Proportions of volatile fatty acids in rumen fluid*

| | Immature | | Mature | |
|---|---|---|---|---|
| | Stalk | Tops | Stalk | Tops |
| Molar % | | | | |
| Acetic acid | 68.6 | 76.3 | 69.3 | 77.6 |
| Propionic acid | 22.8 | 16.6 | 22.83 | 15.00 |
| Butyric acid | 7.83 | 7.0 | 7.66 | 6.83 |

Samples of rumen contents from animals fed cane stalk showed higher propionate to acetate ratio than when tops were fed, but there were no discernible differences due to stage of maturity of the cane (table 2).

Proximate analyses of feed and faeces are shown in table 3. Calculations of Brix values on a dry matter basis showed this measure to be greater for immature (50.5°) as compared with mature stalk (43.5°). Both mature and immature tops had similar Brix values (20.9° for immature compared with 21.5° for mature tops)

*Table 3:*
*Composition (%) of sugar cane fractions for the different treatments*

| | Immature | | Mature | |
|---|---|---|---|---|
| | Stalk | Tops | Stalk | Tops |
| Sugar cane fractions | | | | |
| Dry matter | 16.0 | 21.2 | 25.9 | 25.3 |
| Ash[1] | 0.51 | 1.64 | 0.55 | 2.45 |
| Lipids[1] | 1.50 | 1.40 | 1.10 | 2.30 |
| N x 6.25[1] | 1.33 | 1.85 | 0.82 | 1.64 |

[1] Dry matter basis

*Table 4:*
*Mean values for animal performance in the experiment of Alvarez and Preston (1976) with immature and mature cane*

| | Immature | Mature | SEx |
|---|---|---|---|
| Daily gain in LW, kg | .27[a] | .52[b] | ± .026 |
| Daily feed intake, kg | | | |
| Sugar cane | 13.8 | 12.4 | |
| Total DM | 4.25 | 4.78 | |
| Consumption index[1] | 1.87 | 2.03 | ± .06 |
| Feed conversion[2] | 19.4 | 9.48[b] | ± .27 |

[1] Feed DM (kg)/100 kg LW
[2] DM intake/gain in LW
[ab] Means without superscript in common differ at P<.05

## Discussion

The analyses performed on the cane used in the present experiment show the expected differences in Brix and DM between the mature and immature canes, and agree with the results of Banda and Valdez (1976) in indicating more cell wall material (fibre) in the immature cane. Nevertheless, the digestibilities obtained in vivo do not show the large differences found by these authors using an in vitro technique, which gave 57.5% for digestibility of immature cane and 70.5% for mature cane. This discrepancy suggests the need for a comparative examination of a range of cane samples by the two techniques and perhaps the need for some caution in extrapolating from the in vitro technique.

In comparing the experiment with that of Alvarez and Preston (1976), the canes used were similar in Brix and DM but in the present experiment there were no differences in digestible DM intake for the four treatments, suggesting that the animals ate to an energy requirement dictated by the level of supplementation used; whereas in the earlier experiment there was a significant differences equivalent to some 24% greater consumption of cane DM for animals given mature compared with those given immature cane.

In the present experiment, each part of the cane was fed separately while in the experiment of Alvarez and Preston (1976) whole cane was used. Linear combination of the consumption figures shown in table 1 shows no difference in consumption to be expected between mature and immature whole cane. Ferreiro and Preston (1976) have observed with mature cane that inclusion of tops increases performance over stalks alone. If this effect were obtainable only with mature cane it might explain the apparent differences in consumption data between the two experiments.

The results reported here suggest that the explanation of the superiority of mature cane, in terms of animal performance, is not because of its improved digestibility over immature cane. It is becoming clear that the major limiting nutrient with cane diets is protein, and consequently explanations of the difference in performance between mature and immature cane are likely to lie in the direction of improved efficiency of rumen microbial synthesis with mature cane.

The response to protein on cane diets, is steep, and only a relatively small change in synthesising efficiency of the rumen microbial population would be required to explain the observed difference in animal performance

## Conclusions

The nutritional superiority of mature over immature cane is not due to improved digestibility, or voluntary intake.

## References

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