THE EFFECT OF FORAGE ON VOLUNTARY INTAKE AND LIVEWEIGHT GAIN IN CATTLE RECEIVING SUGAR CANE JUICE

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In the first of two experiments, eight crossbred Zebu bulls were randomly divided into two treatment groups. Each group received 5 kg/head/d of either chopped whole sugar cane or chopped grass (*Brachiaria decumbens*). The animals were fed 750 g/d of cottonseed meal plus 70 g/d of minerals and had free access to sugar cane juice containing 0.8% urea sad 0.01% formaldehyde, throughout the 84 day experimental period. There was a significant difference ($P < .05$) in dry matter intake between the grass and cane-fed animals (6.08 and 4.74 kg DM/d respectively) accounted for largely by differences in intake of cane juice (4.16 and 2.95 kg DM/d).

In the second experiment, eight crossbred Zebu bulls were randomly allocated to two treatment groups. All animals were fed Leucaena leucocephala at a rate of 1.6% of liveweight (fresh basis). Four animals also received 1 kg/d cottonseed meal. Initially the supplemented animals consumed more cane juice than the non-supplemented group but by week 4 this difference had disappeared.

The type of forage offered to cattle receiving diets based on sugar cane juice appears to affect juice intake. In addition, protein supplementation can be expected to increase juice intake when fed with low-nitrogen forages, this effect being less important with a high-nitrogen forage such as leucaena.

Key words: Cattle, sugar cane juice, leucaena, feed intake

Preliminary experiments in Mexico on the use of extracted sugar cane juice as the basic energy source for growing cattle demonstrated its high potential for promoting liveweight gain (Sanchez and Preston 1980). Work in Santo Domingo on milk production suggested that the type of forage included in the ration could have an important influence on production (Gill et al 1981). Substitution of grazing by chopped whole sugar cane decreased milk production in animals fed molasses or cane juice, the effect being more pronounced in the cows receiving juice.

The experiments to be described here were designed to compare the effects of different forages and the presence or absence of a protein supplement on the voluntary intake of sugar cane juice and the consequent effect on weight gain.

Materials and Methods

Experiment 1: Eight crossbred Zebu bulls with an average initial live weight of 254 kg were randomly divided into two treatment groups. One group received 5 kg/head/d of chopped whole sugar cane while the other four animals had 5 kg/head/d of cut grass (*Brachiaria decumbens*). . All animals received 750 g/d of cottonseed meal plus 70 g/d of minerals. In addition each bull had free access to sugar cane juice containing 0.8% urea and 0.01% formaldehyde as a preservative. The cattle were kept in individual pens with free access to water. Intake of juice and forage was measured daily. The cattle were weighed every two weeks and liveweight gain calculated by linear regression over the 84 day experimental period. Samples of the

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grass, sugar cane and cottonseed meal were taken at fortnightly intervals for determination of dry matter (DM), organic matter (OM) (ashing at 500°C for 4 h) and total nitrogen (Kjeldahl method). Samples of the juice were taken twice weekly for measurement of pH and °Brix. The proceedures for extracting the cane juice and chopping the whole cane were the same as described by Gill et al (1981) .

Experiment 2: Eight crossbred Zebu bulls of about 300 kg liveweight were randomly allocated to two treatment groups. All eight animals were offered sugar cane juice (with 0.8% urea) ad libitum and Leucaena leucocephala at the rate of 1.6% of liveweight (fresh basis). Four of the animals received 1 kg/d cottonseed meal. The animals were kept in individual stalls with water freely available. Each animal also received 70 g/d of minerals. Intakes of juice and leucaena were measured daily over a period of 5 weeks.

Results and Discussion

Experiment 1: Intake and liveweight gain data for the animals receiving grass or chopped whole sugar cane as the forage supplement are given in Table 1. Total DM intake was higher ($P < .05$) in the grass-fed animals apparently due to the higher intake of cane juice ($P < .05$).

Table 1:

The effect of cut grass or chopped whole sugar cane supplementation on intake and liveweight gain in animals receiving cane juice ad libitum with 750 g/d of cottonseed meal

	Grass	Sugar Cane	$SE_{\bar{x}}$	Probability
Feed intake, kg DM/d				
Sugar cane juice	4.16	2.95	± .32	0.04
Forage	1.24	1.11	± .06	0.15
Cottonseed meal	0.68	0.68		
Total	6.08	4.74	± .27	0.02
Liveweight gain kg/d[1]	0.742	0.610		0.18
Consumption index[2]	2.03	1.79	±0.086	0.07
Feed conversion[3]	8.31	7.82	± .40	0.43

[1] By regression of liveweight on time on experiment

[2] kg DM/100 kg liveweight/d

[3] kg DM/kg liveweight gain

Sanchez and Preston (1980) reported a significant positive effect of the protein supplement on voluntary intake and liveweight gain of cattle receiving cane juice as the basis of the diet, They also suggested that poor quality forage had a negative effect on growth rate.

Salais et al (1977) compared Bermuda grass with chopped whole sugar cane in cattle fattening diets based on liquid molasses. Intake of molasses and liveweight gain were higher on grass than on sugar cane.

It is not yet understood how forage quality affects voluntary intake on sugar-based diets. The protein content of sugar cane is less than in grass and the rate of degradation of sugar cane fibre in the rumen is very much slower (Amarelys Santana and F D De B Hovell unpublished data). Protein: energy relationships probably affect intake by changing the level of energy metabolism; while rate of fibre breakdown in the rumen is likely to influence rate of passage of digesta. Work is proceeding in both these areas with molasses and cane juice-baaed dicta. The difference in total DM intake of the grass and cane-fed animals is reflected in the data for liveweight gain (0.742 kg/d on grass versus 0.610 kg/d on cane-fed animals (P = .18)).

Table 2:

Adaptation to sugar cane juice in presence or absence of cottonseed meal (Experiment 2)

Stage of experiment (Weeks)	Intake of juice (litres/100 kg LW/d) With cottonseed meal	Without cottonseed meal	$SE_{\bar{x}}$	Probability
2	7.0	5.1	± .50	P .01
3	7.2	5.4	± .54	P .01
4	7.2	6.8	± .31	NS
5	7.5	7.1	± .67	NS

Experiment 2: Leucaena has a much higher protein content than either grass or cane, however, further supplementation with cottonseed meal (1 kg/d) significantly (P < .01) increased the intake of sugar-cane juice during the second and third weeks of experiment 2. In subsequent weeks (weeks 4 and 5) there was no difference between treatments (Table 2). Other workers have reported a minimum ratio of protein to energy to support maximum voluntary intake (Egan 1974), suggesting that the presence of protein (at a postruminal level) increases the rate of metabolism of VFA's. The present results suggest that the intake of juice is primarily limited metabolically by the rate of absorption of VFA's from the rumen and that this control is modified in the presence of protein at a postruminal level. The initial response to cottonseed meal demonstrates that this supplement produces an immediate increase in the flow of protein into the duodenum, whereas the gradual increase in intake of the unsupplemented treatment suggests adaptation of the rumen microbes to the leucaena; finally resulting in a relatively high flow of microbial protein into the duodenum, sufficient to reach the appropriate protein to energy ratio. At this point, supplying supplementary protein as cottonseed meal had no effect on voluntary intake but would be expected to increase liveweight gain.

Conclusions

The quality of forage offered to cattle receiving rations based on sugar cane juice appears to have a marked effect on intake of the juice and on liveweight gain. In addition, protein supplementation would be expected to increase intake of juice when offered with low-nitrogen forages, but this effect is less important with a high quality forage such as leucaena.

References

Egan 1974 Protein-energy relationships in the digestion products of sheep on herbage based diets differing in digestibility and nitrogen concentration. Australian Journal of Agricultural Research 25:613-630

Gill Margaret, Berry S, Vasquez 0 & Preston T R 1981 Molasses and sugarcane juice as energy supplements for milk production Tropical Animal Production 6:~27132

Salais F J, Sutherland T M and Wilson A 1977 Effect on animal performance of different sources of forage in dicta based on molasses/and urea. Tropical Animal Production 2:158-162

Sanchez 11 and Preston T V. 1980 Sugar cane juice as cattle feed: comparisons with molasses in the presence or absence of protein supplement. Tropical Animal Production 5:117-124

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