RUMEN ADAPTATION TO DIETS BASED ON SUGAR CANE

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Ten animals fitted with rumen canulas were used to study adaptation to sugar cane diets since it was anticipated that a lactic fermentation might be the cause of metabolic disturbances during the period of adaptation. The animals were divided into two groups: (a) changed in stages of 7 days from receiving only chopped cane tops (100% tops) to (75% tops: 25% chopped stem) to (50% tops: 50% stem) to (25% tops: 75% stem); (a total of 28 days); and (B) an abrupt change in one day from 100% tops to 25% tops: 75% stem. Samples of rumen fluid were taken every 6 days one hr before and 3 and 6 hr after feeding in the morning. There were indicators of fluctuations of a wider magnitude in rumen parameters for the abrupt than for the gradual changeover. After 4 weeks the rumen fermentation pattern was identical for both systems. It is concluded that the risk of metabolic upsets in cattle changed over to sugar cane diets is negligible.

Key Words: Cattle, sugar cane, adaptation, rumen fermentation

It is known that the pattern of rumen fermentation changes with the type of diet, and normally when a change is made from a forage to a grain diet, the change is made gradually in order to avoid metabolic disturbances. With rapidly fermentable diets high in carbohydrates the metabolic turn about is considerable. changes occurring in the rumen resulting in a lactic fermentation.

It has been observed that when animals originating from grazing pasture are given feed based on sugar cane, there is often a period of 12-13 weeks when the growth of the animals is very uneven. This seems to be the period needed to adapt to the sugar cane diet.

In the experiment reported here we have measured some rumen parameters when the diet was changed either gradually, or abruptly.

Materials and Methods

Animals and Design: Ten Swiss X Zebu steers fitted with rumen canulas and weighing approximately 190 kg were divided into two groups of 5 (groups a and B). Sampling was within 5 periods of 6 days.

Diets: Group a was given initially a diet of chopped cane tops (100% tops). Chopped sugar cane stalk was substituted for the tops, changes being made at 7 day intervals by progressive substitution of 25% tops by stalk until the diet consisted of 25% tops: 75% stalk. (Thus the stages were 100% tops; 75% tops: 25% stalk; 50% tops: 50%

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stalk; 25% tops: 75% stalk). In group B the change was made abruptly from 100% tops one day to 75% stalk/25% tops the next day. These animals continued to receive 75% stalk/25% tops throughout the experiment. In addition all the animals received 10 g urea per kg fresh stem/top, salt, minerals, and water ad libitum.

Measurements: Rumen samples were taken 1 hr before feeding, and 3 and 6 hr after feeding on days 2, 4 and 6 of each period. The biomass of rumen protozoa, total VFA, proportions of VFA, and rumen ammonia were determined by the methods described by Minor et al (1977). Lactic acid was measured according to the method of Barker and Summerson (1941).

Results and Discussion

Changes in rumen parameters are shown in figures 1 to 4 and in table 1.

Larger fluctuations in dry matter intake were observed when the change was abrupt than when it was gradual. However, in the final periods, intakes were essentially similar. Rumen pH, one hr before feeding increased during the experiment, although differences between the two groups were small. pH 6 hr after feeding showed the same tendency, but with greater ranges with group B, reaching the values reported by Priego (1974)

Table 1:
Values for voluntary feed intake, ammonia and lactic acid in rumen fluid

			Rumen NH3, m-eq/litre				Lactic acid m-eq/litre	
	DM intake kg/d		Gradual		Abrupt		Gradual	Abrupt
	Gradual[1]	Abrupt[1]	1 hr before[2]	6 hr Aft[2]	1hr before	6 hr after	(6 hr after feeding)	
Day 6	3.62	3.23	30.7	32.5	29.7	29.7	8.0	3.1
Day 12	4.20	3.75	7.5	7.5	10.1	12.2	12.2	18.2
Day 18	3.40	3.75	6.8	8.1	7.4	13.5	4.2	4.5
Day 24	4.15	4.20	5.5	9.1	6.6	6.4	6.2	3.8
Day 30	4.45	4.30	4.6	5.8	5.4	3.5	3.9	4.0

[1] Refers to the treatment
[2] Refers to time of sampling

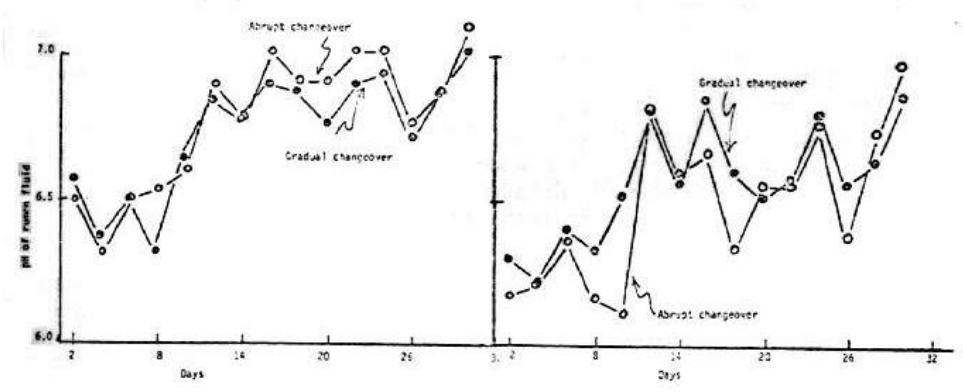

Figure 1a:
pH of rumen fluid for samples taken 1 hr before feeding

Figure 1b:
pH of rumen fluid for samples taken 6 hr after feeding

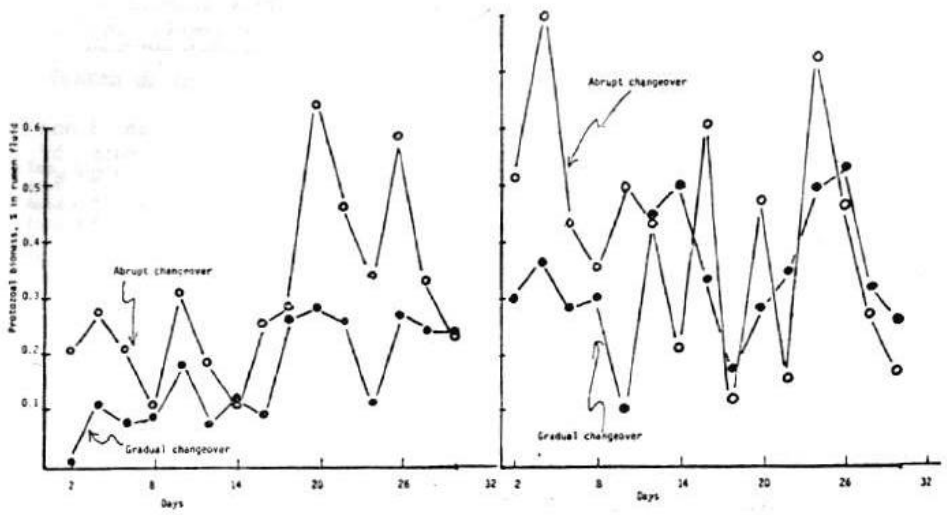

Figure 2a:
Protozoal biomass in samples of rumen fluid taken 1 hr before feeding

Figure 2b:
Protozoal biomass in samples of rumen fluid taken 6 hr after feeding

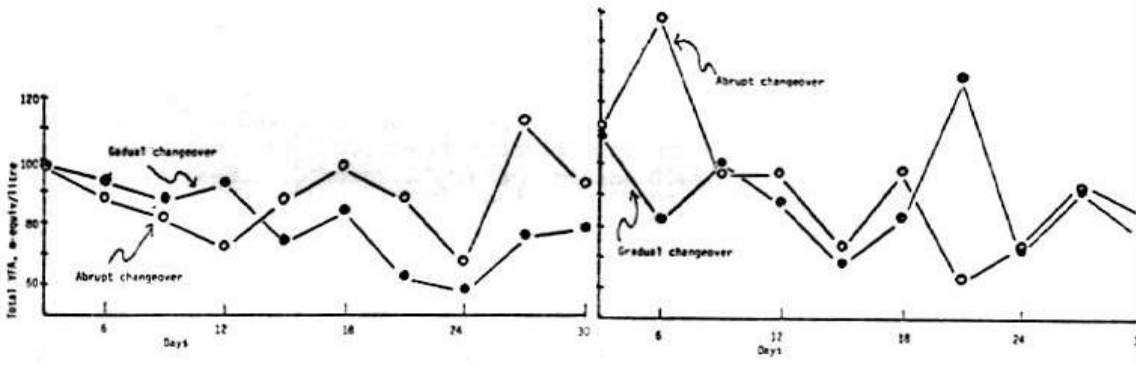

Figure 3a:
Total VFA concentration in rumen fluid samples taken 1 hr before feeding

Figure3b:
Total VFA concentration in samples of rumen fluid taken 6hr after feeding

Before feeding, the protozoal biomass was rather low, and there was little variation except for the two last periods with group B. However 6 hr after feeding we observed with group a, a series of cycles during the whole adaptation period similar to the diurnal fluctuations reported by Valdez et al (1977). It seemed that the abrupt change in diet had an even greater effect on the adaptation of the micro-organisms to the change of substrate, and it resulted in larger fluctuation in the biomass.

The molar proportions of VFA were typical of those usually observed on sugar cane diets. The values before feeding were similar for both changeover procedures, however, there were wider fluctuations at the 6 hr sample for the abrupt changeover. There was a tendency for propionate to increase and acetate to decrease in both groups.

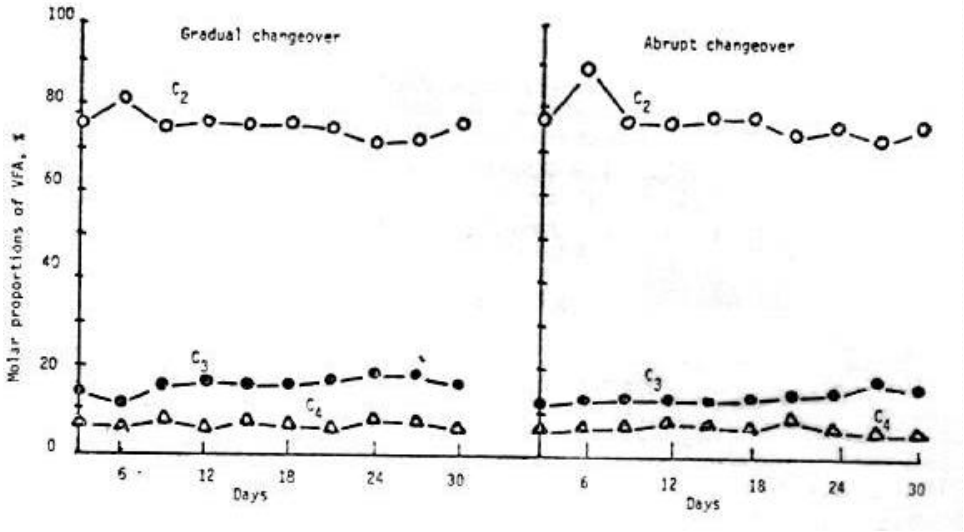

Figure 4a:
Proportions of VFA in samples of rumen fluid taken 1 hr before feeding

Total VFA levels before feeding showed slightly greater fluctuations during adaptation with group B. There was a tendency for this to decrease during the experiment, and at the end, the two groups were very similar.

Ammonia levels in the rumen were higher with both groups in the initial period, falling throughout the experiment. The lowest level which was reached by the final sample was similar to the limit recommended by Satter and Roffler (1977).

Lactic acid levels showed small differences in the first two periods, being very similar in the remaining periods although the levels were slightly higher than those reported by Marty and Sutherland (1970) with adaptation to diets of molasses.

The main source of the day to day fluctuations of the parameters measure was very probably related to variation in the composition of the cane due to changes in sugar and dry matter content during the trial caused by changes in temperature, sun light and rain (Ferreiro et al 1977). Other workers have reported large differences in the performance of cattle fed cane of different composition, e.g. immature as opposed to mature cane (Alvarez 1976), and it is possible that the variations observed in this experiment arose from similar but smaller changes.

Conclusions

The results indicate that changes in cane composition probably had a greater effect on rumen parameters, than the methods used to adapt the animals to the new diet. It appears therefore that there is little likelihood of metabolic problems arising during adaptation to cane diets even when this is made abruptly in the space of one day.

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