Tropical Animal Production 1983 8:215-222

SUPPLEMENTATION OF CATTLE WITH GREEN BANANA
I. EFFECT ON THE DIGESTION PARAMETERS OF THE FIBRE IN SUGARCANE TOPS[1]

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The effect of a green banana supplementation on fibre degradability was evaluated in feeding systems based on sugarcane tops. Six steers fitted with rumen cannulae, averaging 12 months and 240 kg of age and weight, respectively, were utilized. The animals were fed sugarcane tops ad libitum, a meat urea protein meal supplement (40:60) and green bananas in variable quantities, according to the treatment. Within the treatment, the green bananas represented 0, 21.6, 35.9, 55.1, 60.1 and 70.7% of the total DM intake. In situ rumen degradation, using dacron bags was the technique employed to determine accumulative digestibility of the cell wall constituents. The rumen degradation periods considered were: 6, 12, 18, 24, 48, 72 and 96 and 120 hr. Supplementary green banana levels higher than 21.6% resulted in an increment of the length of the slow digestion period and had a negative bearing on the potential degradation and digestibility rate of the fibre at the rumen level.

Key Words: Green bananas, sugarcane tops, digestion rate, fibre, starch

In Central America and the Caribbean the yearly production of bananas is 6,539.000 MT (FAO 1978), 20% of which is discarded because it does not meet export requirements of because of market saturation. Only part of the waste bananas is locally used for human feeding and monogastric animals; and the surplus is discarded, resulting in consequent pollution and problems of low efficiency utilization of the fruit. According to Le Dividich et al (1976), green banana waste is a good source of energy (3.0 Mcal ME/kg DM), rich in starch(72% of dry matter) and low protein and crude fibre contents (5.1 and 3.7% respectively). The availability and nutritional characteristics of waste banana make it a potentially highly valuable resource for cattle feeding,as starch sources have been shown to allow a more efficient utilization of the energy generated during the process of rumen fermentation, by generating greater proportions of propionate (Ørskov 1978) and improveing nitrogen retention (Ruiz and Ruiz 1978), apparently due to an increase in microbial protein synthesis (Olivo 1978). However, the utilization of energy supplements for cattle fed forages causes a reduction in digestibility (Lamb and Eadie 1979; Mertens and Loften 1980) and in the

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digestibility speed of the fibrous fragments (Campling 1966). Based on these antecedents the present work was carried out with the object of assessing the effect that a supplementation with wate green banana may have on the parameters of rumen digestion of the fibrous fraction and on cattle feeding sub-systems based on sugarcane tops.

Materials and Methods

Animals and their management: Six Romosinuan x Brahman steers fitted with rumen cannulae, averaging 240 kg and 12 months of weight and age, respectively were used. Before beginning the experiment, the animals were freed of internal and external parasites and for 30 days adapted to the experimental rations.

Treatments: The animals consumed cut sugarcane tops (*Sacchaum officinarum*) ad libitum, plus a protein supplement in which the meat meal represented 40% of the nitrogen, and urea the remaining 60%. This supplement was offered at variable quantities to give a crude protein intake of 325 g/100 kg LW/d. Moreover, minimum quantities of molasses were given as a vehicle for the protein supplement. The levels of waste green banana used were 0.0, 0.39, 0.80, 1.20, 1.68 and 1.89 kg DM/100 kg LW/day, which in turn represented 0.0, 21.6, 36.9, 55.1, 60.1 and 70.7% of total dry matter intake. The rations employed are given in Table 1.

Table 1:

Description of the rations given to steers fitted with rumen cannulae, kg DM/100 kg LW/day

Green banana	Sugarcane	Molasses	Meat and bone meal	Urea
0.000	*ad libitum*	0.152	0.253	0.053
0.388	" "	0.147	0.230	0.049
0.800	" "	0.152	0.231	0.048
1.200	" "	0.152	0.214	0.045
1.680	" "	0.160	0.194	0.040
1.889	" "	0.154	0.202	0.042

Determination of the accumulative digestibility of the cell wall constituents: The accumulative digestibility of the cell wall constituents (ADCW) of the sugarcane tops was determined by means of the in sity digestion technique, using dacron bags (Ørskov et al 1980). The digestion periods used were 6, 12, 18, 24, 48, 72, 96 and 120 hr. 5 g of sugarcane tops dry matter were introduced in the bags. The sugarcane tops had been previously ground to 3 mm particles in diameter. Replicates were used only in the first three rumen degradation periods. The ADCW values were corrected by the in and outflows of particles in the

bags, according to the methodology proposed by Playne et al (1978).

Digestion parameters: The ADCW in function of the degradation time at the rumen level was described by the function.

$$ADCW_i = \frac{1}{b + e^{-ct}}$$

were: $ADCW_i$ = Accumulative digestibility of the cell wall constituents at the given banana level, % (i = 1, 2, ...6)

$1/b$ = Potential digestibility of the cell wall constituents (CWC), %

c = Acceleration rate of the digestion of the cell wall constituents (CWC)

t = Degradation time, hours

Also estimated was the mean digestion time, defined as the number of hours required to digest 50% of the CWC potentially digestible.

Data analysis: The variations in the acceleration rate and the mean time of the cell wall constituents digestion, in function of the level of supplementary banana, were analysed by means of a non-linear regression model test.

Results

Accumulative digestibility of the cell wall constituents: Figure 1 shows the changes in the accumulative digestibility of the cell wall constitutents (ADCW) of sugarcane tops in function of the time they stay in the rumen. Table 2 gives regression coefficients and their de

Table 2:

Parameters and reliability of the model which describes the ADCW of sugarcane tops in function of the time[a/], for the different levels of supplementary banana

Level of banana %	Parameters					r^2
	b	±	s_b	c	± s_c	
0.0	0.0211	0.0012	0.1876	0.0168		0.94**
21.6	0.0190	0.0009	0.2151	0.0162		0.95**
35.9	0.0226	0.0012	0.1472	0.0189		0.93**
55.1	0.0198	0.0008	0.1021	0.0072		0.98**
60.1	0.0265	0.0013	0.0944	0.0079		0.99**
70.7	0.0262	0.0013	0.0476	0.0016		0.99**

a/ $ADCW, \% = \frac{1}{b + e^{-ct}}$

** Level of signification $p < 0.01$

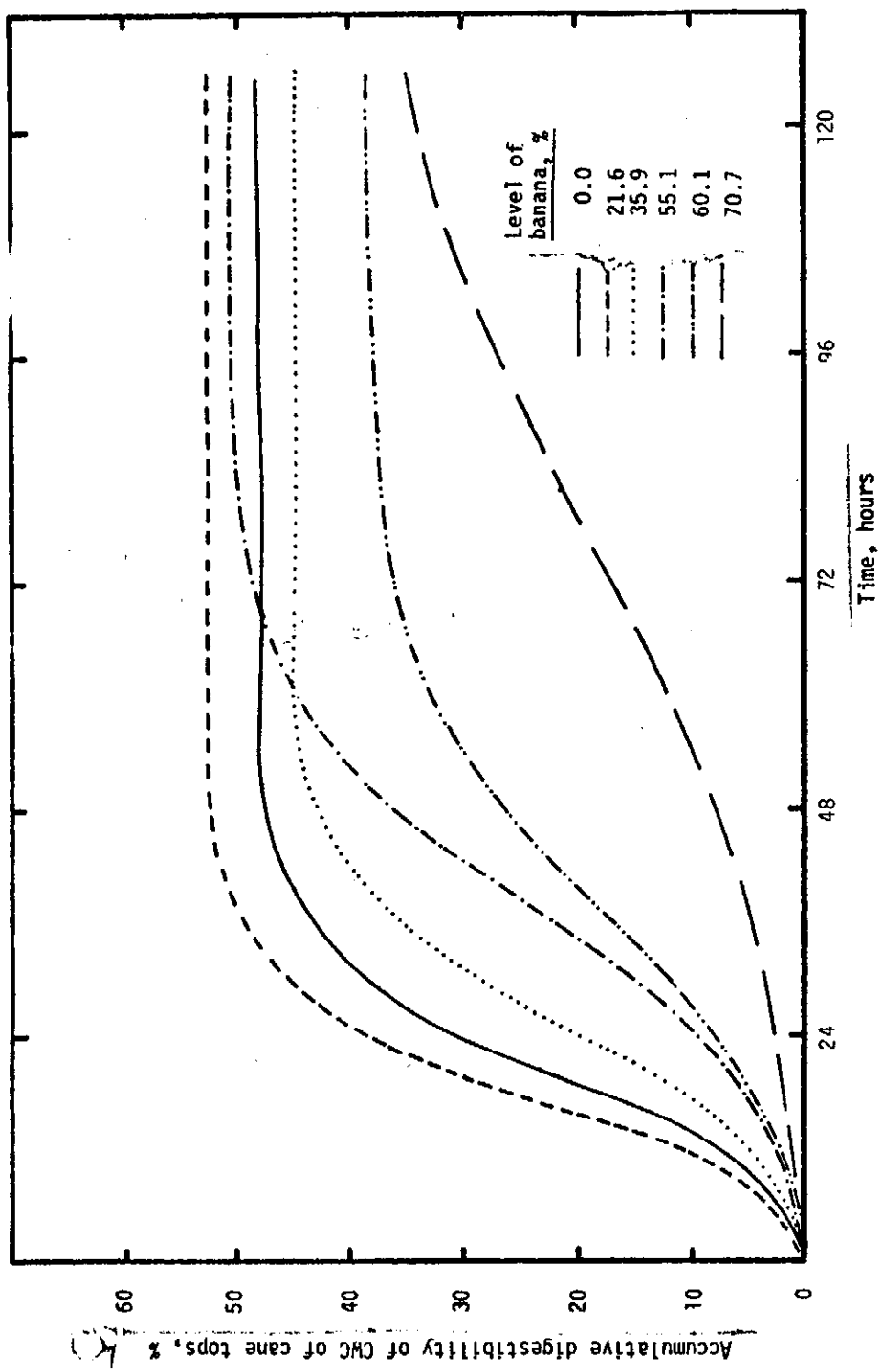
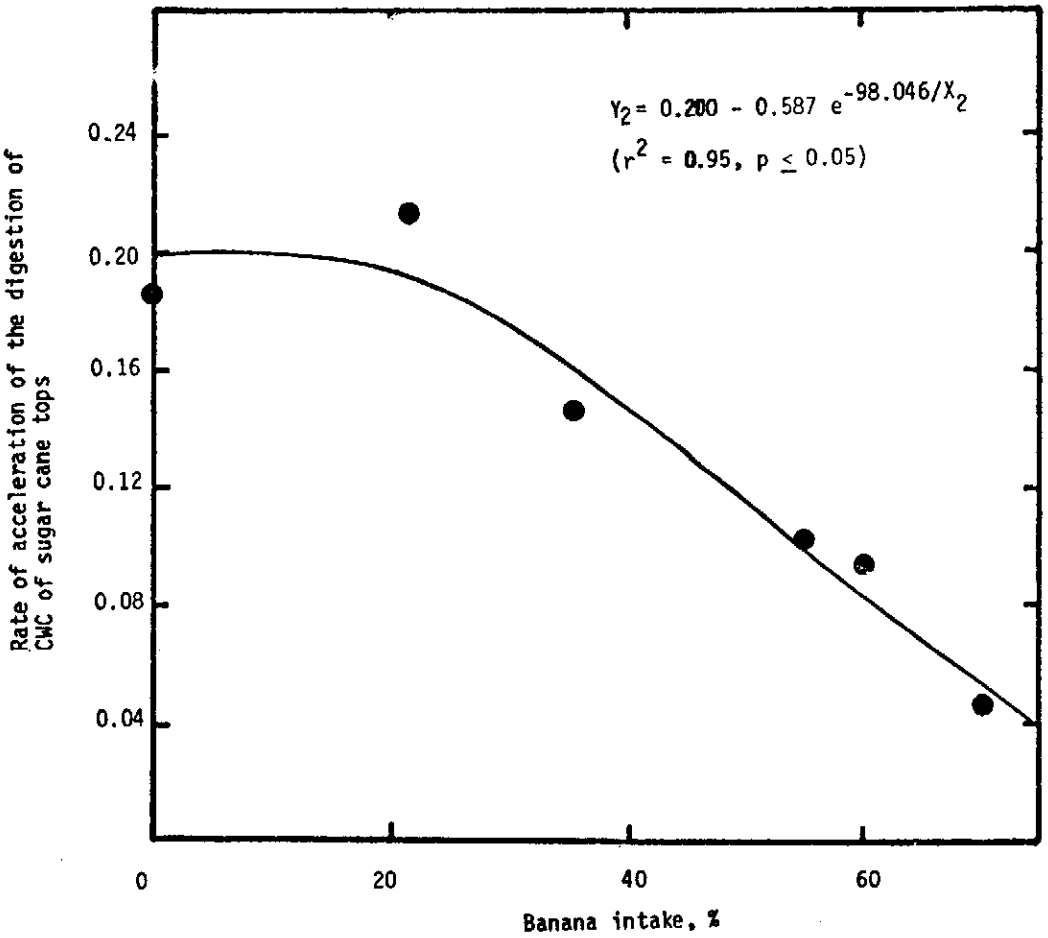


Figure 1:
Accumulative digestibilities of the cell wall constituents of cane tops (Y_1) in function of time (X_1) and level of supplementary banana (X_2)

Figure 2:

Acceleration rate of the digestion of cell wall constituents of sugar cane tops (Y_2) in function of the proportion of supplementary green banana (X_2)



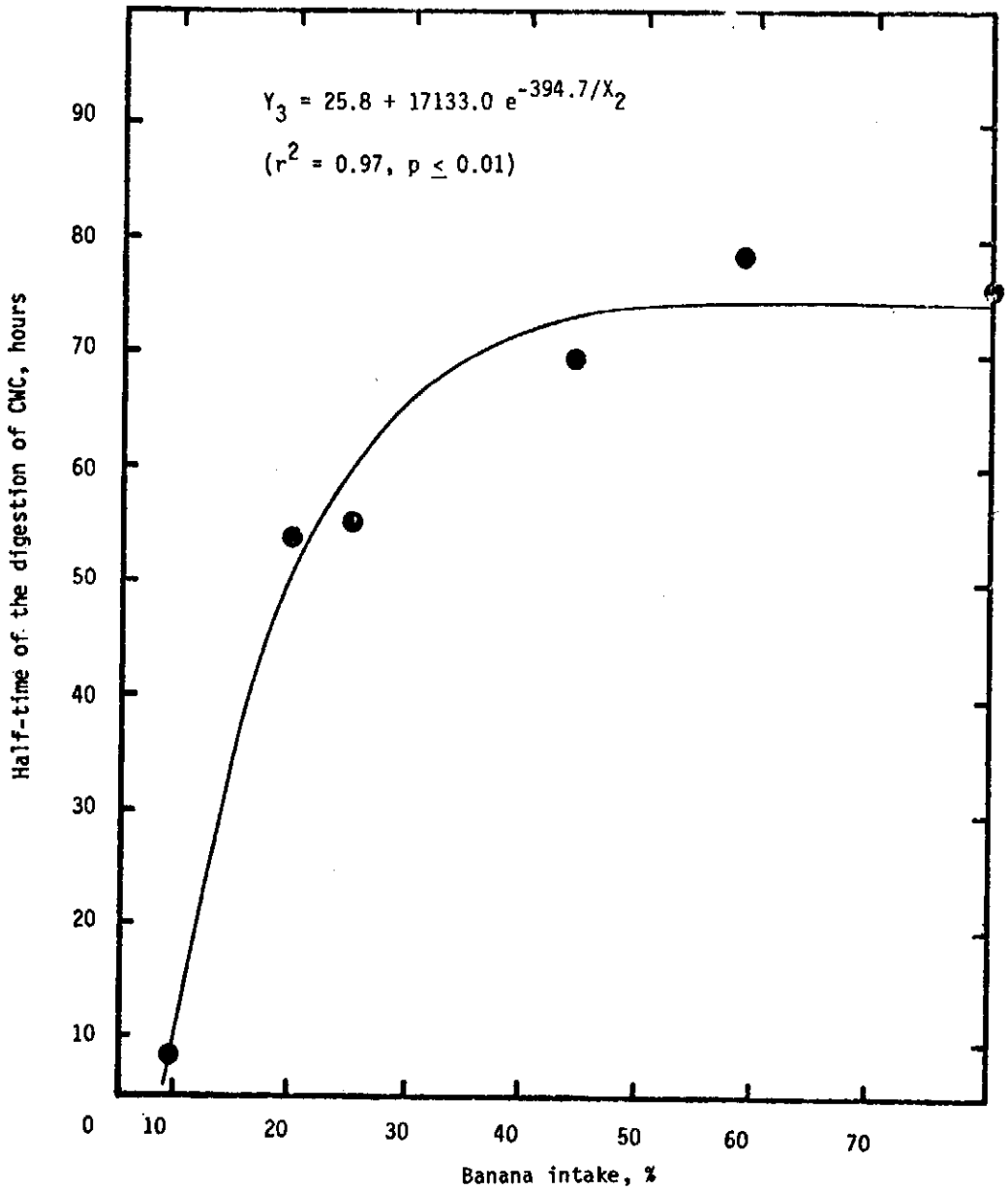
viations, as well as the reliability of the equations which describe the performance of the ADCW in function of time

Rumen degradation of the cell wall constituents in sugarcane tops, during the first 24 hr of digestion was negatively affected by the use of banana at levels higher than 21.6%. This effect was particularly critical when the banana represented more than 55.1% of the ration, as in those cases the ADCW in 24 hr was less than 9.4%. The time required to digest 99% of the potentially degradable cell wall was 39.6 hr when the banana constituted 21.6% of the ration and increased to 173,4 hr in the treatment with the highest banana level (70.7%). On the other hand, the exponential chosen to describe the ADCW changes in function of the time, showed a high degree of adjustment (Table 2), in all supplementa ry banana levels studied.

Rate of acceleration of the digestion of the cell wall constituents: In Figure 2 the changes in the acceleration rate of the CWC digestion are shown in function of the level of supplementary green ba

Figure 3:

Digestion half time of cell wall constituents of cane tops (Y_3) in function of the proportion of green banana in the ration (X_2)



nana. It is observed that at low banana levels the digestion accelara tion rate tends to remain maximum and constant, while rations at banana levels higher than 21.6%, this rate tends to drop drastically.

Digestion half time of the cell wall constituents: Up to a level of 35% of banana in the ration, increasing the level of banana had a strong effect on the length of half-time. However, higher level of banana supplementation had little effect on half time and this became to stabilize around 75 hr. This relationship it shown in Figure 3.

Discussion

Mertens and Loften (1980) have proposed the hypothesis that the effect of starch on the digestibility of fibre may manifest itself in: a) a lengthening of the initial period of slow digestibility, b) a drop in the digestion rate, c) a drop in potential digestibility, d) a combination of the previous effects. The same authors found that adding starch had a linear effect on the lengthening of the slow digestion period and caused a drop in the potential digestibility value, but did not affect the digestion rate of the fibre. In turn, these parameters were negatively affected in this study by a heavy starch supplementation. The discrepancy with regards to the effect of starch on the fibre degradation rate may be attributed to the differences in the methodology used (in vitro vs in sity; utilization of a model which separates rates into a slow digestion period and a rapid digestion period vs a model which considers a single rate for the entire digestion period) or to the fact that work was done on different forages (*Dactylis*, Bermuda and *Medicago* vs *Saccharum*). Akin (1979) points out that there are differences between pasture species with regards to their morphology and the type of bacteria associated with the degradation of the fibre.

The negative effect which the green banana has when offered at levels above 21.6% of the ration, on the digestion parameters of the fibre may be explained by the change in the population of microorganisms, in favour of a predominance of amylolytic bacteria over cellulolytic ones, as a result of the competence for essential nutrients (Slyter et al 1979; Slyter et al 1971); besides the fact that under these circumstances the synthesis of cellulolytic enzymes is inhibited (Leatherwood 1973).

The drop in rumen pH which normaly occurs with diets rich in easily fermentable carbohydrates (Sutton 1979) has often been used to explain the drop in the fermentive capacity of the microorganisms (Bryant 1973; Terry et al 1969); however, as a result of adding urea to the supplement, the pH values at the time of offering the supplement and three hours later were 7.0 $\pm$ 0.05 and 7.2 $\pm$ 0.17 for which reason this factor apparently had no implication in the reduction observed in the digestion of the fibre.

It is concluded that in feeding systems based on sugarcane tops, the utilization of supplementary green banana at levels above 21% exert a deleterious effect on the length of the slow digestion period, and the degradation and potential digestibility rate of the cell wall constituents.

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Received June 21,1983