THE BANANA PLANT AS CATTLE FEED: DIGESTIBILITY AND VOLUNTARY INTAKE OF DIFFERENT PROPORTIONS OF LEAF AND PSEUDOSTEM[1]

D Ffoulkes and T R Preston[2]

CDIPCA, CEAGANA, Santo Domingo, Dominican Republic

Four young Zebu bulls of about 200 kg were used in a 4 x 4 latin square design to determine voluntary intake and digestibility of mixtures of banana pseudostem and leaf (100:0, 67:33, 33:67, 0:100, dry matter basis). The diets were made isonitrogenous by adding urea. All animals received 60 g/d of mineral supplement. The diet of banana stem only was more digestible (75.4%) than the leaf (65.2%). There was a linear decrease in voluntary intake of DM (Y = 4.59 - 0.67x + 0.04; r^2 = 0.99), and in digestible DM (Y = 3.08 - 0.39x + 0.08;r^2 = 0.93) as the proportion of leaf (x) increased in the diet. The effect of the banana leaf in increasing . voluntary intake is attributed to its role in providing by-pass protein.

Key words: Cattle, banana forage, digestibility, voluntary intake

Little work has been done on the use of banana forage as a feed. In a digestibility trial at this Centre, it was found that, by using a ratio of 4:1 of stem and leaf to simulate the natural proportions of the forage component (after harvesting the fruit), the digestibility of the forage was 70.2% ± 2.1 (SEx), and the voluntary consumption index was 2.06 ± 0.03 kg DM/100 kg live weight/day (Espejo et al 1978).

The purpose of this experiment was to obtain more information about the digestibilities and voluntary intakes of different proportions of leaf and stem, and compare the results with those of the whole mature plant without fruit.

Materials and Methods

Animals, Design and Treatments: Four young Zebu bulls with an initial weight of about 200 kg were used in a 4 x 4 latin square design with periods of WO weeks. The animals were allocated the following proportions of leaf and stem in the dietary treatments:

Diet	Dry matter basis		Fresh matter basis	
	Leaves	Stem	Leaves	Stem
A	100	-	100	-
B	67	33	50	50
C	33	67	20	80
D	-	100	-	100

The diets were made isonitrogenous by adding 16 g molasses/urea (21%) per kg fresh material of stem and 30 g pure molasses per kg of leaf. All animals received 60 g/d of mineral supplement.

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[2] FAO consultant DOM/77/002.

Procedure: The first week of every period was for adapting the animals to the diets, which were fed to them in individual stalls. For the second week, the animals were transferred to digestibility crates where faeces and refusals were collected and weighed daily, and representative samples taken far dry matter (DM) analysis.

The leaves and stem of the banana plant were chopped separately in a stationary chopper, and before preparing the diets, samples of each were taken daily to determine the DM content. DM for the molasses additive was determined after each preparation. Digestibilities and voluntary intakes were calculated on a DM basis.

The animals were fed twice daily, half the diet in the morning and the remainder in the afternoon, with the pure molasses and molasses/urea additions being given at the first feed.

Results

The results for apparent digestibility and voluntary intake are given in Table 1. The diet of banana stem only was significantly ($P < .02$) more digestible (75.4%) than the leaf (65.2%) and the 33:67 mixture of leaf and stem (65.9). The digestibility of the 67:33 leaf/stem mixture tended ($P < .08$) to be lower than that for the stem only.

There was a linear decrease in voluntary intake of DM ($Y = 4.59 - 0.67x \pm 0.04; r^2 = 0.99$), and digestible DM ($Y = 3.08 - 0.39x \pm 0.08; r^2 = 0.93$) as the proportion of pseudostem (x) increased in the diet.

Table 1:
Mean values for apparent digestibility and voluntary intake of different proportions of mature banana leaf and pseudostem in diets fed to Zebu bulls

	Leaf : Pseudostem proportions (DM basis)				
	100:0	67:33	33:67	0:100	SEx
Apparent DM Digestibility, %	65.18a	69.35ab	65.90a	75.43b	±2.0
Voluntary Intake, kg DM/d	4.58a	3.98b	3.15c	2.62d	±0.18
Digestible DM intake, kg/d	3.06a	2.81ab	2.10bc	1.99c	±0.24
Consumption index[1]	2.15a	1.86ab	1.47bc	1.23c	±0.39

abcd Means within rows without letters in common are significantly different ($P < 0.05$).
[1] kg DM/100 kg live weight/day.

When intake was corrected to constant live weight, using the consumption index unit, there was a decrease in daily DM consumption of about 15% between dietary treatments, ($Y = 2.15 - 0.37x \pm 0.02; r^2 = 0.99$) as the proportion of banana pseudostem in the diet was increased.

Discussion

The low voluntary intakes associated with high proportions of pseudostem in the diet may have been due to a physical constraint attributable to the high moisture content of this material (Table 2). The intake of large quantities of water in the fresh matter may well have decreased the capacity of the animal to raise its DM intake.

Table 2:
Mean values for dry matter contents of diets of whole banana leaf and pseudostem in successive periods

	Leaf : Pseudostem proportions (DM basis)			
	100:0	67:33	33:67	0:100
Period 1	15.6	11.4	8.9	7.3
2	18.7	12.6	9.8	7.6
3	14.7	10.1	8.4	6.4
4	16.5	11.4	8.5	6.3
Mean	16.4	11.4	8.9	6.9
SEx	±0.86	±0.51	±0.32	±0.32

Another factor which may have contributed to the low intakes of pseudostem was the low protein content of the diet. Table 3 shows that for the banana stem diet, protein N amounted to less than 1% of the DM intake. Therefore, there might have been insufficient protein nitrogen arriving at the duodenum to stimulate feed intake (Kempton et al 1977).

As a consequence of low intake on the diet of banana pseudostem, rumen turnover rate was probably low. The diet would therefore be exposed to a longer period of degradation in the rumen, which could account for the high apparent digestibilities.

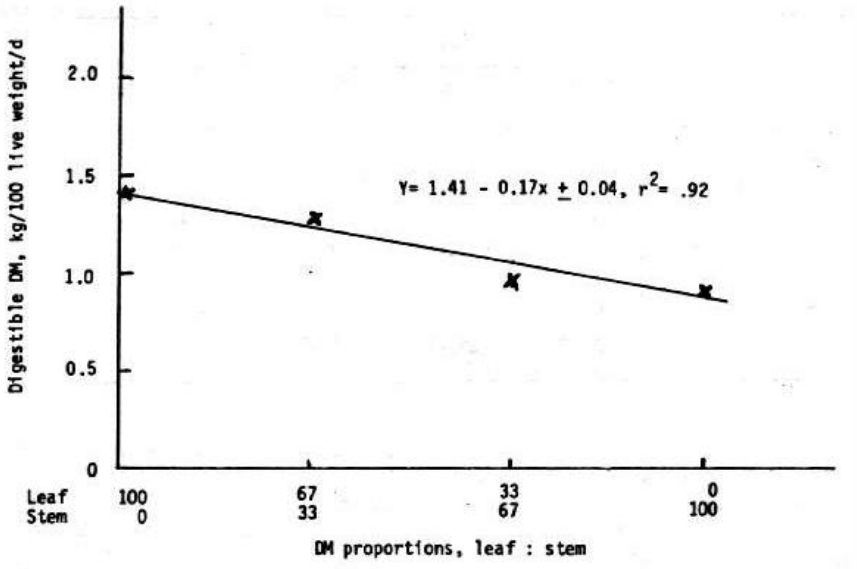
The digestibility of the banana leaf was lower than for the stem (65.2 vs75.4%), due perhaps to a shorter retention time in the rumen, since DM intake of the leaf was 4.58 kg/day which is a 75% increase in intake over the diet of psuedostem alone. No urea was added to the banana leaf diet, however, there was an intake of 120 g/d of N in the form of protein (Table 3). This was apparently sufficient to provide for the microbial requirements in the rumen as well as that needed in the form of by-pass protein to stimulate voluntary feed intake. Furthermore, in a situation where rumen turnover rate is rapid, protein tends to be less degraded in the rumen (Sutherland 1976, as cited by Kempton et al 1977).

Table 3:
Sources of N in banana leaf and pseudostem diets made approximately isonittogenous by adding appropriate amounts of urea in a molasses/urea (21%, w/w) mixture

	Leaf: Pseudostem-proportions (DM basis)			
	100:0	67:33	33:67	0:100
Daily intake, g				
Dry matter	4,580	3,980	3,150	2,620
Protein[1]	750	440	310	130
NPN from urea	-	30	50	60
Total N	120	100	100	80

[1] Assumes all the N in the banana forage is in the form of protein. The banana leaf contained 2.5% N in DM and the stem 0.75%

Figure 1:
Regression of Consumption Index of digestible DM on cane: banana DM proportions in the diet



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