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IN SITU DRY MATTER DEGRADATION CHARACTERISTICS OF BANANA REJECTS, LEAVES, AND PSEUDOSTEM

(With 2 Tables and One Figure)

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SUMMARY

Banana rejects, leaves, and pseudostem were collected from commercial refrigerators in Khartoum North Central Fruit and Vegetable Market. The chemical composition, ruminal dry matter degradability characteristics were determined for every type of waste. The dry matter degradability was determined by the nylon bag technique using fistulated calves. Every waste was incubated for 6, 12, 24, 48, 72 and 96 hours in the rumen. The dry matter disappearance rate increased with length of the incubation period. The banana rejects have the highest solubility, degradability rate, and effective degradability followed by the pseudostem, and finally the leaves.

Key words: *Banana, banana by- products, feedstuffs*

INTRODUCTION

Seasonal shortage of feed sources often imposes a major challenge in livestock production in tropics (Aregheore, 2000). Sudan, like most of developing countries, is battling against the problem of feeding its large livestock population. The problem can be solved by using unconventional feedstuffs in animal feeding provided that; they are available, of good nutritive value and economical compared with the conventional feed.

A lot of work was done in Latin America and Asia investigating, the possibility of substituting cereal components in the ration with banana by-products (Tewe, 1983; Viswanathan *et al.*, 1989). The total annual production of banana in the Sudan was estimated at 491.140

tones (Ministry of Agriculture Republic of Sudan, 2004). Data concerning the use of banana by products as livestock feed seems to be limited, this study was undertaken to assess the potentiality of banana by products (fruit rejects, leaves, and pseudostem) as ruminant feed supplement.

MATERIALS and METHODS

1. By products resources:

Samples were collected from Khartoum North Central Fruit and Vegetable Market. The Samples were air dried.

2. **Chemical analysis:**

Ash was determined by igniting the samples in a muffle furnace at 525^{o}C for 8 hr. Crude protein content was measured by the Kjeldhal method (AOAC, 1980). Ether extracts (EE) were determined by the method of AOAC (1980). Crude fiber (CF) was determined according to the method of Van Soest (1970).

3. *In situ* dry matter (DM) degradation:

The nylon bag technique of (Ørskov and McDonald, 1979) was used to measure the DM degradation characteristics of banana by products. Samples were milled in a hammer mill through a 3 mm sieve and subjected to standard rumen degradability procedures using three castrated calves of approximately 300 – 350 kg live weight. The calves were fed a diet containing alfalfa hay and concentrate at maintenance level, and were allowed free access to fresh water and mineral salt licks. Throughout the experimental period, nylon bags with 35 – 40 µm pore size containing 5 g samples in duplicate were incubated in each animal for each of the testing time periods: 6, 12, 24, 48, 72 and 96 hours. The bags were removed, after incubation in the rumen, then washed with cold running water until the washing water ran clear and colorless. Zero time samples were not incubated in the rumen, but were washed with running cold water as above to determine their solubility at time 0 h. The bags were oven dried at 60^{o}C for 48 h.

The DM degradation data were fitted to the exponential equation (Ørskov and McDonald, 1979)

$$P = a + b\,(I - e^{-ct})$$

Where P is the disappearance of nutrient during time t; a the soluble nutrient fraction which is rapidly washed out of the bags and is assumed to be completely degradable; b the proportion of insoluble nutrient, which is potentially degradable by micrograms; c the degradation rate of fraction b per hour.

The effective degradability of samples was calculated using the equation shown below, at three rumen fractional outflow rates (*r*) of 0.03, 0.05 and 0.08 h^{-1}.

$$P = a + \frac{b \times c}{c + r}$$

P is the effective degradability of DM.

RESULTS

Chemical composition: The Chemical composition of the banana by-products is presented in Table (1). The CP content ranged from 5.55% in banana rejects to 9.06% in banana leaves. The CF ranged from 12.6% in banana rejects to 44% in banana pseudostem.

Table 1: Chemical composition of the different banana by-products.

Chemical composition / Banana by-products	DM (%)	CP (%)	CF (%)	EE (%)	Ash (%)
Banana rejects	100	5.55	12.6	2.59	9.9
Banana leaves	100	9.06	39	2.02	13.7
Banana pseudostem	100	6.76	44	2.51	14.65

Fig. (1) shows the dry matter degradability of the banana by-products. Banana rejects showed the highest DM degradation rate at all the incubation time, followed by pseudostem and the lowest values were in the leaves.

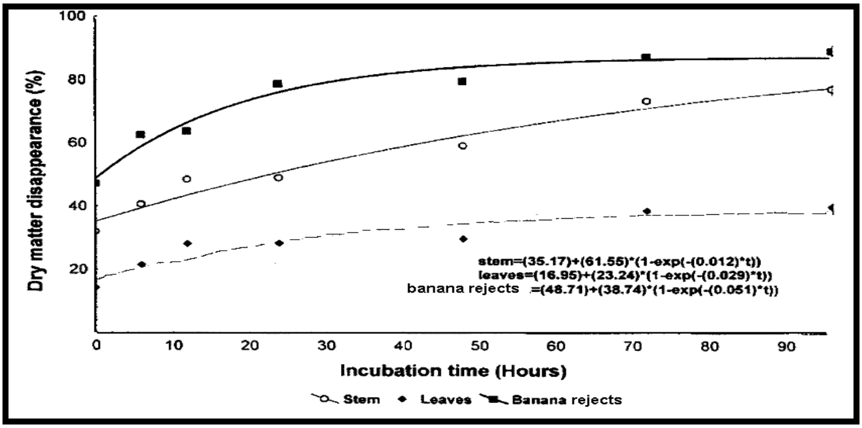

Fig. 1: Ruminal Dry Matter Degradability of Banana By- products

Table (2) shows the dry matter degradation kinetics of the banana by-products. Banana rejects showed the highest values for a, b, c fractions as well as the effective degradability at all the ruminal outflow rates, while the pseudostem exhibited the highest potential degradability.

Table 2: Rumen degradation kinetics of DM different banana by products.

Fitted Values	a	b	a + b	c	Pe at		
Banana by-products	(%)	(%)	(%)	(%)	$r_{(0.03)}$	$r_{(0.05)}$	$r_{(0.08)}$
Banana rejects	48.71	38.74	87.45	0.051	73.04	68.27	63.79
Banana leaves	16.95	23.24	40.19	0.09	28.37	23.13	25.94
Banana pseudostem	35.17	61.55	96.72	0.012	52.77	47.09	42.2

a = rapidly soluble fraction
b = the fraction which is subjected to degradation
a + b = potential degradability
c = constant representing the fractional disappearance rate per unit time *t*
Pe = effective degradability
r = rumen wall particle outflow rate

DISCUSSION

The banana rejects had less ash, crude protein, ether extract, and crude fiber than the pseudostem and leaves but more NFE; as compared to that reported by Suleiman, and Mabrouk (1999).

Banana leaves contained more crude protein, ether extract, and NFE, less ash and crude fiber than the pseudostem. This is in accordance with the finding of Viswanathan *et al.* (1989).

The leaves have higher crude fiber than the finding of Johri *et al.* (1967); Garcia *et al.* (1973) and Maika and Krebs (1989). Higher crude protein and ether extract, than that found in this study, are reported by Johri *et al.* (1967), Garcia *et al.* (1973) and Maika and Krebs (1989). These differences may be attributed to differences in the soil, climatic conditions, genotype, and stage of growth (Mohammed and Salih, 1991).

The dry matter disappearance rate of the banana by-products increased with the length of the incubation time; this is in agreement with the finding of (Ørskov, 1991) that incubation period length is the major factor determining the extent by which feedstuff are broken by the rumen microorganisms .

The banana rejects exhibited the highest degradability rate; and this is most probably due to the high solubility of its content, which is inferred from the washing loss at the zero time. Although the leaves have less crude fiber content than the pseudostem but its degradability rate was lower than that of the pseudostem. This can be attributed to the difference in the cell wall contents which are most probably got lignified, and lignin is known to resist the microbial breakdown of the cell wall (McDonald *et al*., 2002). Another explanation is that the pseudostem contained more soluble contents than the leaves, this is inferred from the (a) value, which is washed out quickly resulting in fast degradability rate. It is summed from this study that banana by-products have a potentiality as ruminants' feed supplement; further work should be done to study their digestibility.

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