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ORIGINAL RESEARCH ARTICLE

Chemical constituent and free choice intake of ensiled *Albizia saman* pods with cassava peels by Bunaji cattle in the humid zone of Nigeria

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ABSTRACT

The study aimed to evaluate the chemical composition and the free choice intake of ensiled Albizia saman pods with cassava peels by Bunaji bull in the humid zone of Nigeria. Albizia saman pods (AsP) and cassava peels (CsP) were ensiled in differing proportions and used as diets 1 (75% AsP + 25% CsP), II (50% AsP + 50% CsP) and III (25% AsP + 75% CsP) for 30 days. Silage characteristics (temperature, colour, aroma, texture and pH) were examined. The dry matter (DM) and its contents of ash, crude Protein (CP), crude fibre, ether extract, neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were analyzed using the standard procedure, while feed preference by Bunaji cattle was assessed using coefficient of preference technique. The colour of the silages was dark-brown, odour was alcohol and fruit while the texture was firm. The pH values ranged between 3.55 and 4.46, temperature ranged from 30 to 32 °C. DM, ash, CP, crude fibre, ether extract, NDF, ADF and ADL were in the range of 42.1-69.9%, 4.3-7.0%, 11.4-16.9%, 7.7-10.0%, 36.2-48.0%, 23.9-30.0% and 8.2-13.8% respectively. All the silages in each treatment were acceptable as CoP was above unity. The good quality and chemical composition of the silages from Albizia saman pods and cassava peels as well as its good acceptability to Bunaji bulls showed that the silages could be used as a supplementary diet to ruminants, especially during the dry season period.

Keywords: *Albizia saman* pod, Silage, feed preference, Bunaji cattle.

INTRODUCTION

Inadequate availability of protein for ruminant animals during the dry season is a serious recurrent problem in Nigeria. It is one of the major constraints to ruminant animal production (Heady, 1994) and leads to sub-optimal animal production (Ngongoni and Manyuchi, 1993). The adverse effects of under-nutrition in ruminant production can be improved by supplementing the diet of ruminants with feeds stuff that are available and affordable. The conventional commercial protein supplements are either unavailable or too expensive and they are, therefore, beyond the reach of most smallholder ruminant farmers. *Albizia saman* is a fast growing multipurpose tree, found in the tropics. It is described as rain-tree plant with a well spread canopy and used for its fruits (pods) and leaves as fodder (NFTA, 1995). The leaves are not readily acceptable by ruminants and this could be due to the presence of anti-nutrients (Babayemi *et al.*, 2004). The pods are highly relished by ruminants (Otukoya and Babayemi, 2007), as they scavenge on them when they drop on the ground during the production season. The high relish of the pods by ruminants has been attributed to its sugary tegmen a source of water soluble carbohydrate (Babayemi and Daodu, 2011). However, the high crude protein content of the pod is present in the seed which is hard to break when ingested by ruminants as a good number of them escaped mastication (Durr, 2001; Jolaosho *et al.*, 2006; Daodu *et al.*, 2010; Babayemi and Daodu, 2011). The strategy of ensiling the pod with Guinea grass (*Panicum maximum*) for 42 days (Igbekoyi, 2008), improved the digestibility of the pod through enhanced water imbibitions by the pods from the grass. This method is however not sustainable due to the scarcity of grass in the dry season when the pods are available. Moreover, the process of grass harvesting seems cumbersome, uneconomical (high level of labour involvement) and seasonal (abundant grass only in rainy season and the availability of pod in the dry season), indicating the need for a more realistic medium.

Cassava peel is an agricultural by-product obtained when cassava tuber outer covering is removed during processing. It is relatively high in moisture of about 74% (Otukoya and Babayemi, 2008) and available on daily basis in many parts of Nigeria. Since *Albizia saman* pod is available in the mid dry season between January and March, information on its collection and immediate processing with cassava peel is scanty. *Albizia saman*, a tropical browse tree is characterised with abundant production of pods which are relished by ruminants. However, the seeds are extremely hard for mastication thereby limiting its optimum utilization for cattle production. Soaking and drying

have little effect on degradability of *Albizia saman* Pod (AsP) as information on anaerobic fermentation of AsP for seed utilisation is scanty. Therefore, the study was undertaken to assess the silage characteristics, chemical composition, cassava peel, and acceptability of ensiled Albizia pod with cassava peel by Bunaji bulls.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Large Ruminant Unit of the Teaching and Research Farm, University of Ibadan, located at 7° 27'N and 3° 45'E with an altitude of 200 – 300 m above the sea level. The temperature at the time of study was between 25 and 29 °C while the average annual rainfall was 1250 mm.

Collection of pods and cassava peels

Since Albizia pods falls in January and February, they were picked manually. To ensure adequate representation, pods were sourced from 26 trees within the University of Ibadan campus. Daily collections were air dried under shade to prevent deterioration by fungal infection. A known weight of fresh sample of the pods was randomly taken and oven dried at 48ºC for dry matter (DM) determination and chemical analysis. Fresh cassava peels from some cassava processing centres in Ibadan metropolis, Nigeria, were collected between 10.00 and 12.00h. The time frame was imposed to ensure early collection and loading materials the same day to prevent spoilage due to its high moisture content. Representative samples of a known quantity from at least three different processing centres were also obtained for DM and laboratory analysis.

Silage preparation

Albizia saman pods (AsP) and cassava peels (CsP) were ensiled in differing proportions and used as diets I (75% AsP + 25% CsP), II (50% AsP + 50% CsP) and III (25% AsP + 75% CsP). Each of the diets was 100kg proportionately and was replicated five times using 120kg capacity plastic drums. The plastic material was wizened with an appropriate nylon, ensuring its extension above the plastic. The loading of the diet was followed by thorough compression, in order to dislodge trapped air. Therefore, the protruded nylon was folded inward and sand bags were placed on it as reported (Babayemi 2009). The silages were left to ferment for 30 days and thereafter terminated for the determination of silage characteristics. The silage temperature, colour, aroma, texture and pH were assessed following the procedure as reported (Babayemi and Igbekoyi, 2008).

Determination of free choice intake

In order to measure the free choice intake (acceptability) of the diets, coefficient of preference (CoP) technique as outlined by Bamikole *et al.* (2004) was employed using six yearling Bunaji bulls. Each diets, was placed in a separate feeder. The assumption was that all the experimental animals would prefer only one diet. After the feeding duration of two hours, remnants of the feed were weighed to infer the actual feed intake. The trial lasted for seven days. The diet was judged to be acceptable if the CoP is greater than unity (one) using the procedure of calculation outlined (Bamikole *et al.,* 2004 and Babayemi *et al.,* 2006).

Determination of chemical composition and statistical analysis

Untreated pods and cassava peels as well as the ensiled feeds were analysed for crude protein, crude fibre, ash and ether extract as described (AOAC, 1990). Fibre fractions consisting of acid detergent fibre (ADF), neutral detergent fibre (NDF) and acid detergent lignin (ADL) of the samples were also determined as reported (Van Soest *et al.,* 1991). Data obtained were analysed using descriptive statistics and ANOVA at p=0.05

RESULTS

On dry matter (DM) basis the whole *Albizia saman* pod (AsP) was analysed to contain 18.89g/100g CP, with a DM content of 71.2% and variation existed in the CP and DM of cassava peel from different sources with 55 - 66 g kg^{-1} and 25.2 - 26.3% respectively as presented in Table 1.

Table 1: Dry matter and chemical composition (g/100gDM) of *Albizia saman* pod and cassava peel from different sources

Parameters	*Albizia saman* pods	Cassava peel (1)	Cassava peel (2)	Cassava peel (3)
DM	71.20	26.25	26.00	25.15
ASH	5.67	7.00	7.00	6.00
CP	18.89	6.58	6.34	5.48
Crude fibre	9.67	11.00	12.00	10.00
Ether extract	11.00	10.00	11.00	11.00
NDF	42.00	52.00	49.00	46.00
ADF	31.00	25.00	27.00	25.00
ADL	18.00	11.00	12.34	10.45

DM = Dry Matter CP = Crude protein NDF = Neutral Detergent Fibre ADF = Acid Detergent Fibre; ADL = Acid Detergent Lignin

Table 2: Physio-chemical characteristics of *Albizia saman* pod and cassava peel silages

PARAMETERS	75%AsP+25% CsP	50%AsP+50% CsP	25%AsP+75% CsP	SEM
Temp(°c)	32.00[a]	30.00[b]	30.00[b]	0.37
pH	4.46[a]	3.83[b]	3.55[c]	0.95
Smell	Alcoholic and fruity	Alcoholic and fruity	Alcoholic and fruity	
Texture	Dry and Firm	Semidry and Firm	Semidry and Firm	
Colour	Dark-brown	Dark-brown	Dark-brown	

[abc=] Means on the same row with different superscripts differ significantly (P < 0.05)
AsP = *Albizia saman* pod CsP = Cassava peel

The physico-chemical characteristics of *Albizia saman* pod (AsP) and cassava peel (CsP) silages is shown in Table 2. Significant differences were observed in the pH and temperature of the silages. The sensory evaluation indicated that all the silages had a characteristic alcohol and fruity smell, typical of well fermented silage. The texture of silage in treatment 1 was dried and firm while those of treatments 2 and 3 were semidry and firm. From the visual observation using a standard colour chart, the colour of all the silages was dark-brown. The dry matter (DM) and chemical composition of the silages are shown in Table 3. Differences were observed in the values of DM, ash, CP, NDF, ADF, ADL. The NDF value varied between 36.20 g/100gDM and 48.02 g/100gDM, ADF value ranged from 23.96 to 30.00g/100gDM while the ADL value varied between 8.23 and 13.89 g/100gDM. Presented in Table 4 is the free choice intake of ensiled *Albizia saman* pod with cassava peel. All the diets had a CoP value above unity which implied that they were all well accepted.

DISCUSSION

All the *Albizia saman*-cassava peel mixture ensiled well with pH values that fell within the optimum range of 3.5 and 5.0 reported by Menesses *et al.* (2007) for good silage, as pH is a key criterion to evaluate silage fermentation. The lower the pH, the better preserved and more stable is the silage. This result is higher than 3.2 obtained by Oduguwa *et al.* (2007) but lower than 5.4 reported by Oluwadamilare (1997). Differences among the values obtained could be due to the variation in the dry matter and the buffering capacity of the ensiled material. Temperature is an important factor in determining the quality of silage and it has a direct impact on the silage colour. The lower the temperature during ensilage, the less will be the colour change. The temperature values obtained for silages in the study was within the range of 28°C to 35°C obtained by t'Mannetje (1999) and Jianxin (2002) for good silage. Silages with temperature value above this will be overheated making the protein available in the silage to be indigestible (Acid detergent insoluble Nitrogen) (ADIN) and also reduces the availability of carbohydrate. Differences were not observed in the smell of the silages as all were characterized by an alcoholic and fruity smell indicating that the silages were good and could serve as feed for ruminants. Kung and Shaver (2002) have indicated that good silage should exhibit a pleasant and a fruity smell as a rancid or butter smell indicates poorly fermented silage dominated by clostridia bacteria that produces high levels of butyric acid. Good silage usually should preserve well the original colour of the pasture or any material ensiled (t'Mannetje, 1999; Oduguwa *et al.*, 2007). The results in this study agree with the observation of earlier researchers (Otukoya and Babayemi, 2007; Otukoya and Babayemi, 2008). Variation existed in the texture of the silages, but they were all firm and recognizable. This characteristic of the silages is in accordance with the report of McDonald *et al.* (1996). The level of dryness might be due to the varied level in the dry matter of the ensiled material.

Table 3: Dry matter and chemical composition (g/100gDM) of *Albizia saman* pod and cassava peel silage

Parameters (%)	75%AsP+25%CsP	50%AsP+50%CsP	25%AsP+75%CsP	SEM
DM	69.93[a]	54.92[b]	42.12[c]	3.75
Ash	4.33[b]	4.29[b]	7.00[a]	0.49
CP	16.91[a]	14.80[b]	11.37[c]	0.81
Crude fibre	7.67[b]	8.33[ab]	10.00[a]	0.44
Ether extract	9.67	10.66	11.00	0.29
NDF	48.02[a]	46.12[b]	36.20[c]	0.50
ADF	27.11[b]	23.96[c]	30.00[a]	0.34
ADL	13.89[a]	8.23[c]	11.02[b]	0.26

[abc=] Means on the same row with different superscripts differ significantly (P < 0.05)
DM = Dry Matter CP = Crude protein NDF = Neutral detergent fibre ADF = Acid detergent fibre
ADL = Acid detergent lignin AsP = *Albizia saman* pod CsP = Cassava peel

Table 4: Free choice intake of ensiled *Albizia saman* pod with Cassava peel by Bunaji bulls

Treatments	Mean daily intake (kg)	Coefficient of preference (CoP)
100%AsP	4.12	0.816
75%AsP+25%CsP	5.58	1.105
50%AsP+50%CsP	5.54	1.097
25%AsP+75%CsP	4.96	0.982

AsP = *Albizia saman* pod CsP = Cassava peel

Notwithstanding, there was no effluent loss, also neither viscous nor slimy appearance were observed which indicate that the silages were well preserved and could be presented as good feed for ruminants. Although, physico-chemical properties of silage may not be sufficient in determining the quality of silage, the chemical composition of the silages is a good indication of the nutrient composition of the feed. The variation in the dry matter content could be due to the differences in the DM of the ensiled material. The crude protein of the silages, a nutrient which mostly limit the performance of grazing ruminant had values between 11.3 and 16.91 g/100gDM. Differences observed among treatments could be due to the variation in the inclusion of *Albizia saman* pods and cassava peel.

The crude protein values obtained in the present study was above the CP value of 10 – 12% recommended by ARC (1985) for ruminants, and also above 8%, a minimum requirement for ruminants. According to Norton (2003), feed containing less than 8% CP cannot provide the minimum ammonia levels required by rumen microorganisms to support optimum activity. Thus, *Albizia saman* and cassava peel silage at any of the proportions is beneficial and therefore can be used for supplementing the low protein pastures and crop residues especially during the dry season. The values of 36.20 to 48.02 g/100gDM obtained for the Neutral detergent fibre (NDF) of the silages in the present study are similar to the result of Inyang *et al.* (2010) in which *Albizia saman* pod was ensiled with cassava peel but lower than the values of 56.0- 65.0 g/100gDM values reported by Babayemi and Igbekoyi (2008) when AsP was ensiled with Guinea grass at graded levels. The NDF value also increased with an increase in the AsP level which is in line with the result obtained by Babayemi and Igbekoyi (2008). The NDF values obtained were below the level of 55 - 60 g/100gDM reported by Meissner *et al.*(1991), that could limit the intake of ruminant as NDF is inversely proportional to feed intake, the higher the NDF the lower the intake. Acid detergent fibre (ADF) is correlated with digestibility of a feed, the lower the ADF the higher the digestibility since high lignin is reported to physically encrust structural carbohydrates, preventing enzyme attack and inhibiting attachment of rumen microorganisms (Coombe, 1981). The values of 23.96-30.0 g/100gDM obtained in the present study are close to the recommended value of 25% for ruminants (NRC, 1985) and also similar to 23 - 26.3% values obtained by Daodu and Babayemi (2009) for some hedge row plants.

The level of acceptability is also another medium used in assessing the quality of a feed. According to Armstrong (1997), taste (and to a lesser degree sight and smell) enables animals to discriminate among different feeds. Feed preferences tend to result from a combination of taste and post-ingestive feedback. The animal's physiological condition is related to the chemical characteristics of the feed (Provenza, 1997). Animals prefer foods that meet their nutritional needs. The CoP of all the diets was above unity indicating acceptability. This could be due to the high crude protein of the diet and the relishes that has been established about *Albizia saman* pod (Otukoya and Babayemi, 2007)

CONCLUSION

The results showed that silage quality and the free choice intake of the ensiled *Albizia saman* with cassava peel are indicative that all the silages were well prepared and preserved and can be used as supplementary diet to grazing cattle that feed on low quality forages especially during the dry season.

CONFLICT OF INTEREST

Authors declare that no conflict of interest exist concerning this manuscript.

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