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ORIGINAL RESEARCH ARTICLE

Silage characteristics and acceptability of maize stover, cassava tops ensiled with *Albizia saman* pods

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ABSTRACT

The use of preserved feedstuff in form of silage is a very good strategy to improve livestock performance during seasonal shortages. This study was conducted to determine the silage characteristics and the co efficient of preference of the experimental diets containing different portions of Cassava tops (CST), Maize Stover (MST) ensiled with Albizia saman pods (ASP). The ensiled mixtures were: T1: 40% CST + 0% ASP + 60% MST, T2: 30% CST + 10% ASP+ 60%MST, T3: 20% CST + 20%ASP + 60% MST, T4: 10% CST + 30% ASP + 60% MST and T5: 0% CST + 40% ASP + 60% MST. The pH of silage ranged between 4.26and 4.44, temperature ranges between 27.74 and 31.62^{0}C, odour of silage were fruity. The acceptability studies using ruminants indicated that the silages had high coefficient of preference and nutritive value. This study showed that silage mixture containing cassava tops, Albizia saman pods and maize stover could be a better alternative feedstuff for ruminants during the dry season.

Keywords: livestock, preference, nutritive value, dry season, feedstuff.

INTRODUCTION

Dry season feed in ruminant production is still a challenge in Nigeria. There is usually limited and often inadequate supply of forages especially during the dry season (Babayemi *et al*., 2003). Smith *et al*. (1995) observed that dry season feeding of ruminant has always been a critical problem to livestock farmers as feed supplies are limited both in quantity and quality. Profitability of the venture has been hampered by high cost of conventional animal feedstuffs and overall reduction in the productivity of ruminants in terms of meat and milk.

The natural pastures and crop residues available to animals during the dry season after crop harvest are usually fibrous and devoid of most essential nutrients which are required for improved microbial fermentation and improved performance of the animal (Dixon and Egan, 1987). However, supplement feeding has been observed to correct nutrient deficiencies, improve forage utilization and animal performance (Kunkle *et al*., 2000).

Crop residues such as Maize Stover, Cassava tops and pods of rain tree plants are among the most widely available, materials in the majority of developing countries that have potentials as low cost feeds for ruminants (Smith, 1993). Cassava tops, Maize Stover and *Albizia saman* pods are prone to spoilage over a short period. However, it is possible to conserve them for use during future periods of feed shortages. Conservation can be achieved by sun drying (hay) and by fermentation (silage) (Mannetje, 1999). Ensiling can also render some previously unpalatable products useful to livestock by changing the chemical nature of the feed (Kayouli and Lee, 1999).

Free choice intake or acceptability study of a feed is a quick assessment of the physical quality of the feed by the animal. It is one of the *in vivo* trials that reveal the actual reaction of animals to a feed. This conversely depicts the efficiency of the feed in the rumen (Van Soest, 1994).

The research is aimed at examining the silage characteristics, and Acceptability of the experimental diets containing different

proportions of maize stover, cassava tops ensiled with *Albizia saman* pods.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the small ruminant unit of the Department of Animal Science, University of Ibadan, Ibadan, Nigeria. It is situated in the derived savanna vegetation belt (Latitude $7^0$27'N and $3^0$45'E) at an altitude between 200m and 300m above sea level; mean temperature of 25 – 29^0C with an average annual rainfall of about 1250 mm. The soils are much drained and belong to the alfisol (Rhodic kandiustalf).

Preparation of Samples

The fresh Cassava tops were harvested from Oyo village; Fresh Maize Stover was harvested from the maize farm around University of Ibadan while the pods of *Albizia saman* were handpicked underneath the tree within University of Ibadan campus and were properly sun dried.

The fresh Cassava tops and Maize Stover were chopped separately into 3-5 cm size and wilted for 24 hours. These chopped materials were mixed together with sundried *Albizia saman* pods, filled into the mini silos of 4 litters' paints plastic containers to form five treatments as shown in Table 1.

Table 1. Gross composition (%) of experimental silage

	Treatments				
Ingredients	T1	T2	T3	T4	T5
CT	40	30	20	10	-
ASP	-	10	20	30	40
MST	60	60	60	60	60

CT – Cassava Tops ASP – Albizia saman pods MST – Maize Stover

The ensiled material were well compressed, made air tight by keeping sand bags weighing 50 kg on top and kept under shade for 30 days

Silage Quality

Sub-samples were taken from the five different treatments and used for quality assessment. The assessed quality characteristics were colour, smell, texture, taste, pH and temperature according to Babayemi and Igbekoyi (2008). The temperatures in the silo were taken by dipping a laboratory thermometer 15 cm depth inside each treatment for 2 – 3 minutes. The pH of each treatment (sample) was determined using a pocket pH meter (Hanna portable meter). Other quality parameters of silage (odour and texture) were assessed after ensiling as described by t'Mannetje (1999).

Coefficient of reference (CoP)

A cafeteria method of feeding was adopted as reported by Babayemi *et al.* (2007).The ensiled treatments were offered free-choice to the 3 Cattle (90-100kg), 3 West Africa Dwarf (WAD) sheep (19 – 21 kg) and 3 West Africa Dwarf (WAD) Goats (17-19 kg) in feeding troughs at the same time for the period of 8 hours each day for 3 days.

Equal amount (in tripiclate) of the dietary treatment (2kg each for Sheep and Goats while 5kg each for cattle) were offered to the animal in separate feeders, and feeders were strategically placed in the pen as reported by Bamikole *et al*. (2004), changing the position of the feeders daily for three days

Consumption was measured by deduction of remnants from the amount offered. CoP was calculated as ratio between the intakes from each diet divided by the average intake of the diets (Babayemi *et al.,* 2006). A diet was inferred to be relatively acceptable provided the CoP is greater than or equal to unity.

Coefficient of preference (CoP)

$$= \frac{\text{Intake of individual silage}}{\text{Mean intake of the five silage types}}$$

If CoP is < 1, the material is poorly accepted and when > 1, the material is well accepted (Karbo *et al*. (1993) and Bamikole *et al*. (2004).

Statistical analysis

All data collected were subjected to a one way analysis of variance using the procedure of SAS (1999) computer software package and treatment means were compared and separated using the Duncan's Multiple Range Test (Duncan, 1955). The statistical design is a completely randomized design.

RESULTS AND DISCUSSION

Presented in Table 2 are the quality parameters of the ensiled feed materials. Colour of the silages varied from light green (TI – T4) to greenish brown in T5 silage. It was observed that the light green colour of the treatments (T1-T4) silages and the brownish green for treatment (T5) was close to the original colour of the feed materials and this was in agreement with the findings of (t'Mannetje, 1999; Jianxin, 2002; Oduguwa *et al*., 2007). The odour observed in this study varied from fruity (T1 – T3) to fruity/alcohol (T4 & T5). The result (odour) obtained is comparable with that of several authors (Jianxin, 2002; Menenses *et al*., 2007; Oduguwa *et al*., 2007). These authors reported that the end product of good silage should have a pleasant/fruity smell. All the treatments had firm textures. Generally, all the parameters of physical characteristics studied were accepted for good silage as reported by Kung and Shaver (2002) cited by Babayemi (2009).

Table 2: Physical characteristics of cassava tops and maize stover ensiled with Albizia *saman* pods.

	Parameters		
Treatment	colour	Texture	Aroma
T1	Light green	Firm	Fruity
T2	Light green	Firm	Fruity
T3	Light green	Firm	Fruity
T4	Light green	Firm	Fruity / alcoholic
T5	Greenish brown	Firm	Fruity / alcoholic

CT – Cassava Top; MST – Maize Stover; ASP – Albizia saman pod
T1-- 40% CT +60% MST + 0% ASP, T2-- 30% CT +60% MST + 10% ASP,
T3-- 20% CT +60% MST + 20%ASP,
T4-- 10% CT +60% MST + 30% ASP, T5-- 0% CT +60% MST + 40% ASP

In addition, pH of silages ranged from 4.2 to 4.5 (Figure I). This result was higher than that recorded by Oduguwa *et al*. (2007) who reported pH of 3.2. Also, the result was lower than the range (4.5 – 5.5) as reported by Menenses *et al*. (2007) but similar to pH of 4.3 to 4.7 obtained by Kung and Shaver (2002) and pH range of 4.2 – 5.0 obtained by Babayemi (2009). Generally pH is one of the simplest and quickest ways of evaluating silage quality. However pH may be influenced by the moisture content and the buffering capacity of the original materials. Silage that has been properly fermented will have a much lower pH (be more acidic) than the original forage. Kung and Shaver (2002) in their interpretation of silage analysis stated that a good quality grass and legume silage-pH values in the tropics ranges between 4.3 and 4.7.

The temperature of the silages ranged from 28.12 ^{0}C to 31.62 ^{0}C in this study (Figure II) is similar to temperature of fermenting forages which vary from 27^{0}C to 38^{0}C reported to produce excellent silages (Nagel and Broderick, 1992). The optimal internal temperature during fermentation is below 37.78^{0}C. Higher temperatures often result in poorer – quality silage (Adesogan and Newman, 2010).

The Coefficient of preference (CoP) of the experimental diets by goats, sheep and cattle is presented in Table 3. Coefficient of Preference (CoP) is a direct measure of acceptability and nutritional capabilities of a feedstuff. In recent times, cafeteria techniques have been used to assess the acceptability of some forage (Bamikole *et al*., 2004, Babayemi *et al*., 2006 and Babayemi, 2007). The highest CoP value obtained in T5 were 1.30, 1.26 and 1.20 for cattle, sheep and goat respectively while the least values of CoP of 0.89 was obtained in T1 and T2 for goat, for sheep T1 and T4 while 0.75 was recorded for Cattle in T1.

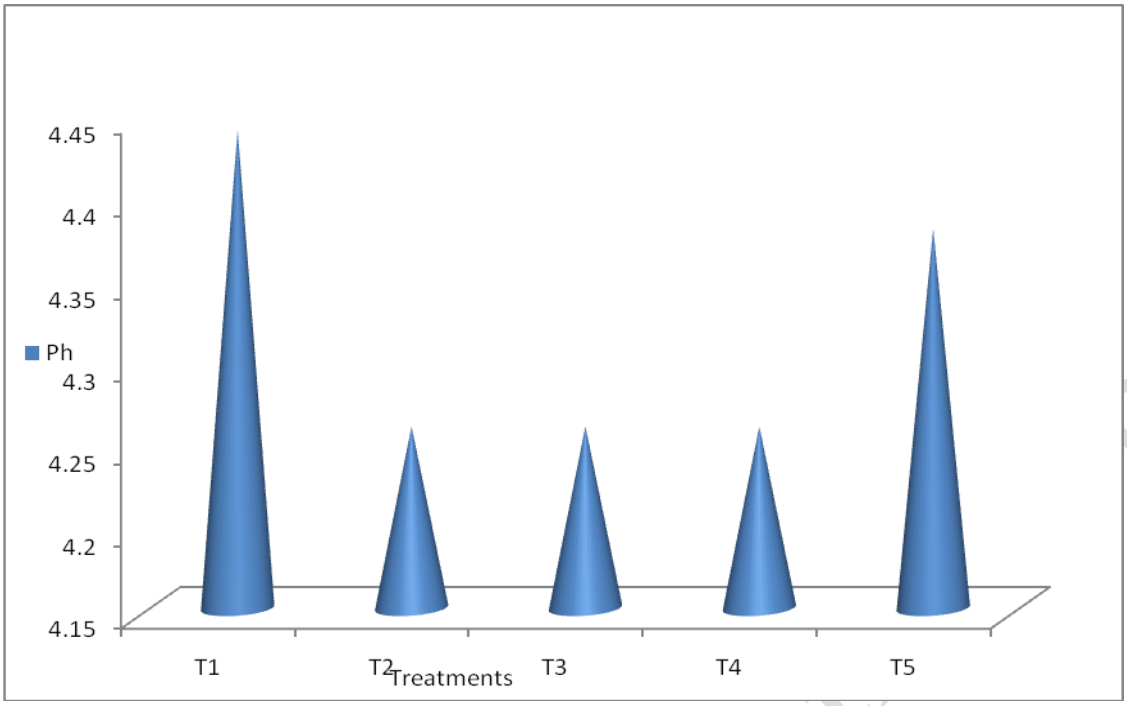

Fig. 1: pH of cassava tops, maize stover ensiled with *Albizia saman pods*

CT – Cassava Tops MST – Maize Stover ASP – Albizia saman pod
T1-- 40% CT +60% MST + 0% ASP
T2-- 30% CT +60% MST + 10% ASP,
T3-- 20% CT +60% MST + 20% ASP
T4-- 10% CT +60% MST + 30% ASP,
T5-- 0% CT +60% MST + 40%

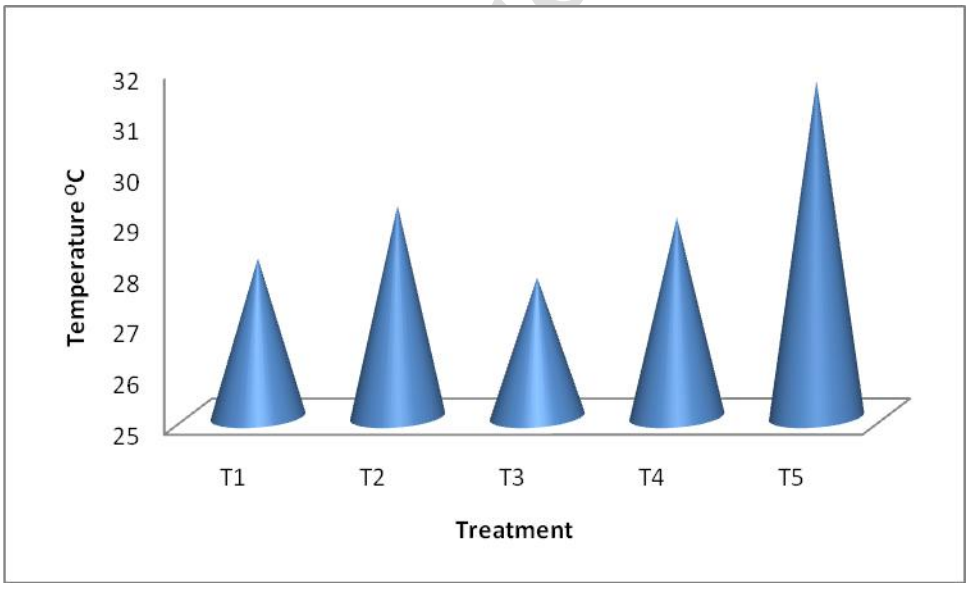

Fig. 2: Temperature of cassava tops, maize stover ensiled with *Albizia saman pods*

CT – Cassava Tops MST – Maize stover ASP – Albizia saman pods
T1-- 40% CT +60% MST + 0% ASP, T2-- 30% CT +60% MST + 10% ASP, T3-- 20% CT +60% MST + 20% ASP, T4-- 10% CT +60% MST + 30% ASP, T5-- 0% CT +60% MST + 40%

Table 3: Coefficient of preference (CoP) of Cassava tops, Maize Stover ensiled with *Albizia saman* pods by the 3 breeds of ruminants

Treatment	Cattle		Sheep		Goat	
	Intake g/DM	CoP	Intake g/DM	CoP	Intake g/DM	CoP
T1	2.63[b]	0.75	0.77	0.94	0.50	0.89
T2	3.17[b]	0.90	0.93	1.13	0.50	0.89
T3	3.50[ab]	1.00	0.60	0.73	0.53	0.95
T4	3.77[ab]	1.10	0.77	0.94	0.60	1.07
T5	4.50[a]	1.30	1.03	1.26	0.67	1.20
SEM	0.26		0.123		0.044	

[a,b] Means on the same column with different superscript, differ significantly (P<0.05)
CoP—Coefficient of preference, CT - Cassava Top; MST – Maize Stover ASP – Albizia saman pod
T1-- 40% CT +60% MST + 0% ASP
T2-- 30% CT +60% MST + 10% ASP,
T3-- 20% CT +60% MST + 20% ASP,
T4-- 10% CT +60% MST + 30% ASP,
T5-- 0% CT +60% MST + 40%

CONCLUSION

This study revealed that the nutritional potential of cassava tops, maize stover ensiled with *Albizia saman* pods for feeding ruminants. The nutritional assessment has shown that ensiling technology is probably an alternative method that can provide a well preserved product/feed at a low cost for longer periods of time for our animals during droughts. An animal feeding trial is recommended to ascertain if the animals can optimize these potentials.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest concerning the submission of this manuscript for publication.

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