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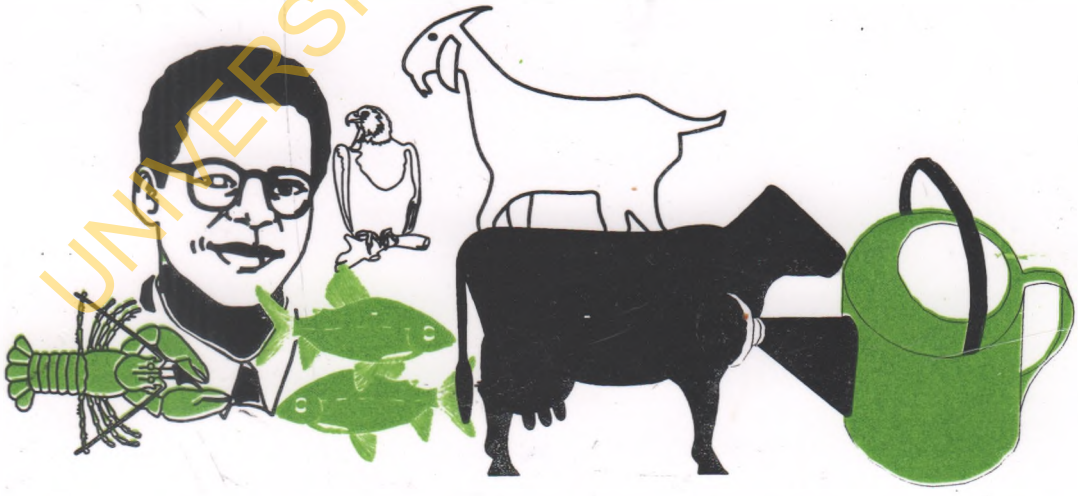

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QUALITY AND ACCEPTABILITY OF VELVET BEAN (*Mucuna pruriens*) FOLIAGE ENSILED WITH WHOLE PLANT MAIZE BY WEST AFRICA DWARF RAMS

BY

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ABSTRACT

This experiment was conducted to determine the suitability of Velvet Bean Foliage (VBF) and Whole Plant Maize (WPM) silage as dry season feed for ruminants in Southwest of Nigeria. In this study, WPM was ensiled with five levels of VBF (0, 25, 50, 75 and 100%). Physical characteristics, temperature, pH and proximate composition of the silages were assessed after 21 days of ensiling. Preference for the silage by ruminants was determined using twelve West African dwarf (WAD) rams. Results revealed that pH, temperature and physical characteristics of all silages were within acceptable range except for VBF -100 which did not make good silage. The appearance, smell and texture of all the silage mixtures compromised increasing level of VBF while the pH increased. The pH of the silage varied from 3.92-7.98. Dry matter (DM), crude protein (CP) and crude fibre (CF) concentration in the silages ranged from 20.67 – 26.65, 8.02 – 15.77, 26.42 - 1926g/100g, respectively. The DM and CF of the silages reduced with increasing level of VBF in the mixture while the CP increased.

Coefficient of preference (CoP) for the silage varied from 0.79 to 1.13 while percentage preference varied from 15.58 - 22.50%. The coefficient of preference (CoP) was above unity for VBF (0, 25, 50 and 75) but less than unity for VBF- 100, showing that rams preferred silage with whole plant maize to sole VBF.

This result suggests that quality of Whole plant maize silage improved when velvet bean foliage was added; however, acceptability by WAD rams was compromised.

Keywords: Velvet bean foliage, whole plant maize, silage, quality, acceptability, rams.

INTRODUCTION

One of the problems of ruminant production in the tropics is the scarcity of energy and protein feedstuffs during the dry season. Dry season is always associated with scarcity of forages (Bamikole and Babayemi, 2004) resulting in staggered growth pattern, weight loss and high mortality, coupled with reduced milk yield and high reproductive failure (Babayemi, 2009). This situation causes the nomads to travel long distances in search of pasture for their livestock and in the process, losing some of these animals to snake bite and exposures to harsh weather (Iyayi *et al*., 2003). Forages, crop residues and by – products are usually consumed fresh by domestic animals in the rainy season but deteriorate rapidly, especially in the dry season. Hence the need for conservation in form of silage, which is less weather-dependent like hay. These forages are abundant in supply and high in nutritive value during the rainy season. Physical quality of a feed can be assessed by free choice intake and acceptability studies. Acceptability and nutritional ability of forage or feedstuff can be measured directly from coefficient of preference (COP) using free choice technique (Bamikole *et al*., 2004; Babayemi *et al*., 2006 and Olorunnisomo, 2011). Ensiling is an efficient method of forage preservation and serves as a means of salvaging under utilized pasture for better acceptability and degradability. Velvet bean (*Mucuna pruriens*) is a tropical legume belonging to the family Fabaceae of the sub- division Palpilionoideae. Many experiments have been carried out on *Mucuna* seeds as feed for poultry and other monogastrics (Iyayi and Egharevba, 1998., Onwuka, 1997., Emenalom and Udedibe, 1998). This study was

designed to investigate the quality and acceptability of velvet bean foliage ensiled with whole plant maize by West African dwarf rams.

MATERIALS AND METHODS

Silage making:

Velvet bean foliage was harvested manually at the onset of flowering while whole plant maize was harvested at milking stage of growth. The harvested fodder crops were chopped mechanically and wilted for 24hours in order to reduce the moisture content. The fodder crops were chopped into 2-3cm length for ease of compaction and consolidation for silage. Filling and compaction was done simultaneously to eliminate air. The silage was prepared in polythene bags in triplicates. The polythene bags were sealed and compressed with weights in small 4litre mini silos for laboratory analysis, while another set of silages were compressed with piles of heavy sand bags in 200litre container for acceptability studies. Fermentation was done for 21days. The treatments were: VFB - 0, VFB – 25, VFB – 50, VFB – 75 and VFB – 100.

Determination of silage quality:

Fermentation was terminated after 21 days of ensiling and the silage was opened to determine the silage quality. Parameters studied under quality evaluation were: colour, aroma, texture, pH and temperature as described by Olorunnisomo (2011) and Babayemi and Igbekoyi (2008). Immediately the silage was opened, a thermometer was inserted to determine the temperature. The pH of the silage was determined as described by Falola *et al,* (2013). Colour assessment was determined by visual observation, with the use of colour charts. The aroma of the silage was assessed with respect to pleasant, fruity or pungent. From different points and depths of the silage Sub-samples were taken and mixed together for dry matter determination by oven drying at $65\ ^{O}C$ until a constant weight was achieved. The samples were later milled and stored in an air – tight container until they were ready for chemical analysis stored.

Chemical analysis:

Crude protein, crude fibre, ether extract and ash content of the silages were carried out in each of the three replicates of each treatment as described by AOAC (1995). The fibre components including neutral detergent fibre, acid detergent fibre and acid detergent lignin were determined according to Van Soest *et al.*, (1991). Data were analyzed by analysis of variance, ANOVA, using the procedure of SAS outlined by SAS, (2002). The significant means were then compared using Least Significant Difference (LSD) of the same package.

Acceptability/ Free choice study:

The study was carried out at the sheep unit of Teaching and Research farm, University of Ibadan. Twelve West Africa dwarf rams were used in this free choice study that lasted for 14 days, including 7 days of adaptation. The animals were housed in a group pen within the ruminant house with cross ventilation. 4kg each of five different feed samples which constituted the dietary treatments were served separately on five different wooding feeders on cafeteria basis, thus each animal has free access to each of diet in the feeding trough. The positioning of the feed was changed daily to prevent animals' adaptation to a particular feeding trough. The

amount consumed was monitored for six hours daily and the quantity of feed consumed was measured and recorded. Feed preference was determined from the Coefficient of Preference (CoP) value calculated from the ratio between the intakes of each individual feed sample divided by the intake of five feed samples (Bamikole *et al.*, 2004). On the basis, a feed was taken to be relative preferred if the CoP value is greater than unity.

$$CoP = \frac{\text{Intake of individual feed offered}}{\text{Mean intake of all the feed offered}}$$

Data collected were subject to analysis of variance (ANOVA) using procedure of SAS (SAS, 2002). The significant means were compared using least significant different (LSD) method.

RESULTS AND DISCUSSION

Silage characteristics:

Physical characteristics of the silages are presented in the Table 1. Treatments 1, 2, 3 and 4 were similar in their properties, having pleasant colour, firm texture pH of 3.92-4.91 and temperature 29.62-28.90^{0}C respectively. But treatment 5 (100% *Mucuna puriens*) silage differered sharply in all these physical characteristics, having fairly pleasant odour, firm but wet texture with pH of 7.98 and temperature of 30.46^{0}C. However, all the silages maintained their original colour, which ranged from green in T_1 to dark green in T_2 and T_3 to dark green in T_4 and very dark colour in T_5.

Good silage usually preserves the original colour of the pasture or any forage (Mannatje, 1999). All the characteristics colour obtained from these silages were similar to the original colour. The dark colouration of these silages increased with increased inclusion level of *Mucuna pruriens* in the silage which does not necessarily make the silage to be a bad one. This was against the report of Olorunisomo (2011) that dark colouration of silage indicates bad silage, but in line with Oduguwa *et al.* (2007) good silage will have its colour close to the original colour, which was an indication of good quality silage that was well preserved.

T_1 to T_2 silages had pleasant aromas which is an indication of good silage as reported by Babayemi (2009) that a pleasant aroma is an indication of well made silage. Optimum temperature range of 27.62 - 30.46 reported for these similar silages were similar to the values of 28.3-29.1^{0}C reported by Babayemi (2009) and within the range (27-38^{0}C) reported by Muck (1996) for excellent silage production. Temperature increased within increased level of *Mucuna pruriens* inclusion in the silage. However, McDonald *et al.*, (1995) reported that temperatures above 30^{0}C for the grass silage would produce dark yellow or brown sugar, due to caramelization of sugars in the forage. The texture of the silages T_1 to T_4 was firm but T_5 appeared to be wet but firm. Firm texture of silage is expected to be the best texture of good silage (Kung and Shaver, 2002). Slimy text or wet texture indicates spoilage in the silage.

The pH of the silages was within the range of 3.92-7.98. pH value for silages T_1, T_2, T_3 and T_4 were within the acceptable pH range for a good silage and T_5 had a pH of 7.98 which was above the recommended pH value for a good silage. Silage that has been properly fermented will have lower pH value (Menesses *et al.*, 2007, Babayemi, 2009, Olorunisomo, 2011). A good quality grass and legume silage pH values in the tropics ranges between 4.3 and 4.7

(Olorunisomo, 2011). However, pH may be affected by the moisture content and the buffering capacity of the original materials due to the fact that they are low in soluble carbohydrate (Mc Donald *et al.,* 1995).

Proximate composition:

Proximate composition of silage after 21days of ensiling is shown in Table 2. The dry matter ranged from 20.67% in T_5 (100% *Mucuna pruriens*) silage to 25.65% in T_1 (100% whole maize silage). Crude protein values were 8.02% in T_1 (100% whole maize silage) to 15.77% in T_5 (100% *Mucuna pruriens* silage). Crude fibre values were 26.42% in T_1 to 19.26% in T_5. Ether extract ranged from 2.25% in T_1 to 7.49% in T_5 while Nitrogen free extract (NFE) ranged from 41.36% in T_5 to 56.71 in T_1.

Crude protein and ether extract increased with the increasing inclusion of *Mucuna pruriens* in the silage while the Dry matter, crude fibre, Nitrogen free extract decreased with increasing level of *Mucuna pruriens* in the silage. There are significant differences ($P< 0.05$) in all the parameters across the treatment. The CP contents in T_1 and T_2 are within the critical value of 7% recommended for small ruminants (NRC, 1981) while T_3 is within the minimum protein requirement of 10-12% recommended by ARC (1984) for ruminants while the CP contents of T_4 and T_5 were slightly above the recommended value by ARC (1984). Decrease in NFE percentage across the treatments is a good indication that whole maize stover has high soluble carbohydrates needed to supply energy. Also, the slight decrease in CP content across the treatments after ensiling might be due to the heat production during ensiling which may have bound forage protein with forage carbohydrates fractions, rendering the protein fraction less degradable.

Acceptability study:

Forage acceptability of the ensiled forage by rams is presented in Table 3. The forage preference showed that T_2 (75%whole maize +25% *Mucuna pruriens*) silage was consumed most (468kg/day). On the basis of animal preferences, T_2 was higher than the rest, with highest CoP above unity (1.13), followed by T_1 (100 %whole maize silage), with CoP (1.07) followed by T_3 (50% whole maize +50% *Mucuna pruriens*) with CoP (1.02) followed by T_4 (25% maize+75 % *Mucuna pruriens* silage) with CoP of 1.00. The CoP of T_5 (100% *Mucuna Pruriens* silage) was below the unity (0.79), indicating that the forage was not acceptable to the rams. Acceptability of forage by animals might not be unconnected with many factors such as physical structure and chemical composition of the forage (Van Soest *et al.,* 1991).

100% ensiled *Mucuna pruriens* foliage without whole maize was equally not accepted by the animals., this could be due to poor silage characteristics such as mouldy growth and dark appearance of the silage which could be poisonous to the animals (Mc Donald *et al;* 1995). It was observed with increasing level of *Mucuna pruriens* in the diet; the animals generally prefer maize silage to *Mucuna* silage. This observation was supported by Mannatje (1999). Also, it was observed that inclusion of whole maize stover enhanced the acceptability of the silage because the animals were adapted to feeding on maize stover.

Table 1: Physical characteristics and pH of whole maize and Velvet bean (*Mucuna pruriens*) silage

Parameter	T_1	T_2	T_3	T_4	T_5
Appearance	Green	Dark green	Dark green	Dark	Very Dark
Smell	very pleasant	Very pleasant	Pleasant	Pleasant	Fairly pleasant
Texture	Firm	Firm	Firm	Firm	Firm but wet
PH	3.92	4.19	4.45	4.71	7.98
Temperature	27.62	28.40	28.70	28.90	30.46
Moulds	Absent	Absent	Absent	Very few	Present

T_1 =100% WMS

T2 =75% WMS+25% MPS

T_3 =50% WMS+50% MPS

T4=25% WMS+75% MPS

T_5=100% MPS

WMS (whole maize stover)

MPS (*Mucuna pruriens* silage)

Table 2: Proximate Composition of whole maize stover/Mucuna *pruriens* silage

Parameters (%) (g/100g)	T_1	T_2	T_3	T_4	T_5	SEM
Dry matter (%)	26.65^a	23.48^a	21.80^b	21.57^b	20.67^a	0.67
Crude protein (%)	80.02^c	8.98^c	11.74^b	13.01^a	15.77^a	0.54
Crude fibre (%)	26.42^a	26.20^a	24.02^b	21.64^{ab}	19.26^c	1.24
Ether Extract (%)	2.35^c	3.69^b	4.67^b	6.60^a	7.49^a	0.09
Ash (%)	6.50^c	8.36^b	10.39^b	14.39^a	16.11^a	0.12
Nitrogen Free Extract (%)	56.71^a	52.77^b	49.18^b	44.36^c	41.36^c	2.43

a,b,c: Means within the same row with different superscripts are significantly different (P< 0.005)

Table 3: Acceptability of whole maize stover - *Mucuna pruriens* silage by rams

Parameter	T_1	T_2	T_3	T_4	T_5	SEM
Intake (kg/day)	4.45^b	4.68^a	4.26^c	4.17^c	3.24^d	0.10
Coefficient of Preference	1.07^b	1.13^a	1.02^c	1.00^c	0.79^d	0.002
% Preference	21.39^d	22.50^a	20.48^c	20.05^d	15.58^c	1.02
Ranking	2^{nd}	1^{st}	3^{rd}	4^{th}	5^{th}	

a,b,c : Mean within the same row with different superscript are significantly different (P< 0.05).

CONCLUSION AND RECOMMENDATION

Results showed that silage characteristic in term of colour, aroma, texture temperature and pH were similar among the silage and were within the acceptable properties of good silage except T_5 (100% *Mucuna pruriens*) silage which exhibited poor silage quality and was not accepted by the experimental animals. Therefore ensiling *Mucuna pruriens* with whole maize stover enhanced the acceptability of the diet by WAD sheep.

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