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QUALITY AND PROXIMATE COMPOSITION OF *PANICUM MAXIMUM* ENSILED WITH PALM PRESSED FIBRE AND CASSAVA PEELS

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ABSTRACT
Quality and proximate composition of *Panicum maximum* ensiled with palm pressed fibre and cassava peels were investigated. Four silage mixtures were assigned to one of the following treatments in a Completely Randomized Design: Treatment 1 (T_1) = 100% *Panicum maximum*; Treatment 2 (T_2) = 50% *Panicum maximum* + 50% Cassava peels; Treatment 3 (T_3) = 50% *P. maximum* + 50% palm pressed fibre; Treatment 4 (T_4) = 50% *Panicum maximum* + 25% palm pressed fibre + 25% cassava peels. The experiment lasted for 45 days for ensilage of the feed mixtures. On day 45 of the experiment, subsamples were collected from each treatment for silage qualitative assessment. The results showed that the silage pH values (3.5-5.0) were generally acidic. Based on the colour, absence of mould and a pleasant acid smell, the silage was considered to be of good quality. The proximate compositions of the ensiled feed stuffs differed significantly ($p<0.05$) for unensiled and ensiled feed stuffs. The organic acids (lactic acid: 8.62-10.88% and acetic acid: 0.37-0.53%) and ammonia nitrogen (2.12 – 2.49%) also showed significant difference ($p<0.05$) and were within ranges for good quality silage. The study has shown that the diet (*Panicum maximum*/palm pressed fibre/cassava peels) silage in the ratio of 50:25:25 can serve as a sustainable feedstuff for ruminants during the dry season.

Key words: Panicum maximum, palm pressed fibre, cassava peels, silage

Introduction

Majority of ruminants in Tropical Africa are raised on natural pasture, which decline rapidly in quality and quantity in the dry season. This poses a great problem, which can be solved through preservation of feedstuffs (Obua, 2005). Attention has therefore been turned lately to using less expensive crop residues and agro-industrial by-products, which can be utilized by ruminants. Nigeria is one of the leading growers of oil palm in the world (Bamikole and Babayemi, 2007). Up to 258,000 tonnes of liquid sludge and 608,700 tonnes of palm pressed fibre are generated annually (Bamikole and Babayemi, 2007). Palm Pressed Fibre (PPF) is the collection of the pericarp obtained after extraction of palm oil from the boiled and sterilized oil palm fruits (Bamikole and Babayemi, 2007). Similarly, cassava peels, one of the major kitchen/industrial wastes from cassava tuberous root processing are found in abundance with average annual tuberous root yield of 21.1t/ha (Udoh *et al.,* 2005). Since the root constitutes 21.1t/ha, it follows that 4.2t/ha of cassava peels are available for ruminant feeding (Ifut, 1987). It is highly relished by small ruminants. Cassava peel is an important source of energy in ruminant feeding systems, serving either as the main basal diet or as a supplement. But studies have shown that cassava peels should not be fed alone, as their protein and mineral contents cannot support optimum rumen function and therefore needs to be combined with other feedstuff like *Panicum maximum*, for maximum benefit to be derived from utilization of cassava peels to sustain animal growth and productivity. On the other hand, *Panicum maximum* is a large, tufted, fast-growing perennial grass widely distributed in Nigeria and highly relished by ruminants. A combination of cheap but energy- and fibre- rich agro-industrial by-product and forage has great potential in filling the feed gap occasioned by seasonal availability of low quality forage resource. It is in the light of these, that this research was undertaken to determine the quality and proximate composition of ensiled *Panicum maximum* with palm pressed fibre and cassava peels.

Materials and Methods

The research was conducted at the Laboratory Unit of the Department of Animal Science, University of Uyo, Uyo, Nigeria. Cassava peels (CSP) were collected from Garri processing sites around Uyo metropolis and finely chopped for use. Palm Pressed Fibre (PPF) was collected from oil palm processing site at Ibesikpo Asutan

Local Government Area. The *Panicum maximum* was harvested around Use Offot village, Uyo Local Government Area. It was chopped to 2-3cm in length before use. The silage materials (CSP, PPF and *P. maximum)* were thoroughly mixed and 0.25% salt was added per treatment. Four numbered "OK plastic" containers served as silos. The silos were lined with black polyethylene sheets. Each feed mixture forming treatment was then quickly packed into different well labeled silos. The silos were never opened until the 45th day, when it was opened for collection of sub-samples for analyses for the quality assessment of temperature, pH, colour and odour. The temperature in the silos were taken by dipping a laboratory thermometer inside each silo to a depth of about 30cm, for a period of 2 minutes, and the readings taken immediately. Colour assessment was done with visual observation and colour chart. The odour of the silage was perceived and assessed by the researchers. The pH was determined by soaking subsamples per treatment in conical flask using distilled water and readings taken by dipping a pocket Hanna H19812-5 PH/°C/EC/TDS meter into the filtrate. Completely Randomized Design was used and the four ensiled diets forming treatments were: Treatment 1 – 100% *Panicum maximum*, Treatment 2 – 50% *Panicum maximum* + 50% Cassava peels, Treatment 3 – 50% *Panicum maximum* + 50% Palm Pressed Fibre, Treatment 4 – 50% *Panicum maximum* + 25% Cassava peels + 25% Palm Pressed Fibre. Samples of feedstuff (before and after ensiling) used in silage, were analyzed for their proximate components and organic acids according to A. O. A. C. (1990). All data collected were subjected to a one way analysis of variance (ANOVA) using SAS (1990). Where significant differences occurred, these were separated using Duncan's Multiple Range Test SAS (1990).

Results and Discussion

Qualitative Assessment of Silage

The qualitative assessment of the silage is presented in Table 1.1. It was observed that the colours obtained in the ensiled mixture across treatments, were close to the original colour of the feed materials. According to Obua (2005), good silage retains the original colour of the material. The odour of the ensiled feed stuff was generally pleasant across treatments, with T_2 and T_4 silage mixtures being more strongly alcoholic than T_1 (weak alcoholic) and T_3 (slightly alcoholic). The pleasant odour so obtained may be due to some amount of alcohol which combined with acids formed in the silage. The pleasant odour shows good preservation of the silage. However, cassava peel inclusion probably could be responsible for the strong alcoholic odour of T_2 and T_4 diets. This agrees with the findings of several authors (Obua, 2005; Menenses *et al.*, 2007; Babayemi *et al.*, 2009), who all reported that the end product of a well preserved quality silage should have a pleasant/fruity/acceptable odour. The pH values of the silage in this study were $T_1 = 5.0$, $T_2 = 3.5$, $T_3 = 4.4$ and $T_4 = 3.8$. The pH values obtained in this study for T_2, T_3 and T_4 diets were within the range of 3.5 – 4.7 reported as being suitable pH value for good silage (Obua, 2005; Kung and Sharer, 2010) except for control (T_1 = 100% *Panicum maximum*). The lowered pH values obtained for T_2 and T_4 diets could be attributed to the presence of cassava peels, which provided enough water soluble carbohydrate medium for the proliferation of lactic acid bacteria, thus eliciting a much reduced pH compared to the control (T_1) and T_3 diets. The highest pH value of 5.0 observed for T_1 diet in this study may be due to lack of adequate water soluble carbohydrate medium, which did not allow for the proliferation of silage fermentation bacteria. The temperature (°C) of the silage ranged from 28.0-29.0, with no consistent trend across treatments: T_1 (28°C), T_2 (29 °C), T_3 (28 °C) and T_4 (29 °C). However, the temperature values were within the range (27-35 °C) for good silage, according to Obua (2005). There was no mould observed in the ensiled feed stuff. This goes to show that the ensiled feed stuff were well preserved with possible proliferation of lactic acid bacteria.

Proximate composition (%DM) of silage

The proximate compositions (%DM) of ensiled feed stuff and unensiled feed stuff are presented in Tables 1.2a and 1.2b. The dry matter (DM) content of the feed stuffs decreased after ensiling, even in other parameters: crude protein, crude fibre, ether extract, ash and nitrogen free extract, and differed significantly ($P<0.05$) from each other before and after ensiling. The variation may reflect the nutrients of the dietary components. The highest DM

after ensiling was recorded for Treatment 3 (43.50%) while Treatment 1 (31.30%) had the least. The value for dry matter of 100% *Panicum maximum* silage (T_1) in this study (31.30%) is higher than 20.56% reported by Inyang (2011). However, the dry matter for 50% *Panicum maximum* + 50% cassava peels (T_2) in this study (35.00%) compares with the DM of 35.66% reported by Inyang (2011). The high DM value suggests a good source of energy and roughage that could enhance rumination and prevent digestive upset in the rumen of ruminants for the production of volatile fatty acids.

The crude protein (CP) in this present study ranged from 9.63-15.75% in the unensiled to 8.68-12.93% in the ensiled mixture, and differed significantly ($P<0.05$) across treatment means. According to Obua (2005), the loss of crude protein during ensilage could be as a result of proteolysis. The highest CP values of 15.75% and 12.93% was recorded in T_4 before and after ensiling while the least values of 9.63% and 8.68% was recorded in T_3, in both unensiled and ensiled feed stuff. The CP value obtained for 100% *Panicum maximum* silage (T_1) (10.04%) after ensiling is lower than 12.25% CP reported by Inyang (2011). Also, the CP value obtained in this study for 50% *Panicum maximum* + 50% cassava peels (T_2) (10.21%) is higher than 7.0% CP obtained by Inyang (2011) for the same ensiled diet. However, the values for CP after ensiling obtained in this study for T_1, T_2 and T_4, are within the minimum CP recommended daily requirement range of 9.00-14.00% CP (Aduku, 2004) for ruminant animals, except for T3 (8.68% CP). This could be as a result of the inclusion of *Panicum maximum* as the basal feed, which enhanced the crude protein of cassava peels and palm pressed fibre.

Treatment 3 diet recorded the highest crude fibre (CF) value of 7.40% after ensiling while the least value was obtained in T_1 (4.10%), with T_2 diet having 5.06% and T_4 diet, 4.42%. There were significant differences ($P<0.05$) in the mean CF values across treatments in the ensiled and unensiled feed stuffs. The CF values obtained for ensiled 100% *Panicum maximum* (T_1) and 50% *Panicum maximum* + 50% cassava peels (T_2) in this study were lower than 11.83% and 10.71%, reported by Inyang (2011). The highest CF value recorded by T_3 diet before and after ensiling in this study may be due to the high fibrous nature of palm pressed fibre. Also, the reduction observed in CF values across treatment means after ensiling (Table 1.2b), compared to the unensiled (Table 1.2a) may be due to the breakdown of fibres by micro-organisms present in the ensiled mass.

Organic Acids (%DM) of silage

The organic acids (%DM) composition of the ensiled feed combination is presented on Table 1.3. It was observed that there were significant differences ($P<0.05$) in all the parameters measured: lactic acid, acetic acid and ammonia-nitrogen. The lactic acid (LA) values in this study ranged from 8.62-10.88% with T_2 diet having the highest value (10.88%) while the least value was recorded in T_1 diet (8.62%). The LA values obtained in this study lies within the range of 8-12% reported for good silage (Obua, 2005). The LA values obtained for 100% *Panicum maximum* (T_1) and 50% *Panicum maximum* + 50% cassava peels (T_2) in this study is lower than 9.45% and 12.60%, reported by Inyang (2011).

The Acetic Acid (AA) values obtained in this study ranged from 0.37%-0.53%. The T_2 diet had the highest value (0.53%) while T_1 diet recorded the least value (0.37%). These AA values are within the range of <0.5-0.8% (Obua, 2005) acceptable for good silage. This shows possible proliferation of LA bacteria in the ensiled mass.

The ammonia-nitrogen values obtained in this study ranged from 2.19-2.49%, with T_3 diet having the highest value (2.49%) and T_2 diet having the least (2.12%). However, the values of NH_3-N for ensiled 100% *Panicum maximum* (T_1) in this study is lower than 3.73% reported by Inyang (2011), while the NH_3-N for 50% *Panicum maximum* +50% cassava peels (T_2 diet) in this study compares favourably with the value obtained by Inyang (2011) for the same ensiled feed mixtures.

Conclusion

With feed accounting for well over 60% of the total cost of production, it is therefore the utmost desire of the farmer to reduce cost by harnessing the unconventional feed resource available to maximize profit. Thus, given the proximate composition of 50% *Panicum maximum* + 25% palm pressed fibre + 25% cassava peels (T_4), shows that *Panicum maximum*/palm pressed fibre/cassava peels silage in the ratio of

50:25:25 has the potential of meeting the nutritional needs of ruminants in terms of protein and energy and can serve as a sustainable feed stuff for ruminants during the dry season.

Table 1.1: Qualitative Assessment of *silage mixtures*

Parameters	T_1	T_2	T_3	T_4
Colour	Greenish yellow	Brownish green	Brownish green	Brownish green
Temperature (°C)	28.0	29.0	28.0	29.0
Odour	Pleasant (weak alcoholic)	Pleasant (strongly alcoholic)	Pleasant (slightly alcoholic)	Pleasant (strongly alcoholic)
Texture	Firm and moist	Firm and moist	Firm and moist	Firm and moist
pH	5.0	3.5	4.4.	3.8
Mouldiness	Nil	Nil	Nil	Nil

T_1 = 100% *Panicum* silage; T_2 = 50% *Panicum* + 50% cassava peels silage; T_3 = 50% *Panicum* + 50% palm pressed fibre silage; T_4 = 50% *Panicum* + 25% palm pressed fibre + 25% cassava peels silage

Table 1.2a: Proximate Composition (%DM) of unensiled *P. max* with Palm pressed fibre and Cassava Peels

Parameters	T_1	T_2	T_3	T_4	SEM
Dry matter (DM)	34.50^{c}	40.35^{b}	51.56^{a}	41.03^{b}	3.54
Crude protein (CP)	11.81^{b}	11.38^{b}	9.63^{c}	15.75^{a}	1.29
Ether extract (EE)	4.95^{c}	7.41^{c}	21.03^{a}	12.06^{b}	3.50
Crude fibre (CF)	4.66^{c}	6.13^{b}	9.41^{a}	5.40^{c}	1.04
Ash	7.00^{b}	7.20^{b}	6.62^{c}	8.10^{a}	0.31
Nitrogen free extract	72.12^{a}	65.88^{b}	58.31^{c}	58.69^{c}	3.28
Energy ($Kcal^{-1}$)	380.27	375.73	461.03	406.30	19.59

^{a,b,c} means on the same row bearing different superscripts differ (P<0.05) significantly. T_1 = 100% *Panicum* silage; T_2 = 50% *Panicum* + 50% cassava peels silage; T_3 = 50% *Panicum* + 50% palm pressed fibre silage; T_4 = 50% *Panicum* + 25% palm pressed fibre + 25% cassava peels silage

Table 1.2b: Proximate Composition (%DM) of ensiled mixture

Parameters	T_1	T_2	T_3	T_4	SEM
Dry matter (DM)	31.30^{c}	35.00^{b}	43.50^{a}	34.23^{b}	2.62
Crude protein (CP)	10.04^{b}	10.21^{b}	8.68^{c}	12.93^{a}	0.89
Ether extract (EE)	3.63^{c}	6.04^{b}	14.39^{a}	7.56^{b}	2.30
Crude fibre (CF)	4.10^{c}	5.06^{b}	7.40^{a}	4.42^{c}	0.74
Ash	5.99^{a}	4.03^{b}	6.03^{a}	5.81^{a}	0.48
Nitrogen free extract	76.24^{a}	74.66^{a}	63.50^{c}	69.28^{b}	2.88
Energy ($Kcal^{-1}$)	377.79	393.84	418.23	396.88	8.31

^{a,b,c} means on the same row bearing different superscripts differ (P<0.05) significantly. T_1 = 100% *Panicum* silage; T_2 = 50% *Panicum* + 50% cassava peels silage; T_3 = 50% *Panicum* + 50% palm pressed fibre silage; T_4 = 50% *Panicum* + 25% palm pressed fibre + 25% cassava peels silage

Table 1.3: Organic Acids (%DM) of ensiled *P. maximum*, palm pressed fibre and cassava peels

Parameters	T_1	T_2	T_3	T_4	SEM
Lactic acid	8.62^{c}	10.88^{a}	9.75^{b}	9.85^{b}	0.46
Acetic acid	0.37^{c}	0.53^{a}	0.45^{b}	0.45^{b}	0.03
Ammonia-Nitrogen	2.19^{bc}	2.12^{c}	2.49^{a}	2.26^{b}	0.08

^{a,b,c} means on the same row bearing different superscripts differ ($P<0.05$) significantly. T_1 = 100% *Panicum* silage; T_2 = 50% *Panicum* + 50% cassava peels silage; T_3 = 50% *Panicum* + 50% palm pressed fibre silage; T_4 = 50% *Panicum* + 25% palm pressed fibre + 25% cassava peels silage

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