SILAGE QUALITY OF *MEGATHYRSUS MAXIMUS* ENSILED WITH GRADED LEVELS OF *GMELINA ARBOREA* AND ITS NUTRIENT DIGESTIBILITY BY WEST AFRICAN DWARF SHEEP

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ABSTRACT
Ruminant production in the tropics is challenged by forage scarcity in the dry season. The conservation of forages particularly as silage can bridge this gap. This study assessed silage quality and nutrient digestibility of Megathyrsus maximus ensiled with varying levels of Gmelina arborea leaves (GAL) as dry season feed for West African Dwarf (WAD) sheep. Different mixtures of Megathyrsus maximus and Gmelina arborea leaves (GAL) were ensiled and designated as follows: T1: 100% Megathyrsus maximus; T2:75% Megathyrsus maximus + 25% GAL; T3: 50% Megathyrsus maximus + 50% GAL.; T4: 25% Megathyrsus maximus + 75% GAL; T5:100% GAL. Silage characteristics and chemical composition were investigated. Fifteen WAD sheep were used in the digestibility trial. Result revealed pH (4.6-5.1), 26.55% - 31.48% dry matter (DM), 10.93 – 15.88% crude protein (CP), 60.58 – 63.18% Neutral detergent fiber (NDF), 32.72 – 38.75% Acid detergent fiber (ADF), 17.37 – 19.50% Acid detergent lignin (ADL). The order of DM and CP digestibility coefficient of silage diet by WAD sheep is T2, T1, T3, T4 and T5. Megathyrsus maximus ensiled with varying levels of GAL holds potentials as dry season feed for ruminants showing better quality and digestility by WAD sheep as GAL increased in the diets.
Keywords: Guinea grass, WAD Sheep, *Gmelina arborea* leaves, silage.

INTRODUCTION

Forages play important role in ruminant nutrition. During the wet season which corresponds to the period of abundant forages, ruminants gain weight but their productivity becomes very low during the dry periods due to scarcity. Conservation of forages as silage looks to be a preferable alternative for excess fodder during the period of abundance in the wet season (Olorunnisomo and Adewumi, 2015).
Guinea grass (*Megathyrsus maximus*) is a major pan-tropical grass used throughout the tropics for pasture, silage and hay. It is a fast growing leafy grass, palatable and nutritious to livestock. It grows naturally with high yield of palatable fodder well suited for grazing but with a challenge of rapid decline in Crude Protein (CP) and soluble carbohydrate as it matures (Alasa, 2014). *Gmelina arborea* on the other hand is a cheap non-conventional feed resource for ruminants that is available all year round. It is a tropical evergreen tree and a widely grown browsing plant that has been discovered as one of the cheapest ways to reduce the expense of feeding ruminant in the tropics (Okpara *et al.*, 2012). It is rich in nutrients; Okafor *et al.* (2012) revealed that the leaves contain high crude protein and crude fiber with low levels of anti-nutritional chemicals. Ensiling *Gmelina arborea* leaves together with *Megathyrsus maximus* presents an opportunity to preserve their nutrients and enhance their feeding value for small ruminants during the dry season. This study was therefore designed to assess the silage quality and nutrient digestibility of WAD sheep fed *Megathyrsus maximus* ensiled with graded levels of *Gmelina arborea* leaves

MATERIALS AND METHODS

Experimental site

The study was carried out at the small ruminant unit of Teaching and Research Farm of Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Oyo State, Nigeria. Ogbomosho lies at latitude 8°8'N, longitude 4°16'E, in the Guinea savanna zone of Southwest Nigeria

Silage Preparation and *Assessment*

Megathyrsus maximus (Guinea grass) were collected from already existing pasture plot at the Teaching and Research Farm and *Gmelina arborea* was obtained from within the university premises. Both were wilted in order to reduce the moisture content, chopped for ease of compaction and

consolidation of silages. They were mixed homogeneously in a varying proportion as follows: T1: 100% *Megathyrsus maximus;* T2: 75% *Megathyrsus maximus* + 25% *Gmelina arborea;* T3: 50% *Megathyrsus maximus* + 50% *Gmelina arborea;* T4: 25% *Megathyrsus maximus* + 75% *Gmelina arborea;* T5: 100% *Gmelina arborea.*

Fermentation was terminated after 21 days, the pH of the silage was determined using the pH meter. Colour assessment was determined using visual observation with the aid of colour charts. The aroma of the silage was assessed as to whether it is nice or pleasant, moderate or good. Sub samples from different points and depth were taken and mixed together to determine the dry matter. The samples were later milled and stored in air tight containers until needed for chemical analysis.

Silage intake and Nutrient digestibility

Fifteen growing male sheep were obtained from the flock at the small Ruminant unit of Teaching and Research Farm. In a completely randomized design using three triplicates, the rams were allotted to different metabolic cages specially made for a separate collection of urine and faeces. The sheep were fed 4% of their body weights with the silage. Feed intake was determined on the following day by weighing the remnants and subtracting it from the feed served. Representative sample from the orts was obtained for dry matter and nutrient analysis. Fresh water was supplied daily. Sheep were adapted to the cages for 14 days and another 7 days were used for the collection of data. In the morning, before animals were fed, the faecal output was evacuated and weighed. About 10% of each day's collection of faeces from each animal was taken to the laboratory for oven drying at65ºC for dry matter determination. The oven-dried faeces were later bulked, milled and stored in an air-tight container pending the chemical analysis

Chemical and statistical analysis

Crude protein, crude fibre, ether extract and ash of the silages were carried out in triplicates as described by AOAC to the methods of AOAC (2012) and the amount of CP was calculated (N x 6.25). The fibre components including Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF) and Acid Detergent Lignin (ADL) were determined according to Van Soest *et al*. (1991).

Experimental Design and Statistical Analysis

Data were analyzed using analysis of variance by following
the procedure of SAS (SAS, 2012). The significant means were separated by the use of Duncan multiple range F-test of the same package.

RESULTS AND DISCUSSION

Table 1 shows the silage qualities of *Megathyrsus maximus* ensiled with varying levels of GAL. The silage had acceptable physical attributes, with silage colour preserved close to the original colour of the forage (; Oduguwa *et al*., 2007). The aroma of silage from T1 and T2 were pleasant while T3, T4 and T5 were fairly pleasant. The pleasant smell is an indication of well-made silage (Kung and Shaver, 2002) and will stimulate and facilitate feed intake. The pH value of the silages (4.6-5.1) was within the range of 3.5- 5.5 classified to be pH for good silage (Kung and Shaver, 2002).

The result of the chemical composition of *Megathyrsus maximus* ensiled with varying levels of GAL showed significant differences ($P<0.05$) across all the Treatments (Table 2). The dry matter (DM) contents ranged between 26.55-31.48 %. Ensiling with GAL significantly ($p<0.05$) increased CP level from 10.93 to 15.88%. The CP was above the minimum level necessary to provide sufficient nitrogen required by rumen microorganisms to support optimum activity (McDonald *et al* 2011). The Neutral detergent fibre (NDF), Acid detergent fibre (ADF) and Acid detergent lignin (ADL) varied from 59.34-63.18 %, 32.72%-38.75% and 17.37%-19.50%, respectively with the least value recorded in T4. The NDF was within the range of 600-650 $g.kg^{-1}$ DM suggested as the limit above which intake of tropical feeds by ruminant animals would be limited (Van Soest *et al.*, 1991). This may imply that the fibre fractions of the diet have the potential to improve fermentation in the fore stomach of the animals (Ajagbe *et al.,* 2020).

Table 1: Quality of *Megathyrsus maximus* ensiled with varying levels of *Gmelina arborea* leaves (GAL).

Parameters	T1	T2	T3	T4	T5
Observation	Good	Good	Good	Moderate	Moderate
Colour	Light Green	Light green	Green	Dark green	Dark green
Texture	Firm	Firm	Moderately firm	Moderately firm	Moderately firm
Aroma	Pleasant	Pleasant	Fairly pleasant	Fairly pleasant	Fairly pleasant
pH	5.1	4.6	5.0	4.7	5.0
Temperature(°C)	23	25	26	27	29

T1: 100 % *Megathyrsus maximus;* T2: 75 % *Megathyrsus maximus* + 25 % *Gmelina arborea* leaf; T3: 50 % *Megathyrsus maximus* + 50 % *Gmelina arborea* leaf; T4: 25 % *Megathyrsus maximus* + 75 % *Gmelina arborea* leaf; T5: 100 % *Gmelina arborea* leaf.

Table 2: Chemical composition of *Megathyrsus maximus* ensiled with varying levels of *Gmelina arborea* leaves (GAL) fed to West African Dwarf sheep.

PARAMETERS (%)	T1	T2	T3	T4	T5	SEM
Dry matter	28.50^{c}	26.55^{d}	30.00^{b}	31.48^{a}	29.98^{b}	0.25
Crude protein	10.93^{d}	12.25^{c}	13.98^{b}	14.33^{b}	15.88^{a}	0.27
Ether extract	3.65^{b}	3.88^{b}	4.23^{a}	4.22^{a}	4.25^{a}	0.09
Ash	9.58^{b}	10.20^{ab}	9.85^{b}	12.08^{a}	11.55^{ab}	0.66
Neutral detergent fibre	60.58^{b}	61.25^{ab}	60.85^{b}	59.34^{b}	63.18^{a}	0.66
Acid detergent fibre	38.75^{a}	35.80^{b}	34.77^{b}	32.72^{c}	35.18^{b}	0.34
Acid detergent lignin	19.25^{a}	19.50^{a}	18.63^{a}	17.37^{b}	18.37^{ab}	0.36
Calcium	0.23^{b}	0.34^{a}	0.36^{a}	0.37^{a}	0.35^{a}	0.02
Phosphorus	0.35^{ab}	0.33^{b}	0.36^{ab}	0.38^{a}	0.37^{a}	0.01

$^{a, b, c, d:}$ Means along same row with different super scripts are significantly different (P<0.05); SEM: standard error of mean. T1: 100 % *Megathyrsus maximus;* T2: 75 % *Megathyrsus maximus* + 25 % *Gmelina arborea* leaf; T3: 50 % *Megathyrsus maximus* + 50 % *Gmelina arborea* leaf; T4: 25 % *Megathyrsus maximus* + 75 % *Gmelina arborea* leaf; T5: 100 % *Gmelina arborea* leaf.

Table 3: Nutrients digestibility of *Megathyrsus maximus ensiled* with graded levels of *Gmelina arborea* leaves fed to West African Dwarf sheep.

Digestibility coefficients, %	T1	T2	T3	T4	T5	SEM
DM	62.93^{b}	59.12^{b}	65.61^{ab}	76.89^{a}	77.57^{a}	4.23
CP	54.02^{bc}	42.50^{c}	57.81^{abc}	66.16^{ab}	76.41^{a}	5.94
EE	75.48^{bc}	72.75^{c}	77.45^{bc}	84.16^{ab}	92.52^{a}	2.92
ASH	36.36^{b}	39.38^{b}	44.23^{b}	70.52^{a}	82.36^{a}	5.21
NDF	58.29^{bc}	53.75^{c}	47.98^{c}	71.39^{ab}	83.33^{a}	4.94
ADF	47.36^{b}	37.70^{b}	27.24^{b}	54.51^{ab}	77.39^{a}	8.19
ADL	50.51^{bc}	45.76^{bc}	34.62^{c}	63.94^{ab}	80.59^{a}	6.12

$^{a, b, c, d}$: Means along same column with different super scripts are significantly different (p<0.05 ;) SEM: Standard error of mean

DM- Dry matter; CP- crude protein; EE- ether extract; ASH- ASH; NDF- Neutral detergent fiber; ADF-Acid detergent fiber, ADL- Acid detergent lignin,. T1: 100 % *Megathyrsus maximus;* T2: 75 % *Megathyrsus maximus* + 25 % *Gmelina arborea* leaf; T3: 50 % *Megathyrsus maximus* + 50 % *Gmelina arborea* leaf; T4: 25 % *Megathyrsus maximus* + 75 % *Gmelina arborea* leaf; T5: 100 % *Gmelina arborea* leaf.

The apparent digestibility coefficient of *Megathyrsus maximus* ensiled with graded levels of *Gmelina arborea* (GAL) fed to WAD sheep are presented in Table 4. The dry matter digestibility coefficient values were 59.12%, 62.93%, 65.61%, 76.89% and 77.57% for T1, T2, T3, T4 and T5, respectively. Sheep fed T2 had the least (42.50%) CP digestibility coefficient value while sheep fed T5 (sole GAL) had (76.41%) the highest values. The dry matter digestibility in this study ranged from 59.12%-77.57% which was within the rage of 56.62%-81.24% reported by Binuomote *et al* (2021). This is still enough to meet the production and maintenance requirements of small ruminants. The animals fed Treatment 3 had the least value (47.98%) for Neutral Detergent Fibre (NDF) digestibility and those on Treatment 5 had the highest (83.33%) NDF digestibility. The Acid Detergent Fiber (ADF) digestibility varied from 27.21-77.39% while Acid Detergent Lignin (ADL) digestibility value ranged from 34.62-80.59%. The higher fibre digestibility value obtained suggest that the silages were highly degraded in the rumen.

CONCLUSION

It can be concluded that 25% *Panicum maximum* ensiled with 75% GAL gave better nutrient digestibility for WAD sheep fed the silage diet.

REFERENCES

Ajagbe, A.D., Oyewole, B.O., Aribido, S.O. and Oyibo, A. (2020). Nutrient intake of West African Dwarf (WAD) goats fed cassava peels supplemented with nitrogen sources. *GSC Biological and Pharmaceutical Sciences.* 12(01), 189-195 T.O.

Alasa, M.C. (2014). Nutritional assessment of *Megathyrsus maximus* (Jacq.) ensiled with two cultivars of *Lablab purpureus* (*Lablab purpureus* L.) for West African Dwarf Ram. *PHD Thesis. Department of Animal science*. University of Ibadan.

Association of Official Analytical Chemists (AOAC) (2012). Official methods of Analysis, 19th Ed.

Binuomote R.T., Ayantoye, V, Fasesan, D.O. and Ojedokun, P.M. (2021). Nutrient Digestibility Coefficient of West African Dwarf Goat Fed Elephant Grass (*Pennisetum purpureum*) Ensiled with Varying Levels of Cassava Peel and Brewers Dried Grain. *American Journal of Agriculture,* 3(1):67-82

Kung, L., and Shaver R. (2002). Interpretation and use of Silage fermentation analyses reports Dept. of animal and food science, University of Delaware Newark, DE 19717.

Makkar, H.P.S. (2000): Quantification of tannins in tree forage, a laboratory manual for the FAO/IAEA Co-ordinate research project on 'use of nuclear and related techniques to develop simple tannin assays for predicting and improving the safety and efficiency of feeding ruminants on tanniniferous tree forage'. Joint FAO/IAEA of Nuclear Techniques in food and Agriculture, Animal Production and Health sub-programme, FAO/IEAE working Document, IEAE Vienna, Austria.

McDonald, P., Edward, R.A., Greenhalgh, J. F. D., Morgan, C.A., Sinclair, L.A. and Wilkinson, R.G. (2011). Animal nutrition, 7th EDn, Longman scientific and Technical, England.

Oduguwa, B. O., Jolaosho, A. O., Ayankoso, M. T. (2007). Effect of ensiling on the physical properties, chemical composition and mineral contents of Guinea grass and cassava tops silage. *Nig. J. Anim. Prod*. 34: 100- 106.

Okafor, E.C., Lakpini, C.A.M., and Fayomi, A. (2012). Dried Gmelina (*Gmelina arborea Roxb*) Leaves as Replacement Forage to Groundnut Haulms in the Diet of Fattening Red Sokoto Bucks. *International journal of Agriculture and Biosciences*, 1(1): 5-10.

Okpara, O., Akporhuarho, P. O. and Okagbare, G. O. (2012). Determination of Browse Intake and Nutrient Digestibility of Grazing West African Dwarf (WAD) Goats fed Varying Levels of *Gmelina arborea leaves* as supplements in Delta state Nigeria. *International Journal of Animal and Veterinary Advances* 6(2): 52-57.

Olorunnisomo O.A. and Adewumi A.S. (2015).Grass silage as conserved forage for cattle production in the humid parts of Nigeria 1st Biennial conference: Society for Grass Research and Dev. in Nigeria, Dec.6-9, Federal Univ. of Agric. Abeokuta, Nigeria

SAS, (2002). Statistical Analytical Systems. SAS user's guide. Carry, NY: SAS Institute.

Van Soest, P.J., Robertson, J.B., and Lewis, B.A. (1991). Method for dietary fibre, neutral detergent fibre and non-starch polysaccharides in relation to animal nutrition. *Journal of Dairy Science* 74(10): 3583-3597