PHYSICAL QUALITIES AND CHEMICAL COMPOSITION OF ENHANCED ENSILED GUINEA GRASS-CASSAVA PEEL MIXTURE WITH CENTRO LEAVES AND *DELONIX REGIA* SEED MEAL FOR SUSTAINABLE RUMINANT PRODUCTION

***Lamidi, A.A., Etela, I., Ingweye, J.N, Iriso, B.V., Adje, I.C. and Akinseto Alaba**
Department of Animal Science, University of Port Harcourt, Port Harcourt, Rivers State, Nigeria
*Correspondent Author: akeem.lamidi@uniport.edu.ng +2348055219133 / 08103142367

ABSTRACT
All year round feeding has been a challenge to sustainable ruminant production, ensiling grass with forage legumes, neglected seeds and crop waste are means of ameliorating the challenge. A study on physical qualities and chemical composition of enhanced ensiled guinea grass-cassava peel mixture with *Centrosema pubescens* leaves and *Delonix regia* seed meal was carried out. Four weeks regrowth Guinea grass (GGR), *Centrosema pubescens* (CEP), were harvested, wilted and chopped to 2-3 cm, cassava peel (CAP) and *Delonix regia* seed meal (DSM), mixed at different proportions (%) to have 5 experimental treatments: T1 = 100% GGR; T2 = 80% GGR + 10% CAP + 10% CEP; T3 = 80% GGR + 10% CAP + 10% DSM; T4 = 70% GGR + 10% CAP + 15% CEP + 5% DSM; T5 = 70% GGR + 10%CAP + 5% CEP + 15% DSM. Bamma bottles (960ml) were used as laboratory silos, ensiled for 60 days in completely randomize design (CRD). Physical qualities, temperature, pH, chemical compositions were examined. Results show perfect physical qualities across the experimental treatments, temperature and pH ranges from 27.60 – 28.40^{0}C, 4.00 – 4.80, respectively. There was significant difference ($P<0.05$) in all the chemical compositions except the dry matter (DM), nitrogen free extract (NFE), hemicellulose and cellulose across the experimental treatments. The CP was significantly higher ($P<0.05$) in T3 (15.56 %), while T1 had the least CP (9.83 %). The CF, EE, ash, ADF, NDF and ADL ranges from 24.66 – 31.23%, 3.14 – 3.68 %, 8.36 – 9.82 %, 42.13 – 49.35 %, 62.79 – 68.51% and 13.26 – 17.11 %, respectively. Conclusively, ensiling mixture of guinea grass-cassava peel with centro levees and *Delonix regia* seeds gives desirable physical qualities and chemical compositions. The T3 (80% Guinea Grass + 10% Cassava peel + 10% *Delonix regia* seed meal) is recommended.

Key words: Chemical composition, guinea grass, ruminant, silage, sustainable production,

INTRODUCTION
Sessional feed shortage as a result of dry season is a great challenge to sustainable ruminant production in Sub-Saharan region (Lamidi and Ologbose, 2014); it has resulted to poor production in terms of quality and quantity of animal products, sharp reduction in the profit of the enterprise. Its effect on national and sub-regional security cannot be overemphasis and a serious concern to the government at different level, farmers, sociologist and animal scientist especially the ruminant specialist and Forage scientists.

Conservation of forage and utilization of crop residues has a great potential in combating the challenges of seasonal fluctuation of feed resources for ruminant production. Lamidi *et al*. (2020) have observed that the best way to maximally utilize crop wastes is to convert them to useful feed resources for animals, especially ruminant animals. Silage production has been a means of adding value to different crops waste and forages especially grass.

Silages made from tropical grasses alone are poor in nutrient because of the low protein content, suggesting a rich protein source as additive (Lamidi and Ingweye, 2020). Ojo *et al*. (2017) enhanced *Pennisetum purpureum* silage with processed *Enterolobium cyclocarpum*, Lamidi and Ojo (2018) used *Delonix regia* seeds, Legume forage such as Cenro molle by Okunkenu *et al*. (2015). This study assessed the physical qualities and chemical composition of enhanced ensiled guinea grass-cassava peel mixture with Centro leaves and *Delonix regia* seed meal for sustainable ruminant production.

MATERIALS AND METHODS
Experimental site
The study was carried out at the Forage Science laboratory, Department of Animal Science, Faculty of Agriculture, University of Port Harcourt, Rivers State, Nigeria. Port Harcourt is a coastal city located in the Niger Delta region of Nigeria within latitudes 6^o 58' – 7^o 60'E and longitudes 4^o 40' – 4^{o}55'N.

Sources and preparation of experimental materials and experimental treatments
Panicum maximum was harvested at four (4) weeks regrowth from the University community, at 10 cm above ground level, *Centrosema pubescens* was also harvested within the University of Port Harcourt community, Port Harcourt, Rivers State, Nigeria. Two forages were wilted for 24 hours and chopped with forage chopper machine into 2 – 3 cm long pieces. *Delonix regia* seeds were harvested and processed according to Lamidi and

Evien (2019). The grass, cassava peel, *Centrosema pubescens* and *Delonix regia* seed meal were then mixed at different proportions as shown in Table 1:

Table 1: Composition (%) of the experimental treatments

	Experimental materials			
Treatments	Guinea grass	Cassava peel	Centrosema	Delonix seed meal
T1	100	-	-	-
T2	80	10	10	-
T3	80	10	-	10
T4	70	10	15	5
T5	70	10	5	15

Bamma bottles (960ml) were used as laboratory silos after the experimental materials were mixed thoroughly and ensiled; the bottles were tightly tied and covered to avoid air penetration. Each treatment had three replicates and the ensiled materials were kept at room temperature of 28 to 32°C for 60 days.

Physical and chemical quality evaluation of the silage:

Immediately the Bamma glasses were opened, the physical parameters, pH and temperature were assed as described by Lamidi and Akhigbe (2018). Sub-samples of the silage(s) were oven-dried. Dried samples were ground with a Thomas Willey Laboratory Mill-Model 4 and passed through 1-mm sieve, kept for laboratory analysis.

Chemical analysis

The proximate composition of the silage was determined according to AOAC (2000) while neutral detergent fibre (NDF) was determined according to Van Soest *et al.* (1991). Non-fibre carbohydrate was calculated as NFE = 100 – (CP + Ash + EE + CF).

Data analysis

The experimental design was a completely randomized design (CRD), in which the experimental treatments were the only source of variability.

The statistical model is as follows: $Xij = \mu + Ti + \sum ij$

Where Xij = value of observation; μ = population mean; Ti = treatment effect; ∑ij = error term

All data obtained were subjected to the analysis of variance (ANOVA). Means were separated using Least Significant Difference (LSD) SAS (2002) package.

RESULTS AND DISCUSSION

Table 2 shows the physical characteristics for enhanced ensiled guinea grass-cassava peel mixture with Centro leaves and *Delonix regia* seed meal. The colour, odour, wetness and moldiness were olive green, pleasant, moist and no mold, respectively across the experimental treatments. The temperature and pH ranges from 27.60 – 28.40 ^{0}C, 4.00 – 4.80, respectively.

Table 2: Physical characteristics of enhanced ensiled guinea grass-cassava peel mixture with Centro leaves and *Delonix regia* seed meal

	Experimental treatments				
Parameters	T1	T2	T3	T4	T5
Colour	Olive green	Olive green	Olive green	Olive green	Olive green
Odour	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant
Wetness	Moist	Moist	Moist	Moist	Moist
Texture	Smooth	Smooth	Smooth	Smooth	Smooth
Temperature (^{0}C)	28.00	28.40	27.70	27.60	27.80
pH	4.80	4.00	4.00	4.00	4.00
Moldiness	No mold	No mold	No mold	No mold	No mold

Table 3 shows the chemical compositions of enhanced ensiled guinea grass-cassava peel mixture with Centro leaves and *Delonix regia* seed meal. There was a significant difference ($P<0.05$) in all the chemical compositions except the dry matter, nitrogen free extract, hemicellulose and cellulose across the experimental treatments. The CP was significantly higher ($P<0.05$) in T3 (15.56 %), while T1 had least CP (9.83 %) which was similar ($P>0.05$) to T2. The CF was significantly ($P<0.05$) higher in T1 (31.23 %) while the T5 had the least CF (24.66 %DM). The EE, ash, ADF, NDF and ADL significantly ($P<0.05$) ranges from 3.14 – 3.68 %, 8.36 – 9.82 %, 42.13 – 49.35 %, 62.79 – 68.51% and 13.26 – 17.11 %, respectively.

Table 3: Chemical composition of enhanced ensiled guinea grass-cassava peel mixture with Centro leaves and *Delonix regia* seed meal

	Treatments						
Parameters	T1	T2	T3	T4	T5	SEM	LOS
Dry matter	90.90	92.57	89.65	89.78	89.61	0.59	NS
Crude protein	9.83^{c}	11.73^{bc}	15.56^{a}	10.83^{b}	12.72^{b}	0.59	**
Crude fibre	31.23^{a}	27.53^{b}	25.16^{d}	27.39^{c}	24.66^{e}	0.62	**
Ether extract	3.14^{e}	3.68^{a}	3.58^{c}	3.64^{b}	3.52^{d}	0.52	**
Ash	8.36^{e}	9.73^{b}	8.58^{c}	9.82^{a}	8.50^{d}	0.17	**
Nitrogen free extract	37.34	38.92	38.94	38.57	35.18	0.95	NS
Acid detergent fiber	49.35^{a}	47.17^{b}	42.34^{d}	47.05^{c}	42.13^{e}	0.96	**
Neutral detergent fibre	68.51^{a}	65.81^{b}	63.02^{d}	65.71^{c}	62.79^{e}	0.71	**
Acid detergent lignin	17.11^{a}	15.37^{b}	13.45^{d}	15.15^{c}	13.26^{e}	0.47	**
Hemicellulose	19.16	18.64	20.68	18.06	20.66	0.25	NS
Cellulose	32.24	31.8	28.89	31.9	28.87	0.49	NS

$^{a, b, c, d, e}$ Means on the same row with different superscripts differ significantly (P<0.05); SEM= Standard error of mean; T_1 = 100% Guinea Grass; T_2 = 80% Guinea Grass + 10% Cassava peel + 10% *Centrosema pubescens*; T_3 = 80% Guinea Grass + 10% Cassava peel + 10% *Delonix regia* seed meal; T_4 = 70% Guinea Grass + 10% Cassava peel + 15% *Centrosema pubescens* + 5% *Delonix regia* seed meal; T_5 = 70% Guinea Grass + 10%Cassava peel + 5% *Centrosema pubescens* + 15% *Delonix regia* seed meal.

The colour of the experimental treatments (T1 – T5) was close to the original colour of the grass, which was an indication of good quality silage that was well preserved (Oduguwa *et al.*, 2007). The pH value (4.0 – 4.80) recorded in this study can be compared with the value reported (3.50 - 4.00) by *Lamidi et al*. (2021) when ensiled *Panicum maximum* with different proportions of *Calopogonium mucunoides*. Meanwhile, the pleasant odour perceived in all the silage is an indication of normal physical characteristics of good silage (Lamidi and Akhigbe, 2018). Non mold formation was also an indication that the silage maintains the good quality and possibility of nutrients is visible.

The CP of the silage increases as the level of the inclusion of Centro and *Delonix regia* seed meal increases; this is in line with the findings of Lamidi and Ojo (2018) who reported an increasing trend of CP for ensiled guinea grass with varying levels of *Delonix regia* seed meal. The CP contents of the silage (9.83 – 15.56%) were above the critical lower limit (7% CP) which forage intake by ruminants and rumen microbial activity could be negatively affected (Norton, 2003). It implies that the silage would provide the adequate nitrogen requirement for the rumen microorganisms to maximally digest the main components of dietary fibre leading to the production of volatile fatty acids (Lamidi and Ogunkunle, 2016) this in turn facilitate microbial protein synthesis (Lamidi and Aina, 2013) and improve the production of meat, milk, skin and hide for man uses.

CONCLUSION AND RECOMMENDATIONS

Conclusively, ensiling mixture of guinea grass-cassava peel with centro levees and *Delonix regia* seed results to desirable physical qualities and considerable chemical compositions that can meet the requirement of the ruminant animal especially in the dry season. The T3 (80% Guinea Grass + 10% Cassava peel + 10% *Delonix regia* seed meal) is recommended for ruminant farmers.

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