

Proximate and Fiber Composition of *Pennisetum purpureum* Varieties in *Stylosanthes guianensis* Mixed Sward Fertilized with Two Manure Types

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ABSTRACT

This study was conducted to assess the nutritive quality of Elephant grass (*Pennisetum purpureum* Schumach) varieties in a mixed sward with Cook Stylo (*Stylosanthes guianensis*) fertilized with manure. The 3 × 9 factorial experiment was laid out in a split plot design. The treatments were three manure types (swine, poultry, and control) nine levels of grass/legume mixture with three replicates. The results showed that there were significant ($P < 0.05$) differences in most of the growth parameters of the grasses and legumes measured, irrespective of the intercrop and manure types. Fiber content of the plants increased ($P < 0.05$) with the intercrop. Swine fertilized plants had the highest DM, CP, EE, Ash (96.70%, 10.43%, 7.52%, 10.96%), respectively. Sole *S. guianensis* fertilized with swine manure had ($P < 0.05$) highest CP content (17.10%) with the intercrop of Green local var. of *P. purpureum* intercropped with *S. guianensis* had ($P < 0.05$) highest CP content (8.63%) than other mixtures.

The mixture of green local var. of *P. purpureum* with *S. guianensis* produced the highest EE value (9.00%) out of the intercropped plants. Swine fertilized intercrop green local had the highest NDF content (67.67%) and ADF had the highest ($P < 0.05$) value when Abeokuta 1 var. of *P. purpureum* was planted solely (36.67%) for ADL, the value ranged from 9.33% in sole *Stylosanthes guianensis* to 5.22% when Purple var. *P. purpureum* was intercropped with *Stylosanthes guianensis*.

In conclusion, swine manure increased CP content of the mixed sward and the mixture of *P. purpureum* and *Stylosanthes guianensis* increased the EE content.

(Keywords: elephant grass, napier grass, cook stylo, fertilizer, manure, grass, legume, intercrop, nutritive quality, fodder plants)

INTRODUCTION

The nutritive quality of fodder plants especially grasses varies with the varieties, the botanical composition of the swards and the soil nutrient status which can be improved upon with application fertilizer especially organic fertilizer that have slow release of nutrients. Sustainable livestock production is highly dependent on the availability of quality feed and forage resources. Napier grass, also known as elephant, is one of the most important tropical forage crops. It is widely used in cut and carry feeding systems (Lukuyu *et al.*, 2012; Kabirizi *et al.*, 2015) and is of growing importance in other agricultural systems.

Elephant grass (*Pennisetum purpureum* (Schumach) is a deep-rooted high yielding perennial bunch grass that is native to Africa (Boonman, 1993). It grows in tropical and sub-tropical regions with a wide range of annual moisture from 750 to 2,500 mm rainfall and in altitudes ranging from sea level to over 2100 m, but frost appears to limit its cultivation above this altitude (Skerman and Riveros, 1990). It is the most popular perennial fodder recommended for the intensively managed smallholder crop-livestock farming systems in Africa, where 80% of the national milk output is produced. This is because it can withstand considerable periods of drought (Butt *et al.*, 1993), produces greater dry matter (DM) yields than other tropical grasses (Skerman and Riveros, 1990; Boonman, 1997), and is of high nutritive value for dairy cattle particularly when supplemented with high quality feeds such as legumes (Nyambati *et al.*, 2003). Napier grass on average contains 20% DM, 7 to 10% CP, 70% NDF, 45% ADF (Gwayumba *et al.*, 2002; Islam *et al.*, 2003).

The importance of herbaceous forage legumes in increasing herbage production of grasses and quality of feed produced has been recognized (Mureithi *et al.*, 1995). Including a legume in fodder grasses production would not only provide a nitrogen source to promote grass growth but enhance the quality of feed. Legumes benefit grasses by contributing nitrogen to the soil through atmospheric fixation, decay of dead root nodules or mineralization of shed leaves. The inclusion of a legume in Napier grass-based diet has shown to improve animal performance in terms of milk production because of their high nutrient contents (Muinga *et al.*, 1992). All plants depend on soil for their supply of nutrients and grazing ruminant animals obtain the majority of their nutrient from plant growing on such soil. Fertilizers are needed to improve soil chemical and biological properties, and this reflects on the phytonutrient contents and palatability of herbage plants (Alalade *et al.*, 2013). Livestock farmers, many of whom are also crop producers prefer to use the little fertilizer available to them to boost grain yield rather than for pasture production (Nweze and Ezelfeanyi, 2010).

MATERIALS AND METHODS

The field experiment was carried out at the Teaching and Research Farm Unit of the Directorate of University Farms (DUFARMS), while the laboratory analysis was carried out at the laboratory of the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State, Nigeria.

The study was laid out in a factorial arrangement in a split plot design with experimental three manure types (swine, poultry and control), and nine levels of grass/legume mixture (*S. guianensis* + *Pennisetum purpureum* var. green local, sole *Pennisetum purpureum* var. green local, *S. guianensis* + *Pennisetum purpureum* var. purple, sole *Pennisetum purpureum* var. purple, *S. guianensis* + *Pennisetum purpureum* var. Abeokuta 1, sole *Pennisetum purpureum* var. Abeokuta 1, *S. guianensis* + *Pennisetum purpureum* var. Abeokuta 2, sole *Pennisetum purpureum* var. Abeokuta 2 and sole *S. guianensis*).

Proximate composition (dry matter, crude protein, ether extract and ash) were determined according to A.O.A.C. (1995) while non-fiber carbohydrate was calculated as $NFC = 100 - (CP + Ash + EE + NDF)$. Fiber fraction (Neutral detergent fiber (NDF), Acid detergent fiber (ADF) and Acid Detergent Lignin (ADL) were determined with the procedure of Van soest *et al.*, (1991). Cellulose content was taken as the difference between ADF and ADL while hemicellulose content was calculated as the difference between NDF and ADF. Data collected were subjected to Two-Way Analysis of Variance and the treatment means were separated using Duncan's Multiple Range Test using SAS (1999) package.

RESULTS AND DISCUSSION

The effect of manure type and intercrop on proximate composition was significant ($P < 0.05$) (Table 1).

Table 1: Effect of Manure Types and Intercrop on the Proximate Composition (%) of Four Varieties of *P. purpureum/S. guianensis* Mixed Sward.

Manure	DM	CP	EE	ASH	NFC
Swine	96.70 ^a	10.43 ^a	7.52 ^a	10.96 ^a	8.09 ^c
Poultry	96.00 ^b	9.57 ^b	6.63 ^b	10.30 ^b	11.80 ^b
Control	95.19 ^c	8.83 ^c	6.00 ^c	9.59 ^c	14.76 ^a
SEM	0.25	0.42	0.37	0.34	0.53
Intercrop					
Green local + <i>S. guianensis</i>	96.78 ^{ab}	8.63 ^d	8.33 ^a	8.33 ^c	9.59 ^c
Purple + <i>S. guianensis</i>	96.56 ^b	8.53 ^{de}	7.11 ^c	8.33 ^c	11.36 ^{ab}
Abeokuta 1 + <i>S. guianensis</i>	96.44 ^b	8.48 ^{de}	7.44 ^c	9.00 ^c	10.19 ^c
Abeokuta 2 + <i>S. guianensis</i>	97.11 ^{ab}	8.43 ^e	7.11 ^c	8.44 ^c	9.79 ^c
Green local	94.89 ^c	9.11 ^c	5.00 ^d	12.11 ^a	13.11 ^{ab}
Purple	94.44 ^c	9.07 ^c	5.22 ^d	11.56 ^{ab}	13.04 ^{ab}
Abeokuta 1	95.22 ^c	9.08 ^c	5.00 ^d	11.00 ^b	13.59 ^{ab}
Abeokuta 2	94.89 ^c	9.67 ^b	4.89 ^d	11.78 ^a	13.22 ^{ab}
<i>Stylosanthes guianensis</i>	97.44 ^a	15.49 ^a	10.33 ^a	12.00 ^a	10.07 ^c
SEM	0.34	0.24	0.30	0.32	1.81

^{a,b,c,d}: Means in same column with different superscript are significantly ($p < 0.05$) different

SEM= Standard Error of Mean

CP= Crude protein

DM= Dry matter

EE= Ether extract

NFC= Non-fiber carbohydrate

Dry matter (DM) value significantly ($P < 0.05$) ranges from 93.33% green local variety of *P. purpureum* with no fertilizer to 97.67% in green local variety of *P. purpureum* when swine manure was applied while CP value significantly ($P < 0.05$) ranges from 7.89% in Abeokuta 2 variety of *P. purpureum* intercropped with *S. guianensis* without manure application to 17.10% in sole *S. guianensis* with swine manure application. Ether extract value has the highest value of 11.33% in sole *S. guianensis* with swine manure was applied with the least value of 4.67% in Abeokuta 2 variety of *P. purpureum* with poultry manure application and sole Abeokuta 1 variety of *P. purpureum* without manure application. Ash value significantly ($P < 0.05$).

In this study, swine fertilized plants had higher DM, CP, EE, and ash value, the opposite was observed for NFC which was low in swine but was higher than all other four factors in control. The trend was also noticeable in intercrop with green local variety of *P. purpureum* having higher value EE but lower in NFC. The chemical constituents of forage usually indicate the level at which consumption and utilization would yield a positive animal output. In the present study, the CP content of the *S. guianensis* was higher than the range (4-8%) reported by Muraina *et al.* (2013), when same legume was harvested on natural pasture; this might be due to the stage of growth of the plant at harvest which was at 8 WAP.

Furthermore, the crude protein content of grasses as affected by manures in this study ranged between 8.83-10.43% which was above the required level for maintenance in ruminant animals. These values were also above the minimum range of 6.50- 8.0% prescribed for optimum performance of tropical ruminant animals (Minson, 1981). The higher CP recorded for grasses fertilized with cattle and swine manure might be attributed to high carbon: nitrogen ratio which suggests that mineralization takes place at different rates between manures of different animal species (Dele, 2012).

The CP contents results were higher than the recommended requirement (6%) for ruminant animals in the tropics (NRC, 1984; Humpherys, 1991), minimum level (7%) required for optimum rumen functions (Van Soest, 1994) and 8% suggested for ruminal functions (Norton, 1994). The crude protein (CP) content of the intercropped in this study as affected by manure types fell within the range of 15.49% reported by Dele (2012) for *Panicum maximum* and *P. purpureum* when different manure were applied but was lower than sole planted grass which can be attributed to the low level of available P in the soil for the uptake of both plants and this was also corroborated by Tambara *et al.* (2017) who recorded that black oat had a higher average CP level than the rye grass mixture of black oat and Ryegrass and a consortia of Rye grass, forage peanut and red clover. It is also within the range of 6.48-14.45 reported by Muraina *et al.* (2015) for *Stylosanthes* species sown into natural pasture for ruminant feeding.

Moreso, the crude protein (CP) content result obtained for the intercropped in this study after 8 weeks of planting was also in line with the report of Ajayi *et al.* (2007).

The *P. purpureum* intercropped with legume had higher crude protein values than the sole. This could be due to the result of beneficiary association of the legume as supported by Njoka-Njiru *et al.* (2006) that legumes has relatively high nitrogen content in their vegetative matter and also possess the ability to fix atmospheric nitrogen. Grass maturity is usually negatively related to CP content (Norton, 1981). Furthermore, the CP content of grass obtained in this study fell within the range (3-11%) reported for grasses in grazed natural pastures and fodder bank during late dry season and early rainy season (Mani *et al.*, 1992). Ash content of *P. purpureum* were within the range (9-13%) reported for grasses by Mani *et al.* (1992).

The effect of manure types and intercrop on the fiber composition was significantly different ($P < 0.05$) (Table 2). Neutral detergent fiber (NDF) value significantly ($P < 0.05$) ranged from 50.00% in *S. guianensis* without manure to 69.67% in Abeokuta 1 variety of *P. purpureum* when swine manure was applied. Acid detergent fiber (ADF) recorded 27.33% in purple variety of *P. purpureum* intercropped with *S. guianensis* with swine manure application to 36.67% in Abeokuta 1 variety of *P. purpureum* with swine manure application while the value of acid detergent lignin (ADL) was 3.67% in purple variety of *P. purpureum* intercropped with *S. guianensis* without manure to 9.67% Abeokuta 2 variety of *P. purpureum* without manure application. Meanwhile, hemicellulose content ranged from 18.67% in sole *S. guianensis* without manure application to 39.00% Abeokuta 2 variety of *P. purpureum* intercropped with *S. guianensis* when swine manure was applied, the cellulose ranged from 20.33% in mono-cropped *S. guianensis* without manure to 31.00% in Abeokuta 1 variety of *P. purpureum* when swine manure was applied.

The NDF content of *P. purpureum* and *S. guianensis* studied in this research were within the range reported for grasses (40-65.5%) and *Stylosanthes* (62-72%) (Mani *et al.*, 1992) Roughages with NDF content of 45-65% and below 45% are generally considered as medium and high-quality feeds, respectively (Singh and Oosting, 1992). The NDF contents of these pasture components were higher than the range of medially rated feeds (Singh and Oosting, 1992). Thus, the NDF contents of *P. purpureum*, *Stylosanthes* and intercropped revealed that they would be poorly digested, since increase in NDF content has been associated with decrease in digestibility and hence feed intake (Van Soest, 1994; McDonald *et al.*, 2002).

The NDF and ADF values of the grasses followed reversed followed pattern as in the CP with the NDF and ADF values. *P. purpureum* var. Abeokuta 1 intercropped with legume had the highest value and

sole legume had the lowest (52.11%) for NDF and *P. purpureum* purple variety intercropped with stylo had the lowest value (28.89%). It was also recorded that ADF value of sole *P. purpureum* was lower than what was reported by Ojo *et al.* (2013) and this was lower than the intercropped. The less value recorded for ADF for the intercropped was in line with Njoka-Njiru *et al.* (2006) that intercropped legumes benefit the associating grasses by improving the CP content, thereby reducing the fiber content.

The ADF values obtained were slightly lower than that reported by Dele (2012) with respect to the effect of manure type. Acid Detergent Lignin was lower in value compared to what was reported by Olanite *et al.* (2013) which implies that the indigestible portion of the grasses was slightly lower. The ADF values of grasses were within ranges reported by Olanite (2002). The ADL values of sole *P. purpureum* was higher than that of the intercropped across manure types and this shows that the sole is less digestible compared to the intercrop by animals.

The ADL content from the results of this research for all plants and the intercrops were lower than the values reported by Babyle *et al.* (2007) for Napier grass. This may be due to differences in the harvest age or cutting-back of the sward which in this was at 8 WAP and would have reduced lignification and thereby aids

digestibility and utilization. Hemicellulose values of grasses in the intercropped showed similar trend as the ADL and that the intercropping was more digestible than the sole. The fiber contents recorded in this study are within the range that can be degraded by ruminant animals as reported by Anele *et al.* (2008). Sole leguminous forages had lower NDF and ADF contents than sole grasses. This may be attributed to the fact that the amounts of cell wall constituents (NDF and ADF) in legumes are not as large as those of grasses. The proportion of cell wall constituents in grasses is larger than in legumes and also lignified quickly (Buxton 1996). This study confirms that intake and digestibility could be enhanced by the inclusion of legume in sole grass forages.

CONCLUSION

The *P. purpureum* intercropped with *Stylosanthes guianensis* have higher crude protein than the sole, this could be attributed to the result of beneficiary effect of association of the legume plants with grasses. The results further indicate that there was significant gain in CP and reduced ADF and lignin with the application of swine manure into the mixed swards.

Table 2: Effect of Manure Type and Intercrop on the Fiber Composition (%) of Four Varieties of *P. purpureum*/ *S. guianensis* Mixed Sward.

Manure	NDF	ADF	ADL	Hemicellulose	Cellulose
Swine	63.00 ^a	32.15	7.30	30.85 ^a	24.85
Poultry	61.70 ^b	32.44	6.96	29.41 ^b	25.33
Control	60.82 ^b	32.15	7.22	28.37 ^b	25.22
SEM	0.89	0.49	0.39	1.09	0.61
Intercrop/ Sole					
Green local + <i>S. guianensis</i>	65.11 ^a	31.56 ^{cd}	6.33 ^{cd}	33.78 ^a	25.22 ^b
Purple + <i>S. guianensis</i>	64.67 ^a	28.89 ^e	5.22 ^d	35.78 ^a	23.67 ^{bc}
Abeokuta 1 + <i>S. guianensis</i>	64.89 ^a	31.11 ^d	5.89 ^{cd}	33.78 ^a	25.22 ^b
Abeokuta 2 + <i>S. guianensis</i>	66.22 ^a	32.00 ^{cd}	6.33 ^{cd}	34.22 ^a	25.67 ^b
Green local	60.67 ^b	33.22 ^{bc}	8.00 ^{ab}	27.44 ^a	25.22 ^b
Purple	61.11 ^b	34.11 ^{ab}	8.00 ^{ab}	27.00 ^b	26.11 ^{ab}
Abeokuta 1	61.33 ^b	35.44 ^a	7.11 ^{bc}	25.89 ^b	28.33 ^a
Abeokuta 2	60.44 ^b	33.00 ^{bcd}	8.22 ^{ab}	27.44 ^b	24.78 ^b
<i>Stylosanthes guianensis</i>	52.11 ^c	31.33 ^{cd}	9.33 ^a	20.78 ^c	22.00 ^c
SEM	0.79	0.64	0.57	1.08	0.93

a,b,c,d,...: Means in same column for each factor with different superscript are significantly (p<0.05) different

SEM= Standard Error of Mean

NDF= Neutral Detergent Fibre

ADF= Acid Detergent Fibre

ADL= Acid Detergent Lignin

REFERENCES

- Alalade, J.A., W.B. Akanbi, A.A. Akingbade, J.A. Akinlade, J. Gbadamosi, and C.B. Emiola. 2013. "Effects of Manure Types on Herbage Yield and Nutritive Value of *Panicum maximum*". *International Journal of Applied Research and Technology*. 2(11): 77 – 81.
- Anele, U.Y., O.M. Arigede, J.A. Olanite, I.O. Adekunle, A.O. Jolaosho, O.S. Onifade, and A.O. Oni. 2008. "Early Growth and Seasonal Chemical Composition of Three Indigenous Multipurpose Tree Species (MTPS) in Abeokuta, Nigeria". *Agroforestry System*. 73: 89-98.
- Ajayi, F.T., O.J. Babayemi, and A.A. Taiwo. 2007. "Effects of *Stylosanthes guianensis* and *Aeschynomene histrix* on the Yield, Proximate Composition and *in-situ* Dry Matter and Crude Protein Degradation of *Panicum maximum* (Ntchisi)". *Livestock Research for Development*. 19(3).
- Bayble, T., S. Melaku, and N. Prasad. 2007. "Effects of Cutting Dates on Nutritive Value of Napier (*Pennisetum purpureum*) Grass Planted Sole and in Association with Desmodium (*Desmodium intortum*) or Lablab (*Lablab purpureus*)". *Livestock Resources Rural Development*. 120–136.
- Boonman, J.G. 1993. *East Africa's Grasses and Fodders: Their Ecology and Husbandry*. Kluwer Academic Publishers: Dordrecht, Netherlands, p. 341.
- Boonman, J.G. 1997. Farmers' Success with Tropical Grasses: Crop/Pasture Rotations in Mixed Farming in East Africa". Ministry of Foreign Affairs: The Hague, Netherlands.
- Butt, N.M., B. Gary, M.G. Donart, R.D. Southward, and M. Norror. 1993. "Effects of Defoliation on Plant Growth of Napier Grass". *Tropical Science*. 33: 111-120.
- Buxton, D.R. 1996. "Quality-Related Characteristics of Forages as Influenced by Plant Environment and Agronomic Factors". *Animal Feed Science and Technology*. 59:37-49.
- Dele, P.A. 2012. "Evaluation of Dry Matter Yield and Nutritive Quality of Forage, Hay and Silage Produced from Three Grasses Fertilized with Animal Manures". Ph.D. Thesis, Department of Pasture and Range Management, Federal University of Agriculture: Abeokuta, Nigeria. Pp 72-76
- Farrell, G., S.A. Simons. and R.J. Hillocks. 2002. "Pests, Diseases and Weeds of Napier Grass, *Pennisetum purpureum*: A Review". *International Journal Pest Management*. 48:39–48.
- Gwayumba, W., D. Christensen, J. McKinnon, and P. Yu. 2002. "Dry Matter Intake, Digestibility and Milk Yield by Friesian Cows Fed two Napier Grass Varieties". *Asian Australia Journal Animal Science*. 15:516–521.
- Humphreys, L.R. 1991. *Tropical Pasture Utilization*. Cambridge University Press: Cambridge, UK. 202p.
- Islam, M., C. Saha, N. Sarker, M. Jalil, and M. Hasanuzzaman. 2003. "Effect of Variety on Proportion of Botanical Fractions and Nutritive Value of Different Napier Grass (*Pennisetum purpureum*) and Relationship between Botanical Fractions and Nutritive Value". *Asian Australas. Journal Animal Science*. 16:837–842.
- Kabirizi, J., F. Muyekho, M. Mulaa, R. Msangi, B. Pallangyo, Z. Kawube., E. Zziwa, S. Mugerwa, S. Ajanga, and G. Lukwago. 2015. "Napier Grass Feed Resource: Production, Constraints and Implications For Smallholder Farmers in Eastern and Central Africa". The Eastern African Agricultural Productivity Project: Naivasha, Kenya.
- Lukuyu, B.A., C.K. Gachui, M.N. Lukuyu, C. Lusweti, and S. Mwendia. 2012. "Feeding Dairy Cattle in East Africa". East Africa Dairy Development Project: Nairobi, Kenya.
- Mani, R.I., R. Von Kaufmann, A.R. Egan, R.M. Dixon, and J.H.G. Holmes. 1992. "Development of Grazing Strategies for Stylo-Based Pasture Supplies Adapted to Cattle Production Systems". *Proceedings of the regional workshop on the use in Stylosanthes in West Africa*. Kaduna, Nigeria, 26-31 October, 1992. 155-165.
- McDonald, P., R.A. Edwards, J.F.D. Greenhalgh, and C.A. Morgan. 2002. *Animal Nutrition*. Prentice Hall: Harlow, UK.
- Minson, D.J. 1981. "Nutritional Differences between Tropical and Temperate Pastures in Grazing Animals: Disciplinary Approach". *World Animal Science*. Volume 34, Elsevier: Amsterdam, Netherlands. 143-157.
- Muinga, R.W., W. Throrpe, and J.H. Topps. 1992. "Voluntary Feed Intake, Liveweight and Lactation Performance of Crossbred Cows given Napier Grass with Leuceana Forage in Lowland Sub-Humid Tropic". *Animal Production*. 55:331 - 337.

20. Muraina, T.O., J.A. Olanite, V.O.A. Ojo, O.A. Fasae, I.A. Ewetola, O.A. Okukenu, and I.A. Adebisi. 2015. "Assessment of Chemical Composition of Natural Pasture oversown with two Stylosanthes Species for Ruminant Feeding". *Tropical Animal Productions Invest.* 18: 99-10.
21. Mureithi, J.G., R.S. Tayler, and W. Thorpe. 1995. "Productivity of Alley Farming with *Leucaena* (*Leucaena leucocephala* Lam de Wit) and Napier Grass (*Pennisetum purpureum* K. Schum.) in Coastal Lowland Kenya". *Agroforestry Systems.* 31:59 -78.
22. National Research Council (NRC). 1984. *Nutrient Requirement of Domestic Animals. 6th edition.* National Academy Press: Washington, DC.
23. Njoka-Njiru, E.N, M.G. Njarui, S.A. Abdulrazak, and J.G. Mureithi. 2006. "Effect of Intercropping Herbaceous Legumes with Napier Grass on Dry Matter yield and Nutritive value of the Feedstuffs in Semi-Arid Region of Eastern Kenya". *Agricultura Tropica et Subtropica.*
24. Norton, B.W. and D.P. Poppi. 1995. "Composition and Nutritional Attributes of Pasture Legumes. Composition and Nutritional Attributes of Pasture Legumes".
25. Nweze, B.O. and E. Ezelfeanyi. 2010. "Effect of Poultry Manure/Litter on Four Pasture Species". *Proc. 15th Annual Conference of Animal Science Association of Nigeria.* (ASAN). Sept. 13-15, University of Uyo, Nigeria. Pp 643-645.
26. Ojo, V.O.A., P.A. Dele, U.Y. Amole, S.A. Adeoye, O.A. Hassan, J.A. Olanite, and O.J. Idowu. 2013. "Effect of intercropping *Panicum maximum* var. Ntchisi and *Lablab purpureus* on the Growth, Herbage Yield and Chemical Composition of *Panicum maximum* var. Ntchisi at different Harvesting Times". *Pakistan Journal of Biological Sciences.*
27. Olanite, J.A. 2002. "Evaluation of Selected Grass-Legume Mixtures as Feed for Weaner Calves under Traditional Cattle Management in Ibadan, Nigeria". Ph.D. Thesis. Department of Agronomy, University of Ibadan: Ibadan, Nigeria.
28. Olanite, J.A., Ojo, V.O.A., P.A. Dele, U.Y. Amole, S.A. Adeoye, O.A. Hassan, and O.J. Idowu. 2013. "Effect of Intercropping *Panicum maximum* var. Ntchisi and *Lablab purpureus* on the Growth, Herbage, Yield and Chemical Composition of *Panicum maximum* var. Ntchisi at Different Harvesting Times". *Pakistan Journal of Biological Sciences.* 16:1605-1608.
29. Singh, G.P. and S.J. Oosting. 1992. "A Model for Describing the Energy Value of Straws". *Indian Dairyman.* XLI: 32-327.
30. Skerman, P.J. and F. Riveros. 1990. "Tropical Grasses". *FAO Plant Production and Protection Series.* No. 23. FAO: Rome, Italy.
31. Tambara, A. A.C., M.R. Sippert, C.G. Jauris, J.L.C. Flores, E.L. Henz, and J.P. Velho. 2008. "Production and Chemical Composition of Grasses and Legumes Cultivated in Pure Form, Mixed and Consortium". *Acta Scientiarum Animal Science.* v39i3.34661. ISSN 1806-2636.
32. Van Soest, P.J. 1994. *Nutritional Ecology of the Ruminant.* O and B Books, Inc.: Corvallis, OR. 374p.

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SUGGESTED CITATION

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