

BIOMASS ESTIMATION AND SOME CHEMICAL COMPOSITION OF HERBAGE AT LIVESTOCK GRAZING LAND, FEDERAL UNIVERSITY OF KASHERE, GOMBE STATE - NIGERIA

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ABSTRACT

The research was carried out to determine the Biomass and proximate compositions of forage species in the Livestock Research Farm of Federal University of Kashere between July and October, 2019. Two (2) sampling blocks (A and B) 100m² each were demarcated. Sampling commenced in July and thereafter, at 30-days intervals until termination of the trial. In each of the block, a belt transect of 5 m² was randomly laid out and used for determination of yield of uninterrupted growth. Five grasses from the Poaceae family, while three legume, form the family leguminaceae. Other families encountered include Rubiaceae and Solanaceae. *Cenchrus ciliaris* had the higher (16.10%) contribution followed by *Digitaria horizontalis* with 13.20% while *Anogeissus leicarpus* contributed the least 0.20%. Relative proportion revealed that grasses had the higher frequency and percentage (9 and 52.96). The highest yield was obtained in the month of October. Forage yield increased steadily from early wet season to early dry season. Dry matters (DM) start from 91.2% in *Senna obtusifolia* to a maximum of 93.4% in *Digitaria horizontalis* with a mean of 92.54%. Crude protein (CP) varies from 3.3% in *Digitaria horizontalis* with a maximum of 7.7% in *Alysicarpus vaginalis* and a mean of 7.9%. Crude fibers (CF) started from 13.1% in *Digitaria horizontalis* to a maximum of 22.5% in *Alyscarpus vaginalis* and a mean of 16.47%. Ether extract (EE) vary from 2.2% in *Digitaria horizontalis* to a maximum of 7.6% in *Alyscarpus vaginalis* and a mean of 4.72%. Nitrogen free extra (NFE) vary from 62.9% in *Senna obtusifolia* to a maximum of 71.1% and *Digitaria horizontalis* with a mean of 67.1%. Energy increases from 317.1Kcal/g in *Senna obtusifolia* to a maximum of 357.8Kcal/g in *Pennisetum pedicellatum* with a mean of 337.36Kcal/g. There is need of establishment of a mixed sown pasture for better herbage quality and quantity throughout the season at the Livestock Research Farm grazing land.

Keywords: Dry matter yield, forage resources, botanical composition

INTRODUCTION

Rising populations and incomes in developing countries are likely to double demand for livestock products by 2020 (Delgado *et al.* 1999). This strong demand has potential to improve farmers' profitability but will require improved animal feeding in both semi-intensive crop-livestock and more intensive livestock systems. Nigeria has an area of about 93 million hectares; 40 million of which are available for grazing by the national herd. Most of these rangelands are in the Savannah zones of the country (Agishi, 1983). Nigeria herbivorous livestock biomass is estimated at 16.03 TLU, comprising of 60.6% cattle, 35.2% small ruminants, 3.6% equines and 0.6% camels. The distribution of livestock population in ecological zones shows that 90.6% of the cattle, 81.3% of sheep and 76.1% of goats are found in Northern and Southern Sudan Savannah zones. Forages are usually the most cost effective option for obtained feeds particularly ruminants. It is critical to select the most suitable forages for the local ecosystem and climatic condition. The climate, soil types and vegetation of the region support a variety of plants for sustenance of animal resources (Muhammad, 2004). The Sudan region contains 80% of the 28 million hectares of utilizable land suitable for fodder and feed production (Kallah, 1999). This paper evaluate herbage yield and quality of livestock grazing area so as to arrive at the correct carrying capacity and stocking rate of the ruminants.

MATERIALS AND METHODS

Location of the study

The research will be conducted at the Faculty of Agriculture Federal University of Kashere, A Gombe State. Gombe State is located in the Sudan savanna zone in the north eastern part of the country. It falls within longitude 10°57'0''E And latitude 9°46'0''N. Gombe State has annual rainfall of between 850-1500 mm that falls between mid May and terminating in October with a 140 days growing period. The annual maximum temperature is 41°C obtained mostly in April and minimum annual temperature of 13°C obtained mostly in January.

Sampling procedure

Reconnaissance surveys were conducted to identify plant species within the pasture sward. Two (2) sampling blocks (100 m² each) were demarcated in the grazing land. These sampling blocks were considered as site replication within the grazing land. The forages on offer were subjectively stratified into higher, medium and low density areas (i.e. HD MD and LD respectively) using visual ranking estimate (Kallah, 2004). Within each stratum, 5 m² areas were fenced from which samples were harvested for determination of dry yields of uninterrupted growth. The samples were separated into species. Sampling commenced in July and thereafter, at 28 - days intervals until termination of the trail. On each sampling date, an open-ended quadrat measuring 1.0 m² was used to collect sixteen samples randomly from each block to estimate pasture species composition (Muhammad *et al.*, 2005). All plants population that falls within the quadrant were harvested at 5cm stubble height and separated into the component species. The fresh samples weights were taken which were thereafter oven dried at 65°C for 72 hours to determine the yield on dry matter basis.

RESULTS AND DISCUSSION

Result

Forages Available on Offer and Species Composition

The common forages encountered at the Livestock Research Farm of Federal University Kashere grazing area (Table 1) revealed that there were 17 forage species; sixteen of them were found to be ingested by livestock. Two of the grasses; *Andropogon gayanus* and *Hyparrhenia rufa* were, tall growing along streams and isolated patches in the surrounding farming sites of the grazing areas. All the legumes encountered were valuable feed material to the grazing animals. The woody species recorded were *Anogeissus leicarpus*, *Ziziphus mauritina* and *Lannea schepieri* which contribute to the dry season feeding because they were found to be frequently browsed. The forb (*Amorphophallus abyssinicus*) was found to be rejected by livestock.

Table 1: Available forages on offer and Species Composition at Livestock Research Farm of Federal University, Kashere

Genus	Species	Common Name	percentage
<i>Alysicarpus</i>	<i>viginialis</i>	Gadegi	8.70
<i>Pennisetum</i>	<i>pedicellatum</i>	Kyasuwa	2.60
<i>Digitaria</i>	<i>horizontalis</i>	Crab grass	13.20
<i>Stylosanthes</i>	<i>hamata</i>	Cook stylo	3.90
<i>Senna</i>	<i>obtusifolia</i>	Tafasa	11.00
<i>Seteria</i>	<i>pallidifusa</i>	Cottail grass	8.80
<i>Guiera</i>	<i>senegalensis</i>	Sabara	3.00
<i>Anogeissus</i>	<i>leicarpus</i>	Chewing stick	0.20
<i>Ziziphus</i>	<i>mauritina</i>	Ber tree	4.00
<i>Lannea</i>	<i>schepieri</i>	Faru	1.39
<i>Amorphophallus</i>	<i>abyssinicus</i>	NA	1.81
<i>Chloris</i>	<i>Pilosa</i>	Rhode grass	8.40
<i>Andropogon</i>	<i>gayanus</i>	Gamba	3.60
<i>Hyparrhenia</i>	<i>rufa</i>	Thatch grass	3.50
<i>Chloris</i>	<i>gayanus</i>	Finger grass	2.80
<i>Sporobolus</i>	<i>pyramidalis</i>	Pyramid seed	2.00
<i>Cenchrus</i>	<i>ciliaris</i>	Bar grass	16.10

Field survey 2019

The species composition of forages on offer to grazing animals at Livestock Research Farm of Federal University Kashere grazing area (Table 2) indicated that there were 17 forages species. *Cenchrus ciliaris* have higher (16.10%) contribution, followed by *Digitaria horizontalis* with 13.20% while *Anogeissus leicarpus* contributed the least 0.20%.

Table 2: Relative proportion of source fodder at Livestock Research Farm of Federal University, Kashere Grazing Area

Variable	Frequency	Percentage
Grasses	9	52.94%
Legumes	3	17.64%
Forbs	1	5.88%
Shrubs	2	11.76%
Trees	2	11.76%

Field survey 2019

Relative Proportion of Fodder Source

In this study, relative proportions of sources of fodder to grazing ruminant at the grazing area were identified (Table 2). The vegetation was categorized into three layers: ground cover, shrubs and trees. The ground cover was divided into grasses and legumes. The result indicated that grasses had higher frequency and percentage (9 and 52.96%), followed by legumes with frequency and percentage of 3 and 17.64% respectively. Trees and shrubs have frequency and percentage of 2 and 11.76%, while the lower frequency (1.0%) and percentage (5.885) were contributed by forbs.

The Monthly Dry Matter Yield (Kgha^{-1})

The monthly dry matter yield (DMY Kgha^{-1}) of forages on offer available at livestock research farm of Federal University of Kashere grazing area (Figure 1), revealed that lower yield was obtained in the month of July, while the highest yield were produced in the month of October. Dry matter yield increased steadily from early wet season to late dry season.

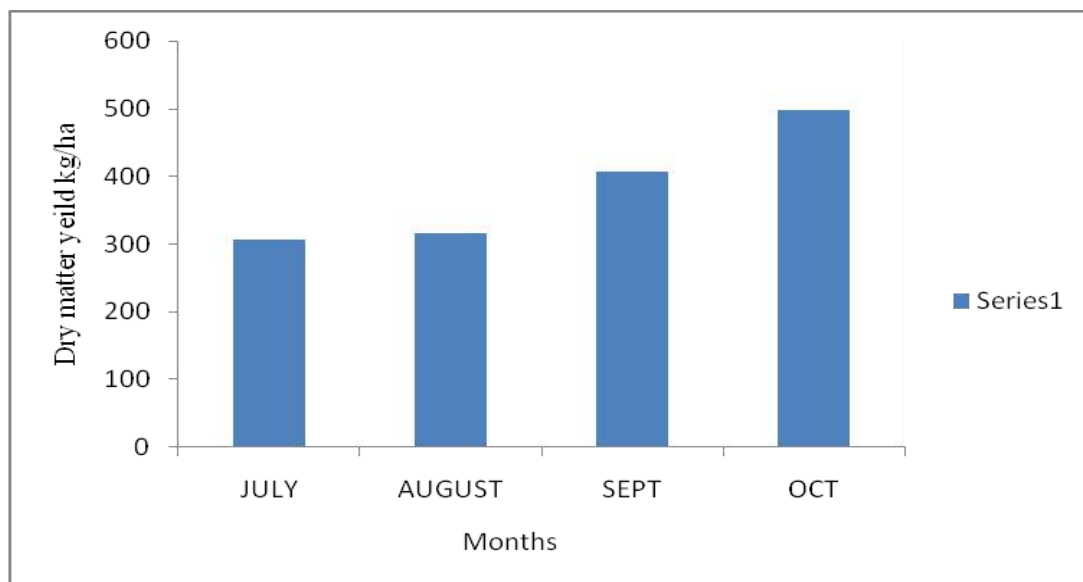


Figure 1: The monthly dry matter yield (DMY Kgha^{-1}) of forages on offer available at livestock research farm of Federal University of Kashere grazing area.

Proximate Composition of Some Available Forages on offer

The result of the proximate compositions of the species (Table 3) shows that Ash varied from 10.3% in *Digitaria horizontalis* to the maximum of 16.1% in *Seteria barbata* with mean of 12.9%. The Dry matter varied from 91.2% in *Sennna obtusifolus* to the maximum 93.4% in *Digitaria horizontalis* with

the mean of 92.54%. But the Crude protein content varied from 3.3% in *Digitaria horizontalis* to the maximum of 7.7% in *Alysicarpus vaginalis* with the mean of 7.9%. Crude fibre start from 13.2% in *Digitaria horizontalis* to the maximum 22.5% in *Alysicarpus vaginalis* with the mean of 16.47%. The Ether extract varies from 2.2% in *Digitaria horizontalis* to the maximum 7.6% in *Alysicarpus vaginalis* with the mean of 4.72%. Whereas the Nitrogen free extract varies from 62.9% in *Alysicarpus vaginalis* to the maximum of 71.1% in *Digitaria horizontalis* with the mean of 67.1%. Also, the Energy content varied from 317.1 Energykcal/g in *Sennna obtusifolus* to the maximum of 357.8 Energy kcal/g in *Alysicarpus vaginalis* with the mean of 337.36 Energy kcal/g.

Table 4: Proximate composition of some forages available at Livestock Research Farm of Federal University of Kashere.

Species	Ash%	DM%	CP%	CF%	EE%	NFE%	Energykcal/(g)
<i>Digitaria horizontalis</i>	10.3	93.4	3.3	13.1	2.2	71.1	317.4
<i>Seteria barbata</i>	16.1	92.9	5.5	ND	ND	ND	346.2
<i>Sennna obtusifolus</i>	12.4	91.2	7.6	13.2	3.9	62.9	317.1
<i>Pennisetum pedicellatum</i>	ND	91.5	5.5	17.1	5.2	ND	357.8
<i>Alysicarpus vaginalis</i>	ND	93.3	7.7	22.5	7.6	ND	348.3
Mean values	12.9	92.54	7.9	16.47	4.72	67.1	337.36

DISCUSSION

Forage Species Composition at Livestock

Seventeen forage species were clearly recognized, bare ground was exposed and litter material of composite species was encountered. Among the species encountered, most were *Cenchrus ciliaris*, *Digitaria horizontalis* and *Seteria pallidifusa*. The results of this study established that species found in Federal University of kashere rangeland belong to three (3) different families which were amongst the common species reported by Agishi (1985). Also, Muhammad *et al.* (2006) and Mohammad *et al.* (2015) reported similar forage families in Sudan Savannah on the rangeland used for grazing by livestock (cattle).

The Seasonal Dry Matter Yield (kg/ha)

The higher forage dry matter yield obtained in the month of October and the lower yield in the month of July with steady dry matter yield that increased from early wet season to late dry season obtained in this study were in consonance with the findings of Okereke *et al.* (1985) who reported the yield of 1,090 DMkg/ha in LWS. The result also confirmed de leeuw (1979) who reported the yield of 1,000-1,500 DMYkg/ha in late wet season, Mohammed *et al.* (2015) also obtained the yield of 702.90 to 2835.69 DMYkg/ha in EWS to LDS. It also agrees with the earlier report of Kallah (2004) whose stated that forage yield of natural pasture in Savannah started from less than 2,000 DM kg/ha in the northern semi-arid to well above 18,000 DMkg/ha in the southern part of the country. Moreover, it is important to note that herbage dry matter yield per hectare varied with rainfall and soil condition (Aduku, 2004). The herbage dry matter yield can be used to estimate the carrying capacity of the grazing land per hectare depending on the period the animals will be allowed to graze a particular area.

Proximate Composition of the Forages

Result obtained for proximate analysis showed value obtained for EE, and CF which are component of carbohydrate and energy were cumulatively high and may meet up the energy requirement of grazing animal. Similarly, the value obtained for CF showed the composite feed material and high fiber content that may be available for microbial degradation. The CF obtained in this study were not within the mean value of 29.95 % reported by Mohammed *et al.* (2015) and Aderinola *et al.* (2006). However, they were below the 59.87 % CF reported by Akinlade *et al.* (2006). This variation could be due to species diversity and differences in stage of growth (Hiernaux and Turner, 1996). Crude protein concentrations in legumes like *Senna obtusifolia*, *Alysicarpus vaginalis* were generally well above 7%, the level below which dry matter (DM) intake becomes depressed (Minson 1980; Humphreys 1991). The CP concentration of *Digitaria horizontalis*, is below 7% (3.3%) while Crude protein concentrations in the grass species *Digitaria gayana*, *Setaria barbata* and *Pennisetum pedicellatum* were between 3.3% to 5.5%. This is in agreement with the complementary roles of grass-legume mixtures in

the utilization of sown or native pasture. The higher CP values of the native grasses (*Digitaria gayana* and *Pennisetum pedicellatum*) in mixture with native legumes indicated that the legumes probably had a positive effect on the quality of the associated species in the native pasture. Similar beneficial effect on quality has been reported by Peters *et al.* (1999). Acceptance of these native species by grazing animals was seen. Reports have indicated that livestock are able to select positively for better quality' feed (Muhammad, 2019)

CONCLUSION

There is need of establishment of a mixed sown pasture to improve herbage quality and quantity it is recommended that estimation of yield and chemical composition should be carried out at a different time of the year in order to come up with more accurate information on effect of seasonal changes on the productivity of herbage. This will provide information necessary to determine the correct number of animals that could optimally be stocked on the grazing land.

REFERENCES

- Adegbola, A. A. (1982), Forage Resources and Beef Production in Nigeria, In: O. A. Osinowo J. Ikhatu and W. O. Ehoche (eds). Beef Production in Nigeria, Proceedings of National Conference on Beef Production, July, 1982 Kaduna, Nigeria, National Animal Production Research Institute, A. B. U. Zaria; Nigeria. Pp. 137-162.
- Aderinola, M.J., Cumming, D.H. and Phillipson, J. (2006). Biomass and production of large African herbivores in relation to rainfall and primary production. *Oecologia* 22:341-354.
- Agishi E.C. (1983): Forage Legumes and grasses of Nigerian tropical pastures
- Agishi E.C. (1985): Forage Resources of Nigerian Rangelands. A paper presented at the "National Conference on small Ruminant Production at Zaria Nigeria October 6th to 11th, 1985.
- Akinlade, J. A., Farinu, G.O., A.A., Odunsi, A.A., Kingbase, F.G., Sodeinde, M.O., Ayansola and O.O. Ojebiyi. (2006). Forage Production Chemical Composition and Voluntary Feed intake of Wild and Cultivated Sunflower Leaves by West African Dwarf Sheep In: I.R. Muhammad, B.F. Muhammad, F. Bibi-Farouk, Y. Shehu (eds) Proc. of the 31st Ann. Conf. Nig. Soc. For Animal Production, BUK 12-15 March, 2006.
- Delgado, C. L., Rosegrand, M. W. and Steinfeld, H. (1999). *Livestock to 2020: The Next Food Revolution*. Food, Agriculture and the Environment Discussion Paper 28. 72 pp
- Hiernaux, P and D.M. Turner. (1996). Climate variability, ecosystem stability and the implications for range and livestock development. Pages 31-41 in R.H. Behnke, I. Scoones, and C. Kerven, eds. *Range Ecology at Disequilibrium*. Overseas Development Institute, London. U.K
- Humphreys, L.R. (1991), Tropical pasture utilization. (Cambridge University Press: UK).
- Kallah, M. S. (1999). Background to grazing resources development Nigeria and its importance to the national economy. *Journal of Nomadic Studies*. 2:50-56.
- Kallah, M.S. (2004). Field Methods for Evaluating Primary Productivity of Pasture. In: Gefu, J.O. and Amodu, J.T. (eds). Forage Production and Management in Nigeria. A Training Manual. N.A.P.R.I., Shika, A.B.U., Zaria.
- Minson DJ (1980). Nutritional differences between tropical and temperate pasture. In: Morley, F.H.N. (Editor). *Grazing animals*. Elsevier, Amsterdam, Netherlands. 103-157
- Mohammed, S.S., Muhammad, I.R. and Baba, M. (2015, March). Evaluation of forage Resources of Zange grazing Reserve in Enhanced livestock production: Proceedings of the 40th Annual conference of Nigerian society for Animal production held from 15th-19th March at Ahmadu Bello University, Zaria, Kaduna State, Nigeria. pp 472-475.
- Muhammad I.R., (2004). Production and utilization of Culumbus grass (*Sorgum mumperodi*) in the savannahs of Nigeria. Ph.D Thesis, Faculty of Agriculture, Amadu Bello University Zaria.
- Muhammad, I.R. (2019). Forage and fodder production in Nigeria: Its sensitivity in sustainable ranching. Bayero University Kano, Professorial inaugural lecture, No.36. 21st Feb. 2019. 54pp. Bayero University Press.
- Muhammad, I.R. and Abubakar, A. (2004). Range lands in Nigeria: a partial resource appraisal towards improving livestock production. In: J.O. Gefu and J.T. Amodu (eds). Forage Production and Management in Nigeria: A Training Manual. 1-10.

- Muhammad, I.R., Abdullahi. B., Mohammed, A.K., Tanko, R.J., Kallah, M.S. and. Alawa, J.P. (2005). Influence of Irrigation Intervals on dry matter yields, Concentration of Crude Protein, Calcium and Phosphorus in *Lablab*, *Purpureum* and *Sorghum almum* fodder in the Sudan Savannah Zone of Nigeria *Nigerian Journal of Animal Production*. (32) 1&2.pp 280-286.
- Okereke, S.N., Samviri. S.T. and K. Santhirasegaram (1985).The vegetation of Wawa/Zange grazing reserve and its utilization during wet season. A paper presented at a conference on grazing development, BASIRDA, Bauchi, Nigeria November,1985