©Kashere J. Anim. Sci. Volume 1 Issue 1 ISSN: 3115-6479 33-40
Date received: 23rd September 2025
Date accepted: 8th November 2025
Date published: 16th November 2025

EFFECTS OF DIFFERENT TYPES OF ANIMAL MANURE ON DRY MATTER YIELD AND NUTRITIVE VALUE OF *PEARL MILLET (PENNISETUM TYPHOID* BURN. F*)*

[1]Sadiq, M. S., [1]Umar, S.J., [2]Dumbari, M .K., [3]Yahaya, Y. A., [4]Musa, U.R., [5]Hassan, N.A and [5]Jidda, M.B
[1]Department of Animal Science, Faculty of Agriculture, Federal University, Kashere, Nigeria
[2]Department of Agriculture Education, Umar Sulaiman College of Education., Gashua, Nigeria
[3]Department of Animal husbandry Services, Federal Ministry of Agriculture and Rural Development, Abuja.
[4]Department of Agric Economic and Extension, Faculty of Agriculture, Federal University, Kashere, Nigeria
[5]Department of Animal Health and Production Technology, Federal College of Horticulture, Dadin Kowa, Nigeria
*Corresponding Author: e-mail: msskumo@gmail.com.
Corresponding Author Phone Contact: 08036954296

ABSTRACT
The experiment was conducted at the screen house of the Department of agronomy, Federal University of Kashere during early rain season of the year 2025.The objective of the study was to determine the effect of organic manure from different animal species on growth, yield and Nutritive value of (Pennisetum typhoid Burn). Pearl millet seeds were sown in 25 plastic container 10kg of soil each perforated at the bottom to allow seepage the treatments consisted organic manure from different species of animal (poultry, cattle, goat, sheep and control) , parameters such as plant height, number, number of tillers ;also pasture yield was determined at the end of the three month experimental period Samples of pearl millet (Pennisetum typhoid) were collected at exactly 3 months, with most of the plant at boot stage and about 2.5% at heading stage, then oven-dried, milled and subjected to proximate and fibre analysis. The results of the study revealed significant difference (p<0.05) among the treatments in terms of plant height and number of tillers per plant, however there is significant differences among the treatments with respect to yield, the highest plant height (80.64cm) was recorded by poultry manure treated (Pennisetum typhoid Burn) pearl millet with least (17.74 cm) by the control, with regard to numbers of tillers cattle and sheep manure along with control did not show any definite pattern of growth. the highest number of tillers (3.80) was recorded at week 11 post sowing by (Pennisetum typhoid Burn) pearl millet treated with sheep manure, furthermore, the highest dry matter yield (0.0499) was recorded by (Pennisetum typhoid Burn) pearl millet treated with poultry manure. Significant differences were observed among proximate composition and fibre fraction. Dry matter content was significantly (p<0.05) higher in Poultry manure (93.00%). While the lowest dry matter was observed in control (83.83%). Crude Protein was significantly higher (p<0.05) in poultry manure (11.57 %) compared to other manure. Similarly for Crude fibre and ether extract recorded significant higher (P<0.05) values in sheep and cattle manure of (35.34 %) (6.83%) respectively. While Nitrogen free component and Ash had significantly greater (P<0.05) values in Cattle and Goat manure (13.67&14.88%) respectively. significant differences were observed among fibre fraction. Neutral Detergent Fibre content was significantly (p<0.05) higher in Goat manure (59.50 %) fallow by cattle manure (58.50%), While the lowest Neutral Detergent Fibre was observed in control (83.83%). Hemicellelose was significantly higher (p<0.05) in sheep manure (16.1%) Similarly for crude Acid detergent Fibre and Acid detergent lignin were significant higher (P<0.05) in poultry manure and Sheep manure of (58.50 %) (8.3%) respectively.

Key words: *Pennisetum*, Plant height, Tillering, Manure

1.0 INTRODUCTION
Pasture is a major agricultural resource supporting both intensive and extensive livestock production. One of the problems confronting animal production in Nigeria most especially in the arid and semi-arid zone is wide variably in the availability and quality of feed for production of ruminant livestock over the feeding/grazing period attributable to the climate variation (Hopkins, 2000). At the peak of dry season and

the depletion of crop residue and forage supply from native rangeland couple with over grazing and bush fire consequences are in adequate supply, feed in term of quality and quantity with The above scenario may severely impact the ever increasing human population in the area of widening the already existing protein gap which may lead to nutritional deficiencies. Tropical soils are known to be limiting in nitrogen, phosphorus and potassium (Pacheco *et al.,* 2023). Introduction of sown pasture has been advocated as a panacea to this menace (NLTP, 2017). Pearl millet ***(****Pennisetum typhoid* Burn .F***)*** is a tropical grass species that is widely used for livestock production in the Savannah zone of Nigeria. The forage is known for its high yield potential which make it an important forage crop for livestock farmers in the region. However, the nutritional quality of pearl millet can be affected by various factors, including soil fertility, cutting stage and management practices (Muhammad *et al*., 2007; Gilies *et al.,* 2020; Amole *et al.,* 2021). One of the management practices that can affect the nutritional quality of pearl millet is the application of organic manure (*Mupenzi et al.*, 2017). The importance of organic manure in increasing biomass production and enhancing feed nutritional quality, and ultimately livestock production cannot be over emphasized (Muinga *et al.,* 2017). Manure is noted to play key roles in provision of year-round high quality forages for the ruminant animals as well as improving the soil nutrient status. Apart from converting and adding atmospheric nitrogen to the soil (Aderinola, 2007), manure can also bring about a cessation to seasonal top dressing of nitrogen fertilizer in a monocrop grass pasture. Inorganic fertilizer application increases the herbage and nutritive quality of plants, but its availability, cost and the negative effect on soil and environment limit its use. Pacheco *et al.* (2023) reported the positive results of the use of organic fertilizer in the improvement of soil fertility. In view of these, this study was conducted to evaluate the effect of manure type on growth and chemical composition of pearl millet. The findings of this study will provide valuable information on the nutritional quality of pearl millet and the management practices that can be used to improve its nutritional value for livestock production in the region.

attendant loss in body weight, low milk yield and poor reproductive performance (Muhammad *et al*., 2007): (Cook *et al.,* 2015).

2.0 MATERIALS AND METHODS

2.1 Experimental Site

The study was conducted at the Screen house teaching and research farm of Federal University of Kashere, Gombe, Gombe State. Akko Local Government Area is located at the Sudan Savannah zone of North- Eastern Nigeria, on latitude 11^0.30N and longitude 100^0 20E and on altitude of 240m above sea level (FAO 2010), it's characterized by short rain fall (4-5 months) which varies from 760mm to 1100m, with long dry season (6-7 months). The ambient temperature could be as low as 24^0 C during the dry cold season (October-January) and as high as 44^0 C during the dry hot season (February-May). (Raji *et al*., 2009).

2.2 Soil Samples of Experimental Site

Soil samples were collected for nutrient analysis from the experimental site with the aid of soil auger at four corners and centre of the plots at 0-30cm depth to make a composite for soil analysis at the beginning of experiment so as to ascertain the levels of nutrients in the soil as well as determining the nutrient requirements. The soil sample was analyzed for physical and chemical properties as described by A.E.S. (1998). The analysis was carried out at the chemical laboratory of the Department of Soil Science, Faculty of Agriculture, Ahmadu Bello University, Zaria. The soil, at 0-15cm consisted of 15.8% clay, 16.2% silt and 68.5% sand and was classified as being sandy loam soil. The soil was slightly acidic with pH (6.36) and of moderate Organic carbon (1.35%). The total nitrogen (0.68%) and available phosphorus (0.028%) were low. The exchangeable cations, Ca2+, Mg2+, K+ were low to moderate in the soil while Na+ was of moderate status.

2.3 Experimental procedure

20 plastic containers measuring 20cm height and 30cm width on top and 16cm at the base were used for the experiment. Containers were perforated to discourage water logging by allowing seepage.

The experiment was laid out in a randomized complete block design (RCBD).There were 4 treatments and a control.

2.4 Sourcing of Experimental Materials and Sowing

Seed of pearl millet (*Pennisetum typhoid)* was purchased from kashere market, the treatments consisted of organic manure from poultry, goat, cattle and sheep, each of which was replicated 4 times; each of the containers were watered a day prior to the sowing and every other day subsequently.

Actual sowing commenced on 1/4/2025 by broadcasting of 15 seeds of (*Pennisetum typhoid)* pearl millet per container later (pot**)** thinned to 5 plant per bucket watering was carried out every other day. Weeding was done by hand pulling as the weeds emerged.

2.5 Manure and Manuring

Poultry dropping (from deep litter), cattle, goat and sheep manure were be use. The poultry dropping and those of goat, sheep and cattle will be collected from Department of Animal science, livestock farm, Faculty of Agriculture. Animal manure was analyzed for its proximate and mineral composition in order to determine the nutrient content. The poultry manure contained 2.80 % total nitrogen (N), 0.28% phosphorus (P). 0.87% potassium (K). The Goat manure contained 2.01 % total nitrogen (N), 0.13% phosphorus (P). 1.67% potassium (K). The Sheep manure contained 1.90 % total nitrogen (N), 0.025% phosphorus (P). 0.05% potassium (K). The Cattle manure contained 1.801% total nitrogen (N), 0.07% phosphorus (P). 1.037% potassium (K) Organic manures from different animal species were applied at sowing at the rate of 2.5 tonnes/ha in split form, bearing in mind that the weight of soil in one hectare to a depth of normal ploughing (15cm) is about 2,000,000kg (N.C Brady .1974). The figures were manipulated to find out the requirement for 10kg of the soil; second application of manure were done at 3 weeks post-planting.

2.6 DATA COLLECTION

A 10kg of top soil (0-15cm) were being put in each of the container after soil analysis.

The height of the plant were measured from the ground level to the tip of the top-most leave or tip of the tassel, numbers of tillers per stand was counted for each pot, biomass yield harvesting was done at exactly 3 months, with most of the plant at boot stage and about 2.5% at heading stage, During harvest the yield from each plastic container was harvested at 10cm above the ground and weighed to determine the yield on fresh basis, the materials were then bulked and sub sample was taken and weighed and this was later oven dried to determine the yield on dry matter basis. Samples were subjected to proximate analysis according to the procedure of (AOAC 2006). The analysis was conducted at the Biochemical Laboratory, Department of Animal Science, Ahmadu Bello University Zaria.

2.7 DATA ANALYSIS

The data generated were be analyzed by Analysis of variance (ANOVA) Using SAS 2022 version 9.2.Means were compared using Duncan multiple range test (Duncan, 1995).

3.0 RESULT

3.1 The Effects of different Animal Manure on Plant Height (cm) of (*Pennisetum typhoid)* pearl millet

The results show that irrespective of the type of manure, Applications of manure did not significantly affect plant height ($p>0.05$) at 3 weeks post sowing. However, significant differences ($p<0.05$) were observed among the treatment in subsequent weeks: 4, 5, 6,7,8,9,10,11,12 and 13 weeks after sowing. In all the treatment, plant height increased with age with the exception of weeks 9.8, 11, 7, and 10 in poultry, Goat, Cattle, Sheep manures and control respectively where there were slight decreases. The highest plant height was recorded in (*Pennisetum typhoid*) pearl millet treated with poultry manure (80.64cm at the 13 weeks followed by (*Pennisetum typhoid*) pearl millet treated with cattle manure (76.22) and the least height were recorded in control (52.67cm).

Table 1: Effect of different animal manure on plant height (cm) of (*Pennisetum typhoid*) pearl millet at 3rd - week to 13th weeks

	Plant Height(cm) (period of weeks after sowing)										
Treatments	3	4	5	6	7	8	9	10	11	12	13
Poultry	20.18^{a}	24.13^{ab}	30.37^{b}	37.47^{b}	55.98^{a}	54.03^{a}	48.85^{c}	51.73^{c}	61.15^{ab}	73.39^{a}	80.64^{a}
Goat	20.65^{a}	22.23^{b}	22.48^{c}	30.63^{c}	52.93^{ab}	50.68^{ab}	53.58^{bc}	58.60^{b}	60.79^{ab}	68.72^{a}	76.28^{a}
Cattle	17.79^{a}	26.18^{a}	30.34^{a}	38.23^{b}	52.11^{a}	52.38^{ab}	58.31^{ab}	68.13^{a}	56.53^{bc}	69.19^{bc}	72.22^{a}
Sheep	17.48^{a}	24.14^{ab}	28.58^{ab}	52.86^{a}	52.34^{ab}	53.38^{ab}	59.55^{a}	62.77^{ab}	64.89^{a}	65.88^{a}	73.50^{b}
Control	17.74^{a}	23.67^{ab}	26.61^{b}	29.14^{c}	47.48^{b}	47.13^{b}	46.40^{d}	44.66^{d}	52.66^{c}	52.67^{c}	52.67^{c}

a, b, c Means on the same row with different superscripts differ significantly (P< 0.05).

3.2. Effect of different animal manure on Number of Tillers per Plant (cm) of (*Pennisetum typhoid*) pearl millet at 10th to 13th weeks

Table 2: shows tillering responses to application of different manure, tillering started at week 10 post sowing, there were no significant difference (p>0.05) among the treatments at weeks 11 and 12 post planting. However, differences (p<0.05) were observed in weeks 10 and 13-post planting. Pearl millet treated with poultry and goat manure showed increase in number of tillers from week 10 to 12 post planting from where they declined to (2.12) in weeks 13-post sowing. However, no definite trend was observed in the case of weeks pearl millet treated with cattle and sheep manures as well as the control. The highest number of tillers was recorded in (*Pennisetum typhoid*) pearl millet treated with poultry manure. (3.80).

Table 2: Effects of different animal manure on Number of Tillers per Plant of (*Pennisetum typhoid)* pearl millet at 10th to 13th week

	(period of weeks after sowing)			
Treatments	10	11	12	13
Poultry	1.83^{b}	2.30^{a}	2.40^{a}	3.80^{a}
Goat	2.18^{ab}	2.38^{a}	2.56^{a}	2.71^{a}
Cattle	2.43^{a}	2.50^{a}	2.15^{a}	2.70^{a}
Sheep	2.57^{a}	3.03^{a}	3.33^{a}	2.38^{b}
Control	2.02^{ab}	2.40^{a}	2.01^{c}	2.12^{c}

a, b, c Means on the same row with different superscripts differ significantly (P< 0.05).

3.3. Effect of different Animal manure on Total Dry matter yield of forage (*Pennisetum typhoid*) pearl millet

The result of total dry matter is presented in table 3. The total dry matter yield of (*Pennisetum typhoid*) pearl millet as treated by different types of animal manure. The results show significant differences (p>0.05) among the treatments with respect to dry matter. However, treatments two three and four were statistically similar, the control recorded the least. The highest yield was recorded in (*Pennisetum typhoid*) pearl millet treated with Poultry manure (0.499) with the least in the control. (0.0152).

Table 3: Effect of different Animal manure on Total Dry matter yield of forage (*Pennisetum typhoid*) pearl millet

Treatments	Yield
Poultry	0.0499[a]
Goat	0.0378[bc]
Cattle	0.0347[bc]
Sheep	0.0292[c]
Control	0.0152[d]

a, b, c,d Means on the same row with different superscripts differ significantly (P< 0.05)

3.4. Effect of different animal manure on Proximate Composition of Pearl millet *Pennisetum typhoid*

Proximate composition of Pearl millet (*Pennisetum typhoid)* as affected by Animal manure is shown in table 4. Significant differences were observed among chemical composition, dry matter content was significantly (p<0.05) higher in Poultry manure (93.00%). While the lowest dry matter was observed in control (83.83%). CP was significantly higher (p<0.05) in poultry manure (11.57 %) compared to other manure. Similarly for Crude fibre and ether extract recorded significant higher (P<0.05) values in sheep and cattle manure of (35.34%) (6.83%) respectively. While NFC and ASH had significantly greater (P<0.05) values in Cattle and Goat manure (13.67, &14.88 %) respectively.

Table 4: Effect of Animal manure on Proximate Composition of Pearl millet *Pennisetum typhoid*

Parameter	DM	CP	CF	EE	NFC	ASH
Poultry	93.00[a]	11.57[a]	35.11[b]	5.83[c]	12.10[ab]	13.17[b]
Goat	88.17[b]	10.31[a]	30.12[c]	5.17[c]	9.66[c]	14.88[a]
Cattle	87.00[bc]	10.39[a]	33.43[a]	6.13[ab]	12.41[ab]	14.67[a]
Sheep	86.00[bc]	9.68[b]	35.34[a]	6.83[ab]	14.13[a]	13.33[b]
Control	83.83[c]	7.75[b]	28.44[c]	6.83[ab]	13.67[ab]	14.67[a]
SEM	1.2	0.67	0.48	0.53	0.49	1.33

a,b,c Means with different superscripts within the same row are significantly (P<0.05) DM dry matter, CP crude protein, CF crude fibre, EE ether extract.

3.5. Effect of different animal manure on Fibre fraction of Pearl millet *Pennisetum typhoid*

Fibre fraction of Pearl millet (*Pennisetum typhoid)* as affected by different animal manure is presented in table 5. The Fibre fraction of *Pennisetum typhoid* as affected by different animal manure shown significant differences. NDF content was significantly (p<0.05) higher in Goat manure (59.50 %) fallow by cattle manure (58.50%), While the lowest NDF was observed in control (83.83%). Hemicellelose was significantly higher (p<0.05) in sheep manure (16.1%). Similarly for ADF and ADL were significant higher (P<0.05) in poultry manure and Sheep manure of (58.50 %) (8.3%) respectively.

Table 5: Effect of different animal manure on Fibre fraction of Pearl millet *Pennisetum typhoid*

Parameter	NDF	ADF	ADL	HEMICELLULOSE	CELLULOSE
Poultry	57.50[b]	58.50[a]	6.3[c]	13.2[c]	23.69[b]
Cattle	58.50[b]	47.00[b]	8.3[a]	11.5[c]	28.03[a]
Goat	59.50[a]	44.50[b]	7.8[b]	15.1[ab]	24.83[b]
Sheep	55.50[bc]	46.00[b]	7.7[b]	16.1[a]	20.09[c]
Control	51.00[c]	39.50[c]	6.1[c]	11.1[c]	24.67[b]
SEM	0.57	0.66	0.05	0.06	0.058

a,b,c Means with different superscripts within the same row are significantly (P<0.05) NDF Neutral detergent fibre, ADF Acid detergent fibre, ADL Acid detergent lignin

4.0 DISCUSSTION

Responses of (*Pennisetum typhoid*) pearl millet to different animal manure were observed to vary as in indicated in table 1- 3 the results indicated no significant differences among the treatments in term of plant height at weeks 3 post planting, however significant differences were observed from the 4 weeks up to 13 week. The highest height (80.64) was recorded in (*Pennisetum typhoid)* pearl millet treated with poultry manure. The higher value in absolute terms recorded by poultry manure in terms of plant high , tiller number and dry matter agrees with the finding of Wilkison (1979); Baba *et al* 2016) who reported that poultry manure from deep litter is generally considered the most valuable manure for fertilizer purpose, owing to its relatively low moisture and high macronutrients content, the results also shows higher total dry matter yield of (*Pennisetum typhoid*) pearl millet treated with poultry manure this is concurs with the report of Abusuar and El-Zalia (2010); Baba *et al.* (2016) who reported that as poultry manure increases, both fresh and dry yields of forage *Sorghum bicolar* (L) Moench). Dry matter production is a function of the nature of competition among the various species. Baba *et al.* (2015) also reported that dry matter yield is a measure of pasture productivity. It is also said to be a measure of photosynthetic efficiency of assimilatory system in plant (Iqbal, *et al.,* 2013). Dry matter yield was significantly ($p<0.05$) influenced by different animal manure,.Poultry manure had the highest dry matter yield (Table 4). The CP value of 7.75–11.5 % obtained across the treatments were greater than the bench mark recommended for good rumen function in matured beef cattle of 7 %, yet adequate for maintenance in sheep and goats as reported by (Wada *et al*., 2016) but would not meet the requirement for high producing dairy cows of 19 % as reported by Sebahattin *et al.* (2011). The crude fibre (CF) and its fractions were however lower than the values reported by Hassan *et al.* (2016). The CF obtained in this study is within the mean value of 29.95 % reported by Mohammed *et al.,* (2015) and Aderinola *et al.,* (2006). However, it is below the 59.87 % reported by Akinlade *et al.,* (2006). As was reported by Adam (2004), the increase in irrigation interval led to increased crude fiber content. This effect could be due to increased irrigation interval led to deep root system that enhanced improvement of nutrient uptake per plant and thus consequently led to improved quality of forage. The nutrient detergent fibre (NDF) was below 60.0 % suggested by Muia, (2000) as critical limit for good utilization of roughages, but its within the mean value of 29.95 % -35.11 reported by Mohammed *et al.,* (2015) and Aderinola *et al.,*(2006). However, it is below the 59.87 % reported by Akinlade *et al.,*(2006). Meanwhile the greater value for CF, ADF and NDF may be due to increased cell wall constituent as the plant matures. This agrees with finding of Berihun (2005), Simachew (2016) and Ashagire (2008). NDF and ADF are within the range reported by several authors (Cook *et al.,* 2005; Aderinola et al., 2006; FAO, 2010).

4.1 CONCLUSION

Based on the results of the study one may wish to recommend the choice of poultry manure among all the organic manures because it produced better yield and nutritive value.

4.2 RECOMMENDATION

Based on the results of the study we recommend that the experiment be repeated under field condition to further elucidate the potentials of these organic manures in improving growth and productivity of (*Pennisetum typhoid)* pasture.

REFERENCE

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.

Aderinola, O. A. (2011). Agronomic performance and nutrient composition of *Andropogon tectorum* as influenced by varied inter-row spacing of *Lablab Purpureus* during a minor wet season in the derived savannah zone of Nigeria. Conference on International Research on Food Security, Management Natural and Resource Rural Development Tropentag, University of Bonn, October 5 – 7.

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

Amole, T.A., Panyan, E., Adekeye, A., Augustine, A., Duncan, A. and Blummel, M. 2021. Productivity, nutritive value and economic potential of irrigated fodder in two regions of Ghana. Agronomy Journal, 114(1): 148-164. Doi: 10.1002/agj2.20884.

AOAC 2005. Association of Official Analytical Chemists. Official Methods of Analysis, 15th edition. Association of Official Analytical Chemists, Washington, DC, USA.

Ashagire, A. A. (2008). Effect of nitrogen fertilizer and harvesting stage on yield and quality of natural pasture in Fogera district north western. MSc. Thesis. Haramay University.Ethiopia, 56p.

Baba .M, Lamir I, Abdullahi. I and M. S. Sadiq,, (2016). Effect of Poultry manure and nitrogen rate from two production on. Nigeria Journal of Animal Production on dry matter and nutritive value of columbus grass *Sorghum almum* 43 (2): 47 – 52.

Baba, M., Gumel, I. A. and Muhammad, I. R. (2015) Compatability of *sorghum almum* (Columbus grass) with three forage legumes. Journal of Aridland Agriculture 2015,1:1-5 online Available at http://scienceflora.org/journal/index.php/jaa/Accessed on1/09/2025

Berihun. M. (2005) Effect of planting patterns and harvesting Days on yield and quality of Bana grass (*Pennisetum purpureum L.) Pennisetum americanum L.*)) Libo Kemkem, North western Ethiopia. Alemaya University, Ethiopia, 93p.

Brady N.C., R.R Weill (2003). The nature and properties of soils (12ed.) prentice Hall international Limited London, U.K.

Cook, B. G., Pengelly, B. C., Brown, S. D., Donnelly, J. L., Eagles, D. A., Franco, MA. Hanson, J., Mullen, B. F., Partridge, I. J., Peters, M., and Schultze-Kraft, R., (2005). Tropical forages. CSIRO, DPI&F (Qld), CIAT and ILRI, Brisbane, Australia Duncan, D. B. (1995). Multiple range and multiple F-test Biometrics, 11:1-42.

Duncan, D. B. (1995). Multiple range and multiple F-test Biometrics, 11:1-42.

FAO, (2010). Grassland Index. A searchable catalogue of grass and forage legumes. FAO, Rome, Italy

Gilles, J.A., Fernand, T., Victor, F.N., David, F.W. and Etienne, T.P. 2020. Protein content of *Brachiaria ruziziensis* (Poceae) under the direct and residual effects of fertilization with hen droppings. *International Journal of Plant and Soil Science*, 32(7): 96-105. Doi:10.4236/as.2019.108084

Hassan, M.R., Muhammad, I.R., Amodu, J.T., Jokthan, G.E., Abdu1, S.B., Adamu, H.Y., Yashim, S. M., Taofik1 I., Tamburawa, M.S. and Musa A. (2016). Growth performance of Red Sokoto bucks fed graded levels of Lablab (*Lablab purpureus* l. Sweet) hay as a supplement to maize (*Zea mays*) Stover basal diet *Journal of Animal Production Research* 28(1):283-298

Hopkins,D.W,2000, Influence of sward species composition on the rate of organic matter decomposition in grass land soil.*journal of Animal science* 39;385-392.

Mohammed, S.S., Muhammad, I.R. and Baba, M. (2015). 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-19thMarch at Ahmadu Bello University, Zaria, Kaduna State, Nigeria. Pp 472-475.

Muhammad, I. R., Kallah, M. S., Adamu, A. M. and Alawa, J. P. (2006). Forage yield, organic and inorganic constituent of Columbus grass (*Sorghum almum*) grown in the savannah of Nigeria. *Savannah journal of Agriculture.* 1(1):52-55.

Muhammad, I. R., Kallah, M. S.,Otchere, E. O., Tanko and Olurujus S. A. S. (1997): The influences of date of planting and fertilizer application on growth components of Columbus grass *(Sorghum almum) .Nigerian journal of Animal Production* VOL 1 (24),62-64

Muia, J. M. K. (2000). Use of Napier grass (*Pennisetum purpureum*) to improve Smallholder milk production in Kenya. PhD. Thesis. Wageningen Agricultural University. The Netherlands. Pp 77.

National Academy Press.

Pacheco, C.A., Oliveira, A. and Tomaz, A. (2023). Effects of Mineral and Organic Fertilization on Forage Maize Yield, Soil Carbon Balance, and NPK Budgets, Under Rainfed Conditions in the Azores Islands (Portugal). Int. J. Plant Prod. 17, 463–475 (2023). https://doi.org/10.1007.

SAS (2022). SAS institute Inc. version 9.4. cary, NC NewYork.

Sebahattin, A., Mevlut, T., Osman, Y. and Murat, Y. (2011). Forage Yield and Quality of Perennial Legumes-grass Mixtures under Rain fed condition. Not, BortHortAgro 39 (1): 114-148. Tessema, Z. and

Baars, R.T. (2006). Chemical Composition and Yield Dynamics of Tropical grasses mixed with Perennial Legumes. *Tropical grasslands,* 40: 150-156.

Wilkison ,S.R.1979.Plant nutrient and economic value of animal manures. Journal of Anmal science ,48:121-133.