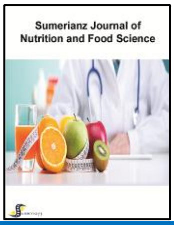
Sumerianz Journal of Nutrition and Food Science, 2020, Vol. 1, No. 1, pp. 1-5
ISSN(e): xxxx-xxxx, ISSN(p): xxxx-xxxx
Website: https://www.sumerianz.com



Original Article Open Access

Effects of Fertilizer Rates on Growth Parameters of Centrosema (*Centrosema Pubescens*) In Mubi Region of Adamawa State Nigeria

Babale D. M.*
Department of Animal Production, Adamawa State University, Mubi, Nigeria

Biyasa J.
Department of Animal Production, Adamawa State University, Mubi, Nigeria

Sukamkari B. Y.
Department of Animal Health and Husbandry, Federal Polytechnic, Mubi

Sunyasemeni E.
Department of Animal Production, Adamawa State University, Mubi, Nigeria

S. Amos
Department of Animal Production, Adamawa State University, Mubi, Nigeria

Abstract

A field trial was carried out in Mubi, Adamawa State, Nigeria in 2019 to investigate effects of fertilizer rates on growth parameters of Centrosema (*Centrosema pubescens*) as it affects the average plant heights, leaf and branch numbers, biomass and dry matter yields at 3, 6, 9 and 12 weeks after planting. The experimental design used was Randomized complete block design (RCBD) with four treatments consisting of fertilizer (NPK 15:15:15) application rates of 0, 30, 40 and 50 Kg/ha replicated four times designated as treatments T_1, T_2, T_3 and T_4 respectively. The results indicated that fertilizer rates showed statistically significant variation ($p<0.05$) in plant heights, leaf and branch numbers, biomass and dry matter yields at the various periods of measurements. However, at 3 weeks after planting the values for leaf numbers showed no statistical significant ($p>0.05$) difference. It can be concluded that utilization of fertilizer for production of Centrosema forage is important for farmer, youth/ unemployed groups and investors who are interested in forage production. It is also recommended that cost- benefit analysis be conducted through hay or silage making applied on animals to determine responses.
Keywords: Growth rates; Centrosema; Fertilizer rates; Mubi region.

1. Introduction

Among the plant nutrients, nitrogen plays a very important role in crop and **animal** productivities. It is reported that due to the process of symbiosis in legumes where mutual contact between rhizobium bacteria and the leguminous crop occur, roots fix atmospheric nitrogen in the nodules which supply nitrogen to the succeeding crops (Giller, 2001). Annual legumes are utilized in the form of green forage, forage dry matter, forage meal, grain, straw, silage, hay, while some of them are suitable for grazing as well (Mihailović *et al.*, 2007). Babale (2019), reported that legume forage plants have higher nutrients and hence feeding values than grasses because of their root nodules which assist in adding nutrients to the soil, host plant and eventually made available to animals. Getnet *et al.* (2003) reported that despite farmers' recognition of the potential contribution of forage legumes to crop-livestock farming systems, their integration into livestock production in sub-saharan Africa is relatively low.

Centrosema is a perennial, twining and trailing legume which will climb associated grasses and fences. Individual plants can spread 1-2m from the strong taproot (Kirkbride and Wiersema, 2005). Leaves **c**omprised of three slightly hairy leaflets. Leaf lets are egg-shaped with obvious veins. The middle leaf is usually largest, about 4 cm wide and 6 cm long (Firth *et al.*, 2002). Kirkbride and Wiersema (2005), reported that Centrosema has excellent capacity to spread through seed (if spelled from grazing) and above-ground runners which root down vigorously at the nodes. Individual plants can colonize over 2 m from the base if growth is unchecked.

Schultze-Kraft and Clements (1990), reported that the plant as forage has excellent feeding value with moderate to high dry matter digestibility (45-65%) and highest for young leaf and stem. The authors further reported that crude protein levels are relatively high for a tropical pasture legume and range from 17-26%, again highest in immature forage. It is readily accepted by cattle when grown with grasses and preferentially grazed to grasses during the dry season (Jones, 2001).

Research is critical to develop novel approaches for overcoming the barriers to successful growth of legumes in association with grasses in warm climates and to identify low-cost, long-term solutions to the problem of nitrogen limitation in low-input systems (Whitbread *et al.*, 2009). Information on the Effects of Fertilizer rates on growth

*Corresponding Author

parameters of Centrosema (*Centrosema pubescens*) in Mubi region of Adamawa State, Nigeria is scarce. The research was therefore carried out to bridge this gap.

2. Materials and Methods

2.1. Study Site

The experiment was conducted at the Livestock Teaching and Research Farm of the Faculty of Agriculture, Adamawa State University Mubi, Nigeria. Mubi is located in the Northern part of Adamawa State. It lies on Latitude $90^{o}11^{I}$ north of the equator and Longitude $13^{o}45^{I}$ east of the Greenwich Meridian at an altitude of 696m above sea level. It is bounded in the South and East by Republic of Cameroun. The State has a land area of $4{,}728.77m^2$ and population of 245,460 (Saidu and Gadiga, 2004), it is situated in the Sudan Savanna zone of Nigeria. The vegetation type is best described as *Combretacious* woodland savanna (Areola, 1983) which consists of grasses or weeds and shrubs collectively making 70% of the entire vegetation. Some of these grasses, weeds and shrubs are used as animal feeds.

The area has two distinct seasons; Rainy season lasts for four (4) months and dry season that lasts for eight (8) months. Annual rainfall ranges from 700-900mm with highest peak in August. The area has minimum temperature of $12.7^{0}C$ in January and maximum of $37^{0}C$ in April (Adebayo, 2004).

2.2. Experimental Seeds

Seeds were gotten from the National Animal Production Research Institute (NAPRI) farm, Ahmadu Bello University, Shikka, Zaria, Nigeria.

2.3. Experimental Design and Treatments

The experimental field was ploughed, harrowed and 12 plots demarcated. Each plot was 3x3 m size with 0.5m between plots and treatment blocks, respectively. The experimental treatments consisted of fertilizer (NPK 15:15:15) application rates of 0, 30, 40 and 50 Kg/ha designated as treatments T_1, T_2, T_3 and T_4 respectively at equal spacing and replicated three times in a Randomized complete block design (RCBD. Weed control was carried out by hoeing at 2 and 4 weeks after planting , as required, to avoid weeds build up to critical levels of infestation (Akobendu and Agyakwa, 1998).

2.4. Parameters Determined

Parameters determined were changes in plant heights, leaf numbers, branch numbers and total biomass at weeks 3, 6, 9 and 12. Plant height was measured from the ground level to the tip of the flag leaf. Leaf and branch numbers were taken from five randomly selected plants in each plot at 2, 3, 6, 9 and 12 weeks after sowing by counting the number of leaves and branches on the randomly selected plants as described by Adesoji *et al.* (2013). Biomass yield was determined using destructive method by using 1.0m x1.0m quadrant. Plants within each quadrant were cut with hand sickle at 5cm above ground level at 6, 9 and 12 weeks after sowing. Using spring balance, the cut plants were weighed fresh before and after oven drying to determine biomass and dry matter yield.

2.5. Data Analysis

Data obtained were subjected to analysis of variance (ANOVA) using a Randomized Complete Block Design using SAS (2001) statistical package at ($p<0.05$). Where significant differences occurred among means, Duncan multiple range test (Duncan, 1955) was used to separate them.

3. Results and Discussions

Table-1. Effects of Fertilizer rates on plant heights (cm)

Treatments	Week 3	Week 6	Week 9	Week 12
T_1	3.63^{a}	8.03^{c}	18.10^{c}	28.23^{d}
T_2	3.63^{a}	10.27^{b}	30.17^{b}	34.10^{b}
T_3	3.63^{a}	9.37^{bc}	29.67^{bc}	32.23^{c}
T_4	3.60^{a}	11.47^{a}	38.80^{a}	42.00^{a}
SEM	0.22	0.50	0.49	0.64

NB: Means in the same vertical column with different superscripts are significantly ($p<0.05$) different.
SEM: Standard Error of the mean

Table 1 shows the effects of Fertilizer rates on plant heights (cm). The result revealed a significant ($p<0.05$) difference for all the weeks observed. Highest values were observed for treatment T_4 being 11.47, 38.80 and 42.00cm while treatment T_1 recorded the lowest values being 8.03, 18.10 and 28.23cm at weeks 6, 9 and 12 after sowing respectively. Kendrick (2008), reported that Nitrogen fertiliser is not usually required in well-managed centro-grass pastures.

Table-2. Effects of Fertilizer rates on Centrosema leaf numbers

Treatments	Week 3	Week 6	Week 9	Week 12
T_1	5.00^a	6.67^c	11.33^c	13.33^d
T_2	5.00^a	7.33^{bc}	13.33^{bc}	14.33^c
T_3	5.00^a	7.67^b	14.00^b	15.00^b
T_4	5.00^a	9.67^a	15.67^a	20.00^a
SEM	0.00	0.29	0.37	0.30

NB: Means in the same vertical column with different superscripts are significantly ($p<0.05$) different.
SEM: Standard Error of the mean

Table 2 shows the effects of Fertilizer rates on Centrosema leaf numbers. The result revealed a significant ($p<0.05$) difference for all except at week 3 where a non-significant ($p>0.05$) difference was observed. Treatment T_4 had the highest values being 9.67, 15.67 and 20.00 while treatment T_1 recorded the values of 6.67, 11.33 and 13.33 at weeks 6, 9 and 12 after sowing respectively. There is progressive increase in leaf numbers with increase in the level of fertilizer application. Tessema *et al.* (2010), had earlier reported that improvement of degraded grasslands could be achieved through the application of organic and/or inorganic fertilizer. That application of inorganic fertilizer can significantly improve the productivity and quality of grasslands.

Table-3. Effects of Fertilizer rates on Centrosema branch numbers

Treatments	Week 6	Week 9	Week 12
T_1	1.33^b	2.33^b	3.33^b
T_2	2.00^a	2.67^{ab}	4.00^a
T_3	2.00^a	3.00^a	3.33^b
T_4	2.00^a	3.00^a	3.67^a
SEM	0.17	0.20	0.22

NB: Means in the same vertical column with different superscripts are significantly ($p<0.05$) different.
SEM: Standard Error of the mean

Table 3 shows the effects of Fertilizer rates on Centrosema branch numbers. The result revealed a significant ($p<0.05$) difference for all except at week 3 where a non-significant ($p>0.05$) difference was observed. The values obtained were T_1 (1.33), T_1 (2.33), T_1 andT_3 (3.33) being lowest and T_2 –T_4 (2.00), T_3-T_4 (3.00) and T_2 (4.00) being highest at weeks 6, 9 and 12 after sowing respectively. Vladeta *et al.* (2012), reported that legumes productivity in semi-arid and arid regions are dependent on climatic factors primarily rainfall, temperature and evaporation. O'Connor *et al.* (2001), had further stressed the importance of rainfall distribution during growing season over total annual rainfall. Fekadu *et al.* (2011), reported that for immediate soil fertility improvement of the existing grasslands, application of inorganic fertilizer is important. However, for sustainable improvement of the grasslands in the long-term, application of organic fertilizer, such cattle manure and wood ash are economical way of degraded grazing land improvement.

Table-4. Effects of Fertilizer rates on Biomass yield of Centrosema

Treatments	Week 6	Week 9
T_1	150.63^c	194.93^d
T_2	140.50^d	290.57^a
T_3	171.33^b	215.27^c
T_4	209.30^a	251.27^b
SEM	4.35	11.39

NB: Means in the same vertical column with different superscripts are significantly ($p<0.05$) different.
SEM: Standard Error of the mean

Table 4 shows the effects of Fertilizer rates on Biomass yield of Centrosema. The result revealed a significant ($p<0.05$) difference for both weeks 6 and 9 under observation. Treatments T_4 (209.30) and T_2 (290.57) as highest values while T_2 (140.50) and treatment T_1 (194.93) as corresponding lowest values of biomass yields at 6 and 9 weeks after sowing respectively were recorded. The result of the study shows that biomass yield increased with increase in level of fertilizer application. Tomoyuki *et al.* (2011), had earlier reported that in grassland management, Nitrogen fertilization is important in that it increases the biomass yield.

Table-5. Effects of Fertilizer rates on Dry matter yields of Centrosema

Treatments	Week 6	Week 9
T_1	57.67c	80.97d
T_2	50.20d	123.73a
T_3	61.30b	92.83c
T_4	73.28a	105.63b
SEM	1.52	5.16

NB: Means in the same vertical column with different superscripts are significantly ($p<0.05$) different.
SEM: Standard Error of the mean

Table 5 shows the effects of Fertilizer rates on Dry matter yields of Centrosema. The result revealed a significant ($p<0.05$) difference for both weeks under observation. Treatment T_4 (73.28) and treatment T_2 (123.73) as highest values with treatments T_1 957.67) and T_3 (92.83) as corresponding lowest values of dry matter yields were recorded at 6 and 9 weeks after sowing respectively. It was found that dry matter yield increased with level of fertilizer application in all weeks measured. The study was in agreement with Tessema *et al.* (2010) that DM yield increases with the application of nitrogen fertilizer. Moreover, Tessema *et al.* (2010) reported that the application of nitrogen fertilizer significantly increased the total DM yield of the natural pasture.

4. Conclusion

From the results of the study, it can be concluded that utilization of fertilizer for production of Centrosema forage is important for farmer, youth/ unemployed groups and investors who are interested in forage production. It is also recommended that cost- benefit analysis be conducted through hay or silage making applied on animals as it affects animal responses.

Conflict of Interest

No conflict of interest.

Acknowledgement

Encouragement and guidance received from Professor Yahaya, M. Sani of the Department of Animal Science and Range Management, Modibbo Adama University of Technology, Yola, Nigeria is gratefully acknowledged.

Reference

Adebayo, A. A. (2004). *Mubi region: A geographical synthesis. Department of geography, federal university of technology, Yola, Nigeria.* Published by Paraclette Publishers Yola. 32-33.

Adesoji, A. G., Tanimu, B. and Labe, D. A. (2013). Influence of incorporated short duration legume fallow and nitrogen on maize. *American-Eurasian Journal of Agricultural and Environmental Science*, 13(1): 58-67.

Akobendu, I. O. and Agyakwa, C. W. (1998). *A handbook of West African weeds.* 2nd edn: Published by African Book Builders LTD: Ibadan, Nigeria. 522-23.

Areola, O. O. (1983). *Soil and vegetable resources in: Geography of Nigeria dev.* Heineman: Ibadan. 26-40.

Babale, D. M. (2019). Nutritional Characteristics of some Indigenous Unconventional Forage Grass and Legume plants and their potential uses as conventional forage crop plants. *GPH-Journal of Agriculture and Research,* 2(2): 1-19.

Duncan, D. B. (1955). Multiple ranges and multiple f-tests *Biometrics,* 11: 1-42. Available: https://doi.org/10.2307/3001478

Fekadu, N., Zewdu, K. T. and Abule, E. (2011). Effect of organic and inorganic fertilizer application on improvement of degraded grazing land in the central highland of Ethiopia. *Livestock Research for Rural Development*, 29(3): 23-31.

Firth, D. J., Jones, R. M., McFadten, L. M., Cook, B. G. and Whalley, R. D. B. (2002). Selection of pasture species for groundcover suited to shade in mature macadamia orchards in subtropical Australia. *Tropical Grasslands,* 36: 1-12. Available: https://pdfs.semanticscholar.org/cbad/89062df016d1f6702d7ad23964062b938935.pdf

Getnet, A., Tekleyohanes, B., Lemma, G., Mesfin, D. and D., G., 2003. "Major herbaceous forage legumes: Some achievements in species and varietal evaluation in ethiopia. In: Kemal ali, seid ahmed, b. Surendra, gemechu kenneni, m. Rajendra and m. Khaled. (eds.). Food and forage legumes of ethiopia: Progress and prospects." In *Proceedings of the work shop on food and forage legumes 22-26 September 2003. Addis Ababa, Ethiopia.*

Giller, K. E. (2001). *Nitrogen fixation in tropical cropping systems.* CAB International, Wallingford, UK. 423.

Jones, R. M. (2001). Evaluation of legumes and grasses in coastal south-east Queensland. *Tropical Grasslands,* 35(2): 85-95.

Kendrick, C. (2008). Centro.

Kirkbride, J. H. and Wiersema, J. H. (2005). Proposal to conserve the name Centrosema pubescens (Fabaceae) with a conserved type. *Taxonomy,* 54(1): 209-10.

Mihailović, V., Pataki, I., Mikić, A., Katić, S. and Vasiljević, S. (2007). Achievements in breeding annual forage crops in Serbia. *A Periodical of Scientific Research on Field and Vegetable Crops,* 44(1): 115-23.

O'Connor, T. G., Hanes, M. L. and Snyman, H. A. (2001). Influence of precipitation and species composition on phytomass of a semi-arid African grassland. *Journal of Ecology*, 89(5): 850-60.

Saidu, I. and Gadiga, B. L. (2004). *Population: A write up in mubi region a geographic synthesisby adebayo a. A. Department of geography, federal university of technology.* Yola; Published by Paraclette Publishers, Yola. 117-19.

SAS (2001). *Statistical analysis system, sas 2001, sas/stat software release 8.02.* SAS Institute Inc. Cary, NC: USA.

Schultze-Kraft, R. and Clements, R. J. (1990). *Centrosema: Biology, agronomy and utilisation.* CIAT: Colombia.

Tessema, Z., Ashagre, A. and Solomon, M. (2010). 'Botanical composition, yield and nutritional quality of grass land in relation to stages of harvesting and fertilizer application in the highlands of Ethiopia. *African Journal of Range and Forage Science,* 27(3): 117-24.

Tomoyuki, N., Naoya, S., Hikara, A., Ichiro, N., Hideaki, M., Kawamoto, Y. and Toru, M. (2011). Effects of nitrogen fertilization to the sward on guinea grass (panicum maximum) silage fermentation. *Asian-Autralian Journal of Animal Science,* 24(3): 358-63.

Vladeta, S., Rade, S., Dragon, D. and J., D. (2012). Effects of row spacing on seed yield of Sianfoin (Onobrychis viciifolia scop.) cultivars. *Turkish Journal of Agricultural Forestry,* 36(1): 35-44.

Whitbread, A. M., Hall, C. A. and Pengelly, B. C. (2009). A novel approach to planting grass–legume pastures in the mixed farming zone of Southern inland Queensland. Australia. *Crop Pasture Science,* 60(12): 1147–55.