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National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ng Url:journals.napri.gov.ng

INFLUENCE OF NPK FERTILIZER RATES AND AGE OF RE-GROWTH ON YIELD PARAMETERS OF *BRACHIARIA* MULATO II IN SHIKA NORTHER GUINEA SAVANNAH OF NIGERIA

[*1]Ahmed, S. A., [2]Abdu, S. B., [1]Amodu,J. T., [1]Hassan, M. R., [1]Ishiaku, Y. M., [1]Ibrahim, H., [1]Sani, R. T., [1]Ibrahim, U. M. and [2]Salisu, S. G.

*[*1]National Animal Production Research Institute, P.M.B 1096, Ahmadu Bello University, Shika, Zaria, Nigeria.*

[2]Department of Animal Science, Ahmadu Bello University, Shika, Zaria, Nigeria.

[*]Corresponding Author: safiyanuahmed2@gmail.com Tel: +2347069108385

ABSTRACT

Two years agronomic experiments were conducted on a one-year old established *Brachiaria mulato* II pasture to evaluate the effect of NPK fertilizer rate and age of regrowth pattern on growth components of *Brachiaria mulato* II. The design was a Split Plot with 3 x 5 factorial arrangement. The main plot was NPK 20:10:10 fertilizer applied at different rates of 0, 50, 100, 150, and 200kg/ha respectively while the sub-plots were stage of harvest at 8,10 and 12 weeks. The results indicated that Plant height differed significantly (P<0.05) with fertilizer levels with 150kgha^{-1} rate recorded the highest value (89.86cm) where 200kgha^{-1} and 50kgha^{-1} were at par (80.77cm vs. 80.45cm), respectively, Number of tillers was significantly (P<0.05) higher (256) at 150kgha^{-1} rate. Leaf Area Index (LAI) differed significantly (P<0.05) across the fertilizer rates where 50kgha^{-1} rate recorded the highest value (4.32) than 4.19 and 4.11 recorded at 200kgha^{-1} and 150kgha^{-1}, respectively. In 2021 Fertilizer rates significantly (P<0.05) affected plant height across the treatments where the highest plant height (89.28cm) was recorded in 200kgha^{-1} application rate which was at par with 50kgha^{-1} application rate (88.68cm) while the lowest plant height (84.31cm) was recorded at 100kgha^{-1} rate. Number of tillers (257) were significantly (P<0.05) higher at 0kgha-^{1} rate while the lowest value (234) was recorded at 100,150 and 200kgha^{-1} rates, respectively. Fertilizer rates significantly (P<0.05) affect LAI where the highest value (4.35) was recorded at 50kgha^{-1} which was at par with (4.27) at 200kgha^{-1} rate and the lowest value (3.98) was recorded at 150kgha^{-1} rate. Ages of regrowth significantly (P<0.05) affected plant height where the highest value (96.41cm) was recorded at 12 weeks and the lowest (81.29cm) was obtained at 8weeks. LAI was higher (4.77) at 12 weeks and the lowest (3.06) was recorded at 8 weeks. In the Combine (Average over the years) fertilizer rates significantly (P<0.05) affected plant height across the treatments where the highest plant height (103.66 cm) was recorded at 0 kg ha^{-1} rate however 50 kg ha^{-1}, 150 kg ha^{-1} and 200 kg ha^{-1} rate were similar (97.47, 99.81 and 99.93 cm respectively), Tiller number was highest at 150 kg ha^{-1} rate (245) and the lowest (206) was recorded at 100 kg ha^{-1}. LAI was highest (P<0.05) at 50 kg ha^{-1} rate (4.33) and the lowest (3.89) at 150 kg ha^{-1} rate. Age of regrowth significantly (P<0.05) affect all the growth components where 12 weeks of age recorded the highest value for Plant height, Leaf number, Tiller number, and LAI (111.43,7,239 and 4.81 respectively). It was concluded that application of NPK 20:10:10 at 200 kgha^{-1} and yield components at 12 weeks age of regrowth was better.

Keywords: *Brachiaria* Mulato II, NPK, Shika, Regrowth.

INTRODUCTION

The major constraint to livestock production in developing countries such as Nigeria is the scarcity and fluctuating quantity and quality of all year-round feed supply. *Brachiaria* is a species of grass originating from the savannas of the Eastern part of Africa. The grass species

is widely used as livestock feed. *Brachiaria* belongs to the C4 plants which tolerate drier conditions and more light exposure than many other plants (Watson and Dallwitz, 2008). *Brachiaria* is the most important forage grass for pastures in the tropics (Singh, 2009). *Brachiaria* cultivars have impacted the economy of various countries in the tropics because of their ability to grow so well in low fertility acid soils and still able to produce highly nutritious forage for many ruminants. *Brachiaria* hybrid CIAT 36087 a high-quality forage grass resistant to spittlebug and adapted to well-drained acid tropical soil. Novizan (2007) states that N, P, and K nutrients in the soil are not sufficiently available and are continuously reduced for the plants growth and taken away at harvest time, washed by erosion and evapotranspiration. By this reason, fertilization is necessary to be conducted on these N, P, and K elements that are absolute macro nutrients in the soil that are beneficial for the plant growth.

MATERIALS AND METHODS

The experiment was carried out at the National Animal Production Research Institute (NAPRl). A one-year old pasture *Brachiaria* Mulato II pasture was used for the experiment. A total land area of 100 m^2 was used for the Experiment. The net plot (45m x 15m) was divided into three main plots, these were later subdivided into five sub plots in three replicates in a Split Plot Design with 3 x 5 factorial arrangement. The main plot was NPK 20:10:10 fertilizer applied at different rates of 0, 50, 100, 150, and 200kg/ha respectively while the sub-plots represent stage of harvest at 8,10 and12 weeks. Fertilizer was applied in two split doses at 4 and 6 weeks after weeding. Agronomic growth component measured include plant height, leaf number, number of tillers and leaf area index of five plant stands from the middle of the plot in each treatment per plot at 8, 10, and 12 weeks of re-growth (2020 and 2021). Plant height was measured using a meter rule, leaf and tiller number were counted and leaf area index was measured using a Ceptometer (AccuPAR) which measures Photosynthetically Active Radiation (PAR) and convert these reading to give Leaf Area Index (LAI) for the plant canopy).

RESULTS AND DISCUSSION

Plant height was significantly higher ($P<0.05$) at 0 $kgha^{-1}$ rate (103.66cm) compared to the other treatments but similar to (99.93cm) at 200$kgha^{-1}$ rate. Tiller number (237) was higher ($P<0.05$) at 150$kgha^{-1}$ similar to (237) at 200$kgha^{-1}$ compared to the other rates. LAI shows a similar trend across the treatments. Age of regrowth significantly affect plant height (111.43) at 12 weeks higher than 8weeks and 10 weeks (89.63 and 96.38) respectively. Leaf number and LAI also were higher ($P<0.05$) at 12weeks of age (7 and 4.81) respectively compared to the other weeks. The combine year shows that Plant height, Leaf number, Tiller number and Leaf area index were significantly ($P<0.05$) higher in all the fertilizer rates and age of regrowth compared to the first and Second year of trial. This shows that the mean values for the combine years of the trial can be the representative of values of the different growth component of *Brachiaria Hybrid* (Mulato II). Hazrat *et al*. (2004) found that plant height generally depends on internode expansion which caused an increase in height with an increase in water depth resulting in the taller plant. Plant height recorded in this study is higher than 74.90cm and 73.40 cm reported by Ahmed *et al*., (2018). Clara (2013) reported a plant height of 65cm for *Brachiaria hybrid* (Mulato II) at 12 weeks. Narongrit (1999) reported that the numbers of tillers in plants usually show a general increase at the initial growth stage and then declines at the final growth stage. Ahmed *et al*. (2018) reported lower number of tillers with age, at 10 weeks, 12 weeks and 14 weeks after sowing (21, 23 and 22,) respectively compared to this study. LAI was significantly ($P<0.05$) higher (4.85) at 12 weeks which was similar with (4.63) recorded at 10 weeks where the lowest (2.73) was obtained at 8 weeks of harvest. Compared to this study, lower LAI was reported for *Brachiaria ruziziensi*s at 12weeks of age (0.60), Ahmed *et al*., (2018). Number of leaves (7) was

higher (P<0.05) at 12 weeks and the lowest (5) was obtain at 8 weeks. Number of tillers was affected (P<0.05) by stages of harvest. The highest value was recorded at 12 weeks while (229) and (225) were recorded at 10 and 8 weeks, respectively. Tiller is an important attribute of grasses as it increases the chances of survival and amount of available forage (Skerman and Riveros, 1990; Laidlaw, 2005). Moreover, it is an indicator of resource use efficiency by the different grass species. The large numbers of tillers produced by some grass species allows them to attain maximum growth at an earlier age and recover faster after defoliation (Laidlaw, 2005). Tillering is also important in forage plants, because of its influence on leaf-area production and dry matter yield. A high rate of tillering complements both yield and resilience of a grass stand under defoliation (Mganga, 2009). Nelson and Zarrough (1981) reported that number of tillers is an indicator of resource use efficiency by different grass species and that the weight of a plant's tillers will determine its productivity. Interaction effect of fertilizer rates and Stages of harvest in the 2020,2021 and the combine growing season.

The significant interaction effect on plant height and number of leaves could be attributed to nutrient uptake by the plant which induced chlorophyll formation and enhance optimum photosynthetic capacity which result to plant growth. Fertilizer rates significantly affected plant height across the treatments, the reason why we have significant interaction in the first year and the combine but not in the second year means that the interaction in the second year was so weak which was even out in the first year or absorbed in the combine analysis. Therefore, presenting no significant interaction, the implication is that only two years agronomic data and combined considered as the third year could not suppress the first-year data, however meaningful conclusion may not be arrived at until many more years data is collected and analyzed together. It can also be concluded that more research is required involving those parameters to ascertain properly their interactive roles. Plant height recorded in this study was higher than (74.90cm and 73.40 cm) reported by Ahmed *et al*. (2019) who applied fertilizer rates of 60kg/ha and 40kg/ha on *Brachiaria ruziziensis*.

CONCLUSION AND RECOMMENDATION

Application of NPK 20:10:10 fertilizer at the rate of 200kg/ha rate and harvesting at 12 weeks of regrowth gave higher yield of growth component

Influence of NPK fertilizer rates and age of regrowth on yield component of *Brachiaria* Mulato II during 2020, 2021 and combine.

Table 1: Influence of NPK fertilizer rates and age of regrowth on yield components of *Brachiaria mulato II* during 2020 growing season

	NPK fertilizer rates ($kgha^{-1}$)						Age of regrowth (weeks)				
Parameter	0	50	100	150	200	SEM	8	10	12	SEM	Interaction
Plant height (cm)	89.86^{a}	80.45^{ab}	77.11^{b}	81.61^{a}	80.77^{ab}	3.290*	70.86^{c}	80.69^{b}	94.33^{a}	5.470*	0.0098*
Leaf number (no)	5.00^{b}	6.00^{a}	6.00^{a}	6.00^{a}	6.00^{a}	0.173*	5.00^{c}	6.00^{b}	7.00^{a}	0.280	0.0010*
Tiller Number (no)	193.00^{c}	236.00^{b}	205.00^{bc}	256.00^{a}	240.00^{ab}	13.970*	221.00^{a}	224.00^{a}	233.00^{a}	23.290*	0.9820^{ns}
LAI	3.90^{ab}	4.32^{a}	4.11^{ab}	3.82^{b}	4.19^{a}	0.150*	2.73^{c}	4.63^{a}	4.85^{a}	0.260*	0.3130^{ns}

^{abc}means with different superscripts along the row within treatment differed significantly ($P<0.05$); SEM= Standard Error of the Mean. LAI=Leaf area index; * = Significantly different means; ns = Not significant

Table 2: Influence of NPK fertilizer rates and age of regrowth on yield component of *Brachiaria Mulato II* during 2021 growing seasons

Parameter	NPK fertilizer rates (kgha^{-1})						Age of regrowth (weeks)				
	0	50	100	150	200	SEM	8	10	12	SEM	Interaction
Plant height (cm)	88.10^{b}	85.87^{b}	84.31^{c}	88.68^{ab}	89.28^{a}	1.976*	81.29^{c}	84.05^{b}	96.41^{a}	3.290*	0.1350^{ns}
Leaf number (no)	6.00	6.00	6.00	6.00	6.00	0.196^{NS}	5.00^{c}	6.00^{b}	7.00^{a}	0.326*	0.3560^{ns}
Tiller Number (no)	257.00^{a}	235.00^{ab}	234.00^{b}	234.00^{b}	234.00^{b}	10.770*	225.00^{c}	229.00^{b}	246.00^{a}	17.950*	0.8740^{ns}
LAI	4.12^{b}	4.35^{a}	4.06^{b}	3.98^{c}	4.27^{ab}	0.153*	3.06^{c}	4.63^{b}	4.77a	0.255*	0.2290^{ns}

^{abc}Means with different superscripts along the row within treatment differed significantly (P<0.05); SEM= Standard Error of the Mean. LAI=Leaf area index * = Significantly different means; ns = Not significant

Table 3: Influence of NPK fertilizer rates and age of regrowth on yield components of *Brachiaria Mulato II* during the Two growing seasons (combined analysis)

	NPK fertilizer rates ($kgha^{-1}$)						Age of regrowth (weeks)			
Parameter	0	50	100	150	200	SEM	8	10	12	SEM	Interaction
Plant height (cm)	103.66^{a}	$97.47b^{c}$	94.88^{c}	99.81^{ab}	99.93^{ab}	2.668*	89.63^{c}	96.38^{b}	111.43^{a}	4.447*	0.0056*
Leaf number (no)	6.00	6.00	6.00	6.00	6.00	0.169^{ns}	5.00^{c}	6.00^{b}	7.00^{c}	0.281*	0.0006*
Tiller Number (no)	225.00^{b}	235.00^{ab}	206.00^{c}	245.00^{a}	237.00^{ab}	11.302*	223.00^{b}	226.00^{ab}	239.00^{a}	18.840*	0.4788^{ns}
LAI	4.01^{bc}	4.33^{a}	4.23^{ab}	3.89^{c}	4.23^{ab}	0.141*	2.89^{c}	4.63^{b}	4.81^{a}	0.234*	0.0251*

^{abc}means with different superscripts along the row within treatment differed significantly (P<0.05); SEM= Standard Error of the Mean. LAI=Leaf area index * = Significantly different means; ns = Not significant.

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