EFFECT OF NPK 15.15.15 ON THE GROTH AND YIELD OF *Bracharia ruziziensis (Congo grass*)

BY

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DEPARTMENT OF CROP SCIENCE
FACULTY OF AGRICULTURE
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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF CROP SCIENCE, FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF AGRICULTURE DEGREE B. AGRIC (CROP SCIENCE)

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CERTIFICATION

This is to certify that this research was carried out by **Violet Osaruese Idehen** of the Department of Crop Science, Faculty of Agriculture, University of Benin, Edo State. Nigeria.

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Prof. S.A. Ogedegbe Date

Project Supervisor.

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Prof. K. E. Law-Ogbomo Date

Head of Department.

DEDICATION

This project work is dedicated to God Almighty for His provision, guidance and faithfulness all throughout the duration of my studies at the University of Benin.

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TABLE OF CONTENTS

CHAPTER THREE

CHAPTER FOUR

CHAPTER FIVE

LIST OF TABLES

ABSTRACT

Effects of fertilizer rates on growth and yield of (Congo grass) *Brachiaria ruzisiensis* was studied during rainy season at the experimental field of the Faculty of Agriculture, University of Benin. Treatments consisting of NPK 15:15:15 application rates of 0, 400, 500, 600, 700 and 800 kg/ha, replicated four times in a randomized complete block design (RCBD) were studied. The objective of the study was to evaluate the effect of different rates of NPK 15.15.15 fertilizer on the growth and yield of *Bracharia ruziziensis.* Proximate analysis were carried out before and after fertilizer application to determine the nutrient status of *Bracharia ruziziensis.* Results of the research revealed significant ($p<0.05$) difference on biomass and dry matter yields. The highest level of fertilizer application (800 kg/ha) rate was significantly better than all others. The study showed that fertilizer application increased the proximate composition and yield of Congo grass. This implies that if the grass is produced widely, feed will be enhanced greatly and farmers/herders conflict will be greatly reduced and this can resolve some of the problems of insecurity in Nigeria. Based on the findings of this research, it is recommended that Congo grass be given up ton800kg/ha NPK 15.15.15 fertilizer during the growing seasons.

CHAPTER ONE

1.0. INTRODUCTION

Brachiaria ruziziensis, commonly known as Ruzi or congo grass, is a perennial, warm-season forage grass native to Africa, but now widely distributed throughout tropical America, south-east Asia and the Pacific (Miles *et al*., 1996). Congo grass is a low-growing, erect or decumbent, rhizomatous and stoloniferous perennial with bright green, moderately hairy leaves 7 – 20 mm wide and 5 – 25 cm long. Leaves arise from trailing stolons that root at the nodes.

It belongs to the grass family Poaceae and is widely cultivated for livestock grazing, hay production, and soil conservation purposes. The genus Brachiaria is famous for high productivity and tolerance to low soil fertility, Thomas and Grof (2006), reported that this plant is tolerant of low soil fertility but responds strongly to N and P fertiliser and relatively free from pests and diseases. It requires moderately high rainfall, but can also tolerate drought, preferably 1000 mm or more.

The three most important species currently utilized for pasture development are *B. brizantha*, *B. decumbens, and B. ruziziensi*s (Germ and Evrard). *Brachiaria ruziziensis* is palatable and its nutritive value is good. Congo grass is adaptable to a wide range of soil conditions, the response of different varieties to weather, climate and fertilizer application may vary among ecological zones. However, the productivity and quality of this grass can be influenced by various factors, including the application of fertilizers.

Fertilizers play a crucial role in promoting plant growth and development by supplying essential nutrients that may be deficient in the soil. They enhance biomass production, nutrient content, and overall quality of forage crops. Dry matter (DM) yields are usually high under heavy fertilizer application Nafatu *et al*. (2015) reported that as the levels of NPK fertilizer increases from 0 kg/ha the dry matter yield of *Brachiaria marandu* grass was increased linearly.

However, the effect of fertilizers on *Brachiaria ruziziensis* in the humid rain forest of Nigeria has not been exhaustively studied. Hence the reason for this study. Understanding the impact of fertilizers on *Brachiaria ruziziensis* is essential for optimizing its productivity and nutritional value. It can also contribute to sustainable forage production systems through a better understanding of the role of fertilizer on herbage yield and quality.

1.2. Objective of the study

The objective of this project was to evaluate the effect of the different rates(0,400,500,600,700 AND 800 k) of N:P: K (15.15.15) fertilizer on the growth, yield and nutritional composition of *Brachiaria ruziziensis.*

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Description of *Bracharia ruziziensis* (Congo grass)

Congo grass is a short-lived perennial grass (Husson *et al*., 2008). It is tufted, creeping (semi-prostrate) and rhizomatous. Roots emerge from nodes and forms a dense leafy cover (Cook *et al.,* 2005). Congo grass has a dense system of bunched, quickly developing roots that grow down to a depth of 1.8 m (Husson *et al*., 2008). Culms grow from the nodes of rhizomes and may reach a height of 1.5 m when flowering (Cook *et al*., 2005). The leaves are soft but hairy on both sides, lanceolate in shape and up to 25 cm long x 1-1.5 cm broad, light-green in colour. The inflorescence consists of 3-9 relatively long racemes (4-10 cm) that bear spikelets in 1 or 2 rows on one side of a broad, flattened and winged rachis (Cook *et al.,* 2005). The spikelets are hairy and may reach 5 mm long. The weight of 1000 grains is about 4 g (Husson *et al*., 2008).

Congo grass is very similar to signal grass (*Brachiaria decumbens*) and is often mistaken for it (Cook *et al*., 2005). Genetic material from Congo grass was used to hybridize with *Brachiaria brizantha* yielding a series of cultivars known as Mulato (Argel *et al*., 2007; Argel *et al*., 2005). *Brachiaria ruziziensis* is a relatively new pasture grass and was introduced into the University of Benin (humid rainforest zone) in 2013 by Prof S.A. Ogedegbe.

2.2 Production of Pasture grasses

Pasture lands are primarily used for the production of adapted, domesticated forage plants for livestock. Pasture lands are seeded, usually to improved species of grass and legumes. Establishing a pasture implies producing a high-quality forage that is well matched to the intended livestock and usage. A producer can carefully plan what is best for his operation. If well planned and carried out, establishing a forage grass pasture can mean years of high-quality feed.

Congo grass can be propagated both from root stock and from seeds (Brenda, 2021). If propagation by seeds is intended, the dormancy of the seeds will be broken after 6 months storage, or by chemical scarification. Seeds can be broadcast on a well-prepared seedbed and should not be sown deeper than 2 cm. The vigor of Congo grass seedlings is high and prevents weed development (Husson *et al*., 2008). If Congo grass is vegetatively propagated, stem cuttings with rooting nodes are required. Congo grass does well under good soil fertility, therefore, it is important to provide N, P and K fertilizers prior to planting and during growth (Cook *et al*., 2005). Congo grass spreads readily in fertile soils with adequate N content. Congo grass flowers later than signal grass. It should be cut before first flowering and then at six week intervals. When grazed, Congo grass withstands limited heavy grazing (Cook *et al.,* 2005). It requires a reasonably high rainfall, and endures dry spells, however 1000 mm or more rain is preferable. It requires a well prepared seed bed but light disc harrowing gives good results. The grass responds well to light, and light intensity increases herbage yields it can also be established for grazing under coconut plantations. Optimum growth occurs at average temperatures of 33/28 °C for day/night and a minimum temperature of 19 °C (Heuzé *et al.,* 2017).

2.3 Importance of pasture

Pasture provides an economical source of livestock feed, reduce labour requirements, build soil tilth and fertility, reduce erosion, and reduce invasions of noxious and poisonous weeds. Grazing animals, such as cows, sheep, and horses, rely on pastures grasses and other vegetation for feed. Pastures provide essential nutrients for animals and help maintain their health and productivity.

Environmental benefits of pasture production are numerous. Well-managed pastures play a crucial role in biodiversity conservation and soil protection. They support a diverse range of plant species and provide habitat for various insects, birds, and small mammals. Reduction in greenhouse gases is a positive impact of pasture production. Grasses and other vegetation in pastures absorb carbon dioxide through photosynthesis, which helps mitigate climate change by reducing greenhouse gas emissions.

Water filtration and bioremediation are important under pasture that act as natural filters preventing sediment runoff and reducing the likelihood of water pollution. The vegetation in pastures helps trap and absorb pollutants. Pastures are critical for supporting livestock production, maintaining ecosystem health, mitigating climate change, conserving biodiversity and protecting water quality. When used for soil erosion control, pasture cover crops may absorb heavy metals from the soil and also protect the soil against erosion.

2.4 Fertilizer application

A fertilizer is any material of natural or synthetic origin that is applied to soil or to plant tissues to supply plant nutrients. For most modern agricultural practices, fertilizer application focuses on three macro nutrients: nitrogen (N), phosphorus (P), and potassium (K) with occasional additions of micronutrients and secondary nutrients.

The most common method of applying nitrogen on existing stands is by broadcasting. Nitrogen (N) and potassium (K) should be split applied to prevent leaching losses. Nitrogen (N) plays a significant role in plant growth and physiological processes, phosphorus (P) plays an important role in protein synthesis, remobilization of sugar to starch and also enhances reproductive growth. Plants require large amounts of potassium (K) to replace those removed during harvesting and grazing and it plays an important role in physiological processes of plants (Cook *et al.,* 2005). It is an important component of the cell wall that enhances the structure of leaves.

2.5 Stress tolerance

Brachiaria ruziziensis lacks certain stress tolerances that are disadvantageous to poor farmers. Breeding stress tolerant varieties in the future would add significant value to this crop. It requires a relatively high fertile soil for good growth as well as adequate fertilizer applied where there is persistent grazing or cutting of the crop. Heavy frosts kill the crop and a light frost will slow down future regrowth. *Brachiaria ruziziensis* flourishes in a well-drained soil and has a poor tolerance to floods and heavy rains (Juan *et al*. 2017).

2.6 Major weeds, pests and diseases of *Brachiaria ruziziensis*

Although it is able to form a dense ground cover to smother weeds, *Brachiaria ruziziensis* is susceptible to certain pests and diseases. It can be attacked by the spittlebug which causes significant damage to the plant in Tropical America affecting the development and persistence of the plants (Teixeria *et al.,* 2012). *Brachiaria* seeds are also affected by the fungus *Sphacelia sorghi* in Congo.

2.7 Uses and consumption of Congo grass

Brachiaria ruziziensis is a valuable forage for livestock. It is palatable and its nutritive value is good (Patra *et al*., 2011) and Haribabu and Savithramma (2013). It is mostly used for direct grazing of permanent pastures, in the open or under coconut plantations. Congo grass can be cut for hay or fed fresh to stalled ruminants (Cook *et al.,* 2005). In Brazil, Congo grass is produced for fodder and for mulch in soybean maize intercropping and also sunflower crops (Giancotti *et al.,* 2015, Ceccon *et al.,* 2014).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Experimental site

The study was conducted between May 2023 and August 2023 at the experimental field of the Faculty of Agriculture, University of Benin, Benin city. (Latitude 6 15’S and 7 34’N Longitude 5 43’S and 6 43’E) which lies at 78m above sea level.

3.2 Source of seeds

The *Brachiaria ruziziensis* plots were established in 2022 with seeds sourced from the National Animal Production Research Institute (NAPRO), Shika Zaria, Nigeria. The pasture was in its second year of growth.

3.3 Treatments and Experimental Design

The treatments consisted of six NPK 15.15.15 rates (0, 400, 500, 600, 700 and 800kg ha^{-1}) designated as R1, R2, R3, R4, R5 and R6, respectively and replicated four times in a randomized complete block design (RCBD).

3.3.1 Experimental layout

six treatments were randomly allotted to plots within four replicates as illustrated below:

Rep I	Rep II	Rep III	Rep IV
2	5	1	3
3	4	3	4
1	1	4	5
4	6	5	6
5	3	2	2
6	2	6	1

3.4 Soil Analysis

Prior to fertilizer application, composite soil samples from the experimental field were randomly taken at depths of 0-15cm with a soil auger. The soil samples were bulked, air dried and ground to pass a 2mm sieve before routine soil analysis (Mylavaparus and Kennelly, 2002). After fertilizer application, soil samples where taken again from each plot and bulked according to treatment, air dried and ground to pass through a 2mm sieve before routine soil analysis.

3.5 Cultural Practices

3.5.1 Land preparation

Land contained already established *Brachiaria ruziziensis* vegetation on prepared beds, which were of 2m × 3m dimension. There were six (6) plots per replication giving a total of 24 plots in the study. The plots were raked and weeded.

3.5.2 Weed control, pests and disease monitoring

To ensure proper growth of the grass, weed control was carried out by hoeing as required, to prevent weeds build up to critical levels of infestation (Akobundu, 1987). Pests and diseases were monitored. However, no devastating incidence of either was witnessed. Signs of chlorosis (yellowing) of leaves was observed before fertilizer application.

3.5.3 Fertilizer application

NPK 15:15:15 fertilizer rates (0, 400, 500, 600, 700 and 800kg ha^{-1}) were applied to plots in three split doses, on 12th May, 2nd June and 19th July 2023 according to treatments.

3.6 Observations and Data Collection

3.6.1 Fresh herbage yield (t ha^{-1})

Biomass yield was determined using destructive sampling with a 1.0m x1.0m quadrant. Plants within each quadrant were cut with hand sickle at 10cm above ground level at the commencement of the study. Spring balance was used to determine the fresh weight of the herbage subsequently converted to t ha-1

3.6.2 Dry matter yield (t ha^{-1})

Sub- sample of the fresh herbage in 3.6.1 above was obtained and weighed using a sensitive scale before drying to constant weight in an oven set to 160°C for 48 hours. After drying, the sample was re-weighed. The sub- sample dry weight was then divided by its fresh weight to obtain a factor that was used to estimate the plot herbage dry weight which was converted into t ha-^{1}.

3.6.3 Proximate analysis of forage

Proximate analysis was carried out on the dried leaf samples in 3.6.2 above. The leaf samples were milled and sieved with a 1mm sieve and analyzed for the contents of crude protein (%), crude fiber, dry matter (%) ash (%), ether extract (%) and nitrogen free extract (%) according to Detmann (2012). The proximate analysis was conducted on leaf samples cut before fertilization (May 2023) and after fertilizer application (August 2023).

3.7 Statistical Analysis

The data collected were subjected to analysis of variance (ANOVA) with SAS software version 9.0 (SAS, 2002). Means were separated using least significant difference (LSD) at 5% level of significance. Data on proximate composition before and after fertilizer application were compared using T test at 5% level of significance.

CHAPTER FOUR

RESULT

Table 1 shows the effect of NPK 15.15.15 rates on initial fresh weight and final fresh weight of *Bracharia ruziziensis*. Both variables were significantly affected by fertilizer application. In the case of initial fresh herbage weight control, 400,700 and 800 kg ha^{-1} NPK 15.15.15 rates were similar. However, in respect to final fresh weight,800 kg ha^{-1} NPK 15.15.15 rate was significantly better than all the others except 700 kg ha$^{-1.}$

Table 2. shows the initial dry and final dry herbage weights of *Bracharia ruziziensis* at eight weeks interval of cutting. The NPK 15.15.15 rates were generally at per, however, 700 kg ha^{-1} NPK was better ($p<0.05$) than 500 kg ha^{-1}. On the other hand, for final dry herbage weight, the NPK 15.15.15 rates of 500, 600,700 and 800 kgha^{-1} were similar and better than 0 and 400 kg ha^{-1} for final dry weight of *Bracharia ruziziensis*.

Table 3 shows the comparison of the proximate fractions of *Bracharia ruziziensis.* Dry matter, crude protein, crude fiber and nitrogen free extract were significantly different. Values obtained after fertilizer application were higher than those before fertilizer application. However, in the case of crude fiber, the trend was opposite because the values were lesser after fertilizer application.

Table 4 shows the physical and chemical properties of soil before and after NPK 15:15:15 fertilizer application. Generally, the soil was of sandy loam texture, the pH of the soil before fertilizer application was higher than after fertilizer application (7.56) before fertilizer application and (6.31 to 6.70) after fertilizer application. The total Nitrogen content was 0.21 Cmol/kg before fertilizer application and was 0.23 Cmol/kg in the soil treated with 500 kg/ha rate.

The available phosphorus was 981.07 Cmol/kg before fertilizer application and apparently were lower after fertilizer application being 740.24 Cmol/kg in the control and much lower values in the substantially fertilized soils. Potassium before fertilizer application was higher than after fertilizer application being (0.78 Cmol/kg) before fertilizer application and was (0.57 Cmol/kg) in the soil treated with 700 Cmol/kg. CEC was 12.35 Cmol/kg before treatment and also reduced after treatment except for treatment 500kg/ha which recorded a higher value of 12.46 Cmol/kg.

Table 1. Effect of N.P.K 15.15.15 rates on fresh herbage yield of *Bracharia ruziziensis*

N.P.K 15: 15: 15 ($kgha^{-1}$)	Initial Fresh weight (tha^{-1})	Finial Fresh Weight (tha^{-1})
0	5.13a	4.83bc
400	3.53abc	4.54c
500	2.98bc	5.03bc
600	2.86c	4.98bc
700	4.61ab	6.15ab
800	4.60ab	7.10a
LSD	1.729	0.657

Letters with similar letters are not significantly different at ($p<0.05$)

Table 2. Effect of NPK 15.15.15 on dry herbage yield of *Bracharia ruziziensis*.

N.P.K 15:15:15 ($kgha^{-1}$)	Initial Dry weight ($t\ ha^{-1}$)	Final Dry Weight ($t\ ha^{-1}$)
0	1.58a	1.07c
400	1.01ab	1.34bc
500	0.83b	1.41ab
600	0.97ab	1.50ab
700	1.54a	1.53ab
800	1.42ab	1.72a
LSD	1.375	0.316

Means followed by similar letters are not significantly different at ($p<0.05$)

Table 3: Comparison of proximate composition analysis *Bracharia ruziziensis* before and after N.P.K 15.15.15 fertilizer application

Proximate composition	Before fertilizer application	After fertilizer application	P value	Significance
Dry matter	90.67	90.89	6.77×10^{-07}	**
Crude protein	16.83	18.21	1.51×10^{-11}	**
Crude fiber	25.43	21.16	1.72×10^{-14}	**
Ether extract	0.49	0.53	0.00127	ns
Ash	6.47	6.53	0.00127	ns
Nitrogen Free Extract	50.89	53.67	2.21×10^{-13}	**

** = significant at 1% level, ns = not significant

Table 4: Physical and chemical properties of soil after N:P: K 15: 15: 15 fertilizer application

	Particle size distribution				pH ratio	(dsm)	cmol/kg								
Treatments	% (clay)	(%) Silt	(%) Sand	Textural class	H_2O	EC	OC	TN	AP	Ca	Mg	K	Na	EA	CEC
Before fertilizer															
	9	14	77	Sandy loam	7.56	0.01	0.56	0.21	981.07	7.32	4.47	0.78	6.69	0.055	12.35
After fertilizer application															
0	12	4	84	Loamy sand	6.42	0.015	0.79	0.10	740.24	2.79	0.62	0.18	0.15	1.20	4.94
400	12	2	86	Loamy sand	6.31	0.017	0.88	0.09	616.37	2.24	0.59	0.28	0.25	1.20	4.56
500	14	4	82	Sandy loam	6.70	0.020	1.65	0.23	582.93	8.82	2.11	0.26	0.27	1.00	12.46
600	16	8	76	Sandy loam	6.31	0.015	1.59	0.11	698.22	3.44	0.61	0.21	0.20	1.20	5.66
700	14	10	76	Sandy loam	6.45	0.020	0.95	0.03	668.05	3.98	0.63	0.57	0.56	1.0	6.74
800	12	4	84	Loamy sand	6.41	0.010	0.88	0.06	688.52	3.38	0.60	0.11	0.09	1.00	5.1

EC – Electrical charge; OC – Organic carbon; N – Nitrogen; AP – Available phosphorus; Ca- Calcium; Mg- Magnesium; K- Potassium; Na – Sodium; EA – Exchangeable acid; CEC – Cation exchange capacity

CHAPTER FIVE

5.0 DISCUSSION

This study showed that fertilizer application increased the proximate composition and herbage yield of the grass This is in line with Mboko *et al* (2011) who stated *that because B. ruziziensis* demands high soil fertility i.e, fertilizers that are rich in macro nutrients (NPK) should be used to maintain productivity under grazing or cutting. This implies that if this grass is produced widely, animal feed will be enhanced greatly and farmers/herders crisis will be reduced significantly.

Fertilizer improved forage yield of *Bracharia ruziziensis*, therefore every time Congo grass is to be cultivated, N.P.K 15.15.15 fertilizer should be provided. As inorganic fertilizer is expensive, Organic sources of fertilization should be employed. These includes the use of poultry manure, cow dung and green manure to supply the necessary nutrients needed for Congo grass to optimize growth and yield.

The fiber content was reduced after fertilizer application, this implies that increase in fiber content with age can be reduced by fertilizer application. This implies that high fiber content which makes the herbage unpalatable to animals can be managed or reversed for the general good of livestock's.

5.1 Conclusion and Recommendation

This study showed clearly that the higher the rate of fertilizer application, the higher the yield generated. Therefore, high amount of NPK fertilizer is recommended for use in the cultivation of Congo grass. Large production of this grass can curb farmers crisis with herds men, it is advised that Congo grass should be produced on a large scale.

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