INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 22, No. 6, p. 54-59, 2023

RESEARCH PAPER OPEN ACCESS

Effect of different fertilizer rate (NPK) on the proximate compositions of Mulato II *(Brachiaria hybrid)* grass

Maurine Bayubay-Abao*, Gerald L. Seridon, Mauricio P. Bayubay

Cagayan State University, Piat Campus, Philippines

Key words: Mulato II, Fertilizer, Proximate analysis, Brachiaria grasses, Nutritib

http://dx.doi.org/10.12692/ijb/22.6.54-59 Article published on June 10, 2023

Abstract

The effect of different fertilizer rate (NPK) on the proximate compositions of Mulato II grass was assessed at Cagayan at the Integrated Farm of Cagayan State University Piat Campus from January-March 2021. Five treatments were used as follows: T1 – 100% (80-60-90kg NPK ha-1) inorganic fertilizer; T2 – 25% (80-60-90kg NPK ha-1) inorganic fertilizer; T3 50% (80-60-90kg NPK ha-1) inorganic fertilizer; T4 – 75% (80-60-90kg NPK ha-1) inorganic fertilizer; T5 – Control. The experiment was laid out following the Randomized Complete Block Design (RCBD) with three (3) replications. Based on the result, applying the recommended rate of inorganic fertilizer (80-60-90kg NPK ha-1) increases the percentage crude protein of Mulato II grass but yield no significant effect on the crude fiber, fat, ash and moisture.

* **Corresponding Author:** Maurine Bayubay-Abao ✉ maurinebayubay08@gmail.com

Introduction

The country has a huge, vast land resources ideal for forage and pasture production intended for dairy and meat production. However, the foremost problem facing dairy animal production in the tropics is the insufficient quality of forage pasture due to low soil fertility. The forages are generally of lower in nutritive value than those in the temperate regions (Akingbade *et al.*, 2004 as cited by Alalade *et al.*, 2014) because native grasses are grown on low fertile soil which is not well suited, for cropping (Humphreys, 1995 as cited by Alalade *et al.*, 2014). For sufficient forage development, available nutrients are important since it will determine the quality of feed to meet the requirements of dairy animals in terms of protein, energy and vitamins.

Brachiaria grasses, especially hybrids, are becoming increasingly popular because of their good yields and high quality. Brachiaria hybrid cultivar (*B. ruziziensis* × *B. decumbens* × *B. brizantha*) Mulato II (CIAT 36087) is the product of the three generations of hybridization and selection initiated by the Forage Project of the International Center for Tropical Agriculture. It is a warm-season grass with excellent nutritive value adapted to tropical region. It is a leafy, vigorous, semi-decumbent perennial grass of medium height growing from 80 cm to 100 cm. Cultivar Mulato II performs well in acid, well-drained soils, although the grass tolerates moderate waterlogging conditions. The forage grass can be established through seeds and vegetative structure such rooted cuttings.

Mineral fertilizers play an important role in sustainable forage production. They maintain and even raise soil fertility, increase crop yields, and improve the feeding value of agricultural produce when applied appropriately. Without mineral fertilizers agriculture would never have been able to quadruple its yields in fifty years and thus earn its place as one of the principal factors in the higher standard of living of civilized countries (Voisin, 1965).

The proper evaluation of high quality forages such as Mulato II *(Brachiaria ruziziensis x B. decumbens x B. brizantha)* which was recently introduced in the country for production is desirable and timely. Since this forage grass is known to produce more dry matter per unit area compared to the commonly used roughage, Napier grass. However, due to increasing fertilizer price in the country farmers opt not to utilize such commercial input on their forage production area.

The major challenge today has been how to overcome the inadequate quality and quantity of cultivated forage grasses most especially during off season. The use of fertilizers to improve forage yield and usage of commercial concentrates as livestock supplements are limited due to inability of farmers to purchase (Sodeinde *et al.*, 2006). Thus, poor nutrition due to shortage of good quality forage limits productivity of ruminants in the country. Dependence on the year-round availability of forages has always been a huge concern to dairy farmers hence, this study. Generally, the study aimed to determine the proximate compositions of the Mulato II forage grass in terms of crude protein, crude fiber, fat, ash and moisture.

Materials and methods

The following materials were used in the study: commercial fertilizers and Mulato II root cuttings.

Collection of soil samples and analysis

The experimental area was ploughed and harrowed twice. Soil samples were collected in the study area. The soil samples were spread in a flat container and air-dried. One kilogram samples were thoroughly pulverized and cleaned to separate foreign matters. The samples were submitted to the Cagayan Valley Integrated Laboratory, Regional Soils Laboratory DARO2, Carig Sur, Tuguegarao City for the soil analysis. The result of the soil analysis was the basis for the fertilizer recommendation for the study.

Land preparation

The experimental area was prepared thoroughly by ploughing and harrowing twice with seven days interval to improve soil structure and condition. This is to hasten plants for proper growth and development of the plants.

Experimental design and treatments

Randomized Complete Block Design (RCBD) was used in the study to test the treatments.

After thorough land preparation, the forage was established at 60 cm between hills x 90 cm between rows. There were a total of fifteen (15) plots with each measuring 22.68 m². Root cuttings were used as planting materials which were secured from CSU Piat Forage Gene Bank. The study was conducted at the Integrated Farm of Cagayan State University Piat Campus from January-March 2021.

The different treatments were: T1 – 100% (80-60-90kg NPK ha-¹) inorganic fertilizer; T2 – 25% (80-60-90kg NPK ha-¹) inorganic fertilizer; T3 50% (80-60-90kg NPK ha-¹) inorganic fertilizer; T4 – 75% (80-60-90kg NPK ha-¹) inorganic fertilizer; T5 – Control.

Fertilizer Application

Fertilizer applied through band application method. Calculated amount of fertilizer per treatment was based from the result of soil analysis. The amount of fertilizer applied was based from the recommended rate per treatment (T1, T2, T3, T4 and T5). Complete fertilizer (14-14-14), Urea (46-0-0) and Muriate of Potash (0-0-60) were used.

Water Management

Forage grasses were watered occasionally to avoid stunted growth. Irrigation was done right after planting followed by 3 days interval as needed to hasten rooting and growing of the plants. Same amount of water was given to plants to avoid bias result.

Weed Management

Weeding was done frequently, three weeks after planting followed by weekly weeding until harvesting period. Forage grass crops need to be weeded, all throughout the growing period to eliminate unwanted grasses.

Harvesting and Data Collection for Analysis

Harvesting was done when the crop reaches 45 days. Five samples for each replication were randomly selected. Collected samples were submitted at the Cagayan Valley Integrated Agricultural Laboratory located at Carig, Tuguegarao City, Cagayan for proximate analysis. A stump (stubble height) of 15cm was left behind after harvesting.

Statistical tool

The data were analyzed using STAR, version 2.0.1 2014. Biometrics and Breeding Informatics, PBGB Division, International Rice Research Institute, Los Baños, Laguna following procedures for analysis of variance (ANOVA) for Randomized Complete Randomized Design (RCBD) to test the significant differences among treatments. The Least Significance Difference (LCD) was used to analyze the mean comparison.

Results and discussions

Average percentage of crude protein (%)

Table 1 presents the percentage of crude protein of Mulato II grass as affected by the different rate of fertilizer application under CSU Piat condition. Based from the result of analysis of variance, the application of 100% recommended rate of inorganic fertilizer has significant effect on the crude protein content of Mulato II with an average of 13.48% compared to the application of 75% RRIF and 50% RRIF with an average of 10.82% and 9.87% respectively. Chemical fertilizer significantly affected crude protein (CP%) content of *Brachiaria hybrid* Mulato II grass. Meanwhile, Yberkew N. *et al.* (2020) also reported that the highest crude protein (CP%) of *Brachiaria hybrid* Mulato II grass was observed for NPS fertilizer (11.08%) compared to the control plot with mean 10.4%.

Table 1. Average percentage crude protein as affected by different rate of NPK on the proximate analysis of Mulato II under CSU Piat condition.

Treatments	% Crude protein
T1 – 100% RRIF	13.48
T2 – 25% RRIF	11.96
T3 – 50% RRIF	9.87
T4 – 75% RRIF	10.82
T5 – Control	12.46
ANOVA RESULT	*
C.V. (%)	9.65
$LSD_{.05}$	2.22

In consentaneous with the factsheet published by the International Center for Tropical Agriculture (CIAT) in 2018, Mulato II grass has the potential of crude protein up to 18% even under low soil quality considering the means of Treatment 1 and Treatment 5. Moreover, with the study conducted by CIAT in 2006 on forage availability and quality of *Brachiaria*

cultivars grazed by dairy cows in two contrasting periods of the year results, revealed that Mulato II obtained the highest %CP with the mean of 8.4 under the dry season compared to the other grasses studied, Mulato and Toledo.

Average percentage of crude fiber (%)

Table 2 shows the% crude fiber of Mulato II grass as affected by different rate of inorganic fertilizer. The highest mean was observed from Treatment 1 followed by Treatment 2, Treatment 4 and Treatment 3 with corresponding mean of 22.96, 21.64, 20.63, 20.36 and Treatment 5 obtained the lowest% crude fiber with a mean of 20.11, respectively. Despite the disparities in the numerical values, no significant difference was observed between treatments.

There were contrasting results reported from the study conducted by Mohamed El-Murtada Hassan Amin (2011), the nitrogen sources application reduced leaf and stem crude fiber content and also, the lowest crude fiber content was recorded when plants were treated with (ASN) fertilizer, while the highest crude fiber content was recorded under the control treatment (i.e. without nitrogen) on fodder maize. However, according to Armstrong, D. G. *et al.* (1950) as cited by Stallcup (1958) that crude fiber is of variable composition, consisting mainly of celluloses, lignin, hemicelluloses, small amounts of crude protein and ash. These constituents appear in different ratios in various species and are also influenced by the stage of maturity of the plant.

Table 2. Average percentage crude fiber as affected by different rate of NPK on the proximate analysis of Mulato II under CSU Piat condition.

Treatments	% Crude fiber
T1 – 100% RRIF	22.96
T2 – 25% RRIF	21.64
T3 – 50% RRIF	20.36
T4 – 75% RRIF	20.63
T5 – Control	20.11
ANOVA RESULT	ns
C.V. (%)	11.60
$LSD_{.05}$	4.62

Average percentage of crude fat (%)

The average percentage of% crude fat applied with different rate of fertilizer is presented in Table 3.

Based from the result of analysis, regardless of treatment differences in percentage of crude fat which ranged from 2.52 to 3.27, means revealed with no significant difference between treatments.

The effect of different rate of NPK application indicates that there was no significant effect to Mulato II grass in terms of% fat taking into consideration that the current recommendation is to not exceed 3.5% of the total ration dry matter as Rumen Unsaturated Fatty Acid Load. These unsaturated fatty acids, when present in high concentrations, have been shown to negatively affect rumen function, including decreased intake, digestion of fibres, and the concentration of fat in milk (www.dairyherd.com).

Table 3. Average percentage crude fat as affected by different rate of NPK on the proximate analysis of Mulato II under CSU Piat condition.

Treatments	% Crude fat
T1 – 100% RRIF	2.78
T2 – 25% RRIF	2.62
T3 – 50% RRIF	2.97
T4 – 75% RRIF	3.27
T5 – Control	2.52
ANOVA RESULT	ns
C.V. (%)	13.02
$LSD_{.05}$	0.69

Average percentage of ash (%)

Table 4 shows Treatment 4 obtained the highest percentage ash with a mean of 31.37 followed by Treatment 3 with a mean of 30.07. Treatment 5 obtained the lowest% ash having a mean of 26.30. No significant difference existed among the treatment which implies that application of fertilizer has no effect on the percentage of ash in Mulato II grass.

The present result was also supported by the findings of Cahit Balabanli *et al.* (2010), the highest ash content was obtained from $N_{80}P_{40}K_{50}$ and $N_{80}P_{80}K_{50}$ treatments 12.20% and 12.04%, respectively while the lowest ash content was obtained from control plot ($N_0P_0K_0$) with a mean of 10.30%, revealing no significant difference between treatments. Also, according to Soleymani *et al.* (2011), there was no

significant difference in % ash among the treatments applied on forage maize even the maximum amount was obtained with 11.33% (60kg/ha N) and 9.66% on control treatment (0kg/ha N).

Table 4. Average percentage ash as affected by different rate of NPK on the proximate analysis of Mulato II under CSU Piat condition.

Treatments	% Ash
T1 – 100% RRIF	23
T2 – 25% RRIF	22.90
T3 – 50% RRIF	30.07
T4 – 75% RRIF	26.30
T5 – Control	19.01
ANOVA RESULT	ns
C.V. (%)	17.93
$LSD_{.05}$	8.19

Average percentage of moisture (%)

Table 5 shows Treatment 4 obtained the highest percentage moisture with a mean of 8.58 followed by Treatment 2 with a mean of 7.15. Treatment 3 obtained the lowest% moisture having a mean of 6.75. No significant difference existed among the treatment which implies that application of fertilizer has no effect on the percentage of moisture in Mulato II grass.

The current finding is similar to the result of Stephen Oyedeji *et al.* (2014) on the yield and proximate composition of three amaranths applied with fertilized (poultry manure) and unfertilized where no significant difference of% ash observed between treatments with mean of 59.40±0.10 and 53.99±0.15 respectively.

Table 5. Average percentage moisture as affected by different rate of NPK on the proximate analysis of Mulato II under CSU Piat condition.

Treatments	% Ash
T1 – 100% RRIF	7.06
T2 – 25% RRIF	7.15
T3 – 50% RRIF	6.75
T4 – 75% RRIF	8.58
T5 – Control	7.03
ANOVA RESULT	ns
C.V. (%)	26.36
$LSD_{.05}$	3.63

Conclusion and recommendations

Based on the findings, it can be concluded that applying the recommended rate of inorganic fertilizer (80-60-90kg NPK ha^{-1}) increases the percentage crude protein of Mulato II grass but yield no significant effect on the crude fiber, fat, ash and moisture. A follow-up study on the effect of different fertilizer rate may be conducted during the wet season of the year.

References

Akingbade AA., Akinlade JA., Aderinola OA. 2004. Pasture Production and Utilization in the derived Savannah of Nigeria. Damanik Publication Mapo Post Office Ibadan Pp16-20.

Alalade JA., Akingbade AA., Akinlade JA., Akanbi WB., Gbadamosi J., Okeniyi G., Akanji KA. 2014. Herbage yield and nutritive quality of *Panicum maximum* intercropped with different legumes. International Journal of Science, Environment and Technology **3(1),** 224-232.

Amin M. 2011. Effect of different nitrogen sources on growth, yield and quality of fodder maize (*Zea mays* L.). Journal of the Saudi Society of Agricultural Sciences **10(1).** DOI: 10.1016/j.jssas.2010.06.003

Argel M., Pedro J., Cultivar Mulato I. 2007. (*Brachiaria hybrid* CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils/Pedro J. Argel, John W. Miles, Jorge D. Guiot, Hugo Cuadrado and Carlos E. Lascano. Cali, Colombia: International Center for Tropical Agriculture (CIAT). 21

Armstrong DG., Cook H., Thomas B. 1950. The lignin and cellulose contents of certain grassland species at different stages of growth. The Journal of Agricultural Science **40(1-2),** 93-99.

Balabanli Cahit , Albayrak, Sebahattin, Yüksel, Osman. 2010. Effects of nitrogen, phosphorus and potassium fertilization on the quality and yield of native Rangeland. Turkish Journal of Field Crops. 15.

Humphreys LR., Partridge A. 1995. A Guide to better pastures for the tropics Published by NSW Agriculture 5th edition: Grass for the tropics: Guinea grass (*Panicum maximum*).

Oyedeji S, Animasaun DA, Bello AA, Agboola OO. 2014. Effect of NPK and poultry manure on growth, yield and proximate composition of three Amaranths. Journal of Botany.

Sodeinde FG, Asaolu VO, Adeleye IOA, Adewumi MK, Oyebanji B, Adeniyi S. 2006. Effect of nitrogen fertilizer on the dry matter productivity of *Panicum maximum* and soil copper and manganese contents in the derived savannah zone of Nigeria. Proceeding of the 31st Annual Conference of Nigerian Society for Animal Production 12th-15th March, 2006. Bayero University Kano, Nigeria.

Soleymani A, Khajedin AA, Shahrajabian MH. 2011. Grain yield and yield components of corn (*Zea mays* L.) hybrids in responseto planting dates in semi-arid region in Isfahan. Res. on Crops **12,** 45-52.

Yiberkew N, Yeshambel M, Asmare B. 2020. Effect of fertilizer types and plant spacings on plant morphology, biomass yield and chemical composition of *Brachiaria hybrid* Mulato II grass grown in Lowlands of Ethiopia. Animal Sciences and Biotechnologies **53(1),** 20-35. https://www. dairyherd. com/news/total-fatty-acids-vs-crude-fat-feed