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Growth and Nutritive Response of Guinea Grass (*Panicum maximum*) to Different Organic Manure Application

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Abstract **Original Research Article**

An experiment was carried out to determine the effect of different organic manure on the growth yield and nutritive value of Guinea grass (*Panicum maximum*). This experiment was designed in a Randomized Complete Block Design with three replicates. Treatments were control (without any manure) (T 1), Goat manure alone (25 t ha -1) (T 2), Poultry manure alone (25t ha -1) (T 3), Cattle manure alone (25 t ha -1) (T 4). These were applied as basal and topdressing application of manure in this experiment and their performance was recorded once in three weeks. Analysis of Variance was performed to define significant difference among treatments ($p < 0.05$). Results revealed that plants grown in Poultry manure (T3)(25 t ha -1) showed significantly ($p < 0.05$) better performance in the measured growth parameters viz. plant height(217.2cm), leaf area, number of tillers, maximum leaf length and maximum leaf width while the lowest performance was observed in control (T1) at 11 WAP(weeks after planting). Further the results of this study revealed that relatively higher total dry matter (149.61g/plant) and nutrition composition viz crude protein (14.48%), Ash content(19.78%),crude fiber(16.17%), Ether extract (8.75%) was obtained from the plants treated with poultry manure alone (T3) followed by T4,T2 whereas the lowest drymatter yield(62.7g/plant) and nutrition composition was observed in control (T1). Therefore, it could be concluded that the poultry manure can be used to enhance the growth and nutritive value of Guinea grass.

Keywords: Leaf area, Number of tillers, Maximum leaf length, Crude protein, Dry matter yield.

INTRODUCTION

Guinea grass (*Panicum maximum*) is one of the main forage species in dryzone of Sri Lanka. It is very palatable to livestock at all stage and is one of the best fodders in the tropic. The Guinea grass plays a vital role in livestock production due to its persistence, growth and quality under proper management [1]. It is one of the leading fodder crops in Eastern region and requires precise amount of plant nutrients at accurate time for better yield and quality.

Low soil fertility generally causes for reduction in forage yield. Nutrition is one of the most important factors that regulate the effectiveness of any livestock venture [2]. As a result, in conventional agriculture, farmers are practiced chemical fertilizers for increasing forage productivity. Instead, the use of chemical fertilizers alone may lead to diminish the soil micronutrients [3] and also surplus application of these fertilizers has resulted environmental problem. Further chemical fertilizers alone generate several deleterious effects to the environment and they should be replenished in every cultivation season because, the synthetic N, P and K fertilizer is rapidly lost by either evaporation or by leaching in drainage water and it causes hazardous environmental pollution [4]. Moreover, the commercial fertilizers are expensive to poor farmers involving in fodder cultivation. Hence, alternative nutrient management is a crucial to overcome the constraints prevailing in Eastern part of Sri Lanka where soil is mostly sandy regosol.

Organic manure can improve soil fertility, increase water-holding capacity, promote beneficial organisms and improve microbial biomass [5]. Besides enhancing forage yield and nutritive value, organic manures also own the capability to improve the physical, chemical, and microbial properties of the soil [6]. Hence, fertilization of fodder land with organic manure sits well within the context of nutrient recycling and environmental protection. Ewetola *et al.* [7] reported that application of organic manure directly to the soil helped in maintaining adequate level of organic matter, which was a critical component of soil fertility and productivity. Organic manure application to sandy soil is not only beneficial for crop growth, but it also improve soil properties of coarse soil [8] and reduce

groundwater contamination caused by leaching of soil nitrogen. Organic manure is abundantly available in Sri Lanka and other developing countries. Therefore, this study was aimed to evaluate the effects of use of organic manure on yield and quality of Guinea grass *(Panicum maximum)*

MATERIALS AND METHODS

Location

The experiment was carried out at the Animal farm of the Eastern University of Sri Lanka. The site was located at an elevation of 100 m above mean sea level. It belongs to the agro-ecological region of low country dry zone in Sri Lanka. The Type of soil is sandy regosol which contains 22 N kg/ha, 235 kg/ha P2O5 and 224 kg/ha K2O .The annual mean rainfall of the district varies from 1600 mm to 2100 mm. The average temperature ranges from 28 ºC to 32 ºC and the humidity ranges from 65% to 86%.

Experimental Design

The experiment consisted of four treatments(without any organic manure –T1,Goat manure –at the rate of 25t ha-1-T2 ,Poultry manure at the rate of 25t ha-1-T3, Cattle manure at the rate of 25t ha-1-T4) and was laidout in a Randomized Complete Block Design (RCBD) with three replication.

Agronomy practices

Land was ploughed and leveled. Subsequently experimental plots were prepared and each plot size was 1m×1m ($1m^2$).Rooted tillers of Guinea grass (*Panicum maximum*) were collected from Animal farm, Eastern University Sri Lanka and tillers were cut into equal size of 5cm each. Tillers were planted at a spacing of 20cm ×20cm to maintain 25 plants/plot (250,000plants/ha). Basal application of organic manures according to the treatments were done one week before planting. As well as Top dressing was done 30 days after planting.

Measurements

Field data was collected in the experiment at two weeks interval from five weeks after transplanting to elevenweeks after transplanting including growth parameters, yield and nutritional compositions

Statistical analysis

Data were statistically analyzed by analysis of variance using the Statistic Analysis System (SAS) 9.1 and Treatment means were compared according to Tukey's honestly significant difference test at $\alpha = 0.05$ probability level.

RESULTS AND DISCUSSION

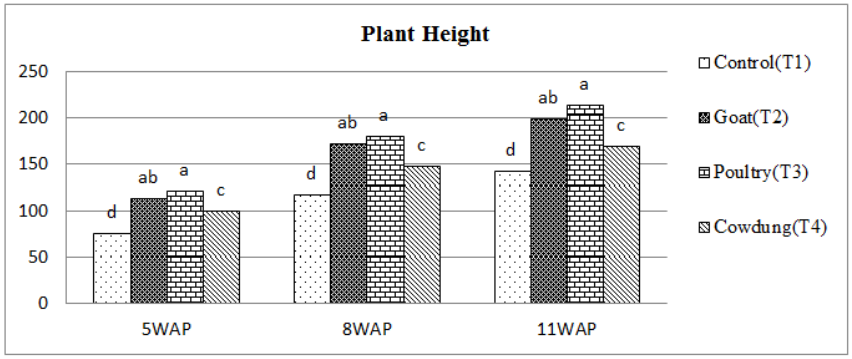

Fig-1: Effect of different organic manure application on plant height at 5, ,8and 11 weeks after transplanting of Guinea grass (*Panicum maximum*) Means followed by the same letter are not significantly different from each other according to Tukey's honestly significant difference test at 5% significant level

The analysis of data on average plant height showed that application of Poultry manure (T3) significantly increase the plant height by 32.5%of Guinea in comparision to control plants ($p<0.05$) followed by T2, T4. This might be due to the source of Nitrogen from poutry manure was found to increase number of nodes, internode length and consequently plant height[9].These results were supported by Shiyam *et al*. [10], who reported that tallest Maize plants were found in plants amended with 2.5 tonnes of poultry manure ha^{-1}.The results showed that plant grown in goat manure (T2) produced significantly (P,0.05) second highest plant height.It was also observed that there were no significant ($p<0.05$) differences in the plant height of the poultry manure (T3) and goat manure (T2).This might be due to the goat manure was also found to be an efficient source of NPKCa Mg [11].These results were conformity with the reports of Rahman *et al* [22], who conducted an experiment of goat manure application on Napier grass.

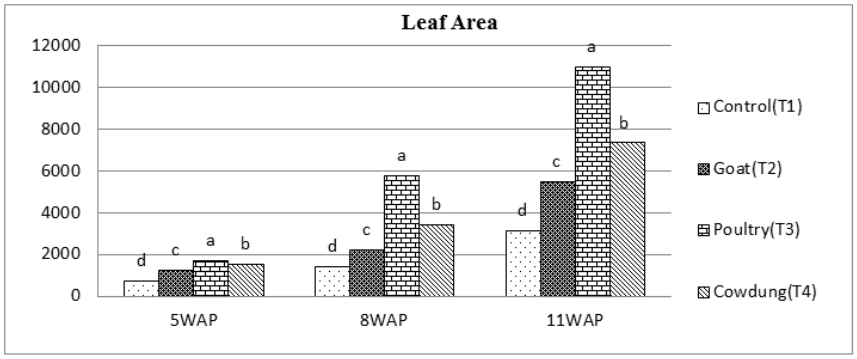

Fig-2: Effect of different organic manure application on Leaf Area at 5, ,8and 11 weeks after transplanting of Guinea grass (*Panicum maximum*) Means followed by the same letter are not significantly different from each other according to Tukey's honestly significant difference test at 5% significant level

Leaf Area is one of the important parameter which determine the final yield of Guinea (*Panicum maximum*).The present investigation showed that application of poultry manure (T3) rate of 25 tonnes/ha) on Guinea grass increased the average leaf area per plant by 81.5% incomparision to control plants (P< 0.05) followed by T4,T2.The highest leaf area was recorded in plots treated with poultry manure could be due to the efficient nitrogen availability as a result the plant uptake more nitrogen and in turn large leaves were observed. These results were supported by Amujoyegbe *et al.,* [12] who reported that poultry manure increased the leaf area and total chlorophyll content of Maize and Sorghum. These results are also confirmed by Shah *et al*. [3] who found greater leaf area with the application of poultry manure.

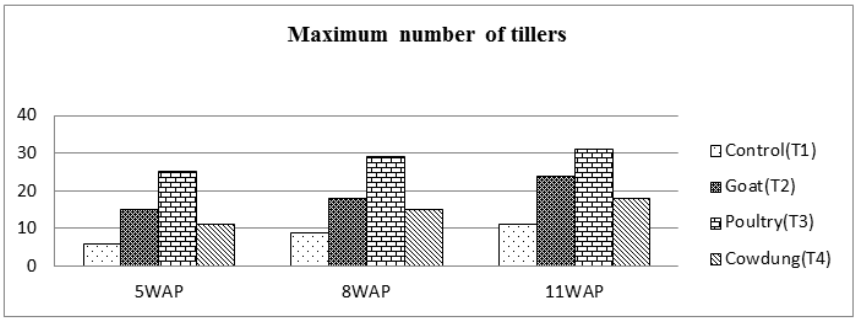

Fig-3: Effect of different organic manure application on maximum mean number of tillers at 5, ,8and 11 weeks after transplanting of Guinea grass (*Panicum maximum*) Means followed by the same letter are not significantly different from each other according to Tukey's honestly significant difference test at 5% significant level.

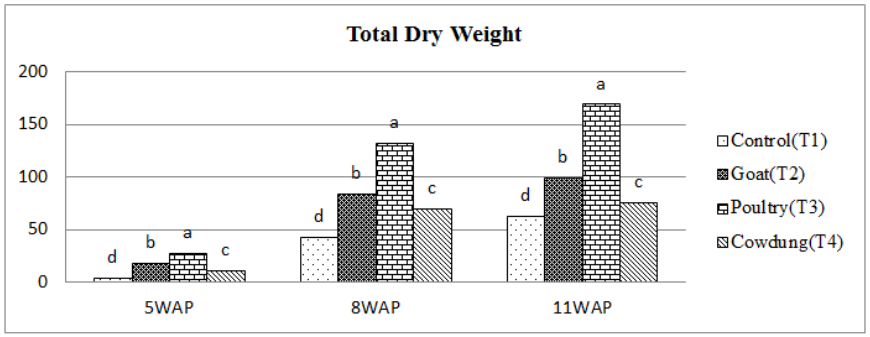

Fig-4: Effect of different organic manure application on total dry weight at 5, ,8and 11 weeks after transplanting of Guinea grass (*Panicum maximum*) Means followed by the same letter are not significantly different from each other according to Tukey's honestly significant difference test at 5% significant level

Throughout the experiment the maximum mean number of tillers per plant recorded in T3 (poultry manure 25 tonnes ha $^{-1}$ while the minimum number of tillers were recorded in T1 (control).The analysis of data on mean number of tillers per plant showed that application of poultry manure on Guinea grass significantly (P< 0.05) increased the mean number of tillers/plant by 61.5% in treated plants comparision to control plants. Gupta *et al*. [14] revealed that poultry manure is very rich animal manure that boosts soil

productivity better than other organic manures and gives considerable increase in organic C, N, available P and exchangeable cations. It is important to note that the positive effects of organic manures on plant growth are not only due to temporal availability of essential minerals but also attributable to the improvement of soil physical chemical and Biological characteristics [15]. These results are coincide with the findings of ogunkunle *et al.* [16] who concluded that application of the poultry manure on Guinea *(Panicum maximum*)significantly increase the number of tillers.

The maximum average total dry weight was recorded in T3 followed by T2, T4 while the minimum average of total dry weight was observed in T1 (Fig 4). The observed increase in total dry matter in response to the poultry manure application could be attributed to the increase leaf area /plant which increased photosynthetic area and improved solar radiation interception that enhanced accumulation of photosynthates. These results are conformity with the reports of Dapaah *et al.* [17] who conducted an experiment of Influence of poultry manure on Onion (*Allium cepa*).

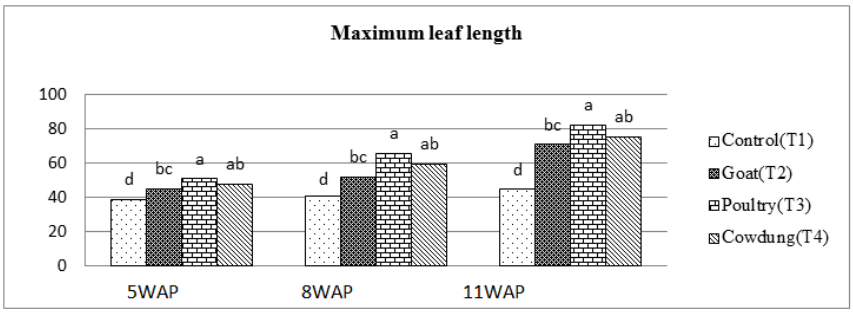

Fig-5: Effect of different organic manure application on maximum leaf length at 5, 8and 11 weeks after transplanting of Guinea grass (*Panicum maximum*) .Means followed by the same letter are not significantly different from each other according to Tukey's honestly significant difference test at 5% significant level

The analysis of data on maximum leaf length showed that application of Poultry manure (T3) significantly increase the leaf length by 42.8 %of Guinea in comparison to control plants ($p<0.05$) followed by T4, T2. This might be due to the continuous release of nitrogen Potassium and Phosphorous from poultry manure, which satisfied nutritional needs of Guinea grass. Especially since these nutrients are present in the poultry manure under a readily available form for plant uptake. The results showed that plant grown in cattle manure (T4) produced second highest leaf length. It was also observed that there were no significant ($p<0.05$) differences in the plant height of the poultry manure(T3) and cattle manure (T4) as well as T4 and T2 at 3 months after transplanting.

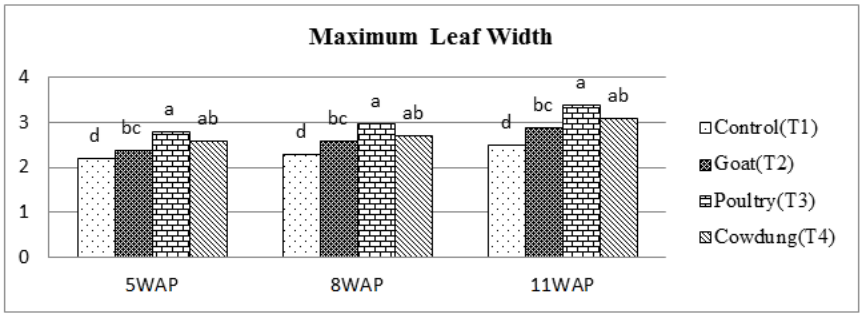

Fig-6: Effect of different organic manure application on maximum leaf width at 5, 8and 11 weeks after transplanting of Guinea grass (*Panicum maximum*). Means followed by the same letter are not significantly different from each other according to Tukey's honestly significant difference test at 5% significant level

Analysis of data in Fig 6 showed that maximum leaf width of Guinea was significantly influenced by different treatments compared with the control. Application of poultry manure with the rate of 25t/ha significantly increased maximum leaf width by 23.52% of Guinea in comparison to control (T1) plants ($P<0.05$). Egerszegi [21] who reported that application of poultry manure increases carbon content, water holding capacity, aggregation of soil, and decreases bulk density. This might be the reason for largest leaf width with the application of poultry manure. This was supported by Jackson [23] who reported that application of Poultry manure had significantly increased plant growth since it contains sufficient amount of water soluble and exchangeable potassium and magnesium. Further the results showed that plants grown in cattle manure (T4) produced second highest leaf width. This might be due to cattle manure application improved the physical soil properties and increased the level of soil nutrition, which improved vegetative growth of the

Guinea (*Panicum maximum*). This is in agreement with the findings of Dawuda *et al.* [11] who reportedthat cattle manure application improved vegetative growthof carrot plant. It was also observed that there were no significant ($p<0.05$) differences in the leaf width of the poultry manure(T3) and cattle manure (T4) as well as T4 and T2 at 3 months after transplanting.

Table-I: Effect of different organic manure application on % of Crude protein, Crude fiber. As well as Ether extract and % of Ash content of Guinea grass (*Panicum maximum*)

Treatments	Crude Protein %	Crude Fiber%	Ether extract %	Ash%
T1	8.36d	15.17ab	3.1d	7.8c
T2	10.42c	15.92a	4.6c	16.96b
T3	14.48a	16.17a	8.75a	19.78a
T4	11.48b	15.96a	6.95b	17.25b

Results obtained revealed that there was significant ($P<0.05$) differences among the treatments on the crude protein of Guinea grass (*Panicum maximum)* (Table 1). *Panicum maximum* fertilized with poultry manure had higher crude protein (14.48%) and was followed by cattle manure while the lowest value was observed on control. This might be due to the availability of essential nutrients in poultry manure especially nitrogen which enhanced and encouraged vegetative growth.

The present study clearly showed that there was no significant ($p<0.05$) differences among the treatments on % of crude fiber. However maximum crude fiber % (16.17) was recorded in poultry manure application (T3) while the minimum crude fiber % was recorded in control (T1).It clearly indicate that application of different manures had no significant influence on crude fiber % of *Panicum maximum*. However Oyedeji *et al.* [18] found maximum crude fiber in *Amaranthus cruentus* with poultry manure application.

Results obtained revealed that there was significant ($P<0.05$) differences among the treatments on the % ash content of Guinea grass (*Panicum maximum)* (Table 1). *Panicum maximum* fertilized with poultry manure had higher ash content (19.78%) and was followed by goat manure while the lowest value was observed on control.

Data recorded on % Ether Extract represented in Table 1. The response of % ether extract to different treatments were significant ($p<0.05$). The maximum % Ether Extract was recorded in T3 (8.75%) (Poultry manure application with the rate of 25 t ha -1) while the minimum % Ether Extract wa recorded in T1 (control). These findings are coincided with the reports of Abau EL-Magd *et al*. [19] who found that poultry manure produced high quality broccoli. The results of present study were in accordance with the results of Munir *et al.* [20] who found that poultry manure gave higher oil contents in sunflower.

Conclusion

The results reveal that the highest plant height(217.2cm), leaf area, number of tillers as well as maximum leaf length and maximum leaf width were achieved in T3 Poultry manure alone (25 t ha -1)followed by T2 Goat manure alone(25 t ha -1).Dry matter yield was remarkably influenced by the application of different organic manure. Maximum dry matter yield was recorded in T3 Poultry manure alone (25 t ha -1) (149.61g/plant) followed by T2 and T4. The plant treated with poultry manure alone significantly ($P<0.05$) increased the crude protein (14.48%), Ash content (19.78%), crude fiber (16.17%), Ether extract (8.75%) contents in Guinea grass (*Panicum maximum*) over the control. Based on these results, it could be concluded that highest yield with optimal nutritive composistions could be obtained by the application of the Poultry manure alone (25 t ha -1) as basal dressing and as top dressing in Guinea grass (*Panicum maximum*) fodder cultivation. This study also confirmed that the use of organic manure is an ecofriendly technique to boost fodder production.

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