Growth Performance of Elephant Grass (*Pennisetum purpureum)* Grown with Different Organic Manures

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Target Audience: Forage Scientists, Livestock farmers and Animal Scientists.

Abstract
This experiment was conducted to examine growth performance of Napier grass on growth fertilized with different organic manures. Four (4) treatments were laid out in Randomized Complete Block Design with three replicates consisting of different manure types. The T1 Napier grass intercropped with legume (groundnut), T2 Napier grass fertilized with cattle dung, T3 was Napier grass fertilized with swine dung and T4 was Napier grass fertilized with poultry manure application. These manures were applied by site placement method two weeks after planting at the rate of 200 kgN/ha based on their nitrogen content. Napier grass stems were planted on ploughed plots with required agronomic practices. Growth parameters such as plant height, leaf length, leaf width and stem circumference were measured at 4, 8, and 12 weeks after planting (WAP). Results obtained showed that manure types showed significant influence ($P<0.05$) on growth parameters measured at different weeks after planting. Higher ($P<0.05$) growth parameters were obtained for Napier grass grown with cattle manure at different weeks after planting. It could be concluded that cattle dung is a preferred organic manure for cultivating elephant grass, as it consistently supported superior vegetative growth and biomass accumulation compared to poultry and swine dung

Keywords: Napier grass, manure, growth, Parameters.

Description of Problem

Elephant grass (*Pennisetum purpureum*) is a common forage plant in the tropics. It is one of the best fodders in the tropics and is particularly pleasant to animals at all stages. Elephant grass is important in animal production because of its persistence, growth, and quality when managed properly (1). It is one of the most important fodder crops in the tropics, and it necessitates the application of specific amounts of plant nutrients at precise times in order to maximize yield and quality. Elephant grass is an excellent fodder crop with a yield of up to 150 tons green matter per hectare each year and is capable of withstanding repeated cuttings (four to six cuts per year), resisting high temperatures, drought stress, low soil fertility and biotic stress (2). Forage yields are typically reduced when soil fertility is low. One of the most essential aspects governing the efficiency of any livestock venture is nutrition (3). As a result, farmers in conventional agriculture use chemical fertilizers to boost forage productivity. Instead, relying solely on chemical fertilizers may deplete soil micronutrients (4), and excessive application of these fertilizers has resulted in environmental issues. Organic manures have the ability to improve the physical, chemical, and microbiological aspects of the soil in addition to increasing forage output and nutritional value (5). As a result, organic manure fertilization of fodder land fits nicely into the context of nutrient recycling and environmental conservation. According to (6), applying organic manure directly to the soil helps maintain an acceptable quantity of organic matter, which is an important component of soil fertility and production. Evaluating the growth performance of elephant grass under different organic manure treatments is therefore essential for identifying the most effective organic nutrient source for enhanced biomass yield. This research was carried out to investigate the influence of different organic manure applications on the growth performance of Napier grass.

Materials and Methods

The study was conducted at Anyigba using the facilities of the Crop Teaching and Research Farm of Prince Abubakar Audu University

Anyigba, Kogi State, Nigeria. The location of the study area lies between Latitude 7^0 15' and 7^0 29'N of the equator and Longitude 7^0 11' and 7^0 32' of Greenwich Meridian. It has a bimodal rainfall pattern with the peak occurring in July and September. The mean annual rainfall is 1,808mm, daily temperatures vary from 17°C to 36°C and humidity 65-85% throughout the year (7). Elephant grass *(Pennisetum purpureum)* was planted in a Randomized Complete Block Design (RBCD) at 25cm x 25cm on different treatments replicated three times with different organic manure application which includes treatment 1 (grass-legume intercrop), cattle manure (treatment 2), swine manure (treatment 3) and poultry manure (treatment 4) respectively. The organic manures were supplied through site placement method 2 weeks after planting at 200kg/haN while other agronomic practices were carried out to ensure effective growth. *Pennisetum purpureum* cuttings were sourced from National Animal Production Research Institute (NAPRI), Zaria, Kaduna State.

Data Collection

After 4,6,8,10 and 12 weeks after planting (WAP) the following data were collected from the plot of *Pennisetum purpureum*: Plant height, leaf length, leaf width and stem circumference. Plant height was measured as the distance between the base of the stem to the tip of the leaf using measuring tape, leaf length was measured from the leaf base to the tip of the leaf using measuring tape etc. Also, at12 weeks after planting the herbage yield of each plot was determined. The harvested forage was air dried for few 7 days to determine the dry matter yield.

Statistical Analysis

All collected data was subjected to Analysis of Variance (ANOVA) using statistical software (SPSS version 23). Significant different means were separated using the same software with Duncan Multiple Range test at 5% level of significance.

Results and Discussion

Growth Performance of Napier grass fertilized with different organic manure

At four weeks after planting, the treatment comparisons yielded significant differences (P<0.05) across all measured parameters (plant height, leaf length, leaf width, and stem circumference). Plant height, leaf width and stem circumference recorded higher significant values (P<0.05) for cattle dung, and poultry manure. The enhanced performance under cattle and poultry manures is consistent with findings that organic applications improve soil nutrient availability and enhance early tiller vigor in elephant grass as stated by (8) and (9).

Table 1: Growth Performance at 4 Weeks after Planting (4WAP)

Parameters	T1 (Control)	T2 (Cattle dung)	T3 (Poultry manure)	T4 (Swine dung)	SEM	LOS
Plant height (cm)	57.93^a	58.65^a	57.76^a	47.15^b	3.80	*
Leaflength (cm)	46.98^a	44.94^{ab}	43.20^{ab}	37.33^b	3.39	*
Leafwidth (cm)	2.09^{ab}	2.39^{ab}	2.55^a	1.97^b	0.20	*
Stem circumference(cm)	5.64^a	5.75^a	4.15^b	4.30^b	0.33	*

^{a,b,c,d} means with different superscripts along the same row shows significant difference at p<0.05, SEM= Standard Error of the Mean. T1, T2, T3 and T4=control, cattle dung, poultry manure and swine dung respectively. LOS=level of significance, *=significantly different, NS=Not Significantly Different.

Table 2: Growth Performance of Napier Grass at 8weeks after planting (8WAP)

Parameters	T1 (Control)	T2 (Cattle dung)	T3 (Poultry manure)	T4 (Swine dung)	SEM	LOS
Plant height (cm)	108.93	108.89	108.21	98.65	6.35	NS
Leaflength (cm)	80.80	81.86	81.29	75.46	4.06	NS
Leafwidth (cm)	2.48^b	2.93^a	2.93^a	2.79^{ab}	0.16	*
Stem circumference	6.89	7.39	7.44	6.65	0.49	NS

^{a,b,c,d} means with different superscripts along the same row shows significant difference at p<0.05, SEM= Standard Error of the Mean. T1, T2, T3 and T4=control, cattle dung, poultry manure and swine dung respectively. LOS=level of significance, *=significantly different, NS=Not Significantly Different.

At 8 weeks after planting, higher performance for leaf width was recorded in cattle dung and poultry dung fertilized grass treatment which were significantly different (P<0.05) from the control for which performed significantly lower than the rest, but statistically similar to swine dung fertilized plot. These observations align with reports that Napier grass responds rapidly to organic manures in early stages but tends to equilibrate at mid-growth as soil nutrient mineralization progresses according to (10).

During twelve (12) weeks of planting, the treatment comparisons yielded significant ($P<0.05$) difference for plant height and stem circumference. Higher performance for plant height was recorded in cattle dung which was significantly different ($P<0.05$) from poultry manure for plant height which performed significantly ($P<0.05$) lower than the rest. For stem circumference cattle dung fertilized grass plot performed significantly ($P<0.05$) better. This suggests a second phase of nutrient uptake favoring more decomposable manures (cattle and poultry), which provide a sustained release of nitrogen and phosphorus needed for structural thickening and elongation at later stages as observed by (11) and (12). The superior performance of cattle and poultry manures is consistent with prior studies showing that manures rich in readily available nitrogen enhance tillering, stem diameter, and height, which are the key determinants of biomass yield (12) and (10). Leaf-related traits (length and width) typically show weaker responsiveness to manure compared with stem traits, a pattern widely reported in Napier grass agronomic studies (9). Furthermore, the delayed but significant improvements at week-12 confirm that organic amendments continue to release nutrients beyond the early establishment phase, supporting structural growth at later maturity stages (11). Overall, cattle dung and poultry manure are superior organic fertilizers for elephant grass, particularly for improving structural traits that correlate strongly with biomass accumulation, while swine dung was less effective throughout the study period. These findings reinforce current recommendations emphasizing the use of nutrient-rich organic manures to maximize forage productivity and improve stem vigor in Napier grass production systems as opined by (8) and 12).

Table 3: Growth Performance of Napier Grass at 12-weeks after planting (WAP)

Parameters	T1 (Control)	T2 (Cattle dung)	T3 (Poultry manure)	T4 (Swine dung)	SEM	LOS
Plant height (cm)	125.02^{ab}	134.47^{a}	$115..53^{b}$	119.02^{ab}	6.59	*
Leaf length (cm)	93.19	97.65	86.99	88.51	4.43	NS
Leaf width (cm)	3.15	3.37	3.32	2.92	0.21	NS
Stem circumference	8.17^{ab}	9.68^{a}	8.21^{ab}	6.99^{b}	0.60	*

^{a,b,c,d} means with different superscripts along the same row shows significant difference at $p<0.05$, SEM= Standard Error of the Mean. T1, T2, T3 and T4=control, cattle dung, poultry manure and swine dung respectively. LOS=level of significance, *significantly different, NS=Not Significantly Different.

Conclusion and Application

The application of organic manures influenced the growth performance of elephant grass (*Pennisetum purpureum*) at different growth stages as significant differences ($P < 0.05$) were observed among treatments for plant height, leaf length, leaf width, and stem circumference, with cattle dung and poultry manure generally enhancing growth better than swine dung, cattle dung consistently produced superior growth values, particularly in plant height and leaf length. Thus, cattle dung is a preferred organic manure for cultivating elephant grass, as it consistently supported superior vegetative growth and biomass accumulation compared to poultry and swine dung.

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