BIOMASS YIELD OF NAPIER GRASS UNDER IRRIGATION SYSTEM AS INFLUENCED BY DIFFERENT FERTILIZERS IN YOLA, ADAMAWA STATE

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ABSTRACT
A field trial was conducted to evaluate the effect of different fertilizers on the fresh forage and dry matter yield of Napier grass (*Pennisetum purpureum*) under irrigation system in Yola, Adamawa State. The treatments comprised NPK fertilizer at 250 kg/ha, cow dung at 7 tons/ha, and a no-fertilizer control. The experiment was laid out in a Randomized Complete Block Design with three replicates. Harvests were carried out at 60, 90, and 120 days after planting (DAP). Results showed that both fertilizer treatments significantly improved fresh and dry matter yields compared to the control. Cow dung consistently produced higher yields than NPK at all stages, with peak performance at 120 DAP. The control plots recorded the lowest yields throughout the study. The findings underscore the potential of organic manure in enhancing biomass production of Napier grass under irrigated conditions. It is therefore recommended that cow dung be adopted for increased forage productivity in semi-arid regions.

Keywords: Napier grass, fresh forage yield, dry matter yield, cow dung, NPK, irrigation

DESCRIPTION OF PROBLEM
In most of the tropical regions of the world, strategic provision of feed to meet up with the nutrient requirement of livestock animals have been a major problem faced by ruminant animal keepers, especially during the dry season. In the small farmers' perspective, this requirement is provided through the basal supply of natural pasture grasses during the rainy season [8]. These grasses are mostly characterized by inadequate nutrients and low herbage yield as they grow on lands that are often short of the required soil nutrients. Since the forages on the rangelands in these areas provide feed which are not adequate for the ruminant animals, there is the need for improving their all-round productivity. Tropical grasses have the ability for high yield and the nutrients are simultaneously enhanced when treated with organic or inorganic fertilizers or established with nitrogen-fixing shrubs or tree legumes [1]. Unfertilized grasses had been described to be less nutritive as forage for ruminant animals [3]. Napier grass (*Pennisetum purpureum* Schummach) is native to Sub-Saharan Africa from where it is believed to have been distributed to other tropical and subtropical regions around the world [7]. The grass is a major tropical grass and it is one of the highest yielding tropical grasses [9]. Forage yield is a critical parameter in pasture production, directly influencing the availability of feed for livestock. Napier grass is a highly productive tropical forage species known for its adaptability and high biomass output. However, its yield is influenced by soil fertility and agronomic practices, particularly fertilizer application [9]. The current study investigates the effects of these two fertilizer types on the fresh and dry matter yield of Napier grass grown under irrigation in Yola, Nigeria. The goal is to determine which fertilizer type optimizes biomass yield for sustainable livestock feeding systems.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the Nyibango research farm along Army Barracks Road in Yola, Adamawa State, Nigeria. The site lies within the Northern Guinea Savannah (Latitude 9°13′–9°37′N and Longitude 12°16′–12°42′E), with sandy loam soils and an annual rainfall of 956 mm [2].

Experimental Design and Agronomic Practice

The experiment was arranged in a Randomized Complete Block Design (RCBD) with three treatments replicated three times:

T1: NPK fertilizer (250 kg/ha) applied 30 days after planting (DAP), using the side placement method of application

T2: Cow dung (7 tons/ha) applied at planting, by evenly spreading the manure within the perimeter of each plot containing this treatment

T3: No fertilizer (control)

Obstacles were cleared before the land as ploughed manually. Each plot measured 3 × 3 meters. Thirty-six stem cuttings were planted per plot using 1 m inter-row and 0.5 m intra-row spacing. There was an alleyway of 2m width between blocks and 2m width between plots. Stem cuttings having three nodes were planted in a slanting position, at an angle of 30-45^{o}, with two nodes buried in the soil. Before planting, the plots were thoroughly irrigated to filled capacity for five days. Irrigation was done every two days, and weeding was performed manually.

Data Collection

Fresh forage yield was measured by randomly harvesting two rows from each plot and weighing the biomass. A sub-sample was taken from each plot, oven-dried at 65°C to constant weight, and used to calculate dry matter content. Measurements were taken at 60, 90, and 120 DAP. Dry matter yield per hectare was determined by using the formula:

$$\frac{\text{Fresh forage yield}}{100} \times \%\ \text{DM content}$$

Data Analysis

Collected data were subjected to analysis of variance (ANOVA), and means were separated using the Least Significant Difference (LSD) test at 5% significance level, using the JMP Statistical Analysis System software [10].

RESULTS AND DISCUSSION

Fresh Forage Yield

Fertilizer application significantly ($P<0.05$) influenced fresh forage yield across all sampling periods. At 60 DAP, cow dung plots recorded higher yields than NPK and control. This trend continued at 90 and 120 DAP. The gradual nutrient release from cow dung possibly sustained vegetative growth better than the fast but short-lived effect of NPK.

Dry Matter Yield

Similar to fresh forage, dry matter yield was significantly ($P<0.05$) affected by fertilizer type and plant age. Cow dung consistently produced higher dry matter yields than NPK and control, particularly at 120 DAP, indicating cumulative benefit from organic fertilization. Control plots had the lowest dry matter yield, likely due to nutrient depletion in the unfertilized soil. The superior performance of cow dung in terms of both fresh and dry yields supports findings by Maleko *et al*. [6] and Abdullahi *et al*. [1], who also reported higher biomass accumulation from organic manure in Napier grass and other tropical forages. The improved soil structure and microbial activity associated with cow dung may have contributed to better nutrient uptake and water retention. Maleko *et al*. [6] reported a DM yield in the range of 8.95 to 14.04 ton/ha for four Napier grass varieties harvested after four months and Kebede *et al*. [5] reported a mean range of 7.97 to 12.57 ton/ha for 10 Napier grass accessions tested across five locations, which are both within 3.25 to 16.88 ton/ha recorded in this study. However, the dry matter values obtained in this study are lower than 26.19 ton/ha reported by Gadisa *et al*. [4] which was harvested at maturity (16 weeks after planting).

Table 1: Biomass Yield of Napier grass at different growth stages under different fertilizers

Stage	Fertilizer	FFY	DMY	DM
60DAP	NPK	34.06^{b}	5.80^{b}	17.12
	Cow dung	40.32^{a}	7.39^{a}	18.34
	No fertilizer	18.14^{c}	3.26^{c}	17.95
	SEM	0.89*	0.14*	
90DAP	NPK	40.87^{b}	8.72^{b}	21.33
	Cow dung	54.16^{a}	11.56^{a}	20.65
	No fertilizer	23.04^{c}	5.09^{c}	22.08
	SEM	0.92*	0.33*	
120DAP	NPK	47.36^{b}	12.62^{b}	26.64
	Cow dung	68.73^{a}	16.88^{a}	24.56
	No fertilizer	32.18^{c}	8.78^{c}	27.28
	SEM	0.97*	0.25*	

Means with different superscript in the same row differ significantly ($p<0.05$), FFY=Fresh Forage Yield, DMY=Dry Matter Yield, DM=Dry Matter, SEM=Standard error of mean, *= Significantly different at ($p<0.05$).

CONCLUSION AND APPLICATION

The application of cow dung significantly improved both fresh forage and dry matter yields of Napier grass compared to NPK fertilizer and no fertilizer. These findings highlight the value of organic manure in enhancing pasture productivity under irrigation in semi-arid environments. It is therefore recommended that cow dung be applied at a rate of 7 tons/ha to maximize forage yield. Also, Napier grass should be harvested at or around 120 DAP for optimal biomass accumulation, and farmers adopt organic fertilization strategies for sustainable forage production.

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