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Comparative Effects of Cow Dung and Poultry Manure on Growth and Yield of Green Amaranth *(Amaranthus Hybridus* L.*)*

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ABSTRACT
Amaranthus hybridus contains large amount of protein and essential amino acids. This study assessed the comparative effects of cow dung and poultry manure on the growth and yield of green amaranth *(Amaranthus hybridus* L.*)*. The experiments were conducted at the teaching and research farms of the Federal College of Forestry,Ibadan, using five treatments: control (T1),120g of poultry manure (T2), 200g of poultry manure (T3), 125g of cow dung (T4), 210g of cow dung (T5). Each treatment was replicated three times in a Complete Randomized Design (CRD). Growth and yield parameters (plant height, stem girth, number of leaves, wet and dry weight) were recorded from 5th week to 7th week after planting, while wet and dry weights were determined after harvest. Descriptive statistics such as mean, percentage and ANOVA were used to analyzed the data. The results indicated clear difference in growth and biomass yield among the treatments. Plants in the control treatment recorded the lowest values across all parameters, with final wet and dry weights of 90.5g and 11.8g, respectively. T3 and T5 produced superior growth, with average wet weights of 168.7g and 172.5g and dry weights of 21.9g and 22.6g, respectively. T2 and T4 also improved plant growth compared to the control but to a lesser extent than the higher application rate (T3 and T5). It is therefore concluded and recommended for farmers to use cow dung as the more suitable organic manure for long- term yield and quality, while poultry manure for short-cycle vegetables.

Keywords: *Amaranthus Hybridus*, Organic Fertilizer, Sustainable Agriculture, Growth And Yield

INTRODUCTION

Green amaranth (*Amaranthus hybridus* L.), locally known as tete among the Yoruba people of Nigeria, is an important leafy vegetable valued for its exceptional nutritional quality, rapid growth rate and adaptability to diverse agro-ecological conditions. The leaves are rich in protein and essential amino acids, particularly asylsine and have been reported to possess protein levels up to thirty times higher than commonly consumed cereals such as rice, wheat, and oats (De Macvean & Poll, 2013). Because of its superior nutrient composition, *Amaranthus hybridus* L plays a major role in improving household nutrition and food security across many parts of sub-Saharan Africa.

Despite its high nutritional and economic importance, the productivity of *Amaranthus hybridus* L is often limited by declining soil fertility, a challenge intensified by continuous cultivation, nutrient depletion, and restricted access to chemical fertilizers among small scale farmers (Sanginga & Woomer, 2009). While synthetic fertilizers can enhance crop yields, their use has been increasingly linked to soil degradation, environmental pollution, and potential health risks. These concerns have intensified the search for more sustainable and environmentally friendly fertility options.

Organic manures such as cow dung and poultry manure present a viable alternative due to their affordability, availability and capacity to improve soil physical, chemical and biological properties. Poultry manure is particularly valued for its high nitrogen, phosphorus, and potassium content, leading to rapid vegetative growth, whereas cow dung contributes substantial organic matter that enhances soil structure, moisture retention, and microbial activity (Azeez & Van Averbeke, 2010; Mbah *et al*., 2004). The use of organic amendments not only reduces dependence on expensive chemical fertilizers but also aligns with sustainable agricultural practices by improving soil health and reducing environmental pollution (Olugbenga *et al*., 2021).

Previous studies have shown that organic manure applications significantly enhance plant height, leaf number, biomass accumulation, and overall yield in amaranth and other leafy vegetables (Sanni, 2012; Akanbi *et al*., 2010). However, differences in nutrient composition, decomposition rate, and soil interaction between cow dung and poultry manure mean that their relative effectiveness may vary. Identifying the optimal application rates of these organic inputs is essential for maximizing crop productivity while maintaining soil health in small-scale vegetable production systems.

This study therefore evaluates the comparative effects of poultry manure and cow dung on the growth and yield of Amaranthus hybridus. It focuses particularly on determining the optimal application rates that enhance performance, with the broader aim of generating practical recommendations for sustainable vegetable production among small scale farmers.

MATERIALS AND METHODS

The field experiment was conducted at the Farm Practical (FAP) plot of the Federal College of Forestry, Jericho, Ibadan, Oyo State, Nigeria. The site is located within the Ibadan South-West Local Government Area at latitude 7°22′N and longitude 3°55′E. The area experiences a humid tropical climate characterized by bimodal rainfall, average annual temperatures ranging from 26–32°C, and relative humidity between 70–85%, depending on the season (FRIN, 2024).

Experimental Design

The experiment was arranged in a Complete Randomized Design (CRD) with three replicates. Five treatments were evaluated:

T1: Control (no manure), T2: 120g poultry manure, T3: 200g poultry manure, T4: 125g cow dung and T5: 210g cow dung

A total of 15 pots (800 g capacity each) were used. Manures were thoroughly mixed with the soil prior to sowing. A schematic arrangement of treatments and replicates was followed to ensure uniform distribution and reduce experimental error.

Experimental Materials

Materials used included topsoil, composted cow dung, poultry manure, pots, ruler, record book, watering can, hoe, cutlass, hand gloves, and head pan. Seeds of green amaranth (*Amaranthus hybridus* L.) served as the experimental crop.

Experimental Procedure

Soil Preparation: The experimental site was cleared, and soil was tilled to a depth of approximately 10 cm. Homogeneous soil was collected and filled into pots.

Manure Application: Cow dung and poultry manure were applied at treatment-specific rates corresponding to 20% and 50% soil-to-manure proportions. Each manure type was thoroughly mixed with the soil before planting.

Sowing: Amaranth seeds were planted using the broadcast method and lightly covered with soil to ensure uniform germination.

Soil Analysis: Pre-experimental soil samples were collected and analyzed for pH, nitrogen, phosphorus, potassium, organic matter, and cation exchange capacity (CEC).

Data Collection: The experiment lasted 10 weeks, during which growth and yield parameters were measured weekly. Data collected included plant height, number of leaves, stem girth, wet weight, and dry weight. Leaf area and final yield at harvest were also recorded.

RESULTS AND DISCUSSION

Table 1 below shows the soil sample was naturally rich in micronutrients, especially zinc (27 mg/kg), copper (2 mg/kg), and manganese (4 mg/kg), compared to the much lower values in cow dung and poultry manure. Iron also followed this trend, with soil containing 1 mg/kg compared to 0.015 mg/kg in cow dung and 0.0125 mg/kg in poultry manure. This suggests that Amaranthus hybridus, which requires micronutrients like Fe, Zn, and Mn for chlorophyll synthesis and enzymatic activity, already had sufficient baseline micronutrient support from the soil. Hence, the role of the organic manures in this study was more geared toward macronutrient enrichment and soil improvement than micronutrient supplementation. Poultry manure had higher calcium (1 mg/kg), magnesium (0.54 mg/kg), and phosphorus (0.0117 mg/kg) compared to cow dung and soil. These nutrients are essential for strong stem development, leaf expansion, and root establishment in A. hybridus. The higher potassium content in poultry manure (0.35 mg/kg) relative to cow dung (0.14 mg/kg) also aligns with the crop's demand for K in regulating water balance and improving yield. Although the soil contained relatively high K (0.49 mg/kg), the addition of poultry manure further enhanced nutrient availability, ensuring better nutrient uptake by the crop. Cow dung, on the other hand, while lower in nutrient concentration, provides a steady release of nutrients and organic matter that helps maintain soil structure and water retention key factors for sustainable Amaranthus production in sandy soils. The soil was dominantly sandy (86.5%), with low clay (11%) and silt (2.5%) contents. Such soils are prone to leaching and poor nutrient retention, which may limit the growth of *Amaranthus hybridus* L if not amended. The table highlights that while the soil itself is rich in micronutrients, supplementation with poultry manure and cow dung is essential to improve macronutrient supply and soil structure.

Table 1: Soil, Cow Dung and Poultry Manure Analysis

Parameter	Poultry manure	Cow Dung	Soil Sample
Fe (mg/kg)	0.0125	0.015	1
Zn (mg/kg)	0.03	0.01	27
Cu (mg/kg)	0.0078	0.002	2
Mn (mg/kg)	0.013	0.0028	4
Ca (mg/kg)	1	0.15	0.3
Mg (mg/kg)	0.54	0.34	0.39
P (mg/kg)	0.0117	0.0083	-0.009
N (mg/kg)	0.5	0.8	1.2
Na (mg/kg)	0.18	0.24	0.16
K (mg/kg)	0.35	0.14	0.49
OC (mg/kg)	0.8	0.5	0.9
OM (mg/kg)	0.09	0.3	0.5
% sand	-	-	86.5
% clay	-	-	11
% Slit	-	-	2.5
pH	6.75	7.24	7.35

Table 2: Effect Of Cow Dung and Poultry Manure on Green Amaranth (*Amaranthus hybridus* L.) Stem Girth (cm)

Treatment	WAP 5	WAP 6	WAP 7
T1 (control)	0.93 c	1.23 c	1.60 c
T2	1.10 b	1.37 c	1.67 c
T3	1.30 a	1.73 b	2.07 b
T4	1.37 a	1.83 ab	2.27 a
T5	1.40 a	2.00 a	2.43 a

*Means with the same letters along the column are not significantly different at 5% level of probability

Treatment Code

T1 = control, T2 = 120g (20%) of poultry manure, T3 = 200g (50%) of Poultry manure, T4 = 125g (20%) of Cow dung, T5 = 210g (50%) of Cow dung.

The results from Table 2 showed that the application of cow dung and poultry manure had a significant impact on the stem girth of green amaranth (*Amaranthus hybridus).*

Compared to the control treatment (T1), where the stem girth was 0.93 cm in WAP 5, 1.23 cm in WAP 6, and 1.60 cm in WAP 7, all the manure treatment groups exhibited significantly higher stem girth measurements. The 50% cow dung treatment (T5) resulted in the greatest stem girth, reaching 1.40 cm in WAP 5, 2.00 cm in WAP 6, and 2.43 cm in WAP 7. This was followed by the 20% cow dung treatment (T4), which had stem girth values of 1.37 cm, 1.83 cm, and 2.27 cm across the three weeks. The 50% poultry manure treatment (T3) also performed well, with stem girth measurements of 1.30 cm, 1.73 cm, and 2.07 cm. In contrast, the 20% poultry manure treatment (T2) showed lower stem girth values of 1.10 cm, 1.37 cm, and 1.67 cm, but these were still significantly higher than the control.

Table 3: Effect of Cow dung and Poultry Manure on the green amaranth (*Amaranthus hybridus* L.*)* Plant Height (cm)

Treatment	WAP 5	WAP 6	WAP 7
T1 (control)	12.20 c	16.50 e	19.50 d
T2	15.50 b	20.10 d	25.33 c
T3	16.17 a	22.13 b	32.33 a
T4	16.37 a	21.13 c	27.17 b
T5	16.43 a	23.17 a	32.67 a

*Means with the same letters along the column are not significantly different at 5% level of probability

Treatment code

T1 = control, T2 = 120g (20%) of poultry manure, T3 = 200g (50%) of Poultry manure, T4 = 125g (20%) of Cow dung, T5 = 210g (50%) of Cow dung.

The results presented in Table 3 above demonstrate the impact of cow dung and poultry manure on the plant height of green amaranth (*Amaranthus hybridus).*

In the control treatment (T1), the plant height was 12.20 cm in week 1, 16.50 cm in week 2, and 19.50 cm in week 3. All the manure treatment groups exhibited significantly greater plant heights compared to the control.

The 50% cow dung treatment (T5) and the 50% poultry manure treatment (T3) were the most effective, resulting in statistically similar plant heights. In T5, the plant height was 16.43 cm, 23.17 cm, and 32.67 cm across the three weeks, while in T3, the values were 16.17 cm, 22.13 cm, and 32.33 cm, respectively. The 125g (20%) cow dung treatment (T4) and the 120g (20%) poultry manure treatment (T2) also showed significant improvements in plant height compared to the control, with T4 having slightly higher values than T2.

Table 4: Effect of Cow Dung and Poultry Manure on Green Amaranth Wet and Dry Weight (G)

Treatment	Wet weight (g)	Dry weight (g)
T1 (control)	90.5	11.8
T2	112.4	15.8
T3	168.7	21.9
T4	145.2	19.1
T5	172.5	22.6

The results above show that application of organic manure (cow dung and poultry manure) remarkably increased both wet and dry biomass of the green amaranth compared to control. The lowest wet and dry weights were observed in control (90.5g and 11.8g respectively), indicating poor growth under unfertilized conditions.

Among the treatments T5 and T3 recorded the highest biomass, with average wet weights above 170g and dry weights above 22g respectively, which were significantly higher than the control. T4 and T2 also improved biomass accumulation but to a lesser extent than T3 and T5.

The observed trend reflects the positive influence of manure on vegetative growth parameters (height and stem girth), which translated into higher shoot biomass. Poultry manure (T3) and the combined treatment (T5) were particularly effective, suggesting a better nutrient release pattern compared to cow dung alone.

In total, the wet and dry weights results confirm that poultry manure is more effective in enhancing both water-rich biomass (wet weight) and assimilated structural biomass (dry weight) than cow dung, while the absence of manure (control) results in the lowest productivity. These findings are in line with reports by Akanbi *et al*. (2007), Adekiya & Agbede (2009), and Ayeni *et al*. (2008) reported that poultry manure significantly enhances both the wet and dry yield of leafy vegetables, emphasizing its effectiveness as an organic nutrient source for improving crop performance. The findings of this study provided valuable insights into the comparative effects of cow dung and poultry manure on the growth parameters of *Amaranthus hybridus* L, a widely cultivated leafy vegetable crop.

The results indicated that the application of both organic amendments, particularly at the 50% level, significantly improved the stem girth and plant height of *Amaranthus hybridus* L compared to the control treatment. This is consistent with previous research that has demonstrated the beneficial impacts of organic fertilizers on the growth and productivity of leafy vegetables (Adekiya and Agbede, 2017).

The superior performance of the 50% cow dung treatment in enhancing stem girth aligns with the findings of Akanbi *et al*. (2007), who reported that cow dung application improved the stem diameter of *Amaranthus cruentus*. This can be attributed to the ability of cow dung to improve soil physical properties, such as water-holding capacity and nutrient availability,

which are crucial for the development of plant structural components (Agbede and Adekiya, 2011).
Regarding plant height, the equally effective performance of the 50% cow dung and 50% poultry manure treatments is supported by the work of Akanbi *et al*. (2010), who found that both cow dung and poultry manure significantly increased the plant height of *Amaranthus cruentus* compared to the control. This can be explained by the fact that these organic amendments provide a balanced supply of essential nutrients, such as nitrogen, phosphorus, and potassium, which are essential for plant growth and development (Adekiya and Agbede, 2009).

CONCLUSION

The results of this study are consistent with and build upon the findings of previous research, further strengthening the evidence for the benefits of organic fertilizers in enhancing the cultivation of Amaranthus and other leafy vegetables; in this light, the study highlights the potential of cow dung and poultry manure as viable and sustainable alternatives to synthetic fertilizers for improving the growth and yield of Amaranthus hybridus, with findings that can inform the development of more efficient and environmentally friendly agricultural practices for the cultivation of this nutritious and economically important leafy vegetable crop. However, further research is needed to compare other organic manures alongside synthetic fertilizers in order to improve amaranth varieties or genotypes, and to explore additional organic plant macronutrients and micronutrients in amaranth research beyond poultry manure and cow dung.

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