EFFECT OF DIFFERENT LEVELS OF POULTRY MANURE ON GROWTH AND YIELD OF A MARANTHUS PLANT (*Amaranthus hybridus*) IN OBIO AKPA, AKWA 'BOM STATE, NIGERIA.

ABSTRACT

The field experiment was carried out at the Teaching and Research farm of Akwa Ibom State University Obio Akpa campus, in 201 B to determine the Optimum Poultry manure rate for Amaranthus. The experiment was laid out in a randomized complete block design replicated three times. The treatments were four rates of poultry manure and 6 t/ha) .Growth and yield parameters were assessed, and data collected were subjected to analysis of variance (ANOVA). Significance difference at 5% probability. Results showed that poultry manure rate had significant (pe 0.05) effects on all the growth and yield parameters assessed except stem girth. The treatment that received 6 t/ ha performed best in all the parameters, while the least was recorded from the control treatment. The application of 6 t/ ha poultry manure, produced 12:19 t/ha fresh foliage yield, followed by the plot that received 4 t/ha poultry (1 1.33 t/ha), The treatment of 2 t/ha produced 7.70 t/ha foliage yield. The lowest foliage yield of 3.18 t/ha was harvested from the control plot the application of poultry manure also enhanced dry matter accumulation. The plot of 6 t/ha poultry manure produced 30.71g matter, while the control treatment had 33.14g. Therefore, the study recommended the application of 4 t/ha poultry manure for optimum fresh foliage yield and dry matter accumulation.

Keywords: Poultry manure, different rate, growth yield parameter, dry matter, harvesting interval, Amaranthus plant.

INTRODUCTION

Amaranthus is a perennial vegetable. Amaranthus is a cosmopolitan genus of herbs. The genus Amaranthus, in the family Amaranthaceae has more than 800 species. These include *Amaranthus hybridus*, *Amaranthus cruetus*, and others are consumed as leaf vegetables (Findal, 1975). Amaranthus originated in America and is one of the oldest food crops in the world, with evidence of its cultivation reaching back as far as 6700 BC. At present, Amaranthus is extensively grown as a green, leafy vegetable in many temperate and tropical regions (Khan, 2021). The largest area ever grown was during the height of the Aztec civilization in Mexico during the 1400s. After the arrival of the Spanish conquistadors in Mexico in the early 1 500s, Amaranthus almost disappeared from America as a crop until research began on it in the US in the 1970s. Amaranthus has spread around the world (Including Mexico, Central America, India, and Nepal).

According to Akubugwo (2007), approximate composition Of Amaranthus hybrids L. Leaves is moisture content 83.48%, Ash, Content 1 3.80%, crude protein 17.92%, crude oil 4. 65%, crude fiber 8.61%, available carbohydrate 52.18 and calorific value (Kcal/ 1 00g) 26 8.92 (Khan, 2021). Nigeria has also been claimed as the center of diversity, corroborated by the prevalent use of local names and the enormous genetic diversity available there. Amaranthus plays important roles in nutrition, it provides calcium, iron, Vitamin A (carotene) Vitamin C (ascorbic acid), (Palada and Chang, 2003). It is used as a refrigerant, diuretic, and purgative, as an enema for stomach troubles, and piles, against cholera, and also as a sudorific. People with hypertension and cardiovascular diseases can use the leaves as an effective alternative to drug therapy (Akubugwo, 2007, Khan, 2021). Their nutrition quality receives world attention, especially as a rich source of minerals and protein (Olufolaji and Tayo, 1980; Ikeh et al., 2023).

Some Amaranthus species are also cultivated for their seeds, which are known to contain about 16% protein and are consequently utilized in confectionaries. Approximately 60 species are presently recognized with inflorescence and foliage ranging from purple and red to gold. The leaf vegetable has a rich profile of essential body metabolites such as vitamins A, 8, and C mineral elements such as irons, calcium, and phosphorus, and some measure of protein (Omueti, l930; Esang et al 2021). It is principally grown for its large fleshly leaves and herbaceous stem which are succulent palatable and nutritious. It can be boiled and added to soups or stews and is also useful for livestock feed and human consumption. Invariably, the leaves of grain amaranthus could be used for feeding rabbits and other micro livestock at the early stages of growth (Palada and Chang, 2003; Akpaninyang and Opara, 2017).

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Amresh et al (2009) reported hepatoprotective and antioxidant activity of 50% ethanol extract of the whole plant of Amaranthus spinous against carbon tetrachloride (CC4) induced. The crop is adapted to a wide range of soil conditions. Sandy soil with slightly acidity is best surfed. A temperature range of 20-300c. is required, the land should be plowed or dug followed by leveling then shallow trenches of width 30-35cm, well rotten farmyard manure is mixed with soil in the trenches (Costea and Demason, 2007). Amaranthus is grown during both wet and dry seasons though irrigation is normally required for dry season crops, since the rate of transpiration by the leaves is fairly high. It prefers soil with a pH above 6. Amaranths are planted either by direct seeding or transplanting. Since amaranths seeds are very small, it is mixed with sand at a ratio of lg seed and obtain a uniform Stand, then cover seed highly with a layer of compost or rice hulls immediately after broadcast (AVROC, 2003; Udounang et al 2022).

In crop production, organic and inorganic materials such as poultry manure are used to supplement chemical fertilizers (Akpan et al. 2024, Khan et al., 2021., Akata et al., 2024). Poultry manure like other manure is known to improve the soil by enhancing both physical and chemical properties. According to Okoli et al (2015) and Ekwere et al (2022), the use of poultry manure in amaranthus production is desirable as it has variable impacts on most parameters assessed, the result of the study showed that the poultry manure rates are capable of improving of the yield of Amarathus. Nweke and Obasi (2013) observed that higher organic manure rates 15 t/ha and 20 t/ha, and pig manure rates 12 t/ ha and 24 t/ha, respectively gave higher yield results than where manure was not applied.

According to Grubben (1976), Amaranthus species are endowed with a rapid growth rate which could encourage shoot re-growth following cutting. Furthermore, Ben et al (2024) and Essien et al (2023) viewed increasing nutrient content is by boosting with organic material; poultry manure. Hence, there is a need to research the effect of different levels of poultry manure on the growth and yield of the amaranthus plant.

MATERIALS AND METHODS

Experimental Site

This research was carried out between July to October, 201 8 at the Teaching and Research Farm, Obio Akpa Campus, Akwa Ibom State University, Nigeria. The research site is situated between latitude 40 31 1 and 5030n and longitude 80 30' and 80 DOE, with an annual rainfall of 2500mm. The total area of land for the experiment was 1 5m x 17m (255 m2). Twelve beds were made With the dimensions Of 4m X 3m each With pathways of 1m within the land area and 0.05m between Other land areas.

EXPERIMENTAL TREATMENTS

Four treatments were replicated three times which included three different levels of Poultry manure and one in which no poultry manure was added used as control, that is C tons ha-I, 2 tons ha", 4 tons ha-I, and 6 tons ha•l. The poultry manures were obtained from the University poultry farm.

NURSERY MANAGEMENT

Amaranthus black seeds were sown in prepared nursery seedbeds on the experiment site. A small quantity of manure was applied in the seedbeds to aid its germination, seeds were sown by broadcasting seeds over the bed. Transplanting was done in the evening to reduce temperature stress,

EXPERIMENT DESIGN

The experiment was laid out in a randomized Complete Block Design (RCBD) With three replications.

CULTURAL PRACTICES

Land preparation: The land was cleared and debris was packed

Transplanting: After 30 days in the nursery, the seedlings were transplanted. The transplanting was done at a spacing of 50cm x 50cm.

Weeding: This was done twice at 2 weeks after transplanting (WAT) and at 6 weeks after transplanting (WAT)

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Fertilizer Application: Poultry manure was applied at 2 weeks and 6 weeks after transplanting using ring method.

Data Collection: Data were collected on the field from four (4) randomly selected plants and were tagged from each plot.

The growth parameters measured were;

Plant Height (cm): The plant height was measured with the aid of a meter rule from the soil level to the plant apex.

Stem Girth (cm): This was measured by tying a thread around the base area and reading the marks of a ruler.

Leaf Area (cm2): This was determined by measuring the length and width of the leaf of tagged plants. It was later corrected factor.

Thus LA = 08 x LW (Kuet and svobada, 1971)

Where

L=Length Of the leaf

W=Width of leaf

Number Of leaves: This was determined by manual counting of the marketable leaves on the plant.

Number of Branches: The number of branches was carefully counted on each tagged plant. The yield components were:

Dry Matter Accumulation (g): This was determined by removing the moisture content of fresh foliage either through Sun drying or oven drying.

Foliage Weight (t/ha): This can be determined by cutting the leaves of the amaranthus plant and weighed

Germination Percentage (%): The germination percentage was determined by dividing the unsuccessful transplants from the successful transplants and multiplying the total by the percentage mark (1 00). The number of unsuccessful plants was out of 576 plant-s, given a germination percentage of 83.33% was recorded.

1 STATISTICAL ANALYSIS

Data collected were subjected to analysis of variance (ANOVA) to determine the level of significance of treatment and means were significantly separated by the use of Least Significant Difference (LSD) at a 5% probability level.

RESULT AND DISCUSSION

Result of soil physico-chemical properties at the Experimental Site before planting (Table 1), The result showed that the soil was sandy soil. Organic carbon and total N content were low (Essien et al., 2023). The soil was acidic (Essien e! al. 2024) Therefore, the soil growth yield required the application of manure for proper yield

Table 1. Soil Physico- Chemical Properties of the Experimental Site before planting

Soil Properties	
Sand	88.70

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Silt	6.30
Clay	5.00
PH (H20)	5.10
Electrical conductivity (ds/m)	0.08
Toatal Nitrogen (%)	0.11
Available phosphorus	87.55
Organic Carbon (%)	1 .42
Exchangeable Ca	3.01
Exchangeable Mg	1.59g
Exchangeable K	0.11
Exchangeable Na	0.07
Exchangeable Acidity	1 .95
ECEC	6.73
Base Saturation (%)	71.03

ECEC- Effective cation exchangeable capacity

Number of Amaranthus leaves Per Plant as Influenced by Poultry Manure Rates.

The number of leaves per plant of Amaranthus was significantly influenced by poultry manu-re application at 4, 6, B, 10, and 12 weeks after transplanting (WAT), shown in Table 2. Th-e amaranthus that received the higher dose of poultry manure (4 and 6 t/ha) was significant-ly taller than those that received 2tfha manure, which were also taller than the control. T-he treatment of 6 t/ha had 38.40, 70.33, 97.52, 103.42, and 1 19.55 leaves per plant at 4, 6,8,10,and 12 WAT, respectively. The control treatment had 14.60, 27.40, 33.70, 38.30 an-d 46 40 leaves per plant, respectively.

Table 2, Number Of Leaves Per Plant as influenced by poultry manure

Rates of Poultry	Weeks After Transplanting (WAT)					
Manure (t/ha)	2	4	6	8	10	12
Control	780	14.6	27-40	33.72	38.30	46.40
2	8.33	22 46	51.70	71.50	80.44	88.21
4	9.40	34.60	68.09	91.30	101 .01	12.40
6	9.42	38.40	70.33	97.52	103 42	119.55
LSD (PSO.05)	NS	3.71	5.00	5.39	6.50	6.80

* NS Not Significant

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Amaranthus Height (cm) as Influenced by Poultry Manure Rates

Plant height as an influence by poultry manure rates indicated a significant difference in all t–he weeks under investigation except at 2 WAT- The increase in poultry manure rate from 2 to 4 t/ha indicated a significant increase in plant height (Table 3), whereas statistically t-here was no significant difference observed between the plant height in 4 t/ha and 6 t/th a rates, at 12 WAT- The plant that received 6 t/ha was significantly different from the hei-ght in 2t/ ha.

Table 3: Amaranthus Height as Influenced by Poultry Manure Rate

Poultry manure	Weeks After Transplanting (WAT					
Rate (t/ ha)	2	4	6	8	10	12
Control	16.75	24.46	26.31	29-40	31.01	35.73
2	15.88	46.67	49.25	53.11	53.14	61.06
4	16.42	57.75	52.36	56.91	61.33	63.9B
6	16 45	58.33	52S4	5720	64.02	64.51
CSO (pso.05)	NS	2.62	2.70	3.01	3.18	3.25

NS = Not Significant

Leaf Area of Amaranthus as Influenced by Poultry Manure Rates

Leaf area as affected by Poultry manure raters varied significantly at 4, 6, 8, 10, and 12 WAT (Table 4). The largest leaf area, 91.33, 100.09, 11 3.70, 95.01, and 9483 cm at 4, 6, 8, 10, and 12 WAT respectively. The leaf area recorded in the treatment of 6 t, the poultry manure rate was not statistically significant, when compared to 91.30, 98.30, 110.66, 9, 3.75, and g3.70, respectively, recorded from the treatment of 4 t/ha with the leaf area of 3 5.02, 29.15, 25.60, 20.48 and 20.11 cm, respectively.

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Table 4: Leaf Area (cm3) Of Amaranthus as influenced by poultry manure rates

Poultry manure Rate (t/ha)	Weeks After Transplanting (WAT) 2	4	6	8	10	12
Control	13.93	35.02	29.15	25.60	20.48	20.1 1
2	1 3.99	50.85	53.01	39.65	39.64	3925
4	14.01	91 .30	98.32	110.66	93.75	9370
6	13.97	91 .33	100.09	11 3.70	95.01	94.33
LSD (P<0.05)	NS	2.17	3.70	3.92	3.42	3.20

NS: Not Significant

Stem Girth Of Amaranthus as Influenced by Poultry Manure Rates

Stern girth as affected by poultry manure was not significantly different (Py 0.05) in all t-he sample weeks (Table 5). However, in the stern girth, the highest dose of poultry manur-e treatment recorded the biggest stem girth and was statistically significant when compared to the mean values recorded in the control treatment

Table 5: Stem girth Of Amaranthus as influenced by poultry manure rates.

Poultry manure Rate (t/ha)	Weeks After Transplanting (WAT) 2	4	6	8	10	12
Control	1 .71	2.84	3.73	3.78	3.79	3.81
2	1 .75	3.71	4.81	4.88	4.89	5.03
4	1 .76	3.75	4.98	5.06	5.08	5.10
6	1.73	3.76	5.10	5.1 1	5.15	5.17
LSD (P<0.05)	NS	NS	NS	NS	NS	NS

NS Not significant

Number Of branches per plant as influenced by poultry manure rates

The number of branches per plant differed significantly (P 0:05) at 1,6,8,10 and 12 WAT (Table 6). The result showed that the Amaranthus plants that received the higher dose of poult-ry manure (4 and 6t/ha) branched profusely compared to the number of branches in 2t/ha plots and control treatment.

The result further indicated a significant increase in the number of branches per plant when 2t/'ha rate was compared to the control plot. At 12 WAT, the plot that received 6 t,fha poultr y manure had 31.75 branches, while 28.60 and 21.77 were recorded in 4 t/ ha and 2t/ha p oultry manure rates, respectively. The least number of branches per plant (14.06) was 0b served from the control treatment.

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Table 6: Number of Branches Per Plant as influenced by Poultry Manure Rates

Poultry manure Rate (t/ha)	Weeks After Transplanting (WAT)					
	2	4	6	8	10	12
Control	0.33	2.89	5.75	972	1241	14.06
2	0.33	4.55	8.06	14.98	19.34	21.77
4	0.32	6.33	10.31	19.11	24.67	28.60 31
6	0.36	6.81	12.41	22.40	26 40	75
LSD (P<0.05)	NS	1.60	1.71	2.18	2.36	3.23

NS = Not significant

Total Fresh Foliage Yield and Dry Matter Accumulation

Total foliage yield as influenced by poultry manure rate varied significantly (P<O.O 5) when compared to 7 70 t/ ha and 3.1 8t/ha from 2t/ha poultry manure and control plots respectively. The total fresh foliage yield obtained from the treatment that received 6t/ ha poultry manure (12.19) t/ha) was not significantly different (+0.05) When compared t-0 1 1 .33 t/ha total fresh foliage yield harvested from the treatment Of 4 t,fha poultry man-ure.

Table 7: Foliage Yield and dry Matter Accumulation (g) of Amaranthus as Influenced b-y Poultry Manure Rates.

Poultry manure rate (t/ha)	Total fresh foliage (t/ha)	Dry matter accumulation 1
Control	3.1 B	23.14
2	770	29.25
4	11 .33	30.71
6	12.19	30.71
LSD €0.05)	1 88	1 .51

DISCUSSION

The significant number of leaves per plant, leave the area, plant height, total fresh foliage yield, and dry matter accumulation in the plots with poultry manure rates could be attributed to the improvement of soil fertility which in turn increased the vigour in terms of the plants. The findings of this investigation are in consonant with the report of Ogedegbe (2013); and Akata (2015) that an increase in the dose of poultry manure significantly increases the growth and fresh foliage yield of Amaranthus curentus.

The poultry droppings obtained were from battery cage houses, which contain higher nitrogen than those from deep litter houses, where sawdust and wood shaving constitute a significant part of total manure, thereby having a high CN ratio and a lower rate of mineralization (Akata, 2006).

Ogedebge (2013) and Akata (2015) reported higher Amaranthus yield in plots treated with manure obtained from battery cages. The increase in growth and yield of Amaranthus could be due to higher nutrient content in the manure (Akpaninyang et al., 2015; Ekwere et al., 2019).

The increase in vegetative growth with an increase in manure rate could be that the nitrogen content of the poultry manure promotes vegetative growth of the plants, this observation conforms with Akata et al., (2016); Ikeh et al., (2013) that N enhanced the photosynthesis process in turn resulted in high vegetative yield.

CONCLUSION

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The application of poultry manure enhanced the growth and yield of Amaranthus. The fresh foliage yield and dry matter accumulation obtained from the treatment of 6t/ha were significantly different when compared to 2t/ha and control treatments. Furthermore, the fresh foliage yield and dry matter accumulation recorded from the treatment that received 6t/ha and 4 t/ha poultry manure were not significantly different. It is recommended that the application of 4t/ha poultry manure should be appropriate for optimum production of Amaranthus in Obio Akpa soils of Akwa Ibom State.

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