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EFFECT OF DIFFERENT LEVELS OF POULTRY MANURE ON THE PERFORMANCE OF AMARANTHUS (*Amaranthus Caudatus* L.) IN BAMA, NIGERIA

Mshelia, J. S., *Degri, M. M.
Department of Agronomy, Faculty of Agriculture, Federal University, Kashere, P. M. B 0182, Gombe State, Nigeria.
* Corresponding Author's email-mikedegri@gmail.com;

ABSTRACT
Field study was conducted in the dry season of 2013 (January – April) on the Teaching and Research farm of College of Education, Science and Technology, Bama, Borno State, Nigeria, to study the effect of different levels of poultry manure on the performance of *Amaranthus caudatus (L).* Data collected were subjected to Analysis of Variance (ANOVA), significant means were separated using Duncans Multiple Range Test. The application of 15 t/ha of poultry manure was significantly ($P \leq 0.05$) better in all the parameters measured (mean plant height, stem diameter, leaf width and length, leaves per plant, branches per plant and fresh harvest per hectare). The highest leaf length (15.80 cm), leaves per plant (85.56), branches per plant (16.30), plant height (80.60 cm) and fresh weight of biomass harvest (21.70 t/ha) were obtained at 15 t/ha poultry manure. It was followed by 20 t/ha, 10 t/ha and 25 t/ha in descending order. While the highest dose of 30 t/ha was only significantly better than the control treatment

KEY WORDS: Amaranthus, poultry manure, level, performance, branches.

INTRODUCTION

Amaranthus (*Amaranthus caudatus* L. Amaranthaceae) is believed to be a native of North, Central, South America, India, or Indo-Chinese region, Mexico and Mediterranean region (Zeven and Zhukousky, 1975; Spetters and Thompson, 2007) and is one of the several species of the Amaranthaceae family. It is a rapidly growing plant with good leaf sizes, stem and flowers. It easily adapts to different environmental conditions and has an efficient type of photosynthesis which allows it to grow quickly not requiring much maintenance; this makes its cultivation much easier than other vegetables (Rajkomar, 2002). Amaranth is an herbaceous annual plant that can be grown under a variety of conditions both humid and arid. It is easily grown from seeds. Many parts of the plant including the leaves stem and seeds are edible and are frequently used as food all over the world. Amaranthus varied in colour depending on the species from green, dark red, etc with smooth body surfaces (stem) except for *A. spinosis* that posses spine on the stem. The leaves are long or oval measuring between 5- 10 cm or longer. It can be grown on a wide range of soils but the best crop is harvested from fertile loamy soils high in organic matter or manure with good drainage as the crop is susceptible to water logging. It requires a pH range of 5.5 to 7.5. The soil should be brought to a fine tilth by harrowing 3 to 4 times and levelling before planting (Ewulo, 2005). In Africa, Amaranthus features predominantly in the vegetable farming systems of the Republic of Benin, Cote d' Ivoire, Tanzania, Zimbabwe and Nigeria, where it is usually grown in family gardens or in small commercial holdings around major urban and semi-urban areas under market gardening (De Lannoy, 2001). The crop is commonly used as leafy vegetables and is a cheap vegetable for the common man, which is highly rich in vitamins A and C in addition, it also provide protein, calcium, folic acid and phosphorus which are all essential nutrients as stated by nutritionists (Makus, 1990). Amaranthus are recommended as a good food with medicinal properties for young children, lactating mothers and patients with constipation, fever, haemorrhage, anaemia etc (Neth, *et al*., 2002). It was reported to contain twice the amount of calcium that fresh milk contains per unit of serving. It also enhances mental development and stimulates the release of growth hormones, hence advisable for children's consumption; it helps lower cholesterol levels significantly in the blood (Sekar, 2010). Ikpe and Powel (2002) reported that manure applied in correct proportion not just improves soil porosity but it also contribute to good plants growth, development and yield (Ijoya and Sophie, 2009). According to Ewulo (2005) and Awodun (2007), Poultry manure contains high amount of nutrients especially nitrogen that are easily taken up by plants for fast growth however, Quinton (2006) reported that manure application should be limited to amount needed to make a difference between crop needs and the existing soil fertility levels, any manure application more or less will result into defect in production, however, there is lack of information on the recommended level of poultry manure required for economical production of Amaranthus in the study area. It is

based on this and lack of information on use of poultry manure on amaranth production to farmers in the area that this experiment was carried out to study the effect of different levels of poultry manure on the performance of Amaranthus in Bama.

MATERIALS & METHODS

The experiment was conducted on the Teaching and Research Farm of the Department of Agriculture, College of Education, Science and Technology Bama, Borno State, in the dry season of 2013 under irrigation. The experiment consisted of six levels of poultry manure and a control with one variety of amaranth laid out in a randomized complete block design (RCBD) and replicated three times. The treatments were: - 0 t/ha (control), 5 t/ha, 10 t/ha, 15 t/ha, 20 t/ha, 25 t/ha and 30 t/ha of poultry manure. Net plot sizes were 1m x 2m. The land was ploughed and harrowed after which the beds were prepared and the different levels of poultry manure were worked into the soil and watered. The seeds were drilled in rows at 20 cm inter-row and covered thinly with soil and mulched with straws and watered daily until germination after which the straws were removed. Data were collected on the following parameters: germination count, plant height, leaf length leaf and width, stem diameter, average number of leaves per plant, branches per plant and fresh weight of harvest at 2,4,6,8 and 10 weeks after sowing (WAS). The data were subjected to Analysis of Variance (ANOVA) and significant means were separated using Duncan's Multiple Range Test (DMRT) as described by Gomez and Gomez (1984).

RESULTS & DISCUSSION

The result of the study carried out on the effect of poultry manure levels on the performance of Amaranthus showed considerable and significant effects on all the parameters measured. These include germination percentage, mean plant height, stem diameter, leaf length, leaf width, mean number of leaves per plant, mean number of branches per plant and fresh harvest weight. There was significant ($P \leq 0.05$) difference in germination percentage among the different levels of poultry manure used in the study (Table 1). The control, 5, 10 and 15 t/ha of poultry manure levels gave the highest percentage germination and were all significantly at par and higher than those obtained from the 20, 25 and 30 t/ha. This could be attributed to the fact that the high levels of poultry manure became injurious to the seeds and killed the embryos before emergence. This was in agreement with the finding of Sekar (2010) that manure when applied in too high dose could affect the germination of seeds as it becomes injurious to the seeds and this according to Ikpe and Powel (2002) is because poultry manure contains high percentage of nitrogen which has burning effect. The mean plant height at 2, 4, 6, 8 and 10 WAS showed significant ($P \leq 0.05$) difference between the treatments (Table 1). Significantly taller plants resulted from the application of 5, 10, 15 and 20 t/ha. Across the sampling periods, application of 15t/ha poultry manure gave the tallest plants, though at par with 20 t/ha, while higher dose of 25 t/ha and 30 t/ha resulted in shorter plants that were only significantly higher than the control. This could be attributed to the low level of nutrients at the control treatment, while at the 25 t/ha and 30 t/ha, the high level of nutrient might have had negative effect on the growth of the crop and this corroborate the report of Quinton (2006) that manure application should be limited to amounts needed to make up for the difference between crop need and the existing soil fertility levels any manure application more or less will result into negative effect on production. Okokoh and Bisong (2011) reported similarly that application of 10 to 15 t/ha of poultry manure resulted in taller plants.Poultry manure application had significant influence on stem diameter in this study (Table 1). The result showed that the application of 10, 15 and 20 t/ha of poultry manure resulted in sufficiently ($P \leq 0.05$) larger stem diameter than other treatments, while higher doses above 20t/ha resulted in decreased stem diameter that was statistically at par with 0 and 5t/ha. Okokoh and Bisong (2011) reported similar findings that application of 10 to 15t/ha of poultry manure enhanced the performance of Amaranthus in a study in Calabar, Nigeria. Leaf width, leaf length and mean number of leaves per plant were found to be significantly influenced by poultry manure application in amaranthus (Table 2). Results from this study indicated that the application of 10, 15, and 20t/ha of poultry manure resulted in significantly ($P=0.05$) higher leaf width, leaf length and number of leaves per plant. The least leaf width leaf length and mean number of leaves per plant were obtained at the control which was statistically the same with the application of 30 t/ha. The best results of amaranth leaf width at all sampling periods were obtained when 15 and 20 t/ha of poultry manure was applied, which were consistently statistically higher while the control and application of 0, 5, or 30 t/ha poultry manure resulted in similar performance which were statistically lower than the result obtained from the application of 10, 15 or 20 t/ha. Mean leaf length and number of leaves per plant followed the same trend with mean leaf width in the study. Okokoh and Bisong (2011) reported similarly in a research in Calabar that the application of poultry manure significantly influenced the performance of amaranthus and that poultry manure application enhanced foliage development. The positive influence of poultry manure on the growth of the crop might be due to the release of the balanced nutrient contained in the organic matter (Cooperband, 2002). Number of branches per plant and weight of fresh harvest were significantly influenced by poultry manure application in this study (Table 3). At all sampling periods, the application of 5 and 20 t/ha of poultry manure produced significantly ($P0 \leq .05$) higher number of branches per plant in amaranthus than other treatments, and were followed by the application of 5, 10 and 25 t/ha which were statistically not different from each other. While the application of 30 t/ha resulted in lower number of branches per plant that was only higher than the control. This corroborates the findings of Massomo and Rweyemany (1989). Awodun (2007); Okokoh and Bisong (2011) also reported similar findings on fluted pumkin and Amaranthus respectively.

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TABLE 1: Influence of different levels of poultry manure on germination, plant height and stem diameter of *Amaranthus caudatus* L. in Bama

Poultry manure (T/ha)		Mean plant height (cm)					Mean stem diameter (cm)				
	Germ (%)	2	4	6	8	10	2	4	6	8	10
0	76.67a	4.50b	11.20c	15.60d	34.12c	48.08e	0.23b	1.14bc	1.34c	1.76d	2.34b
5	86.69a	6.50a	14.12b	20.67c	54.03b	62.00dc	0.30b	1.34b	1.54bc	2.34b	2.81b
10	83.33a	7.17a	19.63a	25.34b	52.60b	72.16bc	0.47a	1.66a	1.74bc	2.40b	3.80a
15	75.00a	7.00a	21.00a	35.34a	65.34a	86.04a	0.50a	1.60a	3.16a	3.46a	3.75a
20	58.33b	6.61a	21.00a	37.34a	66.62a	80.60ab	0.50a	1.56a	3.21a	3.56a	4.10a
25	31.67c	3.33b	12.56c	23.66b	33.33b	68.00cd	0.27b	1.06cd	1.94b	2.19bc	2.40b
30	23.33c	3.57b	10.03c	20.60c	50.14b	68.60cd	0.27b	0.86d	1.80b	1.98d	2.34d

Means with different letters within a column of each treatment group are significantly different at 5% level using DMRT.
ns = not significant.

TABLE 2: Leaf width, leaf length and leaves per plant in *Amaranthus caudatus* L. as influenced by poultry manure levels in Bama

Poultry manure levels (T/ha)	Mean leaf width (cm)					Mean leaf length (cm)					Mean number of leaves /plant				
	2	4	6	8	10	2	4	6	8	10	2	4	6	8	10
0	2.17c	2.73bc	2.97b	3.20b	3.70c	4.13b	5.50c	6.83c	7.80c	8.27c	5.83bc	11.75cd	15.24cd	41.75b	45.66d
5	2.33bc	2.90b	3.43b	4.23b	4.87b	5.13a	7.17b	8.30bc	9.50b	10.50b	6.76ab	15.75b	19.76b	43.50b	57.35c
10	2.60abc	3.57a	4.93a	5.73a	7.03a	5.30a	9.83a	13.17a	14.00a	15.69a	7.33a	20.35a	22.25b	56.93a	71.21b
15	2.73ab	3.96a	5.30a	6.00a	7.23a	5.53a	9.63a	13.96a	14.53a	15.80a	7.33a	21.73a	25.50a	60.05a	85.56a
20	2.83a	3.93a	4.90a	5.53a	7.27a	5.23a	9.50a	12.90a	13.70a	15.13a	5.97abc	21.00a	24.80a	57.75a	84.10a
25	2.20c	2.60bc	3.00b	4.00b	4.28bc	2.97c	6.27c	8.67b	9.10bc	10.13b	5.76bc	13.61bc	17.00c	51.86a	49.82cd
30	2.17c	2.47c	2.90b	3.10b	3.71c	2.53c	5.77c	7.50bc	8.23c	9.93c	4.83c	10.25d	12.75d	2688c	35.87e

Means with different letters within a column of each treatment group are significantly different at 5% level using DMRT. ns = not significant.

TABLE 3: Influence of poultry manure application on number of branches per plant and fresh harvest weight of *Amaranthus Caudatus* in Bama

Poultry manure Level (T/ha)	Mean number of branches /plant				Weight of fresh harvest (t/ha)				
	4	6	8	10	2	4	6	8	10
0	2.19c	5.48d	7.00d	10.13d	0.270b	3.60d	7.70bc	8.30c	8.00d
5	2.43bc	6.08c	10.00b	14.20b	0.400b	6.00bc	9.00b	12.30b	15.00c
10	2.85b	7.13bc	9.80bc	14.10b	0.630a	8.30a	13.70a	17.70a	21.70a
15	3.44a	8.60b	12.40a	16.30a	0.670a	8.00ab	13.70a	18.00a	21.70a
20	4.35a	10.87a	11.00ab	15.80a	0.400b	7.10cd	10.40b	15.00a	18.00ab
25	2.79b	7.04bc	10.00b	14.30b	0.270b	3.00d	5.30c	11.30bc	12.70c
30	2.67bc	6.68c	9.80bc	14.00c	0.330b	3.50d	4.70c	10.70bc	12.00c

Means with different letters within a column of each treatment group are significantly different at 5% level using DMRT. ns = not significant.

Yield of fresh biomass per hectare at different harvest periods were found to be significantly (P≤0.05) influenced by poultry manure level in this study (Table 3). At 2 WAS 10 and 15 t/ha gave yields that were statistically not different from each other, but higher than all the other treatments including the control, that were also statistically lower. At 4 WAS, the highest yield was obtained from the use of 10 t/ha, followed by 15 t/ha, while the higher done of 30t/ha resulted in yield that was not statistically better than the control. This trend was maintained at 6 WAS. At 8 and 10 WAS, the application of 10 and 15 t/ha resulted in significantly higher yield than the other treatments followed by 5, 25 and 30 t/ha which resulted in yield that were statistically the same level and lower. The result shows that the application of poultry manures more than 20 t/ha resulted in decrease in yield. Okokoh and Bisong (2011) reported similar finding that higher yield of fresh leaf and fresh stem in Amaranth were obtained when 10 and 15 t/ha of poultry manure were used. Also good growth of vegetables due to the effect of poultry manure has been reported in bush okra (*Crochorus olitoris*) and the common bean by Massomo and Rweyemany (1989). Enhanced seedling growth and leaf proliferation and expansion in leaf vegetables, attributed to organic soil amendments has similarly been demonstrated in previous field experiments (Kogbe, 1976; Sanchez and Miller, 1986; Obatolu, 1995; Richert and Salomon, (1989). The positive influence of poultry manure on the growth of the crop might be due to the release of the balanced nutrients contained in the organic nutrients as well as the slow release over extended period of time.

CONCLUSION

From the result obtained, it can be concluded that the application of 15 t/ha of poultry manure is recommended. This application is associated with taller plants, larger leaves, more number of leaves per plants, more branches and higher biomass yield per hectare respectively. It is recommended that, the experiment be conducted across different locations with varied ecology in Nigeria.

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