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Full Length Research Paper

Effects of poultry manure from different sources on the growth and marketable yield of leaf amaranth (*Amaranthus cruentus (hybridus) l*) amaranthaceae

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The effects of poultry manure from different sources were evaluated in two growing seasons on the growth parameters and marketable yield of leaf amaranth (*Amaranthus cruentus (hybridus)* L) Amaranthaceae in a field experiment conducted on a slightly acid sandy loam Oxic Tropudalf at the Teaching and Research Farm, University of Ado-Ekiti. The treatments consisted of 10, 20 and 30 metric tonnes (MT) /ha each of manure collected from turkey, layer and broiler pens, and a control (0 MT/ha) in four replications. Plant height, leaf length, number of leaves, stem girth and marketable yield were measured at 5, 6 and 7 weeks after sowing. Plant height, number of leaves and leaf area increased with the application of poultry manure from the different sources. The application of 30 MT/ha rate of manure from broiler and layers significantly (P<0.05) produced the highest number of leaves, plant height and marketable yield.

Keywords: Poultry manure, different sources, growth parameters, marketable yield, Amaranth.

INTRODUCTION

The agricultural lands in Nigeria consist of fragile soils with thin layer of coarse-textured topsoils and dominance of low activity clays as products of intensive weathering and leaching processes (Ahn, 1993). The low inherent fertility status limits the development of sustainable crop production systems even as nutrients are rapidly lost following the opening up of lands for cultivation. Hence, the need to maintain the fertility of upland soils for continuous crop production that emphazises the use of external inputs at economic levels (Opara – Nadi, 1993). The strategies that have been used regarding the build-up and maintenance of soil organic matter at adequate levels are central to this general improvement in soil fertility. Hence, the addition of organic materials as a routine best management practice would necessitate provision of information on the types and rates. Also, pressure from rapid population growth, urbanization and the development of socio-economic infrastructure is the cause of declining arable land. This imposes continuous cultivation and shortened fallows such that the use of fertilizers to supplement soil nutrients, especially nitrogen (N) required for succulent green leafy growth but whose defficiency is widespread, is a component of improved soil management practices. Thus, the recommendations are 60 kgN and 100 kgNha^{-1} for leaf amaranth plants (*Amaranthus cruentus ssp*, L -*hybridus*), *Amaranthaceae* to be harvested by uprooting and repeated cutting, respectively (Olufolaji and Denton, 2000). In many experiments conducted to compare organic manures with chemical fertilizers to supply an equivalent amount of N, the result had often favoured manure application because of its ability to modify the soil physical, biological and chemical properties (Ahn,1993). Also, farmers and gardeners have long recognized the role of manure in replacing nutrients of soils depleted by continuous cropping. These organic nutrient sources(livestock manure, crop residues, municipal wastes, biomass transfer etc) may be used as alternatives to chemical fertilizers.The most popular are manures derived from livestock(cattle, poultry, sheep and goats). The states located in the savannah zone have large populations of cattle, sheep and goats whose droppings(manures) have been used by the farmers. States in the (humid) forest

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zone are not conducive to large ruminant animals but favour poultry production (Uche, 1991). Out of the poultry species, chickens and turkey are amenable to production under intensive management systems and generate large amounts of droppings daily which create waste disposal problems. The aim of this study, therefore, is to assess the effects of poultry manure from these different sources at different levels on the growth and yield of leaf amaranth (*A. cruentus ssp (hybridus)*) and hence make recommendation on its use to farmers.

MATERIALS AND METHODS

The study was carried out in the Teaching and Research Farm, University of Ado-Ekiti, Nigeria in the rainy seasons of 2005 and 2006 (April to July of each year).The study area is located at latitude 7°31'N longitude 5°13'E and covers an area of about 20 Hectares in the rain forest zone of southwestern Nigeria. The area experiences a tropical climate with distinct wet and dry seasons. The dry season spans from November to early March and raining season from late March or early April to October with a dry spell in August. The geology is dominated by crystalline rocks, which form part of the Basement complex of Southwestern Nigeria. They are mostly granitic rock materials (Fasina et al, 2005).

Surface (0-15cm) soil samples were randomly taken, air-dried and passed through 2mm sieve. The soils were analysed using the procedures described in IITA (1979) for pH in 1:2 soil-KCl medium, particle size distribution by the hydrometer method, organic carbon by the wet dichromate oxidation, total N by macro- Kjeldhal method, available P by the Bray P-1 extraction while exchangeable cations were extracted with 1N NH_4Ac and determined with atomic absorption spectrophotometer.The exchangeable acidity (EA) was determined by the titration method. The effective cation exchange capacity (ECEC) was the sum of the exchangeable bases (K+Na+Ca+Mg) and EA and percent base saturation calculated as the sum of the exchangeable bases expressed as a percentage of ECEC.

The droppings were collected at Top feed farm owned by Mrs. Folorunsho at Adebayo Area, Ado-Ekiti. There is a permanent place where they normally burn the poultry manure when nobody has come to request for it. Samples of droppings from the poultry species (turkeys, layers and broilers) were collected and analysed for pH, total N, P, Ca, Mg and K.

There were ten treatments, consisting of 10, 20, and 30 MT/ha application rates of each poultry manure labelled L_1, L_2 and L_3 for layers, B_1, B_2 and B_3 for broilers and

T_1, T_2 and T_3 for turkey, and a control (without manure application) was included. The treatments were arranged as RCBD with 4 replicates.

The site was cleared manually and the residues packed. Beds of 3m long and 2m wide were made with 1m paths in between the blocks and plots.The manures were broadcast and incorporated into surface of the beds two weeks before sowing. Seeds of the leaf amaranth (NHAc 23) were mixed with dry sand and broadcast uniformly on the bed at the rate of 2 kg/ha. From 5 weeks after sowing (WAS), seedlings which were 15cm and above tall were harvested by uprooting. Soil particles were removed from the root portion as much as possible and plants weighed. Sample seedlings were taken for measurement of growth parameters: plant height, leaf area, stem girth, number of leaves and Marketable yield. The harvest was repeated at 6 and 7 weeks after sowing.

Data Analysis

Data collected were subjected to Analysis of Variance (ANOVA) and the means separated using Duncan Multiple Range Test at P =0.05 level.

RESULTS AND DISCUSSION

The chemical composition of the poultry droppings is shown in Table 1. Organic C is similar in the poultry manure sources but the least N content of turkey droppings ensured its high C/N ratio which implies that N may not be easily released for plant uptake and which together with the low N status of the soil, will affect the luxuriant growth of leaf amaranth. Table 2 shows that the soils in the experimental site are slightly acid sandy loams with moderate organic matter content that ranges from 0.08-0.12%. The physical and chemical properties of the soil of the experimental site were a bit higher in the second planting season.

Tables 3, 4, 5, 6 and 7 show the effect of sources and levels of poultry manure on some growth parameters and yield of leaf amaranth. In the first planting season, Plant height increased significantly (P = 0.05) with broiler and layer manure applied at 30MT/ha producing the tallest plants while the control plots had the shortest plants. Plant height increased with the levels of all manures. The tallest plants were obtained from B_3 at 5WAS, from L_3 and B_3 at 6WAS and from B_3 at 7WAS. Similar trend was observed on the effect of manure on number of leaves per plant of amaranth, with L_3 giving the highest at 5WAS which was significantly different from the control, T_1, T_2, and L_1. At 6 and 7 weeks after sowing, the highest number of leaves was obtained from L_3 and B_3. The leaf area also increased with increased level of manure with B_3 having the largest leaf at 5WAS which only differed significantly from the control, T_1, T_2, L_1 and B_1. The largest leaf was recorded from B_3 at 6WAS and 7WAS. For the stem girth, L_3, B_2 and B_3 gave the highest values which were significantly different from others at 5WAS. At

Table 1: Chemical composition of the poultry droppings

%Chemical Composition	Layer	Broiler	Turkey
Organic carbon	18.1	18.3	18.1
N	2.18	2.35	0.90
P	0.50	0.52	0.45
K	1.20	1.23	1.20
Ca	1.10	1.10	1.12
Mg	0.62	0.64	0.42
Na	0.04	0.07	0.04
C/N ratio	8.3	7.8	20.1

Table 2: Some physical and chemical properties of soil of experimental site for the two planting seasons

Parameters	2005	2006
pH (H_2O)	6.70	6.72
Sand, %	79.7	71.9
Silt, %	13.2	18.4
Clay, %	6.4	10.0
Textural class	Sandy loam	Sandy loam
Organic matter(g/kg)	1.42	1.53
Total Nitrogen(g/kg)	0.08	0.09
Available P(mg/kg)	8.3	6.8
Exchangeable cations (cmol/kg)		
Calcium	2.6	3.12
Magnesium	1.72	1.75
Sodium	0.09	0.08
Potassium	0.28	0.39
Exchangeable Acidity	0.24	0.26

Table 3: Efects of poultry droppings on Number of Leaves of *Amaranthus hybridus*

Trteatment	Number of Leaves			Number of Leaves		
	2005			2006		
	6WAS	7WAS	5WAS	6WAS	7WAS	5WAS
C	8.5d	9.7f	9.7f	8.2a	10.0d	11.1ac
T1	9.1cd	10.9de	12.6c	8.8ae	10.2d	10.3a
T2	9.8bc	11.1bd	13.3cde	11.8bd	11.3d	13.3e
T3	11.3ab	11.5bc	13.6cde	12.3bd	13.4bc	14.5de
L1	10.1b	11.4bc	14.1be	10.8a	11.3d	11.2ac
L2	10.5ab	11.7bc	15.1bd	11.8bd	13.5bc	14.3de
L3	13.0a	14.3a	17.1a	14.2bc	15.1ab	16.5b
B1	10.9ab	11.4bc	13.6cde	10.0e	11.5cd	12.0c
B2	10.9ab	12.0b	14.2b	11.5d	13.3bc	14.1de
B3	12.4a	13.4a	17.1a	14.8c	15.8a	16.0b

Means followed with thesame letters within a column are not significantly different at P = 0.05

Table 4: Effects of poultry droppings on the Stem girth of *Amaranthus hybridus*

Treatment	Stem girth(cm) 2005			Stem girth(cm) 2006		
	5WAS	6WAS	7WAS	5WAS	6WAS	7WAS
C	0.3c	0.8ae	0.9c	0.4b	0.7af	0.8a
T_1	0.2b	1.0a	1.0b	0.3b	1.0cd	0.9ad
T_2	0.5cd	0.9ah	1.1bc	0.4b	1.2ce	1.3e
T_3	0.6ce	1.1a	1.5bd	0.5bf	1.0cd	1.3e
L_1	0.4bc	0.9ah	1.1bc	0.4b	1.0cd	1.0cd
L_2	0.5cd	1.1a	1.5bd	0.6bf	1.2ce	1.2ce
L_3	0.8ae	1.4f j	2.0ad	0.6bf	1.3e	1.8gk
B_1	0.7eh	1.2aj	1.2bc	0.9ad	1.2ce	1.4ej
B_2	0.9ah	1.4fj	2.1a	0.7af	1.6gj	1.7g
B_3	0.9ah	1.9k	2.2a	0.9ad	2.0k	2.0k

Means followed with thesame letters within a column are not significantly different at P = 0.05

Table 5: Effects of poultry droppings on the plant height of *Amaranthus hybridus*

Treatment	Plant height(cm) 2005			Plant height(cm) 2006			
	6WAS	7WAS	5WAS	5WAS	6WAS	7WAS	
C	5.1f	8.9f	11.9f	7.3a	10.5ce	14.8g	
T_1	5.6df	9.5ef	14.8e	7.4ab	11.2cf	16.7f	7.6ab
T_2	6.4d	10.9de	18.6d	12.0cdf	18.3c		
T_3	7.8c	12.0cd	19.0d	8.5bc	12.3df	18.9c	
L_1	6.2df	12.2c	14.8e	7.4ab	13.2bd	21.4de	
L_2	7.5ce	14.4b	12.3c	7.9ab	14.3b	23.0h	
L_3	10.6b	16.1a	24.7b	8.7bc	14.6b	22.8dh	
B_1	6.5de	10.2de	15.9e	8.0ab	14.3b	20.6e	
B_2	8.6c	14.3b	18.1d	8.2ab	14.7b	28.5b	
B_3	11.9a	16.7a	29.4a	8.0ab	18.5a	30.1a	

Means followed with thesame letters within a column are not significantly different at P = 0.05

Table 6: Effects of poultry droppings on the Leaf area of *Amaranthus hybridus*

Treatment	Leaf area(cm^2) 2005			Leaf area(cm^2) 2006		
	5WAS	6WAS	7WAS	5WAS	6WAS	7WAS
C	0.9b	2.2d	4.9e	1.9ab	2.2de	3.2fg
T_1	1.3b	3.9bc	6.5d	1.1b	1.8ef	3.7ef
T_2	1.5b	3.9bc	6.9d	1.8ab	2.8cde	5.3ed
T_3	1.8ab	4.4bc	8.2cd	2.6ab	3.0cde	5.8dh
L_1	1.5b	3.6c	7.9d	1.4b	2.2de	4.2efh
L_2	1.8ab	3.9bc	9.4c	2.1ab	3.9bc	6.2cd
L_3	2.8a	5.1bc	11.8b	2.7ab	4.0bc	7.6c
B_1	1.4b	3.6c	7.9d	2.1ab	3.0cde	6.6cd
B_2	1.6ab	4.2bc	11.6b	1.9ab	3.2cd	7.2c
B_3	2.5ab	6.5a	15.4a	2.9ab	4.9b	7.7c

Means followed with thesame letters within a column are not significantly different at P = 0.05

Table 7: Effects of poultry droppings on the Marketable yield of *Amaranthus hybridus*

Treatment	Marketable Yield (MT/ha) 2005			Marketable Yield(MT/ha) 2006		
	5WAS	6WAS	7WAS	5WAS	6WAS	7WAS
C	12.0c	9.0c	4.0e	20.0a	21.0a	12.0e
T_1	16.0c	9.0c	7.0c	18.0b	25.0f	16.0c
T_2	20.0b	11.0bc	7.0c	20.0a	30.0d	14.0d
T_3	26.0b	15.0bc	8.0c	20.0a	29.0de	17.0bc
L_1	19.0bc	13.0c	8.0c	25.0f	28.0e	10.1f
L_2	20.0b	15.0b	12.0b	18.0b	29.0de	10.0f
L_3	34.0a	18.0b	16.0a	32.0e	38.0g	18.0b
B_1	26.0b	15.0b	8.0c	32.0e	28.0e	10.0f
B_2	34.0a	18.0b	12.0b	34.0d	20.0a	30.0a
B_3	41.0a	21.0a	18.0a	36.0c	35.0b	18.0b

Means followed with thesame letters within a column are not significantly different at P = 0.05

6WAS, B_3 gave the thickest stalks which are significantly different from all, this was followed by L_3, B_1 and B_2 while B_2 and B_3 gave the highest values which were superior to all other treatments at 7WAS. There were significant differences (P=0.05) in the yield among the different levels and sources of manure. At 5WAS, B_3 gave the highest yield though not significantly different from L_3 and B_2. The highest yield for the 6^{th} WAS was also recorded from B_3 and was significantly different from L_3, L_2, B_2 and B_1. At 7WAS, B_3 and L_3 gave the highest yield which were significantly different from L_2 and B_2. B_3 gave the highest yield in the 5th, 6th and 7th weeks followed by L_3 and B_2. These findings is being supported by the chemical composition of the poultry droppings (Table 1) where the values for all the nutrient elements were higher in Broiler dungs than in Layer dungs which in turn was higher than in Turkey dungs. Also the C/N ratio was lowest in Broiler dungs which means that nitrogen in Broiler dungs would be more readily released than in others,hence the more luxuriant growth and higher yield recorded in Broiler dungs than in others. Also, Kogbe (1976) recommended that 25-30T/ha is needed to obtain high yield in *Amaranthus hybridus.* The least yields in the study was recorded in the control plot.

The physical and chemical properties of the soil of the experimental site were a bit higher in the second planting season than it was in the first cropping season, hence some higher values recorded in the data taken on the growth parameters and yield for the second cropping season.

Like in the earlier planting season, Plant height, Number of Leaves and Leaf Area per plant were significantly influenced by the different levels and sources of poultry manure in the second planting season. The parameters increased with the levels of all manures, At 5WAS, Layer dungs applied at 30MT/ha produced the tallest plant which was only significantly different from the height recorded for the control plots. The highest Number of Leaves per plant of *Amaranth* was also recorded from Broiler dungs applied at 30MT/ha. There were no significant differences in the Leaf Area but Broiler dungs applied at 30MT/ha gave the largest leaves followed by Layer dungs at 30MT/ha. There were not much differences in the stem girth except B_1 which was significantly different from L_1,T_1,T_2, T_3 and C. At 5WAS, B_3 gave the highest yield followed by B_2

At 6WAS, B_3 gave the highest Number of Leaves though not significantly different from L_3. The thickest stems were found in B_3 which was not significantly different from B_2 but significantly different from L_3 and others, stem girth in L_3 was only significantly different from the control plot. The widest leaves were from B_3 followed by L_3 but not significantly different. The tallest Amaranths were from B_3 and it was significantly different from all others. This was followed by B_2 and L_3 which were not significantly different. L_3 gave the highest yield followed by B_3. Only Broiler dungs gave higher yields at 5WAS, an indication that the rate of release of nutrient in Broiler dungs is higher than for others.

At 7WAS, L_3 gave the highest Number of Leaves though not significantly different from B_3 but significantly different from others. The stem girth followed thesame trend as in 5 and 6 weeks after sowing, B_3 gave the thickest stems though not significantly different from L_3 and B_2. Tallest Amaranths were obtained from B_3 and was significantly different from all. The widest leaves were from B_3, L_3 and B_2. At 7WAS, B_2 gave the highest yield. Generally speaking, the lowest yields in the study were recorded in the control plot. There were significant differences (P=0.05) in the yields among the different levels and sources of manure.

CONCLUSION

It was observed that application of poultry manure

especially broilers at 30MT/ha improved vegetative growth and yield of *Amaranthus.* Kogbe (1976) recommended that 25-30MT/ha is needed to obtain high yield in A. *Hybridus.* Poultry dungs from different sources at different levels significantly (P=0.05) increased plant height,leaf number,stem girth and yield. Broilers droppings at 30MT/ha is recommended for farmers in improving the growth of Amaranthus.

REFERENCES

Ahn PM (1993). West African Soils. Oxford University Press, London. 33-36.

Fasina AS, Aruleba JO, Omotoso SO, Omolayo FO, Shittu OS (2005). Evaluation of Potentials of Some Soils for Crop Production at Ado-Ekiti, South West Nigeria. Niger. J. Soil Sci.15(2):16-20.

IITA (1979): Selected Methods of Soil and Plant Analysis. Manual Series 1. International Institute of Tropical Agriculture, Ibadan. Pp. 70

Kogbe JOS (1976). Studies on the manurial requirement of Nigeria leaf vegetable. Niger. Agric. J. 13: 84-87.

Olufolaji AO, Denton OA (2000). Nigeria's most important vegetable crops. In : Akoroda,M.O. (compiler). Agronomy in Nigeria : A book in support of Agronomy Re-union Day on 04 October, 2000.Department of Agronomy, University of Ibadan, Nigeria : pp. 85-93.

Opara – Nadi OA (1993). Effect of elephant grass and plastic mulch on soil properties and cowpea yield. In: Mulongog, K. and Merckx (ed.) Soil Organic Matter Dynamics and Sustainability of Tropical Agriculture. John Wiley and Sons, New York: pp. 351 – 360.

Taylor (1996). Complementary use of organic fertilizer and chemical fertilizers. Niger. Agric. J. 181-210.

Uche O (1991). Effect of poultry manure on the yield and component of yield of *Amaranthus*. Niger. Farmers' J. 11: 35