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Influence of Varying Rates of Chicken Manure on the Growth and Yield Attributes of Amaranths (*Amaranthus Cruentus*) in Sudan Savanna Nigeria

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Abstract: *The increasingly demand of chicken meat in Nigeria has prompted more poultry farming with consequent effect on increased utilization of organic wastes (e.g chicken manure) as fertilizers. Organic wastes contain varying amounts of water, mineral nutrients & organic matter. While the use of organic wastes as manure has been in practice for centuries word-wide. A field experiment was conducted at the experimental garden of the Department of Agric Education, Federal College of Education, Katsina between the month of June–July, 2014 to study of effect of varying levels of poultry manure obtained from battery cage and deep letter systems on the growth and yield of Amaranthus cruentus. The treatments consisted of 3–levels each of poultry manure (0, 10 and 15 t ha^{-1}), the treatments were arranged in Randomised complete block design (RCBD) and replicated three times. The parameters studied were plant height; number of leaves, stem girth and leaf area/plant. The result showed that application of poultry manure obtained from deep litter system at the rate of 15 t ha^{-1} increases the growth performance of Amaranths.*

Keywords: *Amaranthus, chicken, deep litter, manure, battery cage*

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INTRODUCTION

The use of inorganic fertilizer has not been helpful under intensive agriculture because it is often associated with reduced crop yield, soil acidity and nutrient in balance (Obi and Ebo, 1995; Ojeniyi, 2000; Haruna et al., 2018). Soil degradation which is brought about by loss of organic matter accompanied by continuous cropping becomes aggravated when in- organic fertilizers are applied repeatedly. This is because crop response to applied fertilizer depends on soil organic matter (Adzemi et al., 2017). The quantity of soil organic matter in the soil has been found to depend on the quantity of organic materials which can be applied into the soil either by natural process through roots, stubbles, slough off roots modules & root exudates or by artificial application in the form organic manures which can otherwise be called organic fertilizers. The need to use renewable natural form of energy & reduce the cost fertilizing crops has revived the use of organic fertilizer worldwide. Improvement of environmental conductions & public health are important reasons for advocating increased use of organic materials. The increasingly demand of chicken meat in Nigeria has prompted more poultry farming with consequent effects on increased utilization of organic waste (e.g

chicken manure) as fertilizer. Organic wastes contain varying amounts of water, mineral nutrient and organic matter. The use of organic wastes as manure has been in practiced for centuries world-wide and in the recent times (Gambara et al., 2000). There still exists a need to assess the potential impacts of chicken manure on crop yield and in particular evaluating the critical application levels. Moreover, the need & utilization chicken manure has overtaken the use of other animal manure, because of its high content of Nitrogen, phosphorus & potassium (Schejegel, 1992). Similarly, organic wastes are also being advocated for by different environmental organisations worldwide to preserve the sustainability of agricultural systems. Furthermore, poultry manure is preferred among other animal wastes because of its high concentration of macro-nutrients (Haruna et al., 2019). Duncan, (2005); Oagile and Namasiku, (2010); Chescheir et al., (1986) recorded increased in nitrogen levels from 40-60% and 17–38% with respect to control for Narfolk sandy soils and sandy loam soil respectively, following the application of manure. Furthermore, application of poultry manure to soil enhances concentration of water soluble salts but excessive accumulation of solid salts (or soil salinity) suppresses plant growth. Stephenson et al., (1990) reported the EC of chicken manure of about 11 as/m in the for silt loam soils is too high for salinity sensitive crops.

Amaranths (*Amaranthus cruentus*) is an annual herb erectly or less commonly ascending up to 2 m tall, often reddish tinted throughout, stem stout, branched, angular, glabrous or thick with multi-cellular leaves (Akanbi and Togun, 2002). Vegetable amaranths serve as cheap source of vitamin and minerals to the common man in Nigeria. In Nigeria *amaranthus cruentus* is consumed in several ways depending on the culture and mode of preparation peculiar to the users. It is sometime commonly consumed as vegetable salad, soup and in jallof rice preparation and remedy used as medicinal herbs, as in garlic and onion (*Allium Spp*). *Amarathus cruentus* grows well at day temperature above 25^0C and night temperature not lower than 15^0C. It requires mainly major nutrients such as N, P and K. Akanbi and Togun, (2002) recommended nitrogen at 34 Kg P and 26 kg K ha^{-1} to give the highest fresh leaf yield of amaranths. Yield of amaranths ranging between 4–14 t ha^{-1} of fresh weight have been reported.

However, yield of up 40 t ha^{-1} could be obtained with fertilizer application for amaranth production in unisons. Optimal herbage yields were obtained from 15-20 t ha^{-1} poultry manure. Application of 15 t ha^{-1} of chicken manure was recommended.

MATERIALS AND METHODS

A field experiment was carried out during the rainy season (June-August) 2014, in the demonstration garden of the Department of Agricultural Education, Federal College of Education, Katsina. The research was carried out to study the effect of poultry manure on the growth and yield of amaranths (*Amaranthus cruentus*). The treatments consists of three (3) rates each of chicken manure obtained from two sources viz;- Deep litter and battery cage systems, which were replicated three (3) times. This gives a total of nine (9) plots in each replication having a total of twenty seven (27) plots under consideration, each plot measured 1 m x 1.5 m and separated from each other by 0.5 m and blocks were spaced 1 m apart. The design used for this study was randomised complete block design (RCBD). The treatments combinations were BCM0 BCM1 BCM2, DLM0 DLM1 DLM2. BCM0=control (battery cage manure 0 t ha^{-1}); BCM1=Battery cage manure at 10 t ha^{-1}; BCM2 =Battery cage

manure at 15 t ha^{-1}; DLM0=control (Deep litter manure at 0 t ha^{-1}); DLM1=deep litter manure at 10 t ha^{-1}; DLM2=deep litter manure at 15 t ha^{-1}.

The site was cleared of weeds and other plant debris, the soil tilled and manure incorporated into the plots per treatment basis. Two weeks after the incorporation of the manure, the seeds were sown by drilling, weeding was done at regular intervals.

Soil analyses: soil samples of 0–15 cm depth were taken from the site prior to field preparation which were further bulked and dried for physical and chemical properties analysis.

Poultry manure analyses: Samples of poultry manure from the two sources under consideration were taken to determine the nutrients composition for each.

Parameter studied: The following parameters were observed during the study periods:

Plant height (cm) - The plant height per plant was measured by the use of a meter rule and average height was computed at 1, 2 and 3WAS.

Number leaves - The number of leaves of the tagged plants per plot were calculated and mean computed at 1, 2 and 3WAS.

Leaf area per plant - This was recorded by the use of a graph sheet, a leaf from each of the tagged plants were placed on the graph paper and its boundaries traced on the paper. The enclosed squares were calculated to get the leaf area in cm^2.

RESULTS AND DISCUSSION

Plant height (cm)

The effect of poultry manure obtained from a battery cage and deeper litter systems on the plant height of amaranths was presented in Table 3. At 1 and 2 WAS poultry manure sourced from battery cage both at the rate of 10 and 15 t ha^{-1} respectively produced significant differences on the plant height of amaranths. The highest plants was obtained by amaranths treated with deep litter manure at 3 WAS (41.20) which was statistically similar to the plant height under battery cage at 2 WAS (19.68). The results showed that plant height increased significantly as poultry manure rate increases.

This position was already reported by Opara (1992), Egharevba and Ogbe (2002), the highest plant exhibited by plants treated with poultry manure at the rate of 12 t ha^{-1} might have been due to presence of primary nutrients (N, P and K) plus calcium and magnesium found in organic manure, confirmed by FAO, (2007).

Number of leaves

The number of leaves increased significantly with increased rates of poultry manure at 2-3 WAS (Table 4).When deep litter manure was applied at the rate of 15 t ha^{-1} significantly more number of leaves (14.8) were obtained at 3 WAS, while the untreated plots gave statistically the lowest number of leaves when compared with the leaves from all the treatments under manure at the rate of 10 t ha^{-1} (5.18). Changes in the number of leaves are bound to affect the overall performance of amaranths as the leaves serve as the photosynthetic organ of the plant (Ayodele, 1983).

Stem girth

The effect of poultry manure on stem girth of amaranths was shown in Table 5. Statistically, similar stem girth was obtained under battery cage system at 3 WAS. The highest stem girth was observed when manure from deep litter was incorporated at the rate of 15 t ha^{-1} at 3WAS (3.06). This finding was in harmony with the reports by Akanbi and Togun (2002) that

the widest girth of amaranths stems was recorded at 12 t ha^{-1} at 4 WAS In both cropping seasons.

Leaf area/plant

Effect of poultry manure on leaf area/plant of amaranths (Table 6). Application of poultry manure obtained from the two different treatments (battery cage of deep litter) did not yield any significant differences in L.A at 1 and 3 WAS during the study periods. At 2 WAS and across both treatments similar L.A was recorded statistically (27.49 and 29.56) at 10 and 15 t ha^{-1}. The widest L A was recorded from amaranths treated with deep litter manure at 3WAS at 15 t ha^{-1} (57.75). Akanbi and Togun (2002) reported to have widest L.A when poultry manure was applied at the rate of 12 t ha^{-1} throughout the cropping seasons.

Table 1: Soil physical-chemical analysis

Soil composition	Values
Mechanical composition	
Clay (%)	18.64
Silt (%)	8.00
Sand %)	73.36
Textural classification (USDA) sandy loam.	
Chemical composition	
pH	
% Org C	
Available N (mg/kg).	6.2
Total N P (z/kg)	2.49
	0.12
	0.05

Source: Department of Geography, Umaru Musa Yar'adua University, Katsina

Table 2: Chemical Composition of the Poultry Manure

% Chemical composition	Broilers	Layers
N	0.92	0.69
P	50.39	45.81
K	2.57	2.99
Ca	6.25	1.07
Mg	0.074	0.074
Org C	5.26	5.95

Source: Umaru Musa Yar'adua University, Katsina

Table 3: Effect of poultry manure on plant height (cm) of *amaranths* at 1, 2 and 3 WAS during the year, 2014

Treatments	1 WAS	2 WAS	3 WAS
Battery cage(t/ha)			
0	7.12b	15.7b	32.3
10	9.56a	20.0a	37.3
15	8.61ab	19.7a	34.7
SE±	0.75	1.29	2.52
Deep Litter(t/ha)			
0	7.76b	15.8b	28.8b
10	7.17b	17.8b	34.4ab
15	10.4a	21.8a	41.2a
SE±	0.75	1.29	2.52
B x L	NS	NS	NS

Means followed by same letter (s) within a column of each treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT)

Table 4: Effect of poultry manure on the Number of leaves of *amaranths* at 1, 2 and 3 WAS during the year 2014 cropping season

Treatments	1 WAS	2 WAS	3 WAS
Battery cage(t/ha)			
0	5.18	7.59b	11.2
10	5.56	8.86a	13.5
15	5.28	8.49ab	11.7
SE±	0.16	0.37	0.93
Deep Litter(t/ha)			
0	5.20b	7.94	10.3b
10	5.06b	8.09	11.3b
15	5.76a	8.90	14.8a
SE±	0.16	0.37	0.93
B x L	NS	NS	NS

Means followed by same letter (s) within a column of each treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT)

Table 5: Effect of poultry manure on the stem girth of *amaranths* at 1, 2 and 3 WAS during the year 2014 cropping season

Treatments	1 WAS	2 WAS	3 WAS
Battery cage(t/ha)			
0	1.04b	1.55b	2.52
10	1.30a	1.88a	2.92
15	1.27ab	1.73ab	2.68
SE±	0.084	0.088	0.163
Deep Litter(t/ha)			
0	1.06b	1.50b	2.33b
10	1.12b	1.70ab	2.71ab
15	1.44a	1.95a	3.06a
SE±	0.084	0.088	0.163
B x L	NS	NS	NS

Means followed by same letter (s) within a column of each treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT)

Table 6: Effect of poultry manure on leaf area of *amaranths* at 1, 2 and 3 WAS during the year 2014 cropping season

Treatments	1 WAS	2 WAS	3 WAS
Battery cage(t/ha)			
0	7.03b	19.89b	41.42
10	9.97a	27.49a	50.78
15	8.50ab	23.63ab	50.80
SE±	0.531	1.480	4.147
Deep Litter(t/ha)			
0	7.72b	19.19b	36.96b
10	7.96b	22.26b	48.29ab
15	7.80	29.56a	57.75a
SE±	0.531	1.480	4.147
B x L	NS	NS	NS

Means followed by same letter (s) within a column of each treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT)

CONCLUSION

The findings of this research work showed that, chicken manure resulted in significant increased in growth and yield attributes of amaranths. Application of poultry manure at the rate of 15 t ha^{-1} produced the highest fresh leaves, plant height, stem girth and leaf area/plant when compared to control and with poultry manure at 10 t ha^{-1}. Therefore, this should be recommended to farmers (leafy vegetative growers). More researches should be carried out in this direction by increasing poultry manure application (rate) using the same crop or other leafy vegetative like *Abelmoscus esculentus*.

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