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Effect of Compound Fertilizer on Growth and Yield of Amaranths (*Amaranthus Cruentus* L.) at Hadejia, Jigawa State

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ABSTRACT

Soils in the Nigerian Savannah are generally low in fertility and enhanced crop yield is only possible through external use of manure and inorganic fertilizer. Field research was carried out at Binyaminu Usman Polytechnic farm, Hadejia Jigawa State, during 2016 rainy season to examine the effect of different levels of N.P.K 15:15:15 fertilizer on the growth and yield of vegetable amaranths (Amaranthus cruentus L.). The experiment consisted of four treatments (0, 25, 50 and 75kg/ha⁻¹ N.P.K.) arranged in a randomized complete block design and replicated four times. Data was collected on plant height, number of leaves per plant, stem diameter as well as fresh and dried biomass of the plant. The result showed that application of N.P.K at 75kg/ha produced statistically highest values in terms of all the growth and yield parameters tested. Therefore, among the levels of N.P.K tested, application of 75kg/ha of N.P.K, is the best for vegetable amaranths. However, there is need for further studies to test higher levels of N.P.K fertilizer, other fertilizer formulations and/or organic manure.

Keywords: Amaranth, Growth, N.P.K Fertilizer

Introduction

The family *Amaranthaceae* has more than 80 species of which about 60 are considered weedy and about 50 are considered as post-herbs or leafy vegetable worldwide (Olufolaji, 1989; Ainika *et. al.*, 2012). Schippers (2000) note that all species found in Africa are grown for their leaves. Some varieties are introduced from America for grain production but not very popular in Africa. Three principal species considered for growth production are *A.*

hypochondriachus, *A. cruentus* and *A. caudatus* (N.R.C. 1984).

Amaranthus cruentus is an important vegetable in human diet as a source of nutrients such as vitamin, minerals, water, protein and fibre needed for healthy body growth and sustenance (Bailey, 1992). The young leaves and stems are boiled as greens (Rana, 2003). They are grown as soup vegetables or boiled salad greens (Adeyemi *et. al.*, 1987). The nutrient values of amaranth per 100% edible portion (leaves)

is 85ml water, 48g calorie, 5g protein, 0.7g fat, 5g carbohydrates, 1.5g fibre, 250 mg calcium, 4mg iron, B-carotene equivalent 1800mg, th1.5 mg and ascorbic acid 100mg (Tindall, 1975).

Originally, the bulk of vegetables consumed in Nigeria were supplied by subsistence farmers. Vegetable supply to areas of high demand has remained low and seasonal as the subsistence farmers continue to rely on natural rainfall. Today, high demand for vegetables in the cities and town has stimulated the growth of market gardening along perennial rivers and streams. This is a common sight at Onitsha, Lagos, Port Harcourt, Warri, Sapele, Agbor, Jos, Ibadan, Kaduna, Sokoto and some others towns. Some gardeners rely on irrigation water from streams, wells and boreholes to cultivate vegetables all year round (Ainika *et al.*, 2012).

Optimum nutrient amounts reported for maximum amaranth growth by different researcher are substantially different. Apart from the use of inorganic fertilizers, the level of organic manure in the soil is very essential in promoting crop growth. The complementary use of organic manure and mineral fertilizer has been recommended for sustenance of long term cropping in the tropics (Palm *et al.*, 1997). Akambi and Togun (2002), reported that optimum N and P uptake by amaranth was obtained when 30t/ha compost was applied along with 30kgN/ha fertilizer while the best K uptake was obtained with plants treated with 1.5 t ha⁻¹ compost + 60kg N ha⁻¹

Farmers' use of such input as inorganic fertilizer and manure are quite varied. In order to increase production substantially, cropping may extend to the relatively poor upland soil. It is in view of this need that the study was proposed to determine the effect of compound fertilizer on growth and edible yield of vegetable amaranth.

The main objective of this study is:

To compare the growth performance and yield of *Amaranthus cruentus* on fields treated with different levels of NPK 15:15:15.

The Specific Objectives of this study are:

- To determine the effect of different rates of NPK on the vegetative growth of *Amaranthus cruentus*.
- To determine the appropriate fertilizer rates for the attainment of maximum yield of *Amaranthus cruentus* in the study area.

Material and Methods

Experimental Site

The research was conducted at the research farm of Binyaminu Usman Polytechnic Hadejia (BUPOLY) along Hadejia Malam Madori road, Hadejia (longitude 9° to 11° east, latitude 12° - 13° north) in the Northern Guinea Savanna ecological zone.

Treatments and Experimental Design

The Test crop used for the experiment is amaranths. The experiment comprised of three level of N.P.K 15:15:15 fertilizer as follows (25kg/ha, 50kg/ha, 75kg/ha) and control (0 kg/ha) laid out in a Randomized Complete Block Design (RCBD) and replicated four times.

1) Cultural Practice

a) Land preparation

Land was prepared by clearing the grasses and shrubs from the area, soil was ploughed and harrowed, and then beds were constructed with the dimension of 2 meters by 2 meters.

Sowing

Sowing was done early in the morning when the soil temperature was low. Amaranth was sown by drilling method at the deep of 1 cm at the space of 20 cm between the rows.

Transplanting and Spacing

Transplanting was done at four weeks after sowing (WAS), seedlings were transplanted on at the space of 20 cm by 20 cm and one plant per stand.

Irrigation

Since the research was done during rainy season, plots were only irrigated when necessary.

Fertilizer Application

N.P.K was applied as per the treatment

Weed Control

Weeds were controlled by hoe weeding at three weeks after sowing at the nursery, and then at two weeks after transplanting subsequently the plots were kept weed free by frequent hand pulling.

Data Collection

Five plants were randomly selected at each plot and tagged, data on growth and yield parameters were collected from the three parts of these plants.

Plant height: - A plant height is the above ground height of plant measured with ruler in cm from the ground level to the tip of the stem and the average recorded.

Number of Leaves Per plant: - This was done by manually counting the leaves of the plants and averaged to record the mean for each plot.

Stem Diameter: -Stem diameter was measured from the base of five sampled plants by the use of Vanier caliper, and the average recorded.

Fresh Biomass: - The sampled plants were harvested by gently uprooting, the plants were then partitioned into roots, stems and leaves; weight of the plant parts were then determined by using sensitive scale and mean recorded as fresh weight.

Dried Biomass: - The partitioned plant parts above were then sundried and weight of each part was then weighed using sensitive scale and the means recorded as dried weight.

Data Analysis

All data collected were subjected to analysis of variance using Gen stat Release 10:30E, and where the F-values were found to be significant among the treatment means were tested using LSD test at 5% level of probability.

Results

Effects of different levels of N.P.K 15.15.15 on plant height of amaranth

The response of the shoot height of amaranths is presented in table 1. The result showed that at 3 WAT application of N.P.K. at 75 kg/ha produced statistically tallest plants though at par with 50kg and 25 kg/ha. The control had the lowest plant height. Also at 4 WAT application of N.P.K at 75 kg/ha produced statistically the tallest plants which was at par with 50 kg/ha while 25 kg/ha and 0 kg/ha of N.P.K were similar statistically and the lowest. However all the values at 5 and 6WAT were statistically similar.

Number of leaves per plant of amaranths as influenced by different levels of N.P.K 15.15.15

Table 2 presents the result of number of leaves per plant of the amaranth. The result showed that at 3WAT application of N.P.K at 75kg/ha produced statistically higher number of leaves of the amaranth while control produced the lowest number of leaves at par with 25kg/ha and 50 kg/ha. However at 4WAT the result showed the application of N.P.K at 75kg/ha produced statistically higher number of leaves of the amaranth similar with 50kg/ha statistically, while application of N.P.K at 25kg/ha and control were similar statistically. At 5 and 6WAT no statistical difference was observed between the treatments.

Stem diameter of Amaranth as influenced by different levels of N.P.K 15.15.15 fertilizer.

Table 3 presents the result of stem diameter per plant of the amaranth. The result showed that at 3 WAT application of N.P.K fertilizer at 75kg/ha produced the highest stem diameter values of the amaranth statistically while application of N.P.K fertilizer at 50kg/ha and 25kg/ha were similar statistically while the control produced the lowest stem diameter. However at 4WAT the result showed application of N.P.K fertilizer at 75 kg/ha produced the highest stem diameter at par with 50 kg/ha which in turn was at 25 kg/ha; while 25 kg/ha and control produced statistically similar stem diameter. The result showed that at 5 and 6WAT there were no significant differences across the treatments.

Effect of different levels of N.P.K 15 -15 -15 Fertilizer on Fresh and Dried Biomass of amaranth

Table 4 Presents the values for fresh biomass (weight of fresh leaves, stem and root kg/ha) of the amaranths. The result showed application of N.P.K fertilizer at 75kg/ha produced highest fresh leaves weight, though at par with 50kg/ha. The 50 kg/ha was statistically similar with 25kg/ha which in turn was at par with the control. The application of N.P.K fertilizer at 75kg/ha produced statistically the largest stem diameter followed by 50kg/ha while values obtained with application of 25kg/ha and control were similar statistically.

In terms of fresh root weight, the application of N.P.K fertilizer at 75kg/ha produced the largest weight statistically followed by the 50kg/ha N.P.K while 25kg/ha and 0kg/ha N.P.K (control) produced statistically similar results.

The results of dried biomass weight per plant however, showed that with every increase in application of N.P.K fertilizer from 0 to 75kg/ha there was significant increase in root dry weight and root

dry weight. However, the result showed that application of N.P.K fertilizer at the various levels tested did not cause significant difference in terms of stem diameter.

Table 1. Plant Height

Treatment (kg/ha)	3 WAT	4 WAT	5 WAT	6 WAT
0	8.00c	9.33c	29.0	33.7
25	5.67ab	10.33c	26.0	30.3
50	10.33ab	16.00ab	29.3	33.7
75	13.67a	19.67a	42.3	48.3
LSD	5.6	6.6	22.4	23.9

Table 2. Number of leaves per plant

Treatment (kg/ha)	3 WAT	4 WAT	5 WAT	6 WAT
0	3.33b	7.00b	26.7	31.7
25	4.33b	9.67b	19.0	27.3
50	5.00b	13.33a	18.0	22.7
75	8.00a	16.33a	18.7	22.7
LSD	2.3	3.3	21.2	27.3

Table 3. Stem diameter

Treatment (kg/ha)	3 WAT	4 WAT	5 WAT	6 WAT
0	0.43c	0.93c	3.50	4.33
25	0.60b	1.13bc	3.00	3.67
50	0.73b	1.53ab	3.50	4.17
75	1.10a	1.93a	5.00	6.33
LSD	0.2	0.5	2.4	3.0

Table 4. Yield parameters.

Treatment (kg/ha)	Fresh Weight per Plant (g)			Dry Weight per Plant (g)		
	Leaves	Stem	Root	Leaves	Stem	Root
0	0.53c	2.5c	0.58c	0.13d	0.12	0.10d
25	2.19bc	8.1c	1.28c	0.46c	1.47	0.36c
50	4.29ab	26.9b	2.92b	0.80b	0.98	0.53b
75	7.40a	55.6a	4.60a	1.64a	0.67	0.89a
LSD	3.1	9.3	1.5	0.2	1.90	0.18

Discussion

Fertilizers are applied to supplement natural fertility of soil, compound fertilizers offer advantages of convenience in the field, economic savings and ease in meeting crop nutrients need. The levels of compound fertilizer applied resulted in producing taller plants with higher number of leaves and stem girth. Omotoso and Shittu (2007) reported that application of NPK fertilizer was found to significantly increase growth parameters (plant height, leaf area, root length, number of leaves). This in turn resulted in increased yield and yield components (fresh and dry weights of leaf stem and roots) in line with findings of Awodu *et al.*, (2007). Also, Oad *et al.*, (2001) reported that application of NPK fertilizer doses equally showed efficiency of producing taller plants, more branches increased number of siliqua, lengthy siliqua, bold seeds in siliqua and heavier seeds index, which in turn increased seed yield and oil content of the crop.

Conclusion

The result from the study indicated that application of 75kg/ha of N.P.K (15-15-15) produced the highest growth and yield parameters of amaranths. Therefore, among the levels of N.P.K 15:15:15

Recommendation

Based on the result obtained 75kg/ha of N.P.K (15-15-15) is recommended for the best production of vegetable amaranths in the study area. However, there is need for further studies to test higher levels of N.P.K fertilizer, other fertilizer formulations and/or organic manure.

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