

Response of *Amaranthus Caudatus* to *Moringa Oleifera* Leaf Extract

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Abstract

A field experiment was carried out to determine the effect of *Moringa oleifera* Leaf Extract on the growth of *Amaranthus caudatus*. The treatment consists of three concentrations of *Moringa Leaf Extract* and control, (MLE); 25cl of MLE (T₁) 50cl of MLE (T₂) and 75cl of MLE (T₃) mixed with 1 liter of water for each treatment in a completely randomized block design that contain three (3) replicates with four ridges each. Although the result shows that the mean effect throughout the period of experiment was not significant, but the treated plants produced tallest plant with regards to plant height, widest leaf area and thicker stem girth. Therefore, as a result of the *Moringa* extracts-induced, it increased plant height, leaf area, number of leaves and plant girth of *Amaranthus caudatus*. Also, the higher the concentration of MLE the more growing effect it has over lower concentrations. It was concluded that *Moringa* leaf extract could be used to enhance the growth of *Amaranthus caudatus*.

Background of the Study

Amaranthus caudatus is one of the species of amaranths which is the annual flowering plant. Its origin is Andes from tropical America (Agong, 2006). Amaranths were introduced to Africa in late 17th century. It's mostly grows in Peru, Bolivia and North-Eastern Argentina. Amaranths are grown for many purposes. The leaves are used as vegetables in Africa, especially in Nigeria. The leaves of amaranths can be used for salad, soups and so on. According to Agong 2006, *Amaranthus caudatus*' seed are toasted and popped grounded into flour. Amaranths is the source of income to the farmer, it is also a good source minerals and vitamins. The report of USDA 2015, concluded that amaranths contain a reasonable percentage of protein, carbohydrate, vitamins and minerals. It has an excellent quality of protein because of its high lysine content.

Moringa oleifera is widely cultivated species of the genus *Moringa* which is the only genus in the family of moringaceae (Heuze, Tran, Hassoun, Bastinell and Lebas 2004). It is grows in tropics and subtropical region of the world. They also emphasized that *Moringa oleifera* originated from Southern hill of Himalayas in North-Western India. *Moringa oleifera* is used for many reason; as a food moringa is used in different ways, it is used as salad and making soup. According Bosch (2004) and Foidi, Makkar, and Becker (2001), moringa leaves are valuable sources of protein. In Africa moringa plant is much appreciated for its pod. It is used for medicinal purposes. Orwa, Mutua, Kindt, Jamnadeess and Anthony (2009) explained that moringa roots and bark are used in cardiac and circulatory problems. It is also used in agricultural activities; its extract can be used as a growth hormone for many crops and used as a pesticide (organic pesticide). Foidi et al(2001) stated that phytohormones extracted from moringa leaf have shown to have growth enhancing effect on various plants.

Both the amaranths and the moringa are adapted to the tropical land in every part of the world, in which Nigeria is among the tropical countries. Therefore, if the moringa can grow perfectly in our environment and the amaranth can also grow, it will be important for the farmer and the society in general to make use of available resources as a green manure or foliar spray in order to enhance the growth of our crops. Plant hormones as a growth enhancer, brings the following benefits:

- i. The use of plant growth-hormone will limit the nitrous oxide emulsion which is one of the greenhouse gas that release by Nitrogen base fertilizer which will cause the global warming.
- ii. It reduces the effect of salt accumulation which occurred as a result of too much use of fertilizer (in organic fertilizer).
- iii. It helps the farmers to make use of local available materials to enhance the growth of their crops at lower cost.
- iv. It gives the farmers an alternative when the inorganic fertilizer is beyond his rich.

Statement of the Problem

Amaranths have become a major player in commercial production and marketing. It is increasingly important in Africa as an exotic vegetable grown for city markets, supermarkets, restaurants and hotels. In Nigeria Amaranth production is modest, although widely spread (Nikita, 2015). Amaranths contain good amount of minerals such as iron, calcium magnesium and potassium which are essential components of the cell and body fluids that helps in controlling heart beat and blood pressure (USDA, 2015).

In spite of these advantages however, the average yields of amaranths is very low compared with the potential yield in other countries such as Kenya, America and so many countries. Research has been mostly done in the area of improving crop yield on amaranth in terms of spacing, compare and contrast between organic manure and inorganic manure, fertilizer application, weed control, diseases and so on. Not much has been done on the use of plant growth hormones especially the use of natural products such as *Moringa oleifera* leaf extract.

Objectives of the Study

- i. To determine the effect of *Moringa oleifera* leaf extract on the growth of *Amaranthus caudatus*.
- ii. To determine the effect of different concentration levels of *Moringa oleifera* leaf extract on the growth of *Amaranthu scaudatus*.

Hypothesis

H₁: There is no significant difference in use of *Moringa oleifera* leaf extract on the growth of *Amaranthus caudatus*

H₂: There is no significant difference between the concentration levels of *Moringa oleifera* leaf extract on the growth of *Amaranthus caudatus*.

Materials and Methods

The experiment was conducted during rainy season between August and October, 2017 at school experimental farm at the Department of Agricultural Education, School of Vocational

Education, Federal College of Education (Technical) Gombe, Gombe State (9^o30 and 12^oN, 845' and 11^o45'E) North-eastern Nigeria. The experimental materials include: *Amaranthus caudatus* seeds, *Moringa oleifera* leaves which were collected from the market, weighing balance, hand sprayer, light weighing balance, the cutlass, hoe, watering cane, measuring device such as; centimeter rule, meter rule, 1 litre measuring instrument, 50cl, 75cl measuring device were used. Also, tray was used to dry grasses for mulching. For the extraction of Moringa leaf, a blender was used to mix water with concentrate of Moringa leaf extract.

The experimental plot was cleared using hoe and cutlass and beds were prepared, the plot was divided in 3 blocks at the length of 2m at an interval of 40cm between the blocks, the blocks was splitted into 4 ridges at an interval of 20cm between ridges. The design was completely randomized block design containing four ridges each replicated three (3) times and control. *Amaranthus caudatus* was measured; 3g was sown on every ridge, mulching was done in order to provide shade and prevent it from pests, excessive sunshine and to retain moisture. Weeding and thinning were conducted one week and 2 weeks after germination.

The Moringa (*Moringa oleifera*) leaves were collected from Kwadom market, about 1kg was bought in the market a weighing balance was used to measure 500mg fresh leaves of Moringa. The leaves were crushed using blender and mixed with 1 litre of water, after crushing, filter paper was used to filter the extract where 1.8 litre was collected.

The Moringa Leaf Extract (MLE) was used to treat the *AmaranthusCaudatus* at 3 week after sowing. The treatment consists of three concentrations and untreated as a control, This includes 75CL (T₃), (MLE) 50CL MLE (T₂), 25cl MLE (T₁) mixed with 1 litre of water each apply as a foliar spray and the untreated ridges used as control (T₀).

The treatment done in a randomized methods where every block consist of T₁, T₂, T₃ and T₀ on the split ridges in which each ridge on the replication carried different concentration of Moringa Leaf Extract. Hand sprayer was used to spray the MLE on the leaf of *Amaranthus*. The treatment repeated 3 times at the interval of 2 weeks. The untreated ridge serves as a control in order to determine the effect of Moringa Leaf Extract on the growth of *Amaranthus*. While the different level of concentration of MLE are used to determine the influence of concentration levels by observing the difference on the ridges that show differences in performance.

Data Collection

The data was collected using the following parameters; plant height, number of leaves, leaf area and plant girth. It was collected at 2 weeks interval i.e at 5, 7 and 9 weeks after sowing.

Data Analysis

The collected data was subjected to the analysis of variance (ANOVA) mean difference, using LSD method of analysis at 0.05 or 5% level of significance.

Results and Discussion

Table 1: Effects of *Moringa oleifera* leaf extract on plant height in centimeter

Treatment	5WAS	7WAS	9WAS
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T ₀	19.93	38.00	70.07
T ₁	23.93.	61.53	98.83
T ₂	28.30	66.53	101.62
T ₃	26.40	67.93	103.42
LS	NS	NS	NS
LSD	16.20	62.46	70.46

Table 1 shows the mean effect of Moringa Leaf Extract on plant height, though the effect was not significant throughout the experimental period. However, the plot treated with Moringa leaf extract produced the tallest plants: at 5 WAS, plants treated with 50cl of Moringa leaf extract were the tallest (28.30cm), followed by the 75cl MLE treatment (26.40cm), then the plants treated with 25cl of MLE (23.93cm). The plants treated with MLE were taller than plants which were not treated with Moringa leaf extract. While at 7WAS and 9WAS the plants treated with higher concentration (T₃) of MLE (75cl) produced the tallest (67.93cm and 103.42cm respectively), followed by T₂ then T₁ which were taller than the T₀ that is control. This was as a result of Moringa leaf extract applied to the plants which could be responsible for the increase in their heights. This work is similar with the work of Ndubuaku et. al., (2016) and Fugile (2012), which found that plants treated with Moringa leaf extract, were taller.

Table 2: Effect of *Moringa* leaf extract (MLE) on the number of leaf per plant.

Treatment	5WAS	7WAS	9WAS
T ₀	12	18	16
T ₁	13	20	25
T ₂	13	22	26
T ₃	15	20	26
LS	NS	NS	NS
5% LSD 3DF	6	8	21

Table 2 shows the mean effect of *Moringa* leaf extra on number of leaf plant, even though the mean effect was not significant. Nevertheless, the plants treated with Moringa leaf extract produced higher number of leaves while the untreated plants produced the lower number. At 7 and 9 WAS, the plants treated with 50cl of Moringa leaf extract (T₂) Produced the higher number of leaves (22 and 26 respectively) while at 5WAS plants treated with higher concentration of *Moringa* leaf extract produced higher (15). In all period of the experiment, plants treated with MLE produced higher number of leaves; this may be due to presence of growth hormones contained in Moringa leaf. Therefore, the result showed that MLE has growth effect on amaranthus. This is in line with the work of Emongor, (2015) where he reported on the effects of *Moringa* extract on growth of snap Beans, which stated that the snap bean response to increased levels of Moringa extract concentration was quadratic with respect to plant height, leaf area and number of leaf.

Table 3: Effect of Moringa leaf extract (MLE) on the leaf area (cm²)

Treatment (T)	5WAS	7WAS	9WAS
T ₀	22.00	31.63	33.22
T ₁	41.45	58.96	66.85
T ₂	43.55	57.69	71.90
T ₃	42.40	63.03	74.85
LS	NS	NS	NS
5%LSD	44.68	64.14	36.37

Table 3 shows the mean effect of *Moringa* leaf extract on leaf area of *Amaranthus candatus*. Based on the LSD method of analysis it was not significant ($P \leq 0.05$) but the treated plants produced the greatest leaf area at 7WAS and 9WAS the plants treated with 75cl of MLE (T₃) produced a wider leaves (63.03cm² and 74.85cm² respectively) while at 5WAS the plants treated with 50cl of MLE produced a greater leaf area (43.55cm²) better than plants that were not treated with Moringa Leaf Extract (22.00cm²). This is in tune with the work of Emongor (2015), who found that the leaf area of snap bean was increased after application of Moringa leaf Extract.

Table 4:- Effect of *Moringa* leaf extract on the stem girth of *Amaranthus caudatus* (cm).

Treatment	5WAS	7WAS	9WAS
T ₀	1.98	2.82	3.03
T ₁	2.67	3.82	4.65
T ₂	2.67	4.29	4.80
T ₃	2.72	4.69	4.80
LS ($P \leq 0.05$)	NS	NS	NS
5%LSD	1.56	3.61	3.79

Table 4 shows the effect of the mean different on the stem girth measured within the period of growth. The result showed that the plants treated with MLE produced plants with thicker stem than those not treated. At 5WAS and 7WAS, the plants treated with higher concentration (T₃) produced the greater stem girth (2.72cm and 4.69cm respectively) followed by T₁ and T₂, while at 9WAS the plants treated with 50cl of MLE (T₂) produces the greatest stem girth (4.83cm) This was buttressed by Aluko, (2016) where he reported that Moringa leaf extract had significant effect on the growth and yield of *Capsicum annum*.

Looking at the mean effect of MLE, the treated plants produced thicker stem while the untreated had thinner stems. Therefore, Moringa leaf extract can increase the growth of *Amaranthus caudatus* and the higher the concentration the higher influence it could have over those with lower concentrations.

Conclusion

Moringa oleifera leaf extract increased the growth of *Amaranthus caudatus* which showed on the vegetative part of the plant (plant height, number of leaf, leaf surface area and stem girth). This proved that Moringa leaf contains some growth enhancing hormones. The plants treated with T₃ (75cl) of MLE produced the tallest plants (103cm), widest leaves area (75cm²), thicker stem girth (5cm) and high number of leaf (26). Therefore, it can be concluded that the higher the concentration of MLE, the greater influence on growth of *Amaranthus caudatus*.

Recommendations

Based on the findings of this study, the following recommendations were forwarded:

1. Farmers should make use of local available materials to enhance crop growth.
2. Research and development should make use of this research to bring out the solution of negative effect of Nitrogen based fertilizer and some acidic inorganic fertilizer by conducting thorough research on *Moringa* extract.
3. Government and some agro-based organization should consider research on Natural plants as a growth hormone or as a fertilizer in order to reduce the use of inorganic fertilizer that has residual effect on the environment leading to climate change and global warming.

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