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Growth and Yield Response of Foliar Application with *Moringa Oleifera* Leaf Extract on Okro

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ABSTRACT

The use of chemical fertilizers to improve soil fertility, and hence, crop yield, have been reported to have adverse effects on agricultural products, man and his environment, hence, this research looked into the growth and yield response of foliar application with Moringa oleifera leaf extract on Okro. Different concentrations of Moringa leaf extracts at the rate of 5ml, 15ml and 25ml was assessed on the growth and yield of Okro using topsoil as the growing medium. The experiment was laid out in a randomized complete block design with three replicates. Growth and yield parameters were collected on plant height, number of leaves per plant, number of fruits per plant, and length of fruit per plant. Parameters measured were subjected to Analysis of Variance (ANOVA) for Completely Randomized Design (CRD) and means were separated using Duncan's Multiple Range Test (DMRT) at 5% probability level. The results showed that the treatment with 25ml concentration has a more significant effect than others on Okro. Therefore, treatment with 25ml performed better than the other two treatments in the study area. Hence, this study recommends the foliar application of Moringa extract to farmers for improved yield and production of Okro.

KEYWORDS: ANOVA, CRD, Foliar application, Growth, Okro, Leaf extract, Moringa, Yield

INTRODUCTION

Okra (Abelmoschus esculentus) is a flowering plant in the mallow family cultivated in the tropical, subtropical and warm temperate regions around the world (Chandra et al., 2016). It is valued for its edible green pods. The economic importance of Okra cannot be overemphasized as it ranked third to tomato and pepper (Ibeawuchi, 2007). According to Uzowuru (2010), all parts of the Okra plant are useful, its leaves and tender shoots which are equally rich in nutrients can be cooked and eaten. The pods that are either consumed in fresh or dried form contain a mucilaginous substance used to thicken soups and stews, and as plasma replacement or blood volume expander (Onunkun, 2012). According to Uguru, 2011 the edible portions of the pod are good sources of protein as well as an ascorbic acid content of 20g\100g and high level of calcium, fibre ash; and mature seeds contain about 21% of edible oil.

Okra has high economic value, good nutritional and functional properties and can improve food security (Kumar et al. 2011; Agbenorhevi et al., 2020). Okra is a multipurpose crop and used as a source of nutrition, bio-medicines and industrial by-products (Khan et al., 2013). Okra has huge potential for enhancing livelihood in urban and rural areas and to several stakeholders (NARP, 1993; NAP, 2006; Kumar et al., 2010; Agbenorhevi et al., 2015). It offers a possible root to prosperity for small scale and large-scale producers alike and all those involved in the okra value chain. Okra is also a potential oil and protein crop which also has an exporting value. It contains carbohydrate, protein, and vitamin C in large quantities and the essential and nonessential amino acid it contains is comparable to that of soybean (Adeboye, Awokoya, and Oluseyi (1996). Hence it plays a vital role in the human diet. It commands a high market price in Nigeria markets because it features daily in the diet of most Nigerians. One of the constraints to sustained production of Okra in this region is the lack of hormonal application. This leads to poor plant growth and increased disease pressure which results in the decline in agricultural food production. Plant hormones can be used to increase yield per unit area because they influence every phase of plant growth and development.

Today, farmers are well aware of the application of organic fertilizer to improve their crop production as well as farming land. Applying moringa leaf extract is a cheap and environment-friendly organic technology that increases the growth of most vegetable crops like rape, cabbage and

tomato, and field crops including maize and common beans (Fuglie, 2000).

Nutrients can be applied through foliar methods. Foliar application is feeding the plants by liquid fertilizer directly to the leaves. It is the greatest successful than the conventional application like surface, banded on or beneath the soil surface and low-risk method to plants (Aghtape et al., 2011) due to the low potential to damage the plant roots. The foliar application may be organic or inorganic form. Inorganic fertilizers are expensive and continuous application leads to the reduction in yields and polluting the environment. The fertilizer produced from completely natural raw materials called organic fertilizer and the liquid concentrates containing organic elements called liquid organic fertilizers which do not cause damage to the environment. The foliar application of growth-promoting compounds is used to improve crop growth and yield (Adams and Adams, 2002; Al-Hakimi and Hamada, 2001; Azeem and Ahmad, 2011). Small-scale farmers are interested in natural compounds which are cheap and environmentally friendly. Therefore, one of the effective ways to use low-cost technology with natural sources of nutrients (organic materials) to increase the crop yield by small-scale farmers without polluting the environment is the Moringa Leaf Extract (MLE). It tends to reduce the application frequency of inorganic fertilizer to increase the crop yield during the cropping season. Moringa Leaf Extract (MLE) can be used as a biostimulant and contains macro and micronutrients, amino acids, ascorbic acids, minerals, and growth-enhancing principles (Makkar et al., 2007) such as hormone of the cytokinin type. Growth hormone spray will also cause the plants to be firmer and more resistant to pest and diseases. It possesses about 46 antioxidants and the key ones are ascorbate, carotenoids, phenols and flavonoid (Iqbal and Bhanger, 2006). Application of MLE was shown to increase yields of crops such as onions, bell pepper, soybean, sorghum, coffee, tea, chilli, melon and maize (Fuglie, 2000). This investigation was undertaken to study the effect of different concentrations of application of Moringa (Moringa oleifera) Leaf Extract (MLE) as a foliar application on growth and yield of okra (Abelmoschus esculentus).

MATERIALS AND METHOD

Study area

A field experiment was conducted at the Departmental experimental plot of Osun State College of Education, Ila Orangun from July to October 2018. Ila-Orangun lies to the northeast of the State of Osun quite near the border with Kwara State on 8° 1′North and longitude 04°54′East. The tropical climate of the state is broad of two seasons: rainy season (April-October) and dry season (November – March). The temperature throughout the year ranges between 21^0C to 29^0C while the average annual temperature is 25.2 °C. About 1275 mm of precipitation falls annually and humidity is relatively high. According to the analytical report of the National Population Commission (NPC) (2006), Ila Orangun has 62,049 people with five (5) wards.

Experimental Plot

The land used for both the Moringa plantation and Okra demonstration plots were cleared, ploughed and harrowed and then heaps were made manually according to the local practice of the community. The total number of unit plots was thirty (30) and the size of a unit plot was marked out into 4 m x 3 m. The distance maintained between 2 units plot was 0.50 m and between blocks was 1 m. Okro seeds were sown by dribbling three seeds per heap and was thinned to 2 plants per heap 2 Weeks after Sprouting (WAS). Surface soil samples (0 – 15 cm) collected randomly at the experimental plot were air-dried, sieved and analyzed for soil physical and chemical properties using the procedure described by Udo et al. (2009).

Data collection

Three randomly sampled okra plants to which data on plant height, stem girth, leaf area, and the number of flowers were collected weekly from two WAS. The number of fruit plants, fruit length, fruit breadth and fruit weight of sampled okra plants was collected at harvest, which was observed every five days interval.

Statistical analysis

All data collected were subjected to the generalized model of Statistical package for social science (SPSS) for the analysis of Variance (ANOVA) for Completely Randomized Design (CRD) and means were separated using Duncan's Multiple Range Test (DMRT) at 5% probability level.

RESULTS

Characteristic of the Soil Used

Physical and chemical properties of the soil used for the study.

The soil used was loamy sand which contains 845.60 g kg-1 sand, 71.00 g kg-1 silt and 83.40 g kg-1 clay as shown from soil particle analyze with a pH of 5.5. The soil contains 0.70 g kg-1 organic matter, 1.21 g kg-1 total nitrogen, and 0.58 mg kg-1 available phosphorus. The effective cation exchangeable capacity was 2.27 with 0.50, 0.60, 0.56, and 0.51 cmol kg-1 exchangeable K, C, Mg, and Na, respectively.

Table 1: Properties of the soil used for the study

Variables	Unit	Value
pH		5.5
Organic matter	g kg $^{-1}$	0.70
Total nitrogen	g kg $^{-1}$	1.21
Phosphorus	g kg $^{-1}$	0.58
Cation Exchangeable capacity	Cmol kg $^{-1}$	2.27

Potassium	Cmol kg $^{-1}$	0.50
Carbon	Cmol kg $^{-1}$	0.60
Magnesium	Cmol kg $^{-1}$	0.56
Sodium	Cmol kg $^{-1}$	0.51
Sand	g kg $^{-1}$	845.60
Silt	g kg $^{-1}$	71
Clay	g kg $^{-1}$	83.40

Vegetative parameters

Table 2 shows the influence of various concentrations of Moringa oleifera leaf extract on the height of okra and the number of branches. The extract with 25ml moringa leaf (MLE3) recorded the highest mean of 11.7 at 2 WAS and 22.1 at 4 WAS whereas the highest mean of 34.2 at 12 WAS was also recorded by 25ml of Moringa Leaf extract (MLE3). Significant ($p<0.05$) differences were observed among all the means. The height of the okra sprayed with 5ml Moringa leaf extract was shorter in height as compared to that of 15ml and 25ml moringa leaf extract. The number of branches at 12 WAS for all the levels of concentrations recorded a significant ($p<0.05$) difference (Table 2). MLE3 produced the highest number of branches (7.7) than that of MLE2 and MLE1. The higher number of branches could in turn lead to higher fruit production. The okra differed in the number of branches according to the levels of concentration mix of the moringa leaf extract. This is in line with Jiru et. al 2006 that opined that extracts used in the form of a foliar spray accelerate the growth of young plants.

Table 2: The effect of various concentrations of moringa leaf extract on okro height at 2, 4 and 12 weeks after sprouting

		MLE1	MLE2	MLE3
Plant height at 2weeks (cm)	Mean	7.1b	10.8a	11.7a
	Standard Error	±0.61	±0.47	±1.28
Plant height at 4weeks (cm)	Mean	14.1b	21.0a	22.1a
	Standard Error	±1.43	±0.81	±1.65
Plant height at 12weeks (cm)	Mean	25.2b	32.7a	34.2a
	Standard Error	±1.05	±0.75	±1.01
Number of branches per plant	Mean	5.0c	6.3b	7.7a
	Standard Error	±0.00	±0.33	±0.33

Mean with the same letter are not significantly different (Duncan multiple range test at $p<0.05$)
E1: 5ml Moringa leaf extract concentration
E2: 15ml Moringa leaf extract concentration
E3: 25ml Moringa leaf extract concentration

Fruit parameters

Table 3 shows the summary of the number of fruits at 1st, 2nd and 3rd harvest. Significantly ($p<0.05$) the high number of fruits were produced with MLE3 in all the three harvesting periods as compared to other treatments. Lower numbers of fruits were recorded with MLE1. This performance may not be unconnected with the more favourable environmental conditions provided during the dry season irrigation. This result corroborates the findings of Katung (2007) who reported that changes in environmental conditions influence the growth and performance of okra. Abdul and Aarf (1986) also observed that the number of fruits of okra per plant increases under optimum environmental conditions and performs well. The effect of varietal difference on fruit length (cm), harvested fruit weight (g) and yield of fresh fruit (kg/ha) is presented in Table 4. The results showed that the response of fruit length, was significant ($p<0.05$) with MLE3 recording the highest fruit length of 7.23 cm and MLE1 the lowest with 4.87 cm. This result showed that MLE2 matures earlier than other varieties and stands a better chance of return. This is in line with Radovich and Paull, 2008 which says that plants that are treated with moringa oleifera growth hormone spray will produce more and larger fruits and will consequently have a higher yield at harvest time.

Table 3: The effect of various concentrations of moringa leaf extract on the number of fruits at 1st, 2nd and 3rd week of harvest

		MLE1	MLE2	MLE3
Nos of fruits at 1st week of harvest	Mean	9.0b	11.00a	11.7a
	Standard Error	±0.58	±0.58	±1.28
Nos of fruits at 2nd week of harvest	Mean	10.0b	13.00a	22.1a
	Standard Error	±0.58	±0.00	±1.65
Nos of fruits at 3rd week of harvest	Mean	12.33b	13.67a	16.67a
	Standard Error	±0.33	±0.33	±0.33

Mean with the same letter are not significantly different (Duncan multiple range test at p<0.05)
E1: 5ml Moringa leaf extract concentration
E2: 15ml Moringa leaf extract concentration
E3: 25ml Moringa leaf extract concentration

Table 4: The effect of various concentrations of moringa leaf extract on fruit length, harvested fruit weight and yield of fresh fruit

		(E1)	(E2)	(E3)
Fruit length at harvest (cm)	Mean	4.87b	7.10a	7.23a
	Standard Error	±0.58	±0.31	±0.49
Harvested fruit weight (g)	Mean	370.99b	727.17a	802.68a
	Standard Error	±40.49	±9.44	±49.43
The yield of fresh fruits (Kg/ha)	Mean	10.7a	9.7a	10.7a
	Standard Error	±0.66	±0.12	±0.66

Mean with the same letter are not significantly different (Duncan multiple range test at p<0.05)
E1: 5ml Moringa leaf extract concentration
E2: 15ml Moringa leaf extract concentration
E3: 25ml Moringa leaf extract concentration

CONCLUSION

The study revealed the potentials of the foliar application of various concentrations of aqueous moringa oleifera plant extraction as nutrient source. The result obtained showed that application of 25ml moringa leaf extract gave the optimum productivity for Okra more than MLE1 and MLE2. Therefore, treatment with 25ml performed better than the other two treatments in the study area. Hence, this study recommends the foliar application of Moringa extract to farmers for improved yield and production of Okro.

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