Efficacy of Moringa Extract on Growth and Yield of Okra

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ABSTRACT

Aim: The study was carried out to evaluate robustness of moringa leaf extract on the growth and yield of okra.

Materials and Methods: Moringa leaves were collected; air-dried and milled. 20 kg of the milled leaves was mixed with 675 ml of 80% of aqueous ethanol. The extract was diluted with distilled water at ratio 1:20. The diluted moringa extract was sprayed at the rate of 0ml (control), 5ml, 10ml, 15ml, 20ml, 25ml and 30ml at two weeks interval. The experiment was laid out in a Complete Randomized Design (CRD) and the treatments were replicated seven times. The parameters assessed were the plant height (cm), stem girth (mm), number of leaves per plant, leaf area (cm2), days of flowering after planting, number of fruits per plant and fruit weight.

Results: The result revealed that okra treated with 30ml of moringa extract had the earliest days of flowering at 36days, produced the highest number of fruits with 19 fruits and height of 31.36cm with weight of 24.61g.

Conclusion: It was concluded that the higher rate of the moringa extract application promoted plant height and influenced early flowering and the number of fruits production

Key-words: CRD, Efficacy, Foliar application, Moringa, Okra.

Introduction

Vegetables are important crops for additional supply of human nutritional requirement. *Abelmoscus esculentus* (*Okra* or Okro) is one of the most important vegetable grown in Nigeria. It is an annual crop grown mainly as fruits and leafy vegetables in both green and dried state in the tropics [1]. The crop is used as soup thickener which may also be served with rice and other food types. The fresh fruit is a good source of vitamins and plant protein [2]. It contains about 20% edible oil and protein, while its mucilage is utilized for medicinal purposes. The matured stem contains crude fibre which is used in paper industries and for making ropes [3]. Okra's flower can be very attractive and sometimes used in decorating the room [4].

There is now a growing demand for sound and ecologically compatible and environment friendly techniques in agriculture, capable of providing enough food for the increasing human population, retaining soil quality and improving the quality and quantity of agricultural produce [5,6]. One of the constraints to sustain production of okra is lack of fertilizer application. This leads to poor plant growth and increased disease pressure which results

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in decline in agricultural food production.

Foliar application can be used to increase yield per unit area because they influence every phase of plant and development. Traditionally, there are five groups of growth regulators which are listed: auxins, gibberellins, abscisic acid, ethylene and cytokines [7]. Cytokine enhances food production; Zeatin is one form of the most common forms of naturally occurring cytokine in plants. Fresh Moringa oleifera leaves have been shown to have high zeatin content. Moringa leaves gathered from various parts of the world were found to have high zeatin concentrations of between 5 and 200 mcg/g of leaves [8].

Foliar spray of crops with Moringa leaf extract accelerates plant growth, promotes resistance to stress and increases yield of crops [7]. Moringa leaf extract was sprayed onto leaves of onions, bell pepper, soya beans, sorghum, coffee, tea, chili, melon and maize and was shown to increase yields of these crops [9]. If Moringa extract can increase yield, then the potential benefit to the small holder farmers in Africa would be great. The robustness of Moringa extract on other crops is unknown.

The use of natural growth enhancers which will optimize the production in Nigeria agro-ecology through adequate organic fertilizer application had been advocated [10]. Therefore, the efficacy of moringa leaf extract on the growth and yield of okro was investigated.

Methods and Materials

Materials

The topsoil for the experiment was collected from Horticulture and Landscape Technology Department, Federal College of Forestry, Ibadan potting medium. The moringa leaves was collected at Federal College of Forestry, Ibadan. The Abelmoscus esculentus seeds pack was procured from the National Horticultural Research Institute (NIHORT). The other materials were obtained from Department of Horticulture and Landscape Technology, Federal College of Forestry, Ibadan.

Methods

Moringa leaves were collected, air-dried and milled. 20g of the milled leaves was mixed with 675ml of 80% aqueous ethanol. The extract was diluted in distilled water at ratio 1:20 [8]. 5kg of soil was placed in each polythene pot.

Planting

Seeds of okra were planted at two seeds per pot and later thinned into one plant per stand after germination. At two weeks after sowing (2WAS), the following quantities of moringa extract were sprayed on potted okro plants to make up seven treatments:

T_0 - Control (No Moringa extract)

T_1 - Moringa extract sprayed at 5ml

T_2 - Moringa extract sprayed at 10ml

T_3 - Moringa extract sprayed at 15ml

T_4 - Moringa extract sprayed at 20ml

T_5 - Moringa extract sprayed at 25ml

T_6 - Moringa extract sprayed at 30ml

Growth Parameter Assessment

The experiment was laid out in a Completely Randomized Design (CRD) with seven treatments and seven replicates. Data were taken weekly on

the stem girth, plant height, number of leaves, leaf area, days to flower and number of fruits per plant for a period of six weeks.

Data Analysis

The Statistical Model used is:

$$y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$$

Where y_{ij} = jth observation in group *i*

μ = grand population mean

α_i = effects of group *i*

ε_{ij} = random error

(As per Samuel *et al*., 2012)

Results and Discussion:

The result (Table 1) showed that okra treated with 5 ml of moringa extracts had the best performance in height with an average of 38.42 cm while Okro plant treated with 30 ml of moringa was next with an average mean of 37.33 cm after six weeks of assessment. Although, they were not significantly different from each other when least significant difference was used to separate the means. Okra plant treated with 20 ml performed least with an average of 27.73 cm. It was evident that okro grown with the application of 5 ml moringa extracts performed best and highly significant when compared with all other treatments by carrying the first letter 'a'. In view of this result, it is hypothesized that leaf extract from moringa, having a number of plant growth promoters, mineral nutrients and vitamins in a naturally balanced composition may be beneficial for plant growth and development [12].

The efficacy of moringa extracts on leaf production of okro after six weeks of assessment clearly shown that all the treatments produced uniform numbers of leaves but okra grown with 30ml moringa extract had overall best performance with an average of 9.77 cm leaves. Moringa leaf extract when applied on for drought or salt stressed plants modified plant phenotypic response positively affects growth and productivity with alteration in metabolic process [13].

On stem diameter of okra as shown in the table above. It shows that okra treated with 20 ml of moringa extracts gave the best performance in stem diameter with an average mean of 1.88 mm after six weeks of assessment. Plants grown without application of moringa extracts performed second best with an average mean of 1.45 mm while plants grown with application of 15ml moringa extracts performed least with an average mean of 1.13 mm. The result of the study showed that moringa leaf extract increased vegetative growth and stem diameter of okro. The moringa leaf extract induced increase in vegetative of okro was attributed to the role of cytokine in promoting cell division and elongation [13].

On the efficacy of varying quantities of moringa extracts on leaf area of okro. It was evident that okra grown without moringa extracts had the highest mean value in terms of leaf area (205.529 cm^2). This was followed by okro treated with 5 ml moringa extracts with a mean value of 147.44 cm^2 while okro treated with 20 ml of moringa extract performed least with an average mean of 94.21 cm. Though, there is no significant difference among the treatment at 5% significant level [14].

The extract from drumstick has a high anti-oxidant activity. Moreover, moringa leaf extract is enriched with zeatin, apurine adenine derivative of plant hormone group cytokines [8] which known for stay green and stress tolerance capabilities.

Table 1: Grand Mean robustness of Moringa Extracts after 6 weeks (cm) of assessment on the Height, Leaf Production, Stem diameter and Leaf Area of Okra plant.

Treatments	Height(cm)	Leaf Production	Stem diameter(mm)	Leaf Area(cm2)
T0	28.6b	8.92b	1.45ab	205.529a
T1	38.42a	9.33ab	1.39ab	147.44ab
T2	28.5b	9.00b	1.2ab	112.16b
T3	30.57ab	8.91b	1.13bc	114.94b
T4	27.73b	9.25ab	1.88a	94.21bc
T5	31.38ab	9.25ab	1.25b	138.72ab
T6	37.33a	9.77a	1.14bc	153.21ab

Table 2: Mean robustness of Moringa on Days to Flower, Number of fruits and fruit weight (g).

Treatments	Days to Flower	Number of fruit	Fruits weight (g)
T_0	61.50a	7.75c	7.43e
T_1	55.00abc	6.75c	10.90d
T_2	46.75bc	5.57c	11.93cd
T_3	46.25c	5.5c	14.23c
T_4	45.75c	12.00b	19.85b
T_5	40.25ab	18.50c	24.61a
T_6	35.75d	5.00c	6.97e
GM	49.61	2.91	3.16

The effect of application of varying quantities of moringa extracts on days of flower of okro observed after six weeks shown (Table 2) that okra treated with 30 ml moringa extract flowered earlier than all other treatment by flowered 35 days after planting. This was followed by 25 ml application. Okra grown without moringa extracts flowered after 61 days. The application and use of moringa leaf extract as synthetic hormonal effect clearly showed that the higher concentration treatment revealed the highest performance compared to other concentration. Furthermore, the higher concentration showed the higher concentration of the hormones with early flowering compared to other concentration [15].

On the efficacy of application of varying quantities of moringa extracts

on number of fruits of Okra, it was observed that Okra treated with 30ml has the highest number of fruits with the total number of 18.50 fruits. Okra grown without moringa extract which is control produced the least with the total number of 6.97 (g) fruits. Moringa leaf extract when applied to okra increased plant height, numbers of leaves and hastens the days of flower [12]. This was attributed to moringa leaf extract being rich in zeatin, a cytokines maintained the green photosynthesis area, therefore contributed to higher fruit yield [7].

On the effects of application of varying quantities of moringa extract on fruit weight of Okra, it was observed that Okra treated with 30 ml has the highest weight of (24.61(g)) followed by 25 ml application. Okra grown without moringa extract which is the control has the least weight of 6.91(g). Foliar applications of moringa leaf extract can be used effectively to improve fruit set, yield and fruit-weight of okra [16].

Table 3: ANOVA for Plant Height, Leaf Production, Stem Diameter, Leaf Area, Days to Flower, Number of Fruits and Fruit weight of okro.

	SV	df	SS	MS	F	P-Value
Plant height of Okra	Treatment	6	466.03214	77.67202	3.2453	0.0204
	Error	21	502.60500	23.93357		
	Total	27	968.63714			
Leaf production of Okra	Treatment	6	6.42857	1.07143	0.3516NS	0.90
	Error	21	64.00000	3.04762		
	Total	27	70.42857			
Stem diameter of Okra	Treatment	6	1.91500	0.31917	1.4642NS	0.2383
	Error	21	4.57750	0.21778		
	Total	27	6.49250			
Leaf Area of Okra	Treatment	6	60130.79652	10021.79942	2.3861NS	0.0647
	Error	21	88201.54918	4200.07377		
	Total	27	148332.3457			
Days to Flower of Okra	Treatment	6	1763.92857	293.98810	6.4394	0.0005
	Error	21	958.75000	45.65476		
	Total	27	2722.67857			
Number of Fruits of Okra	Treatment	6	577.00000	96.1667	24.5532	0.0001
	Error	21	82.25000	3.91667		
	Total	27	659.2500			
Fruit weight of Okra	Treatment	6	1013.77697	168.96283	36.5797	0.0001
	Error	21	96.99960	4.61903		
	Total	27	11110.77657			

The Analysis of Variance for Plant Height showed that there is significant difference among the treatments at 5% level of probability which implies that application of moringa extracts on okra gave significant effects on height increase (Table 3). Analysis of Variance for leaf production of okra in table above shows that there is no significant difference among the treatments at 5% level of probability. This indicated that varying quantities of moringa extracts applied gave no significant effect on leaf production of okra. Also, the Stem Diameter of okro in the Table 3 above shows that there is no significant difference among the treatments at 5% level of significant. This indicates that the use of varying quantities of moringa extracts gave no significant effect on stem diameter of okra. Analysis of variance presented in Table 3 above for the Leaf Area of okro showed that there is no significant difference among the treatments at 5% level of probability. This implies that varying quantities of moringa extract applied gave no significant effect on leaf area of okra. Similar observations were observed by some researcher [13,14].

Analysis of variance table 7 for Days of Flower showed that there is significant difference among the treatments at 1% level of probability. This indicates that the application of Moringa extracts give significant effects on days of flowering of okra. Analysis of variance table for Number of Fruits of okro showed that there was significant difference among the treatments of 1% level of probability. This indicated that the application of Moringa extracts gave significant effects on number of fruits. Analysis of Variance for Fruit Weight of okro showed that there were significant differences among the treatments at 1% level of probability (Table 3). This indicated that the application of moringa extracts gave significant effects on fruit weight. Some researcher also advocated similar observations [2,4,13,14].

Conclusion

The use of moringa leaf extract as a natural growth enhancer has been further proven by this work especially on Okra. Moringa leaf extract influence the growth of Okra at any rate of foliar application but has more influence on the days to flowering and on the number of fruits production. The foliar application of moringa leaf extract at the rate of 30 ml gave the earliest flowering days after planting at 36 days and fruits more than other treatments tested with the total number of 19 fruits. From the results of the experiments, it was concluded that the higher rate of the moringa extract application promoted plant height and influenced early flowering and the number of fruits production.

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