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Evaluation of Different Concentrations And Frequency of Foliar Application of *Moringa Extract* on Growth & Yield of Onion, *Allium cepa* Lam

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ABSTRACT

Field trials were conducted between 2010/11 and 2011/12 at the Forestry Research Institute of Nigeria (FRIN) of Federal College of Forestry Mechanization Afaka, Kaduna experimental site, 10^{o} 03^{1}N, 07^{o} 21^{1} E and 644m above sea level in the Northern guinea savanna agro-ecological zone during 2011 to 2012 dry season. The objective was to evaluate the effect of different concentration and frequency of foliar application of Moringa extract on growth and yield of Onion (*Allium cepa* Lam). Fresh *Moringa oleifera* shoots were obtained from experimental site of the College when it was 35 days old, air dried for some days and crushed with water (10kg of dry material in water) in a household blender for 10 minute. The solution was filtered through a filter paper (Whattman No 42) and the liquid extracts obtained were diluted with water to produce the treatments. The treatments consisted of four concentration 2% (1 litre of extract/50 litre of water), 4% (1 litre of extract/25 litre of water), 3.2% (litre of extract/31 litre of water), 3.7% (1 litre of extract/27 litre of water) and a control (no extract) and two frequency of foliar application once (3weeks) and twice 3 and 6 weeks after transplanting. The trial was laid in a Randomized Complete Block Design(RCBD) and replicated three times. Data were collected on number of leaves/plant, plant height and crop vigour score at 5, 7 and 9 WAT. The data collected were subjected to analysis of variance. Result obtained showed a significant (P = 0.05) effect of the treatments on the characters measured with moringa extract concentration ratio of 1:2 (50%) and frequency periods of foliar application at 3, and 6 weeks after transplanting manifesting the highest effect. Based on the result, application of Moringa extract concentration ratio of 1:2(50%) and frequency period of foliar application at 3, and 6 weeks after transplanting of onion should be adopted for use in Northern guinea savannah ecological zone on the variety of onion tested, since it is easier to get Moringa all year round and in large quantities for large hectare of farm land.

Key words: Moringa, Extract, Onion bulb and Concentration

INTRODUCTION

Onion (*Allium cepa L)* is a member of the *Alliaceae* family and it is one of the most important vegetables in the world, whose utility is ranked second to tomatoes (Brice, 2005). According to Purseglove (1985), onion can be grown on a wide range of climatic conditions, but thrive best at mild climate without excessive rainfall or extreme of heat and cold. It requires a land with optimum

soil pH of 6.0-7.0 with good tilt and high moisture content. It is a thermo and photosensitive crop, hence, the production of bulb in onion is controlled by photoperiod, though temperature has marked influence. The day length requirement for onion varies from 11-16 hours.

Onion is consumed in different ways by different people and forms essential part of the traditional daily diet. It is a major spice item and ranks among the top five vegetables in Nigeria, (NIHORT, 1986). It can be eaten raw in salad, fried, boiled or roasted and also used in flavouring, soups, carrot food products and other savory dishes. It is used in every home virtually on daily basis (Hussaini *et al.,* 2000). The bulb is used traditionally as a medicinal herb for the treatment of measles, pneumonia, cold and catarrh. Recent studies have confirmed that onions help in fighting Osteoporosity or bone loss (Biochemist, 2005). Onion production is a viable industry that employs plenty of labour and bulbs are traded in large quantities within and between countries of the world (Curah and Proctar, 1990). Despite the ranking of onion as the second most important vegetable in Nigeria, the present production level does not meet the demand of the teaming populace. Though, the consumption of onion cuts across the country, its production is limited to the northern part of the country, restricted to fadama areas, and grown mostly during the dry season under irrigation.

Similarly, the production level at present is below the optimum realized for other countries. For example, it is 45t/ha in India while it is just 10t/ha in Nigeria (FAO, 2005). Research efforts in improving yield have been limited to areas of nursery raising, transplanting time, plant population, provision of good quality seeds and seedlings, weeding, irrigation, fertilizer application and prevalence of pests and diseases. However, much work has been done on the use of plant growth hormone especially the use of natural products such as M*oringa* extract. According to Forbes and Watson (1992), plant growth regulators are synthetic substances which when applied at low doses, cause changes in the pattern of growth and development. It induces growth and yield due to altered photosynthetic distributive pattern within the plants. According to Mishra (2008), plant growth regulators enhance growth and yield of Chilli pepper by 40%. Martin (2000) and Fuglie (2008) reported increase in plant yield by 25-30% with *Moringa oleifera* extract used as a plant growth hormone. Earlier Foidll *et al*., (2001) reported accelerated growth of young plants increase in stem diameter and large leaves with *Moringa oleifera* extract used as a foliar application, for growth hormone activity. One of the active substances in moringa fresh leaf juice is natural zeatin, a plant hormone from the cytokinis group, in a "bio-dynamic: native" state, working in conjunction with the incredibly powerful cocktail of enzymes, vitamins and minerals contained in moringa juice. There is a dearth of information on the use of *Moringa* extract on the growth of onion in Nigeria. This research therefore evaluated the effect of different concentration of foliar application of *Moringa oleifera e*xtract on growth and yield of onion.

MATERIALS AND METHODS

Moringa shoots were obtained from experimental site of the college when it was 35 days old and was air dry for some days and later crushed and grinded.

Field trials were conducted during 2010/11 and 2011/12 dry season at the Forestry Research

Institute of Nigeria (FRIN) of Federal College of Forestry Mechanization Afaka, Kaduna experimental site, 10^{o} 03^{1}N, 07^{o} 21^{1} E and 644m above sea level in the Northern guinea savanna agro-ecological zone. The treatment consisted of four concentrations viz 2% (1 litre of extract/50itre of water), 4% (1 litre of extract/25 litre of water), 3.2% (litre of extract/31 litre of water), 3.7% (1 litre of extract/27 litre of water) and a control (no extract) and two frequency of foliar application once (3weeks) and twice 3 and 6 weeks after transplanting. The experiment was laid in a Randomized Complete Block Design(RCBD) replicated three times to give a total of ten treatments. Seeds of (COMPR4) were used as test crop and were sourced from the Institute for Agricultural Research/ABU Samaru, Zaria. Nursery bed of 1.0 x 3.0 were marked out and cleared. Poultry manure was applied and the seeds drilled into rows 15cm part to raise onion seedlings. Regular watering was carried out by means of watering-can and hand-pulling of grasses until the seedlings were ready for transplanting at the age of eight weeks after sowing. Prior to land preparation, composite soil samples were collected at five different locations within the farm at the depth of 0-15 and 15-30cm using soil auger and the soil was subjected to laboratory analysis for physical and chemical properties at the soil.

At six weeks after sowing (WAS) the seedlings were transplanted for both seasons respectively. The sunken beds were prepared and watered before transplanting. The size of the bed was 2m x 1.5m = $(3m)^{2}$. The field was marked out into plots and there after leveled. Transplanting was carried out in each year with one seedling per hole at a depth of 5cm by hand with spacing 20cm X 20 cm respectively. Agronomic practices such as irrigation, fertilizer application and weeding were properly observed. Four plants were tagged within a plot for data collection. Data were collected on plant height, number of leaves/plant, and crop vigour score. Plant heights were taken using a meter rule to measure the center leaf from soil level to the tip of the leaf, while number of leaves was obtained by counting the number of leaves from the tagged plant and average were computed at 5, 7 &9 WAT. The crop vigour scores were taken at 5, 7 & 9 WAT using a scale of 1 to 9 where 1 represented dead plant and 9 represented the most vigorous plant. Number of bulbs was taken by counting the number of bulb in each uprooted tagged bulb during harvesting and the average was computed. Bulb diameters were taken by using vernier caliper to measure the diameter of the bulb, weight of the bulb per plant and plot were obtained by using measuring scale graduated in gram (g) to measure the weight and average were computed. The data collected were subjected to analysis of variance as described by (Snedecor and Cochran 1953) and mean were separated using Duncan Multiple Range Test DMRT (Duncan, 1955)

RESULTS AND DISCUSSION

Table 1 shows the physico-chemical properties of the soil of the experimental site at Afaka. It reveals that the soil is clay sandy loam with low value organic carbon, total Nitrogen and available phosphorus.

Table 1: Physico-chemical properties of soil of the experimental site at Afaka

Soil properties	Soil depth (cm)			
	2010/11		2011/12	
	0-15	15-30	0-15	15-30
Clay %	16	30	17	35
Silt %	16	16	19	15
Sand %	68	54	64	50
Textual class	CSL	SCL	CSL	SCL
Soil pH in H_2O	6.40	6.00	6.40	6.20
Soil pH 1:2 50 $CaCl_2$	5.20	5.40	5.20	5.10
Organic matter	2.00	0.76	1.90	0.66
Organic Carbon gkg^{-1}	0.50	0.38	0.42	0.30
Total Nitrogen gkg^{-1}	0.043	0.033	0.038	0.029
Available Phosphorus (ppm)	8.75	7.00	7.20	6.20
CEC meg ($100g^{-1}$ soil)	7.60	9.40	6.60	8.95
Ca	4.00	4.00	3.92	3.28
Mg	1.16	1.36	1.05	0.72
K	0.11	0.97	0.07	0.85
NA	0.32	0.44	0.30	0.35
	CSL= Clay, Sand, Loam		SCL=Sand Clay Loam	

Source: Institute for Agricultural Research, Samaru Zaria

Table 2: The effect of different concentration and frequency period of foliar application of moringa extract on mean number of leaves, plant height and crop vigour score per plant for combined dry seasons of 2011 and 2012 at 5, 7 & 9 weeks after transplanting at Afaka.

Treatment %	No of leaves/plant			Plant height/plant			Crop vigour score/plant		
	5	7	9	5	7	9	5	7	9
50 % once application	7.17b	7.00b	7.75b	38.46	40.48b	40.83b	7.00b	6.67b	7.33ab
3.7% once application	8.25ab	9.00ab	10.42ab	43.06	44.66b	47.72a	8.33ab	8.00ab	8.61ab
3.2% once application	7.09b	8.17b	8.17ab	36.26	39.38b	42.41b	7.60ab	7.67ab	8.00ab
25% once application	9.03a	10.01ab	11.33a	41.94	42.46b	44.23b	9.00a	8.67ab	8.00ab
50% twice application	9.17a	11.50a	11.95a	41.82	48.43a	42.50a	9.00a	9.33a	9.43a
3.7% twice application	7.00b	7.00b	7.83ab	43.06	46.66a	49.01a	7.00b	7.67b	7.33ab
3.2% twice application	8.00ab	9.25ab	9.58ab	36.26	41.63b	42.37b	8.66ab	8.33ab	8.33ab
25% twice application	7.26b	7.75b	7.67ab	41.82	44.92b	44.98b	7.00b	6.67b	7.00b
Control	6.08b	6.33	6.75ab	36.46	38.38c	38.78b	6.00b	6.67ab	6.33ab
SE±	2.828	5.277	6.518	2.304	3.090	2.80	2.96	4.18	3.79
Level of significant	X	◠	◠	NS	X	X	X	X	X

Means followed by the letter(s) within a column and treatment set are not significantly different using DMRT (P=0.05)

Table 2 shows the effects of Evaluation for different concentration and frequency of foliar application of Moringa extract on plant height, number of leaves and crop vigour score for the two years combined of foliar application of Moringa extracts. There were no significant (P = 0.05) effects on plant height at 5 WAT but significant effects were recorded at 7 and 9 WAT. At 7 & 9 WAT Moringa extract at concentrated 50% of ratio (1:2) with twice application showed the highest effect on plant height of (48.43cm) and (50.01cm) and the lowest were obtained from the control (38.12cm) and (38.78cm). The non-significant effect of treatments on mean plant height at 5 WAT might not be unconnected with the time of application which may be early for the effects to manifest immediately. However, the result obtained at 7 & 9 WAT is not in conformity with the report of Edward and Jerry (2008) who found that crop growth and yield characters did not respond to foliar application of *Moringa*. On mean number of leaves/plant and crop vigour score, onion leaves responded to the treatment during the period of observation with foliar application of extract concentration with 50% and twice application produced more number of leaves/plot of 9.17, 11.50 and 11.95 while the lowest was obtained with no extract application (control). The significance obtained during the period of observation is in conformity with report obtained by Foidll *et al.,* (2001) who reported a significant increase in number of leaves with foliar application of *Moringa*. *Moringa* extract also improved the performance of onion at all the periods of observation with 50% concentration and twice application producing the highest crop vigour score of 9.00, 9.33 and 9.43, while the lowest crop vigour score resulted in control.

Table 3: The effect of different concentration and frequency period of foliar application of Moringa extract on mean number of onion bulb weight of bulb and bulb diameter/plant at harvest of 2011 and 2012 at Afaka.

Physical Properties	No of observations	Unit	Minimum Value	Maximum Value	Mean Value	Standard Deviation	Coefficient of Variation
Height of Loading	20	mm	4.17	7.73	6.80	0.969	14.25
Force at Peak	20	N	48.900	67.000	58.535	5.472	9.35
Deformation at Peak	20	mm	4.8500	5.3540	5.0990	0.097	1.90
Stress at Peak	20	N/mm^2	42.500	55.800	49.260	4.403	8.94
Energy to Peak	20	N.m	0.1043	0.1708	0.1344	0.019	14.14
Force at Break	20	N	48.900	67.000	58.420	5.479	9.38
Deformation at Break	20	mm	5.0530	5.3540	5.1241	0.078	1.52
Stress at Break	20	N/mm^2	42.500	55.800	49.120	4.412	8.98
Energy to Break	20	N.m	0.1056	0.1708	0.1357	0.018	13.26
Force at Yield	20	N	19.800	54.300	39.000	7.170	18.38
Stress at Yield	20	N/mm^2	27.300	38.900	33.660	4.011	11.92
Energy to Yield	20	N.m	0.0277	0.1215	0.0584	0.022	37.67
Youngs Modulus	20	N/mm^2	66.65	147.95	195.32	17.850	9.14

Means followed by the letter(s) within a column and treatment set are not significantly different using DMRT (P=0.05)

Table 3 shows the effects on number of bulbs, weight of the bulb and diameter of the bulb at harvest. The application of foliar extract with concentration 50% and twice application produced more number of onion bulb of 16.37, heavier bulb yield of 76.87g with longer bulb diameter of 18.88cm while lowest number of bulb of 12.00, 10.39g and 8.94cm were obtained from the control. The result obtained might be due to the fact that different concentrations of moringa extract have increased protein content and carbohydrate when compared with untreated onion (control). In all characteristics measured, *Moringa* extract with concentration 50% and twice foliar

application produced the highest and this might be as a result of very little quantities of the extract (1litre of extract/50 litres of water) when compared with other concentration (1litre/25litre of water); (1litre extract/31litre of water) and (1litre of extract/27litre of water). According to definition of plant growth regulator; very little quantities of hormone which influence plant growth when they are applied, contributes to the growth and yield of onion (Ortuno *et al.,* 1999). The performance of foliar application of moringa with 50% concentration might also be attributed to little amount required for rapid increase in cell-division, cell-enlargement, strengthens plants, with improves resistance to pests and diseases, prolong life-span, increases in number of leaves which eventually produces more and higher bulbs (Fuglie, 2001). These findings have also been supported by Price (1985) who reported an increase in growth and yield of crop due to use of moringa extrat. The more number of leaves produced on the application of extract with 50% might be, linked with the efficiency of photosynthetic apparatus, which leads to increase in number of bulb produced. This finding is in conformity with Azooz *et al.,* (2004) who reported the accumulation of carbohydrate due to different concentration of GA_3 & IAA treatment might be linked with the efficiency of photosynthetic apparatus, which leads to increase in plant productivity and dry matter production.

CONCLUSION

Foliar application of Moringa extract with concentration 50% and twice application have a good potential for improving growth and yield of onion since *Moringa* extract has some nutritional potentials and it can also improve the nutrient of onion. Based on the result, application of extract with 50% concentration and twice application should be adopted for use in Northern guinea savannah ecological zone on the variety of onion tested, since it is easier to get all year round and in large quantities for large hectare of farm land.

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