FERTILIZATION OF MORINGA LEAFEXTRACT ON GROWTH, YIELD AND QUALITY OF SWEET BELL PEPPER (*CAPSICUMANNUUM*).

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Abstract -Pot experiment was carried out at the teaching and research farm of the department of Agricultural Technology, Captain Elechi Amadi Polytechnic, Rumuola, Port Harcourt to evaluate the effect of rates of moringa leaf extract on growth and fruit quality of bell pepper Capsicum annuum. The treatment were rates or concentrations of the moringa leaf extract (0%, 4%, 8% and 12%) applied to soil filled polybags, arranged in a randomized complete block design replicated three times and using replicates as blocks. The parameters evaluated were plant height, Fruit fresh weight, Fruit dry weight, Proximate analysis, Lycopene and Vitamin A contents. The results show that fresh and dry weight of the bell pepper increased as moringa leaf extract increased. While moisture content increased with decreasing levels of moringa leaf extract, protein, fats, carbohydrate, ash, lycopene, vitamin A and vitamin C contents increased with increasing levels of moringa leaf extract. 12% concentration recorded the highest value in all parameters evaluated. Application of 12% concentration of moringa extracted is recommended.

Keywords: -Bell Pepper Fertilization, Moringa Extract, Yield and Quality

I. INTRODUCTION

Environmentally sustained agriculture is the main drive among the stakeholders in the agri-environmental sector. The use of chemical fertilizers has been identified as one of the factors that have adverse effects on the environment. Chemical fertilizers have also been reported to be detrimental to soil fertility and soil fertility management [1]. So apart from upsetting the soils ecology, it causes crops to be susceptible to pests and diseases ([2],[3]). As a result, environmentally friendly agriculture methods and practices like the use of organic manuring are being encouraged. Various sources and types of organic manures like poultry manure and livestock dung have been used in crop production in recent times in Nigeria but little is known about the use of moringa extract to cultivate crops.

The use of various forms of Moringa oleifera in soil fertility enhancement, crop mineral nutrition and improving quality in crop production is gaining much importance in its use in crop production. The leaves extract aids plant growth, encourages resistance to stress and increases yield of crops ([4],[5],[6]). Moringa leaves have hormonal crop growth promoting

properties which can ameliorate the constraint of low fertility ([7], [8]). This implies that moringa extract can enhance soil fertility, improve crop growth, and yield and positively influence crop produces nutritional quality since there is a direct correlation between plant nutritive value with soil nutrient status [9]. There is not much documented on the quality of crop produce fertilized with moringa leaf extract.

Leafy and fruit vegetables are important because they supply human nutritional requirements. They have been described as high- nutritive value crops high in vitamins, minerals and fibre[10], and they require high soil nutrient status of optimum production of quality crops.

The peppers including bell pepper are widely consumed in Nigeria and the use of moringa extract may be beneficial in bell pepper production and hence improve the nutrition diet of the people.

The study was therefore undertaken to determine the effect of

1. Rates of moringa leaf extract on vegetative growth of sweet bell pepper
2. Rates of moringa leaf extract on fruit yield of sweet bell pepper
3. Rates of moringa leaf extract on fruit quality of sweet bell pepper.

II. MATERIALS AND METHODS

A. Location of Study

The experiment was carried out at the teaching and research farm of the department of Agricultural Technology, Captain Elechi Amadi Polytechnic, Rumuola, Port Harcourt. The institution is in the tropical rain forest ecological zone with the rainfall stretching over ten months with double maxima in July and September.

B. Materials

Sandy loam soil was filled into Poly bag of 27cm height and width 30cm and arranged in the field according to the experimental design. Other materials used were, shovel, hand trowel, wheelbarrow, measuring meter rule, 5F-400 electronic weighting scale and Moringa leave.

C. Experimental design

The experimental treatment was Moringa extracts at levels of concentration 0%, 4%, 8%, and 12%. The experiment design was therefore a randomized complete block design with four treatments replicated three times and using the replicates as blocks. Thus, total experimental units were 4 x 3 = 12 polybags.

D. Moringa leaf extract preparation

The moringa extract was prepared by crushing 10kg of leaves in one liter of water before filtering it. The filtrate was then be diluted in water to give the desired concentration or rate of 0%, 4%, 8% and 12%.

E. Cultural practice

The polybags were filled with topsoil to a depth of 25cm and arranged in open field at the research farm. Randomization was in one direction such that same treatment will not occur within same column or replicate.

Already nursed pepper seedling were transplanted into the polybags and then fertilized with the appropriate moringa concentration or rate.

Weeding was done by hand picking and the plants were rainfed.

F. Data Collection and Data Analysis

Growth and yield parameter of bell pepper measured were plant height, leaf area, fruit fresh weight, and fruit dry weight while quality was assessed by determining the Proximate composition, according to [11], Lycopene and Vitamin A contents in the bell pepper fruits.

Determined values of parameters measured were subjected to statistical analysis and means separated by Duncan Multiple raise test using SPSS 19THedition.

III. RESULTS AND DISCUSSIONS

A. Effect of Moringa Leaf Extract on Vegetative Growth of Bell Pepper

In this study, bell pepper plants grew taller with increasing levels or rates of moringa plant extracts. The plant height or growth rate increased progressively as the concentration of moringa extract increased. Thus, the control plants not fertilised with moringa extracted produced the shortest plants while the bell pepper plants that received the highest concentration of moringa extract had the tallest plants. Similarly leaf production in bell pepper was positively favoured by moringa extract fertilisation, consequently number leaves and leaf area increased with statistical significance from the least values at 0% extract concentration to the highest values expressed by the highest moringa extract concentration of 12%.This finding conformed with that of [1] who reported that bell pepper plants that received moringa extracts produced better vegetative characteristics compared to the control plant that were not fertilized with moringa extract. It also corresponds to the effect observed in the use of poultry manure another organic fertilizer reported by [12]in tomatoes planted in guinea savanna region of Nigeria.

Table 1. Effect of rate of Moringa Extract on vegetative growth of Bell Pepper.

	Vegetative Growth		
	Plant height (cm)	No. of leaves	Leaf Area (cm2)
Moringa extract levels			
0%	24[a]	10[a]	63.8[a]
4%	48[b]	21[b]	120.9[b]
8%	54[c]	28[c]	138.35[c]
12%	71[d]	33.3[d]	133.83[d]
SE	0.169	3.145	0.109
Fcal	*	*	*

Means with different alphabets in same column are statistically different at P = 0.5% by Duncan multiple range test (DMRT)

B. Effect of Moringa Leaf Extract on Fruit Yield of bell pepper

The effect of moringa leaf extract on average fresh and dry weight of bell pepper is shown in table two. The result show that the fresh weight of bell pepper increased with increasing concentration or rate of moringa extract. The least weight was observed in the control plants that received only water or no extract. The highest weight was observed in bell pepper plants that received the highest moringa leaf extract concentration (12% extract)

The same observation was obtained in the dry weight of bell pepper. Dry weight was least in the control (zero level of application) and had the most weight in the highest level of application. Just like the fresh weight increasing level of application of moringa extract resulted in higher dry weight of bell pepper.

These indicated that higher levels of moringa rates an organic manure, led to higher growth accumulation in the fruit and higher dry matter accumulation. This trend is like the report of [13] who observed increasing fruit weight of cayenne pepper with increasing rates of poultry manure another organic manure.

Table 2. Yield Response of bell pepper to levels of application of moringa

Moringa extract Levels	Number of fruits	Fresh weight (g)	Dry weight (g)
0%	3[a]	0.78 [a]	0.31[a]
4%	6[b]	1.11[b]	0. 56[b]
8%	9[c]	1.82[c]	0.98[c]
12%	12[d]	2.41[d]	1.33[d]
SE	0.257	0.235	0.562
Fcal	*	*	*

Means with different alphabets in same column are statistically different at P = 0.5% by Duncan multiple range test (DMRT)

C. Proximate analysis values of bell pepper fertilized with rates of moringa leaf extracts.

The result of the proximate analysis values of bell pepper in response to different concentration of moringa extract is shown on table three. The result shows that the control plants had more water constituent and 12% receiving plants had least water. Moisture content thus increased with reducing rates of moringa extract.

Protein content increased with increasing concentration of applied moringa leaf extract. There was not much difference in the lipid levels of bell pepper as a result of the application of moringa extract. The carbohydrate level (CHO levels) showed that increasing rates of moringa leaf extract increased the amount of carbohydrate in the bell pepper, just as the ash content in the bell pepper fruits increased with increased levels of application of moringa leaf extract. This observation in this study is in line with the finding of several researchers. For instance,[14] reported increasing levels of protein lipids and mineral with increasing levels of organic manure, the above was similar to the observation in this study. This study also observed increasing levels carbohydrate with increasing rates of moringa, the same was observed by [15] in pepper *Capsicum annuum*.

Table 3. Influence of moringa leaf extract concentration on proximate analysis of bell pepper Moringa extract

Levels	Moisture (%)	Protein (%)	Lipid (%)	CHO(%)	Ash (%)
0%	91.54^{c}18.89^{a}	1.11^{a}	2.13^{a}	12.47^{a}	
4%	85.35^{b} 20.85^{b}	1.17^{a}	2.316^{a}	15.12^{b}	
8%	82.68^{b} 23.21^{c}	1.23^{a}	2. 95^{b}	15.85^{b}	
12%	80 .17^{a}27.97^{d}	1.27^{a}	3.31^{c}	16. 97^{c}	
SE	0. 452	0.141	0.311	0.325	0.091

Means with different alphabets in same column are statistically different at P = 0.5% by Duncan multiple range test (DMRT)

D.Effect of Rates of Moringa Leaf Extract on Lycopene and Vitamin C

The influence of moringa leaf extract on lycopene and vitamin C content on bell pepper is shown in table four. The table indicate that lycopene content of bell pepper fruit increased as the concentration of moringa leaf extract increased. 12% concentration had the highest lycopene content followed by 8%, then 4% and least 0%. This observation in this study is similar with the report of [13] in cayenne pepper who observed increase of lycopene levels of the pepper with increasing levels of poultry manure. This means that since lycopene is a precursor to vitamin A, increasing levels of moringa leaf extract will increase vitamin content in bell pepper.

Vitamin C content was observed to be increased in bell pepper fruit in this study as the levels of moringa leaf extract increased. This finding is similar with those of [15] who observed and reported an increasing content of vitamin C in pepper *Capsicum annuum* with increasing rates of moringa leaf extract application.

Table 4. Effect of levels of moringa leaf extract on Lycopene and Vitamin C

Moringa extract Levels	Lycopene	Vitamin C mg/kg
0%	18.89[a]	60.02[a]
4%	20.21[b] 67.91[b]	
8%	21.23[c]70.78[b]	
12%	22.87[d]	82.93[a]
SE	0.332	0.151

Means with different alphabets in same column are statistically different at P = 0.5% by Duncan multiple range test (DMRT)

IV. SUMMARY AND CONCLUSION

The experiment was carried out to determine the effect of rates of moringa leaf extract on growth, yield and fruit quality of bell pepper (*Capsicum annuum*). This studyshowed that growth, leaf production, fresh and dry weight of the bell pepper increased as moringa leaf extract increased. While moisture content increased with decreasing levels of moringa leaf extract, protein, fats, carbohydrate, ash, lycopene, vitamin A and vitamin C contents increased with increasing levels of moringa leaf extract.

Increasing concentration of moringa leaf extract will increase the quality of bell pepper fruit. 12% concentration recorded the highest value in all parameters evaluated. Application of 12% concentration of moringa extracted is recommended for bell pepper production.

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