

## Effect of Organo Mineral Fertiliser and Poultry Manure on the growth, proximate and nutritional analysis of two cultivated varieties of *Corchorus olitorius*

Ogunjinmi S.O.<sup>1</sup>, Olunloyo A.A.<sup>2</sup>, Okoro Robinson M. O.<sup>1</sup>, Olla N.O.<sup>3</sup>,  
Ogunjinmi O.E.<sup>4</sup>, Alabi A.S.<sup>5</sup> and Oladapo Y.<sup>6</sup>

<sup>1</sup>Department of Crop Production Technology, Oyo State College of Agriculture and Technology Igboora, Nigeria.

<sup>2</sup>Department of Agricultural Technology, Federal College of Forestry, Ibadan, Nigeria

<sup>3</sup>Department of Soil Science Technology, Oyo State College of Agriculture and Technology Igboora, Nigeria.

<sup>4</sup>Chemistry Department, The Polytechnic, Ibadan, Ibadan, Nigeria

<sup>5</sup>Department of Forest Technology, Oyo State College of Agriculture and Technology Igboora, Nigeria

<sup>6</sup>Department of Agricultural Technology, State Oyo College of Agriculture and Technology Igboora, Nigeria.

Corresponding author: E-mail: [tolasayo@gmail.com](mailto:tolasayo@gmail.com). 08038174622

### Abstract

A pot experiment was conducted at the Experimental site of the Department of Agricultural Technology, Oyo State College of Agriculture and Technology, Igboora to evaluate the effect of organomineral fertiliser and poultry manure on growth, proximate and nutritional analysis of two cultivated varieties of *Corchorus olitorius* (Angbadu and Oniyaya). The experimental design was a 2 x 3 factorial arrangement in Complete Randomized Design (CRD) and replicated four times. The treatments were 0 t/ha<sup>-1</sup> (Control) and 10 t/ha<sup>-1</sup> (poultry manure and organomineral fertiliser). Data were collected on the growth parameters (number of leaves, plant height and stem girth) at 3, 4, 5 and 6 weeks after planting (WAP). Proximate composition of the shoots (leaves and stems) and roots were evaluated. Results obtained showed that there was a significant effect of the application of poultry manure and organomineral fertiliser at 10 t/ha<sup>-1</sup> on the growth components of the 2 varieties compared to the control. There were significant differences in the leaf count among the treatments with the treatment that had poultry manure application producing the highest leaf count of 68.5 in the Angbadu variety. There was also a significant effect of the application of poultry manure and organomineral fertiliser on the proximate analysis of the varieties. As regards proximate analysis, the Angbadu variety of *Corchorus olitorius* that had the application of organomineral fertiliser had a higher mean value of crude protein (9.63%), crude fibre (6.04%), dry matter (87.35%) and total carbohydrates (61.67%). Poultry manure and organomineral fertiliser could serve as sources of nutrients for *Corchorus olitorius* production where available.

**Key words:** Growth; Organomineral fertiliser; Poultry manure; Proximate analysis.

### Introduction

In Nigeria, as in most other tropical countries of Africa where the daily diet is dominated by starchy staple foods, vegetables are the cheapest and most readily available source of important protein, vitamins, minerals and essential amino acids (Onwordi *et al.*, 2009). Green leafy vegetables are a regular feature in the diet of most Nigerians. According to the

World Health Organization, adequate fruit and vegetable intake entails a consumption of at least 400g of fruits and vegetables per day per capita (an equivalent of 146kg per year per capita). The low consumption of fruits and vegetables globally (below the recommended requirement) is said to be responsible for the increased incidence of cardiovascular diseases as well as some cancers; the two leading causes of death worldwide.

*Corchorus olitorius* belong to the family *Tiliaceae*. It is a popular leafy vegetable grown for its tender fresh leaves rich in vitamins, minerals, protein and carbohydrates. The plant is mainly cultivated for its leaves in Nigeria. (Schippers, 2000). The two most common types in Nigeria are the “Oniyaya” which grows to a height of 15cm and widely branched with broad, deeply serrated leaves and the “Angbadu” which grows taller than the Oniyaya with large finely serrated leaves that are oblong in shape. Among the Yoruba-speaking tribe of southwestern Nigeria, there is a preference for Oniyaya because of the belief that is more mucilaginous (Olasantan, 1992).

A major factor responsible for the reduction in growth and yield of plant is soil fertility. Lack of essential nutrient supply and other soil-related factors such as soil structure, soil pH, leaching are also contributory problems to agricultural production systems in small scale farming.

Fertiliser is any material of natural or synthetic origin that is applied to soil or to plant tissue (usually leaves) to supply one or more plant nutrients essential to the growth of plants. In view of the above, mineral fertilisers and organic fertilisers (ammonium sulphate, urea, NPK 15:15:15, poultry manure, compost) have been widely used by farmers to supplement soil nutrients in order to increase the yield of grown vegetables. Meanwhile, despite the fast nutrient-releasing potential of mineral fertilisers which meet the immediate needs of crops, they are scarce, expensive and have a high pollution effect on the soil and environment (Senjobi *et al.*, 2010). Organomineral fertilisers are developed from farm and city waste and may be fortified with inorganic nitrogen or

nitrogen-phosphorus fertilisers. Organomineral fertiliser is a low input organic fertiliser which is used for improving the nutrient status of tropical soils for sustainable crop production as it combines the good attributes of both sources to enhance yield of crops (Egbuchua and Enujeke, 2013). The intensive cultivation of available land with little or no fertility management has been one of the major factors contributing to the decline in levels of soil nutrients. Improving soil fertility through inorganic fertiliser application has become a major factor that has enabled the world to feed millions of people. However, efforts are being made by researchers globally in finding a possible shift from inorganic fertilisers to organic fertilisers which are cheaper, more readily available to farmers and could maintain soil physical and chemical properties without pollution effect (Senjobi *et al.*, 2010).

The application of materials which are organic and of low input for improving the nutrient status of tropical soils for sustainable crop production and also to overcome the disadvantages of inorganic fertilisers on the environment can be employed using organic-based fertilisers such as organomineral fertilisers. This low input technology based on ready availability, ease of transportation and storage of organomineral fertiliser manufactured from waste in urban centres make it imperative to look at the possibility of the utilisation of organomineral fertiliser to replenish soil nutrients for the cultivation of the two varieties of *Corchorus olitorius* in Nigeria.

This study was therefore carried out to evaluate the effect of organomineral fertiliser and poultry manure on the growth, proximate and nutrition analysis of two

cultivated varieties of *Corchorus olitorius*.

## Materials and Method

### Experimental site

The pot experiment was carried out at the Department of Agricultural Technology, Oyo State College of Agriculture and Technology (OYSCATECH), Igboora, Oyo State. It is located in Latitude 07° 43'N and longitude 03°28'E during the rainy season period.

### Materials used

Two local varieties of *Corchorus olitorius* (Oniyaya and Angbadu) are used and two types of organic fertilisers (Organomineral (O.M) and Poultry Manure (P.M)). The organomineral fertiliser was acquired from Pacesetter Organomineral Fertiliser Plant; Ibadan.

### Experimental treatments, design and cultural practices

Organomineral and poultry manure was applied at rate of 10  $\text{tha}^{-1}$  and 0  $\text{tha}^{-1}$  (control) at two weeks before planting. The experimental design is a factorial of 2x3 arranged in Complete Randomized Design (CRD) and replicated four times making total number of twenty four (24) pots.

Planting was done by broadcasting method of the mixture of 0.5g of *C. olitorius* seeds and 0.1g of fine sand into the pots and were later thinned to twenty (20) stands per pot. Necessary cultural practices such as watering, weeding and pesticides application were also carried out.

### Physical and chemical analysis of soil and organomineral fertiliser

Prior to cropping, organomineral fertiliser and soil samples (0 to 20cm depth) were collected for chemical and physical

analysis. The top soil samples were randomly collected with auger, bulked and sieved through 2 mm mesh. Soil pH was determined in 1:2 water ratios with pH meter. Organic matter was analyzed by normal Walkely Black Dichromate Method, Nitrogen by micro-kjedahl method, available P was extracted with Bray-1 method (Bray and Kurtz, 1945) and the phosphorus in the extract was determined spectrometrically. Exchangeable potassium (K), calcium (Ca), sodium (Na) and magnesium (Mg) were extracted with 0.1 N ammonium acetate. Potassium (K) and Na were read with flame photometer, while Ca and Mg were determined using absorption Atomic Spectrophotometer (AAS). Micronutrients (Fe, Cu, Zn and Mn) were extracted with HCl and read on AAS.

### Data collection and statistical analysis

Agronomic parameters were collected on the growth parameters of number of leaf, plant height and stem diameter at 3, 4, 5 and 6 weeks after planting (WAP); proximate parameter of wet and dry matter weight of shoot (leaf and stem) and root, moisture content; nutritional parameters of crude protein, fat, fibre, total ash and total carbohydrate.

Data collected were analyzed for differences using analysis of variance (ANOVA) techniques based on statistical analysis software DSAASTAT ver. 1.101 (2011). The means were separated with Duncan's Multiple Range Test (DMRT) at 5% level of significance.

## Results

### Characteristics of the experimental soil, nutrient content of poultry manure and organo-mineral fertiliser (Grade B)

The soil of the experimental plot was slightly acidic, with pH value of 6.0. The

organic carbon and total nitrogen were relatively low. Available phosphorus and potassium were very low. Mechanical analysis indicated that the soil is loamy sand (Table 1). The pH value of the poultry manure was 7.10 with a high value of total nitrogen, available phosphorus and total carbon. The available potassium, magnesium, sodium and calcium had lesser values compared to the soil.

The chemical properties of the organomineral showed higher values of calcium, potassium, total nitrogen and manganese.

### **Effects of organo-mineral fertiliser and poultry manure on the growth parameters of *Corchorus olitorius***

#### ***Stem diameter***

The result presented in Table 2 shows there were significant differences in the effect of the application of the treatments in the weeks. There were significant differences at weeks 3, 5 and 6 with poultry manure application having the highest mean values in both varieties but these were not significantly different from the organic manure application and they were significantly different from the control in both varieties.

**Table 1: Physico-chemical properties of the soil nutrient content of poultry manure and organomineral fertiliser (Grade B).**

<b>Properties</b>	<b>Soil</b>	<b>Poultry Manure</b>	<b>Organomineral fertiliser (Grade B)</b>
pH(H <sub>2</sub> O)	6.00	7.10	
Ca (mol/kg)	5.28	4.31	6.00
Mg (mol/kg)	1.45	0.92	
K (mol/kg)	0.48	0.214	6.00
Na (mol/kg)	0.96	0.273	0.80
Al+H (mol/kg)	0.06		
ECEC (mol/kg)	8.23		
Base saturation (%)	99.27		
Total N (%)	0.10	0.34	16.80
Total org C (%)	0.87	6.35	
Average P(mg/kg)	4.22	1040.23	10.30
Mn (mg/kg)	198.00	0.091	572.00
Fe (mg/kg)	13.05	0.356	306.00
Cu (mg/kg)	3.25	0.014	355.30
Zn (mg/kg)	5.80	0.106	96.00
Sand (%)	83.40		
Silt (%)	8.00		
Clay (% <sup>^</sup> )	8.60		
C/N(ratio)		18:68	

**Table 2: Effects of organomineral fertiliser and poultry manure on the stem diameter of *Corchorus olitorius*.**

VARIETY	TREATMENT	Week 3	Week 4	Week 5	Week 6
Angbadu	Control	0.1000b	0.125	0.2000b	0.2750b
	OM	0.2000a	0.2375	0.3500a	0.4750a
	PM	0.2125a	0.325	0.4000a	0.5000a
Oniyaya	Control	0.1000b	0.1125	0.2000b	0.2750b
	OM	0.2000a	0.2875	0.4000a	0.4850a
	PM	0.1875a	0.2875	0.4250a	0.5000a

\*Means with the same letters in each column are not significantly different at  $P < 0.05$

### Plant height

The mean plant height (cm) results showed that there were significant differences among the treatments. The control has the least mean plant height for both varieties in all the weeks.

The poultry manure application had the highest mean plant height for both varieties in the weeks observed. At week 6 the highest mean plant height was recorded in poultry manure application of Variety Angbadu and was not significantly different of that of Variety Oniyaya and organic manure application on Variety Angbadu and which is significantly different of organic manure application on Variety Oniyaya.

### Number of leaves (leaf count)

The mean number of leaves result of the effect of different sources of manures on the 2 varieties of *Corchorus olitorius* shows that there is significant difference among the treatment on the weeks observed. The control has the least mean plant height in both varieties in all the weeks. The poultry manure application have the highest mean plant height in both varieties in the weeks observed. At week 6 the highest mean number of leaves was recorded in poultry manure application on both varieties and was not significantly different from that of the application of organomineral fertiliser.

**Table 3: Effects of organomineral fertiliser and poultry manure on the plant height of *Corchorus olitorius*.**

VARIETY	TREATMENT	Week 3	Week 4	Week 5	Week 6
Angbadu	Control	6.70de	9.07bc	13.00b	20.50c
	OM	12.22cd	20.43ab	35.88a	63.12ab
	PM	18.65ab	28.82a	42.67a	68.50a
Oniyaya	Control	5.55de	7.42c	10.75b	17.70c
	OM	15.00bc	20.20ab	32.62a	53.12b
	PM	21.25a	29.10a	44.38a	68.12a

\*Means with the same letters in each column are not significantly different at  $P < 0.05$

**Table 4: Effects of organomineral fertiliser and poultry manure on the leaf count of *Corchorus olitorius*.**

VARIETY	TREATMENT	Week 3	Week 4	Week 5	Week 6
Angbadu	Control	6.25bc	9.25b	16.75b	29.75b
	OM	8.45abc	23.00a	48.75a	80.50a
	PM	11.25a	25.50a	51.50a	91.50a
Oniyaya	Control	4.75c	7.75b	17.25b	25.75b
	OM	9.75ab	25.25a	53.75a	97.50a
	PM	11.25a	25.25a	52.00a	93.00a

\*Means with the same letters in each column are not significantly different at  $P < 0.05$

#### Effects of organo-mineral fertiliser and poultry manure on the proximate and nutritional parameters of *Corchorus olitorius*.

##### Wet and dry weight

The Table 5 shows the wet and dry weight of the various parts of the two varieties of *Corchorus olitorius* as affected by different manures. Poultry manure had highest means in all the parameters assessed and was not significantly different from organomineral application and they are both significantly different from the

control. Variety Oniyaya had the highest mean total fresh and dry weight with poultry manure application.

##### Nutrition analysis

The results of the proximate and chemical analysis of *Corchorus olitorius* are shown in the Table 6. Nutritional analysis showed that the application of organomineral fertiliser to Variety Angbadu had higher mean crude protein (9.63%), crude fibre (6.04%), dry matter (87.35%) and total carbohydrate (61.67%) and the least mean moisture content of 12.65%.

**Table 5: Effects of organomineral fertiliser and poultry manure on the wet and dry weight *Corchorus olitorius* root and shoot.**

Variety	TRT	Fresh Root Weight (g)	Fresh Shoot weight (g)	Dry Root Weight (g)	Dry Shoot Weight (g)	Total fresh weight (g)	Total dry weight (g)
Angbadu	Control	0.47b	1.65b	0.10b	0.15b	4.20c	0.44b
	OM	3.70a	16.85a	0.90a	2.08a	11.68b	1.81ab
	PM	3.45a	16.32a	1.02a	2.38a	12.50b	2.14ab
Oniyaya	Control	0.50b	1.42b	0.10b	0.15b	5.17c	0.79ab
	OM	4.12a	16.85a	1.10a	2.58a	15.55ab	2.72ab
	PM	3.95a	19.07a	1.05a	2.92a	18.62a	2.85a

\*Means with the same letters in each column are not significantly different at  $P < 0.05$

**Table 6: Effects of organomineral fertilizer and poultry manure on the phytochemical properties of *Corchorus olitorius* leaf**

Variety		Crude Protein %	Crude Fat%	Crude Fibre%	Total Ash%	Moisture%	Dry Matter %	CHO%
Angbadu	Control	6.88	0.43	5.44	18.95	12.65	80.95	50.37
	O.M	9.63	0.46	6.04	19.18	16.53	87.35	61.67
	P.M	9.35	0.45	5.96	24.17	19.05	83.47	58.65
Oniyaya	Control	5.63	0.44	4.27	19.49	13.26	77.9	53.07
	O.M	5.94	0.45	5.08	20.64	17.98	86.74	61.38
	P.M	6.69	0.47	4.87	22.46	22.1	82.02	54.04

### Discussion

Most plants take nitrogen from the soil continuously throughout their lives and nitrogen demand usually increases as plant size increases. A plant supplied with adequate nitrogen grows rapidly and produces large amounts of succulent, green foliage.

The nitrogen content in poultry manure is adequate to boost the two varieties of *Corchorus* (Angbadu and Oniyaya) than the organomineral fertiliser in stem diameter, plant height and number of leaves as a resulting effect on soil compaction with the optimum amount of water and air is achieved. Poultry manure improves the soil fertility as well as soil texture and encourages microbial activity and ultimately conditionalize nitrogen efficacy by supporting of nitrogen utilization.

The results of this study showed that the tallest plants, highest number of leaves and stem diameter recorded in poultry manure application or treated varieties of *Corchorus* can be attributed to the nitrogen concentration. This was in accordance with the work of Adenawoola and Adejoro (2005) who reported that poultry manure increase the growth parameters of *C. olitorius*. Marti and Mills (1991) also reported that adequate supply of nitrogen is

associated with vigorous vegetative growth resulting from high photosynthetic activities. Opeyemi and Adegboyega (2003) noted that animal manure increase number of leaves and stem girth of *C. olitorius*.

The biomass parameters of fresh and dry weight of root and shoot results showed that the poultry manure and organomineral fertiliser application were higher than the control. This result is in accordance to that obtained by Schippers (2000) who reported that the use of manure significantly influence the vegetative yield of *C. olitorius*. Said (1997) reported that the addition of organic manure increase the growth characteristics such as plant height, number of leaves and shoot per plant including fresh root and shoot weights. Also Aluko *et al.*, (2014) reported that the overall performance of *C. olitorius* treated with fertilisers have thicker stem, more leaves and higher dry matter than unfertilized plants.

The phytochemical analysis of the two varieties of *Corchorus olitorius* in percentages of crude protein, crude fat, crude fibre, total ash, moisture, dry matter and carbohydrate were more in content as influenced by poultry manure and organomineral fertilizer application than those of the untreated application. The

application of organomineral fertiliser have higher percentage content in crude protein, crude fat, crude fibre, dry matter and carbohydrate in Angbadu while poultry manure had higher percentage content in total ash and moisture. In Oniyaya variety, poultry manure had higher percentage content in crude protein, crude fat, total ash and moisture. These trends had been reported by Mishra and Gamesh (2005) where they tested how different fertilisers affect the nutrient status of *Abelmoschus esculentus*.

### Conclusion

The results from this study have shown that application of organic manure source on the two varieties of *Corchorus olitorius* positively affects growth performance, proximate and nutritional content. The results showed that the two varieties of *Corchorus olitorius* responded differently to the treatments in relation to growth parameters, biomass and phytochemical composition. The difference between the responses of the two varieties to fertilisers application on growth might be a genetic factor as the two varieties were subjected to the same nutrient and environmental condition.

This study also corroborates with the earlier report of Makinde *et al.*, 2011 that significant higher growth advantage is exhibited by *Corchorus olitorius* with application of the two sources of organic manure over *Corchorus olitorius* without application of manure (Control) throughout the growth period, had proved that there is better growth performance in *Corchorus olitorius* when there is addition in form of organic fertiliser to improve soil nutrient. Also the two sources of organic manure exhibited a more biomass proximate and

better nutritional content than those grown without addition. Plants can only perform well when they enjoy balanced nutrition. *Corchorus olitorius* treated with organic based fertiliser had better yields because they enjoyed balanced nutrition as they contain N, P, K, Ca, Mg and little amount of trace elements such as Mn, Fe, Cu and Zn (Ayeni, 2011).

### Recommendation

Soil amended with application of organomineral can play a vital role in replenishing soil nutrients for the cultivation of crops by small scale farmers because of its availability from urban waste materials, ease of transportation and storage. These features can be fully harnessed by rural farmers who do not have access to poultry farms that can supply them with the required quantities they need for their crop production. It is recommended that low cost base organic farming be adopted by *Corchorus olitorius* farmers instead of high cost inorganic farming.

Therefore, it is recommended that the application of organomineral fertiliser can be recommended for the cultivation of *Corchorus olitorius*. The promising number of leaves and nutritional content obtained with organomineral fertiliser is a pointer to its potential use as nutrient supply in enhancing vegetable production in Nigeria. The use of organomineral fertiliser for *Corchorus olitorius* should be encouraged by farmers because they all contain all the essential elements required by *Corchorus olitorius*; this will bring about yield increase in crop.

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