PERFORMANCE OF JUTE MALLOW (*Corchorus olitorius*) AS AFFECTED BY ACCESSION AND POULTRY MANURE APPLICATION RATES

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Abstract
The study was conducted to evaluate the performance of *Corchorus olitorius* as influenced by accession and poultry manure application rates. The experiment was a 8x4 factorial in completely randomized design (CRD) with four (4) replications. There were four poultry manure (PM) application rates: (0, 7.5, 15 and 22.5 t/ha) and eight accessions of *C. olitorius*. Results of the analysis of variance indicated that accession significantly ($P < 0.05$) affected the number of branches, number of flowers, number of fruits, number of leaves and biomass yield at 8 weeks after transplanting (WAT). Number of branches, number of fruits and number of leaves differed with the accessions at 8 weeks after pruning (WAP). At 8 WAT, accession Ik-1 produced more branches, highest number of flowers and heaviest biomass yield. Maximum number of fruit was obtained in accession Ib-2. Number of leaves was more in Ka-1 accession. At 8 WAP, accession Ka-1 had the highest number of branches and number of leaves. Highest number of fruits was associated with accession Ik-1. Poultry manure application rates showed positive impact on some of the growth and biomass yield of *C. olitorius*. More number of leaves was recorded in plants grown with 7.5 t/ha of PM at 8 WAT. Highest biomass yield was ascribed to the application of 12.5 t/ha of PM which was at par with 7.5 t/ha of PM. At 8 WAP, maximum number of branches and number of leaves were obtained in plants treated with 15 t/ha of PM. Number of fruits increased in plants that received 7.5 t/ha of PM. Interaction of poultry manure x accession had positive influence on most of the parameters evaluated except number of flowers at 8 WAP. Accessional variability in growth and biomass yield warrants selection for crop improvement while application of poultry manure at 7.5 t/ha is recommended for the production of *C. olitorius*.

Key words: *Corchorus olitorius*, accession, poultry manure, performance

Introduction

Jute mallow (*Corchorus olitorius*) belongs to the family Tiliaceae. It is an annual herb and that is widely consumed as a vegetable among rural communities in most parts of Africa (Hassan and Kadhim, 2018; Ndlovu and Afolayan, 2008). *Corchorus olitorius* can reach a height of 2 to 4 m. The plant has a simple, lanceolate, finely serrated leaf distributed alternately (Hassan and Kadhim, 2018). It has small yellow flowers of 2 to 3 mm in diameter with 5 petals. The fruit has numerous seeds enclosed in it. *Corchorus olitorius* is known as wild okra, Jew's mallow and jute mallow (Loumerem and Alercia 2016). In Nigeria, jute is called 'Ahihara' in Igbo, 'Ewedu' in Yoruba and 'Malafiya' in Hausa (Ogunkanmi *et al.*, 2010).

Corchorus olitorius leaves are traditionally used for making soup to accompany starchy balls made from millet, cassava and yam especially among the Yorùbá of southwestern Nigeria (Samuel *et al.*, 2020). Among the people of Okun-Yorùbá speaking communities in Kogi State of North central Nigeria, the young fresh fruits are made into soup known as Tànkèlèkàn which is comparable to Okra. The slimy nature of the soup makes it suitable for easy consumption of starchy balls (Garjila *et al.*, 2017). The leaf is a good source of protein, β-carotene, calcium, iron, vitamin C, folic acid and vitamin B (Sinha *et al.*, 2011; Mavengahama *et al.*, 2013). Many of these indigenous vegetables are more nutritious and they thrive well in rural subsistence farming systems when compared with exotic vegetable species like cabbage and spinach (Modi *et al.*, 2006; Ndlovu and Afolayan, 2008). They have the potential to combat hunger and malnutrition (Jansen Van Rensburg *et al.*, 2004) and fight against modern age diseases such as cancer, HIV and AIDS (Zakaria *et al.*, 2006; Masarirambi *et al.*, 2010). Medicinal uses of *C. olitorius* have been documented by many authors. The leaves and roots are used as herbal medicine for treating gonorrhea as well as toothache (Hillocks, 1998; Asia Vegetable Research Development Center (AVRDC), 2004). Fibres from the bark are used for weaving bags, net and textile production (Sinha *et al.*, 2011).

Earlier reports of Baiyeri and Samuel-Baiyeri (2022) and Baiyeri *et al.* (2023) established the variability in nutritional composition of the fruits of five *C. olitorius* accessions grown in Ekiti State. Stevens *et al.* (2018) reported accessional differences in growth and yield of 20 accessions of Moringa in Nsukka. Previous study by Isuosuo *et al.* (2019) found sufficient genetic variability in the nutritional properties of 14 accessions of *C. olitorius* seeds from Oyo State. Opabode and Adebooye (2005) noted that few germplasms of jute have been collected and evaluated.

Despite the nutritional and economic importance of *C. olitorius*, it has been neglected by scientific research and development in most regions. Its production is constrained by soil fertility depletion. The amount of nutrients present in the soil plays an important role in the performance and yield of crop (Law-Ogbomo and Nwachokor, 2010). In Nigeria, high costs of inputs like fertilizers are a limitation to improving production of vegetables by small holder farmers (Ajayi, 2009; Nanyanzi *et al.,* 2018). Besides, excessive and indiscriminate use of synthetic fertilizers results to soil degradation and imposes a serious threat to human health (Fujimoto, 1998). Organic waste could be a viable alternative to chemical fertilizers. Organic manure as soil amendment is highly important in order to sustain crop production systems since it is a reliable source of nitrogen and carbon (Liang *et al.,* 2012; Rinaldi *et al.,* 2014) and it also moderates soil pH (Abubakari *et al.,* 2015). Application of poultry manure has increased N level of the soil up to 53% (Boateng *et al.,* 2006). Poultry manure promotes and enhances the growth and yield of vegetable plants (Nwangburuka *et al.,* 2012). Limited information is available on the influence of accession and poultry manure application rates on growth and biomass yield of *C. olitorius* in the study area. Information from this study could encourage commercial cultivation of *C. olitorius* to solve the problem of food insecurity. Thus, this study was conducted to evaluate the performance of *C. olitorius* as influenced by accession and poultry manure application rates.

Materials and methods

Experimental site: The field experiment was conducted at the Department of Crop Science Teaching and Research Farm, Faculty of Agriculture, University of Nigeria, Nsukka (07 ^{0} 29' N, 06 ^{0} 51' E and 400 m above sea level), Enugu State, Nigeria from August-November 2021. The experimental site is characterized by sub-humid tropical conditions with bimodal annual rainfall distribution that ranges from 1155 mm to 1955 mm with a shift in the second peak of rainfall from September to October, a mean annual temperature of 29 ^{0}C and a relative humidity that ranges from 69% to 79% (Uguru *et al.,* 2011).

Collection of *C. olitorius* germplasm: Seeds of *C. olitorius* were sourced from three Local Government Areas (LGAs), which include Kabba/Bunu Local Government Area (LGA) of Kogi State, Ikole LGA of Ekiti State and Yewa South LGA of Ogun State, Nigeria. The seeds were sourced from these locations owing to the fact that they were available as at the time of collection. Eight accessions were collected from these LGAs and they were named according to the location of collection (see Table 1).

Table 1: List of accessions showing collection centers in Nigeria and acronyms used in the study.

S/N	State	LGA	Specific location	Acronyms
1	Ekiti	Ikole	Ikole	Ik-1
2	Ekiti	Ikole	Ikole	Ik-2
3	Ekiti	Ikole	Ikole	Ik-3
4	Kogi	Kabba/Bunu	Kabba	Ka-1
5	Kogi	Kabba/Bunu	Kabba	Ka-2
6	Ogun	Yewa South	Ibese	Ib-1
7	Ogun	Yewa South	Ibese	Ib-2
8	Ogun	Yewa South	Ibese	Ib-3

Seed extraction and experimental layout

The dry fruits from the accession were broken manually to obtain the seeds. The experiment was laid out as 8x4 factorial in Completely Randomized Design (CRD) with four (4) replications. The plants were arranged randomly in blocks of four (4) bags comprising of two (2) factors (A and B). Factor A included the eight (8) accessions of Jute mallow (Ik-1, Ik-2, Ik-3, Ka-1 Ka-1, Ka-2, Ib-1, Ib-2 and Ib-3). Factor B involved the four (4) poultry manure application rates (0 t/ha, 7.5 t/ha, 15 t/ha and 22.5 t/ha).

Planting/emergence

The seeds were planted in April 2021 by broadcasting method and covered with a light weight of soil to avoid burying the seeds and for easy emergence. Sprouting of the seeds was observed at four days after planting. The botanical term for the germination process is as known epigeal germination indicating that the cotyledon protruded above the ground. Poultry manure was applied to the soil to supply nutrients to the young seedlings. The poultry manure (PM) was applied in a ring form. The PM was applied to the edges of the nursery bags to avoid touching or affecting the young seedlings one week after emergence. This was done early in the morning before watering the plants. Watering was done morning and evening daily except on a rainy day. Two weeks after planting, fertigation was used to apply the remaining quantity of poultry manure to the plants.

Transplanting

The seedlings were transplanted from the nursery bags to the bags in the field at 4 weeks after planting. The bags were filled with topsoil that was collected from a field at the Departmental Teaching and Research Farm. Each bag weighed 16.5 kg. A total of 128 bags were used for the experiment. All the bags were perforated at the base for aeration and drainage of excess water in order to enhance air circulation and to prevent water-logging. The cultural practices carried out during the course of the experiment were watering, weeding and hand-picking of insects.

Parameters measured

Pruning was done before the first data collection.

Number of leaves: The total number of leaves was counted per plant and the average taken. Both the matured and the young leaves were counted.

Number of fruits: The number of fruits was determined by counting the fruits on each plant and the average recorded.

Number of branches: This was determined by counting the number of branches on each stem of the plant and the average recorded.

Biomass yield (g): The pruning was done at 15 cm above ground level. The weight of freshly harvested shoot (after pruning) was taken with a weighing balance.

Statistical analysis

Following the procedure for completely randomized design (CRD), analysis of variance (ANOVA) was performed on triplicates data collected using GENSTAT (2013) statistical software. Comparison of treatment means was done using LSD at 5% probability level where applicable.

Results

Table 2 shows the physical and chemical properties of the potted soil sample prior to transplanting and the chemical properties of the poultry manure utilized in the experiment. The results indicated that the soil was acidic with a pH value of 5.5 in water (H_2O) and 4.5 in potassium chloride (KCl). The total nitrogen (0.58 g/kg) in the soil sample was very low and the total phosphorus was 9.35 Cmol/kg. The other elements were low. The poultry manure had neutral pH in water and in potassium chloride with respective values of 8.1 and 7.5. Organic matter (355.63 g/kg) and carbon (206.28 g/kg) present were high. Total nitrogen was 9.8 g/kg which implied a high N^+ and other elements present. Total phosphorus was 0.73 Cmol/kg which was low.

Table 2: Physicochemical properties of the soil and poultry manure sample used for the experiment

Sample description	Values	
Physical properties	**Soil**	**Poultry Manure**
Textural class	Loamy Sand	---
Particle sizes		
Clay (g/kg)	100	---
Silt (g/kg)	30	---
Fine sand (g/kg)	330	---
Coarse sand (g/kg)	540	---
Chemical properties		
pH (H_2O)	5.5	8.1
pH in KCl	4.5	7.5
Organic carbon (g/kg)	8.25	206.28
Organic matter (g/kg)	14.23	355.63
Nitrogen (N^+) (g/kg)	0.58	9.8
Exchangeable base		
Sodium (Na^+) (Cmol/kg)	0.03	0.28
Potassium (K^+) (Cmol/kg)	0.07	0.32
Calcium (Ca^+) (Cmol/kg)	1.20	10.40
Magnesium (Mg^+) (Cmol/kg)	0.80	3.36
CEC (Cmol/kg)	12.80	---

Base saturation (%)	16.41	---
Exchangeable acidity		
Aluminium (Al^{3+}) (Cmol/kg)	0.20	---
Hydrogen (H^{+}) (Cmol/kg)	1.20	---
Available phosphorus (Cmol/kg)	9.35	0.73

Source: Laboratory of the Department of Soil Science, Faculty of Agriculture, University of Nigeria, Nsukka.

Accession significantly ($p < 0.05$) influenced number of branches, number of flower, number of fruits, number of leaves and biomass yield at 8 weeks after transplanting (WAT) (Table 3). Accession Ik-1 produced greater number of branches (12.31), more flowers (4.62) and heaviest biomass yield (21.19 g). The values obtained for number of branches were statistically similar with 8.94 and 9.69 recorded in Ka-1 and Ka-2, respectively. Number of flowers in Ik-1 did not differ statistically from 3.44 recorded in Ik-3. Maximum number of fruits of 12.00 was obtained in accession Ib-2. Accessions Ik-3 was at par with Ib-2 accession in terms of number of fruits (11.62). Number of leaves was more in Ka-1 accession with 158.9, although statistically the same with 148.3 recorded in Ka-2. The least number of branches (1.69), number of flowers (0.00), minimum number of fruits (0.06), number of leaves (27.80) and the least biomass yield (3.81 g) were obtained in accessions Ib-2, Ka-1, Ik-2, Ik-3, and Ib-3, respectively. Poultry manure showed significant ($p < 0.05$) effect only on number of leaves and biomass yield at 8 WAT (Table 3). Plant performance in pots treated with poultry manure was better than those in the control pots. More number of leaves (91.5) was obtained in plants grown with 7.5 t/ha of PM. This value was not statistically different from 87.6 and 80.2 recorded when PM was applied at 15.0 and 22.5 t/ha, respectively. Plants in the control where poultry manure was not applied recorded the least value (49.3). Highest biomass yield 12.68 g was obtained in the application of 12.5 t/ha of PM, followed by 7.5 t/ha and 15.0 t/ha of PM that gave the respective values of 12.09 g and 11.38 g. The minimum yield (6.0 g) was recorded in plants grown without poultry manure.

Table 3: Main effect of accession and poultry manure application rates on the number of branches, number of flowers, number of fruits, number of leaves and weight of pruned foliage (g) of *C. olitorius* at 8 WAT

Accession	NOBr	NOFl	NOFr	NOLv	Biomass yield (g)
Ik-1	12.31	4.62	1.12	74.50	21.19
Ik-2	7.81	0.44	0.06	32.80	6.25
Ik-3	4.75	3.44	11.62	27.80	13.06
Ka-1	8.94	0.00	8.94	158.9	13.44
Ka-2	9.69	0.56	9.69	148.3	13.03
Ib-1	6.81	2.75	6.81	60.80	5.44
Ib-2	1.69	0.94	12.00	74.40	7.94
Ib-3	7.88	0.38	7.88	39.80	3.81
F-lsd$_{(0.05)}$	**4.123**	**1.43**	**4.384**	**39.83**	**6.649**
Poultry manure rates (t/ha)					
0	5.47	1.81	6.91	49.3	6.00
7.5	7.41	1.44	7.88	91.5	12.09
15.0	8.84	1.84	6.38	87.6	11.38
22.5	8.22	1.47	7.91	80.2	12.68
F-lsd$_{(0.05)}$	**NS**	**NS**	**NS**	**28.17**	**4.702**

NS = Non significant; NOBr = Number of branches; NOFl = Number of flowers; NOFr = Number of fruits and NOLv = Number of leaves

There was no significant interactive effect between the factors on number of branches, number of flower, number of fruits, number of leaves and weight of pruned foliage (Table not shown for want of space).

Results in Table 4 indicated that number of branches, number of fruits and number of leaves varied significantly ($p < 0.05$) between the accessions at 8 weeks after pruning (WAP) but number of flowers was not statistically different. Accession Ka-1 had the highest number of branches and number of leaves with 26.1 and 229.00, respectively. The value recorded for number of branches was stsitistically similar with 21.2 obtained in accession Ik-1. Similarly, Ka-1 value for number of leaves was not statistically different from 169.6 and 200.5 found in Ka-2 and Ik-1, respectively. Highest number of fruits (44.8) was attributed to accession Ik-1. Accession Ik-2 had the tendency to produce more number of flowers (14.5). However, Ik-3 gave the lowest values for number of branches, number of fruits and number of leaves with 3.0, 3.9 and 10.4, respectively.

Poultry manure application rates had positive impact on number of branches, number of flowers, number of fruits and number of leaves at 8 WAP (Table 4). The results indicated that increasing the poultry manure rate from 15 to 22.5 t/ha decreased the number of branches, number of flowers and number of leaves by 31, 30 and 17.60%, respectively. Maximum number of branches (18.6) and number of leaves (151.7) were produced in plants treated with 15 t/ha of PM. It also had the tendency to produce more flowers (12.0). However, the number of fruits increased in plants that received 7.5 t/ha of PM, this value was not statistically different from 17.7 recorded when plants were fertilized with 15.0 t/ha. Plants grown without (control) poultry manure application were poor in performance with respect to number of branches (5.1), number of fruits (7.1) and number of leaves (48.1).

Table 4: Main effect of accession and poultry manure application rates on the number of branches, number of flowers, number of fruits and number of leaves of *C. olitorius* at 8 WAP

Accession	NOBr	NOFl	NOFr	NOLv
Ik-1	21.2	12.3	44.8	200.5
Ik-2	9.0	14.5	9.5	99.1
Ik-3	3.0	0.9	3.9	10.4
Ka-1	26.1	8.4	6.1	229
Ka-2	15.5	9.6	12.2	169.6
Ib-1	6.9	9.2	15.9	80.6
Ib-2	6.8	6.8	14.4	60.3
Ib-3	9.4	5.3	9.1	61.9
F-lsd$_{(0.05)}$	**8.48**	**NS**	**11.64**	**68.99**
Poultry manure rates (t/ha)				
0	5.1	3.8	7.1	48.1
7.5	12.5	9.4	19.1	130.9
15.0	18.6	12.0	17.7	151.7
22.5	12.8	8.4	14.1	125.0
F-lsd$_{(0.05)}$	**5.99**	**NS**	**8.23**	**48.78**

NS = Non significant; NOBr = Number of branches; NOFl = Number of Flowers; NOFr = Number of fruits; NOLv = Number of leaves

Interaction of poultry manure x accession had significant ($p < 0.05$) influence on number of branches, number of flower, number of fruits and number of leaves at 8 WAP (Table 5). Interaction of 15t/ha and Ka-1 gave the highest number of branches of 42.28. Interaction of plants that received 15 t/ha of PM and accession Ik-2 produced more number of flowers with 38.8. Maximum number of fruit (63.0) and number of leaves (319.8) were recorded in the interaction of 15 t/ha and Ik-1 accession. Interaction of 0 t/ha and Ib-3, 15 t/ha and Ib-2, 22.5 t/ha and Ib-1 had the least number of branches, number of flowers, number of fruit and number of leaves of 0.0. Additionally, interaction of 0 t/ha and Ik-2 gave the least number of flower and number of fruits with 0.0. Also, 0 t/ha poultry manure and Ik-3 had the least number of flowers (0.0).

Table 5: Interaction of accession and poultry manure application rates on the number of branches, number of flowers, number of fruits and number of leaves of *C. olitorius* at 8 WAP

Manure rate (t/ha)	Accession	NOBr	NOFl	NOFr	NOLv

0 t/ha	Ik-1	5.8	4.5	13.8	52.0
0 t/ha	Ik-2	1.0	0.0	0.0	2.8
0 t/ha	Ik-3	2.0	0.0	4.8	4.0
0 t/ha	Ka-1	8.2	4.8	3.8	98.8
0 t/ha	Ka-2	13.0	13.2	15.8	148.8
0 t/ha	Ib-1	4.5	3.8	3.2	32.2
0 t/ha	Ib-2	6.0	3.8	15.6	46.0
0 t/ha	Ib-3	0.0	0.0	0.0	0.0
7.5 t/ha	Ik-1	14.8	10.0	41.8	202.2
7.5 t/ha	Ik-2	14.0	5.2	1.2	129.2
7.5 t/ha	Ik-3	4.5	2.5	2.5	27.0
7.5 t/ha	Ka-1	23.0	11.8	6.5	215.5
7.5 t/ha	Ka-2	13.3	11.5	11.0	146.5
7.5 t/ha	Ib-1	8.8	20.0	41.2	132.0
7.5 t/ha	Ib-2	15.2	10.5	38.5	147.0
7.5 t/ha	Ib-3	6.8	3.8	10.0	47.5
15 t/ha	Ik-1	42.0	15.2	63.0	319.8
15 t/ha	Ik-2	5.5	38.8	9.8	67.5
15 t/ha	Ik-3	3.8	0.0	5.8	2.5
15 t/ha	Ka-1	42.8	9.8	11.2	365.0
15 t/ha	Ka-2	14.0	4.0	9.5	143.8
15 t/ha	Ib-1	14.5	13.2	19.2	158.0
15 t/ha	Ib-2	0.0	0.0	0.0	0.0
15 t/ha	Ib-3	26.0	14.8	23.0	157.2
22.5 t/ha	Ik-1	22.5	19.5	60.5	228.0
22.5 t/ha	Ik-2	15.5	14.0	27.0	197.0
22.5 t/ha	Ik-3	1.8	1.0	2.8	8.2
22.5 t/ha	Ka-1	30.2	7.5	3.0	236.8
22.5 t/ha	Ka-2	22.0	9.8	12.5	239.2
22.5 t/ha	Ib-1	0.0	0.0	0.0	0.0
22.5 t/ha	Ib-2	5.8	12.8	3.5	48.2
22.5 t/ha	Ib-3	5.0	2.8	3.5	42.8
F-lsd$_{(0.05)}$		**16.96**	**NS**	**23.29**	**137.98**

NS = Non significant; NOBr = Number of branches; NOFl = Number of Flowers; NOFr = Number of fruits; NOLv = Number of leaves

Discussion

Effect of accession on the growth, phenology and biomass yield

The study revealed that variability existed among the accessions in some of the growth, phenology and yield of *C. olitorius* assessed. Accession Ik-1 had greater number of branches, more flowers and heaviest biomass yield at 8 WAT. It also recorded more number of fruits at 8 WAP than others. Accession Ib-2 produced more fruits while accession Ka-1 had the highest number of leaves at 8 WAT. At 8 WAP, accession Ka-1 had more branches and highest number of leaves. Number of leaves per plant corresponded with the number of branches on the plant. The higher the branches, the greater were also the number of leaves. However, the inability of the Ik-3 accession sourced from Ikole to produce more number of leaves at 8 WAT and at 8 WAP as well as number of branches and number of fruits at 8 WAP may be linked to genetic defect resulting to poor adaptation to Nsukka environment. The variability observed in some growth, phenology and biomass yield in this study could be attributed to genetic differences and adaptation pattern in the accessions of *C. olitorius*. Earlier report of Nwangburuka *et al.* (2012) found genetic diversity among five accessions of *C. olitorius* in Ogun State. Isuosuo *et al.* (2019) also reported genetic difference in the nutritional properties of 14 accessions of *C. olitorius* from Oyo State. Results of Baiyeri *et al.* (2015) revealed accessional differences in seedling emergence, early growth and leaf proximate compositions of Moringa in Nsukka which was attributed to the variations in genetic potentials of the accessions. Suthar *et al*. (2019) posited genetic variation in seedlings growth and biomass yield of 15 accessions of Guar in Texas. Evaluating the traits of jute accessions is essential for proper utilization of the crop. The variability observed among the accessions could form basis for selection toward crop improvement. Magdalital *et al.* (1997) reported that assessing genetic diversity among accessions and their relationships is of interest for germplasm conservation as well as for breeding purposes. Idahosa *et al.* (2010); Ndukauba *et al*. (2015) reported that genetic differences in any given crop population is important to successfully select and manage yield improvement programmes. Bringing underutilized vegetables into conventional production has far reaching effects of attaining food security and reduction of malnutrition (Van Vuuren, 2006; Modi *et al.*, 2006; Ndlovu and Afolayan, 2008). Genetic improvement of *C. olitorius* (Chweya, 1997) and its formal subsequent cultivation will bring relief to local communities.

Effect of poultry manure application on the growth, phenology and biomass yield

Plants treated with poultry manure significantly performed better with respect to the number of leaves and biomass yield than those grown without poultry manure. This suggests that the nutrient status of the soil was poor and can be attributed to high intensity of rainfall and leaching of basic cations (Table 2). Therefore, application of poultry manure is crucial in the production of jute. The result obtained in this study could be linked to soil nutrient enrichment by the poultry manure that resulted in better performance. The results are in agreement with the findings of Dinesh *et al.* (2010); Mohapatra and Das (2009) who revealed that organic manure increases the vegetative growth and biomass production of crops effectively. Generally, organic materials are known to modify soil properties (Stevens *et al.*, 2018) and boost the soil nutrient content (Dauda *et al.* 2005; Ndukwe *et al.* 2009). Naim *et al.* (2015) reported that application of chicken manure enhanced the growth and yield of *C. olitorius* compared with the control treatment. Olanikan (2006) reported that poultry manure application increased organic matter status of the soil and improved crop yield. Plants treated with 7.5 t/ha produced more leaves at 8 WAT and more fruits at 8 WAP. However, application of 22.5 t/ha increased biomass yield at 8 WAT but at per with 7.5 t/ha. Plants grown with 15.0 t/ha had more branches and more leaves at 8 WAP but statistically similar to what was obtained in 7.5 t/ha. The ability of 7.5 t/ha to improve some of the traits assessed indicated that adequate quantities of nutrient elements were supplied by this rate. Optimum nutrient supply results in the production of high quality and better nutritious plants (Rice *et al.*, 1994). As reported by Adebayo *et al*. (2011), when manure is available in sufficient amounts, plants tend to grow at their optimal potential.

Interaction of poultry manure rates × accession

Interaction of poultry manure rates × accession significantly influenced number of branches, number of fruits and number of leaves. The results could be linked to the genetic constituent of the accessions which increased the nutrient absorption capacity of the poultry manure and this is in line with the report of Olawuyi *et al.* (2011). Results from this study is in agreement with the earlier reports of Agbogidi and Ofuoku (2005) that plants respond differently to environmental factors based on their genetic makeup and their adaptation capability indicating variability among species. Cultivar and environmental differences had produced a wide array of modified forms in plant performance, such that the number and types of modifications have varied in reports by various researchers (Nakasone and Paull, 1998).

Conclusion

The results of the study showed the pronounced impact of poultry manure application on growth and biomass yield of *C. olitorius*. Soil amended with 7.5 t/ha produced more leaves at eight weeks after transplanting and more fruits at eight weeks after pruning. This rate was at par with 22.5 t/ha that had the highest biomass yield at eight weeks after transplanting. Also, 7.5 t/ha was statistically similar with 15.0 t/ha that gave the highest number of branches and number of leaves at eight weeks after pruning. For economic considerations, application of 7.5 t/ha is recommended for the production of *C. olitorius* in the study area.

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