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INFLUENCE OF ORGANOMINERAL FERTILIZER (OMF) ON THE PERFORMANCE OF JUTE MALLOW (*Corchorus olitorius*) IN NORTH CENTRAL NIGERIA

Eifediyi*¹, E. K., Mohammed¹, K. O. and Remison², S. U.

ABSTRACT

¹Department of Agronomy, University of Ilorin, Nigeria, Email and phone number; kevineifediyi@yahoo.ca; +234 8056500881

² Department of Crop Science, Ambrose Alli University, Ekpoma Nigeria

Dwindling soil fertility due to constant erosion and wild bush fire is of major concern in the Southern Guinea savanna zone of Nigeria. Consequently, experiments were conducted at the Teaching and Research Farm of the University of Ilorin, Ilorin - Nigeria in a southern guinea savanna zone of Nigeria during the dry and wet seasons of 2012 to evaluate the effects of organomineral fertilizer on the growth and yield of *Corchorus olitorius*. Five treatments (0t/ha, 1t/ha, 2t/ha, 3t/ha and 4t/ha) were randomly allocated to pots using completely randomized design (CRD) with three replicates and a randomized complete block design (RCBD) with three replicates for the field study. Data were collected on growth parameters; plant height, number of leaves, number of branches, fresh shoots weight per plant and fresh shoot weight per hectare. Analyses of variance (ANOVA) for all data were performed and mean separation was done by using the least significant difference (LSD). The result of the experiments indicated that using OMF significantly increased growth parameters, shoot weight per plant and shoot weight per hectare with the optimum values obtained at the 3t/ha⁻¹ (14,447kg/ha⁻¹ in Experiment 1 and 22,790kg/ha⁻¹ in Experiment 2). Fertilized plants at 3t/ha gave the highest shoot weight per plant (57.9 and 91.16g in Experiments 1 and 2 respectively) and the least weight per plant was obtained in the control plots. Using the 3t/ha was also effective in ensuring good performance in terms of number of leaves and number of branches. There was a yield advantage of twenty seven percent in Experiment 1 and forty nine percent over the control

Keywords: Organomineral fertilizer, growth and yield of *Corchorus olitorius*

INTRODUCTION

Jute mallow (*Corchorus olitorius*) of the Tiliaceae family is a traditional leafy vegetable of many ethnic groups in Nigeria and in Asian countries especially in Pakistan and Bangladesh where it is also an important fibre crop for making sacks and carpets (Chandrasekaran et al., 2010). The crop is a common vegetable in the humid areas of Africa (Schillers, 2000). It thrives well in poor and fertile soils. Opole et al. (1991) asserted that jute mallow and bitter leaf are suitable for resource poor farmers as they are easy to grow and require minimal external inputs, unlike exotic vegetables. However, Ayodele (1993) has recommended a basal application of 200kg/ha⁻¹ of NPK15:15:15 for optimum yield of vegetables in Nigeria. Surprisingly, the need for inorganic fertilizer increased without an increase in the supply of the product to meet the yearning demand by farmers. However, the limited use of inorganic fertilizer by farmers is attributed to scarcity, high cost and the inability to substantially redress the physical fragility and chemical deterioration of the soil (Adeniyi and Ojeniyi, 2005). This necessitates research on the use of organic fertilizers that are cheap, readily available and environmentally friendly (Ayeni, 2010).

Intensive cultivation of this vegetable may lead to the mining of the soil for essential nutrients in urban areas where land is scarce for farming. The need for external inputs in the form of organo mineral fertilizers which is readily available and affordable becomes imperative. The interest in organo mineral fertilizers arose from high cost and scarcity of inorganic fertilizer (Makinde et al., 2010). Organo mineral fertilizer is a low input technology organic fertilizer which is used for improving the nutrient status of tropical soils for sustainable crop production. The reports of Adeoye et al. (2008) and Ojeniyi et al. (2009) revealed the responses of maize and pepper to organomineral fertilizer. Makinde et al. (2010) reported also that the use of organomineral fertilizer enhanced better growth in *Amaranthus cruentus*. Therefore, high and sustained yields of crops can be achieved with judicious and balanced NPK fertilization combined with organic matter amendments (Kang and Balasubramanian, 1990; Makinde et al., 2010). To fill the gap of knowledge on the nutrient needs of the crop, experiments were conducted to assess the growth and yield of *Corchorus olitorius* using organomineral fertilizer.

MATERIALS AND METHOD

The experiments were conducted at the Teaching and Research Farm of the University of Ilorin, Ilorin, Nigeria on Latitude 8° 49' and Longitude 4° 49' East in a Southern Guinea Savanna zone. The area is characterised by a bimodal rainfall pattern, a long rainy season that starts in late April to July and a short rainy period that extends

from September to late October. There is a dry spell in August and the dry season is from November to March. The site was a three year fallow land which was previously cropped to maize and cassava for two years prior to the establishment of the experiment.

A composite soil sample was collected from 0-30 cm depth from twenty locations prior to planting and application of organomineral fertilizer within the experimental plots for physio-chemical characterization. Soil pH was measured (soil: water ratio, 1:2) using a glass electrode; total N content was determined by micro - Kjeldahl method (Bremner, 1965); available phosphorus was determined following Bray No 1 (1 N NH₄F + 0.5N) HCl extractant by vanadomolybdophosphoric acid method (Kuo, 1996), organic carbon was determined using the modified Walkley – Black method (Nelson and Sommers, 1996) and exchangeable bases extraction done using 1N ammonium acetate, exchangeable K and Na were determined using flame photometry while Ca and Mg were analysed by Atomic Absorption spectrophotometry. The plant height was assessed by measuring from the base of the plant to the terminal point of the stem, the number of branches and leaves were assessed by visual count of the green leaves and branches, fresh weight of five tagged plants were uprooted and their weights taken by the use of a weighing balance and fresh weight per plant was calculated and per hectare was extrapolated.

Experiment 1 (Pot Experiment)

The pot experiment commenced on the 25th of February, 2012 with the planting of a local variety of jute mallow in the nursery by drilling. The seedlings were later transplanted into pots containing 10 kg of soil four weeks after planting. Two pots represented a treatment (two plants per pot). The experiment was laid out in a completely randomised design with three replicates. The treatments imposed were five levels of organomineral fertilizer at 0, 1, 2, 3 and 4t/ha. The organomineral fertilizer was evenly mixed with the soil samples before the pots were filled with soil two weeks before transplanting. The organomineral fertilizer was a commercial fertilizer from Pacesetter Grade A and has the following composition; organic carbon 8.34, organic matter content 14.38, nitrogen 4.424 g/kg, calcium 2.8, magnesium 3.87, available phosphorus 7.04 and exchangeable potassium 0.352; Data were collected fortnightly beginning at 4 WAT from the two plants in each pot for the following parameters; plant height, number of branches, number of leaves and data on fresh weight per plant and per hectare were collected at 8 WAT. Plant height was assessed by using a measuring tape from the base to the terminal point of the plant, number of leaves and the number of branches was visually counted. At harvest, the plants were uprooted and weighed measured using a sensitive weighing balance. Analysis of variance (ANOVA) for all measurements were performed using Genstat software version 12 statistical packages for completely randomised design (CRD) and mean separation was done based on the work of Steele and Torrie (1980).

Experiment 2 (Field Experiment)

This experiment commenced on the 25th of July, 2012 with planting of a local variety of jute mallow in a nursery by drilling. The soil was ploughed, harrowed and beds measuring 6metres by 1metre were made with 0.50 metres avenue between the beds. The organomineral fertilizer was properly mixed in the beds by using a spade and a rake two weeks before transplanting was carried out at the rates of 0, 1, 2, 3 and 4 t/ha using a randomized complete block design with three replicates. The seedlings were transplanted at a spacing of 20 x 20 cm and manual weeding was carried out at 3 weeks after transplanting. Data on plant height, number of leaves and branches, shoot weight per plant and per hectare was carried out as in the pot experiment. Analyses of variance (ANOVA) for all measurements were performed using Genstat software version 12 statistical packages for randomised complete block design (RCBD) and mean separation was done based on the work of Steele and Torrie (1980).

RESULTS AND DISCUSSION

Physico-chemical properties of soil and organomineral fertilizer (OMF)

Data on the physico-chemical properties of soil and organomineral fertilizer is presented in (Table 1). The result showed that the soil had a pH of 6.2 which is slightly acidic. The organic matter content, N, P, K and Ca were low (Table 1). The analysis of the OMF used for the study revealed that it was slightly acidic (6.1), contained organic matter, high N, the available P and exchangeable K were moderate, but Ca was low (Table 1). This nutritional status of OMF could be harnessed by crops for its growth and development. Makinde *et al.* (2001) also reported the presence of nutrients in OMF in adequate amount for the utilization of plants for their growth and development.

Growth parameters

Data on the plant height of jute mallow in Experiment. 1 is presented in (Table 2). The result indicated a progressive increase in plant height of the crop with increasing rates of organo-mineral fertilizer application up to an optimum rate of 3 t/ha. There was an increase in plant height with time; the highest increase was from 4 to 6 weeks; there was significant difference ($P < 0.01$) between the treatments at 4 and 6 and 8 weeks after transplanting between the treated plots and the control. In Experiment 2, OMF similarly increased plant height to an optimum of 3t/ha (Table 3). As in Experiment 1, plant height increased with time; the highest increase for the parameter was at 4 to 6 weeks after transplanting. There was significant differences ($P < 0.05$) across the three sampling

periods of 4, 6 and 8 weeks after transplanting (Table 3). This was in conformity with the findings of Egbuchua and Enujeke, (2013); Ojeniyi *et al.*, (2009) who posited that increasing the rate of organomineral fertilizer increased the plant height of maize. Ipimoroti *et al.* (2002) also reported that plant height and leaf area of tea was increased with increased rates of organomineral fertilizer application. The result was also in consonance with the findings of Olaniyi *et al.* (2005) who opined that the application of organomineral fertilizer significantly increased plant height of okra. The data on the number of branches in Experiment 1 are presented in Tables 2. As the rates of OMF increased, there was a significant difference ($P < 0.01$) across the sampling periods of 4, 6 and 8 WAT with the optimum at 3t/ha.

Data on the number of branches in Experiment 2 are presented in (Table 3), there was an increase in the number of branches with time and the optimum at 3t/ha and significant differences ($P < 0.01$) was observed across the sampling periods of 4, 6 and 8 WAT. Applying OMF increased the number of branches which is desired by most farmers because many leaves will be produced as a result and this was in consonance with the findings of Schillers (2000) who asserted that farmers like varieties with profuse branching and fertilization can induce branching. The use of OMF at 3t/ha was sufficient to produce vigorous, healthy plant growth comparable to plants treated with synthetic fertilizers. Olaniyi and Akanbi (2007) reported using 3t/ha of organomineral to enhance the growth of fluted pumpkin (*Telfaria occidentalis*). Akanbi *et al.* (2005), Manios and Kapetanio (1992) also reported an increase in the growth parameters of tomatoes using compost manure. The application of organomineral fertilizer at 4t/ha can lead to luxury consumption by the plant because there was no significant difference between applying 3 and 4t/ha. This was in agreement with the findings of Makinde (2007) using OMF at the rate of 3 t/ha in maize.

Data on the mean number of leaves at 4, 6 and 8 weeks after transplanting are presented in (Table 2). In Experiment 1, as the rate of application increased, there was an increase in the average number of leaves but no significant difference was observed.

Data on the number of leaves in Experiment 2 are presented in (Table 3); there was a progressive increase in the number of leaves as the rate of OMF application increased, The differences between their means was significant ($P < 0.05$) across the three sampling periods of 4, 6 and 8 weeks after transplanting. This is in line with the findings of Makinde (2007) who observed no significant difference in the average number of leaves of maize in the first trial of maize using OMF but recorded significant increase in the number of leaves in the second year.

Data on the fresh shoot weight per plant of jute mallow in Experiments 1 and 2 are presented in Table 4. In Experiment 1, as the rates of OMF increased, there was a significant difference ($P < 0.05$) between the rates of 3, 4 t/ha and the control. In Experiment 2, as the rates increased also, the shoot weight per plant increased. The rates of 3 and 4t/ha performed equally which was significantly different ($P < 0.01$) from the control.

Data on the shoot weight per hectare in Experiments 1 and 2 are presented in Table 4. In Experiment 1, as the rates of application increased, there was an increase in the mean values of the shoot weight. The rates at 3 and 4 t/ha was not different from each other but was significantly different ($P < 0.05$) from the control. In Experiment 2 as the rates of application increased, there was an increase in the mean values of the shoot weight. The rates at 3 and 4 t/ha was not different from each other but was significantly different ($P < 0.01$) from the control. This was in agreement with the findings of Satyanarayana *et al.* (2002) who reported significant response of rice to organomineral fertilizer application which means enough nutrients were released earlier for utilization by plants. Schippers (2000) had opined that the use of manure significantly influences the vegetative yield of *Corchorus olitorius*. The shoot weight from the experiments were lower than 29 kg /10m² (29,000kg/ha) as reported by Grubben and Denton (2004) in Ghana and similar to 20 – 25kg/10m²(20,000 – 25000kg/ha) in Nigeria and also lower than 38kg/10m² (38,000kg/ha) in Cameroun. The results of these experiments were in agreement with the findings of Said (1997) who postulated that the addition of different sources of organic manures increases the plant growth characteristics namely plant height, number of leaves and shoots per plant, fresh weight of shoots of plants.

Table 1: Chemical composition of the soils and organomineral fertilizer

	Soil sample (before cropping)	Soil sample (after cropping)	Organomineral fertilizer
pH(water)	6.20	6.5	6.10
Organic matter content (g kg ⁻¹)	11.02	6.1	14.38
Organic carbon (%)	6.39	3.54	8.34
Nitrogen (g kg ⁻¹)	0.80	1.59	4.42
Calcium (Cmol kg ⁻¹)	1.10	0.90	2.80
Magnesium (cmol kg ⁻¹)	0.90	3.21	3.87
Available p (mg kg ⁻¹)	3.43	2.28	7.04
Exchangeable K (cmol kg ⁻¹)	0.12	0.21	0.35

Table 2: Effects of organomineral fertilizer on the vegetative traits of jute mallow (*Corchorous olitorius*) at 4, 6 and 8 weeks after transplanting.(Experiment 1)

Treatments	Plant height (cm)			Number of branches/plant			Number of leaves/plant		
	4	6	8	4	6	8	4	6	8
0 t/ha	8.97	41	61.7	1.20	2.30	5.07	5.67	6.60	19.40
1 t/ha	9.30	51.4	69.4	1.90	3.20	6.03	6.17	6.97	23.33
2 t/ha	10.47	57.8	73.4	2.07	3.33	6.23	6.10	7.10	26.03
3 t/ha	11.26	66.8	87.8	2.50	4.20	8.90	8.03	8.67	32.67
4 t/ha	11.29	67.4	87.2	2.50	4.10	8.83	6.67	8.17	33.67
Mean	10.26	56.9	75.9	2.03	3.43	7.01	6.53	7.50	27.02
LSD(.01)	0.804	14.93	10.95	0.410	0.516	0.536	n.s	n.s	n.s

Table 3: Effects of organomineral fertilizer on the vegetative traits of jute mallow (*Corchorous olitorius*) at 4, 6 and 8 weeks after transplanting.(Experiment 2)

Treatments	Plant Height(cm)			Number of branches/plant			No of leaves/plant		
	4	6	8	4	6	8	4	6	8
0 t/ha	10.17	46.9	74.40	1.63	4.10	6.63	9.56	45.4	59.7
1 t/ha	10.52	58.1	82.14	2.30	4.37	7.70	10.11	47.2	84.2
2 t/ha	11.86	62.1	84.47	2.63	4.73	8.50	11.78	58.6	89.4
3 t/ha	12.74	76.3	91.44	2.90	7.63	11.20	14.39	64.7	94.9
4 t/ha	12.67	75.5	91.26	2.93	7.67	11.23	14.83	62.4	95.0
Mean	11.59	63.8	84.74	2.48	5.70	9.05	12.13	55.7	84.6
LSD	0.723	11.670	6.904	0.227	1.253	1.268	1.790	10.520	19.980

Table 4: Effects of organomineral fertilizer on fresh weight per plant and per hectare of jute mallow (*Corchorous olitorius*)

Treatments	Experiment 1		Experiment 2	
	Fresh wt (gplant ⁻¹)	Fresh wt (kg ha ⁻¹)	Fresh wt (gplant ⁻¹)	Fresh wt (kg ha ⁻¹)
0 t/ha	40.9	10224	46.2	11549
1 t/ha	45.9	11485	58.14	14603
2 t/ha	50.4	12601	66.61	16652
3 t/ha	57.9	14467	91.16	22790
4 t/ha	56.6	14142	89.35	22337
Mean	50.3	12584	70.39	17586
LSD	9.18	2294	5.89	1472

CONCLUSION

The use of OMF influenced the growth parameters of jute mallow. From the results of the experiments, it was evident that the application of organomineral fertilizer played a vital role in the growth and development of the crop. The application of 3 tons / ha of organomineral fertilizer gave the highest growth and fresh weights in both experiments. The study also revealed that organomineral fertilizer can be gainfully harnessed as a fertilizer by small scale farmers because of its availability compared to inorganic fertilizer.

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