Sandy Soil Improvement Using Organic Materials and Mineral Fertilizer on the Yield and Quality of Jute Plant (*Corchorus Olitorius*)

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Abstract

Sandy soils are generally in need of improvement of their nutrient status. An open field pot experiment was conducted at the Gateway Fertilizer Plant, Abeokuta, Ogun State, Nigeria to evaluate the effect of various organic amendments (poultry manure, cow dung), organo-mineral and inorganic fertilizer on physico-chemical properties of sandy soil and the performance of *Corchorus* grown on it.

Four levels of poultry manure (PM), cow dung (CD), Gateway fertilizer (GF) and organo-mineral fertilizer (OMF), at the rate of 0, 10, 20, and 30 tonnes/ha and NPK at 0, 120, 200 and 250 kg were applied. Pre-treated *Corchorus* seeds were planted and different agronomic data collected at pre-determined days after planting.

Results obtained indicated significant differences ($p < 0.05$) between the treatments and yield components. PM gave the best significant value for the leaf height, leaf length and stem girth. Soil chemical properties (pH, nitrogen, acidity, phosphorus, and organic carbon content) were greatly influenced by the organic amendments as follows: PM at 10 tonnes/ha, CD at 20 tonnes/ha, GF at 20 tonnes/ha, OMF at 30 tonnes/ha and NPK at 200kg/ha.From the result of the experiment, PM at 10 tonnes/ha showed the overall best performance for *Corchorus*, and the trend for all amendments was: PM 10 tonnes/ha > CD 20 tonnes/ha > GF 20 tonnes/ha > OMF 20 tonnes/ha > NPK 250 kg/ha on the sandy soil. The use of organic materials in improving sandy soil to promote optimum crop growth and yield of *Corchorus* is recommended. PM at 10 tonnes/ha, CD and GF at 20 tonnes/ha should be recommended as source of improving sandy soil if optimum production of *Corchorus* is desired.

Keywords: Sandy soil, Organic materials, Inorganic fertilizer, Optimal yield, Jute

1. Introduction

The exposure of land to frequent cultivation without proper management paves way for soil loss through erosion, consequently resulting in accumulation of sandy soils over the surface. Sandy soil to a large extent is deficient in major soil nutrients, consequently resulting in low productivity or yield. This is because it enhances the leaching of essential nutrients required for the optimum growth of planted crops. Therefore, adequate fertilization which encourages rejuvenation of the depleted soil is required for substantial improvement in productivity of such soil (Agboola and Sobulo, 1981; Keit, 1983; Dudal and Byrnes, 1983). Sandy soils though suitable for crops such as water melon, peaches, and peanuts, require an amendment for optimum production of jute mallow.

Jute mallow (*Corchorus olitorius L.*), belongs to the family *Tiliaceae*. Jute plant is a leafy vegetable, grown in Nigeria and in many other tropical countries for its nutritious leaves. It is used for soup and eaten with starchy staple foods, especially in South-Western Nigeria (Epenhuijsen, 1974; Fayemi, 1999; Schippers, 2000). According to Asomani- Boateng et.al., (1996), it is a common vegetable grown in urban cities of western Nigeria by housewives. Sometimes, it is grown around the riverside for commercial reasons.

Nutrition is an important aspect of cropping system and this includes adequate supply of essential nutrients like nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca) etc. to the plant. Nutrient deficient soils like sandy soils do not have the right balance of nutrients. In addition, plants remove nutrients from the soil as they grow, so these nutrients need to be replaced in order for the soil to stay productive. For this reason soil is enhanced by adding fertilizer.

The practice of incorporating agricultural wastes into the soil has virtually replaced the traditional soil fertility rejuvenation methods (such as shifting cultivation and crop rotation) because of increasing pressure on land resulting from rapid population growth and other uses especially non-agricultural uses for quicker economic returns. These agricultural wastes are rich in essential nutrients like nitrogen, phosphorus and potassium (Umenweke, 1995). Application of organic manure to the soil maintains soil fertility for a longer time than the synthetic fertilizers (Alabi, 1990).

Studies have shown that application of nitrogen fertilizer on off-season cover crops increases the biomass (and subsequent green manure value) of these crops, while having a beneficial effect on soil nitrogen levels for the main crop planted during the summer season. Legumes, for example, fix nitrogen from the atmosphere and generally do not require nitrogen fertilizer. Synthetic fertilizers are commonly used for growing all crops, with application rates depending on the soil fertility, usually as measured by a soil test and according to the particular crop. This however, is not within the reach of most peasant farmers probably due to its scarcity and exorbitant price. Thus, for farmers to keep the pace of optimum and sustainable productivity especially at the era of global food insecurity, alternative measures of supplying the deficient soil nutrients particularly on degraded sandy soil is required. This is the premise upon which this study is based. Specifically, this study aims at assessing the effect of various soil amendments on physico-chemical properties of sandy soil and to evaluate the performance of *Corchorus olitorius* under the sandy soil improvement

2. Materials and Methods

2.1 Description of Experimental Site

The experiment was an open field pot experiment. It was carried out at Gateway Fertilizer Plant, Eleweran, Abeokuta, Ogun State, Nigeria which is located on Latitude $7^{0}12^{1}$ N and Longitude $3^{\circ}25^{1}$ E. It is a subtropical region with average rainfall of 250mm and mean temperature of 26°C.

2.2 Methodology

Composite soil samples, which were randomly taken at 0-30cm depth on the same soil type, were potted for the experiment. Soil and organic manure were analysed in the laboratory to ascertain their nutrients composition before the experiment. The experimental design used was 5 x 4 factorial experiments in a completely randomised design (CRD) replicated 3 times. 10kg of soil was bagged, each into a polythene bag totalling 60 bags. The treatments used were poultry manure, cow dung, Gateway fertilizer, organo-mineral fertilizer and NPK fertilizer. Four levels of each treatment were applied at the rate of 0, 10, 20 and 30 tonnes/ha for the poultry manure, cow dung, Gateway fertilizer and organo-mineral fertilizer. The inorganic fertilizer was applied at the rate of 0, 120, 200, 250 kg/ha, (NPK 15-15-15). The soils and manures were left to mineralize for two weeks before planting as described by Haper *et al.* (1980). The bags were perforated at the bottom to allow for easy drainage and facilitate aeration. The local variety of the *Corchorus* seed planted was Eleti eku and this was obtained at The Ministry of Agriculture, Asero, Abeokuta, Ogun State.

Before planting, the seeds were steeped in water at 97°C for 5 seconds to improve seed germination and seedling emergence. Three plants were randomly selected from each pot, tagged and used for weekly observation.

2.3 Data Collection

Morphological data were collected as follows: plant height, leaf length, leaf width, stem girth, number of leaves and yield components such as fresh and dry matter weight of harvested plants for analysis. The data were collected on weekly basis a week after planting till the end of the experiment.

Plant height, leaf length and leaf width were taken using a measuring tape and ruler. The circumference of *Corchorus* plants were taken and divided into two to get the stem girth. The plants were weighed immediately after harvesting to get the fresh weight and oven dried to constant weight to get the dry weight.

Mineral nutrient analysis of the soil was carried out after the final harvesting according to AOAC (1990) as well as the proximate analysis to determine the nutrient uptake.

2.4 Laboratory Analysis

Soil pH was determined in both water and potassium chloride solution 1:1 using glass electrode pH meter (Mclean, 1965). Total nitrogen was determined by Marco-Kjeldahl method of Jackson (1962). Exchangeable cations were determined using flame photometer and exchangeable Mg by atomic absorption spectrometer. Exchangeable acidity was determined by the KCl extraction method (Mclean, 1965). Organic matter was determined using dichromate wet oxidation method (Walkley and Black, 1934).

2.5 Data Analysis

The data collected were subjected to Analysis of variance (ANOVA) and means were separated using Duncan Multiple Range Test (DMRT) at $p = 0.05$ level of significance.

3. Results and Discussion

Table 1 shows the physico-chemical properties of the soil before planting. The percentage (%) sand, silt and clay of the soil before application of amendments were 91, 8.2 and 0.8 respectively indicating the soil to be of sandy with the pH of 7.2. The nitrogen content of the soil was 0.09% which is considerably low compared to the recommended critical level (1.5%) for south western Nigerian soils for most crops. The available phosphorus content of the soil was very low compared to the critical levels (10-12 mg/kg) and the exchangeable potassium content of the soil was 0.17 cmol/kg which is exactly the recommended critical level for south western soils (Omotosho et al., 2008).

The Na, Ca, K, Mg and organic matter contents available in the soil were low and the soil pH indicates that the soil is neutral (FAO, 1984).

Table 2 shows the effect of the amendments on the soil physical properties. The amendments slightly improved the physical properties of the soil.

Cow dung at 20 tonnes/ha showed the highest percentage of silt and NPK 15-15-15 at 250 kg/ha showed the highest percentage of clay in the amended soil.

The physical properties of the soil were influenced by the amendments rates in the following order; NPK 15-15-15 at 250 kg/ha > Organomineral fertilizer at 10tonnes/ha > Gateway fertilizer at 20 tonnes/ha > poultry manure at 20 tonnes/ha > cow dung at 20 tonnes/ha.

Tables 3-6 show the agronomic data for morphological components of the plants from the 1st week after planting till the 4th week.

Among the organic manures, the applications of poultry manure and cow dung at 20 tonnes/ha respectively gave the highest value of the plant height and stem girth. Poultry manure at 10 tonnes/ha gave the highest value for the leaf width and leaf length followed by cow dung at 30 tonnes/ha.

Table 7 showed that the soil amended with organomineral fertilizer at 30 tonnes/ha gave the highest pH level of 8.23 thereby making the soil alkaline. Gateway fertilizer at 10 tonnes/ha, cow dung at 20 tonnes/ha, NPK at 120 kg, 200 kg and 250 kg/ha reduced the pH level to acidic. All other amendments improved the soil pH. There was appreciable increase in the soil fertility at the end of the experiment as confirmed by the soil post analysis and increased crop yield following Kang (1990) and Titiloye (1982) findings which report that high and sustained crop yield could be obtained with judicious and balanced NPK fertilizer combined with organic amendment.

Table 8 shows the nutrient composition of the harvested plants with respect to the various levels of amendment applied. The fresh matter content was significantly ($p < 0.05$) higher by addition of Nitrogen fertilizer, the control levels produced the lowest fresh matter and dry matter content. There was significant difference ($p<0.05$) between the treatments and the yield components.

Table 1. Pre Physico-chemical properties of the soil

Soilproperties	Value
pH(H2O)	7.2
%OC	0.917061
%N	0.092
MehlichP	39.62712
Ca(cmol/kg)	3.000101
Mg(cmol/kg)	0.592917
K(cmol/kg)	0.174747
Na(cmol/kg)	0.102846
Exch.Acidity	0
ECEC	3.870611
Zn(mg/kg)	12.21688
Cu(mg/kg)	1.360375
Mn(mg/kg)	199.8027
Fe(mg/kg)	144.2044
Sand(%)	91
Silt(%)	8.2
Clay(%)	0.8

Table 2. Effect of amendments on the soil physical properties

Amendments	Sand(%)	Silt(%)	Clay(%)
PML1	91	8.2	0.80

CDL1	91	8.2	0.80
GFL1	91	8.2	0.80
OMFL1	91	8.2	0.80
NPKL1	91	8.2	0.80
	NS	NS	NS
PML2	90.7b	8.5a	0.80a
CDL2	90.3b	8.2a	1.13a
GFL2	90.0b	9.2ab	0.80a
OMFL2	87.7a	10.2bc	2.13b
NPKL2	88.0a	10.5c	1.47ab
PML3	89.7	9.2	1.13
CDL3	88.0	11.2	0.80
GFL3	90.3	8.5	1.13
OMFL3	89.0	9.9	1.13
NPKL3	88.3	9.5	2.13
	NS	NS	NS
PML4	89.7b	8.9	1.47ab
CDL4	90.0b	8.5	1.47ab
GFL4	90.7b	8.5	0.80a
OMFL4	88.7a	9.2	2.13ab
NPKL4	88.3a	8.9	2.80b
		NS	

Values followed by the same lowercase letter within columns are not significantly different from each other at $P \leq 0.05$, using the

Duncan’s Multiple Range Test

PML1, PML2, PML3, PML4 (Poultry manure at 0, 10, 20 & 30 tonnes/ha respectively), CDL1, CDL2, CDL3, CDL4 (Cow dung at 0, 10, 20, & 30 tonnes/ha respectively), GFL1, GFL2, GFL3, GFL4 (Gateway fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), OMFL1, OMFL2, OMFL3, OMFL4 (Organomineral fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), NPKL1, NPKL2, NPKL3, NPKL4 (NPK15:15:15 at 0, 120kg, 200kg & 250kg/ha respectively). L1 of all the amendments indicates the control level.

3.1 Agronomic Data

Tables 3-6 show the agronomic data for morphological components of the plants from the 1^{st} week after planting till the 4^{th} week.

Among the organic manures, the applications of poultry manure at 20 tonnes/ha and cow dung at 20 tonnes/ha gave the highest value of the plant height and stem girth. Poultry manure at 10 tons/ha gave the highest value for the leaf width and leaf length followed by cow dung at 30 tonnes/ha. This trend was observed throughout the duration of the experiment before harvest. There was no significant difference in number of leaves in all the amendments applied.

Table 3. Agronomic data at 1^{st} WAP

Amendments	plant height (cm)	stem girth (cm)	leaf number	leaf width (cm)	leaf length (cm)
PML1	3.1a	0.53	3.00a	0.40a	2.23a
CDL1	3.20ab	0.63	3.33ab	0.47a	2.73ab
GFL1	3.47abc	0.67	4.33b	0.77ab	2.83ab

OMFL1	3.60bc	0.60	3.33ab	0.90b	2.93b
NPKL1	3.77c	0.60	4.33b	0.90b	2.47ab
		N.S			
PML2	5.43bc	1.13bc	3.67	0.43a	3.47b
CDL2	5.20bc	1.43cd	4.00	0.83b	3.73b
GFL2	5.60c	1.53d	3.33	0.70ab	3.43b
OMFL2	4.80ab	0.83ab	4.00	0.80b	3.40b
NPKL2	4.37a	0.60a	4.33	0.87b	2.53a
			NS		
PML3	5.60c	1.50b	4.67b	0.63a	3.60b
CDL3	5.23bc	1.33b	4.33ab	0.83ab	4.03b
GFL3	5.47c	0.60a	3.00a	1.00ab	3.67b
OMFL3	4.73ab	0.60a	3.00a	1.10b	2.53a
NPKL3	5.05a	0.70a	3.67ab	0.97ab	2.53a
PML4	5.53b	1.37b	3.33	0.73	3.30abc
CDL4	5.47b	1.50b	3.33	0.93	3.70bc
GFL4	5.27b	0.57a	3.67	1.13	3.80c
OMFL4	3.70a	0.70a	4.00	1.00	3.10ab
NPKL4	4.70ab	0.73a	3.67	0.97	2.90a
			NS	NS	

Values followed by the same lowercase letter within columns are not significantly different from each other at P≤ 0.05, using the Duncan's Multiple Range Test

PML1, PML2, PML3, PML4 (Poultry manure at 0, 10, 20 & 30 tonnes/ha respectively), CDL1, CDL2, CDL3, CDL4 (Cow dung at 0, 10, 20, & 30 tonnes/ha respectively), GFL1, GFL2, GFL3, GFL4 (Gateway fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), OMFL1, OMFL2, OMFL3, OMFL4 (Organomineral fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), NPKL1, NPKL2, NPKL3, NPKL4 (NPK15:15:15 at 0, 120kg, 200kg & 250kg/ha respectively). L1 of all the amendments indicates the control level.

Table 4. Agronomic data at 2nd WAP

Amendments	plant height (cm)	stem girth (cm)	leaf number	leaf width (cm)	leaf length (cm)
PML1	4.30a	0.90	4.60	0.80	2.90
CDL1	5.10b	0.80	5.00	0.90	3.33
GFL1	5.27b	0.80	5.00	1.00	3.47
OMFL1	4.43a	0.77	5.33	1.37	4.00
NPKL1	4.50a	0.70	5.33	0.95	4.40
		NS		NS	NS
PML2	11.63b	1.63b	4.67	2.23	4.67
CDL2	9.03a	1.70b	5.00	2.20	4.60
GFL2	9.17a	1.80b	5.67	1.90	5.10
OMFL2	8.33a	1.03a	5.67	1.97	5.63
NPKL2	8.33a	0.80a	5.00	2.00	4.83
			NS	NS	NS
PML3	10.40c	1.77b	5.33	2.17	5.03
CDL3	9.80bc	1.67b	4.67	2.27	5.50
GFL3	8.93ab	0.87a	5.33	2.03	5.70
OMFL3	8.60ab	0.93a	5.33	1.87	5.40
NPKL3	8.37a	1.10a	5.33	2.60	5.70
			NS	NS	NS

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PML4	8.60a	1.63c	4.33a	2.03abc	5.67
CDL4	10.17b	1.73c	5.33ab	2.40bc	5.77
GFL4	8.93ab	0.93a	5.33ab	1.90a	5.20
OMFL4	9.17ab	1.27b	5.67b	2.00ab	4.97
NPKL4	8.23a	1.00ab	6.00b	2.50c	5.47
					NS

Values followed by the same lowercase letter within columns are not significantly different from each other at P≤ 0.05, using the Duncan's Multiple Range Test

PML1, PML2, PML3, PML4 (Poultry manure at 0, 10, 20 & 30 tonnes/ha respectively), CDL1, CDL2, CDL3, CDL4 (Cow dung at 0, 10, 20, & 30 tonnes/ha respectively), GFL1, GFL2, GFL3, GFL4 (Gateway fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), OMFL1, OMFL2, OMFL3, OMFL4 (Organomineral fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), NPKL1, NPKL2, NPKL3, NPKL4 (NPK15:15:15 at 0, 120kg, 200kg & 250kg/ha respectively). L1 of all the amendments indicates the control level.

Table 5. Agronomic data at 3rd WAP

Amendments	plant height (cm)	stem girth (cm)	leaf number	leaf width (cm)	leaf length (cm)
PML1	5.50	1.17ab	4.33	1.07	3.17
CDL1	6.27	0.97a	4.00	1.13	3.63
GFL1	6.13	1.70b	4.00	1.00	3.67
OMFL1	5.93	1.07a	4.00	1.57	4.43
NPKL1	6.30	0.77a	4.67	1.30	3.17
	NS		NS	NS	NS
PML2	13.73c	1.87b	4.67	2.73	5.37
CDL2	11.97b	1.97b	5.00	2.87	5.80
GFL2	11.13ab	2.13b	5.00	2.43	6.17
OMFL2	11.27ab	1.30a	5.00	2.57	6.70
NPKL2	10.50a	1.07a	5.67	2.67	5.57
			NS	NS	NS
PML3	14.33bc	2.07b	5.00	2.80	5.83
CDL3	15.27c	1.93b	5.00	2.83	6.10
GFL3	13.13b	1.10a	5.67	2.57	6.07
OMFL3	13.33b	1.23a	5.33	2.27	6.70
NPKL3	10.17a	1.23a	5.00	3.10	6.63
			NS	NS	NS
PML4	10.63a	1.90c	5.00ab	2.67ab	6.47
CDL4	15.30c	2.03c	5.33ab	2.97b	6.70
GFL4	13.30b	1.23a	5.33ab	2.50a	5.80
OMFL4	11.67a	1.57b	4.33a	2.33a	5.77
NPKL4	10.57a	1.03a	6.00b	3.00b	6.27
					NS

Values followed by the same lowercase letter within columns are not significantly different from each other at P≤ 0.05, using the Duncan's Multiple Range Test

PML1, PML2, PML3, PML4 (Poultry manure at 0, 10, 20 & 30 tonnes/ha respectively), CDL1, CDL2, CDL3, CDL4 (Cow dung at 0, 10, 20, & 30 tonnes/ha respectively), GFL1, GFL2, GFL3, GFL4 (Gateway fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), OMFL1, OMFL2, OMFL3, OMFL4 (Organomineral fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), NPKL1, NPKL2, NPKL3, NPKL4 (NPK15:15:15 at 0, 120kg, 200kg & 250kg/ha respectively). L1 of all the amendments indicates the control level.

Table 6. Agronomic data at 4th WAP

Amendments	plant height (cm)	stem girth (cm)	leaf number	leaf width (cm)	leaf length (cm)
PML1	11.20	1.17a	4.67	2.47	4.90a
CDL1	12.27	1.10a	4.67	2.53	5.80ab
GFL1	13.00	1.80b	5.00	2.30	5.90abc
OMFL1	12.13	1.23a	5.67	2.60	7.10b
NPKL1	13.10	0.93a	5.33	2.40	6.40ab
	N.S		N.S	N.S	
PML2	21.80b	2.13b	6.00	4.80d	9.03b
CDL2	26.40c	2.23bc	6.33	4.37cd	8.70b
GFL2	28.03bc	2.43c	5.33	3.83bc	8.13ab
OMFL2	18.33a	1.57a	5.33	2.47a	7.07a
NPKL2	26.23c	1.50a	6.00	3.43bc	8.67b
			N.S		
PML3	29.80c	2.23b	5.67	4.20c	8.17bc
CDL3	29.33c	2.20b	5.33	4.00bc	8.20bc
GFL3	25.93b	1.30a	5.33	3.23ab	7.40ab
OMFL3	18.00a	1.40a	5.67	2.77a	6.80a
NPKL3	27.80bc	1.37a	6.33	3.63bc	8.37c
			N.S		
PML4	26.40b	2.27c	5.33ab	3.83ab	7.93b
CDL4	27.50b	2.27c	5.00ab	4.40b	8.83c
GFL4	25.04a	1.40ab	5.00ab	3.00a	7.07a
OMFL4	20.30a	1.83bc	4.67a	3.20a	7.87b
NPKL4	26.73b	1.10a	6.33b	3.63ab	8.03b

Values followed by the same lowercase letter within columns are not significantly different from each other at $P \leq 0.05$, using the Duncan's Multiple Range Test

PML1, PML2, PML3, PML4 (Poultry manure at 0, 10, 20 & 30 tonnes/ha respectively), CDL1, CDL2, CDL3, CDL4 (Cow dung at 0, 10, 20, & 30 tonnes/ha respectively), GFL1, GFL2, GFL3, GFL4 (Gateway fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), OMFL1, OMFL2, OMFL3, OMFL4 (Organomineral fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), NPKL1, NPKL2, NPKL3, NPKL4 (NPK15:15:15 at 0, 120kg, 200kg & 250kg/ha respectively). L1 of all the amendments indicates the control level.

3.2 Soil Post Analysis

Table 7 shows the chemical properties of the analysed soil samples. The chemical properties were significantly different from one another under the various treatments except organic carbon and phosphorus which did not show significant difference in the soils amended with poultry manure at 10 tonnes/ha, cow dung at 10 tonnes/ha, Gateway fertilizer at 10 tonnes/ha, organomineral fertilizer at 10 tonnes/ha and NPK 15-15-15 at 120 kg/ha.

There was appreciable increase in the soil fertility at the end of the experiment as confirmed by post soil analysis. The soil alkalinity was slightly increased due to significant increase in pH for most of the amendments except in soil treated with 20 tonnes/ha and 30 tonnes/ha organo mineral which showed considerable amount of high alkalinity in the soil. There was no significant difference between the control and all the amendments added to the soil with respect to Na, Mg and Ca levels. Nitrogen (%) content was higher in the soils treated with poultry manure and cow dung at both 10 and 20 tonnes/ha respectively. NPK 15-15-15 at 250kg/ha showed the highest amount of Na and K present in the soil. This result corroborates the findings of (Babatola and Olaniyi, 1997) whereby fertilizers (organic and inorganic) had been found to solve the problems of acidity, low nutrient contents, and nutrient imbalance that characterise tropical soils. The amendments increased the Nitrogen (%) content in the soil with cow dung at 20 tonnes/ha and poultry manure at 10 tonnes/ha giving the highest amount.

This contributed to the improved morphological characteristics and yield components of the plants cultivated with amendments at the mentioned levels.

Table 7. Effect of Amendments on the Soil Chemical Properties

Amendments	pH	pH	O.C	Av.p	Acidity	O.M	Na	K	Mg	Ca	N
	(H2O)	(KCL)	(%)	(Mg/kg)			Mg/kg	Mg/kg	Mg/kg	Mg/kg	(%)
PML1	6.23	5.3	0.16	17.53	0.37	0.28	206.7	76.67	23.03	35.7	0.07ab
CDL1	6.20	5.7	0.16	17.53	0.43	0.28	253.3	76.67	23.17	35.7	0.09ab
GFL1	6.17	5.2	0.16	13.57	0.30	0.28	180.0	76.67	22.83	35.60	0.10b
OMFL1	6.20	5.3	0.16	14.73	0.43	0.28	183.3	83.33	23.63	35.43	0.08a
NPKL1	6.20	5.3	0.16	17.53	0.30	0.28	203.3	76.67	23.37	35.57	0.09a
	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
PML2	7.53b	6.6c	0.53	57.53b	0.70	0.92	203.9a	100a	28.60ab	36.30bc	0.90a
CDL2	7.40b	5.5a	0.29	23.20a	0.60	0.50	200a	73.3a	27.73a	34.20a	0.97a
GFL2	7.33b	6.3b	0.24	52.10b	0.70	0.41	200a	106.7a	29.53b	36.90c	0.11b
OMFL2	6.67a	5.5a	0.25	43.80b	1.00	0.43	190a	116.7a	31.07c	41.60d	0.11b
NPKL2	6.67a	5.9bc	0.27	51.10b	1.40	0.46	310a	420b	27.67a	35.10ab	0.12b
			NS		NS	NS					
PML3	7.73c	7.0c	0.61b	76.03c	0.57a	1.06b	230a	123.3a	28.60a	35.7a	0.10bc
CDL3	6.77ab	5.2a	0.13a	21.83a	0.97a	0.23a	283.3ab	150a	28.60a	37.1a	0.09ab
GFL3	7.17b	6.3bc	0.43b	42.37ab	0.53a	0.73b	196.7a	80a	28.7a	41b	0.09ab
OMFL3	7.97a	6.5ab	0.17a	55.33b	0.50a	0.30a	226.7a	123.3a	31.2b	42.5b	0.11c
NPKL3	6.60a	5.9ab	0.53a	43.87b	2.27a	0.93a	373.3b	586.7a	29.6ab	36.8a	0.09a
PML4	7.63b	6.5b	0.27a	48.87a	0.40a	0.39a	216.7ab	156.7ab	26.83a	35.40a	0.87a
CDL4	7.37b	5.5a	0.23a	29.93a	0.33a	0.40a	246.7ab	90a	28.27a	36.40a	0.87a
GFL4	7.40b	6.4b	0.51ab	52.73ab	0.30a	0.87ab	186.7a	126.7ab	30.83b	38.00a	0.11b
OMFL4	8.23c	7.4c	0.61b	72.03b	1.53b	1.06b	273.3b	186.7b	31.43b	41.1b	0.09a
NPKL4	6.63a	6.3b	0.13a	41.23a	0.97ab	0.23a	363.3c	656.7c	27.80a	35.80a	0.1ab

Values followed by the same lowercase letter within columns are not significantly different from each other at $P \leq 0.05$, using the Duncan's Multiple Range Test

PML1, PML2, PML3, PML4 (Poultry manure at 0, 10, 20 & 30 tonnes/ha respectively), CDL1, CDL2, CDL3, CDL4 (Cow dung at 0, 10, 20, & 30 tonnes/ha respectively), GFL1, GFL2, GFL3, GFL4 (Gateway fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), OMFL1, OMFL2, OMFL3, OMFL4 (Organomineral fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), NPKL1, NPKL2, NPKL3, NPKL4 (NPK15:15:15 at 0, 120kg, 200kg & 250kg/ha respectively). L1 of all the amendments indicates the control level.

3.3 Nutrient Composition of Plant Samples

Table 8 shows the nutrient composition of the harvested plants with respect to the various levels of amendment applied.

Plants treated with Gateway fertilizer at 30 tonnes/ha recorded highest amount of nitrogen uptake followed by plant treated with poultry manure at 10 tonnes/ha. There was no significant difference in the Na uptake of the plants in virtually all the amendments added to the soil.

The fresh matter content was significantly ($p< 0.05$) higher by addition of Nitrogen fertilizer, meanwhile the control levels produced the lowest fresh and dry matter content. There was significant difference ($p<0.05$) between the treatments and the yield components. Poultry manure at 30 tonnes/ha gave the highest significant value for the fresh and dry weight of the plant while Gateway fertilizer at 10 tonnes/ha gave the least value for fresh and dry weight. This is indicative of the induced C: N ratio (Omotosho et. al., 2008). As a result of this, the nutrients cannot be easily leached away due to their slow release rate.

Table 8. Nutrient composition of plant samples

Amendments	N	Na	K	Av. P	Wet matter	Dry matter
	(%)	(Mg/kg)	(Mg/kg)	(%)	(g)	(g)
PML1	2.94	5.68	8.57	0.70	15.17	4.35
CDL1	2.94	5.68	8.57	0.69	15.5	4.67
GFL1	2.94	5.46	8.43	0.70	14.87	4.10
OMFL1	2.92	5.57	8.50	0.70	15.07	4.63
NPKL1	2.90	5.66	8.56	0.70	15.83	4.03
	NS	NS	NS	NS	NS	NS
PML2	4.11c	5.13ab	5.80	0.79ab	24.1ab	6.27
CDL2	3.48a	4.70a	7.40	0.77a	24.93ab	6.40
GFL2	5.32d	5.24ab	7.75	0.86c	20.57a	5.67
OMFL2	3.62ab	5.07ab	6.65	0.84c	27.20b	7.43
NPKL2	4.03bc	5.97b	6.97	0.81b	22.50ab	6.87
			NS			NS
PML3	3.90b	5.32	9.05b	0.72a	26.43b	7.43
CDL3	3.48a	4.93	7.75ab	0.76b	24.77ab	5.43
GFL3	3.50a	5.25	8.47ab	0.88c	20.68a	5.20
OMFL3	3.53a	4.85	6.65a	0.86c	26.97b	5.50
NPKL3	3.80ab	5.17	6.65a	0.87c	27.47b	7.00
		NS				NS
PML4	3.34b	5.00	10.65c	0.77a	28.60c	6.77b
CDL4	3.06a	4.93	5.48a	0.88b	18.83a	3.70a
GFL4	4.23d	6.73	7.35b	0.87e	25.70bc	5.83b
OMFL4	3.74c	4.60	6.47ab	0.84d	23.10ab	6.50b
NPKL4	3.95c	4.93	6.96ab	0.82c	25.37bc	5.17ab
		NS				

Values followed by the same lowercase letter within columns are not significantly different from each other at $P\leq 0.05$, using the Duncan's Multiple Range Test

PML1, PML2, PML3, PML4 (Poultry manure at 0, 10, 20 & 30 tonnes/ha respectively), CDL1, CDL2, CDL3, CDL4 (Cow dung at 0, 10, 20, & 30 tonnes/ha respectively), GFL1, GFL2, GFL3, GFL4 (Gateway fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), OMFL1, OMFL2, OMFL3, OMFL4 (Organomineral fertilizer at 0, 10, 20 & 30 tonnes/ha respectively), NPKL1, NPKL2, NPKL3, NPKL4 (NPK15:15:15 at 0, 120kg, 200kg & 250kg/ha respectively). L1 of all the amendments indicates the control level.

4. Conclusion

Results obtained from this study indicate that there was significant difference ($p < 0.05$) in soil amendments for the following morphological components: leaf length, leaf height, stem girth, leaf width fresh matter and dry matter weight. Also there was significant difference between the treatments and yield components. PM at 10 tonnes/ha gave the best significant value for the leaf height, leaf length and stem girth. Soil chemical properties: pH, nitrogen, acidity, phosphorus, organic carbon content available in the soil were greatly influenced by application of the organic matter amendments as follows: PM at 10 tonnes/ha, CD at 20 tonnes/ha and GF at 20 tonnes/ha respectively.

The chemical properties were significantly different from one another under the PM at 10 tonnes, CD at 20 tonnes, OMF at 30 tonnes and NPK at 200 kg per hectare. PM at 10 tonnes/ha showed the overall best performance of *Corchorus* on the sandy soil. Thus the chemical properties of the sandy soil were greatly influenced by the application of organic matter amendments.

Organic carbon and phosphorus were not significantly different in the soil amended with PM 10 at tonnes/ha, CD at 10 tonnes/ha, GF at 10 tonnes/ha, OMF 10 at tonnes/ha and NPK at 120 kg/ha. The plant treated with CD at 10 tonnes/ha had highest amount of nitrogen content followed by plant treated with PM at 10 tonnes/ha. The fresh matter weight was significantly ($p < 0.05$) enhanced by the addition of nitrogen fertilizer while the control (i.e. absence of fertilizer) produced the lowest amount of fresh matter and dry matter weight. From the result the use of organic minerals in improving sandy soil to promote optimum crop growth and yield components of *Corchorus* is recommended.

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