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Research Article

Analysis of Micro and Macro Nutrient Levels in Compost and Vermicompost Fertilizer Formulated from Selected Agro-waste and Comparative Assessment of the Fertilizer Efficiencies

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Abstract

There is global a demand for organic food due to perceived harmful effects of synthetic and chemical fertilizers, herbicides and pesticides to humans health. Owing to this, biofertilizer was produced from some selected organic waste materials through Conventional Compost and Vermicompost methods to determine their macro and micro mineral nutrients, also to ascertain their efficiency in organic farming. The Vermicompost was done with (*Eisena fetilda*) earthworm in an earthen pot with mixture of samples of farm and poultry droppings in the ratio of 5:1. Results of the compost and vermicompost of all the samples showed that macro mineral nutrients of samples A-C are as follows. Fe (24.00mg/kg-33.41mg/kg), Cu (26.01mg/kg-39.15mg/kg), Zn (4.91mg/kg-11.20mg/kg), Mn (27.50mg/kg-34.71mg/kg) while micro mineral nutrients are Mg (21.51mg/kg-4.19mg/kg), Ca (18.20mg/kg-25.51mg/kg) N (20.00mg/kg-29.41.00mg/kg) K (25.51mg/kg-32.01mg/kg) P (30.80mg/kg-38.51mg/kg). Comparatively Vermicompost had better macro and micro nutrient probably due to the action of *Eisenia fetida* which promotes mineralization. Vermicompost fertilizer promotes growth rate of Scent leave due to nutrient balance in organic manure which affects plant growth and development compared to conventional compost fertilizer. Vermicompost and conventional compost fertilizer samples can be utilized as organic fertilizer in crop production and could be commercialized. They can also be applied in waste management to promote healthy environment.

Keywords: Organic Material; Compost; Vermicompost; Micro and Macro Mineral Nutrient; Fertilizer; Growth Rate; Waste Management

Introduction

There is a global demand for organic food due to perceived harmful effects of synthetic and chemical fertilizer, pesticides and herbicides. Due to high increase in world population, there is also an increase in the demand for food [1]. Chemical fertilizer has been used over the years to increase world food production, with little or no attention to its negative impact on the soil and plant as well [2]. In this regard, recent efforts have been channelized towards the production of nutrient rich high quality food in sustainable comportment to ensure bio-safety [3]. Organic waste has traditionally been considered a source of pollution and has not been sufficiently evaluated as a by-product of agricultural activity which could produce organic fertilizer [4]. Organic fertilizers are essential source for plant nutrients and a soil conditioner in agriculture, sources of organic fertilizer includes feacal materials/ manure and urine from different animal and humans, with the addition of plant materials (organic solid waste) or in a special situations waste materials from food or plant processing industries [5]. Organic waste are mostly by-products of agricultural activities, these include crop residual stalks, straw, leaves, roots, husks, shell) and animal waste (manure) [6]. These waste can enhance food production through the use of bio-fertilizers which are becoming popular, they are materials which contains living micro-organism which when applied to plant surfaces they promote growth by increasing the supply of primary nutrients to the host plant [7]. They add nutrient through natural processes such as nitrogen fixation, solubilization of phosphorus and stimulating plant growth along with the synthesis of growth promoting substances. Conventional compost and Vermicompost are two sources of organic fertilizer used by farmers for farming. Composting is the transformation of organic waste by the action of microorganisms, in the first stage simple carbon compounds are mineralized and metabolized by thermophilic microorganisms releasing carbon dioxide, water, ammonia and organic acids reaching temperatures from 45 to 70^{o}C which destroys seeds and pathogenic organisms [8]. Compost fertilizer is the result of various decaying organic substances; composting can be described as the ultimate in waste recycling. It consists of relatively stable decomposed organic materials resulting from the accelerated biological degradation of organic materials under controlled aerobic condition. It is made from plant and animal remains for crop production [9]. Vermicomposting is the process of producing compost by utilizing earthworms to turn the organic waste into high quality compost that consists mainly of worm cast in addition to decayed organic matter [10]. It is a non-thermophilic process of bio-oxidation and stabilization of organic substrate by joint action of earthworm and mesophilic microorganism. The metabolism of annelids generates an organic substrate imparts from microorganisms of the intestine [8]. Different organic waste material like rice straw, dry grass, chippings, cow dung, dry leaves, rotten watermelon, papaya, pine apple, custard apple and guava has been used in preparing vermicompost fertilizer [2,11]. Both conventional compost and vermicompost fertilizer are good source of micro and macro mineral nutrienst which enhance soil nutrient and organic matter when applied to the soil [4,12]. Soil mineral are divided into two types; micro and macro nutrient based on the amount needed by plant to grow [13]. The fourteen mineral nutrients are classified as either micro or macro nutrients based on their requirement and relative fertilization need [7]. There are basically six macro minerals, nitrogen, phosphorus, potassium, calcium, magnesium and sulphur [11,14]. Micro-mineral are essential for plant growth, but plants requires relatively small amount of them, hence the term micro. They include boron, chlorine, copper, iron, manganese, molybdenum and zinc [15]. Although various researchers has evaluated the micro and macro mineral nutrient of both compost and vermicompost fertilizers, there is always variation in the organic materials used in the production processes. The main objectives of this work is to produce conventional compost and Vermicompost fertilizer samples, to determine and compare the micro and macro mineral nutrient content of compost and vermicompost fertilizer produced from organic waste materials viz; Plantain peel, Garden egg, Water melon, Orange and Poultry droppings formulations and to determine their effects on the growth efficiency of Scent leave comparing them with normal sand loamy soil (control).

Materials and Methods

Materials

This includes transparent plastic container, earthen pot, weighing balance, stirrer, 20-mesh Sieve, farming tools (hoe, watering can, and cutlass), meter rule, meter tape, spoilt oranges (*Citrus sinensis*), spoilt garden egg (*Solanum melongena*), cassava (*manihot esculenta*), water melon (*Citrullus lanatus)*, plantain peels (*musa paradisiaca*), poultry droppings and red earthworm*(Eisenia fetida)*.

Sample collection

Spoilt garden egg, water melon, orange, cassava, plantain peel were collected from a dump site in Uli, Anambra State Nigeria, washed with water, cut into smaller sizes and air dried for 5 days. The poultry droppings used as inoculums was collected from poultry farm in same region mentioned above.

Sample preparation

The sample materials were separately grinded to increase the surface area and then sieved with a 20-mesh Sieve (1mm diameter screen) after which, each of the sample materials were isolated in a different container and weighed. The containers were labeled A, B and C.

Sample A	Plantain peel	Garden Egg	Poultry dropping
Kg	5	5	2
Sample B	Watermelon	Orange	Poultry dropping
Kg	5	5	2
Sample C	Cassava	Garden Egg	Poultry dropping
Kg	5	5	2

Table 1: Sample Formulations for Vermicompost and Compost Fertilizer.

Preparation of vermicompost

The method described by [16], was used in the preparation with slight modification in the organic materials used. Vermicompost preparation was done by mixing 5kg of Plantain, 5kg of Garden egg and 2kg of Poultry dropping for Sample A, 5kg of Water melon, 5kg of Orange and 2kg of Poultry dropping for Sample B while 5kg of Cassava 5kg Garden Egg and 2kg Poultry dropping for samples C. The weighing was done at different measurement and ratio as shown in the table 1. They were all weighed into different containers labeled A to C and constantly stirred with 4 (four) liters of distilled water. The mixture was put in an earthen pot containing the earth worm (a transparent double fitted plastic container with the inner one perforated to allow passage of excess water, also labeled A-C which is already filled with sterilized loamy soil to about 2.0cm). The mixture was allowed to pre-decompose for 15 days with intermittent turning. The earthen was covered with jute bag to maintain proper humidity and heat required by *Eisenia fetida* for effective bio conversion of sample materials to organic fertilizer. The set up was allowed for 60 days. Water was sprinkled intermittently to maintain adequate moisture required and the temperature was monitored with the aid of an inserted thermometer between 29-30^{o}C for optimum conversion. Appearance of sticky black coarse mat on the surface of the vermicompost signaled complete conversion.

Compost

Using a similar method described by [16], compost was prepared but in the absence of earthworm; poultry dropping was used as inoculants.

Mineral analysis

The micro/macro mineral nutrients were determined using Atomic Absorption Spectrometer (Schimadzu Model AA6800). Exactly 10g of each sample was weighed into a crucible and pre-ashed using a heater for about 10 minutes. The appearance of a black colour indicated the end of the pre-ashing process. This was heated in a muffle furnace, carbolite model (MA450) at 500^{0}C for about 20h. 1% HNO_3 (1% v/v) was added into the sample. The diluted sample was filtered using a whatmann filter paper. The filtrate was placed in a trace metal bottle for trace mineral analysis using a flame atomic absorption spectrophotometer.

Determination of iron (Fe)

The method described by [17] was used. About 2.5mls of sample was pipette into a test tube in duplicate and 0.4ml of 5N hydroxide (NaOH) was added to bring the pH between 4.0–4.5. Soon 0.75ml of acetate buffer of pH4.5 was added and 0.5ml of 0.1% $\alpha^1 \alpha^1$ dipridyll was also added and 0.35ml of distilled water added to make it up to 5mls. The absorbance was taken at 520nm against the blank.

Determination of calcium

The method described by [17] was used. About 1ml of the sample was pipette into a test tube in duplicate. Then 3ml of calcium working reagent was added and absorbance at 512nm was read against blank water bath. A tula tip spatula tip full sodium periodate was added and was heated for another 10 minutes, cooled and the absorbance was taken at 520nm against the blanks.

Determination of potassium

The method described by [17] was used. About 5mls of sample was pipette into a test tube in duplicate. Then 2mls of colbalnitrite was added, shaken vigorously and allowed to stand for 45 minutes and centrifuged for 15 minutes. The supernatant was drained-off and 2mls of ethanol was shaken vigorously and centrifuged for another 15 minutes. The supernant was drained off and 2ml of distilled water was added to the residue. The solution was boiled for 10 minutes with frequent shaking to dissolve the precipitate. About 1ml of 2% sodium ferric cyanide was added. Then 2mls of distilled water was also added and the solution was shaken to mix well. The absorbance was taken at 620nm against the blank.

Determination of magnesium

The method described by [17] was used. About 5mls of the sample was pipette into a test tube in duplicate. Then 1ml of 0.67N sulphuric acid (H_2SO_4) was added and 1ml of 0.05% titan yellow was added also. Then 1ml of 0.01% gum acacia was added and 2ml of 10% sodium hydroxide (NaOH) was also added. The solution was mixed and the absorbance was taken at 520nm against the blank.

Determination of manganese

The method described by [17] was used. About 5mls of the sample was pipette into a test tube in duplicate and 0.25ml of concentrated sulphuric acid (H_2SO_4) was added and boiled for 1 hour in a boiling water bath. A spatula tip full sodium periodate was added and was heated for another 10 minutes, colled and the absorbance was taken at 520nm against the blank.

Determination of zinc and copper

The method described by [18] was used. Fifty grams of soil was extracted with 100 ml of extraction solution diethyllenetriamine-penta acetic acid DPTA and shaken thoroughly for 2 hours. The solution was filtered through Whatman No. 42 filter paper. The filtrate was read at 568nm for iron. 324.6nm for copper and 214nm for zinc by using the appropriate hallow cathode lamps, in Atomic Absorption Spectrophotometer.

Determination of nitrogen

The method described by [18] was used. Twenty grams of the soil sample was taken in a flask and 20ml of distilled water. 100ml of freshly prepared 0.32% potassium permanganate, solution and ml of 2.5% sodium hydroxide were added. The flask was heated and 30 ml of distillate was collected in 50 ml of N/50 sulphuric acid. The excess acid was titrated against N/50 NaOH solution using methyl red indicator.

Determination of phosphorus

The method described by [18] was used. One gram of soil was suspended in 200 ml of 0.002 N sulphuricated, shaken well and then filtered through Whatman No. 42filter paper. To 10 ml of filtrate, three drops of 0.02 percent, 2, 4-dinitrophenol indicator was added. Whenever the solution became yellow; 2N sulphuric acid added the disappearance of the yellow colour. If the solution becomes colourless after adding the indicator. 4N sodium carbonate was added till it became colourless. To that solution, 2 ml of sulphomolybdic acid, ammonium molydate 25 g in 200 ml; 275 ml con H_2SO_4 diluted to 700 ml both were cooled mixed and made up to 100 ml, add 0.5ml of chlorostannous acid (25g SnCl $2H_2O$ in 50 ml of concentrated HCL diluted to 500 ml with water and made up to one liter with 1.2 N Hcl) were added and made up to 50 m. The solution was shaken well and read in a UV spectrophotometer at 660 nm. After 5 minutes, standard graph was prepared using potassiundihydrogen phosphate.

Cultivation, Bed Preparation and Arrangement

After the complete conversion of the vermicompost and compost, it was then used for cultivation. The normal farming process took place which includes clearing of farm land and preparation of the beds. About 6kg of each of the vermicompost and compost samples (A-C) was then mixed with the soil and watered. Then the six different beds were prepared 2meters distance from each other, one been control. The bed was continuously watered for 2 days, morning and evening before planting. The bed formation and planting arrangement was done based on the table below.

Planting and monitoring

The planting of scent leave was done based on the table 4 with a distance of 1.5 meters from each other. The germination took place 4 days after cultivation on 14th October 2017 and monitoring of growth took place between a period of 31 days during of which the height of the stem were measured followed by the length and width of the leaves using a meter tape and meter rule.

Statistical analysis

Completely randomized design (CRD) by [19] was used. Mean value of all the duplicate analytical determinations were subjected to analysis of variance (ANOVA). Significant difference were determine using SPSS statistical tools version 21 at 5% ($P < 0.05$) acceptable level.

Vermicompost sample A mixed with Sandy loamy soil	Compost sample A mixed with Sandy loamy soil	Vermicompost sample B mixed with Sandy loamy soil	Compost sample B mixed with Sandy loamy soil	Vermicompost sample C mixed with Sandy loamy soil	Compost Sample C mixed with Sandy loamy soil	Normal Sandy Loamy Soil Control
Scent leave	Scent leave	Scent leave	Scent leave	Scent leave	Scent leave	Scent leave

Table 2: Bed formulation and planting format.

Results

Mineral	SAMPLE A		SAMPLE B		SAMPLE C	
Mg/kg	Compost	Vermicompost	Compost	Vermicompost	Compost	Vermicompost
Fe	$28.19^{d} \pm 0.01$	$33.41^{a} \pm 0.01$	$24.00^{f} \pm 0.00$	$29.51^{c} \pm 0.01$	$28.01^{e} \pm 0.01$	$32.00^{b} \pm 0.00$
Cu	$26.01^{f} \pm 0.01$	$39.15^{a} \pm 0.07$	$28.49^{e} \pm 0.01$	$34.80^{c} \pm 0.00$	$34.50^{d} \pm 0.00$	$38.21^{b} \pm 0.01$
Zn	$6.51^{e} \pm 0.01$	$10.00^{b} \pm 0.00$	$4.91^{f} \pm 0.01$	$9.70^{c} \pm 0.00$	$8.61^{d} \pm 0.01$	$11.20^{a} \pm 0.01$
Mn	$27.50^{e} \pm 0.00$	$34.71^{a} \pm 0.01$	$27.80^{f} \pm 0.00$	$32.20^{c} \pm 0.01$	$29.50^{d} \pm 0.01$	$34.49^{b} \pm 0.01$

Table 3: Micromineral composition of 3 Compost and Vermicompost samples AC.
Values are mean duplicate determinations with ± standard deviation. Similar superscripts on the same column are not significantly different ($P< 0.05$).

Mineral	SAMPLE A		SAMPLE B		SAMPLE C	
Mg/kg	Compost	Vermicompost	Compost	Vermicompost	Compost	Vermicompost
Mg	$3.02^{e} \pm 0.03$	$3.79^{b} \pm 0.01$	$3.41^{c} \pm 0.01$	$4.19^{a} \pm 0.01$	$3.31^{d} \pm 0.01$	$3.80^{b} \pm 0.00$
Ca	$20.21^{d} \pm 0.01$	$23.21^{b} \pm 0.01$	$23.19^{b} \pm$ d0.01	$25.51^{a} \pm 0.01$	$18.20^{e} \pm 0.00$	$21.51^{c} \pm 0.01$
N	$22.51^{e} \pm 0.01$	$25.00^{b} \pm 0.00$	$24.60^{c} \pm 0.01$	$29.41^{a} \pm 0.01$	$20.00^{f} \pm 0.00$	$24.01^{d} \pm 0.01$
K	$28.59^{c} \pm 0.01$	$32.01^{a} \pm 0.01$	$28.89^{b} \pm 0.01$	$32.00^{a} \pm 0.00$	$25.51^{d} \pm 0.01$	$25.51^{d} \pm 0.01$
P	$33.51^{c} \pm 0.01$	$38.50^{a} \pm 0.00$	$33.19^{d} \pm 0.01$	$38.51^{a} \pm 0.01$	$30.80^{e} \pm 0.00$	$34.20^{b} \pm 0.00$

Table 4: Macromineral composition of 3 Compost and Vermicompost samples AC.
Values are mean duplicate determinations with ± standard deviation. Similar superscripts on the same column are not significantly different ($P< 0.05$).

Discussion

Compost and vermicompost fertilizer are among the major organic fertilizer sources that are mostly used by farmers. Compost and vermicompost has led to an improvement in the pH, soil organic matter and nutrient content of the soil compared to soil fertilized with synthetic mineral products [20]. Comparatively the mineral composition of both compost and vermicompost fertilizers are as fellows.

Micro mineral analysis

Iron (Fe) mg/kg

Iron is a very vital element for plant life. It assists in overall metabolism of plants.

The iron content of compost and vermicompost fertilizer samples (A–C) are as follows. Sample A compost (28.28mg/kg) while vermicompost sample A had 33.40mg/kg. Sample B compost had

(24.00mg/kg) while vermicompost sample B had (29.50mg/kg). Sample C compost had (28.00mg/kg) while vermicompost sample C had (32.00mg/kg). From the result vermicompost had the highest iron content compared to compost in the entire three fertilizer samples. This agreed with the reports of [16,21] that vermicompost produced fertilizer had higher iron content than compost. Earthworm in vermicomposting releases excess amount of iron and heavy metals from earthworm body into the environment through calciferous gland [22]. The iron content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$). Composting involves beneficial micro-organisms. Combination of both fertilizer sources can be of help especially when iron is the target mineral required by the soil or plant as the case may be. Iron aids chlorophyll synthesis that supports plant photosynthesis.

Copper (Cu) mg/kg

Copper is one of the micronutrients needed in a very small quantity by plants. It activates some enzymes in plants, helps in photosynthesis and plant respiration. The three compost and vermicompost samples (A–C) had a copper content as follows sample A compost had (26.00mg/kg) while vermicomposting (A) had (39.20mg/kg). Sample B compost had 28.80mg/kg while vermicompost sample B had 34.80mg/kg. Sample C compost had 34.50mg/kg while vermicompost sample C had (38.20mg/kg). Generally vermicompost samples had higher copper content in sample A, B and C respectively. This corresponds to the findings of [16,23], they both reported higher content of copper in the vermicompost fertilizers. The high content of copper in vermicompost may be from the presence of copper containing oxidizing enzymes in the vermicompost [24]. The copper content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$). Copper is directly involved in cell wall formation in plants.

Zinc (Zn) mg/kg

Zinc is an essential nutrient generally needed by plant in small amount. It takes part in hormone production and internode elongation. Zinc plays a role in controlling gene expression [25]. The zinc content of sample A compost fertilizer is (6.50mg/kg) while vermicompost had (10.00mg/kg). Sample B compost had (4.90mg/kg) while vermicompost had (9.70mg/kg). Sample C compost had (8.60mg/kg) while sample C vermicompost (11.20mg/kg). Vermicompost fertilizer samples had a better zinc composition among the three samples. This may be from the mineralization effect offered by earthworm which helps in breaking down organic material into simpler surface area to aid microbial activities that releases mineral [26]. The zinc content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$) from each other. Zinc assists plants in withstanding cold temperature, formation of auxins and conversion of starches of sugar.

Manganses (Mn) mg/kg

Manganese is an important plant micronutrient and is required by plants in second greatest quantity compared to iron. It assist plants during respiration, photosynthesis and nitrogen assimilation. Manganese is a catalyst for many enzymes and also facilitates the photosynthesis cum chlorophyll production [24]. Sample A compost had (27.50mg/kg) while vermicompost sample A had (34.70mg/kg). Sample B compost had (27.80mg/kg) while vermicompost had (32.20mg/kg). Sample C compost had (29.50mg/kg) while vermicompost sample C had (34.50mg/kg). Vermicompost sample had higher manganese content more than compost samples. The high presence of magnesium may be from mineralization of magnesium during earthworm activities [24]. The magnesium content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$) from each other except for vermicompost fertilizer in samples A and C. Manganese stabilizes nucleic acid which affects growth rate of plant.

Macro mineral

Magnesium (Mg) mg/kg

Magnesium is the power house behind photosynthesis in plants. It is the central molecule in chlorophyll [27]. It is required to stabilize ribosome particle and the structure of nucleic acid [28]. The magnesium content of sample (A–C) are as follows; Sample A compost had (3.00mg/kg) while vermicompost sample A had (3.80mg/kg). Sample B compost had (3.30mg/kg) while vermicompost sample B had (4.20mg/kg). Sample C compost had (3.40mg/kg) while vermicompost sample C had (3.0mg/kg). Vermicompost samples had high content of magnesium compared to Compost samples. The result agreed with the report of [16,23]. The magnesium content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$) from each other except for vermicompost fertilizer in A and C. The high content of magnesium in vermicompost sample may be from the action of the digestive system of earthworm which supports breaking down of organic matter releasing various mineral. Generally magnesium assists the movement of sugars within a plant.

Calcium (Ca) mg/kg

Calcium is a compound of plant cell walls and regulates cell wall construction. It contributes greatly in the fruit and seed formulation in plants. Calcium is required for cell elongation in both shoots and roots [29]. From the result, the calcium content of all the samples are as follows, Sample A compost had (20.20mg/kg) while vermicompost sample A had (23.20mg/kg). Sample B compost had (23.20mg/kg) while vermicompost simple B had (25.50mg/kg). Sample C compost had (18.20mg/kg) while vermicompost sample C had (21.50mg/kg). Vermicompost fertilizer sample had high calcium content in sample (A–C) respectively. The result agreed with [30,31]. The calcium content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$) from each other except for vermicompost fertilizer in sample A and and compost fertilizer in sample C. Calcium carbonate granule are been produced in the calciferous glands of earthworms which are released during the vermicomposting processing. The high content of calcium in vermicompost sample made it perfect for cultivation.

Nitrogen (N) mg/kg

Nitrogen is an essential element required for successful plant growth. It is considered the most important component of supporting plant growth. It is part of the chlorophyll molecule which gives plants their green colouring matter [1]. The nitrogen content of the three fertilizer sample are as follows. Sample A complete had (22.50mg/kg) while vermicompost sample A had (25.00mg/kg). Sample B compost had (24.60mg/kg) while vermicompost sample B had (29.4mg/kg). Sample C compost had (20.00mg/kg) while vermicompost sample C had (24.50mg/kg). Vermicompost had the highest nitrogen content in three samples. The high presence of nitrogen vermicompost samples agreed with the report of [16,32]. The high content of nitrogen in vermicomposting samples may be from nitrogen released from the organic materials used in the vermicomposting, again earthworn adds their excretory products, mucus and body fluid to the substrate which enhances nitrogen [22]. The nitrogen content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$) from each other. Nitrogen fixing bacteria are found in gut of earthworm and in earth worm cast which affects the nitrogen content of vermicompost. Generally, nitrogen stimulates the formation of fruit buds; increases fruit set and improve quality of fruits.

Potassium (K) mg/kg

Potassium is one of the seventeen essential elements required by plants for healthy growth and reproductions. It enhances enzymes activation, improves crop quality and protein synthesis in plants. The potassium content of sample (A–C) as follows; sample A compost had (28.60mg/kg) while vermicompost sample A had (32.00mg/kg). Sample B compost had (28.90mg/kg) while vermicompost had (32.00mg/kg). Sample C compost had (22.50mg/kg) while vermicompost sample C had (25.50mg/kg). Vermicompost samples had higher Potassium content. The result agreed with [16]. The potassium content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$) from each other except for vermicompost fertilizer in sample A and B and compost and vermicompost fertilizer in sample C. The potassium content of the vermicompost was higher in the vermicompost samples compared to the compost due to changes in the distribution of potassium between exchangeable and non-exchangeable form; organic matter passes through the gut of earthworm thereby transforming unavailable potassium to more soluble form with enhanced rate of mineralization. Potassium is associated with water movement, nutrients and carbohydrate in plant tissue [1].

Phosphorus (P) mg/kg

Phosphorus is one of the main three nutrients most commonly found in fertilizers. It is required by plant to form the seedling stage through to maturity. The three samples A–C had the Phosphorus content as follows; Sample A compost had (33.50mg/kg) while vermicompost sample A had (38.50mg/kg). Sample B compost had (33.20mg/kg) while Vermicompost sample B (38.50mg/kg). Sample C compost had (30.80mg/kg) while sample C vermicompost had (34.20mg/kg). Vermicompost samples had higher phosphorus content compared to compost. The high phosphorus in the vermicompost sample agreed with [16,21]. The magnesium content of both compost and vermicompost fertilizer samples A-C differs significantly ($P < 0.05$) from each other except for vermicompost fertilizer in samples A and B. The high phosphorus content in Vermicompost samples may be from enhanced mineralization and mobilization of phosphorus as a result of increased bacterial feacal phosphate activity of earthworm [33]. Phosphorus helps in promoting crop uniformity and early maturity.

Date	Time	Vermi-compost Bed A (cm)	Compost Bed A (cm)	Vermi-compost Bed B (cm)	Compost Bed B (cm)	Vermi-compost Bed C (cm)	Compost Bed C (cm)	Control Bed (cm)
1/05/2018	9.00am	15.8	14.9	15.9	15.1	16.5	15.0	14.0
2/05/2018	9.00am	17.3	16.0	16.4	16.2	18.2	16.1	14.8
3/05/2018	9.00am	18.5	17.5	18.0	17.9	19.4	17.7	15.4
4/05/2018	9.00am	19.5	18.5	19.1	18.3	20.9	19.7	16.9
5/05/2018	9.00am	23.1	21.0	21.4	20.1	23.0	21.3	17.8
6/05/2018	9.00am	27.2	23.3	23.5	22.7	24.8	23.1	18.4
7/05/2018	9.00am	29.8	25.1	25.6	25.1	27.2	23.4	21.5
8/05/2018	9.00am	32.5	27.8	27.5	27.0	28.4	26.5	22.5
9/05/2018	9.00am	34.7	29.3	29.7	29.3	29.8	28.9	24.1
10/05/2018	9.00am	36.1	31.3	31.8	31.3	32.5	30.9	27.8
11/05/2018	9.00am	37.9	33.9	34.1	33.9	34.7	33.4	29.7
12/05/2018	9.00am	39.1	35.2	36.3	35.2	36.3	35.2	32.1
13/05/2018	9.00am	42.0	39.6	40.0	39.6	40.3	39.6	34.0
14/05/2018	9.00am	43.7	40.8	42.6	40.8	42.4	40.8	35.3
15/05/2018	9.00am	45.4	42.5	44.3	42.5	44.1	42.5	36.0
16/05/2018	9.00am	47.0	43.7	46.7	43.7	46.7	43.7	37.2
17/05/2018	9.00am	48.7	45.1	48.0	45.1	48.5	45.1	38.1
18/05/2018	9.00am	49.0	46.4	50.1	46.4	50.7	46.4	39.7
19/05/2018	9.00am	50.1	48.1	52.2	48.1	51.8	48.1	40.8
20/05/2018	9.00am	51.6	49.8	53.9	50.5	53.7	50.5	41.4
21/05/2018	9.00am	54.2	52.2	55.1	53.2	55.4	53.2	43.0
22/05/2018	9.00am	55.5	53.4	57.2	54.4	58.7	54.4	43.8
23/05/2018	9.00am	57.3	54.9	59.8	55.9	60.5	55.8	44.2
24/05/2018	9.00am	61.7	58.3	65.1	60.3	63.7	59.0	47.3
25/05/2018	9.00am	63.4	61.5	67.6	62.5	65.7	63.1	50.1
26/05/2018	9.00am	65.5	62.2	68.9	63.7	69.6	64.4	51.8
27/05/2018	9.00am	67.1	64.3	71.4	64.3	71.5	66.3	53.2
28/05/2018	9.00am	69.8	66.6	74.8	67.6	73.7	69.6	54.1
29/05/2018	9.00am	72.9	68.3	76.4	70.1	75.5	72.0	56.6
30/05/2018	9.00am	74.4	69.6	78.4	72.4	76.5	74.6	58.8
31/05/2018	9.00am	76.2	71.4	80.5	74.4	77.4	76.3	90.3

Table 5: Monitoring of growth of Scent leaf (*Ocimum gratissimum*) Comparison of Average Height of the stem measured with meter tape and meter rule for a period of 31 days.

Date	Time	Vermi-compost Bed A (cm)	Compost Bed A (cm)	Vermi-compost Bed B (cm)	Compost Bed B (cm)	Vermi-compost Bed C (cm)	Compost Bed C (cm)	Control Bed (cm)
1/05/2018	9.00am	2.1	1.9	2.0	2.0	2.1	2.0	14.0
2/05/2018	9.00am	2.3	2.1	2.2	2.1	2.3	2.2	14.8
3/05/2018	9.00am	2.5	2.3	2.4	2.3	2.5	2.4	15.4
4/05/2018	9.00am	2.7	2.5	2.7	2.6	2.7	2.6	16.9
5/05/2018	9.00am	2.8	2.7	2.8	2.7	2.9	2.8	17.8
6/05/2018	9.00am	3.1	2.9	3.0	2.9	3.0	2.9	18.4
7/05/2018	9.00am	3.3	3.0	3.2	3.0	3.2	3.0	21.5
8/05/2018	9.00am	3.5	3.2	3.4	3.2	3.4	3.2	22.5
9/05/2018	9.00am	3.7	3.5	3.7	3.5	3.7	3.5	24.1
10/05/2018	9.00am	3.9	3.8	4.0	3.8	3.9	3.8	27.8
11/05/2018	9.00am	4.2	4.2	4.4	4.2	4.2	4.2	29.7
12/05/2018	9.00am	4.8	4.8	4.9	4.8	4.9	4.8	32.1
13/05/2018	9.00am	5.1	5.3	5.7	5.3	5.5	5.3	34.0
14/05/2018	9.00am	6.2	6.1	6.5	6.1	6.5	6.1	35.3
15/05/2018	9.00am	6.5	6.4	6.9	6.4	6.9	6.4	36.0
16/05/2018	9.00am	6.8	6.8	7.2	6.8	7.3	6.8	37.2
17/05/2018	9.00am	7.2	7.1	7.5	7.1	7.5	7.1	38.1
18/05/2018	9.00am	7.5	7.4	7.7	7.4	7.9	7.4	39.7
19/05/2018	9.00am	8.0	7.9	8.1	7.9	8.1	7.9	40.8
20/05/2018	9.00am	8.4	8.2	8.5	8.2	8.4	8.2	41.4
21/05/2018	9.00am	8.8	8.4	8.9	8.4	8.8	8.4	43.0
22/05/2018	9.00am	9.2	9.1	9.3	9.1	9.2	9.1	43.8
23/05/2018	9.00am	9.5	9.3	9.6	9.3	9.6	9.3	44.2
24/05/2018	9.00am	9.7	9.5	9.8	9.5	9.8	9.5	47.3
25/05/2018	9.00am	9.9	9.7	10.1	9.7	10.0	9.7	50.1
26/05/2018	9.00am	10.3	9.8	10.3	9.9	10.3	9.9	51.8
27/05/2018	9.00am	10.6	10.0	10.5	10.1	10.6	10.2	53.2
28/05/2018	9.00am	10.8	10.1	10.7	10.2	10.8	10.4	54.1
29/05/2018	9.00am	11.2	10.3	10.9	10.4	11.2	10.7	56.6
30/05/2018	9.00am	11.5	10.6	11.4	10.7	11.5	11.2	58.3
31/05/2018	9.00am	11.9	11.1	11.7	11.2	11.9	11.6	60.6

Table 6: Monitoring of growth of Scent leaf (*Ocimum gratissimum*) Comparison of Average Width of the leaf measured with meter tape and meter rule for a period of 31 days.

Date	Time	Vermi-compost Bed A (cm)	Compost Bed A (cm)	Vermi-compost Bed B (cm)	Compost Bed B (cm)	Vermi-compost Bed C (cm)	Compost Bed C (cm)	Control Bed (cm)
1/05/2018	9.00am	3.5	3.3	3.8	3.7	3.5	3.1	14.0
2/05/2018	9.00am	3.8	3.7	4.2	4.0	3.8	3.4	14.8
3/05/2018	9.00am	4.2	4.0	4.8	4.3	4.2	3.6	15.4
4/05/2018	9.00am	4.8	4.3	5.3	4.7	4.8	4.0	16.9
5/05/2018	9.00am	5.3	4.7	6.1	5.1	5.3	4.6	17.8
6/05/2018	9.00am	6.1	5.4	6.4	6.0	6.1	4.9	18.4
7/05/2018	9.00am	6.4	6.0	6.8	6.4	6.4	5.3	21.5
8/05/2018	9.00am	6.8	6.4	7.1	6.9	6.8	5.8	22.5
9/05/2018	9.00am	7.3	6.5	7.4	7.3	7.7	6.1	24.1
10/05/2018	9.00am	7.6	7.3	7.9	6.5	7.9	6.5	27.8
11/05/2018	9.00am	7.9	7.5	8.5	7.3	8.2	7.3	29.7
12/05/2018	9.00am	8.0	7.8	8.8	7.5	8.6	7.5	32.1
13/05/2018	9.00am	8.3	8.2	9.0	7.8	8.9	7.8	34.0
14/05/2018	9.00am	8.6	8.4	9.3	8.2	9.2	8.2	35.3
15/05/2018	9.00am	8.9	8.6	9.5	8.4	9.6	8.4	36.0
16/05/2018	9.00am	9.2	8.9	9.8	8.6	9.9	8.6	37.2
17/05/2018	9.00am	9.4	9.2	10.0	8.9	10.3	8.9	38.1
18/05/2018	9.00am	9.9	9.6	10.3	9.2	10.8	9.2	39.7
19/05/2018	9.00am	10.3	10.0	10.8	9.6	11.3	9.6	40.8
20/05/2018	9.00am	11.6	10.3	11.4	10.0	11.7	10.0	41.4
21/05/2018	9.00am	11.9	10.6	11.7	10.3	11.9	10.3	43.0
22/05/2018	9.00am	12.4	11.0	10.9	10.6	12.4	10.6	43.8
23/05/2018	9.00am	12.8	11.4	12.2	11.0	12.8	11.0	44.2
24/05/2018	9.00am	13.1	11.8	12.7	11.4	13.1	11.4	47.3
25/05/2018	9.00am	13.3	12.2	13.2	11.8	13.5	11.8	50.1
26/05/2018	9.00am	13.5	12.4	13.5	12.2	13.9	12.2	51.8
27/05/2018	9.00am	13.6	12.9	13.8	12.4	14.3	12.4	53.2
28/05/2018	9.00am	13.9	13.2	14.1	12.6	14.6	12.9	54.1
29/05/2018	9.00am	14.2	13.4	14.4	12.9	14.9	13.2	56.6
30/05/2018	9.00am	14.5	13.7	14.6	13.2	15.2	13.5	58.9
31/05/2018	9.00am	14.8	13.9	14.9	13.5	15.6	13.9	60.3

Table 7: Monitoring of growth of Scent leaf (*Ocimum gratissimum*) Comparison of Average Length of the leaf measured with meter tape and meter rule for a period of 31 days.

Comparative effects of compost and vermicompost fertilizer samples on the growth parameters of scent leave

The result of the average height of the stem, the length and width of leaves as shown in table 4 to 7; generally scent leaves on the vermicompost bed treatment performed better than those on compost treated bed and control (normal sandy loamy soil). This means that vermicompost fertilizers affected generally the growth rate of scent leaves; this agreed with findings of [1,34,35,37]. Vermicompost have been found to be a nourishing organic fertilizer having higher amount of humus, nitrogen, micronutrient and more beneficial soil microbes like nitrogen fixing bacteria and mycorrhizal. The high nitrogen content of vermicompost might have contributed to the better performance in terms of stem height, leave width and length since nitrogen is one of the essential element required for successful plant growth [36,38]. Vermicompost releases nitrogen in nitrate form, which is readily available for plant uptake which enhances crop growth, development and production of fruits [35]. Vermicompost fertilizer have numerous organic matter and microorganisms that brings about balancing of nutrient such nitrogen and micronutrients which affects the structure of chlorophyll and protein synthesis that led to the development of vegetative growth and leaf area in plants.

Conclusion

Comparatively, the micro and macro nutrients of of vermicompost using (*Eisenia fetida*) and conventional compost fertilizer produced from plantain peel, egg, water melon, orange, cassava and poultry droppings. The vermicompost and compost fertilizer produced from the organic materials mentioned was analyzed for micro and macro nutrients.Vermicompost samples had higher mineral content in all the three samples (A--C). Vermicompost fertilizer samples also affected the growth rate of scent leave in terms of stem height, leave length and width more than conventional compost due to balancing of nutrient such as nitrogen, micro and macro nutrients which supports growth. From the study it can said that vermicompost fertilizer are better in terms of its mineral contents and effects on crop growth. The high mineral content of vermicompost samples comes from the mineralization activities of earthworm during the vermicomposting process. Generally both compost and vermicompost fertilizer processing methods can be applied in conversion of organic waste to eliminate health risk associated possible environmental pollutions they can cause so as to improve health.

Authors Contribution

This is our Original collaborative work. Author ERE designed the study, conducted literature searches, managed analysis of the study and wrote the manuscript. Author AJC coordinated the entire study read and supervised the analyses and approved the final manuscript for publication. Author CCO assisted in writing the manuscript, discussion and literature search. Author NBE read the manuscript for final approval.

Conflict of Interest

The authors declare that they have no conflict interests.

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