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Research Article

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Comparative analysis of Macro and Micro nutrients of Bio waste, Compost and Vermicompost (using indigenous *Lumbricus terrestris*) of *Solanum melongena* (fruit) waste

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Abstract There is global demand for organic food due to perceived effects of foods produced with synthetic fertilizers and chemical pesticides. Owing to this, a comparative analysis of macro and micro nutrients in bio waste, compost and vermicompost of *Solanum melongena* waste were done to ascertain their efficiencies in organic farming. The vermicompost was done with indigenous *Lumbricus terrestris* (earth worm) in an earthen pot with mixture of *Solanum melongena* and cow dung in the ratio of 5:1. The biowaste was done in a similar way with exception of cow dung and *Lumbricus terrestris*. The compost was done similarly with the exception of *Lumbricus terrestris*. Results showed that macro nutrients (N, P, K, Ca and Mg) and micro nutrients (Fe, Cu, Zn, and Mn) followed this trend; Vermicompost > compost > bio waste, with exception of zinc. Vermicompost and compost of *Solanum melongena* can be utilized as organic fertilizer in the production of organic foods.

Keywords vermicomposting, solanum melongena, biowaste and organic food.

Introduction

Solanum melongena is a popular traditional vegetable in West Africa whose fruit (garden egg) and has bitter taste and a spongy texture. The stem is usually spiny, the flower either white or purple in color and the leaves are coarsely lobed. The bitter taste of the fruit is associated with high nicotinoid alkaloids. The fruit is very high in vitamins, minerals dietary fibre, and low in fats, protein and carbohydrates [1]. Garden egg is rich in anthocyanin which is regarded as a powerful nutrient for the brain [2]. For optimum growth and development of the plant, temperatures of 32 ^{o}C (daytime) and 21 ^{o}C (night) are required. [1].

The use of worms (usually earthworms) in converting organic wastes into high quality compost, rich in plants nutrients, is known as Vermicomposting. During vermicomposting, worms select some micro organism to thrive while eliminating others [3]. In a typical vermicompost, there is distinct increase in nitrogen fixing bacteria and reduction in pathogen level to zero. Vermicompost when applied in soil improves its water retention, aeration, and stability [3]. Unlike the conventional compost, vermicompost has excellent nutrient rich organic matter know as Vermicast [3].

Different worms have been reported to be very useful in conversion of bio waste to organic fertilizers. *Lumbricus terrestris* (earthworm) is a reddish anecic worm commonly found in Africa. It feeds on plants, dead insects and faeces [4]. In an environment of less noise and vibrations, *Lumbrics terrestris* is a very good agent for turning, fragmenting, and aerating composting material [5]. Compost produced by activities of earthworm usually has higher level of macro and micro nutrients required for plant growth [6].

Solanum melongena is produced in large quantity in northern Nigeria. However, due to poor storage facilities in the country, about 30% of the fruit get spoilt during transportation and at the point of sale. These wastes are of no economic value and often litter the environment. An attempt was made to convert the wastes into organic

fertilizer. This paper reports the comparative analysis of macro and micro nutrients of bio waste, compost and vermicompost of *Solanum melongena* waste.

Methods

Samples collection and preparations

Discarded *Solanum melongena* (garden egg) were collected from a local market in Uli, Anambra State Nigeria, washed with water, cut into smaller sizes and air dried for 5 days. The cow dung used as an inoculums was collected from an abattoir in same region mentioned above. *Lumbricus terrestris* were collected near a stream in same location, cultured and kept for the experiment.

Vermicompost

This was done by mixing *Solanum melongena* with cow dung in the ratio of 5:1. The mixture was put in an earthen pot already filled to about 2.0 cm with sterilized loamy soil [6-9]. The mixture was allowed to pre decompose for 15days with intermittent turning. The earthen was covered with jute bag to maintain proper humidity and heat required by *Lumbricus terrestris* for effective bio conversion of *Solanum melongena* 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 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 signalled complete conversion.

Two similar set ups were made for bio waste and compost, except that in the compost *Lumbricus terrestris* (earthworm) was not added while in the bio waste both cow dung and *Lumbricus terrestris* were not added.

The macro and micro nutrients of biowaste, compost and vermicompost were determined according to the methods describrd by Achikanu, Eze, and Ude 2013.

Results

Table 1: Comparative analysis of the macronutrients of bio waste, compost and vermicompost of *Solanum melongena* waste

Parameters	Bio waste	Compost	Vermicompost
Mg (mg/kg)	1.80	2.40	3.58
Ca (mg/kg)	7.12	9.50	21.30
N (mg/kg)	11.52	17.65	23.40
K (mg/kg)	17.60	23.65	31.74
P (mg/kg)	13.20	23.12	38.40

Table 2: Comparative analysis of the micronutrients of bio waste, compost and vermicompost of Solanum melongena waste

Parameter	Bio waste	Compost	Vermicompost
Fe (mg/kg)	32.10	35.20	39.50
Cu (mg/kg)	25.20	32.50	64.50
Zn (mg/kg)	19.58	9.98	7.50
Mn (mg/kg)	14.70	18.80	30.50

Discussion

The macro and micro nutrients of bio waste, compost and vermicompost of *Solanum melongena* waste are shown in tables 1 and 2 respectively. The level of macronutrients in the samples analysed followed the trend vermicompost > compost > bio waste. There was increase in Magnesium (Mg) and Calcium (Ca) from 1.80 mg/kg (bio waste), to 2.40 mg/kg (in compost) to 3.58 mg/kg (vermicompost) and from 7.12 mg/kg to 21.30 mg/kg respectively, which could be attributed to the mineralization of the earthworm in transforming large portion of calcium and magnesium from combined state to free state as reported by Hemen, Suresh and Baruah, 2013 [10]. Nitrogen (N) content increased from 11.52 mg/kg (in bio waste), to 17.65 mg/kg (compost) to 23.40

mg/kg (vermicompost) due to loss of organic carbon and mineralization of organic matter during bioconversion process [11]. Potassium (K) and Phosphorus (P) increased as shown in table 1, also due to mineralization of both elements in .the bio waste.

The quantities of micronutrients analysed increased from biowaste through compost to vermicompost with the exception of Zinc (Zn). The increases in Iron Fe, Copper Cu, and Manganese Mn could be attributed to mineralization of partially digested worm faecal by bacteria and fungi [11-13]. Decrease in Zinc in vermicompost was because of the selective absorption of Zinc by earthworm [3].

Conclusion

The micro and macro nutrients of vermicompost were better than the compost and bio waste. Vermicomposting of *Solanum melongena* using *Lumbricus terrestris* could be used in making organic fertilizer used in producing organic food and also could be used as a form of waste management technique for bio wastes.

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