



Short Review Paper

Vermicompost: a raw material in sustainability of tropical soils and food security

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Abstract

Turning food waste in every home into vermicompost for application on agricultural lands is a step towards enhancing food security; while concurrently sequestering carbon in the soil. The degraded and depleted tropical soils are high with carbon sink capacity but with low rate of sequestration resulting in low soil quality causing poor crop yields. Soil restorative measures are needed to mitigate soil degradation trends. In this review work, the potentials of the use of vermicompost are examined to propose sustainable pathway, with a view to achieve among other things, improved household waste management, soil productivity, food security and rural household economy.

Keywords: Vermicompost, vermicomposting, soil sustainability, food security.

Introduction

In some parts of Africa, food waste goes to landfills, while environmental concerns on landfills such as release of green house gases into the atmosphere and ground water pollution has been a major challenge^{1,2}. Food waste from several homes constitutes a larger percentage of this landfill³. Food waste is common and produced in every home, the global volume of wasted edible part of food has been concluded to be 1.3 billion tons⁴ and its presence in all landfills is unsightly and unsanitary. The figure of wasted food is alarming especially with food insecurity being a threat in Africa.

Residents can compost their food waste through vermicomposting, a process where detritivorous worms degrade organic waste^{5,6} into manure called vermicompost⁷. The ability of some species of worms to breakdown variety of organic residues is common⁸⁻¹⁰. Worms like *Eisenia fetida* is commonly used in the tropics due to its tolerance to much higher and lower temperature than other detritivorous worms¹¹.

Vermicomposts are peat-like materials produced through the interaction of detritivorous worms and organic material in a non-thermophilic process and are characterized by high pore spaces and the ability to hold water⁹. It is made up of most plant nutrients in readily available forms, such as exchangeable calcium, nitrates, phosphates and soluble potassium^{12,13} and are rich in microbial populations, predominantly actinomycetes, bacteria and fungi^{12,14}.

Vermicomposting is a well recognized practice, in some developed countries¹⁶ and the interaction of the compost

(vermicompost) with their soils has been well researched and found to be beneficial, but vermicomposting is new to many in Nigeria and Rwanda.

The need for vermicompost

High cost of chemical fertilizers and subsequent damage to the soil has in time shifted focus of researchers to several forms of organic amendment which are readily available¹⁶. This is of significance due to ability of organic amendments to conserve the soil while ensuring food security through increase in yield of crop grown^{17,18}.

As stated by several researchers tropical soils have a common problem, degradation, which is evident by poor soil productivity as a result of very low natural fertility, low pH¹⁹, low base saturation, low cation exchange capacity (CEC), nutrient imbalance²⁰, high receptiveness to erosion, low aggregate stability, inclination to surface crusting, soil compaction and erosion, low water holding capacity²¹⁻²⁷. Therefore, the importance of organic amendment to soil productivity cannot be overemphasized. However, while increasing productivity of the soil it has also been of great importance to keep in its sustainability in other to keep the soil alive. Hence the need for vermicomposting, an eco-friendly method that removes waste while making it resourceful. Most other methods adopted in disposing waste have been found to increase level of toxicity the soil, thereby deteriorating the soil.

Potentials of vermicompost in soil

The soils of the tropics are undersupplied in necessary plant nutrients and most times when there available, they are leached

beyond the rhizosphere. These nutrients that the soil desperately need for productivity are trapped in domestic wastes which are readily available. Domestic wastes in vermicompost form contain nutrients¹³ that can easily be assessed by plants²⁸. This nutrient content in the vermicompost is strongly influenced by the organic waste to be disintegrated by the worms. Vermicompost being organic in nature offers opportunity to improve soil fertility²⁹ and soil health³⁰⁻³³.

Vermicompost has been shown to increase soil organic carbon, soil water retention, resistance to erosion³⁴ and enhancement in some other physical properties^{35,36} of soil, such as bulk density³⁷, penetration resistance and aggregate stability³⁸ as well as valuable effect on the growth and development of variety of plants³⁹⁻⁴¹.

There is substantial research indication that the metabolic activity of the microbial biomass in soils can be increased by vermicompost^{42,43}, which has also resulted to considerable increase in enzymatic activities in the soil⁴⁵.

It has been found that there is increase in cation exchange capacity (CEC) of soils amended with vermicompost⁴⁵, this is in line with the conclusions^{39,36}. Vermicompost also reduces soil pH^{36,46} since organic matter has buffering properties.

Influence of vermicompost on plants

Vermicompost contains essential nutrients which have beneficial influence on chlorophyll content of the leaves, growth and nutrition of plants. Researchers in various countries have also concluded that vermicomposts has considerable positive effect on the growth and productivity of plants¹². Diverse greenhouse and on-field studies have researched the effects of vermicomposts of varying sources on a wide array of crops, these includes field crops⁴⁷, cereals and legumes⁴⁸, vegetables^{40,49-51} ornamentals and flowering plants⁴⁰.

Conclusion

There is increasing need for more methods to improve the soil potential, manure from organic waste which are readily available should be a focal point in a country with soils that can hardly hold on to nutrients and need persistent amendment which would buffer leaching. More focus should go into using vermicompost to enhance tropical soils, as a raw material that would kick start the whole process of ensuring food security.

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