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Sustainable Tool for Recycling the Organic Waste and Mitigate the Impact of Climate Change: Vermicomposting

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Abstract

The second most populated Country has produced the highest organic waste material in the world, but improper handling of the organic material led to reduced the quality of natural resources (Land, air, and water). The commonly practiced methods for organic waste management such as land filling, dumping in open area, composting and burning of organic materials. Among these methods, composting is an effective option to convert the organic material to value added product without affecting the environmental quality. However, vermicomposting technique is another sustainable option to manage the organic material as it contains more nutrient and faster method compared to the conventional composting method. The famous statement given by Sir Charles Darwin is "Worms are more powerful than African elephants and more important to the economy than cows" and composting by using the earthworms are the best option for biomass management. The sustainable organic management through vermicomposting was also an eco-friendly practise and reduces the emission of greenhouse gases (GHG) thereby mitigate the impact of climate change.

Keywords: Climate change, Mitigation, Organic waste, Vermicomposting

Introduction:

The agricultural sector in India generates 620 to 680 million tonnes (MT) of organic waste in every year, and out of which 33% was not utilised properly (Jain et al. 2014). The organic waste, also known as biodegradable waste, which is produced mainly from living organisms, either plant or animal. The Green Revolution which is the entry gate for all the chemical product started in our country in 1966-67 to increase higher productivity in agriculture, which has resulted in today's soil health, it's quality and even on human health.

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Moreover, the rapid growing population in India accounted to generate the highest amount of waste in the world, that's more than even China, the most populous country. Further, rising quantities and poor management of organic waste leads to environmental and health issues. These waste materials are decomposable but produces the toxic greenhouse gas, i.e., methane (CH_4), which is more potential than carbon dioxide (CO_2) in influencing atmospheric air temperatures. At present, Increasing the ambient air temperatures was a significant outcome due to climate change. Conventional strategies for waste management often result in severe environmental effects, Examples of improper waste management include indiscriminate dumping, clogged drains, burning of organic waste and improper incineration. Results include the spread of insect- and rodent-mediated diseases, production of greenhouse gases, and increased soil and water pollution (Alam and Ahmade, 2013). Waste management should be properly handled; otherwise, it is detrimental to human health, air pollution, water pollution and contributes to depletion of the ozone layer (Ayilara *et al.,* 2020).

Methods for organic waste management:

In general, waste management comprises 3R concept, *i.e*, reduction, reuse and recycling. The methods for management of waste materials mainly used in India include open dumping, land-filling, composting (aerobic and vermi-composting) and some waste-to-energy initiatives like incineration, and bio-methanation Sharholy M., 2008). Therefore, effective management practices should be applied to minimize the harmful effects of waste management. Among the abovesaid methods, composting/vermicomposting is a highly efficient alternative recyclable method. Composting is a process carried out by microorganisms to produce simpler organic and inorganic by products from complex degradable materials through degradation and transformation. It is a low-cost technology process and nutrient rich bulky organic manure. On the other way, Vermicomposting was also an effective method of composting by converting waste to wealth in less time as compared to other composting methods. It is a process of producing compost by utilizing earthworms to turn the organic waste/crop residue into high nutrient and quality compost that consists mainly of worm excreta in addition to decayed organic matter (Devi and Prakash, 2015). Vermicompost is a eco-friendly practise for developing sustainable agriculture and balancing ecosystem. The article mainly focuses on the Importance, nutrient content, special

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facets of vermicomposting and as sustainable tool to reduce the impact the climate change.

Importance and nutrient content of vermicomposting:

The earthworms eat the waste materials, pass it through their digestive system and passed out as excreta which is a final product and called as vermicompost. It is an organic rich fertilizer which contains humus, N, P and K, micronutrients, beneficial soil microbes (Bacteria, Fungus, Actinomycetes, Diazotrophs etc.), nitrogen fixing and phosphate solubilising bacteria, growth hormones (auxins, gibberellins, cytokinin) and it is suitable alternatives to chemical fertilizers and act as growth promoter and protector for crop plants and it also improves soil physical, chemical and biological properties (Chauhan and Singh 2013). The nutrient status of vermicomposting compared with farm yad manure presented in Table. 1. The nutrient status of the vermicompost and farmyard manure gets vary depending on the material used for vermicomposting (Theunissen et al., 2010).

Table.1 Nutrient content of vermicompost compared with farm yard manure

Nutrient contents	Vermicompost	Farmyard manure
pH	6.7	6.7
EC (mm hos/cm)	3.6	3.1
Organic carbon (%)	13.6	11.8
N (%)	2.63	1.03
P (%)	9.17	6.59
K (%)	2.95	1.55
Ca (%)	7.8	4.5
Mg (%)	2.44	1.19
Fe (ppm)	182	132.8
Zn (ppm)	22.8	16.2
Cu (ppm)	4.8	3.12
Mn (ppm)	84.9	65.3
Boron (ppm)	33.7	35

Earthworms utilises only 5 to 10% consumed materials for their growth and development and rest is passed as cast. The cast from the earthworms attains less than 2 micron which gives fragment and conditioning to materials and increasing surface area which is helpful for microbial development and altering soil physical, chemical and biological activity.

Special facets of vermicomposting:

- Vermicomposting process is faster than traditional composting.
- It is a optimum solution to reuse the organic waste which contains heavy metals.

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- It can be reused as nutrient-rich organic fertilizers
- The vermicomposting proves does not need any sophisticated machinery
- It was ideal for underdeveloped and developing countries.

Tool for mitigate the impact of climate change:

In India, dumping of organic waste on the open land, landfilling and burning of waste materials were practised and these are extremely hazardous to the environment through increasing the greenhouse gases concentration in the atmosphere. The above mentioned waste management practices are responsible for large production of greenhouse gas (GHG) emissions i.e. CH_4, CO_2 and N_2O in the atmosphere. The GHG molecules absorbs radiant energy and trap it in the lower atmosphere, which resulted to increased atmospheric air temperatures. The waste management has recycle organic waste to value added product, i.e., Vermicompost by epigeic earthworms which also helpful in bioremediation of soils. The earthworms break down pollutants, can be very effective at reducing soil pollution.

Conclusion:

Crop residue burning is major constraint in residue management, it will have effect on nutrient status in the soil, pollutes environment, health hazards and also increases soil temperature which will effect on soil beneficial microbial populations. In this context, Vermicomposting is an effective tool to mitigate the impact climate change by reducing the ambient air temperature and more nutritive value compared to other waste and provide additional benefit to the farmers through vermiculture and vermiwash.

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