Vermicomposting: A sustainable technology for Recycling Organic Wastes

Himanshu Garwa*, Dr. Bharati Veerwal

Department of Zoology, Maharana Pratap Government PG College Chittorgarh (Rajasthan)

Email address:- himanshugarwa300@gmail.com

Fig.1- Uses of chemical fertilizers Source- https://www.istockphoto.com

Farmers employ large quantities of chemical fertilizers and pesticides nowadays to increase the output of a variety of agricultural crops. These toxic insecticides and fertilizers reduce soil fertility while harming customers' health. The usage of organic manures has sparked attention due to the negative impacts of chemical fertilizers as reported by Alam et al. (2007).

Sustainable agriculture is a set of methods that preserve resources and the environment without compromising human needs, and the use of organic fertilizers like animal manure has been identified as one of its main pillars. In recent years, rising consumer concern about issues such as food quality, environmental safety, and soil conservation has led to a significant increase in the use of sustainable agricultural practices as study by Tilman et al., (2002).

The hunt for solutions to the issue of excessive use of chemical fertilizers and pesticides has been a response to the uptake of agricultural chemicals. A long-term solution to the issue of chemical input dependency and agriculture sector sustainability is to practice organic farming. Through agronomic crop management techniques, organic agriculture also has the potential to lower greenhouse gas emissions. According to reports, organic farming uses 62–70% less nitrogen than chemical farming (Kramer et al. 2006).

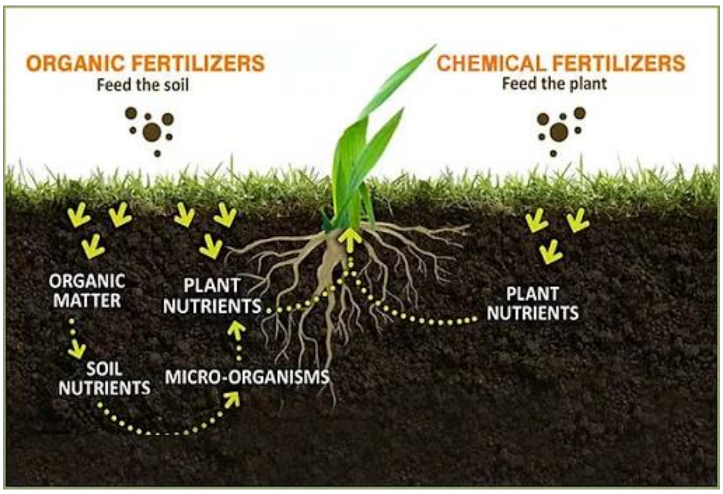

Fig.2- comparision between chemical and organic fertilizers
Source- https://prepp.in/

Santhosh kumar et al. (2017) stated that modern agriculture, which uses pesticides and fertilizers, has a negative impact on the environment by affecting soil fertility, water hardness, the development of insect resistance, genetic variation in plants, and the increase in toxic residue through the food chain. Sustainable agriculture, or organic farming, meets not only the food needs of the present generation in an environmentally friendly manner, but also those of future generations and maintains our environment.

In the most recent initiatives to promote agricultural systems that are both socially and environmentally sustainable, organic farming is being encouraged and is becoming more and more popular around the world, notably in Southeast Asia The system is built on maximizing and effectively utilizing farm-based resources in order to reduce the usage of expensive external inputs like synthetic fertilizers and pesticides as reported by Ramesh et al. (2005).

As a cheap, eco-friendly substitute for inorganic fertilizers, animal dung is a great resource as a soil fertilizer since it offers substantial amounts of macro- and micronutrients for crop growth. However, the usage of manure in agriculture is declining due to rising transportation costs and environmental issues brought on by the indiscriminate and inconvenient timing of its distribution to agricultural areas as reported by Hutchison et al., (2005).

According to Edwards (2004) many various solutions have been developed to solve the growing environmental and economic issues generated by the disposal of organic wastes from home, agricultural, and industrial sources. Vermiculture is the word for the practice of growing earthworms in organic wastes, while vermicomposting is the term for the use of earthworms to treat organic wastes.

Vermicomposting is widely understood to be the solid phase decomposition of organic leftovers in an aerobic environment while taking use of earthworms' and microorganisms' optimal biological activity as reported by (Garg and Gupta, 2009).

Vermicompost is created in a mesophilic environment, and while microorganisms do the biochemical breakdown of the organic material, earthworms are the key players in the process since they aerate, condition, and fragment the substrate, greatly influencing the microbial activity. By gradually lowering the ratio of C:N and enhancing the surface area exposed to microorganisms, earthworms act as mechanical blenders, changing the physical and chemical status of the organic matter. This makes it much more favorable to microbial activity and further decomposition as reported by Domínguez et al., (2010).

Fig.3- Uses of organic fertilizers Source- https://homegrown.extension.ncsu.edu/

Singh et al. (2005) studied the response of Vermicompost was applied to a chilli plant (*Capsicum mannuum L.*), and it was discovered that this increased microbial activity. Due to a greater quantity of branches and fruits, vermicompost improves the performance of crops.

According to the findings of multiple lengthy studies, adding compost enhances the physical characteristics of soil by reducing bulk density and raising soil water holding capacity as reported by Weber et al., (2007).

Numerous direct and indirect positive impacts of using vermicompost have been demonstrated to boost the growth and yield of a wide variety of species. Additionally, using organic fertilizers like vermicompost helps maintain soil fertility and has clear environmental advantages because it makes it possible to recycle organic waste on-farm. However, agricultural producers frequently assert that compared to inorganic fertilizers, crop yields with this type of fertilizer are significantly lower. This is typically linked to the fact that, in comparison to those supplied by inorganic fertilizers, the amount of nutrients provided by organic fertilizers is incredibly inconsistent as reported by Trewavas, (2001).

In most terrestrial habitats, earthworms are the most prevalent soil organisms, and they are crucial to the structure and fertility of soil ecosystems as reported by Bartlet et. al, (2010).

A tube-shaped, segmented animal known as a crawler is frequently observed living in dirt and consuming both live and dead organic debris. The most common term for Oligochaeta in the phylum Annelid is "wiggler." In most areas, earthworms are a prevalent soil creature that contribute significantly to the structure and fertility of soil ecosystems as reported by Bartlett et al., (2010) .

The earthworms contribute significantly to the composting of organic waste and the creation of organic manure, both of which are beneficial for preserving soil fertility, structure, and aeration.

Fig.4-using earthworm for vermicomposting. Source-https://www.istockphoto.com/

The voyage of vermicomposting teaches us how to coexist with nature without harming it. It conserves soil fertility while reducing environmental pollution and the usage of non-renewable natural resources. The practical and distinctive vermicompost for farmers' usage is generated through the application of vermitechnology at the lowest possible cost as investigated by Gupta, (2012)

Vermicompost has high levels of porosity, drainage, water holding capacity, and microbial activity. Earthworms and microorganisms work together to biodegrade organic waste to create vermicompost according to Edwards, C. A., & Burrows, I. (1988).

Similar to pit composting, which involves the biological aerobic transformation of an organic byproduct into a different organic product that can be added to the soil without adversely affecting crop growth, vermicomposting is a straightforward biotechnological composting process in which specific species of earthworms are used to improve the process of waste conversion and produce a better end product as reported by Baca, et al. (1992).

Vermicompost creates a natural fertilizer and enhances the soil's physical, chemical, and biological qualities. These composts aid in nutrient uptake by plants, offer all nutrients in easily accessible forms, and significantly increase the development and output of many field crops according to Scheu, S. (1987).

Vermicompost has high amounts of soil enzymes, is homogeneous, and has appealing aesthetics. It also contains plant growth hormones, improves microbial populations, and tends to hold more nutrients for longer periods of time without having a negative effect on the environment as reported by Ndegwa and Thompson, (2001).

CONCLUSION:

Farmers used excessive amounts of chemical fertilizers and pesticides, as well as unlimited amounts of ground water, to increase production and yield due to the high demand for food on the one hand and their desire for high profits on the other. The positive effects of chemical fertilizers on production and yield encouraged farmers to use these inputs even more, but the consequences of such excessive use of chemicals beyond the limit of consumption of the plants were disastrous

Fig5.-Importance of vermicomposting
Source- https://www.researchgate.net/

Organic farming can provide high-quality food without having a negative impact on the environment or the health of the soil. It is necessary to determine the best regional crops and goods for organic agriculture. Vermicompost is organic, therefore it has no negative health impacts and doesn't pollute the soil or the water. It boosts the population of microorganisms and enhances the physical, biological, and chemical characteristics of the soil, all of which help our agricultural production.

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