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Composting: A Way towards Sustainable Agriculture and Waste Management

Dr. Kamla Malik*, Dr Sarita, Dr Meena Sindhu, Dr. Sikha Mehta, Dr.Monika Kayasth.

Scientist, Department of Microbiology, CCSHAU, Hisar, Haryana, India

Associate Professor, Department of Zoology, G.C. Hisar, Haryana, India

Scientist, Department of Microbiology, CCSHAU, Hisar, Haryana, India

Scientist, Department of Microbiology, CCSHAU, Hisar, Haryana, India

Scientist, Department of Microbiology, CCSHAU, Hisar, Haryana, India

*Corresponding author, e-mail: kamlamalik06@gmail.com

ABSTRACT: Worldwide, agricultural residue burning has become a serious environmental issue that has a very bad effect on human and animal health. It also disturbs the soil structure but huge loss of plant nutrients, effect microflora and causes greenhouse gas emissions. Paddy straw and sugarcane bagasse are agricultural waste which composed of lignocellulose that cannot be degraded easily. Their direct use causes immobilization of nutrients, so composting arises as a safe option, resulting in the reusability of nutrients contained in these residues. Composting is a biochemical process in which aerobic and anaerobic microbes break down organic materials to produce beneficial manure known as compost. In current scenario, great emphasis is being given on organic farming as well as integrated nutrient management strategies. Organic farming has been recommended as an alternative form of agriculture to obtain high-quality food in an environment friendly manner. Composting is a key building block of organic farming and is recognised as a sustainable practice since attempts to preserve both the environment and human safety, as well as provide an economically viable production. In this review. We have discussed the basic information about composting and recent approaches in composting technologies for maintaining sustainability agriculture and waste management.

I. INTRODUCTION

Composting is one of the most effective ways to reduce the quantity of agricultural waste by creating value-added goods and converting these materials for use in agriculture. The biological aerobic/anaerobic degradation of biodegradable materials occurs during composting, which is a natural process that takes place under ideal conditions. Composting may be the greatest option for managing paddy straw in this direction. It is regarded as the most effective strategy since it improves soil fertility, reduces adverse environmental consequences, and ensures environmental protection and safety. (Kausar *et al.*, 2014).

Composting is a technique to reduce the amount of organic waste produced by reusing and producing soil conditioners. As compost has a high organic content (90-95%) but low nitrogen, phosphate, and potassium, it is mostly utilized as a soil conditioner rather as a fertiliser. Furthermore, chemical fertilisers are becoming a more expensive agricultural input. As a result, it is vital to assess the viability and effectiveness of organic wastes not only for enhancing and increasing soil fertility, but also for increasing chemical fertiliser efficiency. The combined use of chemical fertiliser and organic manure has been proven to be quite promising, not only in terms of crop productivity but also in terms of crop production stability. Agri-waste can potentially be used as a source of energy for soil bacteria, enhance soil physical characteristics, organic carbon, accessible nitrogen, phosphorus, and potassium as a result of long-term compost and fertiliser application (Bhatt and Joshi, 2019). Composting plays an important role in organic farming practices as well as in improving soil fertility (Rajkhowa *et al.* 2019). A microbial inoculum or consortium is often made up of a variety of microorganisms that generate enzymes that break down lignocellulosic components. Microbial consortium has the greatest immediate impact on enhancing composting compared to physical and chemical additions since microorganisms are the main players during composting. (Yang and Zhang, 2022).

In the current scenario, an integrated climate-resilient crop management module is required to ensure long-term soil health and crop productivity. Recycling organic waste is one approach to reduce the use of chemical fertilisers in the

situation above. Vermicomposting is a biological process that involves interactions between earthworms and microorganisms that efficiently convert different types of organic waste into nutrient - rich manure (Amouei *et al.*, 2017). It is the process of converting organic waste into nutrient-rich compost by using earthworms. It is believed that earthworms play an important role in agriculture; they eat dead organic waste and discard it as garbage. In addition to improving soil fertility, earthworms accelerate the decomposition of plant litter and organic matter by releasing minerals in a form that is more readily absorbed by plants.

Composting is a biological process facilitated by the activity of microorganisms. These microorganisms are either naturally present in the composting material or added externally to accelerate the process and enhance the quality of the compost. By utilizing the organic matter as a source of energy and nutrients, the microflora decomposes the substrate resulting in the formation of a dark brown, amorphous mixture of compost (Malik *et al.*, 2020). The composting material, provided with sufficient moisture and oxygen, undergoes decomposition at varying temperatures from low to high over a period of approximately three to four months. It is a valuable organic fertilizer as it provides essential nutrients for the growth of crops, reducing the need for chemical fertilizers and contributing to sustainable agriculture (Bhatt and Joshi, 2019). Composting can rapidly consume a substantial proportion of these wastes to produce compost, which can serve as a source of nutrients to improve soil structure, enhance organic matter, and promote growth of plants.

II. PHASES OF COMPOSTING

During composting there is transformation of unstable organic wastes to stable organic product, which undergoes various changes in term of physical, chemical and biological transformation. Although all the phases are intertwined to each other and exact separation is difficult to determine but each phase has its own importance. Composting can be divided into three phases: mesophilic, thermophilic and maturation phase and in last curing phase (Fig. 1).

- An initial, mesophilic phase, in which the decomposition is carried out under moderate temperatures by mesophilic microorganisms.
- As the temperature rises, a second, thermophilic phase starts, in which the decomposition is carried out by various thermophilic bacteria under high temperatures.
- As the supply of high-energy compounds dwindles, the temperature starts to decrease, and the mesophiles once again predominate in the maturation phase

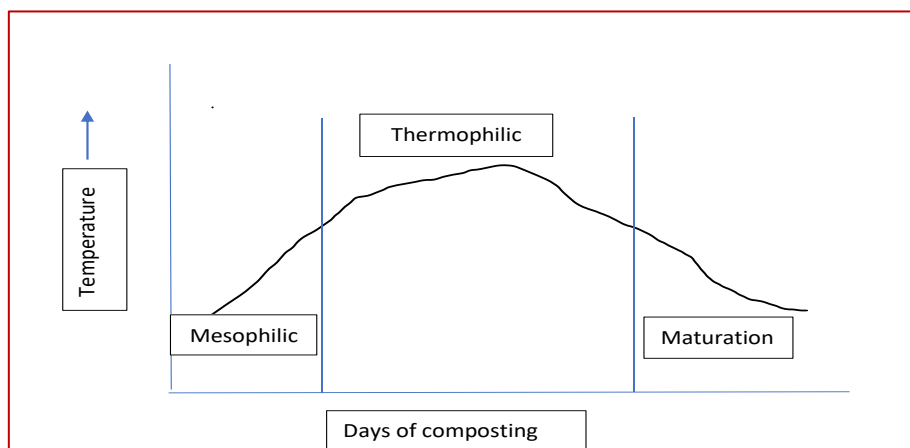


Fig. 1: Compost phases

III. TYPES OF COMPOSTING METHODS

Composting, or controlled decomposition, requires a proper balance of “green” organic materials and “brown” organic materials. “Green” organic material includes grass clippings, food scraps, and manure, which contain large amounts of nitrogen. A “Brown” organic material includes dry leaves, wood chips, and branches, which contain large amounts of carbon but little amount of nitrogen.

Traditional methods of composting:

- Open air composting (hot composting)
- Direct Composting (in-ground composting)
- Indore method
- Coimbatore method
- Bangalore method
- NADEP method

Recent methods of composting:

Composting technology is a kind of biological waste treatments, which has been widely accepted as an alternative method to recycle the organic matter and produce a stable and sanitary soil fertilizer or amendment. For enhance the composting process and reducing environmental risk, there are different recent and advance methods have been used for composting (Fig. 2). There are as follows:

- Tumbler Composting (A form of hot composting)
- Worm Farm Composting (Vermicomposting)
- EMO Composting (Bacteria composting)
- Combination Composting (Compot Composting)
- Commercial Composting
- Mechanical Composting

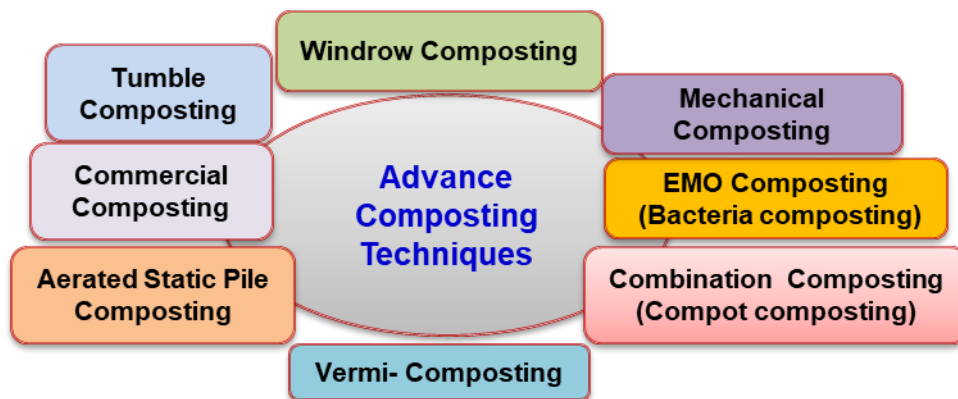


Fig. 1: Recent and advanced technologies in composting

Advantages of Compost

- Enhances porosity and friability of soil.
- Air circulation and drainage of soil is improved.
- Organic matter improves soil fertility and provide nutrients to the plants.
- It provides food to soil microbes which help in improving nutrients to soil and plants.
- Enhances water holding and nutrient holding capacity of soil.
- Improve physical, chemical and biological condition of soil and plant.
- Reduce pollution by transforming the waste into compost.
- Effective management of waste by transforming waste into compost.
- Excessive use does not cause any adverse effect to plants as by chemical fertilizer.

REFERENCES

1. Amouei, A.I., Yousefi, Z. and Khosravi, T. (2017). Comparison of vermicompost characteristics produced from sewage sludge of wood and paper industry and household solid wastes. *Journal of Environmental Health Science & Engineering*, 15(5), 1-6.
2. Bhatt, M.K., Labanya, R. and Joshi, H.C. (2019). Influence of Long-term Chemical fertilizers and Organic Manures on Soil Fertility - A Review. *Universal Journal of Agricultural Research*, 7(5): 177-188.



3. Kausar, H., Mohd, I. R., Mohd, H., Habib, S. H., Othman, R. and Bhuiyan, M. S. H. (2014). Changes of physical and chemical characteristics during microbial composting of rice straw at various pH Levels. *Compost Science and Utilization*, **22**(3):153-163
4. Malik, K., Rani, S., Ahlawat, S., Kumari, N. and Singh, D. (2021). Bioconversion process for compost production from agricultural residue. *International Journal of Chemical Studies*, **9**(2): 827-830.
5. Rajkhowa, D. J., Sharma, A. K., Bhattacharya, P. N. and Mahanta, K. (2019). Bioconversion of agricultural waste and its efficient utilization in the hilly ecosystem of Northeast India. *International Journal of Recycling of Organic Waste in Agriculture*, **8**:11-20.
6. Yang, W. and Zhang, L. (2022). Addition of mature compost improves the composting of green waste. *Bioresource Technology*, **350**:126927.



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