Agricultural Waste to Organic Compost: New Trends for Sustainable Agriculture

Shalini Rai[1] and Alka Sagar[2]
[1]Society of Higher Education and Practical Application, Varanasi, Uttar Pradesh, India
[2]MIET, Meerut, India

Corresponding author : shalinimicro09@gmail.com

INTRODUCTION

Annually, a huge quantity of agricultural wastes are generated in India is estimated to be approximately 620 million tones that must be degraded in terms of organic compost through the bioconversion process. Recently, pollution caused by burning of parali (rabi and kharif crop residues) are red-hot problem in India. Thus, the accumulation of these agricultural wastes causes severe disposal problems concerned with the fertility and microbial ecology of soil, environmental pollution and harmful effect on plant and animal health. Several researchers reported that the disposal of untreated agricultural waste is either performed by dumping, burning or unplanned landfilling. This has led to a serious deleterious contaminating impact on fertility of soil, shifting of beneficial microbial communities, emission of greenhouse gases, air pollution, progressive soil erosion and climate change.

The bioconversion is a sequential process that involves conversion of agricultural waste into raw compost, further humus rich compost fortified with beneficial decomposer microorganisms to produce high quality organic compost that resolve multidimensional problems like soil fertility, environmental pollutions, reduction in use of excessive chemical fertilizers and emission of greenhouse gases. The wide range of bacterial and fungal species has immense importance as decomposer microorganisms that produce fortified organic compost through bioconversion process. The potential decomposer microorganisms comprises either single or combination (consortia/formulation) of beneficial microorganisms like N-fixers, P-solubilizers or K-mobilizers and biocontrol agents that degrade agrowaste through biochemical process and enriches compost to produce bioorganic products. The metabolic activity and biosynthetic capability of specific microorganisms to amend, transform and exploit agrowaste in order to obtain vigor and biomass production give new insight towards microbes based natural bioconversion. Similarly, organic compost is also enriched with amino acids, botanicals, humic acid, mineral nutrients, phytohormones etc., that may add valuable growth in plants.

In concern of sustainable agriculture, organic compost is an alternative natural resource for minimizing the application of chemical fertilizers, management of crop residues and high yield production in the farmer's fields. In this order, controlled composting conducted by potential decomposer microbial communities to degrade agricultural residues properly and provide high-value low-cost bioorganic compost for farmer's. This emerging technique of composting processes can benefit farmers to attract towards organic compost rather than chemical fertilizers and simultaneously it enhanced the production of high-value profitable crops like vegetables, fruits, flowers, and organic crops. The

application of biofortified compost with bioagents, controlled the soil, seed or seedling borne fungal pathogens in the field that reduces the application of biopesticide. Similarly, farmers also applied consortium of microorganisms that are capable of fixing nitrogen, solubilizing phosphorus, zinc and mobilizing potassium that can be fortified with compost. The scientific approaches that targeted farmer-friendly microbe-mediated agricultural waste bioconversion for composting among the grass-root stakeholders are a matter of perception and preference. Several factors that hamper the awareness of technologies among the farmers are lack of knowledge about soil and plant characters, less awareness about effect of chemicals on agricultural foods on human health, dilemma to adopt new technologies, and short-sightedness towards long-term benefits of organic and fortified compost in agriculture. To overcome these problems Indian government started awareness programs using ICT tools or by videos, learning materials or by technical demonstration kits, television/ media adds, new government programs regarding sustainable agriculture are connected farmers to adopt these technologies.

Presently, elevated pollution through burning parali (crop residues) in North India is one of the best examples. Indian government lead and aware farmers for safe and useful decomposition practices of parali (crop residues) rather than burning that destroy microbial ecology, beneficial microbes, soil fertility and elevated air pollution. In this context, bio-decomposers liquid formulation technique has been developed by Indian Agriculture Research Institute (IARI), Dehli, PUSA institute which ensures speedy biodecomposition of crop residues within 8-10 days in fields and after 15 days fields will be ready for next harvest. These efforts can yield desirable impacts on crop yield production, minimizes the application of high-cost chemical fertilizers, integrated farm management practices, limiting hazard of pollutants due to enduring effects of pesticides, dropping production cost of the crops, converting agriculture residue into useful compost and enhancing soil fertility level that lost due to countable changes among farming communities. Therefore, the Indian government has publicized profound interest in promoting adaptation of such environment- and agriculture-friendly practices in farmers through innumerable progressive organizations and funding schemes.

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