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Effective Microorganism Technology: A New Avenue in Organic Fertilization

Effective microorganism technology is a method in which mixed culture of beneficial microorganisms is applied to soil as an inoculant, which increases microbial diversity; enhance soil quality as well as growth, yield and quality of crops. The necessity for chemical fertilisers and pesticides is lowered since EM cultures expedite the decomposition of organic wastes, increase the availability of mineral nutrients and desirable organic compounds to plants, and augment the activity of beneficial microorganisms. Due to its eco-friendly nature and minimal demand on resources like inputs and money, EM has a pretty broad range of applications in many facets of human society. Therefore, effective microorganism technology can be considered as an effective method in organic fertilization.

INTRODUCTION

Conventional agricultural production using chemical fertilizers, pesticides and other synthetic chemicals has become hazardous to soil, climate, environment and human beings. Organic agriculture, combining the traditional farming methods with modern technologies has been proposed as an alternative. It emphasizes on crop rotation, biological pest management, crop and livestock diversification and improving soil fertility by addition of composts and manures. Biological nutrients and biological pesticides together with other cultural practices are the important agricultural inputs needed for organic agriculture production. Organic farming has made extensive use of a microbial inoculum known as "Effective Microorganisms"

(EM), which consists of a mixture of naturally occurring beneficial microbes. Hence, in the organic agriculture movement as well as under the integrated soil fertility system, the use of efficient microorganisms as a soil amendment could play a significant role in plant nutrition.

EFFECTIVE MICROORGANISM TECHNOLOGY

High populations of advantageous microorganisms are grown, applied, managed, and re-established in an environment or system as part of EM technology. EM is a mixture of beneficial microorganisms that can be used as inoculants to broaden the diversity of soil microorganisms. It can also be described as a type of commercial biofertilizer that contains a combination of advantageous microorganisms that coexist and were gathered from the environment naturally. This concept was developed by Prof. Teruo Higa, at the University of the Ryukyus, Japan, in the early 1980 (Higa and Parr, 1994). EM is made by cultivating more than 80 different types of microorganisms, including the lactic acid bacteria *Lactobacillus plantarum*, *Lactobacillus casei*, and *Streptoccus lactis*, the photosynthetic bacteria *Rhodopseudomonas palustrus* and *Rhodobacter spaeroides*, the yeasts *Saccharomyces cerevisiae* and *Candida utilis*, the actinomycetes *Streptomyces albus* and *Streptomyces griseus,* and *Aspergillus oryzae, Penicillium* sp. and *Mucor hiemalis* (fermenting fungi). EM cultures don't contain any genetically modified microorganisms.

Microorganisms from both aerobic and anaerobic environments coexist in EM cultures for the benefit of both (symbiosis). Additionally, it combines with the soil's already-existing microorganisms. They work together to build a live, healthy soil. It is non-toxic and secure for use around people, pets, and the environment. In addition, EM may be used in a variety of other fields, such as agriculture, livestock, gardening, landscaping, composting, bioremediation, septic tank cleaning, algal management, and residential applications.

BENEFICIAL EFFECTS OF EM

Increased beneficial soil microorganisms, improved physical, chemical, and biological soil environments, suppression of soil-borne pathogens and pests, promotion of crop germination, establishment, flowering, fruiting, and ripening, and increased photosynthetic capacity of crops are all benefits of EM. Enhancing the activities of beneficial microorganisms like mycorrhizae and nitrogen-fixing bacteria, EM cultures speed up the decomposition of organic wastes, increase the efficacy of organic matter as fertilisers, increase the availability of mineral nutrients and useful organic compounds to plants, and decrease the need for chemical fertilisers and pesticides.

EM-I AND EM-II

EM I refer to the EM solution stock. It is a dark brown liquid that is inactive and has a pleasant odour and sweet-sour taste. EM-1 should have a pH of less than 3.5. It is deteriorated if it smells bad or has an offensive odour or if the pH is higher than 4.0. Simply dilute the concentrated solution with fresh, chlorine-free water to activate the EM. Thusly created EM solution has a pleasant aroma and is yellowish brown in colour.

The activated and diluted solution is known as EM II. It is prepared by dissolving one litre of EM-I in 19 litres of water containing one kg of jaggery or one litre of molasses. EM II can be diluted and used in composting and as foliar sprays on crops.

METHOD OF APPLICATION OF EM SOLUTION

Use a clean sprayer to apply foliar spray on a weekly basis, making sure to thoroughly moisten the plants. For optimal results, do this in the early morning or late afternoon. As soil drenching, ensure the solution fully wets the soil. It can be applied around mature plants or on open ground. It can also be used in compost preparation. Application of EM to the compost pile will improve the quality and process of composting and reduce bothersome odours and flies.

FERMENTED ORGANIC MATTER (BOKASHI)

Bokashi is prepared by fermentation of organic matter with EM and is equivalent to compost. It can be used as soil amendment, 3-14 days after fermentation and is available as powder or as granules. Ingredients in a typical Bokashi include rice bran, oil cake, fish meal or chicken dung, EM-I, molasses and water. Depending on how it is prepared, bokashi can be either aerobic or anaerobic, the same initial steps apply to both. Add EM to the prepared molasses solution after dissolving the molasses in the water. Check the

moisture content (30-40 percent) as you progressively pour the EM mixture over the organic matter mixture of rice bran, oil cake, and fish meal. In anaerobic bokashi, put the resulting mixture in an airtight bag.

To maintain an anaerobic environment, this is put into another polyethylene bag and sealed tightly. The fermentation period is, more than 3-4 days in tropics and in temperate zone, more than 3-4 days (in summer) and more than 7-8 days (in winter). If you're using aerobic Bokashi, spread the mixture out on a concrete surface and cover it with a gunny bag, a straw mat, or any other similar material. Keep this material out of the rain. In an aerobic environment, bokashi quickly ferments. The temperature should be kept around 35-45^{0}C. The fermenting period is same as that of anaerobic Bokashi. When it emits a lovely fermented smell and white mould is seen, it is perfect for use. When there is sufficient organic matter in the soil, bokashi can be administered at a rate of 200 gm^{-2} to the top soil. It can be applied at 1 kg m^{-2} when the soil is poor or contains little organic matter.

APPLICATION OF EFFECTIVE MICROORGANISM TECHNOLOGY

By boosting photosynthesis, generating bioactive substances like hormones and enzymes, expediting the breakdown of organic materials, and managing soil-borne diseases, microorganisms in EM increase crop health and productivity (Higa, 1996; Hussain *et al*., 2002). Utilizing EM in conjunction with organic soil amendments encouraged the mineralization of nutrients, and its usage with fresh organic material was preferable to compost (Fatunbi and Ncube, 2009). Effective Microorganism (EM-1) based compost improved the nutrient content and favoured plant growth parameters, increased yield and cost-benefit ratio in *Vigna mungo* (Namasivayam and Bharani, 2012). Packialakshmi and Yasotha (2014) reported that EM treatment increased the microbial population and enhanced growth and yield of green gram. Plant nutrients that are required for plant growth were present in the activated effective microorganism (EM) solution.

Farmyard manure treated with this solution contained microorganisms that speed up the breakdown of organic components, and the coexistence of these microorganisms improved the uptake of plant nutrients. As a result, it is an effective organic soil supplement that, when used properly, boosts crop output, especially in locations with poor soil moisture and fertility (Saidia and Mrema, 2016).

CONCLUSION

A naturally occurring species of coexisting microorganisms are combined and fermented in an acidic media to create an EM culture. Due to its eco-friendliness and low capital and cost input requirements, EM is used widely in many realms of human society. The inherent power of agricultural soil is strengthened by EM technology, which also reduces energy loss during the recycling of farm goods, reduces the prevalence of insect pests and plant diseases, and increases the production of foods that are safer for human health. So, using EM technology in agriculture can help produce more food while also preserving the environment.

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