TEACHER & TRAINER GUIDE

Vermicomposting

PowerWorms Project

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VERMICOMPOSTING

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VERMICOMPOSTING

This guide is for VET Students/Teachers and Amateur Farmers

What you will learn

You will learn how to produce and use vermicompost to obtain the nutrients needed by agricultural products. The guide was prepared to contribute to the development of your technical knowledge and skills on vermicomposting

Guide Key Achievements

- Explains vermicomposting and its importance for a sustainable environment.
- Explains the terms and terminology related to vermicompost production.
- Compares vermicompost production methods.
- Classifies the advantages and disadvantages of vermicompost production methods over each other.
- Explains the role of earthworms in vermicompost production.
- Explains the importance of substrate type for the vital functions of earthworms.
- Analyzes the contribution of the substrate type to the composition of the final product, vermicompost.
- Illustrate the key parameters in the design of the living environment (beds) of earthworms.
- Plans the basic processes of vermicompost production.
- Classifies abiotic and biotic parameters affecting vermicompost production.
- Explains how to harvest vermicompost.
- Explains the importance of vermicompost for plants and soil.

- Explains the economic benefits of vermicomposting.
- Designs the requirements for the vermicompost production facility.
- Explains the current state of the market in vermicompost production as a commercial activity.
- Compares legal regulations and incentives for vermicompost production in different countries.
- Explains the functions, advantages and disadvantages of plant nutrients.

This course includes

- A total of 15 video lessons
- A total of 16 sections
- Downloadable educational materials
- Certificate of completion

Introduction to Vermicomposting

Increasing urbanization, industrialisation and economic growth lead to the production of large quantities of solid waste worldwide. The management of this solid waste has become an ecological and technical problem. Sustainable solid waste management practices are indispensable for keeping the environment healthy and clean [1]. The situation of solid waste generation is worsening almost everywhere in the world. Studies indicate that by 2025, 1.8 million tonnes of solid waste per day will be generated in the Asia Pacific region alone [2]. According to different studies, an average of 0.77 kg of solid waste per person per day is generated in developing countries. It is estimated that the world's solid waste generation will increase to 3 billion tonnes by 2025 [3],[4].

The lack of appropriate technology for the economic recycling of solid waste in developing countries has resulted in large quantities of solid waste that pose significant technical, economic and environmental problems. Although there are many strategies for solid waste management, including waste minimisation, recycling at source, waste-to-energy, incineration and composting, it is known that some of these treatment and disposal methods can cause serious environmental problems. There are numerous scientific studies showing that waste disposed in landfills or open landfills causes groundwater contamination due to leaching of organic and inorganic compounds in the waste [5],[6].[7]. Landfilling and incineration processes are not preferred much considering their negative environmental impacts and low economic contribution. Waste sludge from treatment plants used as fertiliser can cause toxicity to soil, plants and soil microorganisms when applied directly to agricultural lands due to its high nitrogen (N) and phosphorus (P) content.

Considering all these adverse conditions, vermicomposting, which enables the conversion of solid wastes into organic-rich fertilizer, stands out as an ecologically sound and applicable technology. Vermicomposting is a waste management technology that involves the decomposition of the organic components of solid waste in an environmentally friendly manner to a level where they can be easily stored, processed and applied to agricultural fields without any negative impact [1, 5],[8]. Vermicomposting is a product of the collective work of microorganisms and earthworms under environmentally controlled conditions. In summary, it is a biotechnological process in which organic wastes are converted into nutrient-rich vermicompost using earthworms. The microorganisms present in the system are responsible for the biochemical breakdown of organic matter, while the earthworms are involved in improving the substrate and also in modifying the biological activity. This is a very low-cost technology for the treatment of organic waste using earthworms.

Composting is one of the feasible means for converting bio-degradable solid wastes into beneficial organic soil amendments for supporting an environmentally friendly agricultural production system. Many beneficial organisms and microorganisms act as chemical decomposers in the process of formation of stable organic end-products (compost) during composting. Among them, decomposers like earthworms play a significant role in stimulating the process of composting, enhancing nutrient value while fastening the process of stable organic end-product formation. This process of involvement of earthworms in preparing enriched compost is called vermicomposting. It is one of the simplest methods to recycle agricultural wastes and to produce quality compost.

Earthworm acts physically an aerator, crusher and mixer, chemically a degrader and biologically a stimulator in the process of decomposition. Earthworms consume biomass (decaying organic matter) and excrete it in a digested form called worm casts or worm manure. Worm casts are popularly called as black gold. They are rich in essential plant nutrients, plant growth promoting substances, beneficial soil micro flora and having properties of inhibiting pathogenic microbes. As a result, the organic end products produced by the use of earthworms i.e. vermicompost also inherits most of the beneficial properties (to soil health and crop productivity) of black gold.

Vermicompost acts as an organic soil amendment- improves three dimensional soil health's (physical, chemical & biological properties). On application of vermicompost, it enhances the soil quality by improving its physicochemical and biological properties. The earthworm's underground burrows modify soil hydro-thermal and aeration regimes by making the soil more porous thus, allowing free movement of air, infiltration of water into deeper soil layers for better profile moisture recharge and root water uptake processes. Vermicompost is becoming popular as one the major components of the organic farming system because of its high nutritive value in addition to an important organic soil amendment [9].

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