



ENVIRONMENTAL STUDIES & LIFE SCIENCES

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ENVIRONMENTAL STUDIES & LIFE SCIENCES

Bio-sustainability

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Organic farming
Vermicomposting



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Bio-sustainability

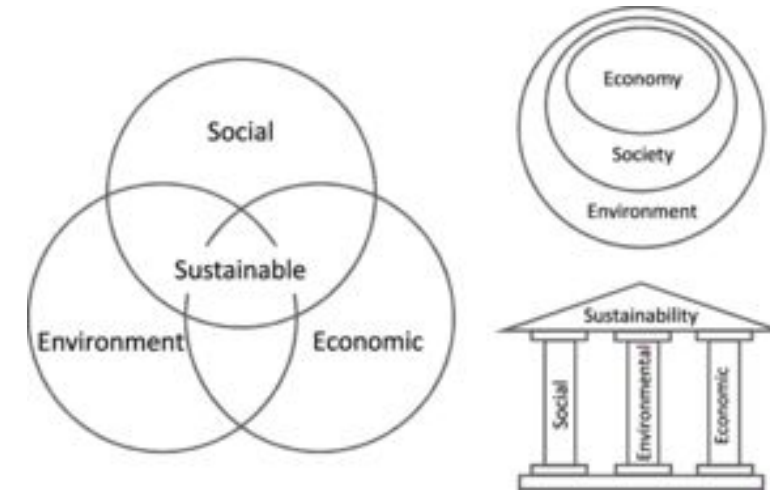
Sustainability is a social goal about the ability of people to co-exist on Earth over a long time.

Sustainability consists of fulfilling the needs of current generations without compromising the needs of future generations, while ensuring a balance between economic growth, environmental care and social well-being.

Bio-sustainability: The quality of being bio-sustainable

FAO - The production, use and conservation of biological resources, including related knowledge, science, technology, and innovation to provide information, products, processes and services to all economic sectors with the aim of moving towards a sustainable economy.

Image source: [Sustainability - Wikipedia](#)



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Bio-sustainability – Organic farming

Organic farming is a method of crop and livestock production that involves choosing not to use pesticides, fertilizers, genetically modified organisms, antibiotics and growth hormones

Holistic system designed to optimize the productivity and fitness of diverse communities within the agro-ecosystem, including soil organisms, plants and livestock



Bio-sustainability – Organic farming

International Federation of Organic Agriculture Movements (IFOAM), an international organization established in 1972 for organic farming organizations defines the goal of organic farming as:

“Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved”

Bio-sustainability – Organic farming

The *general principles* of organic production, include the following:

- **Protect the environment**, minimize soil degradation and erosion, decrease pollution, optimize biological productivity
- **Maintain long-term soil fertility** by optimizing conditions for biological activity within the soil
- **Recycle materials and resources** to the greatest extent possible within the enterprise
- Prepare organic products, emphasizing careful processing, and handling methods in order to **maintain the organic integrity and vital qualities** of the products at all stages of production
- **Rely on renewable resources** in locally organized agricultural systems

Bio-sustainability – Organic farming

In 1921 the founder and pioneer of the organic movement **Albert Howard** and **Gabrielle Howard**, accomplished botanists, founded an **Institute of Plant Industry** to improve traditional farming methods in India.

Methods

Crop rotation

Green manures and compost

Biological pest control

Nitrogen fixing organisms

Natural insect predators

The science of **Agroecology** has revealed the benefits of **polyculture** (multiple crops in the same space), which is often employed in organic farming.

Bio-sustainability – Organic farming

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Planting a variety of vegetable crops supports a wider range of beneficial insects, soil microorganisms, and other factors that add up to overall farm health.

Biological process, driven by microorganisms such as mycorrhiza and earthworms allows the natural production of nutrients in the soil throughout the growing season.

Organic farmers use a number of traditional farm tools to minimize their reliance on fossil fuels

Bio-sustainability – Organic farming

In India, in **2016**, Sikkim achieved its goal of converting to **100% organic farming**.

Kerala, Mizoram, Goa, Rajasthan and Meghalaya, have also declared their intentions to shift to fully organic cultivation

Andhra Pradesh is promoting organic farming, especially **Zero Budget Natural Farming** (ZBNF) which is a form of regenerative agriculture

As of 2018, India has the largest number of organic farmers in the world and constitutes to more than 30% of the organic farmers globally

India has 835,000 certified organic producers

Advantages

Farmers can reduce their cost of production as they do not need to buy expensive chemicals and fertilizers.

Pesticides are not used, hence healthier food & no residues

Organic farms save energy and protect the environment in the long term.

Organic farming can slow down global warming.

Protect Biodiversity (Natural habitat for animals & plants)

Pollution of groundwater can be reduced.

Soil is built with natural fertilizers in order to grow crops.

Soil quality conservation is done due to crop rotation.

Organic farming creates new living areas for wasps, bugs, beetles and flies by giving them water and food.

Advantages



Key Highlights

The central government had launched two dedicated programs in 2015 to provide a boost to natural, organic and chemical-free farming. The schemes include: ***Mission Organic Value Chain Development*** for North East Region (MOVCD) and ***Paramparagat Krishi Vikas Yojana*** (PKVY)

The two programmes were launched to assist farmers to adopt organic farming and improve remunerations due to premium prices.

The Agri-export Policy 2018 also aims to help India emerge as a major player in global organic markets.

Key Highlights

India's major organic exports include flax seeds, sesame, soybean, tea, medicinal plants, rice and pulses. These exports were instrumental in driving an increase of nearly 50 percent in organic exports in 2018-19, touching Rs 5151 Crore.

The centre is further trying to strengthen the organic e-commerce platform www.jaivikkheti.in to directly link farmers with retail as well as bulk buyers. Infusion of digital technology in a much bigger way. This has been one of the major takeaways during the pandemic period.



Certification of Organic Products

The two central programmes PKVY and MOVCD promote certification under ***Participatory Guarantee System*** (PGS) and ***National Program for Organic Production*** (NPOP) respectively targeting domestic and export markets, as certification is an important element of organic producers to build customer confidence.

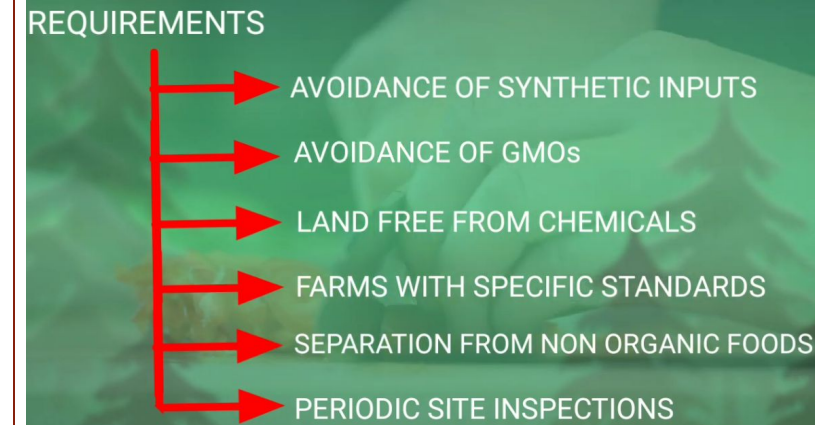
The Food Safety and Standards (Organic Foods) Regulations, 2017 are also based on the PGS and NPOP standards. The consumer should look out for the logos of FSSAI, Jaivik Bharat / PGS Organic India on produce to establish its organic authenticity. PGS Green certification is given to chemical-free produce under transition to 'organic' which takes 3 years.

Things to remember before buying a product

PGS Logo - Participatory Guarantee System (PGS) is a quality assurance initiative that is locally relevant, emphasize the participation of stakeholders, including producers and consumers and operate outside the frame of third party certification

- **PGS Organic** - Farmers which have completed full conversion period without any major or serious non-compliance be declared as "PGS-Organic".
- **PGS Green** - Farmers which have one or more major noncompliance or are under conversion period will be declared as "PGS-Green".

Note : In case of mixed/ processed products if minimum of 95% ingredients is PGS-organic the product may be labeled as PGS-Organic. If proportions of organic ingredients are between 95 and 70% the products can be labeled as "Made with PGS-organic ingredients", but in such cases PGS logo cannot be used.



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Bio-sustainability – Organic farming

Things to remember before buying a product

Before Buying PGS certified products, Please check the following



PGS Organic Logo



Jaivik Bharat Logo

Before Buying Third Party certified products, Please check the following



TraceNet Logo



Source: <https://www.prakati.in/jaivik-bharat-certification-organic-food-india/>

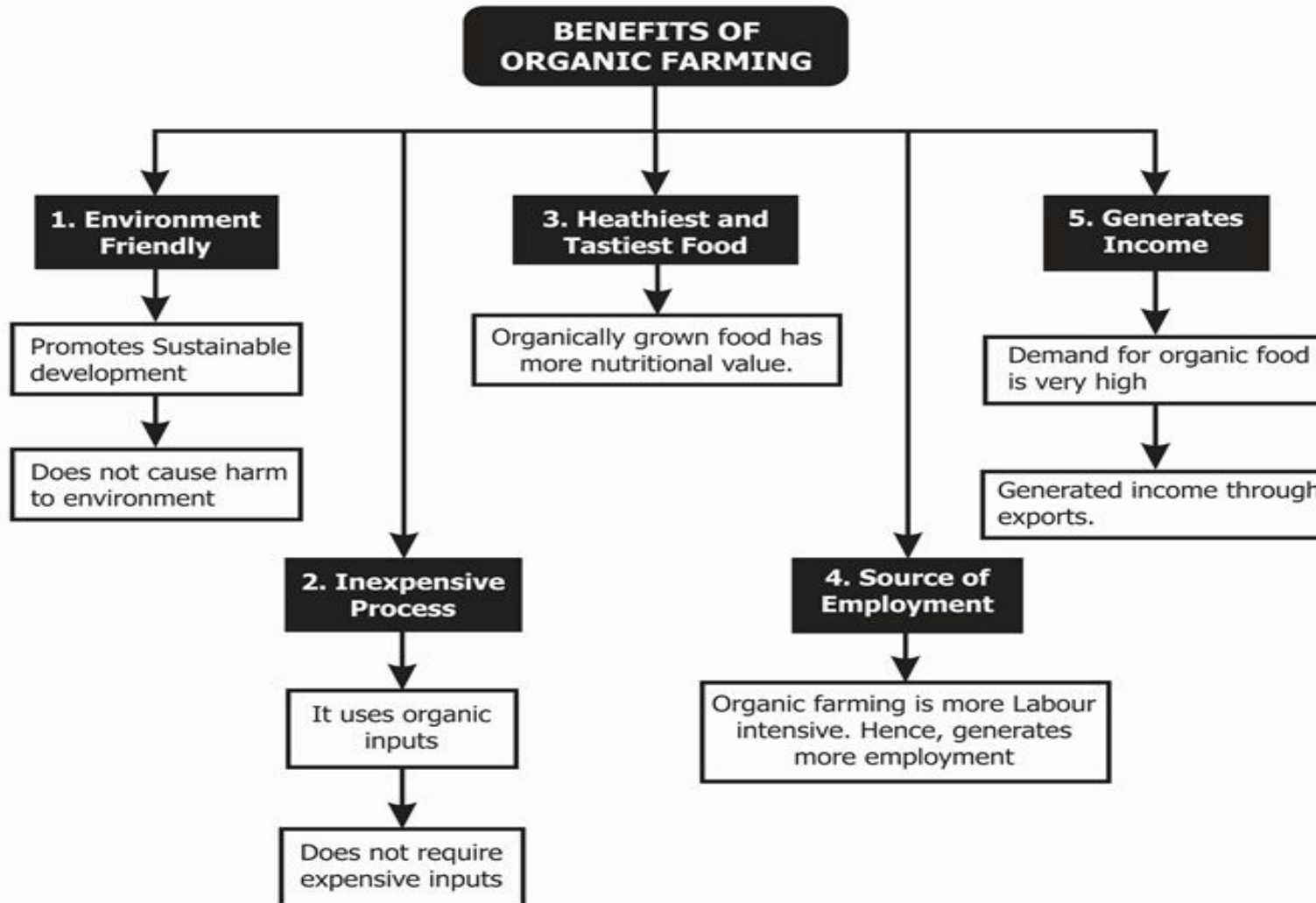
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Bio-sustainability – Organic farming

Types & Techniques



Bio-sustainability – Organic farming



Bio-sustainability – Vermicomposting

Vermicomposting is a type of composting in which certain species of earthworms are used to enhance the process of organic waste conversion and produce a better end-product

It is a **mesophilic process** utilizing microorganisms and earthworms

Vermicompost is the product of the decomposition process using various species of earthworms and this process is called **vermicomposting**. While the rearing of worms for this purpose is called **Vermiculture**

To prepare Vermicompost uses the mixture of decomposing vegetable or food waste, bedding materials etc.



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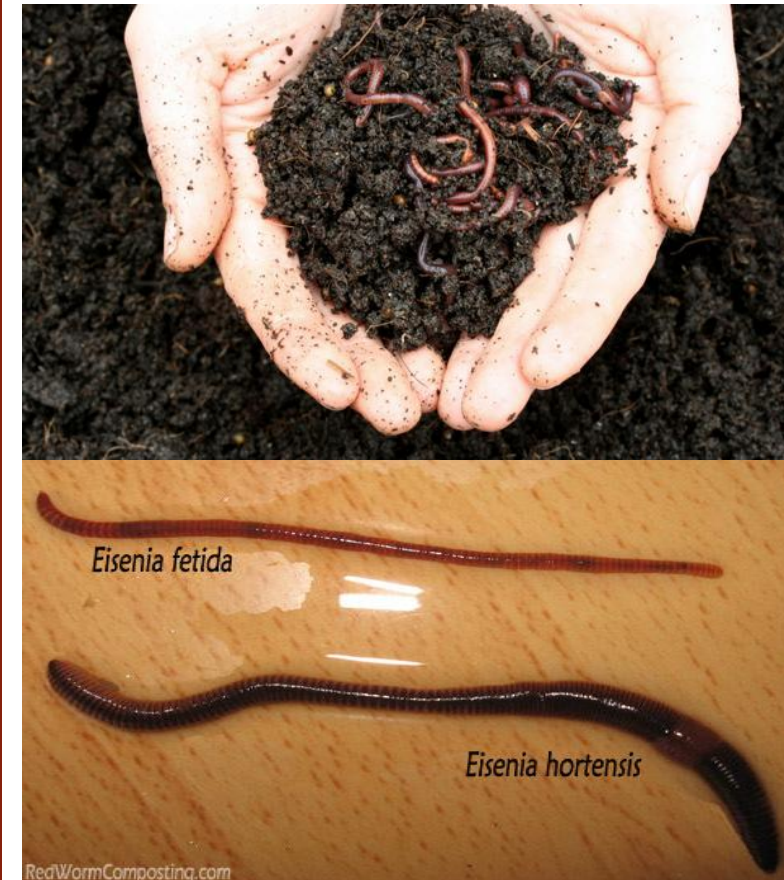
Bio-sustainability – Vermicomposting

Vermicomposting, or worm composting, turns kitchen scraps and other green waste into a rich, dark soil that smells like earth. Made of almost pure worm castings, it's a sort of super compost

Not only is it rich in nutrients but it's also loaded with the microorganisms that create and maintain healthy soil.

It provides a way to treat organic wastes more quickly. The earthworm species most often used are **red wigglers** (*Eisenia fetida*), though **European night crawlers** (*Eisenia hortensis*) and **red earthworm** (*Lumbricus rubellus*) could also be used

Red wigglers are recommended by most vermicomposting experts, as they have some of the best appetites and breed very quickly



Bio-sustainability – Vermicomposting

Vermicomposting contains water-soluble nutrients, & is a nutrient-rich organic fertilizer and soil conditioner in a form that is relatively easy for plants to absorb.

Worm castings are sometimes used as an **organic fertilizer**. Because the earthworms grind and uniformly mix minerals in simple forms, plants need only minimal effort to obtain them.

How to do a Vermicompost at home?

In addition to readily available kitchen scraps, worms, a container, and bedding are required.

One pound of worms, approximately 1,000 worms, to one pound of garbage (worms need to be added gradually)

Since worms are quite sensitive to both light and noise, a dark corner works best

□ Collection of Earthworm Species: Collected from the department of entomology, University of Agriculture Sciences, GKVK, Bangalore-65



1. *Eisenia fetida*



2. *Eudrilus euginae*



3. *Perionyx excavatus*

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Bio-sustainability – Vermicomposting

How to do a Vermicompost at home?

Earthworms thrive at temperatures about 13°-25°C.

Bedding should be about 75 percent water and can be made out of strips of newspaper or shredded grocery bags, cardboard, or egg cartons, composted manure, old leaves, coconut coir, or a mixture of any of these substances.

The material must be clean and non-toxic.



Image source: agritech.ac.in



1. *Eisenia fetida*

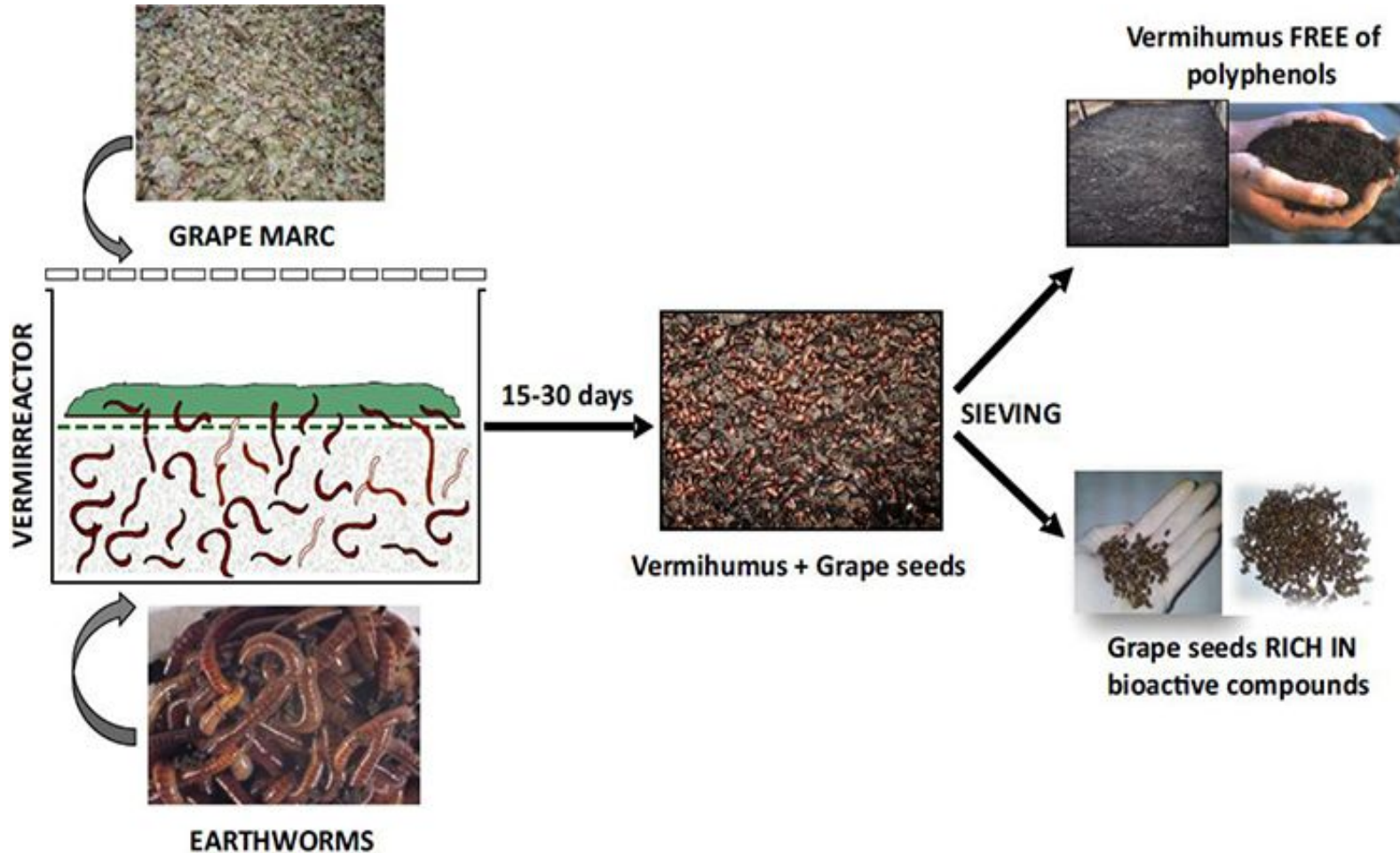


2. *Eudrilus euginae*



3. *Perionyx excavatus*

Waste to value added product



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Bio-sustainability – Vermicomposting

*Vermicomposting
in large scale*



Vermicompost pits in the farmer's field



Healthy worms from the compost pits

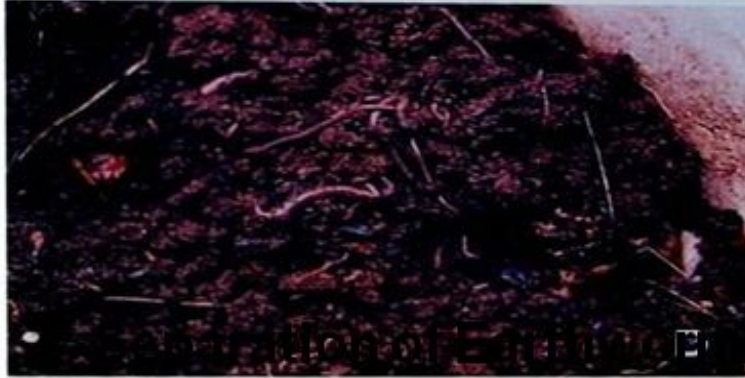


Vermicompost

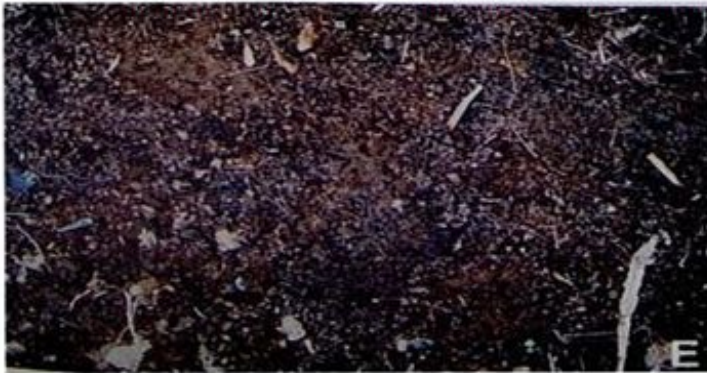
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Bio-sustainability – Vermicomposting

Vermiculture unit for kitchen waste recycling @ PES University



Eisenia fetida, *Eudrilus eugeniae*, *Perionyx excavatus*



Shade drying of Vermicompost



Sieved Vermicompost



Department of Biotechnology,
Vermicomposting unit

Benefits to soil

Improves *soil aeration*

- Enriches soil with microorganisms (adding enzymes)
- Microbial activity in worm castings is 10 to 20 times higher than in the soil.
- Improves *water holding* capacity and increase *soil fertility*.

Benefits in plant growth

- Enhances germination, plant growth, and crop yield
- Improves root growth and structure
- Enriches soil with microorganisms (adding plant hormones such as auxins and gibberellic acid)



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Bio-sustainability – Vermicomposting

Benefits for environment

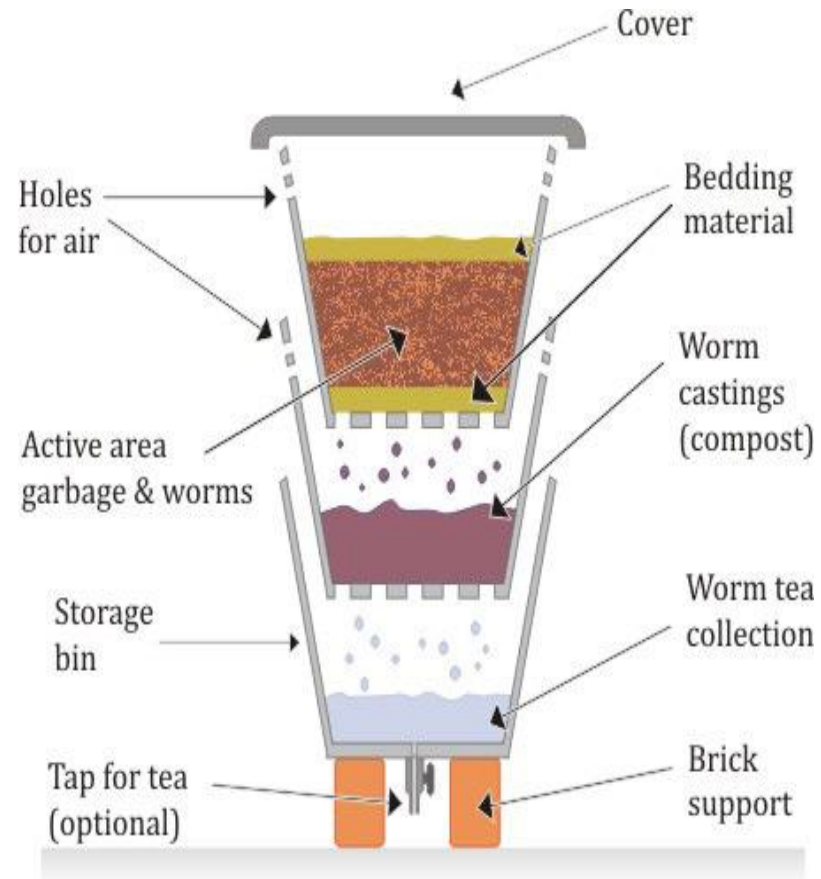
- Bio-wastes conversion reduces waste flow to landfills
- Elimination of bio-wastes from the waste stream reduces contamination of other recyclables collected in a single bin
- Production reduces greenhouse gas emissions such as methane and nitric oxide

Uses

Soil conditioner: Vermicompost can be mixed directly into the soil, or mixed with water to make a liquid fertilizer known as *worm tea*.



Vermicomposting unit



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Bio-sustainability – Vermicomposting

Large scale methods of vermicomposting



PIT and/or BED method



Windrow method

Bio-sustainability – Vermicomposting

The implementation of cutting-edge agricultural practices provides tools and techniques to drive climate-smart agriculture, reduce carbon emissions, and lower the carbon footprint.

Vermicomposting is an integrated biological process of converting organic waste into vermicast by employing earthworms and naturally occurring microbes under a mesophilic environment. Vermicomposting has been reported as a **sustainable technique** for the treatment and management of different organic wastes.

Earthworms increase the bacterial abundance in the soil as their gut conditions are favourable for the multiplication of bacteria and the suppression of fungi.

Vermicomposting - Case study



Source: <https://www.mdpi.com/2071-1050/14/21/13828#>



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THANK YOU

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