

* Advantage of Vermicompost :-

- Vermicompost is a rich source of nutrients, vitamins, enzymes, antibiotics and growth hormones.
- Vermicompost harbours certain microbial populations that help in N fixation and P solubilization.
- Superiority of vermicompost over other synthetic growth media is more pronounced in plant nurseries.
- It improves taste, texture and keeping quality of the produce.
- It does not have foul odour as is associated with manures and decaying organic wastes.

① *Eisenia foetida* and *Eudrilus eugeniae* are exotic worms and *Perionyx excavatus* is a native one being used for vermicomposting in India.

② Epigeic are feeders on leaf litter and soil at upper layer of soil. This group such as *Lampito mauritii* is indigenous and is active in in situ decomposition of organic wastes and residues in soil.

- ① *Eisenia foetida*
- ② *Eudrilus eugeniae*
- ③ *Eisenia foetida* cocoons.

* Mechanism of vermicomposting

① Materials consumed by worms undergo physical breakdown in the gizzard resulting in particles $< 2 \mu$, giving thereby an enhanced surface area for microbial processing. This finely ground material is exposed to various enzymes such as protease, lipase, amylase, cellulase and chitinase secreted into lumen by the gut wall and associated microbes. These enzymes breakdown complex biomolecules into simple compounds. Only 5-10% of the ingested material is absorbed into the tissues of worms for their growth and rest is excreted as cast. Mucus secretions of gut wall add to the structural stability of vermicompost.

* Vermicompost preparation :- ① Basic raw material :-

Any organic material generated in the farm like khusa, leaf, faeces, etc. Horse dung, due to the risk of Tetanus virus, fatal to human being, is not advisable to be used as feeding material for worms.



and direct sunshine.

11. Stop sprinkling of water when 80-98% bio waste is decomposed. Maturity can be judged visually by observing the formation of granular structure of the compost at the surface of the tank.

12. Collect the vermicompost by scrapping layer-wise from the top of the tank and keep it under shade

Separation Techniques :- ① Heap the harvested vermicompost for 6-12 hrs shade for separation of the worm.

② Make small balls of cow dung are kept inside the heap for 2-3 days

③ Remove the balls of cow dung and earthworm can separate from the whole compost for reuse.

④ Sieve gently the vermicompost and pack it for further use or sale.

⑤ Dry vermicompost under shade to keep the moisture content below 20%.

CHEMICAL COMPOSITION :- (leave).

Nutrients

Percent.

| | |
|-------------|-----------|
| Nitrogen | 1.5 - 3.0 |
| Phosphorous | 1.2 - 1.8 |
| Potash | 1.5 - 2.4 |
| Calcium | 0.5 - 1.0 |
| Magnesium | 0.2 - 0.3 |
| Sulphur | 0.4 - 0.5 |
| Iron | 0.8 - 1.5 |

Copper
Zinc
Magnesium

Benefits

- It is micro-organisms like Gibberella etc.
- It attracts

Problems

① **Oxygen**

and forms of carbon

② **Pests**

③ **Environ**

places.

④ **Climate**



Copper (ppm) 22-36.
Zinc 500-1000 ppm
Magnese 1000-2000 ppm.

- Benefits** :
- It improves the physical structure of the soil.
 - It improves the biological properties of the soil enrichment of micro-organisms, addition of plant hormones such as Auxins and Gibberlic acid, and addition of enzymes, such as phosphates, cellulase etc.
 - It attracts deep-burrowing earthworms already present in the soil.

Problems in Vermicomposting :- (leave)

- Odour** :- Putting overabundance of "green" in the bin, which is actually too much nitrogen combining with hydrogen and forms the ammonia? To neutralize the odours, add some sources of carbon like paper, and dried leaves.
- Pests** :- Bad odour can attract pest such as rodents and flies. Fix plastic nets around the bins.
- Environment** :- *Eisenia fetida* worms can attack native worms in natural areas. Don't allow to go out natural places.

Shot on Y15
Vivo AI camera
Rain and bright light is drastically effect to the worm



Subject : Zoology.

Unit - 5.

- 1) Vermicomposting - technology, importance and its relevance.
- 2) How to start a unit at home.
- 3) Maintenance and propagation.

Subtopic - (1) : Vermicompost :- Vermicompost (vermi-comp, Vermiculture) is the product of the decomposition process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste bedding material and vermicast.

Vermicast (also called worm castings, worm humus, worm manure, or worm faeces) is the end product of the breakdown of organic matter by earthworms. These castings have been shown to contain reduced level of contaminants and a higher saturation of nutrients than the organic materials before vermicomposting.

Vermicompost contains water-soluble nutrient and is an excellent nutrient-rich organic fertilizer and soil conditioner. It is used in farming and small scale sustainable, organic, farming.

Vermicomposting can also be applied for treatment of sewage. A variation of the process is vermifiltration which is used to remove organic matter, pathogens and oxygen demand from wastewater or black water of flush toilets.

• **Earthworm** : 1000-1200 adult worms.

• **Water** :- 3-5 liters in every week per heap or pit.

* **Importance of Vermicompost** :- ① **Source of plant nutrient**.

Earthworms consume various organic wastes and reduce the volume by 40-60%. Each earthworm weighs about 0.5 to 0.66g and eats waste equivalent to its body weight and produces cast equivalent to about 50% of the waste it consumes in a day. These worm casting ranges have been analyzed for chemical and biological properties. The moisture content of casting ranges between 32 and 66% and the pH is around 7.0. The worm casting contain higher %age of both macro and micronutrients than the garden compost.

② **Improvement of plant growth and yield** :- Vermicompost plays a major role in improving growth and yield of different field crops, vegetables, and flowers and fruit crops. The application of vermicompost gave higher germination (93%) of mung bean compared to the control (84%).

③ **Reduction in Soil C:N ratio** :- Vermicomposting converts household waste into compost within 30 days reduces the C:N ratio and retains more N than the traditional methods of preparing composts.

④ **Role in Nitrogen cycle** :- Earthworms plays an important role in the recycling of N in different agro-ecosystems, especially under them where the use of agrochemicals is minimal.

Nutrient content of Vermicomposting :-

| Nutrient | Content |
|------------------|---------------------------|
| Organic carbon | 9.15 to 17.98% |
| Total nitrogen | 1.5 to 2.10% |
| Total phosphorus | 1.0 to 1.50% |
| Total potassium | 0.60% |
| Ca and Mg | 22.00 to 70.00 m.e / 100g |
| Available S | 128 to 548 ppm |
| Copper | 100 ppm |
| Iron | 1800 ppm |
| Zinc | 50 ppm |

NRK content in basic manure :-

| Element | Vermi Compost | Farmyard manure | Bacterial compost |
|---------|---------------|-----------------|-------------------|
| N (%) | 2.1 - 2.6 | 1.1 - 1.5 | 1.2 - 1.5 |
| P (%) | 1.5 - 1.7 | 0.7 - 0.8 | 0.7 - 0.9 |
| K % | 1.4 - 1.6 | 0.6 - 0.7 | 0.6 - 0.7 |

Terms related to Vermicomposting :-

- Vermicomposting** :- It is a method of making compost, with the use of earthworms, which generally live in soil, eat biomass and excrete it in digested form. This compost is generally called vermicompost or wormcompost.

if smell is present, it is earthy. The smell may also depend on the type of composted material added to the bin. An unhealthy worm bin may smell, potentially due to low oxygen conditions. Worms require gaseous oxygen. Oxygen can be provided by airholes in the bin, occasional stirring of bin contents, and removal of some bin contents if they become too deep or too wet. If decomposition becomes anaerobic from excess wet feedstock added to the bin, or the layer of food waste have become too deep, the bin will begin to smelt of ammonia.

② **Worm escaping** :- Worms generally stay in the bin but may try to leave the bin when first introduced, or often after a rainstorm when outside humidity is high. Maintaining adequate conditions in the worm bin and putting a light over the bin and cutting a light over the bin when first introducing worms should eliminate this problem.

③ **Nutrient levels** :- Commercial vermicomposters test, and may amend their products to produce consistent quality and results. Because the small-scale and home system use a varied mix of feedstock, the nitrogen, phosphorus and potassium (NPK) content of the resulting vermicompost will also be inconsistent. NPK testing may be helpful before the vermicompost or tea is applied to the garden.

In order to avoid over-fertilization issues, such as nitrogen burn, vermicompost can be diluted as a tea 50:50 with water or as a solid can be mixed in 50:50 with potting soil.

Additionally, the mucous layer created by worms



Paddy husk, marigold and pine needles have also not advised to be used as feeding materials for earthworms.

① **Starter** :- Cow dung, Biogas slurry, or urine of cattle.

② **Soil animal** :- **Earthworms** (Species :- Eisenia foetida)

③ **Method** :- **Bedded** / **vermished**.

* **Favourable conditions of earthworms in the composting material** :-

① **pH** :- Range between 6.5 and 7.5.

② **Moisture** :- 60-70% of the moisture below and above range mortality of worms taking place.

③ **Aeration** :- 50% aeration from the total pore space.

④ **Temperature** :- Range between 18°C to 35°C.

* **Material Required for Vermicomposting** :-

• **Farm waste** (Straw from wheat, soyabean, chickpea, mustard etc) were used for vermicomposting.

• **Fresh dung**.

• **Rock phosphate**.

• **wastes** :- **dump ratio** (1:1 on dry weight basis)



Vermiculture :- It means scientific name- method of breeding and raising earthworm in controlled conditions.

Vermitechnology :- is the combination of Vermiculture and vermicomposting.

* **Thus earthworms can be used in the following areas**

- For development of arable soil, turnover of soil, break down of plant organic matter, aeration and drainage.
- For production of useful products like vermifertilizer and worm tissue for animal feed.
- For maintenance of environmental quality and monitor of the environment for soil fertility, organic and heavy metal non-biodegradable toxic material pollution.

* **Types of Earthworms** :-

• Earthworms belong to phylum **Annelida** of **Animal Kingdom**. They are long and cylindrical in shape and size and having a large number of grooves. There are about 3000 species of earthworms in the world which are adapted to a range of environment. More than 300 species have been identified in India. Although **hermaphrodite**, two mature earthworm are required to propagate. At the time of egg laying, the clitellum is transformed into hard, girdle like capsule called cocoon. Shedding of cocoon ranges from 1 to 5, only a few of them can survive and hatch.

• **Epigeics** are important in **Vermicomposting**. The epigeics such

their casting allows for a "time release" effect, meaning not all nutrients are released at once. This also reduces the risk of burning the plants, as is common with the use and overuse of pest.

④ **pest species** :- Pests such as rodents and flies are attracted by certain materials and odors, usually from large amount of kitchen waste, particularly meat. Eliminating the use of meat or dairy product in a worm bin decreases the possibility of pest.

Subunit :- 5.3 :-

① Maintenance and propagation of vermicomposting.

When we first acquired a worm bin, we had no idea how to maintain a worm farm. We kind of winged it. We assumed the worm farm was self-sufficient, and all we needed to do was top it up with food. This was a rookie mistake. Unfortunately, we ended up having to rectify some serious worm farm problems! But once you know the fundamentals, maintaining a worm farm is easy and fun.

* 9 Fundamentals How to maintain a Worm Farm:

To maintain a thriving worm farm, you need to do the following 9 things:

- ① Know exactly what do worms eat. Take care to not over-feed worms and avoid bad foods.
- ② Add carbon such as paper, cardboard etc. this is called worm bin bedding.
- ③ Neutralise the pH level of the worm bin.
- ④ Regulate bin temperature.
- ⑤ Keep the bedding moist.
- ⑥ Keep the bin dark.
- ⑦ Address worm farm problems e.g. remove any harmful pests.
- ⑧ Empty excess liquid.
- ⑨ Change over trays when full.

We can maintain these problem in the following ways :-

- ① **Smells** :- When closed a well-maintained bin is odorless; if maintained, it should have little smell.

if smell end on the An unheated oxygen can be provided bin, once they become anaerobic for ex of food of ammoniac

② Worm es

often after raining light over introducing

③ Nutrient

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In order burn, ve or as a

Additionally



Old unused buildings can be used. If it is to be produced in open area, shady place is selected. A thatched roof may be provided to protect the process from direct sunlight and rain. The waste heaped for vermicompost production should be covered with moist gunny bags.

Different Structure of Vermicompost production :-

A cement tub may be constructed to a height of 2.0-2.5 ft and a breadth of 3 ft. The length may be fixed to any level depending upon the size of the room. The bottom of the tub is made to slope like structure to drain the excess water from vermicompost unit. A small tank is necessary to collect the drain liquid. Vermicompost can also be prepared in wooden boxes, plastic bin or in any containers with a drain hole at the bottom.

Waste Selection for Vermicompost production :-

Cattle dung (except pig, poultry and goat) farm wastes, crop residues, vegetable waste, agro industrial waste, fruit market waste and all other bio-degradable waste are suitable for vermicompost production. The cattle dung should be decomposed before used for vermicompost production. All other waste should be pre-digested with cow dung for twenty days before put into vermibed for composting. Heavy spices and metallic products are not used in this process.

Material Required :-

- (1) Vermi bin / cemented tank.
- (2) Polythene sheet

- (1) Waste
- (2) Low
- (3) Water
- (4) Br
- (5) Plac
- (6) Ver

Method

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- (2) Ver
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Process

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SubUnit :- 5.2 :- How to Start a unit at home :-

Ans Selection of suitable earthworm :- Vermicompost is a method of making compost with the use of earthworm, which eat biomass and excrete in digested form. This compost is generally called Vermicompost. locally available earthworms are also used for vermicomposting but their mode of feeding is very slow and the earthworm which lives below the soil is also not suitable for vermicompost production. The red worms and African earthworm are promising worms used for vermicompost production.

SELECTION OF SITE :- Vermicompost can be produced in any place with shade, high humidity and cool. A abandoned cattle or shed or poultry shed.