Vermicomposting

Conversion of Organic Wastes into Valuable Manure

In farms as well as in houses large quantities of organic wastes are generated regularly. Disposal of such residues is difficult and could become a serious problem if the residues are not disposed off properly. Besides agricultural wastes, large quantities of domestic wastes (700 million t yr^{-1}) are generated in cities and rural areas. Most of these organic residues are wasted by burning or used as land fillings. These residues contain valuable plant nutrients and through proper treatment of residues, these nutrients can be effectively used for increasing the agricultural productivity. Earthworms convert the residues into valuable source of plant nutrients. The process of preparing valuable manure from all kinds of organic residues with the help of earthworms is called "vermicomposting" and this manure is called vermicompost.

International Crops Research Institute for the Semi-Arid Tropics	Asian Development Bank	Sir Dorabji Tata Trust
Patancheru 502 324, Andhra Pradesh, India	0401 Metro Manila, 0980 Manila The Philippines	Mumbai 400 001 Maharashtra, India

Selection of earthworms

Earthworms are mainly divided into two types:

1. Burrowing type; and
2. Non-burrowing type.

The non-burrowing type of earthworms (*Eisenia* spp, *Eudrilus* spp), available in local markets, is used for preparing vermicompost. These earthworms are red or purple, live on the soil surface, and eat 90% organic waste materials. The burrowing type of earthworms (*Pertima* spp) is generally seen in rice fields. These earthworms are pale in color, live inside the soil, and eat 90% soil; these are not selected for vermicomposting.

Types of organic materials

Vermicompost can be prepared from all types of organic residues such as:

- Agricultural residues
  - dry organic wastes (sorghum straw, rice straw after feeding cattle, dry leaves, pigeonpea residues, groundnut husk, wheat husk)
  - waste vegetables
  - soybean residues
  - weeds (particularly *Parthenium hysterophorus* before flowering)
  - sugarcane trash
- Sericultural residues
- Animal manures
- Dairy and poultry wastes
- Food industry wastes
- Municipal solid wastes
- Biogas-sludge
- Bagasse from sugarcane factories


1

Vermicompost preparation

Vermicompost can be prepared by different methods in shady areas:

1. On the floor in a heap;
2. In pits (up to 1 m depth);
3. In an enclosure with a wall (1 m height) constructed with soil and rocks or brick material or cement; and
4. In cement rings.

The procedure for preparation of vermicompost is similar for all the methods. The preparation in cement rings is described (see Figs. 1–12).


2

Step-wise procedure

- Cover the bottom portion of a cement ring with a polythene sheet (1).
- Spread a layer (15–20 cm thick) of organic waste material on the sheet (2).
- Sprinkle rock phosphate on this layer (3).
- Prepare cowdung slurry (4).
- Sprinkle the slurry as a layer.
- Fill the ring completely with the material in layers (5).
- Paste the top portion of the ring with cowdung or soil (6).
- Allow the material to decompose for 20 days.


3

- After 20 days release selected earthworms through the cracks (7).
- Cover the ring with wire mesh or gunny bags to prevent birds from picking the earthworms (8).
- Sprinkle water at 3-day intervals to maintain adequate moisture and body temperature of the earthworms.
- Check compost after about 2 months.
  - Vermicompost is ready in 2–2½ months (9).
  - It is black and light, and has no smell.

- When the compost is ready, remove from the ring and heap as a cone (10).
- Leave the heap undisturbed for 2 to 3 hours to allow the earthworms to move down the heap slowly.
- Separate the upper portion of the heap (11).
- Sieve the lower portion of the heap to separate the earthworms which can be used again for preparation of vermicompost (12).
- Pack the compost in bags and store these in a cool place.

Repeat process

About 20 days before removing the compost from cement rings place the organic waste, rock phosphate, and cowdung slurry in layers in another set of rings. Follow the step-wise procedure and use the earthworms separated from the compost as mentioned above.

Materials required

Materials required for vermicomposting in one cement ring (90 cm diameter × 30 cm height) or in a pit/walled enclosure (1.5 m × 1 m × 1 m).

Dry organic wastes (DOW)	:	50 kg
Cowdung slurry (CS)	:	15 kg
Rock phosphate (RP)	:	2 kg
Earthworms (EW)	:	500–750
Water (W)	:	5 L every three days
Ratio of DOW:CS:RP:EW:W	=	5:1.5:0.2:50–75:0.5

Precautions

- Use only plant materials such as vegetable peelings, leaves, or grass.
- Remove glass, metal, and plastic materials from the organic material.
- Protect against birds by covering mesh on the rings.
- Sprinkle the water intermittently and maintain adequate moisture.
- Prepare compost under shade to protect from sun and rain.

Usage

Vermicompost can be used for all crops (agricultural, horticultural, ornamental, and vegetable) at any stage of the crop.

Dosage

- For general use in agriculture, 3–4 t ha^{-1}.
- For fruit trees, 5–10 kg per tree.
- For vegetables, 3–4 t ha^{-1}.
- For flowers, 500–750 kg ha^{-1}.

Application

- For agricultural crops: Apply vermicompost by broadcasting when the seedlings are 12–15 cm in height and water the plants normally.
- For flowers, vegetables, and fruit trees: Apply vermicompost around base of the plant, cover with soil, and water regularly.

Availability

The DWACRA (Development of Women and Child in Rural Areas) groups of women are preparing vermicompost in Adarsha Watershed in Kothapally, Andhra Pradesh, India. The compost is not only used for their crops but also sold. Vermicompost is available in Kothapally and at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh.

Advantages and benefits

Advantages

- Contains valuable nutrients [nitrogen (1–1.5%), phosphorus (0.8%), potassium (0.7%), micronutrients], enzymes, plant hormones, and antibiotics required for plant growth.
- Promotes fast growth of plants and increases crop yields.
- Increases the quantity and improves the quality of fruits, vegetables, and flowers.
- Maintains humus content of the soil.
- Increases water-holding capacity of the soil.
- Easy to produce and incurs low cost.
- Reduces salinization and acidification.
- Reduces soil erosion.
- Reduces pest attack.

Benefits to farmers

- Enhancement of soil productivity.
- Increase in yield with less irrigation.
- Less risk of crop loss due to pest attack.
- Crop produce has better taste, luster, keeping quality without toxic residues, and fetches a higher price.

Benefit to industries

- Cost-effective pollution abatement technology.

Benefits to environment

- More groundwater recharge and lesser depletion of groundwater.
- Reduced soil salinization and lesser soil erosion.
- Less pollution as polluting chemicals need not be purchased and used.

Benefits to national economy

- Lesser imports of agrochemicals, saving valuable foreign exchange.
- Boost to rural economy.
- More export of agricultural produce with lower pesticide residues.
- Less expenditure on water supply and pollution control.
- Lesser wasteland formation.

For further details please contact:

Dr S P Wani
Principal Scientist and Regional Coordinator
ICRISAT, Pantancheru 500 324, AP, India

Phone : +91 (40) 3296161
Fax : +91 (40) 3241239
Email : s.wani@cgiar.org