



VERMICULTURE

DESCRIPTION

Vermiculture can be a lucrative economic activity for rural women. Earthworms can be bred in their farm or courtyard to produce organic manure. Earthworms multiplied by this technology can be sold directly as animal feed specially for poultry, fishery and dairy farms. Pharmaceutical companies buy them for drug extracts.

WORKING

Select a place away from direct heat, strong sunlight and incessant rains. Dig a pit measuring 2 feet x 2 feet x 2 feet. Line the pit with polythene (PVC) sheet to arrest escape of earthworm through crevices. (Earthen pot, Brick, Cement tank or Wooden boxes can also be used to house earthworms).

The pit is systematically filled with four layers of waste. First layer -- (Bottom of the pit) is filled upto 2 inches with coconut fibre, rice husk and sugar cane bagasse. Second layer is 2 inches thick, consisting of saw dust, chopped rice/wheat straw. Dampen the bed by sprinkling water. Third layer is the earthworm food, this includes an admixture of cow-dung, green foliage, vegetable remnants, discarded parts of fruits, droppings of horses, asses, pigs, sheep or biogas slurry, human excreta, paper or scrap of cardboards etc. This feed should be spread till a height of 6 to 8 inches.

EARTH WORM

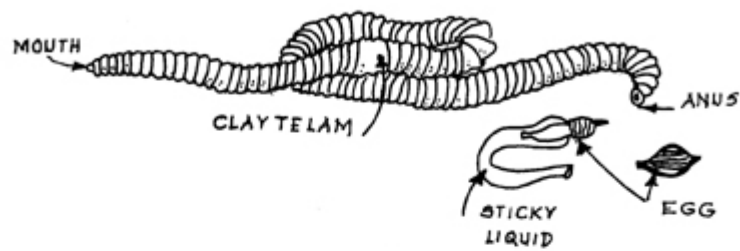


FIG-1

FILLING OF PIT (PIT SIZE 2'0" x 2'0" x 1'6")

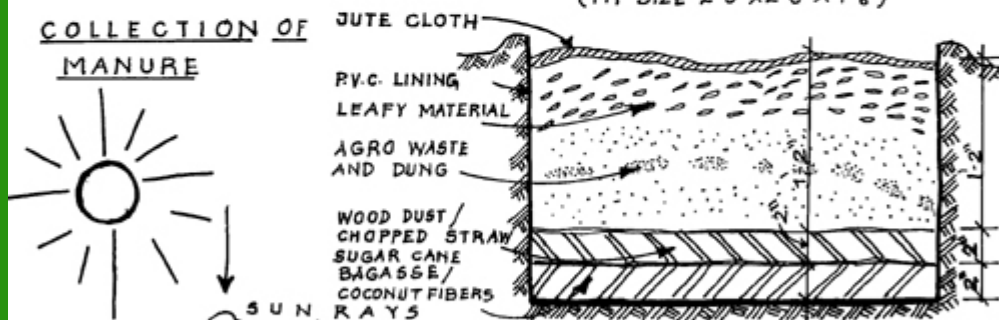


FIG-2

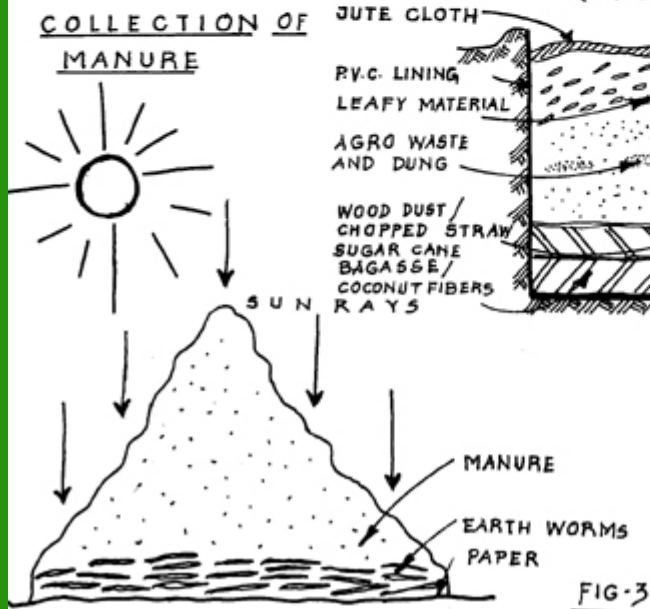


FIG-3

Release about 100 earthworms on the top without hurting them. These earthworms will start penetrating to the bottom. Once all these earthworms disappear, cover the surface with jute bags and keep them wet by sprinkling water in a judicious way.

The jute bags may be turned upside down thrice in the first week, twice in the second week and only once in the third and following weeks, without causing any disruption to the top.

Water and heat inside the tank assist the organic matter to decay & proliferates the number of earthworms - both these take place simultaneously. By 4 to 5 weeks, production of heat inside the pit will cease and will come down to 60^o± to 65^o Fahrenheit. In case no warmth is felt by hands, understand that the manure is almost ready for use. From one tank, 50 kg. of manure is produced.

Spread a paper on the ground and empty the contents of the tank slowly in sunlight making a pyramid like heap. Let this heap remain in daylight for about half to one hour. This will induce the earthworms to penetrate deep and reach the bottom. Now the upper layers of organic manure can be lifted slowly. Later the earthworms at the bottom may be separated from one another and deposited in the refilled tank.

PRECAUTIONS

Rubber, metal, brass pieces and plastics are disliked by earthworms.

Salt, chilly, vinegar, soap or soap water as well as ~ insecticides 80 to destroy the earthworms hence, ought to be avoided. Be watchful of rodents, insects, birds etc. which feed on earthworms.

SOURCE

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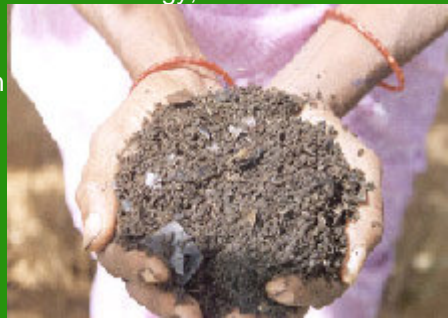


TARA COMPOST PIT FOR ORGANIC WASTE UTILIZATION

TARA (Technology and Action for Rural Advancement) offers a clean technology, which converts organic waste like kitchen waste, leafy waste into active compost. Vermicomposting is the cast or excreta of 'epigeic' (surface feeding) earthworm species produced by the conversion of organic wastes. The process of conversion is known as vermicomposting.

Brief Production Process

Active compost can be prepared easily by anyone, anywhere. It requires only a small area for composting, a little cow dung, leaf or organic waste and some earthworms. A container is required to start the process. This can be made of wood, cement, plastic or even be an earthen pit. The size depends on amount of waste or compost. The container is filled with cow dung and organic waste (kitchen waste, agricultural residue, leaf, litter etc.) in the ratio 1:8 and allowed to decompose for two weeks.



After two weeks about 2000 earthworms are introduced into pit. 50 % moisture has to be maintained by periodic spraying of water and mixing. Roofing is done to protect the container / pit from excessive sunlight and rain. The whole set up should be protected from the attack of ants, rats, and other predators. The worms feed on the waste and excrete small



granular pellets, which are left on the surface. Once the process of conversion is complete, the material can be dumped on the ground, made into a conical heap and left for few hours. The worms can be removed from the base and reintroduced into the next feed mixture while the active compost can be collected separately. The collected castings are dried in shade, sieved to separate cocoons and young ones which can be further reintroduced into the feed mixture.

Areas of Application

The vermicompost is ideal for use in floriculture, horticulture and plantation crops.

Advantage

Compost is rich in nitrates, available form of phosphorous, potassium, calcium and magnesium. Above all it contains a good quantity of vitamins, natural phyto-regulators and micro flora in balanced form which helps in re - establishing the natural fertility of the soil. The processed soil becomes very fertile and its water holding capacity also increases. Available food ingredients for plants are high. This reduces the use of inorganic fertilizers thus increasing the quality of food products. It also plays a vital role both for waste, biomass management and waste land development in rural areas.

Development Status

Commercialized

Technical Data

Brick masonry pit of 12 ft x 5 ft x 3 ft.

Biomass decomposed organic material to fill the pit

Earthworm – 2000 Nos.

Labour – 1 no for two hrs in a day

Economic Data

200 kg of vermicompost produced every month. A minimum profit of Rs 1000 /- month can be achieved after covering all expenses. Additionally each earthworm can be sold at Rs 0.50/- piece.

(These costs do not include building construction. It is assumed that a shed of 10 sqm is available for the above)

Business

TARA organic compost producing technology is profitable for micro and small-scale enterprises. There are no raw material costs. Value addition is purely on account of man power costs. Technology is supplied by TARA (Technology and Action for Rural Advancement) a leading sustainable technology marketing organisation.

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Vermiculture in India

In the past ten years an organization in India has prompted over 2,000 farmers and institutions to switch from conventional chemicals to the organic fertilizer, vermicompost. Noted for its ability to increase organic matter and trace minerals in soil, vermiculture has been the primary focus at Maharashtra Agricultural Bioteks in India, an organization which has initiated both commercial and educational ventures to promote vermiculture.

In 1985, Maharashtra Agricultural Bioteks was formed and established a small plant to manufacture vermicompost from agricultural waste. Those involved believed that a successful commercial venture based on regenerative principles might convince others to adapt sustainable practices.

The organization currently produces 5,000 tons of vermicompost annually. Its real achievement, however, has been in raising awareness among farmers, researchers and policy makers in India about regenerative food production methods. The group is directly responsible for 2,000 farmers and horticulturists adopting vermicomposting. These converts have begun secondary dissemination of the principles they were taught.

In 1991-92, Maharashtra Bioteks and the India Department of Science and Technology promoted the adoption of vermicompost technology in 13 states in India. The group has also established a vermicompost unit with Chitrakoot Gramodaya University, Madhya Pradesh which produces five tons of vermicompost per month.

Education and Demonstration

Nearly 1,000 farmers have reduced their use of chemical fertilizers by 90% by using vermicompost as a soil amendment for growing grapes, pomegranates and bananas. Similar work is underway on mangoes, cashews, coconuts, oranges, limes, strawberries and various vegetable crops.

The organization has devised methods to convert biodegradable industrial waste like pulp waste from paper mills and filter cake and liquid effluent from sugar factories into vermicompost. These wastes are commonly regarded as pollutants, but three facilities are already producing thirty tons of vermicompost each month from this waste.

The organization has also created a program which trains housewives and home gardeners to produce their own vermicompost from household and garden waste. The aim of this work is to increase awareness about regenerative practices. To this end, vermicompost kits have been developed and distributed and in one year 100 housewives were trained to use the kits.

Through its programs with farmers, institutions and at the government level, Maharashtra Agricultural Bioteks is convincing people that vermicompost presents a healthy alternative to chemical fertilizers.

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What is Vermiculture?

Through the simple act of eating, earthworms promote bacterial growth, enhance soil structure and hasten the decomposition of organic matter. However, due to different feeding habits, not all earthworms are suitable for vermiculture.

Earthworms are divided into two groups: humus formers and humus feeders. The first group dwell on the surface and feed on nearly 90% fresh organic materials and 10% soil. They are generally red in color, have a flat tail and are also called epepic or detritivorous worms. It is these worms that are harnessed for vermicomposting. The second group, the humus feeders, are deep burrowing worms that are useful in making the soil porous and mixing and distributing humus through the soil.

Preparing Vermicompost

Materials- Breeder worms, a wooden bed and organic wastes. The bed should be 2 1/2 ft. high x 4 ft. wide x any length desired. Plan on applying two parts worms for every part waste.

Sieving and shredding- Decomposition can be accelerated by shredding raw materials into small pieces.

- **Blending-** Carbonaceous substances like sawdust, paper and straw can be mixed with nitrogen rich materials such as sewage sludge, biogas slurry and fish scraps to obtain a near optimum C/N ratio of 30:1/40:1. A varied mixture of substances produces good quality compost, rich in major and micro nutrients.
- **Half digestion-** The raw materials should be kept in piles and the temperature allowed to reach 50-55OC. The piles should remain at this temperature for 7 to 10 days.
- **Moisture, temperature and pH-** The optimum moisture level for maintaining aerobic conditions is 40-45%. Proper moisture and aeration can be maintained by mixing fibrous with nitrogen rich materials. The temperature of the piles should be within 28-30OC. Higher or lower temperatures will reduce the activity of microflora and earthworms. The height of the bed can help control the rise in temperature. The pH of the raw material should not exceed 6.5 to 7.

After about a month the compost is ready. It will be black, granular, lightweight and humus-rich. To facilitate separating the worms from the compost, stop watering two to three days before emptying the beds. This will force about 80% of the worms to the bottom of the bed. The rest of the worms can be removed by hand. The vermicompost is then ready for application.

Jambhekar, Hemangee. Maharashtra Agricultural Bioteks training material.

Smart farmer gets the worm

S.S. Paliyal

Degradation of organic waste using earthworms is one of the recent developments in biological sciences. Earthworms break down complex organic residues into simpler water-soluble substances. In the biodegradation process, earthworms and microbes work together and produce vermicompost.

The species of earthworms that are being used for compost production are *Eisenia foetida*, *Eudrilus eugeniae*, *Perionyx excavatus*, *Lumbricus rubellus* and *Pheretima elongata*.

Earthworms degrade all types of organic waste, such as agricultural waste, animal droppings, weeds, industrial effluents, forest leaf litter, etc. Plants and herbs that are insecticidal or aromatic should be avoided. Residues rich in lignin, like stalk of woody plants, take relatively more time to degrade.

Rich in nutrients

Vermicompost is rich in plant nutrients. It provides vital macro elements such as N, P, K, Ca, Mg and micro elements such as Fe, Zn, Cu, etc. Apart from this, it contains plant growth-promoting substances such as NAA, cytokinins, gibberalins, etc. It also harbours beneficial microflora.

Worms also have the capacity to store heavy metals and pesticides in their tissues. Thus, to a certain extent, they play a role in detoxifying polluted soils, too.

Technique

Pit method: In the initial stage, go for a bed of size of 10x1x0.3 m. The beds should be treated with chlorpyrifos @ 2ml/litre of water to prevent ant and termite problem. After 15 days, fill the beds in layers with organic residues as explained:

First layer—decomposable plant material (bottom of bed); second layer—cowdung/ farm manure/ biogas sludge; third layer—spread earthworms (1000-2000 in number); fourth layer—cowdung/ farm manure/ biogas sludge; fifth layer—dry crop residue/ green succulent leafy material, plus cowdung; sixth layer—thick layer of mulch with cereal straw (top of bed).

Each layer, except the third, should be 3-4-inch thick, so that the bed material is raised above the ground level. Sufficient dry and green wastes should be used. The mulch at the top prevents loss of moisture and acts as a barrier to predators like birds. The beds should be in shade.

Heap method: In this method, composting is done on the ground without the pits. Organic material is piled up on the ground, as in the pit method, the only difference is that the heap gets a dome shape. The suitable size for a heap is 10x1x0.6 m.

Wooden box or brick column: Here rectangular wooden or brick structures (3x1x1 m) are erected above the ground level and the organic material is dumped inside serially as in earlier methods.

These beds have to be watered regularly to maintain a moisture level of 60-80 per cent till the harvest of compost.

Multiplication of earthworms: Earthworms are bisexual, but cross-fertilisation is the mode of reproduction. Adult worms, 15-21 days after copulation, lay cocoons, which look like coriander seeds. The eggs present inside the cocoon hatch into neonates in about 15-21 days. Neonates take 35-60 days to attain adulthood, which is characterised by a swollen band near the anterior part of the body. *Eudrilus eugeniae*, one of the species used for vermicomposting, completes its lifecycle in about 65-80 days. It lays 400 plus

cocoons in about 60 days.

Vermicomposting can be tested from a small collection of pellets on the top of the beds around 45-60 days after start. This is indicative of good multiplication of worms in the beds. In about 60 days, the material is degraded completely and vermicompost is ready for harvesting.

The rate of degradation depends on the loading of worms. More the worms, faster the degradation. The heap method, however, has proved to be more effective than the pit system.

Harvesting: After 60-70 days, the beds are ready for harvest. Seven days prior to harvesting, watering of the beds has to be stopped so that the earthworms in the top layers move down for want of moisture.

The beds should be disturbed and the material collected in pyramidal heaps for about 24 hours. The semidried compost from the top of the bed can be collected and sieved to remove any inert material. The concentrated vermiculture (earthworms) that remains at the bottom can be used again for vermicomposting. The compost can be dried in shade (12 hours), bagged and stored.

About 3 tonne of vermicompost can be harvested in two months from 10 beds of 10x1x0.6 m each.

Natural enemies: The important natural enemies of vermiculture are ants, termites, flatworm, centipedes, rats, pigs, birds, etc. Preventive measures include treating of the site with insecticide chlorpyrifos 20 EC @ 2 ml/ 1litre or mixing of neem cakes @ 30 g/ 1kg food while filling the beds.

Rainy and winter season favour faster multiplication of worms than summer. With manipulation of soil temperature during summer by providing shade and regular watering, the rate can be enhanced.

Scope

In several experiments, results have indicated that vermicomposting can substitute inorganic fertiliser requirement up to 50-75 per cent when applied @ 10 t/ha.

Vermiculture can be adopted in two ways: by applying vermicompost @2.5-5.0 t/ha at the time of sowing or in-situ vermiculture, wherein earthworms are directly employed in irrigated crop fields.

In case of horticulture, vermicompost can be applied at the time of planting and subsequently at regular intervals, depending on the age of the tree. In-situ vermiculture can be adopted in case of young as well as grown-up trees by releasing requisite number of earthworms at the tree basin or furrow, where adequate organic waste has to be previously dumped.

In-situ vermiculture is gaining significance in irrigated horticulture crops. Earthworms are introduced in situ @ 50,000-2 lakh/ha in crops in the presence of sufficient organic waste. It is also a popular in sugarcane.

Economics: It has been found in tests that the production cost for 1 tonne of vermicompost and 1,000 earthworms is around Rs 500 and 50, respectively. About 3 tonne vermicompost can be harvested in 10 beds.

VERMICOMPOST

Vermicompost is known to be the world's best fertiliser and it is known to change the look of your garden. Vermicompost means that the worms are kept in a bin with shredded paper or other biodegradable bedding. You feed them food waste that you get from your kitchen. They feed on the food waste and digest the waste and bedding then excrete nutrient-rich castings. After a few months, the castings combined with the well-decomposed bedding, become vermicompost -- one of the richest soil improvements around. It is a simple method and it does wonders on your garden, plants, flowers and vegetable garden.



To start Vermicompost you will require the following things.

- A bin
- Biodegradable bedding
- Food waste
- Worms

BIN

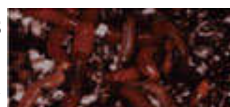
For worm containers use wooden boxes, metal tubs and plastic basins, provided they allow good air circulation. The worm container should be shallow and not too deep, no more than 18 inches deep. To determine the size of bin you need, you'll need to calculate how much food waste your family creates in an average week. For example: If your household creates an average of four pounds of food waste each week, a 2x2' bin should be adequate. The bin should have the greatest surface area for proper air circulation and for dumping more food waste. For proper air circulation drill 1/4" drainage holes through the bottom of your bin. For example for plastic, drill 14-20 holes, 9-12 holes for a wooden container. Raise the bin up on bricks or wooden blocks, and place a tray or a sheet of plastic underneath. Put your bin in some comfortable place, and where worms won't be subjected to extreme temperatures. Worms like temperatures ranging from 55-77° F.

BEDDING

Bedding giving worms a place to work and rest. It also helps hold moisture in your box. Use light, fluffy biodegradable materials free from pesticides or chemicals. For perfect bedding tear newspaper (without the colour comics and glossy advertisements) into thin strips, the thinner the better. You can also use shredded cardboard. Put some sand in to the bedding since it contributes nutrients and grit to help worms digest food waste. Periodically sprinkle small amounts of crushed eggshells or ground limestone, which is a good source of calcium. Plan on 5 to 8 pounds of bedding for a 2'x2' box. Place the bedding in a clean trashcan or other large container. Pour in three pounds of water per pound of dry bedding, and mix well. Note that the bedding should be uniformly damp, but not dripping wet. Toss in a handful of soil, crushed eggshells, or other additives. Lift and fluff the bedding to aerate then put it into the bin. Sprinkle the worms over the surface of the bedding, gently untwining any wiggling clumps. Place a bright overhead light over the bin and the worms will burrow down into the bedding. It is advisable to leave a light on your worm box for the first three or four days. After a few days the worms will settle down and do their best.

WORMS

The best worms for vermicomposting are red worms (*Eisenia foetida* or *Lumbricus rubellus*). The red worm is capable of reproducing quickly in captivity,



while munching profuse quantities of food waste. If your bin is a 2x2' bin then use one pound of worms (1000 worms). You can buy worms from garden centres or nurseries.



FOOD WASTE

Worms are not picky eaters; they will munch on just about anything. Give your worms peels and other vegetable waste. However while giving them banana waste don't put the peel because banana peel attracts fruit flies. You can even toss in coffee filters and tea bags, but do take off the tea bag tag and the little metal. You can also put plate scrapes, eggshells in the bin. Things that are absolutely No-No are meat and bone, dog and cat litter, plastic, glass, aluminium foil and other non-biodegradable items.

FEEDING THE WORMS

To feed the worms divide the bin in four sections. Bury scraps under a few inches of bedding in the first section and cover it with loose plastic or newspaper. After 4/5 days its time to feed the worms again and then fill the scrapes in the second section. This way you can fill all the sections and you don't have to dig into the waste. Remember red worms are voracious eaters but your bin should not smell of bad odour. If that is the case then you have added too much of food and the worms are finding it difficult to cope up. Stir the bedding to aerate, cover the box and add no more food until the smell hasn't gone. Worms are low-maintenance, and you can skip two or three weeks without feeding them. Any longer than that, and you'll have a big box of dead worms.

WORM HARVESTING

The method of harvesting is very simple. Put on your rubber gloves. Place a large sheet of plastic on the floor or on a table. Pour the entire contents of the bin onto the sheet. Shape the compost into cone-shaped mounds. Then shine a bright light above the mounds; this will drive the worms toward the bottom interior of each mound. Wait 5-10 minutes, and then gently scrape off the layers of vermicompost until all you have left is worms. Put the worms into a temporary storage container while you clean out the bin and fill it with fresh bedding. You may see tiny, lemon-shaped cocoons; these contain baby worms, so be sure to add them to the new bin. Bury food scraper for four months and you will get a nice box full of vermicompost after leaving the bin alone for three to four months.

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