

ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN

PALANI

PG DEPARTMENT OF ZOOLOGY

LEARNING RESOURCES

VERMICULTURE

VERMICULTURE

INTRODUCTION

The term vermiculture mainly refers to the scientific process of cultivating worms or artificial rearing of worms to decompose organic food wastes into a nutrient-rich material. The output of vermiculture is called vermicompost and is formed by the process in which earthworms consume the farmyard manure and roughages in addition to the wastes from farms and thereby producing it. The produced vermicompost is rich in terms of nutrients and other plant growth-promoting substances, which are capable of supplying necessary mineral nutrients to help and sustain plants' growth

Merits of Vermicomposting

- Since it does not contain chemical elements, vermicompost being prepared from organic wastes (biodegradable) is a natural fertilizer and eco-friendly too.
- Does not impact the environment, soil, and plants adversely.
- Soil compaction is reduced by it by boosting the soil aeration, tilth and texture.
- Owing to its high organic matter content, it improves the soil's water retention capacity.
- Better nutrient absorption and root growth are promoted by it.
- Both the micro and macronutrients of the soil status are improved by its use.

Types of Earthworms Used in Vermiculture

Earthworms improve the quality of the soil as it recycles the organic waste of different life forms into humus. Based on feeding and burrowing habits, four types of earthworms are cultivated in vermiculture. They are listed below:

- **Endogeic:** These earthworms are characterised by burrowing. They usually create a horizontal burrow, and they feed on the material present at the deep surface of the soil.
- **Epigeic:** These earthworms are found on the upper surface of the soil. They feed on soil litter. They are not for burrowing. They are usually red, brown and red-brown in colour. They are small in size and do not contain stripes, unlike other types of earthworms.
- **Anecic:** They create a vertical burrow, and they feed on a soiled litter. They are found in the upper part of the soil and in deep soil burrows. In grasslands, castings of these earthworms can be found.
- **Compost:** As the name suggests, these earthworms are found in the compost pit. These types of earthworms dwell in warm environmental conditions, in the presence of moisture and in readily available composite materials.

Applications of Vermiculture

- They can be used as fish feed as vermicompost is rich in protein and other nutrients. Care must be taken not to put excess vermicompost as fish food, as it may alter the pH of water.
- For the improvement of land quality. There is a depletion in [soil](#) due to mining, increased use of chemical fertilizers and urbanization. To overcome this, EUI – Earthworm Inoculation Unit has been developed.

Preparation of Compost pit

- Compost pit of any convenient dimension can be constructed in the backyard or garden or in a field.
- It may be single pit, two pits or tank of any sizes (manageable size is 2 m x 1m x 0.75 m) with brick and mortar with proper water outlets.
- To combat the ant menace, have a water column in the centre of the parapet wall of the vermipits
- The ‘four chamber’ pit will facilitate easy and continuous movement of earthworms from one chamber with fully composted matter to the one with the pre-processed waste in the chambers

Preparation of Vermibed

- Vermibed is the layer of moist loamy soil placed at the bottom, about 15 to 20 cm thick above a thin layer (5 cm) of broken bricks and coarse sand.
- Earthworms are introduced into the loamy soil, which the worms will inhabit as their home.
- 150 earthworms may be introduced into a compost pit of about 2m x 1m x 0.75m, with a vermibed of about 15 to 20 cm thickness.
- Handful-lumps of fresh cattle dung are then placed at random over the vermibed.
- The compost pit is then layered to about 5 cm with dry leaves or preferably chopped hay/straw or agricultural waste biomass.
- For the next 30 days the pit is kept moist by watering it whenever necessary.
- The bed should neither be dry or soggy.
- The pit may then be covered with coconut or Palmyra leaves or an old jute (gunny) bag to discourage birds.
- Plastic sheets on the bed are to be avoided as they trap heat.
- After the first 30 days, wet organic waste of animal and/or plant origin from the kitchen or hotel or hostel or farm that has been pre-digested is spread over it to a thickness of about 5 cm. Repeat this twice a week.
- All these organic wastes can be turned over or mixed periodically with a spade.
- Regular watering should be done to keep the pits moist.
- If the weather is very dry, it should be checked periodically.

When will the compost be ready?

- The compost will be ready in 60 to 90 days and the material becomes moderately loose, crumbly with dark brown colour. It will be black, granular, lightweight and humus-rich.
- Presence of earthworm castings (vermicompost) on the top of the bed is also an indicator and vermicompost can be harvested.
- Stop watering two to three days before emptying the beds to facilitate separating the worms from the compost (80 per cent of the worms will move to the bottom of the bed).
- The harvested material should be placed in a heap in the sun so that most of the worms move down to the cool base of the heap.
- In the two or four pit system, watering should be stopped in the first chamber so that worms will automatically move to another chamber where the required environment for the worms are maintained in a cyclic manner and harvesting can be done continuously in cycles.

Advantages of Vermicomposting

- Organic wastes can be broken down and fragmented rapidly by earthworms, resulting in a stable nontoxic material with good structure, which has a potentially high economic value and also act as soil conditioner for plant growth.
- Vermicompost supplies a suitable mineral balance, improves nutrient availability and could act as complex-fertilizer granules.
- Vermicomposting involves great reduction in populations of pathogenic microorganisms, thus not differing from composting from this point of view.
- Vermicomposting also leads to decrease the environmental problems arising from their disposal, without needing in many cases to complete the process.
- It should be realized that vermicomposting can be a useful cottage industry for the underprivileged and the economically weak as it can provide them with a supplementary income.
- If every village can formulate a cooperative society of unemployed youth/women group, it could be a wise venture for them to produce vermicompost and sell it back to the village at a recommended price. The youth will not only earn money, but also aid society by providing excellent quality organic manure for sustainable agro-practices.

PROCESS OF VERMICOMPOSTING

The entire process of vermicomposting is mentioned below:

Aim

To prepare vermicompost using earthworms and other biodegradable wastes.

Principle

This process is mainly required to add [nutrients](#) to the soil. Compost is a natural fertilizer that allows an easy flow of water to the growing plants. The earthworms are mainly used in this process as they eat the organic matter and produce castings through their digestive systems.

The nutrients profile of vermicomposts are:

- 1.6 per cent of Nitrogen.
- 0.7 per cent of Phosphorus.
- 0.8 per cent of Potassium.
- 0.5 per cent of Calcium.
- 0.2 per cent of Magnesium.
- 175 ppm of Iron.
- 96.5 ppm of Manganese.
- 24.5 ppm of Zinc.

Materials Required

- Water.
- Cow dung.
- Thatch Roof.
- Soil or Sand.
- Gunny bags.
- Earthworms.
- Weed biomass
- A large bin (plastic or cemented tank).
- Dry straw and leaves collected from paddy fields.
- Biodegradable wastes collected from fields and kitchen.

Procedure

1. To prepare compost, either a plastic or a concrete tank can be used. The size of the tank depends upon the availability of raw materials.
2. Collect the biomass and place it under the sun for about 8-12 days. Now chop it to the required size using the cutter.
3. Prepare a cow dung slurry and sprinkle it on the heap for quick decomposition.
4. Add a layer (2 – 3 inch) of soil or sand at the bottom of the tank.
5. Now prepare fine bedding by adding partially decomposed cow dung, dried leaves and other biodegradable wastes collected from fields and kitchen. Distribute them evenly on the sand layer.

6. Continue adding both the chopped bio-waste and partially decomposed cow dung layer-wise into the tank up to a depth of 0.5-1.0 ft.
7. After adding all the bio-wastes, release the earthworm species over the mixture and cover the compost mixture with dry straw or gunny bags.
8. Sprinkle water on a regular basis to maintain the moisture content of the compost.
9. Cover the tank with a thatch roof to prevent the entry of ants, lizards, mouse, snakes, etc. and protect the compost from rainwater and direct sunshine.
10. Have a frequent check to avoid the compost from overheating. Maintain proper moisture and temperature.

Used For

- Gardening: Vegetable, Roof top, herbal
- Organic Landscaping
- Agricultural Farms
- Fruit trees (Horticulture)
- Flowering Plants (Floriculture)
- Natural Lawn and Garden care
- Tissue culture Plants
- Sericulture
- Aquaculture

Contains

- Macro nutrients
- Micro nutrients
- Vitamins
- Enzymes
- Hormones like Auxins and Cytokinins
- Beneficial Soil Microflora like Bacteria, Actinomycetes, Protozoans, Fungi and others.

Benefits

- Enables efficient growth
- Increases moisture retention
- Promotes microbial activity
- Controls pest & diseases

VERMIWASH

Vermiwash is a Brown colored liquid fertilizer, which is collected after water passes via a worm culture column. As storehouse of nutrients and microorganisms, Vermiwash is used as a foliar spray for crops. We prepare Vermiwash while maintaining high concentrations of micro and macronutrients, plant hormones to ensure healthy development of plants.

About Vermiwash

- Contains excretory products and excess secretions of earthworms plus micronutrients from soil organic molecule
- Vermiwash has high quantities of nitrogen, phosphorus, potash, calcium, magnesium & zinc and is alkaline
- Fresh vermiwash contains many beneficial microbes helping plant growth and preventing infections
- Sugars, phenols and amino acids are also present
- Hormones promoting plant growth like indole acetic acid, gibberellic acid, and humic acid are present as well
- Vermiwash must be diluted before application or the plant/crop may die

How To Use

- Dilute with water (10%) before spraying effectively on any plant
- Vermiwash should be diluted 5 to 10 times with water and then applied
- Can also be mixed with cow's urine and diluted for use as foliar spray and pesticide as follows
 - 1 litre of vermiwash
 - 1 litre of cow's urine
 - 8 litres of water

Contains

- High amount of enzymes, amino acids
- Heterotrophic bacteria, fungi, actinomycetes including nitrogen fixers, phosphate solubilisers
- Vitamins and hormones like Cytokinins, auxins, gibberellins etc
- Along with macro and micronutrients used as foliar spray

- Soluble Nitrogen, Phosphorus and Potash

Chemical Composition of Vermiwash

Ph	7.48 x 0.03
Electro conductivity dS/m	0.25 x 0.03
Organic Carbon %	0.008 x 0.001
Total Kjeldhal Nitrogen %	0.01 x 0.005
Available Phosphate %	1.69 x 0.05
Potassium (ppm)	25 x 2
Sodium (ppm)	8 x 1
Calcium (ppm)	3 x 1
Copper (ppm)	0.01 x 0.001
Ferrous (ppm)	0.06 x 0.001
Magnesium (ppm)	158.44 x 23.42
Manganese (ppm)	0.58 x 0.040
Zinc (ppm)	0.02 x 0.001
Total Heterotrophs (CFU/ml)	1.79 x 10 ³
Nitrosomonas (CFU/ml)	1.01 x 10 ³
Nitrobacter (CFU/ml)	1.12 x 10 ³
Total Fungi (CFU/ml)	1.46 x 10 ³

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Bees are one of the many insects in the world that can produce something that is beneficial to all of us. We obtain honey from these bees and as we all know, honey is an important food for human beings. Since ancient times, honey is used for treating several diseases, and it is an antioxidant, therefore beekeeping is an important activity

The word ‘apiculture’ comes from the Latin word ‘apis’ meaning bee. So, apiculture or beekeeping is the care and management of honey bees for the production of honey and wax. In this method, bees are bred commercially in apiaries, an area where a lot of beehives can be placed. Usually, apiaries are set up in areas where there are sufficient bee pastures – such as areas that have flowering plants.

Apiculture is the technique or farming practice which involves the production of honey, beeswax, royal jelly, flower pollen, and bee pollen. The process is also known as beekeeping. So, Technically Apiculture is farming honey bees. This process of farming involves the cultivation of bees of the genus Apis (honeybees). In addition to this, honey bees also contribute to the preservation of nature by collecting flower pollen, bee pollen, etc from the flowering plants.

Moreover, bees are considered useful social insects as it provides us with honey and wax. In addition, They also induce pollination of flowers of the majority of damaged bee larvae, pollen grains, etc. of commercially important plants. The most common Indian honey bees that exist and are used in Apiculture are Apis (Megapis) dorsala, A. (microapis) florea and A. indica.

In short, Apiculture is the process of rearing honey bees for generating honey and wax from their comb or beehives. Apiculture involves the Selection of sites for good quality honey and the protection of bees and combs from pests and other diseases.

So, let's explore more about apiculture meaning or apiculture definition, its importance, advantages and disadvantages in detail.

Importance of Beekeeping

The main advantages of beekeeping are:

1. Provides honey, which is the most valuable nutritional food.
2. Provides bee wax which is used in many industries, including cosmetics industries, polishing industries, pharmaceutical industries, etc.
3. Plays an excellent role in pollination. Honey bees are the best pollinating agents which help in increasing the yield of several crops.
4. According to the recent studies, the honey bee's venom contains a mixture of proteins which can potentially be used as a prophylactic to destroy HIV that causes AIDS in humans.

Working at the Beehive

In a colony, there are 10,000 to 60,000 bees! But all of them do not collect nectar- there is a strict division of labour. The queen bee and female bees lay thousands of eggs. Larvae that hatch are fed royal jelly and the duration that they are fed will decide their role as a worker or queen. The drone bees are male and their job is only to help in fertilizing the eggs laid by the queen, and the worker bees do the actual work of collecting nectar.

Different species of Bees

There are different categories or species of bees which are present as follows:

- 1. Rock bee** - Apis Dorsata - Apis dorsata is also commonly known as the rock bee which is a giant bee and as it has a huge size it produces around 40 to 42 kgs of honey per colony.
- 2. European Bee** - Apis Mellifera - Apis mellifera was commonly known by the name of European Bee it is a little bee which is stingless. This bee is not easily available in the local environment, and it produces higher amounts of honey therefore it is often reared by the beekeepers.
- 3. Indian Bee** - Apis Cerana Indica - It is additionally known as the Indian bee. It is frequently used to produce honey and is simple to domesticate. Each colony produces 2 to 5 kilograms of honey annually.
- 4. Little bee** - Apis Florea - The little bee is another name for it. Since it rarely stings, getting honey out of its hive is simple. Each colony makes roughly 1 kg of honey a year.

Types of Bees in Apiculture

- 1. Worker's bees** - are the female members who are incapable of procreation. They are recognized as the colony's most active inhabitants. Age affects how worker bees perform their jobs; they can live for three to twelve months. They carry out inside tasks like scavenging, acting as nurse bees, etc. for the first half of their lives. As scout bees and forager bees, they carry out outdoor tasks in the second half of their lives.
- 2. Queen bees** - referred to as the colony's mother, and the centre of activity inside the hive. She can live for two to five years and produces about 2000 eggs. These eggs may or may not

be fertilized. Unfertilized eggs develop into drones, while fertilized eggs develop into both the queen and worker bees.

3. Drones - Drones are the male members of honey bees that fertilize the young queens in apiculture. Further, it develops into larvae and then matures into an adult. Drones are smaller but stouter than the queen honey bees.

Products Obtained From Apiculture

Besides honey, Bee Apiculture can also provide various byproducts that are economically important and useful. The other byproducts obtained are as below:

1. Honey - Besides being sweet and edible, honey is also packed with various nutrients such as sugar, water, vitamins, minerals, amino acids, enzymes, and some pollens. Moreover, honey has good mineral content such as calcium, iron, manganese and phosphate, etc. in addition, Vitamins obtained from honey are Pantothenic acid, Biotin, Pyridoxine, Ascorbic acid, Thiamine, Riboflavin, etc. Honey is also an energy-rich and anti-oxidant food.

2. Bee Wax - Bee wax is obtained from the secretion of worker bees from their wax glands. These have a very high melting point and it is used in many ways. It can be used in manufacturing cosmetics and ointments such as cold creams, cosmetics, shaving cream, ointments, lipsticks, polishes, etc.

3. Propolis and Balms - Propolis and balms are also obtained from the apiculture process. These products are utilized in repairing the comb. Propolis (Bee glue) are developed from the mixing of saliva and beeswax with exudate taken from tree buds or sap flows. Propolis works by bridging the gaps in the beehive. They have dark brown colour but can even vary sometimes.

4. Royal jelly - Worker honeybees generate a milky secretion called Royal jelly. It includes proteins, vitamins, sugar, fats, water, salts and amino acids. Other bees utilize it to nurture queen bees and thus it is called royal jelly. Royal jelly also has medicinal properties like honey. It is even used in making homoeopathic and ayurvedic medicines.

5. Bee Venom - Bee venom is a poisonous product obtained from honey that makes the bee stings painful. It also has medicinal properties, it can be used to treat rheumatism, arthritis, Parkinson's disease, etc.

Factors Affecting the Process of Apiculture

Apiaries are set up for the large-scale production of honey. To get better results and good quality honey and honey bee products from apiculture, the following steps should be taken into consideration.

1. Pasturage - The taste and odour of honey depends upon crop, flora or pasturage available for the nectar and pollen collection. Flora of honey bees has various flowering plants such as mango, coconut, almond, etc.

2. Beehive - A beehive is a type of box where honey bees are raised. The box has a wire gauze placed inside with a multi-frame honey chamber that helps in laying eggs and gathering honey. There are mainly three types of beehives available in India namely - Langstroth, Newton and Jeolikote.

3. Apiary Location - It is a fixed area or location where beehives are set up to allow maximum nectar and pollen collection in desirable locations. Majorly areas rich in vegetation and flowering plants are chosen as apiary locations. Moreover, hives should be placed on the east side. In addition, it also requires water nearby.

4. Honey Flow and Seasons - the quantity of honey produced by honey also depends on the duration for which abundant flora is available. The honey flow period is defined as the total time taken by honey bees to gather nectar and pollen. Enough quantity of flowers is required to obtain a large quantity of honey.

5. Swarming (Reproduction) - reproduction is a natural process in which all the honey bees locate from one place to another. It is generally carried out in spring for better reproduction in honey bees. The queen leaves the old hives with their workers and drones and migrates to a new shelter. The cost of maintenance of hives is quite high and frequent transfer can also affect the yield and quantity of products.

Importance of Apiculture

Apiculture is practised on a large scale due to its increasing demands in various health and cosmetics sectors as well as due to the many benefits of honey and beeswax. Some important uses of honey and its production are described here:

1. Honey is highly beneficial and used majorly in many human illnesses and its treatment products are related to digestion, dysentery, vomiting and stomach or liver ailments, lung diseases, etc

2. Honey is also an important blood purifier, it's the best for treatment related to cough and cold, sore throat, and ulcers of the tongue, stomach and intestine.

3. Bee wax is also mainly utilized in making cosmetics, creams and ointments.

4. Royal jelly on the other hand is consumed as an invigorating tonic.

5. Propolis is a utilized as health supplement with many antibiotic properties beneficial for getting rid of harmful bacteria in the body.

6. Bee venom is used in treating rheumatism, arthritis and certain central nervous system diseases in humans.

7. Honeybee venom is highly used in destroying the AIDS virus as it includes some important mixtures of proteins.

8. Pollination is also increased with the help of honeybees leading to growth in the yield of several plants.

Different Methods of Apiculture in India

1. Indigenous methods

The Indigenous method is further divided into two techniques, immovable structures and movable structures.

- Immovable structures

This method is practised in villages since ancient times. Small structures are developed in protected places. When dwelling houses are constructed, they also made small chambers in the outer wall of the house for bees to make combs. Many times chambers are also constructed exterior to the chamber and a horizontal slit is made for the entry of bees, on the other side, a large opening is built on the interior side for removal of the comb.

- Movable structures

In this structure, chambers are made up of hollow bags, empty wooden boxes, earthen pots, and others. This is considered less satisfactory as the comb is lost in the process of extraction of honey. Moreover, the good quality of honey is lost due to exposure to dust, tissues of damaged bee larvae, pollen grains, etc. in it.

2. Modern methods

- Beehive

In modern apiaries, Longs Troth's frame hive is commonly used in commercial the production of honey.

1. It has a two-tier structure where the chambers can also be removed from or added as required. Moreover, the hive is made up of a wooden box. Next, the roof is placed on an inner covering above the honey chamber.

Advantages and Disadvantages of Apiculture

Advantages of apiculture

There are several benefits of apiculture such as they act as great pollinating agents, it provides the best nutrition in the form of honey, it also provides beeswax in cosmetics and pharmaceuticals, as well as their venom is used in the treatment of arthritis and snake bites. It is explained in detail in the following points.

1. Plant pollination

Bees move pollen from plant to plant as they gather nectar to bring to their colonies, aiding in the pollination of flowers, vegetables, and fruits in the garden. Honeybees' fuzzy bodies attract pollen, which they then smear on the flowers they visit for nectar. The pollen exchange promotes plant reproduction and the development of fruit and seeds. Fruit and seed harvests will be minimal if feral bees aren't there to pollinate flowers and crops.

2. They help in getting useful by-products

Raw honey is always in demand, and wax and propolis are valuable by-products of bee production. Making candles, waxing wooden furniture, shining concrete worktops, protecting bronze and copper, and waterproofing leather are among the things that can be done using beeswax. Furniture wax and vehicle wax are frequently created from propolis, resin-like material bees produce from tree sap. Propolis, raw honey, pollen, beeswax, and raw honey can all be purchased as natural antibiotics and health supplements.

3. Beekeeping is for profit

Up to 100 pounds of harvestable honey might be expected from a vigorous hive each year. A reduced yield, however, might be brought about by a variety of circumstances. Less honey may be produced because of temperature, weather, and illness.

Disadvantages of apiculture

1. Non-Native Bees

Honey bees are non-native species. Therefore, many beekeepers who raise them for their ability to pollinate and honey, there is a quite concern that they will take over native species.

2. Getting Stung

Honey Bees have stings to protect themselves. It gets attached immediately when perceived as a threat. However, honey bees don't only sting for the sake of it. Honeybees also die a horrific death when they use their stinger.

3. Having To Wear A Beekeepers Suit!

You cannot manage your beekeeping task without wearing a beekeeper's suit, without it, you are likely to get stung.

4. Getting Through The First Year

In the first year, it is difficult to get enough results from the honeybees, as they simply won't have had a chance to produce enough to feed the colony and you.

The first year only includes making wax, raising their young and generating honey for food over winter. So, it requires patience while the hive establishes itself.

5. Risk Of Disease

The main problem that arises in rearing bees is disease. Bees with diseases can quickly spread and kill off the entire colony. Further, the infected bees from one hive can spread the disease to neighbouring hives.

HONEY BEE SPECIES



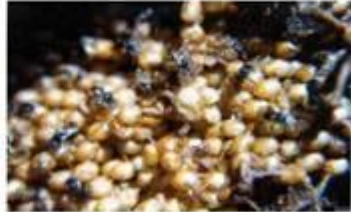
ROCK BEE



LITTLE BEE



INDIAN BEE



STINGLESS BEE