

- iii) 20-30 marks = 3points, B+ grade;
- iv) 30-40 marks =4points, A' grade;
- v) 40-50 marks =5points, A+ grade

Award of Certificate carrying grades: after successful completion of course colorful certificate indicating grade will be awarded to the candidate.

Reservation: NA

COURSE CONTENT: SYLLABUS/PROGRAM:

SCHEME

Vermicompost technology as one of the Certificate Course at undergraduate level

Credits to be earned	:04
Theory paper	:03credits
Practical course/paper	:01

Proposed distribution of the course structure

Sr.No.	Code	Title of the paper	Credit pattern in L:T:P	Credit value
1	VTT - 01	Vermicompost technology	3:0:0	03
2	VTP - 02	Vermicompost technology related to theory (VTP – 01)	0:0:1	01

Open selective course for any students enrolled in the College from different disciplines.

Title of the Course: Certificate Course in Vermicompost technology

THEORY COURSE VT -01

Theory

3 Credits

	Unit-I General Vermiculture/ Vermicompost	12Hrs
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C. Izack Abraham

No: 921

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1. Vermiculture :-

Vermiculture means artificial rearing or cultivation of worms (Earthworms) and the technology is the scientific process of using them for the betterment of human beings.

Vermicompost is the excreta of earthworm, which is rich in humus. Earthworms eat cow dung or farm yard manure along with other farm wastes and pass it through their body and in the process convert it into Vermicompost.

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 waste water or directly from blackwater of flush toilets.

Earthworms :-

Earthworms are commonly found in moist, compost rich soil, eating a wide variety of organic matters, which include detritus, living protozoa, rotifers, nematodes, bacteria and other microorganisms. They are one of the nature's most important detritivores and coprophages, and also serve as

Write 25 lines on a specially pro.

Vermicompost :- Vermicompost 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 materials and Vermicast.

* This process is called "Vermicomposting", with the rearing of worms for this purpose is called "Vermiculture".

* It is a method of preparing enriched compost with the use of earthworms. It is one of the easiest methods to recycle agricultural wastes and to produce quality Compost.

Methods of Vermicomposting :-

* Bed Method

* Pit Method.

Bed Method :-

* Composting is done on the kachcha floor by making bed (6x2x2) feet size of organic mixture. This method is easy to maintain and to practice

Pit Method :-

* Composting is done in the cemented pits

be sensitive to changes in the environment. The total native species numbers were predicted to exceed 1,000.

- * North America:- Approximately 182 earthworm taxa in twelve families were reported from the United States and Canada, of which sixty (about 33%) were introduced. Only two genera of lumbricid earthworms were indigenous to North America while introduced genera have spread to areas without any native species.
- * Currently there is no economically feasible method for controlling invasive earthworms in forests.
- * Earthworms normally spread slowly, but can be quickly introduced by human activities such as construction, earth moving, plantings, and the release of worms used as fishing bait.

* East Asia:-

In Taiwan, *Ponroscolex corethrurus* is known invasive with evidence of it displacing native worms. *Eudrilus eugeniae* has potential to do the same. For Vermicompost, the native or naturalized *Perionyx excavatus* is recommended.

of size $5 \times 5 \times 3$ feet. The unit is covered with thatch grass or any other locally available materials. This method is not preferred due to poor aeration, water logging at bottom, and more cost of production.

Procedure :-

- * Vermicomposting unit should be done in a cool, moist and shady site.
- * Cow dung and chopped dried leafy materials are mixed in the proportion of 3:1 and are kept for partial decomposition for 15-20 days.
- * A layer of 15-20 cm of chopped dried leaves / grasses should be kept as bedding material at the bottom of the bed.
- * Red earth worm (1500-2000) should be released on the upper layer of bed.
- * Water should be sprinkled with care immediately after the release of worms.
- * Bed should be turned once after 30 days for maintaining aeration ready.
- * Compost gets ready in 45-30 days.
- * The finished product is $\frac{3}{4}$ th of the raw materials used.

Preparation :-

- * Vermiculture bed or wormbed (3cm) can be prepared by placing either sawdust or husk or Coir waste, or Sugarcane trash in the bottom of tub / container.
- * A layer of fine sand (3cm) should be spread over the culture bed followed by a layer of garden soil (3cm).
- * All layers must be moistened with water.
- * Shredded paper & cardboard makes an excellent bedding, particularly when combined with typical on farm organic resources such as straw and hay.
- * Worms can be enormously productive and reproductive if conditions are good, however their efficiency drops off rapidly when their basic needs are not met.
- * Vermibeds are made to transform your kitchen garbage and other organic waste into Vermicompost.
- * Vermi Beds are simple to install & their biggest feature is simply sliding the bed away from the installation post.

Food for worms

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food for many low-level consumers within the ecosystems.

Earth worms not only convert garbage into valuable manure but keep the environment healthy.

Local species of earthworm used in Vermiculture:-

There are many local species of earthworms that are used in Vermiculture they are:-

- * *Eisenia fetida*
- * *Lumbricus rubellus*
- * Common earthworm
- * Anecic
- * *Dendrobaena octaedra*
- * Endogeic
- * *Lampito mauritii*
- * Conversion of garbage by earthworms into compost and the multiplication of earthworms are simple process and can be easily handled by the farmers.

* Red worms (*Lumbricus rubellus*):-

* Medium sized

* Cannot survive in ordinary garden and farmsoils-

- * Can thrive well in manure piles and compost heaps.
- * Turning the heap is not required.
- * Field worms (*Allolobophora caliginosa*):
 - * They are medium sized.
 - * Attack compost heap and manure piles from the bottom.
 - * Mix and turn the earth with organic matter and then retreat to the soil.
- * Exotic species of earth worm used in Vermiculture:
 - * Earth worms are invasive species throughout the world. Of a total of about 6000 species of earthworm, about 120 species are widely distributed around the globe.
 - * These are the peregrine or cosmopolitan earthworms. Some of these are invasive species in many regions.
 - * Australia: Australia has 650 known species of native earthworm that survive in both rich and in nutrient poor conditions. Where they may

Worms

A. *Eisenia fetida* :- *Eisenia fetida* known under various common names such as manure worm, redworm, branching worm, potfish worm, tiger worm, etc; is a species of earthworm adapted to decaying organic material

- * These worms thrive in rotting vegetation, compost and manure.
- * They are epigeal, rarely found in soil. In this trait, they resemble *Lumbricus terrestris*.
- * The red wiggler is reddish-brown in colour, has small rings around its body, and has a yellowish tail.
- * Groups of bristles (called setae) on each segment of the worm move in and out to grip nearby surfaces as it stretches and contracts its muscles to push itself forward & backward.
- * *E. fetida* also possesses a unique natural defense system in its coelomic fluid. Cells called coelomocytes secrete a protein called "lysenin", which is a pore forming toxin, which is able to permeabilize and lyse invading cells.
- * It is best at targeting foreign cells whose membranes contain significant amounts of sphingomyelin.

Chitin is also toxic to organisms
spermyelin in their cell walls, including
Bacillus megaterium, though the pathway is
understood.

B. Eudrilus eugeniae :-

- * Eudrilus eugeniae, also called the "African nightcrawler" is an earthworm species native to tropical West Africa and now widespread in warm regions under Vermicompost.
- * It is excellent source of protein and has great pharmaceutical potential.
- * Throughout its life cycle, E. eugeniae grows much more rapidly than Eisenia fetida, in similar environmental conditions.
- * The African nightcrawler grows well at a temperature of $24-30^{\circ}\text{C}$ ($75-86^{\circ}\text{F}$).
- * Maximum weight of around 2.5 grams occurs within 8-10 weeks.
- * The African nightcrawler has a uniform purple-grey sheen and the posterior segments are evenly tapered to a point.
- * The posterior segments do not taper, and the final segment is blunt.

Lumbricus terrestris :-

Lumbricus terrestris is a large, reddish worm species thought to be native to Western Europe, now widely distributed around the world.

- * In some areas where it is an introduced species, some people consider it to be a significant pest for out-competing native worms.
- * Through much of Europe, it is the largest naturally occurring species of earthworm, typically reaching 20 to 25 cm in length when extended.
- * It is a deep burrowing anecic earthworm, that is, it builds deep vertical burrows and surfaces to feed, as opposed to burrowing through the soil for its food as endogeic species.
- * Lumbricus terrestris can strongly influence soil fungi, creating distinctive micro-habitats called "mounds".
- * It is an obligatorily biparental, simultaneous hermaphrodite worm, that copulation occurs on the soil surface.
- * The soil aeration and organic material mixing previously done by the earthworms has ceased in some areas.

D. perionyx excavatus :-

- * perionyx excavatus is a commercially produced earthworm.
- * popular names for this species include composting worms, blues, & Indian blues.
- * this species is marketed for its ability to create fine worm castings quickly.
- * It has recently become more popular in North America for composting purposes.
- * this species belongs to the genus "perionyx". It may have its origins in the Himalayan mountains.
- * It is considered native to tropical East Asia, South Asia and Southeast Asia.
- * This species is suited for vermicomposting in tropical and subtropical regions.
- * It is a tropical earthworm with excellent regeneration capabilities.
- * More than 90% of *P. excavatus* regenerate and survive even after the removal of the headpart containing the CNS, which makes it a good material for study of regeneration mechanisms.

Deadly

Eisenia hortensis :-

- * The European nightcrawler (*Dendrobaena hortensis*) is a medium small earthworm averaging about 1.5g when fully grown.
- * Generally blueish, pink-grey in color with a banded or striped appearance, the tips of their tails are often cream or pale yellow.
- * It was ~~considered~~ part of *Eisenia* until 2003. It is also ~~formerly~~ considered part of the similar *Dendrobaena veneta*, but now just part of the species complex.
- * *D. hortensis* is sold primarily known as bait worm, but its popularity as a composting worm is increasing.
- * ~~*E. hortensis*~~ name is more common in North America, while the *D. veneta* name is more common in Europe.
- * When the species has not been feeding, it is pale pink.
- * The species is usually found in deep woodland litter and garden soils that are rich in organic matter in European countries.