Report on
Seed production and Technology

Experiential Learning Programme (ELP) was sanctioned by ICAR during XII plan with the major aim to develop competence, capability, capacity building, acquiring skills, expertise and confidence amongst the graduates of agriculture. The ELP is offered during final year of the agriculture degree program. This offers the phenomenon of "Learning by doing" and "Seeing by Believing". This could potentially build up the self confidence amongst the youth to train them to become "Job givers rather than Job seekers**".** The main objectives of EL are:

1. To promote professional skills and knowledge through hands on experience.
2. To build confidence and ability to work in project mode.
3. To acquire enterprise management capabilities

Shri Vaishnav Institute of Agriculture, SVVV, Indore had successfully conducted Module on-Seed production and Technology (BAG 802) under Experiential Learning Programme 2021-22.

In this module VIIIth semester students learn firstly importance of seeds in agriculture as well as need of quality seed production. We conducted module on foundation seed production of wheat crop for this we purchase Breeder seed from IARI- Wheat Regional research station, Indore. Following operations are carried out under this programme:

1. Land selection
2. Preparatory tillage
3. Sowing
4. Roughing and Weeding
5. Water management
6. Fertilizer
7. Disease and pest management
8. Harvesting
9. Threshing, storage and Yield.
10. Economics of wheat seed production.

This experiential learning programme in Seed Production and Technology was one of the greatest opportunities for students to learn hands on training regarding quality seed production in wheat crop. It has provided students with skills and knowledge from the start that is from land selection for seed production to till the end that is harvesting and marketing of seed. Under this module students also had a good experience in dealing with the benefits as well as limitations or hurdles that can arise in a foundation seed production of wheat crop. This experiential learning programme has given a good chance to students for practical experience of selection of land, source of seed, preparatory operations as well as managing crops from both biotic factors i.e. dealing from pest and diseases as well as abiotic factors. In addition to all this overall this module has given an excellent exposure to students in seed and how generate more income from quality seed production.

Dr. Ashish H. Bankar
Assistant Professor,
SVIAg, SVVV, Indore

Cultivation of Button Mushroom (Agarics bisporus)

Prof. Vinod Dhar
Head- Centre for Vocational Studies,
Shri Vaishnav Institute of Agriculture,
SVVV, Indore.

TAXONOMIC POSITION

Kingdom : Fungi
Division : Basidiomycota
Class : Agaricomycetes
Order : Agaricales
Family : Agaricaceae
Genus : Agaricus
Species : bisporus

Only seven mushrooms are widely preferred for large-scale cultivation. They are:

1 Paddy straw mushroom - Volvariella spp.

2. Oyster mushroom - Pleurotus spp.

3. Button mushroom -Agaricus spp.

4. Milky mushroom - Calocybe spp.

5. Shiitake mushroom _ Lentinulla spp.

6. Jew’s ear mushroom - Auricularia sp.

7. Reishi mushroom - Ganoderma lucidum

For cultivation of white button mushroom following steps are required:

(i) Spawn production

(ii) Compost preparation

(iii) Spawning

(iv) Spawn running

(v) Casing

(vi) Fruiting

The quality of mushroom compost depends on:

Nature and quality of basic material

Organic and in organic supplements

Management of compost during composting

Ingredient	**Quantity**
Wheat straw or	300 kg
Paddy straw	375 Kg
Wheat/Rice bran	30 kg
Linseed meal	7 kg
CAN	9 Kg
Superphosphate	7.5 Kg
Urea	3.5 kg
Potash	3 kg
Gypsum	30 kg
Folidol dust	225g

COMPOST PREPARATION

To commence the process of composting, cleaning of the composting space is essential and is done by thorough washing by applying 2% formalin solution. . Wheat/paddy straw or any other base material that is to be used as substrate is spread in a thin layer of 8-10 inches thickness over the floor of composting space. Water is sprinkled over the straw and wetting of straw is done repeatedly several times a day for 2 days.

Wetting of the straw

Ingredients like urea, CAN, superphosphate, wheat/paddy bran etc. (except insecticide and gypsum) are thoroughly mixed, wetted with water and then covered with damp gunny bags for 14-16 hours before being mixed with wet wheat/paddy straw.

Mixing of ingredients

Preparation:

- Day 0: On this day fertilizer mixtures are spread evenly on the pre- wetted straw. This mixture is made into a stack with the help of wooden boards or pile formers. Dimensions of pile should be 5’x5’x adjustable length. Height and width of the pile should not be more than this otherwise pile may become too hot due to high temperature and the anaerobic conditions may prevail in the center which may not yield good quality compost.

- Day 1-5: Start monitoring the temperature of the heap. Temperature should start rising after 24-48 hours of stacking and reach 65-70°C in central core. If the moisture of the mixture is less, then water can be sprayed. Watering should be stopped as soon as leaching starts from the bottom of pile. If water starts leaching in large quantity, then it should be collected in a muddy pit and put on the top of the pile.

- Day 6: First turning: On this day first turning is given to the stack. The aim of turning is that every portion of the pile gets equal aeration and water for proper decomposition of the base material. The correct method of turning is as follows:

Turning of compost pile

Opening compost pile (after observing brown colour, checking NH_3 smell and pH value)

- Day- 10: 2nd turning. Break open the stack, remove it as indicated above, water may be added if required and restack it.
- Day-13: 3rd turning: Restack and add required quantity of gypsum
- Day-16: 4th turning
- Day-19:5th turning
- Day-22:6th turning
- Day-25:7^{th} turning add required quantity of insecticide

- Day 28: Filling day. Break open the pile and check for the smell of ammonia, if it persists, give an additional turning after 3 days. This way compost is prepared by long method in 28-30 days. When lightly squeezed in the hand the moisture in compost should be released in the form of little dampness only and the compost fragments should only just bind together.

Filling:

The compost is filled in wooden trays or shelves or in polythene bags (size 18” x 24”) at different rates. During summer, the compost is slightly pressed while filling so that due to the metabolism of the growing mycelium, bed temperature may not rise as enough of heat is generated during that period. Similarly, it is hard-pressed during winter season.

Spawning and filing of compost in polythene bags

Filling of the trays / bags 6-8 inches deep with compost, stacking them closely, with their upper end covered with polythene or newspaper in a closed room, has been found to provide conditions for efficient spawn run and the heat generated can be managed easily. Moreover, it will add to the ideal temperature (25±1º C) required for rapid colonization of the compost with mycelium.

SPAWNING AND SPAWN RUNNING:

a) Spawning: Mixing the mushroom seed or spawn in the compost is called as spawning. There are different methods of spawning which are as follows:

1. Surface spawning: Grain spawn is scattered all over the surface of the compost in trays or racks which is then covered with 2 cm thin layer of compost.

2. Double layer spawning: Usually done under unfavorable environmental conditions at low temperature. First, trays are half filled with compost, spawn is scattered over it, and then trays are filled completely with compost and again spawned in the same manner. Finally, a thin layer of compost is spread on the spawn covering it completely.

Spawn of white button mushroom

3. Thorough spawning: The desired quantity of spawn is mixed thoroughly in the required quantity of compost which is then filled in racks, trays or bags. This type of spawning is done mainly in bag cultivation.

4. Spot spawning: Trays are filled with compost. Spawning is done in 1-2 inches deep hole made in the compost about 4-5 inches apart in rows. A tea spoonful spawn is filled in the holes which are later covered with compost. After spawning, trays or racks are covered with old newspaper sheets and watered lightly with the help of water sprayer. In Polythene bag cultivation, its mouth is tied with the help of thread.

5. Active spawning: Here in place of grain spawn, fresh compost after complete colonization by mushroom mycelium is used as spawn. In this method spawn run is very quick but care should be taken to avoid use of contaminated compost.

Spawn running: The temperature of the mushroom house, where trays or bags are kept for incubation should be maintained between 22-25°C. The humidity should remain at 80-85% RH level. This can be maintained by frequently spraying water on walls and floor of the mushroom house. If temperature is lower than optimum level, it prolongs the spawn run period even up to 22 days while higher temperature retards mycelial growth.

During spawn running, fresh air is not required; hence room should be kept closed to create darkness. Higher CO_2 concentration than the normal level in the air favors mycelial growth of the mushroom

Under favourable environmental conditions within 14-15 days of spawning, the compost surface is covered with the cottony growth of the white mycelium. This condition is called spawn run.

CASING

Covering the top of mushroom beds after completion of spawn run with a layer of appropriate sterilized soil mixture is known as casing. Mushroom growers in different countries use different types of casing materials depending upon their availability. Different materials used in India as casing mixture are:

1) Loam soil + Sand (4:1)

2) Two-year-old farmyard manure + loam soil (1:1)

3) Two-year-old spent compost + sand + lime (4:1:1)

4) Two-year-old spent compost + loam soil + FYM (2:1:1)

5) Paper mulch + 2-year-old spent compost

6) Two- three-year-old spent compost + FYM (1:1)

Casing soil (Mixing peat and garden soil)

Chemical sterilization

Soil is commonly sterilized by the application of 2% formalin (formaldehyde). About 500 ml formalin is diluted with 10 liters of water and used for 1 cubic meter of casing soil. The casing material is spread over a plastic sheet and sprayed with formalin. The treated soil is piled up in a heap and covered with another plastic sheet for 48 hours. The soil is then uncovered and stirred frequently to remove the traces of formalin fumes. This casing material is fit for use one week after treatment, when it is free form smell of formalin.

Application of Casing:

When spawn run is completed, the casing is done over spawn run compost after removing newspaper sheet from the trays on racks or after opening mouth of the poly bags. Spawn run compost is slightly pressed and covered on the surface with 4-5cm thick layer of casing soil. After casing, the temperature of the mushroom house is maintained at 24-25 °C for another 8- 10 days and water is sprayed over casing soil. Within 8-10 days, white mycelium spreads in the casing soil. Thereafter temperature of the mushroom house is lowered down to 18 °C and maintained between 14-18°C during rest of the fruiting period. Whenever required, watering is done with the help of sprayer and RH is maintained at 80-85% throughout the cropping period.

CROP MANAGEMENT:

As soon as the white cottony growth of the mycelium appears on the casing surface, fresh air should be introduced inside the cropping room and bed temperature lowered to 16-18 °C which is to be maintained throughout the cropping period. The CO_2 level is also lowered to below 1000 ppm. Under such conditions, the initiation of fruiting bodies i.e. pinning takes place within 6-7 days of aeration which reaches to the harvesting stage within next 4-5 days.

The individual fruit bodies are harvested carefully without disturbing the adjoining pinnings and before the cap opens. The cropping period lasts for 40-60 days. Mushrooms appear in flushes provided optimum conditions like bed temperature (16-18º C) , relative humidity (80-90 %) by spraying water with misty nozzle, about 4-5 air changes every hour resulting into less than 1000 ppm in the cropping room with no light at all , are maintained.

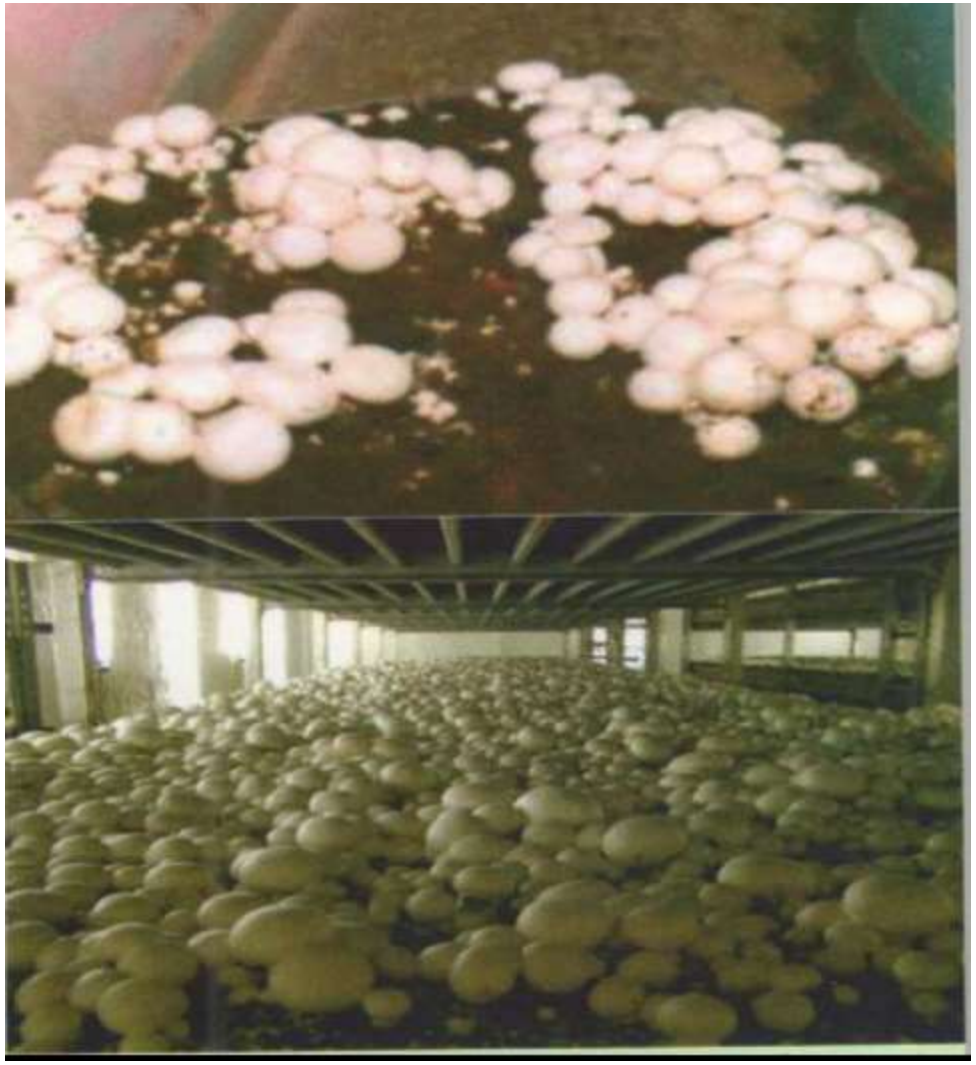
Commercial New Mushroom Shelves

Mushroom crop in polythene bags

The environmental factors like temperature, relative humidity, light, air flow in the cropping room etc., all play vital roles which together determine the nature of further mushroom development. The mushroom crop grows in cycle called —Flushes or “Breaks ". These flushes normally appear in 7-10 days.

HARVESTING:

Timing is the most important factor in button mushroom harvesting. Mushrooms should be picked before the veil breaks and the stem elongates. Damage to pinheads and disturbance of the casing soil must be minimized during picking. The standard harvesting technique consists of grasping the base of the stem, pull it with a twisting motion being careful not to disturb adjacent pinheads.



Yield:

The cropping stage lasts for 40-60 days and production comes to 12-25 Kg / 100 Kg compost depending upon the quality of spawn, compost, casing mixture and prevailing environmental conditions in the mushroom house.

THANKS

Cultivation of Oyster Mushroom (Dhingree Mushroom)

Cultivation of Oyster Mushroom (Dingree Mushroom)

Presenter:

Prof. Vinod Dhar

Head- Centre of Vocational Studies,

Shri Vaishnav Institute of Agriculture,

SVVV, Indore

The taxonomic position of Pleurotus

- Kingdom : Fungi
- Phylum : Basidiomycota
- Class : Agaricomycetes
- Order : Agaricales
- Family : Pleurotaceae
- Genus : Pleurotus
- Species : P. ostreatus

Other cultivation species: P. sajor-caju, P. florida, P. eryngii and P. d'jamor

- Pleurotus mushroom known globally as oyster mushroom is also called “Dhingree” in India.
- The fruit bodies are spatula shaped with different shades of white, cream, grey, yellow, pink or light brown depending upon the species.

Agro-climatic Requirements

- Suitable period of cultivation is from September to March.
- Optimum temperature for growth of most Pleurotus species is 20*C to 28*C.
- However P. sajor-caju can be grown up to 30*C temperature.
- Relative humidity required during its growth is 80 to 85%.

Requirement of Material for Cultivation

- Fresh Spawn (15 days Old)
- Substrate (Wheat/Paddy Straw)
- Poly Propylene Bags (Size- 35x50cm 80 gauge)
- Wheat / Rice bran as supplement
- Rubber band
- Chemicals (Bavistin and Formalin)

Cultivation Technique

Following steps are executed for its cultivation

- Procurement of Spawn
- Substrate Preparation
- Sterilization/ Pasteurization of Substrate
- Spawning
- Cropping and Harvest
- Post Harvest Management

Procurement of Spawn

- Fresh Pleurotus spawn should be about 15 days old grown on wheat, oats, paddy grain with mycelium coating around the grain.
- Spawn should be procured from reliable source.

Substrate Preparation

- Wheat / Paddy / Pulse straw is used as a substrate for its cultivation.
- Straw should be fresh and well dried
- Substrate is soaked in fresh water in water tank.
- Formalin @1ml/liter and Bavistin @2gm/liter are added to the water tank and left over night.
- There after straw is taken out from tank and excess water is drained of by spreading it on cemented floor in shade.

CHOPPING OF PADDY STRAW

SOAKING OF PADDY STRAW

HOT WATER TREATMENT

DRAIN OFF EXCESS WATER

Sterilization of Substrate

- Water is boiled in wide mouth container such as tub or drum.
- Wet substrate are filled in gunny bags and dipped in hot water of 80-85*C for about 20 minutes.
- After these the gunny bags are taken out from tub and excess water is allowed to drain off and substrate allowed to cool.
- At the stage the substrate is ready for spawning.

Spawning

- After cooling the sterilized substrate is mixed with pasteurized rice/wheat bran @6% wet weight of the of the substrate.
- This mixture of substrate is spawned @3% on wet weight basis and 4 to 5kg spawn is sufficient for 100kg prepared substrate.
- Spawning is done either by mixing the spawn with substrate or laid in layers on the substrate.

BED PREPARATION

LAYERING OF SPAWN

PINNING OF BED

SPAWN RUNNING

- Now this substrate is put in polypropylene bag of size 35x50 cm, 80 gauge.
- After spawning bags are tied on the top with the help of rubber band and holes about 1cm diameter are made at 10-15 cm distance across the surface for release of gases and heat generated inside.
- The spawned bags are shifted to clean close and dark room and maintained at 24-25*C with 80-85% RH.
- The spawn run takes 12-14 days.

HANGGING OF BED

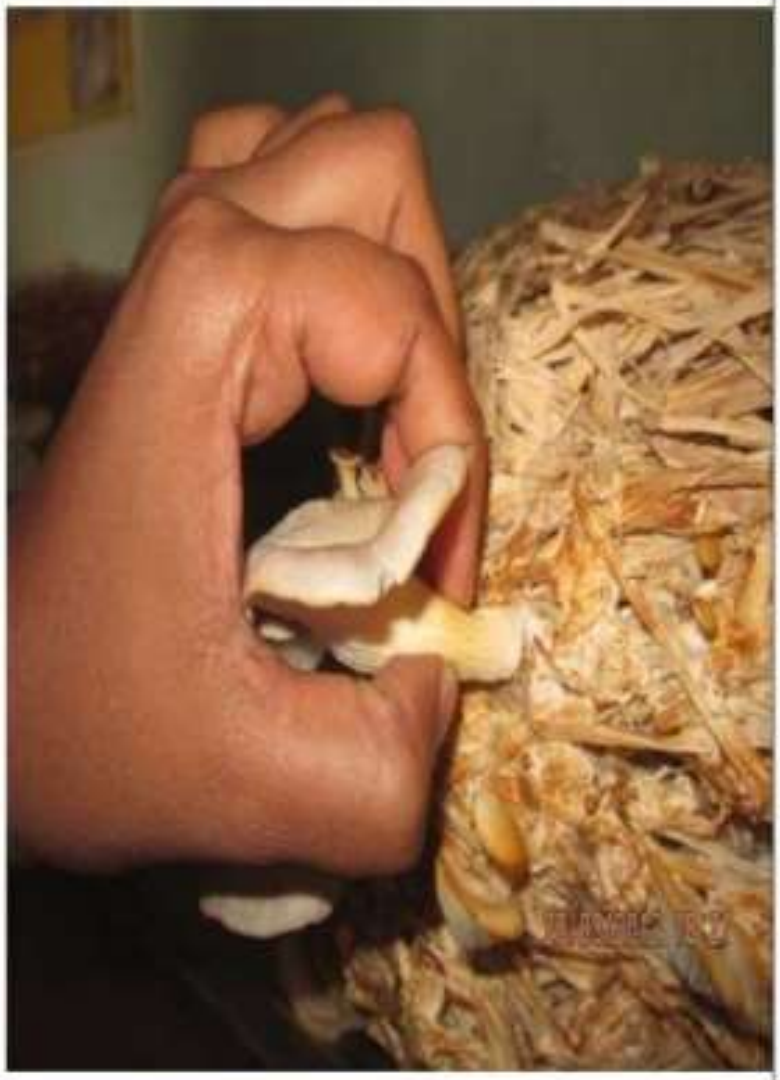
WATERING

PINHEAD STAGE

MATURE MUSHROOM

Cropping and Harvest

- After 20-22 days of spawning bags are fully impregnated with white mycelium.
- The rubber band are opened and bags are kept on racks 20cm apart.
- RH is maintained by spraying water twice a day on the walls and floor of the room.
- A light spray of water is given on bags as soon as the small pin heads emerge.
- Mature mushrooms are ready to harvest 5 to 7 days after appearance of pin heads.
- The fruit of mushroom is harvested by twisting the base of the mushroom.



HARVESTING OF MUSHROOM

PACKING OF MUSHROOM

THANKS

Some important formulations of organic products for soil enrichment

Preparations of liquid manures - many variants of liquid manures are being used by farmers of different states. Few important and widely used formulations are given below:

Sanjivak – Mix 100 kg cow dung, 100 lit cow urine and 500 gm. jaggary in 300 lit of water in a 500-lit closed drum. Ferment for 10 days. Dilute with 20 times water and sprinkle in one acre either as soil spray or along with irrigation water.

Beejamruta – Put 5 kg fresh cow dung in a cloth bag and suspend in a container filled with water to extract the soluble ingredients of dung. Suspend 50 g lime in 1 lit water separately. After 12 – 16 hours squeeze the bag to collect extract and add 5 lit cow urine, 50 gm. virgin forest soil, lime water and 20 lit water. Incubate for 8-12 hours. Filter the contents. The filtrate is used for seed treatment.

Jivamruta – Mix cow dung 10 kg, cow urine 10 lit, Jaggary 2 kg, any pulse grain flour 2 kg and Live forest soil 1 kg in 200 lit water. Ferment for 5 to 7 days. Stir the solution regularly three times a day. Use in one acre with irrigation water.

Amritpani - Mix 10 kg cow dung with 500 gm honey and mix thoroughly to form a creamy paste. Add 250 gm. of cow desi ghee and mix at high speed. Dilute with 200 lit water. Sprinkle this suspension in one acre over soil or with irrigation water. After 30 days apply second dose in between the row of plants or through irrigation water.

Panchgavya – Mix fresh cow dung 5 kg, cow urine 3 lit, cow milk 2 lit, curd 2 lit, cow butter oil 1 kg and ferment for 7 days with twice stirring per day. Dilute 3 lit of Panchgavya in 100 lit water and spray over soil. 20 lit panchgavya is needed per acre for soil application along with irrigation water.

Enriched Panchgavya (or Dashagavya) – Ingredients - cow dung 5 kg, cow urine 3 lit, cow milk 2 lit, curd 2 lit, cow deshi ghee 1 kg, sugarcane juice 3 lit, tender coconut water 3 lit, banana paste of 12 fruits and toddy or grape juice 2 lit. Mix cow dung and ghee in a container and ferment for 3 days with intermittent stirring. Add rest of the ingredients on the fourth day and ferment for 15 days with stirring twice daily. The formulation will be ready in 18 days. Sugarcane juice can be replaced wit 500 g jaggery in 3 lits water. In case of non-availability of toddy or grape juice 100g yeast powder mixed with 100 g jaggery and 2 lit of warm water can also be used. For foliar spray 3-4 lit panchgavya is diluted with 100lit water. For soil application 50 lit panchagavya is sufficient for one ha. It can also be used for seed treatment**.**

Prof Vinod Dhar
Head- Centre for Vocational Studies
Shri Vaishnav Institute of Agriculture,
SVVV, Indore

Vermicompost- efficient organic manure.

Vinod Dhar*

Vermicompost is the end product of a process called vermicomposting, which uses earthworms to increase the speed of the composting process and ensures higher-quality compost. Vermicomposting differs from composting in several ways. It is a mesophilic process, utilizing micro-organisms and earthworms that are active at 10–32°C temperature within the pile of moist organic material. And compared to conventional thermophilic composts, vermicompost is much richer in microbial diversity, populations and activities. The process is faster than composting; because the material passes through the earthworm gut. Earthworm gut is the site of production of genuine humic acids which are distinct from the polysaccharide-gum humic acids. About half of the gums secreted by earthworm are in the form of mucoproteins that help stabilizing pore space distribution. Earthworm castings (worm manure) are rich in microbial activity and plant growth regulators, and fortified with pest repellence attributes as well!

Earthworms feed on the organic waste materials and pass it through their digestive system and give out in a granular form which is known as vermicompost. Simply speaking, vermicompost is earthworm excrement, called castings, which can improve biological, chemical, and physical properties of the soil. The earthworm soil casts are richer in available plant nutrients (nitrate nitrogen, exchangeable Ca, Mg, K and P) and organic matter. The earthworms through their casts and dead tissues supply about 60-90 kg Nitrogen to the soil. Earthworm eats fungal mycelia. Earthworms convert farm waste and organic residues into high quality compost. For this, Eisenia foetida, Perionyx exacavatus, Eudrillus euginiae and Lumbrius rubellus are important. These species can be cultured on organic wastes and dung. They can tolerate temperatures ranging from 0 to 40°C but the regeneration capacity is more at 25 to 30°C and 40–45% moisture level in the pile. These types are red or purple and 10 to 15 cm long but their life span is only 28 months.

Vermicompost contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner. It is used in farming and small scale sustainable, organic farming. Advantages of vermicompost include enriching soil, increasing harvest yields and suppressing plant disease.

Classification of Earthworms: Based on food habits, earthworms may be divided into two classes viz,

1. **Phytophagous:** Vermin falling in this class ingest semi decomposed organic matter and soil. They consume 90% of organic material and 10% soil. Vermin of this class are used for vermicomposting.
2. **Geophagus:** Vermin of this class consume 90% of soil and 10% of organic material. They go deep into the soil by making tunnel and move up and down within the soil and increase the porosity of soil and are also called ploughman. This class is not used for vermicomposting.

Depending on the level up to which they are found in soil, they may be classified as:

1. **Epigeic:** This class of Vermin is surface feeders as they are found on upper layer of soil. They feed on waste and semi decomposed organic waste lying on the surface of the soil. They are best suited for vermicomposting. *Eisenia foetida, Eudrilus eugeniae, Lumbricus rubellus and Perionyx excavatus* are main worms found in this class. They are 3-4 inches long, 3-5 mm in diameter and 0.5-1.5 g in weight. They become reproductive after 30-45 days of their emergence from cocoons. An adult worm lays a single cocoon on every third day and after hatching for 23 days 3-5 worms come out from each cocoon. Their lifecycle is of 1-3 years.
2. **Endogeic:** This class of worms is found in deeper layers of soil and borrows deep into soil. They avoid sunlight and mainly consume soil as their feed. They are not suited for vermicomposting. They are 8-10 inches long and about 5 g in weight. They are also known as Ploughman being agriculture friendly as they increase the porosity of soil. *Metaphire posthuma* and *Octocheatona thrustonae* are names of worms falling under this class.
3. **Epianecic:** This class of worms is deep burrows and moves up and down in the soil. They after collecting feed from upper layer go back into mid layers. They also increase porosity of soil. *Lampito mauritti* fall under this class. They are 3-6 inches in length, 3-5 mm in diameter.

Vermin are bisexual or hermaphrodite but still male and female vermin go into mating for the reasons that their male and female reproductive organs are placed distantly and release time of sperm and ovum do not synchronize with each other. A single vermin lays 17-25 cocoons during its life cycle and on average 3 vermin are produced from single cocoon. They remain reproductive only for 6 months.

Preparation of Vermicomposts

A size of $100m^2$ is required by an average farmer. Preferably, a brick masonry Vermi bed should be constructed for quality production of vermicompost, whose dimension should be 3m x 1m x 0.6m. In this way about 90 such Vermi beds will be accommodated.

Before filling vermibeds with organic material such as waste of field, leaves, twigs of trees, fruit and vegetable waste, kitchen waste, cow dung and bio gas slurry, a stack of such material should be evenly spread over the surface ,thickness of material should be 1 foot and left for 15-20 days for decomposition. As Semi decomposed material is well eaten by vermin, this material should be kept moist for all these days and may be given several turnings.

After semi decomposed organic material is ready it may be filled in Vermi beds up to 0.6m height and water should be spayed to maintain moisture content of material . After this, the vermin may be placed on top layer and again a layer of organic material be spread over it. Jute bags may be placed over it and water should be spayed over this to keep it moist.

In 45-60 days' time Vermi cast is obtained from vermin and found on top, which should be collected with hands and small heaps of these should be left within the bed so that vermin if present in heap move down from it to lower layer of organic matter.

Afterwards, the heap of this Vermi cast should be taken out from bed and allowed to dry maintaining moisture content of 30-35%. This vermicast or vermicompost should then be bagged in convenient sized poly bags.

Chemical composition of vermicomposts

Sr.no.	Particulars	Quantity
1.	pH	6.8
2.	EC	11.7
3.	Total N	0.5-1.0%
4.	P	0.15-0.56%
5.	K	0.06-0.30
6.	Ca	2.0-4.0%
7.	Na	0.02%
8.	Mg	0.46%
9.	Fe	7563ppm
10.	Zn	278ppm
11.	Mn	475ppm
12.	Cu	27ppm
13.	Bo	34ppm
14.	Al	7012ppm

Application rate

S.No.	Crop	Dose per hectare
1.	Paddy	5 t^{-} ha
2.	Pulses	5 t^{-} ha
3.	Oilseeds	7.5-12.5 t^{-} ha
4.	Spices	2-10 Kg/Plant
5.	Vegetables	10-15 t^{-} ha
6.	Fruit crops	5-7.5 t^{-} ha
7.	Cash crops	12.5 t^{-} ha

*Head- Center of Vocational Studies,

Shri Vaishnav Institute of Agriculture,

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Source: Nagavallemma KP, Wani SP, Stephane Lacroix, Padmaja VV, Vineela C, Babu Rao M and Sahrawat KL. 2004. Vermicomposting: Recycling wastes into valuable organic fertilizer.

http:// www.researchgate.net