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Vermicompost : A backbone for sustainable agriculture

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Introduction:

Vermicompost is stable, fine granular organic manure, which enriches soil quality by improving its physicochemical and biological properties. It is highly useful in raising seedlings and for crop production. Vermicompost is becoming popular as a major component of organic farming system.

Vermicomposting is described as "bioxidation and stabilization of organic material involving the joint action of earth worms and mesophilice micro organisms"Under appropriate conditions,worms eat agricultural waste and reduce the volume by 40 to 60%. Vermicompost produced by the activity of earthworms is rich in micro and macro-nutrients, vitamins, growth hormones, enzymes such as proteases amylases ,lipase, cellulose and chitinase and immobilized micro flora.The enzymes continue to disintegrate organic matter even after they have been ejected from the worms. Reduced use of water for irrigation, reduced pest attack, reduce termite attack, reduced weed growth, faster rate of seed germination and rapid seedling growth and development, greater number fruit per plant (in vegetable crop) and greater number of seeds per years (in cereal crops) are only some of the beneficial effects the vermicompost uses in agricultural production. Earthworms and vermicompost can boost horticultural production without agrochemicals.

Vermicomposting materials-

Decomposable organic wastes such as animal excreta, kitchen waste, farm residues and forest litter are commonly used as composting materials. In general, animal dung mostly cow dung and dried chopped crop residues are the key raw materials. Mixture of leguminous and non leguminous crop residues enriches the quality of vermicompost.

There are different species of earthworms viz. Eisenia foetida (Red earthworm), Eudrilus eugeniae (night crawler), Perionyx excavatus etc. Red earthworm is preferred because of its high multiplication rate and thereby converts the organic matter

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in to vermicompost within 45-50 days. Since it is a surface feeder it converts organic materials into vermicompost from top.

Climate and temperature-

The most common worms used in composting systems, redworms (Eisenia fetida, Eisenia andrei, and Lumbricus rubellus) feed most rapidly at temperatures of 15–25 °C (59-77 °F). They can survive at 10 °C (50 °F). Temperatures above 30 °C (86 °F) may harm them.This temperature range means that indoor vermicomposting with redworms is possible in all but tropical climates. Other worms like Perionyx excavatus are suitable for warmer climates.If a worm bin is kept outside, it should be placed in a sheltered position away from direct sunlight and insulated against frost in winter.

Bed method: Composting is done on the pucca / 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 of size 5x5x3 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.

Process of vermicomposting- Following steps are followed for vermicompost preparation

- Vermicomposting unit should be 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.

Fig. 1: Unit of Vermicomposting

Methods of vermicomposting-

Vermicomposting is done by various methods, among them bed and pit methods are more common.

- A layer of 15-20cm of chopped dried leaves/grasses should be kept as

bedding material at the bottom of the bed.

- Beds of partially decomposed material of size 6x2x2 feet.
- Each bed should contain 1.5-2.0q of raw material and the number of beds can be increased as per raw material availability and requirement.
- Red earthworm (1500-2000) should be released on the upper layer of bed.
- Water should be sprinkled with can immediately after the release of worms.
- Beds should be kept moist by sprinkling of water (daily) and by covering with gunny bags/polythene.
- Bed should be turned once after 30 days for maintaining aeration and for proper decomposition.
- Compost gets ready in 45-50 days.
- The finished product is 3/4th of the raw materials used.

Harvesting-

When raw material is completely decomposed it appears black and granular. Watering should be stopped as compost gets ready. The compost shout be kept over a heap of partially decomposed cow dung so that earthworms could migrate to cow dung from compost. After two days compost can be separated and sieved for use.

Stroing and packing of vermicompost-

The harvested vermicompost should be stored in dark and cool place as sunlight will lead to loss of moisture and nutrient content. Moreover, harvested vermicompost material should be stored in open rather than packed in sacs. Packing should be done at the time of selling and laminated sac is always advisable. During compost storage in open place, periodical sprinkling of water should be done to maintain moisture level and beneficial microbial population. Vermicompost can be stored for longer periods of one year without loss of its quality, if its moisture is maintained at 40% level.

Preventive measures-

- ✓ The floor of the unit should be compact to prevent earthworms' migration into the soil.
- ✓ 15-20 days old cow dung should be used to avoid excess heat.
- ✓ The organic wastes should be free from plastics, chemicals, pesticides and metals etc.
- ✓ Aeration should be maintained for proper growth and multiplication of earthworms.
- ✓ Optimum moisture level (30-40 %) should be maintained
- ✓ 18-25oC temperature should be maintained for proper decomposition.

Properties-

- ✓ Vermicompost has been shown to be richer in many nutrients than compost produced by other composting methods. It has also outperformed a commercial plant medium with nutrients added, but levels of magnesium required adjustment, as did pH.
- ✓ However, in one study it has been found that homemade backyard vermicompost was lower in microbial biomass, soil microbial activity, and yield of a species of ryegrass than municipal compost.
- ✓ It is rich in microbial life which converts nutrients already present in the soil into plant-available forms.
- ✓ Unlike other compost, worm castings also contain worm mucus which helps prevent nutrients from washing away with the first watering and holds moisture better than plain soil.

Nutrient content of vermicompost-

The level of nutrients in compost depends upon the source of the raw material and the species of earthworm. A fine worm cast is rich in N P K besides other nutrients. Nutrients in vermicompost are in readily available form and are released within a month of application.

Nutrient Analysis of Vermicompost:

Parameters	**Content**
pH	6.8
OC%	11.88
OM%	20.46
Available N (%)	1.54
Available P (%)	1.30
Available K (%)	0.86
Ca (%)	1.70
Mg (%)	0.06

Advantages of Vermicompost-

1. Vermicompost is the best replacement for chemical fertilizers.
2. Vermicompost is eco-friendly as it is produced by organic waste through vermiculture.
3. Vermicompost is also a natural fertilizer.
4. Water holding capacity increases due to the organic substances used in vermicompost.
5. Improves plants growth and nutrients absorbing capacity.
6. Vermicompost contains antibiotic properties that help to regulate compost.
7. Crop yields and seed germination also improves.

Disadvantages of Vermicompost-

1. Vermicomposting takes a long period of time of 6 months.
2. There is a little odour present in it.

3. The maintenance is high as it has to be kept under maintenance for a long period of time.
4. If not taken care of, there are chances of pathogens and pest problems.
5. Time-consuming process.

Conclusion-

Vermiculture is the scientific process of artificial rearing or cultivation of Earthworms for the improvement of human beings. Vermicompost is the excreta of earthworm that is a rich source of humus. Earthworms feed on cow dung or other farm wastes and pass it through their body converting it into vermicompost. The municipal wastes, toxin-free solid or liquid waste of the industries and household trash can also be converted into vermicompost with this technique. Earthworms not only convert waste into valuable manure but also keep the environment healthy. Conversion of garbage by earthworms into compost and the multiplication of earthworms are simple processes that can be easily handled by farmers.