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VERMICOMPOST: PRODUCTION AND PRACTICES FOR IMPACT ON PLANT GROWTH AND SOIL FERTILITY

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ABSTRACT

Vermicomposting 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. Earthworms consume biomass and excrete it in digested form called worm casts. Worm casts are popularly called as Black gold. Vermicompost 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 a low-technology, environmentally-friendly process used to treat organic waste. The resulting vermicompost has been shown to have several optimistic impacts on plant growth and health. This organic fertilizer is therefore ever more considered in agriculture and horticulture as a promising alternative to inorganic fertilizers and/or peat in greenhouse potting media. In the present investigation the process of vermicompost production is discussed and the nutrient contents are analyzed. It was found that vermicompost is rich in nutrients which enhances plant growth and soil fertility.

KEYWORDS: Vermicompost, Earthworms, Soil fertility, Plant-growth.

INTRODUCTION

Vermicompost is a nutritive organic fertilizer enriched microbiologically-active peat-like material, and is commonly used for management of organic wastes by decomposition and humification of biodegradable organic wastes carried out by microbes present in the soil and gut of earthworms. Vermicompost improve plant growth and development beyond that normally observed from just soil nutrient transformation and availability. These increases in plant productivity have been attributed to improved soil structure and soil microbial populations that have higher levels of activity and greater production of biological metabolites, such as plant growth regulators. Vermicompost could promote early and vigorous growth of seedlings. It has been found to effectively enhance the root formation, elongation of stem and production of bio- mass, vegetables, ornamental plants, etc.More available plant nutrients and microbial metabolites may be released into the growth media because earthworms may stimulate microbial activities and metabolism and also influence microbial populations and after earthworms digest organic matter, they excrete a nutrient-rich waste product called castings.[1] As food passes through their digestive tract, worms secrete chemicals that break down organic matter into sustainable nutrition. These chemicals, excreted with their castings, comprise vermicompost, which improves soil texture, structure and aeration. It can be applied as mulch, incorporated as a component in potting mixes or brewed in water as a compost tea liquid fertilizer.a large nutrient uptake demand, especially for potassium (K), followed by nitrogen (N), sulfur (S),calcium (Ca), magnesium (Mg) and phosphorus (P).[2] Macro- and micronutrients can be obtainedby supplementation of inorganic or organic fertilizers such as vermicompost. Vermicompost is aslow-release fertilizer and is rich with essential plant nutrients produced by the joint action of certainspecies of earthworms (especially *Eisenia fetida* or *Eudriluseugeniae*) and microorganisms in thedecomposition of organic waste such as agro-wastes,[3] sewage sludge,[4] and food wastes.[5] Several studies have shown that vermicompost amendment can directly increase plant productionthrough increasing available plant nutrients and indirectly promote soil quality by improving soilstructure and stimulating microbial activities, relative to conventional chemical fertilization.[6,7] The casts are rich in nutrients, growth promoting substances, beneficial soil micro flora and having properties of inhibiting pathogenic microbes. 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. *Eudriluseugeniae* (night crawler), *Perionyx excavatus* etc. Red earthworm is preferred because of its high multiplication rate and thereby converts the organic matter into vermicompost within 45-50 days. Since it is a surface feeder it converts organic materials into vermicompost from top.

Important characteristics of *Eudrilus eugeniae* (night crawler).

Sr. No.	Characters	*Eudrilus eugeniae*
1	Body length	4-12cm
2	Body weight	0.6-0.6g
3	Maturity	65-70days
4	Conversion rate	3.0 q/1600worms/3 months
5	Cocoon production	1 in every 4 days
6	Incubation of cocoon	25-30days

Types of vermicomposting

The types of vermicomposting depend upon the amount of production and composting structures. Small-scale vermicomposting is done to meet the personal requirement and farmer can harvest 7-12 tonnes of vermicompost annually. While, large-scale vermicomposting is done at commercial scale by recycling large quantity of organic waste with the production of more than 50 – 100 tonnes annually.

2. MATERIALS AND METHODS

2.1. Methods of vermicomposting

Vermicomposting is done by various methods; among them bed and pit methods are more common. 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 (Fig.1). 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.

2.2. 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. • 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 should be made. • 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. • night crawler(1200-1500) should be released on the upper layer of bed. • Water should be sprinkled with can immediately after the release of worms (fig.2) • 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.

2.3. 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.

2.4. 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.

2.5. Soil and Plant 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.

2.6. Nutrient Analysis of Vermicompost.

Sr. No.	Parameters	Content
1.	pH	7.2
2.	OC%	12.70
3.	C/N ration	21.00
4.	Total Nitrogen (%)	12.14
5.	Available N (%)	2.00
6.	Available P (%)	1.00
7.	Available K (%)	0.55
8.	Ca (%)	0.20
9.	Mg (%)	0.09

RESULTS AND DISCUSSION

3.1. Advantages

1. It provides efficient conversion of organic wastes/crop/animal residues.
2. It is a stable and enriched soil conditioner.
3. It helps in reducing population of pathogenic microbes.
4. It helps in reducing the toxicity of heavy metals.
5. It is economically viable and environmentally safe nutrient supplement for organic food production.
6. It is an easily adoptable low-cost technology.

3.2. Doses

The doses of vermicompost application depend upon the type of crop grown in the field/nursery. For fruit crops, it is applied in the tree basin. It is added in the pot mixture for potted ornamental plants and for raising seedlings. Vermicompost should be used as a component of integrated nutrient supply system.

Sr. No.	Crops	Dose/rate
1.	Field crops	6-7t/ha
2.	Fruit crops	4-7kg/plant
3.	Pots	150-250g/pot

3.3. Benefits

Vermicomposting is a highly profitable venture for farmers having dairy units. The approximate cost and benefit under different scale of production.

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