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Self-Employment for Economically Backward Women through Low Cost Vermicomposting

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Abstract
There is a growing realization that vermicomposting provides the nutrients and growth enhancing hormones necessary for plant growth. The fruits, flowers and vegetables and other plant products grown using vermicompost are reported to own better keeping quality. A variety of approaches and design has been developed for vermicomposting systems, but the basic principle is the feeding of acceptable organic materials to earthworms in continuous or batch culture, and the collection of processed waste that ultimately consists of stabilized castings. A tank in our college campus with a dimension of 165 cm × 184 cm × 80 cm was used. All the required organic raw materials were added into the pit and was made sure no toxic waste was added. The pit was covered with jute bags and waster was sprinkled as regular intervals to maintain the temperature. Later we are planning to distribute 30 buckets of compost, each bucket contains- soil, coconut coir, dry leaves, waste and compost with earthworm. After the compost is ready they can prepare their own batch of compost by adding only the raw materials needed, using this method numerous cycles of compost can be yielded, plus clear guidelines were also given to prepare the compost easily.
Keywords: *Vermicompost, Vermicomposting methods.*

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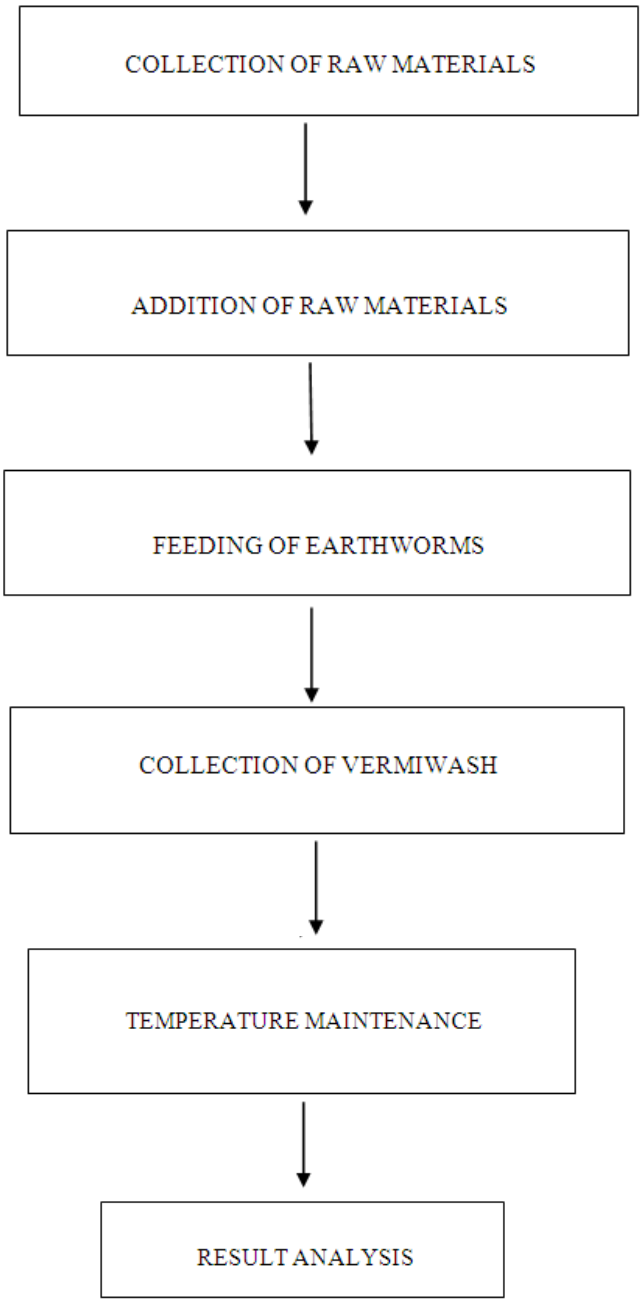
I. INTRODUCTION

In the last few decades, there has been a tremendous increase in Municipal Solid Waste production in India. This is mainly due to the growth of population and economic growth in the country. In order to effectively manage the solid waste and to also produce organic manure which is capable of producing natural vegetation vermicomposting method can be used. The production of vermicompost helps in providing a healthier production of food. A growing number of individuals and institutions are taking interest in the production of compost utilizing earthworm activity. The beds are maintained at about 40 - 50% moisture content and a temperature of 20 - 30 by sprinkling water over the beds. The earthworms being voracious eaters consume the biodegradable matter and give out a part of the matter as excreta or vermi-castings. The vermi-cast containing nutrients, is a rich manure for the plants. When the commercial scale production is aimed at in addition to the cost of production, considerable amount has to be invested initially on capital items. The high variability in the unit capital cost is due to the fact that large units require considerable expenditure on machinery and transport. However, in most of the cases, the activity is viable and bankable.

1.1 Principle of Vermicomposting

The process of vermicomposting is to raise the number of nutrients present in the soil. Compost has a property of allowing water to the plants that are growing. The choice of organism used here are earthworms as the consumer of the organic matter and castings are produced when they excrete. This process is mainly required to add nutrients to the soil. 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, while the rearing of worms for this purpose is called vermiculture. It is one of the easiest methods to recycle vegetable waste and garden waste to produce quality compost; the earthworms consume biomass and excrete it in digested form called worm casts.

II. METHODOLOGY



2.1 COLLECTION OF RAW MATERIALS

The raw materials such as wastes were collected from the nearby shops and a dry leaf from our college campus, cowdung were collected for free from the local vendor and soil, gravel collected from our campus. The tender coconut shells were collected from nearby sellers.

2.2 ADDITION OF RAW MATERIALS

The raw materials that we collected are added in a step by step process. First the compostable sheet was laid in the ground to avoid water seepage and then layer of gravel was placed for around one feet to filter vermiwash. Then tender coconut shell, vegetable waste, dry leaves, food waste was added. Earthworms weighing 1Kg was added and was made sure no toxic waste was added and sprinkled water uniformly to maintain moisture content. Then cowdung, soil was put and sprinkled buttermilk. Vermiwash was collected.

2.3 FEEDING FOR EARTHWORMS

Earthworms are mainly fed up with the fed up with the decomposing organic matter found in the soil. They usually eat leaf, vegetable wastes that is available on the soil. They do not feed on any oil items, dairy products,

salty foods, meat, bone and all. Helpful worm feeding tips .The given food must be cut into smaller pieces. This cutting process decreases the feeding time of worms. Worms usually eat bacteria emerging on the food waste. Along with the bacteria it also takes very small portion of food. Food must be exposed to the external surface. Whenever food exposes to outer surface more, it will breakdown easily so the worms can easily eat their food. Avoid mixing the food, because mixing will make the food to release water so our vermicomposting will be too wet. Small pieces of food are healthier and better.

2.4 COLLECTION OF VERMIWASH

Vermiwash is the fluid extracted from the production of vermicompost in a medium where earthworms are richly populated. The macromolecules from the skin secretion of earthworm are directly able to defend pathogenic soil microbes against the worm and thereby freed the environment from the disease. To get vermiwash, continuously suspended water from the pit is collected at the bottom .Water is sprinkled regularly on the pit to maintain the temperature. After 7 to 10 days, the vermiwash was produce in the pit. After the production of compost, about 5-6 litres of vermiwash (shown in fig 2.4) was collected.

Fig 2.4- Collection of vermicompost

2.5 TEMPERATURE

The optimum temperature for earthworms is between 55-77 degrees. To remain active during winter, the system should be maintained at a temperature above 10°C. Surrounding soil temperature plays important role in reproduction. Temperatures between 60 and 70 degrees Fahrenheit are more suitable for cocoon production `and hatching. Worms can't live in temperatures below icy or above 95 degrees Fahrenheit. Worms consume and digest their food at temperatures greater than 77 degrees Fahrenheit. Growth and activity of earthworms mainly based on the temperature we maintain.

III. EXPERIMENTAL INVESTIGATION

3.1 PROCEEDINGS

i. A tank with a dimension of 165cmx184cmx80cm is used.

ii. A compostable sheet is laid along the floor of the tank to avoid water seepage, as the ground was permeable.

iii. A layer of gravel was placed over the sheets in order to allow aeration and to filter vermiwash.

iv. A layer of tender coconut shells are placed over the gravel to prevent the escape of earthworms.

v. Next a layer of vegetable wastes and food wastes (shown in fig A) are placed, taken from our college canteen.

vi. Then a layer of leaves are put collected from our college garden.

vii. Earthworms weighing 1 kg were added (shown in fig B). It was made sure no toxic waste was added in order to produce good quality organic manure.

viii. Water was sprinkled uniformly to maintain the moisture content.

ix. A layer of cow dung & food waste was added as cow dung acts as the best source for the earthworm.
x. Then a layer of soil is placed as a source of energy for micro-organisms and water was sprinkled. Earthworms ingest soil, digest the organic matter present in it and excrete soil full of plant nutrients known as worm cast which makes soil fertile. They make burrows into the soil and thus they aerate the soil.
xi. Buttermilk was sprinkled (shown in fig C).
xii. After a period of two weeks there was rapid growth in the size of the earthworm(shown in fig D)
xiii. Jaggery was sprinkled. Addition of jaggery accelerates the fermentation.
xiv. Finally the pit was covered with jute bags and water was sprinkled to keep the worms cool.

Fig A -ADDITION OF LAYERS OF WASTE

Fig B–ADDITION OF EARTHWORM

Fig C- SPRINKLING OF BUTTERMILK

Fig D- RAPID GROWTH OF EARTHWORMS

3.2 QUANTITY OF MATERIALS USED

Table 3.2: Quantity of materials used

Item	Quantity in Kg
Coconut shell	3
Vegetable waste	6.5
Food waste	10
Cowdung	2
Soil	3.5

Earthworm	1
Buttermilk	2
Jaggery	1

3.3 ESTIMATION

Table 3.3: Cost estimation of raw materials

MATERIALS	COST in □
COMPOSTABLE SHEETS	50
TENDER COCONUT SHELL	0
JUTE BAG	80
FOOD WASTE	0
EARTHWORM (1Kg)	600
COWDUNG	100
GRAVEL	0
BUTTERMILK	30
JAGGERY	100
PIPE CAP	30

IV. RESULTS AND DISCUSSION

4.1 OUTCOME

After a minimum of 90 days the colour of the compost started to change colour (shown in fig E) and the complete decomposition of the compost took about 100 days with ideal conditions. Once the compost was ready, the residue turns black in colour. On an average about 15 Kg of compost was obtained. After the completion of composting process we have transferred the compost with earthworm to 30 buckets along with some raw materials to encourage home composting **.**Vermicompost stimulates to influence the microbial activity of soil , increases the availability of oxygen , maintains soil temperature, increases soil porosity and infiltration of water, improves nutrient content and increases growth, yield and quality of plant.

Fig E-COLOUR CHANGE IN VERMICOMPOST

Fig F-Compost with earthworm and raw materials

4.2 PRECAUTIONARY MEASURES IN VERMICOMPOSTING:

During Vermicomposting, there are certain points that must be taken care of. This is especially because the earthworms are highly sensitive organisms. Any small change in the thriving conditions would affect their conversion ability. The caution points are as below:

- Compost Material: The compost material must be purely organic. It must be devoid of materials like glass pieces, stones, ceramic pieces, plastic, etc.

- Loading: The vermicompost heap must be filled to the right quantity. It should not be overloaded as overloading causes accumulation of gases and increase in temperature. This would affect their growth and population.
- Drainage Channel: There should be a provision for drainage around the vermicompost heap so that there is no water accumulation. This is especially important during the rainy season.
- Addition of Acidic Substances: Acidic substances like citrus must be avoided. If added they should be added only in small quantities as these acidic substances affect the pH balance of the compost.
- Water Stress: Both dry spell as well as too much water can kill the worms. Therefore, the compost heap must be sprinkled with water daily during summer. The beds must be moisture every alternate day during winter.
- Covering the Beds: The vermicompost beds must not be covered with plastic sheets or tarpaulin. This would lead to accumulation of gases and also increase the heat inside the bed which can be detrimental to the earthworms.
- Protection from pests: No specific diseases can affect the earthworms. However, they must be protected from pests like rats, termites and rats, the vermicompost site is sprayed with 5% neem based insecticide before the heap is filled and covered with a net to protect the worms from predators like birds and pigs.
- Earthworms of only suitable species should be used.
- After completion of the process, the vermicompost should be removed from the bed at regular intervals and replaced by fresh waste materials.

4.3 USES OF VERMICOMPOST

- Vermicompost can be used for all crops: agriculture, horticulture, ornamental and vegetables at any stage of the crop.
- For general field crops: Around 2-3 t ha^{-1} vermicompost is used by mixing with seed at the time of sowing or by row application when the seedlings are 12-15 cm in height. Normal irrigation is followed.
- For fruit trees: The amount of vermicompost ranges from 5 to 10 kg per tree depending on the age of the plant. For efficient application, a ring (15-18 cm deep) is made around the plant. A thin layer of dry cow dung and bone meal is spread along with 2-5 kg of vermicompost and water is sprayed on the surface after covering with soil.
- For vegetables: For raising seedling to be transplanted, vermicompost at 1 t ha^{-1} is applied in the nursery bed. This results in healthy and vigorous seedlings. But for transplants, vermicompost at the rate of 400-500 g per plant is applied initially at the time of planting and 45 days after planting (before irrigation).
- For vegetable and flower crops vermicompost is applied around the base of the plant. It is then covered with soil and watered regularly.
- Organic farmers can use vermicompost as a natural fertilizer to the plants.
- Vermicompost applied near the crown region of the plants acts as natural mulch for the crop plants.
- This earthworm compost can also be used as a potting mix for urban garden plants.
- The major use of vermicompost is its availability at low costs as compared with other natural fertilizers.

4.4 BENEFITS OF VERMICOMPOST IN AGRICULTURE:

- Vermicompost contains an oversized number of plant nutrients which helps in growth and development of the plants and improves quality of the produce.
- Vermicompost contains variety of beneficial microorganisms which improves the soil fertility.
- Earthworms also contain vitamins, hormones and enzymes which help in balanced plant nutrition and plant growth.
- Vermicompost don't have any offensive smell and don't persist with hand for that it will be easily applied within the field.
- Vermicompost improves the physical and chemical properties of the soil and helps in improving the soil fertility on a sustainable basis.

V. CONCLUSION

Vermicomposting may be a process supported earthworms and microorganisms, whose joint action provides degradation and detoxification of organic waste in addition as conversion into a product to be used for agronomic purposes. This eco-friendly method is cost effective and is that the best among other remediation processes. Within the earthworm gut, enzymatic activities cause toxic metal immobilization, which suggests that vermitechnology is as efficient process for the remediation of heavy metals from industrial organic wastes/sludge. It are often concluded that vermiremediation potentially converts sugar industrial sludge to

nutrient-rich organic manure for agricultural applications with reduced toxicity.

The assembly of degradable organic waste and its safe disposal becomes the present global problem. Meanwhile the rejuvenation of degraded soils by protecting topsoil and sustainability of productive soils is a major concern at the international level. Provision of a sustainable environment within the soil by amending with good quality organic soil additives enhances the water holding capacity and nutrient supplying capacity of soil and also the event of resistance in plants to pests and diseases.

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