EARTHWORMS BIOFERTILIZER BY USING EUDRILUS EUGENIAE

More Sonal B.1 and More B. C.2

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ABSTRACT

Soil under the Banyan tree is rich in microbes, which can improve the soil fertility. Similarly, earthworms are soil inhabiting organism and can do wonderful job for man and biosphere. The present study has been conducted to explore the possibility of compost to produce quality bio fertilizers and to study the effect of this microbe rich soil on growth and reproduction of earthworm. Soil of banyan tree, black cotton soil, one month old cow dung and grasses were collected locally. The black cotton soil, organic material and earthworm were kept as a control whereas banyan tree soil with organic material and worms etc were kept as experimental. Both the vermi beds where preserved for 90 days in the laboratory. After three month of experimental period, the growth and reproductive performance of earthworm, E. eugeniae was checked. The maximum number of worms, juveniles and cocoon were observed in the experimental vermi beds as control to control vermi bed. It means earthworm’s activity is closely associated with microbial activity. Simultaneously vermicompost were subjected for analysis of total nutrient like N, P, K, Mg, Ca, Na, Fe, Mn, Cu, Zn. Except Mn, Cu and Ca all remaining nutrient content shown significant increased as compared to control bed. The results indicate that the soil under Banyan tree for vermicomposting can reduce the time of composting and produce rich biofertilizer and found to be good for the growth of earthworms biomass. It’s a feasible technology for earthworm growers, Pharmacist and farmers.

Key Words: Banyan tree, Vermibed, Organic material, Macronutrients, Micronutrients

INTRODUCTION

Biological resources are the mirror of the past, property of the present and treasurers of the future. Rapid biological and biotechnological advancements are expected to change the complexion of the living world in the present millennium. Earthworm has dynamic potentials and can do wonderful jobs for man and biosphere.1-5 Earthworms are also used as protein rich sources of animal feed. They contain 70-80 % protein on a dry weight and also contain essential amino acids, especially rich in lysine. The amino acid composition of earthworm is superior for fish meat.6-9 Earthworms contain all five food stuffs i.e. protein, fats, carbohydrates, minerals and vitamins. They can replace the traditional food for aquaculture industry. There are also reports that earthworms at some places are used as food for human consumption.10-15 A lot of research is in progress in the country to serve worm meal as a protein rich supplement to poultry, aquaculture and domestic animals. Earthworms are known to be associated with medicines since ancient time to cure various human diseases. In India paste of dried worm were prepare for curing disease in Unani system of medicine like treating wounds, chronic boils, piles, hernia and impotency when applied externally.16 And also have been used in folk medicine to treat pyorrhoea and small pox diseases.17 Earthworm have an excellent range of vitamin B-Complex like niacin, riboflavin (B2), panthothenic acid, Thiamine (B1), pyridoxine (B6), Cyanocobalmin (B12), folic acid and biotin. Among these niacin and B12 are of significant value.18,19 Low level of soil fertility is the major problem in the agriculture production in India.
The low fertility of soil has increased the fertilizers which in turn hit the small and marginal farmers. The major manural resources in India are crop residues, tree and agricultural wastes, industrial by-product etc. Earthworms are probably one of the major contributors in the breakdown of organic material and convert it into the bio fertilizers.\textsuperscript{20} They eat and mix large amount of soil with organic matter, deposit their casts on the soil surface. It is rich in N, P, K and other micronutrients.\textsuperscript{21,22} Soil under the old banyan tree rich in microbes because large number of birds releases their excreta on the soil under the tree. By this large number of microbes were available in the particular soil which improves the fertility of soil by microbial activity.\textsuperscript{23} Hence an attempt is made to investigate the performance of banyan tree soil for the development of earthworm’s biomass and nutrient content.

**MATERIAL AND METHODS**

**Collection of material**

The earthworm species *Eudrilus eugeniae* was procured from government agriculture nursery, Sakri, district Dhule, Maharashtra and brought to laboratory. They were maintained and acclimatized in the mixture of organic compost containing soil and month old cow dung for two weeks. Soil of the old banyan tree also brought from Pimplelner (Tehsil- Sakri, district Dhule) town. Partially dried grasses, the quality natural soil and month old cow dung were collected from agriculture field and cow shed respectively.

**Experimental set up**

The experiments were performed in small plastic tough (vermibed) with 5 kg capacity. The tough was dark coloured so that the light will not penetrate inside the tough. A total eight vermibed groups were prepared i.e. four for control and four for experimental. The vermibed content is tabulated in the Table 1.

In the beds sufficient water was sprinkled to maintain moisture and on second day 50 preclitellar worms was selected, weighed and released on the respective vermibeds. They were kept for 90 days in the laboratory under the shed covered with gunny bags, water was sprinkled at the interval of 3-4 days.

**Worm counting and cast analysis**

At the end of experimental period of 90 days, worm cast was collected from upper layer of the vermibed and subjected for nutrient analysis. Similarly all the beds were removed from tough and it was sun dried for a day by making heap within the tough itself. On second day the worms were separated, washed and weight was taken. Similarly, cocoons and juveniles are also separated, counted and tabulated. The formula below was used by Suthar\textsuperscript{24} to determine percent increase in the number of earthworms.

\[
\% \text{ increase} = \frac{\text{EW post - worms intro.}}{\text{Earthworms counted}} \times 100
\]

**Table 1 : Vermibed groups**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Groups</th>
<th>Biomass content (Total 3 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control</td>
<td>Soil (normal 50 % ) + Cow dung 50 % + grasses 100 gm + 50 worms</td>
</tr>
<tr>
<td>2</td>
<td>Expt.</td>
<td>Soil ( banyan tree )50 % + CD 50 % + grasses 100 gm +50 worms</td>
</tr>
</tbody>
</table>

**Table 2 : Earthworm Biomass (weight, juveniles and cocoon)**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Weight of 50 worms (g)</th>
<th>% Increase</th>
<th>No. of juveniles</th>
<th>Weight of juvenile</th>
<th>Number of cocoon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>32</td>
<td>60</td>
<td>148</td>
<td>12</td>
</tr>
<tr>
<td>Expt.</td>
<td>19</td>
<td>36</td>
<td>89.5</td>
<td>188</td>
<td>15</td>
</tr>
</tbody>
</table>
The pH of vermicompost sample was determined by systronics digital pH meter. Nitrogen and Sodium was estimated by the Kjeldahl method. Phosphorus, potassium and calcium contents were analysed by calorimetric and flame photometric method respectively. The micronutrients like Fe, Mg, Cu, Zn, Mn were measured by using atomic absorption spectrophotometer (AAS) method described by Jackson. 25,26 All these parameter were analyzed in Shetjamin laboratory, Satana (Nasik, M.S., India). Result were calculated and analysed statistically.

**RESULTS AND DISCUSSION**

The earthworm biomass in different vermibed was counted after completion of experimental period and the data is presented in Table 2. It is noticed that in all vermibed, the growth was normal, gradually increased and all the pre-clitelar worms transformed into clitelar worms. The maximum weight increase was observed in the experimental vermibed containing soil of banyan tree i.e. 36 g (89.5%). Similarly maximum number of juveniles and cocoon is also observed in the same bed i.e. 188 and maximum cocoon was 92. It means worm’s activity is closely associated with microbial activity. There exist a mutualistic association between earthworms and microorganisms. Our results are corroborated with. 27,29 Maximum biological microbe’s viz., bacteria, fungi, actinomycetes, moulds, protozoa, virus, algae, nematodes etc. are found in banyan tree soil, which release the growth hormones in to the soil and create congenial environment for plant growth. It was also reported that increase in biomass content of earthworm in non-cultivable land it is because of monsoon and plant organic matter. 30

**Measurement of pH**

It influences the reproduction and growth of the worms. In experimental vermibed pH goes towards neutrality i.e. 7.4. While in control the pH was slightly higher i.e. 7.6. It is suggested that pH going towards neutrality is good for worm activities like reproduction and vermicomposting. Because too acidic or alkaline pH is unsuitable for worms. 31,32

**Measurement of nutrient content**

The results of vermibed showed significantly increased in nutrients like Lime and nitrogen where as Na, P, K and Fe were appreciably increased. (Table 3)

<table>
<thead>
<tr>
<th>S/N</th>
<th>Parameters</th>
<th>Control</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>7.6</td>
<td>7.4 (-2.7) NS</td>
</tr>
<tr>
<td>2</td>
<td>Na (ppm)</td>
<td>480</td>
<td>620 (22.58) **</td>
</tr>
<tr>
<td>3</td>
<td>Lime (%)</td>
<td>7.0</td>
<td>7.6 (7.9) *</td>
</tr>
<tr>
<td>4</td>
<td>N (ppm)</td>
<td>225</td>
<td>253 (11.1) *</td>
</tr>
<tr>
<td>5</td>
<td>P (ppm)</td>
<td>175</td>
<td>236 (25.9) **</td>
</tr>
<tr>
<td>6</td>
<td>K (ppm)</td>
<td>660</td>
<td>940 (29.8) **</td>
</tr>
<tr>
<td>7</td>
<td>Ca (%)</td>
<td>0.9</td>
<td>0.65 (-38.5) ***</td>
</tr>
<tr>
<td>8</td>
<td>Mg (ppm)</td>
<td>43.5</td>
<td>43.9 (0.91) NS</td>
</tr>
<tr>
<td>9</td>
<td>Zn (ppm)</td>
<td>6.9</td>
<td>7.2 (4.2) NS</td>
</tr>
<tr>
<td>10</td>
<td>Fe (ppm)</td>
<td>2.3</td>
<td>3.3 (30.3) **</td>
</tr>
<tr>
<td>11</td>
<td>Mn (ppm)</td>
<td>2.0</td>
<td>1.8 (-11.1) *</td>
</tr>
<tr>
<td>12</td>
<td>Cu (ppm)</td>
<td>0.37</td>
<td>0.34 (-8.8) *</td>
</tr>
</tbody>
</table>

* Significant value: P<0.05, ** P<0.01, *** P<0.001.
Values in the parenthesis are percent change over control. CD (Mean ± SEM, n = 4)

While Mn, Cu and Ca found to be significantly decreased and the values of Mg and Zn were no significant. We find similar results with earlier workers Vasanti et al., 33 they revealed that the organic carbon content and fertility status of N, P, K macronutrients are higher in vermicompost. The enrichment of vermicompost with nutrients and microorganisms using different organic and inorganic material with microbial inoculant is now popularizing due to the advantage of using the enriched vermicompost. It increases N, P, K content
during pre-decomposition with bio inoculants. More and Patole reported vermicast has ability to increase the survival role of micro organisation. They also reported that the nitrogen in earthworm casts is completely assimilated by plants thus provides significant source of nutrient for plants. Very recently More et al. (2016) reported that the growth, reproduction and nutrient content of worm Eudrilus eugeniae in the degradation of silver coated paper dishes.

CONCLUSION

From present piece of research work, we concluded that, vermicast containing soil of banyan tree, cow dung and grasses show good growth and reproduction of earthworms. Similarly it also increases macro and micronutrient contents. It is feasible technology for earthworm growers, farmers and soil science.

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