VERMICOMPOSTING OF EICHHORNIA BY USING EARTHWORM SPECIES

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ABSTRACT

In present investigation, earthworm species the *Eisenia foetida* and *Eudrilus eugeniae* have been tested for decomposition of water hyacinth (*Eichhornia* Sp.) along with soil and cow dung. Group I vermibed containing 25% soil, 25% CW and 50% WH in which maximum numbers 63.10 % of earthworm population was recorded. Similarly Group II vermibed containing 25% soil, 25% CW and 50% WH shown 59.34 % of earthworm population. It was more than double within 90 days of experiment. Among these two vermibed Group I was found to be better than Group II but no much variation observed. Group I of *Eisenia foetida* shown significant increase in macronutrients like N, P, K i.e. 3.12%, 13.94%, and 33.42% respectively over the control group. Similarly Group II of *Eudrilus eugeniae* shown increase in macro and micronutrients except Mn and Cu, remaining all other micronutrients like Mg, Fe, Zn, Na, P, Ca and organic carbon were found to be significantly increased in both the group as compare to control.

This result suggested that Water hyacinth (*Eichhornia* Sp.) could be used to grow and reproduce earthworm species. It can be potentially useful as a raw material in vermicomposting and for getting biofertilizer when mixed with 25% soil and 25% CW.

Keywords- Vermicomposting, Biofertilizer, Earthworm, *Eichhornia* Sp. CW (Cow dung)

INTRODUCTION

Vermicomposting helps to process waste and giving biofertilizers proteins. Earthworm eat and mix large amount of soil and organic matter then deposit their casts either on the soil surface or in burrows. The cast contain high concentration of organic material, cations like Fe, Ca, Mg, N, P, K (Shinde et.al.1992)

Water hyacinth (*Eichhornia crassifessolm*) is an attractive lavender flowered floating plant. It is noxious weed which grows abundantly in warm climatic region that has attracted world wide attention due to its fast spread and congested growth, which lead to problem in navigation, irrigation and power generation. On the other hand this weed when mixed with soil can fix atmospheric nitrogen (Dhar, 2010) Some earlier researchers revealed various benefits of this weed e.g. in mud areas water hyacinth could be used in an integrated manner for decentralized waste water treatment system coupled to biogas and compost (Anushri Malik,2007) Extraction of volatile fatty acid from water hyacinth to supplement cow dung as a feed in biogas digester (Ganesh et.al.2001).The eco-friendly and economical aspects of this weed as vermin reactor by using earthworm species like *Eisenia foetida* and *Eudrilus eugeniae* were studied (.Gajalakshmi et.al.,2001) The earthworm species, tested in present investigation i.e.*Eudrilus eugeniae*is well adapted to water hyacinth decomposition.

In India, most of the river, ponds and dams are covered by water hyacinth. This perennial reproduces very rapidly and can adapted in any climatic conditions. This might be a source of organic waste for getting quality biofertilizer and protein rich earthworms. As such biofertilizers made from vermiculture have tremendous applications in all the key developing countries. With tremendous crisis of chemical fertilizers in most of the developing countries including India.

Earthworms are omnivores animals but often selective in their food habits. On the basis of ecological strategies earthworms are divided into epigecic endogeic and anecic forms (Tripathi and Singh,1995).

In present piece of work, attempt has been made to find out the utility of earthworm species for composting water hyacinth along with soil and cow dung for the production of biofertilizer and protein rich earthworm biomass.

RESEARCH METHODOLOGY

The earthworm species *Eisenia foetida* and *Eudrilus eugeniae* was procured from PMC Ward Office, Aundh and brought to laboratory. They were maintained and acclimatized in the mixture of organic compost i.e. soil, cow dung and grasses for 10-15 days. Similarly water hyacinth (WH) was collected from Mula river, near Rajiv Gandhi Bridge ,Aundh, Pune. In order to facilitate earthworm decomposition, the plant material was cut into small pieces of 1-2 cm size and partially air dried before being used in vermicomposting assay. At the same time quality soil (soil with humus) and partially digested cow dung (CD) also brought to laboratory.

Three vermibed groups were prepared by using different proportion of water hyacinth ,cow dung and soil (Table 1). Vermibed were prepared in plastic trays(40cm x 40cm x 20cm) and on second day fullgrown 100 worms were released on vermibed.

Table 1: Vermibed groups

Sr. No.	Groups	Biomass content	Earthworm species
1	Control	25% Soil + 25% CD + 50% WH	Without worms
2	Group 1	25% Soil + 25% CD + 50% WH	*Eisenia foetida*
3	Group 2	25% Soil + 25% CD + 50% WH	*Eudrilus eugeniae*

All these groups were kept in the laboratory for 90 days without any disturb. Water was sprinkled at the interval of 3-4 days. At the end of experiment the top layered soil containing worm cast was removed and analyzed for different macro and micronutrient content.

Vermibed with worms were removed from plastic tray and it was sun dried for 10 hrs by making heaps. The worms were separated, counted and results are tabulated. Percentage of increase in the number of earthworm can be calculated by applying following formula.

$$\% \text{ increase} = \frac{\text{Earthworm counted} - \text{Worm introduced}}{\text{Earthworm counted}} \times 100$$

Similarly total biomass of the worm has determined by using formula $R = (N_2-N_1)/T$ (Sutar, 2006)

Where R = Growth rate, N_1 = Initial earthworm biomass mg., N_2 = end earth worm biomass achieved mg., T= Time period of the experimental day.

The nutrient like N, Ca, and K were checked by flame photometer. Fe, Mn, Cu, Zn and Mg were measured by using Atomic adsorption spectrophotometer, Na by Kjeldal apparatus and P by colorimeter.

RESULT AND DISCUSSION:

Earthworm multiplication during experimental period of 90 days are presented in table 2. It is observed that the population of earthworm was found to be more than double. Similar work was carried out by some earlier worker (More and Ahire ,2018) Effort have been made to find out quality substrate for earthworm production. Among eight types of vermibed tested vermibed containing 25% soil+25%CW and 50% grasses appeared as an ideal substrate in which maximum percent population was recorded and least number of worm population was recorded in the vermibed containing 25% soil and 75% sheep pellet. Whereas vermibed containing poultry dropping shown mortality (More et.al.,2010) Studies on dietary influence on the population of the earthworm *Eudrilus eugeniae*, reported that mix dung and grasses gave higher population of worm than other substrate combination of diet.

Table 2. Multiplication & Growth rate of *Eisenia foetida* and *Eudrilus eugeniae*in bedding material

Group	IN	FN	% Increase	IW (mg.)	FW (mg.)	NB(mg.)	GR
Group I *(E. foetida)*	100	225	55.75%	1070 mg.	2013 mg.	895 mg.	12.05 mg
Group II *(E. eugeniae)*	100	208	50.49%	1117 mg.	2032 mg.	925 mg.	12.38 mg.

Note: IN = Initial No. of worms introduced.
FN = Final No. of worms counted.
IW = Initial weight of worms.
FW = Final weight of worms.
GR = Growth rate of worms.

The biomass production in two different groups is shown in the table 2. The trends shows biomass gradually increased within 90 days of experiment. Biomass of worms in Group II is slightly higher than Group I at the end of composting period.

The growth rate (mg. biomass gained / worm/day) has been considered as a good comparative index to compare the growth of earthworms in deferent waste or food (Edward et.al., 1998) The news paper bedding is more influential in worm biomass production growth rate, while sawdust bedding is better cocoon production and no. of worms.

The result of WH (*Eichhornia crassifessolm*) decomposition its conversion into rich biofertilizer containing valuable macro and micronutrients are presented in table 3. From this table, it is clearly observed that, the macronutrients like N. P and K are significantly increased over the control in all vermibed groups. The micronutrients like Ca and Mn decreased significantly whereas other nutrients like Ca, Mg, S, Fe, Zn, Na & organic carbon as well as percentage moisture were significantly increased. In comparison *E. foetida* decompose rapidly than *E. eugeniae.* In general, the pH values shows near to neutral.

Table 3. Nutrient content of different vermibed.

Nutrients	Control	Vermibed groups	
		Group I	Group II
N (Kg/acre)	162	168 (3.12)*	164 (1.25)*
P (Kg/acre)	15.50	22.7 (31.51)***	19.8 (13.94)**
K (Kg/acre)	377	581 (33.42)***	438 (16.97)**
Mn (ppm)	1.14	1.78 (-6.60)*	1.94 (-17.92)**
Cu (ppm)	0.49	0.41 (-8.33)*	0.38 (-25)**
Na (ppm)	200	260 (8.0) NS	280 (10)*
Zn (ppm)	0.73	1.19 (31.14)**	1.02 (46.99)**
Fe (ppm)	1.83	1.73 (-5.78)*	1.82 (10.98)*
S (ppm)	22.15	21.7 (1.99) NS	18.5 (-8.95)*
Ca (%)	0.37	0.49 (15.49)**	0.44 (21.05)**
Mg (%)	0.19	0.21 (10.0)*	0.16 (35.0)**
Organic (%)	0.65	0.88 (78.18)**	0.89 (78.18)***
Moisture (%)	47	66 (40.90)**	62 (36.37)**
pH	7.15	7.30 (2.09) NS	7.40 (0.69) NS

* Significant value: P<0.05,**P<0.01,***P< 0.001. NS = Non-Significant (P>0.05).

This findings are corroborating with earlier researchers reported that, worms grow and reproduce favorably in 25% WH and 75% CD feed mixture. Further they stated that there was significant decrease in pH, total carbon and C:N ratio. Anushree Malik (2007) revealed that water hyacinth could be potentially useful as raw substrate in vermicomposting if mixed with up to 25% CW. Lara Zirber et.al, 2011, observed that earthworm species *Perionyxex cavatus*, grew and reproduced normally until the incorporation of 50% WH in initial substrate, higher WH proportion induced earthworm mortality[15]. Recycling of agricultural waste by *Eisenia foetida* have been tested for decomposition of agricultural waste along with soil and cowdung (Patole and More 2011)

In nutshell, the earthworm species like *Eisenia foetida* and *Eudrilus eugeniae* are good for composting WH along with 25% Soil and 25% CD as secondly, the aquatic weed WH is the best organic material to get value added biofertilizer, earthworms becomes more than double within 90 days as it is the good source of protein.

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