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# A COMPARATIVE STUDY ON PRODUCTION OF VERMICOMPOST USING TWO INVASIVE AQUATIC WEEDS *Eichhornia crassipes* (MART.) SOLMS AND *Pistia stratiotes* L. AS SUBSTRATES

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## ABSTRACT

**Two noxious exotic aquatic macrophytic weeds *viz., Eichhornia crassipes* (Mart.) Solms and *Pistia stratiotes* L. were subjected to decomposition by a common earthworm *viz* . *Eisenia fetida* to find their efficiency to convert these weeds to valuable vermicompost. compost bed preparation were prepared in compost bins followed by inoculation of earthworms (50 per bin) and half decomposed substrates (1 kilogram per bin). Three replicates were maintained for each treatment. They were sprinkled with water once every week and incubated for 60 days. The products of decomposition *viz*., vermicompost and earthworms were collected from each treatment separately and data collected. The parameters studied from each treatment were yield of compost (%), rate of production of vermicompost (grams/day), average number of *E.fetida* , average weight (g) and height (cm) of the worms harvested. Comparison of the two treatments revealed that the production of vermicompost were more from *Pistia* than *Eichhornia*, the rate of production of vermicompost were more from *Pistia* than *Eichhornia*, the average number of earthworms at harvest were more in the treatment with *Pistia* than in *Eichhornia*, the average weight and height of the worms harvested were almost the same in both treatments. The above observations led to the conclusion that *Pistia* is more readily decomposable than *Eichhornia* in the presence of *Eisenia fetida*. The slow decomposition of *Eichhornia* may be because of it's leathery leaves with thick waxy coating when compared to *Pistia* which has papery leaves. Both the treatments had equal effect on the earthworm selected, that is proved by the latter's equal weight and height in both treatments. Control of these noxious weeds by their large – scale utilization as substrates for making eco-friendly vermicompost is a beneficial technique, better than expensive chemical and biological control techniques. Exploitation of the huge biomass production of these aquatic weeds reduces the hazards of environmental pollution to certain extend.**

**KEYWORDS:** Vermicompost, *Eisenia fetida*, *Eichhornia crassipes, Pistia stratiotes*

The rapid increase in the volume of waste is one aspect of the environmental crisis. An innovative discipline of vermiculture biotechnology, the breeding and propagation of earthworms and the use of its castings has become an important tool of waste recycling the world over. Essentially, the vermiculture provides for the use of earthworms as natural bioreactors for cost-effective and environmentally sound waste management, meet the nutrient needs of the agricultural sector, increased employment opportunity and rapid development of the rural areas.

The present work aims to compare the efficiency of *Eisenia fetida* to convert the invasive aquatic weeds *Eichhornia fetida* and *Pistia stratiotes* to vermicompost.

## MATERIALS AND METHODS

Two aquatic weeds viz. *Eichhornia crassipes* (Water hyacinth) and *Pistia stratiotes* (Water lettuce) were collected from water bodies in Alappuzha district. Two kilograms of each species were accurately weighed and shade dried for one month. Three replicates were maintained for the two treatments with one kilogram in each replicate.

Two hundred number of *Eisenia fetida* were purchased from Socio –Economic forum, Sarvodayapuram, Katoor P.O., Alappuzha in four packets of fifty each. They were released to the compost bins on the same day of purchase. Rectangular compost bins of 60cm x 45cm x 30cm size made of plastic were selected for the study. Coir fibre extracted from coconut were placed at the bottom of the boxes in one inch thickness. One kilogram of fresh cow dung (not slurry) was spread on top of the coir mat in each treatment. Earthworms (*Eisenia fetida*) were placed on the bed with 50 numbers in each treatment on the same day of compost bed preparation. The treatments were incubated for four days. On the 5$^{th}$ day, one kilogram of each shade –dried plant species were inoculated on the compost bed. Three replicates were maintained for each treatment (treatment with *E.crassipes* and *P.stratiotes* as substrates). Wet gunny bag were placed on top of the treatments. They were sprinkled with water once in every week. The treatments were kept undisturbed and incubated at room temperature for 60 days. After 60 days of incubation, the treatments were harvested for vermicompost and earthworms (Plate 6). For this, the compost from each treatment were heaped on a paper separately under mild sunlight. The vermicompost formed were collected from

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top of the heap and kept for further study. The worms clustered at the bottom of the heap were collected separately from each treatment and kept for further study.

The harvested compost were analysed for their average yield and rate of production. The earthworms were analysed for their average number, average height and average weight. The results obtained were tabulated.

The yield of vermicompost was calculated using the formula:

$$\text{Yield (\%)} = \frac{\text{Average weight of vermicompost(kg)} \times 100}{\text{Total weight (kg)}}$$

Total weight = weight of substrate (2kg) + weight of cowdung (2kg)

The Rate of production (g /day) of vermicompost was calculated using the formula :

$$\text{Rate of production} = \frac{\text{Average weight of compost at harvest}}{\text{Total number of days}}$$

The percent increase in number of worms was calculated using the formula:

$$\text{Increase in number(\%)} = \frac{\text{Total No. of worms after harvest} \times 100}{\text{Total number of worms inoculated}}$$

The average weight of worms was calculated using the formula :

$$\text{Av. Weight (g)} = \frac{\text{Total weight of worms (g)}}{\text{Total number of worms}}$$

## RESULTS AND DISCUSSION

After 60 days of incubation, the vermicompost produced were evaluated for their yields on the different substrates. It was observed that *P. stratiotes* was more readily decomposed by *E.fetida* than *E.crassipes* (T-1). The slower rate of decomposition of *E.crassipes* may be due to the thick waxy coating of the leaves when compared to that of *Pistia* which has papery leaves (T- 2). When comparing the number of earthworms at harvest with the time of inoculation, it was observed that their number increased in the treatments with *Pistia* than in *Eichhornia* (T- 3). This may be again because of their better efficiency on *Pistia* that is more readily degradable than *Eichorrnia*. The average weight and height of the worms in the two treatments, were the same in both cases, being approx. 0.18 g and 5 cm respectively (T- 4). This indicates that both the treatments had an equal influence on the worms in their process of decomposition.

**Table 1: Average yield of vermicompost produced from the substrates**

| Substrates | Average weight (kg) | Average yield (%) |
|---|---|---|
| *Eichhornia crassipes* | 3.5 ± 0.25 | 87.5 |
| *Pistia stratiotes* | 3.6 ± 0.20 | 90.0 |

**Table 2: Rate of production of vermicompost from the substrates**

| Substrates | Av. Wt. of compost (kg) | No. of days | Rate of production |
|---|---|---|---|
| *Eichhornia crassipes* | 3.5 ± 0.25 | 60 | 0.058kg/day =58 g/day |
| *Pistia stratiotes* | 3.6 ± 0.20 | 60 | 0.06 kg/day =60g/day |

**Table 3: Average number of *Eisenia fetida* in different treatments**

| Substrates | Av. No. of worms | Increase in no. (%) | Av. Increase (%) |
|---|---|---|---|
| *Eichhornia crassipes* | 172 ± 3 | 30.12 | 29.1 |
| | | 28.09 | |
| *Pistia stratiotes* | 169 ± 2 | 25.64 | 30.3 |
| | | 34.96 | |

**Table 4: Average weight (g) of *Eisenia fetida* in different treatments**

| Substrates | Av. Wt (g) of worms |
|---|---|
| *Eichhornia crassipes* | 0.188 ± 0.015 |
| *Pistia stratiotes* | 0.184 ± 0.010 |

The work is in accordance with the work of Hemen and coworkers (2013) who found that water hyacinth can be converted to valuable vermicompost with the efficiency being more in summer than in winter. The use of vermicompost reactors also supported high efficiency of *Eudrilus eugeniae* on water hyacinth to convert them to vemicompost (Gajalakshmi *et al*., 2002). The vermicompost from water hyacinth was found to be rich in nitrogen, phosphorous and potassium when compared with decomposed water hyacinth (Snehalata *et al*., 2012).

The work on *Pistia* is also supported by Guerrero and Guerrero (2011) and Sannigrahi (2009) where the earthworm biomass and vermicompost yield increased along with increase in NPK content.

Further work on the nutritional status of the vermicomposts produced, the yield of the crops subjected to these vermicomposts, vermicompost from other noxious aquatic weeds such as *Salvinia molesta* are recommended.

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