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EXPERIMENTAL STUDY ON BIODEGRADATION OF GARDEN WASTE, MARKET WASTE USING EISENIA FETIDA & EUDRILUS EUGENIA AND CHECKING THE QUALITY OF MANURE ON TOMATO

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ABSTRACT

An experimental study was performed to evaluate the efficiency of two earthworm species Eisenia fetida, Eudrilus eugenia for the garden waste and market vegetable waste by taking ratio 60:40 in nine trays. Three different experimental works were conducted in the ratio of 60:40. Experiment 1 was considered as a control means that is without using earthworms. In Experiment 2 bedding was done with Eudrilus eugenia, Experiment 3 is comprised of bedding with Eisenia fetida. For each experiment 3 plastic trays were used, where the first tray comprises of vegetable waste with cow dung, second tray comprises of cow dung with garden waste and third tray consists of cow dung +vegetable waste+ garden waste(60:20:20) as bedding material. Pre composting was allowed for 10 days after that Eudrilus eugenia, Eisenia fetida were added in the respective trays. The multiplication of earthworm in terms of number was calculated at the end of Vermicomposting. The N, P, K value of the manure in each tray was estimated after the completion of the experiment. High N, P, K is obtained in Experiment 2 &Experiment 3 compared to control. From this best N, P, K value is chosen for plant growth for getting better yield. Eudrilus eugenia shows quick degradation for both garden waste and vegetable waste when compared to Eisenia fetida.

KEYWORDS: vegetable market waste,garden waste,eudrilus eugeniae,Eisenia fetida,cow dung.

INTRODUCTION

In recent years, rapid growth of urbanization and industrialization has led to generation of large quantities of all kinds of waste (Mohd kamil yusoff et al., 2009). In all these wastes, municipal solid waste is a major concern. Thus, environmental pollution originated from Municipal Solid Waste (MSW) call for more sustainable waste management systems (Adi et al., 2008). As a result, about 50 million ton municipal solid waste is being generated every year in various cities of India (Saha et al., 2010, Kumar et al., 2009). Municipal solid wastes are the waste arising from human activity, which are discarded as useless or unwanted. Major sources of municipal wastes are vegetable waste, agro and kitchen waste, garden waste (Avnish chauhan et al., 2010). It was further reported that approximately 350 million tonnes came directly from agricultural practices (Sharma et al., 2011) in which vegetable market waste is a major proportion. In present day, environments like air, water, soil are getting polluted due to various natural and anthropogenic activities like dumping of municipal solid waste without proper treatment, discharging waste water into the water bodies etc. More seriously, the dumping of municipal solid waste without proper treatment, proper supervision and control leads to fly breeding and other infectious diseases in the society. It is estimated that 1.0 to 1.1 kg of solid waste generated per day per person in a well developed city (Karthikeyan et al., 2007). The disposal of bio – degradable solid wastes from domestic, agriculture

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and industrial sources have caused increasing environmental and economic problems (Joshi and Chauhan 2006).
Disposal of solid wastes can be done by many methods like landfilling, incineration, recycling, conversion to biogas, disposal into sea and composting. Vermicomposting is one of the recycling technologies which will improve the quality of products (Amsath et al., 2008). A possible way to utilize the solid waste is by Vermicomposting technology (Fulekar et al., 2008). The loss of soil organic matter due to intensive agriculture is responsible for a increase in soil fertility. The most common practise to preserve or restore soil fertility is to add organic matter, which preferentially should be sufficiently stabilized to produce beneficial effects.

The present study has been carried out by the production of vermicompost from two different solid wastes using two earthworm species and also to determine the rate of vermicompost on the growth and better yield of tomato plants.

MATERIAL AND METHODS

Plastic bins were used for the experimental work. Vegetable wastes were collected from local market in Karaikudi and cut into small pieces. Garden wastes were collected near hostel garden in Karaikudi. One week old cow dung was also collected from cowshed for the experimental use. Eisenia fetida and Eudrilus eugenia were picked from a stock culture maintained near residential area. For the experiment, 9 plastic trays were used (44cm×35.5cm×21cm) and for each experiment 3 plastic trays were used. The ¾ of the height (16 cm) bedding was done for all the 9 trays and the bedding was done on 60:40 ratios. By using vegetable market wastes (0.009968m^3), garden wastes (0.009968m^3) and cow dung (0.0149952m^3) three different experiments were designed in the plastic trays.

- **Experimental 1:** Bedding without earthworms (control)

TRAY A: Cowdung + Vegetable wastes (60:40)

TRAY B: Cowdung + Garden wastes (60:40)

TRAY C: Cowdung+ Gardenwastes + Vegetable wastes (60:20:20)

- **Experimental 2 :** Bedding with earthworms (Eudrilus eugenia)

TRAY D: Cow dung+ Vegetable wastes (60:40) + (Eudrilus eugenia)

TRAY E: Cow dung+ Garden wastes (60:40) + (Eudrilus eugenia)

TRAY F: Cow dung + Garden wastes + Vegetable wastes (60:20:20) + (Eudrilus eugenia)

- **Experimental 3 :** Bedding with earthworms(Eisenia Fetida)

TRAY G: Cow dung +Vegetable wastes (60:40) + (Eisenia fetida)

TRAY H: Cowdung + Garden wastes (60:40) + (Eisenia fetida)

TRAY I: Cow dung+ Garden wastes + Vegetable Wastes (60:20:20) + (Eiseni fetida)

Pre-composting was allowed for 10 days. After pr-composting nearly 200 earthworms were introduced into the experiment (2) & experiment (3).The moisture content was maintained between 50-70% throughout the study period by sprinkling adequate quantities of water. Proper shading was provided with the help of tent to maintain suitable conditions like temperature (23-28˚C) and pH, for the survival of earthworms. The degradation was allowed to occur in the nine trays continuously for 60 days. After 60 days, earthworms were removed manually and the total number and biomass of earthworms were determined. The following chemical parameters of each bedding materials such as nitrogen, phosphorus, potassium, pH, temperature, moisture content, C/N ratio were analysed after 60 days.

RESULTS & DISCUSSION

The results of phosphorus, potassium, C/N ratios of all experiments are presented in the table 1, 2 and 3 respectively. However, the data on number of earthworms and earthworm's cocoons in the experiments are given in the table 4 and 5.

CARBON, NITROGEN VALUE BEFORE AND AFTER VERMICOMPOSTING

The two important nutrients such as carbon and nitrogen are essential for the efficient vermicomposting process. Carbon is utilised for both energy and growth, while nitrogen is essential for protein synthesis, production and reproduction.

In all the experiments, nitrogen content was increased and organic carbon was decreased after the Vermicomposting process, the values are tabulated below:

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Table 1: Carbon and Nitrogen value before & after Vermicomposting

EXPERIMENTAL TRAYS	CARBON VALUE (%)		NITROGEN VALUE (%)	
STAGES	INITIAL	FINAL	INITIAL	FINAL
EXP:1 A	29.34	26.45	0.95	1.44
B	26.84	23.42	0.86	1.62
C	27.65	24.86	0.93	1.54
EXP:2 D	28.76	23.65	1.08	1.66
E	25.45	22.46	1.04	1.78
F	28.16	20.86	1.06	1.84
EXP:3 G	27.96	22.46	1.12	1.94
H	28.44	20.54	1.16	1.78
I	26.65	18.46	1.18	1.81

The carbon content was analyzed before and after the completion of Vermicomposting work. The reduction in organic carbon could be due to the respiration activity of earthworms and microorganisms. Because of the symbiotic action of micro organisms and the earthworms, a large fraction of organic matter in the initial substrates was let as CO2 by the end of Vermicomposting period, whereas the percentage of carbon decreases significantly (Nogales et al., 1997).

Increase in nitrogen content in the final product in the form of mucus, nitrogenous, excretory substances, growth stimulating hormones and enzymes from earthworms have also been reported (Lair etval., 1997). The increase in nitrogen content during Vermicomposting is due to the nitrogen release by earthworm's metabolic product and dead tissues.

C:N Ratio before and after Vermicomposting

The results show high decrease in C:N ratio in the experiment set up in using earthworms. The C:N ratio of organic waste material, which is the most widely used indices for compost maturation. The part of the carbon is released as CO2 by the process of respiration and production of nitrogen lowers the C:N ratio of the pre-decomposed substrate and positive role of inoculants used in the present study. The C/N ratio below 20 is indicative of acceptable maturing. The C:N ratio value obtained after Vermicomposting ranges from 18:1 to 7:1 which is acceptable for Vermicoposting.

Table2: C/N ratio before and after Vermicomposting

TRAYS	C:NRATIO(BEFORE VERMICOMPOSTING)	C:NRATIO(AFTER VERMICOMPOSTING)
A	31:1	18:1
B	29:1	14:1
C	30:1	15:1
D	28:1	16:1
E	27:1	12:1
F	28:1	11:1
G	25:1	9:1
H	24:1	7:1
I	24:1	8:1

Phosphorous and Potassium value after Vermicomposting

Phosphorus and potassium are the two important parameters that indicate the quality of vermicompost product i.e., manure. The phosphorous and potassium values are tabulated below:

Table 3: Phosphorous and Potassium after Vermicomposting

TRAYS	PHOSPHORUS (%)	POTASSIUM (%)
A	0.72	1.52
B	0.64	1.34
C	0.56	1.29
D	0.92	1.62
E	0.86	1.58
F	0.74	1.46
G	0.90	1.60
H	0.82	1.55
I	0.76	1.48

Comparing all experiments, in experiment (2) - combination of vegetable wastes and cow dung (tray: D) has showed high phosphorous & potassium value. The phosphorous and potassium content according to the waste and cow dung added was given below:

In experiment (1), order of phosphorous and potassium value is A>B>C. Similarly, in experiment (2) order of value is D>E>F and in experiment (3) it is, G>H>I.

Number of earthworms after Vermicomposting

Initially, near 200 earthworms were introduced in the respective trays (D,E,F & G,H,I). After 60 days, the

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number of earthworms were increased was noticed and tabulated below.

Table 4:No.of earthworms after Vermicomposting

***EUDRILUS EUGENIAE* (No.s)**	***EISENIA FETIDA* (No.s)**
380(D)	298(G)
298(E)	255(H)
353(F)	286(I)

Number of cocoons after Vermicomposting

The number of cocoons was observed during Vermicomposting process. Large numbers of cocoons were found in all the sample trays after the completion of the Vermicomposting process.

Table 5:No.of cocoons after Vermicomposting

TRAYS	NO.OF COCOONS
D	548
E	390
F	433
G	412
H	268
I	356

Growth of tomato plant using vermicompost

The vermicompost produced from the solid waste are being used as fertilizer for the growth of tomato plant is under observation.

CONCLUSION

It is concluded that among the two species, Eudrilus Eugenia is more efficient in bioconversion of garden wastes and vegetable market wastes into nutrient rich vermicompost and also have high reproduction rate compared to Eisenia fetida. Moreover, the vermicompost of vegetable market wastes possessed higher nutrient contents probably because it comprises mosaic of materials compared to that of garden wastes. Thus, Vermicomposting was proved to be a better technology than that of sole composting.

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