FLORA AND FAUNA

2015 Vol. 21 No. 2 PP 195-198 ISSN 0971 - 6920

IMPACT ON GROWTH AND REPRODUCTION OF *E. FOETIDA* IN VEGETABLE WASTE DURING VERMICOMPOSTING

RUCHI AGRAWAL, JYOTI SHARMA AND PRAVEEN KUMAR*

Department of Zoology,
B.S.A.(PG) College,
MATHURA (UP)- INDIA
* Author for correspondence –
179, Manas Nagar, Maholi Road,
MATHURA (UP)
pk_sharma75@yahoo.com

Received **:** 12.8.15; ***Accepted*** : 21.10.15

ABSTRACT

Earthworm as one of the best means of abating organic population and also to minimize indiscriminate use of inorganic fertilizers. Earthworms have important functions by virtue of their feeding and general behavioural activities like burrowing, digesting, excreting with micro-organisms and supporting further decomposition of biodegradable matters. The growth and reproductive efficiency of locally available earthworm species, *Eisenia foetida* was accessed in various urban wastes such as vegetable wastes found in market. Maximum weight and length of *Eisenia foetida* was noted in 90 days. Similarly the maximum biomass of 1234 (±0.04) g of earthworm in the VMW was also noted in 90 days. the worms when introduced into wastes thus showed an increased growth rate and reproduction activities.

Figure : 00 References : 16 Tables : 03

KEY WORDS : *Eisenia foetida,* Vegetable market waste, Vermicompost biomass

Introduction

The increasing waste generation rate, high collection cost and dwindling financial resources are the major problems faced by most of the developing countries for efficient solid waste management. In some cities, the organic waste (market, municipal, household) are dumped indiscriminately or littered on the streets causing environmental deterioration. Biological processes such as composting followed by vermicomposting to convert vegetable market waste and hotel waste is agriculturally useful organic fertilizer and would be of great benefit.

In India, about 320 million tones of agricultural waste are generated annually[16] of which vegetable waste alone is in major proportion.

The urban green waste generally comprises of garden or park waste such as grass or flower cutting and hedge trimmings, domestic and commercial food waste and vegetable market waste, the later is generated in large quantities and accumulated in unhygienic way adjacent to vegetable markets emanating unbearable malodor due to lack of proper scientific disposal management particularly in developing countries like India. The vegetable market waste is leftover and discarded rotten vegetables, fruits and flowers in the market. This urban waste can be converted to a potential plant nutrient enriched resource - compost and vermicompost that can be utilized for sustainable land restoration practices. Vermicomposting is a mesophilic process. It is the process in which ingestion ,digestion and absorption of organic waste is carried out by earth worms. It is then followed by excretion of castings through the worms metabolic system, during which their biological activities enhance the levels of plant nutrients of organic waste.

The waste from the vegetable market is

ACKNOWLEDGEMENT: The authors are thankful to Principal, B.S.A. (PG) College, Mathura for providing necessary facilities.

TABLE- 1 : Physico-chemical analysis of VMW-

Characters	Vermicompost				Compost			
	Time-period(Days)				Time-period(Days)			
	0	30	60	90	0	30	60	90
Electrical conductivity (mhos/cm)	225.5 ±0.03	825 ±0.05	1185 ±0.09	2500 ±0.15	225.5 ±0.03	950.2 ±0.04	895 ±0.01	1005 ±0.07
Moisture content	32.2 ±0.03	38.5 ±0.06	44.8 ±0.03	48.9 ±0.02	32.2 ±0.03	35.0 ±0.01	39.9 ±0.05	45.3 ±0.04
Temperature	38.6 ±0.05	36.2 ±0.04	32.8 ±0.03	30.9 ±0.02	38.6 ±0.05	34.2 ±0.02	31.5 ±0.01	30.8 ±0.01
C/N Ratio	25.2 ±0.05	24.8 ±0.07	20.0 ±0.04	18.8 ±0.06	25.2 ±0.05	23.0 ±0.01	23.9 ±0.2	22.5 ±0.03
Total Organic Carbon(g/kg)	390.5 ±0.09	385 ±0.07	372.01 ±0.05	350.8 ±0.06	390.5 ±0.09	389 ±0.04	385.2 ±0.02	380.21 ±0.02
Total Nitrogen	20.8 ±0.06	22.5 ±0.05	27.6 ±0.08	32.5 ±0.06	20.8 ±0.06	22.8 ±0.04	24.9 ±0.05	25.8 ±0.01
pH	5.11 ±0.04	6.05 ±0.03	7.25 ±0.05	8.45 ±0.02	5.11 ±0.04	5.9 ±0.02	6.1 ±0.04	6.2 ±0.02

collected and dumped into the municipal land fills, causing a nuisance because of high biodegradability[4]. This results in loss of potentially valuable material that can be processed as fertilizer, fuel and fodder[1]. The biological treatment of these wastes appear to be most cost effective and carry a less negative environmental impact[5,12]. A possible way to utilize this waste is by vermicomposting biotechnology[3,11] followed by aerobic composting in aerobic bioreactor.

During the process of vermicomposting, the nutrients locked up in the organic waste are changed to simple and more readily available and absorbable forms such as nitrate or ammonium nitrogen, exchangeable phosphorus and soluble potassium, calcium, magnesium in worm's gut. Vermicompost is often considered a supplement to fertilizers and it releases the major and minor nutrients with significant reduction in C/N ratio, synchronizing with the requirement of plants.

Thus, in present study the vegetable market waste (VMW) was collected and composted using *Eisenia foetida* by evaluating its growth and reproduction.

Materials and Methods

The vegetable market waste of about 140 kg was collected, both fresh and decomposed. The above waste was obtained from vegetable market of Mathura that comprises putrefied vegetables such as ladyfinger, cauliflower, potato, tomato and many leafy vegetables.

The five samples of waste were taken for experimentation and analysis upto 90 days. The pre-composting process to be done first. The collected VMW was air dried and spread over a polythene sheet for 48 hours. Pre-composting is the pre-processed and pre-treated practice of VMW. Thus, the air dried samples were pre-composed for 20 days before putting into vermicomposting and composting process.

TABLE- 2: Growth parameters of *E. foetida*-

Parameters	Days			
	0	30	60	90
Weight (g)	0.54±0.01	1.02±0.02	2.15±0.03	3.24±0.02
Length (cm)	7.10±0.01	9.02±0.01	12.04±0.03	13.85±0.02
Biomass (g)	30.4±0.02	500.23±0.03	804±0.02	1234±0.04

Experimental Design -

In each sample 7 kg of substrate mixed with cow dung in 3:1 ratio was taken for vermicomposting and composting. A total of 5 samples of vegetable market waste were taken of which 4 samples were used for vermicomposting *i.e.* comprising species of earthworm and 5th sample was used for normal composting *i.e.* without using any earthworm.

60 earthworms adults were introduced in the 4 samples. All the sample boxes were covered by wooden hardboard to protect the earthworms from the domestic predators. A small hole was drilled on the sample box for air circulation and drainage. The process of vermicomposting and composting were carried out for 90 days.

Physico-chemical analysis -

The homogenised samples of waste material were drawn at 0, 30, 60, and 90 days from each container. Day 0 refers to the time when VMW was filled in boxes with cow waste during pre-composting from each replicate T.O.C., T.N., C/N ratio was analysed. The temperature was noted daily using thermometer and the moisture content was measured gravimetrically.

The pH and dlectrical conductivity of samples were recorded by digital pH meter and conductivity meter respectively.

The T.O.C. of the sample was measured. The total nitrogen was estimated by Micro Kzeldahl method. The C/N ratio was calculated from the measured value of C/N. The harvesting of vermicomposts and compost of earthworm species was calculated after 90 days, at the end of experiment.

Statistical Analyses -

The ANOVA was computed to test the levels of significance of difference B/W vermicompost and compost sample. The probability levels used for statistical significance were $P<0.05$ for the test.

Result and Discussion

The growth parameters of earthworm species cultured in VMW showed that the length increased in *E. fetida* whereas, the net individual weight gained by species was 3.24 g in VMW at the end of experiment (Table 2). The worms when introduced into waste thus, showed an increased growth rate and reproduction activities. The readily available nutrients in VMW enhanced the feeding activity of the worms showing increase in biomass. The higher number of cocoons juveniles and adult collected from the vermicompost processed by *E. foetida* were probably B/C its indigenous nature being acclimatized to the abiotic environmental conditions extremely well.

The reduction in range of temperature while increase in moisture content, pH and electrical conductivity of the substrate, compost and vermicompost were depicted in Table 1. The pre-composting prior to vermicomposting helped in pathogen-reduction. The cow-dung used as the inoculants in vermicomposting process enhanced the quality of feeding re-source attracting the earthworms and accelerated the breakdown of Wt. resulting in the reduction of C/N ratio by increasing certain nutrients. At the state of experiment, the temperature of the substrate was high and then decreased gradually as the composting processed. The total nitrogen content of vermicompost was higher than compost and substrate. The T.O.C. decreased with the passes of time during vermicomposting and composting processes in both the substrate.

Conclusion

It is concluded that earthworm species play a better role in composting as compared with composting substrate without earthworms. Thus, nutrient rich vermicompost has been obtained from

TABLE- 3: Reproduction parameters of *E.foetida* in VMW-

Total No. of cocoon produced after 90 days	No. of cocoon produced /worms	Average cocoon production rate	Average adult no. at the end
300±10	60±0.07	1±0.04	354±0.04

E. fetida. Vermicompost produced by *E.fetida* posed from higher nutrients-N, P, K, Ca and Mg as compared to that of sole compost as well as substrate(VMW). Thus, vermicomposting proved to be a better technology than that of sole compost.

References

1. BAFFI C., DELL ABATE M.T., SILVA S., BENEDITTI A., NASSISI A., GENEVINI P.L. AND ADANI F. (2005) A comparison of chemical, thermal and biological approach to evaluate compost stability. *Geophysical Research Abstracts.* **7** : 09116. European Geosciences Union.
2. BANSAL, S. AND KAPOOR, K.K. (2000) Vermicomposting of crop residues and cattle dung with *Eisenia foetida*. *Bioresource Technol,* **73** : 95-98.
3. BENIFEZ E., NOGALES R., ELVIRA C., MASCIANDARO G. AND CECCANTI, B. (1999) Enzyme and earthworm activities during vermicomposting of carbaryl-trated sewage sludge. *J. Environ. Qual.* **28** : 1099-1104.
4. BOUALLAGUI H. TORRIJOS M., GODON J.J., MOLETTA R., CHEIKH R.B., TOUHAMI Y., DELGENES AND HAMDI M. (2004) Two phases anaerobic digestion of fruit and vegetable wastes : Bioreactor performance. *Biochem. Eng. J.* **21** : 93-197.
5. COKER C. (2006) Environmental remediation by composting. *Biocycle.* **47** : 18-23.
6. ELWELL, D.L., KEENER, H.M., WILES, M.C., BORGER, D.C. AND WILLETT, L.B. (2001) Odorous emission and odor control in composting swine manure/sawdust mixes using continuous and intermittent aeration. *Trans. ASAE* **44**(5) : 1307-1316.
7. GUNADI, B. AND EDWARDS, C.A. (2003) The effect of multiple application of different organic wastes on growth and survival of *Eisenia foetida*, *Pedobiologia* **47**(4) : 321-330.
8. HAN KO, J., KI KIN, Y., HYEON KIM, T., CHI KIM, N. AND UNEDA, M. (2007) Evolution of maturity parameters and heavy metal contents in composts made from animal manure. *Waste Manage.* **28** : 813-820.
9. HOITINK, H.A.J. (2000) Trends in treatment and utilization of solid wastes through composting in the United States, Agric. *Ecosyst. Environ.* **38** : 331-343.
10. KAUSHIK, P. AND GARG, V.K. (2003) Vermicomposting of mixed solid textile mill sludge and cow dung with the epigeic earthworm *Eisenia foetida*. *Bioresource Technol.* **90** : 311-316.
11. MILLS, T. (2006), Composting cafeteria residuals with earthworm. *Biocycle*. **47** ; 55-55.
12. PARASKEVA, P. AND DIAMADOPOULOS, E. (2006) Technologies for olive mill waste water (OMW) treatment: A review. *J. Chem. Technol. Biotechnol.* **81** : 1475-1485.
13. PARTHASARATHI, K. AND RANGNATHAN, I.S. (2002) Supplimentation of pressmud vermicaste with NPK enhances growth and field in *Leguminous crops. J. Curri. Sci.* **2** : 35-41.
14. SHARMA, S., PRADHAN, K., SATYA, S. AND VASUDEVAN, P. (2005) Potentiality of earthworms for waste management and in other uses- A review. *J. Amer. Sci.* **1**(1) : 4-15.
15. SUTHAR, S., AND SINGH, S. (2008) Vermicomposting of domestic waste by using two epigeic earthworms (*Perionyx excavatus* and *Perionyx sansibaricus) Int. J. Environ Sci. Tech.* **5**(1) : 99-106.
16. SUTHAR, S.S., WATTS, J., SANDHU, M., RANA, S., KANWAL, A., GUPTA, D. AND MEENA, M.S. (2005) Vermicomposting of kitchen waste by using *Eisenia fetida*. *Asian J. Microbiol. Biotech. Env. Sci.* **7** : 541-544.