The Bioscan 5(4) : 595-598, 2010
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES

NUTRIENT CONTENT OF SERICULTURE WASTE SUPPLEMENTED VERMICOMPOST BY *PERIONYX EXCAVATUS*

MAMATA PANDEY, T. V. RAO* AND S. K. SATAPATHY
School of Life Sciences, Sambalpur University,
Jyotivihar, Burla - 768 019, Sambalpur, Odisha, INDIA
E-mail: tvrao1951@gmail.com

KEY WORDS
Eri and Tasar waste
Vermicomposting
C, N, P, K, and Na

Received on :
19.08.2010
Accepted on :
27.10.2010

***Corresponding author**

ABSTRACT
Besides silk production sericulture industry also produces large amount of waste which goes unutilized. This organic waste can be profitably utilized for vermicomposting which has a lot of market potential. The present work is intended to investigate the quality of the compost of the sericulture waste produces through vermicomposting. Composting of the waste was done with *Perionyx excavatus,* a locally available epigeic earthworm. During 60 days of the decomposition, nutrients such as organic carbon, available nitrogen, potassium, sodium, and phosphorus were analyzed. Quality of the compost on 0,15,30,45, and 60 days of decomposition depicted that C and, C/N ratio were decreased. On the other hand the content of N, K, Na and P were significantly increased (p d" 0.05) during the period of decomposition. The study infers that the waste from sericulture provides better quality compost in comparison with that prepared from only cow dung.

INTRODUCTION

In the production of raw silk, India occupies second position in the world. Mainly three different species of non mulberry silk *i.e.* Eri, Tasar and Muga are used in this process. In tribal dominated Western Orissa, it provides livelihood to thousands of people. Along with the silk, the industry produces about 5000 ton of waste in different forms as by product (Gunathilagaraj and Ravignanam, 1996).

The waste in sericulture contains organic matter like larval excreta, leaf litter, dead larvae, moth and cocoons (Kamili and Mosoodi, 2000). Presently the Seri-waste rich in organic matter are not utilized properly for any productive propose by the tribal farmers. Organic wastes from animal and plant origin are presently best utilized for vermicomposting by indigenous and exotic earthworms (Nath *et al.,* 2009). Earlier reports have shown that the seri-waste from mulberry culture can also be utilized for production of organic manure by this method. Gunathilagaraj and Ravignanam (1996) and Garg *et al.*, (2006) have reported that the addition of sericulture waste increases N, P, K, Mn, Zn and Fe content of the compost substantiality than the farm yard manure (FYM) supplements. In vermicomposting process exotic earthworms like *Eisenia foetida* are frequently used because of their high fecundity and decomposition rates (Das *et al.,* 2003). Many reports have shown that in Indian conditions, some indigenous earthworms are superior decomposers of organic matter than the exotic species, because of their high fecundity, assimilation, metabolism and adaptability to tropical conditions (Suthar, 2007). Gunathilagaraj and Ravignanam (1996) used *Perionyx excavatus* a locally available epigeic earthworm for the in vermicomposting of sericulture waste. In the present investigation attempt has been made to analyze the dynamic changes of nutrients during the process of vermicomposting using waste from the culture of *P. ricini* (Eri) and *A. mylitta* (Tasar) by *Perionyx excavatus*.

MATERIALS AND METHODS

Experimental setup: Bulk surface soil (1-10cm) from the meadows in the Sambalpur University was collected and mixed thoroughly for experimental purpose. The soil was acidic (pH - 6.4), yellow in color (Laterite) with a texture contents of clay, slit and sand 62%, 21%, and 17% respectively. *Perionyx excavatus* a locally available species of epigeic earthworm collected from dung pit was used as the test species. After collection the worms were cultured in a tank with feed mix of cow dung and soil. Adult earthworms of this culture were used for vermicomposting.

Sericulture waste: Eggs of *Philosamia ricini* (supplied by the Sericulture Department of Government of Orissa) were reared in temperature controlled Eri culture Laboratory of Life Sciences, Sambalpur University. After hatching the larvae were fed with fresh tender castor leaves thrice a day. The wastes produced (larval excreta, leaf litter, dead larvae, moth and cocoons) were collected and air dried. The rearing wastes of Tasar culture were collected from basic seed multiplication and training center (BSMTC), Central Silk Board Kerei, Sundargarh (Odisha).The Vermicomposting beds were prepared by using cement tanks (30 cm length x 45 cm height x 25cm breadth). At the bottom of the tank 8 kg of chips and 8 kg of coarse sand were layered. Mixture of cow dung and sericulture waste (1:1) was layered on the top of it.

Experimental design: The experiment consisted of 2 treatments, which were replicated twice. The control contained only cow dung (CD) as substrate. The design of the experiment was as follows.

Soil + CD+ *P.excavatus* -C (Control)

Soil + CD+ Tasar waste + *P. excavates* -T (Tasar)

Soil + CD + Eri waste + *P. excavatus* - E (Eri)

The experiment continued for 60 days and samples were taken for analysis on 0, 15, 30, 45 and 60 days.

Sampling procedure: The soil samples were taken randomly using a cylindrical soil sampler. Immediately after sampling the soil samples were kept in a bag and placed in deep-fridge at -4°C to minimize the rate of microbial growth. Results of 3 independent experiments on different sampling occasions were used for calculation.

Analytical Methods: Organic carbon was analyzed according to Walkley and Black's rapid oxidation procedure and nitrogen was analyzed Autokjeltech Method (Jackson, 1973). Phosphorus was determined spectrophotometrically by the molybdenum blue method (Olsen *et al.,* 1954). Potassium and sodium contents were analyzed by using flame photometric method (Hesse, 1971) .

Statistical Analysis: The data were analyzed for intrinsic variations using two way Analysis of variance.

RESULTS AND DISCUSSION

Vermicomposting is a process of decomposition, mineralization and separation of the nutrients from organic matter by earthworms. Any decomposable organic matter can be used in this process along with soil. Usually cow dung is the main organic matter supplement for vermicomposting. While assessing the composting potential of any waste it has to be added with the cow dung as control. (Brar *et al.,* 1999; Umamaheswari and Vijayalakshmi, 2003) In the present investigation the waste matter of Eri and Tasar was mixed in a fixed proportion with the cow dung (1:1). Change in the carbon content of compost during decomposition has been depicted in Fig. 1(a). Initially the Eri and Tasar waste supplemented soil had the carbon content was 74.96g and 73.48g respectively. After 60 days of composting the carbon content declined to 57 and 46% respectively. Where as in control (cow dung as supplement) the carbon content decreased by 53%. Two way analysis of variance showed significant difference in the carbon content with respect to different days of composting ($F1 \geq 19.5$, $p < 0.05$) and amendment types($F2 \geq 42.46$, $p < 0.05$). Carbon is the most abundant of all nutrients because it is utilized by the organisms as source of energy for growth, multiplication and maintenance. It is released to the atmosphere in the form of carbon dioxide by the decomposer organisms Hence the process of decomposition can be assessed by measuring the carbon content during various stages of composting.

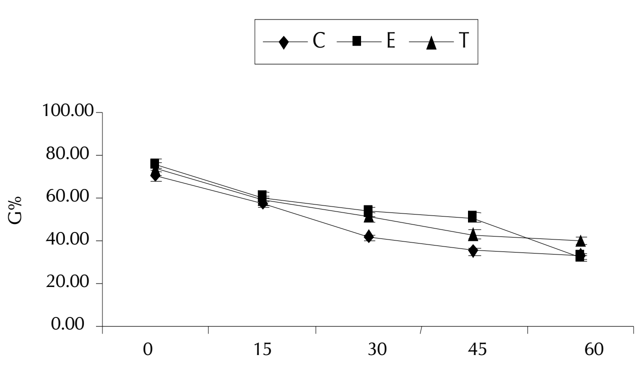

Figure 1(a): Organic carbon of air dried soil on various days of vermicomposting with amendments. (C) Control (no amendment), (E) Eri waste supplement, (T) Tasar waste supplement

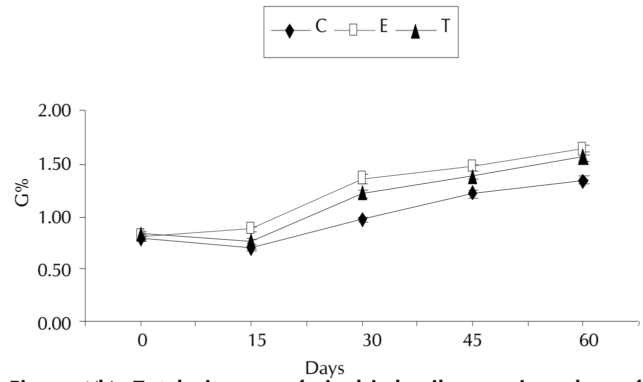

Figure 1(b): Total nitrogen of air dried soil on various days of vermicomposting with amendments. (C) Control (no amendment), (E) Eri waste supplement, (T) Tasar waste supplement

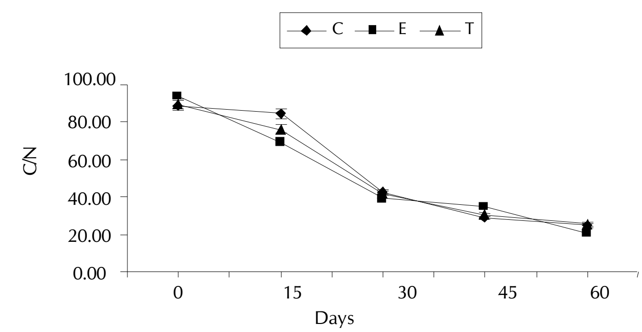

Figure 1(c): Carbon and Nitrogen ratio of air dried soil on various days of vermicomposting with amendments. (C) Control (no amendment), (E) Eri waste supplement, (T) Tasar waste supplement

Several workers (Deka *et al.,* 2003; Sangwan *et al.*, 2008) have reported increase in nitrogen content during decomposition. Our results with Control, Eri and Tasar waste supplements revealed increase in soil nitrogen content by about 92, 99 and 98% respectively during 60 days of composting (Fig. 1, b). Two way analysis of variance showed significant difference in the nitrogen content with respect to

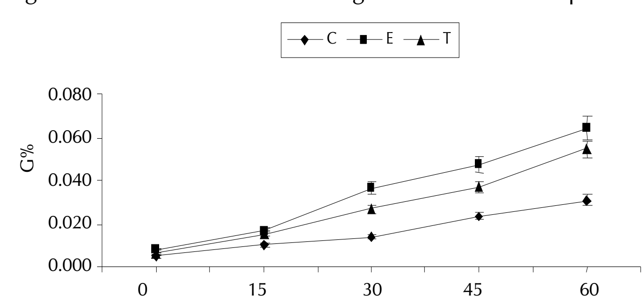

Figure 2(a): Sodium of air dried soil on various days of vermicomposting with amendments. (C)Control (no amendment), (E) Eri waste supplement, (T) Tasar waste supplement

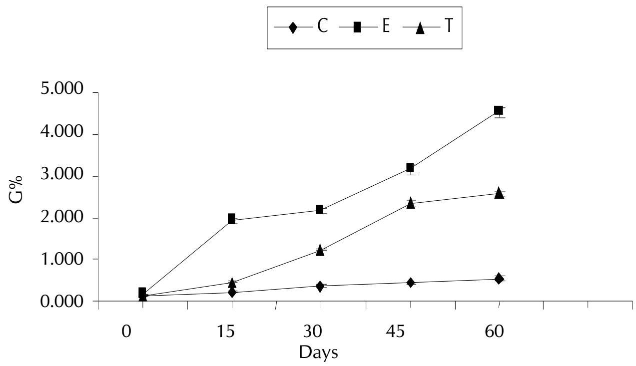

Figure 2(b): Potassium of air dried soil on various days of vermicomposting with amendments. (C)Control (no amendment), (E) Eri waste supplement, (T) Tasar waste supplement

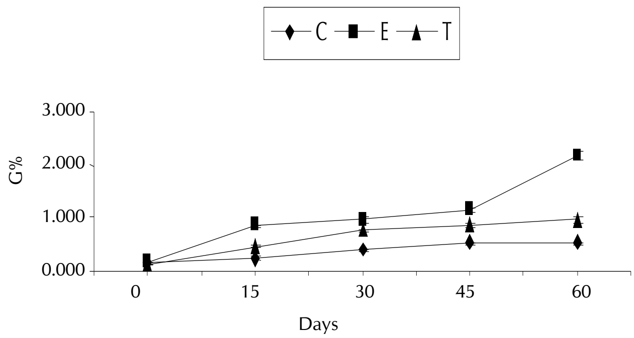

Figure 2(c): Phosphorus of air dried soil on various days of vermicomposting with amendments. (C)Control (no amendment), (E) Eri waste supplement, (T) Tasar waste supplement

different days of composting ($F1 \geq 47.2$, $p<0.05$) and amendment types ($F2 \geq 39.12$, $p<0.05$). Nutrient balance is primarily dependent on the type of food materials used for rearing of silkworms. In a composting system carbon is the major energy source, where as nitrogen determines the microbial population. During decomposition of organic waste materials concentration of carbon decreases while that of nitrogen is increases, resulting in the reduction of C/N ratio (Hamouda *et al.,* 1998). In the present investigation the decline in C/N ratio (Fig. 1, c) during 60 days of decomposition can be attributed to the relative loss of C as carbon dioxide along with the accumulation of nitrogen from various sources. Our results with Eri and Tasar waste decomposition can be compared to the earlier reports of Das *et al.,* (2003). In this investigation we have observed C/N ratio of 20:1 with Eri waste and 26:1 with Tasar waste and 24:1 with cow dung as only supplement. C/N ratio of 25:1 was recommended to be very good as per the reports of Das *et al*. (2003).Therefore the quality of the compost has been enhanced with the addition of seriwaste. The waste from non mulberry silkworm culture can be an excellent source for compost with good fertilizing potential as it has all qualities of manure.

Along with changes in organic nutrients, the minerals and micronutrients are also released by the process of decomposition. Mostly the mineral nutrients like Na, K and P embedded in the organic matter are released in their elemental forms in the compost (Warman and Termeer, 1996). In this investigation it was increased by 82% in control whereas in Eri and Tasar waste supplements it increased by 92 and 91% on 60 days respectively (Fig. 2a). Two way analysis of variance showed significant different in the sodium contents with respect to different days of composting ($F1 \geq 33.4$, $p<0.05$) and amendment types ($F2 \geq 34.47$, $p<0.05$). On 60 day of composting, potassium content increased by 73% in Eri, 83% in Tasar and 72% in control (Fig. 2b). In case of phosphorus it was increased by 87% in Eri, 93% in Tasar and 82% in control (Fig. 2c). Potassium contents with respect to different days of composting showed significant difference. Two way ANOVA depicts significant variation in K content during different days ($F1 \geq 26.20$, $p<0.05$) and amendment types ($F2 \geq 294.36$, $p<0.05$) and in case of phosphorous with respect to different days of composting ($F1 \geq 25.74$, $p<0.05$) and amendment types ($F2 \geq 417.22$, $p<0.05$). The mineral nutrients represent the fertilizing potential of the compost because they are essential elements for growth and development of plants. Our study further revealed that having the high potential of N, P and K nutrients, Eri and Tasar waste can be utilized as a better substrate for vermicomposting.

CONCLUSION

From above results it is evident that vermicomposting of Eri and Tasar waste produces better manure than other organic waste like cow dung. So silk worm culture, being a supportive vocation for small farmers of India, can be made more

Table 1: Seasonal finding of commercial traits of three ecoraces of *Philosamia ricini*

Ecorace	Seasons	Cocoon Wt (g)	Pupal Wt (g)	Shell Wt (g)	Shell Ratio (%)	ERR (%)
Borduar	**Summer**	3.2 ± 0.1	2.7 ± 0.1	0.516 ± 0.01	15.75 ± 0.68	94.98 ± 0.31
	Rainy	3.34 ± 0.05	2.79 ± 0.06	0.54 ± 0.013	16.36 ± 0.61	96.1 ± 0.08
	Autumn	3.47 ± 0.08	2.89 ± 0.07	0.58 ± 0.039	16.77 ± 1.1	96.9 ± 0.059
	Winter	3.79 ± 0.01	3.06 ± 0.08	0.73 ± 0.06	19.26 ± 1.0	97.88 ± 0.13
	Spring	3.5 ± 0.07	2.87 ± 0.07	0.65 ± 0.01	18.45 ± 0.34	96.18 ± 0.08
Titabar	**Summer**	3.11 ± 0.02	2.6 ± 0.02	0.428 ± 0.01	13.72 ± 0.85	94.0 ± 0.032
	Rainy	3.26 ± 0.06	2.8 ± 0.15	0.46 ± 0.02	14.092 ± 0.536	95.12 ± 0.01
	Autumn	3.36 ± 0.17	2.85 ± 0.07	0.51 ± 0.01	15.31 ± 0.81	96.27 ± 0.01
	Winter	3.49 ± 0.08	2.91 ± 0.01	0.578 ± 0.01	16.549 ± 0.52	96.96 ± 0.02
	Spring	3.41 ± 0.06	2.86 ± 0.06	0.54 ± 0.008	16.07 ± 0.55	95.76 ± 0.64
Mendipathar	**Summer**	2.864 ± 0.07	2.616 ± 0.08	0.248 ± 0.0083	8.6 ± 1.1	94.28 ± 0.39
	Rainy	3.03 ± 0.11	2.7 ± 0.126	0.332 ± 0.0083	10.95 ± 1.3	94.52 ± 0.02
	Autumn	3.23 ± 0.03	2.8 ± 0.04	0.44 ± 0.0083	13.71 ± 1.5	95.26 ± 0.03
	Winter	3.39 ± 0.03	2.9 ± 0.06	0.53 ± 0.013	15.69 ± 1.2	95.48 ± 0.08
	Spring	3.27 ± 0.05	2.82 ± 0.036	0.48 ± 0.011	14.62 ± 1.34	95.45 ± 0.01

productive through generation of vermicompost than the present practice of traditional method of waste utilization. Further, this can be of direct help to the poor farmer to improve their income and sustain their livelihood.

REFERENCES

Brar, B. S., Dhillon, N. S. and Vig, A. C. 1999. Integrated use of farm yard manure, biogas slurry and inorganic phosphate in P nutrition of wheat crop. *J. Ind. Soc Soil Sci*. **47:** 264-268.

Das, P. K., Bhogesha, K., Rajanna, L. and Dandin, S.B. 2003. Vermiculture as a means of seri cultural waste management technology an eco friendly approach. *Proc. Nat. Symp. Bioresources, Biotech and Bioenterprise*.pp. 398-402.

Deka, P. K., Paul, S. K. and Borah, A. 2003. Vermitechonology for economic use and control of water hyacinth. *Enviromedia*. **22(3):** 385-387.

Garg, V. K., Kaushik, P. and Dilbaghi, N. 2006. Vermiconservation of waste water sludge from textile mill mixed with anaerobic ally digested biogas plant slurry employing *Eisenia foetida*. *Eco. and Env. Safety*. **65(3):** 412-419.

Gunathilagaraj, K. and Ravignanam, T. 1996. Vermicomposting of Seri cultural waste. *Madras Agric. J.* **83(7):** 455-457.

Hamouda, M. F., Abu Qdais, H. A. and Newham J. 1998. Evaluation of municipal solid waste composting kinetics. *Res. Cons. and Recycling.* **23:** 209-223.

Hesse, P. R. 1971. A textbook of soil chemical Analysis. Chemical Publishing, New York. p. 475.

Jackson, M. L. 1973. *Soil chemical analysis*. Prentice Hall of India Pvt Ltd. New Delhi. p. 498.

Kamili, A. S. and Mosoodi, A. M. 2000. Principle of Temperate Sericulture. Kalyani Publishers, New Delhi. pp. 105-116.

Nath, G., Sing, K. and Singh, D. K. 2009. Chemical Analysis of Vermicomposts / Vermiwash of Different Combinations of Animal, Agro and Kitchen Wastes. *Aust. J. Basic and Appl. Sci.* **3(4):** 3672-3676.

Olsen, **S. R.**, **Cole**, **C. V., Watanabe, F. S. and Dean, L. A**. **1954**. Estimation of phosphorus in soils by extracting with sodium bicarbonate**.** *USDA***.** *Circular*. p. 939**.**

Sangwan, P., Kaushik, C. P. and Garg, V. K. 2008. Feasibility of utilization of horse dung spiked filter cake in vermicomposter using exotic earthworm *Eisenia foetida*. *Bioresource Tech*. **99:** 2442-2448.

Suthar, S. 2007. Vermicomposting potential of *Perionyx sansibaricus* (Perrier) in different waste materials. *Bioresource Tech*. **98:** 1231-1237.

Umamaheswari, S. and Vijayalakshmi, G. S. 2003. Vermicomposting of paper mill sludge using an African earthworm species *Eudrilus eugeniae* (Kinberg) with a note on its physico-chemical features. *Enviromedia.* **22(3):** 339-341.

Warman, P. R. and Termeer, W. C. 1996. Composting and evolution of race track manure, grass clippings and sewage sludge. *Bioresource Tech*. **55:** 95-101.