Uttar Pradesh J. Zool. 26(1) : 123-125, 2006 ISSN 0256-971X

COMPOSTING OF SOME ORGANIC MATERIALS USING *EISENIA FOETIDA* AND CONVENTIONAL MICROBIAL METHODS : A COMPARATIVE STUDY

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The present paper describes variation in some physico-chemical parameters of compost obtained in the laboratory by using *Eisenia foetida* and by conventional methods. The results show a high increase in organic matter, phosphorous, waterholding capacity, and decrease in pH when used earthworms.

Key words : Composting, organic materials, *Eisenia foetida*, microbial methods.

The growth of industries and ever increasing human population has led to an increased accumulation of waste material. The process not only reduces the available fertile lands used to produce food and material but also polluting water, air and soil. Fertilizers, pesticides, herbicides, nematocides and fungicides have been used to increase the yield of crops. These synthetic chemicals enter the soil and water thus cause pollution. Among the various possible methods to improve the nutrient status of soil, vermicomposting appears to be the most promising alternate. It helps to process wastes, simultaneously giving biofertilizer for agriculture and horticulture uses and a high quality protein for supplementing the nutrient deficiencies in animals. Manna et al. (1994) have studied the decomposition of waste material such as wheat straw, maize stalk, chickpea straw, soybean straw and city garbage using three species of epigeic earthworms such as *Lampito mauritii* Kinberg, *Metaphire houlleti* and *Perionyx* spp.

For this experiment, soil was collected from a playground in B.H.E.L., Hardwar. Cow dung was collected from cattle shed; garden leaves were collected from garden and sugarcane thrash was collected from juice venders. The earthworms (*E. foetida*) were procured from Brahamwarchasva Shodh Sansthan of Shantikunj, Hardwar. By using above materials, six sets of experiments were setup. Three of them were test experiments and rest three were control experiments. These experiments were setup by the following methods :

Formation of Bedding : The *E .foetida* were cultured in plastic pots (20 cm height, 35 cm diameter). In the first set of experiments, the bedding included bottom layer of soil followed by the layer of sugascane thrash , cow dung and upper most layer of soil. Twenty earthworms were introduced in this bedding. The control set had the same bedding but without earthworms. In the second set of experiment the partially decomposed straw replaced dung and rest of the bedding was same as that of the first set. The control set of this experimnet did not have worms. In the third set of experimnet the bedding was same as that of the second set, however, the partially decomposed garden leaves replaced partially decomposed straws. The control set of partially decomposed garden leaves did not have earthworms.

Analysis of different parameters : The following physico-chemical parameters of soil were analyzed using standard methods of Trivedi & Goel (1986) included organic matter, total phosphorous, pH and water holding capacity. The change in number of earthworms in each of test experiment was determined by counting them after completion of 60-days.

The initial and final values of different physico-chemical parameters of soil and number of *E foetida* have been presented in Table I. Our data show that there was a 453.2% increase in organic matter in the first set of test experiment while in the control set the increase was only 73.5%. There was a 489% increase in organic matter in the second test of test experimnet, while in the control set the increase was only 94.2%. Similarly there was a 151% increase in organic matter in the third set of test experiment, while in the control set the increase was only 75.9%. The organic matter in both, the test and control experiments increased but test experiment had more value of organic matter in comparison to control experiment. The earthworms (*E. foetida*) cast contain more organic matter and enhance microbial activity as suggested by Agarwal (1998). Hapse *et al.* (1993) observed that vermicomposting increases organic matter. Similar findings have been reported by Narayan (1999).

There was a 254.5%, 136.4% and 104.3% increase in phosphorous in the first, second and third sets of test experiments, respectively. In control, it was 125%, 78.2% and 90%, respectively. *E. foetida* consume organic matter very rapidly and fragment them into much finer particles by passing through a grinding gizzard. The *E. foetida* increase the microbial activity and release the nitrogen, potassium and calcium as suggested by Edwards (1995). Anonymous (1992) established that higher amount of phosphorous is found in test experiment than control experiment using earthworm species.

Table 1 : Physico-chemical parameters of soil used in different test-and control sets and number of earthworms.

Soil parameter	Control set			Test set		
	Initial value	Final value	% change	Initial value	Final value	% change
Organic matter						
Experiment-1	2.87	4.98	73.5	2.84	15.71	453.2
Experiment-2	2.53	4.92	94.2	2.93	17.26	480.0
Experimnet-3	3.49	6.14	75.9	3.84	09.64	151.0
Phosphorus						
Experiment-1	0.20	0.45	125.0	0.22	0.78	254.5
Experiment-2	0.23	0.41	78.2	0.21	0.52	136.4
Experimnet-3	0.20	0.38	90.0	0.23	0.47	104.3
pH						
Experiment-1	8.3	8.0	-3.6	8.1	7.5	-07.4
Experiment-2	8.3	7.9	-4.8	8.4	7.3	-13.1
Experimnet-3	8.3	8.1	-2.4	8.2	7.3	-10.9
Water holding capacity						
Experiment-1	30	41	36.6	31	63.5	104.8
Experiment-2	31	39.5	27.4	32	65.0	103.1
Experimnet-3	39	45	15.3	40	52.0	30.0
No. of worms						
Experiment-1	No worm	No worm	No change	20	295	1375
Experiment-2	No worm	No worm	No change	20	259	1195
Experimnet-3	No worm	No worm	No change	20	351	1655

A decrease in pH by 7.4% was observed in the first set of experiment in the bed with worms while in the control set the decrease was only 3.6%. There was 13.1% decrease in the pH of the second set of test experiment worms while in the control set the decrease was only 4.8%. Similarly, there was 10.9% decrease in pH of the third set of test experiment while in the control set, the decrease was only 2.4%. Earthworm help in adding calcium carbonate, a compound which helps moderate soil pH. Wallwork (1983) suggested all enzymes are active in a very narrow pH range and earthworm' bioreactors efficiently maintain parameters like pH. Similarly, the water holding capacity of test sets increased by 104.8%, 103.1% and 30% in first, second and third sets, respectively, whereas in control the increase was 36.6%, 27.4% and 15.3% respectively. Trivedi & Kumar (1998) reported that vermicomposting increased water holding capacity by encouraging extensive development of roots system of plants. Edward *et al.* (1985) reported increased water holding capacity in their experiments using *E. foetida.* In all three sets of test experiment, there was a tremendous increase in the number of earthworms at the end of the experiment. In the first set it was 1375%, in the second it was 1195% while in the third the increase was 1655%. Thus the present experiments clearly indicate the utility of earthworms in converting the different organic and farm waste materials in to useful compost in a relatively very less duration

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