

Effect of Composting Of Different Organic Wastes with Earthworm Species on C: N Ratio.

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Abstract: A vermicomposting study was conducted with different organic waste like wheat straw, cotton stubble waste and leaf litter by using five species of earthworms i.e. *Eisenia foetida*, *Eudrilus eugeniae*, *Perionyx excavatus*, *Lampito mauritii* and one local. Lowest C:N ratio was recorded in cotton waste inoculated with *Eisenia foetida* over all other combinations except cotton waste inoculated with *Lampito mauritii* and leaf litter inoculated with *Eisenia foetida* and *Lampito mauritii*.

Key words: Earthworm, C:N ratio.

I. Introduction

A large amount organic materials from various sources are available in the country and which can be good supplement not only for plant nutrient but also as a soil amendment. As per survey of India approximately 388.75 million tonnes of agricultural waste, 2073.8 million tonnes of poultry and animal waste, 150 million tonnes of community waste are generated (Adhikari et al., 1997). In all the above waste 7.589, 2.515, 7.457 million tonnes of N, P and K respectively are being wasted. The unutilised part of nutrient of these wastes should be recorded and reduced by compost technology. Therefore it is huge scope to produce energy by organic matter recycling and increase soil productivity.

Organic wastes of biodegradable nature are an essential input to sustainable agriculture. The farm produced crop residue and other organic waste are valuable agricultural input as source of soil organic matter and essential nutrient elements required for crop growth. There by minimize the environmental pollution (Poincelot, 1974). Normally six to seven months are required to decompose organic material. But the decomposition of such organic waste completed 45 days due to addition of earthworm culture (Jambhekar, 1992). Out of all earthworm species *Eisenia foetida*, *Eudrilus eugeniae*, *Perionyx excavatus*, *Dendrobance venata* are organic waste decomposer (Kale and Bano, 1987).

The present study carried out to assess change in C:N ratio during decomposition by different earthworm species.

II. Materials And Methods

The present investigation carried out at College of Agriculture, Nagpur by selecting organic residue i.e. Wheat straw (Ws), Cotton stubble waste (Cw) and Leaf litter (Ll) were decomposed with the help of *Eisenia foetida* (Ef), *Eudrilus eugeniae* (Ee), *Perionyx excavatus* (Px), *Lampito mauritii* (Lm) and Local species of Nagpur in FRBD design. Before preparation of vermibed, the organic waste was covered separately with cow dung sprinkle water for partial decomposition upto 25 days. Then 22.5 kg. of organic waste for each bed of size 1m x 1 m x 0.3 m was taken and spread 2.5 kg cow dung and 375 gm gypsum. Then 75 number of earthworm of each species added as per following treatments: 1) T₁ – Ws + Ef, 2) T₂ – Ws + Ee, 3) T₃ – Ws + Px, 4) T₄ – Ws + Lm, 5) T₅ – Ws + L, 6) T₆ – Cw + Ef, 7) T₇ – Cw + Ee, 8) T₈ + Cw + Px, 9) T₉ – Cw + Lm, 10) T₁₀ – Cw + L, 11) T₁₁ – Ll + Ef 12) T₁₂ – Ll + Ee, 13) T₁₃ – Ll + Px, 14) T₁₄ – Ll + Lm, 15) T₁₅ – Ll + L. The sample was taken periodically from 50th day to 90th day at 10 days of interval. The over dried degraded substance were analysed from organic carbon and total nitrogen by ignition method (Jackson, 1973) and Kjeldahl method (Piper, 1966) respectively.

III. Result And Discussion

ORGANIC CARBON

The results of periodic observation of organic carbon were statistically significant. Amongst the earthworm species lower organic carbon was recorded throughout study period from 50 DAI (31.54%) to 90 DAI (17.73%) by *Eisenia foetida* over local and *Perionyx excavatus*. However the results of *Eisenia foetida* was at par throughout the study period with *Eudrilus eugeniae* and *Lampito mauritii*. The reduction in the rate of lowering of organic carbon content was very slower after 80 DAI. In vermicomposting of organic waste, the reduction of organic carbon during initial period was at very faster rate in wheat straw i.e. at 60 days recorded

significantly lower organic carbon content (30.13%) and in later period of 70 to 80 (19.87%) day the decomposition rate of cotton stubble was faster and recorded lowest organic carbon content at 90th day (19.50%) (Table 1). The result shows efficiency of earthworm which might be related with the softness of organic residue because at initial stage, the wheat straw was softer and with increase in period, cotton waste become softer and their after leaf litter. It is discussed at that probably volatile potentiaators of modifier are responsible for feeding behavior of worms (Kale and Krishnamoorthy, 1981).

IV. total nitrogen

The content of nitrogen during decomposition period were slightly improved and recorded significantly maximum by *Eisenia foetida*, *Eudrilus eugeniae* and *Lampito mauritii* over *Perionyx excavatus* and local species of earthworm. The significantly maximum content of nitrogen was recorded by *Eisenia foetida* (1.556%) followed by *Eudrilus eugeniae* (1.549%) and *Lampito mauritii* (1.531%) over *Perionyx excavatus* (1.390%) and local species (1.367%) at 90 days. Similar trend of increase in nitrogen content due to addition of earthworm was recorded by Arumugam *et al.* (2004) In vermicompost of different organic waste recorded significant result on content of nitrogen (Table 2). Significantly maximum content of N was recorded throughout decomposition period in leaf litter (1.305% - 1.569%) followed by cotton waste (1.266 – 1.508%) and wheat straw (1.076 – 1.359%). The maximum content of total N was associated with maximum content of nitrogen in organic waste residue at initial stage.

V. C:N Ratio

The result showed that the decomposition rate was very faster during initial period and recorded significantly lowest C:N ratio by *Lampito mauritii* (20.88:1) at 60 days over *Perionyx excavatus* (20.89:1) and Local (28.03:1). However the result were at par with *Eiseniae foetida* (20.89:1) and *Eudrilus eugeniae* (21.17:1) at 60th day. The results showed that the maturity of vermicompost of different organic waste attend within 60 days by *Lampito mauritii*, *Eisenia foetida* and *Eudrilus eugeniae*. However *Perionyx excavatus* takes 70 days (20.49:1) and local species takes 80 days (18.01:1). In latter period at 70th day the lowest C:N ratio (15.38:1) to 90th day (11.58:1) was recorded by *Eisenia foetida* which was at par with *Lampito mauritii* and significantly superior over other species of earthworm *Eudrilus eugeniae*, *Perionyx excavatus* and local species. The stabilization in C:N ratio was recorded after 80 days because much reduction was not recorded at 90th day (Table 3). Similar observation was found in reduction of C:N ratio due to decomposition of organic waste through earthworm (Daudt *et al.*, 2004).

The result of C:N ratio due to different organic source are also significantly enfluenced throughout decomposition period. The complete decomposition of leaf litter (17.53:1) and wheat straw (19.89:1) was recorded at 70th day. Further decomposition was significantly faster in cotton stubble (13.01:1) over wheat straw (15.62:1) and at par with leaf litter (13.14:1) The decomposition of wheat is relatively faster at beginning but slower down after four weeks by the end of 21 weeks (Mishra *et al.*, 1982).

VI. Conclusions

Considering the C : N ratio the complete decomposition of cotton stubble waste was recorded in 60 days by *Lampito mauritii*, *Eisenia foetida* and *Eudrilus eugeniae*. The *Eudrilus eugeniae* completely decomposed the leaf litter in 60 days and wheat straw in 70 days. *Perionyx excavatus* takes 70 days for complete decomposition of cotton waste and leaf litter waste and for wheat straw, it required 80 days. However, local earthworm completely decomposed the wheat straw, cotton stubble waste and leaf litter in 80 days. The stabilization in C : N ratio was recorded after 70 days in *Eisenia foetida*, *Eudrilus eugeniae* and *Lampito mauritii*.

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Table 1 : Effect of earthworm and source of organic waste on periodic content of organic carbon.

	50 DAI	60 DAI	70 DAI	80 DAI	90 DAI
Earth worm (EW)					
<i>E. foetida</i>	31.54	28.20	21.58	17.96	17.73
<i>E. eugeniae</i>	31.69	28.38	22.29	18.78	18.59
<i>P. excavatus</i>	36.96	33.20	26.81	23.20	23.02
<i>L. mauritii</i>	31.82	28.22	22.11	17.88	17.91
Local	36.25	33.20	28.78	24.15	24.04
S.E. ± (m)	0.38	0.2	0.12	0.12	0.13
C.D. (P=0.05)	1.11	0.57	0.35	0.35	0.39
Organic waste (OW)					
Wheat straw	33.23	30.13	24.93	21.11	20.98
Cotton stubble	33.95	30.29	23.60	19.67	19.50
Leaf litter	33.78	30.76	24.42	20.40	20.29
S.E. ± (m)	0.296	0.152	0.093	0.095	0.103
C.D. (P=0.05)	0.86	0.44	0.27	0.27	0.30
Interaction (Ew x OW)					
S.E. ± (m)	0.66	0.34	0.2	0.21	0.23
C.D. (P=0.05)	1.91	0.99	0.60	0.61	0.67
C. V. (%)	3.40	1.94	1.48	1.8	1.97

Table 2 : Effect of earthworm and source of organic waste on periodic content of total nitrogen.

	50 DAI	60 DAI	70 DAI	80 DAI	90 DAI
Earth worm (EW)					
<i>E. foetida</i>	1.258	1.358	1.419	1.530	1.556
<i>E. eugeniae</i>	1.257	1.364	1.399	1.506	1.549
<i>P. excavatus</i>	1.159	1.251	1.320	1.377	1.390
<i>L. mauritii</i>	1.297	1.353	1.414	1.509	1.531
Local	1.107	1.248	1.279	1.313	1.367
S.E. ± (m)	0.0081	0.0089	0.013	0.017	0.0074
C.D. (P=0.05)	0.023	0.026	0.039	0.049	0.021
Organic waste (OW)					
Wheat straw	1.076	1.183	1.263	1.355	1.359
Cotton stubble	1.266	1.371	1.405	1.456	1.508
Leaf litter	1.305	1.390	1.431	1.530	1.569
S.E. ± (m)	0.0062	0.007	0.010	0.013	0.006
C.D. (P=0.05)	0.018	0.020	0.030	0.038	0.017
Interaction (Ew x OW)					
S.E. ± (m)	0.014	0.015	0.025	0.029	0.013
C.D. (P=0.05)	0.040	0.045	0.069	N.S.	0.037
C.V.(%)	1.99	2.03	2.95	3.53	1.5

Table 3 : Effect of earthworm and source of organic waste on periodic content of C:N ratio.

	50 DAI	60 DAI	70 DAI	80 DAI	90 DAI
Earth worm (EW)					
<i>E. foetida</i>	25.02	20.89	15.38	11.89	11.58
<i>E. eugeniae</i>	25.40	21.17	16.02	12.56	12.25
<i>P. excavatus</i>	32.15	26.71	20.49	16.92	16.48
<i>L. mauritii</i>	24.72	20.88	15.71	11.93	11.64
Local	33.83	28.03	22.52	18.01	17.66
S.E. ± (m)	0.345	0.289	0.205	0.1	0.163
C.D. (P=0.05)	1.00	0.84	0.59	0.29	0.47
Organic waste (OW)					
Wheat straw	31.84	25.60	19.89	15.74	15.62
Cotton stubble	26.96	22.44	16.65	13.44	13.00
Leaf litter	25.87	22.58	17.53	13.55	13.14
S.E. ± (m)	0.266	0.224	0.159	0.078	0.127
C.D. (P=0.05)	0.77	0.65	0.46	0.22	0.37
Interaction (Ew x OW)					
S.E. ± (m)	0.598	0.501	0.355	0.173	0.283
C.D. (P=0.05)	1.73	1.45	1.03	0.50	0.82
C. V. (%)	3.67	3.69	3.41	2.10	3.52