IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 6 Ver. I (Jun. 2015), PP 46-48
www.iosrjournals.org

Effect of Composting Of Different Organic Wastes with Earthworm Species on Nutrient Status

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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. The result of Eisenia foetida, Lampito mauritii and Eudrilus eugeniae were comparable on nutrient content. The maximum content of nutrients was recorded in vermicompost prepared from leaf litter followed by cotton waste.*
Key Words: *Earthworm, organic waste, nutrient content.*

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 that, to study the periodic effect of earthworm species on quality of vermicompost.

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 designe. 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. cow dung and 375 gm gypsum. Then 75 number of earthworm of each species added as per following treatments : 1) T_1 – Ws + Ef, 2) T_2 – Ws + Ee, 3) T_3 – Ws + Px, 4) T_4 – Ws + Lm, 5) T_5 – Ws + L, 6) T_6 – Cw + Ef, 7) T_7 – Cw + Ee, 8) T_8 + Cw + Px, 9) T_9 – Cw + Lm, 10) T_{10} – Cw + L, 11) T_{11} – Ll + Ef , 12) T_{12} – Ll + Ee, 13) T_{13} – Ll + Px, 14) T_{14} – Ll + Lm, 15) T_{15} – Ll + L. The sample was taken periodically from 50^{th} day to 90^{th} day at 10 days of interval to observe changes in C:N ratio as well as NH_3 – N and NO_3 – N. The sample of 90^{th} day were analysed for nutrients. Analyse of Organic carbon by ignition method (Jackson, 1973), Total nitrogen by Kjeldahl method (Piper, 1966), Prepare diacid mixture (9:4 of HNO_3:$HClO_4$) for analysed. Total phosphorus (Jackson, 1973); Total Potash (Jackson, 1973), Ca and Mg by EDTA complexo metric titration method (Chopra and Kanwar, 1991); Total sulphur (Tatatabi and Bremner, 1970). Micronutrient Fe , Cu, Mn, Zn by atomic absorption spectro-photometer (Lindsay and Norvell, 1978).

III. Result And Discussion

Organic Carbon

Lower organic carbon content was recorded throughout study period from 50^{th} day (31.54%) to 90^{th} day (17.73%) by Eisenia foetida over local and Perionyx excavatus as well as at par with Eudrilus eugeniae and

Lampito mauritii (Table 1). In the organic waste in latter period 70th and 80th day the decomposition rate of cotton stable was very faster and lowest organic carbon content value was recorded at 90th day (19.50%).

Total Nitrogen

The significantly maximum content of N was recorded by Eisenia foetida (1.556%) followed by Eudrilus eugeniae (1.549%) and Lampito maritii (1.531%) over Perionyx excavatus (1.390%) and local (1.367%) at 90th day. The maximum N was recorded throughout decomposition period in leaf litter (1.305% - 1.569%); cotton waste (1.266% - 1.508%) and wheat straw (1.076% - 1.359%) (Table 2).

C:N Ratio

Significantly lowest C:N ratio was recorded by Lampito mauritii (20.88:1) over Perionyx excavatus (26.71:1) and local (28.03:1) and at for with Eisenia foetida (20.89:1) and Eudrilus eugeniae (21.17:1) at 60th day. The result showed that the maturity of vermicompost different organic wastes attend within 60th days by to Lampito mauritii, Eisenia foetida, Eudrilus eugeniae (Table 3). However Perionyx excavatus takes 70 days (20.49:1) and Local species takes 80 days (18.01:1). At 90th day the lowest C:N ratio recorded by Eisenia foetida (11.58:1) at par with Lampito mauritii. Among the organic waste, the decomposition was significantly faster in cotton stubble (13.0:1) over wheat straw (15.62:1) at par with leaf litter (13.14:1).

Nutrient Composition

Among the species of earthworm Eisenia foetida recorded significantly maximum content of total P (1.033%), total K (0.927%) Ca (2.494%), Mg (0.884%), Fe(59.190 $mgkg^{-1}$), Zn(3.813 $mgkg^{-1}$) Cu(1.853 $mgkg^{-1}$) over Perionyx excavatus and local species. However the maximum content of S (1.324 %) and Mn (5.106 $mgkg^{-1}$) recorded by Lampito mauritii and Eudrilus eugeniae respectively. In the vermicompost of organic waste maximum content of Total P(0.949%), Mn(5.07 $mgkg^{-1}$)and Zn (3.591$mgkg^{-1}$) recorded by leaf litter. Cotton stubble vermicompost recorded maximum content of Ca(2.385%) , S(1.226%), Fe(53.863 $mgkg^{-1}$) and Cu(1.762$mgkg^{-1}$), over wheat straw. All similar observation was found by Rao (1994) , Gunathilagraj and Ravignanam (1996).

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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 warm (EW)					
E. foetida	31.54	28.20	21.58	17.96	17.73
E.eugeniae	31.69	28.38	22.29	18.78	18.59
P. excavatus	36.96	33.20	26.81	23.20	23.02
L. mauritii	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 warm (EW)					
E. foetida	1.258	1.358	1.419	1.530	1.556
E.eugeniae	1.257	1.364	1.399	1.506	1.549
P. excavatus	1.159	1.251	1.320	1.377	1.390
L. mauritii	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 (EwxOW)					
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 warm (EW)					
E. foetida	25.02	20.89	15.38	11.89	11.58
E.eugeniae	25.40	21.17	16.02	12.56	12.25
P. excavatus	32.15	26.71	20.49	16.92	16.48
L. mauritii	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 (EwxOW)					
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

Table 4: Effect of earthworms species and organic wastes on nutritional composition of vermicompost at 90th day.

	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Fe $mgkg^{-1}$	Mn $mgkg^{-1}$	Zn $mgkg^{-1}$	Cu $mgkg^{-1}$
Earth worm (EW)									
E. foetida	1.033	0.927	2.494	0.884	1.293	59.190	5.097	3.813	1.853
E.eugeniae	1.003	0.921	2.469	0.867	1.273	58.170	5.106	3.741	1.832
P. excavatus	0.842	0.890	2.159	0.656	0.991	47.622	4.688	2.973	1.576
L. mauritii	1.001	0.923	2.456	0.863	1.324	54.576	4.887	3.564	1.836
Local	0.777	0.878	2.081	0.701	0.949	43.897	4.652	2.779	1.561
S.E. ± (m)	0.0083	0.0052	0.016	0.013	0.014	0.646	0.053	0.067	0.0093
C.D. (P=0.05)	0.017	0.0106	0.033	0.027	0.029	1.32	0.11	0.14	0.019
Organic waste (OW)									
Wheat straw	0.898	0.945	2.242	0.795	1.147	51.947	4.575	3.073	1.691
Cotton waste	0.949	0.835	2.384	0.795	1.226	53.863	4.985	3.459	1.762
Leaf litter	0.947	0.944	2.369	0.793	1.126	52.263	5.097	3.591	1.742
S.E. ± (m)	0.0064	0.004	0.012	0.01	0.011	0.5	0.041	0.052	0.007
C.D. (P=0.05)	0.0131	0.008	0.025	N. S.	0.023	1.02	0.08	0.106	0.014
Interaction (EwxOW)									
S.E. ± (m)	0.0144	0.0089	0.028	0.023	0.024	1.119	0.092	0.117	0.016
C.D. (P=0.05)	0.03	N.S.	0.06	0.05	0.05	2.29	0.19	0.24	0.033
C. V. (%)	2.68	1.71	2.06	4.96	3.51	3.68	3.27	5.99	1.62