Research Article

Effect of Various Additives on Efficiency of Earthworm to Convert Obnoxious Weeds into Vermicompost

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Abstract

A pot experiment was conducted during 2007-08 and 2008-09 in order to investigate the total of 16 treatments combinations consists of 4 obnoxious weeds viz., parthenium, lantana, water hyacinth and ipomea and application of 4 additives viz., control (no any additives), cowdung, trichoderma, trichoderma + cowdung were tested in factorial randomized block design with 3 replications. A uniform quantity (4.00 kg on dry weight basis) of all 4 weed biomass filled in pots having 79 cm diameter with 30 cm height. These weed biomass were treated with 4 additives and then allowed them for aerobic decomposition separately for 30 days. A fixed quantity 200 g of *Eiesenia foetida* earthworms was inoculated at completion of 30 days. Weight gain by earthworm (241.25 g) with conversion rate (107.12 g/day), recovery percentage (64.59) were noted with water hyacinth. Trichoderma + cowdung used as additive proved to be more effective with respect to weight gain by worms (130.81 g) as well as conversion rate (788.69 g/day) and recovery percentage (60.78). The chemical composition of N, P, K, Fe, Zn and Cu increase in the vermicomposts obtained from water hyacinth, parthenium, ipomea and lantana alongwith increased number of earthworms. The concentration of these nutrients further increased in vermicompost with the addition of different additives in ascending order as Trichoderma, cowdung and both of these over no addition of any additives. (Badiyala and Verma, 1990).

Keywords: Additives, earthworms, vermicompost, decomposition and obnoxious weeds

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Introduction

Weeds are untouched source of organics and found in abundance under cropped and non cropped areas. Some species of weeds grow in cropped areas used as a fodder. These weeds contains sufficient quantity of plant nutrients. However, least attention has been paid to harness their potential as a source of plant nutrients in the form of manure.

Abnoxious weeds viz., Parthenum, lantana, water hyacinth, ipomea etc. may also be used as a source of nutrients white it may be offer to natural decomposition for converting into compost. On the other hand large number of macro and micro flora and fauna are found in soil and have an ability to convert all kinds of biowastes into compost. In this context, earthworms as well as lignited fungus are the major bioterminator and may play a significant role in converting of biomass into simplest and available forms to the plants. Vermicompost obtained from weeds also plays a very vital role in improving soil physical and chemical properties. (Bora and Thakuria (2000).

Therefore, the present to the plants carried out to convert obnoxious weeds through use of micro organisms as decomposer and earthworms for decomposition. The surface dweller detritivores earthworms *Eisenia fetida* have an ability to digest and excrete in the form of enriched vermicompost. Therefore the present investigation was conducted.

Material and Methods

A pot experiment was conducted at Vermicompost Production Unit, Department of Agronomy, JNKVV, Jabalpur during 2007-08 and 2008-09.

A total sixteen treatments combinations consisted to 4 obnoxious weeds *(Parthenium hysterophorus* L., *Lantana camera* L., *Eichhornia crassipes* L. and *Ipomea cornea* L.) as well as four additives (Control, Cowdung, *Trichoderma viride,* cowdung + *Trichoderma viride).* These treatments were tested under factorial randomized block design with three replications. The weed biomass used as substrate taken on the basis of dry weight (4 kg each) and additive trichoderma used @ 10 g/kg dry matter of substrate while dung used in the ratio of 3: 1 on the basis of dry matter.

Each treated substrata was kept in earthen pot and subjected to partial decomposition for the period. of 30 days. After completion of partial decomposition period, 200 g clitellets of *Eisenia fetida* species of earthworms were released in each treatment (pot) separately for vermicomposting.

Studies on growth and development of earthworms, rate of conversion and recovery per cent of vermicompost, physical, chemical and biological properties of produce vermicompost were made.

$$\text{Multiplication ratio of earthworms} = \frac{\text{Population of earthworm after completion of vermicompost process}}{\text{Population of earthworm released at the initiation of vermicomposting}}$$

$$\text{Conversion rate (weight/day)} = \frac{\text{Quantity of vermicompost (weight)}}{\text{Number of days taken for complete conversion of substrate into vermicompost}}$$

$$\text{Recovery of vermicompost (\%)} = \frac{\text{Dry weight of vermicompost}}{\text{Population of earthworm released at the initiation of vermicomposting}}$$

Results

Weight gain, conversion rate and recovery per cent of worms

Weight gain by worms and conversion of wastes to vermicompost recovery percentage and production of vermicompost during 2007-08 and 2008-09 are presented in **Table 1**. Data reveal that the earthworms development with respect to multiplication and weight gained, impaired due to substrata of lantana provided to worms. The substrata water hyacinth proved to be better for multiplication and increase in weight of worms during both the years and pooled mean (241.25 g) multiplication worms and improvement in weight of worms (243.3 and 239.2) during 207-08 and 2008-09 as well as in pooled (241.25 g). Data on an average other substrata parthenium and lantana found to be at par but significantly inferior to ipomea and water hyacinth. These results are in close conformity with the finding of Sharma and Shweta (2003).

Table 1 Weight gain by worms, conversion rate and recovery (%) as affected by different treatments

Treatments	Weight gain by worms (g)			Conversion rate (g/day)			Recovery (%)		
	2007-2008	2008-2009	Mean	2007-2008	2008-2009	Mean	2007-2008	2008-2009	Mean
Substrata									
Parthenium	42.18	101.3	71.74	53.03	57.74	55.38	58.46	62.18	60.32
Lantana	96.74	98.0	97.37	30.26	28.82	29.54	42.47	43.25	42.86
Water hyacinth	243.31	239.2	241.25	08.01	106.23	107.12	61.31	67.87	64.59
Ipomea	134.0	83.9	108.95	46.14	46.99	46.56	51.61	57.06	54.33
CD (5%)	4.75	0.83		1.83	1.75		1.57	4.0	
Additives									
Control	102.88	94.3	98.59	42.91	44.06	43.48	46.18	51.81	48.99
Cowdung	140.75	98.0	119.37	62.28	63.41	62.84	55.68	59.12	57.4
Trichoderma	121.47	83.0	102.23	54.36	52.79	53.57	53.25	56.62	54.93
Trichoderma + Cowdung	151.62	110.0	130.81	77.88	79.51	78.69	58.75	62.81	60.78
CD(5%)	4.75	0.83		1.83	1.75		1.57	4.0	

The conversion of wastes into vermicomposts per day significantly charged with change of substratra and maximum rate of 108.01, 106.23 and 107.12 g/day was recorded with water hyacinth and it was minimum (29.5 g/day) under lantana. These views are also corroborated by Nguyen et al. (2000).

The rate of conversion showed correlation with the recovery percentage. The highest recovery (64.59%) was recorded under water hyacinth closely followed by parthenium where a lantana gave the lowest value of recovery (42.86%). Findings are in close conformity with the findings of Kanwar (2004).

Chemical composition

Data presented in **Table 2** and **2b** depicted the chemical composition of different types of vermicompost which were prepared by different weeds substrata with the combination of different additives.

Table 2a Changes in chemical composition (NPK) during process of vermicomposting as affected by different treatments

Treatments	Partial decomposition			Vermicompost		
	2007-08	2008-09	Mean	2007-08	2008-09	Mean
N content (%)						
Substrata						
Parthenium	0.29	0.29	0.29	1.02	0.88	0.95
Lantana	0.25	0.24	0.24	0.82	0.82	0.82
Water hyacinth	0.35	0.6	0.30	1.10	0.79	0.94
Ipomea	0.30	0.18	0.24	0.97	0.66	0.81
CD (5%)	0.04	0.009		0.17	0.014	
Additives						
Control	0.24	0.16	0.2	0.65	0.47	0.56
Cowdung	0.32	0.8	0.30	1.03	0.87	0.95
Trichoderma	0.39	0.20	0.29	0.93	0.72	0.82
Trichoderma+Cowdung	0.30	0.31	0.30	1.00	1.06	0.95
CD(5%)	0.4	0.009		0.17	0.014	
P content (%)						
Substrata						
Parthenium	0.18	0.20	0.19	0.51	0.78	0.64
Lantana	0.20	0.11	0.15	0.54	0.61	0.57
Water hyacinth	0.25	0.17	0.21	0.69	0.65	0.67
Ipomea	0.22	0.80	0.50	0.56	0.54	0.55
CD (5%)	0.02	0.07		0.05	0.008	
Additives						
Control	0.15	0.09	0.12	0.32	0.38	0.35
Cowdung	0.22	0.16	0.19	0.68	0.75	0.71
Trichoderma	0.19	0.13	0.16	0.60	0.67	0.63
Trichoderma+Cowdung	0.25	0.18	0.19	0.71	0.78	074
CD(5%)	0.05	0.007		0.05	0.008	
K content (%)						
Substrata						
Parthenium	0.41	0.50	0.45	0.81	1.16	0.98
Lantana	0.37	0.39	0.38	0.75	0.81	0.78
Water hyacinth	0.51	0.45	0.48	1.02	0.89	0.95
Ipomea	0.45	0.36	0.40	0.8	0.77	0.82
CD (5%)	0.03	0.011		0.05	0.008	
Additives						
Control	0.34	0.34	0.34	0.68	0.66	0.67
Cowdung	0.46	0.44	0.45	0.95	0.93	0.94
Trichoderma	0.13	0.42	027	0.84	0.86	0.85
Trichoderma + Cowdung	0.48	0.50	0.49	1.02	1.17	1.09
CD(5%)	0.03	0.011		0.05	0.008	

Table 2b Changes composition (Fe, Zn, Cu) in substrata as affected by different treatments

Treatments	Partial decomposition			Vermicompost		
	2007-08	2008-09	Mean	2007-08	2008-09	Mean
Fe (ppm)						
Substrata						
Parthenium	310	726.0	518.0	423	1034.0	728.5
Lantana	503	543.0	523.0	487	782.0	634.5
Water hyacinth	402	879.0	640.5	513	1130.0	821.5
Ipomea	345	1045.0	695.0	465	1244.0	854.5
CD (5%)	13.8	8.20		14.9	5.81	
Additives						
Control	216	336.0	276.0	301	533.0	417.0
Cowdung	416	977.0	696.5	353	1218.0	785.5
Trichoderma	342	795.0	568.5	447	1052.0	5549.5
Trichoderma + Cowdung	529	1086.0	807.5	685	1386.0	1035.5
CD(5%)	13.8	8.20		14.9	5.81	
Zn (ppm)						
Substrata						
Parthenium	7.6	30.0	18.8	15.0	74.0	44.5
Lantana	16.1	7.0	11.5	269.8	14.0	21.9
Water hyacinth	31.5	23.0	27.25	76.3	48.0	73.1
Ipomea	23.8	15.0	19.4	50.4	29.0	39.7
CD (5%)	1.7	1.05		2.4	0.99	
Additives						
Control	12.3	11.0	11.65	30.9	29.0	29.95
Cowdung	22.0	21.0	11.5	46.0	44.0	45
Trichoderma	18.0	17.0	17.5	41.5	40.0	40.75
Trichoderma + Cowdung	29.8	26.0	27.9	53.3	52.0	52.65
CD(5%)	1.7	1.05		2.4	0.99	
Cu (ppm)						
Substrata						
Parthenium	9.0	11.0	10.0	18.0	19.0	18.5
Lantana	11.5	6.0	8.75	20.0	12.0	16.0
Water hyacinth	76.3	8.0	42.15	24.6	16.0	20.3
Ipomea	50.4	8.0	29.2	22.5	15.0	8.75
CD (5%)	2.4	0.84		1.6	1.00	
Additives						
Control	30.9	5.0	17.95	16.3	11.0	13.65
Cowdung	46.0	9.0	27.5	22.7	16.0	9.35
Trichoderma	41.5	8.0	24.75	20.6	15.0	17.8
Trichoderma + Cowdung	53.3	12.0	32.65	25.6	19.0	22.3
CD(5%)	2.4	0.83		1.6	1.00	

In the year of 2007-08 water hyacinth had found significant in the respect of N, P and K (1.10, 0.69 and 1.02 %) composition. While parthenium differed significantly in respect of NPK (0.88, 0.78 and 1.16%) from 2008-09. NPK content in additives Trichoderma and cowdung had found significant for partial and vermicompost for both the years (2007-08 and 2008-09). The similar results were observed by Dickerson (1994).

In relation to micronutrient Fe, Zn, Cu had revealed highest values (513, 76.3 and 24.6 ppm) for water hyacinth in the year 2007-08 for vemicompost. While in 2008-09 highest Fe content (1244 ppm) was found in Ipomea and Zn, Cu were recorded highest significant (74.0 and 19.0) in parthenium vermicompost in the year 2008-09. These views are also corroborated by Bansal and Kapoor (2000).

Thus, it is obvious that vermicompost obtained from all 4 weed residues taken under investigation exhibited remarkable increase in nutrient concentration over their partial decomposition status.

It is also remarkable that addition of different additives for hastening the vermicomposting resulted into improvement in the concentration of nutrients than the composts prepared without use of any additive. The woody and fibrous portion of the substrata digested during the decomposition period by the action of different decomposers into organic matter, thereby concentration of minerals nutrients enhanced in vermicomposts. Dickerson (1994), Gangadhar and Andanigowda (1995) and Jayanthi et al. (2002) reported similar NPK range in different substrata as recorded in this finding.

Recovery percentage

The maximum recovery percentage of vermicompost 61.31% and 67.87% during 2007-08 and 2008-09 as well as in pooled 64.59% in water hyacinth. Whereas, the lowest recovery percentage of vermicompost 42.47% and 43.25% during 2007-08 and 2008-09 as well as in pooled 42.86% was noted under Lantana camera. The Trichoderma and cowdung recorded the highest recovery percent (58.75 and 62.81%) in the year 2007-08 and 2008-09 as well as in pooled 60.78%.

Conclusion

Thus, it is concluded that water hyacinth and trichoderma + cowdung proved to be a good additive for increasing the rate of decomposition of substrata and recovery percentage of vermicompost. *Eiesenia foetida* earthworms increased their weight by (241.25 g) with conversion rate (107.12 g/day), recovery percentage (64.59) with water hyacinth. Trichoderma + cowdung used as additive proved to be more effective with respect to weight gain by worms (130.81 g) as well as conversion rate (788.69 g/day) and recovery percentage (60.78).

Further it can be concluded that N, P, K, Fe, Zn and Cu in the vermicomposts were increased when water hyacinth, parthenium, ipomea and lantana wee used for preparation of vermicompost. The concentration of these nutrients further increased in vermicompost with the addition of different additives in ascending order as Trichoderma, cowdung and both of these over no addition of any additives.

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