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VERMICOMPOSTING : RECYCLING ORGANIC WASTES INTO VALUABLE ECOFRIENDLY FERTILIZER

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Abstract

The investigation was undertaken to explore the suitability and potential use of earthworm (*Eudrilus eugineae*) to management of mango litter waste with animal waste, home waste, vegetable waste and paper waste combinations with the production of vermicompost during *Rabi* season of 2011-12. As far as the manurial value is concerned, the treatment (**T_3**) *i.e.* mango litter + vegetable waste was found to be the best from the point of total micronutrients (Fe, Mn, Cu and Zn) content in final vermicompost by the use of earthworm is due to the vermic activity. The vermicomposting as best technology for the recycling of mango litter waste and production of good quality manure from different wastes by using earthworm (*Eudrilus eugineae*). Mango litter + vegetable waste was found to be the best source for rapid composting (70.67 days) followed by mango litter + home waste (73.67 days).

Key words : Vermicompost, micronutrient, mango litter, organic and *Eudrilus eugineae*.

Introduction

The key role of earthworms in improving soil fertility has been known since the dawn of agriculture, but their potential contributions towards agricultural production and pollution control have received the attention recently. With its marvellous capability of breaking, grinding, churning, assimilation and tunnelling, it has proved to be marvellous converter of wastes. Earthworms feed on any organic waste, consume two to five times their body weight and after using 10-15 per cent of the feedstock for their growth, excrete the mucus coated undigested matter as worm cast. Vermicastings are rich sources of macro and micro-nutrients, vitamins, enzymes, antibiotics, growth hormone and immobilized micro flora (Bhawalkar, 1991). Vermicompost refers to organic manure produced by earthworms. Vermicomposting is an appropriate technique for the disposal of non-toxic solid and liquid organic wastes. It helps in cost effective and efficient recycling of animal wastes, crop residues and agro-industrial wastes using low energy. It was therefore, imperative to convert the different wastes to generate in huge amount to produce good quality of vermicompost with a minimum period of time.

Materials and Methods

The present investigation was carried out to explore the suitability and potential use of earthworms to management of mango litter waste with animal waste, home waste, vegetable waste and paper waste combination with the production of vermicompost during *Rabi* season of 2011-12 for ninety days under glass house conditions [Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (Maharashtra)], India. For preparation of vermicompost the dried leaves of mango *i.e.* mango litter was used as a main substrate and other wastes *viz*., animal waste (cow dung), home waste, vegetable waste and paper waste were used as a waste material for different combinations for preparation of vermicompost (table 1). After sufficient watering of the vermibed layer (waste material combination) to 50 per cent moisture content, hundred earthworms of *Eudrilus eugineae* species brought from "Institute of Natural Organic Agriculture, Pune" were introduced as an optimum inoculating density in the vermibed of each crates. The material in the crate was turned over manually at an interval of one month. Optimum moisture level of 50 per cent and average relative humidity was maintained throughout the period

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Table 1 : Quantity of substrate and wastes used for vermicomposting.

Tr. no.	Details of treatments	Treatment	Quantity of wastes (kg)					Total quantity (kg)
			Mango litter (ML)	Cow dung (CD)	Vegetable waste (VW)	Home waste (HW)	Paper waste (PW)	
T_1	Mango litter (control)	ML (control)	5	-	-	-	-	5
T_2	Mango litter + cow dung	ML + CD	5	1.25	-	-	-	6.25
T_3	Mango litter + vegetable waste	ML + VW	5	-	1.25	-	-	6.25
T_4	Mango litter + home waste	ML + HW	5	-	-	1.25	-	6.25
T_5	Mango litter + paper waste	ML + PW	5	-	-	-	1.25	6.25
T_6	Mango litter + vegetable waste + home waste + paper waste	ML + VW + HW + PW	5	-	0.416	0.416	0.416	6.25
T_7	Mango litter + vegetable waste + cow dung	ML + VW + CD	5	0.625	0.625	-	-	6.25
T_8	Mango litter + home waste + cow dung	ML + HW + CD	5	0.625	-	0.625	-	6.25
T_9	Mango litter + paper waste + cow dung	ML + PW + CD	5	0.625	-	-	0.625	6.25
T_{10}	Mango litter + vegetable waste + home waste + paper waste + cow dung	ML + VW + HW + PW + CD	5	0.312	0.312	0.312	0.312	6.25

of composting. To understand the nutrient release pattern under the influence of earthworms and time of composting, an incubation study was conducted for ninety days in Completely Randomized Design comprising of ten treatment combinations replicated three times (Panse and Sukhatme, 2000). The treatment wise vermicompost samples were collected at 30, 60 and 90 days and analyzed for micronutrients (Fe, Mn, Zn and Cu) content by using standard procedure given by (Lindsey and Norvell, 1978).

Results and Discussion

Number of days

The data presented in table 2 and illustrated indicates the period required for complete vermicomposting of different waste material with earthworm species *Eudrilus eugineae*, which varied from 70.67 to 89.33 days. The days required for maturation of vermicomposting material were minimum for mango litter + vegetable waste (70.67 days) and maximum for mango litter + paper waste (89.33 days) indicated that degradation of organic matter was dependent on the C:N ratio of mixtures being composted. Talashilkar *et al*. (1999) observed that an inoculation of earthworm such *E. foetida* and *E. eugineae* resulted into reduction in the period of compost maturation of mango leaves from 135 to 120 days and that of kitchen garbage from 90 to 60 days.

Micronutrient content

The final nutrient content of compost is dependent on the initial nutrient present in the waste. Vermicompost of mango litter alone (**T_1**) noted the lowest content of Fe at all observational periods (76.67, 767.5 and 1535 ppm at 30, 60 and 90 days, respectively). Further, the data revealed that the combination of ML+CW (**T_2**) recorded the highest Fe (866.7 ppm) content at 30 days. Whereas at 60 and 90 days, treatment **T_3** (mango litter + vegetable waste) recorded the significantly highest Fe (1572.5 and 31.45 ppm) content in vermicompost. The data indicated that the Fe was greater in final vermicompost than initial mixture. The increase in Fe content with different combination over single substrate indicated accelerated mineralization with selective feeding by earthworms on material containing these metals (Prakash and Karmegam, 2010). Vermicompost of mango litter alone ML (**T_1**) noted the lowest content of Mn at all observational periods (7.46 ppm, 28.33 ppm, 56.67 ppm at 30, 60 and 90 days, respectively). Addition of vegetable waste to mango litter substrate (**T_3**) registered the significantly highest Mn content under all observational periods (13.5 ppm, 48.33 ppm, 96.67 ppm at 30, 60 and 90 days, respectively). Somewhat higher value of Mn content with mango litter compost and mango litter + cow dung compost were reported by Acharya (2010).

Table 2 : Period required and changes in micronutrients content during vermicomposting of the different waste material at 30, 60, 90 days.

Tr. No.	Number of days	Fe (ppm)			Mn			Zn (ppm)			Cu (ppm)		
		30	60	90	30	60	90	30	60	90	30	60	90
T_1	84.67	76.6	767.5	1535.0	7.47	28.33	56.67	8.95	10.80	17.90	2.13	2.75	5.50
T_2	80.00	866.7	1042.8	1651.7	9.10	39.17	78.33	14.05	22.87	28.10	4.47	4.68	9.37
T_3	70.67	818.3	1572.5	3145.0	13.50	48.33	96.67	54.90	84.67	109.8	4.90	6.08	12.17
T_4	73.67	675.0	1278.3	2556.7	12.47	41.50	84.67	54.02	82.87	108.03	4.37	5.23	10.47
T_5	89.33	140.0	833.3	1611.7	8.57	39.50	70.83	9.32	12.67	18.63	2.50	3.15	6.30
T_6	79.67	636.7	929.2	1858.3	12.47	41.00	82.50	29.52	43.47	59.03	3.80	5.59	7.47
T_7	82.00	526.7	1163.3	2326.7	12.53	44.33	87.50	34.42	34.33	68.83	4.43	4.68	7.37
T_8	78.00	440.0	902.5	1828.3	10.73	39.33	78.67	29.27	41.63	58.53	3.27	4.15	8.30
T_9	81.33	405.0	816.7	1633.3	9.50	35.50	76.83	22.42	32.17	44.90	2.80	3.63	7.27
T_{10}	82.33	473.3	871.7	1743.3	10.03	42.75	85.50	24.37	34.73	48.73	3.60	4.07	8.07
S.E. ±	**0.49**	**16.20**	**46.99**	**60.14**	**0.21**	**0.91**	**2.17**	**0.12**	**0.30**	**0.22**	**0.19**	**0.11**	**0.24**
C.D. (P=0.01)	**1.99**	**65.19**	**189.09**	**251.98**	**0.87**	**3.68**	**8.75**	**0.47**	**1.19**	**0.89**	**0.76**	**0.46**	**0.95**

The higher amount of Mn content in vermicompost of mango litter + vegetable waste may be due to the fact that the vegetable waste contained higher concentration of Mn (Jadia and Fulekar, 2008).

In respect to zinc and copper content in vermicompost, the significantly highest value of zinc (54.90, 84.67 and 109.80 ppm) and copper (4.90, 6.08 and 12.17 ppm) were found with treatment $\mathbf{T_3}$ (mango litter + vegetable waste) and which was significantly superior over rest of all treatments at 30, 60 and 90 days, respectively. While vermicompost of mango litter alone ($\mathbf{T_1}$) noted the lowest content of Zn (8.95, 10.80 and 17.90 ppm) and Cu (2.13, 2.75 and 5.50 ppm) at all observational periods at 30, 60 and 90 days, respectively. Bhangrath (1997) reported that maximum Cu content in the compost of kitchen garbage is due to the addition of mineral matter through various types of vegetable waste such as carrot, brinjal, tomato, leafy vegetables etc.

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