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Changes in colour and temperature during vermicomposting of different organic wastage

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Abstract
In normal vermicomposting black colour indicated in vegetable market waste, very dark brown in soybean straw, dark grey in sugarcane trash and very dark brown in sugarcane trash + soybean straw. While in case of the modified vermicomposting black colour of vermicompost indicated in vegetable market waste, very dark grey in soybean straw, very dark grey in sugarcane trash and very dark grey in sugarcane trash + soybean straw. The result indicated that the temperature was recorded significantly higher in normal vermicomposting (M_1) than modified vermicomposting (M_2) at 15 to 60 days. In treatment the maximum reduction of temperature was recorded with vegetable market waste (T_3) 24.83 ^{0}C over to soybean straw (T_2) 27.17 ^{0}C, sugarcane trash + soybean straw (T_4) 27.67 ^{0}C and sugarcane trash (T_1) 28.67 ^{0}C at all days.

Keywords: Organic wastes, soil, earthworm, colour and temperature

Introduction
Vermi is the Latin Word for worm. Vermicomposting is simply composting with worms. vermicomposting refers to the method of converting organic waste in to worm castings. It is one of the most cost efficient and environmentally friendly methods of waste disposal (Albanell and Plaixats, 1998). Vermicomposting is the best biotechnology to reduce the load on the treatment and disposal of biodegradable agro waste. Earthworms have ability to convert organic waste into valuable resources containing plant nutrients and organic matter, which are essential for maintaining soil productivity.

Vermicompost retains nutrients for long time and while the conventional compost fails to deliver the required amount of macro and micronutrients including the vital NKP to plants in shorter time, the vermicompost does. Vermicompost contains plant hormones like auxin and gibberellins and enzymes which believed to stimulate plant growth and discourage plant pathogens. It improves the fertility and water holding capacity of the soil. It also enriches the soil with useful microorganisms which add different enzymes like phosphatases and celluloses to the soil. Vermicompost enhances germination, plant growth and thus overall crop yield (Gajalakshmi and Abbasi, 2004).

Materials and Methods
Experiment was carried out on changes in chemical properties during vermicomposting of organic residues as influenced by earthworm activity during the year 2015-16 at College of Agriculture, Parbhani. The experiment was laid in factorial completely randomized block design (FRBD) with three replications consisting of two levels of vermicomposting method (normal and modified vermicomposting) and four levels of organic residues in normal vermicomposting (sugarcane trash, soybean straw, vegetable market waste, sugarcane trash + soybean straw) and in modified vermicomposting (sugarcane trash + soil, soybean straw + soil, vegetable market waste + soil, sugarcane trash + soybean straw + soil). The vermicomposting samples were collected at different stages viz., 15th, 30th, 45th, and 60th days and analyzed for its qualities.

The residues *i.e.*, sugarcane trash and soybean straw were collected from farm of College of Agriculture, Parbhani. The vegetable market waste was collected from vegetable market in Parbhani. The blocks were filled with alternate layer of organic residues along with FYM in normal vermicomposting and then blocks were filled with organic residues along with FYM and soil in modified vermicomposting. Species of earthworms *Eisenia foetida* were brought from vermicomposting Unit, Dept. of Soil Science and Agricultural Chemistry, VNMKV, Parbhani. These earthworms were inoculated in vermicomposting block after 10 days from block filling.

Results and Discussion

Periodical changes in colour during vermicomposting

Comparative variation in colour of vermicompost prepared by normal and modified vermicomposting from 15 to 60 days. In normal vermicomposting black colour indicated in vegetable market waste + dung (M_1T_3), very dark brown in soybean + dung (M_1T_2), dark grey in sugarcane trash + dung (M_1T_1) and very dark brown in sugarcane + soybean + dung (M_1T_4).

Table 1: Periodical changes in colour during vermicomposting

Tr No.	Treatments	Colour			
		15 day	30day	45 day	60 day
Normal Vermicomposting					
M_1T_1	Sugarcane trash + dung	Dark grey	Dark grey	Dark grey	Dark grey
M_1T_2	Soybean straw + dung	Dark brown	Dark brown	Dark brown	V. Dark brown
M_1T_3	Vegetable market waste + dung	Dark brown	Dark brown	Black	Black
M_1T_4	Sugarcane trash + soybean straw + dung	Dark brown	Dark brown	Dark brown	V. Dark brown
Modified Vermicomposting					
M_2T_1	Sugarcane trash + dung	Black	Black	V. Dark grey	V. Dark grey
M_2T_2	Soybean straw + dung	Dark grey	Dark grey	V. Dark grey	V. Dark grey
M_2T_3	Vegetable market waste + dung	V. Dark grey	V. Dark grey	Black	Black
M_2T_4	Sugarcane trash + soybean straw dung	Dark grey	Dark grey	V. Dark grey	V. Dark grey

However in case of the modified vermicomposting black colour of vermicompost indicated in vegetable market waste + dung (M_2T_3), very dark grey in soybean + dung (M_2T_2), very dark grey in sugarcane + dung (M_2T_1) and very dark grey in sugarcane + soybean + dung (M_2T_4). The vermicomposting with vegetable market waste was noticed dark colour over to sugarcane trash in both method of vermicomposting. Similarly Nath *et al.* (2009) studied that the vermicompost was much darker in color than originally and had been processed more or less in to homogenous mixture after 50 to 60 days of earthworm's activity.

Periodical changes in temperature during vermicomposting

The result indicated in Table 2 showed that, temperature of vermicomposting material was influenced significantly and decline during normal and modified vermicomposting at all stages.

Table 2: Periodical changes in temperature during vermicomposting

Tr No.	Treatments	Temperature ^{0}C			
Method (M)		**15 day**	**30day**	**45 day**	**60 day**
M_1-Normal vermicomposting		34.17	30.58	28.50	27.50
M_2-Modified vermicomposting		32.42	29.92	27.67	26.67
SE±		0.38	0.23	0.31	0.24
CD at 5%		1.11	0.67	0.91	0.69
Treatment					
T_1	Sugarcane trash	37.00	29.33	29.33	28.67
T_2	Soybean straw	31.17	28.67	28.67	27.17
T_3	Vegetable market waste	29.00	25.67	25.67	24.83
T_4	Sugarcane trash + soybean straw	36.00	28.67	28.67	27.67
SE±		0.54	0.33	0.44	0.34
CD at 5%		1.56	0.94	1.28	0.98
Interaction (M × T)					
SE±		0.76	0.46	0.63	0.48
CD at 5%		2.21	1.33	1.81	1.39
General mean		33.29	30.25	28.08	27.08

In normal vermicomposting (M_1) significantly higher temperature 34.17 to 27.50 ^{0}C was recorded than modified vermicomposting (M_2) was 32.42 to 26.67 ^{0}C temperature at 15 to 60 days. Hence, modified vermicomposting method significantly superior over normal vermicomposting method at 15 and 60 day but at 30 to 45 days they remained at par to each other. The data further revealed that, the temperature of vermicomposting material was significantly affected due to different crop residues at all the stages of vermicomposting. During vermicomposting the maximum reduction of temperature was noticed with vegetable market waste (T_3) 24.83 ^{0}C over to soybean straw (T_2) 27.17 ^{0}C, sugarcane trash + soybean straw (T_4) 27.67 ^{0}C and sugarcane trash (T_1) 28.67 ^{0}C at all days. Further, the result showed that decreasing trend of temperature was observed with decomposition of organic wastes in vermicomposting at different stages. The temperature decreased periodically from 33.29 ^{0}C to 27.08 ^{0}C during 15 to 60 days of vermicomposting.

Table 3: Interaction effect of vermicomposting methods and organic wastes on temperature.

Method level	**Level of organic wastes 15 day**				
Treatment	**T1**	**T2**	**T3**	**T4**	**Mean**
M_1	38.00	31.67	29.33	37.67	34.17
M_2	36.00	30.67	28.67	34.33	32.42
SE±	0.76				
CD at 5%	2.21				
Method level	Level of organic wastes 30 day				
Treatment	T1	T2	T3	T4	Mean
M_1	34.00	30.00	26.33	32.00	30.58
M_2	31.67	29.00	26.67	32.33	29.92
SE±	0.46				
CD at 5%	1.33				
Method level	Level of organic wastes 45 day				
Treatment	T1	T2	T3	T4	Mean
M_1	30.00	29.67	26.00	28.33	28.50
M_2	29.00	27.33	25.33	29.00	27.67
SE±	0.63				
CD at 5%	1.81				
Method level	Level of organic wastes 60 day				
Treatment	T1	T2	T3	T4	Mean
M_1	28.67	28.00	25.00	28.33	27.50
M_2	28.67	26.33	24.67	27.00	26.67
SE±	0.48				
CD at 5%	1.39				

Interaction effect (Table 3) between vermicomposting method and treatment (M × T) was found to be significant at all the stages of vermicomposting. The data indicated that, the maximum reduction of temperature was observed with the treatment combination of modified vermicomposting × vegetable market wastes (M_2T_3) over rest of the treatment combination and it was at par with treatment combination normal vermicomposting × vegetable market wastes (M_1T_3) and modified vermicomposting × soybean straw (M_2T_2) during 15 days, but 30 to 60 days temperature of modified vermicomposting × vegetable market waste (M_2T_3) over to all treatment and it was at par with normal vermicomposting × vegetable market waste (M_1T_3). Temperature was decrease at the end of vermicomposting process and depends upon the type of organic wastes for decomposition. These findings matches with result obtained by Girija *et al.* (2005) [3] studied that in the maturation phase with the earthworm *Eisenia foetida* the temperature was the same (25 ^{0}C) for both the weeds.

Conclusion

The vermicompost of vegetable waste acts as an excellent base for the establishment and multiplication of beneficial and symbiotic microbes. This is a eco-friently and cost effective method. It is an ideal method for the management of solid waste. Hence concluded that vermicomposting with vegetable market waste was noticed dark colour over to sugarcane trash in both method of vermicomposting. The periodically decrease of temperature with modified vermicomposting followed by normal vermicomposting. Temperature should be maintained in between 25-30 °C for proper activity of microorganisms and earthworms.

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