AN AJSS

An Asian Journal of Soil Science

Volume 10 | Issue 1 | June, 2015 | 114-118 | e ISSN-0976-7231 ■ Visit us : www.researchjournal.co.in

Research Article

DOI : 10.15740/HAS/AJSS/10.1/114-118

Influence of agricultural wastes on quality of vermicompost

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Received : 16.04.2015; Revised : 30.04.2015; Accepted : 10.05.2015

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Summary

The experiment was carried out during 2004-2005 at Radiotracer lab of Department of Soil Science and Agricultural Chemistry, Marathwada Agriculture University, Parbhani with seven treatments and five replications, laid out in design Randomized Block Design (RBD). The nutrient status such as total nitrogen, organic carbon,total phosphorus and potassium were recorded at various stages *viz.*, 30, 60 and 90 days after completion of vermicompost. The total nitrogen content was recorded from 0.51 to 1.84 per cent. There was continuous increase in nitrogen content. Glyricidia found to be superior over other treatments with value 1.84 per cent followed by vegetable waste 1.69 per cent and parthenium 1.41 per cent .Garden waste recorded lowest value of total nitrogen 0.51 per cent. The phosphorus showed similar trend of increased value of phosphorus compared to their initials. Significantly superior value was observed in glyricidia 0.82per cent followed by vegetable waste 0.73 per cent and parthenium 0.71per cent. The lowest phosphorus was recorded in garden waste 0.21 per cent. The values of potassium partanis slightly greater than unity, during maturation period of vermicompost.The lowest value was observed in garden waste 0.45 per cent which was increased by 0.15 per cent over initial. Also glyricidia found increased value of potassium 1.18 per cent over its initial. Vegetable market waste recorded highest K content 1.22 per cent followed by parthenium 1.13 per cent. Significant variation in organic carbon content was found during vermicompost preparation which ranged from highest value of organic carbon 26.59 per cent in parthenium to the lowest value of glyricidia 19.02 per cent. Other treatments lies in between them with minor differences in organic carbon content. As compared to orginal C:N ratio, wheat straw recorded maximum drop from 73.14 to 23.20. All treatments showed narrowed C:N ratio *i.e.*, less than 25 at the end of maturation period. E4:E6 ratio measured during different growth stages of vermicompost were tending towards unity. The highest value was recorded for glyricidia 1.14 followed by vegetable waste 1.09, parthenium 0.78, sugarcane trash 0.71, wheat straw 0.68 and sunflower husk 0.47. The nutritive value of agricultural waste was increased in vermicompost.

Key words : Vermicompost, Earthworms, Agricultural waste

How to cite this article : Kulkarni, V.V. and Kuwar, P.V. (2015). Influence of agricultural wastes on quality of vermicompost. *Asian J. Soil Sci.*, **10**(1) : 114-118.

Introduction

Indian agriculture is passing through a dilemma of resource shortage on one hand and waste disposal problem on the other hand. The gap between demand of plant nutrients to agriculture remain to be wide enough leading to danger of shortfall in agriculture production.

On other hand lot of organic residues which are generated as a results of many fold increase in agricultural production are left unattended. On an average nearly 204 million tonnes of crop residues besides 1000 to 1050 million tones of wet dung is generated annually .This marked increase in the generation of biodegradable waste calls for serious attention not only to the disposal problem but also to their resource potential.The term vermicomposting means use of earthworms as a versatile bioreactor for composting organic residues. They consume 80 per cent organic matter and 20 per cent soil. Indian cities and rural areas produces nearly 7000 million metric tonnes of organic wastes (Bhide,1994) per annum. The recycling of organic waste through vermicomposting , ordinary composting may minimise environmental pollution and increase fertilizer value of manures and reduces use of chemical fertilizers.

Though agriculture scenario of India has been changed due to modern intensive agriculture with high dose of fertilizer, the toxicity due to high amount of salt as a residues, deteriorate physical, chemical, and biological properties of soil. By keeping such review in mind, the present investigation was conducted on influence of agricultural wastes on quality of vermicompost.

Resource and Research Methods

The experiment was carried out during 2004-2005 at Radiotracer lab of Department of Soil Science and Agricultural Chemistry, Marathwada Agriculture University, Parbhani in order to study the influence of agricultural wastes on quality of vermicompost with seven treatments and five replications, laid out in Randomized Block Design (RBD). The treatments were T_1- sunflower husk + dung + soil, T_2-wheat straw + dung + soil, T_3- sugarcane trash + dung + soil, T_4- glyricidia + dung + soil, T_5- garden waste + dung + soil, T_6- vegetable market waste + dung + soil, T_7 - parthnium weed + dung + soil. In each pot equal quantity of earthworms *i.e.*, 20 were inoculated. Samples were collected at 30, 60, 90 days after completion of vermicompost *i.e.*, granular dark brown-black colour.The heap was made in shade and uppermost compost was sieved to separate out earthworms (var. *Eisenia foetida)*. The soil selected for investigation was clayey in texture with alkaline in reaction.The nutrient status of soil was medium in organic carbon, available N, available P and available K. The nutrient status of agricultural waste used for vermicompost was analyzed by different methods *viz.*, total N by Microkjeldhal method (A.O.A.C., 1965); total P Vanadomolybdate by yellow colour triacid extract (Jackson, 1973); total K by Flame photometer method (Jackson, 1973); organic carbon by dry combustion method (Chopra and Kanwar, 1980); E_4: E_6 by measuring absorption at 465 and 665 nm wavelength (Stevenson, 1982).

Statistical analysis :

Statistical analysis was carried out by following the standard methods given by Panse and Sukhatme (1967).

Research Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Total nitrogen content of vermicompost at various stages :

There was increase in total nitrogen at various stages of vermicomposting under different agricultural waste (Table 1) indicating highest total N in glyricidia (1.84 %) followed by vegetable waste (1.69 %) and parthenium weed (1.41 %). Though increase in total N was recorded in vermicompost with time the magnitude of increase was lower in order as wheat straw,sunflower husk,garden waste and sugarcane trash. The increase in total nitrogen was attributed to the inherently high N content in glyricidia and vegetable waste and subsequent digestion of N by earthworms and N mineralization. Gupta and Ram Sakal (1967) found more total nitrogen in cast than the surround soil. Similar findings were reported by Mulongoy and Bedret (1992).

Total phosphorus content in vermicompost at various stages :

Total phosphorus content in vermicompost with periodical interval under various waste material, showed similar trend as that of total nitrogen. Highest enhancement was observed under all treatments of waste material at 90 days (Table 1). Among the treatments of waste material, highest total P (0.82 %) was accumulated under glyricidia followed by vegetable waste (0.73 %). However, lowest total P was noticed under wheat straw (0.28 %) followed by sugarcane trash (0.29 %). This different content of total P may be associated with the

Table 1 : Total N, P and K content of vermicompost at various stages (%)

Tr. No.	Treatments	Nitrogen (%)			Phosphorus (%)			Potassium (%)		
		30 DAF	60 DAF	90 DAF	30 DAF	60 DAF	90 DAF	30 DAF	60 DAF	90 DAF
T_1	Sunflower husk	0.62	0.73	0.84	0.26	0.39	0.48	0.81	0.93	1.04
T_2	Wheat straw	0.74	0.82	0.92	0.16	0.23	0.28	0.75	0.86	0.99
T_3	Sugarcane trash	0.68	0.70	0.80	0.20	0.25	0.29	0.93	1.01	1.11
T_4	Glyricidia	1.24	1.38	1.84	0.63	0.72	0.82	0.96	1.03	1.18
T_5	Garden wastes	0.44	0.48	0.51	0.14	0.18	0.21	0.28	0.34	0.45
T_6	Vegetable market wastes	1.11	1.22	1.69	0.54	0.66	0.73	1.11	1.22	1.31
T_7	Parthenim weed	1.02	1.11	1.41	0.54	0.64	0.71	1.04	1.13	1.22
	S.E. ±	0.0304	0.0192	0.0185	0.0202	0.0177	0.0189	0.0149	0.0189	0.0189
	C.D. (P=0.05)	0.0937	0.0591	0.0570	0.0623	0.0545	0.0582	0.0458	0.0583	0.0582

Table 2 : Organic carbon, C:N ratio and E_4:E_6 ratio of vermicompost at various stages

Tr. No.	Treatments	Organic carbon (%)			C:N ratio			E_4:E_6 ratio		
		30 DAF	60 DAF	90 DAF	30 DAF	60 DAF	90 DAF	30 DAF	60 DAF	90 DAF
T_1	Sunflower husk	37.11	27.18	20.83	59.89	37.27	24.79	0.27	0.38	0.47
T_2	Wheat straw	54.13	38.48	21.35	73.14	46.93	23.20	0.43	0.50	0.68
T_3	Sugarcane trash	36.92	24.98	19.94	54.31	35.68	24.92	0.54	0.60	0.71
T_4	Glyricidia	34.94	29.41	19.02	28.19	21.32	10.33	0.90	0.96	1.14
T_5	Garden wastes	32.34	26.52	20.97	73.5	55.27	41.13	0.17	0.23	0.30
T_6	Vegetable market wastes	35.25	25.35	20.11	31.75	20.61	11.89	0.82	0.91	1.09
T_7	Parthenium weed	33.19	28.01	26.59	32.54	25.23	18.86	0.63	0.69	0.78
	S.E. ±	1.3199	1.2848	0.0567	0.410	0.3014	0.2128	0.012	0.021	0.017
	C.D. (P=0.05)	4.0609	3.9531	0.11747	1.261	0.9275	0.6547	0.038	0.053	0.053

higher P content in glyricidia, vegetable waste and parthenium and their subsequent digestion and mineralization through earthworm activity during vermicomposting. The similar results were recorded by Gupta and Ram Sakal (1967) and Sharply and Syers (1976).

Total potassium content in vermicompost at various stages :

There was similar trend of increase in total potassium with periodical incubation of wastes in presence of earthworms as that of total N and total P. But sources of waste material made significant differences in total potassium content (Table 1). More critical insight data revealed that higher total K (1.31 %) was observed under vegetable waste followed by parthenium weed (1.22 %). Sugarcane trash and sunflower husk showed moderate increase in total K. Whereas wheat straw has lowest total K. In general relatively more potassium was absorbed and translocated in fruiting vegetables and addition of soil was also a source of total K. Interaction of added soil K and decomposition of vegetable waste through microbes and subsequent activity by earthworms explains highest total K in vermicompost. Similar findings were reported by Srinivasarao *et al.* (1996) and Mulongoy and Bedoret (1992).

Organic carbon content of vermicompost at various stages :

The organic carbon was in the range of 20 per cent which is better as far as nutrient availability is concerned. The value of parthenium was highest for the organic carbon 26.59 per cent which may be due to its hardy nature after drying (Table 2). Wheat straw, garden waste, sunflower husk, vegetable waste followed it with decreasing organic carbon content. Glyricidia recorded lowest organic carbon 19.02 per cent which may be due to high moisture content in it. Gupta and Ram Sakal (1967), Syers and Springette (1984) and Daniel and Anderson (1992) reported similar findings.

C:N ratio of vermicompost at various stages :

The C:N ratio of agricultural waste is very significant property as far as quality of compost and nutrient availability is concerned. The data on C:N ratio indicated that during maturation period of vermicompost ,all treatments showed decrease in C:N ratio (Table 2). The better decomposition and physical texture of vermicompost justifies the narrower ratio.Glyricidia recorded lowest C:N ratio (10.33) followed by vegetable waste (11.89).These values were self explanatory that the both residues decompose very fastly lowering carbon content and increasing nitrogen content due to net mineralisation process. Julka and Mukharji (1986), Shinde *et al.* (1994) and Choudhary *et al.* (2000) also reported similar findings.

E_4:E_6 ratio of vermicompost at various stages :

In general E_4:E_6 ratio provides the stage of decomposition and extend of maturity of humification process of organic matter. Higher E_4:E_6 ratio under glyricidia,vegetable waste indicated faster decomposition of organic waste material through biological process (by microbes) and by activity of earthworms. These values are indicative of final stage of decomposition. Higher kinetics of decomposition as compared to other waste material used in the present investigation. The data presented in (Table 2) on E_4:E_6 ratio revealed that the values were in between 0.30 to 1.14. The higher values were under glyricidia (1.14) followed by vegetable waste (1.09). However, garden waste recorded lowest (0.47) values of E_4:E_6 ratio followed by sunflower husk (0.47). The findings were supported by the results of Anandan (1988) and Malewar *et al.*(1998).

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