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Effect of Cow-Dung Slurry and *Trichoderma Spp.* on Quality and Decomposition of Teak and Bamboo Leaf Compost

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Abstract

The teak and bamboo leaf litter was decomposed by using cowdung slurry and decomposing culture at agronomy farm, College of Agriculture, Yavatmal during the year 2012-13. Eight different treatments were replicated thrice in randomized block design. C:N ratio were recorded maximum at initial period i.e. 30 days after composting then it gradually decreased upto 240 days after composting in both teak and bamboo leaf litter. The nutritional compositions of compost were recorded maximum in both leaf litter treated with cowdung slurry @10% and decomposing culture Trichoderma spp. @1kg/tonne over its individual addition. Per cent in Humic acid content was recorded maximum in both teak and bamboo leaf litter treated with cowdung slurry @10% and decomposing culture @1kg/tonne while fulvic acid was recorded maximum in both teak and bamboo leaf litter treated with cowdung slurry @10%.

Keywords: Cowdung slurry, C:N ratio, *Trichoderma*.

Introduction

Forest ecosystem is integrated and maintained by the transfer of matter and energy between producers, consumers and decomposers. The rate of litter decomposition is determined by the quality and quantity of the decomposer community, their physical environment and the substrate quality[1]. The plants of teak and bamboo of six years age produce about 3 to 5 t/ha/yr of leaf litter. If due care is taken for its proper management and utilization it will prove beneficial for improving nutritional status of the soil for maintaining the sustainable production as these residues left in the soil increase the organic matter level[2].

The rate of decomposition of tree biomass is higher in species having maximum ash and nitrogen content and lowest C/N ratio and lignin content[3]. The time of composting had definitely reduced by the use of fungi and adjustment of C: N ratio over normal practice of composting which required eight or more months for composting before good quality of compost could be obtained. The present study was therefore, undertaken to study the periodical changes in nutrient composition during the decomposition of teak and bamboo leaf litter and to evaluate the quality of teak and bamboo leaf litter compost.

Material and Methods

An experiment on compost preparation was conducted at Agronomy Farm, College of Agriculture, Yavatmal. Teak and bamboo leaf litter was available at site and cowdung was collected and made available close to the site and decomposing culture *Trichoderma* viz., *T.viride* and *T. harzianum* was used as bioagents.

The compost pits of size 1x1x1 m were filled treatment wise with teak and bamboo leaf litter separately. In each pit, leaf litter was evenly spread up forming a layer of 15 cm thickness. The experiment was conducted with eight treatments and three replication comprising of T_1- Teak leaf litter, T_2-Bamboo leaf litter, T_3-Teak leaf litter +CDS@10%+decomposing culture @ $1kgt^{-1}$, T_4-Bamboo leaf litter +CDS @ 10% + decomposing culture @ $1kgt^{-1}$, T_5-Teak leaf litter +decomposing culture @ $1kgt^{-1}$, T_6-Bamboo leaf litter +decomposing culture@$1kgt^{-1}$, T_7-Teak leaf litter + CDS @ 10%, T_8- Bamboo leaf litter + CDS @ 10%. The fresh cow dung slurry (CDS) with and without decomposing culture as per treatments were thoroughly mixed in a bucket containing 10 liters of water. The mixture was evenly sprinkled on the layer of leaf litter. In this way each pit was completely filled about 1 foot above ground and covered with cow dung and soil slurry and moisture content in each were maintained to 60 per cent as to check the moisture loss from pits. The compost samples were analyzed periodically (after 30, 60, 90, 120, 150, 180, 210, 240 days) for organic carbon, C: N ratio, total N, P, K, Ca, Mg, S and micronutrients like Fe, Cu, Mn and Zn. The humic and fulvic acid contents were assessed after complete decomposition of leaf litter.

Results and Discussion

C/N Ratio: The periodical changes in C:N ratio due to composting of teak and bamboo were significant figure-1. The lowering of C:N ratio were recorded in both teak (29.94 to 13.98) and bamboo (45.77 to 16.79) leaf litter due to inoculation of microbial culture @ 1 kg/tonn and cow dung slurry @ 10% (T_3 and T_4). The decomposition of teak leaf litter found faster

than the bamboo leaf litter due to maximum ash and nitrogen content and low C:N ratio and lignin content[4]. This was due to higher initial nitrogen content in teak leaf litter than bamboo. During decomposition process under acidic conditions, *T.viride* and *T. harzianum* contributed in hastening the decomposition of leaf litter [5]. Rapid decomposition of teak compared to bamboo might be due to the presence of easily decomposable and water soluble material in teak leaf litter compared to bamboo leaf litter. Waxy nature and lower nitrogen content contributed towards low decomposition rate in bamboo leaf litter[6].

The changes in C:N ratio was investigated and found a maximum of 19.54 in teak as against in bamboo leaf litter of 28.88 after 240 days of composting in T1 and T2 figure-1. In a combined treatment where litter, culture and CDS together applied (T3 and T4), the C:N ratio was 29.94, 27.86, 25.71, 23.22, 20.81, 18.43, 16.47 and 13.98 in teak while it was 45.77, 44.11, 41.04, 36.23, 31.10, 25.15, 21.87 and 16.79 in bamboo after 30, 60, 90, 120, 150, 180, 210 and 240 days of composting of teak and bamboo leaf litter figure-1. In *Trichoderma* alone treatment (T5 and T6), change was in the range of 31.97 at 30 days and decreased to 18.59 at 240 days after composting in teak leaf litter.

At 240 days after composting in bamboo leaf, C:N ratio was 24.56 while in the beginning i.e. 30 days after composting it was recorded 54.02 which clearly states a general decrease in C:N ratio by time figure-1. In CDS alone treatment (T7 and T8), C:N ratio changed from 32.34 to low of 18.80 in teak leaf litter while in bamboo leaf litter it was dropped from 54.55 to 27.41 from 30 days until 240 days after composting figure-1.

Nutritional status on composting: Nutritional composition of teak and bamboo leaf litter is furnished in table-1. Nitrogen varied from 1.49 to 1.68 per cent and 0.81 to 0.95 per cent, phosphorus varied from 0.60 to 0.75 and 0.57 to 0.70 per cent, potassium varied from 0.82 to 0.88 per cent and 0.67 to 0.76 per cent, calcium varied from 1.46 to 1.86 per cent and 1.25 to 1.54 per cent,

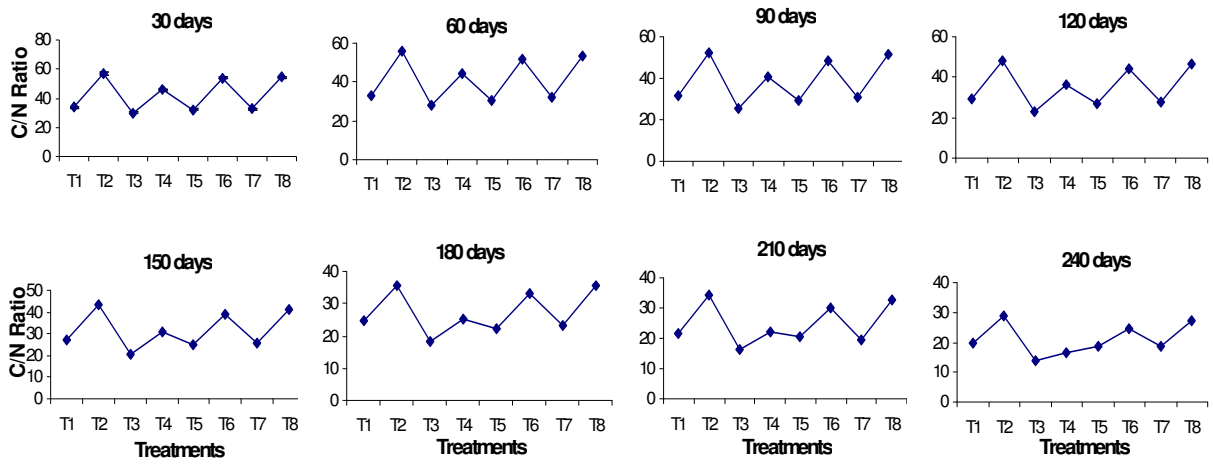

Figure-1
Changes in C/N Ratio during composting of leaf litter

Table-1
Effect of composting on nutritional composition of leaf litter compost

Treatment	N %	P %	K %	Ca %	Mg %	S %	Fe mg/kg	Cu mg/kg	Mn mg/kg	Zn mg/kg
T_1	1.49	0.60	0.82	1.46	0.50	0.72	117.9	53.2	77.9	50.9
T_2	0.81	0.57	0.67	1.25	0.52	0.61	109.1	41.9	67.6	54.6
T_3	1.68	0.75	0.88	1.86	0.67	0.85	132.3	63.4	91.0	61.5
T_4	0.95	0.70	0.76	1.54	0.78	0.74	123.7	49.6	78.9	65.8
T_5	1.55	0.67	0.80	1.78	0.60	0.77	130.4	55.3	86.5	60.1
T_6	0.83	0.65	0.68	1.36	0.63	0.66	115.2	44.6	75.1	62.7
T_7	1.52	0.63	0.81	1.62	0.52	0.77	122.4	54.4	84.3	57.5
T_8	0.81	0.62	0.66	1.30	0.58	0.65	112.4	44.2	73.3	60.2
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S. E. (m) ±	0.01	0.025	0.028	0.020	0.03	0.062	0.016	0.019	0.012	0.015
C.D. (0.05)	0.023	0.076	0.085	0.060	0.09	0.19	0.50	0.057	0.035	0.045

Magnesium varied from 0.50 to 0.67 per cent and 0.52 to 0.78 per cent, sulphur varied from 0.72 to 0.85 per cent and 0.61 to 0.74 per cent and micronutrient Iron varied from 117.9 to 132.3 and 109.1 to 123.1 mg/kg, manganese varied from 77.9 to 91 and 67.6 to 78.9, mg/kg, zinc varied from 50.9 to 61.5 and 54.6 to 65.8 mg/kg and copper varied from 53.2 to 63.4 and 41.9 to 49.6 mg/kg respectively as depicted in table-1.

maximum nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese and copper found in t3 while maximum zinc found in t4 which indicates that bamboo leaf litter rich in zinc as of teak leaf litter. This is due to difference in various physical and chemical properties of teak and bamboo. The content of ash was higher in leaf litter of teak[7].

The increase in nutrient content increased with decomposition rate. The significantly maximum content of these nutrient were recorded in treatment received both microbial culture and CDS in both the leaf litter of teak and bamboo. The content of nutrients were maximum in teak leaf litter than bamboo leaf litter table-1.

Humic acid and fulvic acid content: Monthly decomposition of leaf litter is positively related with temperature and soil moisture. Humic acid and fulvic acid was significantly influenced by different treatments figure-2. Humic acid ranged from 2.73 to 3.57 % and fulvic acid ranged from 12.12 to 15.51 % humic acid was higher in T_3-Teak leaf litter +CDS@10%+ decomposing culture@1kgt^{-1}. Humic acid content was higher with teak leaf litter compared to bamboo leaf litter. But fulvic acid content was highest with bamboo leaf litter + CDS@10% and it was higher with bamboo leaf litter compared to teak leaf litter. A significant increase in non-symbiotic nitrogen fixing capacity of the soil was in accordance with proliferation of aerobic non-symbiotic nitrogen fixing bacteria in soil [7], thus these processes also favored the changes in the humic and fulvic acid proportions during composting up to 240 days. Combined CDS and microbes treatment effect had although led to enrichment of humic acid and nitrogen[8].

Table-2
Changes in C/N ratio during composting of leaf litter compost

Treatment	30 days after	60 days after	90 days after	120 days after	150 days after	180 days after	210 days after	240 days after
T_1	33.67	32.69	31.79	29.33	27.34	24.79	21.5	19.54
T_2	56.97	55.61	52.64	48.00	43.33	35.61	33.97	28.88
T_3	29.94	27.86	25.71	23.22	20.81	18.43	16.47	13.98
T_4	45.77	44.11	41.04	36.23	31.10	25.15	21.87	16.79
T_5	31.97	30.77	29.33	27.11	24.64	22.31	20.39	18.59
T_6	54.02	52.07	48.7	44.13	38.73	33.09	30.00	24.56
T_7	32.34	32.26	30.4	27.9	25.61	23.08	19.55	18.80
T_8	54.55	53.03	51.59	46.56	40.92	35.57	32.5	27.41
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S. E. (m) ±	0.57	0.45	0.60	0.29	0.24	1.05	0.48	0.08
C.D. (0.05)	1.72	1.37	1.82	0.87	0.72	3.19	1.46	0.25

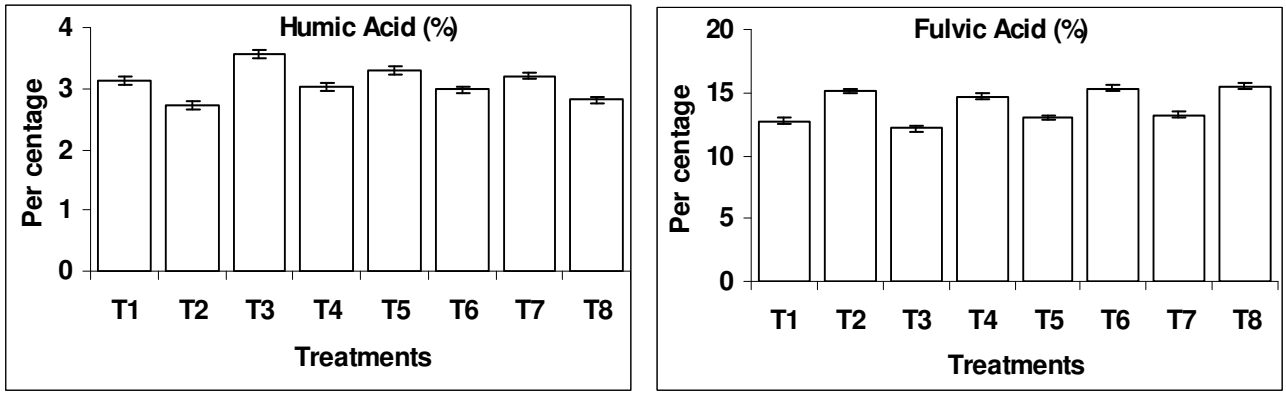

Figure-2
Percent content of Humic and Fulvic acid in Teak and Bamboo leaf compost

Table-3
Percent content of Humic and Fulvic acid in the composted leaf litter

Treatment	Humic acid %	Fulvic acid %
T_1	3.12	12.75
T_2	2.73	15.09
T_3	3.57	12.12
T_4	3.03	14.70
T_5	3.29	12.99
T_6	2.98	15.33
T_7	3.21	13.23
T_8	2.81	15.51
F test	Sig.	Sig.
S. E. (m) ±	0.06	0.20
C.D. (0.05)	0.17	0.60

Conclusion

The nutritional composition of compost, C:N ratio, humic acid, fulvic acid were observed superior in case of both leaf litter treated with 10 % cowdung slurry and 1 kg per tone of decomposing fungi culture. The decomposition was faster with a mixed treatment of CDS which contain more soluble plant constituents. Similarly cellulose, hemicellulose and lignin content also contributed for faster decomposition with the natural increase in temperature and CO_2 which correlates with the findings of Pande [9]. Decomposition of organic matter in general not only increased the microbial population but also enriched the soil by releasing available plant nutrients to a greater extent. This induced activities by various agents for mineralization[8,10]. Thus a wider C:N ratio help to stabilize the N in slowly biodegradable fraction and improve the soil on a long term basis.

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