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BIOLOGICAL AND NUTRIENT ENRICHMENT OF VERMICOMPOST

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ABSTRACT

An experiment was conducted to evaluate the quality and quantity of vermicompost under green house condition in the Department of Agricultural chemistry and Soil Science, Rajasthan College of Agriculture, Udaipur (Rajasthan). Vermicompost prepared from the four different organic sources viz Mustard straw, Wheat straw, Parthenium grasses and Guava leaves with enriched by two ways chemically and biologically. Chemically enriched by Rock phosphate 1%, Gypsum 1% and Rock phosphate + Gypsum 0.5% on each and Biologically enriched by Azotobactor inoculation. The treatments were three times replicated in completely randomized block design .The vermicompost were incubated up to 90 days , Whereas samples were drawn for analysis at 30,60 and 90 days.The results of the present investigation indicated that the supplementation of Rock Phosphate +Gypsum 0.5% on each with inoculation of Azotobactor showed a significant effect on release of different Macro,Micro nutrient, Humus fraction, Urease, Dehydrogenase activity and also increase microbial population over control. As per experimental result Guavas leaves based vermicompost supplemented with Rock phosphate + Gypsum 0.5 % each along with inoculated by Azotobactor gave highest content of P, Zn, Cu, S, Humic acid, Fulvic acid Urease, Dehydrogenese activity, Fe-P, Al-P, citrate soluble –P and all microbial populations.

Key words : *Vermicompost, rockphosphate, gypsum, azotocactor, wheat straw, mustrad straw, parthenium, guava leaf.*

Recycling of crop residues in agriculture brings in the much needed organic carbon and mineral matter back to the soil and can help in reducing the gap between supply and demand for plant nutrients. Lack of adeuuate organic recycling not only aggravate multinutrient deficiencies in soil plant system but also deteriorates soil productivity and create environmental pollution. India has vast potential of about 7000 million metric tones/year of crop residues and other organic materials such as farm wastes, kitchen wastes and dairy wastes (1) and can be recycled in sittu in vitro. Vermicomposting is one of the fastest and effective way of in vitro recycling organic materials in which organic wastes are converted into well decomposed and eco friendly rich source of available plant nutrients containing antibiotics, growth hormones, vitamins, enzymes and immobilized microflora. Epigeic earthworm such as Eisenia foetida, Eudrilus eargenic and Perionyx excavates are being commonly used for vermicomposting of crop residues and other biosolids available at farm. The rate of vermicomposting and quality of vermicompost can be improved by supplementation both chemical (2) and at various crop/organic residues and effect of supplementation with Azotobactor, Rock phosphate and Gypsum on quality and quantity of vermicompost.

Table-: Analytical methods used for vermicompost analysis

Nutrients	Digestion mixture /Extractant	Method	Reference
Nitrogen	H_2SO_4 - H_2O_2 digestion	Colorimetric estimation using Nessler's reagent	(4)
Phosphorus	HNO_3 –$HCLO_4$(10:4) digestion	Vanadomolybdo phosphoric acid yello colour method	(5)
Potassium	HNO_3 – $HCLO_4$ (10:4) digestion	Flame photometrically	(5)
Fe.Mn,Zn and Cu	DTPA extractable	Atomic absorption spectrophotometrically	(6)
Humus fractions		Acid alkali precipitation	(3)
Fungi Bacteria and Actinomycetes		Dilution plate method	(7)
Azotobactor		Most probable Number	(8)

MATERIALS AND METHODS

The experiment was conducted in the green house of the Department of Agricultural Chemistry and Soil Science, Rajasthan College of Agriculture, Udaipur (Rajasthan). The Eisenia foetida an epigeic species of earthworm was used for vermicomposting.

The chopped Wheat straw, chopped Mustard straw, crushed Guava leaves and chopped parthenium grasses (before flowring) were used. The materials were arrange by Agronomy and Horticulture farms, Rajasthan College of Agriculture. Fresh Cow dung provided by Livestock Farm Rajasthan College of Agriculture, Udaipur. Lignite based Azotobctor chroococcum having cfu 2.4/108/g was used. Rock phosphate used was 74 mesh containing 34%P2O5 and was supplied by RSMM Ltd., Udaipur. Gypsum was used containing 29.2% Ca and 18.6% S.

Details of Treatment used in vermicomposting : O_1 Mustrad straw, O_2 Wheat straw, O_3 Parthenium, O_4 Guava leaf. C_1 Control (Non supplement), C_2 Rock phosphate 1%, C_3 Gypsum 1%, C_4 Rock phosphate 0.5% and Gypsum 0.5%. B_1 Without *Azotobactor chroococcum,* B_2 with *Azotobactor chroococcum.*

Earthworm species–Eisenia foetida : The organic substrates were pre soaked in water for 15 days before mixing with cow dung. Decomposing cooled mixture of organic substrates and cow dung was inoculated with

Table-1: Effect of biological and mineral enrichment on Yield (Kg) and quality of vermicompost –C:N and C:P ratio at 90 days.

Treatments	Yield	C : N	C : P
Organic Sources			
Mustrad straw	15.50	25.32	50.62
Wheat straw	13.89	25.94	70.48
Parthenium	14.25	13.85	54.50
Guava leaves	14.13	17.43	43.95
SEm	0.14	0.28	1.01
CD	0.40	0.79	2.87
Mineral suppliments			
Control	14.24	24.33	82.23
Rock phosphate	14.02	21.33	42.91
Gypsum	14.00	19.90	58.38
Rock phosphate + Gypsum	14.52	16.97	36.03
SEm	0.14	0.28	1.01
CD	0.40	0.79	2.87
Azotobacter inoculation			
Without Azotobacter	14.25	24.27	62.13
With Azotobacter	14.14	17.00	47.65
SEm	0.10	0.19	0.72
CD	NS	0.55	2.03

Table-2: Effect of biological and mineral enrichment on Nitrogen,Phosphorus and potsssium (percent) at 30,60 and 90 days.

Treatments	Nitrogen			Phosphorus			Potassium		
	30	60	90	30	60	90	30	60	90
Organic Sources									
Mustrad straw	0.72	0.81	0.89	0.32	0.40	0.48	0.66	0.77	0.86
Wheat straw	0.78	0.90	0.97	0.27	0.37	0.38	3.36	3.56	3.78
Parthenium	2.95	3.05	3.15	0.64	0.75	0.83	4.21	4.32	4.48
Guava leaves	2.13	2.24	2.34	0.80	0.90	0.98	3.53	3.65	3.84
SEm	0.01	0.01	0.01	0.00	0.01	0.01	0.02	0.01	0.02
CD	0.03	0.04	0.04	0.01	0.01	0.01	0.05	0.05	0.07
Mineral suppliments									
Control	1.55	1.65	1.75	0.32	0.43	0.46	2.53	2.70	2.85
Rock phosphate	1.54	1.64	1.72	0.59	0.70	0.77	2.99	3.13	3.28
Gypsum	1.71	1.82	1.89	0.44	0.52	0.59	2.88	3.02	3.22
Rock phosphate + Gypsum	1.78	1.89	1.99	0.69	0.78	0.86	3.36	3.45	3.61
SEm	0.01	0.01	0.01	0.00	0.01	0.01	0.02	0.01	0.02
CD	0.03	0.04	0.04	0.10	0.01	0.01	0.05	0.05	0.07
Azotobacter inoculation									
Without Azotobacter	1.46	1.57	1.65	0.46	0.56	0.61	2.81	2.96	3.15
With Azotobacter	1.83	1.93	2.02	0.56	0.65	0.73	3.06	3.18	3.33
SEm	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01

Table-3: Effect of biological and mineral enrichment on Actinomycetes,Fungi,Azotobacter and Bacteria (*cfu g-1*106) population at 90 days.

Treatments	Actino-mycetes 90 Days	Fungi 90 Days	Azoto-bacter 90 Days	Bacteria 90 Days
Organic Sources				
Mustrad straw	18.20	0.20	2.74	179.00
Wheat straw	16.10	0.16	2.56	166.00
Parthenium	17.10	0.18	2.94	172.00
Guava leaves	19.30	0.21	3.11	196.00
SEm	0.22	0.002	0.29	2.67
CD	0.62	0.006	0.08	7.35
Mineral suppliments				
Control	15.20	0.15	2.14	138.00
Rock phosphate	17.70	0.20	3.15	178.00
Gypsum	15.80	0.17	2.78	170.00
Rock phosphate + Gypsum	22.00	0.22	3.29	227.00
SEm	0.22	0.002	0.03	2.67
CD	0.62	0.006	0.08	7.55
Azotobacter inoculation				
Without *Azotobacter*	1.43	0.01	2.11	17.20
With Azotobacter	33.90	0.36	3.56	339.00
SEm		0.001	0.02	1.89
CD		0.004	0.06	5.34

earthworms and a moisture level of 70% was maintained for a period of 90 days for the process of vermicomposting. The experimental data recorded were subjected to statistical analysis using analysis of variance as described by (9). The critical differences for the treatment comparision were worked out ,wherever the "F" test was found significant at 5% level of significvance.

RESULTS AND DISCUSSION

Yield of vermicompost at 90 days of incubation ranged from highest and lowest under Mustard straw and Wheat straw respectively (Table-1). Reduction in yield of vermicompost takes place mainly due to the degradation of organic fraction. (10) also reported that under suitable condition of decomposition, the material was reduced to about 50-70%, the compost mass substantially reduced with time. The result (Table-1) is clearly indicated that the significant reduction in C:N and C:P ratio of vermicompost at 90 days of incubation. C:N and C:P ratio are highest under Wheat straw based vermicompost.The decreasred C:N ratio occurred because each time organic compound are consumed by microorganisms, two third of carbon is given off as CO_2 and the remaining one third is incorporated along with nitrogen into microbial cells . The same result also showed that the decreased C:N ratio with Rock Phosphate and Azotobacter inoculation (11). (12) also observed a decrease in C:N ratio with the increase in time of decomposition . The experimental result are in tune with (13) who reported that the enrichment of garbage and mechanized compost with Rock Phosphate resulted in decreased in C:N rato for the finished product as composting proceeds.

The data presented in Table-2 showed the significant influence of the nutrient content in vermicompost prepared from the different organic sources with mineral supplementation and Azotobacter inoculation. The Nitrogen content in vermicompost during the composting period of 90 days was influenced significantly with all treatment except control and Rock phosphate 1% being significant at 30.60 and 90 days. The highest Nitrogen and Potassium content under Parthenium based vermicompost with enrichment of Rock phosphate + Gypsum 0.5% on each and Azotobacter inoculation. Phosphorus content superior under vermicompost of Guava leaves based with duel supplimention of Rock phosphate + Gypsum 0.5%. The effect of inoculation with Azotobacter and addition of varying percent of Rock phosphate was studied on N and P transformation increase during composting (11).

The experimental results showed in table no. 3 the highest populatios of Actinimycetes, Fungi, Azotobacter and Bacteria found in Guava leaves based vermicompost with enrichment of Rock phosphate and Gypsum 0.5% on each along with inoculation of Azotobacter at 90 days. (14) reported greatest increase in the number of fungi and actinomycetes during composting period.

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