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Effect of Organic Amendments on Soil Mycoflora

[1]Ravindra Kumar, [1]Seweta Srivastava, [2]Manisha Srivastava and [1]Asha Sinha
[1]Department of Mycology and Plant Pathology,
Institute of Agricultural Sciences, B.H.U., Varanasi-221005, India
[2]Department of Botany, Harish Chandra P.G. College, Varanasi-221001, India

Abstract: In present study, the influences of different organic soil amendments on soil fungi was studied. Soil organisms carry a wide range of processor that are important for soil health and partially in both natural and managed agricultural scales. The total number of organisms, the diversity of species and activity of soil biota will fluctuate as soil environment changes. Three types of soil amendments and fertilizers viz., urea, FYM and vermicompost were used to amend the cultivated agricultural soil. The fungi were isolated from soil by using dilution plate technique and soil plate method. The dynamics of soil fungi were observed qualitatively as well as quantitatively. The maximum number of fungi was recorded when soil amended with FYM (40.6×10^4 g^{-1}), urea (38.8×10^4 g^{-1}) of dry soil at different concentration 2.0, 1.5 and 2.0%, respectively. In control where soil was not amended with any organic amendment, the number of fungi was 13.0×10^4 to 16.8×10^4 g^{-1}, 14.4×10^4 to 16.8×10^4 g^{-1}, 13.8×10^4 to 16.8×10^4 g^{-1} in urea, FYM and Vermicompost, respectively. A total 25 fungi were observed during the experimental period. Eighteen were observed when soil amended with urea, twenty-two observed when soil amended with FYM and 20 when soil amended with vermicompost. In control soil only fifteen fungi were recorded. The result showed that the number of fungi was increased in amended soil. Qualitatively, the fungi *Rhizopus stolonifer*, *Aspergillus niger*, *Aspergillus flavus*, *Trichoderma harzianum*, *Penicillium citrinum*, *Alternaria alternata* and *Curvularia lunata*, White Sterile Mycelium and Black Sterile Mycelium were observed.

Key words: Mineral cycling, fertilizers, fungus culture, urea, farmyard manure (FYM), vermicompost

INTRODUCTION

The microorganisms carry out a number of transformations in the soil as part of their normal activities and at the same time they are instrumental in adding organic matter to soil (Brady and Weil, 1999). The total number of organisms, the diversity of species and the activity of the soil biota fluctuates with changing soil environment. These changes may be caused by natural or imposed systems. Plant residues provide sources of energy and nutrient for the biota, which turnover organic matter improve nutrient availability and soil structures and prevent disease and degrade pollutants. Soil biota can increase and reduce agricultural production (Badale and More, 2000). Well aggregated soils provides a better living environment for soil organisms and support larger population, soil-borne fungi not add

Corresponding Author: Manisha Srivastava, Department of Botany, Harish Chandra P.G. College, Varanasi-221001, India

mucus but the vast network of thread-like hyphae hold the soil particles together improving stability (Otten and Gilligan, 1998; Harris *et al*., 2003; Otten *et al*., 2004). Soil microbial activity is a biomarker of degradation of remediation (Pascual *et al*., 2000). The ecological studies of soil fungal flora was made by Reichardt *et al*. (2001), Li *et al*. (2001) and Marschner *et al*. (2003). In this respect, the soil microflora can be manipulated and protected to enhance the nutrient cycling, which improves chemical and physical properties and regulates the decomposition process in soil (Rezacova *et al*., 2007). Soil amendments such as plant residues, manures and composts play a major role in changing the soil ecosystem; its physio-chemical characteristics and soil microflora are of great significance in soil microbiology (Anastasi *et al*., 2005). Recently, several reports (Wada and Toyota, 2004; Girvan *et al*., 2005) have found that organic amendment may enhance soil functional stability mediated by soil microbial community. Microbial community composition cab be more sensitive to soil amendment with plant residues than microbial biomass and it is possible that the different forms of organic amendments such as organic fertilizers i.e., urea, FYM and vermicompost stimulate soil microbial growth and activity, with subsequent mineralization of soil nutrients (Randhawa *et al*., 2005), but the ability to deliver nutrients depends on the composition of the amendments. Since availability of carbon substrates largely controls microbial growth in soil, it is a key factor governing nitrogen, phosphorus and sulphur cycling. Previous studies have found that amendment with farmyard manure (Toyota *et al*., 1999) and spent mushroom compost (Piqueres *et al*., 2006) significantly affected soil microbial community structure. However, the effects of compost were found to vary depending on both the type of compost and the soil type (Piqueres *et al*., 2006). Microorganisms form a vibrant living community in the soil contributing to a number of nutrient transformations. They are involved in organic matter decomposition, nitrogen-fixation, solubilization and immobilization of several major and minor nutrients (Katayama *et al*., 1998; Lal, 1998; Muller *et al*., 1998). In the present study an attempt has been made to analyze the effect of different amendments on fungal population in soils at different-time intervals (Zaller and Koepke, 2004; Hole *et al*., 2005; Chang *et al*., 2007; Stark *et al*., 2007).

MATERIAL AND METHODS

The whole method was done at Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, B.H.U., Varanasi, India during 1st July 2009 to December 2009. For the study of fungal community associated with soils, different isolation techniques were adopted. The soil inhabiting fungi were studied by Dilution plate technique and soil plate method technique. Dilution plate technique gives the useful information of the number of each type of microorganism in the soil samples. The soil sample was crushed and 10 g of it was suspended in 100 mL of sterilized distilled water. Further dilution series 1:1000, 1:10,000, 1:1, 00, 000 were prepared from it. One milliliter of each dilution was poured individually in sterilized Petri plates. Then 15-20 mL of sterilized nutrient medium was added. Five replications of each dilution were prepared and all plates were incubated 25±2°C for a week. In soil plate method a plate was prepared by transferring a small amount of soil to be examined into sterile petri dish. The amount of soil should result in at convenient number of fungal colonies on each plate. The soil was transferred with help of inoculating needle 10-15 mL of melted agar medium, the dispersal was obtained by gently shaking and rotating the plate before the agar solidifies. The plates were then allowed to incubate at 25-30°C for a period of 2-3 days.

Total No. of fungi/g over dried soil was calculated on the basis of total number of fungi in particular concentration being divided by over dry weight of soil:

$$\text{No. of fungi/g of soil} = \frac{\text{Total No. of fungi} \times \text{Concentration of the solution}}{\text{Over dry weight of the soil}}$$

Frequency and abundance of fungi were determined with the help of following formula (Saksena, 1955). pH was determined with the help of Elico-Electric pH meter. Moisture content was determined on the basis of percentage loss in dry weight. Available Nitrogen was determined by alkaline permanganate method by Subbiah and Asija (1956). The method of Olsen *et al.* (1954) was used for determination of available Phosphorus in soil. Potassium determined by flame photo metrically (Jackson, 1973). Organic carbon in soil was determined by chronic acid rapid titration method (Walkley and Black, 1934). Organic Matter was estimated by multiplying total carbon with constant factor 1.724.

RESULTS

The data of pH, moisture content and average number of fungi per gram of dry soil is presented in Table 1, maximum pH was 7.18 at 30 and 45 days at 2%, maximum moisture was 33.20 at 15 days 1% and maximum average number of fungi 40.6×10^4 at 15 days at 2% concentration of FYM. The maximum fungi were recorded when the soil amended with FYM (40.6×10^4 g^{-1}), urea (38.8×10^4 g^{-1}) and vermicompost (35.6×10^4 g^{-1}) of dry soil at different concentration 2.0, 1.5 and 2.0%, respectively. In control where soil was not amended with any organic amendment, the number of fungi was 13.0×10^4 g^{-1} to 16.8×10^4 g^{-1}, 14.4×10^4 g^{-1} to 16.8×10^4 g^{-1}, 13.8×10^4 to 16.8×10^4 g^{-1} in urea, FYM and Vermicompost respectively. The soil fungi were determined by dilution plate technique, recorded as frequency and abundance of fungi at different organic amendments viz., urea (Table 2), eighteen fungus were found and frequency of *Aspergillus niger* was maximum that is 5 at 1.5% concentration at 15 days and abundance of *Aspergillus niger* is maximum that is 4 at 1.5% at 15 days and 30 days respectively and *Penicillium citrinum,* abundance is maximum (4) at 1.5% concentration of urea at 30 days. Soil amended with FYM (Table 3), twenty-two fungus were observed and *Aspergillus niger* frequency (5) were maximum at 1, 1.5 and 2% concentrations of FYM at 15 days and abundance (4) were maximum at 2% concentration of FYM at 15 and 30 days,

Table 1: The pH, moisture content, average number of fungi/g of soil in control and amended with different concentrations of urea, FYM and vermicompost

Amendments with different concentration	15 Days			30 Days			45 Days		
	pH	Moisture	Average No. of fungi/g×10^4	pH	Moisture	Average No. of fungi/g×10^4	pH	Moisture	Average No. of fungi/g×10^4
Control	7.02	29.94	16.80	7.02	29.94	16.80	7.020	29.94	16.80
Urea									
1.0%	6.80	32.12	27.80	6.74	28.46	17.80	6.920	27.12	16.40
1.5%	6.62	30.86	38.80	6.48	28.44	24.00	6.640	26.22	22.40
2.0%	6.50	31.08	33.60	6.28	27.36	21.80	6.460	25.86	20.40
C.D. at 5%	0.09	01.46	02.17	0.10	00.69	01.87	0.084	00.90	01.86
FYM									
1.0%	6.90	33.20	24.20	6.94	29.28	18.20	6.940	27.30	17.00
1.5%	7.06	32.58	32.40	7.04	29.84	27.60	7.040	26.94	27.20
2.0%	7.10	31.10	40.60	7.18	28.48	34.00	7.180	26.86	31.20
C.D. at 5%	0.08	01.61	02.17	0.14	01.20	02.22	0.180	01.05	02.36
Vermicompost									
1.0%	6.96	29.70	21.20	7.04	28.12	19.20	7.100	26.20	16.40
1.5%	7.20	29.68	30.40	7.14	26.73	25.60	7.280	25.32	21.40
2.0%	7.32	29.37	35.60	7.34	26.52	32.00	7.320	24.18	29.40
C.D. at 5%	0.11	00.87	02.89	0.12	00.75	02.11	0.200	01.05	02.33

Table 2: Isolation of fungi from soil amended with urea

	Concentration																	
	15 days						30 days						45 days					
	1%		1.5%		2%		1%		1.5%		2%		1%		1.5%		2%	
Name of fungi	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A
Rhizopus stolonifer	2	2	2	3	2	2	2	1	2	2	1	2	-	-	1	2	2	1
Aspergillus niger	3	3	5	4	4	3	3	3	3	4	3	4	3	2	3	3	3	2
Aspergillus flavus	3	2	3	3	3	2	2	2	2	3	2	2	2	1	2	2	2	2
Aspergillus terreus	3	2	3	3	2	2	2	1	2	2	1	2	-	-	1	1	2	1
Aspergillus sydowi	2	2	3	2	3	2	1	2	2	2	2	1	1	1	-	-	1	2
Aspergillus fumigatus	3	2	3	3	3	2	1	2	2	2	2	2	1	1	2	1	2	2
Trichoderma viridae	-	-	-	-	-	-	1	2	2	1	1	2	-	-	1	2	1	1
Trichoderma harzianium	2	1	-	-	-	-	2	1	2	2	2	2	1	1	2	2	2	1
Penicillium citrinum	3	3	4	3	4	2	3	3	3	4	4	3	3	2	2	2	2	2
Fusarium oxysporum	2	2	3	3	2	2	2	2	3	2	3	2	2	1	2	2	2	2
Alternaria alternata	2	2	3	2	3	2	2	1	3	2	2	2	-	-	2	2	2	1
Helminthosporium oryzae	1	2	2	2	2	2	-	-	2	2	1	2	1	1	2	1	1	2
Cladosporium cladosporiodes	-	-	2	1	2	2	-	-	2	1	2	1	1	1	2	1	1	1
Phoma hibernica	2	1	2	2	3	2	1	1	2	1	2	2	1	2	2	2	2	1
Curvularia lunata	2	2	3	2	3	2	2	1	2	2	3	2	-	-	2	1	1	2
White Sterile Mycelium	-	-	1	2	-	-	1	2	-	-	2	2	1	-	1	2	1	2
Black Sterile Mycellium	1	2	-	-	-	-	1	1	1	2	-	-	-	-	-	-	1	1

F: Frequency in percent, A: Abundance in absolute number

Table 3: Isolation of fungi from soil amended with FYM

	Concentration																	
	15 days						30 days						45 days					
	1%		1.5%		2%		1%		1.5%		2%		1%		1.5%		2%	
Name of fungi	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A
	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A
Rhizopus stolonifer	1	1	-	-	1	1	1	1	-	-	1	1	1	1	1	2	1	2
Mucor racemosus	1	1	2	1	-	-	1	1	1	1	1	2	2	1	-	-	1	2
Aspergillus niger	5	3	5	3	5	4	3	3	4	3	3	4	4	3	4	3	3	3
Aspergillus flavus	2	1	2	2	3	2	-	-	2	1	2	2	-	-	1	2	2	2
Aspergillus sulphureus	-	-	2	2	2	2	-	-	1	1	2	1	1	1	1	2	2	2
Aspergillus terreus	1	1	1	1	2	1	1	1	-	-	1	2	-	-	-	-	1	1
Aspergillus sydowi	1	1	2	1	2	2	-	-	2	1	2	1	-	-	-	-	1	2
Aspergillus candidus	-	-	-	-	-	-	1	1	1	2	2	2	2	1	1	2	2	2
Aspergillus fumigatus	1	2	1	2	2	1	1	2	2	1	2	2	2	2	2	2	2	2
Trichoderma viridae	1	1	2	1	2	2	1	2	2	1	2	2	1	2	2	2	3	2
Trichoderma harzianium	1	2	1	2	2	2	1	2	2	2	3	2	2	1	3	2	2	2
Penicillium citrinum	3	2	3	3	3	3	3	2	4	2	4	2	2	1	3	3	2	2
Fusarium oxysporum	1	1	2	1	2	2	1	2	2	1	1	1	2	1	1	1	1	1
Alternaria alternata	1	1	2	1	1	2	1	1	1	2	1	1	2	1	1	1	1	1
Nigrospora sphaerica	1	1	2	1	2	2	1	1	1	2	1	2	2	1	1	2	2	1
Chaetomium globosum	1	1	2	1	2	2	1	2	-	-	2	2	-	-	-	-	1	2
Phoma hibernica	1	1	1	1	2	1	-	-	1	1	1	2	1	1	-	-	1	1
Curvularia lunata	1	2	2	1	1	1	1	1	1	2	1	1	1	1	1	1	-	-
White Sterile Mycelium	-	-	1	1	-	-	1	1	1	1	1	1	2	1	1	1	1	1
Pink Sterile Mycellium	-	-	-	-	-	-	1	1	-	-	1	2	1	1	-	-	1	1
Black Sterile Mycellium	1	1	-	-	-	-	1	1	1	1	-	-	1	1	-	-	1	1
Unidentified Species	-	-	1	1	-	-	1	1	-	-	1	1	1	1	-	-	-	-

F: Frequency in percent, A: Abundance in absolute number

respectively. Soil amended with vermicompost (Table 4), twenty fungus were observed in which *Aspergillus niger* frequency (5) and abundance (4) were maximum at 2% concentration

Table 4: Isolation of fungi from soil amended with Vermicompost

	Concentration																	
	15 days						30 days						45 days					
	1%		1.5%		2%		1%		1.5%		2%		1%		1.5%		2%	
Name of fungi	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A
Rhizopus stolonifer	1	1	1	2	2	2	2	1	1	2	-	-	1	1	-	-	1	1
Mucor racemosus	1	1	2	1	2	2	1	1	1	1	-	-	1	1	1	1	-	-
Aspergillus niger	3	2	4	3	5	4	3	2	4	2	4	3	3	2	4	1	4	2
Aspergillus flavus	1	2	2	2	3	2	-	-	2	1	2	2	1	1	1	2	2	2
Aspergillus sulphureus	1	1	1	2	2	2	1	1	2	1	2	2	-	-	1	2	2	1
Aspergillus terreus	-	-	1	1	2	2	1	1	1	1	-	-	-	-	1	1	1	1
Aspergillus sydowi	1	1	1	2	2	1	-	-	-	-	2	1	1	1	1	1	1	2
Aspergillus fumigatus	-	-	2	1	2	2	1	1	1	2	2	2	1	1	1	2	2	2
Trichoderma viridae	-	-	2	1	2	2	1	1	1	2	2	1	-	-	2	1	2	1
Trichoderma harzianium	2	1	2	2	-	-	-	-	1	2	2	2	1	1	1	1	2	1
Penicillium citrinum	3	2	3	2	4	3	3	2	3	2	4	2	3	2	3	2	4	1
Fusarium oxysporum	2	1	1	2	2	1	1	1	1	2	-	-	-	1	1	2	1	1
Alternaria alternata	2	1	1	2	1	2	-	-	1	2	1	1	1	1	1	1	-	-
Cladosporium cladosporiodes	2	1	1	2	2	2	1	1	1	1	2	1	-	-	1	1	2	1
Chaetomium globosum	1	2	1	2	2	2	1	1	1	1	1	2	1	1	-	-	1	2
Curvularia lunata	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	-	-
Pink Sterile Mycellium	1	1	1	2	1	1	1	1	-	-	2	1	1	1	-	-	2	1
Black Sterile Mycellium	1	1	2	1	-	-	1	1	2	1	1	1	1	1	2	1	-	-
Unidentified Species	1	1	-	-	1	1	1	1	2	1	-	-	1	1	1	1	2	1

F: Frequency in percent, A: Abundance in absolute number

Table 5: Isolation of fungi from soil in control condition

	15 days		30 days		45 days	
Name of fungi	F	A	F	A	F	A
Rhizopus stolonifer	2	1	2	1	-	-
Mucor racemosus	2	2	2	2	2	1
Aspergillus niger	4	3	4	2	3	2
Aspergillus flavus	3	2	2	2	2	1
Aspergillus sulphureus	3	2	2	1	2	1
Aspergillus sydowi	2	1	-	-	2	1
Aspergillus candidus	-	-	-	-	2	2
Trichoderma harzianium	3	1	2	2	2	1
Penicillium citrinum	3	3	3	2	2	2
Fusarium oxysporum	2	2	1	2	1	1
Alternaria alternata	2	3	2	1	-	-
Cladosporium cladosporiodes	2	1	1	1	1	1
Curvularia lunata	2	2	2	1	-	-
White Sterile Mycelium	-	-	-	-	1	1
Black Sterile Mycellium	-	-	1	1	-	-

F: Frequency in percent, A: Abundance in absolute number

at 15 days. In control conditions (Table 5) where soil was not amended with any organic amendment only Fifteen fungus were found in which frequency (4) of *Aspergillus niger* was maximum at 15 and 30 days respectively and abundance (3) of *Aspergillus niger, Penicillum citrinum and Alternaria alternata* were maximum at 15 days. They may be classify into three groups according to their appearance, frequency abundance and their sporulation. The values of nitrogen, phosphorus, potassium, carbon and organic matter were furnished in (Table 6). Which indicate the variation of Nitrogen 365-518 kg h^{-1}, Phosphorus 30.5-36.1 kg h^{-1}, Potassium 189-267.2 kg h^{-1}, Carbon 0.28-0.58 percent and Organic matter 0.48-0.99%. The values of NPK were increased in the soil amended with urea, FYM and

Table 6: Nutrient content of the soil after amended with urea, FYM and vermicompost

	Control			1.0%			2%			2.5%		
Urea	15 days	30 days	45 days	15 days	30 days	45 days	15 days	30 days	45 days	15 days	30 days	45 days
N (kg h^{-1})	372.00	368.00	376.00	445.00	429.00	417.00	498.00	473.00	459.00	518.00	508.00	483.00
P (kg h^{-1})	32.40	31.80	32.10	32.80	33.00	31.90	36.00	35.20	32.80	34.70	34.60	33.90
K (kg h^{-1})	248.50	239.90	243.70	202.00	207.30	198.00	216.60	209.10	201.40	197.90	193.50	189.00
C.C. (%)	0.29	0.31	0.33	0.34	0.33	0.35	0.41	0.39	0.37	0.43	0.40	0.38
O.M. (%)	0.50	0.53	0.57	0.59	0.57	0.60	0.71	0.67	0.64	0.74	0.69	0.66
FYM												
N (kg h^{-1})	369.00	365.00	367.00	368.00	378.00	382.00	374.00	385.00	389.00	373.00	381.00	398.00
P (kg h^{-1})	30.80	31.70	30.50	32.00	33.20	32.90	32.90	34.60	34.90	33.70	35.50	36.10
K (kg h^{-1})	235.90	237.10	238.50	239.00	246.00	247.90	238.60	249.20	251.30	241.30	256.80	255.60
C.C. (%)	0.32	0.31	0.34	0.32	0.35	0.35	0.39	0.43	0.47	0.49	0.48	0.50
O.M. (%)	0.55	0.53	0.59	0.55	0.60	0.60	0.67	0.74	0.81	0.84	0.83	0.86
Vermicompost												
N (kg h^{-1})	365.00	372.00	370.00	369.00	374.00	381.00	367.00	380.00	393.00	367.00	386.00	407.00
P (kg h^{-1})	30.70	31.60	31.50	31.90	33.20	33.20	30.60	34.60	35.00	32.10	34.30	34.90
K (kg h^{-1})	242.60	240.40	243.00	239.80	246.10	248.10	242.30	255.30	257.80	243.80	259.80	267.20
C.C.	0.28	0.31	0.32	0.30	0.36	0.39	0.43	0.49	0.51	0.48	0.54	0.58
O.M. (%)	0.48	0.53	0.55	0.51	0.62	0.67	0.74	0.84	0.88	0.83	0.93	0.99

N: Nitrogen, P: Phosphorus, K: Potassium, C.C: Carbon content, O.M: Organic matter

Vermicompost. The nitrogen content varies from in soil amended with urea 368-518 kg h^{-1}, FYM 365-398 kg h^{-1} and Vermicompost 365-407 kg h^{-1}.

DISCUSSION

Moisture content plays an important role in microbial activity in the soil. Increasing moisture contents help in increasing microbial activities. Maximum moisture content (33.20%) was recorded at 15 days sampling amended with FYM. Madge (1965) has shown marked effect of moisture on the number of soil fungi. Moisture content is chiefly responsible for the colonization of microorganisms (Hudson, 1971; Dunn *et al*., 1985; Pandey *et al*., 1991; Marianari *et al*., 2000; Zaller and Koepke, 2004). The pH of the soil varied from 6.28 to 7.34. The pH of soil amended with FYM and vermicompost was higher than the soil amended with urea. The increase in pH was due to decomposition of FYM and vermicompost (Shiralipour *et al*., 1992; Kannan *et al*., 2005).

The dominant fungi were those, which appeared in almost all sampling and more in number. In this group following fungi were included: *Rhizopus stolonifer, Aspergillus niger, Aspergillus flavus, Penicillium citrinum, Fusarium oxysporum* and *Trichoderma harzianium.* In the common group of fungi are *Mucor racemosus, Aspergillus sulphureus, Aspergillus terreus, Aspergillus sydowi, Aspergillus candidus, Trichoderma viridae, Alternaria alternata, Curvularia lunata* and *Cladosporium cladosporiodes* are found they are less than 75% and more than 50%. Rare group included those fungi appeared once. These are *Nigrospora sphaerica, Chaetomium globosum, Phoma hibernica* and *Helminthosporium oryzae.* The beneficial effect of fertilizer in increasing fungal population was reported by many workers (Jadhaw *et al*., 1997; Gunapala and Scow, 1998; Marinari, 2000; Karmegan and Daniel, 2000; ICRISAT and APRLP, 2003) and ascribe the higher nutrient supply as the reason for it. It is also clear from the data that fungal population of amended soil decreased with the increase of incubation period. The reason for it may be that during the early phase of incubation (15 days) most of the nutrient status of fertilizers is utilized by the soil inhabitant, hence, they increased in number, but at later stages nutrient level decreased and consequently lower the fungal counts (Elmholt and Zabruriau, 2005; Singh *et al*., 2007; Guerrero *et al*., 2007; Mandal *et al*., 2007).

It has been attributed by several workers (Agarwal and Chauhan, 1988; Bulluck *et al*., 2002) that urea is a good source of nitrogen for the microbial growth and multiplication. Soil available Phosphorus varied from in soil amended with urea 31.8-36 kg h^{-1}, FYM 30.5-36.1 kg h^{-1} and vermicompost 30.6-35 kg h^{-1}, while the available Potassium in soil amended with these three amendments, ranged between 189-248.5, 235.9-256.8 and 239.8-259.8 kg h^{-1} in urea, FYM and vermicompost, respectively. Soil available Phosphorus, Potassium were either or higher than initial value. In most of the Indian soil the amount of organic matter is relatively less and influence on physical properties can be largeness. The soil organic amendments *viz.* urea, FYM and vermicompost can help to maintain or increase soil organic matter and improve the physical properties. The changes in physico-chemical properties of soil were studied by Das *et al.* (1947), Chander *et al.* (1998), Balloli *et al.* (2000) and Chakrabarti *et al.* (2000).

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