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Effect of Organics on Physico-chemical properties of Inceptisol

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ABSTRACT: An incubation study on the topic entitled, "Effect of organics on physico-chemical properties of Inceptisol" was carried out at Department of Soil Science and Agricultural Chemistry, Post Graduate Institute, MPKV, Rahuri, during 2020-21. The experiment was laid out in a complete randomized block design (CRD) with three replication and seven treatments. The treatment comprised of Soil + FYM @ 10 t ha^{-1} (T_1), Soil + Vermicompost @ 5 t ha^{-1} (T_2), Soil + Poultry manure @ 5 t ha^{-1} (T_3), Soil + Press mud compost @ 5 t ha^{-1} (T_4), Soil + Goat manure @ 5 t ha^{-1} (T_5), Soil + Urban compost @ 10 t ha^{-1} (T_6) and Absolute control (T_7). The results of research indicated that incorporation of organic manures to soil influenced all the properties of soil significantly. The effects of organic manures on soil varied with organic material and incubation period. The application of FYM @ 10t ha^{-1} significantly improved the soil aggregate stability (MWD) and available water content (0.94 mm and 14.00% respectively). The application of FYM @ 10 t ha^{-1} recorded significantly lower pH (7.85). However, the application of vermicompost @ 5 t ha^{-1} was at par with treatment FYM @ 10 t ha^{-1}. The significantly highest EC was recorded with the application of press mud compost @ 5 t ha^{-1} (0.41 dS m^{-1}). The application of poultry manure significantly influenced soil available N, P and K content. The organic carbon content significantly increased at 15 days of incubation and further decreased from 30 days of incubation. The highest organic carbon content was observed with application of FYM @ 10 t ha^{-1} (0.69 % at 15 days of incubation). The application of FYM @ 10 t ha^{-1} significantly increased the Fe and Zn content in soil (5.39 mg kg^{-1} and 0.72 mg kg^{-1} respectively). The Mn content was improved with the application of poultry manure @ 5 t ha^{-1} (7.78 mg kg^{-1}) and application of urban compost @ 10 t ha^{-1} recorded significantly highest Cu content (0.72 mg kg^{-1}).

Keywords: Incubation, organics, physical and chemical properties, Inceptisol.

INTRODUCTION

Agriculture is facing several critical issues like low fertilizer use efficiencies, decreasing factor productivity, low soil organic carbon (SOC) stock, imbalance between nutrient removal and addition to the soil. Depletion of nutrients in soil has been accelerated by increase of intensive cultivation with increased dependence on inorganic fertilizers and decreasing emphasis on the use of organic manure in addition with use of high yielding varieties. Soil organic matter plays a key role in the sustainability of agricultural production, because it possesses many desirable features such as beneficial effects on the soil quality parameters (Liu *et al*., 2006). Organic manures have been proven to enhance efficiency and reduced the need for chemical fertilizers to improve the soil fertility and soil health. Organic material supplies nutrients in small amount and also improves the microbial activities, biodiversity and microbial population in the soil, shows effect on soil structure, nutrient and many other soil physical and chemical parameters (Albiach *et al*., 2000). Organics supply nutrients also improve microbial activities, biodiversity and size of the microbial population in the soil, effect soil structure, nutrient turnover and many other soil physico-chemical parameters. The application of organic material is fundamentally important which supply various kinds of plant nutrients including micronutrient, improve soil physical and chemical properties and hence maintain nutrient holding and buffering capacity and consequently enhance microbial activity. Organic suppliments are used as a common practice to improve soil fertility (Graham *et al*., 2002). Among the main benefits attributed to the use of organic amendments are an improved soil aggregation and reduced bulk density, greater water holding capacity, stabilization of pH, increased CEC and organic matter (Tejada *et al*., 2008). Manures have long been considered a desirable soil amendment and report of its effect on soil properties are numerous (Campbell *et al*., 1986). Thus, it is pertinent to observe some changes in soil properties with time due to application of organic material. Hence, study was carried out to observe the changes in pH, electrical conductivity, organic carbon content and N, P, K content of soil incorporated with FYM, poultry manure, vermicompost, goat manure, press mud compost and urban compost in laboratory incubation condition.

MATERIAL AND METHODS

The soil used for the experiment belongs to *Pather* soil series of Inceptisol order comprises member of fine montmorillionite hyperthermic family of *Vertic Haplustept*. The data of initial soil analysis is presented in Table 1. The organic material used for experimentation were FYM, Vermicompost, Pressmud compost, Poultry manure, Urban compost and Goat manure. The soil and organic manure analysis was carried out by standard procedures. The soil samples were collected from STCR Research Farm, Dept. of Soil Science and Agril. Chemistry, MPKV, Rahuri. There were 07 treatments comprising of FYM, vermicompost, poultry manure, press mud compost, goat manure, urban compost and absolute control. The complete randomized design (CRD) and the treatments were replicated thrice for experimentation purpose. The soil was filled in plastic bottles having 150ml capacity). The FYM, vermicompost, poultry manure, press mud compost, goat manure and urban compost were mixed with soil@ 0.54 g, 0.27 g, 0.27 g, 0.27 g, 0.27 g and 0.54 g per 120 g of soil, respectively on the basis of recommended dose of organic manures. The experiment was continued for 08 weeks. The field capacity of soil was maintained through out of the experimentation period. Water was added to each bottle for keeping the soil moisture at its field capacity throughout the study. The observations of different physico-chemical parameters were recorded at 0, 15, 30, 45 and 60 days.

RESULTS AND DISCUSSION

The soil sample and the organics used was initially analysed for various parameters and the data of same is presented in Table 1 and 2 respectively.

A. Effect of Organic Manures on Soil Aggregate Stability (MWD)

The values of mean weight diameter of organics added and non-added soils at 60 days of incubation period are reported in Table 3. The aggregate stability (MWD) of soil increased at 60 days of incubation significantly and the magnitude of increase was higher in the organics added soil than the control soil. The application of treatment T_1 (Soil + FYM @ 10 t ha^{-1}) resulted highest MWD (0.94 mm) at 60 days after incubation over the control (0.71 mm). Whereas treatment T_5 (Soil + Goat manure @ 5 t ha^{-1}) recorded the lowest MWD (0.72 mm) at 60 days after incubation among the all other treatments. However, the application of treatment T_4 (Soil + Press mud compost @ 5 t ha^{-1}) recorded 0.92 mm MWD at 60 days after incubation which was at par with treatment T_1 (Soil + FYM @ 10 t ha^{-1}).

The increase in aggregate stability (MWD) was attributed to increase in soil organic carbon contents that in turn enhanced aggregation due to addition of organic material with more resistant having longer effect on stability of aggregates. The increase in aggregate stability (MWD) might be attributed to the production of microbial polysaccharides that acts as binding agents between soil aggregate. Wuddivira *et al.* (2009); Annabi *et al.* (2007) found the similar findings.

B. Effect of Organics Manures on Soil Available Water Content

The available water content of soil as influenced by application of different organic manures is presented in Table 3. Application of organic manures in soil significantly increased soil available water content with increased incubation period. The highest increase was up to 14.00 % as compared to initial value of soil (12.17 %) in treatment T_1 (Soil + FYM @ 10 t ha^{-1}) at 60 days of incubation. The application of treatment T_1 (Soil + FYM @ 10 t ha^{-1}) recorded significantly highest available water content i.e. 12.89, 13.27, 13.64 and 14.00 % in soil over the control (12.28, 12.46, 12.73 and 12.96 %) at 15, 30, 45 and 60 days of incubation, respectively. Among the all treatments, lowest available water content was recorded as 13.24 % by the application of treatment T_5 (Soil + Goat manure @ 5 t ha^{-1}) at 60 days of incubation. The application of treatment T_4 (Soil + Press mud compost @ 5 t ha^{-1} recorded 12.87, 13.25, 13.62 and 13.98 % at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment FYM @ 10 t ha^{-1}. The increase in available water content was might because as there is close relationship between organic matter and available water content. Increase in soil organic matter content increases the soil porosity by increasing soil micro pore size distribution which in turn increases available water content in soil. Unagwu *et al.* (2020) reported the similar findings.

C. Effect of Organic Manures on Soil pH

The soil pH as influenced by application of different organic manures is presented in Table 4. The soil pH was significantly decreased in all the treatments during incubation period. Among all the treatments, the application of treatment T_1 (Soil + FYM @ 10 t ha^{-1}) significantly recorded lower pH i.e. 7.93, 7.91, 7.90 and 7.85 at 15, 30, 45 and 60 days of incubation, respectively over the control. The highest decrease in pH was up to 7.85 at 60 days of incubation over the initial pH values of soil i.e. 8.14. However, the treatment T_2 (Soil + Vermicompost @ 5 t ha^{-1}) recorded 7.94, 7.92, 7.91 and 7.86 at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_1 (Soil + FYM @ 10 t ha^{-1}). The decrease in soil pH might be due to release of organic acids like humic acid, carbonic acid, etc. during mineralization of organic manures. The similar results were shown by Roy and Kashem (2014).

D. Effect of Organic Manures on Soil EC

The soil EC as influenced by application of different organic manures is presented in Table 4. Opposite of soil pH, soil EC gradually increased with incubation time significantly and the magnitude of increase was higher in the manure amended soil than the control soil.

Significantly highest EC was recorded with the application of treatment T_4 (Soil + Press mud compost @ 5 t ha^{-1}) i.e. 0.35, 0.37, 0.40 and 0.41 dS m^{-1} at 15, 30, 45 and 60 days of incubation, respectively over the control. Initially soil EC was 0.28 dS m^{-1} which was increased to 0.41 at 60 days of incubation with the application of treatment T_4 (Soil + Press mud compost @ 5 t ha^{-1}). However, the treatment T_2 (Soil + Vermicompost @ 5 t ha^{-1} and FYM @ 10 t ha^{-1}) recorded 0.34, 0.36, 0.39 and 0.40 dS m^{-1} at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_4 (Soil + Press mud compost @ 5 t ha^{-1}). The increase in EC was might be due to degradation and decomposition of organic manures which liberates basic ions in soil solution and subsequently adsorbed on the surface of clay minerals resulting into increase in soil EC. The similar results were shown by Azeez and Averbeke (2012); Roy and Kashem (2014).

E. Effect of Organic Manures on Soil Available Nitrogen

The nitrogen content in soil as influenced by application of different organic manures is presented in Table 5. The application of different organics significantly increased nitrogen content in soil with increase in incubation period in all the treatments. Among all the treatments, application of treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}) recorded significantly higher N content i.e. 186, 190, 195 and 199 kg ha^{-1} at 15, 30, 45 and 60 days of incubation, respectively over the control. The highest increase was up to 199 kg ha^{-1} in treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}) over the initial N content in soil (182 kg ha^{-1}). However, the treatment T_4 (Soil + Press mud compost @ 5 t ha^{-1}) showed 185, 188, 194 and 198 kg ha^{-1} at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}). The increased content of available N in soil might be due to increased microbial population which leads to mineralization of organically bound N to inorganic form. This may be attributed to the decrease in pH of soil which increases the availability of nutrients in soil Bhanwaria and Yadav (2016).

F. Effect of Organic Manures on Soil Available Phosphorus

The phosphorus content in soil as influenced by application of different organic manures is presented in Table 5. The application of organic manures significantly increased phosphorus content in soil up to 30 days of incubation and further decreased from 45 days of incubation. The treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}) significantly increased phosphorus content i.e 19 and 28 kg ha^{-1}over the control which showed 15 and 21 kg ha^{-1} at 15 and 30 days of incubation, respectively. Further at 45 and 60 days of incubation phosphorus content was reduced significantly to 25 and 24 kg ha^{-1}, respectively in treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}). However, the treatment T_2 (Soil + Vermicompost @ 5 t ha^{-1}) recorded 18, 27, 24 and 23 kg ha^{-1} at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}). The initial increase in P content in soil may be attributed to the increase in microbial activity which releases the nutrients by the decomposition of organic materials which related to organic acids which helps in the solubility of native insoluble phosphates or this may be attributed to the decrease in pH of soil which increases the availability of nutrients in soil. The decrease in P content after 30 days of incubation in soil may be attributed to the fixation of P in the form of tricalcium phosphate (Bhanwaria and Yadav 2016).

G. Effect of Organic Manures on Soil Available Potassium

The potassium content in soil as influenced by application of different organic manures is presented in Table 6. The results indicate that potassium content in soil gradually increased with increase in incubation period. Among all the treatments, treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}) recorded the highest K content i.e. 434, 438, 442 and 447 kg ha^{-1} at 15, 30, 45 and 60 days of incubation, respectively over the control. The initial K content in soil was 430 kg ha^{-1} which was increased to 447 kg ha^{-1} in treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}) at 60 days of incubation. However, treatment T_2 (Soil + Vermicompost @ 5 t ha^{-1}) recorded 433, 437, 441 and 446 kg ha^{-1} at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}). The higher availability of K in soil may be due to beneficial effect of organic manure on the reduction of K fixation. The organic manure added interacts with K-clay complex to release K from non-exchangeable fractions to the available pool or this may be attributed to the decrease in pH of soil which related to the release of organic acids which increases the availability of nutrients in soil (Bhanwaria and Yadav 2016).

H. Effect of Organic Manures on Soil Organic Carbon

The organic carbon content in soil as influenced by application of different organic manures is presented in Table 6**.** The results indicate that organic carbon content significantly reached its pick at 15 days of incubation and further decreased from 30 days of incubation. The highest organic carbon content was observed with application of treatment T_1 (Soil + FYM @ 10 t ha^{-1}) i.e. 0.69 % at 15 days of incubation over the control. Initially OC content in soil was 0.59 % which was increased to 0.69 % at 15 days of incubation. However, the treatment T_4 (Soil + Press mud compost @ 5 t ha^{-1}) recorded 0.68, 0.66, 0.64 and 0.63 % OC at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_1 (Soil + FYM @ 10 t ha^{-1}). The results showed that the application of press mud compost decreased organic carbon in soil even though it contains high OC than FYM, this because of higher dose of FYM (10 t ha^{-1}) than press mud compost (5 t ha^{-1}). The improvement in soil organic carbon was attributed to direct addition of organic matter through organic manures.

Table 1: Initial soil analysis.

Sr. No.	Parameters	Incepstisol soil
1.	Aggregate stability (MWD) (mm)	0.69
2.	Available water content (%)	12.17
3.	pH (1:2.5)	8.14
4.	EC (dS m^{-1})	0.28
5.	Available nitrogen (kg ha^{-1})	182
6.	Available phosphorus (kg ha^{-1})	15
7.	Available potassium (kg ha^{-1})	430
8.	Organic carbon (%)	0.59
9.	Fe (mg kg^{-1})	5.27
10.	Mn (mg kg^{-1})	7.65
11.	Zn (mg kg^{-1})	0.63
12.	Cu (mg kg^{-1})	0.62
13.	Total bacteria count (cfu × 10^7 g^{-1} soil)	19.34
14.	Total fungi count (cfu × 10^4 g^{-1} soil)	9.92
15.	Total actinomycetes count (cfu × 10^6 g^{-1} soil)	11.87

Table 2: Characterization of organic manures.

Sr. No.	Parameters	FYM	Vermi compost	Poultry manure	Press mud compost	Goat manure	Urban compost
A.	**Chemical properties:**						
1.	pH (1:10)	7.10	7.19	8.02	7.81	7.25	7.92
2.	EC (dS m^{-1})	2.28	2.51	2.24	3.58	1.19	2.04
3.	Nitrogen (%)	0.79	1.20	2.10	1.45	0.99	1.37
4.	Phosphorus (%)	0.25	1.07	1.28	0.59	0.48	0.28
5.	Potassium (%)	0.48	1.17	1.36	0.45	0.85	0.76
6.	Organic carbon (%)	25.49	25.01	19.71	30.10	14.58	16.25
7.	C : N ratio	32.26	20.84	9.38	20.75	14.72	11.86
B.	**Micronutrients:**						
1.	Iron (mg kg^{-1})	2116	1176	955	843	736	1199
2.	Manganese (mg kg^{-1})	59.30	20.27	64.52	22.18	21.67	22.51
3.	Zinc (mg kg^{-1})	142	96	72.6	79	43.6	23.10
4.	Copper (mg kg^{-1})	96.9	190.1	24.12	57.1	21.04	268.67
C.	**Heavy metals:**						
1.	Lead (mg kg^{-1})	ND	ND	ND	ND	ND	92.50
2.	Cadmium (mg kg^{-1})	0.076	0.054	0.038	0.033	0.032	4.88
3.	Chromium (mg kg^{-1})	ND	ND	ND	ND	ND	18.00
4.	Nickel (mg kg^{-1})	2.200	1.112	0.638	2.228	2.650	43.10

Table 3: Effect of organics on soil available water content (%) and Soil Aggregate Stability (MWD).

Tr. No.	Treatment details	Soil available water content					Soil aggregate stability (MWD)
		Incubation period					Incubation period
		Initial	15 Days	30 Days	45 Days	60 Days	60 Days
T_1	Soil + FYM @ 10 t ha^{-1}	12.30	12.89	13.27	13.64	14.00	0.94
T_2	Soil + Vermicompost @ 5 t ha^{-1}	12.24	12.48	13.02	13.37	13.76	0.83
T_3	Soil + Poultry manure @ 5 t ha^{-1}	12.21	12.44	12.92	13.20	13.62	0.79
T_4	Soil + Press mud compost @ 5 t ha^{-1}	12.44	12.87	13.25	13.62	13.98	0.92
T_5	Soil + Goat manure @ 5 t ha^{-1}	12.19	12.39	12.63	12.95	13.24	0.72
T_6	Soil + Urban compost @ 10 t ha^{-1}	12.20	12.39	12.81	13.04	13.45	0.76
T_7	Absolute control	12.17	12.28	12.46	12.73	12.96	0.71
	Initial (Soil)	**12.17**					**0.69**
	SEm±	-	**0.0036**	**0.0042**	**0.0038**	**0.0040**	**0.0045**
	C.D. at 5 %	-	**0.0108**	**0.0127**	**0.0115**	**0.0121**	**0.0138**

Table 4: Effect of Organics on Soil pH and EC (dS m^{-1}).

Tr. No.	Treatment details	Soil pH					Soil EC (dS m^{-1})				
		Incubation period					Incubation period				
		Initial	15 Days	30 Days	45 Days	60 Days	Initial	15 Days	30 Days	45 Days	60 Days
T_1	Soil + FYM @ 10 t ha^{-1}	8.11	7.93	7.91	7.90	7.85	0.30	0.33	0.35	0.38	0.39
T_2	Soil + Vermicompost @ 5 t ha^{-1}	8.12	7.94	7.92	7.91	7.86	0.29	0.34	0.36	0.39	0.40
T_3	Soil + Poultry manure @ 5 t ha^{-1}	8.15	8.02	7.98	7.96	7.94	0.28	0.32	0.35	0.36	0.38
T_4	Soil + Press mud compost @ 5 t ha^{-1}	8.14	8.01	7.94	7.92	7.89	0.30	0.35	0.37	0.40	0.41
T_5	Soil + Goat manure @ 5 t ha^{-1}	8.13	8.00	7.93	7.91	7.88	0.28	0.31	0.32	0.35	0.37
T_6	Soil + Urban compost @ 10 t ha^{-1}	8.14	8.02	7.95	7.94	7.92	0.29	0.32	0.34	0.35	0.38
T_7	Absolute control	8.14	8.12	8.11	8.10	8.10	0.28	0.30	0.31	0.35	0.36
	Initial (Soil)	**8.14**					**0.28**				
	SEm±	**-**	**0.0067**	**0.0109**	**0.0063**	**0.0060**	**-**	**0.0025**	**0.0028**	**0.0031**	**0.0036**
	C.D. at 5 %	**-**	**0.0202**	**0.0331**	**0.0191**	**0.0183**	**-**	**0.0076**	**0.0085**	**0.0094**	**0.0108**

Table 5: Effect of Organics on Soil Available Nitrogen and Phosphorus (kg ha^{-1}).

Tr. No.	Treatment details	Soil Available Nitrogen (kg ha^{-1})					Soil Available Phosphorus (kg ha^{-1})				
		Incubation period					Incubation period				
		Initial	15 Days	30 Days	45 Days	60 Days	Initial	15 Days	30 Days	45 Days	60 Days
T_1	Soil + FYM @ 10 t ha^{-1}	182	183	185	187	190	15	16	21	18	17
T_2	Soil + Vermicompost @ 5 t ha^{-1}	183	184	186	189	192	16	18	27	24	23
T_3	Soil + Poultry manure @ 5 t ha^{-1}	184	186	190	195	199	17	19	28	25	24
T_4	Soil + Press mud compost @ 5 t ha^{-1}	183	185	188	194	198	16	18	24	21	20
T_5	Soil + Goat manure @ 5 t ha^{-1}	182	184	185	188	191	15	16	23	21	19
T_6	Soil + Urban compost @ 10 t ha^{-1}	183	184	188	190	194	16	17	22	20	18
T_7	Absolute control	182	183	183	186	188	15	15	21	18	16
	Initial (Soil)	**182**					**15**				
	SEm±	**-**	**0.3006**	**0.2457**	**0.1294**	**0.0997**	**-**	**0.1691**	**0.2206**	**0.0282**	**0.2538**
	C.D. at 5 %	**-**	**0.9119**	**1.0345**	**0.3926**	**0.3024**	**-**	**0.2421**	**0.6690**	**0.0856**	**0.7698**

Table 6: Effect of Organics on Soil Available Potassium (kg ha^{-1}) and Organic Carbon (%).

Tr. No.	Treatment details	Soil Available Potassium (kg ha^{-1})					Soil Organic Carbon (%)				
		Incubation period					Incubation period				
		Initial	15 Days	30 Days	45 Days	60 Days	Initial	15 Days	30 Days	45 Days	60 Days
T_1	Soil + FYM @ 10 t ha^{-1}	430	431	434	437	439	0.62	0.69	0.67	0.65	0.64
T_2	Soil + Vermicompost @ 5 t ha^{-1}	432	433	437	441	446	0.61	0.66	0.65	0.63	0.63
T_3	Soil + Poultry manure @ 5 t ha^{-1}	433	434	438	442	447	0.61	0.65	0.64	0.64	0.62
T_4	Soil + Press mud compost @ 5 t ha^{-1}	430	431	434	438	441	0.62	0.68	0.66	0.64	0.63
T_5	Soil + Goat manure @ 5 t ha^{-1}	432	433	436	439	443	0.59	0.63	0.62	0.61	0.61
T_6	Soil + Urban compost @ 10 t ha^{-1}	431	432	435	438	442	0.61	0.64	0.64	0.63	0.62
T_7	Absolute control	430	431	433	435	438	0.59	0.62	0.61	0.60	0.60
	Initial (Soil)	**430**					**0.59**				
	SEm±	**-**	**0.2039**	**0.1127**	**0.3042**	**0.2250**	**-**	**0.0018**	**0.0017**	**0.0002**	**0.0003**
	C.D. at 5 %	**-**	**0.6186**	**0.3418**	**0.9227**	**0.6825**	**-**	**0.0055**	**0.005**	**0.0009**	**0.0009**

Table 7: Effect of Organics on Soil Iron Content and Manganese Content (mg kg^{-1}).

Tr. No.	Treatment details	Soil Fe Content (mg kg^{-1})					Soil Mn Content (mg kg^{-1})				
		Incubation period					Incubation period				
		Initial	15 Days	30 Days	45 Days	60 Days	Initial	15 Days	30 Days	45 Days	60 Days
T_1	Soil + FYM @ 10 t ha^{-1}	5.29	5.34	5.36	5.38	5.39	7.67	7.69	7.72	7.74	7.77
T_2	Soil + Vermicompost @ 5 t ha^{-1}	5.28	5.33	5.34	5.36	5.37	7.65	7.66	7.69	7.71	7.72
T_3	Soil + Poultry manure @ 5 t ha^{-1}	5.28	5.32	5.33	5.35	5.36	7.67	7.70	7.73	7.75	7.78
T_4	Soil + Press mud compost @ 5 t ha^{-1}	5.27	5.31	5.32	5.34	5.35	7.66	7.67	7.70	7.73	7.74
T_5	Soil + Goat manure @ 5 t ha^{-1}	5.28	5.30	5.31	5.33	5.34	7.65	7.67	7.69	7.70	7.73
T_6	Soil + Urban compost @ 10 t ha^{-1}	5.29	5.33	5.35	5.37	5.38	7.66	7.68	7.71	7.73	7.76
T_7	Absolute control	5.27	5.28	5.28	5.29	5.30	7.65	7.66	7.68	7.70	7.71
	Initial (Soil)	**5.27**					**7.65**				
	SEm±	**-**	**0.0025**	**0.0031**	**0.0022**	**0.0033**	**-**	**0.0025**	**0.0028**	**0.0042**	**0.0044**
	C.D. at 5 %	**-**	**0.0076**	**0.0094**	**0.0066**	**0.0101**	**-**	**0.0076**	**0.0085**	**0.0127**	**0.0132**

Table 8: Effect of Organics on Soil Zinc and Copper content (mg kg^{-1}).

Tr. No.	Treatment details	Soil Zn Content (mg kg^{-1})					Soil Cu Content (mg kg^{-1})				
			Incubation period					Incubation period			
		Initial	15 Days	30 Days	45 Days	60 Days	Initial	15 Days	30 Days	45 Days	60 Days
T_1	Soil + FYM @ 10 t ha^{-1}	0.65	0.66	0.69	0.71	0.72	0.63	0.65	0.67	0.69	0.70
T_2	Soil + Vermicompost @ 5 ha^{-1}	0.64	0.65	0.68	0.70	0.71	0.64	0.66	0.68	0.70	0.71
T_3	Soil + Poultry manure @ 5 t ha^{-1}	0.63	0.64	0.65	0.69	0.70	0.62	0.63	0.65	0.67	0.68
T_4	Soil + Press mud compost @ 5 t ha^{-1}	0.64	0.65	0.66	0.69	0.70	0.63	0.64	0.66	0.68	0.69
T_5	Soil + Goat manure @ 5 t ha^{-1}	0.63	0.64	0.65	0.68	0.69	0.62	0.63	0.65	0.66	0.67
T_6	Soil + Urban compost @ 10 t ha^{-1}	0.63	0.64	0.64	0.66	0.68	0.64	0.67	0.69	0.71	0.72
T_7	Absolute control	0.63	0.63	0.63	0.66	0.67	0.62	0.63	0.64	0.65	0.66
	Initial (Soil)	**0.63**					**0.62**				
	SEm±	-	**0.0021**	**0.0023**	**0.002**	**0.0013**	-	**0.0005**	**0.0004**	**0.0013**	**0.0007**
	C.D. at 5 %	-	**0.0064**	**0.0069**	**0.006**	**0.0039**	-	**0.0014**	**0.0013**	**0.0038**	**0.0022**

The highest amount of soil organic carbon at the beginning of the incubation was due to availability of a larger pool of the less resistant fractions that were broken down and recycled, thus resulting in lower contents remaining at the end of incubation, so the organic carbon decreased as the incubation period increased. Mineralization process occurs when organic manures added in soil, thus the OC content in soil decreases with time. The similar results were shown by Roy and Kashem (2014); Follett *et al.* (2007); Sarkar and Bandyopadhyay (2018); Pascual *et al.* (1997).

I. Effect of Organics on DTPA- Fe content in soil

The iron content in soil as influenced by application of different organic manures is presented in Table 7. Application of organic manures significantly increased iron content with increase in incubation period. The treatment T_1 (Soil + FYM @ 10 t ha^{-1}) recorded highest iron content i.e. 5.34, 5.36, 5.38 and 5.39 mg kg^{-1} over the control 5.28, 5.28, 5.29 and 5.30 mg kg^{-1} at 15, 30, 45 and 60 days of incubation, respectively. The highest increase in iron content was up to 5.39 mg kg^{-1} in treatmentT_1 (Soil + FYM @ 10 t ha^{-1}) over initial Fe content in soil (5.27 mg kg^{-1}). However, the treatment T_6 (Soil + Urban compost @ 10 t ha^{-1}) showed 5.33, 5.35, 5.37 and 5.38 mg kg^{-1} at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_1 (Soil + FYM @ 10 t ha^{-1}).The increase in iron content in soil was attributed to the micronutrient content in the organic manures and also the effect of organic acids produced during decomposition of soil minerals and due to increased availability due to conversion of ferric iron to ferrous iron or might be due to decrease in organics and oxides surfaces. These results are in agreement with those of Jat *et al.* (2012).

J. Effect of Organics on DTPA- Mn content in soil

The manganese content in soil as influenced by application of different organic manures is presented in Table 7. The application of organic manures to soil significantly increased manganese content with increase in incubation period. The highest Mn content was recorded with the application of treatment T_3 (Soil + Poultry manure @ 5 t ha^{-1}) i.e. 7.70, 7.73, 7.75 and 7.78 mg kg^{-1}over the control 7.66, 7.68, 7.70 and 7.71 mg kg^{-1} at 15, 30, 45 and 60 days of incubation, respectively. Initially Mn content in soil was 7.65 mg kg^{-1}. However, the treatment T_1 (Soil + FYM @ 10 t ha^{-1}) recorded 7.69, 7.72, 7.74 and 7.77 mg kg^{-1} at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatmentT_3 (Soil + Poultry manure @ 5 t ha^{-1}). The increase in Mn content in soil might be due to higher amount of Mn content in organic matter or may be attributed to the conversion of higher oxides of manganese to Mn^{2+} as a result of microbial and chemical reduction and certain organic acids released during decomposition of organic manures. The results are in close conformity with those of Zeynep (2019).

K. Effect of Organics on DTPA- Zn content in soil

The zinc content in soil as influenced by application of different organic manures is presented in Table 8. The zinc content in soil significantly increased with increase in incubation period. Among all the treatments, application of treatment T_1 (Soil + FYM @ 10 t ha^{-1}) recorded significantly highest zinc content i.e. 0.66, 0.69, 0.71 and 0.72 mg kg^{-1}over the control 0.63, 0.63, 0.66 and 0.67mg kg^{-1} at 15, 30, 45 and 60 days of incubation, respectively. Initial Zn content in soil was 0.63 mg kg^{-1}. However, the treatment T_2 (Soil + Vermicompost @ 5 t ha^{-1}) recorded 0.65, 0.68, 0.70 and 0.71 mg kg^{-1} at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_1 (Soil + FYM @ 10 t ha^{-1}). The increase in Zn content in soil might be due to addition of organic manures which was having high amount of Zn. During decomposition, released organic acids resulted in high rate of mineralization over the time which enhanced the Zn availability of soil and also due to the formation of organic-zinc complexes, which are soluble, mobile and readily available. Similar findings were also observed by Jat *et al.* (2012).

L. Effect of Organics on DTPA- Cu content in soil

The copper content in soil as influenced by application of different organic manures is presented in Table 8. The copper content in soil increased significantly with increase in incubation period. The highest copper content was observed with application of treatment T_6 (Soil + Urban compost @ 10 t ha^{-1}) i.e. 0.67, 0.69, 0.71 and 0.72 mg kg^{-1} over the control 0.63, 0.64, 0.65 and 0.66mg kg^{-1} at 15, 30, 45 and 60 days of incubation, respectively. Initial Cu content in soil was 0.62 mg kg^{-1}. However, the treatment T_2 (Soil + Vermicompost @ 5 t ha^{-1}) recorded 0.66, 0.68, 0.70 and 0.71 mg kg^{-1} at 15, 30, 45 and 60 days of incubation, respectively which was at par with treatment T_6 (Soil + Urban compost @ 10 t ha^{-1}). The increase in copper content might be attributed to the addition of organic manures. Higher availability of this micronutrient in soil due to the addition of organics manures was ascribed to the formation of chelates with organic ligands which have lowered susceptibility to adsorption, fixation and precipitation in the soil and also to mineralization of organic manures and releases micronutrient. The results are in close conformity with those of Zeynep (2019).

CONCLUSIONS

The application of FYM @ 10 t ha^{-1} to soil (Inceptisol) was found superior as evident from higher values of mean weight diameter, available water content, soil pH, organic carbon, iron and zinc content and other physico-chemical properties of Inceptisol under 60 days of incubation study. Among all the treatments, the application poultry manure @ 5 t ha^{-1} had distinct effect on N, P, and K content in soil, followed by application of press mud compost @ 5 t ha^{-1} which had a significant effect on soil properties under 60 days incubation study.

FUTURE SCOPE

Looking upon the excellent performance for better approach organic manures in enhancing production, productivity and soil fertility, further refinement is in need with the following direction to generate more scientific information and justification of their effect.

A) A keen study need to be carried out at regular intervals for nutrient releasing pattern of FYM, vermicompost, poultry manure, goat manure, press mud compost and urban compost.

B) Correlation of impact of all sources of organic manures on nutrient content and uptake at regular interval need to be carried out.

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REFERENCES

Albiach, R., Canet, R., Pomares, F. and Ingelmo, F. (2000). Microbial biomass content and enzymatic activities after the application of organic amendments to a horticultural soil. *Journal of Bioresource Technology*, *75*, 43-48.

Annabi, M., Hoyot, S., Francou, C., Poitrenaud, M. and Bissonnais, Y. L. (2007). Soil aggregate stability improvement with urban compost of different maturities. *Soil Science Society of American Journal, 71*, 413-423.

Azeez, J. O. and Averbeke, W. V. (2012). Dynamics of soil pH and electrical conductivity with the application of three animal manures. *Communications in Soil Science and Plant Analysis*, *43*, 865-874.

Bhanwaria, R. and Yadav, B. L. (2016). Effect of organic manure and soil moisture regimes on residual soil fertility and biological properties under mustard crop with saline water irrigation. *Research in Environmental and Life Sciences*, *9*(9), 1135-1139.

Campbell, C. A., Schnitzer, M., Stewart, J. W. B., Biederbeck, V. O. and Selles, F. (1986). Effect of manure and P fertilizer on properties of a Black Chernozem in Southern Saskatchewan. *Canadian Journal of Soil Science, 66*, 373-385.

Follett, R. F., Paul, E. A. and Pruessner, E. G. (2007). Soil carbon dynamics during a long-term incubation study involving ^{13}C and ^{14}C measurements. *Soil Science, 172*, 189-208.

Graham, M. H., Haynes, R. J. and Meyer, J. H. (2002). Changes in soil chemistry and aggregate stability induced by fertilizer applications, burning and trash retention on long-term sugarcane experiment in South Africa. *Soil Biology and Biochemistry*, *34*, 93-102.

Jat, G., Sharma, K. K. and Jat, N. K. (2012). Effect of FYM and mineral nutrients on physico-chemical properties of soil under Mustard in Western and Arid Zone of India. *Annals of Plant and Soil Research*, *14*(2), 167-166.

Liu, X., Herbert, S. J., Hashemi, A. M., Zhang, X. and Ding, G. (2006). Effect of agricultural management on soil organic matter and carbon transformation- A review. *Plant, soil and Environment*, *52*, 531-43.

Pascual, J. A., Garcia, C., Hernandez, T. and Ayuso, M. (1997). Changes in the microbial activity of an arid soil amended with urban organic waste. *Biological Fertilizers Soils*, *24*, 429-434.

Roy, S. and Kashem, M. A. (2014). Effect of organic manures in changes of some soil properties at different incubation periods. *Open Journal of Soil Science*, *4*, 81-86.

Sarkar, A. and Bandyopadhyay, K. (2018). Effect of incubation duration of incorporated organics on saturated hydraulic conductivity, aggregate stability and sorptivity of alluvial and red- laterite soils. *Journal of the Indian Society of Soil Science*, *66*(4), 370-380.

Tejada, M., Gonzalez, J. L., Hernandez, M. T. and Garcia, C. (2008). Agricultural use of leachates obtained from two different vermicomposting processes, *Bioresource Technology*, *99*, 6228-6232.

Unagwu, B. O., Ene, J. and Azuka, C. V. (2020). Effect of different organic amendment sources on the physico-chemical properties of a nutrient depleted Vertisol. *Nigerian Journal of Soil Science*, *29*(2), 68-73.

Wuddivira, M. N., Stone, R. J. and Ekwue, E. I. (2009). Structural stability of humid tropical soils as influenced by manure incorporation and incubation duration. *Soil Science Society of American Journal*, *73*, 1553-1360.

Zeynep Demir (2019). Effect of vermicompost on soil physico-chemical properties and Lettuce (*Lactuca Sativa* Var. Crispa) yield in greenhouse under different soil water regimes. *Communications in Soil Sciences and Plant Analysis*, *50*, 2151-2168.

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