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Effect of different organic matter on some physical and chemical properties of soil collected from rice field

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Abstract
Present experiments were conducted to see the effect of different organic matter on some physical and chemical properties of soil collected from rice field. Ten treatments *viz.,* T1- 100% N through city compost, T2- 75% N through city compost, T3- 100% N through vermicompost, T4- 75% N through vermicompost, T5- 100% N through Industrial waste-1, T-6 75% N through Industrial waste-1, T-7 100% N through Industrial waste-2, T-8 75% N through Industrial waste-2, T-9 100% N through FYM and T-10 75% N through FYM were used for study and a medium duration scented rice variety “Tarun Bhog” was taken as test crops. The results revealed that the significantly highest (7.48) pH of soil was found in treatment T4, highest EC (Electrical conductivity) value 0.23 dsm^{-1} recorded in treatment T2 and OC (Organic carbon) value 0.67% was observed in T5. The maximum and bulk density found insignificant and it varied from 1.32-1.37Mg m^3. The status primary nutrient (N, P, K) in soil after harvest was recorded significantly highest (220, 11.93, 345.75 kg ha-1 respectively) in the treatment T5. Application of T5- 100% N through Industrial waste-1 was found best among all the organic manure in rice cultivation.

Keywords: Organic matter, EC, OC, vermicompost and industrial waste

Introduction
The green revolution in India during the late 1960,s has no doubt brought about self-sufficiency in food grain production, but now has reached a plateau and is sustained with diminishing returns and falling dividends. However, indiscriminate use of inorganic fertilizers particularly N, P and K and plant protection chemicals for maximizing crop yields has resulted in the deterioration of the physical, chemical and biological health of the rice growing soils. Currently, there is a growing concern about the sustainability of the rice production system as the rice yield is either stagnant or have declined in a number of states such as Punjab, Haryana, eastern Uttar Pradesh, Madhya Pradesh, Bihar, Himachal Pradesh and Jammu & Kashmir (Chand and Haque, 1998; Ladha *et al.*, 2000; Mahajan *et al.*, 2002 & 2008; Paroda, 1996) [3, 9, 11, 14]. In recent past, Indian farmer showed tendency to apply more nitrogenous fertilizers to maximize rice yield. High nitrogen application without appropriate balance with phosphorus, potassium and other nutrients may result negative effect on soil. Thus, an adequate supply of phosphorus and potassium is essential since phosphorus stimulates root development and necessary for cell division. Potassium plays vital role for cells and their enzymatic and metabolic functions. In fact both P & K help plant to improve the efficiency of N uptake and also to protect against stress, such as drought or caused by pests & diseases. Balanced nutrition requires supply of adequate quantity of not only N, P and K but also other essential nutrients.
The inorganic fertilizer industries *viz.*, urea, super phosphate and muriate of potash are need based industries but at the same time they pollute environment. To combat this problem, it is necessary to adopt organic nutrient management for better yield and non-polluting environment. Now a day the concept of health food and organic farming is catching up very fast, the world over. Crop plants remove varying amounts of different nutrients from soil and to compensate the loss from the soil, organic amendments must be added (Singh and Mandal, 2000) [21]. FYM, the most commonly and widely used organic nutrient is a rich source of primary, secondary and micronutrient to the plant growth. It is the constant source of energy for heterotrophic micro organisms that helps in increasing the availability of nutrients, and thereby improves the quantity and quality of crop production (Dixit and Gupta, 2000) [6]. Vermicompost is an entirely naturally produced organic nutrient which maintains the soil ecosystem and leaves no adverse effect on it. Crop residues have potential for improving soil and water conservation and, sustaining soil productivity and enhancing crop yields (Das *et al.*, 2003) [4].

The goal of sustainable agriculture is to maintain a non-negative trend in productivity while maintaining soil physical and chemical properties at optimum. According to Logsdon *et al.* (1993) [10] and McGarry *et al.* (2000) [12] inorganic farming systems are reported to be associated with a decline in soil structure and soil aggregation, a decrease in water infiltration and an increase in soil bulk density, soil salinity, nitrogen leaching and ground water contamination. On the other hand, organic farming eliminate or minimize the use of most inorganic fertilizers and pesticides, it can improve soil, water and environmental quality and thus improve the overall quality of life. The application of composted organic amendments has numerous advantages, compared to non-composted ones (Fernández *et al.*., 2008) [7]. Besides, composting is considered a suitable waste management strategy, along with anaerobic digestion (Alvarenga *et al.*, 2017) [2]. The production of organic wastes is increasing worldwide and then, nowadays, farmers have more access to composted amendments from different origins. Furthermore, the use of on-farm compost has increased in recent years, thus replacing commercial compost (Pane *et al.*, 2015) [13]. Therefore, the use of organic compost represents both an appropriate waste management strategy and an interesting agricultural practice (Pérez-Piqueres *et al.*, 2006) [16]. A major advantage of using organic waste from farms as fertilizer is that some of the most critical nutritional elements can be provided at little cost. By contrast, the application of chemical fertilizers is costly and may exacerbate environmental problems. Therefore, utilization of organic manures may enhance efficient nutrient use in rice and reduce the need for chemical fertilizers. Compare to chemical farming this method was self sufficient, self dependant and relies more biological inputs (Singh *et al.*, 2001) [1]. In present investigation different organic manures were used for rice cultivation and evaluated their effects on physical and chemical properties of soil.

Materials and Methods

Site description

A field experiment was conducted on Vertisol of Research Farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. Raipur is situated at 210 4' North Latitude and 810 4' East Longitude with the altitude of 293 meter above mean sea level. The region comes under dry and sub-humid climatic condition. The average rainfall of the area is 1400-1600 mm. The weather data during experimental period was collected from the meteorological observatory located at Labhandi (Indira Gandhi Agricultural University), Krishaknagar, Raipur. Major amount of precipitation occurs between June and December (about 5-6 Months) which is the main rice growing season. The hottest and coolest months are May and December, respectively.

Experimental Soil

The experimental soil (Vertisol) is fine montmorillonite, hyperthermic, udic chromustert, locally called as Kanhar and is identified as Arang II series. It is usually deep, heavy clayey (50%), dark brown to black in colour and neutral to slightly alkaline in reaction due to presence of lime concentrations. The soil was analyzed for its initial characteristics as per the methods mentioned below and some important physicochemical properties of the soil.

Experiment design

Details of the experiment

Location	:	Instructional cum Research Farm, I.G.K.V. Raipur
Soil Type	:	*Vertisols*
Season	:	*Kharif* 2017
Crop	:	Rice
Variety	:	Tarun Bhog
Treatment	:	10
Design	:	Randomized block design
Replications	:	Four
Net Plot size	:	9m x 4m (36 m^2)
Gross Plot area	:	(1440m^2)
Spacing	:	20 cm x 10 cm
RDF	:	100:60:40 kg/ha (N: P_2O_5: K_2O)

Soil analysis

The initial soil sample and plot wise samples collected at harvest were collected and analyzed for chemical properties like pH, EC, OC, and contents of available N, P and K following standard procedures.

Statistical analysis

The data collected from field observations and those recorded in laboratory were subjected to statistical analysis by standard analysis of variance technique. For significant treatment effects, standard error of means (SEm ±) and critical differences were calculated at 5 per cent level of significance.

Results and Discussion

Effect of organic manures on pH, EC and OC

The pH was found significantly highest in treatment T4 7.48 followed by T7 7.43 and T2 7.38. Whereas minimum in T5, T8, T9, and T10. The pH obtained from different treatment may be ranked in order T4>T7>T3>T6>T2>T6>T1>T8>T9>T10. Patil *et al.* (2003) [15] also found the similar result due to application of organic manure.

The highest EC value 0.23 dsm^{-1} in soil at harvest was observed in treatment T2 followed by T3 and T10 whereas minimum EC value 0.13 dsm^{-1} was recorded in T1 and T7.

Highest OC value 0.67% was observed in T5 which was the highest in all 10 treatments and higher OC values found in rest of the treatment. Due to available nitrogen was significantly superior over rest of the treatment. Organic carbon status of soil enhanced in all organic added treatment compared to initial value. This result is also supported by Lamani *et al.* (2000) [9].

Table 1: Effect of organic manures on pH, EC and Organic carbon in soil after harvest

Treatments	pH	EC dSm^{-1}	OC%
T1- 100% N through city compost	7.28	0.13	0.64
T2- 75% N through city compost	7.38	0.23	0.64
T3- 100% N through Vermicompost	7.40	0.22	0.64
T4- 75% N through Vermicompost	7.48	0.20	0.64
T5- 100% N through Industrial waste-1	7.23	0.17	0.64
T-6 75% N through Industrial waste-1	7.38	0.19	0.66
T-7 100% N through Industrial waste-2	7.43	0.18	0.67
T-8 75% N through Industrial waste-2	7.28	0.16	0.61
T-9 100% N through FYM	7.23	0.19	0.60
T-10 75% N through FYM	7.20	0.22	0.60
CD (0.05%)	0.18	0.02	0.08

Effect of different organic manures on bulk density

Data represented in table indicates the status of bulk density in soil after harvest. The bulk density was recorded in treatment T5 1.33 (Mg m^3) followed by t6 1.36 (Mg m^3). This similar result was also found by Mausavi *et al.* (2012) and Pravin *et al.* (2012).

Table 3: Effect of different source of organic manures on bulk density

Treatments	Bulk Density (Mg m^3)
T1- 100% N through city compost	1.36
T2- 75% N through city compost	1.35
T3- 100% N through Vermicompost	1.34
T4- 75% N through Vermicompost	1.32
T5- 100% N through Industrial waste-1	1.33
T-6 75% N through Industrial waste-1	1.36
T-7 100% N through Industrial waste-2	1.37
T-8 75% N through Industrial waste-2	1.36
T-9 100% N through FYM	1.34
T-10 75% N through FYM	1.34
CD (0.05%)	NS

Nutrient status in soil after harvest

N in soil was observed in various treatments shown in table. N in soil was found significantly highest in treatment T5 220.00 (kg ha-1) followed by treatment T6 207.50 (kg ha-1). Whereas minimum N in soil was in T2, T3, T4, T10. N in soil from different treatment may be ranked in order T5>T6>T7>T8>T9>T1>T10>T4>T3>T2. N status in soil was highest in T5 because of the N content in treatment T5. Similar result was also reported by Singh *et al.*, 2005.

P in soil was found significantly highest in T5 11.93 (kg ha-1) followed by T6 11.90 (kg ha-1). Whereas, minimum P in soil was in T2, T4, T8, T9. P in soil from different treatment may be ranked in order T5>T6>T7>T9>T1>T10>T9>T8>T4>T2. When the soil becomes basic, available phosphorus is increased. Devasingheet *et al.* 2013 [5]. Similar result was found by Sellathurai *et al.* (2015) [17], Hussaini *et al.* (2005) [8], Ali *et al.* (2006) [1].

K in soil was found significantly highest in T5 345.75 (kg ha-1) followed by T3 342.25 (kg ha-1). Whereas, minimum K in soil was T7 291.00 (kg ha-1) T8 285.75 (kg ha-1). K in soil from different treatment may be ranked in order T5> T3>T1>T9> T10> T2> T4> T7> T8. Similar result was found in Shekara *et al.* (2010) [18].

Table 2: Effect of different source of organic manure on nutrient status in soil after harvest

Treatments	N in soil (kg ha-1)	P in soil (kg ha-1)	K in soil (kg ha-1)
T1- 100% N through city compost	173.00	11.2	341.00
T2- 75% N through city compost	163.00	10.30	328.25
T3- 100% N through Vermicompost	166.75	11.23	342.25
T4- 75% N through Vermicompost	167.00	10.33	328.00
T5- 100% N through Industrial waste-1	220.00	11.93	345.75
T-6 75% N through Industrial waste-1	207.50	11.90	320.50
T-7 100% N through Industrial waste-2	195.00	11.83	291.00
T-8 75% N through Industrial waste-2	192.00	10.60	285.75
T-9 100% N through FYM	191.75	11.60	337.75
T-10 75% N through FYM	170.25	10.75	335.00
CD (0.05%)	22.50	4.95	22.15

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