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Effect of rice residues and organics source on physico-chemical properties of the soil

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Abstract
The study entitled was carried out during *Kharif* season of 2018-2019 at Research farm of, Indira Gandhi krishi Vishwavidhyalaya, Raipur, Chhattisgarh. The experiment was laid out in randomized block design three replication and ten treatment combinations rice residue with organic source. The treatment combination for rice were T1 [Control (N0:P0:K0], T2 [100% NPK (100:60:40)], T3 [100% Rice Residue], T4 [150% Rice Residue], T5 [50% N Rice Residue + 50% N Green Manure], T6 [75% N Rice Residue + 25% N Green Manure], T7 [50% N Rice Residue + 50% N Vermicompost], T8 [75% N Rice Residue + 25% N Vermicompost], T9 [100% N Rice Residue + BGA+ Azospirillum], T10 [150% N Rice Residue + BGA+ Azospirillum]. The incorporation of rice residue with organics reduced the bulk density and increased porosity of soil. While the soil pH was non significantly increased but Organic Carbon and electrical conductivity were significantly increased in incorporation of rice residue along with organics. The available nitrogen, phosphorus, potassium and micro nutrient iron, copper, manganese and zinc status in soil was not significantly influenced due to the incorporation of rice residue. In present study it is clearly indicated that incorporation of rice residue along with organics had higher yield as well as maintained soil physico- chemical and biological properties.

Keywords: Physico-chemical, rice residues, *Kharif*

Introduction

Crop residues are those portions of the crop which is left out in field after harvesting and threshing of the crop. The crop residue may or may not be utilised by the farmer. The crop residue has some precious nutrient contents which can be utilised by crop by proper management practices. The crop residue are considered as waste material but after scientific or tradition management it becomes useful and it helps in nutrient recycling by providing some nutrients to soil and plant. It is less investment with high profit deal without any environmental degradation instead of that it is organic in nature and helps in the improving soil physical, chemical and biological property of the soil. It improves the soil dynamics by increasing the organic carbon and organic matter content in the soil. It becomes the source of nutrition for the growth and development of the microorganisms. It helps in sustainable and ecological growth of the farmer by healthy soil and environment.

Various farming activities adopted by farmer are the major causes of the reduction in the soil organic matter as well as reduction in soil quality due to improper utilization of the land and inorganic fertilizer. Soil organic matter plays a vital role in the improvement of the physical, chemical and biological properties of the soil. The soil organic matter has a direct correlation with the other nutrient content in the soil. Soil organic matter increases the soil dynamics and also establish positive correlative with the environment (Dalal and Mayer, 1986) [6]. Crop residues are important sources of essential plant nutrients which is important components for the stability of agricultural ecosystems and their ecology.

Rice straw is best well known for their nutrients (Ponnamperuma, 1982) [13]. During the harvesting of the rice crop its straw is placed in soil itself and about 15 cm crop residue are left in the field. The straw content left in the field is serious problem and it creates burden over the soil for their decomposition because a very short gap available between the harvesting of the rice crop and cultivation of the wheat crop. Stubble burning, is a traditional practice commonly aimed at controlling the soil borne crop diseases, is a common practice in India particularly in an area where, there is a short fallow period or scarcity of water. Although such practice of stubble management does not reportedly affect the wheat yield adversely, the stubble burning is not scientific method for proper disposal of the straw and even it causes loss of energy and environmental pollution. Besides, crop burning of the stubble also causes loss of organic matter and plant nutrients.

Materials and Methods

Site description

The study (2018-19) on RCS was conducted at the research farm of the IGKV, Raipur and Chhattisgarh, India. The experimental site is situated in plains of Chhattisgarh at Eastern part of Raipur and it's located between $20^0 4^0$ North latitude and $81^0 39^0$ East longitudes with an altitude of 293 m above mean sea level. The soil of experimental site is represented as a Typic chromesterts (Vertisols) (Arang-I series). It is locally called Kanhar. The soil is characterized by silty clay texture and moderate to slow internal drainage, medium to deep depth, and brownish gray in surface color, sub angular to angular, blocky structure and neutral in reaction. The top-soil (0–15 cm layer) at the start of experiment was neutral (electrical conductivity 0.14 dSm$_{-}^{1}$) with pH 6.95, and contained 0.60 % Walkley-Black carbon, 225 kg ha^{-1}available N (Subbiah and Asija, 1956) [17], 23.8 kg ha^{-1}0.5 M NaHCO3-extractable P (Olsen *et al.*, 1954) [10] and 403 kg ha^{-1}1 N NH_4OAc -extractable K.

Experimental details

The experiment was laid out in a randomized plot design with a total of ten treatments replicated three times. T1 [Control (N0:P0:K0], T2 [100% NPK (100:60:40)], T3 [100% Rice Residue], T4 [150% Rice Residue], T5 [50% N Rice Residue + 50% N Green Manure],T6 [75% N Rice Residue + 25% N Green Manure],T7 [50% N Rice Residue + 50% N Vermicompost], T8 [75% N Rice Residue + 25% N Vermicompost], T9 [100% N Rice Residue + BGA+ Azospirillum], T10 [150% N Rice Residue + BGA+ Azospirillum]. The soil bulk density at 0–15 cm depths was measured on undisturbed soil cores (Blake and Hartge, 1986) [4]. All data were analyzed by analyses of variance (ANOVA) in a randomized plot design. The treatment means were compared using least significant differences for the effects as well as comparison of one and other treatments (Gomez and Gomez, 1984).

Results and discussion

1. Bulk density, Porosity and pH

The data presented in Table 1. revealed that, the bulk density of soil was non significantly influenced by rice residue management. The lowest soil bulk density (1.30 Mg m-3) was recorded under T-10[150% RR+ BGA+ Azospirillum] and the highest soil bulk density (1.45 Mg m-3) was recorded under T1 [control]. The incorporation of crop residues decreased the bulk density may be due to addition of organic matter and subsequent increase in porosity of soil. Similar results were reported by Walia *et al*. (1995) [19] and Belakki *et al.* (1998) [1]
The data presented in Table 1. revealed that, the porosity of soil was non significantly changed by rice residue incorporation The effect of various combination of different level of rice residue incorporation did not change significantly among the treatments

Electrical conductivity and Organic carbon

The data of electrical conductivity and organic Carbon presented in Table 1. indicated that the incorporation of rice residue caused increase in the electrical conductivity and organic carbon of soil irrespective of initial value (0.22 dSm^{-1}). The e highest value of organic carbon (0.67 %) was recorded with the soil organic carbon content was increased due to incorporation of organic materials. Similar results were reported by Gangaiah *et al.* (1999) [7], Regar *et al.* (2005) [14] and Singh *et al.* (2009) [15].

Soil available nitrogen, phosphorus and potassium

The data of soil available nitrogen, available phosphorus status (kg ha^{-1}), are presented in Table 2. It is revealed that the soil available nitrogen, phosphorus status was not significantly influenced due to incorporation of crop residue. The highest available nitrogen (259 kg ha^{-1}), phosphorus status (18 kg ha^{-1}) was recorded under T8 and the highest soil available potassium status (359 kg ha^{-1}) was recorded in T10. Similar results were reported by Prasad and Sinha (2000) [12] and Surekha *et al.* (2004) [16].

Soil available Micronutrients

The data presented in Table 2. showed that the available iron, manganese and copper status of soil was non significantly influenced due to incorporation of rice residue over the treatments. The highest soil available iron iron (27 mg kg^{-1}), manganese manganese (22 mg kg^{-1}) and copper status (2.6 mg kg^{-1}) was recorded under treatment T10 [Rice residue 150% + BGA + Azospirillum]. And the result showed the available zinc content in soil was non significantly affected due to incorporation of rice residue over the treatments. The highest value of available zinc status was recorded under T2 [(0.6 mg kg^{-1})RDF], T4 [(0.6 mg kg^{-1}) Rice residue 100%] and T 10 [0.6 mg kg^{-1}) Rice residue 150% + BGA + Azospirillum].

Table 1: Effect of rice residues with different organics on Bulk density, Porosity (%), pH, EC and OC (%) of the soil after harvest of rice crop

Treatments	Bulk density (mg/m^3)	Porosity (%)	pH	EC(dsm-1)	OC %
T1- Control	1.45	37	7.2	0.27	0.57
T2- RDF	1.43	38	7.2	0.26	0.60
T3- 100% RR	1.35	41	7.2	0.32	0.63
T4- 150% RR	1.32	42	7.4	0.36	0.64
T5- 50% RR+ 50% GM	1.40	39	7.2	0.28	0.59
T6- 75% RR+ 25% GM	1.39	39	7.2	0.32	0.59
T7- 50% RR+ 50% VC	1.42	38	7.5	0.28	0.58
T8-75% RR+ 25% VC	1.41	38	7.4	0.28	0.63
T9- 100% RR+ BGA+ Azospirillum	1.34	42	7.3	0.25	0.61
T10- 150% RR+ BGA+ Azospirillum	1.30	43	7.4	0.28	0.67
C.D at 5%	NS	NS	NS	.003	.006

Table 2: Effect of rice residues with different organics on Available N,P,K and micronutrient of the soil after harvest of rice crop

Treatments	N Kg ha^{-1}	P Kg ha^{-1}	K Kg ha^{-1}	Fe mg kg^{-1}	Mn mg kg^{-1}	Cu mg kg^{-1}	Zn mg kg^{-1}
T1- Control	243	15	340	15	15	0.2	1.8
T2- RDF	258	17	356	20	17	0.6	2.0
T3- 100% RR	245	16	349	18	19	0.4	2.2
T4- 150% RR	248	16	358	26	21	0.6	2.3
T5- 50% RR+ 50% GM	248	17	355	22	18	0.5	2.4
T6- 75% RR+ 25% GM	258	16	357	26	19	0.5	2.5
T7- 50% RR+ 50% VC	253	17	345	25	21	0.5	2.2
T8-75% RR+ 25% VC	259	18	350	24	19	0.5	2.1
T9- 100% RR+ BGA+ Azospirillum	253	16	353	25	19	0.4	2.3
T10- 150% RR+ BGA+ Azospirillum	256	16	359	27	21	0.6	2.6
C.D at 5 %	NS	NS	NS	NS	NS	NS	NS

Plate 1: Glimpses of Experiment

Conclusion

The incorporation of rice residue along with different organic manures and fertilizer like, Rice residue, Vermicomposting, green manure, BGA, Azospirillum, and urea, DAP, MOP had improved the physico-chemical properties of soil i.e. there is the reduction in bulk density and increased the soil porosity and organic carbon status of the soil.

Whereas non significantly change was observed in pH however the electrical conductivity was significantly higher as compared to initial status of the soil. The incorporation of rice residue along with different organic manures had non significantly change the available major nutrients (N, P and K) and micronutrients (Fe, Zn, Cu and Mn) in the soil.

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