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Influence of rice straw and nitrogen management on soil properties and nutrients status under rice-wheat cropping system

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Abstract
A field experiment was conducted on Crop Residue and Nitrogen Management under Rice- Wheat cropping System in Zone III B of Bihar at farmer's field near VKSCOA, Dumraon, Buxar during the year 2020-21 and 2021-22. The experiment was laid out in split plot Design with sixteen treatment Combinations and three replications in which four levels of rice straw management (S1- Straw Incorporated (SI), S2-Straw Incorporated + EM 1% Spray (SIE), S3- Straw Retention & Surface Mulching (SR), S4-Straw Retention & Surface Mulching + EM 1% Spray (SRE) and four levels of Nitrogen (N1-Control (No Nitrogen), N2-75% RD of N, N3- 100% RD of N, N4-125% RD of N). Among the rice straw management significantly highest soil organic carbon 0.49 under Straw Retention & Mulching +EM 1% and under Nitrogen Management. Among soil physical property B.D. was significantly affected by straw management and Nitrogen management. Straw incorporation has significant beneficial effects on soil properties.

Keywords: Nitrogen management, straw management, EM, rice, wheat, soil properties and soil organic carbon

Introduction
Rice-wheat cropping system of the Indo-Gangetic Plains has played a significant role in the food security of India. This system spread over a vast area spanning from Punjab in the Northwest to Northeast. Conservation agriculture involving zero or minimum-tillage and innovations in crop residue management to avoid straw burning should assist in achieving sustainable productivity and allow farmers to reduce nutrient and water inputs, and reduce risk due to climate change. Crop residues generally left over plant parts of crops after harvest and threshing are important natural resources. The crop residue recycling helps in converting the surplus farm waste into useful products to meet the nutrient requirements of crops apart from improving the ecological balance of crops production system, but burning of rice straw is common in north-western parts of India causing nutrient losses, and serious air quality problems affecting human health and safety. About 82% of rice residue produced is burnt in the field after harvesting rice by combine harvester, resulting in the substantial loss of plant nutrient there in. Straw carbon, nitrogen and sulphur are completely burnt and also lost to the atmosphere in the burning process of rice straw. In addition, the ash lying on the surface of soil after burning absorbs the applied weedicide and decrease the efficiency of herbicides. Residue incorporation legumes have been reported to have greater influence over crop yield and enrichment of soil physicochemical and biological properties by Mandal *et al.*, (2004) [3]. Incorporation of crop residues alters the soil environment, which in turn influences the microbial population and activity in the soil and subsequent nutrient transformations. It is through this chain of events that management of crop residues regulates the efficiency with which fertilizer, water, and other reserves are used in a cropping system. The removal of crop residues leads to low soil fertility and thereby decreased crop production. Organic materials such as crop residues offer sustainable and ecologically sound alternatives for meeting the nutrient requirements of crops. In addition to their role as the primary source of C inputs, crop

residues, and the way they are managed, have a significant impact on soil physical properties. EM inoculation to the soil can improve the quality of soil, plant growth and yield (Nayak *et al.*, 2020) [5]. EM used in many crops to enhance soil fertility, increase crop productivity, and control plant diseases (Ndona *et al.*, 2011) [6]. EM can used as a alternative of chemical fertilizers. EM facilitates to enhance soil quality with the aid of fixing atmospheric nitrogen. Levai (2006) [2] mention that improvement in soil fertility has positive effect on plant growth, flowering, fruit development and ripening in crops.

Methods & Materials

An Experiment was conducted during the year 2020-22 at farmer's field in V.K.S. College of Agriculture Dumraon (Buxar) Bihar jurisdiction having the latitude of Dumraon, Bihar, India is 25.550114 and the longitude is 84.150017. Experiment was conducted in split plot design and having replication three with following treatment details:

Table 1: Treatment Details

Rice Straw Management (Main Plot: 4 Nos.)		Nitrogen Management (Sub Plot: 4 Nos.)	
S1	Straw Incorporated (SI)	N1	Control (No Nitrogen)
S2	Straw Incorporated + EM 1% Spray (SIE)	N2	75% RD of N
S3	Straw Retention & Surface Mulching (SR)	N3	100% RD of N
S4	Straw Retention & Surface Mulching + EM 1% Spray (SRE)	N4	125% RD of N

Table 2: Soil Characteristics

S. No.	Parameters	Initial Value	Remark
1.	Texture class	Clay Loam	Bouyoucos Hydrometer method
2.	Bulk density	1.38 g/cc	Core-Method
3.	pH	6.8	Digital pH meter
4.	EC (dS/m)	0.16	Conductivity meter
5.	Organic Carbon (%)	0.44	Walkley& Black Titration method
6.	Available P2O5 (Kg/ha)	20.6	Olsen method
7.	Available K2O (Kg/ha)	238	Morgan method
8.	Available Nitrogen (Kg/ha)	226	Alkaline –Per magnate

Dry Bulk Density

Soil samples were taken with cylinders of known volume at each cracking stage. Samples were weighed and then oven-dried for 48 hours at 105°C. Dried soil samples were weighed again. Dry bulk density was calculated as:

$\rho b = Ws/Vt$

Where, ρ b is dry bulk density of soil (g cm-3), W s is weight of dry soil sample (g), and Vt is volume of cylinder (cm3).

Results and Discussion

In table 3 show data related to pH and EC were found non-significant under Rice straw management and nitrogen management but higher pH was found in starw incorporated as well as in 125% RD of N. Significantly results found of soil organic carbon and bulk density. Addition of rice straw decreased soil bulk density (Mousavi *et al.* 2012) [4]. In that study, the incorporation of rice straw resulted in greater increases in soil organic C ((Thanh *et al.* 2016) [10]. However, Thanh *et al.* (2016) [10] observed that N fertilizer requirement was reduced by about 20% in a long-term study with rice straw incorporation. Soil organic C is the main component of soil organic matter, which plays an important role in the supply of nutrients and improves biological and physical properties of the soil. Rice straw incorporation has been shown to increase soil organic C (Chivenge *et al.* 2020) [7]. The treatment effects were found non-significant for soil pH all throughout the experimental period as presented in the Table 3 similar result was found by Singh and Dhillon (2020) [1].

Table 3: Effects of Rice Straw and Nitrogen Management on pH, EC and SOC after Harvest of Wheat Crop

Rice straw management				
Treatments	**pH**	**EC (dSm^{-1})**	**SOC (%)**	**B.D. g/cc**
Straw Incorporated	6.8	0.16	0.45	1.38
Straw Incorporated +EM 1%	6.7	0.16	0.47	1.37
Straw Retention & Mulching	6.7	0.17	0.48	1.36
Straw Retention & Mulching +EM 1%	6.6	0.18	0.49	1.36
S.Em±	0.11	0.2	0.009	.001
CD at 5%	NS	NS	0.03	.003
Nitrogen management				
Treatments	**pH**	**EC (dSm^{-1})**	**SOC (%)**	**B.D. g/cc**
Control (No-N)	6.7	0.16	0.45	1.38
75% of RD of N	6.7	0.16	0.47	1.37
100% RD of N	6.7	0.17	0.47	1.36
125% RD of N	6.8	0.18	0.49	1.36
S.Em±	0.11	0.2	0.009	.001
CD at 5%	NS	NS	0.03	.003

Rice straw has been reported as materials improving soil fertility by promoting soil organic matter (SOM) and soil moisture contents (Ruensuk *et al.*, 2008) [9].

Effect of rice straw and nitrogen management on soil available nutrients harvest of wheat crop as shows in Table no. 4 result was found significant under rice straw management and nitrogen management in reference to Nitrogen and Potassium Content while Phosphorus result was non-significant similar result also found by Rajkhowa and Borah (2008) [8].

Table 4: Effects of Rice Straw and Nitrogen Management on Soil Available Nutrients Harvest of Wheat Crop

Treatments	N(Kg/ha)	P O (Kg/ha) 2 5	K O(Kg/ha) 2
Rice straw management			
Straw Incorporated	232.58 (2.82%)	21.03(2.08%)	260.05(6.94%)
Straw Incorporated +EM 1%	235.83 (4.15%)	22.18(7.12%)	262.63(9.37%)
Straw Retention & Mulching	236.00 (4.23%)	22.42(8.11%)	266.47(10.68%)
Straw Retention & Mulching +EM 1%	250.92 (5.94%)	22.68(9.17%)	273.03(12.83%)
S.Em±	1.25	0.67	2.59
CD at 5%	4.41	NS	9.12
Nitrogen Management			
Control (No-N)	226.25 (0.11%)	20.90(1.43%)	245.70(3.13%)
75% of RD of N	234.80 (3.75%)	21.68(4.98%)	260.17(8.52%)
100% RD of N	242.83 (6.93%)	22.58(8.76%)	275.29(13.54%)
125% RD of N	252.00 (10.32%)	23.13(10.93%)	281.00(15.30%)
S.Em±	0.94	0.64	2.66
CD at 5%	2.76	NS	7.81

Conclusion

Application of rice straw and nitrogen management into wheat soil Straw Retention & Mulching +EM 1% along with nitrogen management improve soil organic carbon and improve bulk density. Incorporating the rice straw in the succeeding crop wheat crop served nutrients recycling and increases available status of nitrogen and potassium. In addition, rice straw incorporation resulted in low soil bulk density, which is helpful for soil preparation. Therefore, Straw Retention & Mulching +EM 1% in soil perhaps is a good

References

1. Singh G, Dhillon BS. Effect of crop residue incorporation on physical and chemical properties of soil under rice-wheat, guar-wheat and cotton-wheat cropping systems. J Pharmacog Phytochem. 2020;9(6):185-187.
2. Lévai L, Veres SZ, Makleit P, Marozsán M, Szabó B. New trends in plant nutrition. In: Proceedings of 41st Croatian and 1st International Symposium on Agriculture. ISBN 953-6331-39-X; c2006. p. 435-436.
3. Mandal KG, Misra AK, Hati KM, Bandyopadhyay KK, Ghosh PK, Manoranjan M, *et al*. Rice residue - management options and effects on soil properties and crop productivity. J Food Agric Environ. 2004;2(1):224-231.
4. Mousavi *et al.* Effects of Rice Straw Incorporation on Some Physical Characteristics of Paddy Soils. J Agr. Sci. Tech. 2012;14:1173-1183.
5. Nayak *et al.* Beneficial effect of effective microorganism on crop and soil - A review. J Pharmacog Phytochem. 2020;9(4):3070-3074.
6. Ndona RK, Friede JK, Spornberger A, Rinnofner T, Jezik K. Effective micro-organisms (EM): An effective plant strengthening agent for tomatoes in protected cultivation. Biol Agric Hortic. 2011;27:189-203.
7. Chivenge P, Rubianes F, Romasanta RR, Hung NV. Sustainable Rice Straw Management. International Rice Research Institute (IRRI), Los Baños, Laguna, Philippines. The Author(s), 2020, 131.
8. Rajkhowa, Borah. Effect of rice (*Oryza sativa*) straw management on growth and yield of wheat (Triticum aestivum). Indian J Agron. 2008;53(2):112-115.
9. Ruensuk N, Mongkonbunjong P, Leuchikam C, Inthalaeng W. Rice straw management in the area of continuous rice planting. Rice Res J. 2008;2:35-46.
10. Thanh ND, Hoa HTT, Hung HC, Nhi PTP, Thuc DD. Effect of fertilizer on rice yield improvement in coastal sandy soil of Thua Thien Hue province. Hue Univ J Sci Agric Rural Dev, 2016, 119.