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Response of organic manure and crop residue in combination with inorganic fertilizers and FYM on the productivity of wheat

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Abstract

A field experiment was conducted during *Rabi* season of 2009-10 and 2010-11, to study the response of incorporation of vermi-compost and rice husk on yield and yield attributes of the timely sown wheat. Application of vermi-compost @ 4.5 t/ha and recommended dose of nitrogen (150 Kg/ha) and phosphorus (60 Kg/ha) resulted significantly higher grain yield in comparison to all other treatment combinations.

Key Words *:* Vermi-compost, rice husk, wheat, timely sown, INM, yield, yield components.

W heat is predominant winter crop (*Rabi*) of northern plain zone of the India. During the past few years, stagnation or decline in the productivity of wheat crop has raised doubts on the sustainability. The resource degradation is proceeding at an alarming rate in the western plain zone for the wheat productivity. The most important factor is that the heavy and imbalance use of chemical fertilizers has led to think about the use of organic manures in intensive growing areas for sustaining production system. Therefore, to sustain the land as well as to achieve production potential of crops, judicious use of organic manures and their scientific management is important. Hence, it is desirable to improve or maintain crop productivity by increasing the efficiency of applied nutrients and maintain a balance between supply and demand of nutrients by crop through integration of organic and inorganic sources of nutrients for sustainable production and also till now no systematic work has been done to evolve technology for incorporation of various crop residues into the soil and farmers are not able to get higher yield from less productive or degraded land. Keeping this in view, the present study on utilization of crop residue (Rice Husk) and vermi- compost in wheat was carried out to evaluate the integrated nutrient management practices

Materials and Methods

The field experiment was conducted during *Rabi* season of 2009-10 and 2010-11 at KVK Farm, (28^{0}4' latitude, 77^{0}11' E longitude and 207.1m above MSL)SVPUA & T, Bulandshahr. The soil was a sandy loam having 64% sand, 18% silt and 18% clay with pH 7.1, having organic matter content 0.62 per cent and available N, P_2O_5 and K_2O 184.1 kg, 20.8 kg and 145.0 kg/ ha respectively. The experiment was laid out in split plot design with 3 replications.

The main plot treatments were 3 sources of organics, viz. no residue, rice husk (4.5 t/ha) and vermi-compost (4.5 t/ ha) and 8 combination levels of FYM (10 t/ha), nitrogen and phosphorus in sub plot treatments viz. – N_0 , N_{150} , P_{60} , N_{150} + P_{60} , N_{150} + FYM, P_{60} + FYM, FYM and N_{150} + P_{60} +FYM

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during both the years. A timely sown variety PBW-550 of wheat was sown in II[nd] week of November in both years. The organic manure singly and in combination were applied uniformly as per treatment and incorporated into the soil three weeks before sowing. All other observations were performed as per recommendation for the crop. The data on yield and yield attributes were recorded in different treatments.

Result and Discussion

Yield of Wheat

Incorporation of vermi-compost @4.5t/ha in wheat significantly increased the grain and straw yield of wheat (Table 1). Addition of crop residues and subsequent decomposition released nutrients that helped to increase the values of yields and yields attributing characters of wheat, except the grain number per spike, which ultimately resulted into higher grain and biological yield compared to no residue incorporation. Effect of crop residue (Rice Husk) and vermi-compost was found to be non-significant on harvest index.

Application of recommended dose of N and P with FYM increased the grain and biological yield of wheat as compare to rest of the treatments. Addition of inorganic N and P with FYM increased the supply of nutrients in higher amount and for longer duration, which ultimately resulted in higher grain and biological yield during. Application of N and P significantly increased the harvest index and grain straw ratio of wheat during 2009-10 only. The higher yield may be due to fact that that these organic manures/ residue supplies direct available proportion of water stable aggregates of the soil.

Organic matter is known to function as source of energy for soil micro-flora which in turns brings about transformation of inorganic nutrients in a form that can readily be utilized by growing crops. Similar observations have been recorded by researchers in rice and wheat field. (**Channabasanagowda *et al.,* 2008 and Dadhich. *et al.,* 2012**)

Yield attributing characters of wheat

Application of organic manure also influenced the yield component of wheat, viz. effective tillers, spike length, grain weight per spike and 1000-grain weight increased significantly with addition of rice husk@ 4.5t/ha and vermi-compost @ 4.5t/ha (Table 2)..Vermi-compost incorporated field showed highest values of yield attributing characters of wheat. . Application of vermi-compost and rice husk and its sub sequent deco mposition in soil release d plant nutrients in slow manner in continuously throughout the crop growth period causing better availability of nutrients to the wheat crop. (**Channabasanagowda *et al*., 2008.**)

Application N (150 Kg/ha) and P (60 Kg/ha) with FYM (10 t/ ha) increased the values of yield attributing characters significantly. Higher amount of nutrients with FYM application increased the availability of nutrients in root zone, thus more uptake of nutrients by crop resulted in higher values of yield attributing characters.

On the basis of the present investigation, it can be concluded that vermi-compost @4.5 t/ha alongwith recommended dose of nitrogen (150 Kg/ha) and phosphorus (60 Kg/ha) were found to be significant higher in terms of grain and biological yield. Therefore, the bioconversion technology for vermi-compost incorporation provides an eco-friendly option for the sustainable agriculture. These compost and rice husk may be used for integrated nutrient management of crop by inclusion of recommended dose of chemical fertilizers to maximize the benefit to crop yield.

Table 1. : Grain yield, biological yield, and harvest index of wheat as affected by different treatments.

Treatments	Grain Yield (t/ha)		Biological Yield (t/ha)		Harvest Index	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
Organic residues						
No residue	2.79	3.26	6.55	7.24	0.426	0.450
Rice Husk	3.04	3.41	7.24	7.71	0.419	0.442
Vermi-compost	3.54	4.21	8.87	9.44	0.399	0.445
CD at 5%	0.34	0.08	0.83	0.44	NS	NS

Inorganic fertilizers with FYM						
N_0	1.69	2.31	4.01	5.27	0.421	0.438
N_{150}	3.98	4.05	10.18	9.81	0.391	0.412
P_{60}	1.82	2.61	4.44	5.87	0.410	0.444
FYM	2.11	2.41	5.28	5.74	0.399	0.419
$N_{150}+P_{60}$	4.00	4.73	9.11	10.09	0.439	0.468
N_{150}+FYM	4.56	4.82	10.03	10.48	0.454	0.459
P_{60}+FYM	1.95	2.71	4.62	6.28	0.422	0.429
$N_{150}+P_{60}$+FYM	5.22	5.38	11.62	11.97	0.449	0.449
CD at 5%	0.48	0.09	0.82	0.53	NS	0.03

Table 2. : Effective tillers, spike length, grain weight per spike and 1000- grain weight of wheat as affected by different treatments.

Treatments	**Effective Tillers**		**Spike length (cm)**		**Grain weight per spike (g)**		**1000 grain weight**	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
Organic residues								
No residue	287.2	211.7	10.11	8.32	1.04	1.06	38.74	39.21
Rice Husk	308.4	225.3	10.41	8.72	1.14	1.17	39.22	43.22
Vermi-compost	333.5	250.1	11.00	9.05	1.20	1.21	39.24	44.27
CD at 5%	19.4	7.2	0.48	0.36	NS	0.06	NS	1.98
Inorganic fertilizers with FYM								
No	227.1	234.4	9.36	9.22	0.82	0.79	34.6	35.81
N_{150}	358.6	387.4	11.68	11.67	1.30	1.39	42.11	43.05
P_{60}	237.1	252.2	10.02	10.14	0.89	0.85	34.38	34.94
FYM	291.7	246.2	9.61	9.71	0.98	0.95	37.81	38.64
$N_{150}+P_{60}$	389.3	410.1	10.95	11.32	1.35	1.39	32.73	33.43
N_{150}+FYM	385.2	403.3	11.52	11.55	1.34	1.37	40.79	42.22
P_{60}+FYM	235.3	260.6	9.13	9.11	1.04	0.99	36.42	37.12
$N_{150}+P_{60}$+FYM	393.4	438.2	11.78	11.86	1.36	1.44	42.64	43.79
CD at 5%	18.9	13.8	0.55	0.52	0.10	0.09	2.17	1.91

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