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Study the combined effect of organic manure and inorganic fertilizers on growth and yield of late sown wheat (*Triticum aestivum* L.)

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Abstract
The present experiment was conducted during the *Rabi* season of 2016-17 at Sithouli experimental farm, school of Agriculture, ITM University Gwalior, Madhya Pradesh to evaluated the combined effect of organic manure and inorganic fertilizers doses on the growth and yield of late sown wheat (Variety, Lok-1).The experiment was laid out in Randomized Block Design (RBD) having three replications. The experiment comprises of nine different treatments T_1: Control, T_2: 100% RDF + 10 t FYM ha^{-1}, T_3: 100% RDF + 05 t FYM ha^{-1}, T_4: 75% RDF + 10 t FYM ha^{-1}, T_5: 75% RDF + 05 t FYM ha^{-1}, T_6: 100% RDF + 05 t VC ha^{-1}, T_7: 100% RDF + 2.5 t VC ha^{-1}, T_8: 75% RDF + 05 t VC ha^{-1} and T_9: 75% RDF + 2.5 t VC ha$^{-1.}$ A constant spacing of 20 x5 cm was kept, and 100 kg ha^{-1} seed rate. Recommended dose of fertilizers (100% RDF) were applied at the rate of 100: 40: 20 kg ha^{-1}. Farm yard manure (5 &10t ha^{-1}) and vermicompost (2.5 &5 t ha^{-1}) was applied as per treatment. All other agronomic practices were kept uniform for all treatments. The findings of the present study indicated that application of 100 per cent RDF (100: 40: 20 :: N:P:K kg ha^{-1}) along with 10 t FYM or 05 t Vermicompost ha^{-1} produced higher growth and yield attributes of wheat. Maximum grain yield (4583.3 kg ha^{-1}) was produced with 100 per cent RDF + 05 t VC ha^{-1} closely followed by 100 per cent RDF + 10 t FYM ha^{-1} with 4464.3 kg ha^{-1} grain yield. Whereas, maximum net returns of Rs.62789 ha^{-1} and benefit cost ratio (3.20) were found with 100 per cent RDF + 10 t FYM ha^{-1} treatment. It can be concluded that from present study, that application of 100 per cent RDF (100: 40:20:: N:P:K kg ha^{-1}) along with 10 t FYM ha^{-1} produced higher growth and yield of wheat. This treatment gave higher net returns and benefit cost ratio in late sown wheat under sandy loam soils of Northern Madhya Pradesh.

Keywords: Cucumber, Boron, Yield, Quality, Konkan

Introduction
Wheat is one of the most important staple food of India grown in diverse agro-climatic conditions from 11°N - 35°N latitude and 72°E- 92°E longitudes. Wheat is a important winter season crop of India and improvement in its productivity has played a key role in making the country self-sufficient in food grains. Crop occupies an area of about 28.8 million hectares with total production of 80.7 million tonnes and a productivity of 2.87 tonnes ha^{-1} which share about 12.56 per cent of total production of the world (Anonymous, 2014) [2].

Chemical fertilizers or organic manures alone cannot sustain the desired levels of crop production. Integration of chemical and organic sources and their efficient management have shown promising results not only in sustaining the production but also in maintaining soil health (Aulakh, 2011) [3]. The continuous use of NPK fertilizers has remarkably increased production but simultaneously brought about problems related to secondary and micronutrient deficiencies, particularly those of sulphur and zinc in soils. Sulphur performs many physiological functions like synthesis of sulphur containing amino acids which have a positive role in improving quality of grains. Zinc is also an important micronutrient reported deficient in Indian's soils and plays a significant role in various enzymatic and physiological activities of plant bodies. Judicious use of farm yard manure (FYM) or vermicompost with chemical fertilizers improves soil physical, chemical and biological properties and improves crop productivity (Sharma *et al*, 2007) [5].

Fertilizer use especially N, P and K is considered as a corner stone in any drive for increasing the wheat yield. But the continuous use of micronutrient free high analysis NPK fertilizers in

The intensive cropping system with diminishing use of organic manures has resulted in the depleting of micronutrients from the soil reserve. Integration of organics with inorganics has been found to be quite promising not only in maintaining higher productivity but also in providing greater stability in crop production. Application of organic manures may also help to check the emerging deficiency of nutrients other than N, P and K. Further, it brings economy and efficiency in fertilizers. The INM affects the Physical, Chemical and Biological environment of the soil and thus preserve the soil health.

Materials and methods

The present investigation entitled "Study the combined effect of organic manure and inorganic fertilizers on growth and yield of late sown wheat (*Triticum aestivum* L.)" was conducted at experimental Farm, ITM University, Gwalior (M. P.) during the *Rabi* season of 2016-17. The details of various materials used and the methods employed in carrying out the experiment are described in detail in this chapter, under appropriate headings and sub-headings. The experiment was laid out at Sithouli experimental farm, school of Agriculture, ITM University Gwalior (Madhya Pradesh), during *Rabi* season of 2016-17. Area of the experimental field having fairly uniform topography with gentle slope and adequate drainage. Gwalior is situated in gird zone at the latitude of 26°.13' North and longitude 76°.14' east with an altitude of 211.52 meters above mean sea level, in Madhya Pradesh. The Region comes under semi-arid sub-tropical climate with extreme weather condition having hot and dry summer and cold winter. Generally, monsoon sets in during the last week of June. Annual rainfall ranges from 700 to 800 mm, most of which falls during last week of June to the middle of September. Winter rains are occasional and uncertain. The maximum temperature goes up to 47 ^{o}C during summer and minimum as low as 2.8 ^{o}C during winter. The nutrient was applied at the different rate of recommended dose of fertilizers (RDF). However, 100 kg N and 40 kg P_2O_5 and 20 kg K_2O ha^{-1} was used as a 100% RDF. The nitrogen, Phosphorus and potassium were applied through urea, DAP and MOP. The full dose of phosphorus, potassium and half dose of nitrogen were given below the seed at the time of sowing as basal. Whereas, the remaining half dose of nitrogen was top-dressed after first irrigation. In manure treatments FYM and vermicompost were applied before field preparation or before sowing of crop as per treatments. The experiment was laid out in a randomized block design with three replications. Each replication accommodated nine treatments. All the treatments were randomized separately in each replication. Treatment details:T_1: Control,T_2: 100% RDF + 10 t FYM ha^{-1},T_3: 100% RDF + 05 t FYM ha^{-1},T_4: 75% RDF + 10 t FYM ha^{-1},T_5: 75% RDF + 05 t FYM ha^{-1},T_6: 100% RDF + 05 t VC ha^{-1},T_7: 100% RDF + 2.5 t VC ha^{-1},T_8: 75% RDF + 05 t VC ha^{-1},T_9: 75% RDF + 2.5 t VC ha$^{-1.}$

Result and Discussion

Growth attributing character

Study the combined effect of organic manure and inorganic fertilizers on growth and yield of late sown wheat (*Triticum aestivum* L.) related to the impact of different combinations of organic manures and inorganic fertilizers on growth, yield attributes, yield and economics of late sown wheat are embodied and explained in this chapter. The data of the final observations of the various parameters were subjected to statistical analysis and the results have, therefore, been presented through tables and suitable diagrams. Integrated use of fertilizers with vermicompost and farm yard manure increased the plant height, number of effective tillers, spike length, grains spike^{-1}, grain weight of spike (g) and the test weight. The enhanced early vegetative growth in terms of height, dry matter accumulation and vigorous root system resulted in more spikes which consequently increased the number of spike bearing tillers significantly. Number of spike m^{-2} area produced by the application of 100 per cent RDF along with vermicompost 5 t ha^{-1} (555.0 spike m^{-2}) or FYM 10 t ha^{-1} (540.5 spike m^{-2}) were found to be the highest and the lowest from control (268.3 spike m^{-2}). It might be due to stimulated vegetative growth of wheat on account of adequate and prolonged supply of essential nutrients. The probable reason may be that adequate supply of all the nutrients, resulted in greater accumulation of carbohydrates, amino acids and their translocation to the productive organs, which, in-turn improved all the growth and yield attributing characters. Results confirm the finding of Karki *et al*. (2005) [13], Faujdar and Sharma (2013) [11]. Similarly, the number of effective tillers plant^{-1}, grains spike^{-1}, grain weight of spike and test weight produced by the application 100 per cent RDF + 5t vermicompost or 100 per cent RDF + 10 t FYM ha^{-1} were found to be significantly higher than the other treatments and the lowest from the control. Also reported that organic manures with other combinations significantly increased the number of tillers m^{-2}.

Table 1: This table shows analysis of plants

Symbol	Treatments	Plant Population m^{-1}		Plant height (cm)			Number of tillers plant^{-1}			Number of spike m^{-2}	Length of spike (cm)	Number of grains spike^{-1}	Weight of grains spike^{-1}	Test weight (g)
		At 20 DAS	At harvest	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest	268.3	7.3	24.47	8.4	35.7
T_1	Control	20.87	20.55	15.5	39.47	84.84	3.39	7.91	9.01	540.5	8.34	31.86	11.16	41.08
T_2	100% RDF + 10 t FYM ha^{-1}	20.83	20.7	20.27	50.93	102.02	4.44	11.17	16.38	490	8.06	29.53	10.34	40.95
T_3	100% RDF + 05 t FYM ha^{-1}	21	20.66	19.07	48.6	101.05	4.17	10.6	15.59	477.9	8.28	29.63	10.38	40.1
T_4	75% RDF + 10 t FYM ha^{-1}	21.2	20.73	19.17	48.83	100.85	4.2	10.38	15.8	457.6	8.03	28.75	9.95	39.94
T_5	75% RDF + 05 t FYM ha^{-1}	20.97	20	18.33	46.7	96.89	3.62	9.78	14.51	555	8.43	32.67	11.35	41.92
T_6	100% RDF + 05 t VC ha^{-1}	21.07	20.67	20.93	51.4	102.75	4.58	11.27	16.67	495.4	8.19	30.34	10.62	40.82
	100% RDF + 2.5										7.85			

T_7	t VC ha^{-1}	21.07	20.53	19.6	49.93	102.59	4.29	10.95	15.77	489.5		28.1	9.84	40.15
T_8	75% RDF + 05 t VC ha^{-1}	21.2	20.6	18.13	46.2	99.28	3.97	9.84	14.83	446.8	7.78	27.87	9.76	40.13
T_9	75% RDF + 2.5 t VC ha	20.93	20.27	18	45.87	96.04	3.77	9.4	13.27	13.1	0.09	0.71	0.23	0.43
S. Em. (±)		0.34	0.29	0.34	0.66	1.71	0.11	0.21	0.25	38.3	0.26	2.09	0.67	1.27
C.D. at 5%		NS	NS	1.01	1.95	5.01	0.31	0.61	0.74					

Yield attributing characters

The grain yield per hectare was recorded after harvest and statistically analyzed data is presented in table 2, which indicated that there was a significant difference in grain yield due to different organic manure and fertilizers treatments as compared to control. Grain yield varied from 2261.9 to 4583.3 kg ha^{-1} under different treatments and the magnitude of increase in yield due to various organic manure and fertilizers treatments was 63.16 to 102.63 per cent over control. The maximum grain yield (4583.3 kg ha^{-1}) recorded with treatment T_6 (100% RDF + 05 t VC ha^{-1}) closely followed by 100 per cent RDF + 10 t FYM ha^{-1} (T_2) with 4464.3 kg ha^{-1} grain yield. Minimum grain yield (2261.9 kg ha^{-1}) was observed in control (T_1).It is revealed from results that increasing the levels of FYM from 5 to 10 t and vermicompost 2.5 to 5.0 t with 100 per cent RDF increased the grain yield significantly. on the other side, application of 75 per cent RDF + 10 t FYM ha^{-1} (T_4) was at par with 100 per cent RDF + 05 t FYM ha^{-1} (T_3) and 75 per cent RDF + 05 t VC ha^{-1} (T_8) was comparable with 100 per cent RDF + 2.5 t VC ha^{-1}(T_7). Thus we can save 25 per cent RDF with the application of 5.0 t FYM or 2.5 t vermicompost in late sown wheat.

Table 2: This table shows there was a significant difference in grain yield due to different organic manure and fertilizers treatments as compared to control.

Tr. No.	Treatments	Yield parameters			
		Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
T_1	Control	2261.9	3690.4	5952.3	38.00
T_2	100% RDF + 10 t FYM ha^{-1}	4464.3	6190.4	10654.7	41.91
T_3	100% RDF + 05 t FYM ha^{-1}	4047.6	5832.6	9880.2	40.95
T_4	75% RDF + 10 t FYM ha^{-1}	3809.5	5446.4	9255.9	41.16
T_5	75% RDF + 05 t FYM ha^{-1}	3779.7	5565.4	9345.2	40.45
T_6	100% RDF + 05 t VC ha^{-1}	4583.3	6369.0	10952.3	41.83
T_7	100% RDF + 2.5 t VC ha^{-1}	4166.6	5981.4	10148.0	41.06
T_8	75% RDF + 05 t VC ha^{-1}	3988.1	5744.0	9732.1	40.99
T_9	75% RDF + 2.5 t VC ha	3690.5	5297.6	8988.1	41.07
S. Em. (±)		119.5	168.7	282.7	0.32
C.D. at 5%		350.40	494.7	829.2	0.93

Conclusion

With a view to draw definite conclusion from the results of present investigation, the grain yield and monetary returns have been the major considerations. The findings of the present study indicated that application of 100 per cent RDF (100: 40: 20: N: P: K kg ha^{-1}) along with 10 t FYM or 05 t Vermicompost ha^{-1}produced higher growth and yield attributes of wheat. Maximum grain yield (4583.3 kg ha^{-1}) was produced with 100 per cent RDF + 05 t VC ha^{-1} closely followed by 100per cent RDF + 10 t FYM ha^{-1} with 4464.3 kg ha^{-1} grain yield. Whereas, maximum net returns of Rs.62789 ha^{-1} and benefit cost ratio (3.20) were found with 100 per cent RDF + 10 t FYM ha^{-1} treatment from the present study it can be concluded, that application of 100 per cent RDF (100: 40:20:: N:P:K kg ha^{-1}) along with 10 t FYM ha^{-1} produced higher growth and yield of wheat. This treatment gave higher net returns and benefit cost ratio in late sown wheat under sandy loam soils of Northern Madhya Pradesh.

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