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Effect of integrated nutrient management (INM) on growth, yield and yield attributes of Wheat (*Triticum aestivum* L.)

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Abstract
Wheat (*Triticum aestivum* L.) constitutes the most essential cereal crop in the world. Integrated nutrient management is the application of chemical fertilizers and organic manures together for crop productivity. The experiment was carried out to evaluate the effect of chemical and organic fertilizers on growth, yield, and yield characteristics of three wheat varieties. The experiment arranged with a randomized block design with nine treatments and replicated thrice. In comparison to other treatments, DBW 187 + 120:60:40 N:P:K kg/ha had a significant effect on the growth and yield of wheat crops. At each growth stage, T8 (DBW 187 + 120:60:40 N:P: K kg/ha) exhibited higher growth parameters, including plant height, number of tillers per square meter, dry matter, etc. T8 (DBW 187 + 120:60:K kg ha1 N:P) exhibited a higher grain yield, straw yield, and harvest index as a result of this factor (N:P: K kg ha1). T8 (DBW 187 + 120:60:40 N:P: K kg/ ha) was characterized by increased gross returns, net returns, and B: C ratio.

Keywords: Wheat, nutrient management, yield, economics

Introduction
Wheat (*Triticum aestivum* L.) ranks first position in the world among cereals both in respect of area and production. It is a crop that is primarily grown in temperate regions. It constitutes the staple food in at least 43 countries. The most important wheat-growing countries are Russia, USA, China, India, Canada, Argentina, Australia and several European countries (Desai *et al.*, 2015) [4]. Wheat is a major agronomic crop belonging to the family Poaceae which is well known for flour, pasta, pastry, semolina, crumpets, flake, chapatti, cookies, etc. It is a chief staple food that supplies approximately 35% of the total food consumed by the global population. The total production of wheat estimated in 2019-2020 was 765.41million metric tons (Shabandeh *et al.*, 2020) [13].

Vermicomposting is bio-oxidation and stabilization of organic material involving the joint action of earthworms and microorganisms. Although microbes are responsible for the biological degradation of organic matter, earthworms are the important drivers of the process, conditioning the substrate and altering biological activity (Aira *et al.*, 2002) [1]. The earlier workers reported a positive effect of vermicompost application on the growth and productivity of cereals and legumes (Suthar, 2006) [10]. For sustainable crop production the integrated use of chemical and organic fertilizer has been highly beneficial (Yasin *et al.*, 2015) [14].

The world consumption of potassium (K), phosphorus (P), and nitrogen (N) in 2018/2019 was 34.0, 45.9, and 119.5 tons/year, respectively (IFA, 2014). (Add some recent review or data). Due to the continuous growth in population, demand for plant nutrients is expected to increase continuously (Keeney *et al.* 1990). Health problems and unrecoverable environmental pollution are seen due to the intensive use of inorganic fertilizers in agriculture (Chandini *et al.*, 2019) [3]. For sustainable crop production the integrated use of chemical and organic fertilizer has been reported to be highly beneficial (Yasin *et al.*, 2015) [14]. The concept of integrated nutrient management should be followed to prevent severe health hazards and to protect the environment. Integrated nutrient management refers to the combination of all possible sources of nutrients like organic sources and inorganic sources or components in a judicious way for obtaining an ecologically sound environment and economically optimal farming system (Jat *et al.*, 2015).

Integrated use of organic and inorganic nutrient sources helps in gaining sustainable yield and improved soil quality for enhanced production (Brar *et al.*, 2015) [2].

Materials and Methods

The Field trial was conducted at the research farm of the Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara, Punjab. Urea, single super phosphate(SSP) and murate of potash (MOP) to fulfill the requirement of nitrogen(N), phosphorus(P) and potassium(K) respectively. The experiment was laid out in randomized block design (RBD) which consists of nine treatments. The treatment combinations were T1-Unnat PBW 550 + Control, T2-Unnat PBW 550 + 120:60:40 kg NPK/ha, T3-Unnat PBW 550 + Vermicompost, T4-HD 2967 + Control, T5-HD 2967 + 120:60:40 kg NPK/ha, T6-HD 2967 + Vermicompost, T7-DBW 187 + Control, T8-DBW 187 + 120:60:40 kg NPK/ha and T9-DBW 187 + Vermicompost. The growth parameters recorded were Plant height, Number of tillers, Number of leaves, Plant dry weight and the yield parameters recorded were Length of spike, Number of grains per spike, Test weight, Grain yield and Straw yield. The growth parameters of the plants were recorded at frequent intervals from germination till harvest and finally, the yield parameters were recorded after harvest. These parameters were statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design.

Results and Discussion

Plant height (cm)

Maximum plant height (106.2 cm) was recorded in the treatment combination of DBW187 + 120:60:40 kg NPK/ha T8 over the other treatments (Table-1). However, the treatment (T7) DBW187 + Control (105.6 cm) was found to be statistically at par than (T8) DBW187 + 120:60:40 kg NPK/ha. The variety DBW187 was superior than HD 2967 and Unnat PBW 550. However, minimum plant height (85.7 cm) was observed in the treatment (T3) Unnat PBW 550 + vermicompost. The reason for increased plant height is due to the application of 120:60:40 kg NPK/ ha which made nutrients available to crop at the vegetative stage due to higher cell division, higher nutrient uptake and higher photosynthetic rate. It might be due to the stimulated vegetative growth of wheat on account of an adequate and prolonged supply of essential nutrients. Similar results were also reported by Meena *et al.* (2013) [15], Kaur *et al.* (2018) [7], and Singh *et al.* (2020) [9]. Maximum plant height (98cm) was attained when NPK was applied at the rate of 200-150- 125 kg/ha against minimum plant height which was observed from treatment where no fertilizer was applied. The plant height increased linearly with each successive increase in NPK which was attributed to the gradual increase in plant height. Height of wheat plant was maximum in T4 (85 cm) treatment with NPK dose. These results are in agreement with Ayub *et al.*, (2002), and Maqsood *et al.*, (2001).

Table 1: Effect of integrated nutrient management on plant height (cm) of wheat

Treatment Combinations	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	120 DAS
1. Unnat PBW 550 + Control	16.9	45.2	73.1	85.7
2. Unnat PBW 550 + 120:60:40 kg NPK/ha	17.6	46.6	75.0	86.5
3. Unnat PBW 550 + Vermicompost	16.2	44.1	72.4	84.9
4. HD 2967 + Control	24.6	71.7	88.7	102.7
5. HD 2967 + 120:60:40 kg NPK/ha	26.8	72.7	89.7	103.9
6. HD 2967 + Vermicompost	24.2	70.9	87.1	101.7
7. DBW 187 + Control	28.4	75.6	90.7	105.6
8. DBW 187 + 120:60:40 kg NPK/ha	29.1	76.2	91.9	106.2
9. DBW 187 + Vermicompost	27.3	74.7	89.8	104.6
F test	S	S	S	S
S.Em (±)	0.41	0.28	0.36	0.27
CD (P = 0.05)	1.25	0.86	1.08	0.82

Number of leaves per plant

Maximum no. of leaves/plant (45.7) were recorded in the treatment T8 in the combination DBW 187+ 120:60:40 kg NPK/ ha, whereas the treatments Unnat PBW 550 + control, HD 2967 + 120:60:40 kg NPK/ ha and Unnat PBW 550 + 120:60:40 kg NPK/ ha were found to be statistically at par with (T8) DBW 187 + 120:60:40 kg NPK/ ha. The minimum number of leaves per plant (35.0) were observed in the treatment (T6) HD 2967 + Vermicompost.

Application of high doses of fertilizers increased NPK uptake by crop due to the well-developed root system resulting in better absorption of water which made the production of a higher number of leaves per plant. The results are in agreement with the findings of Meena *et al.* (2013) [15], Kaur *et al.* (2018) [7], and Singh *et al.* (2020) [9]. Some interesting variations caused by the various cultivars have been noticed where significant trends in plant height, no. of tillers m^{-2}, dry matter accumulations, and leaf area index were observed by showing its superiority in DBW187 followed by HD2967, which being at par with each other (Singh *et al.* 2021) [12].

Table 2: Effect of integrated nutrient management on no. of leaves/plant of wheat

Treatment Combinations	No. of leaves/plant			
	30 DAS	60 DAS	90 DAS	120 DAS
1. Unnat PBW 550 + Control	5.7	25.3	63.9	42.1
2. Unnat PBW 550 + 120:60:40 kg NPK/ha	5.9	21.0	66.0	43.3
3. Unnat PBW 550 + Vermicompost	4.9	20.8	56.4	38.1
4. HD 2967 + Control	5.5	28.8	58.3	39.1
5. HD 2967 + 120:60:40 kg NPK/ha	5.7	33.3	64.0	43.1
6. HD 2967 + Vermicompost	4.7	32.7	50.3	35.0
7. DBW 187 + Control	5.2	35.1	61.1	40.3
8. DBW 187 + 120:60:40 kg NPK/ha	5.8	36.4	69.0	45.7
9. DBW 187 + Vermicompost	4.9	26.8	52.4	36.7
F-test	S	NS	S	S
S.Em (±)	0.43	4.42	2.90	1.16
CD (P = 0.05)	1.29	-	8.70	3.49

Plant dry weight (g)

Maximum plant dry weight (69.4g) was recorded in the treatment T8 (DBW187 + 120:60:40 kg NPK/ha) over the other treatments (Table 3). However, the treatment T7 (DBW187 + Control) (68.7g) was found to be statistically at par with T8 (DBW187 + 120:60:40 kg NPK/ha). Variety DBW187 was found to be superior to other varieties HD 2967 and Unnat PBW 550. The treatment (Unnat PBW 550 + vermicompost) recorded minimum dry weight as compared to the other treatments.

The addition of higher doses of fertilizers to variety DBW 187 led to balanced proportions of plant nutrients supplied to crop according to the need during the growth period resulting favorable increase in plant height, and the number of leaves per plant which in turn led to higher dry weight. Similar results were also observed by Meena *et al.* (2013) [15], Kaur *et al.* (2018) [7], and Singh *et al.* (2020) [9].

Some interesting variations caused by the various cultivars have been noticed where significant trends of plant height, no. of tillers/m^2, dry matter accumulations, were observed by showing its superiority in DBW- 187 followed by HD-2967, which is at par with each other (Singh *et al.* 2021) [12].

Table 3: Effect of integrated nutrient management on plant dry weight (g/plant) of wheat

Treatment Combinations	Plant dry weight (g/plant)			
	30 DAS	60 DAS	90 DAS	120 DAS
1. Unnat PBW 550 + Control	3.3	11.7	53.4	59.8
2. Unnat PBW 550 + 120:60:40 kg NPK/ha	3.7	12.3	52.5	60.4
3. Unnat PBW 550 + Vermicompost	3.2	11.2	52.5	59.1
4. HD 2967 + Control	7.2	12.3	51.5	67.3
5. HD 2967 + 120:60:40 kg NPK/ha	7.3	16.8	56.2	68.3
6. HD 2967 + Vermicompost	6.8	16.2	50.3	66.6
7. DBW 187 + Control	7.3	16.8	56.8	68.7
8. DBW 187 + 120:60:40 kg NPK/ha	7.6	17.4	57.5	69.4
9. DBW 187 + Vermicompost	7.1	16.2	51.8	67.4
F test	S	S	S	S
S.Em (±)	0.09	0.11	0.26	0.23
CD (P = 0.05)	0.30	0.36	0.79	0.72

Number of tillers/m^2

The maximum number of tillers/m^2 (353.7) were recorded in the treatment combination of DBW 187 + 120:60:40 kg NPK/ ha over the other treatments. However, the treatment T1 (Unnat PBW 550 + Control) (353.0) was found to be statistically at par than (DBW 187 + 120:60:40 kg NPK/ ha). Variety DBW 187 outperformed other varieties (HD 2967 and DBW 187). The minimum number of tillers/m^2 were observed in the treatment (T6) HD 2967 + vermicompost.

The increased number of tillers were due to the higher metabolic rate, higher photosynthetic rate, cell division. Similar results were also observed by Singh *et al.* (2021) [12], Kirandeep *et al.* (2020) [9], and Kaur *et al.* (2018) [7]. DBW-187 and HD-2967 proved to be the best in terms of growth parameters. Therefore, these varieties may be selected for obtaining a higher growth point of view (Singh *et al.* 2021) [12].

Table 4: Effect of integrated nutrient management on the number of tillers/m^2 of wheat

Treatment Combinations		Number of tillers/m^2		
	30 DAS	60 DAS	90 DAS	120 DAS
1. Unnat PBW 550 + Control	227.3	315.5	390.2	353.0
2. Unnat PBW 550 + 120:60:40 kg NPK/ha	228.3	312.0	389.8	347.4
3. Unnat PBW 550 + Vermicompost	225.5	310.4	387.1	351.3
4. HD 2967 + Control	215.6	296.0	367.8	328.6
5. HD 2967 + 120:60:40 kg NPK/ha	216.2	296.8	368.7	329.3
6. HD 2967 + Vermicompost	214.6	295.5	366.5	327.6
7. DBW 187 + Control	225.1	310.4	388.3	346.3
8. DBW 187 + 120:60:40 kg NPK/ha	226.0	316.4	391.3	353.7
9. DBW 187 + Vermicompost	224.69	309.8	387.2	345.4
F-test	S	S	S	S
S.Em (±)	0.33	0.15	0.32	0.53
CD (P = 0.05)	1.01	0.82	0.97	1.61

Yield and Yield attributes

Higher yield attributes like the number of grains per spike (44.7), length of the spike (10.5), and test weight (44.4 gm) were found significantly higher in T8 and treatment T2 was at par with T8. Higher grain yield (49.9 q/ ha) and straw yield (59.9 q/ ha) were found in T8 while the lowest was recorded with T6. The higher straw yield was found in T8 (59.9 q/ ha) and the lowest was in T9 (45.4 q/ ha). Variety DBW 187 is superior over all varieties taken under research as it has a superior higher yield potential as compared to other varieties. This variety (DBW 187) comprises a higher number of grains per spike, average length of the spike and test weight, which in turn resulted in higher grain and stover yield. The yield potential of DBW 187 was increased due to the application of higher doses of fertilizers which made better availability of nutrients to the crop because higher doses of fertilizers balanced the leaching losses and nutrient deficiencies in the soil. Similar results were reported by Devi *et al.* (2011), Kaur *et al.* (2018) [7], Singh *et al.* (2021) [12], and Kirandeep *et al.* (2020) [9].

Variety DBW-187, produced significantly highest grain yield of (56.00 q/ ha), straw yield (72.40 q/ ha), and total biological yield (138.84 q/ ha) followed by HD-2967 which gave (52.05 q/ ha) grain yield, (68.28 q/ ha) straw yield and (110.33 q/ ha) total biological yield. The higher yields with DBW-187 were mainly attributed due to higher growth and yield attributes owing to their genetic capability as compared to HD-2967 (Singh *et al.* 2021) [12]. These results were in close conformity with those of Brijkishor (1998).

Table 5: Effect of integrated nutrient management on yield and yield attributes of wheat

S. No.	Treatment combinations	Yield Attributes				
		Number of Grains per Spike (cm)	Length of the spike (cm)	Test weight (g)	Grain Yield (q/ ha)	Stover Yield (q/ ha)
1.	Unnat PBW 550 + Control	38.9	10.5	43.4	40.1	59.0
2.	Unnat PBW 550 + 120:60:40 kgNPK/ha	42.5	10.3	42.2	49.7	47.5
3.	Unnat PBW 550 + Vermicompost	41.1	10.3	42.9	45.6	58.2
4.	HD 2967 + Control	44.0	9.8	39.3	38.4	54.6
5.	HD 2967 + 120:60:40 kg NPK/ha	44.2	9.8	39.5	47.9	55.5
6.	HD 2967 + Vermicompost	41.7	9.7	38.0	40.2	53.9
7.	DBW 187 + Control	39.0	10.2	41.3	40.4	46.6
8.	DBW 187 + 120:60:40 kg NPK/ha	44.7	10.4	44.4	49.9	59.9
9.	DBW 187 + Vermicompost	40.2	10.1	40.1	46.2	45.4
	F-Test	S	S	S	S	S
	S.Em (±)	0.16	0.04	0.42	0.18	0.25
	CD (p=0.05)	0.49	0.13	1.27	0.55	0.77

Conclusion

In conclusion, it is inferred from the present investigation showed that the variety DBW 187 of wheat has highest growth, yield and yield characteristics are directly influenced by the application of 120:60:40 N:P: K kg/ ha. A maximum value for T8 was discovered for many characteristics, including plant height, tillers/m^2 and dry weight. The use of 120:60:40 N:P: K kg/ha in the variety DBW 187 also produced the highest yield and yield characteristics, maximum gross return, and maximum net return B: C ratio.

References

1. Aira M, Monrot F, Dominguez J, Mato S. How earthworm density affects microbial biomass and activity in pig manure. European J Soil Biol. 2002;38:7-10.
2. Brar BS, Singh J, Singh G, Kaur G. Effect of long-term application of inorganic and organic fertilizers on soil organic carbon and physical properties in maize wheat rotation. Agron. 2015;5:220-238.
3. Chandini, Kumar R, Kumar R, Prakash OM. The impact of chemical fertilizers on our environment and ecosystem. Research trends in environmental sciences; c2019. p. 69-86.
4. Desai H, Dodia I, Desai C, Patel Hiren. Integrated Nutrient Management in Wheat (*Triticum aestivum* L.). Trends in Biosciences. 2015;8:472-475.
5. Devi KN, Singh MS, Singh NG, Athokpam HS. Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.). Journal of Crop and Weed. 2011;7(2):23-27.
6. IFA. 82nd IFA Annual Conference, Sydney, May 2014 Fertilizer Outlook 2014-2018 P. Heffer and M. Prud'homme, IFA; v2014.
7. Kaur R, Kumar S, Kaur R, Kaur J. Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.) under irrigated conditions. International Journal of Chemical Studies. 2018;6(4):1800-1803
8. Keeney D. What goes around comes around- The nitrogen issues cycle. In Third Int. Dahila; c1990.
9. Kirandeep, Sharma M, Singh R. Effect of Different Sowing Techniques and Varieties on yield of Wheat (*Triticum aestivum* L.). Journal of Krishi Vigyan. 2020;9(1):92-98.
10. Shabandeh M. Global wheat production from 2011/2012 to 2019/2020 (in metric tons). Statista; c2020.
11. Sheoran S, Raj D, Antil RS, Mor VS, Dahiya DS. Productivity, seed quality, and nutrient use efficiency of wheat (*Triticum aestivum* L.) under organic, inorganic, and INM practices after 20 years of fertilization. Cereal Research Communications. 2017;45(2):315-325.
12. Singh V, Kaur S, Singh J, Kaur K, Gupta RK. Rescheduling fertilizer nitrogen topdressing timings for improving productivity and mitigating N2O emissions in timely and late sown irrigated wheat (*Triticum aestivum* L.), Archives of Agronomy and Soil Science. 2021;67(5):647-659.
13. Suthar S. Effect of vermicompost and inorganic fertilizer on wheat (*Triticum aestivum*) production, Nature, Env. and Poll. Technol. 2006;5:197-01.
14. Yasin GC. Effect of Integrated Nutrient Management on wheat. A review journal of Biology, agriculture, and health care, 2015, 5(13).
15. Meena BL, Rattan RK, Datta SP. Efficacy of seed treatment in ameliorating iron deficiency in aerobic rice on a calcareous soil. J Indian Soc. Soil Sci. 2013;61:147-152.