Original Research Article

Effect of integrated nutrient management on yield, yield attributes and nutritional status of different wheat (*Triticumaestivum*) genotypes

ABSTRACT

Haryana is the second-largest producer of wheat within the country, with approximately 12 percent of total wheat production. The production of wheat in Haryana was 11.9 metric tonnes and productivity 4786 kg ha-1from 2.53 mha (Anon, 2020). The nutrient supplying capacity of the soil and fertilizers application schedule plays a vital role within the production potential of wheat. Integrated Nutrient Management (INM) plays a vital role in increasing the organic carbon, biological, physical & chemical properties of soil. Therefore, an experiment was laid out with four varieties of wheat *viz.*, WH 283, RAJ 3765, WH 1105, NABI Black Wheat, and six integrated nutrient management treatments *viz.*, T1: 100 % RDF (150 kg N + 60 kg P + 25 kg ZnSO4ha-1), T2: 90% RDF+10% Bio-Fertilizer (Rhizobium + PSB), T3: 80% RDF+ 10% (VC) + 10% Bio-fertilizer (Rhizobium + PSB), T4: 70% RDF+ 20 % (VC) + 10% Bio-fertilizer (Rhizobium + PSB), T5: 60 % RDF+ 30 % (VC) + 10% Bio-fertilizer (Rhizobium + PSB) and T6: Control during Rabi season of 2019-20 at Research Farm of the Faculty of Agricultural Sciences, SGT University Gurugram. The experiment was carried out in split block design replicated thrice. The results revealed higher plant height (95.7 cm) at maturity with WH 283, followed by WH 1105 (92.7 cm) and Raj 3765(85.5 cm), while lower values were recorded with NABI Black(77.5 cm). The utmost yield parameters *viz.*, spike length (12.7 cm), spikes per m2 (368.1), and test weight (44.0 g) were recorded with wheat WH 1105. The maximum yield (44.9 q ha-1), straw yield (59.9 q ha-1), and harvest index (41.4%) were recorded with the application of 100% recommended dose of fertilizer (RDF).

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Keywords: Genotypes, integrated nutrient management, wheat, yield

INTRODUCTION

India is predominantly an agriculture-based country, and over 65 percent of the population depends on agriculture for their livelihood. India recorded a spectacular feat in achieving self-sufficiency in food production during the mid-1960s. Today, our country enjoys the status of surplus in wheat grain production against the shortage at the time of independence. In India, wheat is grown in an area of 31.3 M ha with a total output of 107.8 M tons and productivity of 2390 kg/ha(Anon, 2020).

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It occupies a prominent position among the foodstuff crops not only in terms of area, production, and productivity, but it also bears versatility in adaptation to a good range of agro-climatic conditions. Several problems, including soil fertility deterioration and environmental pollution emerging from this agricultural system, are affecting soil productivity adversely(Goel *et al.*, 2020. Therefore, an integrated nutrient management (INM) approach gained momentum and importance for a sustainable agriculture system.

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The integrated application of organic manures and mineral fertilizers results in a rise in the nitrogen concentration, better utilization of phosphorus and potassium gives the improved soil properties, better absorption of water, and nutrients mineralization from the soil

(Barret *al.*, 2015). Tweet *al.*, (2019) stated in their research organic manure and biofertilizers amendments could substitute about half the recommended chemical fertilizers in winter wheat production without decreasing grain yield. The maximum leaf area index was recorded in PBW-343 followed by Malviya-234 and NW-1012 with 4.8 m2, 4.3 m2, and 4.1 m2.respectively, reported by Chauhan *et al.*, (2020). Patel *et al.*, (2018) recorded that the supply of the proper amount of nutrients, mainly nitrogen, at active growth stages of the crop results in an increase in leaf area development and LAI. Therefore, it has become necessary to develop an integrated plant nutrient management system that involves the integrated use of inorganic fertilizers, organic sources, and bio-fertilizers for maximizing wheat productivity in the semi-arid zone.

The objective of this revolutionary approach is the efficient, reasonable, and economical use of all the natural sources in production systems to maximize the yield of a cropping system with no adverse effect on the agro-ecosystem.

MATERIALS AND METHODS

The field experiment was performed during *rabi* season 2019-20 at the Agronomy Research Field of the Faculty of Agricultural Sciences, SGT University, Gurugram. The experimental field soil was sandy loam in texture, low in nitrogen (160.4Kg ha-1), medium in phosphorus (12.3Kg ha-1), and low in potassium (110.1Kg ha-1).

The experiment was performed in split-plot design with WH 283, RAJ 3765, WH 1105, NABI Black Wheat genotypes in main plots. The INM fertilization asT1: 100 % RDF (150 kg N + 60 kg P + 25 kg ZnSo4/ha), T2: 90% RDF+10% Bio-Fertilizer (Rhizobium + PSB), T3: 80% RDF+ 10% (VC) + 10% Bio-fertilizer (Rhizobium + PSB), T4: 70% RDF+ 20 % (VC) + 10% Bio-fertilizer (Rhizobium + PSB), T5: 60 % RDF+ 30 % (VC) + 10% Bio-fertilizer (Rhizobium + PSB) and T6: Control in sub-plots with three replications.

Five representative spikes were harvested from marked rows from each plot. The spike length (cm) was measured from base to top of the spike and average spike length was calculated. Five random spikes were harvested from marked rows from each plot. The number of grains was counted by crushing the spikes by hands. The biomass obtained for individual plot threshed, cleaned and grains obtained were converted into q/ha.The soil samples were collected from each plot from the experimental field at 0-15 cm depth before and completion of the study. Composite samples were prepared and analyzed for the chemical and physical properties of soil under study.Growth, yield and yield parameters were statistically analyzed by using statistical methods described by PanseSukhatme (1985). To see the significance of treatments effect, the data were subjected to statistical analysis by the "analysis of variance" technique given by Fisher (1958).

RESULTS AND DISCUSSION

The effect of experimental variables is reflected in the wheat crop's grain yield, which is a major criterion for identifying the efficiency of various treatments in a given condition. The different factors, which can affect the grain yield which may be the ultimate aim of the research investigations. Grain yield of a crop is directly related to various yield attributes, *viz.*,spikes/m2, grains per spike, test weight, etc.

Spike length

Spike length was significantly affected by different genotypes under study. The data in Table 1 showed that maximum spike length was (12.7 cm) recorded with WH 1105, which was statistically similar with WH 283 (12.2 cm), Raj 3765 (12.2 cm), and significantly higher than NB black (10.6 cm). Mahajan et *al*.(2011) also observed that the maximum differences in yield attributes may be due to genetic makeup.

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The higher spike length (13.3 cm) was recorded at 100% RDF, which was significantly higher than the rest of the treatments. The spike length recorded with 90% RDF + Bio-Fertilizer+ Rhizobium + PSB (12.8 cm) was at par with 80% RDF+10VC (Vermi- Compost) +Bio-Fertilizer (12. cm) and significantly higher than the rest of the treatments. The data in Table 1 also indicated that the spike length recorded with 70% RDF + 20% VC +Bio-Fertilizer (11.7 cm) was at par with 60% RDF+30VC (Vermi- Compost) +Bio-Fertilizer (11.2 cm) but higher than control (10.1 cm). Similar findings were observed by researchers that maintaining an adequate and balanced supply of nutrients can improve growth and higher photosynthesis that resulted in maximum higher spike length (Richards, 2000).

Number of Spikes

The number of spikes was not found significantly affected by the different cultivars under study. The data in Table 1 indicated that the maximum number of spikes/m2 were recorded with Raj 3765 (383.8) followed by NB black (357.2) and WH 283 (342.7). The PBW-343 cultivar recorded maximum dry matter accumulation, which was significantly superior to Malviya-234 and NW-1012 at all growth stages of the crop up to harvest stage indicating varietal differences by Chauhan *et al*. (2020).

The maximum numbers of spikes/m2 (407.1 cm) were recorded at 100% RDF, which was much higher than the rest of the treatments. The data in Table 1 indicated that the number of spikes/m2 recorded with 90% RDF + Bio-Fertilizer+ Rhizobium + PSB (385.8) were statistically at par with 80% RDF+10VC (Vermi- Compost) +Bio-Fertilizer (377.1) and significantly higher number of spikes/m2 than rest of treatments. The data in Table 1 also indicated that the number of spikes recorded with 70% RDF + 20% VC +Bio-Fertilizer (355.4) was significantly higher than 60% RDF+30VC (Vermi- Compost) +Bio-Fertilizer (339.1). The minimum number of spikes/m2 was recorded with the control treatment (313.3). Similar results on yield attributes were also recorded by Basir*et al*. (2020).

Grains per spike

Grains per spike were affected by different genotypes may be due to genetic variations. The data in Table 1 specified that maximum grains spike-1 (27.3) were recorded with WH 283, followed by Raj 3765 (26.6) and NB black (10.6). The minimum numbers of grains per spike were recorded with WH 1105 (23.6). Malik *et al*. (2014) also reported that yield attributes viz. filled grains per ear head and test weight differed significantly among cultivars. The data in the Table 1 indicated that among fertilizer treatments, maximum grains per spike were recorded at 60% RDF+30VC (Vermi- Compost) +Bio-Fertilizer (26.6), however all INM treatments viz. 100% RDF (25.7), 90% RDF + Bio-Fertilizer+ Rhizobium + PSB (25.5), 80% RDF+10VC (Vermi-Compost) +Bio-Fertilizer (25.4), 70% RDF + 20% VC +Bio-Fertilizer (25.6) were at par with each other.

Test weight

Test weight was significantly affected by different cultivars under study. The data in Table 1 indicated that the maximum test weight (44.0 g) was recorded with WH 1105, which was significantly higher than other cultivars under study. Among other cultivars, maximum test weight was recorded with WH 283 (41.4 g), which was considerably higher than Raj 3765 (41.4 g) and NB black (37.0).

Among INM treatments, maximum test weight (41.7 g) was recorded with 100% RDF, which was notably higher than the rest of the treatments (Table 1). The test weight recorded with 90% RDF + Bio-Fertilizer+ Rhizobium + PSB (41.5 g) was significantly higher than 80% RDF+10VC (Vermi- Compost) +Bio-Fertilizer (41.0 g), 70% RDF + 20% VC +Bio-Fertilizer

(40.7 g) was statistically at par with 60% RDF+30VC (Vermi- Compost) +Bio-Fertilizer (40.3 g) and control (38.6 g). Table 1 showed a significant decrease of test weight with the decrease in the recommended dose of fertilizers from 100% RDF to control. The addition of N doses through Vermi-compost from 10 to 30 kg/ha in succession resulted in a decrease in the spike length (12.6-11.2 cm), spikes m-2 (377.1-339.1), and 1000-grain weight (41.0-40.3 g). Similar findings have been reported by Mattas, *et al*. (2011) ;Kaur, 2015;Mumtaz*et al*. (2015).

Grain yield

The Data in Table 1 indicated that grain yield significantly differed with different cultivars under study. The maximum grain yield (40.5 q/ha) was recorded with WH 1105 which was statistically at par with WH 283 (38.3 q/ha), significantly higher than the rest of the cultivars under study. The grain yield recorded with WH 283 (38.3 q/ha) was statistically similar to Raj 3765 (37.1 q/ha) and significantly higher than NB Black (35.0 q/ha). Chauhan et *al*. (2020) also reported the significant role of wheat varieties and reported that PBW343 produced the highest grain yield significantly higher than all other varieties. A similar finding of variation in grain yield was reported by Singh et *al*. (2019).

The data in Table 1 indicated that among nutrient treatments, the maximum grain yield (44.9 q/ha) was recorded at 100% RDF, which was significantly higher than the rest of the fertilizer treatments. The grain yield recorded with 90% RDF + Bio-Fertilizer+ Rhizobium + PSB (414 q/ha) was significantly higher than 80% RDF+10VC (Vermicompost) +Bio-Fertilizer (38.7), 70% RDF + 20% VC +Bio-Fertilizer (36.1 q/ha), 60% RDF+30VC (Vermicompost) +Bio-Fertilizer (34.6 q/ha) g) and control (30.8 q/ha). Similarly, increasing N rates increased grain yield in bread wheat were also reported earlier by Pramanik and Bera (2013) and Patel *et al*. (2014). All the INM treatments differed significantly from each other. There was a significant decrease in grain yield and the recommended dose of fertilizers from 100% RDF to control. The increase in grain yield at the higher N through fertilizers might be due to the sufficient availability of nitrogen that increased N mobilization to the grain at the grain filling stage. The highest grain yield of wheat was recorded with the integrated application of NPK+ Azolla compost than RDF and control by Bharati*et al*. (2017).

Straw yield

The Data in Table 1 showed that straw yield was not significantly affected by different cultivars under study. The maximum straw yield (53.3 q/ha) was recorded with WH 1105, followed by WH 283 (52.8 q/ha). The minimum straw yield was recorded with Raj 3765 (48.9 q/ha). The effect of cultivars was also reported by Chauhan*et al*.(2020) that the maximum grain yield 39.45 q/ha was recorded with cultivar PBW-343which was significantly higher over the rest of the cultivars. The data in the Table 1 showed a significant decrease in straw yield with a decrease in the recommended dose of fertilizers from 100% RDF to control. Maximum straw yield (59.9 q/ha) was recorded at 100% RDF, significantly higher than the rest of the treatments. The straw yield recorded with 90% RDF + Bio-fertilizer+ Rhizobium + PSB (56.2 q/ha) was significantly higher than 80% RDF+10VC (Vermicompost) +Bio-Fertilizer (53.4 q/ha), 70% RDF + 20% VC +Bio-Fertilizer (48.7 q/ha), 60% RDF+30VC (Vermicompost) +Bio-fertilizer (48.4 q/ha) and control (44.7 q/ha). 70% RDF + 20% VC +Bio-fertilizer were at par with 60% RDF+30VC (Vermicompost) +Bio-fertilizer. Inoculation of *Azospirillum*+ PSB significantly recorded 9.9% and 32.3% higher straw yield over control and *Azospirillum*in treated wheat crop by Havlin*et al*. (2006). Further studies showed that the application of organic manures, i.e., FYM @ 10 t/ha and vermin-compost 5 t/ha with 60 kg P_2O_5/ha or 40 kg P_2O_5/ha + PSB and 40 kg S/ha produced the maximum straw yield of wheat reported by Ullah *et al*. (2018). Adoption of

INM practices significantly enhanced yields in rice and wheat crops compared to chemical fertilizers alone Sharma *et al*. (2019).

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Biological Yield

The Data in Table 1 showed that biological yield was not significantly affected by different cultivars under study. The maximum biological yield (93.8 q/ha) was recorded with WH 1105, followed by WH 283 (91.1 q/ha) and Raj 3765 (86.0 q/ha). The minimum biological yield was recorded with NB black (87.5 q/ha). Similar results were also reported by Pathania *et al*. (2018).

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The data in Table 1 showed a significant decrease of biological yield with the decrease in the recommended dose of fertilizers from 100% RDF to control. Among INM treatments, maximum biological yield (104.8 q/ha) was recorded with 100% RDF, which was NO higher than the rest of the treatments. The biological yield recorded with 90% RDF + Bio-fertilizer+ Rhizobium + PSB (97.6 q/ha) was significantly higher than 80% RDF+10VC (Vermicompost) +Bio-fertilizer (92.1 q/ha), 70% RDF + 20% VC +Bio-fertilizer (84.8 q/ha) was and 60% RDF+30% VC (Vermicompost) +Bio-fertilizer (83.0 q/ha). The biological yield recorded with control (75.5 q/ha) was significantly lower than the rest of the treatments under study. This decrease in straw yield and biological yield might be due to lack of N, an essential component of vitamins energy systems and a constituent of specific organic compounds of physiological importance by Singh *et al*.(2006). Similar results of the application of integration of 75% NPK+ vermicompost @ 2.5ton/ha, and azotobactor were noted in the grain yield and yield attributes of wheat byKaur*et al*.(2018).

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Harvest index (%)

Harvest index (%) was significantly affected by different cultivars under the present study (Table 1). The maximum harvest index (42.1%) was recorded with Raj 3765, which was considerably higher than the rest of the wheat genotypes. The harvest index of 41.3% recorded with WH 1105 was considerably higher than WH 283 (40.2%). The minimum harvest index of 38.1% was recorded with NB Black.

The data in Table 1 indicated that nutrient application doses significantly affected the harvest index of different wheat genotypes. The maximum harvest index, 41.4%, was recorded at 100% RDF followed by 70% RDF + 20% VC +Bio-Fertilizer (40.9%) and was significantly higher than the rest of the treatments. The harvest index recorded with 90% RDF + Bio-Fertilizer (Rhizobium + PSB) (40.8%) was higher than 80% RDF+10VC (Vermi- Compost) +Bio-Fertilizer (40.4%), and 60% RDF+30VC (Vermi- Compost) +Bio-Fertilizer (40.0%). The data in Table 1 indicated that a significantly lower harvest index (38.9%) was recorded with the control treatment. Higher plant height, tillers, growth, and yield parameters might be due to more availability and uptake of nitrogen at the highest dose (RDF). The more growth and development increase with the increase in N from control to RDF by urea and DAP, beyond that limit, it can cause toxicity and reduce the plant yield noted by Sharma *et al*. (2007). The increase in growth and yield attributes may be due to addition of organic manures along with chemical fertilizers sustained the yield through increased nutrients availability and nutrient use efficiency. Similar results of improvement in yield attributes and yield of wheat crop were also recorded with the application of 75 % NPK + vermicompost @ 2.5 t/ha + azotobacter closely followed by 100 % RDF (Ramandeep *et al*., 2018).

Effect on the nutrient's status in soil Organic Carbon

The Data in Table 2 showed no change in organic carbon percent with different cultivars under study. The organic carbon percent was recorded similarly before and after the experimental crop was harvested. The organic carbon percent recorded with WH 1105, WH 283, and NB black was 0.3% for each cultivar before and after the study.

The data in Table 2 showed that INM treatments did not influence organic carbon percent. The organic carbon percent recorded with different INM treatments was 0.3%. Singh *et al*. (2006) reported that the available nutrient status of the soil decreased appreciably in the continuous cropping of rice and wheat grown in sequence. The N mineralization pattern and microbial biomass are the key mechanism affecting the fertility to meet the nutritional demand of the crops Ali *et al*. (2021). The application of compost or manure increased the amount of mineral-associated organic carbon within macro-aggregates by biochemical mechanism, while inorganic fertilization enhanced the carbon quantity by a physical protection mechanism. The no change in carbon percentage may be due to the continuous removal of native soil carbon, absence of the absence of external application and one growing season under study. The soil organic carbon accumulation depends on the carbon input sourced and mineralization and stabilization is long term process outlined by Xie et *al*. (2017); Yadav *et al*. (2020).

Nitrogen

The Data in Table 2 indicated no significant increase in the available nitrogen status of soil with different cultivars under study. The available nitrogen status ranged between 161.2 to 161.6 and 161.6 to 161.8 Kg/ha before and after the experiment, respectively. The change in available nitrogen status recorded between before and after study with WH 283, Raj 3765, WH 1105, and NB black was 0.2, 0.1, 0.1, and 0.2 kg/ha, respectively. Singh *et al.* (2017) recorded that the nitrogen uptake varied with different basmati cultivars.

The data in Table 2 showed no significant effect of an increase in vermin-compost level from 10 to 30% on change in available nitrogen in one crop duration time. The change in available nitrogen status recorded with 100% RDF, 90% RDF + Bio-fertilizer+ Rhizobium + PSB, 80% RDF+10VC (Vermicompost) +Bio-fertilizer, 70% RDF + 20% VC +Bio-fertilizer and 60% RDF+30VC (Vermicompost) +Bio-fertilizer were 0.2, 0.2, 0.1, 0.2 and 0.2 percent, respectively. There was no change in available nitrogen with the control treatment. Several studies found an increase in N in soil by the application of organic manures, Kumar, (2015). Tong *et al.* (2007) recorded that optimum N application increased N content in soil and N uptake in plants. Khalifa *et al.* (2005) recorded that N content and uptake increased due to increasing N applications. The maximum available nitrogen (165 kg/ha) was recorded in the treatment with integrated nutrient management of 100% NPK +25% N through vermin-compost, was significantly superior over rest of the treatments 125% RDF and 100% NPK + 25% N through FYM by Yadav *et al*., (2020).

Phosphorous

The Data in Table 2 showed no significant increase in the available phosphorous status of soil with the different cultivars under study. The available phosphorous status in the soil ranged between 12.6 to 12.8 and 12.8 to 13.1 kg/ha before and after the experiment. The percent change in available phosphorus status between before and after the study was recorded with WH 283, Raj 3765, WH 1105, and NB black were 2.3, 2.3, 1.6, and 2.3 percent, respectively. The highest P uptake was recorded in HD2987 and HD2967, and the lowest P uptake was recorded in WR544 and HD2931with 30.3 kg/ha, 29.9 kg/ha, and 25.0 kg/ha, 26.6 kg/ha, respectively (Hakeem*et al*., 2010). The data in Table 2 showed that the available phosphorous status of soil was not affected with an increase in Vermi-compost from 10% to 30% of the nutrient dose in one crop duration time. The available phosphorous range in treatments lied between 12.4 to 12.9 Kg/ha and 12.9 to 13.3 kg/ha before and after study, respectively. The change in available phosphorous status recorded with 100% RDF, 90% RDF + Bio-Fertilizer+ Rhizobium + PSB, 80% RDF+10VC (Vermi-compost) +Bio-Fertilizer, 70% RDF + 20% VC +Bio-Fertilizer and 60% RDF+30VC (Vermi-compost) +Bio-Fertilizer and control were 2.3, 3.0, 1.6, 2.4 and 1.6 percent, respectively. Higher content and uptake of nutrients have been reported with an optimum dose of fertilizers. Singh *et al*.(2017 and Singh *et al*. (2019), reported an increase in soil available phosphorus due to FYM application.

Potassium

The Data in Table 2 showed that there was no significant increase in the available potassium status of soil with the different cultivars under study. The available potassium status in the soil ranged between 111.8 to 112.2 and 112.0 to 112.6 kg/ha before and after the experiment. The change in available potassium in status between before and after a study recorded with WH 283, Raj 3765, WH 1105, and NB black were 0.5, 0.4, 0.2, and 0.3 percent, respectively. The data in Table 2 showed no significant effect on the available potassium status of soil with an increase in vermi-compost from 10% to 30% of the nutrient dose in one crop duration time. The available potassium range in treatments plots ranged between 111.5 to 112.4 kg/ha and 111.9 to 112.2 kg/ha before and after study. The change in available potassium in status recorded with 100% RDF, 90% RDF + Bio-Fertilizer+ Rhizobium + PSB, 80% RDF+10VC (Vermi-compost) +Bio-Fertilizer, 70% RDF + 20% VC +Bio-Fertilizer and 60% RDF+30VC (Verm-icompost) +Bio-Fertilizer was 0.4% for each treatment. The minimum (0.2%) percent change was recorded with the control treatment. The integrated application of FYM with 100 % NPK maintained the initial K status of soils, compared to 100 % NPK, application of FYM along, and 150 % NPK that resulted in increased of K content by 18.3 and 10.7 %, respectively (Bharti and Sharma, 2017). Continuous integrated use of farmyard manure, wheat straw and green manuring with inorganic minerals increased the NPK uptake, soil fertility, and yield enhancement in pearl millet and wheat crops Bairwa *et al*. (2013).

CONCLUSION

The findings of the present investigation concluded that Wheat genotype WH 1105 recorded significantly higher spike length (12.7 cm), number of spikes/m-2(368.1), 1000-grain weight (44.0 g), and grain yield (40.5 q ha-1), followed by WH 283, Raj 3765, and NB Black. The highest wheat grain yield (44.9 q/ha) was recorded with 100% RDF by synthetic fertilizer that was statistically higher than the rest of the INM treatments. Raj 3765 resulted in the highest harvest index, and higher HI was recorded with the recommended dose of fertilizers through synthetic fertilizers and decreased with an increase in nitrogen levels through the integration of vermin-compost. The increased supply of NPK fertilizers, FYM and azotobacter and may increase the nutrient uptake improved the grain and straw yields by stimulating the rate of various physiological processes. There was no significant effect of genotypes and INM treatments on soil organic carbon, available nitrogen, phosphorous, and potassium status. However, there was 0.2, 0.2, 0.1, 0.2, 0.2 and 0 percent increase in available N status, 2.3, 2.3, 1.6, and 2.3 percent increase in available P status and 0.5, 0.4, 0.,2 and 0.3 percent in available K status and at 100, 90, 80, 70, 60% N through fertilizers integrated with organics and the control, respectively. The integrated management of organic and inorganic sources improved Soil organic carbon, available N, available P, and resulted into improved soil health.

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Table 1. Effect of integrated nutrient management on yield attributes and yield of different wheat genotypes.

Genotypes	Spike Length (cm)	No. of pikes/ m^{-2}	Grains/spike	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest Index (%)

WH283	12.2	342.7	27.3	41.4	38.3	52.8	91.1	40.2
Raj 3765	12.2	383.8	26.6	40.2	37.1	48.9	86.0	42.1
WH1105	12.7	368.1	23.6	44.0	40.5	53.3	93.8	41.3
NABI Black	10.6	357.2	25.7	37.0	35.0	52.5	87.5	38.1
SEm±	0.4	22.0	1.3	0.3	1.2	1.1	2.0	0.002
CD (P=0.05)	1.4	NS	NS	1.1	3.2	N/A	N/A	0.01
INM Treatments								
T1	13.3	407.1	25.7	41.7	44.9	59.9	104.8	41.4
T2	12.8	385.8	25.5	41.5	41.4	56.2	97.6	40.8
T3	12.6	377.1	25.4	41.0	38.7	53.4	92.1	40.4
T4	11.7	355.4	25.6	40.7	36.1	48.7	84.8	40.9
T5	11.2	339.1	26.6	40.3	34.6	48.4	83.0	40.0
T6	10.1	313.3	26.0	38.6	30.8	44.7	75.5	38.9
SEm±	0.14	3.7	0.6	0.1	0.4	0.5	0.8	0.002
CD (P=0.05)	0.4	10.5	NS	0.2	0.9	1.6	2.3	0.01

NS: Not Significant

Table 2. Effect of integrated nutrient management on change in carbon percentage, nitrogen, phosphorous and available potassium status (kg/ha) in soil under different wheat genotypes.

Genotypes		Average N	% variation	Average P	% variation	Average K	% variation

	OC % AE		(kg/ha)		(kg/ha)		(kg/ha)
WH283	0.3	161.2	0.2	13.1	2.3	112.4	0.5
Raj 3765	0.3	161.6	0.1	13.0	2.3	112.6	0.4
WH1105	0.3	161.6	0.1	12.8	1.6	112.0	0.2
NABI Black	0.3	161.3	0.2	13.0	2.3	112.4	0.3
SEm(±)	0.0	0.2		0.1		0.2	
CD (P=0.05)	NS	NS		NS		NS	
INM Treatments							
T1	0.3	161.2	0.2	12.9	2.3	112.2	0.4
T2	0.3	161.6	0.2	13.3	3.0	112.2	0.4
T3	0.3	161.9	0.1	12.9	1.6	112.9	0.4
T4	0.3	161.4	0.2	12.7	2.4	112.9	0.4
T5	0.3	162.1	0.2	13.1	1.5	111.9	0.4
T6	0.3	161.7	0	12.9	1.6	112.2	0.2
SEm±	0.0	0.0		0.1		0.4	
CD (P=0.05)	NS	NS		NS		NS	

NS: Not Significant; [OC- Organic carbon].