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Research Article

Effect of Different Integrated Management Practices on Growth of Different Wheat Genotypes

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ABSTRACT

An experiment was conducted during Rabi season of 2019-20 at Research Farm of the Faculty of Agricultural Sciences, SGT University Gurugram. The experiment was laid out in split block design with four varieties 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 $ZnSo_4$ ha^{-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. The highest growth parameters were recorded with WH 1105 followed by WH 283 and Raj 3765. The lowest growth parameters were recorded with NB black. The treatments were replicated thrice. The maximum growth parameters viz., plant height (93.8 cm), numbers of tillers in running meter (81.4) and dry matter accumulation (982.2g) per square meter were recorded with the application of 100% RDF and minimum at T6 at maturity.

Keywords: *INM, Plant height, Leaf area index, Dry matter accumulation.*

INTRODUCTION

India is second largest producer of wheat (*Triticum aestivum* L.) in the world after China (134.34 million tonnes) with about 12% share in total world wheat production. In India, wheat is grown on about 30.60 million hectare area with a production of 98.38 million tonnes and average productivity is 3216 kg ha^{-1} during 2016-17 (Anonymous, 2017). India is predominantly an agriculture-based country and more than 2/3rd of the population depends on agriculture for their livelihood. India recorded a spectacular achievement in attaining the self-sufficiency in food grain production by the introduction of high yielding fertilizer responsive dwarf varieties of cereals, particularly wheat and rice in the mid-1960s. The objective of this green revolution approach is the efficient, judicious and economic use of all natural sources in production system to maximize the yield of a cropping system without any adverse effect on the agro-ecosystem.

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Therefore, it has become necessary to develop an integrated plant nutrient management system, which involves the integrated use of inorganic fertilizers organic sources and bio-fertilizers for maximizing wheat productivity. Despite of spectacular increase in production and productivity of wheat in India requires further increase in wheat production to feed the increasing population, to maintain adequate buffer stocks, to meet the requirement of processing industries and for export business. Integrated nutrient management (INM) plays an important role in providing balance the nutrition of agricultural crops. Organic manures and seed treatment with bio-fertilizers treatment improve soil's fertility and provides critical biosphere's functions. The combined use of organic manure and inorganic nutrients improved fertility status (N, P and K) of soil. Regular and judicious use of fertilizer not only help in raising good crop yields on a sustainable basis but can also help the farmers to gain consistency in higher profit.

RESULTS AND DISCUSSION

Plant Height (cm)

Plant height recorded at different growth intervals of wheat as influenced by genotypes and various nutrient's level is presented in Table no 1. Data indicated that plant height of wheat Genotypes increased successively with the advancement in the age of crop, highest recorded at maturity. Among genotypes, WH 1105 attained maximum plant height (24.8 cm) which was statistically higher than WH 283, Raj 3765 and NB black at 30 DAS. At 60DAS and 90DAS the higher plant height (57.1 & 87.7cm) was recorded with WH 1105 which was statistically at par with WH 283 (52.1 & 85.7 cm) and was significantly higher than NB black. At maturity WH 283 showed highest plant (95.7 cm) that was significantly at par with WH 1105 (92.7 cm) and significantly higher than Raj 3765 (85.5 cm) and NB Black (77.5cm). The plant height was influenced significantly at all the stages of crop growth and cultivars reported by Muhammad et al. 2015 and Netam et al. 2020.

Table 1: Effect of Integrated Nutrient Management on Plant Height (cm) of Different Wheat Genotypes

Treatment/Genotypes	30 DAS	60 DAS	90 DAS	Maturity
WH283	22.8	52.14	85.7	95.7
Raj 3765	20.9	46.4	77.4	85.5
WH1105	24.8	57.1	87.7	92.7
NABI Black	17.2	38.5	70.0	77.5
SE(m)±	1.11	3.8	2.02	2.2
CD at 5%	2.79	9.42	5.04	5.7
Treatments				
T1	22.9	52.4	85.3	93.8
T2	22.3	51.01	82.5	92.1
T3	21.7	49.5	81.6	89.9
T4	21.02	48.2	80.2	87.3
T5	20.7	46.6	79.1	84.3
T6	20.1	43.2	72.6	79.5
SE(m)±	0.76	1.9	2.1	1.6
CD at 5%	1.54	4.02	4.4	3.3

The highest plant height recorded at 30 DAS (22.9 cm), 60 DAS (52.4 cm) and 90 DAS (85.3 cm) with 100 RDF which was significantly at par with 90% RDF + Bio-Fertilizer (Rhizobium + PSB) 22.3 cm, 51.0 cm and 82.5 cm respectively. Integrated nutriment management and phosphate solubilizing bacteria increased the dry, matter accumulation, number of effective tillers, grains spike-' and the test weight. The enhanced early, vegetative growth in terms of higher leaf area, dry matter accumulation and vigorous root system resulted in more, spikes which consequently increased the number of

spike bearing tillers significantly. The plant height recorded at 90% RDF + Bio-Fertilizerwas statistically at par with 80% RDF+10VC (Vermi- Compost) +Bio-Fertilizer and significantly higher than T5 and T6. The lowest height reported at control at 30, 60, 90DAS as 20.1, 43.2 and 72.6 cm respectively. Choudhary (2000) recorded significant increase in plant height, dry matter accumulation and number of tillers m^{-1} in wheat with increase in fertilizer levels up to 120 kg N ha^{-1}.

Number of tillers per meter row length (t/mrl)

Number of tillers per meter row length recorded at different growth intervals of wheat as influenced by genotypes as well as various nutrient doses shown in Table 2. The data in the table 2 indicated that number of tillers increased successively with the advancement in the age of crop but number of tiller decline at maturity. The maximum number of tillers per meter row length at 30 DAS (51.2 m^2) which was higher than WH283, Raj 3765 and WH 1105 genotypes. At 60 DAS maximum number of tillers recorded with Raj 3765 (72.4/ m^2) followed by WH 1105 (67.7), NB Black (69.1) and WH 283 (56.5) at 60 DAS. The maximum number of tillers recorded with Raj 3765 (86.9/ m^2) followed by NB Black (82.5), WH 283 (83.1), and WH 1105 (81.3) at 90 DAS. The number of tillers found with Raj 3765 (76.7/ m^2) followed by WH 1105 (73.6), NB Black (71.4), and WH 283 (68.5) at maturity.

Table: 2: Effect of Integrated Nutrient Management on tillers per meter row length of Different Wheat Genotypes

Treatment/Genotypes	30 DAS	60 DAS	90 DAS	Maturity
WH283	35.4	56.5	83.1	68.5
Raj 3765	38.1	72.4	86.9	76.7
WH1105	44.2	69.7	81.3	73.6
NABI Black	51.2	69.1	82.5	71.4
SE(m)±	6.4	2.5	3.1	4.4
CD at 5%	N/A	N/A	N/A	N/A
Treatments				
T1	46.6	72.3	94.5	81.4
T2	44.1	70.2	90.8	77.1
T3	42.9	69.1	85.6	75.4
T4	41.3	66.5	80.9	71.1
T5	40.3	64.0	76.6	67.8
T6	38.2	59.5	72.2	62.6
SE(m)±	6.4	2.9	0.5	0.7
CD at 5%	N/A	N/A	1.6	2.1

The data in table 2 maximum numbers of tillers recorded (46.6), (72.3) with 100% RDF followed by 90% RDF + 10% bio-fertilizer (Rhizobium + PSB) (44.0) and (70.2) at 30 and 60 DAS. The lowest number of tillers/m^2 38.2 and 59.5 recorded with control at 30 and 60 DAS respectively. /m^2The number of tillers/m^2 with 90% RDF+ Bio-Fertilizer (90.8) was statistically higher than T3, T4, T5 and T6. The lowest number of tillers/m^2 (72.2) recorded with control at 90 DAS. Similar results were also reported by Devi et al. (2011). The data in table 2 indicated that maximum numbers of tillers (81.4) recorded at maturity with 100% RDF which was statistically higher than rest of treatment. The number of tillers/m^2 recorded with 90% RDF+ Bio-Fertilizer (77.1) was statistically at par with 80% RDF+10%VC+ Bio-Fertilizer (75.4) which was significantly higher than rest of treatments. Integrated nutriment management and phosphate solubilizing bacteria increased the number of tillers. The lowest number of tillers/m^2 (62.6) recorded with control at

Maturity. Similar results were reported by Mendhe et al. (2002) that nitrogen @ 125 kg ha^{-1}significantly increased plant height (130.09 cm) and number of effective tillers per hill (9.29) as compared to application of nitrogen @ 75 and 100 kg ha^{-1}.

Leaf Area Index (LAI)

Data in Table 3 indicated that the Leaf Area Index recorded at different growth intervals of wheat as influenced by different genotypes. The leaf area index of wheat increased with advancement of growth stages up to 60 DAS and showed declined trend at 90 DAS. The maximum leaf area index recorded with WH 1105 (2.2) which was significantly higher than rest of genotypes under study at 30 DAS. The data shown in table 3 indicated that the WH 283 also recoded significantly higher (2.1) LAI than Raj 3765 (1.8) and NB black (1.6) at 30 DAS. The data recoded at 60 DAS indicated the maximum leaf area index recorded with WH 1105 (4.1) was significantly higher than rest of genotypes. The data in table 3 indicated that the WH 283 also recoded significantly higher (3.9) LAI than Raj 3765 (3.7) and NB black (3.5) at 30 DAS. The data recorded at 90 DAS showed that the maximum leaf area index recorded with WH 1105 (3.2) was significantly higher than rest of genotypes under study. The data in table 3 indicated that the WH 283 also recoded significantly higher (3.0) LAI than Raj 3765 (2.8) and NB black (2.7) at 90 DAS. The lowest LAI recorded with NB black. In difference in plant height may be due to their genetic characters reported by Muhammad et al. (2015).

Table 3: Effect of Integrated Nutrient Management on leaf area index (LAI) of Different Wheat Genotypes

Treatment/Genotypes	30 DAS	60 DAS	90 DAS
WH283	2.1	3.9	3.0
Raj 3765	1.8	3.7	2.8
WH1105	2.2	4.1	3.2
NABI Black	1.6	3.5	2.7
SE(m)±	0.01	0.02	0.02
CD at 5%	0.03	0.1	0.1
Treatments			
T1	2.2	4.6	3.4
T2	2.1	4.4	3.2
T3	2.0	3.9	3.1
T4	1.9	3.7	2.8
T5	1.7	3.2	2.5
T6	1.6	3.1	2.3
SE(m)±	0.02	0.04	0.04
CD at 5%	0.1	0.1	0.1

Data in the table 3 indicates that LAI of wheat genotypes was influenced by different nutrient doses. The maximum leaf area index recorded with 100% RDF (2.1) which is statistically similar to 90% RDF + 10% Bio-fertilizer (2.1) and significantly higher than rest of treatments under study. The data in the table 3 also indicated that maximum LAI (4.6) reported with 100% RDF (4.6) was significantly higher than all rest of treatments under study. The enhanced vegetative growth in terms of higher leaf area with introduction of bio-fertilizer is similar to RDF may be due increased in mineralization of N and P. The LAI reported with 90% RDF + 10% Bio-fertilizer (4.4) which is significantly higher than the 80%, 70%, 60% and Control with 3.9, 3.7, 3.2 and 3.1 respectively. The minimum LAI (3.1) was reported with control treatment. Singh et al. (2006) also reported that the growth parameters improved significantly because of integrated nutrient management practices over

remainder of the rest of treatment. The data in the table 3 showed that maximum LAI (3.4) reported at 100% RDF, which was significantly higher than all rest of treatments under study at 90 DAS. The LAI reported with 90% RDF + 10% Bio-fertilizer (3.2) which is statistically at par with 80% RDF + 10% VC+10% Bio-fertilizer (3.1) and significantly higher than the rest of treatment. This might due to application of organic matter and bio fertilizer that help in higher nutrient mobility and therefore, plant uptake more nutrients by reducing nutrient losses through leaching, runoff etc.The minimum LAI (2.3) was reported with control treatment.

Similarly, Sarkar et al. (2004) found that the plant height and leaf area duration increased with the increasing levels of nitrogen upto 80 kg N ha^{-1} together with green manuring crops.

Dry Matter Accumulation/m^2 (DMA/ m^2)

The Dry matter accumulation in plants is influenced by cultivar characters and different nutrient doses. The data in the Table no. 4 on DMA/m^2 recorded at different growth stages of wheat crop by different cultivars. Data in the table 3 showed that highest DMA/m^2 (22.0 g) recorded with WH 283 which is statistically at par with WH 1105 (21.8 g) and statistically higher than Raj 3765 (21.2 g) & NB black (18.2g). The DMA/m^2 recorded with WH 1105 (164.8 g) is statically at par with WH 283 (162.0 g) and Raj 3765 (152.8 g), which is statistically higher than NB black (128.7 g) at 60 DAS. The data in table 3 at 90 DAS showed that among genotypes, WH 1105 (504.7 g) is statically at par with WH 283 (498.6 g) which is statistically higher than Raj 3765 (477.8 g), NB black (165.7). The maximum DMA/m^2 at maturity recorded with 1105 (981.8 g) is statically at par with WH 283 (972.7 g) which is statistically higher than Raj 3765 (923.8 g), NB black (897.4 g). The varieties contributed different DMA/m^2 at different crop growth stages may be due to their genetic characters also reported by Wajid et al. (2006).

Table 4: Effect of Integrated Nutrient Management on dry matter accumulation per meter square (LAI) of Different Wheat Genotypes

Treatments/Genotypes	30 DAS	60 DAS	90 DAS	Maturity
WH283	22.0	162.0	498.6	972.7
Raj 3765	21.2	152.8	477.8	923.8
WH1105	21.8	164.8	504.7	981.8
NABI Black	18.2	128.7	465.7	897.4
SE(m)±	0.7	6.8	6.6	11.4
CD at 5%	2.7	24.3	23.3	40.5
Treatments	30 DAS	60 DAS	90 DAS	Maturity
T1	22.1	161.5	505.5	982.2
T2	21.5	159.0	495.1	965.5
T3	20.9	154.0	490.9	958.8
T4	20.5	150.9	483.8	943.1
T5	20.1	149.0	478.3	927.5
T6	19.7	137.8	465.5	886.5
SE(m)±	0.4	3.3	6.3	11.9
CD at 5%	1.3	9.6	18.0	34.1

The dry matter accumulation was significantly affected by INM doses as shown in table 4. The highest DMA/m^2 (22.6 g) recorded with 100% RDF which is significantly at par with 90% RDF + 10% Bio-fertilizer (21.5 g) and 90% RDF + VC+ 10% Bio-fertilizer (20.9) but statistically higher than rest of treatment at 30 DAS. The minimum DMA/m^2 (19.7 g) was recorded with control treatment. The data in table 4 at 60 DAS showed that maximum DMA/m^2 (161.5 g) recorded with 100% RDF which is significantly at par with 90% RDF + 10% Bio-fertilizer (159.0 g) and 90% RDF + VC+ 10% Bio-fertilizer (154.0) but

statistically higher than rest of treatment at 60 DAS. The minimum DMA/m^2 (137.8 g) was recorded with control treatment.

The data in table 4 showed the maximum DMA/m^2 (505.5 g) recorded with 100% RDF which is significantly higher than rest of treatments The DMA/m^2 recorded with 90% RDF + 10% Bio-fertilizer (495.1 g) was statistically similar to 90% RDF + VC+ 10% Bio-fertilizer (490.9 g) but statistically higher than rest of treatment at 90 DAS. The minimum DMA/m^2 (465.5 g) was recorded with control treatment. The data recorded at maturity showed that maximum DMA/m^2 (982.2 g) recorded with 100% RDF dose which is significantly higher than rest of treatments. The data on DMA/m^2 recorded with 90% RDF + 10% Bio-fertilizer (965.5 g) which is statically similar to 90% RDF + VC+ 10% Bio-fertilizer (958.8 g) but statistically higher than rest of treatment at maturity. The minimum DMA/m^2 at maturity (886.5 g) was recorded with control treatment. The similar result was reported by (Afzal et al., 2005) and (Mubarak & Singh, 2011).

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