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Influence of integrated nutrient management on growth parameters and yield of black wheat (*Triticum aestivum* L.)

VARUN SHARMA, KAMALESH KUMAR AND LAKHWINDER SINGH
General Shivdev Singh Diwan Gurbachan Singh Khalsa College, Patiala, 147001

Abstract

A field experiment was conducted at Campus for Research and Advanced Studies, Dhablan, P.G. Department of Agriculture, G.S.S.D.G.S. Khalsa College, Patiala during Rabi *season of 2021-2022 with aim to find the "Influence of integrated nutrient management on growth parameters and yield of black wheat (*Triticum aestivum *L.)".The experiment was conducted in Randomized block design with 12 treatments and replicated thrice.* T_{12}*: 10t FYM* ha^{-1} *+ 2t VC* ha^{-1} *+ 3t PM* ha^{-1} *+ 1t NC* ha^{-1} *+* Azotobacter *5 kg* ha^{-1} *The data on plant height as influenced In present investigation the plant height of Black wheat crop was highest (24.95 cm) at 30 DAS with application of N:P:K @ 120:60:40 and was at par with treatment* T_{10}*:10t FYM* ha^{-1} *+ 2t VC* ha^{-1} *+ 3t PM* ha^{-1} *+1t NC* ha^{-1} *+* Azotobacter *5 kg* ha^{-1}*. All the treatments have significant influence upon the straw yield . The maximum biological (112.49) yield was observed in 10t FYM* ha^{-1}*+ 2t VC* ha^{-1} *+ 3t PM* ha^{-1}*+1t NC* ha^{-1}*+*Azotobacter *5 kg* ha^{-1}*. This might be due to fulfillment of nutrient requirement of black wheat crop achieved by supplying nutrients properly with integrated manner, On the other hand lowest biological yield (57.73) results were recorded by control plot..*

Keywords: *Triticum asetivum* L., integrated nutrient management, growth, yield

Introduction

Wheat (*Triticum asetivum L.*) is a major grain crop grown in India, Also known as the "king of cereals. Wheat is a major food crop and a major source of energy for the people of India. Wheat grains contain more protein than other grains, which is especially important for good bread quality due to the presence of the characteristic substance "gluten". Wheat is relatively high in niacin and thiamine. Wheat grains contain about 65% carbohydrates, 12% protein, and 1.5% fat, 1-1. 2% fiber, 0.05% calcium, 0.32% phosphorus and 0.17% riboflavin (Anonymous 2017).

The Black Wheat variety is named "NABI MG 2583", indicating a dual biofortification line that is expected to have a significant impact on human health due to its

higher zinc and iron content compared to conventional wheat. Black Wheat is a combination of purple and blue genes. Colored wheat has attracted the attention of many breeders worldwide, but this strain has a low yield due to traction resistance. "What sets Black Wheat apart" by color is a pigment called "anthocynin" that determines the color of fruits and vegetables. The concentration of these pigments determines the color of other natural foods. The concentration of anthocyanin in regular wheat is 5 ppm. On the other hand, one grain of Black Wheat contains about 100 to 140 ppm of anthocyanin. This makes Black Wheat a scientifically healthier choice. Since this anthocyanin are natural antioxidants produced in the field during grain filling. Black Wheat is not produced through genetic engineering. It was developed through traditional plant breeding, a method of altering the genetic patterns of plants to increase their usefulness to humans. So, it is not harmful to our body at all. For this purpose, exotic germ plasma produce from Japan was crossed with abnormal high yielding and diseases resistant wheat cultivator and after selection, Black Wheat was developed in India at

NABI, Mohali under the leadership of Pioneer scientist Dr. Monika Garg after 7 years of long research in different seasons and regions to check its adaptability and yield pottentional at India environmental conditions. Black Wheat is rich in vitamin B, protein, diterity fibre and other nutrient's like phosphorus, potassium, calcium, magnesium, manganese, selenium and copper. The polysaccharide and protein content of Black Wheat seed higher than that found in common wheat. Black Wheat is estimated to have the highest anthocyanin content of all colored varieties, contains about 60% more iron and is more nutritious than regular wheat varieties. It contains 17.71% protein and is richer in anthocyanins, with very little blue and purple wheat. On average, 100 grams of Black Wheat was calculated to contain 71 grams of carbohydrates, 13 grams of protein, 10 grams of fiber, and 3.40 grams of fat. On an average, Black Wheat bread contains 313 cal energy, 53g carbohydrates, 6g of fats and 9g of protein per 100gm of serving. Black Wheat chapatti is better option for people who are allergic to wheat , suffering from digestive disorders because wheat protein "gluton" triggers inflammation affecting soft tissue and organs of a body. Black Wheat is a boon for people suffering from stress, as it is effective to tackle

Materials and methods

The field experiment was conducted at Campus for Research and Advanced Studies, Dhablan, P.G. Department of Agriculture, G.S.S.D.G.S. Khalsa college Patiala. It is situated at about 24-26º North Latitude and 76-24º East Longitude at an altitude of about 250 m above the mean sea level. It is in south eastern direction in Punjab state and North West India. The experimental plot was homogenous in fertility having assured irrigation and other required facilities. Patiala is situated in the northern part of Punjab and have sub-tropical zone with extremely hot summer and cold winter. The climatic condition of agronomy research farm at Dhablan is sub-tropical with hot dry summer, hot and humid, rainy and cold winter months. Weekly maximum and minimum temperatures during the Rabi season of year 2021-2022 ranged from 35.9 ^{o}C and 0.34^{o}C respectively. Weekly maximum and minimum relative humidity ranges from 94.9 and 35 % during cropping season. Weekly maximum and minimum evaporation ranges from 8.5 to 341 mm during cropping season. The total rainfall of 100.5 mm was received during the entire crop growing season. Soil of experimental field was sandy clay in texture with pH 7.44 (basic), medium in organic carbon (0.72%) walkley and black 1934), low in available nitrogen (246.67 kg ha^{-1}), medium in available phosphorous (22.6 kg ha^{-1}) and low in available potassium (129.81 kg ha^{-1}).

The experiment was laid out in factorial randomized block design with 12 treatments; all treatment was replicated three times. Variety NABI MG 2583 was cultivated with the spacing of 20 × 10 cm. The seed rate of crop was 30 kg ha^{-1}.

All the growth parameters were recorded at 30, 60, 90 DAS and at harvest. All the data recorded during the investigation were subjected to Analysis of variance (ANOVA) as described by Gomez and Gomez (1984) for using Randomized Block Design at 5% level of significance.

Results and discussion

Plant height (cm)

Plant height is an important parameter of plant during the growth and development of the crop. The data on plant heightas influenced In present investigation the plant height of Black wheat crop was highest (24.95 cm) at 30 DAS with application of N:P:K @ 120:60:40 and was at par with treatment 10t FYM ha^{-1} + 2t VC ha^{-1} + 3t PM ha^{-1} +1t NC ha^{-1} + *Azotobacter* 5 kg ha^{-1}(Table 1). It was due to higher concentration of nutrients in plant because nutrient availability was higher due to application of chemical fertilizer which are fast releasing that increases photosynthesis activity in plant thereby rapid cell division and elongation which further leads to better growth of plants: Organic manure doesn't show is affect in early stage of plant growth because they release nutrients slowly to after mineralization. Significantly lowest plant height (16.02) at 30 DAS was recorded with control plot.

At 60 DAS 90 DAS 120 DAS and at harvesting highest plant height (57.63, 87.63, 93.80 cm) was recorded with the application of 10t FYM ha^{-1} + 2t VC ha^{-1} + 3t PM ha^{-1} + 1t NC ha^{-1} + *Azotobacter* 5 kg ha^{-1} were applied. The treatment statistically at par with the application 15t FYM

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

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
T_1: Control	16.02	45.83	74.93	79.90
T_2: 100% RDF ha^{-1}	24.95	53.60	85.37	92.97
T_3: 75% RDF ha^{-1}	21.13	51.73	80.87	86.43
T_4: 50% RDF ha^{-1}	20.97	50.73	81.80	87.37
T_5: 10t FYM ha^{-1}	19.93	51.10	81.70	86.77
T_6: 15t FYM ha^{-1}	21.00	52.77	82.17	87.73
T_7: 3t PM ha^{-1}	22.13	53.80	83.20	88.77
T_8: 2t VC ha^{-1}	21.87	52.10	82.47	88.03
T_9: 50% RDF ha^{-1}+2t VC ha^{-1}	21.90	53.30	85.90	92.27
T_{10}: 15t FYM ha^{-1}+ 3t PM ha^{-1}	22.53	55.97	86.46	92.03
T_{11}: 5t FYM ha^{-1}+ 2t VC ha^{-1}	23.23	56.60	86.56	92.68
T_{12}: 10t FYM ha^{-1}+ 2t VC ha^{-1} + 3t PM ha^{-1}+ 1t NC ha^{-1}+*Azotobacter* 5 kg ha^{-1}	24.28	57.63	87.63	93.80
SEm(±)	0.68	0.56	0.90	0.88
CD 5%	1.41	1.17	1.89	1.83

ha^{-1} + 2t VC ha^{-1}. In control plots, significantly lowest plant was recorded at 60 DAS, 90 DAS, 120 DAS and at harvesting.

The higher plant height was due to the availability of more amounts of nutrients combined with the bio fertilizers and organic manures. It was higher due to the availability of higher amount of chemical nutrients along with organic manure and bio- fertilizers in balanced proportion. Similar results was reported by Singh et al. (2018) with the application of 100% RDF + vermicompost + @ 2 t ha^{-1} + PSB and Kaur *et al*. (2018) showed that the higher values of growth parameters were reported with integrated nutrient management.

Number of tillers (m^{-2})

Tillers are one of the most important factors of grain yield and straw yield. The data regarding the number of tillers as affected by different integrated nutrient management treatments are presented in Table 2 It was evident from the data that number of tillers influenced by different integrated nutrient management treatments. The highest number of tillers (10.25 cm) at 30 DAS were recorded with the application of N:P:K @ 120:60:40 kg ha^{-1} and it was due to higher dose of chemical fertilizer as these are readily available to plants.

At 60 DAS , 90 DAS , 120 DAS and at harvesting maximum number of tillers (16.77, 21.80, 20.97) was recorded with application of 10t FYM ha^{-1}+ 2t VC ha^{-1} + 3t PM ha-1+1t NC ha^{-1} +*Azotobacter* 5 kg ha^{-1} were applied . The treatment statistically at par with application of N:P:K @ 120:60:40 kg ha^{-1} . The reason for higher value of tiller is due to the more availability of nutrients and other treatment which result in better crop growth, it is due to integrated use of organic fertilizer, chemical fertilizer and bio fertilizer which help in higher nutrient mobility and therefore, plant uptake more nutrients by reducing nutrient losses through leaching, runoff etc. Similar results were reported by Kaur *et al*. (2018) and Mubarak and Singh (2011) they also showed that integrated use of nutrients enhance the value of plant growth and development with higher dose of chemical nutrients.

Grain yield (q ha^{-1})

The beneficial effects on the yield of wheat can judge the efficiency of different treatments towards the improvement in yield. The data on seed yield as affected by different INM treatments are presented in Table 3 it was evident from the data that grain yield of wheat significantly varied due to different INM treatments. The seed yield of wheat among all treatments was highest (53.29) under 10t FYM ha^{-1} + 2t VC ha^{-1} + 3t PM ha^{-1} + 1t NC ha^{-1}+*Azotobacter* 5 kg ha^{-1}, While minimum seed yield was recorded with untreated plot (24.30). The integrated use of

Table 2: Effect of integrated nutrient management on number of tillers plant^{-1} of black wheat crop

Treatments	Numbers of tillers plant^{-1}			
	30 DAS	60 DAS	90 DAS	At harvest
T_1: Control	6.70	11.53	14.90	14.93
T_2: 100% RDF ha^{-1}	10.25	15.97	20.80	20.47
T_3: 75% RDF ha^{-1}	8.17	12.87	17.07	16.37
T_4: 50% RDF ha^{-1}	6.97	13.17	17.36	16.67
T_5: 10t FYM ha^{-1}	7.37	13.70	17.87	17.20
T_6: 15t FYM ha^{-1}	7.87	14.37	18.53	17.87
T_7: 3t PM ha^{-1}	7.63	14.30	18.47	17.80
T_8: 2t VC ha^{-1}	7.80	14.50	18.67	18.00
T_9: 50% RDF ha^{-1}+2t VC ha^{-1}	7.53	14.03	18.20	17.53
T_{10}: 15t FYM ha^{-1}+ 3t PM ha^{-1}	8.70	15.50	19.67	19.08
T_{11}: 5t FYM ha^{-1}+ 2t VC ha^{-1}	8.17	15.73	20.07	19.22
T_{12}: 10t FYM ha^{-1}+ 2t VC ha^{-1} + 3t PM ha^{-1}+ 1t NC ha^{-1}+*Azotobacter* 5 kg ha^{-1}	8.97	16.77	21.80	20.97
SEm(±)	0.40	0.49	0.68	0.39
CD 5%	0.91	1.81	1.21	1.82

organic manure (FYM), inorganic source of nutrients and biofertilizers might have supplied readily available nutrients to wheat which resulted in greater assimilation, production and partitioning of dry matter yield, which finally enhanced the yield Choudhary *et al*. (2017), Kidane (2014).

Incorporation of bio fertilizers not only increased the growth attributes but also help to increase the yield, the increase in yield might be attributed to supply of plant hormones (auxin, cytokinin, gibberellins etc.) by the micro organisms inoculated or by the root resulting from reaction to microbial population as observed by Rasool *et al*. (2015) and Patel *et al*. (2017).

Straw yield (q ha^{-1})

It is clear from the data represented in Table 3 All the treatments have significant influence upon the straw yield. The maximum straw yield (59.20) was observed 10t FYM ha^{-1} + 2t VC ha^{-1} + 3t PM ha^{-1}+1t NC ha^{-1}+*Azotobacter* 5 kg ha^{-1} which closely followed by N:P:K @ 120:60:40 kg ha^{-1}. While minimum value straw yield (33.53) was observed by control plot. Superiority in yield due to application of INM treatments owed to enhance the availability of the nutrients which helped in better growth resulting into increased photosynthesis. This helped in storage of more photosynthesis and their translocation to sink and thus contributed enhanced yell. These results are in close conformity to the findings of Baig *et al* (1999), Srivastava and Tripathi (1999).

Choudhary *et al.* (2017). Kaur *et al*. (2018), Singh *et al*. (2018) also reported the similar findings that combined effect of organic manure (FYM), bio-fertilizers and chemical fertilizers with sulphur in balanced proportion play a vital role in decompostion and easy release of different nutrients and their uptake by the crop which led to higher dry mater accumulation and its translocation in different plant parts of growth and yield parameters.

Biological yield (q ha^{-1})

It is explicit from the data represented in Table 3 that biological yield was significantly influenced by inorganic nutriens, FYM and their inoculation with *Azotobacter* with neemcake. All the treatments have significant influence upon the straw yield. The maximum biological (112.49) yield was observed in 10t FYM ha^{-1}+ 2t VC ha^{-1} + 3t PM ha^{-1}+1t NC ha^{-1}+*Azotobacter* 5 kg ha^{-1}. This might be due to fulfillment of nutrient requirement of black wheat crop achieved by supplying nutrients properly with integrated manner, On the other hand lowest biological yield (57.73) results were recorded by control plot. Chopra *et al* (2016), Singh *et al* (2011) and Devi *et al* (2011). Another reason of high yield of Black wheat crop is due to the availability of more nutrients i.e the results in nutrient application was

Table 3: Effect of integrated nutrient management on yield q ha^{-1} of black wheat crop

Treatments	Yield (q ha^{-1})		
	Seed yield	Stover yield	Biological yield
T_1: Control	24.20	33.53	57.73
T_2: 100% RDF ha^{-1}	46.27	57.64	103.91
T_3: 75% RDF ha^{-1}	41.72	51.18	92.90
T_4: 50% RDF ha^{-1}	40.62	50.01	90.63
T_5: 10t FYM ha^{-1}	43.08	52.42	95.50
T_6: 15t FYM ha^{-1}	42.30	51.70	94.00
T_7: 3t PM ha^{-1}	42.48	52.05	94.53
T_8: 2t VC ha^{-1}	45.23	54.57	99.80
T_9: 50% RDF ha^{-1}+2t VC ha^{-1}	44.98	53.95	98.93
T_{10}: 15t FYM ha^{-1}+ 3t PM ha^{-1}	42.82	52.15	94.97
T_{11}: 5t FYM ha^{-1}+ 2t VC ha^{-1}	44.72	55.36	100.08
T_{12}: 10t FYM ha^{-1}+ 2t VC ha^{-1} + 3t PM ha^{-1}+ 1t NC ha^{-1}+*Azotobacter* 5 kg ha^{-1}	53.29	59.20	112.49
SEm(±)	0.56	0.85	1.23
CD 5%	1.27	1.93	2.78

better due to additional supply of nutrients through *azotobacter* which might have increased nutrient uptake and better translocation of nutrients, Singh *et al*. (2018) also reported that the phosphate solublising micro-organism (PSM) in combination with phosphorus fertilizer and organic manure significantly improved grain and biologically yield of black wheat.

References

Baig, M. J.; Swain, P. and Murthy, K. S. (1999). Heterosis in growth and yield of rice hybrids as influence by different nitrogen levels. Oryza 36 (4): 309-314.

Choudhary, R.R.; Prajapat, A.L.; Choudhary, S.L. and Meena, O.P. (2017). Response of cultivars to nutrient management International Journal of Current Microbiology and Applied Sciences 6 (8): 1607-1612.

Choudhary, R.R.; Yadav, H.L.; Choudhary, S.L.; Prajapat, A.L. and Choudhary, R. (2017). Effect of integrated nutrient management on growth of wheat (*Triticum aestivum* L.) cultivars. International Journal of Current Microbiology and Applied Sciences 6 (8)2369-2374.

Gomez, K.A. and Gomez, A.A. (1984). Statistical procedures for agricultural research (2 ed). john wiley and sons, New York Pp 680.

Kaur, R. Kumar; S. Kaur, and R. Kaur (2018). Effect of integrated serien management on growth and yield of wheat (*Triticum aestivum* L.) under irrigated conditions International Journal of Chemical Studies 6 (4) 1800-1803.

Kidane, T.A. (2014). Effect of integrated nutrient management on soil properties, whet yield and residual effect on pearl millet Ph.D thesis Department of Agriculture Chemistry and Soil Science CCSHAU, Hisar.

Mubarak, T. and Singh, K.N. (2011). Notriem management and productive of wheat (*Triticum aestivum* L.) based cropping system in temperate zone. Indian Journal of Agronomy: 56(3)176-181.

Patel, H.K, Sadhu, A.C.; Lakum, Y.C. and Suthar, J.V. (2014). Response of integrated nutrient management on wheat (*Triticum aestivum* L.) and its residual effect on succeeding crop. International Journal of agricultural Sciences and veterinary medicine 2(4)2320-3730.

Rasool, S.; Kanth, R.H. Hamid, S. Raja WAlie, B.A. and Dar, Z.A . (2015). Influence of integrated nutrient management on growth and yield of sweet com (*Zea mays* L.) under temperate conditions of Kashmir valley. American Journal of Experimental Agriculture 7(5)315-325.

Singh, G.; Kumar, S.; Sidhu GS and Kaur, R. (2018). Effect of integrated nutrient management on yield of wheat (*Triticum aestivum* L.) under irrigated conditions. International Journal of Chemical Studies 6 (2): 904-907.