E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(9): 479-482
Received: 22-06-2024
Accepted: 30-07-2024

Ayushi Saini
Faculty of Agriculture, Vivekananda Global University, Jaipur, Rajasthan, India

Arjun Lal Prajapat
Faculty of Agriculture, Vivekananda Global University, Jaipur, Rajasthan, India

Pooran Mal Meena
Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Ravi Kumar Saini
Faculty of Agriculture, Vivekananda Global University, Jaipur, Rajasthan, India

Corresponding Author:
Ayushi Saini
Faculty of Agriculture, Vivekananda Global University, Jaipur, Rajasthan, India

Effect of nutrient management on growth, yield and quality of wheat (*Triticum aestivum* L.)

Ayushi Saini, Arjun Lal Prajapat, Pooran Mal Meena and Ravi Kumar Saini

DOI: https://doi.org/10.33545/2618060X.2024.v7.i9Sg.1523

Abstract
A field experimented was conducted at Research Farm, Vivekananda Global University, Jaipur during *rabi* season of 2023-24 to study the effect of nutrient management on growth, yield and quality of wheat. The results reveals that the application of 100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} recorded significant improvement in growth, yield attributes and yield along with protein content in wheat under the agro-climatic condition of Jaipur, Rajasthan.

Keywords: Wheat, vermicompost, spike length, tillers and protein

Introduction
Wheat (*Triticum aestivum* L.) is the most important staple food crop of the world and emerged as the backbone of India's food security. It is cultivated in almost all countries; the major wheat producing countries are China, India, USA, Russia, France and Australia. It is one of the most important and remunerative *rabi* cereal crop of India.

In modern agriculture, keeping in mind status of the soil health, it is well recognized that neither organic manures nor chemical fertilizers individually can supplement the balanced amount of nutrients required by the plant to sustain production. Area under cultivation of wheat cannot be stretched beyond certain limits only possibility is the maximization of production per unit area per unit time and maintenance of soil fertility (Ramesh *et al.*, 2009) [8]. Long term studies being carried out at several locations in India indicated that application of all the needy nutrients through chemical fertilizers have deteriorating effect on soil health leading to unsustainable yields (Eid *et al.*, 2006) [3]. Under these circumstances integration of chemical and organic sources and their management have shown promising results not only in sustaining the productivity but have also proved effective in maintaining soil health and enhanced nutrient use efficiency (Chesti *et al.*, 2013) [2].

Wheat is nutrient exhaustive and had resulted in decline of soil organic carbon and deteriorating soil health in general for sustainability of the system well as the overall soil health, organic sources play an important role. To curb this trend of declining yield, there is a need to adopt the concept of integrated nutrient management. The appropriate combination of mineral fertilizer, organic manures, compost or bio-fertilizers along with incorporation of micronutrients can be feasible and viable to sustain agriculture as a commercial and profitable means ensuring high yield of crop without deterioration in quality of the produce.

Nitrogen occupies a conspicuous place in plant metabolism. Nitrogen fertilizer is known to effect on the various growth attributes, yield attributes and yield. Appropriate management of N fertilization has the potential to improve the yield and nutritional quality of wheat (Shi *et al.*, 2010) [10]. Phosphorus is of paramount importance for increasing yield and energy transfer in the living cells by means of high energy phosphate bonds of ATP. Thus, it is considered important for formation and translocation of carbohydrates, fatty acids, glyceriods and other essential intermediate compounds. Potassium (K) uptake by crop is at par or higher than nitrogen (N) uptake. Wider nutrient consumption ratio is aggravating the problem of negative nutrient balance in soils, also for K, which plays a major role in influencing the quality parameters. The

farmers apply FYM @ 10 t ha^{-1} but certainly they face a challenge especially in deciding the quantity of vermicompost. Therefore, it is right time to evaluate the feasibility and efficacy of these manures in improving and building up of soil fertility in combination with chemical fertilizers. Thus, to maintain soil health, an integrated nutrient management approach involving vermicompost and inorganic sources has to be standardized so as to compare the efficacy of different sources of organic manures with recommended level of FYM/fertilizers (Upadhyay *et al*., 2011) [14].

Materials and Methods

An experiment was conducted during *rabi* season of 2023-24 at Research Farm, Vivekananda Global University, Jaipur. The soil was loamy sand in texture having a pH of 8.3 (Alkaline), EC 1.1 (dS m^{-1}), low in organic carbon (0.14%) and low available nitrogen (132.7 kg ha^{-1}), medium in available phosphorus (16.3 kg ha^{-1}) and low in available potassium (150.4 kg ha^{-1}). The experiment was conducted in randomized block design with replicate thrice consisted of ten nutrient management treatments *viz.* (T_0) Control, (T_1) 50% RDF (60-30-30 kg N-P-K ha^{-1}), (T_2) 75% RDF (90-45-45 kg N-P-K ha^{-1}), (T_3) 100% RDF (120-60-60 kg N-P-K ha^{-1}), (T_4) 50% RDF + FYM 3 t ha^{-1}, (T_5) 75% RDF + FYM 3 t ha^{-1}, (T_6) 100% RDF + FYM 3 t ha^{-1}, (T_7) 50% RDF + FYM 2 t ha^{-1} + Vermicompost 1 t ha^{-1}, (T_8) 75% RDF + FYM 2 t ha^{-1} + Vermicompost 1 t ha^{-1} and (T_9) 100% RDF + FYM 2 t ha^{-1} + Vermicompost 1 t ha^{-1}. The treatments were allocated randomly to each plot. Urea, di ammonium phosphate and murate of potash were used as a source of nitrogen, phosphorus and potassium. The crop was fertilized as per treatment and a full dose of phosphorus and potassium as basal and nitrogen applied as basal as well as top dressing. Manures were applied one month before sowing. Raj-3077 variety of wheat was used as a test crop. Other crop management methods were accompanied as per the recommendation of the area.

Statistical analysis and interpretation of data: Data recorded on various parameters of wheat crop in the experiment was subjected to analysis by using Fisher's method of analysis of variance (ANOVA) and interpreted as outlined by Gomez and Gomez (1984) [4]. The levels of significance used in 'F' and 't' test was p= 0.05. Critical difference values were calculated where F test was found significant.

Results and Discussion

Nutrient management practices exerted significant effect on growth characters, yield attributes, yield and protein content in wheat. Application of 100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} recorded significantly higher plant height (84.5 cm), number of tillers (107.1 m^{-1} row length) and dry matter accumulation (266.3 g m^{-1} row length) over rest of the treatments at harvest (Table 1). Increase in plant height might be due to application of combined nutrient management to favorable function of adding organics in plant to improve cell enlargement and cell elongation which results in more vegetative growth and ultimately increased the plant height. Similar results were also reported by Sepat *et al*. (2010) [9] and Singh *et al*. (2011) [11]. Increase in number of tillers may be due to role of combined nutrient management in improving utilization of nitrogen which directly plays a role in cellular metabolism and reflected in higher of tillers. These results are in close conformity with the finding of Ram and Mir (2006) [7]; Singh *et al*. (2007) [13] and Singh *et al*. (2008) [12]. The differences was noted due to the improvement in number of tillers and plant height accomplished with more number of leaves led to positive effect on dry matter accumulation. The results are in close agreement with the findings of Sepat *et al*. (2010) [9] and Singh *et al*. (2011) [11].

Among the treatments, application of 100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} recorded significantly higher number of effective tillers (100.21 m^{-1} row length), spike length (9.33 cm) and number of spikelets $spike^{-1}$ (31.62) which was statistically at par with 75% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} over rest of the treatments. However, test weight was found to be non-significant (Table 2). Adequate availability and translocation of nutrients tends healthy plant which led to more spike length positively completed with more spikelet $spike^{-1}$ and effective tillers. Such an improved yield attributes can be linked with balanced nutrition particularly nitrogen which play a vital role in cell division and cell elongation as well as increase in sink size which provide a feedback to sources for production of higher amount of photo-synthates. Higher level of nutrients improved the fertility level of soil and creates congenial condition for better growth and development thus, improved the yield attributes. Similar findings were also reported by Singh *et al*. (2007) [13]; Singh *et al*. (2011) [11]; Barthwal *et al*. (2013) [1] and Jat *et al*. (2013) [5].

Significantly higher grain yield (42.0 q ha^{-1}), straw yield (61.3 q ha^{-1}) and biological yield (103.4 q ha^{-1}) were recorded with application of 100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} which was statistically at par with 75% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} over rest of the treatments. However, harvest index was found to be non-significant (Table 3). The favourable effect of combined use of organic and inorganic manures on sink component could be attributed to better development of the plants in terms of plant height and dry matter production leading to increased bearing capacity due to optimum growth and development of plants on account of synergistic effect of combined use of organic and inorganic manures. The increase in the yield attributes of wheat due to application either of RDF + FYM or RDF + vermicompost may be due to supply of more nutrients interns resulted in proper development of grain. Further, increased availability of nutrients with application of inorganic fertilizers and organic manures might have enhanced the nutrient uptake and consequently, grain yield. Similar results were reported by Barthwal *et al*. (2013) [1] and Jat *et al*. (2013) [5].

The data pertaining to protein content in grain are presented in Table 4. Among the treatments, significantly higher protein content (11.31%) was recorded with application of 100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} which was statistically at par with 75% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} over rest of the treatments (Table 4). The increase in protein content with increasing nitrogen fertilization might be due to utilization of photosynthetic material for protein synthesis. These results are in close agreement with those of Verma *et al*. (2010) [15]. The reason given by them that application of nitrogen greater proportion of photo-synthase was diverted to protein synthesis in grains. This finding is in conformity with the findings of Neigh *et al*. (2013) [6].

Table 1: Growth characters of wheat as influenced by nutrient management practices at harvest stage

Treatments	Growth characters at harvest		
	Plant height (cm)	No. of tillers (m^{-1} row length)	Dry matter accumulation (g m^{-1} row length)
Control	62.3	78.9	223.9
50% RDF (60-30-30 kg N-P-K ha^{-1})	68.9	85.1	246.5
75% RDF (90-45-45 kg N-P-K ha^{-1})	70.5	88.7	250.0
100% RDF (120-60-60 kg N-P-K ha^{-1})	74.6	92.3	253.7
50% RDF + FYM 3 t ha^{-1}	71.5	90.2	251.4
75% RDF + FYM 3 t ha^{-1}	76.2	94.5	256.3
100% RDF + FYM 3 t ha^{-1}	78.9	96.7	257.6
50% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	80.7	99.9	259.4
75% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	82.1	101.7	262.3
100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	84.5	107.1	266.3
S.Em±	0.97	1.4	1.7
LSD (*P = 0.05*)	2.82	4.4	5.1

Table 2: Yield attributes of wheat as influenced by nutrient management practices

Treatments	Yield Attributes			
	No. of effective tillers (m^{-1} row length)	Spike length (cm)	Spikelets $spike^{-1}$	Test weight (g)
Control	70.24	6.53	25.62	35.28
50% RDF (60-30-30 kg N-P-K ha^{-1})	82.62	7.05	26.25	35.70
75% RDF (90-45-45 kg N-P-K ha^{-1})	90.81	7.72	26.63	35.86
100% RDF (120-60-60 kg N-P-K ha^{-1})	94.18	8.35	27.02	36.17
50% RDF + FYM 3 t ha^{-1}	86.12	8.37	28.65	36.48
75% RDF + FYM 3 t ha^{-1}	93.45	8.49	28.77	37.26
100% RDF + FYM 3 t ha^{-1}	97.48	9.10	30.53	37.62
50% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	88.69	8.52	29.19	37.09
75% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	98.08	9.25	30.87	37.49
100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	100.21	9.33	31.62	38.10
S.Em±	1.33	0.23	0.67	1.74
LSD (*P = 0.05*)	3.95	0.68	1.98	NS

Table 3: Yield and harvest index of wheat as influenced by nutrient management practices

Treatments	Yield (q ha^{-1})			Harvest index (%)
	Grain yield	Straw yield	Biological yield	
Control	23.0	37.2	60.2	38.23
50% RDF (60-30-30 kg N-P-K ha^{-1})	30.6	48.0	78.7	38.91
75% RDF (90-45-45 kg N-P-K ha^{-1})	34.2	52.6	86.7	39.39
100% RDF (120-60-60 kg N-P-K ha^{-1})	36.7	56.2	92.8	39.44
50% RDF + FYM 3 t ha^{-1}	34.3	51.4	85.7	40.00
75% RDF + FYM 3 t ha^{-1}	36.7	56.3	93.1	39.45
100% RDF + FYM 3 t ha^{-1}	39.5	59.6	99.1	39.83
50% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	36.2	53.3	89.5	40.42
75% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	41.8	59.9	101.7	41.10
100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	42.0	61.3	103.4	40.65
S.Em±	1.5	1.1	1.8	1.15
LSD (*P = 0.05*)	4.3	3.4	5.4	NS

Table 4: Protein content (%) in wheat grain as influenced by nutrient management practices

Treatments	Protein content (%)
Control	9.00
50% RDF (60-30-30 kg N-P-K ha^{-1})	9.88
75% RDF (90-45-45 kg N-P-K ha^{-1})	10.06
100% RDF (120-60-60 kg N-P-K ha^{-1})	10.50
50% RDF + FYM 3 t ha^{-1}	10.31
75% RDF + FYM 3 t ha^{-1}	10.50
100% RDF + FYM 3 t ha^{-1}	10.69
50% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	10.81
75% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	10.94
100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1}	11.31
S.Em±	0.15
LSD (*P = 0.05*)	0.45

Conclusion

On the basis of one year experiment it may be concluded that application of 100% RDF + FYM 2 t ha^{-1} + VC 1 t ha^{-1} recorded significant improvement in growth, yield attributes and yield along with protein content in wheat under the agro-climatic condition of Jaipur, Rajasthan.

References

1. Barthwal A, Bhardwaj AK, Chaturvedi S, Pandiaraj T. Site specific NPK recommendation in wheat (*Triticum aestivum*) for sustained crop and soil productivity in mollisols of Tarai region. Indian J Agron. 2013;58(2):208-214.
2. Chesti S, Tomer S, Singh S. Effect of irrigation and fertility levels on growth, yield and quality of mustard (*Brassica juncea*). Indian J Agron. 2013;37(1):76-78.

3. Eid RA, Sedera A, Attia M. Influence of nitrogen fixing bacteria incorporation with organic and inorganic fertilizers on growth, flower yield and chemical composition of Celosia argentia. World J Agric Sci. 2006;2(4):450-458.
4. Gomez AK, Gomez AA. Statistical Procedures for Agriculture Research. New York: John Wiley & Sons; c1984. 680 p.
5. Jat G, Majumdar SP, Jat NK, Majundar SP. Potassium and zinc fertilization of wheat (*Triticum aestvum*) in Western arid zone of India. Indian J Agron. 2013;58(1):67-71.
6. Neigh S, Masoni A, Ercoli L, Mariotti M, Arduini I. Effects of nitrogen splitting and source on durum wheat. Cereal Res Commun. 2013;41(2):338-347.
7. Ram T, Mir MS. Effect of integrated nutrient management on yield and yield attributing characters of wheat (*Triticum aestivum*). Indian J Agron. 2006;31(3):189-192.
8. Ramesh P, Panwar NR, Singh AB, Ramana S. Production potential, nutrient uptake, soil fertility and economics of soybean (Glycine max)-based cropping systems under organic, chemical and integrated nutrient management practices. Indian J Agron. 2009;54(3):278-283.
9. Sepat RN, Rai RK, Dhar S. Planting systems and integrated nutrient management for enhanced wheat (*Triticum aestivum*) productivity. Indian J Agron. 2010;55(2):114-118.
10. Shi R, Zhang Y, Chen X, Sun Q, Zhang F, Romheld V, *et al*. Influence of long-term nitrogen fertilization on micronutrient density in grain of winter wheat (*Triticum aestivum* L.). J Cereal Sci. 2010;51:165-170.
11. Singh CM, Sharma PK, Kishor P, Mishra PK, Singh AP, Verma Rajhans, *et al*. Impact of integrated nutrient management on growth, yield and nutrient uptake by wheat (*Triticum aestivum* L.). Asian J Agric Res. 2011;5(1):76-82.
12. Singh F, Kumar R, Pal S. Integrated nutrient management in rice-wheat cropping system for sustainable productivity. J Indian Soc Soil Sci. 2008;56(2):205-208.
13. Singh RK, Singh SK, Singh LB. Integrated nitrogen management in wheat (*Triticum aestivum*). Indian J Agron. 2007;52(2):124-126.
14. Upadhyay VB, Jain V, Vishwakarma SK, Kumhar AK. Production potential, soil health, water productivity and economics of rice (*Oryza sativa*) based cropping systems under different nutrient sources. Indian J Agron. 2011;56(4):311-316.
15. Verma G, Mathur AK, Bhandari SC, Kanthaliya PC. Long term effect of integrated nutrient management on properties of a typic haplustert under maize-wheat cropping system. J Indian Soc Soil Sci. 2010;58(3):299-302.