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Impact of Integrated Nutrient Management on yield, quality and nutrient uptake by Wheat (*Triticum aestivum* L.) Crop in sandy loam soils of Agra

Dr. Yogesh Singh
Department of Agricultural Chemistry and Soil Science, R.B.S. College, Bichpuri, Agra-283105 (U.P.)
Corresponding Author: Dr. Yogesh Singh

Abstract

A research experiment, the impact of integrated nutrient management on yield, quality and nutrient uptake by wheat (*Triticum aestivium* L.) crop in sandy loam soils of Agra was conducted during the Rabi season of 2023-20224 at the Department of Agricultural Chemistry and Soil Science, Agricultural Research Farm, of R.B.S. College, Bichpuri, Agra (U.P.). The treatment ware tasted in randomized block design with three replication. The integrated nutrient management treatments are To (Control), T_1 (50 % NPK/ha), T_2 (50 % NPK+10tons FYM/ha), T_3 (50 % NPK/ha+ Azatobactor), T_4 (50 % NPK+20 kg ZnSO4/ha)and T_5 (50% NPK+20 kg ZnSO4/ha+Azatobactor),T6 (100% NPK/ha), T7(100 % NPK+10 tons FYM/ha),T8 (100 % NPK/ha+ Azatobactor), T9(100 % NPK+20kg ZnSO4/ha)and T10(100 % NPK+20kg ZnSO4/ha+Azatobactor). The result revealed that the integrated nutrients management treatments T_{10} proved significant better results in terms of growth, yield attributes, yield, protein content in grain, nutrient NPKZn content and uptake both grain and straw in comparison to control. The performance of treatment may be arranged in descending order $T_{10}>T_9>T_8>T_7>T_6>T_5>T_4>T_3>T_2>T_1>T_0$.

Keywords: Integrated Nutrient Management, NPKZn, FYM, Azatobactor, Wheat etc.

Introduction

Wheat (*Triticum aestivum* L.) is the oldest and second most important food crop next to be rice and it contributes nearly35% to the national food basket. It is the main sources of food for the majority of people of the world. It is the good sources of carbohydrate, protein and richer in dilatory fiber, contain vitamin B, iron, manganese and other essential nutrients. Wheat plays crucial role ensuring food security. Wheat is grown all over the world. In India, its grown in U.P., Rajasthan, Haryana Punjab Madhya Pradesh Bihar, West Bengal and Gujarat, covering million-hectare land. Decline the crop yields and depleting soil fertility due to continuous cropping, over mining of soil nutrients, imbalance and inadequate fertilizer use, also decreasing crop response to nutrients. In fact, integrated nutrients management system improve the productivity of wheat crop

Materials and Methods:

The field experiment was laid out during Rabi season of 2023-2024 on wheat crop at the Research Farm of R.B.S. College, Bichpuri, Agra (U.P.).The soil was sandy loam in texture, with pH 8.4,organic carbon 0.40%, available N 144.5 kg/ha, available P 18 kg/ha, and available potash 190.50 kg/ha. Experiment was laid out in Randomized Block Design having 10 treatments and 3 replications in wheat crop. The nutrient was applied through Urea 46% N, DAP (18% N & 46% P_2O_5), Muraite of potash (60%K_2O) and Zinc sulphate (33% Zn) respectively, as per treatment, were applied in furrows 3-4 cm below the seed at sowing time. Remaining half

quantity of nitrogen as per treatment was applied at the crop stage of 30 days after sowing. The amount of farm yard manures (FYM) and Azatobactor was applied. The wheat variety PBW-343 was sown on 25 October 2023 and harvesting at maturity on 5 April, 2024. The details of the treatment are given in (Table1).

Table1: Treatment details

Treatment	Combination
T_0	Control
T_1	50 % NPK/ha
T_2	50 % NPK+10tons FYM/ha
T_3	50 % NPK/ha+ Azatobactor
T_4	50 % NPK+20kg znSO4/ha
T_5	50 % NPK+20kg znSO4/ha+Azatobactor
T_6	100% NPK/ha
T_7	100 % NPK+10tons FYM/ha
T_8	100 % NPK/ha+ Azatobactor
T_9	100 % NPK+20kg znSO4/ha
T_{10}	100 % NPK+20kg znSO4/ha+Azatobactor

Results and Discussion:

Growth Character*:*

Data pertaining to different growth, parameter i.e. plant height (cm), no of tillers/plant given in (Table2).The various INM treatment had favorable and significant on plant height and number of tillers per plants as compared to control. Application of 50 and 100% NPK in combination of with FYM, Zn and Azatobactor progressively improved the above character. The treatment T10 gave maximum result as comparison to rest of the treatment and lowest under unfertilized control. Similar result was reported by **Das and Ram (2005), Kumawat *et. al* (2006)**, **Ravankar *et. al* (2006) and Yadav *et. al* (2007).**

Yield attributes and Yield:

The data of yield attributing character i.e. spike length, no. of grains per spike, 100 grain weights, were recorded at harvest presented in (Table2). The application of NPK enhanced the value of this character significantly over control. The combined application of NPK (50 and 100%) with FYM (10 t/ha) resulted additive effects on those character. The maximum impact on yield attributing character was recorded under T10 (100 % NPK+20kg znSO4/ha+Azatobactor) treatment. Application of Azatobactor and zinc application alone or in combination enhanced the value of these characters but the effect of these was less pronounced than FYM. . Similar, findings were also reported by **Kumawat *et. al* (2006)**, **Ravankar *et. al* (2006) and Yadav *et. al* (2007).**

Grain and Straw yield:

The results of yield study as affected by different treatments are summarized in (Table 2). The minimum yield of grain and straw of wheat were recorded under control treatment. Application of 50 and 100% recommended dose of NPK significant improve the wheat production over control. Application of 50 and 100 % NPK Zn and Azatobactor improve the grain and straw yield of wheat crop as comparison to lower doses. The treatment T10 gave highest result followed by other treatment. The superiority of treatment may be arranged descending order $T_{10}>T_9>T_8>T_7>T_6>T_5>T_4>T_3>T_2>T_1>T_0$. The increment due to the application of mineral fertilizer with combination of micro nutrient and FYM and Azatobactor provide all the essential nutrients in proper ratio to plant and soil as improve the yield of wheat crop. Similar findings were also reported by **Singh and Pathak (2003), Das and Ram (2005), Chauhan *et. al* (2005), Kumawat *et. al* (2006) and Ravankar *et. al* (2006).**

Table 2: Growth parameters and yield attributes, Yield and Protein Content

Treatment	Plant height (cm)	No. of tillers/plant	Spike length (cm)	No. of grain/spike	100, grain weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Protein Content (%)	
								Grain	Straw
T_0	68.6	46.4	6.7	33.2	33.3	40.02	42.4	10.15	3.02
T_1	72.7	47.0	7.8	35.3	33.8	43.3	44.8	10.8	3.09
T_2	77.8	49.2	8.6	36.4	34.4	45.21	46.6	11.5	3.33
T_3	78.9	53.0	9.3	37.3	35.5	47.3	48.5	11.7	3.46
T_4	80.02	55.5	9.5	37.8	35.9	48.7	50.5	12.3	3.55
T_5	80.9	59.4	9.8	38.4	36.6	50.33	53.2	12.5	3.70
T_6	81.02	65.0	10.0	39.0	37.3	52.4	55.6	12.7	3.90
T_7	81.35	67.0	10.4	39.5	38.0	54.5	58.4	12.9	4.20
T_8	82.00	69.02	10.6	40.4	38.5	56.6	59.6	13.3	4.40
T_9	83.45	71.33	10.8	40.9	39.0	57.8	61.5	13.4	4.61
T_{10}	87.7	76.0	11.0	41.4	40.3	58.9	62.8	13.6	4.83
SEm ±	**1.13**	**1.81**	**0.08**	**0.74**	**0.65**	**0.72**	**0.78**	**0.015**	**0.11**
CD at 5%	**2.31**	**3.91**	**0.23**	**1.72**	**1.86**	**1.60**	**1.74**	**0.04**	**0.24**

Protein Content:

The result of protein content both grain and straw of wheat crop presented in (Table2). The protein content in grain and straw was significant affected by various treatments. The maximum value of protein content was recorded under unfertilized control treatment. The application of recommended dose of 50 and 100 % NPK in corporation with FYM, Zn and Azatobactor improve the protein content in Wheat grain and straw. The highest values were recorded under T10 treatment in comparison to other treatment and lowest under control treatment. Similar result reported by **Das and Ram (2005), Chauhan *et. al* (2005), Kumawat *et. al* (2006) and Ravankar *et. al* (2006).**

Nutrient Content:

The data pertaining to nutrient content in wheat grain and straw are summarized in (Table3). In general the wheat grain contains more nutrients as compared to straw. The application of 50 and 100% NPK with combination of FYM, Zn and Azatobactor improve progressively the value of nutrient content in both grain and straw of wheat crop. The highest value of NPK & Zn were recorded under T10 treatment in comparison to other treatment. The addition of nutrient in soil improve the fertility status of soil improve the availability of nutrients and improve the nutrient content in wheat grain and straw. The result are in close conformity with the findings of **Singh and Pathak (2003), Das and Ram (2005) and Chauhan *et. al* (2005).**

Table 3: Effect of different treatment on NPK and Zn content and uptake

Treatment	N-content (%)		N-uptake (kg/ha)		P-content (%)		P- uptake (kg/ha)		K-Content (%)		K- uptake (kg/ha)		Zn-Content (mg/kg)		Zn-Uptake (g/ha)	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
T_0	2.02	0.51	63.2	21.2	0.20	0.10	6.3	3.9	0.52	1.81	17.2	65.5	25.0	17.1	80.2	70.5
T_1	2.25	0.56	67.3	23.3	0.22	0.12	8.4	4.5	0.55	1.85	20.5	70.3	27.1	19.2	86.3	75.3
T_2	2.29	0.58	70.5	25.4	0.23	0.13	9.5	5.3	0.58	1.88	22.4	74.5	29.20	20.3	88.5	79.2
T_3	2.35	0.60	78.8	28.5	.024	0.14	10.2	5.9	0.60	1.92	25.3	76.5	30.5	20.9	90.6	86.3
T_4	2.40	0.63	82.4	32.4	0.26	0.15	11.3	6.7	0.61	1.95	28.2	78.4	31.4	21.5	93.5	88.4
T_5	2.48	0.65	85.5	35.3	0.27	015	12.5	8.3	0.62	1.97	30.5	80.1	31.8	22.0	96.6	92.6
T_6	2.52	0.67	88.5	38.2	0.28	0.16	12.8	8.9	0.64	1.99	32.4	82.3	32.0	22.4	99.4	98.7
T_7	2.55	0.68	94.3	43.5	0.29	0.18	13.5	9.3	0.66	2.10	33.0	85.6	32.4	22.8	105.2	101.2
T_8	2.59	0.70	97.2	46.4	0.30	0.17	13.8	9.8	0.68	2.15	33.4	87.4	32.6	23.5	108.5	109.3
T_9	2.62	0.71	99.5	48.2	0.31	0.18	14.5	10.3	0.69	2.18	34.3	90.5	32.7	24.2	110.8	112.8
T_{10}	2.65	0.73	102.6	50.2	0.32	0.19	15.1	10.5	0.70	2.22	35.2	96.8	33.2	24.6	115.3	118.6
SEm ±	**0.01**	**0.003**	**1.51**	**1.11**	**0.003**	**0.002**	**0.42**	**0.25**	**0.004**	**0.012**	**1.13**	**1.49**	**0.08**	**0.21**	**2.65**	**2.36**
CD at 5%	**0.028**	**0.012**	**3.25**	**2.35**	**0.007**	**0.005**	**0.90**	**0.63**	**0.009**	**0.027**	**2.30**	**3.50**	**0.19**	**0.45**	**5.8**	**4.86**

Nutrient Uptake:

The data of NPK and Zn uptake by wheat grain and straw are summarized in (Table3). The lowest value of nutrient uptake by wheat crop was noted in unfertilized control (T0). The application of integrated use of nutrient 50 and 100% NPK, FYM, Zn and Azatobactor improve significant effects on nutrient uptake by wheat crop as compared to control. The highest value were noted under T10 (100 % NPK+20kg znSO4/ha + Azatobactor) treatment followed by rest of the treatment. The superiority of nutrient uptake arrange in descending order $T_{10}>T_9>T_8>T_7>T_6>T_5>T_4>T_3>T_2>T_1>T_0$.The nutrient management treatment improve the soil fertility status and improve the grain and straw yield of wheat crop and also increased the uptake of more nutrient by wheat grain and straw. Similar result was also reported by **Singh and Pathak (2003), Das and Ram (2005), Chauhan *et. al* (2005) and Sharma et.al (2015).**

Conclusion:

The basis of the results of the present study concluded that the integrated use of nutrient both organic and inorganic sources perform better in terms of growth, yield and nutrient uptake by wheat crop in sandy loam soils of Agra.

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