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Nutrient uptake studies conducted in wheat (*Triticum aestivum* L.) using integrated nutrient management treatments

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Abstract
At the Research Farm, A.K.S. University, Satna (M.P.), a field experiment was carried out during the rabi season of 2022–2023 to examine the impact of wheat yield and nutrient uptake. The wheat variety Pusa Tejas, HI-8759 showed a noticeably greater grain yield of 40.86 q/ha after applying 100% RDF (N-120 P-60 K-40), along with the largest total uptake of N, P, and K (143.56, 23.51, and 122.08 kg/ha, respectively). The study found that applying 100% RDF or T_2 to wheat yielded significantly higher grain yield and maximum total uptake of nitrogen, phosphorus, and potassium. However, T_7 (75% RDF + Vermicompost @ 4 t/ha + *Azotobacter*) was superior in terms of yield, but the apparent yield was significant in terms of parameters. After the wheat was harvested, the larger dose of integrated nutrient supply enhanced the remaining attributes of the soil, including organic carbon, electrical conductivity, and accessible N, P_2O_5, and K_2O/ha.

Keywords: Nutrients uptake, integrated nutrient management, wheat, *Azotobacter*

Introduction
Wheat (*Triticum aestivum* L.) is the second-largest cereal crop in India. It is the most important cereal crop for human consumption. Wheat is a nutritious supplement with a protein content of 8.0-15.0%, 60-68% carbs, 1.5-2.0% fat, 2.0-2.5% cellulose, and 1.5-2.5% minerals (Sharma, 2000; Singh, 2017) [9, 11]. Wheat is a staple food that contributes to food and nutritional security, with over 65 percent of the population consuming it in different ways (Sutar *et al*. 2018, Singh *et al*. 2019) [13, 12]. India produces approximately 998.70 lakh tonnes of wheat from 29.65 lakh hectares, with a productivity of 3368 kg per hectare. Madhya Pradesh is a major wheat-growing state in India, covering 53.16 lakh hectares and producing 159.10 lakh tonnes with a productivity of 2993 kg ha^{-1} (Anonymous, 2017-18) [1]. Biofertilizers enhance soil fertility and quality, making them a valuable modern agricultural tool. According to Joseph *et al*. (2015) [4], nutrient supplementation is a cost-effective and environmentally friendly way to support fruit crop growth and development (Ranthawa *et al*. 2018) [8]. The intensive cropping system is incorporating recycling farm by-products to enhance crop productivity and soil health. This eco-friendly approach benefits all living organisms and provides food for better health. Integrated nutrient management (INM) is a balanced fertilization approach that maintains soil fertility by integrating various nutrient resources and fertilizers. Organic manures like vermicompost, poultry manure, FYM (cattle nanure), and composts are used to achieve this (Onte *et al*. 2019) [7].

Materials and Methods
The research was conducted at A.K.S. University's Research Farm in Satna, Madhya Pradesh, between 2022 and 2023. This chapter describes the experimental materials and techniques utilized during the inquiry. The presentation includes both field observations and laboratory chemical determinations. The study aims to evaluate the balance of nutrients in wheat crop production and integrated nutrient management in irrigated conditions in Satna region of Madhya Pradesh. Three replications of the randomized complete block design (RCBD) were designed for different treatments. The wheat crop variety Pusa Tejas (HI-8759) was sown at a rate of 100 kg seed per hectare. In the T_2 treatment, the prescribed uniform dose of 120 kg N + 60 kg P_2O_5 and 40 kg K_2O/ha was administered.

On the other hand, organic materials (FYM, vermicompost, and biofertilizers) were combined with inorganic NPK in the INM treatments (T_3 to T_{10}).

Results and Discussion

The study found that effective tillers had a row length of 114.80 m, spikes of 47.2/plant, seed yield of 23.37 g per plant, and 1000-seed weight of 41.25 g. The best treatments with higher doses of inorganic and organics were T_7 (75% RDF + Vermicompost @ 4 t/ha + *Azotobacter*), T_3 (75% RDF + FYM @ 5 t/ha), and T_4 (75% RDF + Vermicompost @ 2 t/ha). These treatments resulted in maximum yield-attributes due to increased dry matter production and effective partitioning to the economic sink. The control treatment resulted in minimum parameters such as effective tillers, spikes per plant, seed yield, and 1000-seed weight.

The goal of the study was to apply 100% RDF (N120 P60 K40) to agricultural crops in order to boost grain yield. When the treatment was contrasted with other organic-cum-organic sources of nutrients, the grain yield (40.86 q/ha) increased significantly. The increased yield was ascribed to higher rates of photosynthesis and maximal growth parameters, both of which are linked to increased productivity. Compared to other INM treatments with lower nutritional levels, the higher amount of multi-nutrient administration through INM sources, such as T_2, T_7, T_3, T_4, and T_9, was determined to be superior. Better crop growth and yields are the result of improved soil physico-chemical and biological characteristics as well as nutrient usage efficiency, which are linked to the greater yield response brought about by various organic INM treatments.

Wheat grain had higher nitrogen and phosphorus content than straw, but straw had higher potassium content. This could be due to seeds as a nitrogen sink. The applied organic nitrogen sources T_2, T_7, T_3, T_4, and T_9 produced larger nitrogen, phosphorus, and potassium levels than other treatments. This could be due to increased microbial activity, root growth promotion, and leaf chlorophyll concentration. The soil's accessible nutrients were increased by three to four organic nutrient supplements.

The total N, P, and K uptake was found to be greatly boosted by applying both organic and inorganic fertilizers to plant growth, grain yield, and nutrient uptake. There was a considerable increase in the total N, P, and K uptake by grain and straw under the treatments T_2, T_7, T_3, T_4, and T_9. This led to higher yields and nutrient contents. While K absorption was higher in straw, N and P uptake was higher in grain. These treatments have a very positive effect on plant development, grain output, and nutrient uptake. This could be because they affect the carbon cycle, which raises CO_2 fixation and effectively transfers nutrients to growing grains. These findings corroborate earlier research by Menon and Srivastava (1984) [5].

The harvest soil's pH was slightly higher by INM treatments (7.36 to 7.53) compared to the control (7.32), possibly due to reduced CO_2 generation and organic acid presence. INM also increased multinutrients linked to soil microbial and metabolic activity.

Table 1: Yield and nutrients uptake of wheat as influenced by INM treatments

Treatments		Seed yield (q/ha)	Straw yield (q/ha)	N-uptake (kg/ha)			P-uptake (kg/ha)			K-uptake (kg/ha)		
				Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
T_1	Control	28.88	46.93	53.43	26.42	79.85	6.30	4.79	11.09	14.27	48.81	63.08
T_2	100% (NPK 120:60:40)	40.86	60.78	91.53	52.03	143.56	14.51	9.00	23.51	27.87	94.21	122.08
T_3	75% RDF + FYM 5 t/ha	38.78	58.45	84.15	47.05	131.20	12.80	8.07	20.87	25.59	83.58	109.17
T_4	75% RDF + VC (2 t/ha)	37.55	57.10	79.61	43.62	123.23	11.27	7.25	15.52	23.88	78.80	102.68
T_5	75% RDF + *Azotobacter*	33.72	53.19	67.44	34.84	102.28	8.97	6.06	15.03	18.38	62.76	81.14
T_6	75% RDF + PSB	31.24	52.30	61.23	33.37	94.60	7.75	5.75	13.50	16.49	59.62	76.11
T_7	75% RDF + VC 4 t/ha + *Azoto.*	39.15	59.62	86.13	49.25	135.38	13.19	8.53	21.72	26.54	88.83	115.37
T_8	50% RDF + FYM 5 t/ha + VC (2 t/ha)	34.83	54.13	72.45	37.08	109.53	9.40	6.33	15.73	19.50	66.04	85.54
T_9	50% RDF + VC 4 t + *Azoto.*+ PSB	36.27	55.92	76.17	40.09	116.26	10.63	6.71	17.34	21.25	73.81	95.06
T_{10}	50% RDF + VC 2 t + PSB	32.39	51.27	61.86	31.22	93.08	7.35	5.54	12.89	16.42	56.40	72.82
S.EM ±		0.27	0.21	0.75	0.57	1.32	0.025	0.022	0.047	0.33	0.94	1.27
C.D. (P = 0.05)		0.77	0.61	2.18	1.64	3.82	0.073	0.063	0.136	0.95	2.73	3.68

Table 2: Residual soil properties after harvest of wheat as influenced by INM treatments

Treatments		pH	E.C. (dS/m)	O.C. (%)	Avail-N (kg/ha)	Avail-P_2O_5 (kg/ha)	Avail-K_2O (kg/ha)
	Initial value	7.50	0.30	0.54	198.0	14.0	236.0
T_1	Control	7.32	0.33	0.49	192.0	12.4	230.6
T_2	100% RDF (NPK @ 120:60:40 kg/ha)	7.36	0.38	0.50	197.2	15.6	235.9
T_3	75% RDF + FYM @ 5 t/ha	7.38	0.36	0.58	200.3	17.8	238.7
T_4	75% RDF + Vermicompost @ 2 t/ha	7.41	0.36	0.56	202.0	15.9	238.0
T_5	75% RDF + *Azotobacter* (10 ml/kg seed)	7.46	0.34	0.53	198.9	16.8	235.6
T_6	75% RDF + PSB (10 ml/kg seed)	7.48	0.32	0.50	199.7	17.3	232.7
T_7	75% RDF + Vermicompost @ 4 t/ha + *Azotobacter* (10 ml/ kg seed)	7.52	0.37	0.58	204.3	18.4	236.9
T_8	50% RDF + FYM @ 5 t/ha + Vermicompost @ 2 t/ha	7.52	0.35	0.57	205.0	18.7	239.5
T_9	50% RDF + Vermicompost @ 4 t/ha + *Azotobacter* (10 ml/kg seed) + PSB (10 ml/kg seed)	7.53	0.38	0.59	204.7	17.4	238.7
T_{10}	50% RDF + Vermicompost @ 2 t/ha + PSB (10 ml/ kg seed)	7.52	0.36	0.58	203.4	17.8	237.8
S.EM ±		0.005	0.005	0.005	0.73	0.008	1.39
C.D. (P = 0.05)		0.016	0.014	0.015	2.11	0.024	4.03

Conclusion

The study aimed to investigate the effects of different treatments on wheat grain yield. The treatment T_2 (100% RDF (NPK @ 120:60:40 kg/ha)) was found to increase yield attributing parameters, with effective tillers, spikes, seed yield, and 1000-seed weight. The second, third, and fourth best treatments were T_7 (75% RDF + Vermicompost @ 4 t/ha + *Azotobacter*), T_3 (75% RDF + FYM @ 5 t/ha), and T_4 (75% RDF + Vermicompost @ 2 t/ha), respectively. The application of 100% RDF (N120 P60 K40) resulted in significantly higher grain yield (40.86 q/ha), followed by T_7 (39.15 9 q/ha), T_3 (38.78 q/ha), T_4 (37.55 q/ha), and T_9 (36.27 q/ha). The percentage of nitrogen and phosphorus (N) and potassium (P) contents was higher in wheat grain than straw, while K content was higher in straw. The application of inorganic and organic sources of nutrients resulted in maximum total nitrogen, phosphorus, and potassium (N, P, and K) uptake (143.56, 23.51, and 122.08 kg/ha).

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References

1. Anonymous. Ministry of Agriculture & Farmers Welfare, Govt. of India; c2017-18a.
2. AOAC. Official Methods of Analysis. 14th ed. Washington D.C., U.S.A.: Association of Official Agricultural Chemists; c1997.
3. Desai HA, Dodia NA, Patel MD, Patel HK. Integrated nutrient management in wheat (*Triticum aestivum* L.). Trends Biosci. 2015;8(2):472-475.
4. Joseph MH, Dhargave TS, Deshpane CP, Shrivastava AK. Microbial solubilization of phosphate: Pseudomonas versus *Trichoderma*. Ann Plant Soil Res. 2015;17(3):227-232.
5. Menon KKG, Srivastava. Increasing plant productivity through improved photosynthetic process. Indian Acad Sci (Plant Sci). 1984;23:359-378.
6. Kumar M, Yaduvanshi NPS, Singh YV. Residual effect of organic and inorganic fertilizers on soil fertility, growth and yield of wheat under reclaimed sodic soil. Ann Plant Soil Res. 2015;17(3):248-252.
7. Onte S, Singh M, Kumar S, Pyati PS. Impact of organic nutrient management on crop quality, yield and soil health. Int J Curr Microbiol Appl Sci. 2019;8(5):394-402.
8. Ranthawa PG, Mevada KD, Ombase KC, Dodiya CJ, Bhadu V, Purabiya VS, *et al*. Integrated nitrogen management through different sources on growth and yield of wheat (*Triticum aestivum* L.). J Pure Appl Microbiol. 2018;12(2):905-911.
9. Sharma SN. Wheat. In: Rathore PS, ed. Techniques and Management of Field Crop Production. Agrobios; c2000. p. 96-120.
10. Srivastava LK, Mishra VN, Bachkaiya V. Regression models for some soil quality parameters under integrated use of nutrients in Vertisols of Chhattisgarh. Ann Plant Soil Res. 2015;17(4):381-384.
11. Singh V. Effect of balanced use of nutrients on productivity and soil economies of wheat. Ann Plant Soil Res. 2017;19(1):105-109.
12. Singh M, Kumar S, Prasanna SP. Impact of Organic Nutrient Management on Crop Quality, Yield and Soil Health: A Review by Santosh Onte. Int J Curr Microbiol Appl Sci. 2019;8(5):394-402.
13. Sutar R, Sujith GM, Devakumar N. Growth and yield of cowpea (*Vigna unguiculata* L.) as influenced by jeevamrutha and panchagavya application. Legume Res; c2018. p. 3932.
14. Verma RK, Shivay YS, Kumar D, Ghasal PC. Productivity and profitability of wheat (*Triticum aestivum* L.) as influenced by different cropping systems and nutrient sources. Indian J Agron. 2016;61(4):429-435.
15. Yaduvanshi NPS, Sharma DR, Swarup A. Impact of integrated nutrient management on soil properties and yield of rice and wheat as a long-term experiment on a reclaimed sodic soil. J Indian Soc Soil Sci. 2013;61:188-194.