INTEGRATED NUTRIENT MANAGEMENT'S EFFECT ON SOIL QUALITY, YIELD ATTRIBUTES, AND WHEAT (TRITICUM AESTIVUM L.) GROWTH

[1]Raghvendra Singh, [2]Ravikesh Kumar Pal, [3]Aneeta Yadav, [4]Ashish Srivastava, [5]Rubi Gautam, [6]Sakshi Lodhi

Faculty of Agricultural Science & Allied Industries, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

drraghvendra.fas@ramauniversity.ac.in

Abstract

The " Integrated nutrient management's effect on soil quality, yield attributes, and wheat (triticum aestivum l.) Growth" in the Rabi season crop of 2023–2024 was the subject of a field experiment conducted at Rama University at Mandhana, Kanpur. N1: Recommended dose fertiliser [RDF] (120:60:40), N2: 100% N through FYM, N3: 100% N through vermi compost, N4: 75% RDF + 25% N through FYM, N5: 50% RDF + 25% N through FYM + 25% N through vermi compost, N6: 75% RDF + 25% vermi compost, and N7: Control (No Fertiliser) were the seven treatments with different INM levels that were included in the experiment. Three replications of each treatment were carried out using a Randomised Blocks Design (RBD). Karan Vandana was the wheat variety used in the experiment (DBW 187). The experimental soil had a pH between 7.2 and 7.8, medium levels of organic carbon, and medium levels of potassium, phosphorus, and nitrogen. greater nutrient uptake was found to be significantly greater in this pattern, and the results seemed to show that the INM level with 50% RDF + 25% N through FYM + 25% N through vermi compost had significant growth, yield qualities, and grain yield varied with the different nutrient levels. The farmer's methods produce the lowest grain yield, growth traits, and yield qualities. The decomposition of crop residues and the use of organic manures resulted in an improvement in soil quality at the INM levels. With 25% FYM, 25% vermicompost, and 50% RDF, the INM levels have the highest net return and benefit cost ratio.

KEYWORDS: INM, yield, soil health parameter, wheat.

Introduction

Punjab is the most productive state in India, whereas Uttar Pradesh is the largest in terms of area and overall wheat production. Uttar Pradesh produced 33.95 million tonnes of wheat in 2023–2024, with a productivity of 3604 kg ha-1 on 9.42 million hectares, or 31.16% of India's total wheat producing area.(Unknown 2023–24) It seems unlikely that additional acreage will be planted to wheat very soon. Productivity must therefore increase in order to generate this additional wheat. India's decreasing wheat production has been caused by a number of issues, such as inadequate tillage techniques, postponed planting because of erratic monsoon seasons, water constraint, weed infestation, inferior seeds, and bad soil from excessive fertiliser use **Bhatt, M.K., Labanya R., Joshi H.C., Pareek N., Chandra, R. and Raverkar K.P. 2017.**.

The growth and development of the wheat crop depend on plant nutrients. It responds very well to nutrients from a variety of integrated nutrition management sources, maximising wheat crop output through prudent fertility control. Maintaining and even increasing soil fertility is the fundamental idea behind integrated nutrient management (INM), which aims to sustain crop output over an extended period of time. **Meena, R.P., Sharma, R.K., Tripathi, S.C., Gill, S.C., Chhokar, R.S., Meena, A and Sharma, I. 2015.** Combining the use of all available nutrient sources with scientific management of those sources can result in the maximum potential development, production, and quality of various crops and cropping systems. By encouraging a healthy soil structure, enhancing soil cation exchange capacity, and raising the amount of organic manures applied annually, physical and chemical conditions are improved. and availability of plant nutrients, raising the humus content, and acting as a substrate for microbial activities. **Shahid, M., Saleem, M. F., Khan, H. Z., Wahid, M. A. and Sarwar, M. (2015).**

It is responsible for the growth and development of all biological tissues. The wheat crop reportedly reacted more favorably to the recommended nitrogen dosage. **H.A. Desai, I.N. Dodia, C.K. Desai, M.D. Patel and H.K. Patel 2015.**The ecology is in risk due to the over use of artificial fertilizers and pesticides. As a result, developing a suitable manufacturing system is crucial to attaining maximum productivity and minimizing environmental damage. More than other elements, nitrogen has a significant impact on the growth, development, and quality of wheat. But too much nitrogen lowers wheat yield and quality. Consequently, more resources and focus have been allocated to nitrogen management than to any other natural element. Nitrogen is also essential because it is a component of nucleic acids, which are the building blocks of all proteins, including the enzymes that control nearly every biological process, protein, chlorophyll, protoplasm, and other materials that boost agricultural output. **Argal, M.S., Verma, S.K. and Tomar, P.S. (2017).**

MATERIALS & METHODS

During the 2023–2024 growing season, the current study, “Impact of integrated nutrient management on wheat (triticum aestivum l.) Growth, yield attributes, and soil quality" is being carried out. An outline of the trial's meteorological and environmental conditions, as well as the tools and methods employed, has been given in this section. The research was conducted during the Rabi season in 2023–2024 on the official campus of Rama University in the rural area of Mandhana, 10 km from Kanpur, in the central region of Uttar Pradesh. The soil is alluvial and partly sodic due to the lower terrain.

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Uttar Pradesh. The soil is alluvial and partly sodic due to the lower terrain. The experiment site is in the subhumid subtropical zone of the Indo-Genetic plains. At about 125.9 meters above mean sea level, Kanpur (U.P.) is situated on the Gangetic plain. The coordinates are 79º 31} to 80º 34} East and 25º 56} to 28º 58} North. The experimental farm is located beneath the Indo-Gangetic alluvial tract and is tube well irrigated.
Like North India, the region has a subtropical climate. The region receives its typical seasonal rainfall of about 816 mm, mostly from the second or first week of June until mid-October, with a few winter showers. Cold temperatures and sometimes frost are features of winter. The summer months are hot and dry. The scorching breezes from the west start in April and continue until the monsoon season.

RESULTS & DISCUSSION

Effect of different INM levels on yield:

A statistical analysis of the wheat crop's grain yield revealed that the impact of various nutrient sources (INM) on wheat crop grain yield was considerable. The highest grain yield was recorded by treatments N5 (50 percent RDF + 25 percent N through FYM + 25 percent N through vermicompost), which were statistically comparable to treatments N1 (100 percent RDF and N6) but statistically superior to N4 (75 percent RDF + 25 percent N through FYM), N3 (100 percent N through vermicompost), and N2 (100 percent N through FYM). The N7 control plot had the lowest wheat crop grain yield. **Gurwider Singh, Santosh Kumar, Gurjagdeep Singh Sidhu and Rmandeep Kaur 2018.** A statistical analysis of the wheat crop's straw yield revealed that the impact of various nutrient sources (INM) on the crop's straw production was considerable. The highest straw yield was recorded by treatments N5 (50 percent RDF + 25 percent N through FYM + 25 percent N through vermicompost), which were statistically comparable to treatments N1 (100 percent RDF and N6) but statistically superior to N4 (75 percent RDF + 25 percent N through FYM), N3 (100 percent N through vermicompost), and N2 (100 percent N through FYM). The N7 control plot had the lowest straw yield on the wheat crop. **Gangawar, M., Pandove G., Brar S. K., Sekhon K.S., Kaur, S. and Kumar R. 2018.**

A statistical analysis of the wheat crop's biological yield revealed that the impact of various nutrient sources (INM) on the crop's biological output was considerable. The highest biological yield was recorded by treatments N5 (50 % RDF + 25 % N through FYM + 25 % N through vermicompost), which were statistically comparable to treatments N1 (100 % RDF and N6) but statistically superior to N4 (75 % RDF + 25% N through FYM), N3 (100 % N through vermicompost), and N2 (100 % N through FYM). **Kumar, S., Sharma, P.K., Yadav, M.R., Sexena, R., Gupta, K.C., Kumar, R., Garg, N.K., Yadav, H.L. 2019.** The N7 control plot had the lowest wheat crop biological yield. According to a statistical analysis of the wheat crop's harvesting index, the impact of various nutrient sources (INM) on the index was shown to be substantial. In comparison to treatments N7-Control, N4-75 percent RDF + 25% N through FYM, N3-100 percent N through vermicompost, N2-100 percent N through FYM, and other treatments, the treatments N1-100 percent RDF recorded the highest harvesting index, which was statistically comparable to treatments N5-50 percent RDF + 25% N through FYM + 25% N through vermicompost. The N6- 75% RDF + 25% vermicompost control plot had the lowest harvest index number for the wheat crop.

Effect of different INM levels on soil health parameter:

The highest pH values were recorded by treatments N5 (50 % RDF + 25 N through FYM + 25 % N through vermi compost), which were statistically comparable to treatments N1 (100 % RDF) and N6 (75 % RDF + 25% vermicompost) but statistically superior to N4 (75 % RDF + 25% N through FYM), N3 (100 % N through vermicompost), and N2 (100 % N through FYM). The N7 control plot had the lowest soil pH value. According to a statistical analysis of the soil electric conductivity, the impact of various nutrient sources (INM) on soil electric conductivity was shown to be substantial. The highest soil electric conductivity was recorded by treatments N5 (50 percent RDF + 25 percent N through FYM + 25 percent N through vermicompost), which were statistically comparable to treatments N1 (100 percent RDF and N6) but statistically superior to N4 (75 percent RDF + 25 percent N through FYM), N3 (100 percent N through vermicompost), and N2 (100 percent N through FYM). The N7 control plot has the lowest recorded soil electric conductivity.

According to a statistical analysis of the soil organic carbon, the impact of various nutrient sources (INM) on soil organic carbon was shown to be considerable. The highest soil electric conductivity was recorded by treatments N3–100% N through vermicompost, which were statistically comparable to treatments N2–100% N through FYM and N5–50% RDF + 25% N through FYM + 25% N through vermicompost, but statistically superior to N1–100% RDF, N6–75% RDF + 25% vermicompost, and N4–75% RDF + 25% NthroughFYM. The N7 Control plot has the lowest soil organic carbon.

The N3-100 percent N through vermicompost had the highest amount of available nitrogen, followed by N2-100 percent N through FYM, N5-50 percent RDF + 25% N through FYM + 25% N through vermicompost, and N1-100 percent RDF. N4-75 percent RDF + 25% N through FYM and N6-75 percent RDF + 25% vermicompost had the lowest amount of N. Significant differences were seen between all other Ncontaining treatments. **Bartaula, S., Panthi1, U., Adhikari, A., Mahato, M., Joshi, D. and Aryal, K. (2020).**While the lowest N was recorded under the N4 - 75% RDF + 25% N through FYM, the highest available P was found under the N5 - 50% RDF + 25% N through FYM + 25% N through vermicompost, followed by N3 - 100% N through vermicompost and N6 - 75% RDF + 25% vermicompost and N2 - 100% N through FYM and N1 - 100%RDF and N7 Control.Significant differences were found between all other P-containing treatments. The N3-100 percent N through vermicompost had the highest available K, followed by N2-100 percent N through FYM, N5-50 percent RDF + 25% N through FYM + 25% N through vermicompost, N6-75 percent RDF + 25% vermicompost, N4-75 percent RDF +

25% N through FYM, and N1-100 percent RDF. The N7 control had the lowest K. Significant differences were observed between all other Kcontaining treatments.

Effect of different of INM levels on Economic:

Under farmer practice, the highest cultivation cost was noted. N5: 50% RDF plus 25% N from FYM plus 25% N from vermicompost, as determined by farmer practice The cultivation costs were lower for N1 (100 percent RDF), N6 (75 percent RDF + 25 percent vermicompost), N4 (75 percent RDF + 25 percent N through FYM), N3 (100 percent N through vermicompost), N2 (100 percent N through FYM), and N7 (control). 50% RDF + 25% N through FYM + 25% N through vermicompost, followed by farmer practice, yielded the highest value gross return under N5. The gross return was lower for N1 (100 percent RDF), N6 (75% RDF + 25% vermicompost), N4 (75% RDF + 25% N through FYM), N3 (100 percent N through vermicompost), N2 (100 percent N through FYM), and N7 (control). **Wairagade, M.N., Choudhary, A.A., Mairan, N.R., and Kirnapure, V.S. 2020.**

N5 had the highest net return, with 50% RDF + 25% N from FYM + 25% N from vermicompost, followed by farmer practice. 100 percent RDF, 75 percent RDF plus 25 percent vermicompost, 75 percent RDF plus 25 percent N through FYM, 100 percent N through vermicompost, 100 percent N through FYM, and N7-Control all had lower net return values. The N5- 50% RDF + 25% N via FYM + 25% N through vermicompost, followed by farmer practice, had the highest benefits-cost ratio value. The benefits cost ratio was lower for N1 (100 percent RDF), N6 (75 percent RDF + 25 percent vermicompost), N4 (75 percent RDF + 25 percent N through FYM), N3 (100 percent N through vermicompost), N2 (100 percent N through FYM), and N7 (control).

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TableNo.6 Effect of INM levels on Yield (qha^{-1}) of wheat crop

S.N.	Treatments	Yield (qha^{-1})			Harvest index(%)
		Grain Yield (qha^{-1})	Straw Yield (qha^{-1})	Biological Yield (qha^{-1})	
N_1	100%RDF	39.10	57.78	96.88	40.36
N_2	100%NthroughFYM	27.00	48.98	75.98	35.53
N_3	100% Nthroughvermi compost	27.19	49.19	76.38	35.60

N_4	75% RDF + 25%NthroughFYM	28.10	49.43	77.43	36.29
N_5	50% RDF + 25% N through FYM + 25% N through vermi compost	40.27	64.29	104.56	38.51
N_6	75% RDF + 25% vermi compost	28.37	56.46	84.83	33.44
N_7	Control (No Fertilizer)	25.49	45.65	71.14	35.83
	SEm±	0.92	0.20	2.46	0.45
	CDat5%	3.28	1.00	7.32	2.30

TableNo.7 Effect of INM on soil pH, Soil electrical conductivity (dSm^{-1}) and Organic carbon (%)after harvest of wheat crop.

S.N.	Treatments	Soil pH	Electrical conductivity (dSm^{-1})	Organic carbon (%)
N_1	100%RDF	8.18	0.24	0.498
N_2	100% N through FYM	8.10	0.18	0.718
N_3	100% Nthroughvermi compost	8.15	0.22	0.735
N_4	75% RDF + 25%NthroughFYM	8.17	0.23	0.471
N_5	50% RDF + 25% N through FYM + 25% N through vermi compost	8.2	0.25	0.567
N_6	75% RDF + 25% vermi compost	8.17	0.23	0.485
N_7	Control (No Fertilizer)	7.8	0.16	0.357

	SEm±	0.07 8	0.02	0.046
	CDat5%	NS	NS	NS

Table No. 8 Effect of INM on available N, P and K (kgha^{-1}) after harvest of wheat crop

S.N.	Treatments	AvailableNutrients(kg ha^{-1})		
		N	P	K
N_1	100%RDF	236.35	14.24	220.34
N_2	100% N through FYM	247.38	14.75	233.38
N_3	100% Nthroughvermi compost	248.10	15.20	237.65
N_4	75% RDF + 25%NthroughFYM	215.79	13.90	229.32
N_5	50% RDF + 25% N through FYM + 25% N through vermi compost	240.48	15.30	231.54
N_6	75% RDF + 25% vermi compost	216.15	14.78	230.86
N_7	Control (No Fertilizer)	200.39	14.00	211.68
	SEm±	2.953	0.683	2.396
	CDat5%	7.895	0.965	6.923