



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(7): 710-713
Received: 24-05-2026
Accepted: 28-06-2026

SL Dobale

M.Sc. Scholar, Department of
Agronomy, School of Agriculture
Science, Technology & Research,
Sardar Patel Agriculture
University, Balaghat, Madhya
Pradesh, India

JS Bisen

Associate Professor, Department of
Agronomy, School of Agriculture
Science, Technology & Research,
Sardar Patel Agriculture
University, Balaghat, Madhya
Pradesh, India

Devendra Turkar

Assistant Professor, Department of
Agronomy, School of Agriculture
Science, Technology & Research,
Sardar Patel Agriculture
University, Balaghat, Madhya
Pradesh, India

Sanjay Bhelawe

Assistant Professor, Department of
Agronomy, School of Agriculture
Science, Technology & Research,
Sardar Patel Agriculture
University, Balaghat, Madhya
Pradesh, India

TH Nengparmoi

Assistant Professor, Department of
Agronomy, School of Agriculture
Science, Technology & Research,
Sardar Patel Agriculture
University, Balaghat, Madhya
Pradesh, India

Corresponding Author:

SL Dobale

M.Sc. Scholar, Department of
Agronomy, School of Agriculture
Science, Technology & Research,
Sardar Patel Agriculture
University, Balaghat, Madhya
Pradesh, India

Influence of integrated nutrient management on growth and yield of rice (*Oryza sativa* L.)

SL Dobale, JS Bisen, Devendra Turkar, Sanjay Bhelawe and TH Nengparmoi

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i7i.6003>

Abstract

The present investigation entitled “Influence of Integrated Nutrient Management on Growth and Yield of Rice (*Oryza sativa* L.)” was conducted at Research farm of Sardar Patel University, Balaghat (M.P.) during Kharif season of 2023 in RBD with three replications and nine treatments which include integration of inorganic fertilizer with organic (FYM and Vermicompost) and bio-fertilizers (*Azotobacter*). The Study revealed that the characters Days to fifty percent flowering, Days to maturity, Plant height, Number of productive tillers plant⁻¹, Panicle length, Number of filled grains panicle⁻¹, Number of unfilled grains panicle⁻¹, Spikelet fertility, Test weight, Grain yield (q ha⁻¹), Straw yield (q ha⁻¹) and Harvest index (%) reported significant variation between different integrated nutrient treatments. Pooled data revealed that the maximum grain yield (q ha⁻¹) was recorded by T₈ (42.33 q ha⁻¹), which was at par with T₉ (42.13 q ha⁻¹) and T₂ (40.33 q ha⁻¹), which suggest that inorganic nutrient applied in integration with organic nutrient increases the yield. The maximum net monetary return and B:C ratio was recorded by T₂ (44663.83 Rs/ha), which was at par with T₈ (44021.33 Rs/ha), while minimum was reported by T₆ (18717.16 Rs/ha).

Keywords: Integrated, FYM, vermicompost, bio-fertilizer, *Azotobacter*, etc.

1. Introduction

Rice (*Oryza sativa* L.) serves as a main food source for more than half of the world's population, especially in Asia and Africa. More than 100 countries cultivate this crop, in which Asia contributes the majority in area and production. In tropics as well as parts of temperate regions of the world, rice is one of the most significant cereal crops. The United Nations designated 2004 as the ‘International Year of Rice’ with the theme “Rice is life” to highlight the significance of the rice crop as a source of food, for trade, and the tight ties between rice-based systems and many cultures and people worldwide, especially in developing countries. For small-scale farmers in particular, rice is crucial as an income-producing crop because it offers a source of revenue.

In the year 2021 around the world, rice was grown over an area of 165.25 million hectares, with a total production of 787.29 million tons and yield of 4.76 tons per hectare (FAOSTAT, 2021) [10]. In India, rice is raised on an area of 46.38 million ha with an annual yield of 130.29 million tons and a productivity of 2.809 tons/ha (Anonymous, 2023a) [2]. The area under paddy reflected a 4.44 percent increase in 2023-24 compared to 2022-23, with the area expanding from 3,848.00 thousand hectares in 2022-23 to 4,019.00 thousand hectares in 2023-24. Due to the increase in the area under paddy, production also showed a 4.41 percent increase in 2023-24 compared to 2022-23, with production rising from 13,126.00 thousand tons in 2022-23 to 13,705.00 thousand tons in 2023-24 (Anonymous, 2023b) [3].

The integrated nutrient supply system is the most logical concept for managing long term soil fertility and productivity (Ramesh *et al.*, 2009) [21]. Use of organic manures, green manures, crop residues along with inorganic fertilizers not only reduces the demand of inorganic fertilizers but also increases the efficiency of applied nutrients due to their favorable effect on physical, chemical and biological properties of soil (Pandey *et al.*, 2007) [18]. Most studies have focused on general nutrient management practices without tailoring them to the unique soil and climatic conditions of region. There is a need for more localized research examining the impact of INM in increasing the rice yield under these conditions. However, due to the above point the main purpose of this research is to study the effect of INM on growth and yield parameters of rice.

2. Materials and Methods

The field experiment was carried out during the *Kharif* season of 2023-24 at the Student Research Farm, Department of Agronomy, School of Agricultural Science, Technology, and Research, SPU Balaghat. The experimental field's soil consisted of medium black clay (Vertisols). The climate in Balaghat is subtropical, defined by hot summers and generally dryness except during the southwest monsoon season. The experiment was conducted using a Randomized Block Design (RBD) featuring three replications and nine treatments. Experiment consist of T₁: Control, T₂: 100% RDF (100:50:50 N: P₂O₅: K₂O kg ha⁻¹), T₃: 75% RDF + FYM@ 5 t/ha, T₄: 50% RDF + FYM@ 10 t/ha, T₅: 75% RDF + VC@ 2 t/ha, T₆: 50% RDF + VC@ 4 t/ha, T₇: 50% RDF + AC@ 15 g/kg seed, T₈: 50% RDF + FYM@ 5 t/ha + AC@ 15 g/kg seed, T₉:

50% RDF + VC@ 2 t/ha + RC@ 15 g/kg seed. The rice variety Kranti was transplanted at a spacing of 20 cm x 15 cm. The necessary quantities of fertilizers, namely FYM, vermicompost, urea, SSP, and MOP, were quantified using a weighing balance at the time of preparation of manures and fertilizers according to treatments. The crop was grown with recommended package of practices and was harvested at maturity. Analysis of variance was used to statistically examine the recorded data and significance was determine as given by Panse and Sukhatme (1967) ^[19] for Randomized Block Design.

3. Results and Discussion

3.1 Growth parameters

Table 1: Days to 50% flowering, Days to maturity and Plant height (cm), as influenced by different treatments.

Tr. No.	Treatments	DF	DM	PH (cm)
				90 DAS
T ₁	Control	89	118	93.33
T ₂	100% RDF	91	121	95.33
T ₃	75% RDF + FYM@ 5 t/ha	89	119	94.00
T ₄	50% RDF + FYM@ 10 t/ha	89	119	93.33
T ₅	75% RDF + VC@ 2 t/ha	89	120	94.67
T ₆	50% RDF + VC@ 4 t/ha	89	118	93.33
T ₇	50% RDF + AC@ 15 g/kg	88	118	93.00
T ₈	50% RDF + FYM@ 5 t/ha+ AC@ 15 g/kg	91	122	96.00
T ₉	50% RDF + VC @ 2 t/ha + AC@ 15 g/kg	92	122	96.00
	S.Em =	0.75	0.61	0.67
	CD (5%) =	2.24	1.82	2.00
	CV =	1.44	0.88	1.22

The observations regarding the growth parameters (table 1) viz., days to 50% flowering, days to maturity and plant height (cm) were significantly influenced by different integrated nutrient management treatments. The growth characters were observed significantly higher under T₉: (50% RDF+VC@ 2 t/ha+AC@ 15 g/kg) than in the rest of the nutrient management treatments in the study, while it was recorded significantly lowest in absolute control (T₁) treatment. This increase in growth parameters with increased fertilizer doses might be due to the availability of sufficient nutrients by mineralization of basic organic and inorganic sources of nutrient at proper growth stages of crop. This

facilitated the availability of required nutrients for the healthy growth and development of rice. The better nutrition to the plant resulted more plant height (cm), which resulted in better light interception and accumulation of more photosynthesis. The findings were analogous to those obtained by Shanthi and Rao (2016) ^[22], Singh *et al.*, (2017) ^[23], Singh *et al.*, (2018) ^[24], Balasubramanian (2019) ^[6], Ajaykumar and Sivakumar (2020) ^[1], Chakraborty *et al.*, (2020) ^[8], Dongre *et al.*, (2022) ^[9], Mangaraj *et al.*, (2022) ^[14] and Kumar *et al.*, (2023) ^[13].

3.2 Yield attributes and yield

Table 2: Number of productive tillers plant⁻¹, Panicle length (cm), Spikelet fertility (%), Test weight (g), Seed yield (qt ha⁻¹) and straw yield (qt ha⁻¹)

Tr. No	Treatments	Number of tillers plant ⁻¹	Panicle length (cm)	Spikelet fertility (%)	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)
T ₁	Control	7.00	17.00	75.12	22.57	33.67	53.03
T ₂	100% RDF	9.33	19.67	82.40	24.47	40.33	55.53
T ₃	75% RDF + FYM@ 5 t/ha	8.33	18.67	81.78	23.43	37.77	54.13
T ₄	50% RDF + FYM@ 10 t/ha	7.33	18.00	78.87	23.07	35.37	54.80
T ₅	75% RDF + VC@ 2 t/ha	8.00	18.17	80.10	23.53	37.60	52.73
T ₆	50% RDF + VC@ 4 t/ha	7.67	18.00	77.70	23.03	36.50	53.77
T ₇	50% RDF + AC@ 15 g/kg	7.33	17.83	75.28	22.97	36.57	57.30
T ₈	50% RDF + FYM@ 5 t/ha+ AC@ 15 g/kg	9.33	19.83	83.84	24.67	42.33	56.63
T ₉	50% RDF + VC @ 2 t/ha + AC@ 15 g/kg	9.67	20.00	83.68	25.33	42.13	55.63
	S.Em =	0.41	0.30	0.54	0.50	0.74	0.81
	CD (5%) =	1.22	0.91	1.60	1.50	2.23	2.42
	CV =	8.60	2.83	1.16	3.67	3.38	2.55

The important yield contributing characters (Table 2) like the number of productive tillers plant⁻¹, panicle length (cm), test weight (g), grain yield (qt ha⁻¹) and straw yield (qt ha⁻¹) was significantly influenced by different nutrient treatments. The yield contributing characters was significant more under treatment T₉: (50% RDF + VC @ 2 t/ha + AC@ 15 g/kg) than in

the rest of the nutrient management treatments in the study, while it was recorded significantly lowest in absolute control (T₁) treatment. The grain yield of rice was found to be significantly higher (42.33 qt ha⁻¹) in T₈: (50% RDF + FYM@ 5 t/ha+ AC@ 15 g/kg). The grain and straw yield are lowest under nutrient management treatment (T₁). Adequate supply of NPK played a

crucial role in physiological developmental processes in plants life. Important nutrients might have accelerated the growth processes that resulted in increasing of grain yield and straw yield of the crop. This is due to efficiently utilization of crucial nutrients in production of higher grain and straw yield. These results were in agreement with the findings of Baishya *et al.*, (2015) ^[5], Mondal *et al.*, (2015) ^[17], Shanthi and Rao (2016) ^[22], Kumar *et al.*, (2017) ^[11], Mishra *et al.*, (2017) ^[16], Tiwari *et al.*, (2017) ^[25],

Singh *et al.*, (2018) ^[24], Tomar *et al.*, (2018) ^[26], Balasubramanian (2019) ^[6], Kumar *et al.*, (2019) ^[12], Bordoloi and Islam (2020) ^[7], Chakraborty *et al.*, (2020) ^[8], Sai Ram *et al.*, (2020), Ashem and Roy (2022) ^[4], Dongre *et al.*, (2022) ^[9], Mangaraj *et al.*, (2022) ^[14], Kumar *et al.*, (2023) ^[23] and Manjappa (2023) ^[15].

3.3 Economics

Table 3: Cost of cultivation (Rs/ha), Gross monetary returns (Rs/ha), Net monetary returns (Rs/ha) and Benefit cost ratio (B: C Ratio) as influenced by various treatments

Tr. No.	Treatment combination	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C Ratio
T ₁	Control	46340.84	81449.33	35108.49	1.76
T ₂	100% RDF	51713.84	96377.67	44663.83	1.86
T ₃	75% RDF + FYM@ 5 t/ha	57870.59	90564.63	32694.04	1.56
T ₄	50% RDF + FYM@ 10 t/ha	64027.34	85425.43	21398.09	1.33
T ₅	75% RDF + VC@ 2 t/ha	60370.59	89990.80	29620.21	1.49
T ₆	50% RDF + VC@ 4 t/ha	69027.34	87744.50	18717.16	1.27
T ₇	50% RDF + AC@ 15 g/kg	49387.34	88420.03	39032.69	1.79
T ₈	50% RDF + FYM@ 5 t/ha+ AC@ 15 g/kg	56887.34	100908.67	44021.33	1.77
T ₉	50% RDF + VC @ 2 t/ha + AC@ 15 g/kg	59387.34	100322.07	40934.73	1.69

The data recorded in Table 3 showed that the among different integrated nutrient management treatments, the application of treatment 50% RDF + FYM@ 5 t/ha+ AC@ 15 g/kg (T₈) recorded significantly maximum gross monetary returns of 100908.67 Rs ha⁻¹ and net monetary returns of 44663.83 Rs ha⁻¹ was reported by treatment T₂ (100% RDF) during *Rabi*, 2023-24 as compared to other integrated nutrient management treatments. The maximum cost of cultivation recorded in treatment 50% RDF + VC @ 2 t/ha + AC@ 15 g/kg (T₉) than rest of nutrient management treatments and the benefit cost ratio of rice fertilized with 100% RDF (T₂) was found significantly superior (2.00) as compared to other nutrient management treatments. These confirm with findings Baishya *et al.*, (2015) ^[5], Kumar *et al.*, (2017) ^[11], Mishra *et al.*, (2017) ^[16], Tiwari *et al.*, (2017) ^[25], Tomar *et al.*, (2018) ^[26], Bordoloi and Islam (2020) ^[7], Sai Ram *et al.*, (2020) ^[20], Ashem and Roy (2022) ^[4], Dongre *et al.*, (2022) ^[9], Kumar *et al.*, (2023) ^[13] and Manjappa (2023) ^[15].

4. Conclusion

Based on the results of an experiment, it could be concluded that among the different integrated nutrient management treatments used, application of T₉: 50% RDF + VC @ 2 t/ha + AC@ 15 g/kg and T₈: 50% RDF + FYM@ 5 t/ha + AC@ 15 g/kg should be adopted for higher growth, yield, and net monetary returns of rice than other nutrient management treatments.

References

1. Ajaykumar R, Sivakumar SD. Effect of integrated nutrient management on growth, physiological, nutrient uptake, root and yield parameters of transplanted lowland rice. *Current Journal of Applied Science and Technology*. 2020;39(40):35–43.
2. Anonymous. Agricultural statistics at a glance 2022. Directorate of Economics and Statistics, Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India, New Delhi; 2023.
3. Anonymous. Economic Survey of Madhya Pradesh 2023–24. Directorate of Economics and Statistics, Government of Madhya Pradesh; 2023.
4. Ashem SS, Roy AKS. Influence of integrated nutrient management in summer rice (*Oryza sativa* L.) under Terai zone of West Bengal. *Biological Forum – An International Journal*. 2022;14(4):357–362.
5. Baishya LK, Rathore SS, Singh D, Sarkar D, Deka BC. Effect of integrated nutrient management on rice productivity, profitability and soil fertility. *Annals of Plant and Soil Research*. 2015;17(1):86–90.
6. Balasubramanian A. Effect of integrated nutrient management practices on growth, yield and nutrient uptake of rice (*Oryza sativa* L.). *Journal of Pharmacognosy and Phytochemistry*. 2019;8(4):1047–1049.
7. Bordoloi P, Islam M. Effect of integrated nutrient management on productivity of rice (*Oryza sativa* L.) and soil fertility status under rainfed condition of Meghalaya. *Journal of Krishi Vigyan*. 2020;9:176–179.
8. Chakraborty S, Rahman A, Salam MA. Effect of integrated nutrient management on the growth and yield of Boro rice (*Oryza sativa* L.) cultivars. *Archives of Agriculture and Environmental Science*. 2020;5(4):476–481.
9. Dongre A, Kumar N, Thakur AK, Salam PK, Chandrakar T, Singh DP. Effect of integrated nutrient management on growth, yield and economics of direct seeded rice (*Oryza sativa* L.) under midland situations. *Pharma Innovation*. 2022;11(8):1370–1373.
10. Food and Agriculture Organization of the United Nations. FAOSTAT statistical database. 2021.
11. Kumar V, Kumar T, Singh G, Singh RA. Effect of integrated nutrient management on yield of rice and its residual effect on wheat in rice–wheat system under lowland. *Annals of Plant and Soil Research*. 2017;19(4):360–365.
12. Kumar B, Tripathi S, Sharma A. Effect of integrated nutrient management on soil health and yield of crops under rice–wheat cropping system in alluvial soil of Bihar, India. *Journal of Pharmacognosy and Phytochemistry*. 2019;8(5S):441–445.
13. Kumar N, Tiwari BK, Tiwari RK, Gajbhiye M. Effect of integrated nutrient management on growth, yield attributes, productivity and profitability of direct seeded rice under rainfed conditions. *International Journal of Environment and Climate Change*. 2023;13(4):80–88.
14. Mangaraj S, Paikaray RK, Maitra S, Pradhan SR, Garnayak LM, Satapathy M, *et al.* Integrated nutrient management improves the growth and yield of rice and green gram in a rice–green gram cropping system under the coastal plain

- agro-climatic condition. *Plants*. 2022;11:142.
15. Manjappa K. Integrated nutrient-management practices effect on productivity of rice (*Oryza sativa*) and soil properties under rainfed lowland rice situation: A long-term study. *Indian Journal of Agronomy*. 2023;68(2):133–139.
 16. Mishra KN, Patra AK, Garnayak IM, Mohanty AK, Swain SK. Long-term effects of integrated nutrient management on productivity and soil properties of rice (*Oryza sativa*) cropping system in coastal Odisha. *Indian Journal of Agronomy*. 2017;62(3):239–246.
 17. Mondal S, Mallikarjun M, Ghosh M, Ghosh DC, Timsina J. Effect of integrated nutrient management on growth and productivity of hybrid rice. *Journal of Agricultural Science and Technology*. 2015;17:297–308.
 18. Pandey AK, Gopinath KA, Bhattacharya R, Hooda KS, Sushil SN, Kundu S, *et al.* Effect of source and rate of organic manures on yield attributes, pod yield and economics of garden pea grown under organic farming system. *Indian Journal of Agricultural Sciences*. 2006;76(4):230–234.
 19. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. 2nd ed. New Delhi: Indian Council of Agricultural Research; 1956.
 20. Ram MS, Shankar T, Maitra S, Duvvada SK. Effect of integrated nutrient management on growth, yield, nutrient content and economics of summer rice (*Oryza sativa* L.). *International Journal of Pure and Applied Biosciences*. 2020;8(3):421–427.
 21. Ramesh P, Panwar NR, Singh AB, Ramanna 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 Journal of Agronomy*. 2009;54(3):278–283.
 22. Shanthi K, Rao PC. Effect of integrated nutrient management on soil fertility after kharif rice (*Oryza sativa* L.). *International Journal of New Media Studies*. 2017;4(2):1–5.
 23. Singh S, Bohra JS, Singh YV, Upadhyay AK, Verma SS, Mishra PK, Raghuveer M. Effect of integrated nutrient management on growth and development stages of rice under rice–wheat ecosystem. *International Journal of Current Microbiology and Applied Sciences*. 2017;6(7):2032–2042.
 24. Singh NP, Singh MKS, Tyagi S, Singh SS. Effect of integrated nutrient management on growth and yield of rice (*Oryza sativa* L.). *International Journal of Current Microbiology and Applied Sciences*. 2018;7:3671–3681.
 25. Tiwari A, Singh N, Kumar A. Effect of integrated nutrient management (INM) on soil properties, yield and economics of rice (*Oryza sativa* L.). 2017. doi:10.13140/RG.2.2.10695.19366.
 26. Tomar R, Singh NB, Singh V, Kumar D. Effect of planting methods and integrated nutrient management on growth parameters, yield and economics of rice. *Journal of Pharmacognosy and Phytochemistry*. 2018;7(2):520–527.