



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
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NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(4): 490-493
Received: 05-01-2026
Accepted: 07-02-2026

Sheetal Naik
M.Sc. Scholar (Soil science and
Agricultural Chemistry, College of
Agriculture, Indira Gandhi Krishi
Vishwavidyalaya, Raipur,
Chhattisgarh, India

Vinod Nayak
Scientist, Department of soil
science, College of Agriculture,
Indira Gandhi Krishi
Vishwavidyalaya, Raipur,
Chhattisgarh, India

Corresponding Author:
Sheetal Naik
M.Sc. Scholar (Soil science and
Agricultural Chemistry, College of
Agriculture, Indira Gandhi Krishi
Vishwavidyalaya, Raipur,
Chhattisgarh, India

Effect of jeevamrit along with FYM and vermicompost on soil chemical and biological properties under rice crop

Sheetal Naik and Vinod Nayak

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i4g.5396>

Abstract

A field experiment titled “Effect of Jeevamrit along with FYM and vermicompost on soil chemical and biological properties under rice crop” was conducted during Kharif 2024 at the Instructional-cum-Research Farm, IGKV, Raipur (Chhattisgarh). The study aimed to evaluate the impact of integrated nutrient management using organic (FYM, vermicompost, Jeevamrit) and inorganic (RDF) sources on rice yield, soil chemical, and biological properties. The soil was a neutral *Vertisol* (pH 7.2) with moderate organic carbon (0.6%) and low nitrogen status (209.88 kg ha⁻¹).

The experiment was laid out in RCBD with seven treatments and three replications. Among treatments, T₆ (50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval) recorded the highest yield and yield attributes. Post-harvest soil analysis showed a significant increase in available nitrogen, with the highest value in T₆ (210.31 kg ha⁻¹), while other soil parameters remained non-significant.

Microbial analysis revealed that T₅ recorded the highest bacterial (45.33 × 10⁷ CFU g⁻¹) and fungal population (15.67 × 10⁴ CFU g⁻¹), while the lowest was observed in control.

Overall, the integration of 50% RDF with vermicompost and Jeevamrit proved to be an effective and sustainable nutrient management strategy for improving soil fertility, microbial activity, and rice productivity.

Keywords: FYM, jeevamrit, vermicompost, RDF, rice

Introduction

Rice (*Oryza sativa* L.) is the most important staple food crop in India and across many parts of the world, serving as the primary source of calories for a large proportion of the population. Ensuring sustainable rice production is therefore crucial for food security. However, the intensive and imbalanced use of chemical fertilizers over the years has led to several concerns, including soil degradation, nutrient imbalances, and declining soil health. This has necessitated a shift towards integrated and organic nutrient management practices that enhance crop productivity while maintaining soil fertility and biological activity.

Among the various organic sources of nutrients, farmyard manure (FYM) and vermicompost are widely recognized for their ability to improve soil structure, enhance nutrient availability and support microbial populations. Another promising input is *Jeevamrit*, a traditional liquid organic formulation prepared from cow-based products (cow dung and cow urine) along with jaggery and pulse flour. *Jeevamrit* is reported to stimulate microbial activity in the soil, enhance nutrient mineralization, and act as a carrier of plant growth-promoting microbes, thereby improving both the chemical and biological properties of the soil.

The present study was undertaken to investigate the effect of *Jeevamrit* in combination with FYM and vermicompost on soil chemical and biological properties under rice cultivation. The findings are expected to provide valuable insights into the role of organic nutrient sources in sustaining soil fertility and productivity of rice-based systems.

Materials and Methods

Recommended doses of N: P: K- 120:60:40 kg ha⁻¹ and FYM @ 24 t ha⁻¹ through VC and FYM

were computed on account of N equivalence. Before transplanting full amount of VC and FYM were applied and mixed with soil. After transplanting, concentrated jeevamrit was applied according to treatments. The experimental plants were given uniform recommended cultural practices during the entire course of investigation.

Preparation of jeevamrit

- Fresh cow dung (10Kg) and cow urine (10 L) was added in

water.

- Jaggery (2 Kg), pulse flour (1Kg) and live soil (1 Kg) were mixed in 200 L of water.
- The above mixture was stirred properly (morning and evening) for 4 days for 5-10 minutes.
- On 12th day the solution was filtered and filtrate was ready for soil drenching per spray.

Table 1: Initial chemical properties of the experimental soil

S.N.	Properties	Value	Remark	Method of estimation
1.	pH (1:2.5)	7.20	Neutral	Glass Electrode pH Meter by Piper (1967) ^[8]
2.	EC (dS m ⁻¹)	0.22	Normal	Conductivity salt Bridge by Black (1965) ^[2]
3.	Organic carbon (%)	0.60	Medium	Walkley Black's Rapid Titration Method (1934) ^[14]
4.	Available N (kg ha ⁻¹)	209.88	Low	Alkaline Permanganate method by Subbiah and Asija (1956) ^[12]
5.	Available P (kg ha ⁻¹)	13.50	Medium	0.5 M NaHCO ₃ by Olsen (1954) ^[7]
6.	Available K (kg ha ⁻¹)	332.11	Medium	Neutral Normal Ammonium Acetate Method by Hanwey and Heidel (1952)
7.	Available S (kg ha ⁻¹)	24.08	Medium	0.15% CaCl ₂ turbidity method by Williams and Steinbergs (1969) ^[15]
8.	Available Zn(mg kg ⁻¹)	2.28	Sufficient	DTPA extraction method (1978) by Lindsay and Norvel
9.	Available Cu(mg kg ⁻¹)	2.17	Sufficient	DTPA extraction method (1978) by Lindsay and Norvel
10.	Available Fe(mg kg ⁻¹)	32.05	Sufficient	DTPA extraction method (1978) by Lindsay and Norvel
11.	Available Mn(mg kg ⁻¹)	26.70	Sufficient	DTPA extraction method (1978) by Lindsay and Norvel

Results and Discussion

Effect of different nutrient management on yield and yield attributes of rice

Plant height at harvest (cm)

Plant height was significantly increased with different nutrient practices on rice which ranged between 100.09 to 126.10 cm. The maximum value of plant height (126.10 cm) was reported in the treatment (T₆) 50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval. The lowest plant height (100.09 cm) was reported in (T₁) control. Similar results have been reported by Ahmad and Tripathi (2022) ^[1].

Number of effective tillers per hill at harvest

The number of effective tillers were significantly increased with different nutrient practices on rice which ranged between 5 to 10.02 tillers hill⁻¹. The maximum number of effective tiller (10.02) was reported in the treatment (T₆) 50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval and the lowest number of effective tiller (5) was reported in (T₁) control. Similar results have been reported by Verma *et al.* (2024) ^[13].

Number of filled grains per panicle

The number of filled grains panicle⁻¹ were significantly increased with different nutrient practices on rice which ranged between 90.70 to 114.10 grains panicle⁻¹. The maximum number of filled grains (114.10) was reported in the treatment (T₆) 50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval and the lowest number of filled grains (90.70) was reported in (T₁) control. Similar findings were seen by Sharma *et al.* (2024) ^[10] on rice.

Test weight (g)

Test weight differed non-significantly. The range of test weight varied between 20.56 to 21.72 g. Ghasal *et al.* (2024) ^[3] found similar data pertaining to test weight.

Grain and Straw yield (q ha⁻¹)

Grain and straw yield (q ha⁻¹) was significantly increased with different nutrient practices on rice which ranged between 30.95 to 64.61 q ha⁻¹ and 47.56 to 80.56 q ha⁻¹ respectively. The higher

grain yield (64.61 q ha⁻¹) and straw yield (80.56 q ha⁻¹) was reported in the treatment (T₆) 50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval and the lowest value of grain (30.95 q ha⁻¹) and straw yield (47.56 q ha⁻¹) was reported in (T₁) control. The results are also in conformity with findings of Kumar *et al.* (2014) ^[5].

Effect of different nutrient management on chemical properties of soil

pH, EC and OC

In Table 3, it is noticeable that no treatment had a significant effect on pH, EC and OC during the period of investigation. The values of pH, electrical conductivity and organic carbon ranged from 7.11 to 7.20, 0.20 to 0.25 dSm⁻¹ and 0.60 to 0.65%, respectively.

Available nitrogen, phosphorus, potassium, sulphur and available micronutrients (Zn, Cu, Fe, Mn)

In Table 4, it is noticeable that the available nitrogen (kg ha⁻¹) was significantly increased with different nutrient practices on rice which ranged between 195.36 to 210.31 kg ha⁻¹. The higher available nitrogen (210.31 kg ha⁻¹) was reported in the treatment (T₆) 50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval and the lowest value of available nitrogen (195.36 kg ha⁻¹) was reported (T₁) control. Similar results were observed by Sharma *et al.* (2022) ^[11].

In Table 4, it is observed that no treatment had a significant effect on available phosphorus, potassium, sulphur and available micronutrients.

Effect of different nutrient management on viable microbial activity of soil

Bacterial and Fungal Population

The bacterial and fungal population of rice soil is enhanced by various different nutrient practices. The maximum bacterial population (45.33 x 10⁷ CFU g⁻¹) fungal population (15.67 x 10⁴ CFU g⁻¹) was recorded in (T₅) 75% N through Vermicompost + 4 application of jeevamrit at 20 days interval and lowest population (15.00 x 10⁷ CFU g⁻¹) was recorded in (T₁) control. Similar result also observed by Rathod *et al.* (2018) ^[9] and Sharma *et al.* (2022) ^[11].

Table 2: Effect of different nutrient management on plant height, number of effective tillers hill⁻¹, number of filled grains panicle⁻¹, test weight, grain and straw yield

	Treatments	Plant height (cm)	No. of effective tillers hill ⁻¹	No. of filled grains panicle ⁻¹	Test weight of 1000 grain (g)	Grain Yield (q ha ⁻¹)	Straw Yield (q ha ⁻¹)
T ₁	Control	100.09	5.00	90.70	20.56	30.95	47.56
T ₂	100% RDF (N, P ₂ O ₅ , K ₂ O 120:60:40 kg ha ⁻¹)	124.25	9.70	111.66	21.47	63.67	80.01
T ₃	75% N through FYM + 4 application of jeevamrit at 20 days interval	110.52	7.77	98.53	21.30	57.67	74.44
T ₄	50% RDF + 50% N through FYM + 2 application of jeevamrit at 30 days interval	123.67	9.65	109.68	21.53	62.16	80.00
T ₅	75% N through Vermicompost + 4 application of jeevamrit at 20 days interval	111.71	8.09	100.17	21.38	58.28	76.67
T ₆	50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval	126.10	10.02	114.10	21.72	64.61	80.56
T ₇	50% RDF + 25% N through FYM + 25% N through Vermicompost + 2 application of jeevamrit at 30 days interval	125.56	9.97	112.89	21.61	62.39	80.22
	SE(m) ±	4.40	0.87	4.24	0.97	1.56	2.04
	CD(P=0.05)	13.57	2.69	13.08	NS	4.82	6.29

*RDF = Recommended dose of fertilizer, FYM = Farm Yard Manure, N₂ = Nitrogen, P₂O₅ = Phosphorous, K₂O = Potassium.**Table 3:** Effect of different nutrient management on soil pH, electrical conductivity and organic carbon

	Treatments	pH	EC (dSm ⁻¹)	Organic carbon (%)
T ₁	Control	7.19	0.20	0.60
T ₂	100% RDF (N, P ₂ O ₅ , K ₂ O 120:60:40 Kg ha ⁻¹)	7.20	0.24	0.61
T ₃	75% N through FYM + 4 application of jeevamrit at 20 days interval	7.11	0.23	0.64
T ₄	50% RDF + 50% N through FYM + 2 application of jeevamrit at 30 days interval	7.13	0.23	0.62
T ₅	75% N through Vermicompost + 4 application of jeevamrit at 20 days interval	7.14	0.24	0.65
T ₆	50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval	7.15	0.25	0.63
T ₇	50% RDF + 25% N through FYM + 25% N through Vermicompost + 2 application of jeevamrit at 30 days interval	7.17	0.25	0.64
	SE(m) ±	0.09	0.02	0.06
	CD(P=0.05)	NS	NS	NS
	Initial	7.20	0.22	0.60

*RDF = Recommended dose of fertilizer, FYM = Farm Yard Manure, N₂ = Nitrogen, P₂O₅ = Phosphorous, K₂O = Potassium**Table 4:** Effect of different nutrient management on soil available macronutrients and micronutrients

	Treatments	N (kg ha ⁻¹)	P (kg ha ⁻¹)	K (kg ha ⁻¹)	S (kg ha ⁻¹)	Zn (mg kg ⁻¹)	Cu (mg kg ⁻¹)	Fe (mg kg ⁻¹)	Mn (mg kg ⁻¹)
T ₁	Control	195.36	12.97	325.23	23.87	1.96	1.96	30.66	25.66
T ₂	100% RDF (N, P ₂ O ₅ , K ₂ O 120:60:40 Kg ha ⁻¹)	207.25	14.47	328.87	25.54	2.39	2.23	31.34	26.79
T ₃	75% N through FYM + 4 application of jeevamrit at 20 days interval	204.21	13.84	330.01	25.37	2.50	2.33	35.33	28.46
T ₄	50% RDF + 50% N through FYM + 2 application of jeevamrit at 30 days interval	208.52	14.10	329.65	25.76	2.35	2.27	33.73	27.56
T ₅	75% N through Vermicompost + 4 application of jeevamrit at 20 days interval	206.54	13.90	329.57	25.83	2.49	2.30	35.20	28.45
T ₆	50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval	210.31	15.08	327.50	26.52	2.30	2.28	33.61	27.24
T ₇	50% RDF + 25% N through FYM + 25% N through Vermicompost + 2 application of jeevamrit at 30 days interval	209.67	14.74	328.68	26.35	2.31	2.25	32.17	26.97
	SE(m) ±	3.73	1.07	4.73	1.81	0.10	0.07	1.40	0.63
	CD(P=0.05)	11.19	NS	NS	NS	NS	NS	NS	NS
	Initial	209.88	13.50	332.11	24.08	2.28	2.17	32.05	26.7

*RDF = Recommended dose of fertilizer, FYM = Farm Yard Manure, N₂ = Nitrogen, P₂O₅ = Phosphorous, K₂O = Potassium.**Table 5:** Effect of different nutrient management on viable microbial count in soil

	Treatments	Bacteria (x 10 ⁷ CFU g ⁻¹)	Fungi (x 10 ⁴ CFU g ⁻¹)
T ₁	Control	15.00	4.67
T ₂	100% RDF (N, P ₂ O ₅ , K ₂ O 120:60:40 Kg ha ⁻¹)	28.67	8.33
T ₃	75% N through FYM + 4 application of jeevamrit at 20 days interval	44.33	13.33
T ₄	50% RDF + 50% N through FYM + 2 application of jeevamrit at 30 days interval	40.00	10.33
T ₅	75% N through Vermicompost + 4 application of jeevamrit at 20 days interval	45.33	15.67
T ₆	50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval	42.33	12.00
T ₇	50% RDF + 25% N through FYM + 25% N through Vermicompost + 2 application of jeevamrit at 30 days interval	41.33	11.67
	SE(m) ±	3.08	1.00
	CD(P=0.05)	9.23	3.08

*RDF = Recommended dose of fertilizer, FYM = Farm Yard Manure, N₂ = Nitrogen, P₂O₅ = Phosphorous, K₂O = Potassium.

Conclusion

The study clearly indicates that integrated nutrient management significantly influence the growth and yield of rice. It also enhances the chemical and biological properties of soil. Among the treatments, application of 50% RDF + 50% N through Vermicompost + 2 application of jeevamrit at 30 days interval proved most effective, showing superior performance in yield and yield attributes of plant, along with improved post-harvest soil nutrient status.

However, Application of fertilizer in combination with FYM, vermicompost and jeevamrit under INM significantly influenced on soil microbial population. Maximum load of microbial population was found with application of 75% N through Vermicompost + 4 application of jeevamrit at 20 days interval treatments as compared to other and minimal value of microbial population were found under control plots.

Finally, it can be concluded that the combined use of 50% RDF, 50% vermicompost, and jeevamrit effectively enhances soil fertility, supports microbial diversity, and optimizes rice yield, making it a viable and sustainable practice for long-term soil and crop health.

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