PLANT SCIENCE TODAY
Vol 12(sp3): 01–05
https://doi.org/10.14719/pst.8412

eISSN 2348-1900

RESEARCH ARTICLE

Effect of organic foliar nutrition on the productivity of rice (*Oryza sativa* L.)

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Received: 20 March 2025; Accepted: 24 May 2025; Available online: Version 1.0: 26 July 2025

Cite this article: Rathika S, Ramesh T, Vinodhini SM, Parthiban T, Sangeetha JVV, Vallal KS, Rajakumar D, Nageswari R, Ajmal SS, Akanksha M, Jeyasrinivas R. Effect of organic foliar nutrition on the productivity of rice (*Oryza sativa* L.). Plant Science Today. 2025;12(sp3):01–05. https://doi.org/10.14719/pst.8412

Abstract

A field trial was conducted at the Anbil Dharmalingam Agricultural College and Research Institute (ADAC & RI), Tamil Nadu Agricultural University (TNAU), Tiruchirappalli during the Samba season of 2020 and 2021 to evaluate the effect of foliar applications of vermiwash, panchagavya and jeevamrutha on rice productivity. The chosen experimental design was Randomized Block Design (RBD) with three replications, comprising seven treatments. These included the standard recommended fertilizer dose (187.5:50:50 kg NPK ha^{-1}) alone and in combination with either a 2.5 % or 5 % spray of vermiwash, panchagavya, or jeevamrutha. Foliar applications of vermiwash, panchagavya and jeevamrutha were applied at panicle initiation, tillering and flowering stages in the variety TNAU Rice TRY 3. The results demonstrated that combining the recommended dosage of the fertilizers (187.5:50:50 kg NPK ha^{-1}) with 5 % vermiwash foliar spray remarkably enhanced growth parameters such as total number of tillers, plant height and total accumulation of dry matter while also improving physiological traits (e.g., SPAD value) and yield components, including productive tillers, test weight, grains per panicle and both grain and straw yield.

Keywords: growth; jeevamrutha; organic foliar nutrition; panchagavya; rice; vermiwash; yield

Introduction

Rice is one of the most widely consumed cereals acting as staple food crop for large populations in Asia, Africa and Latin America, with Asia being the largest consumer and producer of the cereal. Globally, rice was planted over an area of 165 million hectare, yielding 522.65 million tonnes with an overall average productivity of 4.3 tonnes per hectare. In India, rice covers approximately 24 % of the actual gross cropped area. It contributes nearly 40 % to the food grain production, making the country the second-largest producer after China where rice cultivation in India spans 47.82 million hectares, producing 137.83 million tonnes with a productivity of 3.1 tonnes per hectare (1, 2). In Tamil Nadu, rice is cultivated on 2.20 million hectares, yielding 6.12 million tonnes of production with a productivity of 2.79 tonnes per hectare (3). Worldwide, rice contributes to over 21 % of per capita energy intake and 15 % of per capita protein, alongside wheat and maize. This highlights its significance as a staple food for more than half of the global population, especially in Asia (4).

The Green Revolution initially led to a remarkable increase in agricultural output in India, but it also resulted in significant ecological drawbacks. The extensive use of synthetic fertilizers, growth promoters, pesticides and high-yielding seed varieties negatively impacted ecosystems by degrading soil health, compromising water quality, contaminating food and reducing the genetic diversity of wild seed varieties. Moreover, the haphazard of chemical fertilizers and pesticides has deteriorated soil quality and diminished beneficial microbial populations, ultimately lowering productivity in intensive agricultural systems. This has sparked growing interest in

organic farming as an alternative to counteract the adverse effects of modern chemical-intensive agriculture (5). The second Green Revolution is thus defined by the widespread adoption of organic farming practices (6). Organic agriculture adopts a holistic approach that focuses on conserving natural resources by relying on locally available inputs, especially on-farm resources such as livestock wastes, which can be effectively recycled for sustainable crop production. These adapted organic practices hold substantial promise for broader acceptance among farmers (7).

Foliar spraying involves the application of nutrient-rich liquid solutions directly onto plant leaves, enabling the absorption of essential nutrients through foliar tissues. This method significantly reduces nutrient losses typically associated with soil application, such as absorption and leaching under conventional moisture conditions (8, 9). In the organic cultivation of rice, a range of Indigenous Tech-nical Knowledge (ITK) practices and organic amendments including panchagavya, amirthakaraisal, amrithpani, egg amino acid (EAA), fish amino acid (FAA) and vermiwash are employed to boost plant growth and development. Recent studies have demonstrated that foliar applications of panchagavya, jeevamrutha and vermiwash effectively enhance overall crop performance.

Despite limited scientific research on the effect of organic inputs, particularly their impact on rice growth and yield, it is essential to examine how various organic nutrients, when applied as foliar sprays, influence rice productivity. This study aims to investigate the effects of different organic nutrients in the form of foliar sprays on the productivity of rice.

Materials and methods

A field trial was carried out at the ADAC & RI, TNAU, Tiruchirappalli, to analyse the effect of foliar nutrition (organic) on rice productivity during the Samba season of 2020 and 2021. The experiment was carried out in field No. A4b, located in Block A. The trial was conducted at a location with coordinates 78° 36′ E longitude and 10° 45′ N latitude, at an elevation of 85 m above sea level (ASL).

Weather and climate

The experimental site received an average annual rainfall of 828 mm, with mean maximum and minimum temperatures of 35.8 °C and 25.6 °C respectively. During the cropping season, 125.8 mm of rainfall was recorded over 10 rainy days, with average maximum and minimum temperatures of 32.7 °C and 22.9 °C. The relative humidity averaged 83 % in the morning and 48 % in the afternoon. The site received approximately 5.5 hours of bright sunshine daily, with an average wind speed of 4.6 km/hr and a mean evaporation rate of 5.4 mm per day.

Soil characteristics

Before the experiment, soil samples were randomly collected, combined and tested for their physical and chemical properties. The soil was characterized as sandy clay loam and classified under the Vetric Ustropept series. Soil analysis revealed a pH of 8.7, electrical conductivity (EC) of 0.59 dS/m and organic carbon content of 0.55 %. The experimental soil had a low concentration of available nitrogen (202.6 kg/ha), a moderate amount of available phosphorus (22.4 kg/ha) and a high level of available potassium (278.2 kg/ha).

Varietal characteristics

The medium-duration variety TNAU Rice TRY 3 was used in this study. With a growth duration of 135-140 days, it is cultivated during the Samba, Late Samba or Thaladi seasons. This variety has a yield potential of 6050 kg ha^{-1} and produces medium bold, white grains (10).

Treatment details

The experiment was laid out in a Randomized Block Design (RBD) with three replications, comprising seven treat-ments as detailed below:

T_1 - RDF (187.5:50:50 kg NPK ha^{-1})

T_2 - RDF + Vermiwash 2.5 % foliar spray

T_3 - RDF + Vermiwash 5 % foliar spray

T_4 - RDF + Panchagavya 2.5 % foliar spray

T_5 - RDF + Panchagavya 5 % foliar spray

T_6 - RDF + Jeevamrutha 2.5 % foliar spray

T_7 - RDF + Jeevamrutha 5 % foliar spray

Where, RDF - Recommended dose of fertilizer, Foliar spraying was applied at panicle initiation, tillering and flowering stages.

Preparation of panchagavya

Panchagavya is an organic liquid fertilizer prepared by fermenting a blend of ingredients, including 7 kg of cow dung, 3 L of cow milk, 1 kg of cow ghee, 10 L each of cow urine and water, 3 L of tender coconut water, 3 kg of jaggery, 2 L of cow curd and 12 ripe Poovan bananas. These ingredients are mixed in the required proportions and placed in an earthen pot kept in the shade, with the mixture being mixed and stirred twice a day (20 min in the morning and evening) to increase aerobic microbial activity. After 15 days of incubation, the fermented solution is filtered through cheesecloth and applied using standard sprayers. For foliar applications, a 3 % dilution of the stock solution is prepared, while for soil application, 20 L of the 3 % solution is applied per acre through flooding during the descending phase of the moon following biodynamic principles to enhance root growth, nutrient uptake and soil microbial activity.

Preparation of jeevamrutha

Jeevamrutha is prepared by mixing 10 L of cow urine, 2 kg of pulse flour, 2 kg of jaggery, 10 kg of cow dung and a handful of garden soil, with the total volume modified to 200 L.

The mixture is placed in a drum, covered with a wet gunny bag and kept in the shade, where it is stirred clockwise three times daily to promote fermentation. Although it becomes usable after 6-7 days, the strong odour makes it preferable to apply within 3-4 days of preparation (11). For field application, 200 L of jeevamrutha is required per acre and it can be applied twice a month either mixed with irrigation water or as a 10 % foliar spray.

Preparation of vermiwash

Vermiwash is extracted from fresh vermiwash prepared with earthworms using a vermiwash collecting device. The apparatus consists of a plastic drum with a capacity of two liters and a tap affixed at the bottom. The container is filled

with a 3 cm thick layer of broken bricks, followed by a 2–3 cm layer of sand and then filled with vermicompost containing earthworms. Simultaneously, one litre of fresh water is added to the drum. After 10 hr, a container is placed below the tap to collect the vermiwash (12). Nutrient composition of different organic foliar nutrients are given in Table 1 (13, 14).

Table 1. Nutrient composition of organic foliar nutrients.

Parameters	Pancha gavya	Jeevamrutha	Vermiwash
pH	6.82	7.07	7.48
Soluble salt (EC dsm^{-1})	1.88	3.40	1.39
Total nitrogen (%)	0.10	770	0.01
Total phosphorous (ppm)	175.4	166	16900
Total potassium (ppm)	194.1	126	25
Total zinc (ppm)	1.27	4.29	0.02
Total copper (ppm)	0.38	1.58	0.01
Total iron (ppm)	29.71	282	0.06
Total manganese (ppm)	1.84	10.7	0.58

Observations recorded

At the rice harvest stage, growth parameters including tillers per square meter, plant height, dry matter production and SPAD values were recorded. Yield parameters such as productive tillers per square meter, grains per panicle and test weight were also measured. Grain and straw yields were harvested from the net plot area and expressed in kg/ha.

Statistical analysis

The data were systematically organized and analyzed using the appropriate statistical methods. A one-way ANOVA was performed with AGRES software to assess the impact of the treatments. Statistical significance was assessed at a 5 % probability level (P = 0.05), with differences considered significant if they exceeded the critical difference (CD). Results that were not statistically significant were marked as 'NS'.

Results and Discussions

Impact of organic foliar nutrients on rice growth parameters

The focal growth parameters including plant height, tiller density (m^{-2}), dry matter production and SPAD values were recorded at the harvest stage (Table 2). The treatment using the recommended dose of fertilizers combined with a 5 % vermiwash foliar spray resulted in plants measuring 111.2 cm in height, with 452 tillers per square meter, 10957 kg/ha of dry matter and a SPAD value of 35.3. These results were statistically similar to those from the treatment with the recommended dose of fertilizers and a 5 % panchagavya foliar spray, which recorded a height of 106.3 cm, 425 tillers per square meter, 10756 kg/ha of dry matter and a SPAD value of 34.9.

Organic nutrients contain beneficial microorganisms and growth-promoting substances that stimulate the production of growth hormones in plants. This leads to improved plant height, leaf area and overall vigor. These results are consistent with the findings of researchers who reported that organic inputs enhance soil fertility by increasing soil organic matter and total nitro-gen content, thereby improving nutrient availability for plants (15, 16). The integration of poultry manure and vermiwash significantly increases plant height and dry weight while also enhancing the overall yield and quality of mustard. The increased growth and yield observed in studies using panchagavya and vermiwash can be attributed to their nutrient enrichment, presence of growth-promoting substances, stimulation of rapid cell division and multiplication, improved photosynthesis, enhanced soil health, disease resistance properties and synergistic effects when combined.

The increase in dry matter production (DMP) and SPAD value might be attributed to the organic foliar sprays of vermiwash and panchagavya applied during critical growth stages, along with recommended dose of fertilizers. This combination likely provided additional nitrogen, enhancing photosynthetic activity and improving light absorption (17).

Impact of organic foliar nutrients on rice yield parameters

The treatment involving the recommended dose of fertilizers combined with a 5 % foliar spray of vermiwash produced significantly higher numbers of productive tiller numbers (285 m^{-2}) and a total of 122 grains per panicle (Table 3). This treatment also recorded a higher test weight (17.6 g), which was statistically on par with the recommended fertilizer + a 5 % panchagavya foliar spray which yielded 269 productive tillers m^{-2}, 118 grains per panicle and a test weight of 17.4 g (Table 2).

These findings are consistent with those of an earlier study which reported that the combined foliar application of 7 % vermiwash and 6 % panchagavya significantly enhanced plant height, dry biomass, nodulation, pod formation, seeds per pod, seed yield and stover yield in black gram (14). This treatment also led to greater gross and net returns in comparison to the other treatments. The nutrients provided by vermiwash and panchagavya likely boost photosynthetic efficiency, leading to improved assimilation of photosynthates, which in turn increases grain weight and enhances grain quality (18).

Table 2. Impact of organic foliar nutrition on rice growth parameters.

Treatments	Plant height (cm)	Number of tillers/m^2	DMP (kg/ha)	SPAD value
T1 - RDF	86.3	363	9102	29.2
T2 - RDF + Vermiwash 2.5 %	95.7	402	9483	32.1
T3 - RDF + Vermiwash 5 %	111.2	452	10957	35.3
T4 - RDF + Panchagavya 2.5 %	93.4	386	9231	31.8
T5 - RDF + Panchagavya 5 %	106.3	425	10756	34.9
T6 - RDF + Jeevamrutha 2.5 %	91.6	372	9185	30.2
T7 - RDF + Jeevamrutha 5 %	102.4	414	10067	32.6
CD (P = 0.05)	7.8	32	833	2.4

RDF- Recommended dose of fertilizer, **DMP**- Dry matter production.

Table 3. Impact of organic foliar nutrition on rice yield parameters.

Treatments	Productive tillers/m²	No. of grains/panicle	Test weight (g)
T1 - RDF	216	98	17.0
T2 - RDF + Vermiwash 2.5 %	245	107	17.3
T3 - RDF + Vermiwash 5 %	285	122	17.6
T4 - RDF + Panchagavya 2.5 %	233	103	17.2
T5 - RDF + Panchagavya 5 %	269	118	17.4
T6 - RDF + Jeevamrutha 2.5 %	221	101	17.1
T7 - RDF + Jeevamrutha 5 %	257	110	17.2
CD (P = 0.05)	28.2	8.3	NS

RDF- Recommended dose of fertilizer.

Impact of organic foliar nutrients on rice yield

Foliar applications of vermiwash, panchagavya and jeevamrutha, along with the recommended fertilizer dose, significantly boosted rice grain yield (Table 4). The highest yield of 4763 kg ha^{-1} was achieved with the combination of recommended dose of fertilizers and a 5 % vermiwash foliar spray, which was statistically comparable to the 4655 kg ha^{-1} yield obtained with the 5 % panchagavya foliar spray. Straw yield varied from 6075 to 7160 kg ha^{-1}, with the maximum recorded in the 5 % vermiwash treatment (7160 kg ha^{-1}), which was statistically comparable to the 5 % panchagavya treatment (7075 kg ha^{-1}).

Table 4. Effect of organic foliar nutrition on rice yield.

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)
T1 - RDF	4088	6075
T2 - RDF + Vermiwash 2.5 %	4325	6363
T3 - RDF + Vermiwash 5 %	4763	7160
T4 - RDF + Panchagavya 2.5 %	4261	6317
T5 - RDF + Panchagavya 5 %	4655	7075
T6 - RDF + Jeevamrutha 2.5 %	4118	6181
T7 - RDF + Jeevamrutha 5 %	4438	6618
CD (P = 0.05)	372	535

RDF- Recommended dose of fertilizer.

Foliar application enables rapid nutrient absorption and utilization by plants, thereby promoting enhanced growth and yield. Vermiwash enriches plants with essential macro and micronutrients, which improves nutrient and protein content (19). The rapid uptake of nitrogen, phosphorus, potassium and micronutrients during critical growth stages stimulates cell division and enhances metabolic activity. This results in increased number of leaves, plant height, amount of chlorophyll content and improved photosynthetic efficiency, ultimately enhancing yield attributes and overall rice productivity. These findings are consistent with previous studies (20, 21). Moreover, liquid organic manures contain plant growth regulators, nucleobases, vitamins, amino acids, sugars and organic acids, all of which synergistically promote plant growth, seed germination and yield enhancement, as demonstrated in tomato cultivation (22).

Conclusion

The experimental results suggest that foliar applications of vermiwash, panchagavya and jeevamrutha, when combined with the recommended dose of fertilizers, significantly enhanced various growth and yield parameters of rice. Among the treatments, the integration of 5.0 % vermiwash foliar spray with the recommended fertilizer dose (187.5:50:50 kg NPK ha^{-1}) resulted in a markedly higher grain yield compared to the other treatments. In contrast, the application of the recommended fertilizers alone did not supply sufficient nutrients for optimal crop growth, leading to reduced yields. Therefore, it is recommended to apply the recommended fertilizer dose along with a 5.0 % vermiwash foliar spray at the panicle initiation, tillering and flowering stages to boost rice productivity.

Acknowledgements

We gratefully acknowledge Tamil Nadu Agricultural University, Coimbatore, India.

Authors' contributions

SR and TR contributed to the conceptualization and methodology of the experiment. SR collected the data, performed the analysis and wrote the first draft of the manuscript. TR provided overall supervision of the experiment. SMV, TP, VVSJ, SVK, DR and RN reviewed and edited the manuscript. SR, TR, SAS, AM and RJ contributed to the final revision of the manuscript. All authors have read and agreed to the published version of the manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None.

References

1. India Stat. Area and production of rice in India 2023. India Stat; 2023 [cited 2024 Jan 4]. https://www.indiastat.com
2. Ministry of Agriculture and Farmers Welfare. Agricultural Statistics at a Glance 2023. Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India; 2023 [cited 2024 Jan 4]. https://desagri.gov.in/document-report/agricultural-statistics-at-a-glance-2023/
3. Ministry of Agriculture and Farmers Welfare. Area, Production and Productivity of Rice in Tamil Nadu 2023. India Stat; 2023 [cited 2024 Jan 4]. https://www.indiastat.com
4. Gnanamanickam SS. Biological control of rice diseases. Dordrecht: Springer Science & Business Media; 2009. https://doi.org/10.1007/978-90-481-2465-7_1
5. Mohring N, Muller A, Schaub S. Farmers' adoption of organic agriculture a systematic global literature review. European Review of Agricultural Economics. 2025;51(4):1012–44. https://doi.org/10.1093/erae/jbae025
6. Singh R, Jat NK, Ravisankar N, Kumar S, Ram T, Yadav RS. Present

status and future prospects of organic farming in India. Indian Journal of Agricultural Research. 2023;57(4):123–35.

7. Sreenivasa MN, Naik N, Bhat SN. Beneficial traits of microbial isolates of organic liquid manures. In: Reddy MS, Desai S, Sayyed RZ, SarmaYR, Rao VK, Reddy BC, editors. Plant Growth Promotion by Rhizobacteria for Sustainable Agriculture. India: Scientific Publishers; 2010. p. 223.
8. Ranjith R, Subrahmaniyan K, Elamathi S, Manimaran R, Manikandan K, Devi TS. Integrated rice farming systems for improved growth, yield and pest reduction. Plant Science Today. 2024;11(sp4):01–10. https://doi.org/10.14719/pst.5108
9. Ranjan P, Kumar B, Mala A, Priyadarshi S, Shri A, Babu L, et al. Effect of foliar spray of nano urea on yield and economics of rice. The Pharma Innovation Journal. 2023;12(1):3030–3. https://doi.org/10.22271/tpi.2023.v12.i1ai.19419
10. Agritech Portal - Tamil Nadu Agricultural University. https://agritech.tnau.ac.in/agriculture/TRY%203.html
11. Vasanthkumar HH. Jeevamrut slurry preparation. Siri Samruddhi. 2006;1:4–5.
12. Nath G, Singh K, Singh DK. Chemical analysis of vermicomposts/vermiwash of different combinations of animal, agro and kitchen wastes. Australian Journal of Basic and Applied Sciences. 2009;3(4):3671–6.
13. TNAU Agritech Portal – Organic farming: Composting techniques. https://agritech.tnau.ac.in/org_farm/orgfarm_ofk_soil.html
14. Bendalam P, Kaviti VL. Vermiwash. Just Agriculture. 2020;1(4):42–3.
15. Banerjee T, Singh A, Umesha C. Application of solid and liquid organic manures on growth and yield attributes of mustard. International Journal of Research in Agronomy. 2024;7(S-12):67–9. https://doi.org/10.33545/2618060X.2024.v7.i12Sb.2095
16. Zhou Z, Zhang S, Jiang N, Xiu W, Zhao J, Yang D. Effects of organic fertilizer incorporation practices on crops yield, soil quality and soil fauna feeding activity in the wheat-maize rotation system. Frontiers in Environmental Science. 2022;10:1058071. https://doi.org/10.3389/fenvs.2022.1058071
17. Yogendra D, Mehera B, Kumar P. Effect of vermiwash and panchagavya on growth and yield of black gram. International Journal of Research in Agronomy. 2024;7(S-5):1–3. https://doi.org/10.33545/2618060X.2024.v7.i5Sc.759
18. Raman R, Krishnamoorthy R. Impact of organic foliar nutrition and its efficacy on sustainable production of rice. Acta Scientific Agriculture. 2019;3(10):1–5. https://doi.org/10.31080/ASAG.2019.03.0647
19. Kumar D, Sharma SK, Kumar B, Kumar S, Kashyap S, Kumar R. Potential of vermiwash prepared from different combinations of organic wastes to improve the growth, yield and quality of organic black gram. Legume Research. 2025;48(3):430–6. https://doi.org/10.18805/LR-4957
20. Sathiyabama N, Aruna L, Illakia K, Dhayanithi C, Naresh VS, Jayaraghavi R, et al. Effect of organic manure on growth and yield of transplanted rice (*Oryza sativa* L.) under coastal Cauvery Deltaic Region. International Journal of Current Microbiology and Applied Sciences. 2021;10(06):715–28. https://doi.org/10.20546/ijcmas.2021.1007.079
21. Nautiyal S, Bankoti P, Kukreti N. Influence of organic manure on growth of transplanted rice (*Oryza sativa* L.). International Journal of Agriculture and Food Science. 2024;6(1):107–10. https://doi.org/10.33545/2664844X.2024.v6.i1b.173
22. Ukale DU, Bhagwat RV, Upadhyay SK, Cukkemane N, Cukkemane AA. Metabolic analysis of liquid formulations of organic manures and its influence on growth and yield of *Solanum lycopersicum* L. (tomato) crop in field. Biocatalysis and Agricultural Biotechnology. 2016;8:50–4. https://doi.org/10.1016/j.bcab.2016.08.007

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Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

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