

RESEARCH ARTICLE

The Effects of Organic Manures and Silicon Nutrition on the Productivity of Rice

C Raajkiran^{1*}, S Jawahar²^{1*}Department of Agronomy, Annamalai University, chidambaram- 608 002, Tamil Nadu, India.²M. S. Swaminathan Agricultural college and Research Institute, TNAU, Eachangottai, Thanjavur-614902, Tamil Nadu, India..

ABSTRACT

A field experiment was carried out during the Samba season of 2022-2023 at the Experimental Farm, Department of Agronomy, Annamalai University, Tamil Nadu, to study the effect of organic manures and silicon nutrition on the productivity of rice. The treatments comprised of T₁ – Recommended dose of fertilizers (RDF) (150:50:50 kg NPK ha⁻¹), T₂ – RDF + Farm Yard Manure (FYM) @ 12.5 t ha⁻¹, T₃ – RDF + Green manure (GM) @ 6.25 t ha⁻¹, T₄ - RDF + Poultry manure (PM) @ 2 t ha⁻¹, T₅ – RDF + FYM @ 12.5 t ha⁻¹ + PM @ 2 t ha⁻¹, T₆ – RDF + GM @ 6.25 t ha⁻¹ + PM @ 2 t ha⁻¹, T₇ - RDF + FYM @ 12.5 t ha⁻¹ + Si @ 200 kg ha⁻¹ through Diatomaceous Earth (DE), T₈ – RDF + GM @ 6.25 t ha⁻¹ + Si @ 200 kg ha⁻¹ through DE, T₉- RDF + PM @ 2 t ha⁻¹+ Si @ 200 kg ha⁻¹ through DE, T₁₀- RDF + FYM @ 12.5 t ha⁻¹+ PM @ 2 t ha⁻¹ + Si @ 200 kg ha⁻¹ through DE, T₁₁- RDF + GM @ 6.25 t ha⁻¹+ PM @ 2 t ha⁻¹+ Si @ 200 kg ha⁻¹ through DE. The treatments were laid out in randomized block design and replicated thrice. Among the different treatments imposed, T₁₁- RDF + GM @ 6.25 t ha⁻¹+ PM @ 2 t ha⁻¹+ Si @ 200 kg ha⁻¹ through DE recorded the highest yield Root length (cm), Root volume (cc) of rice.

Received: 26 Jan 2025

Revised: 17 Feb 2025

Accepted: 16 Mar 2025

Keywords: *Diatomaceous earth, Rice, Growth, Yield.*

INTRODUCTION

Rice plays an important role in Indian agriculture, and it is the staple food for more than 60% of the population. Rice accounts for 42% of all food grain production and 45% of cereal production. India cultivates rice on 46.37 million hectares, the most of any rice-producing country, with an annual yield of approximately 130.29 million tonnes and a productivity of 2.8 t ha⁻¹ (MAFW, 2022). Rice is grown on 2.2 million hectares in Tamil Nadu, with an annual production of 8.65 million tonnes and an average productivity of 3.93 tonnes per hectare. Out of the total rice production in India, only 14.29 Mt comes from

dry-season (rabi) rice, and the rest from wet-season (kharif) rice. (Mondal et al., 2021). Rice yields are dropping due to poor soil health, imbalanced fertiliser use, a lack of suitable rice types, pest infestation, and frequent floods and droughts. Inadequate provision of macro- and micronutrients affects rice growth and production. (Datta et al., 2017). Similarly, due to their low nutrient status, utilising organic nutrient management alone will not result in increased crop yield. To address these concerns and improve crop yield and sustainability, an integrated approach that recognises the role of soil as a storehouse of essential

Corresponding author mail: raajkiranagr@gmail.com



Copyright: © The Author(s), 2025. Published by Madras Agricultural Students' Union in Madras Agricultural Journal (MAJ). This is an Open Access article, distributed under the terms of the Creative Commons Attribution 4.0 License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited by the user.



nutrients and encourages its efficient management is required. (Parven *et al.*, 2020).

MATERIALS AND METHODS:

A field experiment was conducted at the Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India in 2022. The soil of the experimental field was clay loam with low available nitrogen, medium available phosphorus, high available potassium, and medium available Silicon. The field experiment was laid out in Randomized Block Design (RBD) with 11 treatments and replicated thrice. The treatments were viz., T₁: Recommended dose of fertilizer (150:50:50 kg NPK ha⁻¹), T₂: RDF + FYM @ 12.5 t ha⁻¹, T₃: RDF + Green manure @ 6.25 t ha⁻¹, T₄: RDF + Poultry manure @ 2 t ha⁻¹, T₅: RDF + FYM @ 12.5 t ha⁻¹+ PM @ 2 t ha⁻¹, T₆: RDF + GM @ 6.25 t ha⁻¹+ PM @ 2 t ha⁻¹, T₇: RDF + FYM @ 12.5 t ha⁻¹+ Si @ 200 kg ha⁻¹ through Diatomaceous Earth, T₈: RDF + GM @ 6.25 t ha⁻¹+ Si @ 200 kg ha⁻¹ through Diatomaceous Earth, T₉: RDF + PM @ 2 t ha⁻¹+ Si @ 200 kg ha⁻¹ through Diatomaceous Earth, T₁₀: RDF + FYM @ 12.5 t ha⁻¹+ PM @ 2 t ha⁻¹+ Si @ 200 kg ha⁻¹ through Diatomaceous Earth, T₁₁: RDF + GM @

6.25 t ha⁻¹+ PM @2 t ha⁻¹+ Si @ 200 kg ha⁻¹ through Diatomaceous Earth. The variety Sigappi was selected for the study. The individual plot size was 5.0 x 4.0 m, formed with ridges and furrows. The experimental data were collected from the net plot (4.5m x 3.5m) and statistically analysed as described by Gomez and Gomez (2010). The data for yield were collected at harvest, and soil analysis was done after harvest.

RESULTS AND DISCUSSION:

The application of organic manures and silicon nutrition has significantly influenced the root length in rice. Among the various treatments, the treatment T₁₁(RDF + GM @ 6.25 t ha⁻¹ + PM @ 2 t ha⁻¹ + Si @ 200 kg ha⁻¹ through Diatomaceous Earth) significantly registered the highest root length of 23.50 and 29.30 cm at Active tillering and flowering days and the lowest root length of 13.73 and 17.21cm were registered in the control treatment T₁ (RDF) on 30 and 60 DAT. From the data, the highest root volume of 34.60 and 42.80 cc at 30 and 60 DAT was recorded, and the lowest root volume of 23.62 and 29.38 cc was registered in the treatment T₁ (RDF). It might be because the treatment combination containing green manure and

Table 1. Effect of organic manure and silicon nutrition on Root length (cm) and Root volume (cc) of rice at tillering and flowering stages.

Treatments	Root length (cm)		Root volume (cc)	
	Active tillering	Flowering	Active tillering	Flowering
T ₁ - Recommended dose of fertilizer (150:50:50 kg NPK ha ⁻¹)	13.73	17.21	23.62	29.38
T ₂ -RDF + FYM @ 12.5 t ha ⁻¹	15.32	19.03	25.23	31.41
T ₃ - RDF+ Green manure @ 6.25 t ha ⁻¹	15.53	19.25	25.34	31.87
T ₄ - RDF + Poultry manure @ 2 t ha ⁻¹	16.92	20.96	26.94	33.85
T ₅ - RDF + FYM @ 12.5 t ha ⁻¹ + PM @ 2 t ha ⁻¹	18.30	22.65	28.63	35.81
T ₆ - RDF + GM @ 6.25 t ha ⁻¹ + PM @ 2 t ha ⁻¹	18.72	23.62	29.04	36.24
T ₇ - RDF + FYM @ 12.5 t ha ⁻¹ + Si @ 200kg ha ⁻¹ through Diatomaceous Earth	20.09	25.33	30.67	38.17
T ₈ - RDF + GM @ 6.25 t ha ⁻¹ + Si @ 200kg ha ⁻¹ through Diatomaceous Earth	20.34	25.69	30.91	38.51
T ₉ - RDF + PM @ 2 t ha ⁻¹ + Si @ 200kg ha ⁻¹ through Diatomaceous Earth	21.72	27.38	32.52	40.52
T ₁₀ - RDF + FYM @ 12.5 t ha ⁻¹ + PM @ 2 t ha ⁻¹ + Si @ 200 kg ha ⁻¹ through Diatomaceous Earth	23.11	29.05	34.21	42.51
T ₁₁ - RDF + GM @ 6.25 t ha ⁻¹ + PM @ 2 t ha ⁻¹ + Si @ 200 kg ha ⁻¹ through Diatomaceous Earth	23.50	29.30	34.60	42.80
CD (p=0.05)	1.37	1.62	1.59	1.92
SEm±	0.68	0.80	0.79	0.95

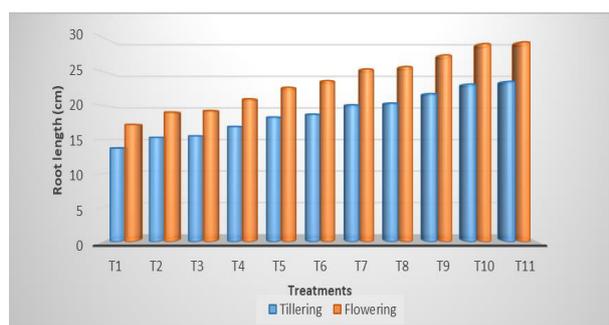


Fig 1. Effect of organic manure and silicon nutrition on Root length (cm) of rice at tillering and flowering stages

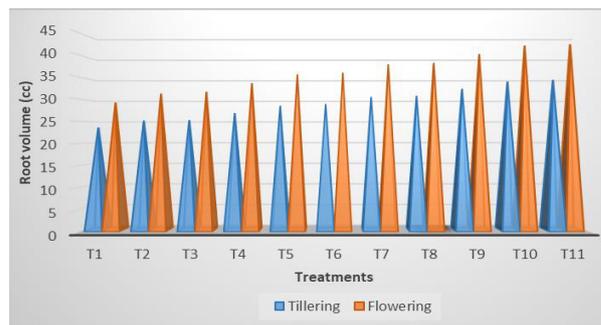


Fig 2. Effect of organic manure and silicon nutrition on Root volume (cc) of rice at tillering and flowering stages

poultry manure positively favoured the root length and volume. Green manure had a complex plant organic structure that had undergone chemical and enzyme degradation in lowland rice soils, which became a hormone that together enhanced the root respiration, formation, development, and its proliferation. These results are in accordance with the results of Devi *et al.*, (2022). The application of organic manures offered a balanced nutritional release pattern to the crop, providing nutrients such as available N, soluble K, exchangeable Ca, Mg, and P that the crop could readily take and it accelerated the plant growth thus influencing the root growth. Also, the application of silicon improved the rigidity of the cells, which allowed roots to penetrate deeper into the soil, searching for water and nutrients more effectively. In addition, it acts as a barrier against the pathogens, which paved the way for better growth of the above-ground parts, ultimately resulting in better root growth. These results are similar to the results of Mini *et al.*, (2023).

CONCLUSION:

The experimental results showed that there was a marked variation in the productivity of rice to organic manure and silicon nutrition. In light of the facts mentioned above, it can be concluded that conjoint application of RDF + GM @ 6.25 t ha⁻¹ + PM @ 2 t ha⁻¹ + Si @ 200 kg ha⁻¹ through Diatomaceous Earth (T₁₁) was the optimal nutrient management practice to boost the productivity and profitability of rice. Therefore, this treatment can be recommended to the farming community, especially under low land conditions.

Funding and Acknowledgment:

The author should acknowledge for this research received no specific grant from any fundings. I would

like to thank Dr. S. Jawahar for his valuable guidance throughout my research.

Ethics Statement:

The authors affirm that this work was conducted in accordance with the highest ethical standards. All research methods and data collection practices complied with relevant institutional guidelines. This article adheres to principles of honesty, transparency, and respect for intellectual property.

Originality and Plagiarism:

This article represents the original work of the authors and has not been submitted elsewhere for publication. All information, data, and ideas that are not the authors' own have been properly cited and referenced in accordance with academic standards. The authors affirm that no part of this manuscript has been plagiarized or copied from previous works without proper acknowledgment.

Concent for Publication:

All authors have reviewed and approved the content of this article and consent to its submission and publication in the journal.

Completing intrests:

The author(s) declare that there are no competing interests. This article was completed as part of academic coursework and was not influenced by any external funding, commercial interests, or personal relationships that could affect the objectivity of the work.

Data Availability:

The data supporting the findings of this study are available from the corresponding author upon

reasonable request. All data were collected and analyzed as part of the research conducted for academic purposes. No proprietary or confidential data were used in this study.

Author Contribution:

RC: Conceptualization, Resources, Data curation, Writing - original draft. JS: Conceptualization, Supervision, Funding acquisition, Writing - review & editing, Methodology, Validation, Visualization.

REFERENCES

- Datta, A., H. Ullah and Z. Ferdous. 2017. Water management in rice. Rice production worldwide, 255-277. https://doi.org/10.1007/978-3-319-47516-5_11
- Devi, K. E., Mehera, B., Meshram, M. R., & Sanodiya, L. K. (2022). Effect of varieties and organic manure on growth and yield of Black Rice (*Oryza sativa* L.). The Pharma Innovation Journal, **11(4)**: 1680-1684. <https://doi.org/10.9734/IJECC/2023/v13i82033>
- Gomez, K. A. and A. A. Gomez. 2010. "Statistical procedures for agricultural research."
- MAFW. 2022. Agricultural Statistics at a Glance 2022. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation and Farmers welfare, Directorate of Economics and Statistics, Government of India.
- Mini, V. 2023. Effect of silicon application on abiotic and biotic stress management in rice in Typic Ustipsamments of Kerala, India. The Pharma Innovation, **12(8)**: pp. 2063-2065. ISSN (P): 2349-8242 <https://doi.org/10.56093/ijas>
- Mondal, P., A. K. Sadhukhan, A. Ganguly and P. Gupta. 2021. Optimization of process parameters for bio-enzymatic and enzymatic saccharification of waste broken rice for ethanol production using response surface methodology and artificial neural network–genetic algorithm. Biotech, **11**, 1-18. <https://doi.org/10.1007/s13205-020-02553-2>
- Parven, H., S. Kumar, S. Shambhavi, S. Kumar, R. Kumar, and D. Kumari. 2020. Long Term Effect of Integrated Nutrient Management on Secondary and Micronutrient of Alluvial Soils. Int. J. Curr. Microbiol. Appl. Sci, **9**: 1990- 1999. <https://doi.org/10.20546/ijcmas.2020.902.227>