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

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**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.

**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 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 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).

**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** |
| T1 - Recommended dose of fertilizer (150:50:50 kg NPK ha-1) | 13.73 | 17.21 | 23.62 | 29.38 |
| T2 -RDF + FYM @ 12.5 t ha-1 | 15.32 | 19.03 | 25.23 | 31.41 |
| T3- RDF+ Green manure @ 6.25 t ha-1 | 15.53 | 19.25 | 25.34 | 31.87 |
| T4- RDF + Poultry manure @ 2 t ha-1 | 16.92 | 20.96 | 26.94 | 33.85 |
| T5- RDF + FYM @ 12.5 t ha-1 + PM @ 2 t ha-1 | 18.30 | 22.65 | 28.63 | 35.81 |
| T6- RDF + GM @ 6.25 t ha-1 + PM @ 2 t ha-1 | 18.72 | 23.62 | 29.04 | 36.24 |
| T7- RDF + FYM @ 12.5 t ha-1 + Si @ 200kg ha-1 through Diatomaceous Earth | 20.09 | 25.33 | 30.67 | 38.17 |
| T8- RDF + GM @ 6.25 t ha-1+ Si @ 200kg ha-1 through Diatomaceous Earth | 20.34 | 25.69 | 30.91 | 38.51 |
| T9- RDF + PM @ 2 t ha-1+ Si @ 200kg ha-1 through Diatomaceous Earth | 21.72 | 27.38 | 32.52 | 40.52 |
| T10- 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 |
| T11- 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** |

**Figures**

**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**

**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.

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