Biological Forum – An International Journal **15(10): 1432-1435(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Efficacy of Rice Rich (Gluconate and lactate based organic nutrients) for yield enhancement of Rice (*Oryza sativa* L.) in Vertisols of Chhattisgarh

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(Received: 26 August 2023; Revised: 26 September 2023; Accepted: 08 October 2023; Published: 15 October 2023)
(Published by Research Trend)

ABSTRACT: The present investigation aimed to evaluate the efficacy of Rice Rich (Gluconate and lactate based organic nutrients) for yield enhancement of Rice (*Oryza sativa* L.) in *Vertisols* of Chhattisgarh during the kharif season of 2022-23. The experiment was conducted at the Instructional Farm, Alesur, Dau Kalyan Singh College of Agriculture and Research Station, Bhatapara (C.G.), using a Randomized Block Design with 11 treatments replicated three times. The results indicated that the application of Rice Rich significantly affected various growth parameters of rice plants. The Panicle length, filled grain yield, test weight, grain yield, straw yield, and harvest index were also highest in treatment T_5, closely followed by T_4 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT). consistently yields significant improvements across all parameters, offering farmers a valuable tool to optimize rice production, enhance grain quality, and increase overall crop performance. This study underscores the practical value of organic nutrient supplementation in modern agriculture. A study evaluated the effect of an organic nutrient supplement, Rice Rich, on rice grown in *Vertisols*. Rice Rich applied alone or with reduced fertilizer significantly improved plant growth and yield parameters like panicle length and grain/straw yield, showing promise to enhance productivity in these soils.

Keywords: Gluconate, Lactate, Rice, Yield, Rice Rich, Vertisols, DKS CARS.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most favoured cereal and major staple food for more than half of the global population and considered as the "global grain". The by-products of milling, including bran and rice polish (finely powdered bran and starch resulting from polishing), are sometimes used as livestock feed. Oil is processed from the bran for both food and industrial uses. Broken rice is used in brewing, distilling, and in the manufacture of starch and rice flour. Hulls are used for manufacture of fuel, packing material, industrial grinding, fertilizer and industrial chemical called furfural. The straw is used for feed, livestock bedding, roof thatching, mats, garments, packing material, and broom straws.

India is the world's second largest producer and consumer of rice after China and the largest exporter of rice in the world. Globally, 118 countries grow rice. Asia accounted for about 86% of the global rice area and contributed about 90% to global rice production. In world has 164.62 million hectares area under rice cultivation with 504.71 million tonnes production and 3100.00 kg ha^{-1} productivity (Anonymous, 2021a). Rice plays a vital role in India's national food security. It is contributes 43 per cent of total food grain production and 46 per cent of total cereal production in India. India has the world largest area under rice cultivation. India has 45.07 million hectares area with 122.27 million tonnes production and 2713 kg ha^{-1} productivity (Anonymous, 2021b). Chhattisgarh, the central eastern state is also called as the "Rice bowl of India". The total estimated area of Rice in Chhattisgarh is 3.70 million ha, production is 4.89 million tonnes and productivity are 3002 kg/ ha, in 2021 (Anonymous, 2021c).

Gluconate and lactate based organic material is a specially developed product through the formulation of Proteino-Lacto-Gluconate. Boost the rice panicles (or) spikelets thus increase in rice Productivity. This product tested in different agricultural universities and research stations. It is totally Bio-available and Residue-free. Recommended for organic cultivation. The gluconate and lactate-based product is formulated for testing the efficacy improving the soil health and yield of rice crop (Sahasra crop science, 2013 and Avinash *et al.*, 2023).

MATERIAL AND METHODS

A field experiment was carried out on rice during *kharif* season, 2022 at Instructional Farm, Alesur, Dau Kalyan Singh College of Agriculture and Research Station, Bhatapara (C.G.).

The experiment involving the cultivation of Rice (*Oryza sativa* L.) with the CG Zinc Rice 2 variety took

place during the *Kharif* season of 2022. The study employed a Randomized Block Design to ensure accurate and unbiased results. The date of transplanting the rice was recorded as 27/07/2022. In this experiment, there were 11 different treatments being tested, and each treatment was replicated three times. The Recommended Dose of Fertilizer (RDF) used was 120 kg N, 60 kg P_2O_5, and 40 kg K_2O per hectare. The spacing between rows and plants was set at 20 cm × 10 cm (Row × Plant). Overall, the total area used for this experiment covered 1437.5 square meters, providing a comprehensive and controlled environment for studying the CG Zinc Rice 2 variety under various treatments and conditions.

RESULTS AND DISCUSSION

The data pertaining to panicle length (cm), filled grains (panicle^{-1}), Test weight (g), Grain yield (t ha^{-1}) and straw yield (t ha^{-1}) of rice are presented in Table 1. Panicle length was noted significantly highest (24.74cm) in the treatment T_5 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT) which was at par with treatment T_3 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 3ml/L (30, 60, 90 and 110 DAT), T_4 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT), T_7 (50% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT) and T_8 (50% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT). While significantly minimum panicle length (21.01) was noted in the treatment T_1 Control (No Fertilizer). This was due to the synergistic effect of inorganic fertilizers and organic nutrients which promoted optimum vegetative growth and development of the rice plants, thereby laying the foundation for better reproductive growth including longer panicles. Even at lower doses and combinations with inorganic fertilizer, Rice Rich led to longer panicles compared to the control without fertilizer. However, the maximum increase in panicle length was observed with 75% RDF along with 5 ml/L of Rice Rich, indicating that the organic nutrients complemented the effects of inorganic fertilizers in promoting overall growth and development resulting in elongated panicles. These outcomes are consistent with findings of Moro *et al.* (2015).

Filled grain yield was noted significantly highest (175.33 panicle^{-1}) in the treatment T_5 (75% RDF+ Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT) which was at par with treatment T_2 (100 % RDF), T_3 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 3ml/L (30, 60, 90 and 110 DAT) (170.60 panicle^{-1}), T_4 (75% RDF+ Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT) (171.80 panicle^{-1}), T_7 (50% RDF+ Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT) and T_8 (50% RDF+ Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT). While significantly minimum filled grain yield (156.83 panicle^{-1}) was noted in the treatment T_1 Control (No Fertilizer). The significantly higher filled grain yield in treatments T_5, T_3, and T_4 can be attributed to the application of Rice Rich organic nutrients. These nutrients enhanced nutrient availability, leading to improved plant growth, increased photosynthesis, and efficient assimilation of nutrients. Consequently, more grains were developed and filled in the panicles, resulting in higher grain yield. In contrast, the control group (T_1) without fertilizers suffered from nutrient deficiencies, leading to a lower filled grain yield. These outcomes are consistent with findings of Manimaran *et al.* (2019) and Kumar *et al.* (2022).

Significantly highest test weight recorded in treatment T_5 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT) from all the treatment, while lowest was recorded in treatment T_1 Control (No Fertilizer). The significantly higher test weight in treatment T_5 can be attributed to the application of Rice Rich organic nutrients, which enhanced nutrient availability and promoted optimal plant growth. The increased nutrient uptake and assimilation resulted in healthier and heavier grains, leading to higher test weights. In contrast, the control group (T_1) lacking fertilizers exhibited lower test weight due to nutrient deficiencies, resulting in lighter grains. These findings highlight the importance of organic nutrient supplementation for improving grain quality and test weight in rice plants.

Grain yield was noted significantly highest (5.48 t ha^{-1}) in the treatment T_5 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT) which was at par with treatment T_4 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT) (5.07 t ha^{-1}). While significantly minimum test weight (2.67 t ha^{-1}) was noted in the treatment T_1 Control (No Fertilizer). The treatment with 75% recommended dose of fertilizers along with 5 ml/L of Rice Rich (an organic nutrient containing Gluconate and lactate) applied at key growth stages resulted in the highest grain yield. This was due to the synergistic effect of inorganic fertilizers and organic nutrients which optimized nutrient availability and uptake for improving various yield contributing factors like number of effective tillers, panicle length, number of grains and overall plant growth. The organic nutrients in Rice Rich helped in producing more tillers, longer panicles with more grains and better plant development - all of which contributed to higher biomass production and ultimately higher economic yield. The maximum increase in grain yield was observed with 75% RDF along with 5 ml/L of Rice Rich, indicating that the organic nutrients complemented the effects of inorganic fertilizers in terms of improving growth parameters and yield related characters responsible for higher yield. The finding of present study is in accordance with those of Kumar *et al.*, (2018) and Siddika *et al.* (2016).

Straw yield was noted significantly highest (6.71 t ha^{-1}) in the treatment T_5 (75% RDF+ Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT) which was at par with treatment T_4 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT) (6.63 t ha^{-1}),

T_3 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 3ml/L (30, 60, 90 and 110 DAT) (6.04 t ha^{-1}) and T_6 (50% RDF+ Rice Rich (Gluconate and lactate based organic nutrients) 3ml/L (30, 60, 90 and 110 DAT) (5.48 t ha^{-1}). While significantly minimum straw yield (3.91 t ha^{-1}) was noted in the treatment T_1 Control (No Fertilizer). The treatments with Rice Rich organic nutrients resulted in significantly higher straw yield compared to the control due to the overall better growth and development of rice plants enabled by the supply of micronutrients and growth promoting substances through Rice Rich. The highest straw yield was recorded with 75% recommended fertilizer dose plus 5 ml/L of Rice Rich applied at key growth stages, indicating that the organic nutrients complemented the effects of inorganic fertilizers in optimizing nutrient availability and uptake for improving growth parameters responsible for higher biomass production and straw yield. The finding of present study is in accordance with those of Kumar *et al.* (2018) and Manimaran *et al*. (2019).

Table 1: Panicle length(cm), Filled grains panicle^{-1}, Test weight (g), Grain yield (t ha^{-1}) and Straw yield (t ha^{-1}) as influenced by the efficacy of Rice Rich (Gluconate and lactate based organic nutrients).

Tr. No.	Panicle length (cm)	Filled grains panicle^{-1}	Test weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
T_1	21.01	156.83	20.43	2.67	3.91
T_2	22.61	166.33	22.23	3.58	5.18
T_3	23.67	170.60	22.87	4.65	6.04
T_4	24.09	171.80	22.92	5.07	6.63
T_5	24.74	175.33	23.69	5.48	6.71
T_6	22.78	164.13	22.13	3.54	5.48
T_7	23.09	165.00	22.33	3.67	5.49
T_8	23.30	165.87	22.63	3.93	5.52
T_9	21.39	160.30	21.07	2.83	3.99
T_{10}	21.76	160.43	21.21	3.13	4.13
T_{11}	22.19	162.17	21.60	3.25	4.47
SEm±	**0.57**	**3.54**	**0.21**	**0.27**	**0.46**
CD (0.05)	**1.67**	**10.46**	**0.61**	**0.80**	**1.37**

***T_1**=Control (No Fertilizer), **T_2**=100 % RDF, **T_3**=75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 3ml/L (30, 60,90 and 110 DAT), **T_4**= 75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT), **T_5**=75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT), **T_6**= 50% RDF+ Rice Rich (Gluconate and lactate based organic nutrients) 3ml/L (30, 60, 90 and 110 DAT), **T_7**= 50% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT), **T_8**= 50% RDF+ Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT), **T_9**= Rice Rich (Gluconate and lactate based organic nutrients) 3ml/L (30, 60, 90 and 110 DAT), **T_{10}**= Rice Rich (Gluconate and lactate based organic nutrients) 4ml/L (30, 60, 90 and 110 DAT) and **T_{11}**= Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT).

CONCLUSIONS

In conclusion, the application of Rice Rich, an organic nutrient containing Gluconate and lactate, had a substantial positive impact on various growth and yield parameters of rice. Notably, it led to longer panicles, higher filled grain yield, and increased test weight, highlighting its potential to enhance grain quality. Moreover, Rice Rich significantly boosted grain yield and straw yield with treatment T_5 (75% RDF + Rice Rich (Gluconate and lactate based organic nutrients) 5ml/L (30, 60, 90 and 110 DAT) emerging as the most promising. These findings reinforce the value of organic nutrient supplementation, which synergistically complemented inorganic fertilizers, optimizing nutrient availability. Overall, Rice Rich shows promise in improving rice production, aligning with prior research and demonstrating its potential to enhance crop performance and yield.

FUTURE SCOPE

The following are some potential areas of future scope based on the study:

1. Evaluate the effects of Rice Rich under different soil types and agro-climatic conditions. Since the study was conducted in Vertisols of Chhattisgarh, evaluating its performance in other soil types can provide more insights.
2. Test different application rates and timings of Rice Rich. While 4-5 ml/L at key growth stages showed promise, optimization of dose and frequency can help maximize benefits.
3. Analyze the impact of Rice Rich on soil health parameters like organic carbon, microbial population, enzyme activities over time with repeat applications. This can establish its role in improving soil fertility.
4. Study the physiological and biochemical basis of yield enhancement induced by Rice Rich through

analysis of growth and yield attributes, photosynthesis rate, nutrient uptake efficiency etc.

5. Combine Rice Rich with other organic sources like farm yard manure, vermicompost etc. to evaluate synergistic effects on productivity.
6. Assess the economics of Rice Rich application - whether benefits outweigh costs. This will help promote its adoption.
7. Extend the study to different rice varieties, cropping systems and production practices commonly followed by farmers.

Acknowledgement. The authors are highly thankful to DKS College of Agriculture and Research Station, Bhatapara for providing research field and other necessary facilities for carrying out this research work. We sincerely acknowledge the support provided by the Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur during the study. We are grateful to Dr. Angad Singh Rajput and Dr. P. R. Mirjha for their valuable guidance throughout the research period. Our sincere thanks to all the technical and field staff at the research station for their endless efforts in setting up the experiments and handling all the operations smoothly. We are thankful to Sahasra Crop Science Pvt. Ltd. for providing test material. We are highly obliged for the motivational support and encouragement received from friends and family during the entire course of study.

Conflict of interest. None

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How to cite this article: Saraswati Karwar, Angad Singh Rajput, PR Mirjha, Monika Patel and Meena Kumari (2023). Efficacy of Rice Rich (Gluconate and lactate based organic nutrients) for yield enhancement of Rice (*Oryza sativa* L.) in Vertisols of Chhattisgarh. *Biological Forum – An International Journal*, *15*(10): 1432-1435.