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Impact of Organic Nutrient Sources on Growth and Yield of Rice Varieties (*Oryza sativa* L.) and Yield Validation Using SPSS Model

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

A field experiment was conducted during Kharif 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) to determine the "Impact of organic nutrient sources on growth and yield of rice varities (*Oryza sativa* L.) and Yield Validation Using SPSS Model". The experiment was laid out in Randomized Block Design comparising of 9 treatment which include 3 varieties RNR-15048,BPT-5204 AND NDR-359, 4 organic manures, Vermicompost 10(t/ha) and Panchagavya 6%+ Vermicompost 5(t/ha)+ Panchagavya 3%. Whose effect is observed in varieties rice. The treatmentsconsisted of organic nutrient sources and rice varities. [Panchagavya 6%+ Vermicompost 10t/ha, Panchagavya 3%+Vermicompost 5t/ha] and the rice varities [RNR-15048, BPT- 5204, NDR-359]. Whose effect is observed in paddy. The results observed that the treatment

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with application of NDR-359 + vermicompost 5t/ha + panchagavya 3% recorded higher plant height, number of tillers/hill, plant dry weight(g), CGR,RGR and yield parameter number of panicles/hill, number of grains/panicles, number of grains, test weight, grain yield, straw yield and harvest index. Treatment 9 has shown 44.62% increase over predicted yield whereas there was 28.89% increase in treatment 8 over predicted yield through SPSS model. From the basis of one year experimentation, it is concluded that Panchagavya 3% + Vermicompost 5(t/ha) was found more productive for the variety NDR-359.

Keywords: Organic nutreints; varities; growth; yield; yield validation using SPSS model.

1. INTRODUCTION

"Rice (*Oryza sativa* L.) is one of the most important staple food crops as it helps to sustain two thirds of the world's population" Kahani et al. [1]. India is an important centre of rice cultivation. Rice is a nutritional staple food which provides instant energy as its most important component is carbohydrate (starch), it also provides 27% of dietary energy supply, 20% of dietary protein and 3% of dietary fat. It can contribute nutritionally significant amounts of thiamine, riboflavin, niacin and zinc to diet, but smaller amounts of other micronutrients.

In Asia, rice is a major source of calories, especially for the poor, which eat from 50 to 80 percent of the daily calories from it. In Asia, where it is a staple of culture and tradition, and over 90% of the world's rice is grown and eaten. While it is true that rice is not a tropical plant, it is believed to belong with moist, humid areas. China (32.7%), India (26.0%), Thailand (5.3%), Myanmar (4.8%), the Philippines (2.8%), Brazil (2.0%), and Japan (1.9%) are the top 10 suppliers of rice in the world [2]. To name a few other uses, the 85% of the rice is also used in cerelac, snack foods, brewed beverages, flour, oil, syrup, and religious rituals.

Organic recycling and organic farming could survive the dual purpose of minimising pollution and utilising game in your form waste from for increasing the soil productivity. Kenchaiah [3] observed a positive insolence influence of format manure on rice plant tight number of tillers per hill and dry weight production with increasing a yield and yield. Moorthy (1994) obtained higher plant growth attributes and grain yield in low land rice applied with *Sesbania aculeate*. The plant growth characters and yield were marked influent by poultry manure and panchagavya so waste composed can increase in the yield of many crop like rice groundnut sorghum petal millet and tainted condition crops, Somasundaram et al. [4].

Ayurveda uses the term "panchagavya" to describe a fermented product formed from five components obtained from cows, including milk, urine, dung, and bile clarified butter and curd. In India, the contribution of foliar panchagavya to the production of numerous plantation crops has received considerable attention [5]. Often used for horticultural and agricultural crops, Panchagavya is a well-known foliar nutrition made by organic producers in Tamil Nadu [6]. The goal of the current study was to test the hypothesis that foliar panchagavya administration will have on various physiological parameters, yield.

"Panchagavya, an organic product has potential to play the role in promoting immunity growth and providing immunity in plant system. The use of organic liquid such as panchagavya results in higher growth, yield and quality of crops. Different species of insect pests were reported to be associated with spinach in different areas of the country. Usually, the management of the pests is insecticides oriented but the problems associated with synthetic chemicals with., development of pest resistance objectionable pesticides residue and higher cost etc, has necessitated development of new control methods. Several plants and its products are known to be potential resources". Choudhary et al. [7]. Beaulah et al. [8] concluded that "the beneficial microorganisms from panchagavya and their presence in the rhizospheres environment of the root zone influence the plant growth and crop yield".

"Vermicompost has been considered as a soil additive to reduce the use of mineral fertilizers because it provides required nutrient amounts, increases cation exchange capacity and improves water holding capacity" (Tejada and Gonzaler, 2009). "Vermicompost not only increases yield of rice but can also substitute chemical fertilizer to some extent" (Sharma et al. 2008; Guera, 2010).

"Vermicomposting is an effective biological process for conversion of organic wastes into a stable end product, where in microbial activity plays an essential role. Earthworms are mainly responsible for fragmentation and conditioning of the substrate, increasing surface area for microbial activity and significantly altering biological activity of the process" (Domynguez 2004) "Vermicompost is homogenous, with desirable aesthetics and possess plant growth hormones and high levels of soil enzymes, while enhancing microbial population and tending to hold more nutrients over longer periods without adverse impacts on the environment. In India, about 320 million tonnes of agricultural wastes are generated annually. The vermicompost is a rich source of beneficial microorganisms and nutrients" [9]. Increase in crop yield, soil nutrients status and nutrients uptake was reported due to application of vermicompost.

2. MATERIALS AND METHODS

The experiment was conducted during *Kharif* season of 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the field constituting a part of central gangetic alluvium is neutral and deep. The soil of the experimental field was sandy loam in texture, nearly neutral in soil reaction (pH 7.8), low level of organic carbon (0.51%), available N (78.9 kg/ha), available P (32.88 kg/ha) and available K (385.10 kg/ha). Nutrient sources were Panchagavya and vermicompost to fulfilled with Nitrogen, Phosphous, Potassium respectively. The treatment were RNR-15048+ Vermcompost 10 (t/ha), RNR-15048+ Panchagavya-6%, RNR- 15048+ Vermicompost 5 (t/ha) + Panchagavya-3%, BPT -5204 + Vermcompost 10 (t/ha), BPT- 5204 + Panchagavya-6%, BPT–5204+ Vermicompost (5t/ha) + Panchagavya-3%, NDR–359+ Vermicompost 10 (t/ha), NDR-359 + Panchagavya-6%, NDR-359 Vermicompost 5 (t/ha) + Panchagavya - 3%. The experiment was laid out in Randomized Block Design, with 9 treatments replicated thrice. The observations were recorded for plant height (cm),number of tillers/hill, plant dry weight(g), Crop growth rate (g/m2/day), Relative growth rate (g/g/day), Number of effective tillers, number of panicles/hill, number of grains/panicles, number of grains, test weight (g), grain yield (t/ha), straw yield (t/ha) and harvest index (%). The collected data was subjected to statistical analysis by analysis of variance (ANOVA) was used statically to examine these variables using SPSS (Statistical Product and Service Solutions). The sum of weather parameters and the sum product of several weather parameters were utilised to determine the correlation coefficient. Many regressions have been carried out using the dependent variable (yield) and the independent variables (time, sum, and sum products depending on meteorological conditions). The regression equation has been generated using the regression formula.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

3.1.1 Plant height

The data revealed that significant and higher plant height (112.6 cm) was observed in treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%] and there was no statiscally at par value.

The results of the present study are also in line with Emily [10] who reported that, the plant height, leaf area, leaf area index, total chlorophyll content and dry matter production increased significantly due to spraying panchagavya 4 %. Vennila and Jayanthi [11] revealed that "application of 100% recommended dose of fertilizer along with panchagavya spray (2%)", increased plant height of crops with vermicompost application had also been reported by Thanunathan et al. [12].

3.1.2 Number of tillers/plant

The data revealed that treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%] recorded significant and maximum number of tillers/hill (12.7) and there was no statiscally at parvalue.

An increase in the number of productive tillers could be attributed to the improvement in soil physical and chemical properties and better availability of nutrients by the addition of fertilizer, vermicompost. Similar findings were also reported by Kamakar et al. [13] increase the numbers of effective tillers.

3.1.3 Plant dry weight (g)

Results revealed that treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%] recorded siginificantly higher plant dry weight

(52.3 g).which was superior to all the treatment and treatment T7 with the application of [NDR-359 + Vermicompost (10t/ha)].

The probable reason for higher dry matter production might the application of vermicompost stimulated the plant growth due the higher microbial activity and soil reaction and large portion of nitrogen in vermicompost in organic fractions and fermented solution of panchagavya contains various salts rich in N, P, K, S and micronutrients in plant available form. Hence, availability of these nutrients to plants helps in the higher dry matter production in plants. The results were also found to be similar with findings of Shrimal and Khan [14] and Gopal et al. [15].

3.1.4 Crop growth rate (g/m^2/day)

The data recorded that during 80-100DAS that treatment T9 [ZnO (900 ppm) + Boron (0.5%)] was highest crop growth rate (26.44 g/m^2/day). which was superior to all the treatment and treatment T7 with the application of [BPT-5204 + Panchagavya 6%]

3.1.5 Releative growth rate (g/g/day)

The data revealed that during 80-100, treatment T8 [NDR-359 + Panchagavya 6%], and there was no statiscally at par value.

3.2 Yield Parameter

3.2.1 Number of effective tillers/hill

The data showed that treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%] recorded significantly number of effective tillers/hill (12.7/hill) and there was no statiscally atpar value.

3.2.2 Number of panicle/hill

The data showed that treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%] recorded significantly higher number of panicle/hill (7.6/hill) and there were no stastically at par value.

3.2.3 Number of grain/panicle

The data recorded that significant and higher number of grains/panicle (114.7), and there were nostastically at par value.

3.2.4 Test weight (g)

Significant and maximum test weight (21.8) was recorded in treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%]. However, treatment T7 [NDR-359 + Panchagavya 6%] was stastically at par with the treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%].

3.2.5 Grain yield (t/ha)

Significant and higher grain yield (5.64 t/ha) was obtained in treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%], and there were no stastically at par value.

3.2.6 Straw yield (t/ha)

Significant and higher stover yield (7.34 t/ha) was obtained in treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%], and there were no stastically at par value.

3.2.7 Harvest index (%)

Significant and higher harvest index (41.63 %) was obtained in treatment T9 [NDR-359 + Vermicompost (5t/ha) + Panchagavya 3%], which was superior to all the treatment and treatment T6 with the application of [BPT-5204 + Vermicompost (5 t/ha) + Panchagavya 3%], T3 application of RNR-15048+Vermicompost (5t/ha) + Panchagavya 3%.

When the ten randomly selected plants in each plot were harvested, the number of panicles (productive tillers) per hill, panicle length, total number of grains, number of filled grains per panicle, and thousand grains weight were noted (Hemalatha et al. 2000).

The higher increase in the yield has been reported to be associated with the release of macro and micro nutrients during the course of microbial decomposition. Organic matter also functions as source of energy for soil micro flora which brings about the transformation of other nutrients held in soil or applied through other means, in a form that is readily utilized by growing plants which helped in increase of seed yield. The results were in accordance with Jadhav et al. [16] yield attributes which eventually helped in increase in seed yield. The results were found to be similar with Vimalendran and Wahab [17].

Table 1. Impact of Organic nutrient sources and growth attributes of rice varieties

Sl. No	Treatment	100 DAT			80-100 DAT	
		Plantheight (cm)	Number of tillers/hill	Dry weight	CGR ($g/m^2/day$)	RGR (g/g/day)
1	RNR-15048 + Vermicompost 10(t/ha)	108.5	10.8	50.0	25.93	0.012
2	RNR-15048 + Panchagavya 6%	107.4	10.4	49.3	25.65	0.012
3	RNR-15048+Vermicompost(5t/ha) + Panchagavya 3%	111.2	11.8	51.1	24.22	0.011
4	BPT-5204 + Vermicompost 10(t/ha)	107.9	10.5	49.7	25.89	0.012
5	BPT-5204 + Panchagavya 6%	105.2	10.3	49.5	26.44	0.012
6	BPT-5204 + Vermicompost(5t/ha) + Panchagavya 3%	110.5	11.5	50.7	26.20	0.011
7	NDR-359 + Vermicompost 10(t/ha)	111.8	12.1	51.9	25.47	0.011
8	NDR-359 + Panchagavya 6%	109.7	11.2	50.6	26.44	0.013
9	NDR-359 + Vermicompost(5t/ha) + Panchagavya 3%	112.6	12.7	52.3	22.78	0.009
	F test	S	S	S	S	S
	SEm(±)	0.20	0.13	0.12	0.47	0.0003
	CD (P=0.05)	0.61	0.39	0.37	1.41	0.009

Table 2. Impact of Organic nutrient sources and yield attributes of rice varieties

SL.No	Treatments	No. of effective tillers/hill	No. of grains/panicle	No. of panicles/hill	Test weight(g)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1	RNR-15048 + Vermicompost 10(t/ha)	10.8	105.0	6.7	16.2	4.40	6.40	39.84
2	RNR-15048 + Panchagavya 6%	10.4	111.0	7.2	14.7	3.99	5.90	40.15
3	RNR-15048+Vermicompost(5t/ha) + Panchagavya 3%	11.8	104.7	7.4	18.3	4.94	6.93	41.55
4	BPT-5204 + Vermicompost 10(t/ha)	10.5	110.7	6.9	15.9	4.15	6.18	40.19
5	BPT-5204 + Panchagavya 6%	10.3	101.3	7.3	15.1	3.82	5.70	40.27
6	BPT-5204 + Vermicompost(5t/ha) + Panchagavya 3%	11.5	104.3	7.4	17.4	4.77	6.84	40.97
7	NDR-359 + Vermicompost 10(t/ha)	12.1	105.3	6.6	21.3	5.14	7.10	37.86
8	NDR-359 + Panchagavya 6%	11.2	98.0	7.1	19.7	4.67	6.56	41.60
9	NDR-359 + Vermicompost(5t/ha) + Panchagavya 3%	12.7	114.7	7.6	21.8	5.64	7.34	41.63
	F test	S	S	S	S	S	S	S
	SEm(±)	0.13	1.24	0.08	0.21	0.09	0.07	0.51
	CD (P=0.05)	0.39	3.70	0.24	0.63	0.26	0.20	1.23

The maximum grain and straw yield was due to marked improvement in dry matter accumulation, yield attributes and greater nutrient content and their uptake by rice crop. These findings are in direct conformity with that of Barik et al. [18].

3.2.8 Yield validation using SPSS model

The multi-regression analysis using SPSS has been employed for the estimation of rice yield. The regression for SPSS model is Y = 15.266 + (0.292 x Z21 of prediction year) + (0.066 x time) Here, Z21 is the sum product of minimum temperature. The yield obtained in treatment 9 with NDR-359 + Vermicompost (5 t/ha) + Panchagavya 3% (5.6 t/ha) showed 44.62% increase over the predicted yield through SPSS model (2.88 t/ha) [19-28].

4. CONCLUSION

Based on the previous findings, it can be concluded that the use of NDR-359 Vermicompost 5 (t/ha) and Panchagavya 3% has enhanced the characteristics of growth and yield of the rice variety NDR-359 while also proving to be profitable. Further studies are required to confirm the findings as they are based on only one season.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kahani F, Hittalmani S. Genetic analysis and traits association in F2 intervarietal populations in rice under aerobic condition [journal]. J Rice Res. 2015;03(4):2375.
2. Anonymous. Advances in nutrient dynamics in soil – plant – Atmosphere system for improving nutrient use efficiency. Training manual. Bhopal: IISS. 2014;70.
3. Kenchaiah. Organic farming studies in rice [Ph.D. thesis] Tamil Nadu Agriculture University Coimbatore; 1997.
4. Somasundaram E, Amanullah MM. Panchagavya on growth and productivity of crops: A review. Green Farming. 2007;1:22-6.
5. Selvaraj N. Report on organic farming at horticulture Research Station. Ooty: Tamil Nadu Agricultural University. 2003;2-5.
6. Swaminathan C, Swaminathan V, Vijayalakshmi K. Panchagavya – Boon to organic farming. Lucknow: International Book, Distributing Co.; 2007.
7. Choudhary KM, Patel MM, Pagar RD. Effect of foliar application of panchagavya and leaf extracts of endemic plants on groundnut (*Arachis hypogaea* (L.)). Agricultural Research Communication Centre. 2014;37(2):223-6.
8. Beaulah A. Growth and development of Moringa (Moringa oleifera Lan.) under organic and inorganic systems of culture [Ph. D. thesis]. Coimbatore: Tamil Nadu Agriculture University; 2002.
9. Pant SR, Yami KD. Selective utilization of organic solid wastes byearthworm (*Eisenia foetida*). Nepal J Sci Technol. 2008;9: 99-104.
10. Emily ACS. Standardization of organic production packages for *Withania somnifera* Dunal [M.Sc. Thesis]. Coimbatore: Tamil Nadu Agricultural University; 2003.
11. Vennila C, Jayanthi C. Response of okra to integrated nutrient management. J Soils Crops. 2008;18:36-40.
12. Thanunathan K, Imayavarambarn V, Singaravel R, Kandasamy S. Effect of fly ash on growth, yield and nutrient uptake of sesame. Sesame Safflower Newsl. 2001;16.
13. Kamakar. Influences of soil physical and chemical properties of vermicompost. Agric Sci Dig. 2011. 2010;31(4):319-21.
14. Shrimal P, Khan TI. Studies on the Effects of Vermicompost on Growth Parameters and chlorophyll Content of Bengal Gram (*Cicer arietinum* L.) var. RSG896. IOSR J Environ Sci Toxicol Food Technol. 2017;11(5):12-6.
15. Choudhary GL, Sharma SK, Singh KP, Choudhary S, Bazaya BR. Effect of Panchagavya on Growth and Yield of Organic black gram [*Vigna mungo* (L.) Hepper]. Int J Curr Microbiol Appl Sci. 2017;6(10):1627-32.
16. Jadhav RP, Khafi HR, Raj AD. Effect of Nitrogen and Vermicompost on Protein Content and Nutrients uptakein Pearl Millet

[*Pennisetum glaucum* L.) R. Br. Emend Stuntz]. Agricultural Science Digest. 2011; 31(4):319-321.
17. Vimalendra L, Wahab K. Effect of foliar spray of panchagavya on yield attributes, yield andeconomic of baby corn. J Agron. 2013;12(2):109-12.
18. Barik AK, Raj A, Saha RK. Yield performance, economics and soil fertility through organic sources (vermicompost) of nitrogen as substitute to chemical fertilizers inwet season rice. Crop Res (Hisar). 2008;36(1/3):4-7.
19. Chaudhary RS, Das A, Patnaik US. Organic farming for vegetable production using vermicompost and FYM in Kokriguda watershed of Orissa. Ind J Soil Conserv. 2004;31(2):203-6.
20. Dass A, Chandra S. Irrigation, spacing and cultivar effects on net photosynthetic rate, dry matter partitioning and productivity of rice under system of rice intensification in mollisol of northern India. Exp Agric. 2013;49(4):504-23.
21. Dominguez J. State of the art and new perspectives on vermicomposting research. In: Edwards CA, editor. Earthworm ecology. 2nd ed. Raton, FL: CRC Press. 2004;401-24.Bac?
22. Khan U, Mishra B, Pachauri P, Kumar Y. Effect of integrated nitrogen management on yield and nitrogen nutrition of irrigated rice (*Oryza sativa*). Indian J Agric Sci. 2006;76(3):176-80.
23. Kumar B, Gupta RK, Bhandari AL. Soil fertility changes after long term application of organic manures and crop residues under rice-wheat System. J Indian Soc Soil Sci. 2008;56:80-5.
24. Singh S, Singh V, Khanna R, Kumar P, Shukla R. Effect of nitrogen and sulphur fertilization on growth and yield of rice (*Oryza sativa* L.). Progressive Research. 2019;14(1):526-30.
25. Singh RK, Dawson J, Srivastava N. Effect of sources ofnutrient on growth and yield of black gram (*Vigna mungo* L.) Varieties in NEPZ of India. J Pharmacogn Phytochem. 2017;6(4):1064-6.
26. Somasundaram E, Sankaran N, Meena S, Thiyagarajan TM, Chandaragiri K, Pannerselvam S. Response of greengram to varied levels of panchagavya (organic nutrition) foliar spray. Madras Agric J. 2003;90:169-72.
27. Sridhar K, Srinivas A, Kumar KA, Ramprakash T, Rao PR. Physiological growth parameters of rabi rice (*Oryza sativa* L.) under alternate wetting and drying irrigation with varied nitrogen levels. Int J Curr Microbiol Appl Sci. 2019;8(1): 1-15.
28. Suthar S. Nutrients changes and biodynamic of epigeic earthworms *Perionyx excavatus* (Perrier) during recycling of some agricultural wastes. Biores. Technol. 2007;98:1608-14.

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