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Effect of Farm Yard Manure, Green Manure and Vermicompost on Growth and Yield of Rice

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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 season 2022-23 at student's instructional farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.). The present experiment having 9 treatment combinations replicated thrice in randomized block design, Rice variety CSR-36 was grown with growth, yield, yield attributing characters. The grain and straw yields increased with integration of green manure +farm yard manure + vermicompost treatment i.e., 75% RDF+25% N through FYM+GM+VC. The maximum plant height (90 DAT) and number of tillers per hill of rice (127.13 cm) and (59.37). The highest grain and straw yield were observed

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54.47 qha^{-1} and 64.49 qha^{-1} in the treatment 75% RDF + 25 % N through FYM + GM + VC. The treatment combination 75 % RDF + 25 % N through FYM + GM + VC came out to be the best dose for most of the characters of the rice crop under study.

Keywords: Rice; green manure; vermicompost; farm yard manure; yield.

1. INTRODUCTION

"The demand for rice, the most important staple food crop of the world, is expected to be 800 million tons by the end of 2025. To feed more than 9 billion people by 2050 will require a doubling of production on a sustainable basis. Interestingly, more than 75% of rice production comes from 79 million ha of irrigated lowland and it is predicted that 17 out of 75 million hectares of Asia's flood irrigated rice crop will experience physical water scarcity and 22-million-hectare areas may experience economic water scarcity, questioning the rice production sustainability in traditional wetland ecosystem under flooded condition. Apart from the arsenic, toxicity, and nitrate contamination, methane emission in traditional rice culture threatens the issues pertaining to rice yield sustainability and profitability under the backdrop of a shrinking water resource base" [1]. To increase the productivity of rice, it is important to maintain the fertility and organic matter status of soil.

Phosphorus is a constituent of DNA and RNA, which are genetic materials used in the synthesis of proteins. Fundamentally, phosphorus is vital to humans as well since it aids in the development and maintenance of bodily structures and cells. One of the "work horse" nutrients for plants is potassium. It may not be restricted to any particular plant ingredient for this reason [2].

"In vermicompost, the secretions from worms and associated microbes act as growth promoters. Since, it is a natural eco-friendly approach; it does not have any adverse impact on the soil or the environment. Certain metabolites produced by the earthworms may also be responsible to stimulate the plant growth. Vermicompost also helps in preventing plant diseases. The nutrients present in vermicompost are readily available. A positive effect of vermicompost application on yield attributes and yield of various crops. Vermicompost helps in improving and protecting fertility of top soil and also helps in boosting up the productivity by 40 %" [3].

"FYM is a cheap source organic amendment which increases the productivity of rice in a similar manner. Earthworms break down organic matter, producing vermicompost, also known as *worm castings, worm humus, worm poop, worm manure, or worm faeces* (*Eisenia fetida* and others). As compared to the organic materials used for vermicomposting, these excreta have been shown to contain lower levels of contaminants and a higher saturation of nutrients. Numerous nutrients have been found to be more abundant in vermicompost than in compost made using other composting techniques" [4].

"Green manure crops provide organic matter as well as additional nitrogen, especially if they are legumes, due to their ability to fix nitrogen from the air with the help of root nodule bacteria. Green manure crops also act as a barrier against erosion and leaching. Green manure should be incorporated into the soil prior to flowering because it is grown for its green leafy material, which is high in nutrients and protects the soil. Green manures will not break down quickly in the soil, but will gradually add nutrients to the soil for the next crop. Soil health and crop productivity are maintained by using an integrated nutrition approach that uses a variety of plant nutrient sources, including chemical fertilizer, biological sources of nutrient, organic manures, and green manure" [5].

2. METHODS AND MATERIALS

The relevant information regarding material used method adopted to carry out the present investigation is described under the following heads.

2.1 Experimental Site

To carry out the present investigation the experiment was conducted at student's instructional farm of C. S. Azad University of Agriculture and Technology Kanpur, during *Kharif* season of 2022.

2.2 Geographical Situation

Geographically, district Kanpur, Mahanagar lies between 25.26° and 26.58° north latitude and

79.31° and 80.34° east longitude. It is situated at an elevation of 124 meters above the sea level in the alluvial belt of Gangetic plains of central Uttar Pradesh.

2.3 Edaphic Condition

The soil was moist, well drained with uniform plane topography. The soil of the experimental field was alluvial in origin, sandy loam in texture and slightly alkaline in reaction having pH 8.40 (1:2.5 soil: water suspension method given by Jackson, [6], electrical conductivity 0.50 dSm^{-1} (1:2.5 soil: water suspension method given by Jackson, [6], low in organic carbon percentage in soil is 0.44 per cent (Walkley and Black's rapid titration method given by Walkley and Black, [7], in available nitrogen 165.40 kg ha^{-1} (Alkaline permanganate method given by Subbiah and Asija, [8] medium in available phosphorus as sodium bicarbonate-extractable P was 11.21 kg ha^{-1} (Olsen's calorimetrically method**,** Olsen et al. [9],, medium in available potassium was 275.20 kg ha^{-1} (Flame photometer method given by Hanwey and Heidel, [10].

2.4 Treatment Details

The experiment was replicated three times and set up using a randomized block design. The 9 treatments consisted of T_1: Control, T_2: 100% recommended dose of fertilizer (RDF) (120:60:60 NPK), T_3: 75% RDF+25% Nitrogen(N) through Farm Yard Manure (FYM), T_4: 75% RDF+25% N through Vermicompost, T_5: 75% RDF+25% N through Green Manure(GM), T_6: 75% RDF+25% N through FYM+VC, T_7: 75% RDF+25% N through VC+GM, T_8: 75% RDF+25%N through FYM+GM and T_9: 75% RDF+25% N through FYM+GM+VC.

2.5 Raising of Nursery

Treated seed were sown in the nursery on 15 June, 2022 before sowing the field was prepared with three cross ploughing with country plough followed by planking and then the nursery beds were prepared above the ground levels of about 5 cm.

2.6 Harvesting and Threshing

The crop was harvested after attaining physiological maturity when the grains attained golden color and showed to contain about 21% moisture.

The threshing was done manually plot wise separately after recording the weight of air dried bundles. The grain and straw weight were recorded plot wise separately.

2.7 Yield

2.7.1 Grain Yield

The threshed and cleaned grains from each net plot were weighed with help electronic balance in kg $plot^{-1}$ and converted into multiplying with conversion factor.

2.7.2 Straw Yield

The straw yield was calculated by deducting the grain yield from biological yield of each net plot in kg plot then converted into q ha^{-1} by multiplying with the conversion factor.

2.8 Statistical Analysis

Data analysis was statistically analysed by standard method (Chandel, 1975). The data recorded on various growths, yield attributes, yield component in the experiment were analysed statistically as per procedure. The standard errors of mean were calculated in each item of investigation and critical differences (CD) at 5 % level was worked out for comparing the treatment means wherever 'F' test was found significant. The analysis of the variance table (ANOVA table) has been given in the appendices.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

Data pertaining to growth parameters, mainly plant height (cm) and number of tillers per hill, was clearly revealed in Table 1. The average plant height at 90 DAT (cm) and number of tillers per hill of rice were affected by different doses of NPK, Farm Yard Manure, Vermicompost and Green Manure. The plant height at 90 DAT (days after transplanting) and the number of tillers per hill of rice were significantly increased over control. The maximum plant height (90 DAT) and number of tillers per hill of rice (127.13 cm) and (59.37) were recorded in 75% RDF + 25% N through FYM+GM+VC (T_9) and the minimum plant height and number of tillers per hill were recorded in control (98.08 cm) and (45.85). Similar findings were reported by Siavoshi et al. [11], Deshpande and Devasenapathy, [12] and Moe et al. [13].

Table 1. Effect of different treatment combinations on growth parameters of rice

S. No	Treatment	Plant height (cm)	No. of tillers hill^{-1}
1	T_1 – Control	98.08	45.85
2	T_2 - 100% RDF(120:60:60)	134.63	53.50
3	T_3 - 75% RDF+25% N through FYM	116.94	52.39
4	T_4 - 75% RDF+25% N through VC	119.12	53.36
5	T_5 - 75% RDF+25% N through GM	126.71	56.35
6	T_6 - 75% RDF+25% N through FYM+VC	122.03	55.66
7	T_7 - 75% RDF+25% N through VC+GM	120.19	54.60
8	T_8 - 75% RDF+25% N through FYM+GM	126.41	58.13
9	T_9 - 75% RDF+25% N through FYM+GM+VC	127.13	59.37
S.E (m) ±		2.28	1.32
CD at 5%		6.87	4.01

Table 2. Effect of different treatment combinations on yield parameters of rice

S. No	Treatment	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})
1	T_1 – Control	19.64	35.42
2	T_2 - 100% RDF(120:60:60)	48.35	57.08
3	T_3 - 75% RDF+25% N through FYM	46.35	55.05
4	T_4 - 75% RDF+25% N through VC	47.42	58.04
5	T_5 - 75% RDF+25% N through GM	49.54	61.83
6	T_6 - 75% RDF+25% N through FYM+VC	50.10	58.41
7	T_7 - 75% RDF+25% N through VC+GM	52.27	59.79
8	T_8 - 75% RDF+25% N through FYM+GM	51.46	61.77
9	T_9 - 75% RDF+25% N through FYM+GM+VC	54.47	64.49
S.E (m) ±		0.71	1.39
CD at 5%		2.27	3.42

3.2 Yield

It was observed that the application of different doses of NPK and FYM, Vermicompost and green manure enhanced the grain yield and straw yield of rice crop significantly over. Maximum grain and straw yield (54.47 and 64.49 q ha^{-1}) was recorded under the 75% RDF + 25 % N through FYM + GM + VC (T_9) and minimum grain and straw yield of rice were recorded in control (19.64 and 35.42 q ha^{-1}). These findings are further supported by the findings of Tabassum et al. [14] Iqbal et al. [15] and Anisuzzaman et al. [16] Bouyoucos [17], Gomez & Gomez [18], Lindsay and Norvell [19].

4. CONCLUSION

The current study demonstrates the benefit of the application of 75 % RDF + 25 % N through Farm Yard Manure + Green Manure + Vermicompost (T_9), significantly increased plant height, number of tillers per plant, grain and straw yield. Finally, it can be concluded that the treatment T_9 (75% RDF + 25 % N through FYM + GM + VC is the best option for improving the growth and yields of rice crops [20,21].

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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