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Impact of organic fertilizers on growth, yield, and quality of paddy (*Oryza sativa* L.)

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Abstract
A research investigation into the impact of organic manures on the growth and yield of paddy was carried out at the Agricultural Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur, during the Kharif season of 2023-24. The experiment employed a Randomized Block Design with eight distinct treatments. Findings indicated that the highest plant population was observed in treatment T6, which utilized Vermicompost at 5 t/ha, followed by Vermicompost at 2.5 t/ha. Similarly, the maximum yield was recorded for the T6 treatment with Vermicompost at 5 t/ha.

Keywords: Paddy, organic mannues, Vermi-compost, INM introduction

Introduction
Modern agriculture successfully alleviated food scarcity and achieved self-sufficiency in food grain production. However, over time, it has encountered environmental challenges, including reduced crop productivity, declining soil fertility, and ecological pollution. Despite being practiced for less than five decades, this system now shows evidence of yield stagnation and decreasing trends in grain production, input efficiency, and overall productivity (Anonymous, 2010) [1]. Despite advancements in crop improvement and yield management technologies, sustainable agricultural production remains elusive. Consequently, there is a growing call for a shift from chemical-based to organic farming practices.

To sustain agricultural output, enhance soil fertility, mitigate soil degradation, and address environmental concerns, organic farming—synonymous with organic agriculture—has gained traction, with research initiatives emerging in agricultural systems since the late 1990s. Organic manures, such as compost, have proven agronomically valuable, generally leading to higher yields across various crops. However, field studies and theoretical analyses of soil processes suggest that organic farming can result in inefficient nutrient management, causing site-specific challenges. Understanding the short- and long-term effects of organic resources on soil quality, particularly how nitrogen (N) sources influence these outcomes, is critical for optimizing their use. While most observations focus on short-term impacts, the repeated application of organic resources and their temporal nutrient availability require further study across short, medium, and long terms to identify underlying dynamics.

Rice, a vital staple cereal, supports over one-third of the global population's nutritional needs (FAO, 2003) [2]. Asia accounts for 90% of global rice production and consumption, with India and China comprising half of the world's rice cultivation area. Indian agriculture has advanced significantly over recent decades, driven by the Green Revolution's adoption of high-yielding varieties, improved irrigation, fertilizers, and modern farming techniques. Rice is a key carbohydrate source, containing approximately 87% starch, 7-8% protein with high digestibility and nutritional value, and low crude fiber and fat (1-2%). Rice alone provides nearly one-fifth of global dietary energy, surpassing wheat and maize.

Nitrogen (N) is the most critical plant nutrient, significantly enhancing crop yields (Salman *et al.*, 2012) [6]. It is supplied by natural sources such as soil minerals, organic matter, rice straw, manure, and water from rain or irrigation. However, crop residues are increasingly diverted for animal feed and fuel, reducing their return to the soil. Soil organic matter must be replenished through organic inputs like manures (Glaser *et al.*, 2001) [3]. Organic fertilizers, despite their lower nutrient content, are insufficient alone to meet the demands of high-yielding rice varieties. While inorganic fertilizers boost yields, their overuse has led to soil degradation and reduced productivity over time (Hepperly *et al.*, 2009) [4]. In Western systems, reliance on chemical fertilizers, growth regulators, and pesticides has caused health and environmental issues (Padmanabhan, 2013) [5].

Given these concerns, a balanced approach integrating organic and inorganic fertilizers is necessary to maintain soil health and achieve optimal yields. Combining safe modern technologies with traditional organic practices offers potential for improved productivity. Organic farming is gaining popularity in response to consumer demand for sustainable methods. Organic fertilizers have significantly enhanced crop growth and yield (Somasundaram, 2007) [7]. However, there is a lack of research on the impact of organic nutrient sources on paddy growth, yield attributes, and production in the central zones of Uttar Pradesh. Therefore, a study was conducted in this region to address this gap.

Research Methodology

During the Kharif season of 2023-2024, the study was carried out at the Agriculture Research Farm, Faculty of Agriculture Sciences and Allied Industries, Rama University, Kanpur. For this, an eight-treatment randomized block design was employed. Similarly, the impact of organic nutrient sources on rice growth, yield characteristics, and yields was examined using the Paddy variety Basmati 370. At 20, 30, 60, and after harvest, data on growth, yield characteristics, and yield attributes were gathered.

Results and Discussion

Treatment T6 Vermicompost (5t/ha) had the highest plant population, according to the study. Treatment T1 FYM (10 T/ha) had values of 29.97 and 28.54 at 15 days after sowing and at harvest, respectively, followed by treatment Vermicompost (2.5t/ha) with values of 32.70 and 30.69. At both growth phases, the lowest plant population (26.56 and 24.58) was noted in T1 (Control treatment). However, for the plant population at 15 DAS and harvest stage, all treatments were comparable to one another.

In a similar vein, treatment T6 Vermicompost (5T/ha) produced the maximum plant height (20.23 cm) after 30 days, followed by T2 FYM (5T/ha) and Vermicompost (2.5t/ha), which produced 20.23 cm and 19.82 cm, respectively, while treatment T1 (Control treatment) produced the lowest plant height (14.55 cm). In a similar vein, treatment T6Vermicompost (5 T/ha) showed the maximum plant height of 33.09 cm 60 days after planting, which was considerably comparable to T2 FYM (5 T/ha) and Vermicompost (2.5 t/ha). 33.09 cm was the largest plant height recorded, and 24.95 cm was the lowest. The treatment T6 Vermicompost (5t/ha) had the highest plant height (42.35 cm) at 90DAS compared to the other treatments. Treatments T5 (40.52 cm) and T1 (40.52 cm) were the next two treatments, but all were follower treatments. T1 (40.52 cm), although there was a statistically significant difference between the two following treatments. Treatment T1 (control) showed the noticeably lowest plant height (23.83 cm). The data shown in table 4.2.1 makes it abundantly evident that different treatments caused a significant deviation in the paddy grain yield. Treatment T6Vermicompost (5 t/ha) produced the considerably highest grain yield (2234.62 kg/ha), followed by T5Vermicompost (2.5 t/ha) with 2146.25 kg/ha and T2 FYM (5 T/ha) with 2043.39 kg/ha. Treatment T6Vermicompost produced the significantly lowest grain yield (1423.59 kg/ha).

Table: Effect of organic treatments combination on Plant population, plant height and grain yield

Treatment	Plant Population		Plant Height				Grain Yield
	15 DAS	At harvest	30 DAS	60 DAS	90DAS	At harvest	
T0	26.56	24.58	14.55	24.95	33.62	50.12	1423.59
T1	29.97	28.54	15.59	31.42	40.52	54.35	2043.39
T2	25.48	25.48	14.79	27.29	36.02	51.72	1200.45
T3	29.58	29.58	14.72	26.75	35.05	52.89	1234.42
T4	31.56	31.47	15.15	27.62	36.35	52.42	1322.49
T5	32.86	31.12	15.75	32.55	40.82	53.39	2146.25
T6	32.70	32.09	16.29	33.09	42.35	56.75	2234.62
T7	29.97	24.26	15.62	28.22	35.19	53.19	1999.32
T8	28.66	30.07	15.59	28.12	36.45	52.62	1771.72
CD	1.43	1.65	0.33	0.84	1.31	0.35	126.733
CV	2.74	3.23	1.19	1.68	2.011	0.39	4.036
S.Em	0.48	0.551	0.13	0.30	0.46	0.13	42.97

Conclusion

Treatment T6 Vermicompost (5 t/ha) had the highest plant population, followed by treatment Vermicompost (2.5 t/ha) with values of 32.70 and 30.69, and treatment T1 FYM (10 T/ha) with 29.97 and 28.54 at 15 days after sowing and harvest, respectively, according to the study that was carried out. At both growth phases, however, T1 (Control) had the lowest plant population (26.56 and 24.58). The treatment T6 Vermicompost (5 T/ha) had the maximum plant height (33.09 cm) 60 days after planting, which was considerably comparable to T2 FYM (5 T/ha) and Vermicompost (2.5 t/ha). 33.09 cm was the largest plant height recorded, and 24.95 cm was the lowest.

The maximum plant height (42.35 cm) was recorded at 90 DAS by treatment T6 Vermicompost (5 t/ha), which was followed by treatments T5 (40.52 cm) and T1 (40.52 cm). Nevertheless, each of the subsequent treatments was statistically substantially different from one another. However, T11 is substantially comparable to T10 (50% DAP + FYM (5 t/ha)). Treatment T1 (control) showed the noticeably lowest plant height (23.83 cm).

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