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Influence of integrated nutrient management on growth and yield of rice (*Oryza sativa* L.)

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Abstract
At the Department of Agriculture, United University, Rawatpur, Jhalwa, Prayagraj (U.P.), a field experiment was carried out during the Kharif season of 2022. To study about "Effect of integrated nutrient management on growth and yield of Rice (*Oryza sativa* L.)" of Prayagraj, U.P. The research field of the treatment consisted of T_1 Control, T_2 50% RDF, T_3 75% RDF, T_4 100% RDF, T_5 50% RDF + 50% FYM, T_6 75% RDF + 25% FYM, T_7 50% RDF + 50% PM, T_8 75% RDF + 25% PM, T_9 50% RDF + 50% GM, T_{10} 75% RDF + 25% GM Rice Variety Sarju-52 A randomised block design (RBD) experiment with three replications was run to evaluate the performance of rice. The experiment finding revealed that rice 75% RDF + 25% GM performed better compared to other treatments *i.e.* plant height (114.53 cm), tillers /hill (19.30), dry weight (77.63 g), panicle length (30.93 cm), number of grain per panicle (219.37), test weight (28.04 g), grain yield (5.59 t/ha), stover yield (6.91 t/ha) and harvest index (42.78%) were found significantly higher than other treatments.

Keywords: Rice, integrated nutrient management, growth and yield

Introduction
Rice (*Oryza sativa* L.) is a member of the Poaceae family. One of the most significant cereal crops during the Kharif season is rice. It has a good amount of protein (6–10%), carbohydrates (70–80%), minerals (1.22%), and vitamins (1.22%), and it is a good source of energy. (Vitamin E, thiamine, riboflavin, and niacin) The world's population of half consumes the most calories (26.2%) from rice in developing nations, where it ranks second in terms of food grain production. (Tomar *et al*., 2018) [12]. India takes pride in its position as the world's leading producer of rice among the food crops farmed worldwide. India trails China in both production and land area. It is grown on 43.79 million hectares in India with a production of 115.60 million tonnes and an average productivity of 2578 kg/ha. Uttar Pradesh has the most land planted in rice, whereas West Bengal has the highest production and Punjab has the highest productivity. In Uttar Pradesh, rice is grown on 5.95 million hectares with a production of 13.27 million tonnes and a productivity of 2230 kg ha^{-1} (Anonymous, 2021) [1].
Rice productivity and production are maintained and improved through integrated nutrient management (INM), which plays a significant role in this process. To meet the growing demand for rice grain production while maintaining the sustainability of crop production, organic and inorganic fertilizers must be used together. (Datta and Singh, 2010) [4]. The integrated approach to nitrogen management is adaptable, uses fewer pesticides while maximizing effectiveness and enhancing soil health. Integrated nutrition management is the greatest solution to meet the constant need of an expanding population. By reducing nutrient losses to the environment, regulating the nutrient supply, and resulting in high nutrient usage efficiency, INM has been demonstrated to significantly increase rice yields. (Parkinson *et al*., 2013) [7].

Materials and Methods
Agricultural Research Farm of United University, Rawatpur, Jhalwa, Prayagraj (U.P.), India hosted a field experiment in Kharif 2022 to investigate the effects of integrated nutrient management on the growth and yield of rice (*Oryza sativa* L.) under integrated nutrient techniques. The experiment was set up using a three-replication randomized block design. Eleven treatments were used in the investigation. *viz*., T_1 Control, T_2 50% RDF, T_3 75% RDF, T_4 100% RDF, T_5 50% RDF + 50% FYM, T_6 75% RDF + 25% FYM, T_7 50% RDF +50% PM, T_8 75% RDF + 25% PM, T_9 50% RDF + 50% GM, T_{10} 75% RDF + 25% GM Rice Variety

"Sarju-52" was sown after pre-sowing irrigation using 40 kg ha^{-1} seed rate. A basal dose of 120 kg N, 60 kg P_2O_5, 40 kg K was applied per hectare as recommended dose of fertilizer. Before sowing, FYM was mixed into the soil and applied to the field in accordance with the treatment instructions. So, rhizobium and PSB were added to the seeds' inoculum. The data gathered for each character was subjected to statistical analysis using the "analysis of variance" technique. Overall differences were evaluated using the "F" test of significance at the recommended threshold of significance of 5%. Cochran and Cox (1959) [3]. For comparing treatments, critical differences at a 5% level of probability were determined.

Results and Discussion

Effect on growth parameters

At harvest, significantly highest plant height (114.53 cm), number of tillers $hill^{-1}$ (19.30), dry weight (77.63 g) was recorded in the treatment with T_{10} (75% RDF + 25% GM) over all the other treatments. However, the treatments T_8 (75% RDF + 25% PM) and T6 (75% RDF + 25% FYM) was found to be statistically at par with T_{10} (75% RDF + 25% GM).

Several workers reported similar findings about the influence of varied ratios of chemical and organic fertiliser on changing the growth characteristics of rice (Biswanath *et al*., 2019) [2]. This might be explained by the quick release of nutrients from the inorganic source combined with the organic supply, which leads to improved vegetative growth. (Siddaram *et al*., 2010) [9]. The photosynthesis and respiration rates, which ultimately promote plant growth in terms of increased plant height, leaf area, and tillers/hill, etc., are the most likely causes of the greatest accumulation of dry matter. As a result, the treatment that achieved the greatest growth also accumulated more dry matter, and comparable results have also been reported by Kumar (2016) [6].

Effect on yield and yield attributes

Significantly higher panicle length (30.93 cm), number of grain per panicle (219.37), test weight (28.04 g), grain yield (53.01 t/ha), stover yield (6.91 t/ha), was observed with the T_{10} (75% RDF + 25% GM) and harvest index was observed with the T_9 (50% RDF + 50% GM) which was (45.12%%) over rest of the treatments except T_8 (75% RDF + 25% PM) panicle length (30.13 cm), number of grain per panicle (216.60), test weight (27.33 g), grain yield (5.59 t/ha), stover yield (6.74 t/ha) and T_6 (75% RDF + 25% FYM) panicle length (29.43 cm), number of grain per panicle (209.62), test weight (26.47 g), grain yield (5.21 t/ha), stover yield (6.54 t/ha) and minimum harvest index (42.81%) was recorded with the treatment T_1 (control) which are statistically at par with T_{10} (75% RDF + 25% GM).

The better nutrient utilisation may be the cause of the increased grain yield/hill under variety. The rice with a short shelf life has a higher potential for producing the most grains than the other varieties. Another explanation for the high yield of the variety may be enhanced growth characteristics that result in increased grain production. The same results were reported by (Ranjitha *et al*., 2013) [8]. The increased nutrient supply with more organics, which improved soil physico-chemical and biological characteristics by providing microbes with essential nutrients, could be the cause of the improvement in grain production with the INM treatment. (Subha *et al*., 2004) [11]. The capacity for appropriate and constant nitrogen delivery and nutrient translocation to the sink in the soil can be credited with the increased yield characteristics. (Subehia and Sepehya, 2012; Gautam *et al*., 2013) [10, 5].

Table 1. Effect of integrated nutrient management to growth of rice.

Tr. No.	Treatment combination	At harvest		
		Plant height (cm)	Number of tillers $hill^{-1}$	Dry weight (g)
T1	Control	94.67	14.57	57.28
T2	50% RDF	97.17	15.07	62.83
T3	75% RDF	107.60	17.67	71.00
T4	100% RDF	109.57	18.13	73.20
T5	50% RDF+50% FYM	102.03	16.23	65.73
T6	75% RDF+25% FYM	110.60	18.43	74.83
T7	50% RDF+50% PM	104.90	16.73	70.37
T8	75% RDF+25% PM	112.90	18.87	76.37
T9	50% RDF+50% GM	106.00	17.23	71.13
T10	75% RDF+25% GM	114.53	19.30	77.63
	S.Em ±	3.68	0.91	3.01
	CD (p=0.05)	10.94	2.71	8.92

Table 2: Effect of integrated nutrient management to yield attribute and yield of rice.

Tr. No.	Treatment combination	Panicle length (cm)	Number of grain per panicle	Test weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest Index (%)
T1	Control	22.50	183.40	21.83	3.88	5.21	42.81
T2	50% RDF	24.20	188.49	22.40	4.25	5.65	42.96
T3	75% RDF	27.87	205.57	25.03	4.92	6.06	44.81
T4	100% RDF	28.67	207.60	25.83	5.06	6.25	44.76
T5	50% RDF+50% FYM	25.10	192.93	23.57	4.54	5.78	43.91
T6	75% RDF+25% FYM	29.43	209.62	26.47	5.21	6.54	44.37
T7	50% RDF+50% PM	25.90	199.60	24.10	4.63	5.88	44.06
T8	75% RDF+25% PM	30.13	216.60	27.33	5.23	6.74	43.44
T9	50% RDF+50% GM	26.77	202.61	24.63	4.91	5.98	45.12
T10	75% RDF+25% GM	30.93	219.37	28.04	5.59	6.91	44.70
	S.Em ±	1.16	7.31	1.16	0.2329	0.1938	1.2133
	CD (p=0.05)	3.47	21.73	3.46	0.6919	0.5758	-

Conclusion

The study's findings indicate that treatment T10, which applied 75% RDF and 25% GM, produced the maximum plant height, number of tillers per hill, dry weight (g), panicle length, number of panicles, number of grains per panicle, seed yield, straw yield, test weight, and harvest index.

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