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## Effect of integrated nutrient management and panchgavya spray on growth and yield of rice (*Oryza sativa* L.)

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### Abstract

A field experiment entitled “Effect of Integrated Nutrient Management and Panchgavya spray on growth and yield of Rice (*Oryza sativa* L.) was conducted during *Kharif* 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.8), low in organic carbon (0.35%), available N (243 kg/ha), available P (20.10 kg/ha) and available K (105 kg/ha). The experiment was laid out in Randomized Block Design, with nine treatments consists of viz., 1: (RDF 50% + FYM 5t/ha) +P<sub>1</sub>- 3%, 2: (RDF 50% + FYM 5t/ha) +P<sub>2</sub> - 6%, 3: (RDF 50% + FYM 5t/ha) +P<sub>2</sub> -9%, 4: (RDF 75% +FYM 5t/ha) + P<sub>1</sub> -3%, 5: (RDF 75% + FYM 5t/ha) + P<sub>2</sub> -6%, 6: (RDF 75% + FYM 5t/ha) + P<sub>3</sub>- 9%, 7: (RDF 100% +FYM 5t/ha) + P<sub>1</sub> - 3%, 8: (RDF 100% + FYM 5t/ha) +P<sub>2</sub>- 6%, 9: (RDF 100% + FYM 5t/ha) + P<sub>3</sub> - 9% and were replicated thrice. Results obtained that there was significant increase in growth parameters viz., Plant height (90.17), Number of tillers/hill (12.33), Dry matter accumulation (44.93/hill), Crop growth rate (16.78 g/day/m<sup>2</sup>) and yield attributes viz., Grain yield (6.28 t/ha), Straw yield (7.91t/ha) and Harvest index (44.25%) were recorded with the application of (RDF 100% + FYM 5t/ha) +P<sub>2</sub>- 6%. Therefore, it is concluded that the application of (RDF 100% + FYM 5t/ha) +P<sub>2</sub>-6% was more productive and economically feasible.

**Keywords:** Rice, integrated nutrient management, FYM, panchgavya

### Introduction

Rice production in India is an important part of the national economy. Rice (*Oryza sativa* L.) belongs to family Poaceae. Rice is one of the most important cereal crops of *kharif* season. Rice is the seed of the grass species *Oryza sativa* (Asian rice) or less commonly *Oryza glaberrima* (African rice). The name wild rice is usually used for species of the genera *Zizania* and *Porteresia*, both wild and domesticated, although the term may also be used for primitive or uncultivated varieties of *Oryza*.

Rice is an excellent source of carbohydrates containing approximately 87% in grain. It contains 7 to 8% of protein, which has higher digestibility, biological value and more nutritious, possesses lower crude fibre and lower fat (1 to 2%). Nearly twenty percent of the world's dietary energy is provided by rice alone, which is higher than either wheat or maize.

Total production of Rice during 2019-2020 is estimated at record 117.94 million tonnes. It is higher by 8.17 million tonnes than the five years average production of 109.77 million tonnes. In the 2020/2021 crop year, China produced over 148 million metric tons of milled rice, a higher volume than any other country, India came in second place with 122 metric tonnes of milled rice in that year. The highest productivity is 6710 kg/ha in china followed by Vietnam. In India West Bengal is the largest producer of rice. The area of Rice in India in the year 2022/2021 is about 45,400 thousand hectare and in the year 2021/2022 the area increased to about 47,000 thousand hectares. In India West Bengal is the largest producer of rice. Two crops of rice are raised in a year in this state. Rice is regarded as the master crop of coastal India and in few regions of eastern India.

INM involving combined use of organic and inorganic fertilizer has been developed. The uses of adequate dose of organic sources coupled with chemical fertilizer are expected to ensure optimum growth condition under intensive pattern of farming using high yielding varieties. INM helps to restore and sustain fertility and crop productivity. Integrated nutrient management favorably affected the physical, chemical and biological environment of soil. The concept of INM in rice is the maintenance of plant nutrient supply to achieve a given level of crop production by optimizing the benefits from all possible sources of plant nutrients in an

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integrated manner, appropriate to each cropping system and farming situation. One major task of INM will be to least stop the ongoing loss of surface or top nutrients. The main objective of INM is to maintain or enhance soil productivity through balanced use of mineral fertilizers with organic and biological sources of plant nutrients. Integrated nutrient management (INM) or integrated nutrient supply (INS) system aims at achieving efficient use of chemical fertilizers in conjunction with organic manures. Long term fertilizer experiments involving intensive cereal based cropping systems reveal a declining trend in productivity even with the application of recommended levels of N, P and K fertilizers (Mahajan *et al.*, 2002; Mahajan and Sharma, 2005). The crop productivity increases from the combined application of chemical fertilizers and organic manures. FYM contains about 0.5% nitrogen, 0.2% phosphorus, 0.5% potassium. Long term combined application of NPK fertilizers at optimum levels and FYM increases the grain yield and also increases the availability of nutrients in soil at all locations.

Panchagavya is an organic product that can be used as manure. Panchagavya plays a major role in the growth of rice crop and also increases the immunity of crop. By increasing the immunity the crop will be able to resist the pest and diseases caused by them. It has micro nutrients like nitrogen, phosphorus and potassium which are the major nutrients required for the growth of plants. Panchagavya also contains many vitamins, amino acids. It also contains Gibberellins and auxins which regulate the growth of plants. Panchagavya also contains microorganisms like *Psuedomonas*, *Azotobacter*, phosphor bacteria which are considered to be beneficial for rice crop. Panchagavya has the capacity to restore the yield efficiency level. It can be easily prepared at the field level without any special techniques. Panchagavya, an organic source of nutrition, is an indigenous material which is used widely for agricultural and horticultural crops. Panchagavya had positive influence on beneficial microorganisms present in the soil and influence the crop growth and yield. Panchagavya is now gaining attention as an efficient organic growth promoter. Physico-chemical properties of Panchagavya revealed that they possess almost all the major nutrients, micronutrients and growth hormones (IAA and GA) required for crop growth.

### Materials and Methods

This experiment was carried out during *Kharif* 2021 at Crop Research Farm, Department of Agronomy, NAI, SHUATS, Prayagraj, (U.P.) which is located at 25.28°N latitude, 81.54°E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Prayagraj, Rewa road, about 5 km away from Prayagraj city. The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.8), low in organic carbon (0.35%), available N (243 kg/ha), available P (20.10 kg/ha) and available K (105 kg/ha). The experiment was laid out in Randomized Block Design, with nine treatments consists of *viz.*, 1: (RDF 50% + FYM 5t/ha) +P<sub>1</sub> - 3%, 2: (RDF 50% + FYM 5t/ha) +P<sub>2</sub> - 6%, 3: (RDF 50% + FYM 5t/ha) +P<sub>2</sub> - 9%, 4: (RDF 75% +FYM 5t/ha) + P<sub>1</sub> - 3%, 5: (RDF 75% + FYM 5t/ha) + P<sub>2</sub> -6%, 6: (RDF75% + FYM 5t/ha) + P<sub>3</sub>- 9%, 7: (RDF 100% +FYM 5t/ha) + P<sub>1</sub> -3%, 8: (RDF 100% + FYM 5t/ha) +P<sub>2</sub>- 6%, 9: (RDF 100% + FYM 5t/ha) + P<sub>3</sub> - 9% and were replicated thrice. Rice variety Shiats dhan 3 was taken as test crop. The crop matures in

about 130-138 days. The yield potential of the crop is 6.5 t/ha. The main field was prepared by ploughing with the help of cultivator. The main field was puddled by tractor drawn puddler and later it was leveled by planker. The 21 days old seedlings were transplanted to the main field. The transplanting was done at a spacing of 20 × 10 cm. All the nutrients such as (N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O) were applied to the soil in form of urea, DAP and MOP respectively. The 100% recommended dose of fertilizer is 120:60:60. FYM is incorporated into the soil after puddling and before transplanting of seedling at a recommended rate of 5 t/ha. Panchagavya spray of 3%, 6%, 9% is sprayed to the crop at an interval of 15,30 and 45 days after transplanting. The growth parameters were recorded at periodical intervals of 20,40,60,80 DAT and at harvest stage from the randomly selected five plants in each treatment. Statistically analysis was done and mean compared at 5% probability level of significant results.

### Results and Discussion

#### Effect of Integrated Nutrient Management and Panchagavya spray on growth parameters of Rice

Effect of Integrated Nutrient Management and Panchagavya spray on growth parameters of Rice are presented in Table 1. The results obtained that maximum Plant height (90.17 cm), Number of tillers/plant (12.33), Dry matter accumulation (44.93 g), Crop growth rate (16.78 g/day/m<sup>2</sup>), Relative growth rate (0.01 g/g/day) were recorded with application of (RDF 100% + FYM 5t/ha) +P<sub>2</sub>- 6% closely followed by the plant height (88.20), number of tillers/plant (12.17), Dry matter accumulation (43.2) which was recorded in the treatment of (RDF 100% + FYM 5t/ha) +P<sub>2</sub>-3%. Maximum plant height and maximum number of tillers are obtained due to the application of 100% dose of recommended fertilizer which are helpful for the increase of vegetative growth. Higher Dry matter accumulation is because of the better nutrient availability which increased plant height and produced more number of shoots. Organic manure (FYM) and inorganic fertilizers combinedly influenced the growth attributes. Treatment combination of (RDF 100% + FYM 5t/ha) +P<sub>2</sub>-6% showed the highest growth characteristics because of the correct application of 100% recommended dose of fertilizers with FYM combined with the application of Panchagavya 6% which imparts immunity to the crop against pests and diseases.. The lowest growth is recorded in the treatment combination of (RDF 50% + FYM 5t/ha) +P<sub>1</sub>- 3% because of the less application of recommended dose of fertilizer which indirectly reduces the availability of nutrients to the crop. The favorable effect of integrated nutrient management through both inorganic fertilizers and organic manures on higher crop growth and yield was also reported by Kumar *et al.* (2008) [2].

#### Effect of Integrated Nutrient Management and Panchagavya spray on yield parameters of Rice

Higher grain yield and availability of nutrients to the crop efficiently is achieved with the incorporation of FYM to the soil. Effect of Integrated Nutrient Management and Panchagavya spray on yield parameters of Rice are presented in Table 2. The maximum number of panicles /hill (12.53), Number of grains/hill (118.13), Panicle length (32.13 cm), Test weight (24.27 g), Grain yield (6.28 t/ha), Straw yield (7.91 t/ha) and Harvest index (44.25%) were recorded with application of (RDF 100% + FYM 5t/ha) +P<sub>2</sub>- 6% closely

followed by the number of panicles /hill (11.80), number of grains/hill (113.07), Panicle length (29.97 cm), Test weight (21.23 gm), Grain yield (5.80 t/ha), Straw yield (7.40 t/ha) and Harvest index (43.92%) which was recorded in the treatment of (RDF 100% + FYM 5t/ha) +P<sub>2</sub> -3%. The higher grain and straw yield might be attributed because of rapid decomposition of Farm yard manure and release of nutrients throughout the crop growth period combined with proper utilization of nutrients. The lowest yield was obtained in the treatment combination of (RDF 50% + FYM 5t/ha) + P<sub>1</sub> - 3%

when compared to the rest of the treatments because of the less application of recommended dose of fertilizer. The higher yield might be due to the better and optimum nutrient availability to the crop from the 100% RDF and Panchagavya spray 6% compared to other levels. The improvement in nutrient uptake in Rice crop may be due to adequate availability of nutrients in the soil and positive interaction effects of organic and inorganic sources of nutrients (Bairwa *et al.* 2009)

**Table 1:** Effect of Integrated Nutrient Management and Panchagavya spray on growth parameters of Rice

Treatment combinations	Plant height (cm)	At Harvest			At 80 - Harvest	
		Number of tillers/hill	Dry matter accumulation (g)	Crop growth rate (g/m <sup>2</sup> /day)	Relative growth rate (g/g/day)	
1: (RDF 50% + FYM 5t/ha) +P <sub>1</sub> -3%	81.5	11.30	36.90	13.81	0.003	
2: (RDF 50% + FYM 5t/ha) +P <sub>2</sub> - 6%	83.5	11.40	37.53	13.94	0.006	
3: (RDF 50% + FYM 5t/ha) +P <sub>2</sub> - 9%	82.4	11.83	38.03	15.06	0.006	
4: (RDF 75% +FYM 5t/ha) + P <sub>1</sub> -3%	84.5	11.43	39.63	16.11	0.004	
5: (RDF 75% + FYM 5t/ha) + P <sub>2</sub> -6%	81.0	12.00	41.30	15.06	0.006	
6: (RDF75% + FYM 5t/ha) + P <sub>3</sub> - 9%	85.4	11.47	39.60	16.56	0.004	
7: (RDF 100% +FYM 5t/ha) + P <sub>1</sub> -3%	88.5	12.17	43.20	16.67	0.006	
8: (RDF 100% + FYM 5t/ha) +P <sub>2</sub> - 6%	90.2	12.33	44.93	16.78	0.006	
9: (RDF 100% + FYM 5t/ha) + P <sub>3</sub> - 9%	84.2	11.80	40.57	16.17	0.005	
F test	S	S	S	S	S	
S.Em (±)	0.18	0.09	0.24	0.89	0.004	
CD (5%)	0.53	0.28	0.71	2.67	0.001	

**Table 2:** Effect of Integrated Nutrient Management and Panchagavya spray on yield parameters of Rice

Treatment combinations	No. of panicles /hill	No. of grains /hill	Panicle length (cm)	Test Weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
1: (RDF 50% + FYM 5t/ha) + P <sub>1</sub> - 3%	7.53	92.33	25.90	18.23	4.35	6.34	40.70
2: (RDF 50% + FYM 5t/ha) +P <sub>2</sub> - 6%	9.07	94.13	26.53	18.37	5.13	7.20	41.59
3: (RDF 50% + FYM 5t/ha) +P <sub>2</sub> - 9%	10.0	102.07	27.77	21.00	4.97	7.10	41.15
4: (RDF 75% +FYM 5t/ha) + P <sub>1</sub> - 3%	9.47	99.40	27.30	19.03	4.90	6.97	41.27
5: (RDF 75% + FYM 5t/ha) + P <sub>2</sub> - 6%	11.07	109.33	28.63	20.37	5.60	7.27	43.50
6: (RDF75% + FYM 5t/ha) + P <sub>3</sub> - 9%	9.63	97.57	26.40	18.77	4.90	6.97	41.29
7: (RDF 100% +FYM 5t/ha) + P <sub>1</sub> - 3%	11.8	113.07	29.97	21.23	5.80	7.40	43.92
8: (RDF 100% + FYM 5t/ha) +P <sub>2</sub> -6%	12.53	118.13	32.13	24.27	6.28	7.91	44.25
9: (RDF 100% + FYM 5t/ha) + P <sub>3</sub> - 9%	9.50	106.73	26.91	19.40	5.20	7.24	41.80
F test	S	S	S	S	S	S	S
S.Em (±)	0.42	1.74	0.4	0.48	0.17	0.11	0.85
CD (5%)	1.25	5.21	1.2	1.45	0.51	0.33	2.55

## Conclusion

From the above experiment it is concluded that transplanting of Rice with the application of (RDF 100% + FYM 5t/ha) +P<sub>2</sub>- 6% has been found to be more productive and remunerative.

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