



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(1): 650-656
Received: 20-11-2025
Accepted: 22-12-2025

Abhay Kumar Yadav
Research Scholar, Department of
Agronomy, Shri Durga Ji Post
Graduate College, Chandeshwar,
Azamgarh, Uttar Pradesh, India

Mukul Dutta Pandey
Assistant Professor & Head,
Department of Agronomy, Shri
Durga Ji Post Graduate College,
Chandeshwar, Azamgarh

Amarjeet Prajapati
Research Scholar, Department of
Agronomy, Shri Durga Ji Post
Graduate College, Chandeshwar,
Azamgarh, Uttar Pradesh, India

Pooja
Department of AG Statistics,
College of Agriculture, Acharya
Narendra Deva University of
Agriculture and Technology
Kumarganj, Ayodhya,
Uttar Pradesh, India

Corresponding Author:
Abhay Kumar Yadav
Research Scholar, Department of
Agronomy, Shri Durga Ji Post
Graduate College, Chandeshwar,
Azamgarh, Uttar Pradesh, India

Effects of integrated plant nutrient supply system (IPNS) on growth, yield, and performance of rice (*Oryza sativa* L.)

Abhay Kumar Yadav, Mukul Dutta Pandey, Amarjeet Prajapati and Pooja

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i1.4756>

Abstract

The Integrated Plant Nutrient Supply System (IPNS) offers a sustainable approach to enhancing crop productivity by combining organic, inorganic, and biological sources of nutrients. This study investigated the effects of IPNS on the growth, yield, and overall performance of rice (*Oryza sativa* L.) under field conditions. A field trial was conducted at agriculture research farm of Shri Durga Ji Post Graduate College, Chandeshwar, Azamgarh during *Kharif* season of 2024-25 under randomized block design with multiple treatment combinations including chemical fertilizers, farmyard manure, green manure, and biofertilizers. Key growth parameters such as plant height, tiller number, and leaf area index were measured, along with yield attributes like panicle length, grain number, and grain yield. The results suggested that IPNS significantly enhanced vegetative growth and yield attributes when compared to sole chemical fertilizer application. Among the treatments, the integration of 50–75% recommended dose of fertilizers (RDF) with organic and biological inputs yielded the best performance in terms of productivity and nutrient use efficiency. The findings underscore the potential of IPNS in achieving sustainable rice production by improving crop yield and maintaining soil health. The study concluded that IPNS not only enhances rice yield but also contributes to soil health and long-term sustainability, making it a viable strategy for integrated nutrient management in rice cultivation.

Keywords: Integrated Plant Nutrient Supply System (IPNS), (*Oryza sativa* L.), organic fertilizers, biofertilizers, soil fertility, sustainable agriculture

Introduction

Rice (*Oryza sativa* L.) is a globally crucial food crop, serving as the staple diet for over half of the world's population. It provides a significant source of calories and protein, particularly in Asia. In India, rice makes up roughly 45% of all food produced and aids in maintaining food sufficiency. It and its derivatives provide 60-70% of the energy needed by over two billion people. In 2022-23, rice is produced on 47.8 million hectares, with a productivity of 2838 kg ha⁻¹ and a production of 135.8 million tonnes, according to the Directorate of Economics and Statistics, DA & FW. With a 5.70 million ha area and a 15.27 million Tonnes rice production, Uttar Pradesh was the greatest state (Anonymous, 2025) ^[1].

Integrated plant nutrient supply system (IPNS System) sometimes also known as integrated plant nutrition system (IPNS) or integrated nutrient management (INM) is a sustainable approach to crop production that combines various sources of plant nutrients to optimize soil fertility and plant nutrition. According to Yadav and Meena, 2014, combining organic and inorganic fertilizers has been shown to meet crop nutritional needs and maintain large-scale productivity targets. Chicken excrement, or poultry dung, is utilized as a concentrated organic manure. This contains a significant amount of potassium, phosphorus, nitrogen, and other micronutrients. The average nutrient content is 3.03% N₂, 2.63% P₂O₅ and 1.4% K₂O in this manure. Blue-green algae (BGA), also known as cyanobacteria, are used in rice cultivation as a biofertilizer to improve soil fertility and increase crop yield.

The study aimed to evaluate the effects of different IPNS treatments on the growth, yield, nutrient uptake, and economics of the Narendra-118 rice variety during the kharif season of 2024-25.

Materials and Methods

The experiment was conducted at Agriculture Research Farm of the Shri Durga Ji Post Graduate College Chandeshwar Azamgarh, (UP). The experimental site is situated, about 08 km away from Azamgarh district head quarter on Azamgarh-Ghazipur road at 26°04' N latitude and 83°11' E longitudes and an altitude of 84 meters above mean sea level.

The experiment was carried out by using Randomized Block Design (RBD) with nine different treatments combinations

replicated three times. The rice variety Narendra-118 is a high-yielding, semi-tall, long-duration rice variety (approximately 145 days) with a reported yield of 5.6 t/ha. Known for its long, slender grains and good responsiveness to nitrogen. It is also reportedly tolerant to submergence and some major diseases and insect pests. This variety is released from Narendra Deva University of Agriculture and Technology, Ayodhya as suggested by its name and the reference to a document.

Table 1: Details of treatments

Treatment No	Treatments Details
T ₁	Control
T ₂	100% RDF
T ₃	75% RDF + 25% FYM
T ₄	75% RDF + 25% BGA
T ₅	75% RDF + 25% Poultry manure
T ₆	50% RDF + 25% BGA + 25% FYM
T ₇	50% RDF + 25% BGA + 25% Poultry manure
T ₈	50% RDF + 25% FYM + 25% Poultry manure
T ₉	25% RDF + 25% FYM + 25% BGA + 25% Poultry manure

Results and Discussion

Different growth attributes were recorded at various stages of rice *i.e.* at 30, 60, 90 DAT and at harvest. The results and discussion on growth attributes are described here under as follows:

Plant Height: An interception of data revealed that plant height increased with advancement of crop growth stages up to 90 DAT and it increases slowly. T₂ (100% RDF) produced significantly taller plants at all the growth stages *i.e.*, at 30, 60, 90 DAT and at harvest as compared to other treatments.

Table 2: Effect of IPNS on plant height at various growth stages of rice

Treatments	Plant height (cm)			
	30 DAT	60 DAT	90 DAT	At harvest
T ₁ =Control	38.8	70.3	84.6	85.6
T ₂ =100% RDF	44.4	85.9	105.3	107.5
T ₃ =75% RDF + 25% FYM	43.1	83.6	97.7	101.0
T ₄ =75% RDF + 25% BGA	42.1	83.4	96.3	99.1
T ₅ =75% RDF + 25% Poultry manure	43.7	84.3	103.3	105.5
T ₆ =50% RDF + 25% BGA + 25% FYM	41.1	79.8	94.4	97.1
T ₇ =50% RDF + 25% BGA + 25% Poultry manure	41.2	81.6	94.7	97.6
T ₈ =50% RDF + 25% FYM + 25% Poultry manure	42.0	81.9	94.9	98.0
T ₉ =25% RDF + 25% FYM + 25% BGA + 25% Poultry manure	41.0	78.3	93.9	96.8
SEm ±	0.496	2.833	3.479	3.511
CD (P=0.05)	1.501	8.568	10.520	10.617

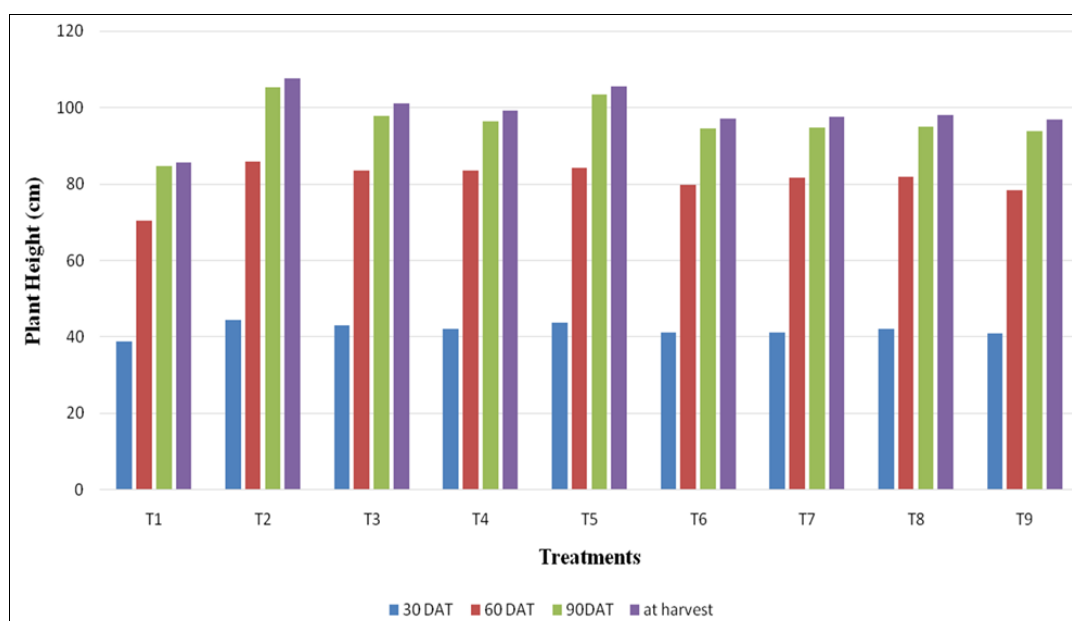


Fig 1: Effect of IPNS on plant height at various growth stages of rice

Number of tillers hill⁻¹

At 30 DAT there was less significant difference among the treatments. T₅ (75% RDF + 25% poultry manure) was showing highest number of tillers hill⁻¹ which showed at par with T₂ (100% RDF) and T₃ (75% RDF + 25% FYM). At 60 and 90 DAT, T₅ (75% RDF + 25% Poultry manure) was observed as producing maximum no of tiller hill⁻¹ which showed at par with T₂ (100% RDF). At harvest stage T₅ (75% RDF + 25% Poultry manure) showed highest no of tiller hill⁻¹ which was at par with T₂ (100% RDF) and T₃ (75% RDF + 25% FYM). up to 60 DAT

no of tiller hill⁻¹ increased rapidly. From 60 to 90 DAT no of tillers hill⁻¹ was increased slowly and from 90 DAT to at harvest no of tillers hill⁻¹ was decreased. This was might be due to mutual competition among the plants for light, nutrient and other growth inputs resulting in mortality of tillers after flowering. The highest no of tillers hill⁻¹ at flowering stage because of higher availability of nutrients which facilitated proper synchronized tillering. Similar results were found by Devi and Manimaran (2012) [12].

Table 3: Effect of IPNS on number of tillers hill⁻¹ at various growth stages of rice

Treatments	Numbers of tillers hill ⁻¹			
	30 DAT	60 DAT	90 DAT	At harvest
T ₁ =Control	6.1	9.1	11.6	9.9
T ₂ =100% RDF	10.2	15.2	17.9	16.3
T ₃ =75% RDF + 25% FYM	9.8	14.1	16.4	15.3
T ₄ =75% RDF + 25% BGA	9.1	14.1	16.3	14.4
T ₅ =75% RDF + 25% Poultry manure	10.3	16	18.5	16.7
T ₆ =50% RDF + 25% BGA + 25% FYM	8.3	12.3	15	13.1
T ₇ =50% RDF + 25% BGA + 25% Poultry manure	8.9	13.1	15.2	13.5
T ₈ =50% RDF + 25% FYM + 25% Poultry manure	8.9	13.3	15.5	13.9
T ₉ =25% RDF + 25% FYM + 25% BGA + 25% Poultry manure	8.1	12.2	14.9	13.0
SEm ±	0.36	0.48	0.59	0.50
CD (P=0.05)	1.09	1.45	1.79	1.51

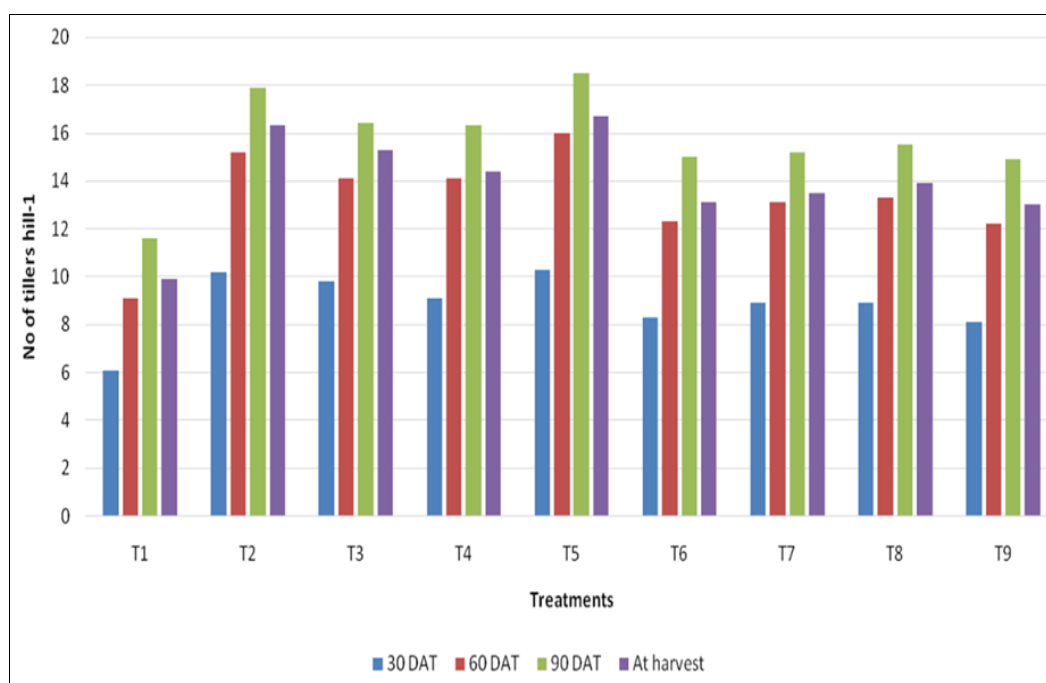


Fig 2: Effect of IPNS on number of tillers hill⁻¹ at various growth stages of rice

Dry matter accumulation

The data regarding dry matter accumulation was recorded at 30, 60, 90 DAT and at harvest as affected by various treatments suggest that in general, dry matter accumulation by plant continued to increase at successive growth stages and the highest dry matter accumulation was recorded at harvest stage. The maximum dry matter accumulation obtained by T₅ treatment at all growth stages i.e., 30 DAT, 60 DAT, 90 DAT and at harvest. The minimum dry matter accumulation was obtained in T₁ (Control) at 30, 60, 90 DAT and at harvest.

Leaf area Index

Data observed for Leaf area index was affected by different treatment recorded at 30, 60, 90 DAT and at harvest have been summarized in Table 4 and depicted in Figure 4. It is evident from the data that LAI increased with the advancement of crop growth up to 90 DAT. The rate of increase was rather slow during initial crop growth period i.e. up to 30 DAT then increase up to 90 DAT and decreases from 90 DAT to at harvest. It is obvious from the data that at 30 DAT various INM practices had less significant effect on LAI while at rest of the stage LAI was affected significantly due to different INM practices.

Table 4: Effect of IPNS on dry matter accumulation (gm^{-2}) at various growth stages of rice

Treatments	Dry matter accumulation (gm^{-2})			
	30 DAT	60 DAT	90 DAT	At harvest
T ₁ =Control	189.64	352.15	574.54	725.27
T ₂ =100% RDF	240.92	490.34	895.39	1289.75
T ₃ =75% RDF + 25% FYM	238.71	482.53	878.30	1287.13
T ₄ =75% RDF + 25% BGA	235.72	475.17	868.88	1276.16
T ₅ =75% RDF + 25% Poultry manure	244.96	501.71	908.32	1341.36
T ₆ =50% RDF + 25% BGA + 25% FYM	228.24	455.84	844.12	1181.20
T ₇ =50% RDF + 25% BGA + 25% Poultry manure	231.99	464.75	850.98	1202.06
T ₈ =50% RDF + 25% FYM + 25% Poultry manure	233.29	469.82	860.82	1255.51
T ₉ =25% RDF + 25% FYM + 25% BGA + 25% Poultry manure	225.66	449.11	836.24	1177.82
SEm $\pm$	4.52	15.22	22.40	26.72
CD (P=0.05)	13.67	46.03	67.74	80.78

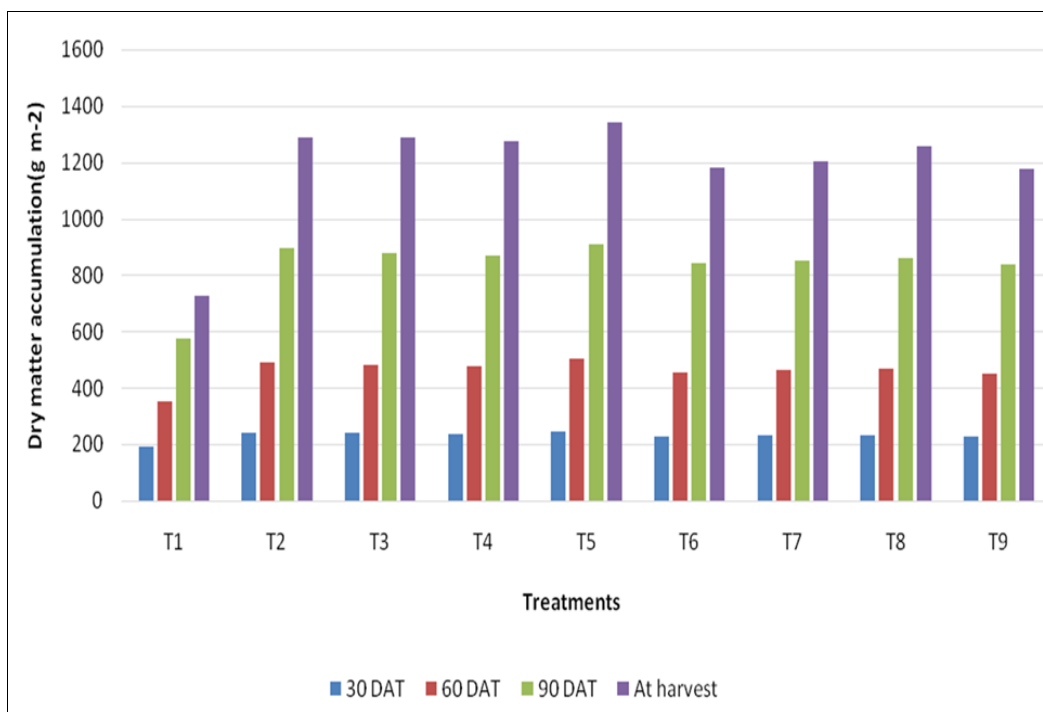
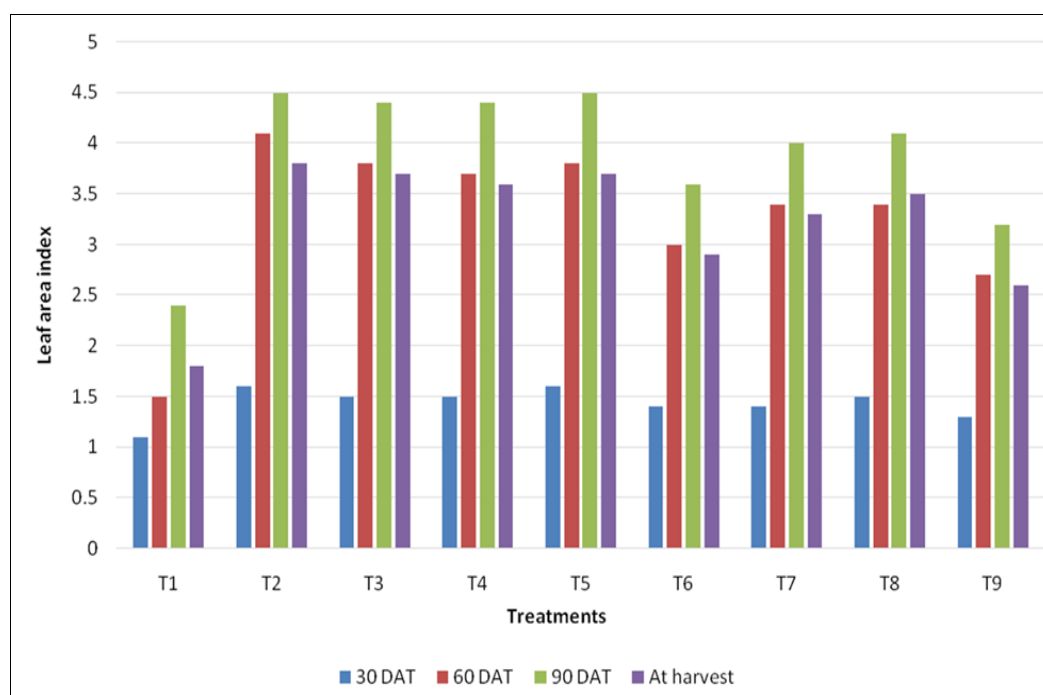
**Fig 3:** Effect of IPNS on Dry matter accumulation (gm^{-2}) at various growth stages of rice**Fig 4:** Effect of IPNS on leaf area index at various growth stages of rice

Table 5: Effect of IPNS on leaf area index at various growth stages of rice

Treatments	Leaf area index			
	30 DAT	60 DAT	90 DAT	At harvest
T ₁ =Control	1.1	1.5	2.4	1.8
T ₂ =100% RDF	1.6	4.1	4.5	3.8
T ₃ =75% RDF + 25% FYM	1.5	3.8	4.4	3.7
T ₄ =75% RDF + 25% BGA	1.5	3.7	4.4	3.6
T ₅ =75% RDF + 25% Poultry manure	1.6	3.8	4.5	3.7
T ₆ =50% RDF + 25% BGA + 25% FYM	1.4	3.0	3.6	2.9
T ₇ =50% RDF + 25% BGA + 25% Poultry manure	1.4	3.4	4.0	3.3
T ₈ =50% RDF + 25% FYM + 25% Poultry manure	1.5	3.4	4.1	3.5
T ₉ =25% RDF + 25% FYM + 25% BGA + 25% Poultry manure	1.3	2.7	3.2	2.6
SEm ±	0.034	0.116	0.153	0.117
CD (P=0.05)	0.102	0.351	0.464	0.353

Yield attributing Characters

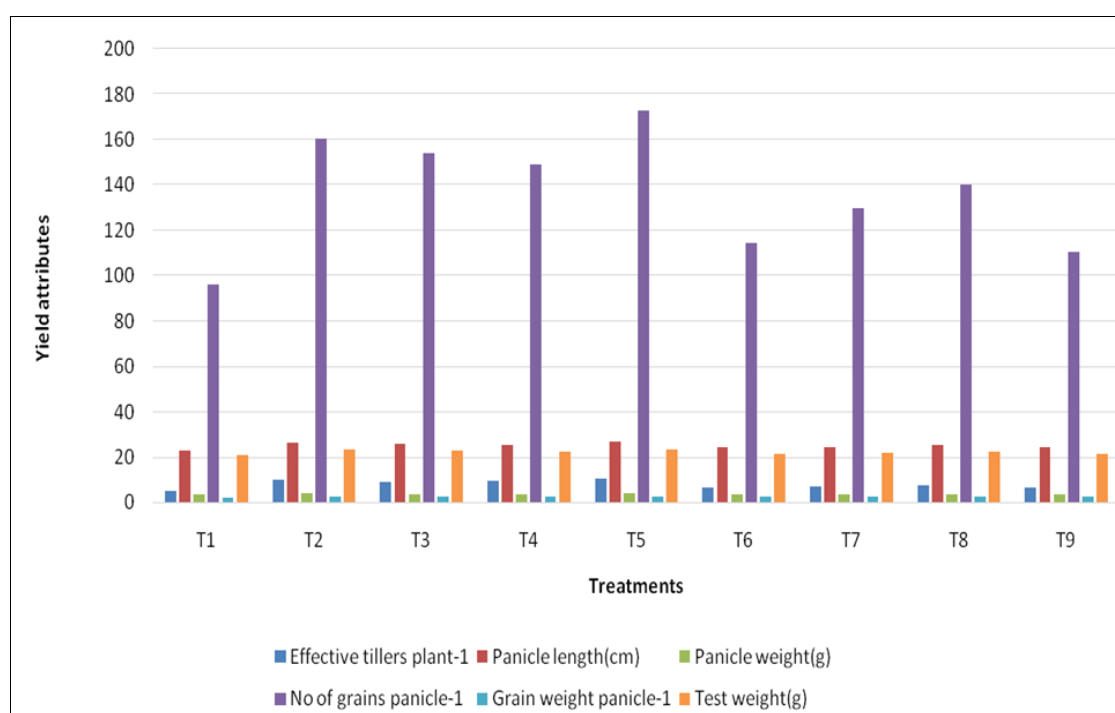
The yield attributes of the rice depend upon the various yield attributes like panicle length (cm), panicle weight (g), numbers of grains panicle⁻¹, grains weight panicle⁻¹ and test weight (g) have been summarized in Table 5 and depicted in Figure 5. The scrutiny of data of yield attributes clearly reveals that there was a significant impact in the yield attributing character's like as panicle length (cm), panicle weight (g), numbers of grains

panicle⁻¹, grains weight panicle⁻¹ except test weight.

Critical observation of the data recorded on grain yield (t ha⁻¹) have been summarized in Table 5 and depicted in Figure 5. T₅ (75% RDF + 25% Poultry manure) showed the maximum no of effective tillers hill⁻¹ i.e., 10.40 which was at par with T₂ (RDF (100%) and T₄ (75% RDF + 25% BGA). Lowest value was by T₁ (Control).

Table 6: Effect of IPNS on effective tillers hill⁻¹, panicle length, panicle weight, grains panicle⁻¹, grain weight panicle⁻¹ and test weight of rice

Treatments	No of Effective tillers hill ⁻¹	Panicle length (cm)	Panicle weight (g)	No of grains panicle ⁻¹	Grain weight panicle ⁻¹	Test weight (g)
T ₁ =Control	4.87	22.94	3.29	96.07	2.18	20.71
T ₂ =100% RDF	9.87	26.18	3.77	160.47	2.60	23.21
T ₃ =75% RDF + 25% FYM	8.87	25.64	3.65	154.07	2.55	22.96
T ₄ =75% RDF + 25% BGA	9.40	25.40	3.62	149.00	2.50	22.32
T ₅ =75% RDF + 25% Poultry manure	10.40	26.61	3.81	172.87	2.65	23.45
T ₆ =50% RDF + 25% BGA + 25% FYM	6.67	24.09	3.46	114.53	2.42	21.41
T ₇ =50% RDF + 25% BGA + 25% Poultry manure	7.00	24.18	3.54	129.60	2.44	21.61
T ₈ =50% RDF + 25% FYM + 25% Poultry manure	7.53	25.26	3.60	140.00	2.47	22.17
T ₉ =25% RDF + 25% FYM + 25% BGA + 25% Poultry manure	6.20	24.12	3.44	110.47	2.38	21.18
SEm ±	0.45	0.46	0.05	7.02	0.05	0.71
CD (P=0.05)	1.35	1.40	0.16	21.22	0.16	NS

**Fig 5:** Effect of IPNS on effective tillers hill⁻¹, panicle length, panicle weight, grains panicle⁻¹, grain weight panicle⁻¹ and test weight of rice

Grain & Straw yield

Critical observation of the data recorded on grain yield (t ha^{-1}) have been summarized in Table 7 and depicted in Figure 6. T_5 (75% RDF + 25% Poultry manure) showed the maximum no of effective tillers hill^{-1} i.e., 10.40 which was at par with T_2 (RDF (100%)) and T_4 (75% RDF + 25% BGA). Lowest value was by T_1 (Control).

The data recorded on straw yield (t ha^{-1}) have been presented in Table 7 and depicted in Figure 6. The higher straw yield of 7.46 t ha^{-1} which was recorded with T_5 (75% RDF + 25% Poultry manure), which was significant over all the treatments and at par with T_2 , T_3 , T_4 , T_6 , T_7 , T_8 . The lowest straw yield of 4.25 t ha^{-1} was recorded with treatment T_1 (Control). The highest biological

yield of 13.18 t ha^{-1} was recorded treatment with T_5 (100% RDF + 25% Poultry manure) which was significant over all the treatments and at par with T_2 (100% RDF). The lowest biological yield was recorded with treatment T_1 (Control) with 7.17 t ha^{-1} . Harvest index indicates the relationship between economic yield and biological yield. It is clearly revealed from the data there was variation in harvest index among the treatments but it could not reach to the level of significance so the treatments are non-significant with each other. The maximum harvest index was recorded with T_5 (75% RDF + 25% Poultry manure) and minimum under T_1 (Control). INM can increase the harvest index.

Table 7: Effect of IPNS on grain yield, straw yield, biological yield and harvest index of rice

Treatments	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
T_1 =Control	2.94	4.35	7.29	40.33
T_2 =100% RDF	5.30	7.01	12.31	43.08
T_3 =75% RDF + 25% FYM	5.25	6.99	12.23	42.91
T_4 =75% RDF + 25% BGA	5.17	6.95	12.12	42.66
T_5 =75% RDF + 25% Poultry manure	5.63	7.46	13.09	43.00
T_6 =50% RDF + 25% BGA + 25% FYM	4.89	6.85	11.69	41.87
T_7 =50% RDF + 25% BGA + 25% Poultry manure	5.01	6.86	11.87	42.23
T_8 =50% RDF + 25% FYM + 25% Poultry manure	5.12	6.92	12.04	42.53
T_9 =25% RDF + 25% FYM + 25% BGA + 25% Poultry manure	5.15	6.95	12.10	42.56
SEm $\pm$	0.09	0.22	0.29	0.51
CD (P=0.05)	0.26	0.65	0.86	NS

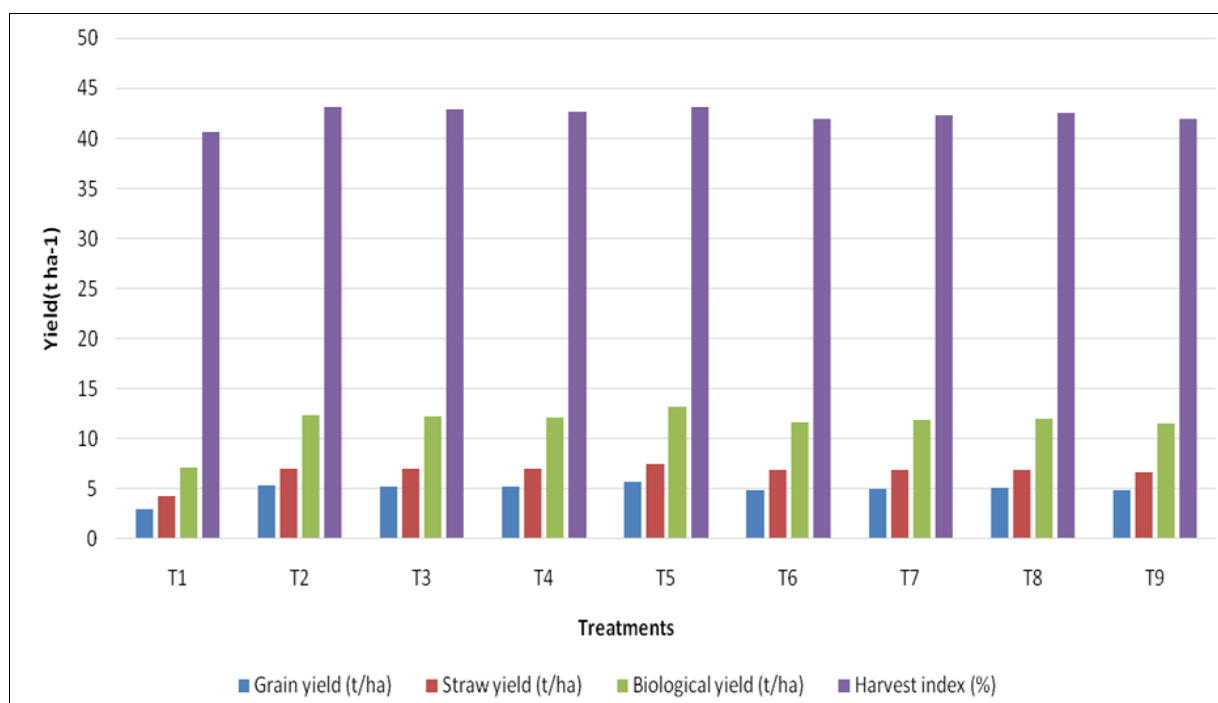


Fig 6: Effect of IPNS on grain yield, straw yield, biological yield and harvest index of rice

Conclusion

On the basis of present investigation, 75% RDF together with 25% nutrients from poultry manure be recommended to the farmers of eastern districts of Uttar Pradesh for better growth, more dry matter production, high grain and stalk yield. Inclusion of FYM and BGA has also enriched the nutrient status of soil and plant both and showed positive impact on grain and straw yield. Thus, 75% RDF + 25% BGA or 75% RDF + 25% FYM could also be an alternative which may be remunerative for rice cultivation with sustained soil health and increased production.

References

- Anonymous. All India APY Dash Reports [Internet]. New Delhi: Directorate of Economics and Statistics, DA & FW; 2026 [cited 2026 Jan 23]. Available from: <https://upag.gov.in/dash-reports/allindiaapy>
- Aasif M, Chinnamani I, Kumar NS, Hemalatha M, Suresh S. Influence of integrated nutrient management practices on yield and nutrient uptake of rice under system of rice intensification. *Int J Adv Agric Sci Technol*. 2018;5(7):10-16.

3. Acharya R, Dash AK, Senapati HK. Effect of integrated nutrient management on microbial activity influencing grain yield under rice-rice cropping system in an acid soil. *Asian J Soil Sci.* 2012;7(2):355-359.
4. Adhikari J, Sarkar MAR, Uddin MR, Sarker UK, Hossen K, Rosemila U. Effect of nitrogen fertilizer and weed management on the yield of transplanted aman rice. *J Bangladesh Agric Univ.* 2018;16(1):12-16.
5. Babar S, Dongale JH. Effect of integrated use of inorganic and organic manure on yield and monetary returns of mustard-cowpea-rice cropping sequence in lateritic soils of Konkan. *J Soils Crops.* 2011;21:225-233.
6. Baishya LK, Rathore SS, Singh D, Sarkar D, Deka BC. Effect of integrated nutrient management on rice productivity, profitability and soil fertility. *Ann Plant Soil Res.* 2015;17(1):86-90.
7. Bamugade NV. Effect of manure and fertilizer with and without phosphate solubilizer on growth, yield and nutrient uptake by Sahyadri Hybrid-2 [M.Sc. Thesis]. Dapoli: Dr. B.S. Konkan Krishi Vidyapeeth; 2007.
8. Bari ASMF, Khan MA, Sultana S, Hasanuzzaman M, Sultana N. Effect of various inorganic fertilizer and manure with different water managements on yield and yield attributes of boro rice. *J Exp Biosci.* 2013;4(2):1-6.
9. Chesti MH, Kohli A, Mujtaba A, Sofi JA, Nazir Q, Tabasum P, *et al.* Effect of integrated application of inorganic and organic sources on soil properties, yield and nutrient uptake by rice (*Oryza sativa* L.) in intermediate zone of Jammu and Kashmir. *J Indian Soc Soil Sci.* 2015;63(1):88-92.
10. Das D, Dwivedi BS, Singh VK, Datta SP, Meena MC, Chakraborty D, *et al.* Long-term effects of fertilizers and organic sources on soil organic carbon fractions under a rice-wheat system in the Indo-Gangetic Plains of north-west India. *Soil Res.* 2017;55(3):296-308.
11. Davari MR, Sharma SN. Effect of different combinations of organic materials and biofertilizers on productivity, grain quality and economics in organic farming of basmati rice (*Oryza sativa* L.). *Indian J Agron.* 2010;55:290-294.
12. Devi S, Manimaran S. Study of effective microorganisms (EM) on different organic wastes and their effect on growth and yield of rice. *Int J Pharm Life Sci.* 2012;3(6):1710-1714.
13. El-Hawary MM, El-Kholy MH. Decreasing nitrogen fertilizer by using some biofertilizers for rice crop under saline soil conditions. *Curr Trends Nat Sci.* 2019;8(15):6-16.