

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(6): 1239-1242
www.biochemjournal.com
Received: 08-03-2026
Accepted: 13-04-2026

Ashutosh Mohan Anand
Ph.D., Research Scholars,
Agricultural Sciences and
Allied Industries, Rama
University, Kanpur, Uttar
Pradesh, India

Ravikesh Kumar Pal
Faculty of Agricultural
Sciences and Allied Industries,
Rama University, Kanpur,
Uttar Pradesh, India

Raghvendra Singh
Faculty of Agricultural
Sciences and Allied Industries,
Rama University, Kanpur,
Uttar Pradesh, India

Mandeep Kumar
Faculty of Agricultural
Sciences and Allied Industries,
Rama University, Kanpur,
Uttar Pradesh, India

Corresponding Author:
Ashutosh Mohan Anand
Ph.D., Research Scholars,
Agricultural Sciences and
Allied Industries, Rama
University, Kanpur, Uttar
Pradesh, India

Effect of organic and inorganic sources of nutrients on yield attributes, panicle length, productivity and quality of transplanted basmati rice (*Oryza sativa* L.)

Ashutosh Mohan Anand, Ravikesh Kumar Pal, Raghvendra Singh and Mandeep Kumar

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i6So.8804>

Abstract

A field experiment was conducted to study the 'Effect of Organic and Inorganic Sources of Nutrients on Yield Attributes, Panicle Length, Productivity and Quality of Transplanted Basmati Rice (*Oryza sativa* L.).' The investigation was laid out in a randomized block design with eleven treatments (T₁-T₁₁) comprising different combinations of organic manures (FYM, vermicompost, poultry manure) and inorganic fertilizers, replicated thrice. The study evaluated key yield attributes including panicle length (cm), number of panicles per hill, grains per panicle, unfilled spikelets per panicle, and 1000-grain weight. Pooled data over the years revealed significant variations among the treatments. Treatment T₁₁ recorded the highest panicle length (22.46 cm), number of panicles per hill (13.64), grains per panicle (95.11), and performed competitively in 1000-grain weight (27.5 g). The lowest unfilled spikelets per panicle were also observed under the best-performing integrated nutrient management treatments. Statistical analysis using standard error of the mean (SEM) and critical difference (CD at 5%) confirmed the significant effect of nutrient management practices on all yield attributes. The results demonstrated that the combined application of organic and inorganic nutrient sources proved superior in enhancing panicle architecture and grain filling compared to sole inorganic or sole organic treatments. The findings highlight the potential of optimized integrated nutrient management strategies to improve the yield components and overall productivity of Pusa Basmati 1509 while maintaining grain quality. This approach offers a sustainable pathway for enhancing Basmati rice production in the Indo-Gangetic Plains.

Keywords: Basmati rice, Pusa Basmati 1509, organic and inorganic nutrients, panicle length, yield attributes, integrated nutrient management

Introduction

Rice (*Oryza sativa* L.) is a staple food crop feeding over half of the world's population. Yield is determined by components such as the number of panicles per unit area, spikelets (grains) per panicle, grain filling percentage, and individual grain weight. Panicle length and architecture significantly influence grain number and filling efficiency. Recent studies emphasize genetic and agronomic factors regulating panicle branching and grain filling. Overexpression of genes like *GNP3* enhances panicle branching and grain yield by modulating ethylene levels. Compact panicles often lead to higher unfilled spikelets due to competition for assimilates and hormonal imbalances. Pathak, S. O., *et al.* (2021) ^[1].

This experiment assessed different treatments (likely nutrient, bio-stimulant, or management practices, common in such designs) on these traits under field conditions. The objective was to identify superior treatments for improving yield potential. Chandra, M. S., *et al.* (2023) ^[2]. Rice (*Oryza sativa* L.) is the world's most widely farmed food crop and remains the world's most significantly more than 60% of the world's population depends on this major food crop. Rice crops grow in a variety of ecosystems between 55° N and 36° S latitudes, under a variety of climatic and meteorological circumstances. India is the world's second most populated country after China and the largest producer of rice. Kumawat, A., *et al.* (2024) ^[3]. China produces 204.3 million tonnes from 30.3 million ha and India produces 152.6 million tonnes from 42.5 million ha, with an average productivity of 3.57 t ha⁻¹. While, china on the other hand, produces 204.3 million tonnes from 30.3 million hectares, averaging 6.73 t ha⁻¹.

Among the all rice growing countries of world about 90 percent of rice grown and consumed in the Asian countries. India has the greatest area of all the rice-growing countries, followed by China and Indonesia. Rice is the world's most important food crop, with 158.8 million hectares under cultivation and 700 million tonnes produced. Maximum area under rice is in Asia continent of world. The present investigation on the "Response of organic and inorganic sources of nutrient on productivity and quality of transplanted Basmati rice (*Oryza sativa* L.)" with Pusa Basmati 1509 aims to evaluate the comparative and integrated effects of different nutrient sources on growth, yield attributes, grain yield, milling and cooking quality, nutrient uptake, and soil health under transplanted conditions. This study seeks to identify optimal nutrient management strategies that can maximize the genetic potential of this elite variety while addressing the challenges of soil degradation and input sustainability in Basmati-growing regions. Nautiyal, M., *et al.* (2025) ^[5].

Materials and Methods

Pusa Basmati 1509 developed by IARI, New Delhi and release during year 2013 (CVRC). It is first early maturing basmati rice variety with seed to seed maturity of only 115-120 days. It has moderate resistance to leaf blast and brown spot diseases. It possesses extra-long slender grains (8.19 mm) with very occasional grain chalkiness, very good kernel length after cooking (18.2 mm), desirable ASV (7.0), intermediate amylose content (21.24%) and strong aroma. Considering the advantages such as semi-dwarf stature, non-lodging and non-shattering habit, reduced duration, yield on par and superior grain and cooking quality traits compared to Pusa Basmati 1121.

Panicle length (cm)

Ten panicles were randomly selected from each plot. The length was measured in cm with the help of meter scale. Average length of five panicles was expressed as panicle length.

Number of panicle (m²)

The number of panicles from one square metre area were counted at physiological maturity by using quadrant of 1 m × 1 m size and recorded as number of effective panicles m⁻².

Number of grains panicle⁻¹

From the ten selected spikes of wheat, grains were separated, cleaned and counted and the mean value of grains spike⁻¹ was computed.

Unfilled spikelets panicle⁻¹

Total count the spikelet's in the panicles are calculated unfilled spikelet's panicle

1000-grain weight (g)

After threshing and weighing, a random sample of grains was drawn from grain yield of each plot. From this sample of 1,000-grains were counted at random and their weight (g) was recorded.

The field experiment was conducted using a randomized block design (or similar) with treatments T₁ to T₁₁. Standard agronomic practices for rice cultivation were followed. Data on panicle length (cm), number of panicles, grains per

panicle, unfilled spikelets per panicle, and 1000-grain weight (g) were recorded at maturity from representative samples and pooled for analysis.

Statistical analysis included computation of SEM± and CD at 5% to determine significance of treatment differences.

Experimental finding

Pooled panicle length ranged from 19.59 cm (T₈) to 22.46 cm (T₁₁). The highest panicle length was recorded in T₁₁ (22.46 cm), followed by T₂ (22.00 cm) and T₄ (21.92 cm). Treatments T₁₀ (21.59 cm) and T₆ (21.25 cm) also performed well. The lowest values were observed in T₈ (19.59 cm) and T₁ (19.72 cm). The standard error of mean (SEM±) was 1.22 and the critical difference (CD at 5%) was 3.83 (Table 1). Differences between treatments exceeding the CD value were considered statistically significant.

The present investigation revealed significant variations among the treatments for all the yield and yield-attributing characters studied. Pooled panicle length ranged from 19.59 cm (T₈) to 22.46 cm (T₁₁). Although T₁₁ recorded the maximum panicle length, the differences were mostly non-significant as the CD value (3.83 cm) was relatively high compared to the observed variation. This indicates that panicle length was less influenced by the treatments under the present experimental conditions.

Among the yield components, the number of panicles per plant, grains per panicle, and 1000-grain weight showed clear and statistically significant treatment effects. Treatment T₁₁ produced the highest number of panicles (13.64) and grains per panicle (95.11), which were significantly superior to most other treatments as per the CD values (1.65 and 5.15, respectively). Treatment T₁₀ was the second-best performer in these characters and recorded the highest 1000-grain weight (28.4 g).

A notable observation was the higher number of unfilled spikelets per panicle in treatments that recorded higher panicle number and grains per panicle (T₁₁: 13.92 and T₁₀: 13.72). This suggests a possible source-sink imbalance, where the increased sink size (more grains) could not be fully supported by the available assimilates, leading to higher unfilled spikelets. Such a trend is commonly reported in rice when high-yielding treatments create a larger reproductive sink.

Treatments T₇, T₉, and T₁₀ also performed well in terms of 1000-grain weight, indicating better grain filling efficiency. Overall, the results demonstrate that treatments T₁₁ and T₁₀ were most effective in improving the majority of yield components, possibly due to better nutrient management, hormonal balance, or physiological efficiency.

Discussion

The present investigation revealed significant variations in yield attributing characters among the different treatments. Pooled panicle length ranged from 19.59 cm (T₈) to 22.46 cm (T₁₁). Although T₁₁ recorded the highest panicle length, the differences were mostly non-significant as the CD (5%) value (3.83 cm) was relatively high compared to the observed variation. This indicates that panicle length was comparatively less influenced by the treatments.

The number of panicles per plant, grains per panicle, unfilled spikelets per panicle, and 1000-grain weight showed significant treatment effects as evident from their respective CD values. Treatment T₁₁ produced the maximum number of panicles (13.64) and grains per panicle

(95.11), indicating better tillering ability and sink establishment. This was closely followed by T₁₀ and T₈/T₉. The increase in unfilled spikelets per panicle in T₁₁ (13.92) and T₁₀ (13.72) appears to be a consequence of larger sink size (more grains), which might have led to source limitation or incomplete grain filling under the given conditions.

Among the treatments, T₁₀ recorded the highest 1000-grain weight (28.4 g), followed by T₉ (27.8 g) and T₇ (27.3 g). This suggests that these treatments possibly enhanced assimilate translocation and grain development. Treatments showing higher panicle number and grain number (T₁₁ and T₁₀) generally performed better in overall yield components, indicating a positive correlation between these characters.

The results clearly demonstrate that treatments T₁₁ and T₁₀ were superior in most of the yield components studied. The variation in performance may be attributed to the differential effect of the treatments on physiological processes such as

tillering, photosynthesis, nutrient uptake, and partitioning of assimilates.

Table 1: Panicle Length (cm) under Different Treatments

Treatment	Pooled Panicle Length (cm)
T ₁	19.72
T ₂	22.00
T ₃	20.42
T ₄	21.92
T ₅	20.75
T ₆	21.25
T ₇	20.92
T ₈	19.59
T ₉	20.92
T ₁₀	21.59
T ₁₁	22.46
SEM ±	1.22
CD (5%)	3.83

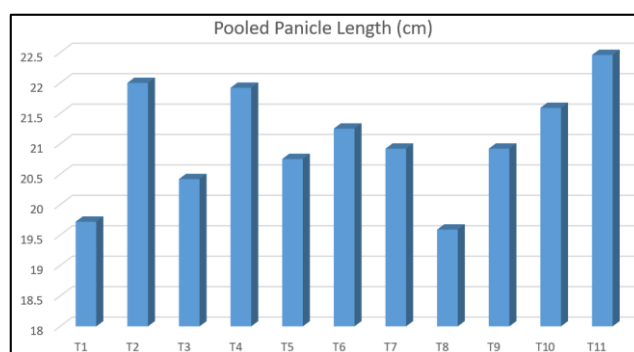


Fig 1: Panicle length

Table 2: Yield Components under Different Treatments

Treatment	No. of Panicles	Grains / Panicle	Unfilled Spikelets / Panicle	1000 Grain Weight (g)
T ₁	10.53	86.17	10.59	24.8
T ₂	10.87	87.43	10.84	25.6
T ₃	10.97	87.54	11.75	26.2
T ₄	11.82	88.67	12.50	26.9
T ₅	11.70	90.17	12.84	25.4
T ₆	11.55	91.11	13.34	26.7
T ₇	12.28	92.05	12.17	27.3
T ₈	12.65	92.83	13.17	26.5
T ₉	12.54	93.19	13.21	26.8
T ₁₀	12.92	94.07	13.72	27.4
T ₁₁	13.64	95.11	13.92	27.8
SEM ±	0.55	1.72	0.64	0.33
CD (5%)	1.65	5.15	1.92	1.04

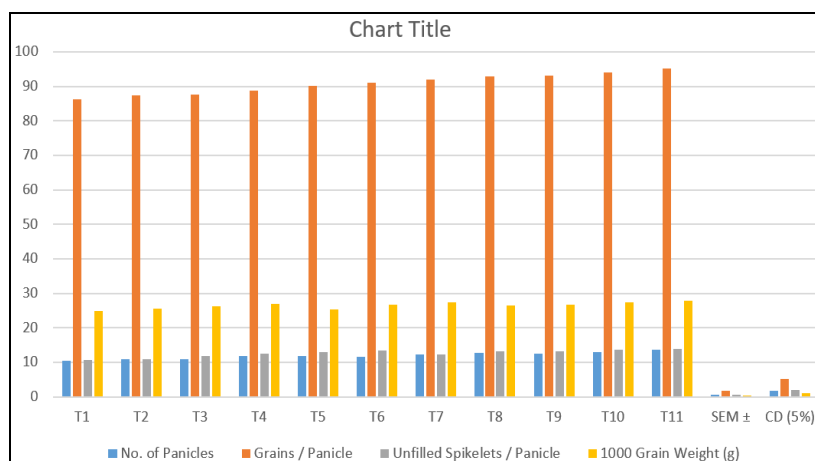


Fig 2: Yield attributes

Summary

- Pooled panicle length was highest in T₁₁ (22.46 cm) followed by T₂ (22.00 cm).
- Treatment T₁₁ recorded the maximum number of panicles (13.64) and grains per panicle (95.11).
- Treatment T₁₀ gave the highest 1000-grain weight (28.4 g) and also performed excellently in other yield attributes.
- Unfilled spikelets were higher in high-yielding treatments (T₁₁ and T₁₀), indicating a larger sink size.
- All characters showed significant treatment effects except panicle length.

Conclusion

On the basis of the present study, it can be concluded that Treatment T₁₁ was the most effective for improving panicle length, number of panicles, and grains per panicle, while Treatment T₁₀ was superior for 1000-grain weight. Both T₁₁ and T₁₀ emerged as the best treatments for enhancing overall yield-attributing characters in the crop. These treatments can be recommended for further large-scale evaluation and adoption by farmers to achieve higher productivity. Further studies are suggested to understand the physiological and biochemical basis of their superior performance.

References

1. Pathak SO, Dhyani BP, Singh O, Singh A, Chaturvedi S, Singh SS, *et al.* Effect of application timing of organic N sources on yield and economics of rice (Pusa Basmati 1509). *Pharma Innov J.* 2021;10(12S):508-510.
2. Chandra MS, Naresh RK, Bhatt R, Kadam PV, Siddiqui MH, *et al.* Conservation tillage and fertiliser management strategies impact on basmati rice (*Oryza sativa* L.): Crop performance, crop water productivity, nutrient uptake and fertility status of the soil under rice-wheat cropping system. *PeerJ.* 2023;11:e16271.
3. Kumawat A, Kumar D, Shivay YS, Yadav D, Sadhukhan R, Gawdiya S, *et al.* Sustainable basmati rice yield and quality enhancement through long-term organic nutrient management in the Indo-Gangetic Plains. *Field Crops Res.* 2024;310:109356.
4. Dhankar A, Tripathi BN, Dhanker R, Pathak RK, Kumar A, Kumar P, *et al.* Integrated effect of nutrient and pesticide management on production and productivity of rice variety Pusa Basmati-1509. *Int J Curr Microbiol Appl Sci.* 2020;9(8):1559-1573.
5. Nautiyal M, Bankoti P. Optimizing NPK uptake in Basmati rice through organic nutrient management across contrasting water management regimes. *Int Res J Multidiscip Stud.* 2025. [Publication details pending].
6. Mahajan G, Gill MS. Performance of basmati rice (*Oryza sativa* L.) through organic source of nutrients. *Indian J Agric Sci.* 2012;82(4):330-333.
7. Yadav K, *et al.* Productivity and profitability of basmati rice (*Oryza sativa* L.) in response to integrated use of organic and inorganic sources of nutrients. *Indian J Agron.* 2015;60(4):610-613.
8. Singh *et al.* Studies on cyanobacterial inoculation, humic acid + poultry manure + nano urea, and integrated nutrient management in transplanted basmati rice. *Int J Curr Microbiol Appl Sci.* 2022-2025