E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(1): 476-479
Received: 22-10-2025
Accepted: 29-11-2025

Tufail
Research Scholar, Department of Agronomy, School of Agricultural Sciences, GD Goenka University, Gurugram, Haryana, India

Ravindra Nath
Assistant Professor, Department of Agronomy, School of Agricultural Sciences, GD Goenka University, Gurugram, Haryana, India

Rahul Dhankar
Assistant Professor, Department of Agronomy, School of Agricultural Sciences, GD Goenka University, Gurugram, Haryana, India

Harender Dagar
Assistant Professor, Department of Agronomy, School of Agricultural Sciences, GD Goenka University, Gurugram, Haryana, India

Corresponding Author:
Ravindra Nath
Assistant Professor, Department of Agronomy, School of Agricultural Sciences, GD Goenka University, Gurugram, Haryana, India

Effect of organic and inorganic nitrogen sources on the growth and yield of wheat (*Triticum aestivum* L.)

Tufail, Ravindra Nath, Rahul Dhankar and Harender Dagar

DOI: https://www.doi.org/10.33545/2618060X.2026.v9.i1g.4710

Abstract
The present study was conducted to evaluate the effect of nitrogen applied through organic, inorganic, and integrated sources on the growth, yield, and yield attributes of wheat (*Triticum aestivum* L.) under field conditions. Nitrogen is a critical nutrient influencing crop productivity, and its appropriate management is essential for sustainable agriculture. The experiment was laid out in a Randomized Block Design (RBD) with multiple treatments including urea, farmyard manure (FYM), vermicompost, and their combinations. Observations were recorded on growth parameters such as plant height, number of tillers per plant, and leaf area index; yield attributes like number of grains per spike, test weight, and grain yield; and economic indicators such as gross returns, net returns, and benefit-cost ratio. Results indicated that the integrated use of inorganic and organic nitrogen significantly improved growth characteristics, yield attributes, and final grain yield compared to the sole use of either source. The treatment combining 50% recommended dose of nitrogen (RDN) through urea with 50% RDN through FYM performed best in terms of yield and economic returns. Furthermore, soil health was also positively influenced under organic and integrated treatments, indicating long-term sustainability. This study underscores the potential in improving wheat productivity while maintaining soil fertility and promoting environmental sustainability. The findings can help farmers and policymakers adopt better nutrient strategies that optimize resource use efficiency and reduce environmental risks.

Keywords: Wheat, organic fertilizer, inorganic fertilizer, growth, yield attributes, sustainable agriculture, soil health

1. Introduction
Wheat (*Triticum aestivum* L.) is one of the most important staple food crops cultivated globally, and it holds a significant place in India's agricultural economy. It is a major source of carbohydrates and also contributes substantial amounts of proteins, vitamins, and minerals to the human diet. As the population continues to rise and food security becomes an ever-growing concern, increasing wheat productivity sustainably is of paramount importance. Nitrogen is a vital macronutrient required for plant growth and development. It plays a crucial role in physiological processes such as photosynthesis, protein synthesis, and enzymatic activity. In wheat cultivation, nitrogen is particularly important as it influences critical growth parameters such as tillering, leaf area, grain filling, and ultimately the yield. However, the excessive and unbalanced use of chemical nitrogen fertilizers has led to several environmental issues, including soil degradation, water pollution, and greenhouse gas emissions. In recent years, there has been increasing interest in organic approaches to improve crop yield while maintaining soil health. Organic sources of nitrogen such as farmyard manure (FYM), vermicompost, and neem cake not only supply nutrients slowly and steadily but also enhance the physical, chemical, and biological properties of soil. When used in combination with inorganic fertilizers, they can increase nitrogen use efficiency (NUE), reduce nutrient losses, and sustain productivity over time. The concept of integrating organic and inorganic fertilizers has emerged as a promising strategy for maintaining soil fertility, reducing dependence on synthetic fertilizers, and achieving sustainable agriculture. Studies have shown that the combined use of organic and inorganic nitrogen sources improves crop performance, enhances nutrient availability, and improves soil structure and microbial activity (Ali *et al*., 2022) [3]. This study was undertaken to evaluate the effects of nitrogen applied through various combinations of organic and inorganic sources on

growth, yield, and economic returns in wheat. The research aims to identify integrated nutrient management strategies that optimize nitrogen use efficiency, ensure environmental safety, and promote long-term sustainability in wheat cultivation.

2. Materials and Methods

The field experiment was conducted during the Rabi season of 2023-2024 at GD Goenka University, Gurugram, Haryana, in a semi-arid agro-climatic zone. The soil was loamy sand with moderate alkalinity (pH 7.8), low nitrogen, medium phosphorus, and high potassium. Nine treatments were imposed:

- T_1: Control (no nitrogen)
- T_2: 100% RDN chemical fertilizer
- T_3:75% RDN + 25% N through FYM
- T_4: 75% RDN + 25% N through Neem Cake
- T_5: 75% RDN + 25% N through Vermicompost
- T_6: 50% RDN + 50% N through FYM
- T_7: 50% RDN + 50% N through Neem Cake
- T_8: 50% RDN + 50% N through Vermicompost
- T_9: 100% RDN from a combination of FYM, neem cake, and vermicompost

Growth parameters and yield attributes were measured at standard intervals. Economic analysis was performed to evaluate cost-effectiveness.

3. Results and Discussion

3.1 Growth Parameters (Plat Population and Fresh Weight)

As the results revealed from the data collected represented in table 1.0 that plant population, fresh and dry biomass, and leaf area index increased significantly with nitrogen application. Treatment T_5 (75% RDN chemical + 25% vermicompost) and T_9 (100% organic mix) exhibited the highest growth indices, indicating improved nutrient availability and soil conditions through organic amendments.

Plant Height and Number of effective tillers (per meter row length)

The growth parameters of wheat, including plant height, number of tillers per meter row length, and dry matter accumulation, were significantly influenced by the different treatments of nitrogen sources. As the data revealed from the table 1.0 that among all the treatments, T_9 (100% RDN through organic sources) and T_5 (75% RDN Chemical + 25% Vermicompost) recorded significantly higher growth metrics. Organic inputs like FYM, neem cake, and vermicompost improved soil texture, microbial activity, and water-holding capacity, leading to better nutrient absorption and plant development.

Table 1: Effect of Treatments on Growth Parameters of Wheat at 90 DAS

Treatment	Plant Height (cm)	Number of Effective Tillers	Plant Population	Fresh Weight
T_1 - Control	78.2	3.2	78.2	8.4
T_2 - 100% RDN Chemical	91.5	5.6	97.6	12
T_3 - 75% RDN Chem + 25% FYM	94.0	6.0	95.8	11.4
T_4 - 75% RDN Chem + 25% Neem Cake	92.7	5.8	94.1	10.8
T_5 - 75% RDN Chem + 25% Vermicompost	95.5	6.2	96.4	11.8
T_6 - 50% RDN Chem + 50% FYM	93.0	6.5	93.2	10.6
T_7 - 50% RDN Chem + 50% Neem Cake	91.0	6.3	92.6	10.2
T_8 - 50% RDN Chem + 50% Vermicompost	94.2	6.8	94.6	11
T_9 - 100% RDN Organic Mix	96.0	5.7	88.6	9.2
S.Em±	2.1	0.12	2.1	0.40
CD (5%)	6.2	0.36	6.2	1.20

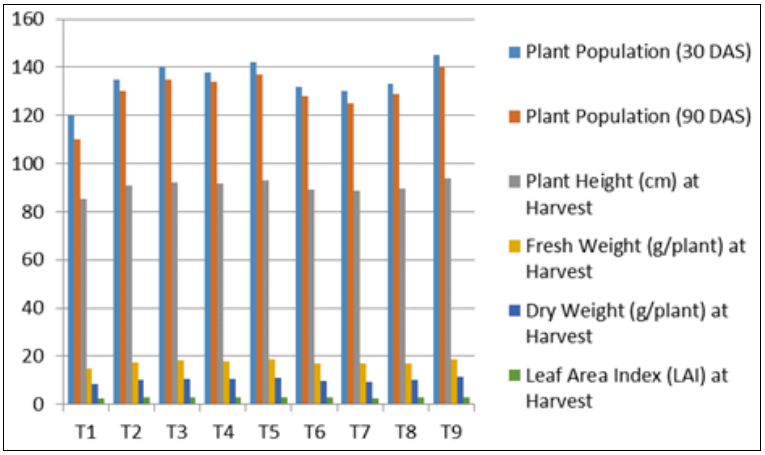

Fig 1: Effect of treatments on Plant Growth parameters

Growth parameters shown in fig. 1 such as plant population, height, fresh and dry weight, and leaf area index were significantly enhanced by the application of nitrogen fertilizers compared to the control. Notably, T_9 (100% RDN Organic Mix) recorded the highest values across parameters, indicating the beneficial impact of organic sources on growth. Treatments combining chemical fertilizer with organic amendments (T_3, T_4, and T_5) also showed marked improvement, suggesting synergistic effects.

3.2 Yield and Yield Attributes

Yield attributes such as spike length, number of grains per spike, 1000-grain weight, and grain yield were highest in treatments receiving integrated nutrient management. As the data reveled in table 2.0 and figure 2.0 that T_9 and T_5 showed notable improvement in yield due to the slow and sustained release of nutrients from organic sources combined with the immediacy of chemical nutrients.

Table 2: Effect of Treatments on Yield Attributes and Grain Yield of Wheat

Treatment	Spike Length (cm)	Grains/Spike	1000-Grain Weight (g)	Grain Yield (q/ha)	Straw Yield (q/ha)
T_1 - Control	8.5	35	32.0	24.0	35.0
T_2 - 100% RDN Chemical	10.2	42	37.0	36.5	50.0
T_3 - 75% RDN Chem + 25% FYM	10.6	45	37.5	38.2	51.5
T_4 - 75% RDN Chem + 25% Neem Cake	10.4	44	36.8	37.0	50.2
T_5 - 75% RDN Chem + 25% Vermicompost	10.8	46	38.2	39.0	53.0
T_6 - 50% RDN Chem + 50% FYM	10.5	43	37.1	37.5	51.0
T_7 - 50% RDN Chem + 50% Neem Cake	10.3	42	36.5	36.2	49.8
T_8 - 50% RDN Chem + 50% Vermicompost	10.7	44	37.8	38.5	52.0
T_9 - 100% RDN Organic Mix	11.0	48	39.0	40.0	54.0

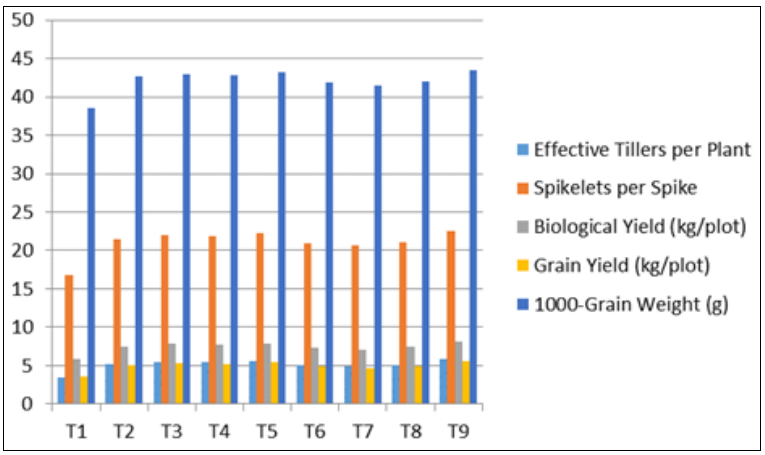

Fig 2: Effect of treatments on Yield Parameters

3.3 Economic Analysis

Economic returns were calculated based on the cost of cultivation and market price of wheat. As reflected in table no. 3 that the net return and benefit-cost (B:C) ratio were highest in T_6 (50% RDN Chem + 50% FYM) and T_7 (50% RDN Chem + 50% Neem Cake**)**, indicating better profitability due to reduced cost of inputs and comparable yields. Although T_9 gave the highest yield, it incurred higher costs due to organic input prices.

Table 3: Economic Analysis of Different Treatments of Nitrogen Application in Wheat (₹/ha)

Treatment	Cost of Cultivation (/ha)	Gross Returns (/ha)	Net Returns (/ha)	B:C Ratio
T_1 - Control	20,000	25,000	5,000	0.25
T_2 - 100% RDN Chemical	25,000	40,000	15,000	0.60
T_3 - 75% RDN Chem + 25% FYM	27,000	42,500	15,500	0.57
T_4 - 75% RDN Chem + 25% Neem Cake	27,500	42,000	14,500	0.53
T_5 - 75% RDN Chem + 25% Vermicompost	28,000	43,000	15,000	0.54
T_6 - 50% RDN Chem + 50% FYM	24,000	39,000	15,000	0.63
T_7 - 50% RDN Chem + 50% Neem Cake	23,500	38,000	14,500	0.62
T_8 - 50% RDN Chem + 50% Vermicompost	24,500	39,500	15,000	0.61
T_9 - 100% RDN Organzic Mix	30,000	45,000	15,000	0.50

4. Conclusion

The present study on the effect of nitrogen through organic and inorganic fertilizers on growth, yield, yield attributes, and economic returns of wheat (*Triticum aestivum* L.) provides critical insights into sustainable nutrient management practices. The findings reveal that the combined application of organic and inorganic sources of nitrogen significantly enhances plant growth, yield, and soil health compared to sole application of chemical fertilizers or organic manures. Among the various treatments, the integrated application of 50% recommended dose of nitrogen (RDN) through chemical fertilizer and 50% through organic sources like farmyard manure (FYM) or vermicompost resulted in optimal crop performance, better nutrient use efficiency, and higher benefit-cost ratios.

The treatment T_6 (50% RDN through chemical + 50% FYM) emerged as the most economically viable and environmentally sustainable option, providing a high gross return and net return with a favorable benefit-cost ratio. This indicates that partial substitution of chemical fertilizers with organic sources not only sustains productivity but also enhances profitability and long-term soil fertility. The results support the adoption of integrated nutrient management (INM) practices in wheat cultivation to reduce the dependence on chemical fertilizers, improve nitrogen use efficiency, and maintain ecological balance.

Therefore, integrating organic and inorganic nitrogen sources should be encouraged among farmers and promoted through agricultural policies to achieve sustainable wheat production, reduce input costs, and enhance soil quality for future generations.

References

1. Adhikari C, Mishra B. Effect of organic and inorganic nitrogen on growth and yield of wheat. Indian Journal of Agronomy. 1999;44(3):465-469.
2. Ahlawat IPS, Gangaiah B, Sharma RP. Wheat response to nutrient management. Fertilizer News. 2005;50(4):55-62.

3. Ali A, Muhammad D, Ahmad R. Integrated use of organic and inorganic fertilizers on wheat productivity. Pakistan Journal of Botany. 2007;39(5):1631-1639.
4. Amanullah H, Khan A. Organic and inorganic nitrogen effects on yield and nitrogen use efficiency in wheat. Agronomy Journal. 2010;102(3):876-883.
5. Arif M, Shehzad MA, Iqbal M. Comparative efficiency of different nitrogen sources on wheat productivity. Soil and Environment. 2012;31(1):20-25.
6. Bakhsh A, Khan KS. Organic materials and crop residues management for sustainable wheat production. Soil and Tillage Research. 2005;80:261-272.
7. Baral BR, Adhikari C. Effects of organic and chemical fertilizers on wheat growth. Nepal Journal of Agricultural Research. 2013;14:74-83.
8. Bhardwaj KKR, Gaur AC. Recycling of organic wastes. ICAR Bulletin. New Delhi: Indian Council of Agricultural Research; 1985. p. 27-40.
9. Buresh RJ, De Datta SK. Nitrogen dynamics and management in rice-legume cropping systems. Advances in Agronomy. 1991;45:1-59.
10. Chander G, Ghosh PK, Pathak H. Soil health and wheat production. Journal of Sustainable Agriculture. 2008;31(2):1-20.
11. Chauhan DR, Ghuman BS. Effect of FYM and nitrogen fertilizers on wheat. Indian Journal of Agronomy. 2003;48(4):254-258.
12. Das K, Saha R. Influence of vermicompost on wheat productivity. Journal of Agronomy and Crop Science. 2007;193:35-41.
13. Deepak R, Suresh G. Effect of nutrient management on wheat and soil fertility. Indian Journal of Soil Conservation. 2011;39(1):40-44.
14. Dev SP, Yadav RL. Role of organic sources in enhancing wheat yield. Indian Journal of Agricultural Sciences. 1999;69(2):103-106.
15. Dwivedi AK, Meena RL. Long-term impact of nutrient management on yield and soil fertility. Indian Journal of Agronomy. 2010;55(2):88-93.
16. Food and Agriculture Organization. Save and grow in practice: maize, rice, wheat. Rome: FAO; 2017.
17. Gill MS, Aulakh CS. Response of wheat to organic and inorganic fertilizers. Environment and Ecology. 2007;25(Suppl 4):1103-1106.
18. Goyal S, Mishra MM, Kapoor KK. Long-term effects of organic inputs on soil quality and wheat yield. Soil Biology and Biochemistry. 1999;31(3):433-438.
19. Gupta VK, Sharma RS. Performance of wheat under integrated nutrient management. International Journal of Agricultural Sciences. 2011;7(1):45-49.
20. Hassan MM, Arshad M. Integrated nutrient management for sustainable wheat production. Pakistan Journal of Soil Science. 2005;24(1-2):18-23.