

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(7): 796-800
www.biochemjournal.com
Received: 08-04-2026
Accepted: 12-05-2026

Kunti Banjare
Assistant Professor,
Department of Horticulture,
Revendra Singh Verma Collage
of Agriculture and Research
Station, Bhatapara,
Chhattisgarh, India

Dr. Neeraj Shukla
Professor, Department of
Vegetable Science, Indira
Gandhi Krishi
Vishwavidyalaya, Raipur,
Chhattisgarh, India

Dr. Annu Verma
Professor, Department of
Vegetable Science, Indira
Gandhi Krishi
Vishwavidyalaya, Raipur,
Chhattisgarh, India

Dr. Deo Shankar
Professor, Department of
Vegetable Science, Indira
Gandhi Krishi
Vishwavidyalaya, Raipur,
Chhattisgarh, India

Dr. Hemlata Nirala
Assistant Professor,
Department of Agronomy,
Revendra Singh Verma Collage
of Agriculture and Research
Station, Bhatapara,
Chhattisgarh, India

Dr. Praveen Gupta
Guest Scientist, Department of
Horticulture, Dau Kalyan
Singh Collage of Agriculture
and Research Station,
Bhatapara, Chhattisgarh,
India

Corresponding Author:
Kunti Banjare
Assistant Professor,
Department of Horticulture,
Revendra Singh Verma Collage
of Agriculture and Research
Station, Bhatapara,
Chhattisgarh, India

Effect of integrated nutrient management on economics of tomato cultivation

Kunti Banjare, Neeraj Shukla, Annu Verma, Deo Shankar, Hemlata Nirala and Praveen Gupta

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i7Sj.9113>

Abstract

A field experiment was conducted during the Rabi seasons of 2023-24 and 2024-25 at the Horticultural Research-cum-Instructional Farm, RSV-CARS, Bemetara, Chhattisgarh, to evaluate the effect of integrated nutrient management (INM) on the economics of tomato (*Solanum lycopersicum* L.) cultivation. The experiment was laid out in a Randomized Block Design with eight nutrient management treatments and three replications using the cultivar 'Kashi Aman'. Economic parameters, including cost of cultivation, gross return, net return, and benefit-cost (B:C) ratio, were evaluated. The highest cost of cultivation (Rs. 196,496 ha⁻¹) was recorded with 75% RDF + 6 t ha⁻¹ FYM, whereas the lowest (Rs. 110,731 ha⁻¹) was observed in the control. The maximum gross return (Rs. 548,915 ha⁻¹) and net return (Rs. 402,154 ha⁻¹) were obtained with 100% RDF. However, the highest B:C ratio (3.82) was recorded with 75% RDF, followed by 100% RDF (3.74). The study indicates that 100% RDF maximized profitability, while 75% RDF provided the highest economic efficiency, making both treatments suitable nutrient management options for sustainable tomato cultivation.

Keywords: Tomato, INM, RDF, economics, B:C ratio

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most widely cultivated vegetable crops in the world because of its high nutritional value, adaptability, and substantial contribution to agricultural economies and human nutrition (Li *et al.*, 2025) [8]. Globally, tomato production has expanded considerably due to increasing consumer demand for fresh vegetables and processed products rich in vitamins, minerals, lycopene, and other bioactive compounds (FAOSTAT, 2024) [3].

In India, tomato is an important commercial vegetable crop that provides employment and income to millions of farmers, but its productivity and profitability are often constrained by poor soil fertility and imbalanced nutrient management practices (Verma *et al.*, 2025) [11]. The continuous dependence on chemical fertilizers alone has resulted in declining soil organic matter, nutrient imbalances, reduced nutrient-use efficiency, and environmental degradation, thereby threatening the sustainability of intensive vegetable production systems (Gourkhede *et al.*, 2026) [5].

Integrated Nutrient Management (INM), which combines inorganic fertilizers with organic manures and beneficial microorganisms, has been recognized as an effective strategy for maintaining soil fertility while improving crop productivity and environmental sustainability (Muradi *et al.*, 2026) [9]. The integrated use of farmyard manure, vermicompost, biofertilizers, and recommended doses of fertilizers improves soil physical, chemical, and biological properties, resulting in enhanced nutrient availability and uptake by tomato plants (Singh *et al.*, 2023) [10]. Several field investigations have demonstrated that INM significantly improves vegetative growth, fruit yield, fruit quality, and nutrient-use efficiency compared with the sole application of inorganic fertilizers (Kushum *et al.*, 2022) [7]. Economic analysis has become an indispensable component of nutrient management research because farmers readily adopt technologies that maximize net returns while minimizing production costs (Dass *et al.*, 2008) [2]. Recent studies have further shown that integrating recommended fertilizer doses with vermicompost and biofertilizers enhances gross returns, net returns, and benefit-cost ratio, making INM an economically viable option for sustainable tomato

production (Barman *et al.*, 2024) ^[1]. Therefore, evaluating the effect of integrated nutrient management on the economics of tomato cultivation is essential for identifying profitable and sustainable nutrient management strategies that can improve farmers' income while conserving soil health under diverse agro-climatic conditions (Jaiswal *et al.*, 2026) ^[6].

Materials and Methods

A field experiment was conducted during the Rabi seasons of 2023-24 and 2024-25 at the Horticultural Research-cum-Instructional Farm, RSV CARS, Bemetara, Chhattisgarh, India. The experimental site is situated in the Chhattisgarh Plains agro-climatic zone and experiences a subtropical climate characterized by hot summers, moderate rainfall during the monsoon season, and cool winters. The soil of the experimental field was representative of the region and suitable for tomato cultivation. Standard agronomic and plant protection practices recommended for tomato cultivation were followed uniformly in all the treatments throughout the experimental period.

The experiment was conducted using tomato (*Solanum lycopersicum* L.) variety 'Kashi Aman'. The trial was laid out in a Randomized Block Design (RBD) with eight treatments and three replications, comprising a total of 24 experimental plots. The crop was transplanted at a spacing of 90 cm × 60 cm. The recommended dose of fertilizers (RDF) for tomato was 120:100:80 kg N:P₂O₅:K₂O ha⁻¹. The treatments consisted of different levels of inorganic fertilizers alone and in combination with organic nutrient sources as follows: T₁: Control (Without RDF), T₂: 50% RDF, T₃: 75% RDF, T₄: 100% RDF, T₅: 50% RDF + FYM @ 12 t ha⁻¹, T₆: 75% RDF + FYM @ 6 t ha⁻¹, T₇: 50% RDF + Vermicompost @ 6 t ha⁻¹ and T₈: 75% RDF + Vermicompost @ 3 t ha⁻¹. Farmyard manure (FYM) and vermicompost were incorporated uniformly into the soil approximately 15 days before transplanting. Phosphorus and potassium were applied as basal doses at the time of transplanting, while nitrogen was applied in three equal splits: one-third as basal and the remaining two-thirds at 30 and 60 days after transplanting (DAT).

The economics of tomato cultivation under different integrated nutrient management treatments was assessed using the prevailing market prices of inputs and produce during the respective crop seasons. The following economic parameters were calculated:

Cost of cultivation (Rs ha⁻¹): Total expenditure incurred on land preparation, seedlings, fertilizers, organic manures, labour, irrigation, plant protection chemicals, harvesting, and other cultivation operations.

Gross return (Rs ha⁻¹): Calculated by multiplying fruit yield with the prevailing market price of tomato.

Net return (Rs ha⁻¹): Obtained by subtracting the total cost of cultivation from the gross return.

The recorded data from both years were subjected to analysis of variance (ANOVA) appropriate for the Randomized Block Design (RBD). Treatment means were compared using the Least Significant Difference (LSD) test at the 5% probability level ($p \leq 0.05$) as described by Gomez and Gomez (1984) ^[4]. Pooled analysis over the two

years was performed after testing the homogeneity of error variances to determine the overall treatment effects.

Results and Discussion

Cost of cultivation (Rs/ha)

The data presented in Table 1 and Fig 2 indicated that the cost of cultivation varied considerably among the different integrated nutrient management treatments due to differences in the quantity and type of nutrient inputs applied during the two years of experimentation. Among the treatments, the lowest cost of cultivation was recorded under T₁ (Control without RDF), amounting to 109,231 Rs/ha during 2023-24, 112,231 Rs/ha during 2024-25 and 110,731 Rs/ha in the pooled analysis. This was followed by T₂ (50% RDF) with pooled cultivation cost of 119,996 Rs/ha, and T₃ (75% RDF) with 122,879 Rs/ha. The application of the recommended dose of fertilizers (T₄: 100% RDF) increased the cultivation cost to 146,761 Rs/ha in 2023-24 and 149,761 Rs/ha in 2024-25, with a pooled mean of 148,261 Rs/ha. The increase in cost was mainly due to the higher quantity of chemical fertilizers applied compared to the lower RDF treatments. The treatments involving the integration of inorganic fertilizers with organic manures recorded comparatively higher cultivation costs. Among these, the highest cost of cultivation was observed under T₆ (75% RDF + 6 t ha⁻¹ FYM), with 182,996 Rs/ha during 2023-24, 209,996 Rs/ha during 2024-25 and a pooled mean of 196,496 Rs/ha.

Gross return (Rs/ha)

Gross return varied considerably among different fertility treatments is presented in Table 1 and Fig 2. The highest gross return was recorded under T₄ (100% RDF) (547640, 550190 and 548915 Rs/ha during 2023-24, 2024-25 and pooled data, respectively), which was superior over all other treatments. It was followed by T₈ (75% RDF + 3 t/ha vermicompost) (534470, 530960 and 532715 Rs/ha, respectively) and T₆ (75% RDF + 6 t/ha FYM) (500370, 529490 and 514930 Rs/ha, respectively). The lowest gross return was recorded under T₁ (control) (149865 Rs/ha pooled). The higher gross return under 100% RDF might be attributed to higher yield obtained due to balanced and adequate nutrient supply, resulting in better growth and productivity of the crop. These findings are in close conformity with the results of Singh *et al.* (2023) ^[10], who reported higher gross returns under integrated nutrient management practices.

Net return (Rs/ha)

Net return also differed among various treatments and presented in Table 1 and Fig 3. The maximum net return was recorded under T₄ (100% RDF) (400879, 403429 and 402154 Rs/ha, respectively), which was significantly higher than other treatments. It was followed by T₈ (75% RDF) (344224, 340714 and 342469 Rs/ha, respectively). The lowest net return was observed under T₁ (control) (40634 Rs/ha pooled). The increased net return under higher fertility levels might be due to higher yield and better economic efficiency, which outweighed the cost of inputs. These findings are in agreement with Meena *et al.* (2016) ^[11], who also reported higher net returns with balanced fertilization practices.

Benefit-cost ratio (B:C Ratio)

The benefit-cost ratio varied among treatments is presented in Table 1 and Fig 4. The highest B:C ratio was recorded under T₃ (100% RDF) (3.82, 3.82 and 3.82, respectively), followed by T₄ (75% RDF) (3.73, 3.75 and 3.74, respectively) and T₈ (75% RDF + 3 t/ha vermicompost) (2.81, 2.79 and 2.80, respectively). The lowest B:C ratio was recorded under T₁ (control) (1.37 in pooled).

The higher B:C ratio under 100% RDF might be due to higher yield and relatively lower cost compared to treatments involving higher quantities of organic inputs. Although integrated treatments improved yield, the higher cost of FYM and vermicompost reduced the B:C ratio. These findings are in close conformity with Singh *et al.* (2023) ^[10], who also reported higher economic returns and B:C ratio under optimum fertilizer application.

Table 1: Effect of integrated nutrient management on economics of different treatments of tomato.

Treatment	Cost of Cultivation (Rs/ha)			Gross Return (Rs/ha)			Net Return (Rs/ha)			B-C ratio		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
T ₁ : Control (Without RDF)	109231	112231	110731	147810	151920	149865	38579	42689	40634	1.35	1.39	1.37
T ₂ : 50% RDF	114996	124996	119996	302700	322890	312795	187704	207894	197799	2.63	2.81	2.72
T ₃ : 75% RDF	117879	127879	122879	449770	449950	449860	331891	332071	331981	3.82	3.82	3.82
T ₄ : 100% RDF	146761	149761	148261	547640	550190	548915	400879	403429	402154	3.73	3.75	3.74
T ₅ : 50% RDF + 12 t/ha FYM	179496	199496	189496	477120	481220	479170	297624	301724	299674	2.66	2.68	2.67
T ₆ : 75% RDF + 6 t/ha FYM	182996	209996	196496	500370	529490	514930	317374	346494	331934	2.73	2.89	2.81
T ₇ : 50% RDF + 6 t/ha Vermicompost	187746	199746	193746	497780	487720	492750	310034	299974	305004	2.65	2.60	2.62
T ₈ : 75% RDF + 3 t/ha Vermicompost	190246	200246	195246	534470	530960	532715	344224	340714	342469	2.81	2.79	2.80

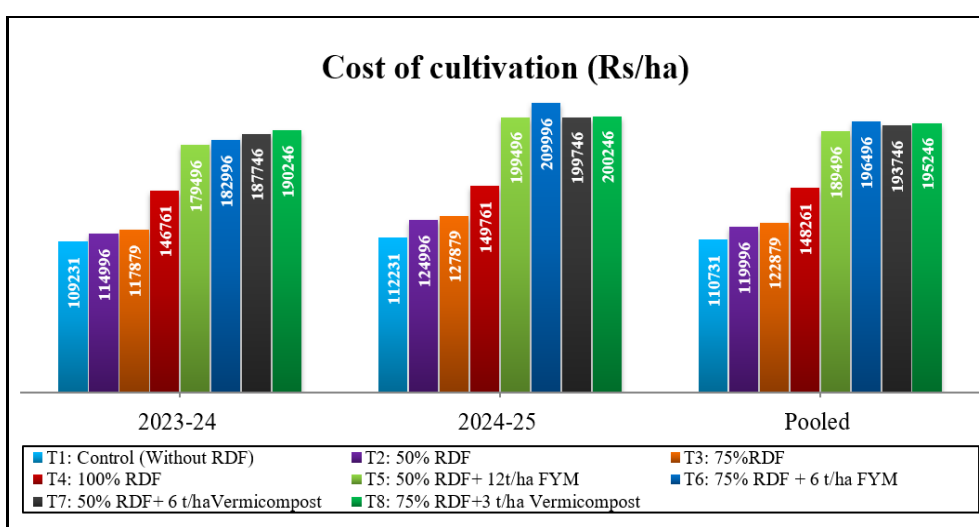


Fig 1: Effect of integrated nutrient management on cost of cultivation of tomato.

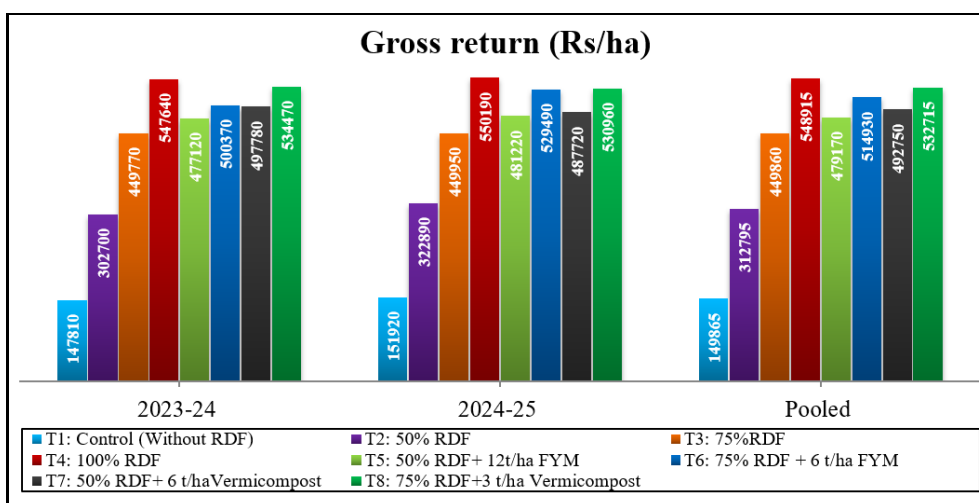


Fig 2: Effect of integrated nutrient management on gross return of tomato.

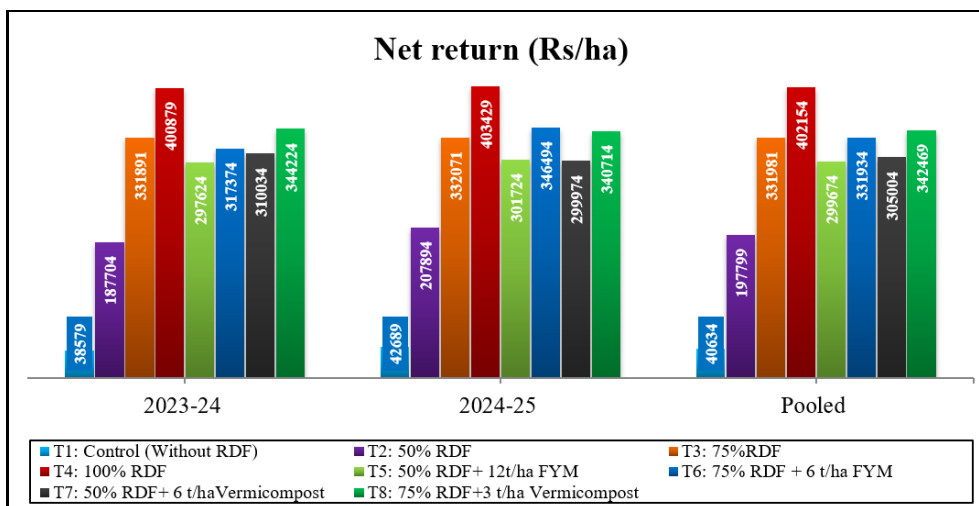


Fig 3: Effect of integrated nutrient management on net return of tomato.

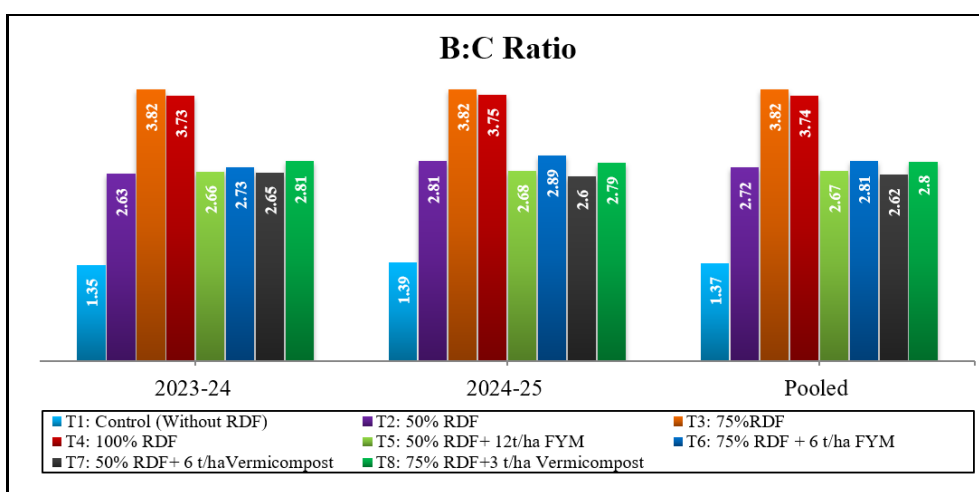


Fig 4: Effect of integrated nutrient management on b:c ratio of tomato.

Conclusion

The present investigation revealed that integrated nutrient management practices significantly influenced the economics of tomato cultivation. Among the different nutrient management treatments, 100% recommended dose of fertilizers (RDF) proved to be the most profitable by recording the highest gross return (₹548,915 ha⁻¹) and net return (₹402,154 ha⁻¹) in the pooled analysis of two years. Although the integration of farmyard manure and vermicompost with reduced fertilizer levels enhanced economic returns over the control, the higher cost associated with organic manure application increased the overall cost of cultivation, thereby reducing the benefit-cost ratio. The 75% RDF treatment recorded the highest benefit-cost ratio (3.82), indicating superior economic efficiency due to its lower production cost while maintaining comparatively high returns. The findings suggest that balanced nutrient management is essential for maximizing profitability in tomato production. Therefore, 100% RDF may be recommended where the primary objective is to maximize gross and net income, whereas 75% RDF offers the highest economic efficiency and may be preferred under resource-limited conditions. Further long-term studies integrating organic nutrient sources with balanced fertilizer application are needed to improve soil health, sustain productivity, and enhance the profitability of tomato cultivation under diverse agro-climatic conditions.

References

- Barman GD, Trivedi J, Sharma D, Gupta P, Xalxo VJ, Dubey R, *et al.* Effect of integrated nutrient management on economics of tomato. *International Journal of Advanced Biochemistry Research*. 2024;8(1S):34-37.
- Dass A, Lenka NK, Sudhishri S, Patnaik US. Influence of integrated nutrient management on production, economics and soil properties in tomato (*Lycopersicon esculentum*) under on-farm conditions in eastern Ghats of Orissa. *Indian Journal of Agricultural Sciences*. 2008;78(1):40-43.
- FAOSTAT. Crops and livestock products [Internet]. 2024. Available from: <https://www.fao.org/faostat/>
- Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. New York: John Wiley & Sons; 1984.
- Gourkhede PH, Gore AK, Patil MG. Long-term organic nutrient management in tomato enhances yield, quality, profitability, and soil health in semi-arid conditions. *Scientific Reports*. 2026;16:11133.
- Jaiswal AK, Kunjam K, Samrath R, Sao R, Kerketta A, Verman V. Effect of integrated nutrient management on yield and economics of tomato (*Solanum lycopersicum* L.) under central plains of Chhattisgarh. *International Journal of Research in Agronomy*. 2026;9(2):115-120.

7. Kushum S, Singh D, Deepanshu. Effect of integrated nutrient management on the growth, yield and quality in tomato (*Solanum lycopersicum* L.). International Journal of Environment and Climate Change. 2022;12(11):2802-2811.
8. Li Y, Zhang R, Zhang C, Li Q, Nie L, Wang C, *et al.* Integrative approaches to nutrient management in tomato cultivation for improved sustainability and productivity. Frontiers in Plant Science. 2025;16:1626136.
9. Muradi KB, Chaithra BS, Suresh K. Sustainable integrated nutrient management in horticultural and vegetable crops: Mechanisms, innovations, and global food security: A review. International Journal of Research in Agronomy. 2026;9(3):527-542.
10. Singh DP, Maurya BK, Kumari M, Singh RP, Singh DB, Kumar P. Response of integrated nutrient management on growth and yield attributes in tomato (*Solanum lycopersicum* L.). Annals of Agricultural Research. 2023;44(1):120-126.
11. Verma NK, Meena DC, Sharma MM, Kumar M. Effect of integrated nutrient management on growth, yield and quality of tomato (*Solanum lycopersicum* L.). Journal of Advances in Biology & Biotechnology. 2025;28(6):1028-1035.