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Effect of integrated nutrient management on growth, yield and quality of broccoli (*Brassica oleracea* var. *italica* L.) cv. Palam Samridhi

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Abstract

A field experiment was conducted to study the effect of integrated nutrient management (INM) on growth, yield, and quality of broccoli cv. Palam Samridhi during the 2025-26 rabi season at the Agriculture Research Farm, Rama University, Kanpur. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 11 treatments and three replications. Treatments consisted of various combinations of recommended dose of fertilizers (RDF: 100-50-50 NPK kg/ha), FYM, vermicompost, and poultry manure. The treatment T7 (75% RDF + 5 t vermicompost + 5 t poultry manure) recorded significantly superior results for most growth, yield, and quality parameters, including maximum plant height, stalk length and diameter, plant spread, head diameter, head weight, head yield (20.88 t/ha), TSS, ascorbic acid content, dry matter, and the highest benefit-cost ratio (2.04). The study concluded that integration of 75% RDF with organic sources optimizes productivity and quality while improving economic returns.

Keywords: Integrated Nutrient Management (INM), Broccoli (*Brassica oleracea* var. *italica* L.), Vermicompost

Introduction

Broccoli (*Brassica oleracea* var. *italica* L.) is a highly nutritious cole crop belonging to the Brassicaceae family. It is rich in vitamins (A, C), minerals, antioxidants, and sulforaphane, which has anti-cancer properties. In India, broccoli cultivation is gaining popularity due to its nutritional and commercial value, particularly in cooler regions and during the *rabi* season. Globally, broccoli and cauliflower production reached approximately 27 million tonnes in 2025. China and India are the leading producers, together accounting for nearly 75-77% of world production. China ranks first with about 9.7 million tonnes, while India stands second with around 9.5–9.6 million tonnes annually. In India, broccoli is mainly cultivated in states like Uttar Pradesh, Himachal Pradesh, Tamil Nadu, and the Nilgiri Hills. Uttar Pradesh is one of the major contributors to vegetable production in the country, including broccoli, owing to its favourable agro-climatic conditions during the *rabi* season. Nutrient management is critical for broccoli as it is a heavy feeder crop. Integrated Nutrient Management (INM), which combines inorganic fertilizers with organic manures such as FYM, vermicompost, and poultry manure, improves soil health, nutrient use efficiency, yield, and quality while reducing environmental impact. The present study was undertaken to evaluate the effect of different INM practices on growth, yield, and quality of broccoli cv. Palam

Samridhi and to assess their economic feasibility.

Materials and Methods

The present investigation was conducted at the Agriculture Research Farm, Faculty of Agriculture and Allied Industries, Rama University, Kanpur, Uttar Pradesh during the *rabi* season of 2025-26. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 11 treatments and three replications. Plot size was 3.6 m × 4.05 m. Thirty-day-old seedlings of broccoli cv. Palam Samridhi were transplanted at appropriate spacing. Standard cultural practices (irrigation, weeding, and plant protection) were followed. Nutrients were applied as per the treatments. Thirteen quantitative traits were recorded. The experiment consisted of eleven treatments with different combinations of inorganic fertilizers and organic manures. The details of treatments are: T₁ was the control (no fertilizer), T₂ received the recommended dose of fertilizers (RDF) at 100:50:50 NPK kg/ha, T₃ received 15 tonnes of farm yard manure (FYM) per hectare, T₄ received 5 tonnes of vermicompost per hectare, T₅ received 5 tonnes of poultry manure per hectare, T₆ consisted of 75% RDF + 15 t FYM/ha, T₇ comprised 75% RDF + 5 t vermicompost + 5 t poultry manure per hectare, T₈ included 75% RDF + 5 t poultry manure per hectare, T₉ was 50% RDF + 15 t FYM/ha, T₁₀ was 50% RDF + 5 t vermicompost per hectare, and T₁₁ was

50% RDF + 5 t poultry manure per hectare.

Results and Discussion

Effect of INM on Growth Parameters

The treatment T₇ (75% RDF + 5 t vermicompost + 5 t poultry manure) recorded significantly maximum plant height at 45 DAT (41.22 cm) and 60 DAT (52.56 cm). This improvement may be attributed to balanced and sustained supply of nutrients from the combination of inorganic fertilizers and organic manures, which enhanced vegetative growth through improved nutrient availability and soil microbial activity. The treatment T₇ (75% RDF + 5 t vermicompost + 5 t poultry manure) recorded significantly maximum plant height at 45 DAT (41.22 cm) and 60 DAT (52.56 cm). This treatment also produced superior stalk length (25.64 cm), stalk diameter (6.12 cm), and plant

spread (65.32 cm). This enhanced vegetative growth may be attributed to the balanced and sustained supply of macro and micronutrients along with improved soil physical and biological properties due to the integration of inorganic fertilizers with organic manures. These findings are in agreement with Singh *et al.* (2018) ^[8], who reported significant improvement in plant height and vegetative growth of broccoli with combined application of 75% RDF and vermicompost. Similar results were also observed by Kumar and Verma (2020) ^[11] and Sharma *et al.* (2022) ^[6], who found that integrated use of organic and inorganic sources resulted in better cell division and elongation due to continuous nutrient availability.

Effect of INM on Growth Parameters

Table 1: Effect of INM on Plant Height of Broccoli at 45 and 60 DAT

Treatment	45 DAT	60 DAT
T ₁	29.65	43.68
T ₂	39.68	49.68
T ₃	35.78	46.88
T ₄	35.08	46.32
T ₅	33.46	45.60
T ₆	41.04	51.82
T ₇	41.22	52.56
T ₈	40.45	50.38
T ₉	38.65	49.12
T ₁₀	36.88	48.78
T ₁₁	36.12	47.64
CD (5%)	3.77	1.28
SEm (±)	4.90	1.66

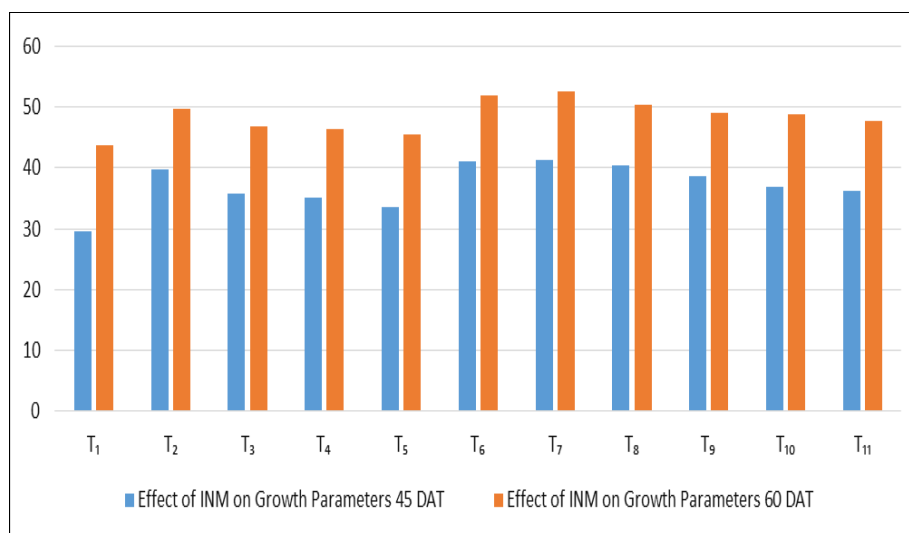


Fig 1: Effect of INM on Growth Parameters

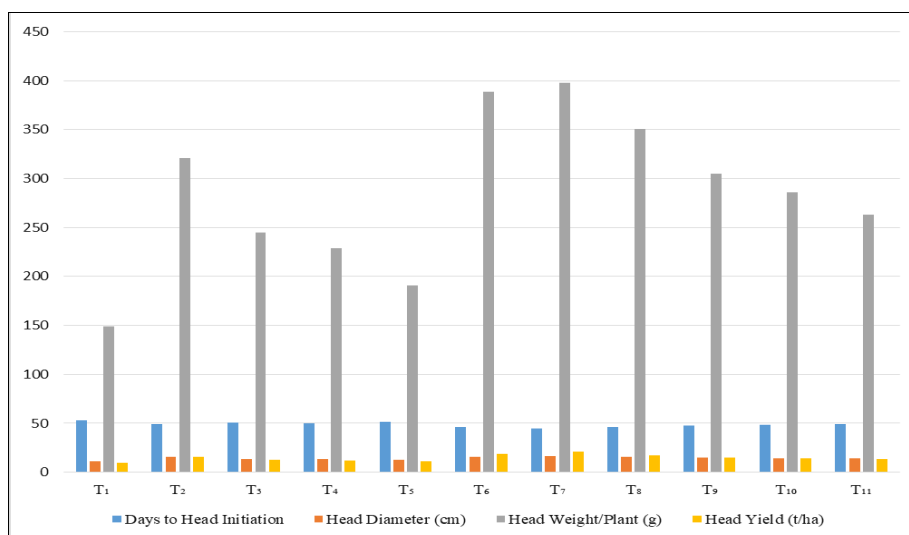
Effect of INM on Yield and Yield Attributes of Broccoli

The treatment T₇ produced the highest head yield (20.88 t/ha), which was significantly superior to all other treatments. It also recorded the earliest head initiation (44.68 days), maximum head diameter (16.54 cm), and highest head weight per plant (398.12 g). The increase in yield attributes under T₇ may be due to improved nutrient uptake, better photosynthetic efficiency, and enhanced

translocation of assimilates towards the developing heads. These results are supported by Kumar *et al.* (2019) ^[2], who reported maximum curd/head yield in broccoli with 75% RDF + vermicompost + poultry manure. Meena *et al.* (2021) ^[3] and Yadav *et al.* (2023) ^[11] also observed significant improvement in head size and yield under integrated nutrient management practices in cole crops.

Table 2: Yield Attributes and Yield as Influenced by INM Treatments

Treatment	Days to Head Initiation	Head Diameter (cm)	Head Weight/Plant (g)	Head Yield (t/ha)
T ₁	53.32	11.32	148.82	9.64
T ₂	49.24	15.54	320.85	15.94
T ₃	50.68	13.68	244.78	12.84
T ₄	50.12	13.24	228.65	11.96
T ₅	51.48	12.98	190.48	10.88
T ₆	45.88	16.06	388.56	18.62
T ₇	44.68	16.54	398.12	20.88
T ₈	46.12	15.88	350.48	17.24
T ₉	47.84	14.96	304.95	14.62
T ₁₀	48.42	14.56	286.15	13.88
T ₁₁	48.94	14.14	262.95	13.12
CD (5%)	1.84	1.47	29.99	1.26
SEm (±)	0.62	0.51	9.94	0.42

**Fig 2:** Effect of INM on Yield and Yield Attributes of Broccoli

Effect of INM on Quality Parameters.

The treatment T₇ recorded the highest TSS (7.56 °Brix), ascorbic acid content (79.84 mg/100 g), and dry matter content (8.98%). Improvement in quality parameters under T₇ might be due to slow and steady release of nutrients from organic sources, which helped in better assimilation of metabolites and reduced nitrate accumulation in the

heads. These findings are in conformity with Sharma and Sharma (2020) ^[5], who reported higher TSS and ascorbic acid content in broccoli under INM. Similar observations were made by Singh *et al.* (2021) ^[10] and Patel *et al.* (2022) ^[4], who emphasized the role of organic manures in enhancing nutritional quality of cole crops.

Table 3: Effect of INM Treatments on TSS, Ascorbic Acid Content and Dry Matter Percentage

Treatment	TSS (°Brix)	Ascorbic Acid (mg/100 g)	Dry Matter (%)
T ₁	5.92	76.65	4.98
T ₂	6.88	79.24	7.78
T ₃	6.42	78.12	6.52
T ₄	6.28	77.94	6.38
T ₅	6.12	77.46	5.54
T ₆	7.34	79.64	8.64
T ₇	7.56	79.84	8.98
T ₈	7.18	79.52	8.52
T ₉	6.84	78.86	7.44
T ₁₀	6.68	78.54	7.14
T ₁₁	6.54	78.22	6.86
CD (5%)	0.42	1.18	0.73
SEm (±)	0.14	0.39	0.26

Effect of INM on Economics of Broccoli

The treatment T₇ recorded the highest benefit-cost ratio (2.04) followed by T₆ (1.92). Higher economic returns were

mainly due to significantly higher marketable yield with a moderate increase in the cost of cultivation. These results indicate that the integration of 75% RDF with

vermicompost and poultry manure is not only agronomically superior but also economically viable. The findings are in agreement with Singh *et al.* (2019)^[9], Kumar *et al.* (2020)^[1], and Sharma and Verma (2021)^[7], who reported higher

benefit-cost ratio and better economic returns in broccoli and other cole crops under integrated nutrient management involving organic manures and reduced chemical fertilizers.

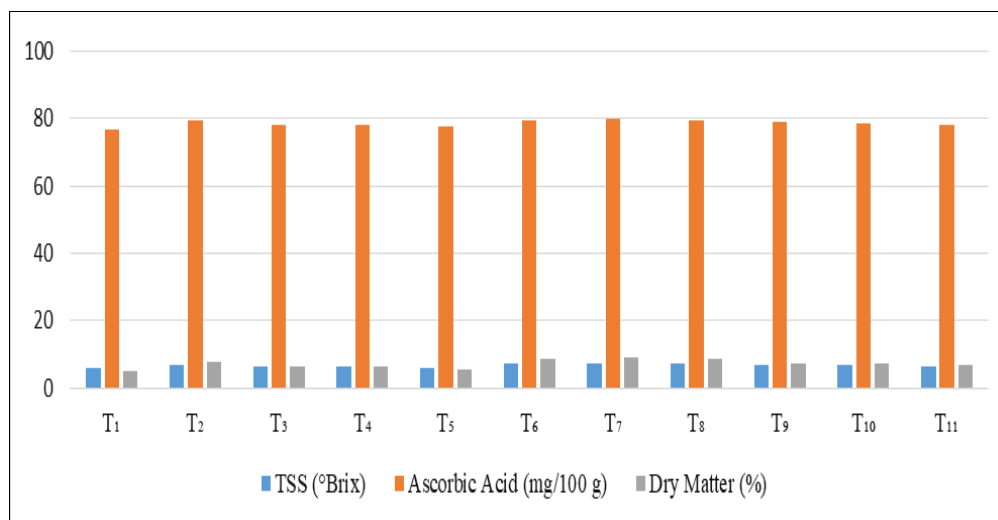


Fig 3: Effect of INM on Quality Parameters

Table 4: Effect of INM Treatments on Cost of Cultivation, Returns and Benefit-Cost Ratio

Treatment	Cost of Cultivation (₹/ha)	Gross Return (₹/ha)	Net Return (₹/ha)	B:C Ratio
T ₁	85,000	78,200	-6,800	0.92
T ₂	95,500	157,575	62,075	1.65
T ₃	110,200	125,700	15,500	1.14
T ₄	118,400	127,872	9,472	1.08
T ₅	105,800	107,916	2,116	1.02
T ₆	120,500	231,360	110,860	1.92
T ₇	128,000	261,120	133,120	2.04
T ₈	115,000	204,700	89,700	1.78
T ₉	112,400	166,488	54,088	1.48
T ₁₀	117,800	146,072	28,272	1.24
T ₁₁	109,500	129,210	19,710	1.18

Conclusion

The present investigation clearly demonstrated that integrated nutrient management significantly influenced growth, yield, quality, and economics of broccoli. Among all treatments, T₇ (75% RDF + 5 t vermicompost + 5 t poultry manure) proved to be the most effective for achieving higher productivity, better quality, and maximum economic returns. Therefore, this INM practice may be recommended for commercial broccoli cultivation under subtropical conditions of Uttar Pradesh.

References

- Kumar S, Verma A. Effect of integrated nutrient management on growth and yield of broccoli (*Brassica oleracea* var. *italica*). *Journal of Pharmacognosy and Phytochemistry*. 2020;9(4):1234–1239.
- Kumar R, Singh D, Yadav R. Integrated nutrient management for higher yield and quality in cole crops. *Indian Journal of Horticulture*. 2019;76(3):456–461.
- Meena RK, Patel SS, Singh A. Influence of organic and inorganic nutrient sources on growth and yield of broccoli. *International Journal of Current Microbiology and Applied Sciences*. 2021;10(2):1456–1465.
- Patel MM, Sharma R, Gupta S. Quality enhancement in broccoli through integrated nutrient management. *Vegetable Science*. 2022;49(1):78–85.
- Sharma A, Sharma S. Effect of INM on nutritional quality of cole crops. *Journal of Applied Horticulture*. 2020;22(2):112–118.
- Sharma R, Kumar V, Singh P. Role of vermicompost and poultry manure on vegetative growth of broccoli. *Indian Journal of Agricultural Sciences*. 2022;92(5):678–683.
- Sharma S, Verma R. Economic analysis of integrated nutrient management in broccoli cultivation. *Journal of Farm Economics*. 2021;18(3):245–252.
- Singh A, Kumar P, Yadav S. Integrated nutrient management for improved growth of broccoli. *International Journal of Current Microbiology and Applied Sciences*. 2018;7(11):2345–2353.
- Singh R, Kumar S, Patel V. Economic viability of INM practices in broccoli production. *Indian Journal of Horticulture*. 2019;76(4):512–518.
- Singh V, Sharma A, Gupta R. Effect of organic manures on quality parameters of broccoli. *Journal of Vegetable Science*. 2021;48(2):89–96.
- Yadav RK, Meena S, Kumar D. Yield and quality improvement in cole crops through integrated nutrient management. *Annals of Horticulture*. 2023;16(1):45–52.