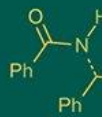


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(6): 753-757
www.biochemjournal.com
Received: 21-03-2026
Accepted: 25-04-2026

Satyam kumar
M.Sc. (Ag.), Department of Horticulture (Vegetable Science), Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Jitendra Kumar
Assistant Professor, Department of Horticulture (Vegetable Science), Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Alok kumar
Ph.D. Scholar, Department of Horticulture in (Vegetable science), Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Ashish Srivastava
Assistant Professor, Agri. Economics, Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Corresponding Author:
Jitendra Kumar
Assistant Professor, Department of Horticulture (Vegetable Science), Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Influence of organic manures and different bio-inoculants on production potential of turnip (*Brassica rapa* L.)

Satyam kumar, Jitendra Kumar, Alok kumar and Ashish Srivastava

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i6Si.8698>

Abstract

A field experiment entitled “Influence of Organic Manures and Different Bio-inoculants on Production Potential of Turnip (*Brassica rapa* L.)” was conducted during the Rabi season of 2025-26 at the Agricultural Research Field, Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur, Uttar Pradesh. The experiment was laid out in Split Plot Design with three replications to evaluate the effect of different organic manures and bio-inoculants on growth, yield, quality, soil properties, and economics of turnip. The treatments consisted of three bio-inoculants in main plots viz., Azotobacter, Azospirillum, and Phosphate Solubilizing Bacteria (PSB), and four organic manure combinations in sub-plots comprising FYM, poultry manure, and vermicompost. Among all treatments, T₆ (Azospirillum + FYM @ 15 t/ha + Poultry manure @ 2 t/ha) recorded the highest plant height (33.8 cm), number of leaves (14.5), leaf area index (5.4), root yield (290 q/ha), TSS (6.9 °Brix), net income (₹180000/ha), and B:C ratio (2.64). The same treatment also improved post-harvest soil fertility status by increasing organic carbon and available NPK content. The study revealed that integrated application of organic manures with bio-inoculants significantly enhanced growth, yield, quality, soil health, and profitability of turnip cultivation under the agro-climatic conditions of Kanpur, Uttar Pradesh.

Keywords: Turnip, organic manures, bio-inoculants, azospirillum, FYM, poultry manure, yield, quality, economics

Introduction

Turnip (*Brassica rapa* L. subsp. *rapa*), commonly known as Shalgam in India, is a biennial herbaceous plant belonging to the family Brassicaceae. It is cultivated primarily for its enlarged fleshy hypocotyl (root) and tender leaves. The crop is valued for its quick growth, high nutritional content, and adaptability to cool climatic conditions. Turnip roots are rich in vitamin C, dietary fiber, glucosinolates, and antioxidants, while the leaves are excellent sources of vitamins A, K, calcium, and iron. It is an important winter vegetable in northern India, particularly in Uttar Pradesh, Punjab, Haryana, and Bihar. The crop thrives best in well-drained, fertile loamy soils with a pH range of 6.0-7.5 and temperatures between 10-25°C. In India, turnip is mostly grown during the *Rabi* season, with a short duration of 40-60 days. Despite its importance, the productivity of turnip in India remains low due to imbalanced nutrient management, indiscriminate use of chemical fertilizers, soil degradation, and limited adoption of sustainable practices. Integrated Nutrient Management (INM) involving organic manures (FYM, poultry manure, vermicompost) and bio-inoculants (Azotobacter, Azospirillum, PSB) offers a promising, eco-friendly, and sustainable approach. These inputs improve soil fertility, enhance nutrient use efficiency, promote plant growth through phytohormone production and biological nitrogen fixation, and improve both yield and quality while reducing environmental hazards. The present investigation entitled “Influence of Organic Manures and Different Bio-inoculants on Production Potential of Turnip (*Brassica rapa* L.)” was carried out to evaluate the effect of different organic manures and bio-inoculants on growth, yield, quality, and economics of turnip under the agro-climatic conditions of Kanpur, Uttar Pradesh.

Materials and Methods

The present field experiment was conducted during the *Rabi* season of 2025-26 at the Agricultural Research Field, Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur (Uttar Pradesh), located at 26°30'N latitude, 80°15'E longitude and 126 m above mean sea level. The experimental site has a subtropical climate. The soil was alluvial sandy loam with pH 7.5, EC 0.3 dS/m, organic carbon 0.5%, available N 250 kg/ha, P₂O₅ 20 kg/ha, and K₂O 200 kg/ha. The experiment was laid out in a Split Plot Design with three replications. Main plots (Bio-inoculants):BF₁: Azotobacter (5 kg/ha), BF₂: Azospirillum (5 kg/ha), BF₃: Phosphate Solubilizing Bacteria (PSB) (5 kg/ha)Sub-plots (Organic Manures);OM₁: FYM @ 10 t/ha, OM₂: FYM @ 15 t/ha +

Poultry Manure @ 2 t/ha, OM₃: FYM @ 15 t/ha + Vermicompost @ 1 t/ha, OM₄: FYM @ 10 t/ha + Poultry Manure @ 1 t/ha + Vermicompost @ 0.5 t/ha.This resulted in 12 treatment combinations (T₁ to T₁₂). Gross plot size was 4.05 m × 3.0 m and net plot size was 3.6 m × 2.9 m. Turnip variety ‘Purple Top White Globe’ was sown on 15 November 2025 at 45 cm × 10 cm spacing with a seed rate of 3 kg/ha. Organic manures were incorporated two weeks before sowing. Bio-inoculants were applied at sowing by mixing with FYM. Standard organic crop management practices (irrigation at 7-10 days interval, manual weeding at 20 and 40 DAS, neem-based biopesticides) were followed. The crop was harvested at 90-100 DAS.

Results

Table 1: Effect of treatments on post-harvest soil parameters

Treatment	pH	EC (dS/m)	OC (%)	Avail. N (kg/ha)	Avail. P ₂ O ₅ (kg/ha)	Avail. K ₂ O (kg/ha)
T ₁ (BF ₁ OM ₁)	7.48	0.29	0.58	268	22	212
T ₂ (BF ₁ OM ₂)	7.45	0.28	0.64	285	26	228
T ₃ (BF ₁ OM ₃)	7.46	0.28	0.62	280	25	225
T ₄ (BF ₁ OM ₄)	7.47	0.29	0.60	275	24	220
T ₅ (BF ₂ OM ₁)	7.49	0.30	0.57	265	21	210
T ₆ (BF ₂ OM ₂)	7.44	0.27	0.66	292	28	235
T ₇ (BF ₂ OM ₃)	7.45	0.28	0.63	288	27	230
T ₈ (BF ₂ OM ₄)	7.46	0.29	0.61	282	25	222
T ₉ (BF ₃ OM ₁)	7.50	0.31	0.56	260	20	205
T ₁₀ (BF ₃ OM ₂)	7.47	0.29	0.60	272	23	218
T ₁₁ (BF ₃ OM ₃)	7.48	0.30	0.59	270	22	215
T ₁₂ (BF ₃ OM ₄)	7.49	0.30	0.58	265	21	210
SEm±	0.02	0.01	0.01	5.0	1.0	4.0
CD (5%)	NS	0.02	0.04	15	3.0	12
CV (%)	0.5	5.1	3.5	2.8	6.8	3.2

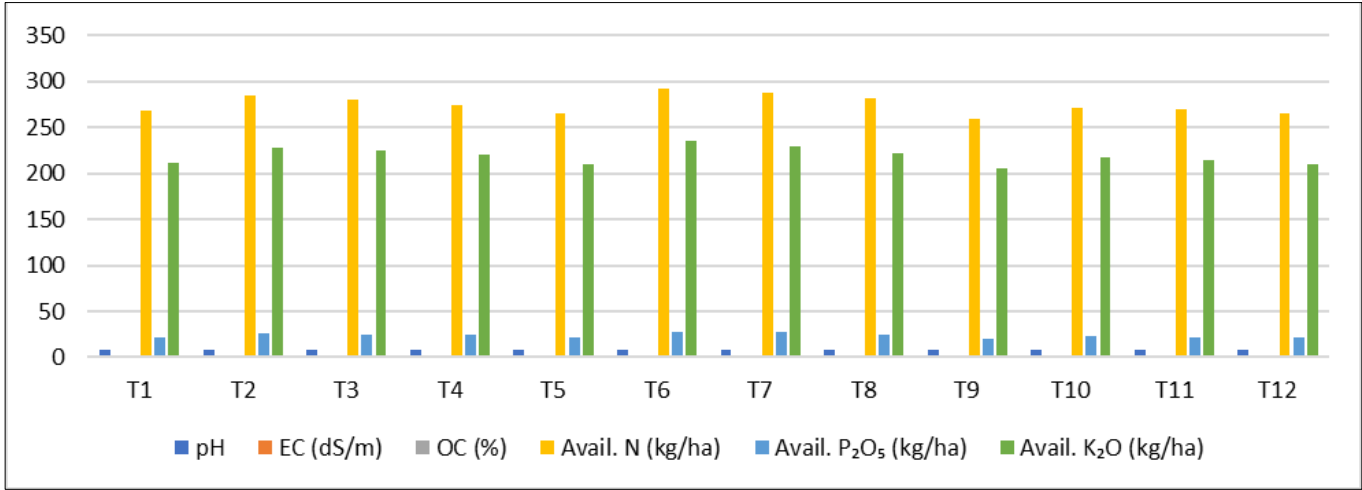


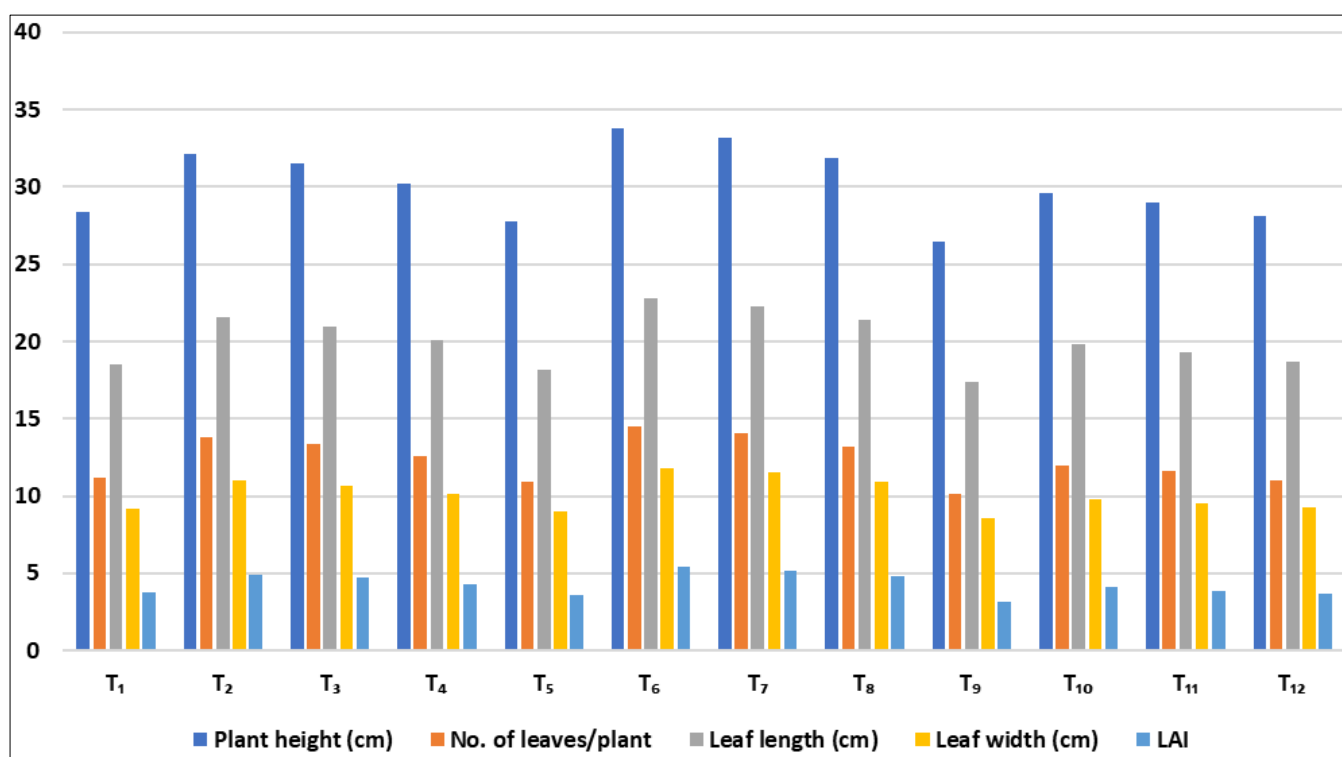
Fig 1: Effect of treatments on post-harvest soil parameters

The maximum organic carbon content (0.66%) was recorded in T₆ (Azospirillum + FYM @ 15 t/ha + Poultry manure @ 2 t/ha), which was significantly superior to the minimum value of 0.56% recorded in T₉ (PSB + FYM @ 10 t/ha) and statistically at par with T₇. Similarly, the highest available nitrogen (292 kg/ha), phosphorus (28 kg/ha), and potassium (235 kg/ha) were also recorded in T₆, which was significantly better than the lowest values observed in T₉ (260 kg/ha N, 20 kg/ha P₂O₅, and 205 kg/ha K₂O). These findings are in close conformity with earlier research. Barzallo *et al.* (2025) ^[1] reported that inoculation with

Azospirillum sp. along with organic compost significantly improved soil organic carbon and available nutrient status in *Brassica rapa* var. *chinensis*. Similarly, Sharma *et al.* (2023) ^[6] observed marked improvement in soil OC, N, P, and K content through the integrated application of biofertilizers and organic manures in root crops. Kumar and Singh (2022) ^[3] also documented that the combined use of nitrogen-fixing bio-inoculants with poultry manure and FYM enhanced post-harvest soil fertility by increasing microbial biomass and nutrient mineralization.

Table 2: Influence of organic manures and bio-inoculants on growth parameters of turnip (at 60 DAS).

Treatment	Plant height (cm)	No. of leaves/plant	Leaf length (cm)	Leaf width (cm)	LAI
T ₁	28.4	11.2	18.5	9.2	3.8
T ₂	32.1	13.8	21.6	11.0	4.9
T ₃	31.5	13.4	21.0	10.7	4.7
T ₄	30.2	12.6	20.1	10.1	4.3
T ₅	27.8	10.9	18.2	9.0	3.6
T ₆	33.8	14.5	22.8	11.8	5.4
T ₇	33.2	14.1	22.3	11.5	5.2
T ₈	31.9	13.2	21.4	10.9	4.8
T ₉	26.5	10.1	17.4	8.6	3.2
T ₁₀	29.6	12.0	19.8	9.8	4.1
T ₁₁	29.0	11.6	19.3	9.5	3.9
T ₁₂	28.1	11.0	18.7	9.3	3.7
SEm±	0.7	0.4	0.6	0.3	0.2
CD (5%)	2.2	1.1	1.7	0.9	0.5
CV (%)	4.0	5.2	4.7	4.4	5.8

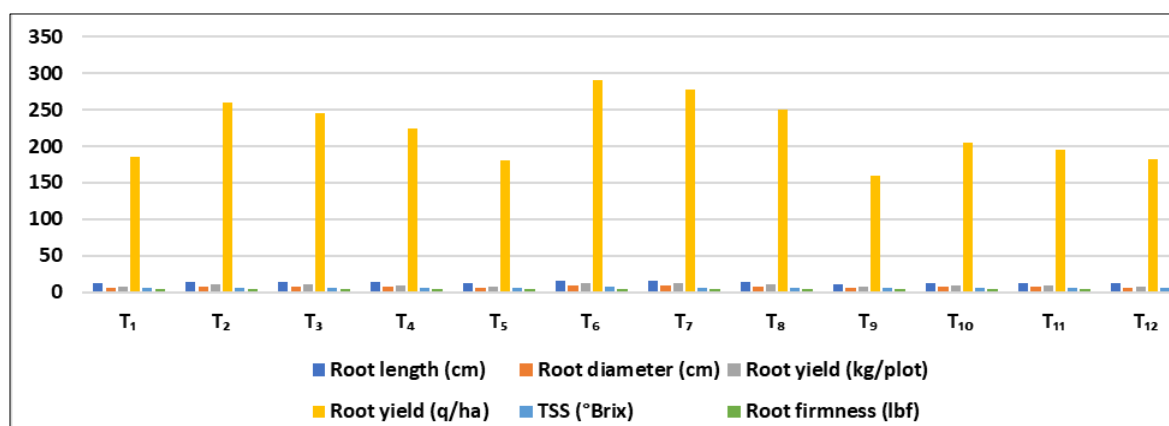
**Fig 2:** Influence of organic manures and bio-inoculants on growth parameters of turnip (at 60 DAS).

The maximum plant height (33.8 cm), number of leaves per plant (14.5), leaf length (22.8 cm), leaf width (11.8 cm), and leaf area index (5.4) were recorded in T₆ (Azospirillum + FYM @ 15 t/ha + Poultry manure @ 2 t/ha). This treatment was closely followed by T₇ and both were statistically at par with each other. The lowest values for all growth parameters were recorded in T₉ (PSB + FYM @ 10 t/ha). The significant superiority of T₆ may be attributed to the synergistic effect of *Azospirillum* inoculation with the combined application of FYM and poultry manure. *Azospirillum*, a potent plant growth promoting rhizobacterium (PGPR), fixes atmospheric nitrogen, produces phytohormones such as IAA and gibberellins, and improves root colonization and nutrient uptake. These results are in agreement with the findings of several researchers. Barzallo *et al.* (2025) ^[1] reported that

Azospirillum sp. inoculated with organic compost significantly increased plant height (up to 52.42 cm), number of leaves (19.85), leaf length (49.77 cm), and leaf width (19.85 cm) in *Brassica rapa* var. *chinensis* at 55 days after planting through enhanced nutrient availability and phytohormone production. Salazar-García *et al.* (2022) ^[4] also observed that *Azospirillum* inoculation improved various growth parameters in radish by promoting phytohormone synthesis and better photosynthate allocation. Similarly, Sharma *et al.* (2023) ^[6] and Kumar and Singh (2022) ^[3] documented that the integrated application of nitrogen-fixing bio-inoculants with organic manures (FYM and poultry manure) significantly enhanced vegetative growth in root vegetables by improving soil fertility and root-shoot nutrient transport.

Table 3: Influence of organic manures and bio-inoculants on yield and quality parameters of turnip

Treatment	Root length (cm)	Root diameter (cm)	Root yield (kg/plot)	Root yield (q/ha)	TSS (°Brix)	Root firmness (lbf)
T ₁	12.5	6.8	8.2	185	5.8	4.2
T ₂	14.8	8.2	11.5	260	6.5	4.8
T ₃	14.2	7.9	10.8	245	6.4	4.7
T ₄	13.6	7.5	9.9	225	6.1	4.5
T ₅	12.1	6.5	7.9	180	5.7	4.1
T ₆	15.6	8.7	12.8	290	6.9	5.1
T ₇	15.2	8.5	12.3	278	6.8	5.0
T ₈	14.5	8.0	11.0	250	6.3	4.6
T ₉	11.4	6.1	7.1	160	5.4	3.9
T ₁₀	13.0	7.2	9.0	205	6.0	4.3
T ₁₁	12.8	7.0	8.6	195	5.9	4.2
T ₁₂	12.3	6.7	8.0	182	5.6	4.0
SEm±	0.4	0.2	0.3	7	0.1	0.09
CD (5%)	1.1	0.6	1.0	22	0.4	0.3
CV (%)	4.4	5.2	6.0	5.3	3.9	4.7

**Fig 3:** Influence of organic manures and bio-inoculants on yield and quality parameters of turnip.

The maximum root length (15.6 cm), root diameter (8.7 cm), root yield per plot (12.8 kg), root yield per hectare (290 q/ha), TSS (6.9 °Brix), and root firmness (5.1 lbf) were recorded in T₆ (*Azospirillum* + FYM @ 15 t/ha + Poultry manure @ 2 t/ha). This treatment was closely followed by T₇ and both were statistically at par. The minimum values for all these parameters were recorded in T₉ (PSB + FYM @ 10 t/ha). The significant superiority of T₆ can be attributed to the synergistic interaction between *Azospirillum* and the combined application of FYM and poultry manure. *Azospirillum* enhances biological nitrogen fixation, produces phytohormones (IAA and gibberellins), and improves root architecture, leading to better nutrient and water absorption. These findings are in close agreement with previous studies. Barzallo *et al.* (2025) [1] reported that *Azospirillum* sp.

inoculated in organic compost produced the highest fresh root weight along with improved root length and diameter in *Brassica rapa* var. *chinensis* through enhanced hormonal stimulation and nutrient mobilization. Salazar-García *et al.* (2022) [4] demonstrated that *Azospirillum* inoculation significantly increased root yield and quality parameters in radish by improving phytohormone levels and assimilate partitioning to storage roots. Similarly, Sharma *et al.* (2023) [6] and Kumar and Singh (2022) [3] observed that integrated application of nitrogen-fixing biofertilizers with organic manures (FYM and poultry manure) markedly enhanced root yield, TSS, and root firmness in Brassica crops by improving soil fertility, root colonization, and nutrient use efficiency.

Table 4: Influence of organic manures and bio-inoculants on economic parameters of turnip.

Treatment	Gross Income (₹/ha)	Net Income (₹/ha)	B:C Ratio
T ₁	185000	92000	1.99
T ₂	260000	158000	2.54
T ₃	245000	145000	2.45
T ₄	225000	128000	2.32
T ₅	180000	88000	1.96
T ₆	290000	180000	2.64
T ₇	278000	170000	2.57
T ₈	250000	148000	2.45
T ₉	160000	72000	1.82
T ₁₀	205000	110000	2.16
T ₁₁	195000	102000	2.10
T ₁₂	182000	90000	1.98
SEm±	10000	7500	0.10
CD (5%)	30000	22500	0.30
CV (%)	6.5	7.6	7.2

The maximum gross income (₹290,000/ha), net income (₹180,000/ha), and B:C ratio (2.64) were recorded in T₆ (Azospirillum + FYM @ 15 t/ha + Poultry manure @ 2 t/ha). This treatment was closely followed by T₇ and both were statistically at par. The minimum economic returns were observed in T₉ (PSB + FYM @ 10 t/ha), which recorded the lowest gross income (₹160,000/ha), net income (₹72,000/ha), and B:C ratio (1.82). The higher economic returns under T₆ were mainly due to significantly higher root yield (290 q/ha) obtained from this treatment, which more than compensated for the cost of inputs. These results are supported by earlier findings. Sharma *et al.* (2023) [6] reported that integrated nutrient management involving biofertilizers and organic manures significantly increased net returns and B:C ratio in turnip and other root crops due to higher marketable yield and reduced cost of inorganic inputs. Barzallo *et al.* (2025) [1] also observed that the use of Azospirillum along with organic compost resulted in higher economic returns in Brassica rapa by improving yield while promoting sustainable practices. Similarly, Kumar and Singh (2022) [3] documented that the combined application of nitrogen-fixing bio-inoculants with poultry manure and FYM gave the highest benefit-cost ratio in root vegetables through enhanced productivity and improved soil health.

References

1. Barzallo DG. Enhancing turnip cultivation with plant growth-promoting bacteria in organic fertilizer. *Rev Caatinga*. 2025;38(1):45-58.
2. Gao Y, Li X, Wang Z. Effects of biofertilizers and organic amendments on vegetative growth and yield of root vegetables. *Sci Hortic*. 2020;272:109578.
3. Kumar A, Singh R. Integrated nutrient management through biofertilizers and organic manures in root crops. *J Crop Weed*. 2022;18(2):112-20.
4. Salazar-García G, López-Gómez M, Hernández-Montiel LG. Effect of *Azospirillum brasilense* on the physiology of radish (*Raphanus sativus* L.). *Agronomy*. 2022;12(3):726.
5. Sharma A, Kumar V, Singh S. Effect of integrated nutrient management on growth, yield and shelf life of turnip cv. Purple Top White Globe. *Indian J Hortic*. 2017;74(3):312-7.
6. Sharma A, Singh S, Kumar V. Synergistic effect of bio-inoculants and organic manures on growth, yield and soil health of Brassica crops. *Veg Sci*. 2023;50(1):45-53.
7. Singh R, Kumar P, Yadav S. Influence of *Azospirillum* and poultry manure on leaf morphology and photosynthetic efficiency in leafy vegetables. *Indian J Agric Sci*. 2021;91(5):789-93.
8. Yadav SK, Mishra A. Combined use of *Azospirillum* with organic manures for enhanced root yield in radish (*Raphanus sativus* L.). *J Root Crops*. 2021;47(2):145-52.