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Enrichment of vermicompost by using biofertilizer and its effect in *Calendula* (*Calendula officinalis* L.)

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ABSTRACT

The present investigation was conducted during the Rabi season of 2025–26 at the Horticultural Research cum Instructional Farm, Department of Floriculture and Landscaping, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, the present research work is entitled “Enrichment of vermicompost by using biofertilizer and its effect in *Calendula* (*Calendula officinalis* L.)”. The experiment was laid out in a Randomized Block Design with three replications and eight treatments. The treatments consisted of control (T_0), vermicompost enriched with *Azotobacter* @ 5% (T_1), vermicompost enriched with *Azospirillum* @ 5% (T_2), vermicompost enriched with PSB @ 5% (T_3), vermicompost enriched with *Azotobacter* @ 5% + *Azospirillum* @ 5% (T_4), vermicompost enriched with *Azotobacter* @ 5% + PSB @ 5% (T_5), vermicompost enriched with *Azospirillum* @ 5% + PSB @ 5% (T_6), and vermicompost enriched with *Azotobacter* @ 5% + *Azospirillum* @ 5% + PSB @ 5% (T_7). T_7 recorded the highest values for most growth, flowering and root parameters. At 90 DAT, it recorded 49.93 cm plant height, 192.00 leaves plant⁻¹, 39.30 cm N–S plant spread, 39.86 cm E–W plant spread and 16.33 mm stem diameter. Fresh and dry shoot weights were 300.40 and 99.00 g, respectively. T_5 recorded the earliest first flower appearance (44.00 days), while T_7 recorded the earliest 50% flowering (51.66 days). T_7 recorded 6.63 cm flower diameter, 3.66 g average flower weight, 98.33 flowers plant⁻¹ and 4.33 days shelf life. T_7 recorded 20.10 cm root length, 15.36 g root fresh weight, and 5.63 g root dry weight.

Keywords: *Calendula*, Vermicompost, Biofertilizer, *Azotobacter*, *Azospirillum*, PSB

Introduction

Floriculture is an important branch of horticulture dealing with the production and management of flowering and ornamental crops. *Calendula* (*Calendula officinalis* L.) is one of the cultivated seasonal flowers and belongs to the Asteraceae family. It is a tetraploid plant with 32 chromosomes ($2n = 4x = 32$) (Golestani *et al.*, 2013) [1]. is an important seasonal flowering crop grown under winter conditions. The crop has ornamental, medicinal and commercial importance and is valued for its attractive flowers and multiple uses. *Calendula* has become well established as a winter-season flower in India. The flowers contain important bioactive compounds such as flavonoids, carotenoids, volatile oils, and vitamin A, and are used in pharmaceutical, cosmetic, and food industries (Ehsan *et al.*, 2012) [2]. Vermicompost contains essential macro- and micronutrients, humic substances and beneficial microorganisms. The nutrient concentration varies according to the type of organic substrate, earthworm species and vermicomposting conditions. Generally, well-rotted vermicompost contains about 1.2–2.5% nitrogen (N), 0.9–1.7% phosphorus (P) and 1.5–2.5% potassium (K). Application of vermicompost improves soil structure, aeration, porosity, water-holding capacity and nutrient availability, and stimulates microbial activity in the soil. Biofertilizers contain beneficial microorganisms capable of improving nutrient availability. *Azotobacter* and *Azospirillum* are associated with biological nitrogen fixation and plant growth promotion, while phosphate-solubilizing bacteria can improve phosphorus availability. The combined use of these microorganisms with vermicompost may provide complementary effects on nutrient availability and plant growth. Biofertilizers represent an important strategy for sustaining soil fertility and crop yield over the years. Utilizing fertilizers, manure, and bio-fertilizers together not only improves soil health but also enhances crop growth and output (Sowmya *et al.*, 2017) [3]. the present investigation was undertaken to evaluate different combinations of biofertilizer-enriched vermicompost for improving growth, flowering and root development in calendula under the agro-climatic conditions of Raipur, Chhattisgarh.

Materials and methods

The field experiment was conducted during the Rabi season of 2025–26 at the Horticultural Research cum Instructional Farm, Department of Floriculture and Landscaping, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. The experimental site is situated at an elevation of approxi

mately 289.56 m above mean sea level and falls under the dry sub-humid agro-climatic zone. The experiment was laid out in a Randomized Block Design (RBD) with three replications and eight treatments, comprising T₀: Control; T₁: vermicompost enriched with *Azotobacter* @ 5%; T₂: vermicompost enriched with *Azospirillum* @ 5%; T₃: vermicompost enriched with PSB @ 5%; T₄: vermicompost enriched with *Azotobacter* @ 5% + *Azospirillum* @ 5%; T₅: vermicompost enriched with *Azotobacter* @ 5% + PSB @ 5%; T₆: vermicompost enriched with *Azospirillum* @ 5% + PSB @ 5%; and T₇: vermicompost enriched with *Azotobacter* @ 5% + *Azospirillum* @ 5% + PSB @ 5%. For preparation of enriched vermicompost, well-decomposed vermicompost was weighed at 720 g per experimental plot and spread uniformly on a clean polyethylene sheet. Biofertilizer cultures were applied according to the respective treatment combinations at the rate of 1 L per 100 kg vermicompost. The cultures were diluted with water and sprinkled uniformly over the vermicompost, followed by thorough mixing. The material was then covered with a moist jute bag for approximately 1–1.5 weeks under suitable moisture conditions. The enriched vermicompost was subsequently applied uniformly to the respective plots at the time of transplanting. The experimental field was brought to fine tilth through repeated ploughing and leveling. Urea @ 174 kg ha⁻¹, muriate of potash @ 50 kg ha⁻¹ and single super phosphate @ 188 kg ha

Result and discussion

3.1 Vegetative parameter

Plant height :- Plant height increased progressively with crop age. T₇ recorded 18.73, 39.10 and 49.93 cm at 30, 60 and 90 DAT, respectively, whereas T₀ recorded 12.20, 25.86 and 31.50 cm. The higher growth observed under T₇ may be attributed to the combined effects of *Azotobacter*, *Azospirillum* and PSB on nutrient availability and uptake. The application of biofertilizers along with organic growing media improved plant height in calendula, which may be attributed to better nutrient availability and enhanced plant growth. The present findings are in close agreement with Jogi *et al.* (2022) [4] (Kaushik *et al.*) [5], (Verma *et al.*) [6], Thakur *et al.* (2016) [7]

Number of leaves :- The number of leaves increased with crop age. T₇ recorded 40.00, 145.43 and 192.00 leaves plant⁻¹ at 30, 60 and 90 DAT, respectively. The control recorded 31.10, 115.50 and 131.66 leaves plant⁻¹. The observed response may be associated with improved nutrient availability particularly nitrogen and phosphorus, and enhanced microbial activity. The application of biofertilizers along with organic growing media increased the number of leaves in calendula. This improvement may be attributed to better nutrient availability and enhanced vegetative growth due to the combined application of *Azotobacter*, *Azospirillum* and PSB. The present findings are in close agreement with Thakur *et al.* (2016) [7], Jogi *et al.* (2022) [4], (Kaushik *et al.*) [5],

Plant spread :- At 90 DAT, T₇ recorded 39.30 cm N–S spread, 39.86 cm E–W spread. The application of biofertilizers and organic growing media resulted in greater plant spread in calendula, indicating better vegetative development under improved nutrient conditions. The present findings are in close agreement with Jogi *et al.* (2022) [4], Thakur *et al.* (2016) [7], (Verma *et al.*) [6].

Stem diameter :- Stem diameter showed an increasing trend with treatment application, and the maximum stem diameter (16.33 mm) was recorded under T₇ at 90 DAT. The application of biofertilizers along with organic growing media improved stem diameter in calendula, which may be attributed to better nutrient availability and plant growth promotion. Lower stem diameter under less effective treatments may be due to comparatively poor nutrient availability. The present findings are in close agreement with Thakur *et al.* (2016) [7], Jogi *et al.* (2022) [4].

Fresh weight of shoot :- T₇ recorded the maximum fresh shoot weight (300.40 g) compared with 231.66 under T₀. Higher shoot biomass under T₇ may be attributed to improved nutrient availability and enhanced plant growth due to the

application of biofertilizers. The application of biofertilizers along with organic growing media increased fresh shoot weight in calendula, indicating improved vegetative growth and biomass accumulation. The present findings are in close agreement with Thakur *et al.* (2016) [7], Hoseini-Mazinani and Hadipour (2014) [8], and Mehdi *et al.* (2022) [9].

Dry weight of shoot :- The maximum dry shoot weight (99.00 g) was recorded under T₇, whereas the minimum (78.33 g) was observed under T₀. The higher dry biomass under T₇ may be due to better nutrient availability and enhanced plant growth resulting from biofertilizer application. The present findings are in close agreement with Mehar *et al.* (2022) [10], Thakur *et al.* (2016) [7], Mehar *et al.* (2022) [10], and Shaabani *et al.* (2022) [11].

Flowering parameter

50% flower appearance:- The earliest 50% flowering was recorded under T₇ (51.66 days). Suitable nutrient management and biofertilizer application influenced the time required to attain 50% flowering in calendula. The present findings are in close agreement with Thakur *et al.* (2016) [7], Jogi *et al.* (2022) [5], Kumar and Singh (2013) [12] and Pushparaj and Tamrakar (2025) [13].

Flower diameter :- T₇ recorded the maximum flower diameter (6.63 cm), whereas T₀ recorded the minimum flower diameter (3.76 cm). The greater flower diameter under T₇ may be associated with better root development, as increased root length can enhance nutrient and water uptake, thereby promoting flower development and diameter. The present findings are in close agreement with Hoseini-Mazinani and Hadipour (2014) [8], while similar findings were reported by Jogi *et al.* (2022) [4], Mehdi *et al.* (2022) [9], and Pushparaj and Tamrakar (2025) [13].

Average flower weight:- T₇ recorded the maximum average flower weight (3.66 g) compared with 1.90 g under T₀. The use of biofertilizers and suitable nutrient management increased flower weight in calendula, which may be attributed to improved nutrient availability and better flower development. The present findings are in close agreement with Hoseini-Mazinani and Hadipour (2014) [8], while similar findings were reported by Jogi *et al.* (2022) [4], Mehdi *et al.* (2022) [9] and Pushparaj and Tamrakar (2025) [13].

Number of flowers plant⁻¹:- T₇ recorded the maximum number of flowers (98.33 flowers plant⁻¹) compared with 68.66 flowers plant⁻¹ under T₀. The application of biofertilizers and organic nutrient sources increased the number of flowers in calendula, indicating improved flowering performance under favourable growing conditions. The present findings are in close agreement with Hoseini-Mazinani and Hadipour (2014) [8], while similar results were reported by Jogi *et al.* (2022) [4], Mehdi *et al.* (2022) [9], Parveen *et al.* (2022) [14] and Pushparaj and Tamrakar (2025) [13].

Shelf life :- T₇ recorded the highest shelf life (4.33 days) compared with 2.00 days under T₀. the application of biofertilizers improves nutrient availability and promotes the development of stronger and healthier flower tissues. These stronger tissues help delay flower deterioration and maintain flower quality for a longer period, thereby improving the shelf life of calendula flowers. The present findings are in close agreement with Hoseini-Mazinani and Hadipour (2014) [8], while similar findings were reported by Harish *et al.* (2018) [15] and Jogi *et al.* (2022) [4].

Root parameter

Root length :- The maximum root length (20.10 cm) was recorded in T₇ (Vermicompost enriched with *Azotobacter* @ 5% + *Azospirillum* @ 5% + PSB @ 5%), whereas the minimum (12.90 cm) was recorded in T₀. The combination of *Azotobacter* and PSB creates a beneficial environment for root growth. These findings were in close agreement with Pushparaj and Tamrakar (2025) [13] in calendula, Verma *et al.* (2025) [6] in marigold.

Fresh weight of root :- The maximum root fresh weight (15.36 g) was recorded in T₇ whereas the minimum (11.23 g) was recorded in T₀. The better root growth in biofertilizer-inoculated plants might be

attributed to easy uptake of nutrients and the production of growth-promoting substances such as auxins, which stimulated root initiation, cell division and elongation. These findings were in close agreement with Sardoei (2014) [16].

Dry weight of root :- The maximum root dry weight (5.63 g) was recorded in T_7 whereas the minimum (3.73 g) was recorded in T_0 . The increase in dry weight of root under T_7 might be attributed to the combined beneficial effects of *Azotobacter*, *Azospirillum* and PSB, which enhanced nutrient availability and promoted root development. These findings were in close agreement with Sardoei (2014) [16], Pansuriya & Chauhan (2015) [17].

Table 1. Effect of biofertilizer-enriched vermicompost on plant height of *Calendula*.

Treatment	30 DAT (cm)	60 DAT (cm)	90 DAT (cm)
T_0	12.20	25.86	31.50
T_1	14.26	31.90	39.36
T_2	14.53	32.73	40.50
T_3	15.63	34.06	41.90
T_4	16.76	33.10	42.86
T_5	18.33	35.76	46.10
T_6	17.40	37.60	43.53
T_7	18.73	39.10	49.93
$SE_m \pm$	0.67	1.67	2.48
CD at 5%	2.03	5.07	7.53
CV (%)	7.26	8.58	10.24

Table 2. Effect biofertilizer-enriched vermicompost on number of leaves plant⁻¹.

Treatment	30 DAT	60 DAT	90 DAT
T_0	31.10	115.50	131.66
T_1	33.33	134.50	182.66
T_2	37.10	131.10	177.33
T_3	36.06	132.23	178.66
T_4	37.16	130.83	179.33
T_5	33.66	141.60	186.00
T_6	33.33	135.88	184.00
T_7	40.00	145.43	192.00
$SE_m \pm$	1.58	3.17	4.66
CD at 5%	4.58	9.62	14.17
CV (%)	7.80	4.12	4.58

Table 3. Effect of biofertilizer-enriched vermicompost plant spread and stem] diameter at 90 DAT.

Treatment	N-S 90 DAT (cm)	E-W 90 DAT (cm)	Stem diameter 90 DAT (mm)
T_0	31.53	30.66	8.30
T_1	32.90	33.00	13.33
T_2	32.30	31.10	13.56
T_3	33.60	33.26	14.33
T_4	34.26	35.40	14.00
T_5	36.13	37.23	16.04
T_6	37.56	36.10	15.53
T_7	39.30	39.86	16.33
$SE_m \pm$	1.54	1.37	0.78
CD at 5%	4.69	4.18	1.60
CV (%)	7.73	7.03	9.78

Table 4. Effect of biofertilizer-enriched vermicompost fresh weight of shoot and dry weight of shoot.

Treatment	Fresh shoot weight (g)	Dry shoot weight (g)
T_0	231.66	78.33
T_1	253.66	83.66
T_2	256.00	88.66
T_3	268.66	90.00
T_4	274.00	89.00
T_5	283.33	92.00
T_6	259.33	93.00
T_7	300.40	99.00
$SE_m \pm$	12.08	3.69
CD at 5%	36.60	11.19
CV (%)	7.87	7.16

Table 5. Effect of biofertilizer-enriched vermicompost 50% Flowering and flower diameter under different treatments.

Treatment	50% flowering (days)	Flower diameter (cm)
T_0	66.00	3.76
T_1	60.00	4.40
T_2	59.00	4.70
T_3	61.00	5.30
T_4	56.00	6.40
T_5	55.33	6.20
T_6	58.00	6.23
T_7	51.66	6.63
$SE_m \pm$	2.29	0.52
CD at 5%	6.95	1.59
CV (%)	6.79	16.74

Table 6. Effect of biofertilizer-enriched vermicompost average weight of flower, number of flower and shelf life.

Treatment	Average flower weight (g)	Flowers plant ⁻¹	Shelf life (days)
T_0	1.90	68.66	2.00
T_1	2.86	74.00	2.66
T_2	2.54	76.00	3.00
T_3	2.96	86.66	2.33
T_4	3.40	92.66	3.33
T_5	3.46	97.00	4.10
T_6	3.20	95.00	3.96
T_7	3.66	98.33	4.33
$SE_m \pm$	0.30	3.02	0.30
CD at 5%	0.92	9.19	0.90
CV (%)	17.53	6.07	16.11

Table 7. Effect of biofertilizer-enriched vermicompost root length, fresh weight of root and dry weight of root under different treatments.

Treatment	Root length (cm)	Fresh weight of root (g)	Dry weight of root (g)
T_0	12.90	11.23	3.73 ^c
T_1	15.86	12.56	4.46 ^{bc}
T_2	15.20	12.90	4.70 ^b
T_3	16.53	13.06	4.20 ^{bc}

(continued on next page)

Treatment	Root length (cm)	Fresh weight of root (g)	Dry weight of root (g)
T ₄	18.26	13.36	4.53 ^{bc}
T ₅	19.36	14.66	5.00 ^{ab}
T ₆	18.36	13.13	4.70 ^b
T ₇	20.10	15.36	5.63 ^a
SE _m ±	1.04	0.67	0.26
CD at 5%	3.16	2.04	0.81
CV (%)	10.57	8.79	10.10

4. Conclusion :- The conclusion drawn from the experimental results revealed that the application of T₇ (Vermicompost enriched with *Azotobacter* @ 5% + *Azospirillum* @ 5% + PSB @ 5%) was found effective for improving various growth, flowering and root parameters of calendula. Treatment T₇ recorded superior performance in terms of plant height (18.73, 39.10 and 49.93 cm at 30, 60 and 90 DAT, respectively), number of leaves (40.00, 145.43 and 192.00 plant⁻¹ at 30, 60 and 90 DAT, respectively), plant spread (39.30 cm N-S and 39.86 cm E-W), stem diameter (16.33 mm), fresh weight of shoot (300.40 g), dry weight of shoot (99.00 g), 50% flowering (51.66 days), flower diameter (6.63 cm), average flower weight (3.66 g), number of flowers (98.33 plant⁻¹), shelf life (4.33 days), root length (20.10 cm), fresh weight of root (15.36 g) and dry weight of root (5.63 g). T₅ (Vermicompost enriched with *Azotobacter* @ 5% + PSB @ 5%) ranked second whereas T₀ (Control) recorded the lowest performance for most growth, flowering and root parameters. Thus biofertilizer enriched could be adopted by the *Calendula* producers which need higher price for beautifully fresh flower and ecofriendly way.

References

- Golestani M, Dolatkahi A, Kazemi F. Effect of planting dates on flowering period of *Calendula officinalis*, *Bellis perennis* and *Viola* spp. *Advances in Crop Science*. 2013;3(8):563-567.
- Ehsan O, Javad M, Reza M. Medicinal and ornamental importance of *Calendula officinalis* L.: A review. *Journal of Medicinal Plants Research*. 2012;6(35):4889-4893.
- Sowmya KA, Prasad VM. Effect of NPK and bio-fertilizers on growth, yield and quality of China aster (*Callistephus chinensis*) cv. Shashank. *International Journal of Current Microbiology and Applied Sciences*. 2017;6(10):3204-3210.
- Jogi P, Tirkey T, Tamrakar SK. Effect of chemical and bio-fertilizers on quantitative characteristics of marigold (*Calendula officinalis* L.). *Plant Ecophysiol*. 2022;2:25-34.
- Kaushik R, Gupta P, Choudhary T, Kumar V, Pradhan MK. Synergistic impact of biofertilizer consortia on vegetative growth of gladiolus under different concentrations. *Int J Adv Biochem Res*. 2025;9(Suppl 9):1665-1667.
- Verma LS, Choudhary S, Kashyap M, Tigga NK, Kumar T, Gupta S, et al. Impact of biofertilizers on growth performance of African marigold var. *Pusa Bahar* (*Tagetes erecta* L.). *Int J Adv Biochem Res*. 2025;9(8):506-509.
- Thakur R, Dubey RK, Kukal SS, Kapoor S. Interactive effect of biofertilizers and organic potting media on growth and flowering of calendula (*Calendula officinalis* Linn.). *Indian J Ecol*. 2016;43(1):245-248.
- Hoseini-Mazinani M, Hadipour A. Increasing quantitative and qualitative yield of *Calendula officinalis* L. by using bio-fertilizer. *J Med Plants*. 2014;13(50):83-91.
- Mehdi N, Thaneshwari, Raut S. Effect of organic and inorganic fertilizers on growth and flowering of *Calendula officinalis* L. *Pharma Innov J*. 2022;11(6):2131-2135.
- Mehar R, Kumar A, Sharma RK, Gallani R, Rathore GPS. Effect of growing media on growth and flowering of calendula (*Calendula officinalis* L.). *J Ornament Hort*. 2022;25(1-2):1-8.
- Shaabani M, Iriti M, Mortazavi SN, Amirmohammadi FZ, Zamanian K. The effects of two organic fertilizers on morpho-physiological traits of marigold (*Calendula officinalis* L.). *S Afr J Bot*. 2022;148:330-335.
- Kumar A, Singh Y. Effect of foliar feeding of nitrogen and GA3 on vegetative growth, flowering behavior and yield of calendula (*Calendula officinalis* L.). *Prog Hort*. 2013;45(2):322-325.
- Pushparaj, Tamrakar SK. Studies on the effect of cycocel and bio-fertilizers on the vegetative growth, flowering attributes and flower yield of calendula (*Calendula officinalis* L.). *Int J Adv Biochem Res*. 2025;9(SP-12):378-381.
- Parveen N, Tamrakar SK, Tigga R, Minz RR. Effect of varying levels of fertilizer and plant geometry on growth, flowering and yield of calendula (*Calendula officinalis* L.). *J Krishi Vigyan*. 2022;11(1):123-129.
- Harish S, Doddajappalavar S, Naik BH, Chandrashekar S, Nandeesh, Kantharaj Y. Enhanced flower yield and quality attributes of chrysanthemum (*Dendranthema grandiflora* Tzvelev) inoculated with phosphorus-solubilizing bioinoculants. *Int J Curr Microbiol Appl Sci*. 2018;7(4):1821-1827.
- Sardoei AS. Vermicompost effects on the growth and flowering of marigold (*Calendula officinalis* L.). *Eur J Exp Biol*. 2014;4(1):651-655.
- Pansuriya PB, Chauhan RV. Effect of integrated nutrient management on growth, yield and quality of gladiolus (*Gladiolus grandiflorus* L.) cv. Psittacinus Hybrid. *Journal of Horticulture*. 2015;2(2):128-129.
- Jadhav PB, Singh A, Mangave BD, Patil NB, Patel DJ, Dekhane SS, et al. Effect of organic and inorganic fertilizers on growth and yield of African marigold (*Tagetes erecta* L.) cv. *Pusa Basanti* Gainda. *Ann Biol Res*. 2014;5(9):10-14.
- Kaushik H, Singh JP, Braj Mohan, Rajbeer, Nathiram. Effect of inorganic fertilizer (nitrogen) and bio-fertilizer (*Azospirillum*) on growth and flowering in African marigold (*Tagetes erecta* L.) cv. *Pusa Narangi* Gainda. *Int J Agric Sci*. 2013;9(1):189-192.

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