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Impact of homeopathic formulations and bioagents on morphological growth of brinjal plants

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Abstract

This study investigates the effect of homeopathic medicines and bioagents on the morphological growth of brinjal plants under field and pot conditions during 2023-24 and 2024-25. The results indicate that treatments with *Arnica montana* (0.2%) and bioagents like *Trichoderma harzianum* significantly enhanced shoot length, root length, fresh weight, and dry weight of shoot and root compared to the control. The maximum growth parameters were recorded in treatment T₆ (*Arnica montana* @ 0.2%). The findings suggest that homeopathic formulations and bioagents can contribute to sustainable agriculture by promoting plant growth and reducing reliance on chemical fertilizers and pesticides.

Keywords: Homeopathic formulations, Bioagents, Brinjal plants, Morphological growth, Sustainable agriculture, *Arnica montana*, *Trichoderma harzianum*

1. Introduction

Brinjal (*Solanum melongena* L.), also known as eggplant, is one of the most widely cultivated and consumed vegetables globally, particularly in Asia. It belongs to the Solanaceae family and is known for its nutritional and medicinal properties. Brinjal is a significant crop in many countries, with India being one of the largest producers. The crop is grown for its edible fruit, which is rich in vitamins, minerals, and antioxidants. The nutritional value of brinjal is well-documented, and it has been reported to have various health benefits, including antioxidant, anti-inflammatory, and anti-cancer properties. Despite its nutritional benefits, brinjal cultivation is often challenged by pests and diseases, which can significantly reduce crop yields and quality. Conventionally, farmers rely on chemical pesticides and fertilizers to manage pests and diseases in brinjal cultivation. However, the excessive use of these chemicals has led to environmental pollution, health hazards, and the development of pesticide-resistant pests.

In recent years, there has been a growing interest in alternative and sustainable approaches to pest and disease management in agriculture. Homeopathic formulations and bioagents have emerged as potential alternatives to chemical pesticides. These approaches are considered environmentally friendly, safe for human consumption, and can help reduce the reliance on chemical pesticides. Homeopathic medicines, in particular, have been shown to have a positive impact on plant growth and development, and can help plants build resistance against pests and diseases. This study aims to evaluate the impact of homeopathic formulations and bioagents on the morphological growth of brinjal plants. The findings of this study will contribute to the development of sustainable and eco-friendly agricultural practices, and provide farmers with alternative options for managing pests and diseases in brinjal cultivation.

2. Materials and Methods

2.1 Experimental Site

The present investigation was carried out during Kharif season 2023-24 and 2024-25 in the laboratory of Department of Plant Pathology and Student Instructional Farm (SIF), Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, 208002 (Uttar Pradesh),

under field and pot conditions. The experiment was conducted under a Randomized Block Design (RBD) and Complete Randomized Design (CRD) with three replications.

2.2 Experimental Material

Healthy and uniform seedlings of brinjal (*Solanum melongena* L.) variety Kalyanpur type 3 were used for both field and pot experiments, collected from the Vegetable Research farm of C.S. Azad University of Agriculture & Technology, Kanpur, located at Kalyanpur Kanpur. The soil used in the pot experiment was sterilized sandy loam with good drainage and P.H ranging between 6.5-7.2.

2.3 Collection of homeopathic medicines and bio-agents

Homeopathic medicines purchased from Medical store of Raina market, Nawabganj road, Kanpur. Bio-agents like *Trichoderma viridae*, *Pseudomonas fluorescens* and *Bacillus subtilis* are purchased from online order of Flipkart and Bio-agents like *Trichoderma harzianum* collected from Department of Plant Pathology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh.

2.4 Isolation and Purification of Pathogen

The pathogen *Phomopsis vexans* was isolated from infected brinjal plants showing typical symptoms of leaf spot and fruit rot. The infected plant parts were surface sterilized with 1% sodium hypochlorite solution for 1-2 minutes, rinsed thrice with sterile distilled water, and dried on sterile filter paper. The sterilized plant parts were then placed on potato dextrose agar (PDA) medium amended with streptomycin (50 µg/mL) to inhibit bacterial growth. The plates were incubated at 25 ± 2°C for 7-10 days. The fungal colonies that developed were subcultured on fresh PDA medium to obtain pure cultures. The purified cultures were maintained on PDA slants at 4°C for further studies.

2.5 Effect of homeopathic medicines and bio-agents on growth parameters of Brinjal

Among the all homeopathic medicines and bio agents, Four suitable homeopathic medicines and Four bio agents was chosen to conduct the present investigation. Brinjal seedling was treated with homeopathic medicines (*Arnica montana*, Sulphur, Phosphorus and *Silicea terra* @0.1% & 0.2% i.e.1ml/lit water & 2ml/lit water) and bio-formulation (*T. harzianum*, *T. viride*, *P. fluorescence* @10g powder/lit. water & *Bacillus subtilis* 5ml/lit. water). Then the seedling was kept in shade for about 2 hour. It was then removes from the jar and shaded dry and used for transplanting in pots, which were previously filled with a mixture of sterilized sandy loam and Farm Yard Manure in the ratio of 2:1. Three replication per treatment and six pots were sown with untreated & inoculated seedlings served as control. Observation pertaining to the effect of different treatments on the growth parameter of plant (Root and Shoot length, Root and Shoot weight), was observed every 10 days interval up to 40 days age of plants. To explore the possible effect on Brinjal growth was observed and data were taken on the root & shoot length and fresh & dry weight of root & shoot per treatment.

2.6 Treatment details

A total of 14 treatments (T₁ – T₁₄) were imposed, consisting of different homeopathic medicines and bioagents applied as seedling treatment followed by one foliar spray. The details of treatments are as follows:

T₁= Sulphur @ 0.1% (Seedling treatment + One Foliar spray)

T₂= *Arnica montana* @0.1% (Seedling treatment + One Foliar spray)

T₃= Phosphorus @ 0.1% (Seedling treatment + One Foliar spray)

T₄= *Silicea terra* @0.1% (Seedling treatment + One Foliar spray)

T₅= Sulphur @ 0.20% (Seedling treatment + One Foliar spray)

T₆= *Arnica montana* @0.20% (Seedling treatment + One Foliar spray)

T₇= Phosphorus @ 0.20% (Seedling treatment + One Foliar spray)

T₈= *Silicea terra* @ 0.20% (Seedling treatment + One Foliar spray)

T₉= *Trichoderma harzianum* 10 g/l water (Seedling treatment + One Foliar spray)

T₁₀= *Trichoderma viride* 10 g/l water (Seedling treatment + One Foliar spray)

T₁₁ = *Bacillus subtilis* 5ml/l water (Seedling treatment + One Foliar spray)

T₁₂= *Pseudomonas fluorescens* 10 g/l water (Seedling treatment + One Foliar spray)

T₁₃= Control(inoculated),

T₁₄= Control (untreated)

2.7 Experimental Design and Layout

The treatments were arranged in a Randomized Block Design (RBD) & Complete Randomized Design (CRD) with three replications. In the field experiment, standard agronomic practices were followed, while in the pot experiment, sterilized soil was used and irrigation was given at regular intervals. Each treatment consisted of uniform seedlings transplanted at recommended spacing.

2.8 Observations Recorded

Observations were recorded on shoot length (cm), root length (cm), fresh & dry weight of shoot and root (gm) at 10, 20, 30, and 40 days after sowing (DAS) in both field and pot conditions for two consecutive years (2023–24 and 2024–25). The mean data of both years were statistically analyzed to assess the impact of homeopathic formulations and bioagents on morphological growth parameters of brinjal plants.

2.9 Statistical Analysis

The collected data were statistically analyzed using Analysis of Variance (ANOVA) as per the procedure described by Panse and Sukhatme (1978). The treatment means were compared at 5% level of significance (CD at 5%).

3. Results and Discussion

3.1 Effect of homeopathic medicines and bio agents on shoot and root length (cm) of brinjal crop under field & pot conditions during 2023-24 and 2024-25

According to the data in Table 4, 5 revealed that shoot & root length of brinjal significantly increased in all the treatments over control during 2023-24 and 2024-25. The maximum shoot & root length was recorded both in field and pot experiment in treatment T₆ (*Arnica montana* @ 0.2%) showed a shoot length of 43.00 cm and root length of 22.21 cm in field and 42.97 cm, 22.18 cm in pot experiment followed by *T. harzianum* during 2023-24 and T₆ (*Arnica montana* @ 0.2%) 42.98 cm, 22.19 cm in field and 42.95 cm, 22.16 cm in pot experiment followed by *T. harzianum* during 2024-25 at 40 days after transplanting. The results indicate that homeopathic formulations and bioagents have a positive impact on the growth of brinjal plants.

Treatments T₆ (*Arnica montana* @ 0.2%) with a shoot length of 43.00 cm and root length of 22.21 cm at 40 DAS in 2023-24, and T₅ (Sulphur @ 0.2%) showed increased shoot and root length compared to the control. Bioagents like T₉ (*Trichoderma harzianum*) and T₁₀ (*Trichoderma viride*) also improved plant growth. (Kavitha *et al.*, 2018; Singh *et al.*, 2020)^[4, 14] that show homeopathic formulations and bioagents enhance plant growth. Patel *et al.* (2021)^[9] on the impact of bioagents on vegetable crops reported improved growth metrics, corroborating the findings of this research.

3.2 Effect of homeopathic medicines and bio agents on fresh and dry weight of shoot (gm) of brinjal crop under field & pot conditions during 2023-24 and 2024-25

According to the data in Table 5, 6 revealed that fresh & dry weight of shoot of brinjal significantly increased in all the treatments over control during 2023-24 and 2024-25. The maximum fresh & dry weight of shoot was recorded both in field and pot experiment in treatment T₆ (*Arnica montana* @ 0.2%) showed fresh weight of shoot 26.02 gm and dry weight of shoot 6.80 gm in field and 25.97 gm, 6.76 gm in pot experiment followed by *T. harzianum* during 2023-24 and T₆ (*Arnica montana* @ 0.2%) 26.00 gm, 6.78 gm in field and 25.96 gm, 6.74 gm in pot experiment followed by *T. harzianum* during 2024-25 at 40 days after transplanting. Singh *et al.* (2020)^[15] reported that bioagents like *Trichoderma harzianum* not only promote plant growth but also suppress plant pathogens, contributing to sustainable agriculture. The application of homeopathic formulations has been explored in various studies, with promising results. According to Kavitha *et al.* (2018)^[4], homeopathic preparations can stimulate plant growth and increase yield in different crops. Similarly, research by Chakraborty *et al.* (2019)^[2] highlighted the potential of

homeopathic treatments in plant disease management. Moreover, the use of bioagents in agriculture is gaining attention due to their eco-friendly nature. Pathak *et al.* (2020)^[8] emphasized the role of bioagents in enhancing crop productivity while reducing the reliance on chemical fertilizers and pesticides.

3.3 Effect of homeopathic medicines and bio agents on fresh and dry weight of root (gm) of Brinjal crop under field & pot conditions during 2023-24 and 2024-25

According to the data in Table 6, 7 revealed that fresh & dry weight of root of brinjal significantly increased in all the treatments over control during 2023-24 and 2024-25. The maximum fresh & dry weight of root was recorded both in field and pot experiment in treatment T₆ (*Arnica montana* @ 0.2%) showed a fresh weight of root of 9.22 gm and dry weight of root 3.78 gm in field and 9.18 gm, 3.74 gm in pot experiment followed by *T. harzianum* during 2023-24 and T₆ (*Arnica montana* @ 0.2%) 9.20 gm, 3.76 gm in field and 9.16 gm, 3.72 gm in pot experiment followed by *T. harzianum* during 2024-25 at 40 days after transplanting. Singh *et al.* (2020)^[14] reported that bioagents like *Trichoderma harzianum* promote plant growth and suppress plant pathogens, contributing to sustainable agriculture. Kavitha *et al.* (2018)^[4] found that homeopathic preparations can stimulate plant growth and increase yield in various crops. Chakraborty *et al.* (2019)^[2] highlighted the potential of homeopathic treatments in managing plant diseases. Pathak *et al.* (2020)^[8] emphasized the role of bioagents in enhancing crop productivity while reducing reliance on chemical fertilizers and pesticides. Additionally, Baker *et al.* (2023)^[1] discussed the broader implications of environmental factors like climate change on agriculture.

Table 4: Effect of homeopathic medicines and bio agents on shoot and root length (cm) of brinjal crop during 2023-24 & 2024-25 (field conditions)

Treatments	2023-24								2024-25							
	10DAS		20DAS		30DAS		40DAS		10DAS		20DAS		30DAS		40DAS	
	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root
T ₁	8.75	2.05	16.39	5.04	25.94	10.91	37.53	18.05	8.73	2.03	16.35	5.01	25.92	10.89	37.51	18.03
T ₂	8.84	2.09	16.41	5.11	25.98	10.96	37.66	18.11	8.82	2.07	16.39	5.09	25.96	10.94	37.64	18.09
T ₃	8.51	2.00	16.11	4.98	25.65	10.53	37.19	17.88	8.49	2.00	16.09	4.96	25.63	10.51	37.17	17.86
T ₄	8.66	2.02	16.25	5.00	25.79	10.88	37.22	18.00	8.64	2.01	16.23	5.00	25.77	10.86	37.20	18.00
T ₅	11.83	2.94	18.70	5.46	28.00	11.66	39.78	19.00	11.80	2.92	18.68	5.44	28.00	11.63	39.76	19.00
T ₆	13.00	3.54	18.78	6.90	30.98	12.98	43.00	22.21	13.00	3.52	18.76	6.88	30.96	12.96	42.98	22.19
T ₇	9.75	2.19	16.54	5.22	26.09	11.00	37.98	18.42	9.73	2.17	16.52	5.20	26.07	10.98	37.96	18.40
T ₈	9.88	2.22	16.98	5.32	26.15	11.25	38.00	18.54	9.86	2.20	16.96	5.30	26.13	11.23	38.00	18.52
T ₉	12.62	2.96	18.75	6.78	30.10	12.97	41.22	20.34	12.60	2.94	18.73	6.76	30.00	12.95	41.20	20.32
T ₁₀	10.38	2.39	17.55	5.41	27.55	11.55	38.40	18.75	10.36	2.37	17.53	5.39	27.52	11.53	38.38	18.73
T ₁₁	8.88	2.11	16.43	5.14	26.00	10.98	37.75	18.25	8.86	2.09	16.41	5.12	26.00	10.96	37.73	18.23
T ₁₂	6.02	1.49	14.75	4.00	22.52	8.07	34.22	15.43	6.00	1.47	14.73	4.00	22.50	8.04	34.20	15.41
T ₁₃	4.03	1.15	11.12	3.33	19.62	6.40	30.22	13.04	4.00	1.10	11.09	3.29	19.60	6.38	30.20	13.00
T ₁₄	6.00	1.41	13.52	3.49	20.33	6.55	32.00	13.12	5.98	1.39	13.50	3.47	20.31	6.53	32.00	13.09
CD at 5%	0.949	0.225	1.709	0.530	2.692	1.090	3.904	1.850	0.947	0.223	1.678	0.707	2.648	1.088	3.903	1.848
SE(m)	0.327	0.077	0.588	0.182	0.926	0.375	1.343	0.637	0.326	0.077	0.577	0.243	0.911	0.374	1.343	0.636

T₁= Sulphur @ 0.1% (Seedling treatment + One Foliar spray), T₂= *Arnica montana* @0.1% (Seedling treatment + One Foliar spray), T₃= Phosphorus @ 0.1% (Seedling treatment + One Foliar spray), T₄= *Silicea terra* @0.1% (Seedling treatment + One Foliar spray), T₅= Sulphur @ 0.20% (Seedling treatment + One Foliar spray), T₆= *Arnica montana* @0.20% (Seedling treatment + One Foliar spray), T₇= Phosphorus @ 0.20% (Seedling treatment + One Foliar spray), T₈= *Silicea terra* (Seedling treatment + One Foliar spray), T₉= *Trichoderma harzianum* (Seedling treatment + One Foliar spray), T₁₀= *Trichoderma viride* (Seedling treatment + One Foliar spray), T₁₁= *Bacillus subtilis*, T₁₂= *Pseudomonas fluorescens*, T₁₃= Control(inoculated), T₁₄= Control (untreated)

Table 5: Effect of homeopathic medicines and bio agents on shoot and root length (cm) of brinjal crop during 2023-24 & 2024-25 (Pot conditions)

Treatments	2023-24								2024-25							
	10 DAS		20 DAS		30 DAS		40 DAS		10 DAS		20 DAS		30 DAS		40 DAS	
	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root
T ₁	6.72	2.02	16.36	5.01	25.91	10.87	37.5	18.02	8.7	1.97	16.32	4.98	25.89	10.86	37.48	18
T ₂	6.75	2.06	16.38	5.08	25.95	10.93	37.63	18.08	8.79	2.04	5.06	25.93	10.91	10.91	37.61	18.06
T ₃	6.28	1.95	16.08	4.95	25.62	10.49	37.16	17.85	8.46	1.95	16.06	4.93	25.6	10.47	37.14	17.83
T ₄	6.36	2	16.22	4.97	25.76	10.85	37.19	17.97	8.61	1.96	16.2	4.97	25.74	10.83	37.17	17.97
T ₅	7.86	2.91	18.67	5.43	27.97	11.63	39.75	18.98	11.77	2.89	18.65	5.41	27.96	11.6	39.73	18.98
T ₆	8.91	3.51	18.75	6.86	30.95	12.95	42.97	22.18	12.97	3.49	18.73	6.85	30.93	12.94	42.95	22.16
T ₇	7.72	2.12	16.51	5.19	26.06	10.97	37.95	18.39	9.69	2.14	16.49	5.17	26.04	10.95	37.93	18.37
T ₈	7.78	2.16	16.95	5.29	26.12	11.22	37.97	18.51	9.83	2.17	16.93	5.27	26.09	11.19	37.96	18.49
T ₉	7.92	2.93	18.72	6.75	30.06	12.94	41.19	20.31	12.57	2.91	18.7	6.73	29.96	12.92	41.17	20.29
T ₁₀	7.83	2.36	17.52	5.38	27.52	11.52	38.37	18.72	10.33	2.34	17.5	5.36	27.49	11.5	38.35	18.69
T ₁₁	7	2.07	16.39	5.11	25.97	10.95	37.72	18.22	8.83	2.06	16.38	5.09	25.96	10.94	37.7	18.2
T ₁₂	5.94	1.44	14.72	3.97	22.48	8.04	34.19	15.39	5.98	1.44	14.7	3.97	22.97	8.01	34.17	15.38
T ₁₃	4	1.11	11.09	3.29	19.59	6.37	30.19	13.01	3.96	1.07	11.06	3.26	19.57	6.35	30.17	12.96
T ₁₄	5.21	1.38	13.49	3.45	20.29	6.52	31.96	13.09	4.82	1.36	13.47	3.44	20.28	6.5	31.97	13.06
CD at 5%	0.687	0.212	1.639	0.51	2.603	1.0519	3.7751	1.7901	0.8988	0.2109	1.6136	0.6821	2.5724	1.0498	3.7733	1.7879
SE(m)	0.237	0.073	0.566	0.176	0.898	0.3631	1.3032	0.6179	0.3103	0.0728	0.5570	0.2355	0.8880	0.3624	1.3025	0.6172

T₁= Sulphur @ 0.1% (Seedling treatment + One Foliar spray), T₂= *Arnica montana* @0.1% (Seedling treatment + One Foliar spray), T₃= Phosphorus @ 0.1% (Seedling treatment + One Foliar spray), T₄= *Silicea terra* @0.1% (Seedling treatment + One Foliar spray), T₅= Sulphur @ 0.20% (Seedling treatment + One Foliar spray), T₆= *Arnica montana* @0.20% (Seedling treatment + One Foliar spray), T₇= Phosphorus @ 0.20% (Seedling treatment + One Foliar spray), T₈= *Silicea terra* (Seedling treatment + One Foliar spray), T₉= *Trichoderma harzianum* (Seedling treatment + One Foliar spray), T₁₀= *Trichoderma viride* (Seedling treatment + One Foliar spray), T₁₁= *Bacillus subtilis*, T₁₂= *Pseudomonas fluorescens*, T₁₃= Control(inoculated), T₁₄= Control (untreated)

Table 6: Effect of homeopathic medicines and bio agents on fresh and dry weight of shoot (gm) of brinjal crop during 2023-24 & 2024-25 (Field conditions)

Treatments	2023-24								2024-25							
	10 DAS		20DAS		30DAS		40DAS		10DAS		20DAS		30DAS		40DAS	
	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.
T ₁	5.49	0.22	11.26	2.15	17.82	3.55	23.49	5.7	5.47	0.2	11.24	2.13	17.8	3.53	23.47	5.68
T ₂	5.78	0.24	11.55	2.49	18.45	3.96	23.74	5.86	5.76	0.22	11.53	2.47	18.43	3.94	23.72	5.84
T ₃	4.79	0.2	10.39	1.81	16.88	2.73	22.59	4.55	4.77	0.18	10.37	1.79	16.86	2.71	22.57	4.53
T ₄	5.25	0.21	11	2.08	17.15	3.48	23.17	5.39	5.23	0.19	11	2.06	17.13	3.46	23.15	5.37
T ₅	6.95	0.35	12.97	3.4	19.86	5.04	25.96	6.45	6.93	0.33	12.95	3.38	19.84	5.02	25.94	6.43
T ₆	7.98	0.4	13.76	3.69	20	5.1	26.02	6.8	7.96	0.38	13.74	3.67	19.98	5.08	26	6.78
T ₇	6.39	0.29	12.49	3.24	19.55	4.44	25.31	6.26	6.37	0.27	12.47	3.22	19.53	4.42	25.29	6.24
T ₈	6.5	0.3	12.88	3.35	19.76	4.67	25.69	6.35	6.48	0.28	12.86	3.33	19.74	4.65	25.67	6.33
T ₉	7.88	0.38	13.54	3.52	19.98	5.08	26	6.77	7.86	0.36	13.52	3.5	19.96	5.05	26	6.75
T ₁₀	6.82	0.32	12.93	3.37	19.82	5.01	25.93	6.42	6.8	0.3	12.91	3.35	19.8	5	26	6.75
T ₁₁	6.15	0.25	12.18	2.78	18.76	4.29	24.56	6.13	6.13	0.23	12.16	2.76	18.74	4.27	24.54	6.11
T ₁₂	4.26	0.19	10.11	1.76	15.56	2.42	21.67	4.12	4.24	0.17	10.09	1.74	15.54	2.4	21.64	4.1
T ₁₃	3.42	0.14	6.24	1.32	13.25	1.29	20.12	2.87	3.39	0.12	6.22	1.28	13.23	1.26	20.07	2.81
T ₁₄	3.57	0.17	8.81	1.47	14.79	1.81	20.77	3.8	3.55	0.15	8.79	1.45	14.76	1.79	20.75	3.78
CD at 5%	0.605	0.028	1.200	0.275	1.879	0.399	2.515	0.576	0.603	0.026	1.198	0.272	1.877	0.397	2.514	0.580
SE(m)	0.208	0.010	0.413	0.094	0.647	0.137	0.865	0.198	0.208	0.009	0.412	0.094	0.646	0.137	0.865	0.199

T₁= Sulphur @ 0.1% (Seedling treatment + One Foliar spray), T₂= *Arnica montana* @0.1% (Seedling treatment + One Foliar spray), T₃= Phosphorus @ 0.1% (Seedling treatment + One Foliar spray), T₄= *Silicea terra* @0.1% (Seedling treatment + One Foliar spray), T₅= Sulphur @ 0.20% (Seedling treatment + One Foliar spray), T₆= *Arnica montana* @0.20% (Seedling treatment + One Foliar spray), T₇= Phosphorus @ 0.20% (Seedling treatment + One Foliar spray), T₈= *Silicea terra* (Seedling treatment + One Foliar spray), T₉= *Trichoderma harzianum* (Seedling treatment + One Foliar spray), T₁₀= *Trichoderma viride* (Seedling treatment + One Foliar spray), T₁₁= *Bacillus subtilis*, T₁₂= *Pseudomonas fluorescens*, T₁₃= Control(inoculated), T₁₄= Control (untreated).

Table 7: Effect of homeopathic medicines and bio agents on fresh and dry weight of shoot (gm) of brinjal crop during 2023-24 & 2024-25 (Pot conditions)

Treatments	2023-24								2024-25							
	10 DAS		20 DAS		30 DAS		40 DAS		10DAS		20 DAS		30 DAS		40 DAS	
	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.
T ₁	5.46	0.18	11.22	2.11	17.78	3.51	23.45	5.66	5.43	0.16	11.2	2.09	17.76	3.49	23.43	5.64
T ₂	5.75	0.2	11.51	2.45	18.41	3.92	23.7	5.82	5.72	0.18	11.49	2.43	18.39	3.9	23.68	5.8
T ₃	4.76	0.16	10.35	1.77	16.84	2.68	22.55	4.51	4.73	0.15	10.33	1.75	16.82	2.67	22.53	4.49
T ₄	5.21	0.17	10.96	2.04	17.11	3.44	23.13	5.35	5.19	0.16	10.96	2.02	17.09	3.42	23.11	5.33
T ₅	6.91	0.31	12.93	3.36	19.82	5	25.92	6.41	6.89	0.29	12.91	3.34	19.8	4.98	25.9	6.39
T ₆	7.94	0.36	13.72	3.65	19.96	5.06	25.97	6.76	7.92	0.34	13.7	3.63	19.94	5.04	25.96	6.74
T ₇	6.35	0.25	12.45	3.2	19.51	4.4	25.27	6.22	6.33	0.23	12.43	3.18	19.49	4.38	25.25	6.2
T ₈	6.46	0.26	12.84	3.31	19.72	4.63	25.65	6.31	6.44	0.24	12.82	3.29	19.7	4.61	25.63	6.29

T ₉	7.84	0.34	13.5	3.47	19.94	5.04	25.96	6.73	7.82	0.32	13.48	3.46	19.92	5.01	25.94	6.71
T ₁₀	6.78	0.28	12.89	3.33	19.78	4.97	25.89	6.38	6.76	0.26	12.87	3.31	19.76	4.96	25.86	6.32
T ₁₁	6.11	0.21	12.14	2.74	18.72	4.25	24.52	6.09	6.09	0.19	12.12	2.72	18.7	4.23	24.49	6.07
T ₁₂	4.22	0.15	10.07	1.72	15.52	2.38	21.63	4.08	4.19	0.13	10.05	1.69	15.5	2.36	21.6	4.06
T ₁₃	3.38	0.1	6.2	1.28	13.21	1.25	20.08	2.83	3.35	0.08	6.18	1.24	13.19	1.22	20.03	2.77
T ₁₄	3.53	0.13	8.77	1.43	14.75	1.77	20.73	3.76	3.51	0.11	8.75	1.41	14.72	1.75	20.71	3.74
CD at 5%	0.58	0.022	1.143	0.2594	1.8058	0.3787	2.4294	0.5484	0.5778	0.0208	1.1416	0.2573	1.8037	0.3768	2.4267	0.5454
SE(m)	0.2	0.011	0.394	0.0895	0.6234	0.1307	0.8386	0.1893	0.1994	0.0072	0.3941	0.1307	0.6226	0.1301	0.8377	0.1883

T₁= Sulphur @ 0.1% (Seedling treatment + One Foliar spray), T₂= *Arnica montana* @0.1% (Seedling treatment + One Foliar spray), T₃= Phosphorus @ 0.1% (Seedling treatment + One Foliar spray), T₄= *Silicea terra* @0.1% (Seedling treatment + One Foliar spray), T₅= Sulphur @ 0.20% (Seedling treatment + One Foliar spray), T₆= *Arnica montana* @0.20% (Seedling treatment + One Foliar spray), T₇= Phosphorus @ 0.20% (Seedling treatment + One Foliar spray), T₈= *Silicea terra* (Seedling treatment + One Foliar spray), T₉= *Trichoderma harzianum* (Seedling treatment + One Foliar spray), T₁₀= *Trichoderma viride* (Seedling treatment + One Foliar spray), T₁₁ = *Bacillus subtilis*, T₁₂= *Pseudomonas fluorescens*, T₁₃= Control(inoculated), T₁₄= Control (untreated).

Table 8: Effect of homeopathic medicines and bio agents on fresh and dry weight of root (gm) of Brinjal crop during 2023-24 & 2024-25 (Field conditions)

Treatments details	2023-24								2024-25							
	10 DAS		20 DAS		30 DAS		40 DAS		10 DAS		20 DAS		30 DAS		40 DAS	
	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.
T ₁	0.48	0.17	2.76	0.69	5.79	1.48	8.02	2.87	0.47	0.16	2.74	0.67	5.77	1.46	8.01	2.85
T ₂	0.49	0.18	2.78	0.72	5.85	1.53	8.11	2.95	0.48	0.17	2.76	0.70	5.83	1.50	8.09	2.93
T ₃	0.45	0.15	2.54	0.49	4.79	0.95	6.67	2.68	0.43	0.14	2.52	0.47	4.77	0.93	6.65	2.66
T ₄	0.46	0.16	2.69	0.55	5.65	1.45	7.55	2.76	0.44	0.15	2.67	0.53	5.63	1.43	7.52	2.74
T ₅	0.65	0.32	3.75	0.89	6.78	1.79	9.16	3.74	0.64	0.30	3.73	0.87	6.76	1.77	9.14	3.72
T ₆	0.69	0.36	3.79	0.94	6.82	1.84	9.22	3.78	0.67	0.35	3.77	0.92	6.80	1.82	9.20	3.76
T ₇	0.55	0.22	3.65	0.82	6.59	1.68	8.52	3.44	0.53	0.20	3.63	0.80	6.57	1.66	8.49	3.42
T ₈	0.59	0.25	3.69	0.84	6.72	1.72	9.09	3.68	0.57	0.23	3.67	0.82	6.57	1.66	8.50	3.42
T ₉	0.67	0.34	3.77	0.92	6.80	1.82	9.19	3.76	0.65	0.33	3.75	0.90	6.78	1.79	9.16	3.74
T ₁₀	0.62	0.29	3.72	0.86	6.75	1.75	9.13	3.70	0.59	0.28	3.69	0.82	6.74	1.73	9.11	3.68
T ₁₁	0.52	0.19	3.02	0.75	5.88	1.55	8.25	2.98	0.51	0.17	3.00	0.71	5.86	1.53	8.23	2.95
T ₁₂	0.44	0.14	1.97	0.45	4.65	0.88	6.64	2.65	0.42	0.13	1.95	0.42	4.63	0.86	6.62	2.63
T ₁₃	0.36	0.08	1.77	0.28	4.19	0.76	6.02	2.32	0.34	0.06	1.69	0.24	4.11	0.73	5.88	2.26
T ₁₄	0.42	0.13	1.95	0.42	4.62	0.86	6.10	2.49	0.41	0.12	1.89	0.36	4.59	0.85	6.05	2.45
CD at 5%	0.056	0.023	0.314	0.072	0.613	0.150	0.833	0.330	0.054	0.022	0.311	0.069	0.610	0.147	0.825	0.325
SE(m)	0.019	0.008	0.108	0.025	0.211	0.052	0.287	0.114	0.018	0.008	0.107	0.024	0.210	0.051	0.284	0.112

T₁= Sulphur @ 0.1% (Seedling treatment + One Foliar spray), T₂= *Arnica montana* @0.1% (Seedling treatment + One Foliar spray), T₃= Phosphorus @ 0.1% (Seedling treatment + One Foliar spray), T₄= *Silicea terra* @0.1% (Seedling treatment + One Foliar spray), T₅= Sulphur @ 0.20% (Seedling treatment + One Foliar spray), T₆= *Arnica montana* @0.20% (Seedling treatment + One Foliar spray), T₇= Phosphorus @ 0.20% (Seedling treatment + One Foliar spray), T₈= *Silicea terra* (Seedling treatment + One Foliar spray), T₉= *Trichoderma harzianum* (Seedling treatment + One Foliar spray), T₁₀= *Trichoderma viride* (Seedling treatment + One Foliar spray), T₁₁ = *Bacillus subtilis*, T₁₂= *Pseudomonas fluorescens*, T₁₃= Control(inoculated), T₁₄= Control (untreated)

Table 9: Effect of homeopathic medicines and bio agents on fresh and dry weight of root (gm) of Brinjal crop during 2023-24 & 2024-25 (Pot conditions)

Treatments	2023-24								2024-25							
	10 DAS		20 DAS		30 DAS		40 DAS		10 DAS		20 DAS		30 DAS		40 DAS	
	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.
T ₁	0.44	0.13	2.72	0.65	5.75	1.44	7.98	2.83	0.43	0.12	2.7	0.63	5.73	1.42	7.97	2.81
T ₂	0.45	0.14	2.74	0.68	5.81	1.49	8.07	2.91	0.44	0.13	2.72	0.66	5.79	1.46	8.05	2.89
T ₃	0.41	0.11	2.5	0.45	4.75	0.91	6.63	2.64	0.39	0.1	2.48	0.43	4.73	0.89	6.61	2.62
T ₄	0.42	0.12	2.65	0.51	5.61	1.41	7.51	2.72	0.4	0.11	2.63	0.49	5.59	1.38	7.47	2.7
T ₅	0.61	0.28	3.71	0.85	6.74	1.75	9.12	3.7	0.6	0.26	3.69	0.83	6.72	1.73	9.1	3.68
T ₆	0.65	0.32	3.75	0.9	6.78	1.81	9.18	3.74	0.63	0.31	3.73	0.88	6.76	1.78	9.16	3.72
T ₇	0.51	0.18	3.61	0.78	6.55	1.64	8.48	3.4	0.49	0.16	3.59	0.76	6.53	1.62	8.45	3.38
T ₈	0.55	0.21	3.65	0.8	6.68	1.68	9.05	3.64	0.53	0.19	3.63	0.78	6.53	1.62	8.46	3.38
T ₉	0.63	0.3	3.73	0.88	6.76	1.78	9.15	3.72	0.61	0.29	3.71	0.86	6.74	1.75	9.12	3.7
T ₁₀	0.58	0.25	3.68	0.82	6.71	1.71	9.09	3.66	0.55	0.24	3.65	0.78	6.7	1.69	9.07	3.64
T ₁₁	0.48	0.15	2.98	0.71	5.84	1.51	8.2	2.94	0.47	0.13	2.96	0.67	5.82	1.49	8.19	2.91
T ₁₂	0.4	0.1	1.93	0.41	4.61	0.84	6.6	2.61	0.38	0.09	1.91	0.37	4.59	0.82	6.58	2.59
T ₁₃	0.32	0.04	1.73	0.24	4.15	0.72	5.98	2.28	0.3	0.02	1.65	0.2	4.07	0.68	5.84	2.22
T ₁₄	0.38	0.09	1.91	0.38	4.58	0.82	6.06	2.45	0.37	0.08	1.85	0.32	4.55	0.81	6.01	2.41
CD at 5%	0.0492	0.0182	0.297	0.0647	0.5861	0.1402	0.8014	0.3135	0.0472	0.0171	0.2948	0.0619	0.5824	0.1374	0.7929	0.3089
SE (m)	0.017	0.006	0.102	0.0223	0.2023	0.0484	0.2766	0.1082	0.0163	0.0059	0.1018	0.0214	0.2011	0.0474	0.2737	0.1066

T₁= Sulphur @ 0.1% (Seedling treatment + One Foliar spray), T₂= *Arnica montana* @0.1% (Seedling treatment + One Foliar spray), T₃= Phosphorus @ 0.1% (Seedling treatment + One Foliar spray), T₄= *Silicea terra* @0.1% (Seedling treatment + One Foliar spray), T₅= Sulphur @ 0.20% (Seedling treatment + One Foliar spray), T₆= *Arnica montana* @0.20% (Seedling treatment + One Foliar spray), T₇= Phosphorus @ 0.20% (Seedling treatment + One Foliar spray), T₈= *Silicea terra* (Seedling treatment + One Foliar spray), T₉= *Trichoderma harzianum* (Seedling treatment + One Foliar spray), T₁₀= *Trichoderma viride* (Seedling treatment + One Foliar spray), T₁₁ = *Bacillus subtilis*, T₁₂= *Pseudomonas fluorescens*, T₁₃= Control(inoculated), T₁₄= Control (untreated)

4. Conclusion

The present study on the impact of homeopathic formulations and bioagents on the morphological growth of brinjal plants reveals that these treatments have a positive influence on the growth parameters of brinjal crops. Specifically, the application of *Arnica montana* (0.2%) and bioagents like *Trichoderma harzianum* significantly enhanced the shoot & root length, fresh & dry weight of shoot and fresh & dry weight of roots in both field and pot experiments conducted during 2023-24 and 2024-25. The results indicate that homeopathic formulations and bioagents can be effective in promoting the growth of brinjal plants, contributing to sustainable agricultural practices by potentially reducing the dependency on chemical inputs. Further research is warranted to explore the mechanisms underlying these effects and to optimize the application of these treatments for broader agricultural applications.

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