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Impact of Vermicompost on the Growth of Zinnia (Zinnia Elegans)

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Abstract
The goal of this experiment is to determine how vermicompost affects the vegetative and reproductive development characteristics of the well-known ornamental plant Zinnia elegans. Earthworm action breaks down organic material to produce vermicompost, an environmentally friendly organic addition that enhances the soil's microbial flora and nutrient content. A greenhouse study evaluated five treatments, each using a different ratio of vermicompost. With 80% vermicompost treatment demonstrating the greatest overall growth performance, the findings showed noteworthy advancements in plant height, number of leaves, number of flowers, and biomass.

Keywords: Vermicompost, Zinnia elegans, plant growth, organic fertilizer

INTRODUCTION:

The beautiful and colorful blossoms of Zinnia (Zinnia elegans) make it a popular ornamental plant that is grown all over the world. It needs soil with a high nutrient content in order to flourish and produce flowers. Because vermicompost is a biologically active organic fertilizer that improves soil structure, aeration, and microbial activity, it is a perfect input for environmentally friendly floriculture. The effect of different amounts of vermicompost on Zinnia's development parameters is examined in this study.

Materials and Methods:

Pot experiment was conducted in 2025 (February-June, 2025) to find the impact of vermicompost on the growth of Zinnia (Zinnia elegans). Vermicompost was prepared from kitchen waste at Mata Gujri Mahila Mahavidyalaya (Autonomous) Jabalpur having the characteristics N 1.8%, P 1.33% and K 1.28%. Experiment was conducted in pots with five treatments and three replications.

Experimental Setup:

Location: Controlled greenhouse environment at Mata Gujri Mahila Mahavidyalaya (Autonomous) Jabalpur.

Treatments:

T1: Control (100% soil)
T2: 20% Vermicompost + 80% Soil
T3: 50% Vermicompost + 50% Soil
T4: 80% Vermicompost + 20% Soil
T5: 100% Vermicompost

Duration: 60 days after transplanting

Data Collection Parameters:

- Plant height (cm)
- Number of leaves
- Number of flowers
- Total biomass (g)

Statistical Analysis:
Data were analyzed using Analysis of Variance (ANOVA). The significance of the differences among treatment means was tested using the Least Significant Difference (LSD) at a 5% level of probability ($p<0.05$). Additionally, the coefficient of variation (CV%), F-values, and standard errors (SE) were calculated to ensure robustness of results.

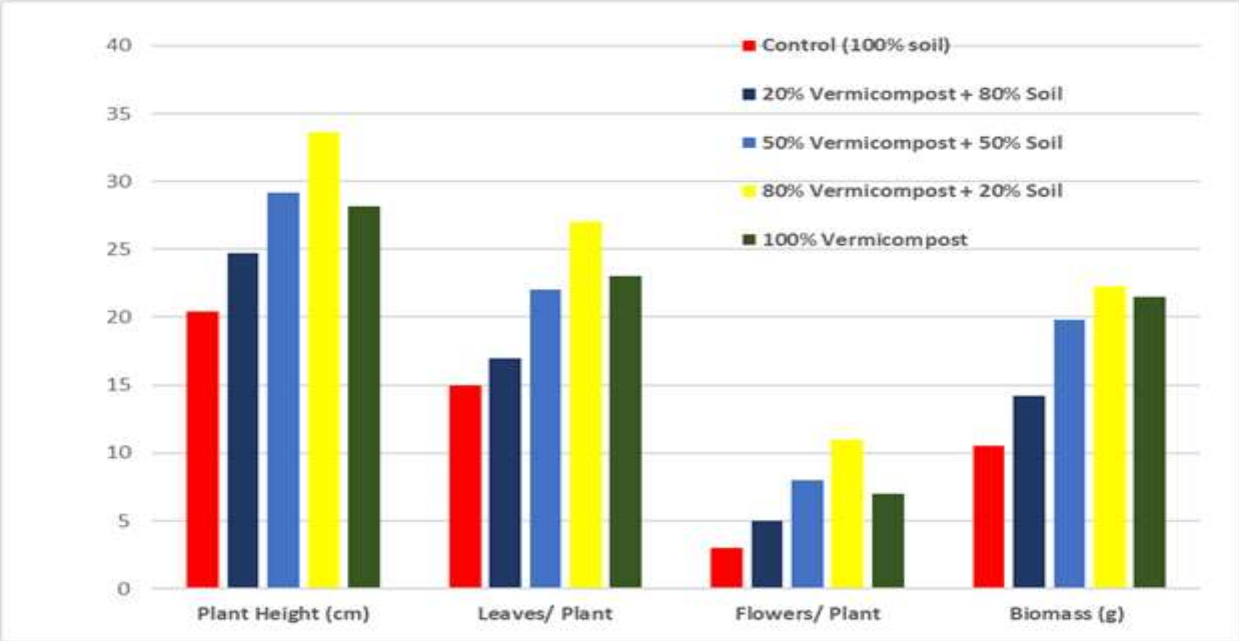
Results:
The experiment aimed to assess the impact of various vermicompost concentrations on the growth parameters of Zinnia elegans. The results are presented in table-1 and figure-1 for each treatment, highlighting their effects on plant height, leaf count, flower number, and total biomass.

Table 1: Effect of vermicompost on growth parameters of Zinnia

Treatment		**Plant Height (cm)**	**Leaves/ Plant**	**Flowers/ Plant**	**Biomass (g)**
T1	Control (100% soil)	20.4	15	3	10.5
T2	20% Vermicompost + 80% Soil	24.7	17	5	14.2
T3	50% Vermicompost + 50% Soil	29.2	22	8	19.8
T4	80% Vermicompost + 20% Soil	33.6	27	11	22.3
T5	100% Vermicompost	28.2	23	7	21.5
LSD (P=0.05)		8.71	8.46	5.33	8.96
CV (%)		18.23	23.16	44.61	28.89
SE ±		2.22	2.15	1.36	2.28

The statistical analysis confirms that the differences among the treatments are highly significant ($p<0.05$) across all parameters.

Figure 1: Effect of vermicompost on growth parameters of Zinnia



T1 – Control (100% Soil): Plants grown in pure soil (without vermicompost) exhibited the lowest growth across all parameters. The average plant height was 20.4 cm, with 15 leaves per plant, 3 flowers per plant, and a total biomass of 10.5 grams. This served as the baseline to compare the effect of vermicompost.

T2 – 20% Vermicompost + 80% Soil: Introduction of a small proportion of vermicompost (20%) showed noticeable improvement in plant performance. The plant height increased to 24.7 cm, with 17 leaves, 5 flowers, and biomass rising to 14.2 grams. This treatment marked a positive shift from the control, suggesting early-stage benefits of vermicompost addition.

T3 – 50% Vermicompost + 50% Soil: A balanced mixture of vermicompost and soil resulted in significant enhancement across all parameters. The plants reached a height of 29.2 cm, with 22 leaves and 8 flowers, while producing a biomass of 19.8 grams. This clearly indicated that a 1:1 mixture offers an optimal nutrient balance and aeration for Zinnia growth.

T4 – 80% Vermicompost + 20% Soil: This treatment demonstrated the **best performance overall**. Plant height peaked at 33.6 cm, the number of leaves increased to 27, flower count reached 11, and biomass was recorded at 22.3 grams. These results strongly suggest that a higher vermicompost ratio can maximize Zinnia's growth potential.

T5 – 100% Vermicompost: Interestingly, while still superior to the control, the plants in pure vermicompost (without soil) showed a **slight decline** compared to the 80% treatment. The average plant height dropped to 28.2 cm, with 23 leaves, 7 flowers, and 21.5 grams of biomass. This indicates that while vermicompost is beneficial, excessive concentration may lead to reduced aeration or salt build-up, slightly impeding optimal growth.

Discussion:

Vermicompost had a beneficial impact on every growth variable of Zinnia. According to the data, the highest plant height and biomass were found at 80% vermicompost (T4), indicating that the ideal substrate is one that is both nutrient-rich and aerated. The modest decrease at 100% vermicompost (T5) may be caused by an overabundance of nutrients, which interferes with root oxygenation and causes minor physiological stress.

The increased number of leaves and flowers is thought to be caused by the slow release and high microbial activity of vermicompost, which promotes nutrient absorption and plant metabolism. The ANOVA's F-values imply significant treatment effects, and the comparatively small coefficient of variation (CV%) suggests data consistency. These results are consistent with earlier research, such as M. Dhagat et.al (2023); Atiyeh et al. (2000); Arancon et al. (2003), Sinha et al. (2010); and Kale (1998), which showed that vermicompost has a beneficial effect on vegetable and ornamental plants.

According to studies, vermicompost enhances soil microbial dynamics and enzyme activity in addition to boosting nutrient availability (Lazcano and Domínguez, 2011). Nitrogen, phosphorus, potassium, and helpful microbes that promote plant development are abundant in it (Arancon et al., 2003; Joshi et al., 2015). The efficacy of vermicompost in boosting plant development has been shown in numerous studies covering a wide range of crops. Atiyeh et al. (2000) found that vermicompost improved plant growth and development in container media. Likewise, Nethra et al. (1999) discovered that vermicompost treatment increased the yield and quality of China aster flowers. The advantages of vermicompost were thoroughly reviewed by Edwards and Arancon (2004), who gave special emphasis to its higher nutrient content and microbial activity when compared to conventional compost. For its dual purpose in waste treatment and plant growth promotion, Sinha et al. (2010) proposed integrating vermiculture into agricultural operations.

The significance of substrate composition was highlighted by Garg and Kaushik (2005), who demonstrated that combining vermicompost with soil dramatically enhanced the physicochemical characteristics of the soil and led to higher crop yields. Lazcano and Domínguez (2011) described how the microbial communities in vermicompost affect plant health, development, and defense against pathogens. Vermicompost has been shown by Bhat et al. (2013) and Prakash and Karmegam (2010) to be particularly helpful in increasing flowering and biomass accumulation in floriculture crops. Zaller (2007) found that vermicompost extracts enhanced both growth and pest resistance in flowering plants.

Pathma and Sakthivel (2012) supported these results by demonstrating that vermicompost increased nutrient absorption efficiency and plant enzyme activity. Additionally, Yadav and Garg (2011) proved its function in enhancing soil fertility and microbial biomass. In conclusion, the literature supports the idea that vermicompost is a viable alternative to synthetic fertilizers because it greatly improves plant vegetative and reproductive development factors.

Conclusion:

The best organic amendment for fostering the development and flowering of Zinnia elegans is vermicompost. The optimum overall outcomes were achieved with a vermicompost combination of 80%. This supports its viability as a long-term alternative to synthetic fertilizers in ornamental horticulture.

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