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Assessing the influence of different potting media on vegetative and floral attributes of marigold (*Tagetes erecta*) *cv.* Pusa Narangi Gainda

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Abstract
A field experiment entitled "Assessing the Influence of Different Potting Media on Vegetative and Floral Attributes of Marigold (*Tagetes erecta* L.) *cv.* Pusa Narangi Gainda" was conducted during the Rabi season of 2024–25 at the Department of Floriculture and Landscaping, College of Horticulture and Research Station, Sankara, Patan, Durg (Chhattisgarh). The experiment was laid out in a Completely Randomized Design (CRD) comprising nine treatments and three replications to determine the most suitable potting medium for growth and flowering in marigold. The treatments included: T_0 (Soil + Sand, 1:1), T_1 (Soil + Sand + FYM, 1:1:2), T_2 (Soil + Sand + Vermicompost, 1:1:2), T_3 (Soil + Sand + Cocopeat, 1:1:2), T_4 (Soil + Sand + Rice husk, 1:1:2), T_5 (Soil + Sand + Poultry manure, 1:1:2), T_6 (Soil + Sand + Mushroom compost, 1:1:2), T_7 (Soil + Sand + Leaf mold, 1:1:2), and T_8 (Soil + Sand + Bio-compost, 1:1:2). Significant variation was recorded among treatments for vegetative and floral parameters. The treatment T_2 (Soil:Sand:Vermicompost, 1:1:2) produced maximum plant height (56.10 cm), number of leaves (81.33), and stem diameter (13.00 mm), followed by T_5 and T_6. The highest number of flowers per plant (26) and longest blooming duration (46.5 days) were also recorded under T_2, while the minimum values were observed in the control (T_0). The superior performance of T_2 (Soil:Sand:Vermicompost, 1:1:2) may be attributed to improved nutrient supply, humic acid presence, and enhanced microbial activity that improved nutrient uptake and root growth. Therefore, vermicompost-based potting media (T_2) proved most effective in promoting vegetative vigor, flowering duration, and flower yield, making it a sustainable and eco-friendly option for quality marigold production under pot conditions

Keywords: African marigold; potting media; vegetative growth; floral attributes; organic amendments.

Introduction
Marigold (*Tagetes spp.*), belonging to the family Asteraceae, is one of the most popular ornamental crops, valued for its bright flowers, adaptability and wide utility in garlands, landscaping and religious purposes (Garge *et al*., 2021) [14]. Besides its ornamental role, marigold is also a source of lutein for nutraceutical use, poultry feed additives and bio-pesticidal applications due to its antimicrobial and insect-repellent properties (Chavan *et al*., 2022; Brennan *et al*., 2020) [9, 7]. Among different species, African marigold (*T. erecta*) is particularly important for its large flower size, profuse blooming and extended vase life (Atzori *et al*., 2021) [4]. In India, marigold is cultivated on 15.11 thousand hectares with an annual production of 966.43 thousand tonnes (NHB, 2023-24). Major producing states include Tamil Nadu, Karnataka, Madhya Pradesh and West Bengal, while Chhattisgarh is emerging as a potential contributor (APEDA, 2023-24) [3]. Pusa Narangi Gainda, a cultivar released by IARI, is preferred for its compact growth, bright orange flowers and consistent performance under both field and pot conditions, making it ideal for nutrient and potting media studies.

Potting media plays a crucial role in container-grown ornamentals. Soil alone often lacks proper drainage and nutrient balance; hence it is supplemented with amendments like sand, FYM, vermicompost, poultry manure, mushroom compost, cocopeat and rice husk (Devi *et al*., 2024; Chaudhary *et al*., 2024) [10, 8]. Vermicompost is particularly rich in macro-and micro-nutrients, humic acids and growth regulators (Ali, 2014; Lakra *et al*., 2021) [2, 18], while poultry manure and mushroom compost supply high organic matter and promote microbial activity (Kumar *et al*., 2019; Singh *et al*., 2021) [17, 22]. Such combinations can significantly influence vegetative growth and flower yield in marigold. Keeping these points in view, the present investigation entitled "Assessing the Influence of Different Potting Media on Vegetative and Floral Attributes of Marigold (*Tagetes erecta*) *cv.* Pusa Narangi Gainda" was conducted to evaluate the effect of different media combinations on growth and flowering.

Materials and Methods

The present investigation entitled "Assessing the Influence of Different Potting Media on Vegetative and Floral Attributes of Marigold (*Tagetes erecta* L.) *cv.* Pusa Narangi Gainda*"* was conducted during the Rabi season of 2024–25 at the Department of Floriculture and Landscaping, College of Horticulture and Research Station, Sankara, Patan, Durg (Chhattisgarh). The experimental site is situated at 21°32′N latitude, 81°36′E longitude and 317 m above mean sea level. The region falls under a tropical wet and dry climatic zone, characterized by an average annual rainfall of about 1052 mm, with temperature variations ranging from 10.2°C to 40.2°C during the cropping period. The experiment was laid out in a Completely Randomized Design (CRD) comprising nine treatments replicated thrice, using ten plants per treatment, making a total of 270 plants. The treatments consisted of different combinations of soil, sand, and organic amendments as follows: T_0 – Soil + Sand (1:1), T_1 – Soil + Sand + FYM (1:1:2), T_2 – Soil + Sand + Vermicompost (1:1:2), T_3 – Soil + Sand + Cocopeat (1:1:2), T_4 – Soil + Sand + Rice husk (1:1:2), T_5 – Soil + Sand + Poultry manure (1:1:2), T_6 – Soil + Sand + Mushroom compost (1:1:2), T_7 – Soil + Sand + Leaf mold (1:1:2), and T_8 – Soil + Sand + Bio-compost (1:1:2). Observations were recorded on both vegetative and floral attributes. The vegetative parameters included plant height (cm), plant spread (North–South and East–West directions in cm), number of branches per plant, number of leaves per plant, and stem diameter (mm), which were recorded at 25, 50, and 75 days after planting (DAP). The floral parameters include blooming period (days), number of flowers per splant, and flower diameter (cm).

The organic amendments varied in nutrient composition: vermicompost contained ~2.0% N, 1.1% P_2O_5 and 0.5% K_2O (Mohdilyas *et al*., 2015); poultry manure contained 2.23% N, 0.83% P_2O_5 and 2.35% K_2O (Adekiya & Agbede, 2009) [1]; while mushroom compost was rich in organic matter with 0.80% N, 0.17% P_2O_5 and 0.48% K_2O (Beckers, 2019) [5]. Healthy 20-day-old seedlings were transplanted into 8-inch perforated polybags filled with respective media, and irrigation was given on alternate days depending on moisture status. A foliar spray of 19:19:19 NPK (2 g L^{-1}) was applied immediately after transplanting and repeated at 15-day intervals, while intercultural operations such as manual weeding and staking with bamboo sticks were performed as needed. Plant protection measures included neem oil (2 ml L^{-1}) for leaf miner, thiamethoxam (1 g L^{-1}) for mealy bug and proxima (0.2 ml L^{-1}) for mite management, ensuring healthy crop growth (Devi *et al*., 2024) [10].

Statistical Analysis

Data were subjected to analysis of variance (ANOVA) under CRD following the procedure of Fisher (1954) [12]. Treatment means were compared at 5% level of significance (CD at 5%) and variability was assessed using coefficient of variation (CV%). Standard errors of mean (SEm) and difference (SEd) were also calculated to ensure reliability of results.

Results and Discussion

The effect of different potting media on vegetative and floral attributes of *Tagetes erecta cv.* Pusa Narangi Gainda was evaluated. Results revealed that organic amendments, particularly vermicompost, played a significant role in enhancing both growth and flowering behavior.

Vegetative Attributes

The vegetative attributes of marigold were significantly influenced by different potting media at 25, 50 and 75 DAP. At 25 DAP, the maximum plant height (25.00 cm), plant spread (13.20 cm), number of branches (5.33), number of leaves (25.33) and stem diameter (5.00 mm) were all recorded in T_2 (Soil: Sand: Vermicompost, 1:1:2), followed closely by T_5 (23.26 cm, 12.63 cm, 5.16, 23.13, 4.86 mm) and T_6 (22.00 cm, 12.10 cm, 4.83, 22.03, 4.66 mm), while the lowest values were observed in the control T_0 (16.00 cm, 9.03 cm, 3.00, 16.33, 3.33 mm). At 50 DAP, the superiority of T_2 was again evident, with the tallest plants (37.00 cm), widest spread (29.70 cm), highest branching (6.86), maximum leaves (49.66) and thickest stems (9.66 mm), whereas T_5 (35.20 cm, 28.80 cm, 6.65, 47.66, 9.33 mm) and T_6 (33.80 cm, 27.50 cm, 6.20, 45.76, 8.93 mm) followed and T_0 remained the lowest (26.00 cm, 22.00 cm, 4.30, 31.67, 7.00 mm). At 75 DAP, T_2 once again recorded maximum values for plant height (56.10 cm), plant spread (43.96 cm), number of branches (9.66), number of leaves (81.33) and stem diameter (13.00 mm), statistically at par with T_5 (54.70 cm, 42.83 cm, 9.40, 79.10, 12.60 mm) and T_6 (53.26 cm, 41.73 cm, 9.10, 77.13, 12.03 mm), while T_0 remained inferior (44.52 cm, 34.50 cm, 7.00, 63.33, 9.70 mm). The consistent superiority of vermicompost (T_2) across all growth stages may be attributed to its rich nutrient profile, humic acids and bioactive compounds such as auxins, gibberellins and cytokinins that stimulate root activity, enhance nutrient uptake and improve overall vegetative vigor (Lakra *et al*., 2021) [18]. Poultry manure and mushroom compost also enhanced vegetative attributes due to their nutrient richness, organic matter content and ability to improve soil structure and microbial activity (Devi *et al*., 2024) [10]. In contrast, the least performance of the control medium (T_0) reflected the limitations of nutrient-deficient soil and sand mixture, which restricted vegetative growth and photosynthetic efficiency (Patel *et al*., 2020; Kaur & Dhatt, 2015).

Floral Attributes

The flowering attributes of marigold were significantly influenced by different potting media (Table 3). Among all treatments, the medium containing vermicompost (T_2: Soil + Sand + Vermicompost, 1:1:2) recorded the best floral performance with the longest blooming period (46.5 days), highest number of flowers per plant (26), and largest flower diameter (5.9 cm), followed by poultry manure (T_5) and mushroom compost (T_6), which also showed enhanced flowering but were slightly inferior to vermicompost. The superiority of vermicompost may be attributed to its balanced nutrient composition, humic substances, and bioactive compounds that stimulate flower initiation, improve nutrient uptake and enhance assimilate translocation towards reproductive growth (Lakra *et al*., 2021; Gupta & Sahu, 2022; Mann *et al.*, 2023) [18, 15, 19] . Poultry manure and mushroom compost also improved flowering parameters due to their high organic matter and nitrogen content that promoted vegetative vigor and better flower development (Kumar *et al*., 2019; Devi *et al*., 2024) [10, 17]. In contrast, the control treatment (T_0: Soil + Sand, 1:1) exhibited the shortest blooming duration (33.9 days), fewest flowers (19 per plant) and smallest flower diameter (3.1 cm) owing to poor nutrient availability and low organic content, which limited growth and delayed flowering (Patel *et al*., 2020; Kaur & Dhatt, 2015). Thus, vermicompost-based medium proved most effective in promoting early, profuse and superior flowering in marigold, followed by poultry manure and mushroom compost, while the control medium was found to be the least effective.

Table 1: Effect of different media on plant height and plant spread of marigold (*Tagetes erecta cv.* Pusa Narangi Gainda)

Notation	Treatment combination	Plant height (cm)			Plant spread (N-S) & (E-W) (cm)		
		25 DAP	50 DAP	75 DAP	25 DAP	50 DAP	75 DAP
T_0	Soil: Sand (1:1)	16	26	44.52	9.03	22	34.5
T_1	Soil: Sand: FYM (1:1:2)	19.96	30.8	50.35	11.06	26.03	39.3
T_2	Soil: Sand: Vermicompost (1:1:2)	25	37	56.10	13.2	29.7	43.96
T_3	Soil: Sand: Cocopeat (1:1:2)	20.76	32.3	51.8	11.56	27.03	40.5
T_4	Soil: Sand: Rice husk (1:1:2)	17.2	27.5	46	9.6	23	35.73
T_5	Soil: Sand: Poultry manure (1:1:2)	23.26	35.2	54.7	12.63	28.8	42.83
T_6	Soil: Sand: Mushroom compost (1:1:2)	22	33.8	53.26	12.1	27.83	41.7
T_7	Soil: Sand: Leaf mold (1:1:2)	18.2	28.5	47.45	10.03	24.03	36.8
T_8	Soil: Sand: Bio compost (1:1:2)	19	29.5	48.9	10.53	25.03	38.13
	C.D.	0.762	0.847	3.453	1.069	1.471	1.790
	SE(m)	0.255	0.283	1.153	0.357	0.491	0.598
	SE(d)	0.360	0.400	1.631	0.505	0.695	0.846
	C.V.	2.188	1.571	3.967	5.577	3.280	2.637

Table 2: Effect of different media on number of branches, number of leaves and stem diameter of marigold

Notation	Treatment combination	Number of branches per plant			Number of leaves per plant			Stem diameter (mm)		
		25 DAP	50 DAP	75 DAP	25 DAP	50 DAP	75 DAP	25 DAP	50 DAP	75 DAP
T_0	Soil: Sand (1:1)	3	4.3	7	15.33	31.7	63.33	3.33	7	9.7
T_1	Soil: Sand: FYM (1:1:2)	4.26	5.8	8.55	19.73	41.3	73.13	4.36	8.46	11.4
T_2	Soil: Sand: Vermicompost (1:1:2)	5.33	7	9.66	25.33	49.66	81.33	5	9.66	13
T_3	Soil: Sand: Cocopeat (1:1:2)	4.56	6.1	8.83	20.83	43.73	75.13	4.56	8.73	11.8
T_4	Soil: Sand: Rice husk (1:1:2)	3.5	4.75	7.45	16.33	34.13	66.23	3.63	7.5	10.16
T_5	Soil: Sand: Poultry manure (1:1:2)	5.16	6.65	9.4	23.13	47.66	79.1	4.86	9.33	12.6
T_6	Soil: Sand: Mushroom compost (1:1:2)	4.86	6.35	9.1	22.03	45.76	77.13	4.66	9.06	12.2
T_7	Soil: Sand: Leaf mold (1:1:2)	3.8	5.1	7.93	17.43	36.53	69.13	3.86	7.86	10.6
T_8	Soil: Sand: Bio compost (1:1:2)	4	5.45	8.23	18.53	38.9	71.1	4.1	8.16	11
	C.D.	0.389	0.448	0.378	0.973	0.891	1.058	0.347	0.436	0.510
	SE(m)	0.130	0.150	0.126	0.325	0.298	0.353	0.116	0.146	0.170
	SE(d)	0.184	0.212	0.179	0.459	0.421	0.500	0.164	0.206	0.241
	C.V.	5.266	4.531	2.585	2.834	1.256	0.840	4.709	2.997	2.591

Table 3: Effect of different potting media on flowering attributes of marigold

Notation	Treatment combination	Blooming periods (days)	No. of flower per plant	Flower diameter (cm)
T_0	Soil: Sand (1:1)	33.9	19	3.1
T_1	Soil: Sand: FYM (1:1:2)	39.6	22.2	4.4
T_2	Soil: Sand: Vermicompost (1:1:2)	46.5	26	5.9
T_3	Soil: Sand: Cocopeat (1:1:2)	41.5	22.9	4.8
T_4	Soil: Sand: Rice husk (1:1:2)	35.8	20.3	3.5
T_5	Soil: Sand: Poultry manure (1:1:2)	44.2	24.3	5.5
T_6	Soil: Sand: Mushroom compost (1:1:2)	42.4	23.5	5.1
T_7	Soil: Sand: Leaf mold (1:1:2)	36.9	20.9	3.8
T_8	Soil: Sand: Bio compost (1:1:2)	38.7	21.5	4.1
	C.D.	2.162	0.519	0.486
	SE(m)	0.722	0.173	0.162
	SE(d)	1.021	0.245	0.229
	C.V.	3.131	1.346	6.288

Conclusion

The present investigation on *Tagetes erecta cv.* Pusa Narangi Gainda revealed that different potting media had a significant effect on the vegetative and floral attributes of marigold. Among all treatments, the combination of Soil: Sand: Vermicompost (1:1:2) proved to be the most effective medium, resulting in superior plant height, number of leaves, stem thickness, and overall plant spread. It also produced the maximum number of flowers per plant, longest blooming duration, and largest flower diameter. Thus, vermicompost improves soil texture, aeration, and water-holding capacity, while encouraging beneficial microbial populations that accelerate organic matter decomposition and nutrient cycling. The synergy of these factors leads to sustained nutrient release and optimum plant growth. Poultry manure and mushroom compost also performed notably well, producing results comparable to vermicompost in many parameters. The high nitrogen and organic matter content of poultry manure

enhanced vegetative growth, while the rich organic composition of mushroom compost improved soil structure and moisture retention. However, their effects were slightly lower than vermicompost due to differences in nutrient balance and microbial activity.

In contrast, the control treatment (Soil + Sand) showed the least performance for almost all growth and flowering parameters, confirming that the absence of organic amendments results in nutrient deficiency, poor aeration, and limited microbial activity—factors that collectively restrict plant vigor and floral development. Overall, it can be concluded that incorporating vermicompost at a 1:1:2 ratio with soil and sand offers a sustainable, eco-friendly, and cost-effective solution for improving marigold production under pot conditions. This medium not only enhances growth and yield attributes but also contributes to soil health through improved biological activity and organic matter content. Hence, vermicompost-based potting media can be effectively recommended for commercial and home-scale marigold cultivation to achieve superior flower quality, higher productivity, and environmental sustainability.

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