

1 **Effect of different growing media on growth and flower production of Oriental lily (*Lilium orientalis*)**
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4
5 **ABSTRACT**

6 Oriental lily (*Lilium orientalis* L.) is a popular and beautiful flowering plant known for its large, colorful, and
7 fragrant blooms. Oriental lilies are perennial plants that grow from bulbs and can reach impressive heights,
8 producing tall and sturdy stems. Their flowers come in various striking colours, including shades of pink, white,
9 red, and bi-color combinations. Growing media, also known as potting mix or substrate, refers to the material
10 used to grow plants in containers, pots, or raised beds. It is a crucial component in container gardening and
11 hydroponics, as it provides physical support, nutrients, and aeration for plant roots to grow and thrive.
12 Therefore, present investigation was carried out at the Department of Horticulture, Naini Agricultural Institute,
13 Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during
14 the Winter-2022 with a view to determine the effect of different growing media and different varieties of oriental
15 lily for its growth, flowering, yield and to work out the economics of various treatments. Under this experiment,
16 two factors viz., 3 different varieties (factor A) and 6 treatments comprising of different growing media (factor
17 B) were used. The study was examined using factorial randomized block design. From the present investigation
18 it is concluded that the media V₂M₃ (Trocadero variety was grown in Soil + Sand + Vermicompost +
19 Vermiculite (1:1:1:1) was found to be the best in terms of vegetative growth, flowering, and bulb production. In
20 case of bulblets of liliium, was to all best with media V₃M₃(Robina variety was grown in Soil + Sand +
21 Vermicompost + Vermiculite (1:1:1:1) was found best. The highest benefit cost ratio was recorded 2.57 with a
22 M₃ (Soil + Sand + Vermicompost + Vermiculite (1:1:1:1).

23 **Keywords:** *Oriental lily, vermicompost, vermiculite, perlite.*

24 **INTRODUCTION**

25 The Oriental lily, botanically known as *Lilium orientalis* L., is a popular flowering plant known for its large,
26 showy, and fragrant blooms. It belongs to the lily family, Liliaceae, and is native to the regions of Japan, China,
27 and Korea. Oriental lilies are widely cultivated for their beautiful flowers, which come in various colours,
28 including white, pink, red, and bi-colour combinations. Oriental lilies typically grow from bulbs and can reach a
29 height of 2 to 6 feet (60 to 180 cm). They have tall, sturdy stems and lance-shaped leaves that are arranged in
30 whorls or spirals along the stem. The flowers are large, often measuring 6 to 10 inches (15 to 25 cm) in diameter
31 and have distinctively curved petals with prominent stamens and pistils. One of the most notable traits of
32 Oriental lilies is their captivating fragrance. The flowers emit a strong, sweet scent that is often described as
33 rich, spicy, and exotic. The fragrance can be quite powerful and can fill a room or garden with its delightful
34 aroma. The Oriental lily is native to various regions in East Asia, including Japan, China, and Korea. It is
35 believed to have originated in these areas where it naturally grew in wild habitats. Over time, the beauty and
36 fragrance of Oriental lilies captured the attention of horticulturists and plant enthusiasts, leading to their
37 cultivation and popularity worldwide. Oriental lilies were introduced to the Western world in the late 19th
38 century, and since then, they have been widely cultivated and hybridized for their stunning blooms. Through
39 selective breeding and hybridization, horticulturists have developed numerous cultivars and varieties of Oriental
40 lilies with different flower colours, forms, and fragrances, enhancing their ornamental value and appeal. Today,

1 Oriental lilies are grown and enjoyed by gardeners and flower enthusiasts in various parts of the world, adding
2 beauty and elegance to gardens, flower beds, and floral arrangements. Chromosome number of oriental lily is
3 $2n=24$. The range of lilies in the Old World extends across much of Europe, across most of Asia to Japan, south
4 to India, and east to Indochina and the Philippines. In the New World they extend from southern Canada
5 through much of the United States. Vermicompost is rich in essential plant nutrients, including nitrogen,
6 phosphorus, potassium, micronutrients, and organic matter. Several studies have demonstrated that the
7 application of vermicompost in floriculture can enhance nutrient availability and improve soil fertility, leading
8 to improved plant growth, vigor, and flowering. Vermicompost, produced through the decomposition of organic
9 matter by earthworms, is renowned for its nutrient-rich composition. It contains essential elements such as
10 nitrogen, phosphorus, potassium, micronutrients, and organic matter. These components play a vital role in
11 enhancing nutrient availability and improving soil fertility, ultimately leading to improved plant growth, vigor,
12 and flowering (Atiyeh *et al.*, 2002). Vermiculite is a different material from vermicompost. Vermiculite is a
13 mineral that is commonly used as a soil amendment in horticulture and agriculture. It provides several benefits
14 such as improved water retention and aeration in soil mixes. Studies have demonstrated that the incorporation of
15 vermiculite in growing media can enhance water retention while maintaining proper drainage. The unique
16 structure of vermiculite, with its laminated layers, allows it to hold moisture and release it gradually to plant
17 roots, promoting optimal hydration levels (Liu *et al.*, 2016). Perlite, a lightweight mineral material composed of
18 volcanic glass, is widely recognized for its beneficial properties as a soil amendment in horticulture. Studies
19 have shown that incorporating perlite into growing media for floriculture crops provides several advantages.
20 One of the primary benefits is its excellent water-holding capacity combined with proper drainage. Perlite's
21 porous nature allows it to absorb and retain water, preventing waterlogging and ensuring adequate oxygen
22 availability to plant roots (Beeson *et al.*, 2018). The Oriental lily is a highly valued cut flower globally, known
23 for its large, fragrant blooms in captivating colors. Different growing media such as perlite, vermicompost, and
24 cocopeat have a significant impact on the growth and development of Oriental lilies. Perlite improves root
25 development, moisture management, and soil compaction. Vermicompost enhances nutrient availability, soil
26 structure, and microbial support. Cocopeat retains moisture, provides nutrients, and suppresses weeds. These
27 growing media create optimal conditions for Oriental lilies by improving soil structure, nutrient availability, root
28 development, and moisture levels. Considering the specific needs of Oriental lilies, such as well-drained soil and
29 adequate nutrients, is important when selecting growing media. Research on the effect of different growing
30 media on Oriental lilies helps maximize plant performance, improve cultivation practices, and promote
31 sustainable agriculture. It involves investigating parameters like nutrient retention, water holding capacity, and
32 microbial activity to enhance resource efficiency and minimize environmental impact. Evaluating Oriental lily
33 varieties in various soil media helps identify high-yielding cultivars with adaptable growth and flowering
34 patterns. Thus, a research was conducted in the department of Horticulture with objectives to evaluate the effect
35 of different growing media on plant growth, flowering, and quality of Oriental lily (*Lilium orientalis*) in
36 Prayagraj climatic conditions.

Comment [D1]: This does not need a separate line. The chromosome number can be written in bracket as well after the name of Oriental Lily

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1 MATERIAL AND METHODS

2 The present investigation was done to understand the effect of different varieties and growing media on plant
3 and floral growth and yield of Oriental lily. The investigation was carried out at Horticultural Research Farm
4 (HRF), Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture,
5 Technology and Sciences (SHUATS), Prayagraj during *Winter Season 2022*. The field experiment comprising of
6 6 treatment combinations were grown under Factorial Randomized Block Design (FRBD) with three
7 replications. Observations were recorded at different growth parameters like plant height, number of leaves per
8 plant, Leaf area, flowering parameters like 1. Days to taken to first bud initiation, Length of first flower bud,
9 Diameter of first flower bud, stalk diameter and yield parameters like number of bulbs per plant etc. The data
10 were analysed by the method suggested by Fisher and Yates, 1963. The different combination of growing media
11 comprised of are M₁ (Soil + Sand + Vermicompost (1:1:1 v/v); M₂ (Soil + Sand + Vermicompost + Perlite
12 (1:1:1:1 v/v); M₃ (Soil + Sand + Vermicompost + Vermiculite (1:1:1:1 v/v); M₄ (Cocopeat +
13 Vermicompost (1:1 v/v); M₅ (Cocopeat + Vermicompost + Perlite (1:1:1 v/v); M₆ (Cocopeat +
14 Vermicompost + Vermiculite (1:1:1 v/v) while varieties comprised of V₁ (Monteneu); V₂ (Trocadero); V₃
15 (Robina).

16 RESULTS AND DISCUSSION

17 A) Vegetative Parameters

18 Plant height and Number of leaves per plant

19 The significantly maximum plant height at 80 DAP (67.88 cm) was recorded in V₂M₃ (Trocadero variety was
20 grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (65.62 cm) in V₂M₅ (Trocadero
21 variety was grown in Cocopeat + Vermicompost + Perlite (1:1:1 v/v) and the minimum plant height (57.65 cm)
22 was recorded in V₃M₁ (Robina variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v). The better plant
23 height of one variety of Oriental lily over another variety when grown in Soil + Sand + Vermicompost +
24 Vermiculite media compared to other media can be attributed to several reasons. Firstly, the specific
25 composition of the media provides a well-balanced nutrient supply, allowing for optimal plant growth and
26 development. The combination of soil, sand, vermicompost, and vermiculite ensures a good balance of organic
27 matter, water retention, aeration, and nutrient availability, promoting vigorous root growth and subsequently
28 leading to taller plants. Additionally, the improved physical properties of the media, such as enhanced drainage
29 and moisture-holding capacity, create favorable conditions for root development, allowing the plants to access
30 essential nutrients and water efficiently. These factors collectively contribute to better nutrient uptake, enhanced
31 physiological processes, and ultimately, increased plant height in the Oriental lily variety grown in the specified
32 media. Similar findings were reported by Treder (2008) in Oriental lily; Sindhu *et al.*, (2010) in gerbera; Al-
33 Mazouriet *al.*, (2020) in marigold; Thakur and Grewal (2018) in Chrysanthemum; Yuliana *et al.*, (2020) in
34 gladiolus.

35 The significantly maximum number of leaves at 90 DAP (59.77 leaves) was recorded in V₂M₃ (Trocadero
36 variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (59.21 leaves) in V₂M₅
37 (Trocadero variety was grown in Cocopeat + Vermicompost + Perlite (1:1:1 v/v) and the minimum number of
38 leaves (45.22 leaves) was recorded in V₃M₁ (Robina variety was grown in Soil + Sand + Vermicompost (1:1:1
39 v/v). The higher number of leaves per plant in one variety of Oriental lily compared to another variety when

Comment [D2]: In order to enhance the academic tone of the user's text, the following revision is proposed: Incorporate a control treatment and provide further clarification regarding the procedure and experimental design employed in the experiment. In the concluding section, the author has additionally computed the Benefit-Cost Ratio (B-C Ratio) without providing details regarding the methodology employed in the study. The authors should provide explicit details regarding the specific setting in which the study was conducted, such as whether it took place in a natural field environment, controlled pots, pots within a field setting, or pots within a greenhouse facility.

1 grown in Soil + Sand + Vermicompost + Vermiculite media can be attributed to several factors. Firstly, the
2 specific media composition provides a well-balanced nutrient supply, ensuring optimal plant nutrition and
3 promoting leaf development. The combination of soil, sand, vermicompost, and vermiculite offers a favourable
4 environment for root growth and nutrient uptake, resulting in increased foliage production. Additionally, the
5 improved physical properties of the media, such as enhanced water retention and aeration, support healthy root
6 systems, enabling efficient nutrient absorption and subsequent leaf formation. The balanced nutrient availability,
7 along with the improved root development, contributes to the higher number of leaves per plant in the Oriental
8 lily variety grown in the specified media. The findings of the present investigation are in conformity with the
9 reports of **Treder (2008)** in Oriental lily; **Lalmuanpuiet al., (2021)** in gerbera; **Balan et al., (2020)** in
10 tuberose; **Khan et al., (2020)** in Chrysanthemum.

11 **B) Floral parameter**

12 **Days taken for first flower bud initiation; Number of days taken to first flowering**

13 Minimum number of days taken for first flower bud initiation (37.8 days) was recorded in V_2M_3 (Trocadero
14 variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (39.3 days) in V_2M_5
15 (Trocadero variety was grown in Cocopeat + Vermicompost + Perlite (1:1:1 v/v) and the maximum number of
16 days taken for first flower bud initiation (44.0 days) was recorded in V_1M_4 (Monteneu variety was grown in
17 Cocopeat + Vermicompost (1:1 v/v). While V_3 (Robina) did not flower. Minimum number of days taken for first
18 flowering (73.4 days) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost +
19 Vermiculite (1:1:1:1) followed by (74.0 days) in V_1M_1 (Monteneu variety was grown in Soil + Sand +
20 Vermicompost (1:1:1 v/v) and the maximum number of days taken for first flowering (79.1 days) was recorded
21 in V_1M_4 (Monteneu variety was grown in Cocopeat + Vermicompost (1:1 v/v). While V_3 (Robina) did not
22 flower. The early flowering of one Oriental lily variety, compared to another, when grown in Soil + Sand +
23 Vermicompost + Vermiculite media can be attributed to the favourable growing conditions provided by this
24 specific media composition. The combination of soil, sand, vermicompost, and vermiculite creates a well-
25 balanced and nutrient-rich substrate, promoting optimal root development and efficient nutrient uptake. The
26 enhanced nutrient availability and balanced moisture retention within the media stimulate early bud initiation
27 and development. Additionally, the improved aeration and drainage properties of the media prevent
28 waterlogging and provide an optimal environment for early flowering. The optimized nutrient supply, moisture
29 management, and root development in the specified media contribute to the early flowering of the Oriental lily
30 variety grown in this growing medium. The findings of the present investigation are in conformity with the
31 reports of **Treder (2008)** in Oriental lily; **Gupta et al., (2014)** in marigold; **Thakur and Grewal (2018)**; **Khan**
32 **et al., (2020)**; **Singh et al., (2015)** in Chrysanthemum.

33 **Length of first flower bud and Diameter of first flower bud**

34 Maximum length of first flower bud (14.04 cm) was recorded in V_2M_3 (Trocadero variety was grown in Soil +
35 Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (13.91 cm) in V_2M_2 (Trocadero variety was grown
36 in Soil + Sand + Vermicompost + Perlite (1:1:1:1 v/v) and the minimum length of first flower bud (12.19 cm)
37 was recorded in V_1M_1 (Monteneu variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v). While V_3
38 (Robina) did not flower. Maximum diameter of first flower bud (35.14 mm) was recorded in V_2M_3 (Trocadero
39 variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (33.88 mm) in

1 V_2M_4 (Trocadero variety was grown in Cocopeat + Vermicompost (1:1 v/v) and the minimum diameter of first
2 flower bud (27.72 mm) was recorded in V_1M_1 (Monteneu variety was grown in Soil + Sand + Vermicompost
3 (1:1:1 v/v). While V_3 (Robina) did not flower. The extended length and diameter of flower buds observed in one
4 variety of Oriental lily, compared to another, when cultivated in Soil + Sand + Vermicompost + Vermiculite
5 media, can be attributed to the optimal growing conditions provided by this specific media composition. The
6 combination of soil, sand, vermicompost, and vermiculite creates a well-balanced and nutrient-rich substrate
7 that promotes healthy root development and effective nutrient absorption. The abundance of nutrients stimulates
8 vigorous bud growth and elongation, resulting in longer flower buds. Moreover, the presence of vermiculite
9 enhances the media's water retention capacity, ensuring consistent moisture levels necessary for proper bud
10 development. The ideal combination of nutrients and enhanced water management in the specified media
11 contributes to the superior length and diameter of flower buds in the Oriental lily variety cultivated in this
12 growing medium. The findings of the present investigation are in conformity with the reports of **Treder (2008)**
13 in Oriental lily; **Gupta et al., (2014)** in marigold; **Thakur and Grewal (2018)**; **Khan et al., (2020)**; **Rahaet al.,**
14 **(2015)** in Chrysanthemum.

15 **Flower stalk diameter**

16 Maximum flower stalk diameter (7.55 mm) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand
17 + Vermicompost + Vermiculite (1:1:1:1) followed by (7.03 mm) in V_2M_2 (Trocadero variety was grown in Soil
18 + Sand + Vermicompost + Perlite (1:1:1:1 v/v) and the minimum flower stalk diameter (5.70 mm) was recorded
19 in V_1M_5 (Monteneu variety was grown in Cocopeat + Vermicompost + Perlite (1:1:1 v/v). While V_3 (Robina)
20 did not flower. The findings of the present investigation are in conformity with the reports of **Treder (2008)** in
21 Oriental lily; **Sindhu et al., (2010)** in gerbera; **Al-mazouriet al., (2020)** in marigold; **Thakur and Grewal**
22 **(2018)**; **Rahaet al., (2015)**; **Khan et al., (2020)** in Chrysanthemum; **Kumar et al., (2022)** in tuberose.

23 **Vase Life**

24 Maximum vase life of flower (12.09 days) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand
25 + Vermicompost + Vermiculite (1:1:1:1) followed by (11.39 days) in V_1M_3 (Monteneu variety was grown in
26 Soil + Sand + Vermicompost + Vermiculite (1:1:1:1 v/v) and the minimum vase life of flower (9.38 days) was
27 recorded in V_1M_1 (Monteneu variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v). While V_3 (Robina)
28 did not flower. The findings of the present investigation are in conformity with the reports of **Treder (2008)** in
29 Oriental lily; **Abdul-Shahib et al., (2023)** in gerbera; **Al-mazouriet al., (2020)** in marigold; **Singh et al., (2015)**;
30 **Rahaet al., (2015)**; **Khan et al., (2020)** in Chrysanthemum; **Kumar et al., (2022)** in tuberose.

31 **Conclusion**

32 From the present investigation it is concluded that the media V_2M_3 (Trocadero variety was grown in Soil + Sand
33 + Vermicompost + Vermiculite (1:1:1:1) was found to be the best in terms of vegetative growth, flowering, and
34 bulb production. In case of bulblets of liliium, was to all best with media V_3M_3 (Robina variety was grown in Soil
35 + Sand + Vermicompost + Vermiculite (1:1:1:1) was found best. The highest benefit cost ratio was recorded
36 2.57 with a M_3 (Soil + Sand + Vermicompost + Vermiculite (1:1:1:1).

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Table 1 Performance of different varieties and growing media on vegetative and floral parameters studied for Oriental lily.

Treatment Combination (Variety x Media)	Plant height at 80 days after planting	No of leaves at 80 days after planting	Days taken to first bud initiation (days after planting)	Length of first flower bud (cm)	Diameter of first flower bud (mm)	Number of days taken to first flowering (days after planting)	Flower stalk diameter (mm)	Vase life of flower (days)
V ₁ M ₁	63.59	46.77	42.6	12.19	27.72	74.0	6.56	9.38
V ₁ M ₂	65.72	51.65	41.7	12.63	29.48	76.1	6.15	10.02
V ₁ M ₃	66.13	53.34	40.5	12.75	30.39	76.8	6.67	11.39
V ₁ M ₄	64.09	47.02	44.0	12.70	28.08	79.1	6.10	10.00
V ₁ M ₅	64.99	52.53	42.4	12.24	29.28	76.1	5.70	10.02
V ₁ M ₆	64.59	48.36	42.5	12.43	29.78	75.9	6.36	10.41
V ₂ M ₁	64.26	54.97	39.9	13.14	32.66	78.5	6.63	10.35
V ₂ M ₂	66.70	56.28	39.0	13.91	33.91	79.1	7.03	11.24
V ₂ M ₃	67.88	59.77	37.8	14.04	35.14	73.4	7.55	12.09
V ₂ M ₄	64.73	57.49	40.6	13.50	33.88	78.8	6.68	10.73
V ₂ M ₅	65.62	59.21	39.3	13.47	33.77	78.4	6.39	11.26

V₂M₆	65.23	55.75	39.3	13.19	32.77	78.0	6.48	11.04
V₃M₁	57.65	45.22	*	*	*	*	*	*
V₃M₂	58.13	47.68	*	*	*	*	*	*
V₃M₃	61.69	49.32	*	*	*	*	*	*
V₃M₄	60.63	48.96	*	*	*	*	*	*
V₃M₅	58.33	47.42	*	*	*	*	*	*
V₃M₆	58.73	49.20	*	*	*	*	*	*
F 'test'	S	S	S	S	S	S	S	S
SE (d)	0.027	0.438	0.13	0.048	0.017	0.179	0.067	0.089
CD_{0.05}	6.255	0.894	0.028	0.105	0.035	0.374	1.025	0.365

* V₃ did not flower; ** V₁ did not have bulblets

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