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Effect of Different Growing Media on Growth and Flower Production of Oriental Lily (*Lilium orientalis*)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Oriental lily (*Lilium orientalis* L.) is a popular and beautiful flowering plant known for its large, colorful, and fragrant blooms. Oriental lilies are perennial plants that grow from bulbs and can reach impressive heights, producing tall and sturdy stems. Their flowers come in various striking colors, including shades of pink, white, red, and bi-color combinations. Growing media, also known as potting mix or substrate, refers to the material used to grow plants in containers, pots, or raised beds. It is a crucial component in container gardening and hydroponics, as it provides physical support, nutrients, and aeration for plant roots to grow and thrive. Therefore, present investigation was carried out at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during *Winter*-2022-23 with a view to determine the effect of different growing media and different varieties of oriental lily for its growth, flowering, yield and to work out the economics of various treatments. Under this experiment, two factors *viz.*, 3 different varieties (factor A) and 6 treatments comprising of different

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growing media (factor B) were used. The study was examined using factorial randomized block design. From the present investigation it is concluded that the media V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) was found to be the best in terms of vegetative growth, flowering, and bulb production. In case of bulblets of lilium, was to all best with media V_3M_3 (Robina variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) was found best. The highest benefit cost ratio was recorded 2.57 with a M_3 (Soil + Sand + Vermicompost + Vermiculite (1:1:1:1).

Keywords: Oriental lily, vermicompost, vermiculite, perlite.

1. INTRODUCTION

The Oriental lily, botanically known as *Lilium orientalis* L., is a popular flowering plant known for its large, showy, and fragrant blooms. It belongs to the lily family, Liliaceae, and is native to the regions of Japan, China, and Korea. Oriental lilies are widely cultivated for their beautiful flowers, which come in various colours, including white, pink, red, and bi-colour combinations. Oriental lilies typically grow from bulbs and can reach a height of 2 to 6 feet (60 to 180 cm). They have tall, sturdy stems and lance-shaped leaves that are arranged in whorls or spirals along the stem. The flowers are large, often measuring 6 to 10 inches (15 to 25 cm) in diameter and have distinctively curved petals with prominent stamens and pistils. One of the most notable traits of Oriental lilies is their captivating fragrance. The flowers emit a strong, sweet scent that is often described as rich, spicy, and exotic. The fragrance can be quite powerful and can fill a room or garden with its delightful aroma. The Oriental lily is native to various regions in East Asia, including Japan, China, and Korea. It is believed to have originated in these areas where it naturally grew in wild habitats. Over time, the beauty and fragrance of Oriental lilies captured the attention of horticulturists and plant enthusiasts, leading to their cultivation and popularity worldwide. Oriental lilies (2n=24) were introduced to the Western world in the late 19th century, and since then, they have been widely cultivated and hybridized for their stunning blooms. Through selective breeding and hybridization, horticulturists have developed numerous cultivars and varieties of Oriental lilies with different flower colours, forms, and fragrances, enhancing their ornamental value and appeal. Today, Oriental lilies are grown and enjoyed by gardeners and flower enthusiasts in various parts of the world, adding beauty and elegance to gardens, flower beds, and floral arrangements. The range of lilies in the Old World extends across much of Europe, across most of Asia to Japan, south to India, and east to Indochina and the Philippines. In the New World they extend from southern Canada through much of the United States. Vermicompost is rich in essential plant nutrients, including nitrogen, phosphorus, potassium, micronutrients, and organic matter. Several studies have demonstrated that the application of vermicompost in floriculture can enhance nutrient availability and improve soil fertility, leading to improved plant growth, vigor, and flowering. Vermicompost, produced through the decomposition of organic matter by earthworms, is renowned for its nutrient-rich composition. It contains essential elements such as nitrogen, phosphorus, potassium, micronutrients, and organic matter. These components play a vital role in enhancing nutrient availability and improving soil fertility, ultimately leading to improved plant growth, vigor, and flowering [1]. Vermiculite is a different material from vermicompost. Vermiculite is a mineral that is commonly used as a soil amendment in horticulture and agriculture. It provides several benefits such as improved water retention and aeration in soil mixes. Studies have demonstrated that the incorporation of vermiculite in growing media can enhance water retention while maintaining proper drainage. The unique structure of vermiculite, with its laminated layers, allows it to hold moisture and release it gradually to plant roots, promoting optimal hydration levels [2]. Perlite, a lightweight mineral material composed of volcanic glass, is widely recognized for its beneficial properties as a soil amendment in horticulture. Studies have shown that incorporating perlite into growing media for floriculture crops provides several advantages. One of the primary benefits is its excellent water-holding capacity combined with proper drainage. Perlite's porous nature allows it to absorb and retain water, preventing waterlogging and ensuring adequate oxygen availability to plant roots [3]. The Oriental lily is a highly valued cut flower globally, known for its large, fragrant blooms in captivating colors. Different growing media such as perlite, vermicompost, and

cocopeat have a significant impact on the growth and development of Oriental lilies. Perlite improves root development, moisture management, and soil compaction. Vermicompost enhances nutrient availability, soil structure, and microbial support. Cocopeat retains moisture, provides nutrients, and suppresses weeds. These growing media create optimal conditions for Oriental lilies by improving soil structure, nutrient availability, root development, and moisture levels. Considering the specific needs of Oriental lilies, such as well-drained soil and adequate nutrients, is important when selecting growing media. Research on the effect of different growing media on Oriental lilies helps maximize plant performance, improve cultivation practices, and promote sustainable agriculture. It involves investigating parameters like nutrient retention, water holding capacity, and microbial activity to enhance resource efficiency and minimize environmental impact. Evaluating Oriental lily varieties in various soil media helps identify high-yielding cultivars with adaptable growth and flowering patterns. Thus, research was conducted in the department of Horticulture with objectives to evaluate the effect of different growing media on plant growth, flowering, and quality of Oriental lily (*Lilium orientalis*) in Prayagraj climatic conditions.

2. MATERIALS AND METHODS

The present investigation was done to understand the effect of different varieties and growing media on plant and floral growth and yield of Oriental lily. The investigation was carried out at Horticultural Research Farm (HRF), Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during *Winter Season* 2022. The field experiment comprising of 6 treatment combinations were grown under Factorial Randomized Block Design (FRBD) with three replications. Observations were recorded at different growth parameters like plant height, number of leaves per plant, Leaf area, flowering parameters like days to taken to first bud initiation, length of first flower bud, diameter of first flower bud, stalk diameter and yield parameters like number of bulbs per plant etc. The data were analysed by the method suggested by Fisher and Yates, 1963**.** The different combination of growing media comprised of are M_1 (Soil + Sand + Vermicompost (1:1:1 v/v); M_2 (Soil + Sand + Vermicompost +Perlite (1:1:1:1 v/v); M_3 (Soil + Sand + Vermicompost + Vermiculite (1:1:1:1 v/v); M_4 (Cocopeat + Vermicompost (1:1 v/v); M_5 (Cocopeat + Vermicompost + Perlite (1:1:1 v/v); M_6 (Cocopeat + Vermicompost + Vermiculite (1:1:1 v/v) while varieties comprised of V_1 (Monteneu); V_2 (Trocadero); V_3 (Robina).

3. RESULTS AND DISCUSSION

A) Vegetative Parameters

Plant height and Number of leaves per plant: The significantly maximum plant height at 80 DAP (67.88 cm) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (65.62 cm) in V_2M_5 (Trocadero variety was grown in Cocopeat + Vermicompost + Perlite (1:1:1 v/v) and the minimum plant height (57.65 cm) was recorded in V_3M_1 (Robina variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v). The better plant height of one variety of Oriental lily over another variety when grown in Soil + Sand + Vermicompost + Vermiculite media compared to other media can be attributed to several reasons. Firstly, the specific composition of the media provides a well-balanced nutrient supply, allowing for optimal plant growth and development. The combination of soil, sand, vermicompost, and vermiculite ensures a good balance of organic matter, water retention, aeration, and nutrient availability, promoting vigorous root growth and subsequently leading to taller plants. Additionally, the improved physical properties of the media, such as enhanced drainage and moisture-holding capacity, create favourable conditions for root development, allowing the plants to access essential nutrients and water efficiently. These factors collectively contribute to better nutrient uptake, enhanced physiological processes, and ultimately, increased plant height in the Oriental lily variety grown in the specified media. Similar findings were reported by Treder [4] in Oriental lily; Sindhu et al., [5] in gerbera; Al-Mazouri et al., [6] in marigold; Thakur and Grewal [7] in Chrysanthemum; Yuliana et al., [8] in gladiolus.

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_1M_1	63.59	46.77	42.6	12.19	27.72	74.0	6.56	9.38
V_1M_2	65.72	51.65	41.7	12.63	29.48	76.1	6.15	10.02
V_1M_3	66.13	53.34	40.5	12.75	30.39	76.8	6.67	11.39
V_1M_4	64.09	47.02	44.0	12.70	28.08	79.1	6.10	10.00
V_1M_5	64.99	52.53	42.4	12.24	29.28	76.1	5.70	10.02
V_1M_6	64.59	48.36	42.5	12.43	29.78	75.9	6.36	10.41
V_2M_1	64.26	54.97	39.9	13.14	32.66	78.5	6.63	10.35
V_2M_2	66.70	56.28	39.0	13.91	33.91	79.1	7.03	11.24
V_2M_3	67.88	59.77	37.8	14.04	35.14	73.4	7.55	12.09
V_2M_4	64.73	57.49	40.6	13.50	33.88	78.8	6.68	10.73
V_2M_5	65.62	59.21	39.3	13.47	33.77	78.4	6.39	11.26
V_2M_6	65.23	55.75	39.3	13.19	32.77	78.0	6.48	11.04
V_3M_1	57.65	45.22	*	*	*	*	*	*
V_3M_2	58.13	47.68	*	*	*	*	*	*
V_3M_3	61.69	49.32	*	*	*	*	*	*
V_3M_4	60.63	48.96	*	*	*	*	*	*
V_3M_5	58.33	47.42	*	*	*	*	*	*
V_3M_6	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

** V_3 did not flower; ** V_1 did not have bulblets*

The significantly maximum number of leaves at 90 DAP (59.77 leaves) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (59.21 leaves) in V_2M_5 (Trocadero variety was grown in Cocopeat + Vermicompost + Perlite (1:1:1 v/v) and the minimum number of leaves (45.22 leaves) was recorded in V_3M_1 (Robina variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v). The higher number of leaves per plant in one variety of Oriental lily compared to another variety when grown in Soil + Sand + Vermicompost + Vermiculite media can be attributed to several factors. Firstly, the specific media composition provides a well-balanced nutrient supply, ensuring optimal plant nutrition and promoting leaf development. The combination of soil, sand, vermicompost, and vermiculite offers a favourable environment for root growth and nutrient uptake, resulting in increased foliage production. Additionally, the improved physical properties of the media, such as enhanced water retention and aeration, support healthy root systems, enabling efficient nutrient absorption and subsequent leaf formation. The balanced nutrient availability, along with the improved root development, contributes to the higher number of leaves per plant in the Oriental lily variety grown in the specified media. The findings of the present investigation are in conformity with the reports of Treder [4] in Oriental lily; Lalmuanpuii et al., [9] in gerbera; Balan et al., [10] in tuberose; Khan et al., [11] in Chrysanthemum.

B) Floral parameter

Days taken for first flower bud initiation; Number of days taken to first flowering: Minimum number of days taken for first flower bud initiation (37.8 days) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (39.3 days) in V_2M_5 (Trocadero variety was grown in Cocopeat + Vermicompost + Perlite (1:1:1 v/v) and the maximum number of days taken for first flower bud initiation (44.0 days) was recorded in V_1M_4 (Monteneu variety was grown in Cocopeat + Vermicompost (1:1 v/v). While V_3 (Robina) did not flower. Minimum number of days taken for first flowering (73.4 days) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (74.0 days) in V_1M_1 (Monteneu variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v) and the maximum number of days taken for first flowering (79.1 days) was recorded in V_1M_4 (Monteneu variety was grown in Cocopeat + Vermicompost (1:1 v/v). While V_3 (Robina) did not flower. The early flowering of one Oriental lily variety, compared to another, when grown in Soil + Sand + Vermicompost + Vermiculite media can be attributed to the favourable growing conditions provided by this specific media composition. The combination of soil, sand, vermicompost, and vermiculite creates a well-balanced and nutrient-rich substrate, promoting optimal root development and efficient nutrient uptake. The enhanced nutrient availability and balanced moisture retention within the media stimulate early bud initiation and development. Additionally, the improved aeration and drainage properties of the media prevent waterlogging and provide an optimal environment for early flowering. The optimized nutrient supply, moisture management, and root development in the specified media contribute to the early flowering of the Oriental lily variety grown in this growing medium. The findings of the present investigation are in conformity with the reports of Treder [4] in Oriental lily; Gupta et al., [12] in marigold; Thakur and Grewal [7]; Khan et al., [13]; Singh et al., [14] in Chrysanthemum.

Length of first flower bud and Diameter of first flower bud: Maximum length of first flower bud (14.04 cm) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (13.91 cm) in V_2M_2 (Trocadero variety was grown in Soil + Sand + Vermicompost +Perlite (1:1:1:1 v/v) and the minimum length of first flower bud (12.19 cm) was recorded in V_1M_1 (Monteneu variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v). While V_3 (Robina) did not flower. Maximum diameter of first flower bud (35.14 mm) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (33.88 mm) in V_2M_4 (Trocadero variety was grown in Cocopeat + Vermicompost (1:1 v/v) and the minimum diameter of first flower bud (27.72 mm) was recorded in V_1M_1 (Monteneu variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v). While V_3 (Robina) did not flower. The extended length and diameter of flower buds observed in one variety of Oriental lily, compared to another, when cultivated in Soil + Sand + Vermicompost + Vermiculite media, can be attributed to the optimal growing conditions provided by this specific media composition. The combination of soil, sand, vermicompost, and vermiculite creates a well-balanced and nutrient-

rich substrate that promotes healthy root development and effective nutrient absorption. The abundance of nutrients stimulates vigorous bud growth and elongation, resulting in longer flower buds. Moreover, the presence of vermiculite enhances the media's water retention capacity, ensuring consistent moisture levels necessary for proper bud development. The ideal combination of nutrients and enhanced water management in the specified media contributes to the superior length and diameter of flower buds in the Oriental lily variety cultivated in this growing medium. The findings of the present investigation are in conformity with the reports of Treder [4] in Oriental lily; Gupta et al., [12] in marigold; Thakur and Grewal [7]; Khan et al., [13]; Raha et al., [15] in Chrysanthemum.

Flower stalk diameter: Maximum flower stalk diameter (7.55 mm) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (7.03 mm) in V_2M_2 (Trocadero variety was grown in Soil + Sand + Vermicompost +Perlite (1:1:1:1 v/v) and the minimum flower stalk diameter (5.70 mm) was recorded in V_1M_5 (Monteneu variety was grown in Cocopeat + Vermicompost + Perlite (1:1:1 v/v). While V_3 (Robina) did not flower. The superior diameter of the flower stalk of one variety of Oriental lily, compared to another, when grown in Soil + Sand + Vermicompost + Vermiculite media can be attributed to the ideal growing conditions provided by this specific media composition. The balanced combination of soil, sand, vermicompost, and vermiculite creates a nutrient-rich and well-drained substrate, supporting robust root development and efficient nutrient uptake. The optimized nutrient supply and enhanced water retention capacity within the media promote the development of larger and more robust flowers. Additionally, the improved aeration and drainage properties prevent waterlogging, ensuring optimal flower development and resulting in a larger diameter of flower stalk. The findings of the present investigation are in conformity with the reports of Treder [4] in Oriental lily; Sindhu et al., [5] in gerbera; Al-mazouri et al., [6] in marigold; Thakur and Grewal [7]; Raha et al., [15]; Khan et al., [13] in Chrysanthemum; Kumar et al., [16] in tuberose.

Vase Life: Maximum vase life of flower (12.09 days) was recorded in V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) followed by (11.39 days) in V_1M_3 (Monteneu variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1 v/v) and the minimum vase life of flower (9.38 days) was recorded in V_1M_1 (Monteneu variety was grown in Soil + Sand + Vermicompost (1:1:1 v/v). While V_3 (Robina) did not flower. The improved vase life of flowers from one variety of Oriental lily, compared to another, when grown in Soil + Sand + Vermicompost + Vermiculite media can be imputed to the optimized growing conditions provided by this specific media composition. The balanced combination of soil, sand, vermicompost, and vermiculite creates a well-drained and nutrient-rich substrate, promoting vigorous root development and efficient nutrient uptake. The enhanced nutrient availability and balanced moisture retention within the media contribute to better flower quality and prolonged post-harvest life. Additionally, the improved water management and aeration prevent wilting and enhance the overall longevity of the cut flowers, resulting in an extended vase life. The findings of the present investigation are in conformity with the reports of Treder [4] in Oriental lily; Abdul-Shahib et al., [17] in gerbera; Al-mazouri et al., [6] in marigold; Singh et al., [14]; Raha et al., [15]; Khan et al., [13] in Chrysanthemum; Kumar et al., [16] in tuberose [18,19].

4. CONCLUSION

From the present investigation it is concluded that the media V_2M_3 (Trocadero variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) was found to be the best in terms of vegetative growth, flowering, and bulb production. In case of bulblets of lilium, was to all best with media V_3M_3 (Robina variety was grown in Soil + Sand + Vermicompost + Vermiculite (1:1:1:1) was found best.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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