STANDARDIZATION OF GROWING SUBSTRATE FOR ASIATIC, ORIENTAL AND LA HYBRIDS OF LILIUM

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Abstract. The investigation was conducted in three types of Liliums viz., Asiatic, Oriental and LA hybrids at Horticultural Research Station, Tamil Nadu Agricultural University, Located in The Nilgiris district of Tamil Nadu, India to standardize the growing substrate for lilium. Three cultivars were used in Completely Randomized Design viz., 'Black out', 'Courier', Acapulco" in seven growing media viz., Sand as substrate for lilium + Soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; Volume/Volume) (T_1), Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (2:1:1; Volume/Volume) (T_2), Cocopeat as substrate for Lilium + Farm Yard Manure as substrate for lilium (1:1; Volume/Volume) (T_3), Cocopeat as substrate for lilium + soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; Volume/Volume) (T_4), Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + cocopeat as substrate for Lilium (1:1; Volume/Volume) (T_5), Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + Vermicompost as substrate for lilium (2:1; Volume/Volume) (T_6), Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost as substrate for lilium + cocopeat for lilium (2:1:1; Volume/Volume) (T_7). In Asiatic, oriental and LA hybrids recorded maximum height of lilium 157.21 cm, 168.67 cm and 148.41 cm respectively in T_4 media. In lilium emergence of bulb sprout took 13.93 days in T_7. Bulbs grown in T_7 medium produced more number of flowers per spike of 6.05.The findings revealed that among the different types of Substrate, consisting of Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost as substrate for lilium + cocopeat as substrate for lilium (2:1:1; Volume/Volume) was found to be suitable for growing Asiatic, Oriental and LA hybrids of Lilium.

Keywords: *cut flower, media, substrate, vegetative parameter, flower yield*

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Introduction

Lilium is the leading cut flower and is cultivated in the Netherlands, with 76% of the global cultivated area, followed by France, Chile, Japan, The United States, New Zealand and Australia. It is mainly used for stage decoration, bouquet preparation, pot plant for display purpose and garden plant. Plants of the genus Lilium (*Lilium* sp.) normally grow from bulbs belonging to the family Liliaceae. Commercial cultivation of lilium is noticed in Himachal Pradesh, Uttrakhand, Jammu and Kashmir, Haryana and Tamil Nadu. In India, according to the National Horticulture Database, 283 thousand hectares were used for floriculture production during 2021–2022; 2295 thousand tonnes of loose flowers and 833 thousand tonnes of cut flowers were produced (Source: Ministry of Agriculture and Farmers Welfares). The entire value of India's exports of floriculture in 2022–2023 was Rs. 707.81 Crores/USD 88.38 Million. Karnataka, Andhra Pradesh, Tamil Nadu, and Madhya Pradesh produce more than 50% of the products used in floriculture. The Indian floriculture sector is ready to enhance its share of global trade with the assistance of technical collaborations from overseas businesses. Lilium are mostly classified into Asiatic, Oriental and Longiflorum hybrids. The Asiatic hybrids, which have a wide range of petal colors including orange, white, yellow, pink, red, purple, and salmon, were developed through interspecific cross breeding. Early to late flowering were observed in Asiatic hybrids. The five species of the Archelirion section were crossed to create the oriental hybrids, which play a significant role in the lily hybrid group. Large spectacular flowers with a nice aroma are typical in Oriental hybrids. The Leucolirion section's Longiflorum hybrids, which are the result of intra- or interspecific hybridization, feature trumpet-shaped, pure white flowers that bloom throughout the year with a characteristic fragrance. It ranks 4th position in the world cut flower trade. These hybrid lilies enjoy excellent consumer preference for their relatively easy cultural requirements, higher returns per unit area, ability to grow as pot plants and comparatively less susceptibility to insects, pests and diseases. The flowers has many meaning ie. symbolize purity, innocence and complete life. It is a herbaceous perennial, bulbiferous plant and bulbs have many imbricate, fleshy scales without tunic. The growing media decides the quality and yield of the plant. Edwards and Burrows (1988) reported that Vermicompost is a finely structured, mature peat-like material that is stabilized by the interaction of earthworms and microorganisms. It also has a high porosity, water-holding capacity, and microbial activity (Kaushal and Kumari, 2020). Cocopeat, a waste product from coconut husks, is completely devoid of nourishment provides a fantastic water-retention ability, acceptable pH, electrical conductivity and other chemical attributes (Kalaivani and Jawaharlal 2019; Abad et al., 2002). The present investigation was carried to standardize the growing media in lilium potted plants. Therefore, this study aimed to address these challenges by standardization of growing substrate for Asiatic, Oriental and LA hybrids of lilium.

Materials and methods

An experimental study conducted on lilium at the Horticultural Research Station, TNAU in The Nilgiris, Tamil Nadu, India. The location is specified with its geographical coordinates and altitude 2635 m, along with climatic data such as mean annual rainfall (1632 m), average maximum (26°c) and minimum temperatures (20°c), and average relative humidity (75%). The study involves planting of 50

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bulbs per square meter of different lillium cultivars, including Asiatic (Black Out), Oriental (Courier), and LA hybrids (Acapulco), in various growth media.

Treatments details

Table 1. *Different media for Lilium*

T_1	Sand as substrate for lilium + Soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; Volume/Volume)
T_2	Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (2:1:1; Volume/Volume)
T_3	Cocopeat as substrate for Lilium + Farm Yard Manure as substrate for lilium (1:1; Volume/Volume)
T_4	Cocopeat as substrate for lilium + soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; Volume/Volume)
T_5	Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together at One Volume) + Cocopeat as substrate for Lilium (One Volume) (1:1; Volume/Volume)
T_6	Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together two Volume) + Vermicompost as substrate for lilium (One Volume) (2:1; Volume/Volume)
T_7	Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together two Volume) + Vermicompost as substrate for lilium (One Volume) + Cocopeat as substrate for lilium (One Volume) (2:1:1; Volume/Volume)

Details of observations

After the calibration/acclimation period, the observations were recorded i.e. period from start of the experiment at regular intervals. Observation on height of lilium, early emergence of bulb sprout, Lilium leaves per plant, earliness in lilium, length of the lilium stalk, buds per spike number, lilium bud length, lilium flowers per spike in numbers and flower size were recorded Experiment was adopted in Completely Randomized Design. Five plants were chosen at random for observation and data were analyzed statistically.

Statistical analysis

The statistical analysis and interpretation of collected data, employing Microsoft Excel for initial processing and subsequently utilizing the advanced statistical tools in R Studio, incorporating agricolae and ggplot2 packages (R Core Team, 2022). The mean of three replications was calculated to enhance analytical precision and the application of the Analysis of Variance (ANOVA) technique underscored the assessment of significance across parameters, with a significance level set at $P = 0.05$ for discerning mean differences among treatment groups. Gomez and Gomez (1984).

Results and discussion

The results of the experiment are presented in *Table 2* and *3* and *Figures 1, 2, 3, 4, 5, 6* and *7.* Significant differences were observed for all the characters studied.

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Early emergence of bulb sprout

The effect of growing media on different types of liliums for early emergence of bulb sprout is presented in *Figure 1*. Significant differences were noticed for all the varieties and media. Among the three types of lilium, LA type took minimum days of 27.89 days followed by Asiatic type (29.50 days). Among the different types of media, T_7 media took minimum days of 13.93 days for bulb sprouting followed by T_2 media (31.68 days). Interaction effect of different types of media and lilium showed significant effect on sprouting of bulbs. The minimum days of 13.58 days was recorded by LA in T_7 media for bulb sprouting. The emergence of the lilium could be endorsed to the soil which increased porosity and aeration brought about by the addition of sand and cocopeat, which foster the optimum conditions for delicate sprouts to thrive and encourage early sprouting in lilium. Lyngdoh et al. (2015) found early sprouting in a cocopeat-based medium during scale propagation in lilium.

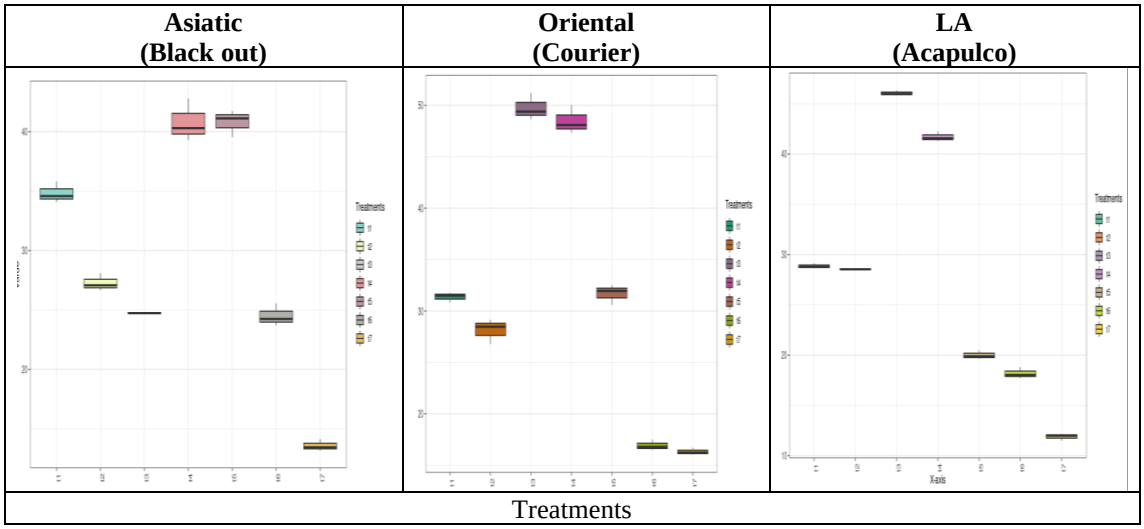

Figure 1. *Impact of growing media on early emergence of bulb sprout*

Height of lilium plant (cm)

With respect to the mean height of lilium plant cv. 'Courier'" recorded 121.01 cm followed by 'Black Out' 114.12 cm. Among the several growing medium, maximum height of lilium plant (158.10 cm) was considerably noticed in T_4 - Cocopeat as substrate for lilium + Soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; volume/volume) followed by T_3- Cocopeat as substrate for Lilium + Farm Yard Manure as substrate for lilium (1:1; volume/volume) (128.77 cm). The interactions between cultivars and growing media for the Oriental hybrid 'Courier' was noticed in T_4- Cocopeat as substrate for lilium + Soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; volume/volume) recorded maximum height of lilium (168.67 cm). Asiatic, oriental and LA hybrids recorded maximum plant height of 157.21 cm, 168.67 cm and 148.41 cm respectively for T_4 media were presented in *Table 2*. Between cultivars, there was a substantial difference in plant height this may due to the genotypic variations between the cultivars. Similar trend in different media was also concluded by Singh (2013) in Alstroemeria.

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Table 2. *Impact on height of lilium plant on different growing media (cm)*

Treatments/varieties	Asiatic (Black out)	Oriental (Courier)	LA (Acapulco)	Mean
T_1- Sand for lilium + Soil for lilium + Farm Yard Manure for lilium (1:1:1; volume/volume)	91.54 ± 2.14^{d}	85.26 ± 2.99^{e}	92.54 ± 1.41^{d}	89.78
T_2- Sand for lilium + Soil for lilium + Farm Yard Manure for lilium (2:1:1; volume/volume)	91.91 ± 2.07^{d}	83.42 ± 2.78^{e}	89.76 ± 2.58^{d}	88.36
T_3- Cocopeat for Lilium + Farm Yard Manure for lilium (1:1; volume/volume)	94.05 ± 2.28^{d}	144.28 ± 2.99^{b}	147.98 ± 0.40^{a}	128.77
T_4- Cocopeat for lilium + soil for lilium + Farm Yard Manure for lilium (1:1:1; volume/volume)	157.21 ± 3.9^{a}	168.67 ± 7.14^{a}	148.41 ± 0.936^{a}	158.10
T_5- Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together at One Volume) + Cocopeat as substrate for Lilium (1:1; Volume/Volume)	143.82 ± 5.70^{b}	130.68 ± 4.98^{c}	101.49 ± 4.39^{c}	125.33
T_6- Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together two Volume) + Vermicompost as substrate for lilium (2:1; Volume/Volume)	106.82 ± 1.92^{c}	114.43 ± 5.05^{d}	113.12 ± 2.34^{b}	111.46
T_7- Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together two Volume) + Vermicompost as substrate for lilium + Cocopeat as substrate for lilium (2:1:1; Volume/Volume)	113.49 ± 3.68^{c}	120.36 ± 3.47^{cd}	118.80 ± 0.32^{b}	117.55
Mean	114.12	121.01	116.01	117.05
MSE	11.38	19.88	4.94	
CV (0.05)	2.95	3.68	1.91	

MSE: mean standard error, CV: coefficient of variation

Lilium leaves per plant

Lilium leaves per plant differed significantly from each other and the result is presented in *Figure 2*. Notably maximum leaves per plant was observed in cultivar 'Black Out' (65.85) in comparison to 'Acapulco' (58.25). The treatment T_4 Cocopeat as substrate for lilium + soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; volume/volume) that produced the maximum leaves per plant (84.61) followed by T_3- Cocopeat as substrate for Lilium + Farm Yard Manure as substrate for lilium (1:1; volume/volume) (75.76). Least, Lilium leaves per plant (40.03) were recorded in T_7- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + Vermicompost as substrate for lilium + Cocopeat as substrate for lilium (2:1:1; Volume/Volume) which is on par with the T_6- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for

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lilium) + Vermicompost as substrate for lilium (2:1; Volume/Volume). In oriental lilies 'Courier' recorded the maximum leaves per plant (93.06 Nos) in T_5- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + cocopeat as substrate for Lilium (1:1; volume/volume and Least was recorded in the cv. 'Acapulco' (52.74) was grown T_1- Sand as substrate for lilium + Soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; Volume/Volume). Media added with Vermicompost revealed to be the best for increasing the number of leaves per plant. The treatment T_7 (T_1 + Vermicompost + Cocopeat; 2:1:1; Volume/Volume). The vegetative growth of lilium was enhanced by the addition of cocopeat together with vermicompost as a source of organic nutrients. Moghadam et al. (2012) also noted an increase in the leaves on vermicompost amended in the media in Asiatic hybrid 'Navona'. Substrate with rice hull, sawdust, and pine bark (1:1:1; Volume/Volume) produced the maximum leaves in lilium cultivar "Orange Pixie" produced (Jong et al., 2002; Zamin et al., 2020).

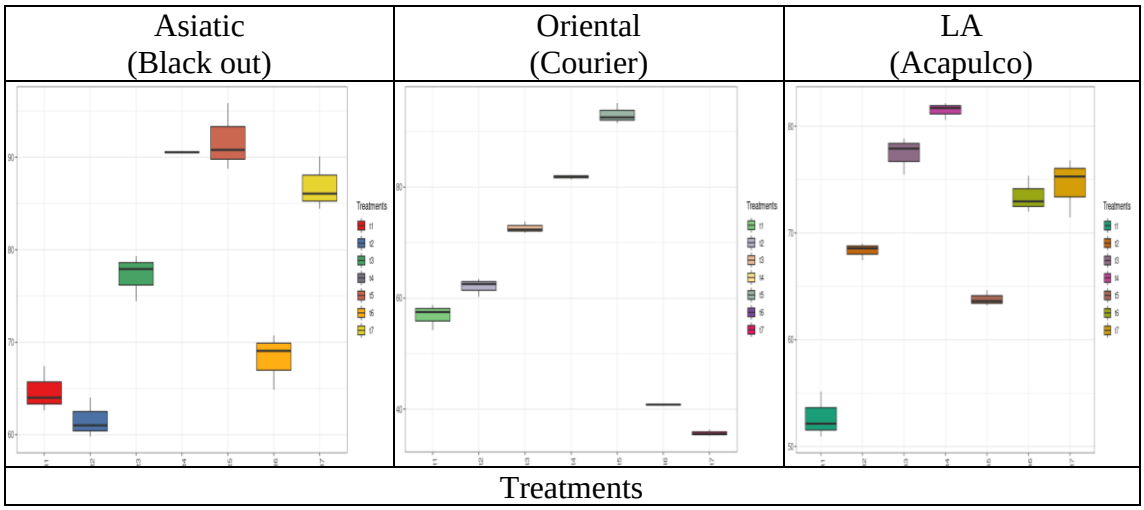

Figure 2. *Impact of different substrate on lilium of leaves per plant*

Early flowering in lilium

The information in *Table 3* shows that cultivars, growing substrate, and their interactions had a substantial impact on earliness in flowering in LA hybrid. Earliness in lilium flowering was noticed in cultivar 'Courier' (86.33 days) followed by 'Black out' (85.68 days). Additionally, early flowering (90.69 days) was noted when cultivars of Lilium bulbs were planted in medium with T_2- Sand as substrate for lilium + Soil as substrate for lilium + Farm Yard Manure as substrate for lilium (2:1:1; volume/volume). Flowering was expressively accelerated in T_7- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost as substrate for lilium + cocopeat as substrate for lilium (2:1:1; Volume/Volume) over all other treatments. Additionally, it can be ascribed to increased vegetative growth and leaf number per plant in the medium, which considerably aided in the accumulation of photosynthates, resulting in optimal growth, early bud development, and flowering. According to Seyedi et al. (2012), cocopeat as a medium amendment likely promotes better growth of plants to shorten the number of days between planting and reproductive stage.

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Table 3 . *Effect of different substrate on early flowering in lilium*

Treatments/varieties	Asiatic (Black out)	Oriental (Courier)	LA (Acapulco)	Mean
T_1- Sand for lilium + Soil for lilium + Farm Yard Manure for lilium (1:1:1; volume/volume)	109.45 ± 2.27^{b}	89.18 ± 0.16^{c}	93.53 ± 1.09^{b}	97.39
T_2- Sand for lilium + Soil for lilium + Farm Yard Manure for lilium (2:1:1; volume/volume)	91.91 ± 1.24^{cd}	86.33 ± 2.33^{c}	93.84 ± 3.04^{b}	90.69
T_3- Cocopeat for Lilium + Farm Yard Manure for lilium (1:1; volume/volume)	84.15 ± 2.88^{d}	90.55 ± 3.02^{c}	82.32 ± 1.03^{c}	85.67
T_4- Cocopeat for lilium + soil for lilium + Farm Yard Manure for lilium (1:1:1; volume/volume)	92.54 ± 3.75^{c}	80.80 ± 0.51^{d}	84.39 ± 2.28^{c}	85.91
T_5- Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together at One Volume) + Cocopeat as substrate for Lilium (1:1; Volume/Volume)	85.68 ± 0.61^{cd}	69.30 ± 1.49^{e}	130.35 ± 2.80^{a}	95.11
T_6- Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together two Volume) + Vermicompost as substrate for lilium (2:1; Volume/Volume)	126.42 ± 5.01^{a}	124.38 ± 0.56^{b}	126.25 ± 5.00^{a}	125.68
T_7- Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together two Volume) + Vermicompost as substrate for lilium + Cocopeat as substrate for lilium (2:1:1; Volume/Volume)	124.16 ± 0.89^{a}	136.68 ± 0.29^{a}	122.76 ± 2.21^{a}	127.87
Mean	102.04	96.74	104.78	101.19
MSE	7.92	2.50	7.81	
CV (0.05)	2.75	1.634	2.66	

MSE: mean standard error, CV: coefficient of variation

Length of the lilium stalk

These results suggest that the combination of substrates used in treatment Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium (All Together at One Volume) + Cocopeat as substrate for Lilium (1:1; Volume/Volume) (T5) resulted in the tallest lilium stalks (99.00cm) for the Oriental hybrid 'Courier', while treatment Cocopeat for Lilium + Farm Yard Manure for lilium (1:1; volume/volume) (T3) produced the tallest stalks of 91.08 cm for the Asiatic cultivar 'Black Out'. However, similar outcomes were also seen in different growing medium, demonstrating the beneficial impact of media changes on plant growth and development in lilium as reported by Moghadam et al. (2012) (*Fig. 3*).

Lilium flowers per spike in numbers

An analysis of the data in *Figure 4* reveals that lilium cultivars differ significantly from one another with respect to Lilium flowers per spike in numbers. Lilium flowers per spike in numbers was recorded in cultivar ‘Acapulco’ (4.70) as compared to cv ‘Black Out’ (4.54).

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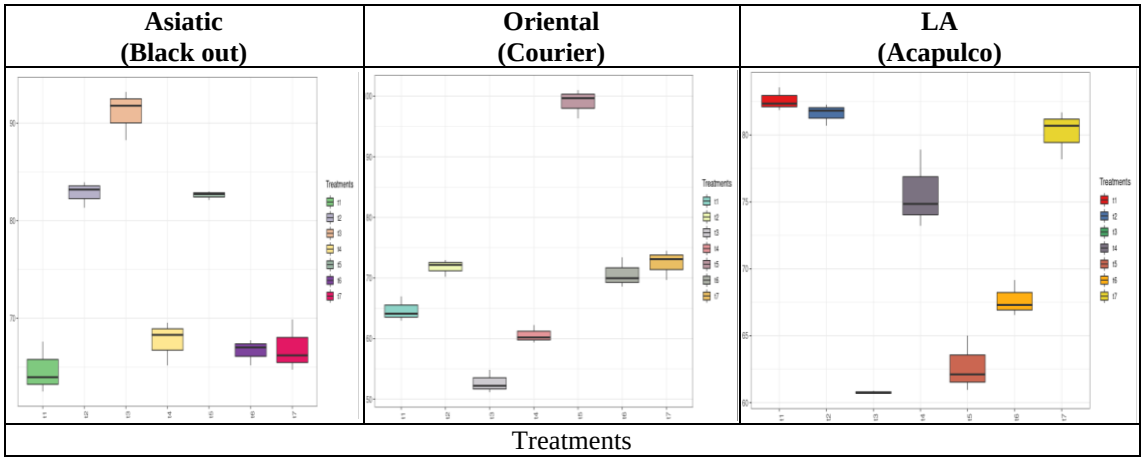

Figure 3. *Influence of different growing media on Length of the lilium stalk (cm)*

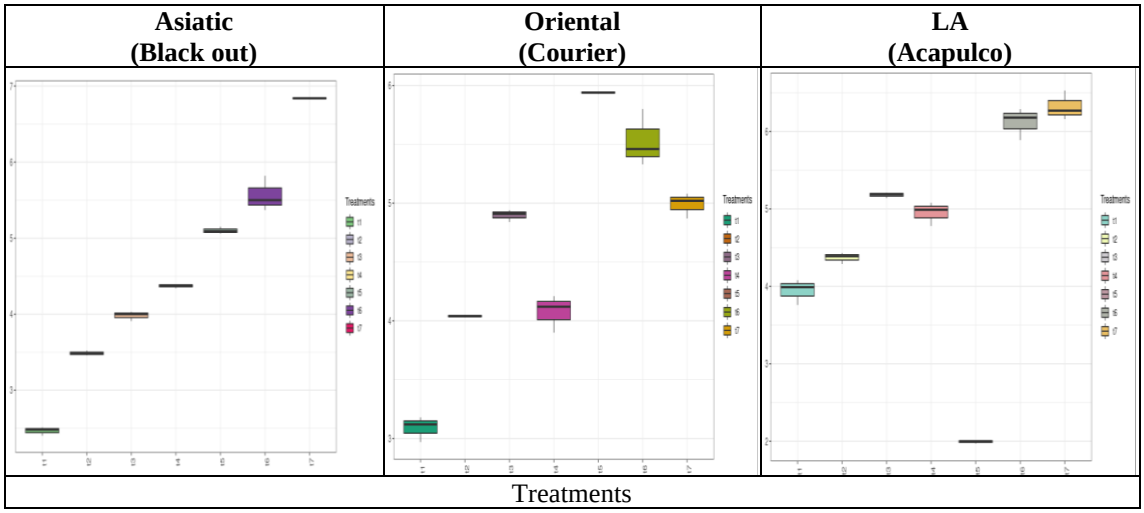

Figure 4. *Influence of different growing media on Lilium flowers per spike in numbers*

Lilium bulbs grown in T_7- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost as substrate for lilium + cocopeat as substrate for lilium (2:1:1; Volume/Volume) produced. Maximum flowers per spike in numbers (6.05). The treatment T_1- Sand as substrate for lilium + Soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; volume/volume) recorded minimum of 3.16 flowers per spike in numbers. Among the different growing substrate, T_7- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost as substrate for lilium + cocopeat as substrate for lilium (2:1:1; Volume/Volume) produced maximum flowers per spike in numbers in comparison to all other substrate. The medium that had been altered with vermicompost and cocopeat provided ideal growing conditions, which improved plant health and led to the production of more flowers or spikes.

When utilized as soil amendments in horticultural crops, vermicompost is a sustainable source of macro and micronutrients and has a large potential to dramatically improve plant growth (Sahni et al., 2008). Similar research on the Asiatic hybrid lily 'Navona' by

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Moghadam et al. (2012) revealed that medium modified with various vermicompost doses produced more blossoms per spike. Rajera et al. (2017) obtained similar results with LA hybrids under Himachal Pradesh conditions. Karaguzel (2023) reported that peat and pumice with the largest number of florets (15.0 florets plant-1) in gladiolus.

Lilium bud length

Figure 5 makes clear that cv. 'Acapulco' (12.20 cm) had longer buds than 'Black out' (11.51 cm). Maximum bud length of 15.66 cm was observed in growing substrate T_7- (Sand for as substrate lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost as substrate for lilium + cocopeat as substrate for lilium (2:1:1; Volume/Volume). The interaction of cultivars and growing medium reveals that Oriental hybrid 'Courier' bulb bulbs produced the bud length (16.12 cm) in T_7- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost as substrate for lilium + cocopeat as substrate for lilium (2:1:1; Volume/Volume). The plants accumulate the carbohydrates synthesized during the vegetative phase will be utilized during the development of flowers. In contrast to other growing media, where there were more buds and spikes, the carbohydrates created in the plants raised on M1 develop were directed toward the creation of fewer buds/spikes, making the buds larger and healthier. Our results closely match those of De Hertogh (1989), who claimed that flower buds (5.59). On the other hand, M1 (sand + soil + FYM; 1:1:1; v/v) had the fewest flowers per spike (3.53).

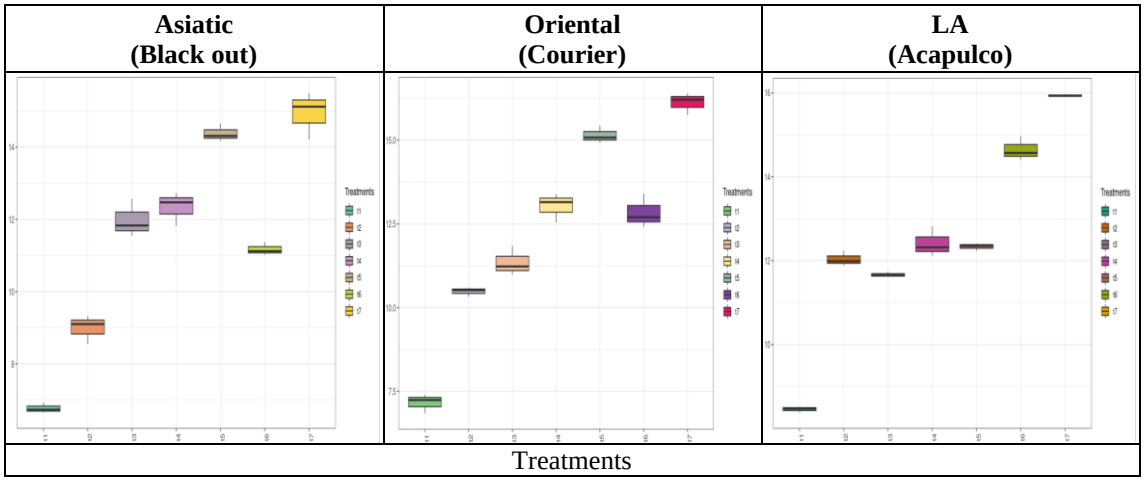

Figure 5. *Effect of different substrate on Lilium bud length (cm)*

Flower size (cm)

Figure 6 represents the data for media, and their interactions all significantly affected variation in flower size (cm) in Oriental hybrid cultivars. Maximum flower size were obtained in cv. 'Courier' (12.54 cm) as compared to cv. 'Black Out' (11.84 cm). Among different growing media, larger sized flower (15.39 cm) were noticed in T_5- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + cocopeat as substrate for Lilium (1:1; volume/volume). Considerably, flower size (9.64 cm) was recorded minimum in T_1- Sand as substrate for lilium + Soil as substrate for lilium + Farm Yard Manure as substrate for lilium (1:1:1; volume/volume).

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The size of the blossom and the quantity of flowers on a spike are inversely connected, according to De Hertogh (1989).

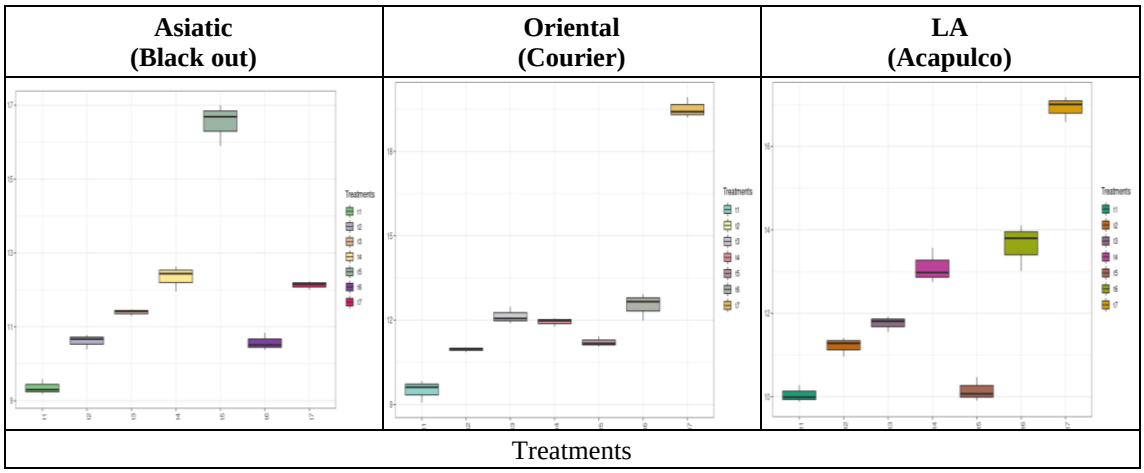

Figure 6. *Influence of different growing media on flower size (cm)*

Duration of flowering

As shown in *Figure 7, a*mong the different types of lilium, LA hybrid "Acapulco "recorded maximum number of days for flowering (30.5 days) and minimum number of bulbs observed by Asiatic cultivar "Black out" (27.6 days) which is on par with oriental hybrid "Courier" (25.7 days).

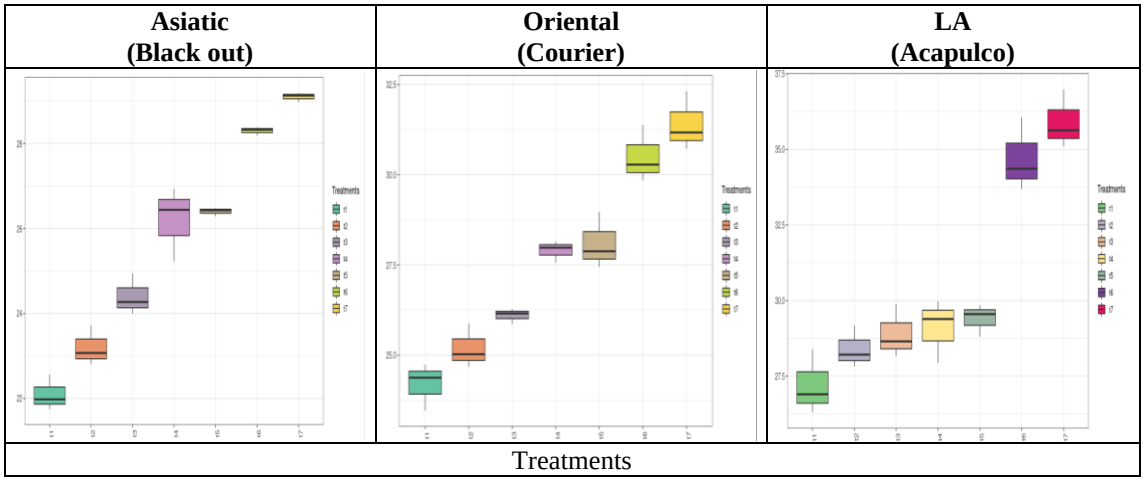

Figure 7. *Effect of different substrate on duration of flowering in Liliums*

Among them T_7- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost as substrate for lilium + cocopeat as substrate for lilium (2:1:1; Volume/Volume) recorded maximum duration of flowering (32.1 days). The interaction effect of media with lilium varieties revealed that LA hybrid "Acapulco" recorded maximum duration of flowering (32.1 days). While Asiatic types recorded minimum days of flowering (22.1 days) and it may be due to varietal character. Lily bulbs grown in T_7 generated the most flowers per spike, and they

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survived the longest compared to plants grown on alternative media, which produced fewer blooms per spike. Chandrakar et al. (2009) in Alstroemeria, reported that maximum flowering in two successive flushes was attained in crop grown on medium containing sand + soil + cocopeat + vermicompost + FYM (1:1:1:1, v/v), is likewise supportive of our findings. According to Prisa et al. (2011), Asiatic hybrid cut stems produced on novel amendments outperformed those grown on conventional substrate in terms of flower quality and longevity.

Conclusion

The present investigation was carried out in three types of Liliums viz., Asiatic, Oriental and LA hybrids at Horticultural Research Station, Tamil Nadu Agricultural University, The Nilgiris, Tamil Nadu during to standardize the growing substrate for liliums. The experiment was laid out in a Completely Randomized Design consisting of three cultivars i.e. 'Black out, 'Courier', Acapulco". Findings revealed substrate consisting of T_7- (Sand as substrate for lilium + Soil as substrate for Lilium + Farm Yard Manure as substrate for lilium) + vermicompost for lilium + cocopeat for lilium (2:1:1; Volume/Volume) was found to be suitable for Lilium.

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