

## Effect of Different Genotypes and Growing Conditions on Floral Parameters of Asiatic Lily

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### ABSTRACT

The present investigation was conducted during 2019-20 at CCS HAU, Hisar, Haryana to find out the most suitable variety and growing condition for the production Asiatic lily. The experiment comprised of 12 treatment combinations [4 varieties (Courier White, Tresor, Nova Lux & Red Stone) and 3 growing conditions (polyhouse of 200  $\mu$ , green shade-net of 50% shade & open field)], each replicated thrice. The results revealed that the variety Tresor performed better in most of the floral parameters viz. early floral bud emergence (54.11 days), early colour change of first floral bud (103.08 days), early opening of first flower (105.19 days); and maximum floral bud length (9.52 cm), floral bud diameter (3.28 cm), stem/stick length (83.49 cm) and stem/stick diameter (1.03 cm) as compared to other varieties. Red Stone variety performed next to Tresor in various parameters viz. days taken to emergence of flower bud, floral bud length, floral bud diameter, stick length and stem/stick diameter. However, the maximum number of flowering buds/plant (6.97) were obtained in variety Nova Lux followed by Tresor (4.20) and the maximum flower diameter (20.02 cm) was recorded in variety Courier White followed by Red Stone (18.35 cm). Out of the three growing conditions, varieties of Asiatic lily cultivated under polyhouse comparatively performed better in most of the floral parameters, resulting in early bud emergence (49.83 days), early colour change of first floral bud (99.32 days), early opening of first flower (102.68 days). In addition, maximum number of flowering buds/plant (5.06), floral bud diameter (3.42 cm), flower diameter (20.59 cm) and stick length (100.00 cm) were also observed under polyhouse. However, the floral bud length (9.89 cm) was recorded maximum under shade-net, whereas stick diameter (1.05 cm) was recorded maximum under open field condition. Henceforth, varieties viz. Tresor and Red Stone grown under polyhouse performed comparatively better than the other treatment combinations of varieties and growing conditions.

**Keywords:** Asiatic lily, Tresor, Red Stone, Nova Lux, Courier White, Polyhouse, Shade-net, Open field, Floral parameters

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## INTRODUCTION

Flowers are the symbol of love, beauty and peace. They form the soul of garden and convey the message of nature to mankind. These are not only important for their aesthetic value but also have great significance from commercial point of view. In India, area under floriculture is 3.2 lakh hectares with a production of 19.6 lakh tonnes of loose flowers and 8.2 lakh tonnes of cut flowers (Anonymous, 2018a). The cut flowers like rose, gladiolus, tuberose, lily, etc. are commonly and frequently demanded both in the local as well as international market. Among these, lily is one of the most important cut flower crop. Lily ranks fourth among top ten cut flowers of the world next to rose, chrysanthemum and tulip (Chaudhary et al., 2018). In India, lilies are famous among the growers of Haryana, Himachal Pradesh, Jammu and Kashmir, Uttarakhand and Tamil Nadu owing to its high profitability with in a short growing period of four months. In Haryana, area under lily crop is nearabout 9.0 hectare with a production of 11,45,000 sticks and mainly grown in Kurukshetra, Karnal, Sonapat and Panipat districts (Anonymous, 2018b). Among the lily hybrids, especially Asiatic and Oriental types strengthen their roots in the market for cut flower, pot plant and bulb production (Lian, Chakarabarty, & Paek, 2003). The red and brown colour flowers get the highest price in Asiatic hybrid.

Lily is gaining popularity in last decade due to its large and attractive flowers having capacity to rehydrate after a long transportation. Lily produce very attractive flowers with a wide range of colours and shapes which is used as cut flowers, wonderful flowering pot plants and have a great ornamental value for landscape purpose. Quality of lily depends on characteristics of flowers / inflorescence, i.e. flower colour, flower diameter and stick length that influence the buyer's perception and can obtain a higher price in the market. These qualitative traits are controlled by many interacting genetic factors and can be modified by environmental factors such as light, photoperiod and temperature. The maximum day and night temperature

range for obtaining good yield is 21 to 25°C and 12 to 15°C, respectively. Lilies grow well with low light intensity of 2000 to 3000 foot candle. Therefore, during summer and winter seasons, shade net can be used to cut off 75 and 50 per cent light, respectively. The optimum humidity inside the green house must be 80-85 per cent. Sandy loam soil with pH 6-7 is suitable for lily cultivation. Bulbs are planted at a spacing of 20×30 cm in the month of October-November in plains.

Among the several factors influencing the growth, yield and quality of flowers, the selection of suitable variety/hybrid and growing environment plays significant role in the performance in terms of growth and flowering parameters of this crop under local agro-climatic conditions, for ensuring higher production of quality flowers that fetches higher income to the flower growers. It has been reported that crop yield depends on the response of plants to the environmental influences (Ellis et al., 1990), for example, temperature has considerable influence on crop timing and yield (Pearson, 1992) and light is primary determinant of crop growth. The flowering in this species was adversely affected when the plants were grown under 50 per cent shade (Einert, & Box, 1967). In the district Hisar and other urban areas of the state it has been observed that varieties of Asiatic lily with a wide range of size, shape and colour are grown as garden plants by some amateurs. So, the agro-climatic condition of the state is quite favourable for the cultivation of this flower crop, but its commercial cultivation has not been started yet by the flower growers due to the lack of proper knowledge about its production technology and unavailability of quality planting materials. Keeping all these in views, the present experiment was conducted to find out the most suitable variety as well as growing condition for the production of quality flowers of Asiatic lily under Hisar condition.

## MATERIALS AND METHODS

The experiment was conducted at Research Farm of Agri-tourism Centre, CCS HAU, Hisar (Haryana) during the cropping year

2019-20. The experimental site has a semi-arid subtropical climate with hot, dry and desiccating winds during summer season and severe cold during winter season. During the cropping period (November to June 1<sup>st</sup> week) of this year, the mean weekly maximum temperature (43.2 °C) was recorded in last week of May, while the minimum (2.6 °C) was recorded in last week of December. The area also got unpredictable rains in the month of March from thunderstorms in association with the passing western disturbances. The soil of district Hisar has been derived from Indo-Gangetic Alluvial Plain, which is sandy loam in texture and has some amount of calcium carbonate in the profile. Physico-chemical analysis of soil of the experiment field was done and it was found to be sandy loam in texture, alkaline in nature, medium in organic carbon, low in available nitrogen, high in available phosphorus and high with respect to available potassium. The experiment was laid out in Randomized Block Design (factorial) with three replications and twelve treatment combinations, comprising of four varieties (Courier White, Tresor, Red Stone and Nova Lux) and three growing conditions (polyhouse of 200 µ, green shade-net of 50 shade and open field). As per requirement, uniform sized programmed bulbs of four varieties of Asiatic lily were procured from the Progreen Biotech Private Limited, New Delhi, treated with carbendazim (Bavistin) 0.2 % plus mancozeb (Indofil M-45) 0.35% and planted as per layout plan on dated 7<sup>th</sup> November, 2019 with spacing of 30 x 20 cm and at 6-8 cm depth on raised bed of 15 cm height, 1.25 m width and 1.50 m length in each plot. Various horticultural practices like- irrigation, fertilization, intercultural operations *viz.* weeding, hoeing, earthing up, staking etc., and plant protection measures were adopted according to the 'Package of practices for horticultural crops' as recommended by SAU's and ICAR Institutes for this crop.

The observations on flowering parameters in this trial were recorded on five healthy plants as selected randomly in each plot. The data on days taken from planting of bulbs to the first sign of bud appearance on stem as visible with naked eye and the colour

change as well as opening of first floral bud/flower in the spike of five selected plants in each treatment were recorded and later on the average of such varied dates were calculated. For the observations on number of flowering buds/ plant, flower bud length (cm) and flower bud diameter (cm), five healthy plants were selected in each treatment before the opening of first floral bud in the spike. Total number of opened flowers in each spike and the length of three healthy flower/floral buds as well as diameter of these three healthy flower/floral buds in each spike of these five plants were counted/measured with the help of foot scale/digital Vernier Caliper at the stage of colour change in floral bud, respectively and then the average per spike was calculated for each treatment. For the observation on size (diameter) of flower (cm), five healthy plants were selected at full bloom stage in each treatment and the diameter of three flowers of each spike was recorded as a distance between apices of petals in the East-West and North-South directions with the help of foot scale and then the average size (diameter) of flower per spike was calculated. For the observations on stem/stick length and diameter (cm), five healthy plants were selected at the harvesting stage of spike in each treatment. Stem/stick length was measured by leaving 10 cm from the soil surface to the top of inflorescence with the help of meter rod and stem diameter was measured about 13 cm above the ground level with the help of digital Vernier Caliper in each plant at the first floral bud opening stage, and then the average stem/stick length and diameter per plant was calculated for each treatment.

The recorded data on different parameters were statistically analysed by applying the analysis of variance technique and the treatment differences were tested by 'F' test of significance on the basis of null hypothesis (Cochran, & Cox, 1963). Statistical analysis was done by using OPSTAT statistical software design developed by CCS HAU, Hisar to find out the significance of variation resulting from the experimental treatments. All tests of significance were made at 5% level of the significance.

## RESULTS AND DISCUSSION

### *Effect of varieties on floral parameters*

Days taken to emergence of floral bud, days taken upto the colour change of first flower/floral bud and days taken upto the opening of first flower were significantly influenced by the varieties of Asiatic lily (table 1). The minimum days upto the emergence of floral bud (54.11 days), change in colour of first flower/floral bud (103.08 days) and the opening of first flower (105.56 days) were taken by variety Tresor, whereas the maximum days (57.00) upto the emergence of floral bud were taken by Nova Lux, while the maximum days upto the change in colour of first flower/floral bud (109.23) as well as opening of first flower (111.82) were taken by Red Stone. Such variation in number of days required for these three parameters might be due to the different genetic constitution of these varieties and prevailing environmental conditions during the crop growth period. Further, the flower bud length, flower bud diameter, stem/stick length, size (diameter) of flower, stem/stick diameter and number of flowering buds/plant (figure 1) were also significantly influenced by the varieties of asiatic lily. The longest flower bud (9.52 cm) and the maximum flower bud diameter (3.28 cm) as well as stem length (83.49 cm) was recorded in variety Tresor, while the shortest flower bud (8.16 cm) and the minimum flower bud diameter (2.87 cm) as well as stem length (68.18 cm) was recorded in Nova Lux. The maximum size of flower (20.02 cm) was obtained in variety Courier White followed by Red Stone (18.35 cm), while the minimum flower size (16.60 cm) was recorded in Tresor. The maximum stem diameter (1.03 cm) and number of flowering buds/plant (6.97) were recorded in varieties Tresor and Nova Lux, respectively, whereas the minimum number of flowering buds/plant (3.64) and stem diameter (0.90 cm) was recorded in Courier White. Such variation in these flower parameters might be due to the different genetic constitution of these varieties as well as prevailing environmental conditions during the reproductive phase of this crop. Sankari, Anand, & Anita, (2017) also reported that among the Asiatic varieties, Tresor and

Brunello were superior by producing more stem length, number of leaves/plant and number of flower buds/plant. Similar variations in floral parameters of lily varieties were also observed by Bhat, Patra, & Mohanty, (2016) and Chandrashekar et al. (2018).

### *Effect of growing conditions on floral parameters*

The data recorded on days taken upto the emergence of floral bud, colour change of first flower/floral bud and the opening of first flower was found significantly influenced by the growing conditions (table 1). Varieties when grown under polyhouse took the minimum days upto the emergence of floral bud (49.83 days), colour change in first flower/floral bud (99.32 days) and the opening of first flower (101.61 days), and it was followed by varieties when grown under shade-net, whereas the maximum days upto emergence of floral bud (59.67 days), colour change in first flower/ floral bud (112.68 days) and opening of first flower (115.35 days) were recorded in varieties when grown under open field condition. Such results might be due to the accumulation of more photosynthates in plants under polyhouse which triggered early initiation of floral buds in this crop. Fatmi, Singh, & Bharti (2018) also studied the effect of growing conditions on various growth and floral parameters of *Lilium* and observed early bud emergence (42.00 days) and early flower opening (33.62 days) under poly house as compared to shade-net condition. Similar results were also reported by Talukdar et al. (2003) in chrysanthemum and Kumari, Kumar, & Singh (2019) in Oriental hybrid lily.

The data depicted in table 1 clearly indicates that the number of flowering buds/plant (figure 1), flower bud length and flower bud diameter were significantly influenced by the different growing conditions. However, the maximum number of flowering buds/plant (5.06) and diameter of flower bud (3.42 cm) was obtained when the varieties grown under polyhouse, but the longest flower bud (9.89 cm) was obtained when the varieties grown under shade-net, whereas the minimum flowering buds/plant (4.24) were recorded under shade-net and the shortest flower bud

(8.23 cm) as well as minimum diameter of floral bud (2.68 cm) was noticed under open field condition. Kumari, Kumar, & Singh (2019) also reported that, in Oriental hybrid lily, the flower quality characters like- time required to bud initiation and number of buds/plant were found superior under polyhouse as compared to shade-net condition. The longer flower buds in varieties under shade-net condition either may be due to the production of less number of flowering buds/plant or might be due to the favourable micro-climatic conditions (*viz.* soil moisture, soil & air temperature, relative humidity, etc). during the bud development stage which kept them in fully extended shape under the shade-net as compared to open field and polyhouse conditions. Flower bud length of lilies depends on the growing conditions, variety and the number of buds on the stem (De Hertogh, & Le Nard, 1993). Similar results were also found by Parekh et al. (2002) in rose and Shylla et al. (2003) in lily.

The size (diameter) of flower (figure 2), stem/stick length and stem/stick

diameter was also significantly influenced by different growing conditions (table 1). The maximum size of flower (20.59 cm) and stem length (100.00 cm) was recorded in plants grown under polyhouse, whereas the maximum diameter of stem (1.05 cm) was recorded in plants grown under open field condition, but it was also followed by plants grown under polyhouse (0.98 cm). The minimum size of flower (15.51 cm) and stem diameter (0.93 cm) was recorded in plants grown under shade-net, while the minimum stem length (54.90 cm) was recorded in plants grown under open field condition. Jhon et al. (2005) reported that the polyhouse environment significantly improved the flower quality of tulip. Similar results were also observed by Mohanty et al. (2011) in rose. The maximum stem diameter as recorded under open-field condition might be due to the less plant height which ultimately increased the girthsize of stem at observation point. Almost the similar results were observed by Palai (2009) in chrysanthemum and Kumari, Kumar, & Singh (2019) in Oriental hybrid lily.

**Table 1: Effect of different genotypes and growing conditions on floral parameters of Asiatic lily**

Treatments	Days taken to emergence of floral bud	Days taken upto the colour change of first flower/floral bud	Days taken upto the opening of first flower	No. of flowering buds/plant	Flower bud length (cm)	Flower bud diameter (cm)	Size (diameter) of flower (cm)	Stem/stick length (cm)	Stem/ stick diameter (cm)
<b>Genotypes (V)</b>									
V <sub>1</sub> : Courier White	56.11	106.30	109.01	3.64	8.81	2.96	20.02	74.19	0.90
V <sub>2</sub> : Tresor	54.11	103.08	105.56	4.20	9.52	3.28	16.60	83.49	1.03
V <sub>3</sub> : Nova Lux	57.00	107.72	110.47	6.97	8.16	2.87	17.06	68.18	0.99
V <sub>4</sub> : Red Stone	54.89	109.23	111.82	4.06	9.33	3.16	18.35	82.42	1.02
CD at 5%	0.55	2.27	2.36	0.16	0.08	0.09	0.29	2.05	0.03
<b>Growing Conditions (C)</b>									
C <sub>1</sub> : Polyhouse	49.83	99.32	101.61	5.06	8.75	3.42	20.59	100.00	0.98
C <sub>2</sub> : Shade-net	57.08	107.76	110.68	4.24	9.89	3.11	15.51	76.30	0.93
C <sub>3</sub> : Open field	59.67	112.68	115.35	4.85	8.23	2.68	17.93	54.90	1.05
CD at 5%	0.48	1.97	2.04	0.13	0.07	0.08	0.25	1.77	0.03
<b>Genotypes x Growing Conditions (V x C)</b>									
V <sub>1</sub> C <sub>1</sub>	50.33	98.33	100.73	3.90	8.62	3.30	22.60	97.37	0.85
V <sub>1</sub> C <sub>2</sub>	57.67	108.10	111.34	3.27	9.75	3.05	17.54	71.94	0.90
V <sub>1</sub> C <sub>3</sub>	60.33	112.47	114.94	3.75	8.07	2.54	19.92	53.27	0.97
V <sub>2</sub> C <sub>1</sub>	48.33	91.40	93.13	4.55	9.32	3.62	19.24	106.33	1.03
V <sub>2</sub> C <sub>2</sub>	55.67	106.00	108.93	3.75	10.50	3.30	14.12	81.37	0.97
V <sub>2</sub> C <sub>3</sub>	58.33	111.84	114.62	4.32	8.75	2.92	16.45	62.77	1.08
V <sub>3</sub> C <sub>1</sub>	51.33	102.93	105.35	7.40	7.88	3.20	19.71	92.00	1.00
V <sub>3</sub> C <sub>2</sub>	58.33	108.20	111.07	6.35	9.10	2.93	14.50	65.16	0.93
V <sub>3</sub> C <sub>3</sub>	61.33	112.03	114.98	7.15	7.50	2.47	16.97	47.38	1.05
V <sub>4</sub> C <sub>1</sub>	49.30	104.60	107.24	4.39	9.18	3.54	20.79	104.33	1.02
V <sub>4</sub> C <sub>2</sub>	56.67	108.73	111.37	3.60	10.22	3.16	15.88	86.73	0.92
V <sub>4</sub> C <sub>3</sub>	58.67	114.37	116.86	4.17	8.60	2.77	18.37	56.19	1.12
CD at 5%	NS	3.93	4.08	NS	NS	NS	NS	3.55	0.06

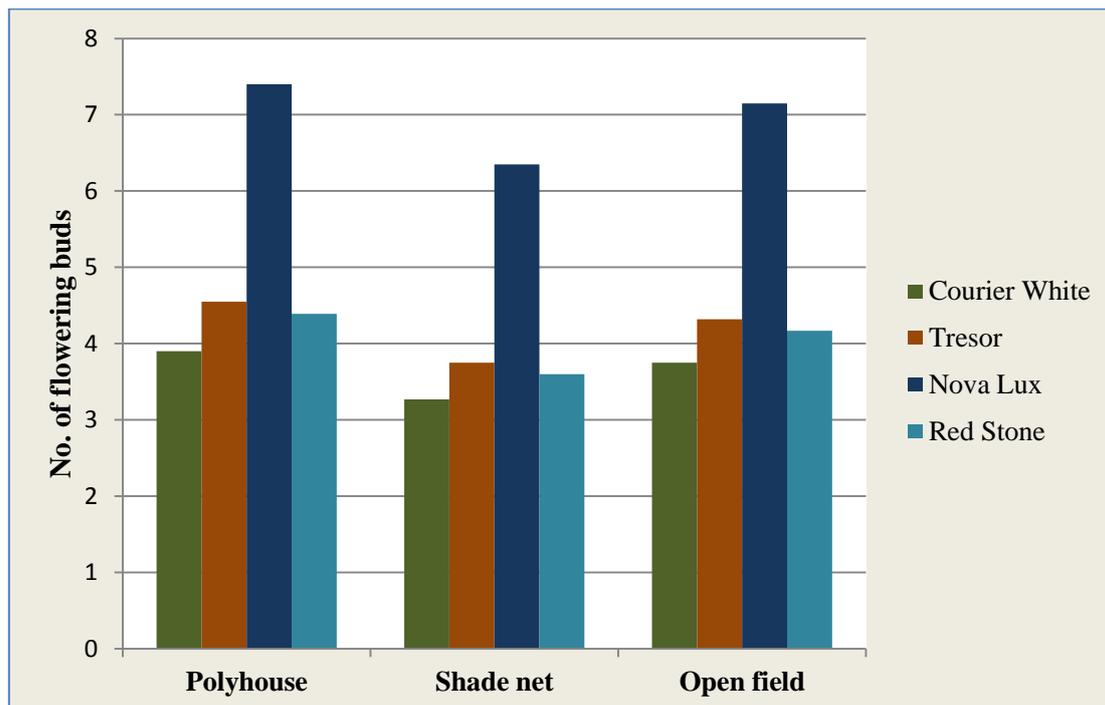


Fig. 1: Comparative performance of varieties of Asiatic lily under different growing conditions with respect to number of flowering buds/ plant

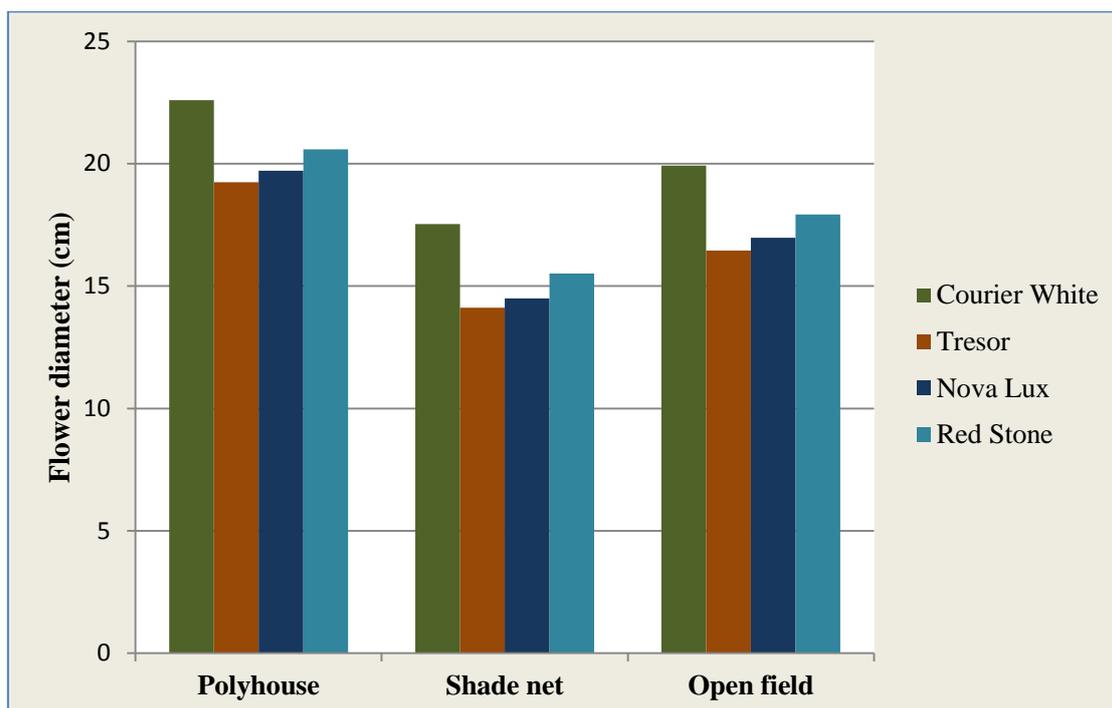


Fig. 2: Comparative performance of varieties of Asiatic lily under different growing conditions with respect to size (diameter) of flower (cm)

**Interaction effect of varieties and growing conditions on floral parameters of Asiatic lily**

Among the floral characters, these four parameters viz. days taken upto the change in colour of first flower/floral bud, days taken upto the opening of first flower, stem/stick diameter

length and stem/stick diameter were significantly influenced by the interaction of growing conditions and the varieties (table 1). The early change in colour of first flower/floral bud (91.40 days), early opening of first flower (93.13 days) and the maximum stem

length (106.33 cm) was recorded in variety Tresor when grown under polyhouse (V<sub>2</sub>C<sub>1</sub>), while the maximum stem diameter (1.12 cm) was recorded in Red Stone when grown under open field condition (V<sub>4</sub>C<sub>3</sub>). The maximum days for colour change in first flower/floral bud (114.37) and the opening of first flower (116.86) were taken by variety Red Stone when grown under open-field condition (V<sub>4</sub>C<sub>3</sub>), whereas the minimum stem length (47.38 cm) was recorded in variety Nova Lux when grown under open-field condition (V<sub>3</sub>C<sub>3</sub>), while the minimum stem diameter (0.85 cm) was recorded in Courier White when grown under polyhouse (V<sub>1</sub>C<sub>1</sub>). In similar direction, Mohanty et al. (2011) also conducted an experiment at Bhubaneswar to study the comparative performance of three rose varieties under four growing environments and concluded that the performance of plants grown under polyhouse was most satisfactory with respect to improvement in growth, yield and quality of roses.

### CONCLUSION

From the present investigation, it is concluded that the variety Tresor performed better in floral parameters as compared to other varieties viz. Courier White, Nova Lux and Red Stone, resulting in early floral bud emergence (54.11 days), early colour change of first flower/floral bud (103.08 days), early opening of first flower (105.56 days), and the maximum floral bud length (9.52 cm), floral bud diameter (3.28 cm), stem/stick length (83.49 cm) and stem/stick diameter (1.03 cm). However, the maximum number of flowering buds/plant (6.97) were recorded in variety Nova Lux and the maximum flower diameter (20.02 cm) was observed in Courier white. Out of the three growing conditions, varieties of Asiatic lily cultivated under polyhouse performed better in most of the floral parameters than the shade-net as well as open-field conditions, resulting in early bud emergence (49.83 days), early colour change of first flower/floral bud (99.32 days), early opening of first flower (101.61 days), and the

maximum number of flowering buds/plant (5.06), floral bud diameter (3.42 cm), flower diameter (20.59 cm) and stem/stick length (100.00 cm). However, the floral bud length was recorded maximum (9.89 cm) under shade-net, whereas stem/stick diameter was recorded maximum (1.05 cm) under the open-field condition. Henceforth, the var. Tresor and Red Stone grown under polyhouse of 200  $\mu$  comparatively performed better than the other combinations of varieties and growing conditions in floral parameters.

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