



## Evaluation of liliium hybrids (*Lilium x hybrida*) for growth, flowering and bulb attributes in the hilly regions of Uttarakhand

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The present study was initiated to elucidate performance of 18 exotic liliium hybrids (*Lilium x hybrida*) to assess their suitability for commercial cultivation in the hilly regions of Uttarakhand. The investigation was carried out at Jilling Floritech farm during 2014-15 under protected conditions in Randomised Block Design. All the 18 hybrid varieties showed significant variation for vegetative, flowering and bulb attributes. Analysis of data indicated that among the cultivars studied, earliest sprout emergence (4.66 days) was recorded in 'Yellow Diamond'. Earliest flower-bud initiation (30.33 days) was recorded in 'Bach' and flower-bud colour break stage (46.33 days) and flowering (50.00 days) in 'Detroit'. Maximum number of flower buds/plant (8.66) was recorded in 'Pollyana', longest inflorescences (25.23cm) in 'Indian Summerset', maximum flower diameter (17.66cm) in 'Creil' and 'Golden Tycoon', maximum plant height (145.13cm) in 'Bright Dimond', and maximum stem thickness (1.86cm) in 'Novana'. However, maximum number of bulblets (6.66) per plant was recorded in 'Ceb Dazzle'.

**Key words:** Liliium hybrids, evaluation, vegetative and flowering attributes, bulblets

### INTRODUCTION

Floriculture is being increasingly regarded as a viable diversification from traditional field crops due to its higher returns per unit area and the increasing popularity of "saying it with flowers". Liliium is an important crop grown for cut-flower and pot plant production. Liliium is native to Asia, Europe and North America, and belongs to the family Liliaceae with over 100 species (McRae, 1998). Liliium is one of the six major genera of bulbous flowers (geophytes) produced worldwide (Hertogh and Nard, 1993). In India, liliium was introduced during the 1980's, and since then, a large number of varieties have been introduced from exotic sources at various Central State research centres and agricultural universities. Liliium hybrids are gaining popularity in the Indian market due to their long-stemmed flowers of various colours/shades and a prolonged vase-life. However, information on production of cut-flowers in lily is scarce. In Uttarakhand, it is one of the promising ornamentals and is fast establishing itself as an important cut-flower crop among growers. Therefore, location-specific varietal evaluation has become essential to recommend superior varieties. Due to its immense importance a

great demand in the Indian flower market, an experiment was conducted to assess its performance and short-list superior varieties of liliium for hilly regions of Uttarakhand.

### MATERIAL AND METHODS

The present study was carried out at Jilling Floritech farm, Padampuri, Nainital, Uttarakhand, India, an export oriented unit located in the mid-hills of North Himalayas at an altitude of 1817m above mean sea level (29.35°N, 79.60°E). The experimental material consisted of 18 varieties of liliiums, viz., Amateras, Bach, Blackout, Bright Diamond, Brindisi, Brunello, Ceb Dazzle, Creil, Detroit, Golden Tycoon, Hyde Park, Indian Summerset, Novana, Pavia, Pollyana, Tresor, Vermeer and Yellow Diamond. The experiment was laid out in Randomized Block Design, with 3 replications, under naturally-ventilated polyhouse. Forced bulbs of 14"-16" circumference, procured from Onings Holland Flower bulbs BV and VWS Export-Import of Flower bulbs BV, Holland, were treated with Bavistin @ 2.0 g/l for 30 minutes and planted at a spacing of 15cm x 15cm during February 2014-2015. Full dose of well-rotted FYM, besides phosphorus and

potassium in the form of single super phosphate (SSP) and muriate of potash (MoP), respectively, was incorporated into the soil before planting the bulbs. Nitrogen was applied in the form of calcium ammonium nitrate (CAN) at 20, 40 and 60 days after bulb-sprouting. The crop was irrigated lightly through a drip irrigation system, and was raised under uniform cultural conditions. Various parameters on plant growth, flowering traits and bulblet yield were recorded in five plants in each variety, in each of three replications. Data were statistically analyzed using ANOVA with the help of online OPSTAT (Statistics Analytical Software) developed by Department of Computer Section, CCS, HAU, Hisar, Haryana, India, and as outlined by Gomez and Gomez (1994).

## RESULTS AND DISCUSSION

Results in this study revealed significant differences among all the 18 varieties tested. Perusal of data on vegetative characters (Table 1) indicates that cultivar 'Yellow Diamond' recorded minimum days (4.66) to sprout-initiation, followed by 'Vermeer' (5.33) and 'Bright Diamond' (5.33 days), whereas this was maximum in 'Pavia' (11.66 days). Early bulb-sprout is a desirable character as a cultivar consumes fewer resources, and, time from planting to harvest of flowers (Sindhu and Singh, 2012). Plant height is an important criterion for selecting liliium cultivars, as, taller plants are generally preferred for cut-flower production and shorter ones for pots. All the hybrids under our study differed significantly with respect to plant height. Results revealed that among all the cultivars, maximum plant height (145.13cm) was recorded in 'Bright Diamond', followed by 'Pollyana' (143.50cm); however, minimum height was recorded in 'Novana' (86.53cm). Flowering stem diameter/thickness is an important physical-quality parameter in liliium because the strength of a flowering stem is determined by its thickness. Significant variation among different varieties of hybrid liliium was recorded for diameter of the flowering shoot in the present study. Data indicated that the variety Novana recorded maximum flowering stem diameter (1.86cm) and minimum diameter was recorded in 'Pollyana' (1.03cm). This variation in flower-stalk thickness could be due to a difference in the genetic make up of the liliium hybrids. Number of leaves per flowering shoot is also an important character, because, it not only improves aesthetic value but is also involved in photo-synthesis. Production of

photoassimilates is directly related to number of leaves/leaf area essential for growth and development of the flowering stem, survival of the mother bulb and development of new daughter-bulbs (Bhandari and Srivastava, 2016). In the present study, highest leaf number was recorded in the variety Pollyana (133.66), significantly at par with 'Blackout' (121.66) and 'Bright Diamond' (122.66). On the other hand, minimum number of leaves (63.33) was recorded in 'Indian Summerset'. These results are supported by earlier findings of Negi *et al* (2014).

Data presented in Table 2 show significant differences for flowering and bulblet production traits. Days to flowering signifies earliness or lateness in flowering habit of the genotypes, which is helpful in determining availability of the flowers for a longer period. Among all the varieties, 'Bach' took minimum days (30.33) to flower bud-initiation, followed by 'Detroit' (32.00 days) and 'Bright Diamond' (33.33 days), and maximum in 'Hyde Park' (40.33 days). Findings in this investigation are in close agreement with Dhiman (2003) who observed significant variation among liliium hybrids with respect to days to bud-formation under Kullu conditions. Liliium variety 'Detroit' recorded minimum days (46.33) to attain colour-break in the first flower-bud, followed by 'Blackout' (47.00 days), whereas, 'Pavia' took the longest (69.33). These findings are supported by earlier work (Thakur *et al*, 2015). Number of flower buds per shoot is an important character deciding the cost of flowering shoots in the wholesale and retail markets. Generally, 4-5 flowers per stem are considered "A" grade quality flowers in liliium. In the present study, performance of 'Pollyana' was better with maximum number of flower-buds per shoot (8.66), followed by 'Brunello' (8.33) and 'Ceb Dazzle' (8.33), and was minimum (4.33) in 'Brindisi'. Variation in number of buds in these cultivars may be attributed to inherent genetic factors and environmental factors. Data recorded on days to taken first-flower opening from planting (and appearance of flower-bud) revealed that the earliest to flower was 'Detroit' (50.00 days), followed by 'Blackout' (51.33 days), whereas, 'Pavia' recorded maximum number of days (75.33). Flower-size is an important parameter in cut-flowers. Larger blooms are preferred by the consumer and these fetch a better price than the smaller ones. Data (Table 2) indicated that 'Golden Tycoon' and 'Creil' recorded maximum flower-diameter (15.13cm), followed by 'Hyde Park' (17.00cm) and 'Detroit'

Table 1. Performance of exotico liliium hybrids for vegetative traits

Cultivar	Days to sprout initiation	Plant height (cm)	Stem girth (cm)	No. of leaves/plant
Amateras	7.66	110.46	1.46	93.33
Bach	5.00	129.80	1.23	107.33
Blackout	6.66	113.50	1.33	121.66
Bright Diamond	5.33	145.13	1.13	122.66
Brindisi	6.33	97.26	1.76	72.00
Brunello	6.00	93.40	1.83	85.33
Ceb Dazzle	7.33	107.80	1.26	86.33
Creil	5.33	119.16	1.33	100.66
Detroit	6.66	123.16	1.23	115.00
Golden Tycoon	6.66	129.86	1.26	109.33
Hyde Park	5.66	140.80	1.13	127.66
Indian Summerset	6.33	87.30	1.66	63.33
Novana	7.66	86.53	1.86	75.00
Pavia	11.66	133.43	1.06	113.33
Pollyana	8.66	143.50	1.03	133.66
Tresor	8.33	114.20	1.23	104.00
Vermeer	5.33	118.76	1.26	107.66
YellowDiamond	4.66	91.90	1.76	70.66
S.E.m $\pm$	<b>0.98</b>	<b>0.93</b>	<b>0.04</b>	<b>1.13</b>
CD 0.05%	<b>0.34</b>	<b>2.70</b>	<b>0.13</b>	<b>3.26</b>

Table 2. Performance of exotic liliium hybrids for flowering attributes

Cultivar	Days to flower-bud	Days to attaining	No. of flower buds/plant	Days to first-flower opening	Length of inflorescence (cm)	Flower diameter (cm)	No. of bulblets/ bulb
Amateras	35.66	53.66	6.66	57.33	21.40	14.76	5.66
Bach	30.33	58.66	5.33	63.66	19.40	15.13	3.66
Blackout	34.00	47.00	6.33	51.33	24.46	14.80	4.66
Bright Diamond	33.33	48.66	4.66	53.33	17.30	14.13	3.66
Brindisi	35.33	56.33	4.33	61.33	17.26	13.86	3.33
Brunello	36.66	60.66	8.33	64.33	23.70	15.30	4.33
Ceb Dazzle	38.33	58.33	8.33	62.66	21.73	15.90	6.66
Creil	36.00	57.66	7.00	62.00	21.40	17.66	6.00
Detroit	32.00	46.33	4.66	50.00	20.30	16.50	4.66
Golden Tycoon	37.00	64.33	5.66	67.00	18.16	17.66	3.66
Hyde Park	40.33	57.00	5.33	59.33	18.70	17.00	5.66
Indian Summerset	38.00	60.00	4.66	63.66	25.23	15.83	4.66
Novana	35.66	58.66	7.33	62.66	19.86	13.03	5.66
Pavia	38.33	69.33	8.00	75.33	25.00	14.33	3.66
Pollyana	39.33	65.33	8.66	69.33	23.63	13.66	6.33
Tresor	37.00	67.66	7.66	71.66	24.50	14.66	5.66
Verneer	37.33	55.66	6.66	60.66	24.16	13.66	4.66
Yellow Diamond	36.33	54.00	4.33	57.00	22.00	14.80	5.66
<b>S.Em.±</b>	<b>0.47</b>	<b>0.60</b>	<b>0.36</b>	<b>0.54</b>	<b>0.37</b>	<b>0.21</b>	<b>0.37</b>
<b>CD 0.05%</b>	<b>1.35</b>	<b>1.73</b>	<b>1.05</b>	<b>1.57</b>	<b>1.06</b>	<b>0.62</b>	<b>1.08</b>

(16.50cm); however, this was minimum in 'Novana' (13.03cm). Inflorescence length in different liliium varieties differed significantly. Among all the hybrids, longest inflorescence (25.23cm) was observed in 'Indian Summerset', followed by 'Pavia' (25.00cm), and, minimum in 'Brindisi' (17.26cm). Variation in inflorescence length in these cultivars may be attributed to genetic and environmental factors. Similar results on growth and flowering in gladiolus under favourable climatic conditions was reported by Muhammad *et al* (2013). Among all the liliium hybrids studied, significant differences were observed with respect to bulblets production. 'Ceb Dazzle' recorded maximum number of bulblets (6.66) per plant, followed by 'Pollyana' (6.33), whereas 'Brindisi' recorded minimum number of daughter bulblets (3.33) per plant. Significant differences in various bulblet characters in liliium hybrids have also reported by Kumar *et al* (2011).

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