**Evaluation of Lisianthus (*Eustoma grandiflorum*) cultivars for growth and floral characters under Prayagraj agro-climatic conditions**

**Abstract**

The present investigation entitled “Evaluation of Lisianthus (*Eustoma grandiflorum*) cultivars for growth and floral characters under Prayagraj agro-climatic conditions” was carried out from December, 2024 to May, 2025 under naturally ventilated polyhouse, Department of Horticulture, SHUATS, Prayagraj. Fifteen lisianthus cultivars Arena Red**,** A Baby Pink**,** C Purple**,** A Pink**,** C Pink Picotee**,** A White**,** C Yellow**,** Croma III Lavender**,** C White**,** C Blue Picotee**,** A Clear Pink**,** Sunrise White**,** A Purple**,** A Gold, and C Green Ain were evaluated in a Randomized Block Design (RBD) with three replications. The results revealed significant variation among the cultivars for all parameters studied. Cultivar Arena Red (V1) consistently outperformed others in growth and flowering attributes, including plant height (44.5 cm), plant spread (26.7 cm²), number of primary branches (6.9) and number of sprays (6.9). It also recorded the earliest bud initiation (115.3 days) and first flowering (132.5 days). Floral quality were also highest in V1 with the highest bud length (3.9 cm), bud diameter (2.38 cm), stalk length (11.2 cm) and vase life (11.4 days). Cultivar A White (V6) followed closely, while C Blue Picotee (V10) showed the poor performance in most traits. Based on the findings, Cultivars Arena Red and A White can be grown for protected cut flower production under Prayagraj conditions.

***Keywords****:* lisianthus, cultivars, protected cultivation, flower yield, floral traits

**Introduction**

Lisianthus (*Eustoma grandiflorum*), a herbaceous annual belonging to the family *Gentianaceae*, has garnered increasing global recognition as a premium cut flower due to its elegant, rose-like blooms, wide colour spectrum, long vase life, and graceful floral architecture. The name *Eustoma*, derived from the Greek words “*eu”* (beautiful) and “*stoma”* (mouth), reflects the ornamental value and aesthetic appeal of the flower. Its commercial importance has grown rapidly since its domestication in the early 20th century, with intensive breeding resulting in cultivars of diverse flower forms, colours, and environmental adaptations (Kumaresan *et al.,* 2024). The high-quality, long-lasting blooms make lisianthus a preferred choice for wedding arrangements, formal events, and international export markets, where visual quality and postharvest longevity are key factors.

In the International floriculture market, lisianthus is now regarded among the top ten most important cut flowers, frequently referred to as the “next rose” due to its similar appearance and market appeal (Fang *et al.,* 2018). In India, lisianthus cultivation is gaining momentum, especially under protected cultivation systems in regions such as Karnataka, Tamil Nadu (notably in Ooty and Kodaikanal), and parts of Himachal Pradesh. The species shows high market potential as a niche, high-value crop for commercial growers (Kumari *et al.,* 2024). However, due to its sensitivity to high temperatures, particularly during the seedling stage where rosette formation may occur, its adaptability in subtropical and lowland areas like Prayagraj remains underexplored. Protected environments such as naturally ventilated

polyhouses offer a promising solution to mitigate environmental stress and support year- round production (Gupta and Pathania, 2024).

Despite the growing market demand, research on varietal evaluation of lisianthus under Indian plains is limited. Different cultivars may vary in growth, floral quality, flowering behaviour, and yield depending on their genetic makeup and interaction with local environmental conditions. Hence, systematic evaluation of commercial cultivars under specific agro-climatic zones is necessary to identify genotypes best suited for local production. The present investigation was therefore, undertaken to evaluate 15 cultivars of lisianthus under the agro-climatic conditions of Prayagraj with the objectives of assessing their performance in terms of growth, floral quality, yield potential, and postharvest longevity. The findings of this study are expected to contribute to varietal selection, optimized production practices, and commercial expansion of lisianthus in northern India’s floriculture sector.

**Materials and Methods**

The field trial was conducted during 2024-2025 in naturally ventilated polyhouse, Department of Horticulture, SHUATS, Prayagraj. Fifteen lisianthus cultivars Arena Red**,** A Baby Pink**,** C Purple**,** A Pink**,** C Pink Anexotee**,** A White**,** C Yellow**,** Croma III Lavender**,** C White**,** C Blue Picotee**,** A Clear Pink**,** Sunrise White**,** A Purple**,** A Gold, and C Green Ain were evaluated in a Randomized Block Design with three replications. Standard cultivation practices were followed. Observations were recorded on growth and floral parameters and analyzed statistically using ANOVA. Critical difference at 5% significance level was used to compare treatment means.

**Results and Discussion**

**Growth Attributes**

The analysed performance of lisianthus cultivars for vegetative attributes under Prayagraj agro-climatic conditions is presented in Table 1.

The data on plant height revealed significant differences among the lisianthus cultivars evaluated. Significantly taller plants (44.5 cm) were observed in cultivar V1 – Arena Red followed by V6 – A White (40.0 cm), while shorter plants (23.0 cm) were recorded in V10 – C Blue Picotee compared to all other cultivars. The wide variation in plant height among cultivars is largely attributed to their distinct genetic makeup influencing vegetative vigour. Environmental factors under polyhouse conditions, such as light, temperature, humidity, and nutrient supply, further modulate growth. Similar findings were reported by Hamo *et al.* (2010) and Anitha *et al.* (2013), who observed genotypic and environmental interactions as key contributors to variation in plant stature in lisianthus.

Significantly higher plant spread (26.7 cm) were observed in cultivar V1 – Arena Red, which was at par with by V6 – A White (25.6 cm), while lower spread (14.8 cm) was observed in V10 – C Blue Picotee compared to all other cultivars. The extent of lateral growth is closely linked to photosynthetic efficiency, biomass accumulation, and overall plant architecture. These differences are genetically governed and modulated by agro-climatic conditions. Similar observations were reported by Schijlen *et al.* (2004) and Sultana *et al.* (2021), highlighting plant spread as a critical growth indicator in lisianthus. Significantly more number of primary branches (6.9) were observed in cultivar V1 – Arena Red, which was at par with by V6 – A White (6.7), while less number of primary branches (4.0) was observed in V10 – C Blue Picotee compared to all other cultivars. The significant variation among

cultivars is likely due to their genetic predisposition for axillary bud development and responsiveness to protected environmental conditions. These findings align with those of Silva *et al.* (2021) and Dhiman *et al.* (2020), who noted similar branching variability in ornamental crops.

**Floral attributes**

The performance of lisianthus cultivars for floral quality and yield attributes under Prayagraj agro-climatic conditions is represented in Table 2.

Significantly less days to 1st bud initiation (115.3) were observed in Cultivar V1 – Arena Red, which was at par with by V6 – A White (116.2), while more days (130.2) was recorded in V10

– C Blue Picotee compared to all other Cultivars. These differences reflect genetic control

over flowering physiology, as well as environmental modulation. The findings are in line with Dhiman *et al.* (2020) and Hohn *et al.* (2024), who emphasized the influence of genetic and climatic factors on floral initiation. Significantly less days to first flowering (132.5) were

observed in Cultivar V1 – Arena Red, which was at par with by V6 – A White (133.1), while more days (150.9) was recorded in V10 – C Blue Picotee compared to all other Cultivars. Early flowering cultivars are advantageous for timely market supply and efficient crop rotation. Genotypic control and responsiveness to protected cultivation were key contributors, corroborating the findings of Ecker *et al.* (2020) and Sultana *et al.* (2021).

Significantly higher bud length (3.9 cm) were observed in Cultivar V1 – Arena Red, which was at par with by V6 – A White (3.7 cm), while lower bud length (2.5 cm) was observed in V10 – C Blue Picotee compared to all other Cultivars. A significant variation in bud length was observed among the different lisianthus cultivars, which can be primarily attributed to genetic differences influencing floral development. Bud length is a key morphological trait reflecting the growth potential and floral quality of a cultivar (Hamo *et al.,* 2010). The inherent genetic makeup of each cultivar determines the extent of bud elongation, while environmental factors such as temperature, light intensity, and nutrient availability under polyhouse conditions may further influence this trait. Differences in physiological responses to growing conditions also contribute to the observed variability (Anitha *et al.,* 2013). These findings are in agreement with Dhiman *et al.* (2007), who similarly noted that both genetic and environmental factors significantly affect bud development in lisianthus.

Significantly higher bud diameter (2.38 cm) were observed in Cultivar V1 – Arena Red, which was at par with by V6 – A White (2.32 cm), while lower bud diameter (1.74 cm) was observed in V10 – C Blue Picotee compared to all other Cultivars. Bud diameter is an important floral quality parameter reflecting the visual appeal and marketability of cut flowers (Hamo *et al.,* 2010). Genetic constitution is key in determining floral bud size, while environmental influences such as light, nutrients, and temperature can further modulate this trait. These observations are consistent with the findings of Anitha *et al.* (2013) and Dhiman *et al.* (2007), who reported significant variability in floral size traits due to genotypic and environmental factors.

Significantly more stalk length (11.2 cm) were observed in cultivar V1 – Arena Red, which was at par with by V6 – A White (10.9 cm), while less stalk length (6.2 cm) was observed in V10 – C Blue Picotee compared to all other cultivars. Stalk length contributes significantly to the commercial value of cut flowers and is governed by both genetic and environmental factors. Genetic potential for stem elongation, combined with polyhouse conditions such as adequate light, temperature, and nutrients, can enhance stalk growth (Philip *et al.,* 2019; Shivaprasad *et al.,* 2016). These findings are in agreement with Anitha *et al.* (2013), who highlighted genetic control and environmental modulation of flower stem development.

**Vase Life and Yield attributes**

Significantly high vase life (11.3 days) were observed in Cultivar V1 – Arena Red, which was at par with by V6 – A White (11.1 days), while low vase life (7.1 days) was observed in V10 – C Blue Picotee compared to all other Cultivars. Vase life is a vital trait for marketability and consumer satisfaction. Genetic factors influence senescence rate, water uptake, and resistance to microbial blockage (Ahmad, 2016; Dhiman *et al.,* 2020). Environmental factors during crop growth, such as nutrient status, light, and humidity, also affect postharvest quality. These findings agree with Kwon *et al.* (2024), who observed that stem strength and physiological robustness influence postharvest flower longevity.

Significantly more number of sprays per plant (6.9) were observed in Cultivar V1 – Arena Red, which was at par with by V6 – A White (6.7), while less number of sprays (4.0) was observed in V10 – C Blue Picotee compared to all other Cultivars. The number of sprays is an important yield component in cut flower production, governed by genetic traits controlling axillary bud activation and influenced by environmental conditions such as light and nutrient availability (Harbaugh, 2007; Wegulo and Vilchez, 2007). Genetic makeup plays a central role, while polyhouse conditions influence physiological and morphological responses (Ahmad, 2016; Harbaugh, 2007). These results corroborate the findings of Anitha *et al.* (2013) and Dhiman *et al.* (2020), who reported that genotype-environment interaction significantly affects floral productivity in ornamental crops.

**Table 1. Performance of lisianthus cultivars for vegetative attributes under Prayagraj agro-climatic conditions**

|  |  |  |  |
| --- | --- | --- | --- |
| **Cultivars** | **Plant height (cm)** | **Plant spread (cm)** | **Number of primary branches** |
| V1 : Arena Red | 44.5 | 26.7 | 6.9 |
| V2 : A Baby Pink | 38.0 | 24.4 | 6.5 |
| V3 : C Purple | 31.0 | 20.8 | 5.4 |
| V4 : A Pink | 24.1 | 16.0 | 5.8 |
| V5 : C Pink Picotee | 27.6 | 19.1 | 5.9 |
| V6 : A White | 40.0 | 25.6 | 6.7 |
| V7 : C Yellow | 25.1 | 16.7 | 6.1 |
| V8 : Croma III Lavender | 36.5 | 23.5 | 6.3 |
| V9 : C White | 35.1 | 22.6 | 6.0 |
| V10 : C Blue Picotee | 23.0 | 14.8 | 4.0 |
| V11 : A Clear Pink | 26.6 | 18.3 | 5.4 |
| V12 : Sunrise White | 33.0 | 21.7 | 5.2 |
| V13 : A Purple | 29.1 | 20.0 | 4.9 |
| V14 : A Gold | 25.5 | 17.5 | 4.4 |
| V15 : C Green Ain | 26.1 | 15.9 | 5.7 |
| **F- TEST** | **S** | **S** | **S** |
| SE.d (±) | 0.7 | 0.7 | 0.1 |
| CD0.05 | 1.4 | 1.5 | 0.3 |
| CV (%) | 2.7 | 4.3 | 3.1 |

**Table 2. Performance of lisianthus cultivars for floral quality and yield attributes under Prayagraj agro-climatic conditions**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Cultivars** | **Days to first bud initiation** | **Days to first flowering** | **Bud length**  **(cm)** | **Bud diameter**  **(cm)** | **Stalk Length**  **(cm)** | **Vase life**  **(days)** | **No. of sprays per plant** |
| V1 : Arena Red | 115.3 | 132.5 | 3.9 | 2.38 | 11.2 | 11.4 | 6.9 |
| V2 : A Baby Pink | 117.7 | 135.2 | 3.5 | 2.28 | 10.6 | 10.9 | 6.2 |
| V3 : C Purple | 121.5 | 139.9 | 3.2 | 2.10 | 9.5 | 9.6 | 6.6 |
| V4 : A Pink | 128.1 | 148.7 | 2.7 | 1.82 | 7.8 | 7.6 | 6.4 |
| V5 : C Pink Picotee | 123.8 | 140.7 | 3.0 | 2.02 | 9.0 | 9.1 | 6.3 |
| V6 : A White | 116.2 | 133.1 | 3.7 | 2.32 | 10.9 | 11.1 | 6.7 |
| V7 : C Yellow | 126.9 | 145.2 | 2.7 | 1.86 | 8.1 | 8.0 | 6.1 |
| V8 : Croma III Lavender | 118.4 | 136.8 | 3.5 | 2.22 | 10.3 | 10.5 | 5.9 |
| V9 : C White | 119.1 | 137.9 | 3.4 | 2.18 | 10.1 | 10.1 | 5.8 |
| V10 : C Blue Picotee | 130.2 | 150.9 | 2.5 | 1.74 | 6.2 | 7.2 | 4.0 |
| V11 : A Clear Pink | 124.8 | 142.4 | 3.0 | 1.98 | 8.8 | 8.7 | 5.4 |
| V12 : Sunrise White | 120.1 | 138.6 | 3.3 | 2.14 | 9.9 | 9.9 | 5.2 |
| V13 : A Purple | 122.4 | 141.3 | 3.1 | 2.06 | 9.3 | 9.3 | 4.9 |
| V14 : A Gold | 125.6 | 144.0 | 2.8 | 1.92 | 8.4 | 8.4 | 4.4 |
| V15 : C Green Ain | 129.2 | 149.0 | 2.6 | 1.79 | 6.9 | 7.3 | 5.7 |
| **F- TEST** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| SE.d (±) | 2.0 | 3.0 | 0.1 | 0.06 | 0.5 | 0.4 | 0.1 |
| CD0.05 | 4.0 | 6.2 | 0.2 | 0.12 | 1.0 | 0.8 | 6.2 |
| CV (%) | 2.0 | 2.6 | 4.0 | 3.58 | 6.5 | 5.0 | 2.6 |

**Conclusion**

On the basis of the research trial conducted on lisianthus (Eustoma grandiflorum), it is concluded that Cultivar Arena Red (V1), A White (V6), A Baby Pink (V2), Croma III Lavender (V8) and C White (V9) performed significantly better in terms of plant height, number of primary branches, plant spread, number of days for bud initiation, days to first flowering, bud length, bud diameter, stalk length, vase life and number of flowers per plant. Hence, Cultivar Arena Red, A White, A Baby Pink, Croma III Lavender and C White are suitable to be grown as cut flower crop under Prayagraj agro-climatic conditions.

**Reference**

Ahmad, H. (2016). Phenotypic screening of lisianthus *(Eustoma grandiflorum)* lines for production in Bangladesh. Doctoral Dissertation, Department of Horticulture.

Anitha, K., Selvaraj, N., Jawaharlal, M. and Jegadeeswari, V. (2013). Studies on genetic variability, heritability and genetic advance in lisianthus *(Eustoma grandiflorum* (Raf.) Shinners). *Journal of Ornamental Horticulture, 16*(4), 133–137.

Dhiman, M.R., Dey, R.B., Parkash, C., Kumar, S. and Kumar, R. (2020). Evaluation of lisianthus *(Eustoma grandiflorum* (Raf.) Shinn) genotypes for growth and flowering traits. *Journal of Ornamental Horticulture, 23*(1), 12–19.

Ecker, R., Barzilay, A. and Osherenko, E. (2020). Population means and correlation analyses of growth parameters in lisianthus *(Eustoma grandiflorum* Shinn.). *Euphytica, 78*, 193–197.

Fang, F., Oliva, M., Ehi-Eromosele, S., Zaccai, M., Arazi, T. and Oren-Shamir, M. (2018). Successful floral dipping transformation of post-anthesis lisianthus *(Eustoma grandiflorum)* flowers. *The Plant Journal, 96*(4), 869–879.

Gupta, C. and Pathania, S. (2024). Dynamics in temperate floriculture. *Indian Horticulture*,

*69*(5), 52–55.

Harbaugh, B.K. (2007). Lisianthus: *Eustoma grandiflorum*. In *Flower Breeding and Genetics: Issues, Challenges and Opportunities for the 21st Century* (pp. 644–663). Dordrecht: Springer Netherlands.

Hamo, L.B.M., Kitron, M., Bustan, A. and Zaccai, M. (2010). Effect of shade regime on flower development, yield and quality in lisianthus. *Scientia Horticulturae, 124*(2), 248–253.

Hohn, D., Peil, R.M.N., Marchi, P.M., Trentin, R. and Grolli, P.R. (2024). Growth analysis of six lisianthus (*Eustoma grandiflorum*) cultivars in different growing seasons. *Communicata Scientiae, 15*, 4215–4215.

Kumaresan, M., Rajaselvam, M., Devi, K.N. and Vasanthkumar, S.S. (2024). A newly emerging potential cut flower of lisianthus (*Eustoma grandiflorum*) in Tamil Nadu: A review. *T*, 790–795.

Kumari, R.V., Karthik, D.R. and Shalini, M. (2024). Effect of nutrient levels and spacing on vegetative growth and yield of lisianthus (*Eustoma grandiflorum*) under polyhouse condition. *Plant Archives, 24*(2), 98–105.

Kwon, H.S., Leporini, C., Kim, S. and Heo, S. (2024). Prolonged vase life by salicylic acid treatment and prediction of vase life using petal colour senescence of cut lisianthus. *Postharvest Biology and Technology, 20*(9), 112–125.

Philip, P., Sankar, M., Sreelatha, U., Minimol, J.S., and Anupama, T.V. (2019). Evaluation of cut rose varieties for commercial cultivation under humid tropics of Kerala. *Journal of Tropical Agriculture, 57*(2), 76–82.

Rehana, S., and Bala, M. (2022). Under exploited ornamental crops: Treasure for floriculture industry. *Annals of Horticulture, 15*(1), 43–55.

Schijlen, E.G., De Vos, C.R., van Tunen, A.J., and Bovy, A.G. (2004). Modification of flavonoid biosynthesis in crop plants. *Phytochemistry, 65*(19), 2631–2648.

Shivaprasad, S.G., Nataraj, S.K., Latha, S., Ravi, C.H. and Suryakant, K.V. (2016). Evaluation and correlation studies of rose cultivars under naturally ventilated polyhouse. *Research in Environment and Life Sciences, 9*(9), 1097–1099.

Silva, M., Segundo, V.C.V., Antonio, J., Filho, D.B., Vasconcelos, A.A., and Innecco, R. (2021). Performance of lisianthus varieties under shaded environment. *Revista Agrogeoambiental, 13*(3), 46–52.

Sultana, M.N., Rakibuzzaman, M., and Uddin, A.F.M.J. (2021). Influence of light spectrums on seedling emergence and growth of lisianthus (*Eustoma grandiflorum*) cultivars. *Journal of Bioscience and Agriculture Research, 28*(2), 2355–2362.

Wegulo, S.N., and Vilchez, M. (2007). Evaluation of lisianthus cultivars for resistance to

*Botrytis cinerea. Plant Disease*, *91*(8), 997–1001.