Varietal evaluation of Gerbera under shade net condition in Prayagraj agroclimatic condition

ABSTRACT

Gerberas are widely cultivated and have a significant market value due to their popularity as ornamental plants and their traditional medicinal uses. The global gerbera market includes various segments, such as cut flowers, potted plants, and medicinal products. Therefore, present investigation was carried out with title at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during the *Winter*-2022-23 to determine the performance of different varieties of gerbera for its growth and flowering. Under this experiment, overall, 8 varieties were used comprising of variety Shveen, Petali, Livia, Hiami, Deepti, 17026, Alcochate and Breakdance. The current study found that variety Hiami performed better in terms of characters like plant height at 30, 60 and 90 DAP (18.13, 21.20 and 23.77 cm respectively); early for days to first flower bud emergence (39.43 DAP); days from bud to flowering (9.97 days); number of days for flowering from planting (54.53 DAP); number of days for peak flowering (58.17 DAP); maximum number of buds (10.63 buds); stalk length (64.77 cm); diameter of flower (9.33 cm) and yield per 200 m^2 (11693 flowers). Variety Deepti performed better for parameters like number of leaves at 30, 60 and 90 DAP (7.53, 10.37 and 12.63 leaves respectively); plant spread at 30, 60 and 90 DAP (18.77, 26.13 and 35.30 cm respectively); Vase life (8.80 days); second highest for yield per 200 m^2 (10263 flowers).

Keywords: *Gerbera, Varieties, stalk length, yield.*

INTRODUCTION

Gerbera (*Gerbera jamesonii* Hook.) came into dictionary of floriculture after it was discovered by pre-Linnean botanist, Gronovious but it received its fortunate name in honour of German naturalist, 'Traugott Gerber' who travelled in Russia in 1743. It belongs to family Asteraceae and is suitable both for export and domestic market, because of its potential to withstand in long transportation. It is a diploid species with somatic chromosome number 2n=50. The modern gerbera arose from *G. jamesonii* hybridized with *G. viridifolia* and possibly other species. It is commonly known as 'Transvaal Daisy', 'Barberton Daisy' or 'African Daisy' and is a small group of temperate and tropical Asian and African perennial herbs.

The plants are stemless and tender perennial herbs, leaves are radical, petioled, lanceolate and deeply lobed. They produce very attractive flower heads. Flower head is solitary; many flowered, with conspicuous ray florets in one or two rows. Based on flower head types or forms they are grouped into single, double, and semi double cultivars. The flower stalks are long, thin hollow and leafless. This characteristic has popularized gerbera and is in great demand in market for preparation of bouquets.

The consumers' preference changes with time. Hence, crop improvement is the need of the time to sustain the availability of desirable cultivars. Improvement through selection depends upon the variability existing in the available genotypes, which may be either due to different genetic constitution of cultivars or variations in the growing environments. Gerbera is a vegetatively propagated crop through suckers on commercial scale and selection is an easy method for varietal improvement in it. Selection is effective only when the observed

variability in the population is heritable in nature. Genetic variance, heritability and other genetic parameters are reported to be subject to fluctuations with changing environments (**Lal *et al*., 1982**). [7].

Netherland is the largest producer of gerbera in the world, accounting for over 78% of the global production. According to the Food and Agriculture Organization (FAO) of the United Nations, Netherland produced over 213,000 metric tons of gerbera in 2021. According to the Indian Council of Agricultural Research (ICAR), gerbera is primarily cultivated in the states of Karnataka, Maharashtra, Tamil Nadu, and West Bengal. It is grown in both open fields and under protected cultivation, such as polyhouses and shade nets. The area under production of gerbera in India is estimated to be around 6.42 thousand hectares and production is 2.65 million metric tons. Karnataka ranks first in gerbera production followed Maharashtra and Tamil Nadu. In Uttar Pradesh, area under production is 0.56 thousand hectares with production of 0.73 million metric tons. (***Source:*** *NHB,* Ministry of Agriculture & Farmers Welfare, Government of India, 2021-22).

Germplasm is the basic material with a breeder to initiate his crop improvement programme. It consists of genetic variability for quantitative and qualitative traits. A proper understanding of classification of cowpea germplasm for qualitative and quantitative traits may serve as useful guidelines for plant breeders for selection and improvement of the crop. Yield is a complex character and depends upon number of component characters which are quantitatively inherited. As such before launching any breeding programme, a thorough knowledge of the nature and magnitude of genetic variability and extent of association between yield and other components is essential. Evaluation of genotypes to assess the existing variability is considered as preliminary step in any crop improvement programme. Information on the magnitude of variation in the available genetic material and the part played by the environment on the expression of plant characters are prime importance for the appraisal of the magnitude of possible improvement.

Varietal evaluation is a crucial process in the world of gerbera cultivation. It allows growers and researchers to compare different gerbera varieties, observing their growth rates, flower size, colors, and overall health under similar conditions. By identifying the best-performing varieties, growers can choose the most suitable ones for specific purposes such as cut flower production, potted plants, or landscaping, ultimately leading to increased productivity and profitability. Moreover, the evaluation helps in determining disease and pest resistance, enabling growers to select varieties better suited for their local conditions, thus reducing the need for chemical treatments and production costs. Additionally, the assessment of flower quality aids in ensuring market acceptance, as superior attributes like size, shape, color, and longevity become apparent. Not only does varietal evaluation contribute to crop improvement, but it also fosters sustainability and resource management by identifying varieties that require fewer inputs, promoting environmentally friendly practices and conserving valuable resources in gerbera farming.

The performance of each cultivar varies with the region, season and other growing condition However the concept of protected cultivation of gerbera is new The success of hi tech floriculture depends on the selection of proper varieties Considering the commercial importance of this crop, there is a prime need for identification of a suitable cultivar for specific region The promising varieties can be assessed for their stability across the environment Hence, this study is being conducted to identify the suitable gerbera cultivar under protected

cultivation with respect to flower yield, quality of flower and its important traits for plains of Prayagraj Uttar Pradesh.

MATERIAL AND METHODS

The present investigation was done to understand the performance of different varieties for plant and floral growth and yield of Gerbera. 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. Observations were recorded at different growth parameters like plant height, number of leaves, plant spread, flowering parameters like number of days taken for first flower bud emergence, number of buds per plant, stalk length and yield parameters like yield per 200 m^2. The data were statistically analysed by the method suggested by **Fisher and Yates, 1963** [3]**.** The different varieties used for varietal evaluations were V_1 (Shveen); V_2 (Petali); V_3 (Livia); V_4 (Hiami); V_5 (Deepti); V_6 (17026); V_7 (Alcochate) and V_8 (Breakdance).

RESULTS AND DISCUSSION

A) Vegetative Parameters

Plant height and Number of leaves (Table 1)

The maximum plant height at 90 DAP (23.77 cm) was observed in variety Hiami followed by variety Livia with 21.60 cm. Minimum plant height at 90 DAP (16.00 cm) was observed in variety Petali. The improved performance of one variety of gerbera under a shade net compared to other varieties can be attributed to its specific genetic traits and adaptability. This variety may possess characteristics that enable it to thrive in reduced light conditions, promoting elongated and controlled growth. Its inherent ability to efficiently utilize available light resources allows it to maintain optimal photosynthesis and growth rates under shade. Additionally, this variety might have a natural inclination towards vertical growth, which is further enhanced in the sheltered environment provided by the shade net. As a result, it exhibits superior plant height compared to other varieties in such conditions. Similar findings were reported by **Sil *et al.*, (2017)** [11]; **Singh *et al.*, (2017)** [12]; **Deepa *et al.*, (2019)** [2] in gerbera.

The maximum number of leaves at 90 DAP (12.63 leaves) was observed in variety Deepti followed by variety Hiami with 12.47 leaves. Minimum number of leaves at 90 DAP (8.77 leaves) was observed in variety Alcochate. The enhanced performance of one gerbera variety under a shade net compared to others in terms of leaf production can be attributed to its genetic predisposition for shade tolerance and resource allocation. This variety might have evolved mechanisms that maximize leaf development and photosynthetic efficiency under reduced light conditions. Its genetic traits likely prioritize leaf growth over other competing processes, resulting in a higher leaf count. Moreover, the shade net creates a more favourable microclimate, optimizing light distribution and reducing stress on the plant, allowing this variety to allocate more energy towards leaf production, ultimately leading to a greater number of leaves. Similar findings were reported by **Jhangde *et al.*, (2019)** [4]; **Akhtar *et al.*, (2019)** [1] in gerbera.

Plant spread (Table 1)

The maximum plant spread at 90 DAP (35.30 cm) was observed in variety Deepti followed by variety Breakdance with 33.33 cm. Minimum plant spread at 90 DAP (26.40 cm) was observed in variety Alcochate.

The superior performance of one gerbera variety under a shade net concerning plant spread can be attributed to its genetic characteristics and growth behaviour. This specific variety may possess traits that promote lateral growth and branching, allowing it to take advantage of available space more effectively. The shade net provides a controlled environment that encourages horizontal expansion without excessive competition for light and resources. Additionally, the reduced light intensity may trigger specific genetic responses in this variety, leading to a broader canopy and denser foliage. As a result, the shade net fosters ideal conditions for this gerbera variety to exhibit better plant spread compared to others. Similar findings were reported by **Jhangde *et al.*, (2019)** [4]; **Maitra *et al.*, (2020)** [8] in gerbera and **Kumar *et al.*, (2020)** [5] in marigold.

B) Floral parameter

Days for first flower bud emergence, Days from bud to flowering and Number of days for flowering from planting (Table 1)

The minimum days for first flower bud emergence (39.43 days) was observed in variety Hiami followed by variety Livia with 56.67 days. Maximum days for first flower bud emergence (114.03 days) was observed in variety Petali. The minimum days from bud to flowering (9.97 days) was observed in variety Hiami followed by variety 17026 with 13.53 days. Maximum days from bud to flowering (15.23 days) was observed in variety Petali. The minimum number of days for flowering from planting (54.53 days) was observed in variety Hiami followed by variety Livia with 70.83 days. Maximum number of days for flowering from planting (127.20 days) was observed in variety Petali. The improved performance of one gerbera variety under a shade net concerning early bud emergence, days from bud to flowering and number of days for flowering from planting can be attributed to its inherent genetic traits and shade tolerance. This specific variety might have evolved mechanisms that enable it to initiate bud development even in lower light conditions. The shade net creates a more favourable microenvironment, maintaining stable temperatures and reducing stress on the plant. This enhances the early activation of flowering genes in the variety, resulting in faster bud initiation and development. Additionally, its natural adaptability to shade allows it to thrive in such conditions, leading to earlier bud emergence compared to other varieties that may require higher light intensity. Similar findings were reported by **Deepa *et al.*, (2019)** [2]; **Akhtar *et al.*, (2020)** [1]; **Maitra *et al.*, (2020)** [8] in gerbera and **Pani *et al.*, (2020)** [10] in Rose.

Number of buds per plant and Number of days for peak flowering (Table 1)

The maximum number of buds per plant (10.63 buds) was observed in variety Hiami followed by variety Deepti with 9.33 buds. Minimum number of buds per plant (4.60 buds) was observed in variety Petali. The superior performance of one gerbera variety under a shade net in terms of producing more buds per plant can be attributed to its genetic predisposition and adaptability to reduced light conditions. This particular variety may have evolved traits that promote prolific bud formation even in lower light intensities. The shade net creates a controlled environment, which reduces stress and creates optimal conditions for bud development. The variety's genetic makeup likely prioritizes reproductive growth, leading to a higher bud formation rate. Additionally, the reduced competition for light and resources under the shade net further enhances the allocation of energy towards bud production, resulting in more buds per plant compared to other varieties. Similar findings were reported by **Singh *et al.*, (2017)** [13] in gerbera.

The minimum number of days for peak flowering (58.17 days) was observed in variety Hiami followed by variety Livia with 74.50 days. Maximum number of days for peak flowering (131.13 days) was observed in variety Petali. The superior performance of one gerbera variety under a shade net concerning an early peak in flowering can be attributed to its genetic predisposition and adaptability to reduced light conditions. This specific variety might have evolved traits that promote rapid flowering onset and synchronization. The shade net creates a controlled environment, providing consistent light levels and reducing stress on the plant. As a result, the variety's genetic makeup is triggered to initiate and accelerate the flowering process, leading to an early and concentrated peak in flower production. Additionally, the reduced competition for light and resources under the shade net further enhances its ability to reach an early peak in flowering compared to other varieties. Similar findings were reported by **Deepa *et al.*, (2019)** [2]; **Akhtar *et al.*, (2020)** [1] in gerbera.

Stalk length, diameter of flower, vase life and yield per 200 m^2 (Table 1)

The maximum stalk length (64.77 cm) was observed in variety Hiami followed by variety Shveen with 58.00 cm. Minimum stalk length (49.87 cm) was observed in variety Petali. The maximum diameter of flower (9.33 cm) was observed in variety Hiami followed by variety Livia with 8.67 cm. Minimum diameter of flower (7.47 cm) was observed in variety Shveen. The better performance of one gerbera variety under a shade net, resulting in greater stalk length and flower diameter, can be attributed to its specific genetic traits and adaptability to reduced light conditions. This particular variety may possess characteristics that promote elongated stem growth, enabling it to reach for available light. The shade net provides a controlled environment that fosters vertical growth without excessive competition for light. As a result, the variety allocates more energy to stalk development, leading to longer stems compared to other varieties that might require higher light intensities for elongation. Additionally, the shade net's sheltered environment reduces the risk of physical damage and allows uninterrupted stem growth. Similar findings were reported by **Sil *et al.*, (2017)** [11]; **Deepa *et al.*, (2019)** [2]; **Akhtar *et al.*, (2020)** [1] in gerbera.

The maximum Vase life (8.80 days) was observed in variety Deepti followed by variety Alcochate with 7.93 days. Minimum Vase life (4.43 days) was observed in variety Breakdance. The better performance of one gerbera variety under a shade net, resulting in more vase life, can be attributed to its genetic traits and adaptability to reduced light conditions. This specific variety may possess characteristics that promote better water uptake and nutrient retention in its stems and flowers. The shade net provides a controlled environment, reducing stress and transpiration, which helps preserve the flower's freshness and vitality. Additionally, the variety's natural tolerance to shade enables it to sustain optimal flower health for a longer duration. As a result, it exhibits an extended vase life compared to other varieties that might require higher light intensities and experience quicker wilting. Findings were in accordance with earlier findings of **Singh *et al.*, (2017)** [12]; **Jangde *et al.*, (2019)** [4]; **Akhtar *et al.*, (2020)** [1]; **Maitra *et al.*, (2020)** [8]in gerbera.

The maximum Yield per 200 m^2 (11693 flowers) was observed in variety Hiami followed by variety Deepti with 10263 flowers. Minimum Yield per 200 m^2 (5060 flowers) was observed in variety Petali. The better performance of one gerbera variety under a shade net, resulting in more yield per 200 m^2, can be attributed to its genetic traits and adaptability to reduced light conditions. This specific variety may possess characteristics that promote better water uptake and nutrient retention in its stems and flowers. The shade net provides a controlled

environment, reducing stress and transpiration, which helps preserve the flower's freshness and vitality. Additionally, the variety's natural tolerance to shade enables it to sustain optimal flower health for a longer duration. As a result, it exhibits an extended yield per 200 m^2 compared to other varieties that might require higher light intensities and experience quicker wilting. Findings were in accordance with earlier findings of **Singh *et al.*, (2017)** [13]; **Jangde *et al.*, (2019)** [4]; **Akhtar *et al.*, (2020)** [1]; **Maitra *et al.*, (2020)** [8] in gerbera.

Conclusion

The current study found that variety Hiami performed better in terms of characters like plant height at 30, 60 and 90 DAP (18.13, 21.20 and 23.77 cm respectively); early for days to first flower bud emergence (39.43 DAP); days from bud to flowering (9.97 days); number of days for flowering from planting (54.53 DAP); number of days for peak flowering (58.17 DAP); maximum number of buds (10.63 buds); stalk length (64.77 cm); diameter of flower (9.33 cm) and yield per 200 m^2 (11693 flowers). Variety Deepti performed better for parameters like number of leaves at 30, 60 and 90 DAP (7.53, 10.37 and 12.63 leaves respectively); plant spread at 30, 60 and 90 DAP (18.77, 26.13 and 35.30 cm respectively); Vase life (8.80 days); second highest for yield per 200 m^2 (10263 flowers).

References

1. Akhtar, M. D., Singh, D., & Fatmi, U. (2020). Varietal evaluation of Gerbera (*Gerbera jamesonii*) under naturally ventilated polyhouse condition in Prayagraj. *International Journal of Current Microbiology and Applied Sciences*, 9(10), 2633-2639

2. Deepa, M. S., Sudarshan, G. K., & Keerthishankar, K. (2019). Evaluation of gerbera (*Gerbera jamesonii*) cultivars for growth, flowering and yield under different growing structure. *International Journal of Chemical Studies*, 7(1), 1138-1140.FAOSTAT (2020). www.fao.org/faostat/en/data/CC. Food Supply-Crops Primary Equivalent. Visited on 15/12/2022.

3. Fisher, R.A. and Yates, F. (1967). "The Design of Experiments: Statistical Principles for Practical Applications." *New York*: Hafner Publishing Company.

4. Jangde, T., Sharma, G., Jangde, B., & Banjara, N. C. (2019). Evaluation of gerbera (*Gerbera jamesonii*) cultivars under naturally ventilated polyhouse in Chhattisgarh plain. *Journal of Pharmacognosy and Phytochemistry*, 8(3), 2112-2114.

5. Kumar, R., Prasad, V. M., & Singh, D. (2021). Varietal evaluation of chrysanthemum (Dendranthema grandiflora L.) under Prayagraj agro-climatic conditions. *The Pharma Innovation Journal*, 10(12), 245-248.

6. Kumar, V., Singh, R. S., Pal, M., Ojha, M. D., Singh, A. P., Verma, R. K., & Singh, P. K. (2020). Varietal performance of marigold (*Tagetes spp*.) under sub-tropical condition of Bihar. *Journal of Pharmacognosy and Phytochemistry*, 9(3), 922-924.

7. Lal, S. D., Seth, J. N.; Yadav, J. P. and Danu, N. S. (1982). Genetic variability and correlation studies in rose *Programming Horticulture*., 14(4): 234-236.

8. Maitra, S., Shankar, T., Sairam, M., & Pine, S. (2020). Evaluation of Gerbera (*Gerbera jamesonii* L.) Cultivars for Growth, Yield and Flower Quality under Protected Cultivation. *Indian Journal of Natural Sciences*, 10(60), 20271.

9. NHB (2022). National Horticultural Board, Ministry of Agriculture and Farmers Welfare, *Government of India*, 2021-22).

10. Pani, P. K., Saravanan, S. S., & Bahadur, V. (2020). Varietal Evaluation of Hybrid Tea Rose under Prayagraj Climatic Condition. *International Journal of Current Microbiology and Applied Sciences*, 9(10), 3571-3576.

11. Sil, M., Sarkar, M. M., Raghupathi, B., & Mondal, S. (2017). Varietal Evaluation of Gerbera (*Gerbera jamesonii*.) Grown in a Polyhouse. *International Journal of Current Microbiology and Applied Sciences*, 6(7), 810-814.

12. Singh, B., Pinder, R., Srivastava, R., & Yadav, H. (2017). Varietal Evaluation of Gerbera Cultivars Under Shade Net Conditions. *Chemical Science Review and Letters*, 6(21), 500-504.

13. Singh, P., Bhardwaj, A., Kumar, R., & Singh, D. (2017). Evaluation of Gerbera Varieties for Yield and Quality under Protected Environment Conditions in Bihar. *International Journal of Current Microbiology and Applied Sciences*, 6(9), 112-116.

Table 1 Performance of different varieties for vegetative and floral parameters studied for Gerbera.

Variety Notation	Variety details	Plant height (cm) [90 DAP]	No of leaves [90 DAP]	Plant spread (cm) [90 DAP]	Days for first flower bud emergence (DAP)	Number of buds per plant	Days from bud to flowering (days)	Number of days for flowering from planting (DAP)	Number of days for peak flowering [DAP]	Stalk length (cm)	Diameter of flower (cm)	Vase life (days)	Yield per 200 m^2 (Flowers)
V_1	Shveen	20.47	9.87	30.87	58.20	5.63	14.13	75.03	78.80	58.00	7.47	6.43	6193
V_2	Petali	16.00	12.13	32.00	114.03	4.60	15.23	127.20	131.13	49.87	8.00	4.70	5060
V_3	Livia	21.60	11.40	32.60	56.67	5.50	14.13	70.83	74.50	55.23	8.67	6.63	6050
V_4	Hiami	23.77	12.47	30.90	39.43	10.63	9.97	54.53	58.17	64.77	9.33	7.90	11693
V_5	Deepti	16.50	12.63	35.30	62.87	9.33	14.90	77.80	81.13	50.70	8.17	8.80	10263
V_6	17026	17.13	10.87	30.67	84.03	8.40	13.53	96.13	99.97	52.93	8.30	8.03	9240
V_7	Alcochate	17.77	8.77	26.40	59.20	7.47	14.73	73.97	77.47	56.73	8.27	7.93	8217
V_8	Breakdance	18.33	10.37	33.33	81.20	6.47	14.43	95.30	100.90	57.00	8.40	4.43	7110
'F' test		**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S.E. (m) ±		**1.37**	**0.15**	**1.71**	**4.34**	**0.25**	**0.37**	**5.28**	**5.13**	**3.12**	**0.32**	**0.28**	**1.67**
C.D. at 5%		**2.95**	**0.32**	**3.67**	**9.31**	**0.53**	**0.80**	**11.32**	**10.99**	**6.69**	**0.69**	**0.57**	**3.54**
C.V.		**8.88**	**1.65**	**6.65**	**7.66**	**4.20**	**3.29**	**7.71**	**7.15**	**6.87**	**4.73**	**4.78**	**2.53**