

Original Research Article

<https://doi.org/10.20546/ijcmas.2021.1003.022>

Evaluation of Gerbera Varieties for Yield and Quality under Protected Environment Conditions in Hyderabad

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ABSTRACT

Keywords

Gerbera varieties,
Polyhouse
conditions,
Chlorophyll

Article Info

Accepted:

04 February 2021

Available Online:

10 March 2021

An experiment was conducted to evaluate ten varieties of gerbera under polyhouse conditions in Hyderabad. Vegetative, flowering and flower characters varied significantly among the cultivars and variations in different growth parameters were prominent. Mean performance of the cultivars revealed that cv. Helix recorded maximum plant height, flower diameter, flower stalk diameter and ray florets. The same cultivar Helix also produced maximum number of suckers per plant, number of flowers per plant, Fresh weight of flower, dry weight of flower and possessed longest field life which was at par with cv. Goliath. The cv. Goliath found superior with respect to maximum chlorophyll content, minimum days required for commence of first-flower and days taken for 50% flowering. Maximum disc diameter and number of leaves were produced by cv. balance. While cv. Savannah had significantly maximum leaf area and length of the flower stalk. However, The cv. 'Montenegro recorded least mean value in terms of plant height, number of leaves per plant, leaf length, leaf breadth, leaf area, number of suckers, chlorophyll content, flower diameter, flower stalk diameter, ray florets, disc diameter, number of flowers per plant and took maximum days for first flower opening, 50 % flowering and which was late in inducing flowering has lesser duration of flowering. Cultivar Helix exerted best performance on various growth and flower characters along with the cultivars Goliath, Danaellen, Balance and Savannah.

Introduction

Gerbera (*Gerbera jamesoni* Bolus) is an attractive cut flower crop belonging to the Asteraceae family, which is largest family of flowering plants. It occupies a unique position in beauty and trade among cut flowers and has significant demand due to its multitude of colours. Variety in color has made this flowering plant attractive for use in garden decorations, such as herbaceous borders,

bedding, pots, rock gardens and for cut flowers as it has a long vase life (Chung *et al.*, 2005).

Besides this, performance of each cultivar varies with the region, season and other growing conditions. Considering the commercial importance of this crop, there is a prime need for identification of suitable cultivars for specific regions. Hence, the present study is being conducted to identify

the suitable gerbera cultivars under protected conditions with respect to flower yield, quality and its important traits for plains of Telangana. Hence, the present investigation was planned with the objective to evaluate the performance of gerbera varieties under rain shelter in respect of growth, flowering and yield to explore the possibilities of identifying suitable varieties for commercial cultivation.

Gerbera as a cut flower has tremendous demand in domestic and international markets. Though, different cultivars of gerbera exist in Telangana, none has been officially released. Hence it is needed to evaluate varieties for their vegetative, yield and quality characters and finally to recommend the suitable variety the agro-climatic conditions of Telanagana.

Materials and Methods

The present investigation was carried out in Horticulture Garden, College of Horticulture, SKLTSU, Hyderabad during the year 2015-16 and 2016-17. The experiment consisted of ten cultivars of gerbera viz., Balance, Stanza, Savannah, Dana Ellen, Goliath, Primerose, Helix, Liberty, Sabrina and Montenegro were bought from Kumar Florist (KF Bio plants), Pune. The genotypes were evaluated in randomized block design (RBD) replicated three times. Raised beds of 30 cm height 70cm width and 16 meter long were prepared inside a naturally ventilated poly house of 500sq.m (30mX20m.). Recommended dose of neem cake, FYM were applied at the time of planting. Tissue cultured plants of above mentioned varieties were planted on 2nd January 2014 at a spacing of 30 X 30 cm in two rows in each bed.

The data recorded on 21 parameters consisting of morphological trait, floral trait and quality traits from five randomly tagged plants in each plot. The data obtained were

analyzed statistically and the significance level among the treatments was compared at 5 per cent of probability.

The observations for vegetative parameters such as the plant height were measured from base to crown portion of plant using a ruler from the tagged plants. Number of leaves was counted at flowering stage. Leaf length and leaf breadth were recorded using ruler and expressed in cm. Number of suckers were counted after the time of flowering, Leaf area was measured by using Leaf area meter and chlorophyll content was instantly measured by SPAD meter. The floral parameters including numbers of flowers were determined by counting the number of the first appearing flowers till the last flowers to open, by continual removing the flowers as and when it opened. Flower stalk length was recorded from the upper end to the lower end of stalk using ruler and expressed in cm. Flower stalk diameter were recorded in the middle of the stalk using vernier caliper. Flower diameter was noted in the middle cross section of the flower using ruler (cm). Total number of ray florets in each flower was counted after separation of the petals. Fresh weigh and dry weight of flowers were taken by weighing from randomly selected flowers. Longevity of flower was recorded in a tagged plants from the day it opened to the day it end its life. Flowers were harvested early in the morning when two rows of disc florets were fully opened and perpendicular to the stalk. It was harvested with sideward push of the flower stem at the base. The harvested flowers were immediately placed in clean water to remove field heat.

Results and Discussion

The data on various vegetative characters are presented in Table 1. Significant differences were recorded among cultivars for all the characters studied (Fig. 1 and 2).

Vegetative growth parameters

The results obtained from the present investigation on various parameters exhibited significant differences among the cultivars as was evident from Table 1.

Plant height

The data regarding the plant height is an important parameter which determines the vigour and yield of the plant and showed significant differences among genotypes (Table 1). Plant height was maximum in cultivar 'Helix' (45.46 cm) and the next superior cultivars were Balance (41.17 cm) and Stanza (41.01 cm) and both were at par while cv. Montenegro being the short stature recorded minimum plant height (27.82 cm). Intermediate plant height was recorded in cv. Savannah and cv. Danaellen (39.07 and 38.97, respectively). The plant height being genetically factored, it is expected to vary among the cultivars (Sarkar and Ghimiray, 2004). The marked variation in the plant height may be due to varietal characters. Similar findings observed in Singh *et al.*, (2017) and Chobe *et al.*, (2010).

Number of Leaves, Leaf length and Leaf breadth

Gerbera cultivars showed significant variation for Number of leaves per plant, Leaf length and Leaf breadth as shown in Table 1. The cv. Balance exhibited more number of leaves per plant (50.16). Maximum leaf length and width were found from cv. Savannah (26.31 cm and 13.37 cm, respectively) which were on par with cv. Balance and Number of leaves, Leaf length and Leaf breadth were minimum in cv. Montenegro (22.00, 19.41 and 9.92, respectively).

Wankhede and Gajbhiye (2013) suggested that variation in leaf production per plant among the varieties might be due to varietal

characters. Variation in leaf production per plant has also been reported by Headu *et al.*, (2012).

Leaf area and Leaf area index

Higher leaf area and Leaf area index were found in cv. Savannah (197.92 cm² and 0.2193) followed by cv. Stanza (188.18 cm² and 0.2093) and cv. Danaellen (181.21 cm² and 0.2010) while least being in cv. Montenegro (123.93 cm² and 0.1377). Large sized and higher number of leaves gives higher leaf area.

Maximum leaf area increased the photosynthetic efficiency of leaf surface leading to increased production of flowers. Variation in leaf area indicates additive gene effects would be effective in gerbera (Nair and Shiva, 2003). The results were in accordance with the findings of Headu *et al.*, (2012).

Number of suckers per plant and Chlorophyll content

Propagation of cultivars in terms of suckers per plant per year produced by cultivar was found more in cv. Goliath (9.20) as compared to other cultivars which was found to be at par with the cultivars Danaellen, Helix and Balance (9.00, 7.90, and 7.20, respectively). The same cultivar Goliath recorded significantly maximum leaf chlorophyll content (75.96) which was found to be at par with the other cultivars Danaellen and Stanza (70.65 and 70.30). Whereas, cv. Montenegro exhibited poor suckering habit (4.20) and minimum chlorophyll content (58.97).

Higher chlorophyll content, which might have led to increased photosynthesis and increased carbohydrates. Chobe *et al.*, (2010) and Magar *et al.*, (2010) reported similar observations in gerbera varieties.

Flowering characters

The perusal of data presented in Table 2 revealed that flowering characters varied significantly among the cultivars. Cultivar Goliath recorded significantly earlier for first-flower opening and days taken for 50% flowering (66.30 and 78.10, respectively). Since early and late flowering characters are genetically controlled, cultivars might be chosen accordingly for getting prolonged flowering duration. Similar variation in first flower opening was reported in 10 cultivars of gerbera by Rajiv kumar, 2013 and 50% flowering was reported in 12 cultivars of gerbera by Lagamanna *et al.*, (2015) who also recorded significant variation among different gerbera for flowering characters and attributed it to genetic makeup of varieties.

However, the cv. Helix was also superior with respect to flowering parameters, recorded maximum duration of flowering (266.10) followed by cv. Goliath and cv. Danaellen (264.30 and 262.50, respectively) while maximum days to first-flower opening, days taken for 50% flowering and minimum days for flower durability recorded by cv. Montenegro.

Slow development of flower after initiation of buds and minimum days for flower durability were marked in cv. Montenegro. The result indicated that Goliath and Helix cultivars performed best in case of days to first-flower opening, Days taken for 50% flowering and flower durability.

Variation in flowering parameters viz., Days to first-flower opening, Days taken for 50% flowering and Duration of flowering showed by different gerbera varieties might be due to variation in their genetic factor. Chobe *et al.*, (2010) recorded similar findings in gerbera varieties.

Flower quality characters

The perusal of data presented in Table 3 indicated that genotypes showed significant variation for flowering and quality characters. Flower quality parameters such as flower diameter, stalk length, stalk diameter, number of ray florets, disc diameter, field life, number of flowers per plant per year, fresh weight and dry weight of flowers were significantly different in cultivars.

Table.1 Vegetative growth characters of gerbera cultivars

Cultivar	Plant height (cm)	Number of leaves/ plant	Leaf length (cm)	Leaf breadth (cm)	Leaf Area	Leaf Area Index	Number of suckers / plant	Chlorophyll content
Helix	45.46	32.52	25.12	12.88	166.23	0.1847	7.90	64.24
Sabrina	34.30	33.66	21.09	10.55	126.19	0.1403	5.30	63.36
Montenegro	27.82	22.00	19.41	9.92	123.93	0.1377	4.20	58.97
Liberty	32.08	34.00	22.34	10.47	148.31	0.1647	6.40	60.84
Primerose	33.61	27.40	19.91	9.32	132.85	0.1477	7.00	59.36
Savannah	39.07	34.56	26.31	13.37	197.92	0.2193	7.10	65.01
Goliath	35.06	32.73	22.10	9.72	157.85	0.1753	9.20	75.96
Stanza	41.01	47.83	25.73	14.90	188.18	0.2093	6.20	70.30
Danaellen	38.97	42.10	24.03	12.07	181.21	0.2010	9.00	70.65
Balance	41.17	50.16	26.27	12.76	176.16	0.1957	7.20	64.07
S.E.D	1.88	1.74	0.97	0.74	4.34	0.00	0.70	2.45
C.D.(0.05)	5.60	5.17	2.90	2.21	12.91	0.01	2.10	7.28

Table.2 Flowering characters of gerbera cultivars

Cultivar	Days to first-flower opening	Days taken for 50% flowering	Duration of flowering	Flower Colour
Helix	68.00	82.50	266.10	Purple
Sabrina	76.30	88.00	240.73	Yellow
Montenegro	80.10	92.50	238.33	Yellow
Liberty	75.20	86.30	255.00	Pink
Primerose	79.30	89.70	244.56	Pink
Savannah	69.33	83.30	260.80	Red
Goliath	66.30	78.10	264.30	Orange
Stanza	74.00	86.30	250.20	Red
Danaellen	69.10	80.30	262.50	Yellow
Balance	71.30	85.20	258.60	White
S.E.D	0.68	0.97	1.88	
C.D.(0.05)	2.04	2.88	5.59	

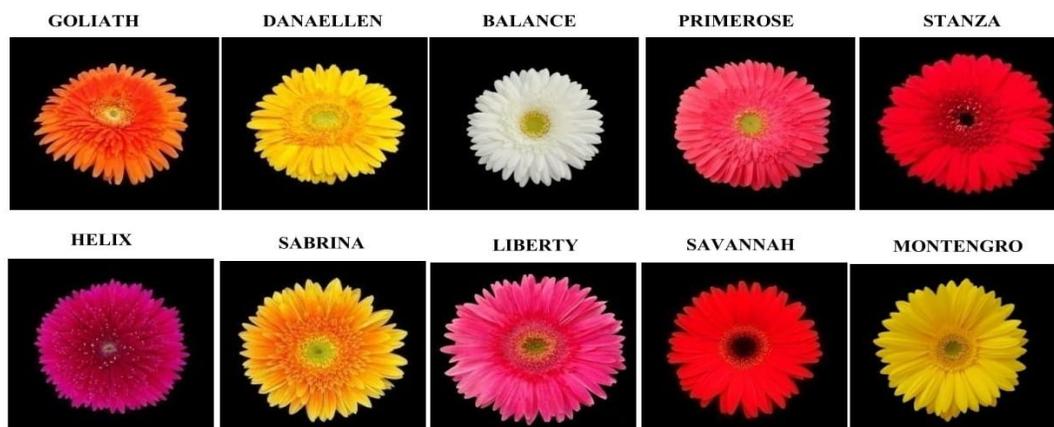
Table.3 Flower characters of gerbera cultivars

Cultivar	Flower diameter (cm)	Flower Stalk diameter (cm)	Length of the flower stalk	Ray florets	Disc diameter (cm)	Field life	Number of flowers / plant	Fresh weight of flower	Dry weight of flower
Helix	13.50	7.68	47.00	176.16	2.40	12.50	32.80	17.80	3.00
Sabrina	9.00	5.09	38.16	121.04	1.70	8.76	21.80	12.15	1.54
Montenegro	8.60	4.90	39.40	62.89	1.60	9.43	16.00	12.71	1.63
Liberty	9.90	6.22	40.00	124.31	2.10	9.90	27.20	16.85	2.90
Primerose	9.50	5.28	44.30	68.20	1.90	10.50	22.10	13.40	2.04
Savannah	10.40	5.85	60.20	62.23	1.70	12.00	28.30	17.61	2.90
Goliath	10.70	6.79	50.46	85.04	2.30	14.16	32.40	18.33	3.35
Stanza	10.20	5.59	48.90	75.10	2.30	11.10	26.10	15.73	2.44
Danaellen	10.40	5.86	50.20	63.36	2.20	13.20	30.60	16.93	2.91
Balance	11.40	5.60	54.40	71.70	2.60	12.40	27.50	16.89	2.88
S.E.D	0.46	0.32	1.67	3.88	0.15	0.77	1.20	0.53	0.21
C.D.(0.05)	1.37	0.97	4.98	11.53	0.44	2.28	3.57	1.57	0.64

Fig.1 Field view of Gerbera cultivation



Fig.2 Selected Gerbera varieties for evaluation



Flower diameter, flower stalk diameter and stalk length

In the present study, flower diameter and stalk length and girth are the parameters that will eventually define the quality and suitability of the cut flower. Flower diameter was maximum in cv. Helix (13.50 cm) followed by cv. Balance (11.40 cm). Whereas minimum flower diameter was recorded in cv. Montenegro (8.60). Similar variation in flower diameter has also been reported in gerbera by Kumar *et al.*, 2013 and Magar *et al.*, 2010.

Stalk diameter varied significantly among the genotypes and cultivars Helix and Goliath recorded more stalk diameter (7.68 and 6.79cm, respectively) while in cv. Montenegro was significantly lower than all the others (4.90cm) has also been reported by Barua *et al.*, (2012) and Rajiv Kumar *et al.*, (2012).

Longest stalk was produced in cv. Savannah (60.20 cm) followed by cv. balance (54.40 cm). While the shortest was found from cv. Sabrina (38.16). The stalk length is a genetic factor therefore; it is expected to vary among the cultivars as earlier observed by Sarkar and

Ghimaray (2004). Stalk length is a very important factor for gerbera cut flower. It decides the quality of cut flowers. As there will be more stalk length more reserved food will be stored in the stalk which will later be available to the flower for longer time period. The findings are in accordance with the result reported by Manaswita Sil *et al.*, (2017), Anand *et al.*, (2013) Ahlawat *et al.*, (2012), Chobe *et al.*, (2010), Pareneetha (2006), Naik *et al.*, (2006) and Singh and Ramchandran (2002).

Ray florets and disc diameter

Number of ray florets ranged from 176.00 (Helix) to 62.89 (Montenegro). Significantly highest number was registered in cv. Helix (176.00), which was statistically and significantly superior over other genotypes. While cv. Montenegro (62.89) recorded lowest number of ray florets. Intermediate cultivars were Liberty, Sabrina and Goliath (124.31, 121.04 and 85.04 respectively).

Maximum diameter of disc was recorded in cv. Balance (2.60 cm), which was at par with cultivars Helix (2.40 cm), Goliath (2.30cm), Stanza (2.30 cm) and Danaellen (2.20 cm). Whereas it was recorded minimum in cv.

Montenegro (1.60 cm) which was at par with cultivars Sabrina (1.70cm) and Savannah (1.70cm). These differences in cut flower quality parameters of gerbera might be due to the inherent characters of the individual cultivars. The similar differences in gerbera have also been reported by Manaswita Silet *al.*, (2017) and Biswalet *al.*, (2017).

Flower yield and Field life

Flower yield decides the significance of the particular genotypes, which are suitable for commercial cultivation. Number of cut-flowers per plant varied from 16 to 38 flowers per plant per year. Significantly the maximum yield was produced by cv. Helix (32.80) closely followed by cv. Goliath and cv. Danaellen (32.40 and 30.60, respectively) and cultivar Montenegro yielded the least number of flowers per plant (16.00). Such variation in flower yield was reported in gerbera by Singh *et al.*, (2016). The differences in flower production among the cultivars might be due to temperature, prevailing in the region along with their genetic variability. Also, additive genes determine the productivity in gerbera plants. This was in accordance to the findings of Barooah and Talukdar (2009).

The increase in flower yield may be attributed to the greater leaf area and more number of suckers and leaves per plant as well as plant spread which might have resulted in production and accumulation of maximum photosynthates, ultimately resulting the production in more number of flowers with bigger size.

With respect to field life of flower on plant, cv. Goliath exhibited longest field life (14.16 days) which was significantly superior over other varieties and at par amongst them and followed by cultivars Danaellen (13.20 days), Helix (12.50 days), Balance (12.40 days) and Savannah (12.00 days). However cv. Sabrina

recorded minimum field life (8.76 days) which is in accordance with the results of Wankhede and Gajbhiye (2013) in gerbera.

Fresh weight and Dry weight of flower

Observations on fresh weight of flowers indicated that the cv. Goliath was recorded maximum fresh weight (18.33g) which was found on par with cultivars Helix, Savannah, Danaellen, Balance, Liberty and Stanza (17.80, 17.61, 16.93, 16.89, 16.85 and 15.73 g respectively) whereas cv. Sabrina exhibited least weight (12.15g). Similarly it was observed that maximum dry weight was recorded in cv. Goliath (3.35 g) and it was at par with cultivars Helix, Danaellen, Savannah, Liberty and Balance (3.00, 2.91, 2.90, 2.90 and 2.88 g respectively). The minimum dry weight of flower was recorded in cv. Sabrina (1.54 g). Dry weight of flower is directly influenced by the fresh weight of flower thus show similar result as fresh weight of flower. This might be due to bigger size of flowers, more stalk length. The difference in quality character might be due to inherent characters of the individual cultivars and presence of additive genes.

In conclusion based on the findings of the experiment, that there were certain anomalies and differences in respect to vegetative growth, flower yield and quality among the genotypes, which could be attributed to the fluctuations in temperature according to season and also to the distinct genetic constitution of each of the cultivar. Gerberas for the market are usually preferred with higher stalk length, bright and even coloration of florets, uniformly opened florets, larger sized flowers and with a long and robust vase life. Considering all the parameters studied and it is concluded that the cultivars Helix and Goliath were found to be the promising cultivars. With respect to parameters viz., plant height (45.46 cm), duration of flowering

(266.10 days), flower diameter (13.50 cm), Flower stalk diameter (7.68 cm), Ray florets (176.16) and number of flowers per plant (32.80) were recorded maximum in cv. Helix. Whereas cultivar Goliath was also superior with rest of the characters, recorded maximum in number of suckers per plant, chlorophyll content, days to first flower opening (66.30 days), days to 50% flowering (78.10 days), field life (14.16 days), number of flowers per plant (32.40), fresh weight (18.33 g) and dry weight (3.35 g) of flowers. Hence these two varieties are suitable for commercial cultivation under naturally ventilated polyhouse in agro-climatic conditions of Hyderabad, Telangana State.

Acknowledgement

It is indeed an immense pleasure for me to express my most sincere and heartfelt gratitude to my guide Dr. A. Manohar Rao, Professor, Department of Horticulture, PJTSAU, Rajendranagar Hyderabad for his untiring guidance, positive suggestion and self dedication enable me to complete this study, without which the very existence of this thesis work would have been impossible.

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How to cite this article:

Vijayalaxmi, M., A. Manohar Rao, P. Saidaiah and Swathi, K. 2021. Evaluation of Gerbera Varieties for Yield and Quality under Protected Environment Conditions in Hyderabad. *Int.J.Curr.Microbiol.App.Sci.* 10(03): 157-165. doi: <https://doi.org/10.20546/ijcmas.2021.1003.022>