



Assessment of Gerbera (*Gerbera jamesonii* Bolus ex. Hooker F.) Cultivars under Different Growing Conditions

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A study was carried out on the growth performance of 9 cultivars of gerbera (*Gerbera jamesonii* Bolus ex. Hooker F.), at G.K.V.K. Bangalore, during 2011-12. Among the nine cultivars studied, there was a significant variation observed for growth, cut flower yield and quality parameters under polyhouse (NVPH) and shade house conditions. The results revealed that, plant height, number of leaves and plant spread (N/S and E/W) were highest under polyhouse condition compared to shadehouse. Among the varieties, cv. Kyillian recorded the highest plant height (40.1 cm), cv. Sonata recorded maximum number of leaves (23.5) and cv. Julia recorded the highest plant spread on both north to south and east to west side (70.0 and 66.9 cm). Flowering characters such as flower bud appearance, bud opening, 50 per cent flowering and days taken to first harvest were found to be significant. Flowering occurred early under polyhouse compared to shadehouse. Among the varieties, cv. Kyillian took less number of days for flower bud appearance and bud opening (44.5 and 10.4 days respectively). The cv. Dameblanche took less number of days (105.3 and 88 days) to 50 per cent flowering and first harvest. Flower quality parameters such as stalk length, stem diameter, flower diameter and number of ray florets were found to be significant. The highest flower quality parameters were recorded under polyhouse compared to shadehouse. The cv. Julia recorded maximum stalk length and stem diameter (67.9 and 0.83 cm respectively). Maximum flower diameter was recorded in cv. Kyillian (10.6 cm). Cultivar Arianna recorded maximum number of ray florets (9.16). Significant differences were found among the yield parameters such as flowers per plant, total yield per plant and flowers per meter square. The highest yield parameters were recorded under polyhouse as compared to shadehouse. Among the treatments, cv. Sonata recorded the maximum number of flowers per plant; and flowers per meter square (4.4, 8.8 and 98.2, respectively).

Key words: Gerbera, Polyhouse (NVPH), Shadehouse, Cultivars and interaction

Gerbera is one of the important cut flower crop and commercially important in floriculture trade across the globe due to the fact of wide range of colours, shapes and sizes. In the family Asteraceae (composite), this group at present comprises 45 species, native to tropical Asia and Africa. About seven species were recorded in India, distributed in the temperate Himalayas from Kashmir to Nepal at an altitude of 1300 to 3200 meters. There is a great demand for gerbera cut flower throughout the year in India. To meet the quality standards, high yielding and long lasting hybrids/ cultivars have to be grown under polyhouse. Performance of gerbera cultivars varies with region, season and other growing condition (Horn *et al.*, 1974). In gerbera, there is always demand for novel types with high yielding genotypes. Considering the importance present investigation was carried out to study the performance of different cultivars of gerbera under different growing conditions in eastern dry zone of Karnataka.

Materials and Methods

The experiment with nine gerbera cultivars under different growing conditions was undertaken at Regional Horticultural Research and Extension Centre, University of Horticultural Sciences campus, GKVK, Bengaluru during 2011 -2012. The experimental site is located at 12°58' latitude North and 77°35' longitude East. The centre is at an altitude of 930 meters above sea level. Nine gerbera cultivars viz., Amlet, Julia, Pasto, Kyillian, Rionegro, Figaro, Dameblanche, Arianna and Sonata were selected for this study. Raised beds of 45 cm height and 90 cm wide to a length of 22m were prepared by leaving walking space of 45 cm between beds. The tissue culture plants were planted at a spacing of 30 x 30 cm on Aug, 2011. The experiment was laid out in a split plot design with three replications. The data was recorded on various parameters viz., vegetative, quality and yield parameters.

Results and Discussion

The data on plant height, number of leaves, plant

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Table 1a. Growth parameters influenced by growing conditions and cultivars

Treatment	Plant height(cm)	No. of leaves	Plant spread (N/S)	Plant spread (E/W)
Main plot				
E1: Polyhouse	36.2	15.7	61.7	58.5
E2: Shadehouse	32.4	11.3	52.4	49.4
S.Em±	0.04	0.25	0.04	0.03
CD at 5%	0.18	1.07	0.15	0.14
Sub-plots				
T1: Amlet	29.8	8.4	50.1	46.5
T2: Julia	38.6	9.9	70.0	66.9
T3: Pasto	26.5	10.4	45.3	41.9
T4: Kyillian	40.1	14.4	58.9	55.4
T5: Rionegro	34.5	11.7	67.9	65.0
T6: Figaro	30.7	11.2	53.5	50.4
T7: Dameblanche	36.7	15.2	56.3	53.3
T8: Arianna	36.0	17.8	57.3	54.3
T9: Sonata	37.5	23.5	59.3	56.5
S.Em±CD at 5%	0.160.32	0.550.11	0.090.19	0.070.15

Table 1.b. Interaction effect of different growth parameters influenced by growing conditions and cultivars

Treatment	E1 (Polyhouse)				E2 (Shadehouse)			
	Plant height (cm)	No. of leaves	Plant spread (N/S) (cm)	Plant spread (E/W) (cm)	Plant height (cm)	No. of leaves	Plant spread (N/S) (cm)	Plant spread (E/W) (cm)
T1	32.7	10.7	53.4	49.7	29.4	7.6	46.7	43.4
T2	40.5	11.1	77.8	74.6	36.7	9.2	62.3	59.3
T3	31.3	12.3	52.3	48.4	23.3	9.6	38.3	35.4
T4	42.5	17.2	64.3	61.3	38.3	12.2	55.4	52.4
T5	34.6	14.7	75.4	72.5	34.4	10.7	60.4	57.6
T6	32.2	14.7	54.7	51.5	29.5	10.1	54.2	51.2
T7	37.2	17.7	60.7	57.7	35.7	13.3	55.4	52.3
T8	36.9	19.6	61.7	58.6	35.2	17.4	53.3	50.4
T9	38.6	26.7	63.4	59.7	36.4	20.4	56.6	53.3
S.Em±	0.22	0.67	0.13	0.10	0.22	0.6	0.13	0.10
CD at 5%	0.46	1.37	0.27	0.21	0.46	1.3	0.27	0.21

spread and their interaction effect are presented in Table.1.a and 1.b. Plant height was found to be maximum under polyhouse (36.2 cm) and it was

minimum (32.4) under shadehouse condition. Among the varieties cv. Kyillian recorded the highest (40.1 cm) plant height. While, it was the lowest in cv.

Table 2 a. Flowering characters influenced by growing condition and cultivars

Treatments	Number of days for flower bud appearance	Days taken for bud opening	Days taken for 50 per cent flowering	Days taken for first harvest
Main plot				
E1: Polyhouse	50.5	11.3	110.5	79.3
E2: Shade house	61.5	11.6	134.4	109.0
S.Em±	0.55	0.063	0.26	0.037
CD at 5%	2.37	0.27	1.14	0.15
Sub-plots				
T1: Amlet	64.8	10.4	112.1	93.0
T2: Julia	58.7	11.5	130.3	91.0
T3: Pasto	62.3	11.1	133.0	98.5
T4: Kyillian	44.5	10.4	114.8	94.0
T5: Rionegro	63.4	11.3	111.6	93.0
T6: Figaro	52.8	12.2	111.5	95.0
T7: Dameblanche	45.2	11.5	105.3	88.0
T8: Arianna	53.6	11.4	168.5	105.1
T9: Sonata	58.7	12.9	115.0	90.0
S.Em±	1.4	0.39	0.35	0.14
CD at 5%	3.02	1.09	0.72	0.28

Table 2.b. Interaction effect of different flowering characters influenced by growing condition and cultivars

Treatment	E ₁ (Polyhouse)				E ₂ (Shadehouse)			
	No. of days for flower bud appearance	Days taken for bud opening	Days taken for 50 per cent flowering	Days taken for first harvest	Number of days for flower bud appearance	Days taken for bud opening	Days taken for 50 per cent flowering	Days taken for first harvest
T ₁	59.2	10.1	96.6	78.0	70.4	10.8	127.6	108.0
T ₂	53.5	11.6	120.3	76.0	64.0	11.4	140.3	106.0
T ₃	59.7	11.2	123.3	85.0	64.9	11.1	142.6	112.0
T ₄	38.0	9.7	98.6	79.3	51.0	10.9	131.0	108.6
T ₅	59.7	11.0	102.3	75.0	67.1	11.6	121.0	111.0
T ₆	45.4	11.5	95.6	77.0	60.1	12.9	127.3	113.0
T ₇	41.0	10.9	92.3	73.0	49.4	12.0	118.3	103.0
T ₈	43.3	11.2	158.6	97.0	63.9	11.6	178.3	113.3
T ₉	54.6	12.6	106.6	74.0	62.9	13.2	123.3	106.0
S.Em±	2.1	0.5	0.5	0.2	2.1	0.5	0.5	0.2
CD at 5%	4.2	1.1	1.0	0.4	4.2	1.1	1.0	0.4

Pasto (26.5 cm). Significant difference was observed between the condition and treatments. The highest plant height was recorded in cv. Kyillian (42.5 cm) under polyhouse condition and it was the lowest in cv. Pasto (23.3 cm) under shadehouse condition. Increase in the plant height may be due to variation in light intensity with changing season under polyhouse condition, where light plays a major role

Table 3.a. Flower quality parameters influenced by growing condition and cultivars

Treatment	Stalk length (cm)	Stem diameter(cm)	Flower diameter(cm)	No. of ray florets
Main plot				
E ₁ : Polyhouse	60.0	0.74	9.4	72.8
E ₂ : Shade house	54.0	0.66	9.3	61.8
S.Em±	0.03	0.002	0.003	0.2
CD at 5%	0.16	0.009	0.015	1.2
Sub-plots				
T ₁ : Amlet	48.6	0.61	9.2	65.3
T ₂ : Julia	67.9	0.83	9.8	79.3
T ₃ : Pasto	56.5	0.67	8.9	63.8
T ₄ : Kyillian	55.5	0.70	10.6	60.6
T ₅ : Rionegro	62.5	0.78	9.6	61.3
T ₆ : Figaro	60.9	0.69	8.9	61.5
T ₇ : Dameblanche	56.1	0.62	8.4	65.5
T ₈ : Arianna	53.4	0.68	9.4	91.6
T ₉ : Sonata	52.0	0.72	9.5	57.0
S.Em±	0.11	0.006	0.007	0.4
CD at 5%	0.22	0.01	0.014	0.9

Table 3.b. Interaction effect of flower quality parameters influenced by growing condition and cultivars

Treatment	E ₁ (Polyhouse)				E ₂ (Shadehouse)			
	Stalk length (cm)	Stem diameter (cm)	Flower diameter (cm)	No. of ray florets	Stalk length (cm)	Stem diameter (cm)	Flower diameter (cm)	No. of ray florets
T ₁	50.7	0.68	9.3	66.3	46.46	0.55	9.1	64.3
T ₂	72.4	0.88	9.8	92.3	63.40	0.78	9.7	66.3
T ₃	60.5	0.71	8.9	66.6	52.50	0.64	8.9	61.0
T ₄	59.5	0.74	10.6	63.0	51.53	0.66	10.5	58.3
T ₅	64.5	0.83	9.6	61.0	60.46	0.73	9.5	61.6
T ₆	63.4	0.75	8.9	63.6	58.46	0.64	8.9	59.3
T ₇	58.6	0.68	8.4	73.3	53.60	0.56	8.4	57.6
T ₈	54.7	0.68	9.5	111.0	50.50	0.67	9.3	72.3
T ₉	54.4	0.74	9.5	58.3	49.53	0.71	9.4	55.6
S.Em±	0.1	0.009	0.009	0.6	0.1	0.009	0.009	0.6
CD at 5%	0.3	0.01	0.020	1.3	0.3	0.01	0.020	1.3

in plant growth. A similar variation in plant height was recorded in gerbera by Mandal and Biswas (2003) and variation among the cultivars may be due to genetic factor (Sarkar and Ghimaray, 2004). Number of leaves were maximum (15.7) under polyhouse condition and it was minimum in shadehouse condition (11.3). Significant difference was observed among the treatments, the highest number of leaves were recorded in cv. Sonata (23.5), followed by cv. Arianna (17.8) and the lowest number of leaves were recorded in cv. Amllet (8.4). There was significant difference between interaction effect of conditions and treatment. The highest numbers of leaves were recorded in cv. Sonata (26.7) under polyhouse and lowest was recorded in cv. Amllet (7.6) under shadehouse. Variation in production of leaves was due to more number of suckers per plant. Similar variation was reported in gerbera by Mahanta *et al.* (2003) and Magar *et al.* (2010).

Plant spread recorded (N/S and E/W) was the highest under polyhouse condition (61.7 and 58.5 cm, respectively); and it was the lowest in shadehouse (52.4 and 49.4 cm respectively). Among the treatments, the highest plant spread (N/S and E/W) was recorded in cv. Julia (70.0 and 66.9 cm, respectively), followed by cv. Rionegro (67.9 and 65.0 cm respectively). Significant differences were observed between the interaction effect of condition and treatment. The highest plant spread (N/S and E/W) was recorded in cv. Julia (77.8 and 74.6 cm respectively) under polyhouse condition, while it was lowest in cv. Amllet (46.7 and 43.4 cm, respectively) under shadehouse condition. Variation in plant spread may be due to favourable microclimate in polyhouse during the crop growth period, which might have enhanced the growth and development of gerbera plants. In shadehouse performance was poor all cultivars for during different crop growth stages. Similar variations in growing

Table 4a. Yield parameters influenced by growing condition and cultivars

Treatment	No. of flowers per plant	Total yield plant (kg)	Flower yield per m ² (kg)
Main plot			
E1: Polyhouse	3.9	7.8	87.0
E2: Shade house	2.9	5.8	65.1
S.Em±	0.0009	0.0006	0.14
CD at 5%	0.004	0.002	0.61
Sub-plots			
T1: Amllet	2.8	5.6	62.9
T2: Julia	3.0	5.9	66.2
T3: Pasto	3.0	5.9	66.3
T4: Kyillian	3.6	7.1	79.2
T5: Rionegro	3.4	6.8	76.1
T6: Figaro	3.1	6.1	68.4
T7: Dameblanche	3.7	7.3	81.6
T8: Arianna	3.9	7.7	85.7
T9: Sonata	4.4	8.8	98.2
S.Em±	0.003	0.001	0.16
CD at 5%	0.007	0.002	0.34

conditions for plant spread was also observed in gerbera by Kumar and Sooch (2003), and Kumar and Yadav (2005).

Observation on all floral characters, viz., days to flower bud appearance, bud opening, days to 50 per cent flowering, days to first harvest and their interaction is presented in Table 2a & 2b. The bud appearance was earlier under polyhouse condition (50.5 days), and it was late in shadehouse (61.5 days). Significant difference was observed among the treatments. The cv. Kyillian took less number of days (44.5 days) for flower bud appearance, followed by cv. Dameblanche (45.2 days) and it was maximum in cv. Amllet (64.8 days). Interaction effect between growing condition and treatments were found to be significant. Flower bud appeared early in cv. Kyillian (38.0 days) under polyhouse and it was late in cv. Amllet (70.4 days) under shadehouse condition. The days taken for bud opening was the least in polyhouse (11.3 days), while it was the highest in shadehouse (11.6 days). There was significant difference among the treatments. The cv. Kyillian and Amllet (10.4 each) recorded the least number of days to bud opening and it was the highest in cv. Sonata (12.9 days). Interaction effects between conditions and treatments on bud opening were significantly different. Days taken to bud opening was the lowest in cv. Kyillian (9.7) under the polyhouse condition and it was the highest in cv. Sonata (13.2 days) under shadehouse. Days to 50 per cent flowering was minimum (110.5 days) under polyhouse condition and it was maximum (134.4 days) under shade house. Among the treatments cv. Dameblanche produced 50 per cent flowering early (105.3 days), followed by cv. Figaro (111.5 days), and it was the highest in cv. Arianna (168.5 days). There were significant differences between conditions and treatments. Minimum duration for 50 per cent flowering was recorded in cv. Dameblanche (92.3 days) under polyhouse condition and it was maximum in cv. Arianna (178.3 days) under shadehouse condition.

Days to first harvest was minimum (79.3 days) under polyhouse condition and it was maximum (109 days) under shadehouse. Among the treatments cv. Dameblanche recorded minimum (88.0 days) days to first harvest, followed by cv. Sonata (90.0 days) and it was maximum in cv. Arianna (105.1 days). There were significant differences between conditions and treatments. Minimum days taken to first harvest was recorded in cv. Dameblanche (73.0 days) under polyhouse condition and it was maximum in cv. Arianna (113.3 days) under shadehouse condition. Variation in flowering character may be due to genetic makeup of varieties (Kandpal *et al.*, 2003)

The flower quality parameters such as stalk length, stem diameter, flower diameter, number of ray florets and their interaction effect significantly varied among the treatments (Table 3a & 3b). The

4. b. Interaction effect of yield parameters influenced by growing condition and cultivars

Treatment	E ₁ (polyhouse)			E ₂ (Shadehouse)		
	No. of flowers per plant	Total yield	Flower yield per m ²	No. of flowers per plant	Total yield	Flower yield per m ²
T ₁	3.3	6.6	73.9	2.3	4.6	51.9
T ₂	3.5	6.9	77.2	2.5	4.9	55.2
T ₃	3.5	6.9	77.0	2.5	4.9	55.6
T ₄	4.1	8.1	90.1	3.1	6.1	68.4
T ₅	3.9	7.8	87.1	2.9	5.8	65.1
T ₆	3.6	7.1	79.4	2.6	5.1	57.4
T ₇	4.2	8.3	92.6	3.2	6.3	70.6
T ₈	4.5	8.7	96.3	3.4	6.7	75.0
T ₉	4.8	9.8	109.3	3.9	7.8	87.1
S.E.m±	0.005	0.001	0.16	0.005	0.001	0.16
CD at 5%	0.01	0.003	NS	0.01	0.003	NS

highest stalk length was recorded under polyhouse (60.0 cm) condition and lowest was recorded in shadehouse (54.0 cm). Among the varieties cv. Julia produced the longest (67.9 cm) stalk length, followed by cv. Rionegro (62.5 cm) and it was the lowest in cv. Amlet (48.6 cm). The interaction effect was found to be significant between growth conditions and treatments. The highest stalk length was recorded in cv. Julia (72.4 cm) under polyhouse condition. While it was the lowest in cv. Amlet (46.46 cm) under shadehouse condition. Stem diameter was maximum under polyhouse (0.74 cm) condition and it was minimum in shadehouse (0.66 cm). Among the treatments maximum stem diameter was recorded in cv. Julia (0.83 cm), followed by cv. Rionegro (0.78 cm) and it was minimum in cv. Amlet (0.61 cm). There was a significant difference between conditions and treatments. Maximum stem diameter was recorded in cv. Julia (0.88 cm) under polyhouse condition and it was minimum in cv. Amlet (0.55 cm) under shadehouse. This result is in accordance with Jeevajoithi *et al.* (2003) who reported that, stalk length increased with the decrease in shade percentage in different cultivars.

Flower diameter was maximum (9.4 cm) under polyhouse condition and it was minimum (9.3 cm) under shadehouse condition. Among the treatments maximum flower diameter was recorded in cv. Kyillian (10.6 cm) followed by cv. Julia (9.8 cm) and it was minimum in cv. Dameblanche (8.4 cm). There was a significant difference between conditions and treatments. Maximum flower diameter was recorded in cv. Kyillian (10.6 cm) under polyhouse condition and it was minimum in cv. Dameblanche (8.4 cm) under shadehouse condition. Number of ray florets were maximum (72.8) under polyhouse and it was minimum (61.8) in shadehouse condition. Cultivar Arianna recorded the maximum (91.6) ray florets followed by cv. Julia (79.3) and it was minimum in cv. Sonata (57.0). Significant difference was found between conditions and treatments. Maximum ray florets were recorded in cv. Arianna (111.0) under polyhouse and it was minimum in cv. Sonata (55.6)

under shadehouse condition. The increased size of flower was due to bigger ray florets recorded in the Arianna genotypes. The above results are in conformity with the findings of Baillet (1976) and Singh and Ramchandran (2002) in gerbera.

Flowers production per plant, total yield per plant and flower yield per square meter and their interaction are presented in Table 4a & 4b. The highest number of flowers per plant was recorded under polyhouse (3.9) condition and it was the lowest under shadehouse (2.9). Significant difference was also observed among the treatments. Cultivar Sonata recorded the highest (4.4) number of flowers per plant, followed by cv. Arianna (3.9) and it was the lowest in cv. Amlet (2.8). Interaction effect between conditions and treatments were found to be significant. The highest number of flowers per plant were recorded in cv. Sonata (4.8) under polyhouse condition and it was minimum (2.3) in cv. Amlet when the plant was grown under shadehouse condition. Total yield per plant was, maximum (7.8 kg) in polyhouse condition and it was lowest in shadehouse (5.8kg) condition. Among the varieties the cv. Sonata produced maximum (8.8) flowers and it was the lowest in cv. Amlet (5.6). Interaction effect between condition and treatments was found to be significant. Maximum flowers were recorded in cv. Sonata (9.8) under polyhouse and it was minimum in cv. Amlet (4.6) under shadehouse condition. Flowers produced per meter square was maximum (87.0) under polyhouse condition and it was minimum in shadehouse (65.1). Among the treatments cv. Sonata recorded the maximum (98.2) flowers per meter square, followed by cv. Arianna (85.7) and it was minimum in cv. Amlet (62.9). The increased flower yield might be due to higher number of leaves resulted in production and accumulation of maximum photosynthates contributing for production of more number of flowers per plant and total yield per plant. The results are in accordance with the findings of Loeser, (1986) and Nair *et al.* (2002) in gerbera under protected condition.

Out of nine cultivars studied, cv. Sonata and Arianna are identified as suitable cultivars for polyhouse cultivation. Therefore, polyhouse growing condition was found to be ideal for growing gerbera for commercial purpose.

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