

## Comparative studies on growth and cut flowers production of gerbera under naturally ventilated polyhouse and low cost greenhouse in north eastern plains of Uttar Pradesh

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### ABSTRACT

In an investigation was carried out to assess the performance of two conditions (naturally ventilated polyhouse and low cost greenhouse) with respect to growth and flowering of 10 gerbera (*Gerbera jamesonii*) cultivars during rainy and winter seasons of 2009-10 and 2010-11. It was revealed that growth, flowering characters and vase-life were found to be significantly higher in the plants grown under naturally ventilated polyhouse. At naturally ventilated polyhouse conditions resulted in an increased flower diameter (8.2 and 12.6%), number of the ray florets (6.5 and 5.9%), stalk length (26.4 and 25.8%), stalk diameter (10.2 and 12.7%) and vase-life (13.2 and 13.9%) over those grown under low cost greenhouse conditions in rainy and winter seasons, respectively. Among the cultivars, maximum growth, flowering characteristic and vase-life was noticed in Silvester followed by Salvatore, which was significantly higher than other cultivars, while it was minimum in Zingaro. A significant increase in flower diameter (12.5 and 15.7%), numbers of ray florets (63.6 and 61.5%), stalk length (19.1 and 18.5%), stalk diameter (39.5 and 37.5%) and vase-life (22.5 and 20.7%) was recorded over the cultivar performing at the lowest in rainy and winter seasons, respectively.

**Key words:** Gerbera, low cost greenhouse, naturally ventilated polyhouse.

### INTRODUCTION

Gerbera as a cut flower has tremendous demand in domestic and international markets. Due to globalization and income generation in different parts of the world per capita consumption of flower in most countries is increasing rapidly. In recent years, commercial production of gerbera has become a major venture in India among the commercial ornamentals. In spite of having an immense possibility for world class production of acclaimed cultivars, India is still lagging behind in international market. The technology for viable production needs to be standardized for Indian climate and soils. More over the commercial floriculture venture is very much cultivar-specific. During the past three decades, improvement of gerbera has evolved into a multibillion dollar industry. Since, 1970s when the micropropagation techniques became available, rapid progress was achieved in selecting and multiplying varieties ideally suited for commercial cultivation to meet the consumer demands. Considering the importance of this crop, there is a prime need for its improvement through selection of suitable cultivars. The yield varies due to environmental conditions and genetic potentialities of the cultivars and different cultivars may not be adaptable for cut flower production in all agro-climatic conditions.

### MATERIALS AND METHODS

The experiment was conducted during rainy and winter seasons of 2009-10 and 2010-11 at Botanic Garden, CSIR-NBRI, Lucknow under naturally ventilated polyhouse and low cost greenhouse conditions. Naturally ventilated polyhouse constructed with UV stabilized polyfilm (200  $\mu$  thickness) as cladding material. The centre height and height below gutter of the polyhouse were six and four metres, respectively. A shade net (white colour) with 50% shade was placed below the roof at four metre height from ground level with a provision to spread and fold depending on the light transmission. The sides of polyhouse were covered with 50% shade net for one metre height (white colour) in order to get proper ventilation and on top and kept 0.8 m height for effective ventilation. A Low cost greenhouse of 200 m<sup>2</sup> (20×10 m) sizes was constructed using 50% of shading net on top and insect proof net of 60 mesh sizes around the structure and the drip irrigation and fogger system was installed for complete cropped area. Soil bed was provided with two rows of drip line at 30 cm distance and inline drippers at 30 cm distance with a discharge rate of 1.3 l per hour. Water soluble fertilizers were dissolved in separate fertigation tank with provision to pump along with water to irrigate the plants. Ten cultivars, viz., Dana Ellen, Dune, Goliath, Intense, Rosaline, Salvatore,

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Scope, Silvester, Sunway and Zingaro were planted on growing medium, viz., soil and sand: FYM: rice husk having pH 6.2 in both the conditions. The experiment was laid out in split plot design with three replications. The beds of 0.75 m width were formed along the width of polyhouse and greenhouse to accommodate two rows of gerbera on each bed. Tissue culture plants with 4-6 leaves were planted at a spacing of 30 cm × 30 cm on beds. Before preparation of beds, mixture of fine sand @ 1 cft/m<sup>2</sup> and decomposed dry FYM @ 5 kg/m<sup>2</sup> as well as NPK @ 20:10:20 g/m<sup>2</sup> were applied as basal dose. The air temperature inside the polyhouse was set at 22°C and maintained with the help of fogger controlled cooling system. Fertigation was done through drippers near the root zone on daily basis and the plants were allowed to put forth 20-25 leaves per plant by periodical removal of flower buds during initial three months for maintenance of good health. Initial doses of NPK grade 19:19:19 were applied through drip at one week interval for three months. After the required foliage was established, the flower buds were allowed for cut flower production. The application of fertilizers and water levels were changed from the vegetative phase to reproductive phase and it was applied with 50:25:50 NPK at 15 days

interval through drip. Observations on morphological and flower traits were recorded periodically for a period of one year and statistically analyzed using split plot design to draw conclusion.

## RESULTS AND DISCUSSION

The outcome of the investigations revealed that the plant height, plant spread, number of leaves per plant, leaf area and number of suckers per plant was higher at naturally ventilated polyhouse than low cost greenhouse conditions (Table 1). The magnitude of percent increase in plant height (16.5 and 14.7%), plant spread (13.2 and 16.8%), number of leaves per plant (18.9 and 25.5%), leaf area (7.4 and 10.9%), number of suckers per plant (17.4 and 18.4%) was higher under naturally ventilated polyhouse over low cost greenhouse conditions during the rainy and winter seasons, respectively. This increase may be due to variation in light intensity with changing season and favorable micro-climate under the polyhouse conditions, where light plays a major role in plant growth and development. Number of suckers per plant increased due to significant correlation between crop production and the climatic variables. The similar observations have been reported by Ambad *et al.* (1)

**Table 1.** Growth characters of gerbera cultivars as influenced by growing environment during rainy and winter seasons.

Treatment	Growth characters									
	Plant height (cm)		Plant spread (cm <sup>2</sup> )		No. of leaves per plant		Leaf area (cm <sup>2</sup> )		No. of suckers per plant	
	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season
Growing environment										
Naturally ventilated polyhouse	38.81	43.58	42.1	53.6	32.0	35.9	184.8	211.5	2.7	4.5
Low cost greenhouse	33.30	37.98	37.2	45.9	26.9	28.6	172.1	190.6	2.3	3.8
CD (P = 0.05)	0.80	0.39	1.27	1.15	0.98	0.86	0.86	0.80	0.17	0.26
Cultivar										
Dana Ellen	33.59	39.44	33.3	43.0	24.7	29.2	160.5	183.8	2.3	4.1
Dune	34.56	38.34	31.3	41.9	24.0	29.4	153.6	176.9	2.6	4.1
Goliath	35.69	40.97	46.5	56.0	23.1	28.0	180.0	203.3	2.6	4.2
Intense	37.99	43.17	49.5	56.6	25.8	30.0	195.1	218.1	2.7	4.4
Rosaline	36.10	41.00	38.5	51.3	23.7	28.5	185.5	204.3	2.2	3.9
Salvadore	39.77	43.93	49.5	57.9	27.2	31.5	202.2	225.6	2.6	4.4
Scope	33.91	38.91	36.3	45.9	23.7	27.6	193.5	215.3	2.5	4.0
Silvester	40.89	45.56	49.7	60.9	27.5	32.3	212.6	235.6	3.0	4.6
Sunway	35.80	39.65	34.1	43.7	24.7	29.5	161.5	183.0	2.4	4.0
Zingaro	32.23	36.88	28.1	40.5	20.4	26.0	142.8	164.6	2.0	3.8
CD (P = 0.05)	6.30	6.00	10.30	10.10	5.79	5.32	43.38	42.49	0.53	0.47

Note: Rainy season = (June, July, Aug.); winter season = (Nov., Dec., Jan.)

**Table 2.** Flowering characteristics and vase-life of gerbera cultivars as influenced by growing environment during rainy and winter seasons.

Treatment	Flowering characteristics												Vase-life (days)			
	No. of days for flower bud initiation to harvest		Flower disc dia. (cm)		Flower dia. (cm)		No. of ray florets		Length of ray floret (cm)		Stalk length (cm)		Stalk dia. (cm)			
	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season		
<b>Growing environment</b>																
Naturally ventilated polyhouse	14.5	12.4	2.25	2.61	10.60	11.70	59.10	61.10	4.60	5.00	60.30	61.90	0.54	0.62	9.4	9.8
Low cost greenhouse	15.8	14.8	1.71	1.92	9.80	10.50	55.50	57.70	4.00	4.30	47.70	49.20	0.49	0.55	8.3	8.6
CD (P = 0.05)	0.35	0.26	0.32	0.23	0.21	0.15	0.53	0.45	0.27	0.12	0.62	0.15	NS	NS	0.80	0.74
<b>Cultivar</b>																
Dana Ellen	15.9	14.3	1.92	2.22	9.80	10.70	60.70	62.70	4.10	4.40	50.60	53.10	0.45	0.50	8.7	9.1
Dune	15.4	13.8	1.97	2.26	10.10	11.00	62.70	64.50	4.10	4.60	51.80	53.40	0.48	0.58	8.9	9.3
Goliath	16.4	14.8	2.00	2.27	10.00	11.00	54.00	56.00	4.20	4.50	54.40	56.00	0.53	0.63	8.8	9.2
Intense	12.9	11.3	2.06	2.32	10.20	11.10	53.20	53.20	4.40	4.80	56.70	58.30	0.55	0.63	8.6	9.3
Rosaline	14.6	13.0	1.95	2.22	9.80	10.50	51.20	54.30	4.10	4.50	52.90	54.50	0.48	0.59	8.8	9.0
Salvadore	17.2	15.7	2.11	2.41	10.70	11.50	71.20	73.30	4.50	4.90	58.50	60.10	0.60	0.64	9.1	9.5
Scope	15.6	14.0	2.03	2.34	10.60	11.30	49.70	51.50	4.30	4.60	52.80	53.50	0.55	0.60	8.2	9.2
Silvester	17.9	16.3	2.15	2.42	10.80	11.80	76.30	78.50	4.70	5.10	59.20	60.80	0.65	0.66	9.8	10.2
Sunway	13.2	15.7	1.83	2.11	10.40	11.40	51.30	55.20	4.40	4.80	54.00	54.40	0.44	0.54	9.0	9.0
Zingaro	12.6	11.0	1.81	2.10	9.60	10.20	42.70	44.70	4.00	4.30	49.70	51.30	0.43	0.48	8.0	8.5
CD (P = 0.05)	2.73	2.49	0.267	0.261	1.04	1.01	14.20	13.93	0.62	0.59	8.43	8.20	0.09	0.06	1.27	1.21

Note: Rainy season = (June, July, Aug.); winter season = (Nov., Dec., Jan.)

and Singh and Mandhar (7). Among the cultivars, maximum plant height, plant spread, number of leaves per plant, leaf area and number of suckers per plant were noticed under Silvester followed by Salvadore, which was significantly higher than other cultivars, while it was minimum in Zingaro (Table 1). The maximum plant height (26.9 and 23.5%), plant spread (76.9 and 50.4%), number of leaves per plant (34.8 and 24.2%), leaf area (48.9 and 43.1%) and number of suckers per plant (50 and 21%) were found to be higher over lower growth cultivar in rainy and winter seasons, respectively. The maximum plant growth in these cultivars might be due to increased plant height, number of leaves, plant spread and higher number of suckers to resource availability and reduced interplant competition in the community. The similar studies have been reported by Naik *et al.* (5) and Sarkar and Ghimiray (6).

The outcome of the investigation revealed that the number of days for flower bud initiation to harvest, flower disc diameter, flower diameter, number of ray florets, length of ray floret, stalk length, stalk diameter and vase-life was higher at naturally ventilated polyhouse conditions than low cost greenhouse conditions (Table 2). The percent increase in number of days for flower bud initiation to harvest (9 and 19.4%), flower disc diameter (31.6 and 35.9%), flower diameter (8.2 and 14.4%), number of ray florets (6.5 and 5.9%), length of ray floret (15 and 16.3%), stalk length (26.4 and 25.8%), stalk diameter (10.2 and 12.7%) and vase-life (13.3 and 14%) was higher over the values recorded in low cost greenhouse conditions in rainy and winter seasons, respectively. However, better quality flowers were harvested during winter season than in the rainy season. Superior quality flowers obtained from the naturally ventilated polyhouse during winter may be attributed to the desirable micro-climate in the naturally ventilated polyhouse and due to the seasonal effects. These results are similar to findings of Gurav *et al.* (4). With the respect to the cultivars, minimum number of days for flower bud initiation to harvest, maximum flower disc diameter, flower diameter, numbers of ray florets, length of ray floret, stalk length, stalk diameter and vase life was noticed in cultivar Silvester followed by Salvadore, which remain significantly higher than other cultivars, while it was recorded the minimum in Zingaro (Table 2). Minimum number of days for flower bud initiation to harvest (42.1 and 48.2%), flower disc diameter (18.8 and 15.2%), flower diameter (12.5 and 15.7%), numbers of ray florets (66.7 and 64%), length of ray floret (17.5 and 18.6%), stalk length (19.1 and 18.5%), stalk diameter (51.2 and 37.5%) and vase-life (22.5 and 20.7%) were found to be higher over lower growth cultivar in rainy and winter seasons, respectively. The flower opening

from appearance of bud was generally early in cultivar having more number of suckers, leaves and higher leaf area. Higher flower diameter and flower disc diameter attained might be due to the inherent characters of individual cultivars. All the cultivars produced longer florets during the winter months than in rainy months. The variations in size and quality of the gerbera flowers were dependent upon the differences in the cultivars, environment and the seasonal conditions. These results are in accordance with the results reported by Dalal *et al.* (3) and Spanomitsis *et al.* (8). Variation in vase-life among the cultivars may be attributed to variations in their genetical make up. Earlier, Anuradha and Narayanagowda (2) have reported the similar results.

Naturally ventilated polyhouse was superior in all aspects and produced good results over low cost greenhouse. However, it require much more initial investment than low cost greenhouse. The study also indicates that substantial production of flowers could be obtained in the low cost greenhouse but not round the year. Therefore, it would be suitable for those who are not capable to high initial investment and can cater the demand for local markets. Performance of cultivars, Silvester, Salvadore, Rosaline, Dana Ellen and Dune were found better in respect of growth, flowering and vase-life under both the conditions and may be recommended for commercial cultivation.

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