



P-ISSN: 2349-8528
 E-ISSN: 2321-4902
 IJCS 2019; 7(5): 2235-2239
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 Received: 10-07-2019
 Accepted: 12-08-2019

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International Journal of Chemical Studies

Varietal evaluation of carnation (*Dianthus caryophyllus* L.) under naturally ventilated polyhouse conditions of Prayagraj

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Abstract

An experiment entitled Varietal evaluation of carnation (*Dianthus caryophyllus* L.) under naturally ventilated polyhouse conditions of Prayagraj was conducted during December, 2018 – April, 2019 in Horticulture Research Field of Department of Horticulture, SHUATS, Prayagraj with respect to vegetative, qualitative, yield and economic parameters. The experiment was conducted in Randomized Block Design (RBD) with eight varieties replicated thrice. The varieties used were Krakatoa, Kino, Loris, Hillary, Madame Colette, Kitaro, Davinci and Cinderella. The results revealed that variety Davinci recorded maximum plant height (73.59 cm), number of shoots per plant (7.44), number of internodes (15.443), internodal length (6.153cm), stalk length (66.1cm), earliness (89 days), number of cut flower stalks per plant (7.55), number of cut flower stalks per square meter (181.2) and benefit cost ratio of 3.73. Variety Hillary (174.99) was recorded with maximum number of leaves, maximum flower length (5.4cm), and maximum flower diameter (6.27cm). Maximum bud length (3.17cm), maximum bud diameter (2.23cm), flower stalk girth (21.33) and maximum vase life (10.67) were recorded in the variety Cinderella. Minimum days taken to bud opening (FBI to paint brush stage) was recorded in the variety Kino (15.67). Thus, among the varieties studied, variety Davinci is more suitable for commercial cultivation under naturally ventilated polyhouse in Prayagraj agro climatic conditions.

Keywords: Carnation, polyhouse, varietal evaluation

Introduction

Carnation is one of the most important cut flower of the world. Carnation (*Dianthus caryophyllus* L.) belongs to the family *Caryophyllaceae* having diploid chromosome number $2n=30$. It is grown in several parts of the world and is believed to be the native of Mediterranean region. There are 280 species of carnation and are found from Siberia to Arctic America, Japan, and in Himalayas, where blooms spring when long days and congenial temperature is found. The centre of origin of carnation is considered to be Spain. Some species are native to Hungary and Alps region. Carnation is a flowering annual but in reality it is treated as biennial and succeeds well as such. According to Theophrastus it was in cultivation in Greece as early as in 300 B.C. it is being cultivated for more than 2000 years. There are several distinct type of carnations and each of these can be grown successfully in cooler parts of the plains and at medium- to- high elevations. It is popular as cut flower on account of its exquisite shape, wide range of colours, good vase life and light in weight which makes it ideal for distant market. Its common name carnation was taken from latin word carnation-carnis which means flesh colour on account of similarity of original colour of carnation and it is also derived from coronation as the carnation flower which were being used in decorating the crown of athletes. The generic word Dianthus is from greek word Dios which means divine and Anthos means flower. The species name *caryophyllus* has been given after generic name of the clove tree- *Caryophyllus aromaticus* which means caryon-nuts; phyllon-leaf, due to resemblance of fragrance of carnation flowers to clove.

Carnation plants are half hardy herbaceous perennial. The flowers are solitary, terminally formed; the petals are broad with frilled margins and the calyx cylindrical with bracts at the base. The hybrids involving many *Dianthus* species are of perpetual flowering types. The florist's carnations are grouped into two major classes such as 'Standard' and 'Spray'. The standard type produces larger blooms on longer flower stalks. On the other hand the spray type produces many flowers of smaller size with weaker stem. Carnations are generally classified as border carnation and picotees which is sub divided into self, bizzares, flakes, picotees, fancies

next category is perpetual flowering and maguerite Carnations. Carnation is grown on large scale in countries like Italy, Spain, Columbia, Kenya, Sri Lanka, Canary Islands, France, Holland, USA, Germany etc. In India the major production regions are located around Bengaluru, Kolkata, Pune, Delhi, Solan, Shimla, Ludhiana, Hyderabad. etc Carnations are commercially utilized for extraction of perfume in France and the Netherlands. The volatile oil of carnation contains 40% benzyl benzoate, 30% eugenol, 7% phenylethyl alcohol, 5% benzyl salicylate and 1% methyl salicylate. About 100g of oil is obtained from 500 kg of flowers. The flower heads are dried and used in pot-pourri, scented sachets and cosmetic products. The plant is quite rich in saponins. The leaves can be simmered in water and this water can be used as soap for cleaning skin, clothes. Due to its aromatic and stimulative properties, carnation is known for its medicinal value, flowers are considered to be cardio tonic, diaphoretic and alexiteric. The whole plant is used as vermifuge in China, while in France, flowers are used for perfume extraction.

The performance of carnation varieties varies with region, season, genotypes and growing environment. In India, there is a wide difference in temperature, light intensity and humidity which not only affect the yield and quality of flowers but also limit their availability for a particular period of a year. Hence it is necessary to evaluate carnation varieties under different geographical area or regions of the country.

Materials and Methods

The experiment was conducted under naturally ventilated polyhouse in the Department of Horticulture, Sam Higginbottom University of Agriculture Technology And Sciences, Prayagraj, during December, 2018- April, 2019. Eight carnation varieties viz., Krakatoa, Kino, Loris, Hillary, Madame colette, Kitaro, Davinci, Cinderella were evaluated with respect to vegetative, qualitative, yield and economic parameters. The experiment was laid out in Randomized Block Design (RBD) with the eight varieties replicated thrice. Flat beds of 1m width and 10 m length with a walking path of 40cm in between beds were made under naturally ventilated polyhouse. The rooted cuttings of eight varieties were planted in two rows on a bed with spacing of 15 × 15 cm. Plant support was provided by using steel poles at 3m distance to both side of the bed and netting was done using plastic wires in three layers. Single pinching was done in all the varieties after they attained six nodes. The data were recorded for growth, flowering, quality, yield and economic parameters at 30, 60, 90 and 120 days after planting. The data recorded from nine randomly selected tagged plants were subjected to statistical analysis.

Results and discussion

Variety Davinci (73.5 cm) was recorded with maximum height followed by variety Kino (61.85 cm) which was at par with variety Hillary (54.61 cm) and minimum plant height was recorded in variety Kitaro (31.44cm). The variation in plant height among the carnation varieties may be due to genetic variability. Another possible reason for variation in plant height may be due to the effect of environmental conditions prevailing during field trial. Similar findings on differences in plant height were recorded by Kumar and Singh (2003) [18], Shahakar *et al.* (2004) [14], Maitra and Roychowdhury (2013) [7] in carnation.

Maximum number of leaves was recorded in the variety Hillary (174.9) which was at par with variety Davinci

(174.22) and minimum number of leaves was recorded in variety Kitaro (86.33). The differences in number of leaves per plant may be due to variation in the rate of vegetative growth among the carnation varieties that could be attributed due to genetic makeup and could have been further influenced by the environment. Similar findings were recorded by Patil *et al.* (2001) [4], Kumar and Singh (2003) [18], Sarkar and Sharma (2016) in carnation.

Maximum number of shoots was recorded in the variety Davinci (7.44) which was at par with variety Krakatoa (7.22) and minimum was recorded in variety Kitaro (4.55). The difference in the number of shoots per plant may be due to the genetic makeup of having different capacity for storing reserved food and could have been further influenced by the growing environment and the effect of pinching. Similar findings were recorded by Shahakar *et al.* (2004) [14], Jose *et al.* (2017) [5] in carnation.

Maximum number of internodes was recorded in the variety Davinci (15.44) which was at par with varieties Kino (14.66), Hillary (14.22), Madame Colette (13.66) and Loris (13.55). Minimum number of internodes was recorded in variety Kitaro (6.1). Variation in number of internodes per stem may be attributed due to the difference in genetic constitution and could also be due to the effect of environmental conditions prevailing during the field trial. Similar findings on differences in number of internodes per stem were recorded by Patil *et al.* (2001) [4], Gharge *et al.* (2011) [4] in carnation.

Maximum internodal length was recorded in the variety Davinci (6.15 cm) which was at par with varieties Kino (6.12 cm) and Hillary (5.13 cm). The minimum internodal length was recorded in variety Kitaro (2.02 cm). The variation in internodal length among the varieties might be due to the genetic makeup and could have been further influenced by the growing environment. Similar findings on differences in internodal length were recorded by Patil *et al.* (2001) [4], Gharge *et al.* (2011) [4], Jose *et al.* (2017) [5] in carnation.

Days taken for flower bud initiation after planting was recorded minimum in variety Davinci (89) followed by variety Kino (95.67) which was at par with variety Cinderella (97.33). Variety Kitaro (132) took maximum days for bud initiation. Variation in days taken to flower bud initiation could have possibly been due to variation in genetic constitution and could have been further influenced by the environment. Similar findings in carnation were recorded by Sahakar and Sable (2003) [12], Reddy *et al.* (2004) [16], Pratibha *et al.* (2013), Jose *et al.* (2017) [5].

Variety Kino (15.67) was recorded with minimum days taken to bud opening which was at par with varieties Davinci (16), Hillary (16.33) and Cinderella (17). Variety Kitaro (23.67) took maximum days for bud opening from flower bud initiation to paint brush stage. Differences in the days taken to bud opening in carnation varieties may be due to genetic makeup of the varieties or due to the influence of growing environment. Similar findings in carnation were recorded by Reddy *et al.* (2004) [16], Jose *et al.* (2017) [5].

Variety Cinderella (3.17 cm) was recorded with maximum bud length which was at par with varieties Hillary (3.13cm), Loris (3.1 cm), Krakatoa (3.07 cm) and Kino (3 cm). Minimum bud length was recorded in variety Kitaro (2.7 cm). Variation in bud length of the carnation varieties is due to the differences in genetic makeup. Similar findings on differences in bud length in carnation were recorded by Maitra and Roychowdhury (2013) [7].

Maximum bud diameter was recorded in variety Cinderella (2.23 cm) followed by variety Kino (2.03 cm) which was at

par with varieties like Hillary (2.03 cm), Loris (2.1 cm), Davinci (2 cm) and Krakatoa (1.93 cm). Minimum bud diameter was recorded in the variety Kitaro (1.67 cm). Variation in bud diameter among carnation varieties is due to the differences in genetic constitution. Similar findings on differences in flower bud diameter in carnation varieties were recorded by Maitra and Roychowdhury (2013)^[7]

The variety Hillary was recorded with maximum flower length (5.4 cm) which was at par with varieties like Loris (5.33 cm) and Davinci (5.27 cm). Minimum flower length was recorded in the variety Kitaro (4.07 cm). Variation in flower length is due to differences in genetic makeup of the various carnation varieties. Similar findings on variations in flower length were recorded by Gharge *et al.* (2011)^[4]

Maximum flower diameter was recorded in the variety Hillary (6.27 cm) which was at par with the varieties Cinderella (6.1cm), Davinci (6.03 cm) and Loris (5.9 cm). Minimum flower diameter was recorded in the variety Kitaro (4.47 cm). The variation in size of flower diameter is due to differences in genetic makeup of the different carnation varieties. Similar findings in carnation were recorded by Reddy *et al.* (2004)^[16]

Maximum flower stalk length was recorded in the variety Davinci (66.1 cm) followed by Kino (61.83 cm) which was at par with variety Loris (58.13 cm) and the minimum stalk length was recorded in the variety Kitaro (34.83 cm). Differences in flower stalk length may be due to the variation in genetic characters of the varieties and could have been further influenced by the growing environment. Similar findings were recorded by Singh and Sangama (2003)^[18], Shahakar *et al.* (2004)^[14], Chauhan *et al.* (2014)^[1], Jose *et al.* (2017)^[5].

Maximum vase life was recorded in variety Cinderella (10.67) which was at par with varieties Kino (10.33), Davinci (10) and Hillary (9.67). Minimum vase life was recorded in variety Kitaro (7). Variation in vase life could be attributed due to the variation in ability to produce ethylene and sensitivity to it among the different carnation varieties. Similar findings on the differences in vase life were recorded by Krishnappa *et al.* (2000), Patil *et al.* (2001)^[4], Singh and Sangama (2003)^[18], Gharge *et al.* (2011)^[4].

Maximum flower stalk girth was recorded in variety Cinderella (21.33 mm) which was at par with variety Loris (20 mm). Minimum flower stalk girth was recorded in variety Kitaro (15.33 mm). Variation in flower stalk girth may be due

to the inherent genetic characters of the carnation varieties. Similar findings were recorded by Shahakar *et al.* (2004)^[14], Reddy *et al.* (2004)^[16]

Maximum number of cut flower stalk per plant was obtained in variety Davinci (7.55) followed by variety Hillary (6.96) which was at par with variety Kino (6.92) and the minimum number of cut flower stalk per plant was recorded in variety Kitaro (1). Differences in the number of cut flower stalks per plant may be attributed due to the productive shoots produced and could have been further influenced the environment. Similar findings were recorded by Dalal *et al.* (2009), Sarkar and Sharma (2016), Jose *et al.* (2017)^[5]. Highest number of cut flower stalk per square meter was recorded in variety Davinci (181.2) followed by variety Hillary (167.04) which was at par with variety Kino (166.08) and minimum number of cut flower stalk per square meter was recorded in variety Kitaro (24). Differences in number of cut flower stalks per square meter may be due to variation in genetic makeup and could have been further influenced by the environment. Similar findings in carnation were recorded by Dalal *et al.* (2009), Singh *et al.* (2013)^[18], Jose *et al.* (2017)^[5].

The maximum gross returns (7,24,800) were obtained from variety Davinci followed by Hillary (6,68,160) with net return of 5,30,510 and 4,73,870 respectively. These varieties exhibited maximum Benefit: Cost ratio of 3.73 and 3.44, respectively.

Table 1: Vegetative parameters of carnation varieties grown under naturally ventilated polyhouse.

Varieties	Plant height	No. of leaves per plant	No. of shoots Per plant	No. of inter-nodes	Inter-nodal length
Krakatoa	43.51	142.33	7.22	11.11	5.03
Kino	61.85	165.66	6.44	14.66	6.12
Loris	45.3	140.89	6.55	13.55	4.71
Hillary	54.61	174.9	6.44	14.22	5.13
Madame colette	44.22	145.44	6.22	13.66	4.54
Kitaro	31.44	86.33	4.55	6.1	2.02
Davinci	73.	174.2	7.44	15.44	6.15
Cinderella	40.65	126.33	5.66	12.33	4.92
Mean	49.39	144.51	6.32	12.63	4.8
F-test	S	S	S	S	S
S.Ed (\pm)	3.49	1.96	0.35	1.14	0.47
C.D at 5%	7.56	4.24	0.75	2.47	1.02

Table 2: Flowering parameters, yield parameters and cost benefit ratio of carnation varieties grown under naturally ventilated polyhouse.

Varieties	Days to flower bud initiation	Days to flower bud opening	No. of cut flower stalks per plant	No. of cut flower per square meter	Cost benefit ratio
Krakatoa	107.33	21.67	5.11	122.64	2.52
Kino	95.67	15.67	6.92	166.08	3.42
Loris	108.6	20	4.96	119.04	2.45
Hillary	101.67	16.33	6.96	167.04	3.44
Madame colette	109.67	19.67	4.92	118.08	2.43
Kitaro	132	23.67	1	24	0.49
Davinci	89	16	7.55	181.2	3.73
Cinderella	97.33	17	5	120	2.47
Mean	105.17	18.75	5.30	127.26	-
F-test	S	S	S	S	-
S.Ed (\pm)	1.2	0.85	0.09	2.18	-
C.D at 5%	2.8	1.8	0.1	4.71	-

Table 3: Quality parameters of carnation varieties grown under naturally ventilated polyhouse.

Varieties	Bud length(cm)	Bud diameter(cm)	Flower length(cm)	Flower diameter(cm)	Flower stalk length(cm)	Flower stalk girth(mm)	Vase Life (days)
Krakatoa	3.07	1.93	5.17	5.7	56.03	19	8.33
Kino	3	2.03	5.1	5.67	61.83	18.67	10.33
Loris	3.1	2.1	5.33	5.9	58.1	20	9
Hillary	3.13	2.03	5.4	6.27	55.5	19.33	9.67
Madame colette	2.83	1.77	4.1	4.57	46.83	16.33	7.67
Kitaro	2.63	1.67	4.07	4.47	34.83	15.33	7
Davinci	2.7	2	5.27	6.03	66.1	17.3	10
Cinderella	3.17	2.23	4.6	6.1	51.8	21.33	10.67
Mean	2.95	1.97	4.88	5.59	53.88	18.42	9.08
F-tes	S	S	S	S	S	S	S
S.Ed (\pm)	0.	0.08	0.09	0.17	1.8	0.61	09
C.D at 5%	0.21	0.18	0.21	0.38	4.09	1.33	1.06

Conclusion

Based on the findings of the experiment it is concluded that the variety Davinci is the mosromising variety with respect to plant height (73.59 cm), number of shoots per plant (7.44), number of internodes (15.443), internodal length (6.153cm), days taken for bud initiation (89), stalk length (66.1cm), number of cut flower stalks per plant (7.55), number of cut flower stalks per square meter (181.2), maximum gross return (7,24,800), maximum net return (5,30,510) and benefit cost ratio of 3.73. This variety is suitable for commercial cultivation under naturally ventilated polyhouse under Prayagraj agro climatic condition.

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