



Studies on the Performance and Flower Characterization of Chrysanthemum (*Dendranthema grandiflora* L.) Genotypes under Uttar Pradesh Conditions

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Authors' contributions

This work was carried out in collaboration between all authors. Author DDS designed the study and performed the statistical analysis. Author ST helped in data collection and prepared the manuscript. Authors SS and PKR managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

In the present study, twelve varieties of CHRYSANTHEMUM collected from the National Botanical Research Institute, Lucknow were evaluated under irrigated condition at Main Experiment Station, NDU&T, Kumarganj, Faizabad during winter season (2011-12). A wide range of variation in the performance of the varieties were observed for various characters. Highest plant height (50.20 cm) and maximum number of florets per flower were observed in Suneel (339.67 cm). Genotype Dentiment showed maximum plant spread (34.74 cm), maximum number of flowers per plant (103.60 g), maximum flower diameter (10.40 cm), and highest weight of ten flowers (63.00 g). As for as suitability of particular genotypes is concerned, maximum number of primary branches in Jaya (10.30) and maximum flower vase life (16 days) in Jayanti was observed. Among all the 12 genotypes, few genotypes like Dentiment produced maximum flower yield (652.68 g per plant)

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followed by Suneel (345.33 g per plant) and Jaya (271.35 g per plant) which were significantly superior than the remaining varieties. Thus, on the basis of flower yield per plant these three genotypes can be chosen for commercial cultivation in Uttar Pradesh condition.

Keywords: *Chrysanthemum*; performance; flower characterization.

1. INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora* L.) belongs to the Asteraceae family (COMPOSITAE) and is one of the most important flower crops in India. The species is suitable for cut flowers with the most important characteristics are due to its attractive colour, long vase life, tough flowers, uniform opening, long erect stem, long inter-nodes, normal spray with high centre bloom and easy to open flower buds at the destination [1]. In Uttar Pradesh, it is primarily grown for decoration and landscaping either in the ground or in pots. No data regarding the suitable commercial cultivars for Uttar Pradesh conditions is available. Thus, it is necessary to identify the most suitable cultivars for the particular region. Keeping in view this lack of information the present study was undertaken to assess the performance of *chrysanthemum* genotypes and to identify superior genotypes for commercial flower yield under Uttar Pradesh.

2. MATERIALS AND METHODS

The present investigation was conducted at Main Experiment Station Horticulture (for morphological observations) and laboratory of Floriculture section (for vase life study), Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad, INDIA during the winter season (2011-12). The twelve varieties of *chrysanthemum* collected from the NBRI Lucknow were evaluated at Main Experiment Station Horticulture under irrigated condition in Randomized Block Design with three replications. Agro-climatically the location of experiment site represents the humid climatic conditions having three climatic seasons i.e. summer, rainy, winter and this region falls under Eastern plains agro climatic zone. The soil of experiment was Sandy loam in texture with 7.9 pH and 0.29 EC, having low levels of nitrogen (165.1 kg/ha), medium in available phosphorous (32.31 kg/ha) and potassium (266.1 kg/ha). The uniform rooted herbaceous cuttings were planted on 15th September at 30 cm distance of row to row and plant to plant. The crop was managed by recommended package of practices. The

observations were recorded on both quantitative traits (viz. plant height was measured with the help of scale in cm, number of primary branches which arise from stem, days taken to first flowering from planting date, days taken to full blooming from planting date, number of flowers per plant, flower diameter in cm, number of florets per flower, weight of ten flowers in grams, flower yield per plant in grams, vase life in days) and qualitative traits (viz. flower colour and type of bloom). Vase life of flowers was recorded by keeping cut flowers of different cultivars in 250 ml conical flask containing 4% sucrose solution at room temperature. The mean values of the five randomly selected plants from each plot were used for statistical analysis. The analysis of variance was carried out as described by Panse and Sukjamte [2].

3. RESULTS AND DISCUSSION

3.1 Performance of *Chrysanthemum* Genotypes

The mean performance of 12 *chrysanthemum* varieties for 11 characters is presented in (Table-1) which showed the significant variation among the different genotypes.

The data revealed that amongst genotypes under this study, the maximum height was recorded in the Suneel variety (50.20 cm) followed by Dentiment (44.50 cm) and Regal Time (36.03 cm), respectively, while as minimum plant height was observed in Sadbhawana variety (17.37 cm). The higher plant height obtained from plants could be attributed to increased photosynthetic capacity of the plants in asters [3]. Suneel, Dentiment, D-5, Jayanti, Mother Teresa, and Sadbhawana were significantly different from the remaining varieties, while Sudha, Jaya, Jayanti and Mix Gulabi were at par with each other. These results could be due to genetic constituents of genotype genetic variability, and agro-climatic conditions. Kim et al. [4] found a range of 19.3–64.6 cm plant height in 15 Taxa of Korean *chrysanthemum* species and Ara et al. [5] found a range of 36-70 cm. While Chandragiri et al. [6] recorded maximum 132.16 cm plant height from Solomon Impala variety of

chrysanthemum. Mean performances among distinct *chrysanthemum* varieties have also been reported by [7-11] for different characters.

Maximum plant spread was measured in Dentiment variety (34.74 cm) followed by Regal Time (31.70 cm) and Suneel (31.50 cm), respectively, whereas minimum plant spread was recorded in D-5 variety (17.20 cm). None of the varieties exhibited significant differences between among distinct Dentiment and Regal Time varieties and among varieties Little Darling, Manbhawan and Mix Gulabi. Increase in plant spread might be due to production of more number of branches and by the genetic nature of the plant. Variation in plant spread is due to additive gene effects [12]. Rao and Sushma [13] recorded maximum plant spread in *chrysanthemum* cultivars Garden Beauty (69.5 cm) followed by PAU-B-43 (54.8 cm) over check Silper (33.7 cm). These findings are also supported [14,7,10,15].

Highest number of primary branches per plant were exhibited in the variety Jaya (10.30) followed by Dentiment (8.17) and Regal Time (7.90), respectively. The lowest value for this parameter was observed in D-5 variety (4.03). Difference in branches among the *chrysanthemum* cultivars could be due to influence of genetically make up of *chrysanthemum* cultivars ([16-18]. Chaugule [19] recorded a maximum 16.56 branches in *chrysanthemum*. Barigidad and Patil [20] also recorded a range of 2.75 to 18.58 branches in case of *chrysanthemum* cultivar.

The lowest value for the trait days to first flowering was observed in the varieties Regal Time (89.00 days), Mix Gulabi (89.33 days), and Sadbhawana (92.33 days), respectively. Jaya showed the greatest value for this parameter (130.67 days). Lower number of days to full blooming was found for Sadbhawana variety (99.33 days) followed by Mix Gulabi (104 days) and Regal Time (107 days), while as Jaya presented the greatest amount of time (156.67 days) to come into full bloom. Sadbhawana, Mix Gulabi, Regal Time and Little Darling did not differ for days required for full blooming while, all other varieties differed significantly to each other. The variation in the required amount of time to full blooming could be due to particular characteristics of the genotypes tested. Barigidad and Patil, [20] reported flowering period range from 50.59 to 132.99 days in *Chrysanthemum*. The mean performances among distinct

chrysanthemum varieties for days to full blooming are also reported by [21,22,10].

Maximum number of flowers per plant was found in Dentiment (103.60) which did not differ from Little Darling (98.40) whereas, lowest number of flowers per plant were recorded in Manbhawan (34.80). Differences were detected among varieties Suneel, Sudha, Jaya, Mix Gulabi, Jayanti and Manbhawan. Ara et al. [5] recorded maximum 70 flowers per plant in *Chrysanthemum*. This data have also been supported by [7,23,15,1] in *Chrysanthemum* and [24] in marigold. Maximum number of florets per flower were found in Suneel variety (339.67) followed by D-5 (336.62) and Jaya (328.10), respectively, while lowest number of florets was recorded in the variety Regal Time (53.07). The varieties Jayanti, Mix Gulabi, Manbhawan, Little Darling and Sudha significantly differed from the remaining varieties while, Suneel, D-5, Jaya, and Dentiment did not differ from each other for this trait. The maximum number of florets per flower is also supported by [25,26].

The highest weights of ten flowers were recorded in Dentiment variety (63.00 g), which was significantly superior than all the varieties for this trait. The lowest weight of ten flowers was recorded for Mother Teresa variety (4.00 g). Differences in floral potentiality, number of florets per flower and weights of ten flowers could be due to variation in genotypes and also to different ecological conditions. The variation among the varieties with respect to flower yield characters was mainly because of increased flower size with prominent central disc florets and also due to the presence of fairly more number of developed ray florets. The maximum ten flowers weight per plant was also reported [27,28,15].

Maximum flower diameter was verified in Dentiment variety (10.40 cm) followed by Suneel (7.97 cm) and Manbhawan (7.83 cm), respectively, while the lowest diameter was recorded in Little Darling variety (3.27 cm). The differences between flower diameter were significantly differ in varieties Dentiment, Jaya and Mix Gulabi while, the varieties Sudha, D-5 and Regal Time were found significantly at par for this trait. Although flower size is a varietal character, it may be influenced in some extent by the total number of flowers born per plant, soil moisture, and source sink relation. Flower diameter of *chrysanthemum* ranged from 8.0 to 12.4 cm [29] and 2.5 to 7.8 cm [5]). Similar variations have been reported previously in *Chrysanthemum* [18,30] and in *Gerbera* [31]).

Table 1. Mean performance of twelve varieties of chrysanthemum for eleven quantitative characters during 2011-12

Characters	Plant height (cm)	Plant spread (cm)	Number of primary branches	Days to first flowering (days)	Days to full blooming (days)	Number of Flowers per plant	Flower diameter (cm)	Number of florets per flower	Weight of ten flowers (g)	Flower yield per plant (g)	Vase life (days)
Varieties											
Mother Teresa	20.15	17.40	6.80	108.00	135.00	79.60	3.77	68.40	4.00	31.84	11.00
Sadbhawana	17.37	19.00	5.20	92.33	99.33	83.00	3.93	69.60	7.50	62.25	14.00
Suneel	50.20	31.50	6.20	117.00	123.67	96.03	7.97	339.67	35.96	345.33	10.00
Regal Time	36.03	31.70	7.90	89.00	107.00	58.20	6.10	53.07	13.00	75.66	13.33
Little Darling	30.10	25.30	5.80	92.33	108.00	98.40	3.27	168.67	12.50	123.00	12.00
Mix Gulabi	23.67	22.50	5.80	89.33	104.00	57.87	5.73	255.00	23.97	138.71	13.00
Jaya	24.28	21.67	10.30	130.67	156.67	67.00	7.77	328.10	40.50	271.35	10.33
Jayanti	23.63	17.92	4.40	94.00	118.00	43.00	4.33	298.02	38.00	163.40	16.00
Manbhawan	28.32	24.65	5.07	100.00	122.00	34.80	7.83	215.39	27.00	93.96	12.33
D-5	36.00	17.20	4.03	120.67	129.00	46.20	6.10	336.62	29.69	136.79	14.33
Sudha	26.07	20.63	4.77	99.33	118.00	74.80	6.00	148.06	15.00	112.20	13.67
Dentiment	44.50	34.74	8.17	99.00	118.00	103.60	10.40	327.20	63.00	652.68	10.67
Grand mean	30.03	23.68	6.20	102.64	119.89	70.21	6.10	217.32	25.86	183.93	12.56
SEm±	0.892	1.094	0.364	3.264	3.861	2.481	0.207	6.595	0.899	5.558	0.559
CD at 5%	2.593	3.180	1.057	9.491	11.226	7.214	0.601	19.176	2.614	16.162	1.625

Table 2. Performance of twelve varieties of chrysanthemum for qualitative characters during 2011-12

Varieties	Flower colour (qualitative traits)	
	Type of bloom	Colour of bloom
Mother-Teresa	Anemone type mini Chrysanthemum	White
Sadbhawana	Double Korean mini Chrysanthemum	Yellow Red
Suneel	Double Korean	Mauve Colour
Regal Time	Double Korean	Pinkish White
Little Darling	Pompon type	Yellow colour, bronze centre
Mix Gulabi	Decorative	Pinkish White
Jaya	Double Korean	Maroon
Jayanti	Decorative	Sulphur yellow
Manbhawan	Double Korean small flowered	Yellow Red
D-5	Double Korean	Red/Bronze
Sudha	Double Korean	Yellow
Dentiment	Anemone	Mauve/Pinkish

Flower yield per plant varied from 31.84 g (Mother Teresa) to 652.68 g (Dentiment). The highest flower yields per plant were found in Dentiment variety, followed by Suneel (345.33 g) and Jaya (271.35 g) which were significantly superior to the remaining varieties. The higher flower yield of promising genotypes might be due to higher number of primary branches, which leads to the production of more number of flowers per plant that directly affect the production of higher flower yield. *Chrysanthemum* flower number was ranged from 25.0 to 100.0/plant [32] and 66.0 to 301.0 /plant [33]. Ara et al. [5] recorded maximum 70 flowers per plant in *Chrysanthemum*. The flower yield data were also supported by [34,7,15].

The longest vase life was observed in Jayanti variety 16 days, followed by D-5 (14.33 days) and Sadbhawana (14 days), while as shortest vase life span was recorded in Suneel variety (10 days). The varieties Sadbhawana, Regal Time, Mix Gulabi, D-5 did not differ from each other. Variations in vase life may be due to the different accumulation of carbohydrates due to varied leaf production and sensitivity of cultivars to ethylene. In turn variations in these aspects might be due to genetical makeup of genotypes. Vetrivel and Jawaharlal [35] recorded longest vase life in the *chrysanthemum* variety Calmiro Sunny (13.11 days) followed by the varieties like Calmiro Pink (13.03), and Amalfi (12.53). This finding has similarity with the result given by [36-41] in *chrysanthemum* and [42] in *Alstoemeria*.

3.2 Flower Characterization

Nine types of flower colours were found in *chrysanthemum* (Table-2). Mother Teresa variety showed white coloured flowers and Anemone

bloom type. Regal Time and Mix Gulabi varieties presented pinkish white bloom colour. Sadbhawana and Manbhawan displayed yellow red bloom colour. Suneel, Little Darling, Sudha, Jaya, Jayanti, D-5 and Dentiment presented mauve, yellow colour with bronze center, yellow, maroon, sulphur yellow, red/bronze, and mauve/pinkish bloom colour, respectively. These variations could be due to genotypic variation. The data have also been supported by [27,21, 10], which reported different flower colours like mauve, yellow, pinkish white, and white etc. in *chrysanthemum*.

4. CONCLUSION

With regards to flower yield per plant the genotypes Dentiment, Suneel and Jaya can be chosen for commercial cultivation in Eastern U.P. condition.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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