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Evaluation of Chrysanthemum Varieties on Growth and Quality under South Saurashtra Region

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ABSTRACT

An experiment was conducted to evaluate the growth and quality performance of chrysanthemum cultivars. Thirteen chrysanthemum cultivars coded from V1 to V13 were used in the experiment. Plant height, plant spread, number of branches per plant, fresh weight and dry weight of plant, diameter of flower at mature stage and stalk length of flower for different cultivars varied significantly. Amongst the chrysanthemum cultivars 'Maghi' showed the maximum plant spread N-S (53.31 cm) & E-W (50.90 cm) , number of branches per plant (66.67), fresh (422.96 g) and dry weight of plant (181.61 g). But it was shown the minimum diameter of flower (3.07 cm). The variety 'Ratlam Selection' showed maximum plant height (51.46 cm). Variety 'Ravi Kiran' recorded maximum diameter (80.07 cm) and stalk length of flower (17.79 cm).

Key words: *Evaluation, Growth, Quality, Chrysanthemum, Varieties.*

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora* Tzevlev.) occupies a prominent place in ornamental horticulture, and it is one of the commercially exploited flower crop. In many countries, including the United States and Japan, it is considered as the number one crop. While in other countries, it ranks next to rose in value of the crop produced. Chrysanthemum belongs to the family 'Asteraceae' and is known as 'Queen of the East' and 'Glory of the East' having diploid chromosome number 2n = 18. It is commonly known as 'Gaul e Dhaudi' and 'Sevanti' in Hindi and Gujrati, respectively. It is derived from two Greek word (*Chryos* – golden, *anthos*-flower) and is the most important flower crops of commercial importance grown in Netherlands and Germany as a spray, cut flower and as a potted plant in America. In international cut flower trade, it ranks next to rose[7].

Chrysanthemum could be grown in any type of soil provided it is well drained. For good performance, it prefers sandy loam soil, rich in organic matter. A soil pH between 6.0 to 7.0 is ideal, however, a soil with pH ranging from 5.0 to 7.0 can also be used for chrysanthemum cultivation.

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In India, chrysanthemum is grown for cut flowers, loose flowers, potted plants and border plants in the garden. The major use of chrysanthemum in our country is for making garlands, veni bracelets, flower decoration and religious offerings and bedding purpose due to its wide range of diversity in the flower number, shape, size and colour. In North India various hues of red, yellow, white and purple chrysanthemums are grown in abundance for decorating the landscape either in the ground or in pots. But, in South India mostly the yellow coloured flowers are preferred and grown as loose flowers for trade. The cultivation of chrysanthemum is gaining importance in Gujarat due to its relative ease in cultivation, high returns and increasing market demand. A large number of varieties and hybrids in chrysanthemum have been developed for cultivation under different agro climatic conditions. However, little research work has been done on performance of chrysanthemum varieties under South Sourashtra region of Gujarat. So, the selection of varieties of higher productivity is important. The purpose of this study was to investigate and evaluate different varieties for various characters under study and selecting best suitable variety for Saurashtra region.

MATERIALS AND METHODS

Experimental site: The experiment was carried out at Jamuvadi Farm, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh during the August 2015 to February 2016.

Planting materials: Growing chrysanthemum plants from a sucker is, the easiest and quickest way to propagate. The rooted suckers of first five varieties Akitha (Red), Poornima (White), Farr (Yellow), Geethanjali (Yellow) and Punjab Anuradha (Yellow) are collected from the Floriculture Research Station, Hyderabad - Telangana and Remaining eight varieties are Ravi Kiran (Red), Ratlam Selection (White), Flirt (Red), Jaya (Red), Thaichen Queen (Pink), Maghi (Yellow), Shyamala (Mauve) and Agina Purple (Purple) are collected from the Navsari Agricultural University, Navsari - Gujarat.

Design of experiment: The experiment was laid out in Randomized Block Design with 13 varieties and replicated for three times. Name of the Varieties are V1 Akitha (Red), V2 Poornima (White), V3 Farr (Yellow), V4 Geethanjali (Yellow), V5 Punjab Anuradha (Yellow), V6 Ravi Kiran (Red), V7 Ratlam Selection (White),V8 Flirt (Red), V9 Jaya (Red),V10 Thaichen Queen (Pink), V11 Maghi (Yellow), V12 Shyamala (Mauve) and V13 Agina Purple (Purple). The rooted suckers are transplanted in the main field at a spacing of 45 cm x 45 cm.

Data collection: Data were collected on plant height, plant spread, number of branches per plant by using scale. Fresh weight and dry weight of plant by using weighing balance. Diameter of flower at mature stage and Stalk length of flower for different cultivars using vernier calipers. Five tagged plants in one plot are used for record the data (plant height, plant spread, number of branches per plant, fresh weight and dry weight of plant). Ten fully opened or bloomed flowers used for recording the diameter of flower at mature stage and Stalk length of flower.

RESULTS AND DISCUSSION

Plant height:

Plant height of chrysanthemum exposed statistically significant variation among 13 cultivars at 30, 60, 90 and 120 days after transplanting (DAT). The plant height ranged from 27.32 to 10.04 cm at 30 DAT. The variety V7 ‘Ratlam Selection’ recorded maximum plant height (27.32 cm), least plant height was recorded in variety V13 ‘Agina Purple’ (10.04 cm) furnished in Table No.1.

With advancement of crop period, an increase in plant height was observed at 60 DAT among the varieties and ranged from 42.25 to 19.65 cm. The variety V7 ‘Ratlam Selection’ exerted its superiority by recording the maximum plant height (42.25 cm), the minimum plant height was recorded in V13 ‘Agina Purple’ (19.65 cm).

The increasing trends of plant height continued even 90 DAT. At this stage, the crop growth further advanced and the height was ranged in between 49.34 to 23.49 cm and the maximum plant height was recorded with variety V7 'Ratlam Selection' (49.34 cm), minimum plant height (23.99 cm) was recorded by variety V13 'Agina Purple' (23.49 cm).

The range of plant height was from 51.46 cm to 27.82 cm. The tallest plant was found from V7 'Ratlam Selection' (51.46 cm), whereas the shortest from V13 'Agina Purple' (27.82 cm) at 120 DAT of chrysanthemum cultivars (Table No.1).

Present study referred that V7 'Ratlam Selection' (White) exposed as the tallest plant among the cultivars at mature stage. Kim *et al*.,[15] found arange of 19.3–64.6 cm plant height in 15 Taxa of Korean chrysanthemum species and Ara *et al*.,[1] found a range of 36-70 cm. While Chandragiri *et al*.,[8] recorded maximum 132.16 cm plant height from Solomon Impala variety of chrysanthemum. Some cultivars of chrysanthemum were vigorous in growth and some were less vigorous, this might be caused by varietal characters responsible by a gene. As a genetically controlled factor, plant height varied among the cultivars of chrysanthemum[3,4,14]. Similar variation in plant height among varieties was also observed in marigold[30] and in rose[13]. The higher plant height obtained from plants could beattributed to increased photosynthetic capacity of the plants in asters[40].

Plant height being genetically controlled factor, the plant height varied among the genotypes. Similar variation in plant height among the genotypes was also observed previously by Narsude *et al.,*[24], Pal and Kumar,[26], Singh and Misra,[33] and Singh *et al.,*[34] in African marigold. Laxmi *et al.,*[18] reported that variety Raichur had highest vegetative growth with an average of 34.77 cm plant height at vegetative development stage. Similarly, Palai[27] reported that under natural conditions cultivar Ratlam Selection had shown highest plant height at vegetative growth which was a spray type chrysanthemum.

Plant spread:

Significant results were obtained for plant spread in N-S and E-W direction of different varieties at different stages of crop growth at 30, 60, 90 and 120 DAT and data are presented in Table No.1. Among the varieties at 30 DAT plant spread in N-S direction ranged from 22.35 to 8.66 cm. At this stage of crop growth for variety V11 'Maghi' recorded maximum plant spread (22.35 cm) which was statistically at par with V7 'Ratlam Selection' (20.58 cm), the minimum plant spread was recorded in V12 'Shyamala' (8.66 cm).

With increasing crop period an increase in plant spread in N-S direction was observed at 60 DAT among the varieties and it ranged from 30.09 to 11.98 cm. The variety V11 'Maghi' recorded the maximum plant spread (30.09 cm) which was at par with V7 'Ratlam Selection' (26.97 cm), the minimum plant spread (11.98 cm) was recorded by variety V5 'Punjab Anuradha'.

The increasing trends of plant spread in N-S direction continued even 90 DAT and ranged from 48.26 to17.86 cm. Maximum plant spread was recorded with variety V11 'Maghi' (48.26 cm) which was statistically at par with V7 'Ratlam Selection' (45.47 cm), The minimum plant spread was shown by variety V5 'Punjab Anuradha' (17.86 cm).

The range of plant spread N-S was from 53.31 cm to 20.18 cm at 120 DAT. The maximum plant spread was in V11 'Maghi' (53.31 cm), which was statistically at par with V7 'Ratlam Selection' (51.57 cm) and least was in V5 'Punjab Anuradha' (20.18 cm) recorded from N-S direction of the plants.

Plant spread in E-W direction varied from 22.13 to 6.54 cm. At this stage of crop growth for variety V11 'Maghi' recorded maximum plant spread (22.13 cm) followed by V7 'Ratlam Selection' (19.52 cm), whereas

variety V12 'Shyamala' recorded the minimum plant spread (6.54 cm).

At the time of 60 DAT results are ranged from 28.41 to 13.33 cm. The variety V11 'Maghi' recording the maximum plant spread (28.41 cm) which was statistically at par with V7 'Ratlam Selection' (26.43 cm), the minimum plant spread (13.33 cm) was recorded by variety V5 'Punjab Anuradha'.

Observed results ranged from 43.70 to 15.72 cm. Maximum plant spread was recorded with variety V11 'Maghi' (43.70 cm) which was statistically at par with V7 'Ratlam Selection' (40.95 cm), the minimum plant spread was recorded by variety V5 'Punjab Anuradha' (15.72 cm) at 90 DAT.

As in case of 120 DAT, the range is from 50.90 to 18.49 cm. The increasing of plant spread continued in variety V11 'Maghi' (50.90 cm) recorded maximum plant spread, which was statistically at par with V7 'Ratlam Selection' (47.99 cm) and minimum plant spread was recorded with V5 'Punjab Anuradha' (18.49 cm).

The increasing plant spread due to increased number of branches was reported by Mishra,[21] and Balaji *et al*.,[2] in chrysanthemum. The difference in a plant spread is a varietal trait and is probably governed by the genetic makeup. Varietal difference in plant spread was reported by Kulkarni and Reddy,[16] in China aster. The better performance of the marigold genotype Coimbatore Local Light Yellow may be due to its genetic makeup and its better adaptability to the prevailing environmental conditions. These results are in conformity with the results reported earlier in marigold[9]. Poonam and Kumar,[28] had reported that Ratlam selection showed the maximum plant spread (59.74 cm) and also discussed about correlation between plant height and plant spread as taller cultivars tend to have more plant spread then shorter cultivar.

Number of branches:

Thirteen cultivars showed statistically significant difference at 30, 60, 90 and 120 DAT for number of branches per plant. At 30 DAT, the number of branches ranged from 22.67 to 7.33. At this stage of crop growth, variety V11 'Maghi' recorded significantly maximum number of branches (22.67) which was found at par with V7 'Ratlam Selection' (20.33), while the variety V10 'Thaichen Queen' showed the significantly minimum number of branches (7.33).

Increase in number of branches was observed at 60 DAT and ranged from 39.33 to 15.33. The results revealed that variety V11 'Maghi' showed the significantly maximum number of branches (39.33) followed by V7 'Ratlam Selection' (33.67) the lowest number of branches was observed in V10 'Thaichen Queen' (15.33).

The increasing trends of number of branches continued even at 90 DAT. The number of branches ranged from 56.67 to 30.00. Significantly maximum number of branches was found with variety V11 'Maghi' (56.67) which is at par with V7 'Ratlam Selection' (53.00), minimum number of branches was observed in V10 'Thaichen Queen' (30.00).

At 120 DAT the range were number of branches is 66.67 to 38.67. The more number of branches was recorded in the V11 'Maghi' (66.67), which is statistically ideal with V7 'Ratlam Selection' (62.67) and less number of branches was observed in the V10 'Thaichen Queen' (38.67).

The variations in number of branches in chrysanthemum varieties is also supported by the findings of Gondhali *et al.*,[11]. They noted that the Nanako had highest number of branches, while Jaya and Mountaineeer showed least branching per plant. Damke *et al.*,[10] reported that the variety Tara produced the highest number of branches. Kanamadi and Patil,[14] reported that the higher number of branches produced by variety Co-1, whereas Basanthi showed poor branching habit. Such differences observed in production of branches among the varieties might be due to inherent

genetic factor[5,12]. Accordingly variations in production of branches among the chrysanthemum cultivars were also reported by Kanamadi and Patil,[14] and Vasanthachari,[37]. Similar observation recorded in marigold by Naik *et al.,*[22] , Verma *et al.,*[39] and Singh and Kumar,[32] . This finding is contrary with the findings of Verma,[38], he has reported that numbers of branches were found in plant with short height then taller ones. Such difference observed in production of branches among the varieties might be due to inherent genetic factors.

Fresh weight and dry weight of plant (g):

Among thirteen cultivars of chrysanthemum, significant difference was observed for the fresh weight and dry weight of plants at full bloom stage which are presented in the Table No.2. The fresh weight is varied from 422.96 (g) to 72.83 (g) at full bloom stage. The highest was observed in the V11 'Maggi' (422.96 g), lowest was observed in the V3 'Farr' (72.83 g). Where in the case of dry weight, the ranges from 181.61 g to 23.00 g. The maximum was in V11 'Maghi' (181.61 g), minimum was from the V5 'Punjab Anuradha' (23.00 g).

The difference in the varieties could be due to their genetical composition. This is in accordance with those reported in tuberose by Yadav *et al*.,[41]. They noted that the fresh and dry weight of leaves were higher in cv. Single, whereas, the fresh and dry weight of bulbs were higher in cv. Double. The total fresh weight was higher in cv. Single, whereas, the total dry weight was higher in cv. Double.

Diameter of flower (cm) at mature stage:

Larger diameter of flowers is a demanding feature which contributes good market values. Significant variation was observed among chrysanthemum cultivars in terms of flower diameter at mature stage. The studied varieties showed significant differences with respect to diameter of flower which ranged from 8.07 to 3.07 cm. The maximum diameter of flower was found in variety V6 'Ravi Kiran' (8.07 cm). Whereas, the minimum diameter of flower was observed in variety V11 'Maghi' (3.07 cm) indicated in Table No.2.

Flower diameter of chrysanthemum ranged from 8.0 to 12.4 cm (Kunigunda,[17]) whereas 1.9 to 15.4 cm and 2.5 to 7.8 cm (Ara *et al*.,[1]). The maximum diameter of 'Crimson Tide' might be due to inherent character of individual cultivars. Similar variations have been reported previously in (Kanamadi and Patil,[14] and Rajashekaran *et al.,*[31]), in Gerbera (Mahmood *et al*.,[19]). The variation in flower diameter may be due to the genotypic character or genotypic expression of the genotypes. These results are in conformity with the results reported earlier in marigold (Bhanupratap *et al.,*[6], Singh and Kumar,[34], Naik *et al.,*[22] , Nandkishor and Raghava,[23] and Verma *et al.,*[39].

Stalk length of flower:

Stalk length is important cut flower trend. Length of flower stalk is a very important quality trait which is considered while grading the flowers. It also plays important role in the shelf life by extending their post-harvest life. The range of flower stalk length among the cultivars from 17.79 cm to 6.61 cm. Significantly superior length of flower stalk was observed with variety V6 'Ravi Kiran' (17.79 cm) among the varieties, which was statistically identicalwith with V4 'Geethanjali' (17.47 cm). Variety V1 'Akitha' showed minimum length of flower stalk (6.61 cm) among varieties, which was statistically at par with V5 'Punjab Anuradha' (6.64 cm).

Increased number of internodes with increased intermodal length resulted in increased stalk length. These results are in accordance with the findings of Manohar Rao and Pratap,[20] in chrysanthemum. The variations in stalk length among the varieties were also reported earlier in China aster[29]. Variation in stalk length among the carnation varieties was observed previously by Naveen Kumar *et al.,*[25] and Singh *et al,*.[35].

Table 1: Evaluation of 13 chrysanthemum cultivars on plant height, plant spread (N-S) (E-W) and number of branches per plant at 30, 60, 90 and 120 DAT

Treatments	Plant height (cm)				Plant spread								Number of branches			
					N-S (cm)				E-W (cm)							
	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT
V1 Akitha	14.29	21.46	26.72	30.77	10.30	15.64	22.10	26.92	10.05	15.77	21.40	23.22	11.00	17.00	35.67	44.00
V2 Poornima	20.45	32.74	37.27	39.94	13.59	20.96	34.27	39.45	12.50	19.56	33.19	36.39	9.67	19.67	38.03	42.64
V3 Farr	16.27	30.58	31.55	36.33	12.87	17.05	23.72	29.49	10.47	16.07	20.86	26.21	9.33	18.32	36.00	39.33
V4 Geethanjali	16.85	27.97	35.32	37.42	10.20	16.97	23.53	28.66	10.66	16.39	20.55	24.32	8.33	19.67	39.33	44.67
V5 Punjab Anuradha	15.94	32.41	38.88	42.24	9.37	11.98	17.86	20.18	8.46	13.33	15.72	18.49	9.33	17.67	36.53	48.00
V6 Ravi Kiran	22.52	38.96	45.97	47.21	13.08	18.98	27.14	35.65	12.75	20.73	24.96	33.45	11.00	26.33	46.00	54.67
V7 Ratlam Selection	27.32	42.25	49.34	51.46	20.58	26.97	45.47	51.57	19.52	26.43	40.95	47.99	20.33	33.67	53.00	62.67
V8 Flirt	16.56	25.85	31.21	35.01	13.63	21.20	37.51	46.35	13.13	21.70	33.88	37.75	9.00	19.67	38.33	50.33
V9 Jaya	15.48	28.75	35.15	38.85	18.00	25.07	42.98	48.62	16.66	25.37	38.39	45.48	17.00	28.31	46.85	58.00
V10 Thaichen Queen	16.31	26.54	33.79	37.31	10.57	14.90	21.54	24.80	10.89	16.09	19.47	20.85	7.33	15.33	30.00	38.67
V11 Maghi	26.77	41.50	47.93	49.94	22.35	30.09	48.26	53.31	22.13	28.41	43.70	50.90	22.67	39.33	56.67	66.67
V12 Shyamala	16.84	26.29	34.96	36.80	8.66	13.51	18.64	21.36	6.54	14.76	18.60	19.91	7.67	19.33	41.12	53.67
V13 Agina Purple	10.04	19.65	23.49	27.82	14.04	21.78	35.03	39.45	10.33	19.60	34.04	38.87	13.33	25.50	46.33	56.67
S.Em.±	0.8702	2.0265	2.5941	2.5162	0.7098	1.1456	1.9906	2.8064	0.841	1.3836	2.1779	2.7485	0.802	1.6355	3.2521	4.3651
C.D. at 5 %	2.5401	5.9152	7.572	7.3446	2.0719	3.3439	5.8104	8.1917	2.4548	4.0386	6.3572	8.0227	2.341	4.7739	9.4927	12.7415
C.V. %	8.31	11.55	12.39	11.08	9.02	10.11	11.26	13.57	11.54	12.26	13.41	14.6	11.58	12.28	13.46	14.89

Table 2: Evaluation of 13 chrysanthemum cultivars on fresh weight of plants, dry weight of plants, diameter of plants and stalk length of flower

Varieties name	Fresh weight of plants (g)	Dry weight of plants (g)	Diameter of plants (cm)	Stalk length of flower(cm)
V1 Akitha	115.83	40.50	5.26	6.61
V2 Poornima	104.17	34.17	5.96	9.67
V3 Farr	72.83	24.33	5.96	9.28
V4 Geethanjali	106.67	35.83	5.90	17.47
V5 Punjab Anuradha	75.67	23.00	4.05	6.64
V6 Ravi Kiran	239.17	89.47	8.07	17.79
V7 Ratlam Selection	175.17	68.33	5.22	13.79
V8 Flirt	177.50	72.67	6.82	14.60
V9 Jaya	175.50	59.17	4.38	10.68
V10 Thaichen Queen	87.67	23.83	7.77	10.39
V11 Maghi	422.96	181.61	3.07	15.78
V12 Shyamala	150.00	65.00	6.68	14.26
V13 Agina Purple	138.00	54.83	3.69	10.14
S.Em.±	7.7047	2.3625	0.1975	0.7901
C.D. at 5 %	22.489	6.896	0.5765	2.3063
C.V. %	8.55	6.88	6.11	11.32

CONCLUSION

Chrysanthemum cultivars showed wide range of variations in their growth and quality characters. On the basis of results of the present experiment out of thirteen varieties tested, V11 'Maghi' showed the maximum plant spread N-S & E-W, number of branches per plant, fresh and dry weight of plant. But it was shown the minimum diameter of flower. The variety V7 'Ratlam Selection' showed maximum plant height. Variety V6 'Ravi Kiran' recorded maximum diameter and stalk length of flower. Over all, the variety V7 'Ratlam Selection' was found best under South Saurashtra agro-climatic region.

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