

## Performance of Thirteen Chrysanthemum Varieties on Flowering, Yield and Quality under South Saurashtra Region

A. Sunil Kumar<sup>1\*</sup> and N. D. Polara<sup>2</sup>

<sup>1</sup>Department of Floriculture and Landscape Architecture, College of Horticulture, Junagadh Agricultural University, Junagadh – Gujarat 362001

<sup>2</sup>Associate Professor, Department of Floriculture and Landscape Architecture, College of Horticulture, Junagadh Agricultural University, Junagadh – Gujarat 362001

\*Corresponding Author E-mail: [adlasunil2@gmail.com](mailto:adlasunil2@gmail.com)

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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. Days to first flower opening, days to 50% flowering, number of flowers per plant, number of flowers per plot, weight of 10 flowers per plant (g), flower yield per plot (kg), flower yield ( $t\ ha^{-1}$ ), vase life of cut flowers (days), shelf life of flowers (day) and in situ longevity (days) for different cultivars varied significantly. Amongst the chrysanthemum cultivars, variety V5 'Punjab Anuradha' required minimum number of days for first flowering (34.20 days) and days for 50% flowering (73.65 days). The variety V10 'Thaichen Queen' showed maximum weight of 10 flowers (34.07 g) and in situ longevity of flowers (14.96 days). The variety V11 'Maghi' was recorded significantly maximum number of flowers per plant (464.53) followed by V7 'Ratlam selection' (260.67), number of flowers per plot (11148.80), followed by 'Ratlam Selection' (6256), flower yield per plot (7.043 kg), followed by the variety 'Ratlam Selection' (5.136 kg), flower yield ( $56.88\ t\ ha^{-1}$ ) which was at par with the 'Ratlam Selection' ( $54.81\ t\ ha^{-1}$ ) and highest shelf life of flower (6.49 days). The Variety V12 'Shyamala' showed significantly the longest vase life (8.20 days).

**Key words:** Shyamala, Ratlam, Flowering, Yield

### INTRODUCTION

In the modern era, floriculture is gaining importance as a good source of income apart from giving pleasure and happiness. Chrysanthemum is one of the important flower crop in Gujarat. Its popularity and demand is increasing day by day because of its keeping

quality and wide range of flower colors and shapes. Chrysanthemum cultivation is gaining good momentum. In this regard, chrysanthemum or queen of east (*Chrysanthemum* spp.) has gained much importance as a cut flower or for garden display.

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There are many varieties of chrysanthemum with magnificent flowers in exhaustive range of colors, shapes, numbers and sizes of flowers and a wide range of keeping quality. Normally performance of varieties depends upon genetic constitution, whereas their expression depends upon the climatic conditions of the region under which it is grown. The success in selection for newer types of chrysanthemum depends on the extent of varietal evaluation available in base materials and the evolved varieties perform best in one or another region depending upon their suitability and adaptability to the given climatic conditions.

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.

#### MATERIAL 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 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 Varietys 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:** Days to first flower opening was counted in days from the date of transplanting to the stage at which the first flower opened in each net plot from the tagged plants and averaged. The number of days taken for 50% of the plants to produce flower in each plot was recorded by counting the days from date of transplanting to the days required to obtain 50% plant produced first flower. The number of flowers per plant was calculated by noting the number of flowers harvested from each of the five tagged plants till the final harvest and average worked. The numbers of flowers harvested at weekly interval from all the plants in the gross plot were counted according to the treatments and replication wise. The average number of flowers per plot was then worked out. From the tagged plants, weight of 10 randomly selected flowers per plant was worked out by recording the fresh weight of flowers and the mean values was worked out. The total yield of flowers per plot from all pickings under various treatments were recorded and expressed in kilogram per plot. The flowers harvested at each picking from the net plot were weighed. The yield per hectare was calculated from the yield obtained from the net plot for each treatment.

The day when 50 per cent of florets were wilted was taken as terminal day of vase life with respect to a particular treatment. The number of days were counted from the day of placing the flower stalk in the vase to the terminal day and expressed as vase life in

days. For this purpose, flowers were harvested at fully opened stage. The stalks were cut to a uniform length and lower leaves were removed leaving only a few upper leaves and then the flowers were placed in 200 ml of tap water taken in flasks.

Hundred gram of flowers from each treatment were kept under ambient condition. Initial weight of selected flowers were recorded and again observed in subsequent hours till flowers in different treatments were found unfit for use was recorded as shelf life of flower.

The insitu longevity of flowers were counted from the day of flower opening to the day up to which the flower having fresh look and marketable quality. For this purpose five randomly selected flowers from each treatment were tagged at the time of flower opening.

## RESULTS AND DISCUSSION

### Days for first flowering

Perusal of the data illustrated in Table 01 revealed significant result and the days for first flowering was observed among thirteen varieties ranged from 34.20 to 92.40 days. The variety V5 'Punjab Anuradha' required significantly minimum number of days for first flowering (34.20 days). Whereas, variety V11 'Maghi' recorded maximum number of days required for first flowering (92.40 days).

The flowering characters in different varieties are dependent on the basis of the concept that proper amount of stored carbohydrates are necessary for inducing the plant from vegetative phase to flowering (Kosegarten and Mengel, <sup>21</sup>). Early flowering habit was observed with variety V5 'Punjab Anuradha' (34.20 days) and found superior to all other varieties tested. This finding was in close confirmation with Kanamadi and Patil<sup>18</sup>. They observed that the variety Sharad Mala took 121.00 days for opening of first flower. The earliest flowering was observed in variety Red Anemone, which had taken minimum number of days to open first flower (73.95 days). This signifies the earliness of a cultivar as reported by Heidmans and Stalk<sup>16</sup>, Negi *et*

*al.*,<sup>33</sup>, Behera *et al.*,<sup>4</sup> and Vasanthachari<sup>49</sup> in chrysanthemum, where the varietal genetic character play an important role. The finding is also corroborates with the finding of Palai<sup>34</sup> in chrysanthemum.

### Days for 50% flowering

Days for 50% of flowering showed significant differences among the varieties. A close view of the data presented in Table 01. The range of days for 50% flowering was 73.65 to 127.17 days. The significantly minimum number of days for 50% flowering was recorded with variety V5 'Punjab Anuradha' (73.65 days). In case of maximum number of days for 50% flowering was observed with variety V11 'Maghi' (127.17 days).

The inherent early flower bud initiation factor in variety V5 'Punjab Anuradha' significantly influenced the days to 50% flowering. The variation for early or late bloom seems to be the varietal character (Kanamadi and Patil, <sup>18</sup>, Behera *et al.*,<sup>4</sup> and Manohar Rao and Pratap, <sup>24</sup>). Similar variations due to varietal trends were also observed in China aster (Agandi,<sup>1</sup>) and in marigold (Vijayalaxmi,<sup>51</sup>). Similar results were reported in marigold by Khanvilkar *et al.*,<sup>20</sup>, Singh *et al.*,<sup>45</sup> and Mehta *et al.*,<sup>26</sup>.

### Weight of 10 flowers (g)

The significant differences were exhibited by the data for this character among the varieties which ranged from 7.83 to 34.07 g. The variety V10 'Thaichen Queen' showed significantly maximum weight of 10 flowers (34.07 g), whereas, the minimum weight of 10 flowers was recorded by V13 'Agina Purple' (7.83 g).

Probably variation in flower weight is depends on varietal character. Mishra<sup>27</sup> observed that the variety Suneel produced the highest flower weight in chrysanthemum. Similar variations for the chrysanthemum cultivars were also reported by Dhahiya *et al.*,<sup>11</sup> where the maximum and minimum flower weight was recorded with the cv. Basanthi and cv. Gauri, respectively. Damke *et al.*,<sup>10</sup> reported the varieties Flirt, Puja and

IIHR-6 gave higher weight of flowers per plant due to their larger size and heavier weight of flowers in chrysanthemum. The weights of flowers are clearly in relation with the size of flowers. The greater the size of the flowers, greater would be the fresh weight of flowers. This variation in flower weight among varieties might be attributed to the higher water and carbohydrates level in the flower. Water plays a very important role to maintain flower turgidity, freshness and petal orientation. The ultimate effect of all these factors resulted into strong and long flower stalks, large sized buds or flower and finally increases in flower weight. Similar variations were also recorded previously in Carnation (Singh *et al.*,<sup>47</sup>, Singh and Sangama,<sup>46</sup>). Similar results were reported by Mathad,<sup>25</sup> Verma *et al.*,<sup>50</sup> Chandrashekara Rao *et al.*,<sup>8</sup> and Singh *et al.*<sup>45</sup> for individual weight of flowers.

#### Number of flowers per plant

Significant differences were found among the varieties evaluated with respect to number of flowers per plant. The data range was found between 65.73 to 464.53. Variety V11 'Maghi' was recorded maximum number of flowers per plant (464.53) followed by V7 'Ratlam selection' (260.67), the minimum number of flowers per plant was observed in variety V10 'Thaichen Queen' (65.73).

Number of flowers produced per plant ultimately determines the vigour of the genotype or variety for the flower production (Anon,<sup>2</sup>). The variety V11 'Maghi' was significantly superior over the other cultivars for maximum number of flowers per plant followed by V7 'Ratlam Selection' and V9 'Jaya'. Mishra<sup>27</sup> observed that the variety Suneel produced the highest number of flowers per plant in chrysanthemum. Kanamadi and Patil<sup>18</sup> in chrysanthemum observed that the variety Red Gold had produced the maximum flowers per plant. Bhati and Chitkara<sup>7</sup> also recorded higher yield of flowers inspite of moderate number of flowers per plant in marigold variety Giant

Double and African orange. Similar trend was also observed by Bhaskaran<sup>6</sup> and Vasanthachari<sup>49</sup> in chrysanthemum. The number of flowers produced per plant may be directly related to the number of branches per plant. Similar results were also reported in marigold by Patil *et al.*,<sup>38</sup> Naik *et al.*,<sup>29</sup> and Bhanupratap *et al.*,<sup>5</sup> reported that plant spread had a positive correlation with number of flowers per plant.

#### Number of flowers per plot

The data were ranged from 1577.60 to 11148.80. The significantly higher results were found for number of flowers per plot in variety V11 'Maghi' (11148.80) followed by V7 'Ratlam Selection' (6256), minimum number of flowers per plot was recorded with variety V10 'Thaichen Queen' (1577.60) presented in the Table 01.

Number of flowers produced per plant ultimately determines the vigour of the genotype or variety for the flower production (Anon,<sup>2</sup>). The variety V11 'Maghi' was significantly superior over the other cultivars for maximum number of flowers per plant followed by V7 'Ratlam Selection' and V9 'Jaya'. Barigdad and Patil<sup>3</sup> noted the Indira variety as the best for number of flowers and cut flower yield. Similar trend was observed by Bhaskaran<sup>6</sup> and Vasanthachari<sup>49</sup> in chrysanthemum

#### Flower yield per plot (kg)

The observed data was varied between 0.733 to 7.043 kg. The variety V11 'Maghi' was found significantly higher results for obtained flower yield per plot (7.043 kg), followed by the variety V7 'Ratlam Selection' (5.136 kg) and V8 'Flirt' (5.136 kg). Whereas. The minimum flower yield per plot was obtained from the variety V5 'Punjab Anuradha' (0.733 kg).

Gondhali *et al.*,<sup>13</sup> obtained higher yield of flowers per plot and per m<sup>2</sup> in chrysanthemum varieties Shyamal and IIHR-5. Damke *et al.*,<sup>9</sup> reported the highest flower yield per plot in variety Tara followed by Kirti in chrysanthemum.

**Flower yield (t ha<sup>-1</sup>)**

The observed data was ranged from 6.52 to 56.88 t ha<sup>-1</sup>. The flower yield was recorded significantly maximum from the V11 'Maghi' (56.88 t ha<sup>-1</sup>) which was at par with the V7 'Ratlam Selection' (54.81<sup>-1</sup>) and minimum flower yield was obtained from variety V5 'Punjab Anuradha' (6.52 t ha<sup>-1</sup>).

The average flower yield per plant, per plot and per hectare also differed with the cultivars. The variety V11 'Maghi' was statistically at par with V7 'Ratlam Selection'. The variety 'Maghi' yielded significantly higher than all the other varieties tested which is in accordance with the reports of Hemalata *et al.*,<sup>17</sup> and Behera *et al.*,<sup>4</sup> where the varietal difference for yield potential may be attributed to additive gene effect. Flower yield per plant is directly related to flower yield per hectare. The increased flower yield might be attributed to more number of leaves resulted in production and accumulation of maximum photosynthetic material which ultimately resulted in production of more number of flowers with bigger sized flowers. Similar variation in Carnation with respect to flower yield was also observed by Sathisha<sup>42</sup>, Naveen Kumar *et al.*,<sup>32</sup>, Patil<sup>37</sup>, Gurav<sup>15</sup>, Shiragur<sup>44</sup>, Ryagi<sup>39</sup> and Shahakar *et al.*,<sup>43</sup>. These findings are similar with the findings reported earlier in marigold (Narsude *et al.*,<sup>31</sup>, Naik *et al.*,<sup>29</sup>, Nandkishor and Raghava<sup>30</sup> and Bhanupratap *et al.*,<sup>5</sup>).

**Vase life of cut flower (days)**

Vase life of cut flowers exhibited significant differences among the varieties. The recorded data was ranged from 3.33 to 8.20 days. Variety V12 'Shyamala' showed significantly the longest vase life (8.20 days). Whereas, the shortest days of vase life was recorded in variety V3 'Farr' (3.33 days).

The vase life is one of the important traits which decide its economic value. The variation in vase life of flower might be due to differences in senescence behaviour of the cultivars by producing higher amount of ethylene forming enzymes and ethylene as

reported by Kavita *et al.*,<sup>19</sup>. Similar variation for vase life in varieties was also reported previously in Carnation by Mahesh<sup>23</sup>, Sathisha<sup>42</sup>, Krishnappa *et al.*,<sup>22</sup>, Pathania *et al.*,<sup>35</sup>, Singh *et al.*,<sup>48</sup>, Shahakar *et al.*,<sup>43</sup> and Patil<sup>37</sup>.

**Shelf life of loose flower (days)**

Significant differences were observed among varieties with respect to shelf life of loose flowers. Among the varieties significantly the highest shelf life of flower was observed with variety V11 'Maghi' (6.49 days), whereas, minimum shelf life was recorded with variety V3 'Farr' (2.24 days).

The variation in shelf life amongst the varieties might be due to different levels of reserve carbohydrates in the plant. It could be due to variation among the varieties for production of photo synthates due to variation in them for photosynthetic area (leaf number and size). Thus, it could be concluded that variation in shelf life of flower of different varieties might be primarily due to their genotypic constitution leading to differential accumulation of carbohydrates. The results are in line with those of Saini *et al.*,<sup>40</sup>, Gupta *et al.*,<sup>14</sup> and Patil<sup>36</sup> reported in gladiolus.

**In situ longevity of flowers (Days)**

The data was ranged from 5.48 to 14.96 days. The recorded data are presented in Table 4.10 and showed in Fig. 4.12. Significantly maximum *in situ* longevity of flowers was recorded with variety V10 'Thaichen Queen' (14.96 days and variety V13 'Agin Purple' (5.48 days) recorded minimum longevity of flowers among varieties.

It depends on the number of flowers per branch, number of days taken for opening of the successive flowers or it might be due to genetic makeup of variety (Wang and Lee, 1994). Nagare and Pal<sup>28</sup>, Sakai *et al.*,<sup>9, 41</sup> and Dunsterville and Dunsterville<sup>12</sup> were in opinion that the genetic constitution of the variety is an important factor which decides the longevity of spikes on the plant reported in orchid.

**Table 1: Performance of 13 chrysanthemum cultivars on days for first flowering, days for 50% flowering, weight of 10 flowers, number of flowers per plant, number of flowers per plot, flower yield per plot and Flower yield**

Treatments	Days for first flowering	Days for 50% flowering	Weight of 10 flowers (g)	Number of flowers per plant	Number of flowers per plot	Flower yield per plot (kg)	Flower yield (t ha <sup>-1</sup> )
V1 Akitha	75.61	111.75	16.40	82.67	1984	1.047	13.56
V2 Poornima	78.26	108.07	23.93	107.20	2572.8	2.648	25.68
V3 Farr	62.72	115.20	13.80	90.27	2166.4	1.081	12.51
V4 Geethanjali	76.81	113.67	12.73	91.87	2204.8	2.206	11.69
V5 Punjab Anuradha	34.20	73.65	12.12	75.53	1812.8	0.733	6.52
V6 Ravi Kiran	86.05	121.56	17.20	124.67	2992	3.680	21.77
V7 Ratlam Selection	62.51	97.39	22.47	260.67	6256	5.136	54.81
V8 Flirt	84.07	121.00	15.93	141.67	3400	4.816	22.34
V9 Jaya	86.22	122.53	11.87	194.33	4664	3.400	23.04
V10 Thaichen Queen	44.80	78.45	34.07	65.73	1577.6	2.983	30.30
V11 Maghi	92.40	127.17	14.93	464.53	11148.8	7.043	56.88
V12 Shyamala	82.80	119.02	31.80	102.93	2470.4	3.119	32.74
V13 Agina Purple	62.15	87.73	7.83	122.40	2937.6	0.875	7.40
S.Em.±	5.0821	7.324	1.1878	11.1065	266.5558	0.2468	2.267
C.D. at 5 %	14.8343	21.3783	3.4671	32.4192	778.0595	0.7204	6.6172
C.V. %	12.32	11.8	11.38	12.99	12.99	14.34	15.99

**Table 2: Performance of 13 chrysanthemum cultivars on vase life, shelf life and longevity of flowers**

Treatments	Vase life (days)	Shelf life (days)	Longevity of flowers (days)
V1 Akitha	3.67	2.67	9.42
V2 Poornima	3.60	3.00	9.85
V3 Farr	3.33	2.24	10.64
V4 Geethanjali	5.47	2.67	9.93
V5 Punjab Anuradha	3.53	3.04	6.56
V6 Ravi Kiran	6.03	3.67	7.00
V7 Ratlam Selection	5.67	3.22	10.96
V8 Flirt	5.67	5.16	11.35
V9 Jaya	4.60	4.67	7.07
V10 Thaichen Queen	5.13	3.22	14.96
V11 Maghi	7.27	6.49	13.55
V12 Shyamala	8.20	6.32	8.27
V13 Agina Purple	4.33	3.51	5.48
S.Em.±	0.24	0.3288	0.8845
C.D. at 5 %	0.69	0.9597	2.5818
C.V. %	7.97	14.85	15.93

### CONCLUSION

The variety V5 ‘Punjab Anuradha’ required minimum number of days for first and 50% flowering. The variety V10 ‘Thaichen Queen’

recorded maximum weight of 10 flowers and *In situ* longevity of flower. The vase life of flower was found best in variety V12 ‘Shyamala’. Variety V11 ‘Maghi’ showed the

maximum number of flowers per plant, flowers per plot and flower yield and shelf life of flower but it was shown the minimum diameter of flower. On the basis of results of the present experiment out of 13 varieties tested, the variety V7 'Ratlam Selection' expressed all the results nearer to the variety V11 'Maghi'. Overall performance of the variety V7 'Ratlam Selection' certified as the best for this study.

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