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Evaluation of different chrysanthemum genotypes for growth and yield parameters under middle Gujarat Agro-climatic Zone

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Abstract
An experiment was carried out to evaluate the performance of eleven chrysanthemum genotype for yield and growth parameters at Anand agricultural university, Anand from 2017-20. Significant variations were observed for various yield and growth parameters during three year. The result from the pooled data of three year showed that among the genotypes evaluated, genotype Sunil recorded maximum plant height (73.91cm) The plant spread (N-S) (49.89) and plant spread (E-W) (43.82) was recorded in genotype Sunil which was at par with the genotype Ratlam selection. Duration of flowering found to be maximum in Pusa Aditya (40.24) days. And maximum average flower weight (3.53 g), maximum Yield (40.78 t/ha) was found in Ratlam selection.

Keywords: Evaluation, chrysanthemum, parameters, middle, *Chrysanthemum morifolium*

Introduction
Chrysanthemum (*Chrysanthemum morifolium* Ramat.) is occupied an important position among flower crops in the world. The genus belonging to the family Asteraceae includes over 200 species of annuals and perennials. 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 colours and shapes. 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. In view of the above, an experiment was carried out to evaluate the performance of different varieties.

Materials and Methods
Experimental site: The present investigation was carried out during August 2017 to February 2020 at college nursery, college of horticulture, Anand, Gujarat (Anand Agricultural University, Gujarat) in order to study the most suitable genotype of chrysanthemum for vegetative and yield parameter.

Design of experiment
The experiment was laid out in Randomized Block Design with 11 different genotype and replicated for three times. Name of the genotype are Pusa aditya (yellow), Shyamal (pink), Dolly white (White), Ravi kiran (Red), Ratlam selection (White), Agina Purple (Purple), Mother Teressa (White), Sunil (Pink), Flirt (Red), Pancho (Light Pink), IIHR-6 (White).
Uniform terminal cuttings five to seven cm long were taken from healthy stock plants, dipped in IBA (Indole-3-butyric acid) 1000 ppm solution for 10 seconds and planted in plug trays containing the coco-peat medium for rooting. The rooted plants were transplanted on Flat beds at a spacing of 30 x 30 cm under open filed condition. The recommended dose of fertilizer was applied to the plants and irrigation was done through furrow method. Pinching was done 30 days after transplanting by removing the terminal portion of the plants. Regular monitoring of plants was done for disease infection and pest infestation. Adequate measure was taken to prevent lodging by staking the plant and disbudding and dishooting also carried out.

Data collection: Data were collected on plant height, plant spread, and number of branches per plant flowering duration, Average flowers weight (g), yield (t/ha) by using standard method. Five tagged plants in one plot are used for record the data plant height, plant spread, number of branches per plant of plant. All the data were statistically analyzed using Agri-stat software and the difference of means were compared at 5% level of significance

Results and Discussion

Vegetative Parameter

Plant height: Plant height of chrysanthemum exposed statistically significant variation among 11 cultivars at harvesting stage. The variety genotype 'Sunil' exerted its superiority by recording the maximum plant height (73.91 cm), the minimum plant height was recorded in genotype 'Dolly white' (28.71 cm). Whereas in genotype 'Ratlam selection' was recorded the plant height (56.00 cm). 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. Similar variation in plant height among varieties was also observed in marigold and in rose. The higher plant height obtained from plants could be attributed to increased photosynthetic capacity of the plants in asters. Similar variation in plant height among the genotypes was also observed previously by Narsude *et al.*, [15] Pal and Kumar [16], Singh and Misra, [22] and Singh *et al.* [24], in African marigold.

Table 1: Evaluation of different chrysanthemum genotype for growth parameters under Middle Gujarat Agro-climatic Zone

Genotype	Plant Height (cm)	Plant spread (N-S) (cm)	Plant spread (E-W) (cm)	Number of branches per plant
Pusa Aditya	45.91	44.00	40.13	11.36
Shyamal	53.12	31.73	31.62	12.04
Dolly white	28.71	24.62	26.56	8.58
Ravi Kiran	49.58	33.40	30.87	12.00
Ratlam selection	56.00	46.82	42.22	12.87
Agina Purple	34.73	33.09	33.47	10.07
Mother Teressa	22.60	28.87	28.18	7.09
Sunil	73.91	49.89	43.82	10.60
Flirt	42.47	29.48	26.44	8.36
Pancho	30.49	34.64	30.64	9.92
IIHR-6	54.91	42.36	41.32	11.96
S.Em	1.54	1.32	1.28	0.29
CD @ 5%	4.37	3.74	3.61	0.81
CV%	10.34	10.95	11.22	8.28

Plant Spread: Significant results were obtained for plant spread in N-S and E-W direction of different varieties at harvest stages of crop growth data are presented in Table No.1 among the varieties at plant spread in N-S direction ranged from 49.89 to 24.62 cm. The genotype 'Sunil' recorded maximum plant spread (49.89 cm) which was statistically at par with genotype 'Ratlam Selection' (46.82 cm), the minimum plant spread was recorded in genotype 'Dolly white' (24.62 cm). Plant spread in E-W direction varied from 43.82 to 26.44 cm at this stage of crop growth for genotype 'Sunil' recorded maximum plant spread (43.82 cm) followed by genotype 'Ratlam Selection' (42.22 cm), and genotype 'IIHR-6' (41.32) whereas genotype 'Flirt' recorded the minimum plant spread (26.44 cm). The increasing plant spread due to increased number of branches was reported by Mishra, [12] and Balaji *et al.*, [3] 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, [7] 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. Poonam and Kumar, [10] 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: Eleven cultivars showed statistically significant difference at harvest stage for number of branches per plant. The number of branches ranged from 12.87 to 7.09. The greater number of branches was recorded in the genotype 'Ratlam Selection' (12.87 and less number of branches was observed in the genotype 'Mother Teressa' (7.09). The variations in number of branches in chrysanthemum varieties are also supported by the findings of Gondhali *et al.*, [5] they noted that the Nanako had highest number of branches, while Jaya and Mountaineeer showed least branching per plant. Damke *et al.*, [4] reported that the variety Tara produced the highest number of branches. Kanamadi and Patil, [6] 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. Accordingly variations in production of branches among the chrysanthemum cultivars were also reported by Kanamadi and Patil and Vasanthachari, Similar observation recorded in marigold by Naik *et al.*, [14] Verma *et al.*, [30] and Singh and Kumar [23]. This finding is contrary with the findings of Verma; 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.

Table 2: Evaluation of different chrysanthemum genotype for yield parameters under Middle Gujarat Agro-climatic Zone

Genotype	Flowering duration (Days)	Average flower weight (g)	Yield (t/ha)
Pusa Aditya	40.24	0.97	15.72
Shyamal	31.03	2.53	13.78
Dolly white	29.38	1.27	17.53
Ravi Kiran	37.71	2.35	16.33
Ratlam selection	33.57	3.53	40.78
Agina Purple	29.82	0.88	8.92
Mother Teressa	25.78	0.38	2.35
Sunil	29.58	2.34	31.41
Flirt	33.53	2.34	13.82
Pancho	23.71	0.60	8.28
IIHR-6	32.36	2.83	17.71
S.Em	0.81	0.04	0.24
CD @ 5%	2.28	0.10	0.69
CV %	7.67	6.09	4.32

Yield attributes

Flowering duration (Days): The genotype Pusa Aditya flowered for a longer period of 40.24 days while the minimum flowering duration (23.71 days) was observed in genotype Pancho. The variation for the duration of flowering among the genotypes can be attributed to differences in genetic makeup of the plants. Similar findings for variation in flowering duration among chrysanthemum genotypes have also been reported by Madam *et al.,* [10] Srilatha *et al.,* [27] Kumar [9]. and Kumar and Poonam [8].

Average flower weight (g): The average flower weight also varied significantly, the maximum being recorded in the genotype Ratlam Selection (3.53 g) whereas the genotype Mother Teressa (0.38 g) had minimum weight. This may be due to variation in number of ray florets. Similar observations were reported earlier by Reddy *et al.,* [21] Kumar [9]. and Swaroop *et al.,* [27]

Yield (t/ha): The average flower weight also varied significantly, yield was found in Ratlam Selection (3.53 g) and (40.78 t/ha) respectively. Higher yields were due to the greater number of flowers and heavier flowers. Several studies reported varietal differences grown in similar environments in flower weight and is genetically determined (Singh *et al.,* Swaroop *et al.,*) [24, 27]

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 eleven genotypes tested, genotype 'Sunil' showed the maximum plant height. plant spread N-S & E-W, number of branches per plant but The genotype 'Ratlam Selection' showed maximum Flower weight and yield. Genotype 'Pusa aditya recorded maximum Flowering duration. Over all, the genotype 'Ratlam Selection' was found best under Middle Gujarat agro-climatic region.

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