Evaluation of chrysanthemum (*Dendranthema grandiflora*) cultivers in respect to their different traits under Prayagraj agro – climatic conditions

ABSTRACT

A field experiment was carried out in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. During rabi season (2021-2022). This study aimed to evaluate different varieties of Chrysanthemum in terms of growth , yield and quality characteristics. The experiment was laid out in Randomized block design (RBD) with 15 treatments and each treatment replicated thrice. The treatments consist of different combinations of varieties . Treatment T4 (Red Baby) was statistically significant compared to other treatment combination, which recorded highest plant height (33.9 cm), No. of branches (31.8), Plant Spread (20.3cm)] , Stalk Length (22.3 cm) , Flower weight (3.8 g) , Self – life (25 days) , Vase life (7.4 days) and quality in comparison to other varieties. The highest Benefit Cost Ratio was found in variety V4 (Red Baby) with 2.32.

Key words: *Chrysanthemum, red baby etc.*

1. INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora*) is one of the most important flower crops commercially grown in different parts of India. It is commonly known as Guldaudi, Autumn Queen or Queen of the East belonging to family Asteraceae. It is mostly used in our country for making garlands,venis,bracelates ,flower decoration and religious offerings (Bohra and Kumar , 2014). But , in South India mostly the yellow-coloured flowers are preferred and grown as loose flowers for trades. Chrysanthemum is one of the most beautiful and perhaps the oldest flowering plant commercially grown in different parts of the world. Its commercial cultivation is being done in states viz., Maharashtra , Rajasthan , Madhya Pradesh and Bihar and in places viz., Delhi, Kolkata, Lucknow, Kanpur and Allahabad mainly for the sake of decoration and participating in flower shows, with the help of pot grown plants.

Growth of chrysanthemum has two distinguished phases, firstly a period of long day conditions (day length more than

12hrs) where the plants grow vegetatively and secondly short-day conditions (daylengths less than 12 hrs), leading to flower induction and development. Long day and short-day conditions are influenced by season and climatic conditions of that particular region. The variations among chrysanthemum varieties are large in response to environment particularly temperature and the interaction between temperature and cultivar occur for every developmental trait. Therefore, varietal evaluation became necessary to identify the suitable variety for the specific region.

Though a large number of chrysanthemum varieties are available in the market, novelty in commercial traits like flower colour, shape, size, growth habit, post-harvest life of the flower, etc., are always valued and preferred by the consumer. There is a perpetual demand for superior varieties over the existing ones. It, thus, becomes necessary to evaluate and categorize available chrysanthemum varieties on the basis of their use. With this in view, investigations were undertaken to evaluate chrysanthemum varieties for various uses.

The variations among chrysanthemum varieties are large in response to environment particularly temperature and the interaction between temperature and cultivar occur for every developmental trait. Therefore, varietal evaluation became necessary in order to identify the best variety for the specific region. The performance of any crop or variety is heavily influenced by the interaction of genotype and environment. As result, varieties that thrive in one region may not thrive in other regions with varying climatic conditions. As a result, new genotypes must be evaluated for quality traits under varying climatic conditions. The study was conducted to evaluate the performance of the cultivars in respect to their different traits.

2.MATERIALS AND METHOD

This experiment was conducted at Floriculture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (UP) in the month of October to February during the winter season of the year 2021-2022.

The different treatment manipulated as follows T1- White Bonsai , T2 - Panchu , T3 - Peet, T4 - Red Baby , T5 - Yellow Jacket , T6 - Telstar , T7 - Parliament , T8 - Chic , T9 - Mango , T10 - Jayanti , T11 - Classic , T12 - Dark Eyes , T13 - Cameo Joy , T14 - Dall Pink and T15 - Pearls . The various varieties were arranged in a Randomized Block Design (RBD) in 3 replications.

3. RESULT AND DISCUSSION

3.1 Growth Attributes

Vegetative parameters viz., plant height , plant spread and number of branches were

recorded at different stages of plant growth from 25 , 50 , 75 and 100 Days after planting (DAP) and the results from the observations made are as follows.

3.2 Plant height (cm)

Significant difference was observed due to different varietal evaluation for plant height, at 100 DAT. The Maximum Plant height at 100 days (33.9 cm) was recorded in the T4 (Red Baby),followed by T5 (Yellow Jacket) with (26.5 cm) and the minimum Plant Height at 100days (2.7 cm) was recorded in T6 (Telstar).

The increase in plant height was associated with rapid cell division and elongation in meristematic region of plants and this has resulted in increased plant height . The variation in plant height may be accredited primarily to difference in genetic character of the genotypes . This might be due to the attribution of combined factors such as genetic characters of the genotypes, pot mixtures and climatic factors like light, maximum and minimum temperature, nutrition ratio in the media etc. (Prabhu *et al.,* 2018) . Similar findings were reported by Niki *et al.,* (2016) and Singh *et al.,* (2017) in chrysanthemum.

3.3 Plant spread (cm)

Significant difference was observed due to different varietal evaluation for Plant Spread, at 100 DAT. The Maximum Plant Spread at 100 days (20.3 cm) was recorded in the T4 (Red Baby), followed by T15 (Pearls) with (15.1 cm) and the minimum Plant Spread at 100 days (5.7 cm) was recorded in T6 (Telstar).

The variation in plant spread among various varieties might be due to genotypic difference in phenotypic expression of plant spread and this variation in genotypes environmental interaction effect on plant spread in chrysanthemum (Kunigunda *et al.,* 2004). Increase in plant spread might be due to production of a greater number of branches and by the genetic nature of the plant (Suvija *et al.,* 2016). Plant spread increase may be due to production of increased number of branches and wider angles from point of origin. Greater plant spread shows better

vegetative growth of plant (Singh *et al.*, 2017). The production of a greater number of branches per plant may be the reasons for increasing plant spread and the genetic characters of the plant (Prabhu *et al.*, 2018). Similar finding was also reported by Niki *et al.,* (2016) and Suvija *et al.*, (2016) in chrysanthemum.

3.4 Number of branches per plant

Significant difference was observed due to different varietal evaluation for Number of branches per plant, at 100 DAT. The Maximum Number of branches per plant at 100 days (31.8) was recorded in the T4 (Red Baby), followed by T14 (Dall Pink) with (25.8) and the minimum Number of branches per plant at 100 days (11.6) was recorded in T1 (White Bonsai).

Number of primary branches plant-1 showed significant variation for the cultivars evaluated and the cv. Red Baby (31.8) recorded maximum number of branches and maintained its superiority over other varieties until the final stage of growth. Such differences observed in production of branches among the cultivar might be due to inherent genetic factors whose performance will be varied over a wide range of environmental condition. This finding is contrary with the findings of Kumar *et al.,* (2014**)** who has reported that maximum numbers of branches was found in taller plants while similar findings has been reported by Verma.

3.5 Flowering Attributes

3.5.1 Day taken to 50% flowering per plot in different varieties of chrysanthemum

Significant difference was observed due to different varietal evaluation for day taken to 50% flowering per plot, The Maximum day taken to 50% flowering per plot (76.6) was recorded in the T10 (Jayanti), followed by T12 (Dark Eyes) with (73.3) and the Minimum day taken to 50% flowering per plot (66.6) was recorded in T5 (Yellow Jacket).

The variation for early or late bloom seems to be the varietal character (Behera *et al.,* 2002). Variation in days taken to fifty per-cent flowering may be due to genetic trait or makeup (Byadwal *et al.,* 2018). The similar results were reported by Naik *et al.,* (2019) in chrysanthemum.

3.5.2 Stalk length (cm) of different varieties of Chrysanthemum

Significant difference was observed due to different varietal evaluation for Stalk length, The Maximum Stalk length (22.3 cm) was recorded in the T4 (Red Baby), followed by T12 (Dark Eyes) and T5 (Yellow Jacket)with (15.8 cm) and the Minimum Stalk length (4.5cm) was recorded in T6 (Telstar).

The variation in flower stalk length among the varieties may be due to environmental conditions prevailed during growth stage of stalk (Baskaran *et al.,* 2010). The variation in stalk length among the various varieties might be due to genotypic differences in phenotypic expression of stalk length (Ona *et al.,* 2015) in chrysanthemum. It was observed that the cultivars with higher plant height produced the longer flower stalk as compared to cultivars with smaller plant as stated by (Jamal *et al.,* 2015).

3.5.3 Flower Diameter (cm) of different varieties of Chrysanthemum

Significant difference was observed due to different varietal evaluation for Flower Diameter. The Maximum Flower Diameter (10.1 cm) was recorded in the T15 (Pearls), followed by T4 (Red Baby) with (7.7 cm) and the Minimum Flower Diameter (3 cm) was recorded in T7 (Parliament).

The variation among the genotypes for diameter of flower may be due to inherent character of individual cultivars (Jamaluddin *et al.,* 2015). This variation may be due to differences in the genetic makeup of cultivars and due to the genotypic differences in phenotypic expression of flower diameter (Singh *et al.,* 2017). Similar finding was reported by Prabhu *et al.,* (2018) in chrysanthemum.

3.5.4 Number of flowers per plant of different varieties of Chrysanthemum

Significant difference was observed due to different varietal evaluation for Number of flowers per plant. The Maximum Number of flowers per plant (33.9) was recorded in the T14 (Dall Pink), followed by T12 (Dark Eyes) with (21.7) and the Minimum Number of flowers per plant (3.9) was recorded in T6 (Telstar).

Number of flowers per plant was varied due to the highest flower number per plant could be attributed to the initiation of more number of branches per plant ultimately resulting in production of more number of flower buds per plant, finally increase yield (Prabhu *et al.,* 2018). Variation of number of flower per plant was due to varietal differences for number of floret spike may be due to the fact that a gene exerts influence on physiological processes

by controlling the synthesis of amino acid and proteins responsible for growth and development (Bajaria *et al.,* 2018).

3.5.5 Number of flowers per plot of different varieties of Chrysanthemum

Significant difference was observed due to different varietal evaluation for Number of flowers per plot. The Number of flowers per plot (146) was recorded in the T14 (Dall Pink), followed by T12 (Dark Eyes) with (105) and the minimum Number of flowers per plot (14.3) was recorded in T6 (Telstar).

The total number of flowers produced per plot was determined genotype of the plant (JinHee Lim *et al.,* 2010). The results obtained in the present study are in agreement with that of Jayanthi and Vasanthachari (2003), Balaji, *et al.,* (2004) and Dilta *et al.,* (2005) and Rao and Pratap, (2006) in chrysanthemum.

3.5.6 Flower weight (g) of different varieties of Chrysanthemum

Significant difference was observed due to different varietal evaluation for Flower weight. The Flower weight (3.8 g) was recorded in the T4 (Red Baby), followed by T9 (Mango) with (3.6 g) and the minimum Flower weight (1.3 g) was recorded in T1 (White Bonsai).

Variation in flower weight depends on varietal character (Dhahiya *et al.,* 2003 and Mishra *et al.,* 2006). The increase in fresh flower weight occurs when the rate of water absorption is greater than the transpiration rate (Baskaran *et al.,* 2010). The variation due to increased flower size with prominent central disc florets and due to the presence of more number of developed ray florets (Keerthi *et al.,* 2017). The weight of flowers may be due to in relationship with the size of flowers. Greater the size of the flowers, greater would be the fresh weight of flowers (Byadwal *et al.,* 2018).

3.5.7 Self- life (Days) of flowers of different varieties of Chrysanthemum

Significant difference was observed due to different varietal evaluation for Self - life of flowers. The Self life of flowers (25) was recorded in the T4 (Red Baby), T12 (Dark eyes) and T14 (Dall Pink) followed by T5 (Yellow Jacket) with (19.6) and the minimum Self life of flowers (11) was recorded in T8 (Chic).

Variation in shelf life within 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 photosynthesis due to variation in them for photosynthetic area. Thus, it could be determined that variation in shelf life of flower of different varieties might be primarily due to their genotypic constitution leading to differential accumulation of carbohydrates (Kumar *et*

al., 2017). More number of leaves might have resulted in increased photosynthetic activity as evidenced by increased accumulation of dry matter and this might have helped in extended shelf life (Dharmendraet *et al.,* 2019).

4.3. ECONOMICS

Significant differences were observed in the cultivation of different varieties of chrysanthemum in terms of economics (gross return, net return and benefit cost ratio). The highest benefit cost ratio (2.32) was recorded in the T4 (Red Baby), however, T5, T7, T9, T12 and T13 were at par.

Table 1. Effect of different cultivars on growth characters of chrysanthemum

Treatment Symbol	Treatment	Plant Height (cm)	Plant Spread (cm)	Number of Branches Per Plant
T1	White Bonsai	4.3	6.7	11.6
T2	Panchu	10.3	6.7	13.7
T3	Peet	12.9	11.1	23
T4	Red Baby	33.9	20.3	31.8
T5	Yellow Jacket	26.5	11.3	23.3
T6	Telstar	2.7	5.7	11.7
T7	Parliament	8	9.1	13.6
T8	Chic	7.1	6.7	16
T9	Mango	13	10.3	19.6
T10	Jayanti	9.9	13.8	15.1
T11	Classic	13.2	11.6	21.3
T12	Dark Eyes	32.3	11.3	18.6
T13	Cameo Joy	6.4	6.2	15.2
T14	Dall Pink	22.7	13.8	25.8
T15	Pearls	12.5	15.1	20.7
	F-Test	S	S	S
	SE(d)	0.79	1.65	0.19
	C.D. at 5 %	1.63	3.41	0.40
	C.V.	6.76	10.73	2.33

TABLE 2. Effect of different cultivars on floral characters of Chrysanthemum :

Treatments Symbol	Treatments	Day taken to 50% flowering per plot	Stalk Length (cm)	Flower Diameter (cm)	Number of flowers per plant (DAP)	Flower weight (g)	Self- life of flowers (Days)
T1	White Bonsai	71.6	6.2	5.4	4.6	1.3	3.1
T2	Panchu	71.6	6.5	5.2	9.2	1.5	3.9
T3	Peet	71.6	10.5	5.2	15.4	1.8	3.9
T4	Red Baby	73.3	22.3	7.7	18.4	3.8	7.4
T5	Yellow Jacket	66.6	15.8	4.6	14.3	1.5	4.1
T6	Telstar	70	4.5	3.3	3.9	1.7	2.9
T7	Parliament	71.6	4.6	3	5.7	2.5	3.6
T8	Chic	72	7.2	5.6	7	2.6	3.7
T9	Mango	77	11.9	5	10.1	3.6	5.4
T10	Jayanti	76.6	11.4	5.2	4.8	2.6	3.8
T11	Classic	70	7.7	4.7	5.6	2.7	4
T12	Dark Eyes	73.3	15.8	4.8	21.7	3.1	6.8
T13	Cameo Joy	71.3	6.1	3.6	5.7	1.5	2.8
T14	Dall Pink	72	14.5	4.9	33.9	2.8	6.5
T15	Pearls	71.6	13.5	10.1	6.9	3.1	6.8
	F - Test	S	S	S	S	S	S
	SE(d)	0.64	0.14	1.89	14.52	1.27	0.37
	C.D. at 5 %	1.32	0.30	3.89	29.90	2.62	0.76
	C.V.	7.42	3.40	20.69	32.51	8.76	9.82

TABLE 3. Economics of various treatments in chrysanthemum cultivation

Treatment Symbol	Treatments	Total Cost of Cultivation	Selling rate (Rs/ha)	Total Yield (t/ha)	Gross returns (Rs/t)	Net returns (Rs/t)	Benefit Cost Ratio (Rs/t)
T1	White Bonsai	216,709	30,000	5.5	165,000	51709	2.00
T2	Panchu	216,709	30,000	6	180,000	36709	2.05
T3	Peet	227,820	30,000	7.5	225,000	2820	2.12
T4	Red Baby	250,042	30,000	10	300,000	220042	2.32
T5	Yellow Jacket	227,820	30,000	6	180,000	197820	2.31
T6	Telstar	216,709	30,000	7	210,000	186709	2.10
T7	Parliament	216,709	30,000	8.5	255,000	38291	2.30
T8	Chic	227,820	30,000	8.7	261,000	33180	2.15
T9	Mango	250,042	30,000	9.8	294,000	43958	2.30
T10	Jayanti	227,820	30,000	8.7	261,000	33180	2.15
T11	Classic	227,820	30,000	9	270,000	42180	2.20
T12	Dark Eyes	250,042	30,000	9.5	285,000	34958	2.28
T13	Cameo Joy	216,709	30,000	6	180,000	36709	2.30
T14	Dall Pink	227,820	30,000	9	270,000	42180	2.20
T15	Pearls	250,042	30,000	9.5	285,000	34958	2.28

4. CONCLUSION

From the present investigation, it is concluded that Variety V4 (Red Baby) performed best in terms of plant growth [plant height (33.9cm), No. of branches (31.8), Plant Spread (20.3cm)] and quality. However, the highest flower yield was found in V14 Dall Pink (33.9).The highest Benefit Cost Ratio was found in variety V4 (Red Baby) with 2.32, however, Varieties T5, T7, T9, T12 and T13 were at par.

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