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Evaluation of different *Chrysanthemum* (*Chrysanthemum × morifolium* Ramat.) varieties under Bundelkhand region

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Abstract

Evaluation of fifteen genotypes of chrysanthemum (*Chrysanthemum × morifolium* Ramat.) has been taken up at Instructional Farm, College of Horticulture, BUA&T, Banda during 2020-2021. The experiment was laid out in Randomized Block Design (RBD) with three replications. The analysis of variance revealed wide and significant variations for most of the characters. The results revealed that highest plant height was recorded in variety Suneel (63.24 cm), whereas maximum number of leaves per plant recorded in Charmis (442.3), maximum number of primary branches per plant (12.60) in Pitika and Maximum stem girth was recorded in variety Basanti (58.51 mm). Plant spread was found maximum in variety Basanti (60.20 cm). Charmis showed maximum number of flower buds per plant (176.46) and number of flowers per plant (165.33). Basanti recorded maximum number of flowers per stem (31). Maximum flower size was recorded in variety Suneel (6.76cm), flower weight in Shyamal (13.47 g). Pitika showed maximum number of suckers per plant (8.00) and stalk length in Dolly White (13.00 cm). As for as days to first flower bud appearance it was minimum in variety Vasantika (71) and minimum days taken to first flowering in Haldighati (86.86). Maximum days to 50% flower senescence found in variety Dolly White (68.00), vase life of flowers in Vasantika (14.73 days) and maximum flowering duration recorded in variety Maghi (53.00 days).

Keywords: Chrysanthemum, genotypes, evaluation, growth, yield

Introduction

Chrysanthemum (*Chrysanthemum × morifolium* Ramat) belongs to the family Asteraceae and originated from China. It is popularly known as Guldaudi, Queen of East and Autumn Queen in India with the basic chromosome number nine. (Gunabhadra *et al.* 2016)^[8]. Chrysanthemum is mainly used as cut flower, pot plant, loose flower and border plant. Cut flowers are used for making bouquet, table arrangement, flower arrangement etc. The major uses of small or loose flowered Chrysanthemum is in making veni, gajra, and garland to offering gods (Negi *et al.* 2015)^[17]. In the genus chrysanthemum and closely related genera, there are many wild species that are able to cross successfully with modern chrysanthemums. Chrysanthemum is annual and perennial herbs, sometime partly woody. Leaves alternate, from nearly entire to much dissected. Inflorescence-heads many flowered disc florets involucre scales imbricate and angled or terete. It is a short day plant. It requires long day for vegetative growth and short day for flowering. It can be propagated both by vegetative and sexual method (Bose *et al.* 2002)^[2]. The variations among Chrysanthemum varieties are huge in response to environment particularly temperature and cultivar occur for every developmental trait. The factors accounting for variation in growth and yield of crop plants are of very complex nature. Its growth and yield are known to be influenced by the environment and the genetic potential to a great extent. The former is controllable to some extent through cultural practices while this governed by the heredity. However, the genetic makeup of any crop can be exploited only when they are subjected to favorable environmental conditions. Therefore, in any crop plant information on genetic characters particularly which those contribute to economic characters would be very useful in planning breeding program leading to effective selection. Various biometrical techniques have been developed to know the genetic architecture of quantitative characters. The purpose of this study is to investigate and evaluate different varieties for various characters and selecting best suitable varieties for Bundelkhand conditions.

Materials and Methods

The present study was conducted at Instructional Farm of Department of Floriculture and

Landscape Architecture, College of Horticulture, Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India during 2020-2021. The experiment was laid out in Randomized Block Design (RBD) with three replications. Fifteen genotypes were examined for growth, flowering and yield. In an open experimental field, plants were planted at spacing of 30x30 cm. As various quantitative characteristics, Plant height (cm), No. of leaves per plant, No. of primary branches per plant, Stem girth (mm), Plant spread (cm), No. of flower bud per plant, No. of flower per plant, No. of flower per stem, Flower size (cm), Flower weight(g), No. of Suckers per plant, Stalk length (cm) and as qualitative characteristics, Days to first flower bud appearance, Days taken to first flowering, Days to 50% flower senescence, Vase life of flowers (days) and flowering duration (days) were all recorded for three random plants. The analysis of variance was carried out using the method suggested by Gomez (1984)^[7]. The correlation coefficient was calculated from the genotypic and phenotypic co-variances as described by Singh

and Chaudhary (1979).

Results and Discussion

Quantitative characters

The result revealed that, highest plant height was recorded in variety Suneel (63.24 cm) among all the cultivars followed by Maghi (55.57cm) and Basanti (52.94cm). Significantly maximum number of leaves per plant recorded in Charmis (442.330) followed by Pitika (346.40) and Basanti (325.86), maximum number of primary branches per plant recorded in Pitika (12.60) followed by Charmis (10.80), and Maximum stem girth was recorded in variety Basanti (58.51 mm) followed by Suneel (54.97mm). Plant spread was found maximum in variety Basanti (60.20 cm) followed by Suneel (52.68cm), Charmis showed maximum number of flower buds per plant (176.46) followed by Vasantika (143.20) and number of flowers per plant recorded in genotype Charmis (165.33) followed by Pitika (139.33).

Table 1: Mean performance of chrysanthemum genotypes for various quantitative characteristics

S. No.	Genotypes	Plant height (cm)	No. of leaves/Plant	No. of primary branches per plant	Stem girth (mm)	Plant spread (cm)	No. of flower bud per plant	No. of flower per plant	No. of flower per stem	Flower size (cm)	Flower Wt.(g)	No. of Suckers per plant	Stalk length (cm)
T ₁	Jaya	45.88	230.93	7.93	37.74	36.28	91.46	80.33	16.06	6.83	5.33	5.66	4.50
T ₂	Gauri	42.18	278.53	7.66	37.08	31.94	95.73	84.06	19.93	3.80	4.00	5.06	4.56
T ₃	Vasantika	25.63	283.60	10.60	33.65	32.38	143.20	131.46	15.20	5.46	3.96	6.20	4.23
T ₄	White Prolific	29.88	85.40	7.46	29.83	24.14	32.26	24.40	7.20	5.53	10.39	3-00	3.56
T ₅	Pitika	18.29	346.40	12.60	37.84	34.92	140.53	139.33	28.80	2.83	1.07	8.00	3.80
T ₆	Charmis	20.20	442.33	10.80	41.60	41.40	176.46	165.33	21.53	4.30	4.58	5.93	6.36
T ₇	Dolly White	44.68	202.86	8.33	25.34	29.96	93.26	77.86	18.26	6.13	5.33	3.20	13.00
T ₈	Maghi	55.57	204.86	6.46	39.21	39.60	107.53	93.23	17.80	3.56	3.36	5.40	12.83
T ₉	Haldighati	13.82	103.26	6.13	29.50	14.95	48.93	39.86	10.26	4.66	2.30	3.00	1.30
T ₁₀	Suneel	63.24	304.06	9.46	54.97	52.68	124.86	109.66	22.53	6.76	12.63	2.33	7.43
T ₁₁	Basanti	52.94	325.86	8.20	58.51	60.20	129.40	117.20	31.00	4.43	3.36	2.86	4.03
T ₁₂	Puja	51.20	198.93	6.00	38.54	32.64	61.26	50.86	15.46	4.93	4.90	3.00	6.63
T ₁₃	Shyamal	35.30	66.53	5.86	23.62	25.01	22.93	16.46	5.26	5.76	13.48	2.60	4.83
T ₁₄	Little Darling	40.50	84.40	6.33	30.88	30.75	68.86	59.26	17.53	6.40	8.35	3.33	5.06
T ₁₅	Himanshu	18.46	228.46	5.33	28.16	30.17	116.34	107.26	23.06	5.86	2.62	4.06	3.26
	SEm±	0.49	23.39	1.14	2.72	0.49	4.16	3.69	2.05	0.21	0.24	0.51	0.23
	C.D.(P=0.05)	1.44	68.11	3.33	7.93	1.44	12.13	10.74	5.99	0.63	0.7	1.48	0.68
	C. V.	2.31	17.73	24.93	12.94	2.31	7.45	7.39	19.80	7.35	7.34	20.84	7.11

Basanti recorded maximum number of flowers per stem (31.00) followed by Pitika (28.80) and Himanshu (23.06), Maximum flower size was recorded in variety Jaya (6.83 cm), followed by Suneel (6.76 cm), flower weight recorded maximum in Shyamal (13.47 g) followed by Suneel (12.63 g). Pitika showed maximum number of suckers per plant (8.00) followed by Vasantika (6.20) and stalk length recorded maximum in variety Dolly White (13.00 cm) followed by Maghi (12.83 cm).

In the present study, plant height is attributed to be an important varietal character that depends upon the genetic constitution. The variation in plant height among the various genotypes might be due to genotypic difference s in phenotypic expression of plant height and variations in different genotype-environmental interaction effects on plant height (Bharti and Jawaharlal, 2014)^[4]. Such a range of variability in plant height among the varieties might be due to inherent genetic factors and morphological adaptations of the varieties to the microclimate, growing environmental conditions, production technology and cultural practices. The increased plant height might be due to rapid meristematic activity, probably true to rapid cell division and elongation during the tender growth stage (Sharova *et al.* 1977)^[23]. Variation in plant height is due to higher nutrient uptake,

especially N₂ is an important constituent of protoplasm and its favorable effect on chlorophyll content of leaves might have increased the synthesis of carbohydrate, amino acid etc. from which phytohormones such as auxin, cytokinins, gibberellins and ethylene have been synthesized resulting in increased plant height (Maynard and David 1987)^[15]. Such a wide range of variability for these traits is mainly due to genetic nature of the variety. The variety Suneel had maximum and Haldighati exhibited minimum plant height. Variation in plant height by different varieties has been advocated by Bala (2015)^[3], Siddiqua *et al.* (2017)^[24], Thakur *et al.* (2018)^[27] and Srilatha *et al.* (2015)^[25] in chrysanthemum. The data reported significant variation among all varieties.

Among the varieties, the number of leaves per plant and number of primary branches differed significantly. The difference in vegetative attributes of different varieties may be due to varied growth rate and their genetic makeup (Thakur *et al.* 2018)^[27]. The variety Charmis had maximum and Shyamal exhibited minimum number of leaves per plant. The data recorded pertaining to number of primary branches per plant showed non-significant variations among different varieties. The variation in number of primary branches per plant might be due to difference in their genetic composition and varied growth among the genotypes of marigold

(Mahantesh *et al.* 2018). The variety Pitika had maximum and Himanshu exhibited minimum number of primary branches per plant. Similar results were recorded by Kumar *et al.* (2015) [12], Thakur *et al.* (2018) [27], Parmar *et al.* (2019) [19], Bala (2015) [3] and Madhumathi *et al.* (2018) [14] in chrysanthemum.

The results of present investigation exhibited significant variation in stem girth and plant spread of chrysanthemum varieties. The maximum stem girth obtained the Variety Basanti, whereas the variety Shyamal reported minimum stem girth. The variety Basanti got maximum plant spread and the minimum plant spread obtained the variety Haldighati. The difference in plant spread per plant is a varietal trait as it is governed by the genetic makeup (Parmar *et al.* (2019) [19]. Increase in plant spread due to production of more number of branches and by the genetic nature of the plant. Plant height and plant spread are positively related to each other. Taller varieties have more plant spread compared to shorter cultivars (Poonam and Kumar, 2007). These results were corroborated with the findings of Bala (2015) [3], Kumar *et al.* (2015) [12], Roopa *et al.* (2018) [22] and Rymbai *et al.* (2017) in chrysanthemum.

The variety Charmis result maximum number of flower buds per plant, whereas minimum number of flower buds per plant observed in Shyamal and Charmis resulted in maximum number of flowers per plant, whereas minimum number of flowers per plant resulted in Shyamal. However, the variety Basanti significantly increased number of flowers per stem whereas Shyamal resulted in minimum number of flowers per stem. The present study is also confirmed with the findings of Ona *et al.* (2019), Rahim *et al.* (2020), Thiripurasundari *et al.* (2020) [28], Archana *et al.* (2019) [1], Kumar *et al.* (2014) [10], Thakur *et al.* (2018) [27], Negi *et al.* (2020) [16] and Parmar *et al.* (2019) [19] in chrysanthemum.

Among different varieties of chrysanthemum exhibited significant variation in flower size and flower weight. The variety Jaya produced maximum flower size while the minimum flower size observed in Pitika. However, the variety Shyamal significantly increased average flower weight of individual flower whereas Pitika resulted in minimum weight of individual flower. The results obtained by Thakur *et al.* (2018) [27], Kumar *et al.* (2014) [10], Archana *et al.* (2019) [1], Roopa *et al.* (2018) [22], Kireeti *et al.* (2017) [11], Patil *et al.* (2017) [20], Gantait and Pal (2011), Siddiqua *et al.* (2017) [24] and Negi *et al.* (2020) [16] in chrysanthemum.

The variety Pitika result maximum number of suckers per plant, whereas minimum number of suckers per plant observed in Shyamal. However, the variety Dolly White resulted in maximum stalk length, whereas minimum resulted in Haldighati. The present study is also confirmed with the findings of Deka and Talukdar (2015) [5], Rym bai *et al.* (2017), Jamaluddin *et al.* (2015) [9], Rai *et al.* (2016) [21], Rahim *et al.* (2020), Kumar *et al.* (2017) [13], Raghupathi *et al.* (2017) in chrysanthemum.

Qualitative characters

The aim of the evaluation was to know the genotypes performance in terms of initiation, duration and vase life of flowers in the region. The qualitative traits were recorded from the initiation of the first flower bud after transplanting (Table 2). Significantly early flower bud appearance was noticed in variety Vasantika (71.00 days) followed by Charmis (71.66 days) while minimum days taken to first flowering in Haldighati (86.86 days) followed by Charmis (90.00 days). Earliest 50% flower senescence found in variety Pitika (29.67 days) from the day when first flower bud appeared followed by Haldighati(34.33 days).

Table 2: Mean performance of chrysanthemum genotypes for various qualitative characteristics

S. No.	Genotypes	Days to first flower bud appearance	Days taken to first flowering	Days to 50% flower senescence	Vase life of flowers (days)	Flowering duration
T ₁	Jaya	91.33	114.93	48.00	9.76	34.66
T ₂	Gauri	93.33	130.26	58.00	11.40	47.00
T ₃	Vasantika	71.00	95.33	45.33	14.73	32.66
T ₄	White Prolific	83.00	95.46	47.33	9.20	33.66
T ₅	Pitika	76.33	95.66	29.67	14.46	19.00
T ₆	Charmis	71.66	90.00	45.66	14.33	31.66
T ₇	Dolly White	79.33	103.60	68.00	9.00	51.00
T ₈	Maghi	98.33	125.80	56.66	11.66	53.00
T ₉	Haldighati	82.66	86.86	34.33	8.00	29.33
T ₁₀	Suneel	89.00	112.26	52.00	10.50	36.33
T ₁₁	Basanti	92.33	113.73	49.66	12.13	40.00
T ₁₂	Puja	88.33	119.26	44.66	7.66	37.33
T ₁₃	Shyamal	93.66	106.66	53.66	7.80	42.33
T ₁₄	Little Darling	86.66	109.00	45.33	10.63	39.33
T ₁₅	Himanshu	86.33	96.60	38.66	7.66	33.33
	SEm±	3.65	3.25	5.15	0.44	4.49
	C.D.(P=0.05)	10.65	9.48	15.01	1.29	13.08
	C. V.	7.4	5.30	18.68	7.25	20.81

Maximum vase life of flowers recorded in variety Vasantika (14.73 days) followed by Pitika (14.46 days) while maximum flowering duration was recorded in variety Maghi (53.00 days) followed by Dolly White (51.00 days).

Data regarding days to first flower bud appearance, days taken to first flowering and flowering duration determines whether a variety is early or late flowering which is an important parameter while selection. Both these traits are helpful in ascertaining availability of flowers for a longer period. It is evident from the data in that there was significant

differences among the varieties in days taken to first flower bud appearance, days taken to first flowering and flowering duration and these results were also experimentally substantiated by Archana *et al.* (2019) [1], Thakur *et al.* (2018) [27], Kumar *et al.* (2015) [12], Singh *et al.* (2017) [26], Jamaluddin *et al.* (2015) [9] and Kireeti *et al.* (2017) [11] in chrysanthemum. The variation for time taken for flowering might be due to the genetic makeup of the variety or the influence of variety and environment by Roopa *et al.* (2018) [22].

Present study found that there is significant variation among various varieties of chrysanthemum. The maximum days to 50% flower senescence observed in variety Dolly White, whereas the minimum days to 50% flower senescence recorded in Pitika. While the variety Vasantika prolonged significantly maximum vase life (14.73 days) than other varieties. Minimum vase life exhibited in Himanshu and Puja. These findings are also in accordance with results of Thakur *et al.* (2018)^[27], Kumar *et al.* (2014)^[10], Archana *et al.* (2019)^[1], Parmar *et al.* (2019)^[19], Kireeti *et al.* (2017)^[11] and Patil *et al.* (2017)^[20] in chrysanthemum flower.

Conclusion

Based on the findings of present study, it can be concluded that variety Charmis and Basanti has performed best for quantitative characters. In these varieties, desirable traits like number of leaves per plant, number of flower buds per plant, number of flowers per plant, stem girth, plant spread, number of flowers per stem recorded high whereas Vasantika has performed best for qualitative characters like days to first flower bud appearance, vase life. These varieties can be recommended for commercial production in Bundelkhand region for important flower yield attributes.

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