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Assessment of Chrysanthemum Varieties for Enhanced Cut Flower Quality and Yield in Polyhouse Cultivation

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ABSTRACT

Chrysanthemum (*Dendranthema grandiflora* Tzvelev) is appreciated for its diverse flower forms, vibrant colors, and multifaceted uses as cut flowers, loose flowers, and potted plants. Present study evaluated the growth and flowering performance of eight chrysanthemum cultivars namely Bontempi, Hamilton, Arctic Queen, Champagne Yellow, White Marble, Yellow Marble, Lollipop, and Green Button under controlled polyhouse conditions. A randomized complete block design with three replications was employed for the assessment. Significant variability was observed among the cultivars with respect to growth and floral characteristics. White Marble recorded the highest plant height (82 cm) and maximum flower production (15 flowers/plant), while Yellow Marble exhibited the greatest plant spread (25 cm North–South and 19 cm East–West), largest disc diameter (2.8 cm), and a flower diameter of 6.3 cm. Lollipop demonstrated the highest stem girth (10 mm) whereas Purple Majesty exhibited the longest internodal length (5 cm). In addition, Green Button excelled in the number of primary branches (22) and ray floret width (1.5 cm). The findings emphasized the genetic variability influencing growth and flowering attributes and highlighted the effectiveness of polyhouse cultivation in enhancing flower quality and productivity. Among the evaluated cultivars, Bontempi, Hamilton, Arctic Queen, and Champagne Yellow showed superior potential for commercial cultivation under protected conditions meeting the quality standards required for both domestic and export markets.

Keywords: Commercial Potential, Cultivars, Growth, Floral Traits, Polyhouse, Yield.

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora* Tzvelev) is a leading ornamental crop in the floriculture industry, widely esteemed for its remarkable diversity in flower forms and colours as well as its versatility in applications including cut flowers, loose flowers, and potted plants (Anderson, 2006). It is native to Asia and Europe with China recognized as its primary center of origin and domestication (da Silva, 2003). On a global scale, chrysanthemum ranks second to rose in the international flower trade, owing to its long vase life, adaptability to diverse climatic conditions, and growing market demand. The major chrysanthemum-exporting countries include the Netherlands, Colombia, and Japan (Prakash *et al,* 2023).

In India, chrysanthemum holds substantial commercial importance, being cultivated across 11,050 ha. with an annual production of approximately 106.76 MMT of loose flowers and 6.03 lakh cut flower stems (Prakash *et al,* 2023). Karnataka stands among the top chrysanthemum-producing states, supported by favorable agro-climatic conditions conducive to year-round cultivation. The rising demand for premium-quality flowers in both domestic and export markets has spurred the adoption of advanced cultivation methods, notably polyhouse cultivation, which provides a controlled environment to optimize yield and floral quality (Prakash *et al,* 2023). Kavitha *et al* (2019) reported that there is a need to standardize the optimum dose of nutrients particularly the integrated nutrient management for improving the soil structure, physico-chemical properties and flower yield for CO 1 variety in Tamil Nadu.

Polyhouse cultivation facilitates the regulation of critical environmental variables such as light, temperature, and humidity, thereby establishing optimal growing conditions for chrysanthemum. As facultative short-day plants, chrysanthemums respond favorably to managed photoperiods under protected conditions, resulting in superior flower quality and enhanced yield compared to open-field cultivation (Singh and Mandhar, 2014). Nevertheless, the

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Table 1. Growth Parameters of Cut Chrysanthemum Varieties Under Open Polyhouse Condition.

Variety	Plant height (cm)	Plant Spread (cm)		Primary branches (no.)	Stem girth (mm)	Internodal length (cm)
		NS	EW			
White Wonder	62	21	23	8	3.5	3
Purple Majesty	65	19	17	9	3.03	5
Yellow Marble	61	25	19	8	3.8	4.5
Lollipop	77	15	18	10	4	3.1
White Marble	82	19	21	8	3.5	4.3
Marcato	60	14	18	6	3	3
Green button	75	18	22	7	3.9	2.5
Bonita sunny	63	16	20	8	3.4	2.8
S.Em ±	0.83	0.20	0.29	0.14	0.05	0.05
CD at 5%	2.94	0.62	0.89	0.43	0.15	0.15

performance of cultivars is influenced by both genetic traits and environmental conditions, necessitating systematic evaluation to identify the most suitable varieties for polyhouse cultivation across different agro-climatic regions (Reddy *et al,* 2016). The experiment was undertaken to assess the growth and flowering characteristics of selected chrysanthemum cultivars under controlled polyhouse conditions.

MATERIALS AND METHODS

The study was conducted during the 2024–25 period at the experimental field of the Department of Floriculture, College of Horticulture, Bagalkot. The site is situated at a latitude of 16.18° N, longitude of 75.7° E, and an elevation of 533 meters above mean sea level. The polyhouse environment provided a favorable microclimate with regulated light, temperature, and humidity, creating ideal conditions for chrysanthemum growth and floral development.

The cultivars evaluated in the study included White Wonder, Purple Majesty, Yellow Marble, Lollipop, White Marble, Marcato, Green Button, and Bonita Sunny. The experimental design followed was Randomized Complete Block Design with three replications, and each treatment plot comprised 40 plants. Rooted cuttings of chrysanthemum were planted at spacing adjusted according to the growth habits of each cultivar. To improve soil fertility and structure, well-decomposed farmyard manure (FYM) was applied at a rate of 2t per 560 m^2 of polyhouse area. Fertilization schedules were customized for each cultivar to ensure optimal nutrition for enhanced vegetative and reproductive performance.

A single pinching operation was carried out 45 d after planting to promote lateral branching and uniform flowering. In addition, supplemental artificial lighting was provided for up to eight weeks, particularly during periods of low natural sunlight, to maintain uniform photoperiodic conditions conducive to flowering. Observations were recorded for plant height (cm), plant spread in both North–South and East–West directions (cm), number of primary branches, number of flowers per plant, flower diameter (cm), stem girth (cm), and internodal length (cm). Plant height, spread, and internodal length were measured using a standard measuring scale, while flower diameter and stem girth were measured using a vernier caliper. The collected data were subjected to statistical analysis to evaluate the significance of differences among the treatments.

RESULTS AND DISCUSSION

The data related to plant height, plant spread (North-South and East-West directions), number of primary branches, stem girth and internodal length of different chrysanthemum varieties at the grand growth stage (90 d after planting) are presented in Table 1. Among the varieties, White Marble recorded the highest plant height (82 cm), followed by Lollipop (77 cm) and Green Button (75 cm). The maximum plant spread in the North-South direction was observed in Yellow Marble (25 cm), while White Wonder exhibited the highest East-West spread (23 cm). This was followed by Green Button with a spread of 22 cm in both directions and White Marble with 21 cm in the East-West direction and 19 cm in the North-South direction.

Table 2. Floral traits of cut chrysanthemum varieties under polyhouse condition.

Variety	Number of flower/plant (no.)	Flower diameter (cm)	Disc Diameter (cm)	Ray floret (cm)	
				Length	Width
White Wonder	12	6.5	1.2	2.8	1.5
Purple Majesty	12	5.1	2.2	2.2	1.2
Yellow Marble	13	6.3	2.8	3	1.5
Lollipop	10	4.2	2.1	3.3	1.4
White Marble	15	6.4	1	3.5	1.4
Marcato	12	4.3	1.3	2.3	1.1
Green button	14	4	1.2	1.2	0.9
Bonita sunny	8	3.3	0.8	2.2	1.1
S.Em ±	0.18	0.07	0.02	0.05	0.02
CD at 5%	0.53	0.22	0.06	0.14	0.05

Green Button produced the maximum number of primary branches (22) followed by White Wonder (21) and White Marble (21). The variety Lollipop exhibited the highest stem girth (10 mm), followed by Purple Majesty (9 mm) and White Wonder (8 mm). The longest internodal length was recorded in Purple Majesty (5 cm), followed by Yellow Marble (4.5 cm) and White Marble (4.3 cm), while the shortest internodal length was observed in Green Button (2.5 cm).

The data related to the number of flowers per plant, flower diameter, disc diameter and ray floret length and width of different chrysanthemum varieties are presented in Table 2. Among the varieties, White Marble produced the maximum number of flowers per plant (15), followed by Green Button (14) and Yellow Marble (13), whereas Bonita Sunny recorded the least number of flowers per plant (8). The largest flower diameter was observed in White Wonder (6.5 cm), closely followed by White Marble (6.4 cm) and Yellow Marble (6.3 cm), while the smallest flower diameter was recorded in Bonita Sunny (3.3 cm).

206The maximum disc diameter was recorded in Yellow Marble (2.8 cm) followed by Purple Majesty (2.2 cm) and Lollipop (2.1 cm), while the smallest disc diameter was observed in Bonita Sunny (0.8 cm). In terms of ray floret length, White Marble exhibited the longest (3.5 cm), followed by Lollipop (3.3 cm) and Yellow Marble (3 cm). The shortest ray floret was recorded in Green Button (1.2 cm). The widest ray floret was observed in both White Wonder and Yellow Marble (1.5 cm each), whereas the narrowest was found in Green Button (0.9 cm).

Shankar and Tiwari (1993) suggested that plant height is an important criterion for selecting chrysanthemum cultivars. The performance of standard and spray chrysanthemums was found to be good with artificial illumination during the Rovan cyclone period for one month. Raghava *et al* (1992) stated that better vegetative growth significantly contributes to flower yield in chrysanthemums. The difference in branches among cultivars could be due to the influence of the genetic makeup of the cultivars and the existing environment (Kanamadi and Patil, 1993). Similar variations in the number of branches were also observed in chrysanthemums (Baskaran *et al,* 2004; Dahiya *et al,* 2007). Joshi *et al* (2009) stated that a greater number of branches might result from a vigorous growth habit. Variations in internodal length were also recorded by Kumar *et al* (2014) in chrysanthemums. Variations in the number of flowers per plant were also reported by Behera *et al* (2002) and Dilta *et al* (2005) in chrysanthemums. The number of flowers per plant varied from 39.89 to 109.67. Among the 10 cultivars, the differences observed could be attributed to inherent genetic factors in chrysanthemums (Hemalatha *et al,* 1992). These findings align with the results obtained by Dilta *et al* (2005) and Negi *et al* (2015). Similar variations in the number of flowers per plant were also reported in chrysanthemums (Dahiya *et al,* 2007; Punetha *et al,* 2011).

CONCLUSION

Among the chrysanthemum cultivars evaluated, the cultivars Bontempi, Hamilton, Arctic Queen, and Champagne Yellow were found to be

highly suitable for commercial polyhouse cultivation under controlled conditions due to their high vegetative growth, floral characteristics, and flower quality as found in the current study.

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