

# Performance of Standard and Spray Chrysanthemum Cultivars (*Dendranthema grandiflora* Tzvelev.) in Polyhouse Conditions

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**Abstract**—An experiment was conducted in polyhouse conditions to evaluate 14 cultivars of chrysanthemum including five standard types and nine spray types. Among standard types maximum plant height (115.79 cm), flower diameter (14.08 cm) and flower stalk length (96.72 cm), and minimum number of days for 50 per cent flowering (122.25) was recorded in cv. Snow Ball, Maximum number of primary branches per plant (5.97) in cv. Star White. Chandrama recorded maximum internodal length (4.67 cm) and maximum flower stalk girth (11.20 mm). Maximum Leaf area index per plant (2.04) was noted in cv. Golden Yellow. Among the spray cultivars, cv. Star Pink recorded maximum plant height (104.29 cm), flower diameter (6.77 cm) and flower stalk girth (6.81 mm). Terry showed (6.48) maximum number of primary branches per plant. The cv. Yellow Spoon (94.63 cm) recorded maximum stalk length. Maximum internodal length (3.56 cm), minimum number of days to 50 per cent flowering (133.50) was noted in cv. Red Stone. Bronze spoon recorded maximum (0.76) leaf area index, more number of flowers per plant (109.67) and number of flowers per square metre (1108.50).

**Keywords:** Standard chrysanthemum, Spray chrysanthemum cultivars, Growth and flower characteristics.

## 1. INTRODUCTION

Chrysanthemum is one of the most beautiful and perhaps the oldest flowering plant, commercially grown in different parts of the world. Chrysanthemum (*Dendranthema grandiflora* Tzvelev) is popular flower meaning *Chryso* – golden, *anthos* – flower, a leading flower crop grown in many parts of the world. It belongs to family Asteraceae (Composite) native to Northern Hemisphere, chiefly Europe and Asia with a few in other areas. It is one of the most beautiful flowering plant referred to as “Queen of the East” and “Autumn flower”. Its commercial cultivation is being done in states viz., Maharashtra, Rajasthan, Madhya Pradesh and Bihar and in places viz., Delhi, Kolkatta, Lucknow, Kanpur and Allahabad mainly for the sake of decoration and participating in flower shows, with the help of pot grown plants. Chrysanthemums are mainly classified under two categories: Large flowered

(standard type) and small flowered (spray type). Large flowered chrysanthemums which produce long, sturdy stems and good keeping quality are further classified into 13 classes which make it suitable for flower arrangement, cut flower production and as potted flowering plant for exhibition and decoration. The extra large bloomed cultivars are used for exhibition value, bouquets, vase etc, whereas small flowered are mostly grown for loose flower and are classified into 10 classes. The standard type flowers fetch higher prices though their share in export market is less but spray types have smaller flower size and have major share in the world market. In International cut flower trade, chrysanthemum ranks next to rose (Bhattacharjee and De, 2003).

## 2. MATERIALS AND METHODS

The experiment was conducted in naturally ventilated polyhouse at Horticultural college and research institute, located at Anantharajupeta, Kadapa district, Andhra Pradesh during the period October 2015 – March 2016. The experimental material consisted of five standards viz., Snow Ball – irregular incurve large, Golden Yellow - irregular incurve large, Angel Pink - spider large, Star White – regular incurve large and Chandrama – intermediate incurve large and nine spray viz., Terry – anemone, White Dolly – anemone, Yellow Spoon – spoon, Red Stone – decorative, Star Pink – decorative, Bronze Spoon – spoon, Paper White – decorative, Kelvin Victory – Pompon and Indiana – pompon cultivars of chrysanthemum. The experiment was laid out in Randomized block design (RBD) with four replications. Five plants were randomly selected from each replication for carrying out performance studies. All the recommended practices were followed. Artificial illumination was provided during Rovani cyclone period for duration of one month during Nov 2015 uniformly for all the replications to continue the vegetative growth of the plants. The data on various vegetative and floral characters were recorded and statistically analysed.

### 3. RESULTS AND DISCUSSION

The data recorded on growth and flowering parameters of standard and spray types presented in Table 1 and 2 revealed significant variations among the cultivars. Among standard cultivars, Snow Ball recorded maximum (115.79 cm) plant height followed by cv. Chandrama (102.20 cm) which were statistically on par with each other whereas cv. Golden Yellow recorded minimum (93.87 cm). Regarding the spray cultivars, cv. Star Pink recorded maximum (104.29 cm) plant height followed by cv. Yellow Spoon (92.59 cm) while it was minimum in cv. Paper White (69.86 cm). The results were in accordance to the findings of Subbiah *et al.* (1973 and 1974) that increase in mean growth rate, plant height, stalk length were dependent on long day conditions and supplemental light provided during vegetative growth.

The standard cv. Star White recorded maximum number of primary branches (5.97) followed by cv. Chandrama (4.14) while it was minimum for cv. Golden Yellow (2.23) in standard cultivars. Among the spray cultivars, cv. Terry recorded maximum number of primary branches (6.48) followed by cv. Yellow Spoon (5.75) while it was less for cv. Red Stone (2.82). Joshi *et al.* (2009) stated that more number of branches might be due to vigorous growth habit.

Maximum internodal length (4.67 cm) was recorded by standard cv. Chandrama followed by cv. Angel Pink (4.43 cm) while minimum (3.73 cm) was recorded by cv. Golden Yellow in standard cultivars. Regarding the spray cultivars, cv. Red Stone showed maximum internodal length (3.56 cm) followed by cv. Indiana (3.30 cm) whereas cv. White Dolly recorded minimum internodal length (2.37 cm). Similar variation due to varieties with respect to internodal length was also recorded by Kumar *et al.* (2014) in chrysanthemum.

Among the standard cultivars, cv. Golden Yellow noted maximum (1.12) leaf area index followed by cv. Chandrama (1.00) whereas minimum (0.68) in cv. Angel Pink. Bronze Spoon showed maximum (0.76) followed by cv. Star Pink (0.73) while minimum in cv. Kelvin Victory (0.38) among the spray cultivars. Nair *et al.* (2002) also reported that higher leaf area index and more number of leaves per plant would have resulted in production and accumulation of maximum photosynthates, resulting in the production of more number of flowers with bigger size flowers in gerbera indicating the vigorous nature of the cultivars.

The standard cv. Snow Ball took minimum number of days (122.25) to 50 percent flowering followed by cv. Star White (127.25 days) whereas cv. Golden Yellow took maximum number of days (137.25) to 50 percent flowering. Among the spray cultivars, cv. Red Stone took minimum number of days (133.50) to 50% flowering followed by cv. Indiana (143 days) whereas cv. Yellow Spoon took maximum number of days (154.50) to 50% flowering. The results are in accordance with the findings of Shekara *et al.* (2013) in daisy.

The non – significant differences were noticed among the standard cultivars indicate that all these five cultivars are of standard type which bears only one flower of large size stem. Variation among the cultivars with regard to number of flowers produced per plant was also reported by Behera *et al.* (2002) and Dilita *et al.* (2005) in chrysanthemum. Among 9 spray cultivars, cv. Bronze Spoon produced maximum number of flowers (109.67) per plant followed by cv. Indiana (92.64), cv. Terry (74.51) whereas cv. Red Stone produced minimum number of flowers (39.89) per plant (Fig 1b). Such differences observed among these cultivars might be due to the inherent genetic factors as reported by Hemalata *et al.* (1992) in chrysanthemum.

There was significant variation observed for stalk length among the standard cultivars *viz.*, cv. Snow Ball recorded maximum stalk length (96.72 cm) followed by cv. Chandrama (82.68 cm) whereas minimum (45.62 cm) was observed in cv. Angel Pink. (Fig 1a) Regarding the spray cv. Yellow Spoon recorded maximum stalk length (94.63 cm) followed by cv. Star Pink (86.14 cm) while minimum stalk length (57.56 cm) was recorded in cv. Paper White. (Fig 1b). It was observed that the cultivars with higher plant height produced the longer flower stalk as compared to cultivars with lower plant as stated by Jamal *et al.* (2015) in chrysanthemum. Similar findings were reported by Ramzan *et al.* (2014), Mantur *et al.* (2005), Fascella and Zizzo (2005) in rose.

The cv. Golden Yellow recorded maximum leaf area index per plant (2.04) followed by cv. Chandrama (1.00) whereas minimum was observed in cv. Angel Pink (0.47). Maximum leaf area index per plant (0.76) was recorded in cv. Bronze spoon followed by cv. Star pink (0.73) whereas minimum was observed in cv. Kelvin Victory and red stone (0.38). Higher leaf area index and more number of leaves per plant as well as plant spread would have resulted in production and accumulation of maximum photosynthates, resulting in the production of more number of flowers with bigger size. The results are in accordance with the findings of Naik *et al.* (2006) in gerbera.

The cv. Snow Ball took minimum number of days (122.25) to 50 percent flowering followed by cv. Star White (127.25 days) whereas cv. Golden Yellow took maximum number of 137.25 days. Among the spray cultivars, cv. Red Stone took minimum number of days (133.5) followed by cv. Indiana (143 days) whereas cv. Yellow Spoon took maximum number of days (154.50) to 50% flowering. Similar variations in observation due to varietal trends were also observed by Shekara *et al.* (2013) in daisy

Maximum flower stalk girth (11.20 mm) was observed in cv. Chandrama followed by cv. Snow Ball (7.63 mm) while minimum (6.05 mm) was recorded by cv. Golden Yellow among the standard type chrysanthemum. Regarding the spray cultivars, cv. Star Pink (6.81 mm) showed maximum flower stalk girth followed by cv. Bronze Spoon (6.37 mm) and minimum (4.81 mm) was observed by cv. White Dolly.

Flower stalk girth plays an important role in the post harvest vase life of cut flowers, as the diameter increases the carbohydrates content of the stalk also increases thereby prolonged the vase life of the cut flowers as stated by Vetrivel and Jawaharlal (2014) in chrysanthemum and Hedau *et al.* (2012) in gerbera.

Maximum flower diameter (14.08 cm) was observed in cv. Snow Ball followed by cv. Star White (12.33 cm) and minimum (10.41 cm) was observed by cv. Angel Pink. Among the spray cv. Star Pink recorded maximum flower diameter (6.77 cm) followed by cv. Red Stone (6.42 cm) and they were statistically on par with each other but found significantly superior over other cultivars whereas cv. Indiana recorded minimum flower diameter (3.32 cm). Greater leaf area may lead to more dry matter accumulation, which resulted in the accumulation of maximum photosynthates that contributed to produce bigger sized flower or more number of flowers by Jamal *et al.* (2015).

The non – significant differences among these cultivars indicate that all these five cultivars are of standard types

which were allowed to bear only three single large flowers per plant (Fig 1 a). More number of flowers (1108.50) per square metre were produced by cv. Bronze Spoon followed by cv. Indiana (923.75), cv. Terry (718.55) whereas less number of flowers (387.63) were produced by cv. Red Stone regarding spray cultivars. Higher yields were due to the more number of flowers and heavier flowers per plant as reported by Sri Latha *et al.* (2015) in chrysanthemum.

The cv. Golden Yellow lasts longer (14.00 days) with sucrose (2%) + 8HQC (500 ppm) followed by cv. Star White (12.00 days) whereas minimum (6.75 days) was recorded by cv. Angel Pink regarding standard cultivars (Fig 2a). In case of spray cultivars the cv. Red Stone lasts longer (9.50 days) followed by cv. Bronze Spoon (8.75 days) whereas minimum (5.50 days) was recorded by cv. Star Pink (Fig 2b). The variations in vase life may be due to the different accumulation of carbohydrates due to varied leaf production and sensitivity of cultivars to ethylene and turn variations in these aspects might be due to genetical makeup of genotypes was reported by Vetrivel and Jawaharlal (2014) in chrysanthemum.

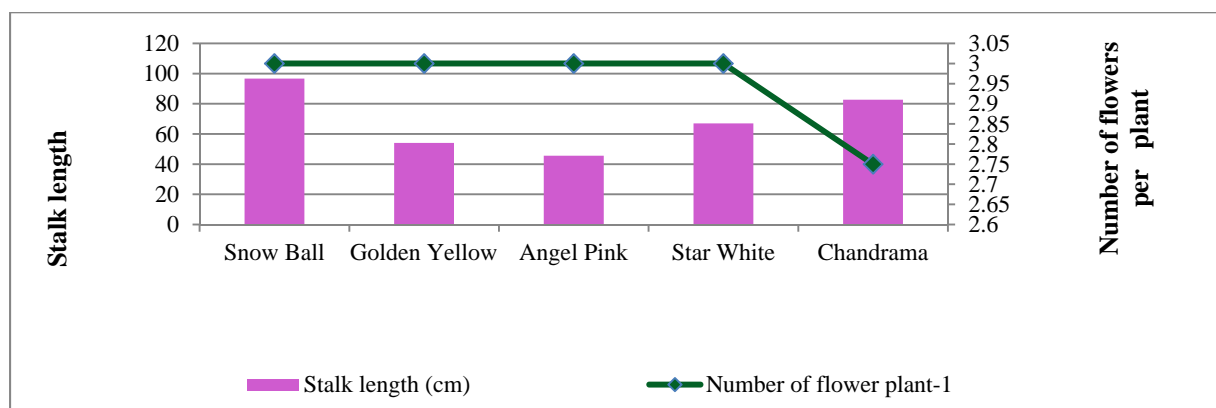


Fig.1(a) Stalk length (cm) and number of flower per plant in standard chrysanthemum cultivars

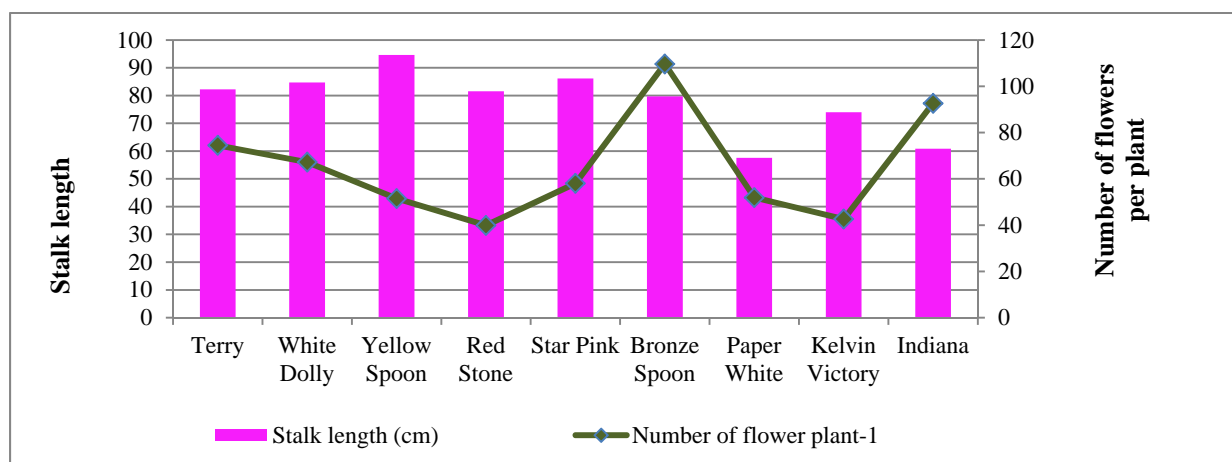


Fig 1(b) Number of flowers plant<sup>-1</sup> and Stalk length (cm) in spray chrysanthemum cultivars

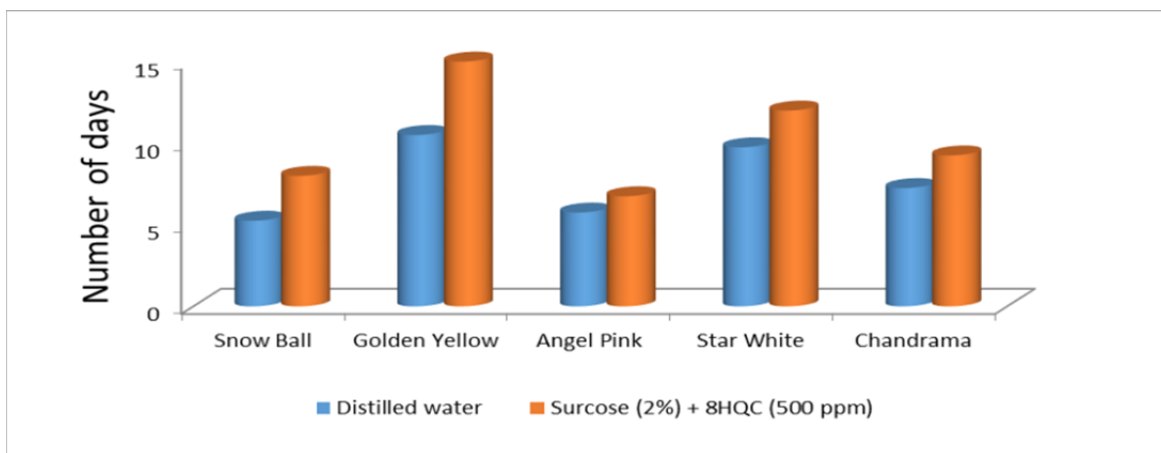


Fig 2(a) Vase life in days indifferent vase solutions of standard chrysanthemum cultivars

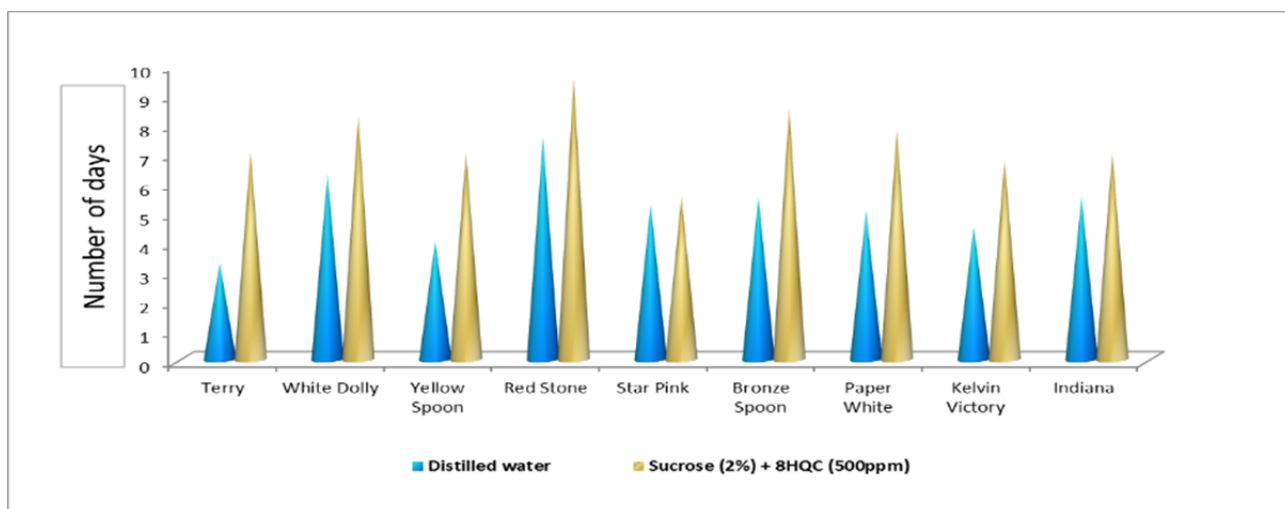


Fig 2(b) Vase life in days indifferent vase solutions of Spray chrysanthemum cultivars

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**Table 1: Performance of standard chrysanthemum cultivars for vegetative and flowering parameters under naturally ventilated polyhouse conditions**

Cultivars	Plant height (cm)	Primary branches	Inter nodal length (cm)	Leaf area index per plant	No. of days to 50 per cent flowering	Flower diameter (cm)	Flower stalk length (cm)	Flower stalk girth (mm)	No. of flowers per square metre	Vase life in sucrose (2%)+ 8HQC (500ppm)
Snow Ball	115.79	3.80	3.92	0.72	122.25	14.08	96.72	7.63	30.00	8.00
Golden Yellow	93.87	2.23	3.73	2.04	137.25	10.61	54.06	6.05	30.00	14.00
Angel Pink	100.28	3.24	4.43	0.68	130.00	10.41	45.62	6.57	30.00	6.75
Star White	96.81	5.97	4.14	0.91	127.25	12.33	67.06	7.07	27.50	12.00
Chandrama	102.20	4.14	4.67	1.00	133.75	11.18	82.68	11.20	30.00	9.25
S.Em±	3.48	0.19	0.09	0.01	0.96	0.14	0.95	0.14	1.12	0.24
CD (P=0.05)	10.73	0.60	0.28	0.03	2.96	0.42	2.93	0.44	3.45	0.70

**Table 2: Performance of spray chrysanthemum cultivars for vegetative & flower parameters under naturally ventilated polyhouse conditions.**

Cultivars	Plant height at harvest (cm)	Primary branches	Internodal length (cm)	Leaf area index per plant	No. of days to 50 per cent flowering	Flower diameter (cm)	Flower stalk length (cm)	Flower stalk girth (mm)	Number of flowers per plant	No. of flowers per square metre	Vase life in sucrose (2%)+ 8HQC (500ppm)
Terry	88.50	6.48	2.97	0.51	146.75	3.73	82.26	6.32	74.51	718.55	7.00
White Dolly	83.12	5.29	2.37	0.48	147.50	5.38	84.72	4.81	67.25	680.23	8.25
Yellow Spoon	92.59	5.75	3.22	0.64	154.50	4.56	94.63	5.85	51.49	516.38	7.00
Red Stone	92.44	2.82	3.56	0.38	133.50	6.42	81.55	5.62	39.89	387.63	9.50
Star Pink	104.29	4.14	3.25	0.73	148.00	6.77	86.14	6.81	58.04	560.40	5.50

Bronze Spoon	74.79	3.80	2.95	0.76	150.25	5.17	79.71	6.37	109.67	1108.50	8.75
PaperWhite	69.86	3.64	3.10	0.41	143.75	5.55	57.56	6.36	51.91	540.03	7.75
Kelvin Victory	78.75	4.67	2.88	0.38	148.50	3.57	73.97	4.88	42.63	439.28	6.75
Indiana	73.72	3.46	3.30	0.50	143.00	3.32	60.83	5.22	92.64	923.75	7.00
S.Em±	1.04	0.11	0.13	0.04	1.49	0.12	2.08	0.12	1.15	4.95	0.11
CD (P=0.05)	3.02	6.48	0.38	0.12	4.35	0.36	6.08	0.36	3.35	14.46	0.31