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RESEARCH ARTICLE :

Flower quality parameters and vase life studies of standard chrysanthemum cultivars (*Dendrathema grandiflora* Tzvelev) in polyhouse conditions

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SUMMARY : An experiment was conducted to evaluate the flowering and vase life performance of standard chrysanthemum cultivars in naturally ventilated polyhouse condition. Among five standard chrysanthemum cultivars Snow ball recorded maximum plant height (115.79 cm), early flower bud initiation (83.50 days), flower stalk length (96.72 cm), flower diameter (14.08 cm) whereas cv. CHANDRAMA recorded maximum flower stalk girth (11.20 mm) and weight of cut stem (156.99g). The maximum vase life (14.00 days) was observed by cv. GOLDEN YELLOW in vase life solution of sucrose (2 %) + 8HQC (500 ppm). The maximum fresh weight (76.53 g) was recorded by cv. CHANDRAMA on second day. Snow Ball recorded maximum (11.76 g) transpiration loss of water on day 1-2 whereas the maximum (9.48 g) water uptake was noted by cv. SNOW BALL on day 0-1 followed by Angel Pink (6.82 g).

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KEY WORDS :
Standard chrysanthemum cultivars, NVPH, Flower characteristics, Vase life studies

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BACKGROUND AND OBJECTIVES

Chrysanthemum is one of the most beautiful and perhaps the oldest flowering plant, commercially grown in different parts of the world. Chrysanthemum (*Dendranthema grndiflora* Tzvelev) is popular flower meaning *Chryos* – 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". The present number of varieties in the world is about 2000 and in India there are about 1000 varieties (Datta and Bhattacharjee, 2001). In International cut flower trade, chrysanthemum ranks next to rose (Bhattacharjee and De, 2003).

The chrysanthemum has been recognized in India as one among the five important commercially potential flower crops by the All India Co-ordinated Floriculture

Improvement Project (ICAR) and is most important flower grown on commercial scale. 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.

Recently the hi-tech units are also venturing for cultivation under green house conditions. Today with the advancement of technology like using the greenhouse for climate control and with the arrival of foreign collaborations with expertise and resources, chrysanthemum cultivation is all set to go hi- tech. At present in India, growing chrysanthemum using the modern methods to alter photoperiod mechanism is at nascent stage with most of the growers concentrated in Bangalore, Pune, Delhi, Calcutta and Yercaud but more and more entrepreneurs are now preparing to take up chrysanthemum cultivation in polyhouse. World trade of fresh cut flower is increasing, day by day. Cut flowers make up about one-third of the value of the global ornamental horticulture market. Fresh flowers lose their freshness and quality both during travel and also during and after arrangements due to flower specific short vase life. Such deficiencies can be ameliorated through application of nutrient additives to vase water.

RESOURCES 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 standard cultivars of chrysanthemum such as Snow Ball – irregular incurve large, Golden Yellow – irregular incurve large, Angel Pink – spider large, Star White – regular incurve large and Chandrama – intermediate incurve large. 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 as recommended by TNAU were followed. The data on various vegetative characters and floral characters were recorded and statistically analysed. The stems were harvested with help of sharp secateurs at 8:00 am in the morning when 50 per cent of flowers were about ¾ th open. The stems length of all flowers were uniformly maintained i.e 35 cm. The cut stems were kept in sucrose (2 %) + 8HQC (500 ppm). The experiment was laid out in CRD with three replications. Observations like vase life, fresh weight of flower, water uptake and transpiration loss of water.

OBSERVATIONS AND ANALYSIS

The data recorded on flowering parameters and vase life studies were presented in Fig. 1 to 3 and Tables 1 to 4 revealed significant variations among the standard chrysanthemum cultivars.

Plant height (cm) :

Snow Ball recorded maximum plant height at harvest (115.79 cm) followed by cv. CHANDRAMA (102.20 cm) which were statistically on par with each other and significantly superior over rest of the cultivars whereas cv. GOLDEN YELLOW recorded minimum plant height (93.87 cm) (Table 1). Shanker and Tiwari (1993) suggested that plant height is an important criterion for selecting chrysanthemum cultivars. Manohar Rao and Pratap (2006) reported that taller plants are generally preferred for cut flower production, whereas medium to short plants are more suitable for high density planting and pot culture in chrysanthemum.

Table 1 : Vase life of standard chrysanthemum cultivars

Name of the cultivar	Sucrose (2%) + 8HQC (500ppm) (days) (S_2)
C_1: Snow Ball	8.000
C_2: Golden Yellow	14.000
C_3: Angel Pink	6.750
C_4: Star White	12.000
C_5: Chandram	9.250
C.D. (P=0.05)	1.546
S.E.+	0.508

Days taken for first flower bud initiation :

The cv. SNOW BALL took minimum number of days

(83.50) to first flower bud initiation followed by cv. STAR WHITE (89) and they were statistically at par with each other and found significantly superior over other cultivars whereas cv. GOLDEN YELLOW took maximum number of days (107.75) to first flower bud initiation (Table 1 and Fig. 1). Variation for late or early flowering seems to be genetically controlled characters in the varieties as stated by Behera *et al*. (2002) in chrysanthemum. Days to bud initiation varied among germplasm were also stated by Joshi *et al*. (2010) in chrysanthemum.

Stalk length (cm) :

Among the five standard cultivars 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. 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) in chrysanthemum.

Flower diameter (cm) :

Significant difference was recorded among the cultivars, where 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. 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). Similar variation was observed by Barigidad and Patil (1992) in chrysanthemum and Gharge *et al*. (2009) and Shiragur *et al*. (2004) in carnation.

Flower stalk girth (mm) :

Chandrama recorded maximum stalk girth (11.20

Table 2 : Fresh weight (g) changes during the period of vase life studies in standard chrysanthemum cultivars

Name of the cultivars	1 day	2 day	3 day	4 day	5 day
Snow Ball	49.323	50.683	46.880	45.658	43.508
Golden Yellow	48.708	51.010	48.938	45.380	43.418
Angel Pink	52.750	54.858	51.048	45.153	40.583
Star White	59.298	61.008	58.705	57.260	55.335
Chandrama	74.268	76.535	74.385	72.428	70.420
C.D. (P=0.05)	0.787	0.968	0.884	0.677	0.447
S.E. ±	0.259	0.318	0.284	0.223	0.147

Table 3 : Transpiration loss of water (g) (TLW) during the period of vase life studies in standard chrysanthemum cultivars

Name of the cultivars	Day 0-1	Day 1-2	Day 2-3	Day 3-4	Day 4-5
Snow Ball	6.338	11.760	4.525	4.113	3.505
Golden Yellow	4.618	3.600	3.685	3.523	2.630
Angel Pink	5.700	5.788	3.490	2.603	4.565
Star White	4.443	3.515	2.578	2.288	3.383
Chandrama	3.555	2.265	3.688	6.623	5.313
C.D. (P=0.05)	0.412	0.215	0.355	0.339	0.314
S.E. ±	0.136	0.071	0.117	0.111	0.103

Table 4 : Water uptake (g) changes during the period of vase life studies in standard chrysanthemum cultivars

Name of the cultivars	Day 0-1	Day 1-2	Day 2-3	Day 3-4	Day 4-5
Snow Ball	9.483	6.505	4.328	4.350	2.713
Golden Yellow	5.855	5.798	4.793	4.160	3.023
Angel Pink	6.820	5.175	2.455	3.293	2.090
Star White	5.620	4.303	0.520	2.055	1.893
Chandrama	3.833	5.668	3.945	2.633	3.813
C.D. (P=0.05)	0.009	0.139	0.129	0.134	0.097
S.E. ±	0.033	0.046	0.042	0.044	0.032

mm) followed by cv. SNOW BALL (7.63 mm) while minimum (6.05 mm) by cv. GOLDEN YELLOW. 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 Paraneetha (2006) and Vetrivel and Jawaharlal (2014) in chrysanthemum.

Weight of cut stem (g) :

Among all the cultivars, maximum weight of cut stem (153.99 g) was recorded in cv. CHANDRAMA followed by cv. SNOW BALL (122.01 g) while minimum weight of cut stem (75.49 g) was recorded in cv. ANGEL PINK. Mahawer *et al.* (2010) Lalan Kumar *et al.* (2010) in dahlia and Kumar and Yadav (2005) in gerbera reported thevariation in flower weight might be due to difference in genetic makeup of the different cultivars.

Vase life :

The maximum vase life (14.00 days) was observed by cv. GOLDEN YELLOW followed by cv. STAR WHITE (12.00 days) whereas minimum (6.75 days) was noted by cv. ANGEL PINK.The variations in vase life may be due to the difference in accumulation of carbohydrates due to varied leaf production and sensitivity of cultivars to ethylene and in turn variations in these aspects might be due to genetical makeup of genotypes as reported by Vetrivel and Jawaharlal (2014).

Fresh weight (g) changes during the period of vase life :

The maximum fresh weight (76.53 g), (74.38 g) was recorded by cv. CHANDRAMA on second and third day followed by cv. STAR WHITE (61.00 g) on second day whereas minimum (40.58 g) was observed by cv. ANGEL PINK on fifth day. The increase in fresh weight can happen only when the rate of water absorption is greater than transpiration rate (Rogers,1973). Similar findings were reported by Baskaran *et al.* (2009) in chrysanthemum.

Transpiration loss of water (g) (TLW) during the period of vase life :

Snow Ball recorded maximum (11.76 g) transpiration loss of water on day 1-2 followed by cv. CHANDRAMA (6.62 g) on day 3-4 while minimum (2.28 g) was noted by cv. STAR WHITE on day 3-4. The water loss due to decline in uptake of water coupled with transpiration leads to water deficit, which ultimately reduces turgidity in cut flowers as stated by Halevy and Mayak (1981) and Baskaran *et al.* (2009).

Water uptake (g) changes during the period of vase life :

The maximum (9.48 g) water uptake was noted by cv. SNOW BALL on day 0-1 followed by ANGEL PINK (6.82 g) while minimum was recorded by cv. STAR WHITE on day 2-3. The increased water uptake maintains turgidity, freshness of flowers and thus enhances vase life owing to improved water balance and post harvest physiology as observed by Kumar *et al.* (2013) in

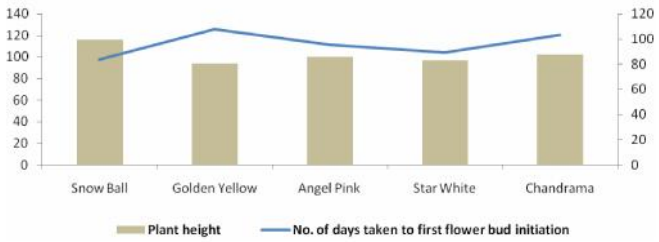

Fig. 1 : Plant height (cm) and No. of days taken to first flower bud initiation in standard chrysanthemum cultivars

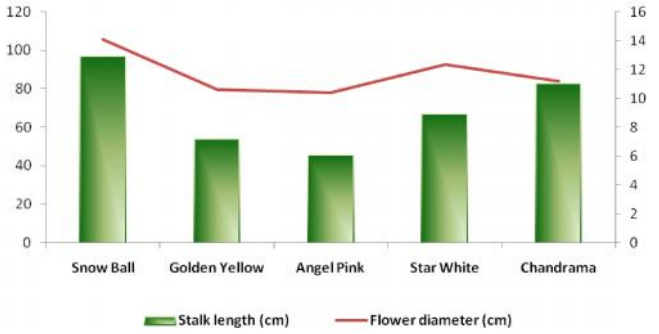

Fig. 2 : Stalk length and flower diameter in standard chrysanthemum cultivars

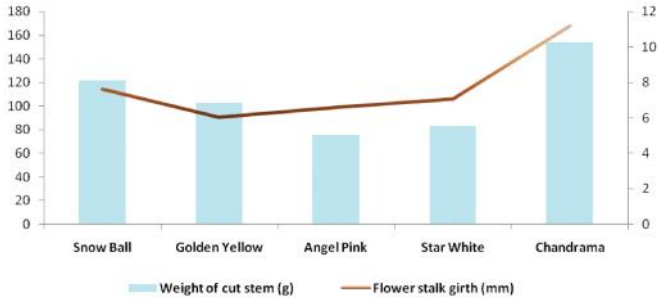

Fig. 3 : Weight of cut stem and flower stalk girth in standard chrysanthemum cultivars

gerbera.

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