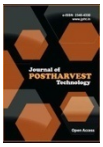

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RESEARCH ARTICLE

Effect of postharvest treatments with different sources of carbohydrate on quality and vase life of gerbera (*Gerbera jamesonii* Bolus ex. Hooker f.) cut flowers cv. Grandola

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ABSTRACT

The postharvest study in gerbera cut flowers vv. Grandola was carried out with different sources of carbohydrate such as sucrose, common sugar, palm crystals, palm sugar and karupatti each at 2, 4 and 6% to assess the quality attributes and vase life. The experiment was laid out in completely randomized block design with 16 treatments and a control in three replications. The observations viz., cumulative water uptake, cumulative transpirational loss of water, water balance, fresh weight of cut flower, cumulative physiological loss in weight, stem strength, diameter of the flower, flower discoloration, freshness of flower, TSS, pH of vase solution and vase life were recorded to test the quality and vase life of gerbera cut flowers. The result revealed that sucrose 4% was found to be the best vase solution and proved better in terms of vase life and its dependent parameters when compared to control.

Keywords: Carbohydrates, common sugar, gerbera, karupatti, palm sugar, palm crystals, postharvest treatments

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INTRODUCTION

Gerbera is commonly known as “Transvaal daisy”, “Barbeton daisy” or “African daisy”. Gerbera, a dwarf herbaceous perennial plant is a member of Asteraceae family. Gerbera is native to South Africa and Asiatic regions. The wide range of colours and the attractive shape of flowers suits very well in flower arrangements. It has occupied 5th position in the world cut flower trade after rose, carnation, chrysanthemum and tulip. Gerbera flowers are in considerable demand in both domestic and export markets. Due to changes in social and cultural life style of people, cut flowers have found an important place in various social functions of daily activities. The cut flowers have a long vase life, which fetches premium market prices. But, the cut flowers are deprived of their natural resources of water and nutrients after being detached from the mother plant, as a result, all life processes are at the expense of reserved food materials. Hence, addition of chemical preservatives to the cut flowers is

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recommended to continue its physiological processes so that the longevity of the flowers can be extended by more number of days (Nair et al., 2000). As cut flowers, unlike most agricultural commodities are harvested before they are fully developed, they are expected to continue their growth in consumers home. Then they are likely to be deprived of their metabolites normally negligible under the conditions under which they are regularly held (Halevy and Mayak, 1979). This necessitates addition of carbohydrates in the holding solutions. Two major factors play a dominant role in postharvest physiology of the cut flowers which are supply of carbohydrates and water balance in the stem. Sugars are the source of energy for respiration, which maintain turgidity and plays an important role in flower freshness. Sucrose treatment leads to an increase in the mechanical rigidity of the stem, which is due to cell wall thickening and lignification of vascular tissues (Steinitz, 1983). Cut flowers are more complex which require special attention in developing handling techniques. Several attempts have been made to study the effect of different sugars to extend the longevity of many cut flowers (Marousky, 1972). But, the present study was carried out to findout the effect of different sources of carbohydrates such as different types of palm and cane sugars.

MATERIALS AND METHODS

The experiment was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar, Chidambaram. Uniform size gerbera fowers Cv. Grandola were collected from the well maintained growing conditions. The flowers were generally cut when the outer ray florets are completely elongated or when outer two rows of disc florets are perpendicular to the flower stem (Salunkhe et al., 1989). Flower stalks are trimmed in equal length and slanting cut was made in the water to provide more uptake of solutions.

The investigation were carried out with different types of carbohydrates such as sucrose, common sugar, palm crystals, palm sugar and karupatti each at 2, 4 and 6% in completely randomized design with 16 treatments and a control in three replcations. The treatments schedule were made such asT_1-sucrose 2%; T_2- sucrose4%; T_3-sucrose 6%; T_4-common sugar 2%; T_5common sugar 4%; T_6- common sugar 6%; T_7- palm sugar 2%; T_8- palm sugar 4%; T_9- palm sugar 6%; T_{10}- palm crystals 2%; T_{11}- palm crystals 4%; T_{12}-palm crystals 6%; T_{13}-karupatti 2%; T_{14}-karupatti 4%; T_{15}-karupatti 6% and T_{16}-control. The flowers were kept at 80 per cent relative humidity in ambient room temperature under 40 W cool white fluorescent light to maintain 12 hours of photoperiod throughout the study period. The observations such as cumulative water uptake, cumulative transpirational loss of water, water balance and cumulative physiological loss in weight were observed at the end of vase life, while the fresh weight of flower, stem strength, flower diameter, pH of vase solution and total soluble solids of cut flowers were observed on 4^{th} and 8^{th} day of vase life. The flower discoloration was assessed according to the procedures described by Macnish et al. (2000).Cumulative water uptake, cumulative transpirational loss of water, cumulative water balance and freshness of flower were assessed by the procedures described by Madhu (1999). TSS was taken as described by Danaee et al. (2011). Differences between treatments were evaluated by Least Significance Difference Test (LSD) at 5% level of significance (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

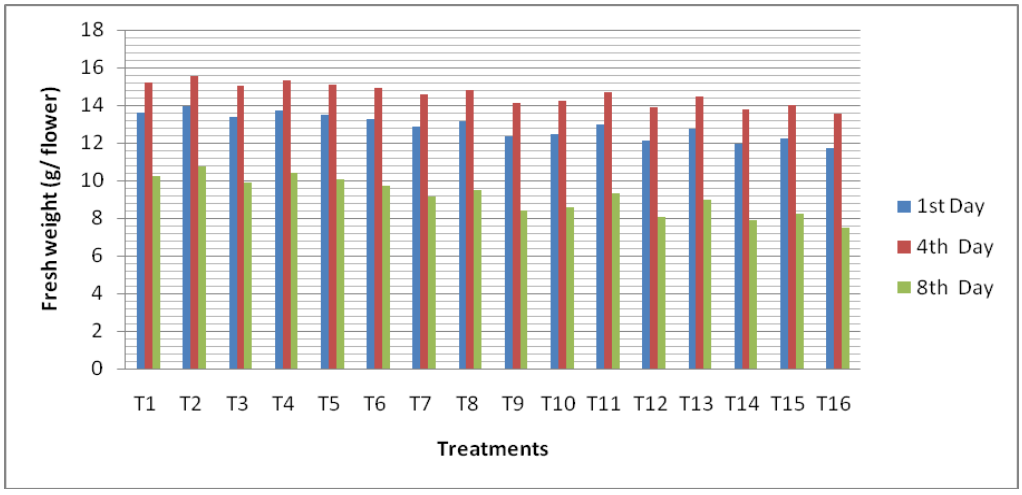
Among the character studied, the cumulative water uptake was found to be influenced significantly by all the treatments compared to the control in the cultivar of Grandola. The maximum water uptake of 23.76 g/ flower was recorded in the flowers treated with sucrose 4% (T2), followed by the treatment with common sugar 2% (T4) (Table 1). Reddy and Singh (1996) reported that increase in water uptake by pulsing treatments of gladiolus might be due to translocated sugars accumulated in

flowers increased the osmotic potential and improved the ability of spikes to absorb water. Supplying cut flowers with exogenous sucrose maintains pool of dry matter and respiratory substrates in flower petals and also induced osmotic adjustment (Bhattacharjee, 1999). The result is in line with the above findings.

Table 1: Effect of postharvest treatments with different sources of carbohydrate on water related attributes of gerbera cut flowers

Treatments	Cumulative water uptake (g/ flower)	Cumulative transpirational loss of water (g/ flower)	Water balance (g/ flower)	Cumulative physiological loss in weight (%)
T_1	22.93	23.22	-0.29	24.88
T_2	23.76	22.45	+1.31	22.97
T_3	22.39	23.60	-1.21	26.25
T_4	23.19	22.84	+0.35	24.23
T_5	22.66	23.41	-0.75	25.57
T_6	22.11	23.78	-1.67	26.81
T_7	21.28	24.34	-3.06	28.98
T_8	21.84	24.15	-2.31	27.59
T_9	20.15	25.09	-4.94	31.87
T_{10}	20.43	24.71	-4.28	31.08
T_{11}	21.56	23.97	-2.41	28.25
T_{12}	19.61	25.44	-5.83	33.49
T_{13}	21.01	24.52	-3.51	29.74
T_{14}	19.33	25.63	-6.30	34.17
T_{15}	19.88	25.26	-5.38	32.70
T_{16}	18.72	25.81	-7.09	35.75
SE_D	**0.15**	**0.15**	**-**	**-**
CD (P=0.05)	**0.31**	**0.31**	**-**	**-**

Fig. 1. Effect of different carbohydrates on fresh weight (g/ flower) of gerbera cut flowers cv. Grandola



With regarding the different carbohydrates used, the minimum cumulative transpirational loss of water and the maximum water balance were observed with the treatments receiving sucrose 4%, followed by common sugar 2% than the other form of

carbohydrates used (Table 1). Piskornik (1981) studied the importance of commercial preservative formulations in extending the vase life of cut flowers. In all the formulations, sucrose is one of the important constituent apart from other sources of carbohydrates and chemicals. Steinitz (1982) was of the opinion that addition of sucrose to the solution increased the mechanical rigidity of the stem by inducing cell wall thickening and lignification of vascular tissues. This might be the reason for the minimum cumulative physiological loss in weight and the maximum water balance in the best treatments.

The fresh weight of gerbera flowers are significantly influenced by different carbohydrates over control. Sucrose 4% was found to be the best to increase and to maintain the fresh weight upto 8 days of vase life compared with other treatments (Fig. 1). Among the various source for the carbohydrates, the sucrose 4%was found to be the best because sucrose might be a good source of energy for the flowers of gerbera and it can effectively be involved in postharvest physiology of flowers such as source of energy for appropriate level of respiratory process, delays in the degradation of proteins and improves the water balance as reported by Nair et al. (2003). This might be the reason for the effective performance of sucrose 4% than the other sources of carbohydrates over control. The cumulative physiological loss in weight of gerbera cut flowers Cv. Grandola was significantly reduced due to the treatment of sucrose 4% (T_2), followed by the common sugar 2% (T_4) (Table 1). This might be due to the influence of sucrose and other carbohydrates on maintenance of mechanical rigidity of flowers by inducing cell wall thickness and lignification of vascular tissues which in total may reduce the physiological loss of water. This result was in accordance with the works of Steinitz (1982). The stem strength and flower diameter were significantly influenced by the different sources of carbohydrates. Among the carbohydrates sources, sucrose 4% (T_2) (Table 1) was found to be the best for the gerbera cut flowers Cv. Grandola. The better stem strength and flower diameter might be due to the constant supply of appropriate source of energy by the sucrose and other sources of carbohydrates than the control. The results are in confirmation with the findings of Adachi et al. (2000) in chrysanthemum and Hajizadesh and Aliloo (2014) in tuberose.

Table 2: Effect of postharvest treatments with different sources of carbohydrate on quality and shelf life of gerbera cut flowers

Treatments	Stem strength (degrees)		Diameter of flower(cm)		Flower discolouration (days)	pH of vase solution		Vase life (days)
	4th Day	8th Day	4th Day	8th Day		4th Day	8th Day	
T_1	75.44	59.14	12.23	11.61	7.86	4.53	5.21	7.96
T_2	78.16	64.83	12.57	11.97	8.31	3.62	4.52	8.32
T_3	73.53	55.34	11.99	11.39	7.57	4.98	5.48	7.71
T_4	76.35	60.99	12.33	11.72	8.01	4.08	4.86	8.09
T_5	74.49	57.28	12.10	11.51	7.71	4.77	5.35	7.83
T_6	72.52	53.49	11.87	11.28	7.41	5.19	5.63	7.60
T_7	69.60	47.82	11.50	10.94	7.91	5.86	6.02	7.22
T_8	71.54	51.60	11.73	11.17	7.26	5.43	5.77	7.49
T_9	65.41	39.92	11.04	10.49	6.20	6.65	6.60	6.56
T_{10}	66.60	41.77	11.15	10.60	6.38	6.27	6.29	6.77
T_{11}	70.57	49.73	11.62	11.06	7.09	5.65	5.89	7.36
T_{12}	63.09	36.35	10.78	10.28	5.85	7.04	6.87	6.12
T_{13}	68.58	45.72	11.39	10.83	6.73	6.06	6.16	7.07
T_{14}	62.04	34.54	10.66	10.17	5.70	7.24	6.99	5.91
T_{15}	64.26	38.14	10.89	10.39	6.01	6.86	6.74	6.34
T_{16}	60.23	30.78	10.41	9.94	5.40	7.43	7.12	5.61
SE_D	**0.86**	**1.69**	**0.09**	**0.08**	**0.12**	**0.17**	**0.11**	**0.10**
CD (P=0.05)	**1.76**	**3.46**	**0.19**	**0.17**	**0.26**	**0.35**	**0.23**	**0.21**

The prolonged freshness (Fig. 2), flower discoloration (Table 2) and higher TSS (Fig. 3) of gerbera cut flowers Cv. Grandola were observed with sucrose 4% (T_2), followed by common sugar 2% (T_4). This might be due to the exogenous supply of carbohydrates which replaced the depleted endogenous carbohydrates utilized during the postharvest life of flowers as reported by Kumar (2005) in gladiolus and Moradi et al. (2012) in dianthus cut flower. The vase life of gerbera cut flower Cv. Grandola was significantly influenced by the treatments of various sources of carbohydrates.

The maximum vase life of 8.32 days was observed with sucrose 4% (T_2), followed by the common sugar 2% (T_4) (Table 2). Addition of sucrose exogenously to the detached cut flowers was found to exert two main effects: first stimulation of growth of petals; second, retardation of various physiological processes of senescence and wilting (Halevy and Mayak, 1981). This might be the reason for the improved vase life under best treatment and other treatments over the control.

Fig 2: Effect of different carbohydrates on freshness of flower (days) of gerbera cut flowers cv. Grandola

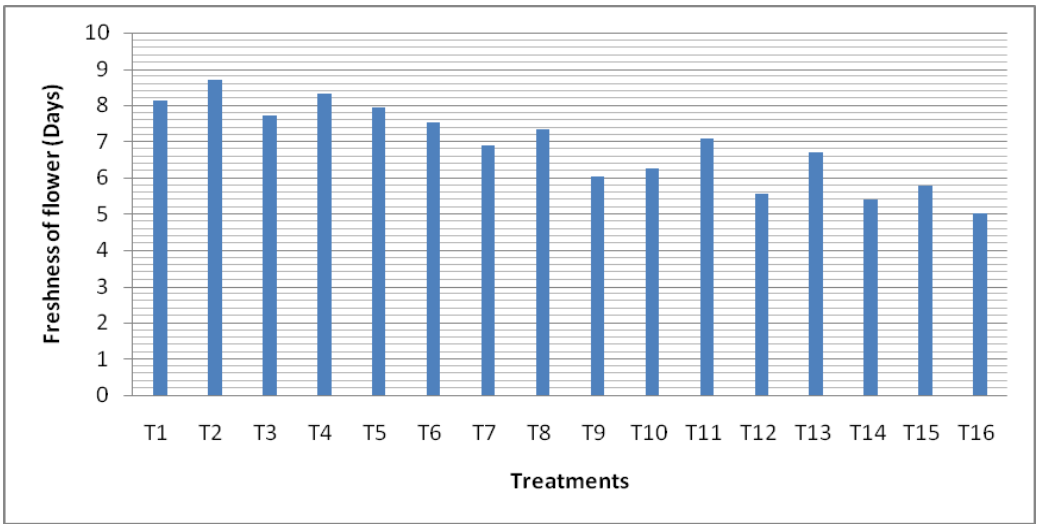
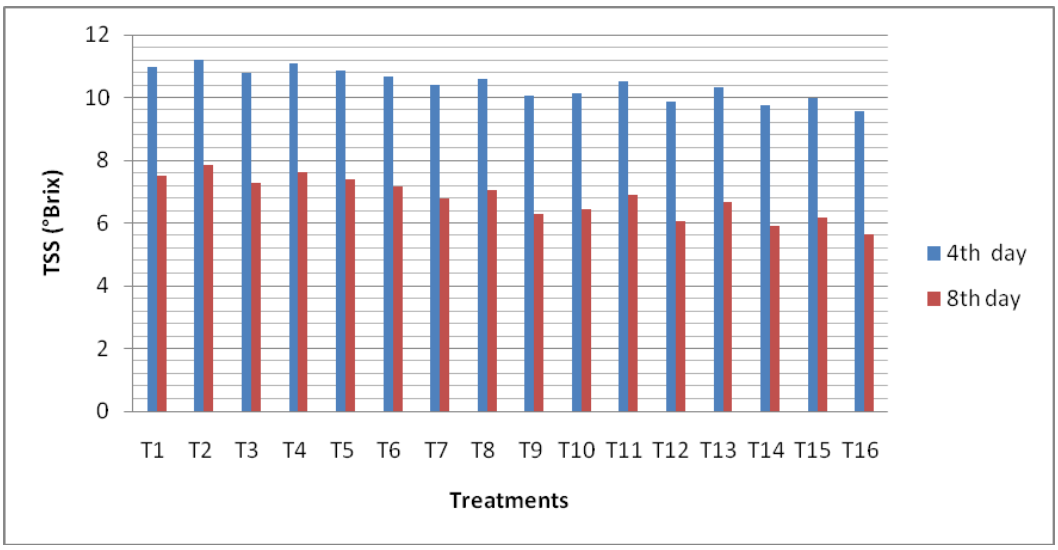


Fig 3. Effect of different carbohydrates on TSS (°Brix)of gerbera cut flowers cv. Grandola



From the Experiment, it is concluded that addition of sucrose 4% (T_2) in vase solution was found to be the best in improving the vase life of gerbera cut flowers Cv. Grandola along with other quality characters of cut flowers such as delayed flower discoloration, improved freshness of flowers, the maximum stem strength and diameter of cut flowers, followed by common sugar 2% (T_4).

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