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RESEARCH PAPER

Effect of sucrose and different chemical combinations to improve post harvest keeping in tuberose spikes

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SUMMARY :

The experiment was conducted to evolve things related to post harvest physiology mechanism of cut flowers at crop physiology laboratory at Department of Crop Physiology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai. This experiment comprised of chemicals *viz.,* silver nitrate, calcium chloride, ascorbic acid, aluminium sulphate, sodium benzoate, sodium thio sulphate, cobalt sulphate, salicylic acid and coconut water with sucrose of two level concentrations 3 per cent and 5 per cent with the aim to increase the vase life of tuberose spikes. This was laid in Completely Randomized Design with three replications. Silver nitrate at 50 ppm+ 5% sucrose showed higher fresh weight of cut spikes over 50 per cent of coconut water + 3% level of sucrose, silver nitrate at 50ppm+ 5% sucrose showed higher per cent of opened florets over control. Silver nitrate at 50ppm+ 5% sucrose showed longest vase life of cut spikes of 18 days when compared to control.

KEY WORDS : Sucrose, Post harvest keeping, Cut flowers, Tuberose spikes

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Tuberose (*Polianthes tuberosa* Linn.) cv. Double is an important commercial flower crop and is extensively cultivated in many sub-tropical and tropical parts of the world including India. It is a native of Mexico and belongs to the family Amaryllidaceae. Corolla segments on long and sturdy spikes. Tuberose spikes are used in bouquets for presenting and in vases for interior decoration. The flowers yield a very valuable floral concrete (0.08 – 0.11 %) on solvent extraction (Singh, 1995). Apart from domestic consumption, tuberose cut spikes has got a very good export potential to other countries (Singh, 1995). Extension of vase life and improvement of florets quality are highly desirable to keep flowers, fresh or in acceptable condition. The grading standard for the marketing of tuberose is a disease-free straight stem of about 70 cm and spike with a minimum of 10 pairs of pure white florets. Since it has delicate flowers and sellers and consumers are keen in extending its vase life, this necessitates improving its post harvest life. Keeping quality of the spikes is only 3 days per floret and vase life of the flowers is only few days.

In earlier times, most of the cut flowers were kept in water but now a day; scientists have introduced many floral preservatives to improve the vase life of cut flowers. Use of floral preservative is the most economical and practicable method for extending the post harvest life of cut flowers (Reid and Kofranek, 1980). When flowers are kept in room temperature in houses for decoration, flowers dry up due to water loss. If

flowers are kept in vase containing water, the main cause of deterioration is stem end rot. Hence, if stem rot at cut end of the stalk is controlled, it may results in enhanced vase life of the flowers.

EXPERIMENTAL METHODS

The experiment was conducted at the Laboratory of Crop Physiology, Department of Crop Physiology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai. Flowering spikes of tuberose (*Polianthes tuberosa* cv. Double) var. Suvasini were harvested in field and used in the experiments. Spikes were fresh and harvested in the morning at a stage when the bottom 2 to 3 florets unfurled. The spikes were brought to laboratory after the harvest and dipping the spikes in water reduced the field heat. Again a cut to a length of 55 cm was given to the spike and all the leaves except 2 to 3 below the florets were removed since leaves should not touch the solution. Removal of lower leaves, cleaning the stems and recutting the base before placing them in the solution were essential.

After recording the fresh weight, the spikes were placed in 500 ml glass beakers containing chemicals and sucrose of 3 per cent and 5 per cent. Then fresh weight of the flowers at the end of the treatment period were recorded and placed in 250 ml bottles containing 200 ml distilled water and only the fresh solutions were used in the experiment. After pulsing, the flower spikes were held in distilled water to study their post harvest physiology. The weight of each bottle and solution or distilled water with or without flower was recorded daily.

Details of treatments are given below in Table A:

Table A : Treatment details

Chemical	Treatments	Concentration (ppm)
Calcium chloride + 3 % sucrose	T_1	1000 ppm
Calcium chloride + 5 % sucrose	T_2	1000 ppm
Silver nitrate + 3 % sucrose	T_3	50 ppm
Silver nitrate + 5 % sucrose	T_4	50 ppm
Ascorbic acid + 3 % sucrose	T_5	200 ppm
Ascorbic acid + 5 % sucrose	T_6	200 ppm
Aluminium sulphate + 3 % sucrose	T_7	400 ppm
Aluminium sulphate + 5 % sucrose	T_8	400 ppm
Sodium benzoate + 3 % sucrose	T_9	2.0mM
Sodium benzoate + 5 % sucrose	T_{10}	2.0mM
Sodium thiosulphate + 3 % sucrose	T_{11}	0.4mM
Sodium thiosulphate + 5 % sucrose	T_{12}	0.4mM
Cobalt sulphate + 3 % sucrose	T_{13}	1.0mM
Cobalt sulphate + 5 % sucrose	T_{14}	1.0mM
Salicylic acid + 3 % sucrose	T_{15}	100 ppm
Salicylic acid + 5 % sucrose	T_{16}	100 ppm
Coconut water+ 3 % sucrose	T_{18}	50 %
Coconut water+ 5 % sucrose	T_{19}	50 %
Control	T_0	With tap water

EXPERIMENTAL FINDINGS AND ANALYSIS

The results of the present study as well as relevant discussions have been presented under following sub heads:

Fresh weight of spikes:

At 4th, 8th and 12th day observations, $AgNO_3$ of 50 ppm with 5% level of sucrose maintained the highest fresh weight (Table 1). It was closely followed by $AgNO_3$ of 50 ppm with 3 per cent level of sucrose. $CaCl_2.2H_2O$ of 1000 ppm with 5 per cent level of sucrose was the next, which maintained the higher fresh weight. It was closely followed by $CaCl_2.2H_2O$ of 1000 ppm with 3 per cent level of sucrose. The lowest fresh weight was found in coconut of 50 per cent with 3 per cent level of sucrose.

Per cent of opened florets:

$AgNO_3$ of 50 ppm with 5 per cent level of sucrose maintained the highest per cent of opened florets. It was followed by $CaCl_2.2H_2O$ of 1000 ppm with 5 per cent level of sucrose. $AgNO_3$ of 50 ppm with 3 per cent level of sucrose closely followed it. Al_2SO_4 of 400 ppm with 5 per cent level of sucrose was the next, which maintained the higher per cent of opened florets. It was closely followed by salicylic acid of 100 ppm with 5 per cent and 3 per cent levels of sucrose. The lowest per cent of opened florets was found in control distilled water (Table 1).

Per cent of unopened florets:

$AgNO_3$ of 50 ppm with 5 per cent level of sucrose maintained the lowest per cent of un-opened florets. It was followed by $CaCl_2.2H_2O$ of 1000 ppm with 5 per cent level of sucrose. $AgNO_3$ of 50 ppm with 3 per cent level of sucrose closely followed it. Al_2SO_4 of 400 ppm with 5 per cent level of sucrose was the next, which maintained the lower per cent of un-opened florets. It was closely followed by salicylic acid of 100 ppm with 5 per cent and 3 per cent levels of sucrose.

Vase life of spikes:

$AgNO_3$ of 50 ppm with 5 per cent level of sucrose registered the longest vase life of 18.0 days. It was closely followed by $AgNO_3$ of 50 ppm with 3 per cent level of sucrose of 16.9 days. $CaCl_2.2H_2O$ of 1000 ppm with 5 per cent level of sucrose was the next, which maintained the longer shelf- life after the above of 16.6 days. It was closely followed by $CaCl_2.2H_2O$ of 1000 ppm with 3 per cent level of sucrose of 16.1 days. The lowest vase life was found in control (distilled water)

of 8.8 days.

Sucrose increased the vase life of cut tuberoses. This is in accordance with the previous results obtained in tuberoses and Gladiolus (Murali *et al.*, 1988). Water deficit has a direct effect on wilting of cut flower (Halvey and Mayak, 1984). Transpiration is essential in extending vase life of cut flowers and any process, which hinders normal transpiration, will decrease the keeping quality of cut flowers, Mayak *et al.* (1984); Mayak and Dilley (1988). Abolition of the compartment of the vacuole and the consequent release of hydrolases resulted in the death of the cell. The presence of cytoplasmic material such as disintegrated mitochondria and different types of membranes in ageing vacuole support this hypothesis. The breakdown of tonoplast is later on followed by autolysis of the cell.

Vascular occlusions decrease uptake of water and consequently reduce vase life of cut flowers. The stem sterilization decreased solution flow resistance (Burdet, 1987). In recent years, direct access to plant cell, plasmolemma and tonoplast has been feasible. The isolated protoplasts of flower petals have been employed for this purpose. It was further observed that the increase in micro viscosity corresponded to an increase in the ratio of free sterol to phospholipid. The free sterol content of flower remained unaltered during senescence, but the content of phospholipid was decreased.

The symptoms of loss of fresh weight of flower tissue such as drying and shrivelling are conspicuous in the final phase of senescence, the loss of water occurring even when the ageing petals of cut flowers are held in water indicating a loss of membrane integrity and consequent increased permeability and leakage, (Halvey and Biran, 1981). During the course of petal senescence, a decrease in the level of following macromolecular components was noticed starch, cell wall polysaccharides, proteins and nucleic acids. The degradation of DNA starts only after the wilting of flower tissue has begun, indicating autolysis leading to the death of the cell.

In the present study, it has been demonstrated that sucrose maintained good water balance in the flower. The effect of sucrose observed in the present study conforms to the results of other researchers who also observed the reduction of moisture stress in cut flowers by sucrose through mediating stomatal movement. Halvey and Mayak (1984); Murali and Narayana Gowda (1988). The results of the present

Table 1: Effect of various chemicals and different concentrations of sucrose on maintain fresh weight of spikes, per cent to opened and unopened flowers and vase life of the spike

Treatments	Concentration of pulsing chemicals and sucrose	Fresh weight of spikes (g)			Per cent of opened florets	Percent of unopened florets	Vase life of spikes (days)
		On 4th day	On 8th day	On 12th day			
T_1	$AgNO_3$ (50 ppm) + 3% sucrose	83.20	78.40	76.10	65.4	34.6	15.1
T_2	$AgNO_3$ (50 ppm) + 5% sucrose	106.00	100.10	98.00	71.2	28.8	18.0
T_3	$CaCl_2.2H_20$ (1000 ppm)+ 3% sucrose	76.80	81.40	69.70	67.2	32.8	16.1
T_4	$CaCl_2.2H_20$ (1000 ppm)+ 5% sucrose	77.80	83.40	71.70	69.1	30.9	16.6
T_5	Ascorbic acid (200 ppm)+ 3% sucrose	60.20	46.20	30.30	48.2	51.8	10.0
T_6	Ascorbic acid (200 ppm)+ 5% sucrose	61.20	47.20	31.20	49.7	50.3	10.2
T_7	Al_2SO_4 (400 ppm)+ 3% sucrose	75.00	65.00	47.10	60.2	39.8	11.6
T_8	Al_2SO_4 (400 ppm)+ 5% sucrose	76.00	67.10	49.30	63.1	36.9	11.8
T_9	Sodium benzoate (2 mM)+ 3% sucrose	58.20	52.20	34.00	54.1	45.9	12.0
T_{10}	Sodium benzoate (2 mM)+ 3% sucrose	60.20	53.10	37.00	58.2	41.8	12.2
T_{11}	STS (0.4 mM)+ 3% sucrose	72.40	68.20	53.20	58.0	42.0	11.1
T_{12}	STS (0.4 mM)+ 5% sucrose	73.40	69.10	54.30	61.0	39.0	12.0
T_{13}	$COSO_4$ (1mM)+ 3% sucrose	63.30	59.40	45.70	58.0	42.0	13.0
T_{14}	$COSO_4$ (1mM)+ 5% sucrose	64.70	61.40	47.30	61.8	38.2	13.6
T_{15}	Salicylic acid (100 ppm)+ 3% sucrose	50.80	47.80	29.80	61.3	38.7	11.6
T_{16}	Salicylic acid (100 ppm)+ 5% sucrose	51.80	49.20	31.20	62.1	37.9	11.8
T_{17}	Coconut water (50%)+ 3% sucrose	48.10	45.80	27.80	58.0	42.0	11.0
T_{18}	Coconut water (50%)+ 5% sucrose	49.30	47.30	30.20	61.0	39.0	11.1
T_{19}	Control (With distilled water)	61.20	48.20	32.30	46.2	53.8	8.8
		SED 0.288 CD (0.05) 0.572	SED 0.132 CD (0.05) 0.342	SED 0.245 CD 0.146	SED 0.4901 CD (0.05) 0.9921	SED 0.3335 CD (0.05) 0.6751	SED 0.1039 CD (0.05) 0.2102

investigation supports an earlier hypothesis that adequate moisture levels can be maintained in cut flowers by maintaining higher water uptake or water retention or both. Different pulsing chemicals in combination increased the vase life of the flowers. Vase life was higher in all combinations except control. Maintenance of improved water status seems to be the most important aspect of extension of longevity. When, sugar alone was used for pulsing, flower vase life was extended only slightly beyond that of control spikes and the combinations with chemicals were better. These results are in accordance with the reports in tuberose Mukhopadhyay and Bankar (1983) and Pathak *et al.* (1980).

Increased longevity of flower by silver nitrate at 50 ppm + 5% sucrose is an expression of the maintenance of better tissue water potential and energy supply. Also silver nitrate at 50 ppm+ 5% sucrose showed higher per cent of opened florets. Silver nitrate and sugar applied will be translocated and accumulated in the flower where it improved the ability to absorb water and maintain turgidity (Halvey and Mayak, 1984). However, sucrose at 5 per cent level has been shown to act as an antidessiccant and to increase cut flower fresh weight and longevity (Marousky, 1989). Silver ions increase the lateral waterflux by lowering the surface tension of water and this removes the air and reestablishes continuous water columns in the xylem. So the use of silver nitrate, calcium chloride and cobalt sulphate in combination with sucrose at higher level may be beneficial for cut tuberoses through which one can achieve the extended vase life and improved the aesthetic value of cut tuberoses.

LITERATURE CITED

Burdet, A.N. (1987). The causes of bent neck in cut roses. *J. Amer. Soc. Hort. Sci.,* **95**: 427-431.

Halvey, A.H. and Biran, I. (1981). Hormonal regulation of tuberization on Dahlia. *Acta Hort.,* **47**:319-329.

Halvey, A.H. and Mayak, S. (1984). Senescence and plant physiology of cut flowers. *Hort. Rev.,***1**:204-236.

Mayak, S. and Dilley, D.K. (1988). Effect of sucrose on response of cut carnation to kinetin, ethylene and abscisic acid. *J. Amer. Soc. Hort. Sci.,* **101**: 583-585.

Mayak, S., Bravdo, B., Guijji, A. and Halvey, A.H. (1984). Improvement of opening of cut gladioli flowers by pre-treatment with high sugar concentrations. *Scientia Hort.,* **1** (4) : 357-368.

Murali, T.P. and Narayana Gowda, J.V. (1988). Effect of growth regulators on biochemical composition of leaves and foliar yield in *Jasminum multiflorum*. *Indian J. Hort.,* **45**: 344-351.

Morusky, F.J. (1989). Water relation effect of floral preservation of bud opening and keeping quality of cut flowers. *Hort. Sci.,* **7**: 114-116.

Mukhopadhyay, A. and Bankar, G. J. (1983). Regulation of growth and flowering of *Polianthes tuberosa* L.with GA_3 and etherel spray. *Scientia Hort.,* **19**(2): 149-152.

Pathak, R.S., Choudhuri, M.A. and Bhattacharjee, S.K. (1980). Effect of germicides, hormones and sugars on the longevity and keeping quality of tuberose (*Polianthes tuberosa* L.). *Indian J. Hort.,* **36** (4) : 454-459.

Reid, M.S. and Kofranek, A.M. (1980). Recommendations for standardized vase life evaluations. *Acta Hort.,* **113**: 171-173.

Singh, K.P. (1995). Improved production technologies for tuberose (*Polianthes tuberosa* Linn.). A review of research done in India. *Agric. Rev.,* **16** (3): 141-166.