

Original Research Article

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Enhancing the Vase Life of Cut Rose cv. Top Secret using Sucrose and Other Chemical Preservatives

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ABSTRACT

An experiment was conducted to find out the best preservative solution for enhancing the vase life of cut rose cv. Top Secret. Nine different combinations of sucrose, Al_2SO_4 , $AgNO_3$ and 8-HQC including control (distilled water) were taken to study the vase life and those were T1: Control, T2: 2% Sucrose + 200ppm Al_2SO_4 , T3: 4% Sucrose + 200ppm Al_2SO_4 , T4: 2% Sucrose + 50ppm $AgNO_3$, T5: 4% Sucrose + 50ppm $AgNO_3$, T6: 2% Sucrose + 200ppm Al_2SO_4 + 300ppm 8-HQC, T7: 4% Sucrose + 200ppm Al_2SO_4 + 300ppm 8-HQC, T8: 2% Sucrose + 50ppm $AgNO_3$ + 300ppm 8-HQC, T9: 4% Sucrose + 50ppm $AgNO_3$ + 300ppm 8-HQC. The study revealed that the treatment T6 increased the water uptake, fresh weight in percentage basis and diameter of the flower and also taken maximum number of days (9 days) for fully opening of flower. Treatment T2 is found to be the best combination for unfolding of 1st petal and to attain marketable stage. Similarly, treatment T3 is found to be the best treatment combination on basis of visual scoring and treatment T7 showed the maximum vase life (12 days) of rose cv. Top Secret.

Keywords

Rose, Vase life,
Sucrose, Chemical
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Introduction

Top secret is amongst one of the very popular varieties of rose grown worldwide due to its magnificent beauty and very attractive deep red colour which is in highest demand in Odisha flower market. Cut flowers are highly perishable commodities and vulnerable to large post-harvest losses. There is a prodigious post-harvest losses in value of cut

flowers which is seen all along the marketing channels and it can be up to 40-50 % (Bhattacharjee, 1999). The most significant elements of quality are shape, size, colour and freshness of the flower from the market point of view.

So the conclusive aim of the consumer is to maintain these components as much as possible and to maintain the flowers in fresh

condition. Hence prolonging the vase life of cut flowers began as an amateur interest in the recent years and it is being practiced on a commercial scale based on scientific principles.

Keeping quality of flowers is affected by pre harvest and post-harvest factors. Pre-harvest factors are genetic or inherent makeup and growing conditions of flowers. In post-harvest factors water relations, respiration, relative humidity, growth regulators, preservative solutions, pre-cooling and storage, packaging and transporting is there. These factors can be taken into consideration to improve the keeping quality of the flowers. The flowers should be cooled as soon as possible after harvest to minimize deterioration. Cooling does this by reducing respiration rate, water loss, ethylene production, microbial development etc. But farmers of Odisha are lacking of these modernized technologies which leads to poor shelf life of flowers resulting in heavy loss to them. Hence this experiment was undertaken to find out the possible ways to enhance the vase life of roses without pre-cooling.

Materials and Methods

The experiment was conducted at PG research laboratory, Department of Horticulture, Institute of Agricultural sciences (IAS), Siksha 'O' Anushandhan Deemed to Be University, Bhubaneswar during February to March 2019 to find out the best combination of sucrose and chemical preservatives for enhancing the vase life of cut rose cv. Top Secret.

During the experiment the following treatments were tested for enhancing the vase life of cut rose cv. 'Top Secret'.

T1 = Control (Distilled Water)
T2 = Sucrose 2 per cent+ Al₂SO₄ (200ppm)

T3 = Sucrose 4 per cent+ Al₂SO₄ (200ppm)
T4 = Sucrose 2 per cent+AgNO₃(50ppm)
T5= Sucrose 4 per cent+ AgNO₃ (50ppm)
T6= Sucrose 2 per cent+ Al₂SO₄ (200ppm)
+8HQC(300ppm)
T7 = Sucrose 4 per cent+ Al₂SO₄ (200ppm)
+8HQC(300ppm)
T8= Sucrose 2 per cent+ AgNO₃ (50ppm)
+8HQC(300ppm)
T9=Sucrose 4 per cent+ AgNO₃ (50ppm)
+8HQC(300ppm)

The above treatments were analysed using Completely Randomized Design with three replications and 54 roses were taken for the above treatments with two numbers of stem per treatment.

Before execution of this experiment, 54 number of 500ml capacity glass containers were properly sterilized to hold the solution. The flowers were harvested at its tight bud stage and immediately after harvesting these cut roses were kept in water. The flowers were taken for the experiment without pre-cooling in a cooling chamber, packed in corrugated fibre board. Then the stalks were kept about 45cm length by giving a slanting cut with a properly sterilized blade for the better absorption and the leaf numbers were maintained with 3 stands of leaves.

Observations on percent uptake by cut flower, increase in fresh weight of flower, diameter of the flower, date of unfolding of first petal, days taken to attain marketable stage, days taken for fully opened flower, quality of flowers by scoring and Vase life were taken in 24 hrs interval every day. After 4days the stems were cut upto 2cm to remove blockage and better absorption of the solution. The data for that day was taken before and after the stem cutting. Visual scoring was done on 4th day of the experiment where the cut roses were scored on the basis of their colour and freshness. For this purpose 10

persons were asked to observe and score the flowers out of 10 for their visual characters and the data was taken.

Statistical analysis

The data concerning vase life recorded for various characters were subjected to statistical analysis based on their sample means, (Gomez and Gomez, 1984). The analysis of variance table was prepared. The effects were tested by 'F' test at 5 per cent level of significance. The critical different at 5 per cent level was calculate for comparing the treatment means.

Results and Discussion

Percentage increase in water uptake

Best water uptake on the basis of both weight and volume was observed under T6 may be attributed to the combined action of aluminium sulphate and 8-HQC in the preservative solution. Aluminium sulphate reduces pH of the solution, effectively inhibits bacterial growth (Liao *et al.*, 2001) and prevents microbial clogging at the microbial cut end of the stem thus improving water uptake. Results of present study are also in conformity with the findings of (Hassanpour *et al.*, 2004) who reported that Al_2SO_4 acidifies vase solution, diminishes bacterial proliferation and enhances water uptake. Addition of 8-HQC improves the water uptake further which also acidifies water and checks microbial growth (Singh *et al.*, 2001). The minimum water uptake was observed under T1 (control) as it didn't contain any sugar or preservatives so it was least effective among all the treatments (Table 1).

Percentage increase in fresh weight

The maximum increase in fresh weight of flower was seen under T6 due to the

combined effect of sucrose, aluminium sulphate and 8-HQC in the preservative solution. Aluminium sulphate increases the fresh weight of flower confirmed by Maryam *et al.*, 2012. It acts as an antimicrobial agent in vase solution (Hassanpour *et al.*, 2004) by inhibiting the bacterial blockage in vessels of cut flowers. 8-HQC and Al_2SO_4 causes partial closure of stomata reducing water loss through transpiration and 8-HQC further effective in enhancing the fresh weight of cut roses confirmed by Patel *et al.*, 2007. As T1 (control) has only distilled water without sucrose and any preservatives, it showed least fresh weight in cut roses (Table 2).

Increase in diameter

Maximum increase in flower diameter (6.95cm) was observed under T6 due to the combined effect of sugar in opening of petals and 8-HQC acts as a biocide. Sucrose inhibits senescence process and maintain water balance reported by Bhattacharjee (1995). These results are also confirmed with the results obtained by Goszczynska *et al.*, (1989) in cut rose 'Sonia'; Bhattacharjee (1993) in cut rose 'Priyadarshini'; Bhattacharjee (1994) in cut rose 'Super Star'; Singh and Tiwari (2002) in rose (Table 3).

Sucrose along with 8-HQC increase the diameter of cut flower which may be due to the chelating property of the 8-HQC which helps in chelating metal ions of enzyme creating vascular blockage and reduce physiological stem blockage in sterilized tissue (Halevy and Mayak,1981).

Similar results are also obtained by Dumbre *et al.*, (2002), Satish *et al.*, (2012). As T1 (control) has only distilled water without sucrose and any preservatives, it showed least diameter (4.21cm) in cut roses.

Table.1 Effect of sucrose and chemical preservatives on percentage water uptake by cut rose stem cv. Top Secret on volume basis

Treatments		Percentage of water uptake (on volume basis)					
		Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
T₁	Distilled Water (Control)	1.72	2.06	2.31	2.98	3.88	-
T₂	Sucrose (2%) + Al ₂ SO ₄ (200ppm)	5.21	7.58	8.98	10.2	12.64	12.66
T₃	Sucrose (4%) + Al ₂ SO ₄ (200ppm)	3.98	5.54	6.76	7.95	9.21	9.23
T₄	Sucrose (2%) + AgNO ₃ (50ppm)	2.32	3.5	4.58	5.68	6.91	-
T₅	Sucrose (4%) + AgNO ₃ (50ppm)	2.30	3.46	4.5	5.17	6.39	6.40
T₆	Sucrose (2%) + Al ₂ SO ₄ (200ppm) + 8-HQC (300ppm)	5.78	8.22	10.57	11.79	14.9	14.10
T₇	Sucrose (4%) + Al ₂ SO ₄ (200ppm) + 8-HQC (300ppm)	4.48	6.84	8.1	9.31	10.68	-
T₈	Sucrose (2%) + AgNO ₃ (50ppm) + 8-HQC (300ppm)	3.96	5.14	6.33	7.49	8.74	-
T₉	Sucrose (4%) + AgNO ₃ (50ppm) + 8-HQC (300ppm)	3.45	4.64	5.77	6.91	8.14	8.15
	SEM (±)	0.004	0.004	0.019	0.019	0.004	
	CD (5%)	0.012	0.014	0.058	0.058	0.013	

Table.2 Effect of sucrose and chemical preservatives on percentage increase in fresh weight of cut rose stem cv. Top Secret

Treatments		Percentage increase in fresh weight				
		Day 2	Day 3	Day 4	Day 5	Day 6
T₁	Distilled Water (Control)	12.16	15.55	17.19	18.35	-
T₂	Sucrose (2%) + Al ₂ SO ₄ (200ppm)	19.50	24.38	29.04	32.67	35.05
T₃	Sucrose (4%) + Al ₂ SO ₄ (200ppm)	17.01	21.67	25.37	28.67	30.46
T₄	Sucrose (2%) + AgNO ₃ (50ppm)	14.03	17.8	20.87	22.61	-
T₅	Sucrose (4%) + AgNO ₃ (50ppm)	12.89	16.67	18.63	20.12	-
T₆	Sucrose (2%) + Al ₂ SO ₄ (200ppm) + 8-HQC (300ppm)	20.45	26.32	31.88	35.64	38.05
T₇	Sucrose (4%) + Al ₂ SO ₄ (200ppm) + 8-HQC (300ppm)	18.80	23.67	28.1	31.53	33.61
T₈	Sucrose (2%) + AgNO ₃ (50ppm) + 8-HQC (300ppm)	15.26	19.33	22.98	25.21	26.86
T₉	Sucrose (4%) + AgNO ₃ (50ppm) + 8-HQC (300ppm)	14.51	18.35	21.99	24.12	-
	SEM (±)	0.004	0.012	0.003	0.004	0.003
	CD (5%)	0.014	0.037	0.011	0.012	0.009

Table.3 Effect of sucrose and chemical preservatives on increase in diameter of cut rose stem cv. Top Secret

Treatments		Increase in diameter (cm)							
		Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9
T ₁	Distilled Water (Control)	2.20	2.68	2.95	3.30	3.88	4.21	4.21	-
T ₂	Sucrose (2%) + Al ₂ SO ₄ (200ppm)	2.64	3.02	3.98	4.62	5.31	6.02	6.65	6.65
T ₃	Sucrose (4%) + Al ₂ SO ₄ (200ppm)	2.89	3.18	4.10	4.96	5.77	6.10	6.68	6.68
T ₄	Sucrose (2%) + AgNO ₃ (50ppm)	3.23	3.85	4.62	5.45	6.18	6.71	6.71	6.71
T ₅	Sucrose (4%) + AgNO ₃ (50ppm)	3.40	3.89	4.68	5.81	6.32	6.77	6.77	6.77
T ₆	Sucrose (2%) + Al ₂ SO ₄ (200ppm) + 8- HQC (300ppm)	2.60	3.24	3.96	4.40	5.81	6.02	6.40	6.95
T ₇	Sucrose (4%) + Al ₂ SO ₄ (200ppm) + 8- HQC (300ppm)	2.81	3.30	3.88	4.62	5.89	6.60	6.89	6.89
T ₈	Sucrose (2%) + AgNO ₃ (50ppm) + 8-HQC (300ppm)	3.02	3.85	4.40	5.31	5.96	6.75	6.75	6.75
T ₉	Sucrose (4%) + AgNO ₃ (50ppm) + 8-HQC (300ppm)	3.19	3.88	4.56	5.23	5.53	5.81	6.68	6.68
	SEM (±)	0.027	0.005	0.005	0.005	0.005	0.027	0.005	0.005
	CD (5%)	0.082	0.017	0.017	0.017	0.017	0.082	0.017	0.016

Days taken to attain marketable stage

The maximum days(3.34days) was taken under T2 while the minimum days were taken(1.67days) taken under T8. However, the days taken to attain marketable stage of flowers under various treatments didn't show any significant variation.

Days for fully opened flower

The best treatment was observed under T6 having maximum days (9days) for fully opened flower followed by T7 having 8.84days which had same components except sucrose. As sucrose promotes unfolding of petals (Nirikoshi *et al.*, 2016), T7 took less days for fully opened flower. The minimum

days (7.17days) under T4 due to the absence of alluminium sulphate which prolong the unfolding of the petals reported by Maryam *et al.*, 2012 and Yayeh *et al.*, (2017) (Table 4).

Vase life

Maximum vase life (12 days) was observed under T7 followed by T6 (11 days) having all the components same except sucrose. Sugar supply increases the longevity, since it acts as a source for nutrition of tissue approaching carbohydrate starvation. Therefore, Sucrose enhances the vase life of cut rose reported by Ichimura *et al.*, 2003, Chaudhary *et al.*, (2018). During the senescence process sucrose helps in improving the vase life of flowers indicated by Lama *et al.*, (2013).

Table.4 Effect of sucrose and chemical preservatives on unfolding of 1st petal, marketable stage, opening of flower, vase life and visual scoring of cut rose stem cv. Top Secret

Treatments		Day of unfolding of 1 st petal	Days taken to attain marketable stage	Days taken for fully opened flower	Vase life	Colour	Freshness
T₁	Distilled Water (Control)	1	2.16	7.34	8	6	6.33
T₂	Sucrose (2%) + Al ₂ SO ₄ (200ppm)	2	3.34	8.67	10	7	7.66
T₃	Sucrose (4%) + Al ₂ SO ₄ (200ppm)	2	3	8.50	10	8	8
T₄	Sucrose (2%) + AgNO ₃ (50ppm)	1	2	7.17	9	7	7
T₅	Sucrose (4%) + AgNO ₃ (50ppm)	1	2	7.34	9	6	5.66
T₆	Sucrose (2%) + Al ₂ SO ₄ (200ppm) + 8-HQC (300ppm)	2	2.67	9	11	6	6
T₇	Sucrose (4%) + Al ₂ SO ₄ (200ppm) + 8-HQC (300ppm)	1.34	2.34	8.84	12	6	6
T₈	Sucrose (2%) + AgNO ₃ (50ppm) + 8-HQC (300ppm)	1	1.67	7.84	10	5	5.33
T₉	Sucrose (4%) + AgNO ₃ (50ppm) + 8-HQC (300ppm)	1	2.67	8	10	5	5.66
	SEM (±)	0.11	0.527	0.372	0.430	0.27	0.31
	CD (5%)	0.330	1.565	1.107	1.278	0.80	0.93

Hajizadeh *et al.*, (2012) reported that aluminium sulphate is a common biocide for increasing the vase life of cut roses further confirmed by Maryam *et al.*, (2012). Aluminium sulphate and sucrose prolonged the vase life of rose which is confirmed in various experiments by Kim *et al.*, (2001), Bala *et al.*, (2008), Farahat *et al.*, (2014), Bajwa *et al.*, (2016). 8-HQC also enhances the vase life of rose reported by Chand *et al.*, (2012). The minimum vase life (8 days) was seen under T1 (control) because it didn't contain sucrose or any preservatives.

Visual scoring

Colour

The maximum score (8) was seen under T3 due to the combined effect of sucrose and aluminium sulphate. Al_2SO_4 reduces pH of the solution, effectively inhibits bacterial growth (Liao *et al.*, 2001) and prevents microbial clogging at the microbial cut end of the stem thus improving water uptake.

Results of present study is also confirmative with the findings of (Hassanpour *et al.*, 2004) who reported that Al_2SO_4 acidifies vase solution, diminishes bacterial proliferation and enhances water uptake. Sucrose at whereas presence of 8-HQC causes petal discoloration and petal drop in the flower and silver nitrate caused stem rotting and poor colour and wilting in some the flowers. So the minimum score (5) was seen under T8 and T9.

Freshness

The maximum score (8) was seen under T3 due to the combined effect of sucrose and Al_2SO_4 . Whereas the minimum score (5.33) was seen under T8 due to the combined effect of silver nitrate and 8-HQC which showed petal discoloration, petal drop, stem rotting and wilting of flowers.

Days of unfolding of 1st petal

Maximum days(2days) taken for unfolding of first petal under T2,T3 and T6 due to the combined effect of sucrose and aluminium sulphate. Sucrose at various concentrations and aluminium sulphate prolong the time period required for opening of flower suggested by Bajwa *et al.*, (2016). Aluminium sulphate alone had positive effect and it is the best in prolonging the bud opening confirmed by Maryam *et al.*, (2012) and Yayeh *et al.*, (2017). As Al_2SO_4 and 8-HQC helps in further water uptake in cut roses that may enhance the unfolding of petal. The minimum day (1day) taken for opening of 1st petal was under T1 (distilled water), T4,T5,T8 and T9 due to the effect of sugar which promotes petal unfolding and as there was absence of aluminium sulphate the opening took place earlier.

From the above investigation, it is concluded that the preservative solution T6 comprising of Sucrose 2% + Al_2SO_4 200ppm + 8-HQC 300ppm has maximum water uptake, fresh weight, flower diameter and takes maximum days to fully opening of flower.

Similarly, treatment T3(Sucrose 4% + Al_2SO_4 200ppm) scores maximum in visual scoring on the basis of colour and freshness whereas preservative solution T7 comprising of Sucrose 4% + Al_2SO_4 200ppm + 8-HQC 300ppm has maximum vase life.

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