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SHORT COMMUNICATION

STUDIES ON POST HARVEST LIFE OF CUT ANTHURIUM FLOWERS

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An experiment was conducted to study the post harvest life of two anthurium cultivars *viz.* Sunset Orange and Agnihotri. Studies involved pulsing of anthurium cut flowers with 10 chemicals, out of which maximum vase life in terms of spadix drying, spathe blueing and loss of spathe glossiness was observed in 100 ppm BA. All the pulsing treatments showed improved water uptake over control, maximum uptake was observed in 4% sucrose, followed by 500 ppm $AgNO_3$. In the holding solution experiment, 100 ppm citric acid + 5% sucrose showed significantly higher vase life in terms of spadix drying, spathe blueing and loss of spathe glossiness. Maximum water uptake was observed in flowers held in 5% sucrose. In the cold treatment experiment, precooling treatment at 15°C for 4 hours resulted in maximum vase life in terms of spadix drying, spathe blueing and loss of glossiness

Key words: **Anthurium, cold treatment, pulsing, vase life**

Anthurium (*Anthurium andreanum* Lind.) cut flower is highly in demand worldwide due to its stylish, exotic and long-lasting heart shaped spathe. In India, cut anthurium flowers are widely used in bouquets and flower arrangements. Anthurium is commercially cultivated in Kerala, Karnataka, Tamil Nadu, West Bengal, Sikkim, Maharastra and pockets of North Eastern parts of India. Though the postharvest life of cut anthurium flowers depends on its genetic constitution and some cultural practices as well, there are some chemicals that are able to extend the post harvest life of cut flowers up to a certain extent (Salvi *et al*. 1997).

Flowers growers in Assam are unaware of proper technology regarding increasing the vase life and storage of cut flowers thereby experience low income. Hence an experiment was conducted to enhance the post harvest life of cut anthurium flowers by means of some floral preservative chemicals in pulsing and holding solution and also by giving some cold treatments prior to holding.

Two anthurium cultivars *viz*. Agnihotri and Sunset Orange were taken to study the post harvest life of cut anthurium flowers in the month of March. The anthurium flowers were grown under shade net where the solar photosynthetic photon flux density (PPFD) ~500- µmol $m^{-2}s^{-1}$ was recorded. The experiment was laid in a completely randomized design (CRD) with factorial treatment combinations consisting of three replications. Fresh anthurium cut flowers with physiologically active long stalks (12-15 inches) were harvested from different plants for each treatment before 10.00 AM and then dipped in water and brought to the laboratory in the month of March. Each stalk was cut at 1 cm just before pulsing. 10 pulsing treatments (Table 1) were given for 15 minutes. The treated flowers were transferred to conical flasks containing double-distilled water. The

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mouths of the conical flasks were covered with cellophane to avoid evaporation. Five-flowers/conical flasks were kept and replicated thrice for each treatment. They were kept at room temperature ranging from 19 to 22°C during the experimentation period (March – April) for studying vase life and water uptake. In the next phase of the experiment, out of the 10 pulsing treatments, the best pulsing solution was taken for the experiment of holding solution. Flowers were pulsed with the best pulsing solution for 15 minutes and were kept in 10 different vase solutions (Table 2), where the vase life and water uptake was recorded. Another phase of the experiment comprised of the cold treatments, where flowers were pulsed in the best pulsing solution, which were then kept in best holding solution and then four different cold treatments (Table 3) were given. Finally the vase life and water uptake was observed. The vase life was recorded from the senescence symptoms like spadix tip browning, spathe blueing and loss in glossiness of spathe (AICRP Floriculture Technical Bulletin 2002) as given in annexure 1.

Significant effect of different pulsing solutions was observed on various aspects of post harvest life of cut anthurium flowers. All the pulsing treatments showed improved water uptake over control, whereas flowers pulsed with distilled water showed the minimum amount of water uptake. Maximum amount of water uptake was observed in flowers pulsed with 4% Sucrose, followed by 500 ppm $AgNO_3$ and 100 ppm BA (Fig. 1) . Pulsing with $AgNO_3$ effectively increased vase life of anthurium cut flowers (Paull 1987). The effect of pulsing with different chemicals on post harvest life of chrysanthemum was investigated by (Madhumita *et al.* 2004) and reported that STS and $AgNO_3$ performed better.

Significant increase in water uptake was observed in Sunset Orange over cv Agnihotri. Maximum days taken for spadix drying was observed in 100 ppm BA followed by 200 ppm $Al_2(SO_4)_3$ and 500 ppm $AgNO_3$ which were at par. 200 and 300 ppm $(Al)_2(SO_4)_3$ have been reported as one of the promising chemicals that enhance post harvest life of cut carnation flowers by (Singh *et al.* 2003). $Al_2(SO_4)_3$ has been reported to have anti-microbial activity thereby improving water balance (Rameshwar 1974). Tiwari and Singh (2002) reported

Table 1. Effect of different pulsing treatments on vase life of anthurium flowers (days taken to reach score 2).

S. No.	Treatment	Vase life (days) in terms of spadix drying			Vase life (days) in terms of spathe blueing			Vase life (days) in terms of loss of spathe glossiness		
		Agni-hotri	Sunset orange	Mean	Agni-hotri	Sunset orange	Mean	Agni-hotri	Sunset orange	Mean
1.	Control (Distilled water)	15.67	16.67	16.17	14.33	13.00	13.67	11.00	12.33	11.67
2.	4% sucrose	22.67	22.67	22.67	21.67	22.67	22.17	16.67	19.67	18.17
3.	500 ppm $AgNO_3$	23.00	24.00	23.50	19.67	23.00	21.33	18.33	23.00	20.67
4.	1000 ppm HQ	21.33	20.33	20.83	19.33	18.00	18.67	15.33	16.67	16.00
5.	100 ppm BA	24.67	24.00	24.33	25.33	22.67	24.00	21.00	22.33	21.67
6.	200 ppm $Al_2(SO_4)_3$	23.00	25.33	24.17	19.67	21.33	20.50	18.33	21.33	19.83
7.	0.25 mM $CuSO_4$	17.33	24.67	21.00	15.33	23.67	19.50	15.33	22.67	19.00
8.	1.0 mM $CuSO_4$	20.67	19.67	20.17	19.00	18.00	18.50	18.33	17.33	17.83
9.	0.25 mM $CaCl_2$	19.00	19.33	19.17	18.67	18.33	18.50	18.33	18.33	18.33
10.	1.0 mM $CoCl_2$	21.00	20.33	20.67	19.67	20.00	19.83	19.33	17.67	18.50
	Mean	20.68	21.77		19.07	20.00		16.87	19.03	
	C.D. at 0.05%									
	T		1.52			1.23			0.82	
	cv.		0.67			0.55			0.37	
	(T x cv.)		2.12			1.74			1.16	

Table 2. Effect of different holding solutions on vase life of anthurium flowers (days taken to reach score 2).

S. No.	Treatment	Vase life (days) in terms of spadix drying			Vase life (days) in terms of spathe blueing			Vase life (days) in terms of loss of spathe glossiness		
		Agni-hotri	Sunset orange	Mean	Agni-hotri	Sunset orange	Mean	Agni-hotri	Sunset orange	Mean
1.	3 % sucrose	24.00	26.33	25.17	23.33	26	24.67	20.67	24.67	22.67
2.	4% sucrose	25.33	28.33	26.83	22.33	28.67	25.50	20.33	27.67	24.00
3.	5 % sucrose	24.00	26.67	25.34	23.67	28.67	26.17	20.33	27.33	23.83
4.	100 ppm citric acid + 5% sucrose	28.67	30.33	29.50	26.33	29.00	27.67	21.33	28.67	25.00
5.	300 ppm citric acid + 5% sucrose	28.67	28.67	28.67	26.33	28.67	27.50	20.33	28.67	24.50
6.	500 ppm citric acid + 5% sucrose	23.67	25.00	24.34	23.67	26.00	24.84	20.33	25.00	22.67
7.	100 ppm $Al_2(SO_4)_3$ + 5% sucrose	23.00	24.67	23.83	19.67	23.00	21.33	18.33	20.33	20.33
8.	100 ppm $AgNO_3$+ 100 ppm citric acid + 5% sucrose	23.00	22.33	22.67	19.67	22.00	20.83	18.33	21.67	20.00
9.	1 mM $CaCl_2$ + 100 ppm $AgNO_3$ + 100 ppm citric acid+5% sucrose	21.67	27.33	24.50	21.00	25.67	23.33	22.33	25.00	23.67
10.	Control (Distilled water)	14.33	18.00	16.17	15.00	16.67	15.83	11.67	17.33	14.50
	Mean	23.63	25.77		22.10	25.44		19.4	24.63	
	C.D. at 0.05%									
	T		0.77			0.71			0.73	
	cv.		0.34			0.32			0.33	
	T x cv.		1.09			1.00			1.03	

Table 3. Effect of different cold treatments on vase life of anthurium flowers (days taken to reach score 2).

S. No.	Treatment	Vase life (days) in terms of spadix drying			Vase life (days) in terms of spathe blueing			Vase life (days) in terms of loss of spathe glossiness		
		Agni-hotri	Sunset orange	Mean	Agni-hotri	Sunset orange	Mean	Agni-hotri	Sunset orange	Mean
1.	15°C for 4 hours	29.67	30.67	30.17	27.33	30.33	28.83	26.67	30.67	28.67
2.	15°C for 8 hours	24.67	22.33	23.50	16.33	20.67	18.50	19.33	18.33	18.83
3.	17°C for 8 hours	22.00	25.67	23.83	16.33	19.33	17.83	14.67	15.67	15.17
4.	17°C for 16 hours	26.33	34.00	30.17	19.67	25.33	22.50	17.33	22.00	19.67
	Mean	25.67	28.17		19.92	23.92		19.50	21.67	
	C.D. at 0.05%									
	T		0.63			0.74			0.71	
	cv.		0.45			0.52			0.50	
	T x cv.		0.89			1.05			1.00	

Annexure I. Vase life evaluation criteria for anthurium cut flowers

a. Rating scale of visual spadix conditions

Score	Spadix condition
1.	No blemishes
2.	Spadix tip showing slight discolouration, browning
3.	Spadix tip showing definite browning
4.	Definite tip browning and drying out, less than 10 % of total length affected
5.	Tip necrotic and dried out, greater than 110 % of total length affected

b. Rating for spathe blueing or blackening

Score	Spathe discolouration description
1.	None- Fresh cut appearance, no blueing
2.	Slight- less than 5 % blueing
3.	Moderate- 5-10 % blueing
4.	Severe- greater than 10 % blueing

c. Rating scale for spathe condition- glossiness

Score	Spathe condition
1.	No loss- high glow, fresh harvest conditions
2.	Slight loss- not objectionable
3.	Slight glow remaining
4.	Severe loss- flat, no glow, wilting of spathe lobes

that more solution uptake was found in flowers kept in $Al_2(SO_4)_3$. Variation in solution uptake may be due to disturbance in transpiration pool and bacterial and fungal species gaining predominance in vase solution of $Al_2(SO_4)_3$ enhanced solution uptake by acting as anti-bacterial agent. Maximum vase life in terms of spathe blueing was observed in 100 ppm BA. Application of BA improved the post-harvest life of cut anthurium flowers was stated by (Salvi *et al*. 1997). BA increased the post harvest life probably by reducing the respiration rate and by its inherent anti-senescence property when used in pulsing or in vase solutions. (Akila *et al.* 2004) reported that *Anthurium andreanum* cv. Temptation showed highest vase life of 36 –66 days when cut flowers were pulsed with 50 ppm BA for 24 hours. Maximum vase life in terms of loss of spathe glossiness was observed 100 ppm BA. In case of cultivars, Sunset Orange showed significantly higher vase life (4.9, 5.2 & 12.8%) in terms of spadix drying, spathe blueing and loss of spathe glossiness respectively than cultivar Agnihotri. The variation in vase life observed among the cultivars has been attributed to differences in number of thick walled supporting cells in xylem element and phloem fibers and presence or absence of a complex ring of secondary thickening in the flower peduncles (Zamski *et al*. 1991).

All the holding solutions performed better in terms of vase life and water uptake than the flowers kept in distilled water. Maximum water uptake was observed in 5% sucrose followed by 100 ppm citric acid + 5% sucrose and 300 ppm citric acid + 5% sucrose which were at par (Fig. 2). The increased vase life with sucrose has been shown to be due to acting as an

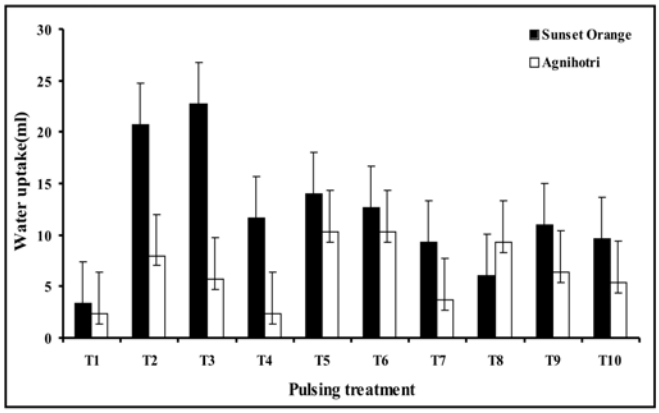

Fig. 1. Effect of pulsing treatments on water uptake of anthurium cut flowers. T1 = Control, T2 = 4% sucrose, T3 = 500 ppm $AgNO_3$, T4 = 1000 ppm HQ, T5 = 100 ppm, BA, T6 = 200 ppm $Al_2(SO_4)_3$, T7 = 0.25 mM $CuSO_4$, T8 = 1.0 mM $CuSO_4$, T9 = 0.25 mM $CaCl_2$, T10 = 1.0 mM $CoCl_2$.

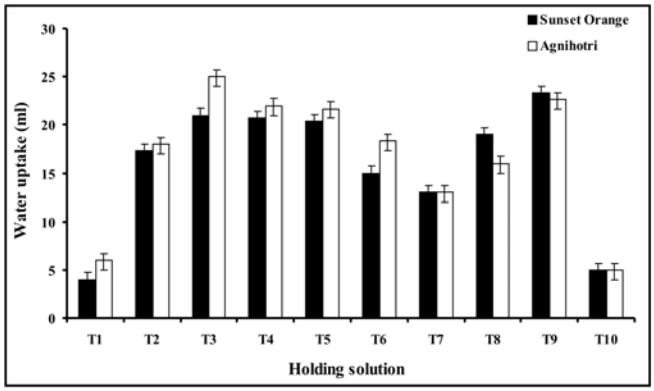

Fig. 2. Effect of holding solutions on water uptake of anthurium cut flower. T1 = 3% sucrose, T2 = 4% sucrose, T3 = 5% sucrose, T4 = 100 ppm citricacid + 5% sucrose, T5 = 300 ppm citricacid + 5% sucrose, T6 = 500 ppm citricacid + 5% sucrose, T7 = 100 ppm $Al_2(SO_4)_3$ + 5% sucrose, T8 = 100 ppm $AgNO_3$ + 100 ppm citric acid + 5% sucrose, T9 = 1mM $CaCl_2$ + 100 ppm $AgNO_3$ + 100 ppm citric acid + 5% sucrose, T10 = Control

oxidizable respiratory substrate and as an anti dessicant, thereby increasing the fresh weight of cut flowers and longevity (Larsen and Frolich 1969).

Flowers held in 100 ppm citric acid + 5% sucrose showed significantly higher vase life in terms of spadix drying. Flowers held in 100 ppm citric acid + 5% followed by 300 ppm citric acid + 5% sucrose showed significantly higher vase life in terms spathe blueing and loss of spathe glossiness and were at par. Sunset orange showed significantly higher vase life 9.06, 15.1 & 27% in terms of spadix drying, spathe blueing and loss of spathe glossiness respectively than cultivar Agnihotri. (Chauhan 2004) studied the effect of preservative chemicals at different concentrations on vase life gerbera cv. Scilla and reported that citric acid at 200 ppm showed maximum vase life. Significant increase in opening of florets, useful life and longevity of spikes with citric acid at higher concentration may be due to acidification of solution, improved water balance and reduction in stem plugging (Durkin 1979).

Keeping the cut anthurium flowers in the best holding solution and giving different cold treatments for different durations revealed that 15^0C for 4 hours resulted in maximum vase life in terms of spadix drying, spathe blueing and loss of glossiness. Sunset Orange showed significantly higher vase life 9.7, 20 & 11 % in terms of spadix drying, spathe blueing and loss of spathe glossiness respectively than cultivar Agnihotri. Pre-cooling of cut flowers improves vase life by reducing the field heat thereby reducing the respiration rate that may cause delay in complete breakdown of stored food materials. (Arora *et al.* 2002**)** reported that tropical flowers like anthuriums, cattleya and poinsettia should be stored at 10-15^0C**.**

It can be concluded that pulsing with 100 ppm BA improved the post-harvest life of cut anthurium flowers probably by reducing the respiration rate and by its inherent anti-senescence property. Similarly, flowers held in 100 ppm citric acid + 5% sucrose showed significantly higher vase life. And pre cooling of cut flowers at 15^0C for 4 hours resulted in maximum vase life by reducing the field heat thereby reducing the respiration rate that may cause delay in complete breakdown of stored food materials.

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