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EFFECT OF PRE CONDITIONING WITH BENZYLADENINE (BA) AND GIBBERILLIC ACID (GA_3) ON POST HARVEST LIFE OF CALLA LILY (*ZANTEDESCHIA* SPP) FLOWER SPIKES AND LEAVES

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ABSTRACT

An experiment was conducted to study the effect of different concentrations of pre conditioning and pulsing durations on vase life of calla lily flowers at Floricultural Research Station, SKLTSHU, Rajendranagar, Hyderabad during 2021-2022 and 2022-2023. The results of the experiment revealed that, among the different treatments studied. The present investigation on studies on the "Effect of pre conditioning with Benzyladenine and gibberillic acid on post harvest life of calla lily (*Zantedeschia spp*) flower spikes and leaves" revealed that, maximum water uptake (27.17 g), transpirational loss of water (15.79 g), water balance (8.13 g), fresh weight change (108.69 %), lowest optical density (0.013) was recorded with GA_3 200 ppm + 8 h when compared to all other treatments.

***Key words*:** pre conditioning, pulsing, post harvest life, calla lily, *Zantedeschia spp*

Introduction

The calla lily (*Zantedeschia spp*) or arum lily is a species of Araceae family and the word 'Calla' is derived from the greek which means 'beautiful', is native to South West Africa. The natural habitat of calla lily is in streams and ponds or on the banks of the rivers. It has arrow shaped leaves and grows to a height of 0.6-1.0m tall. *Zantedeschia* is a herbaceous perennial plant and it has a triggered significant economic growth in the flower and ornamental plant industry due to its showy inflorescences and ornamental leaves. Leaves of calla lily are solid green or green with silver or white flecks and are integral, compact, carried along the stem. The inflorescence consists of a yellow spike in the center of the flower called spadix with true flowers surrounded by the outer part or petal called spathe (Contor and Pop., 2005). The flowers of calla lily appear in various colors of white, yellow, orange, pink, rose, lavender and dark maroon.

Several horticultural products including cut flowers are highly perishable in nature. It is estimated that approximately 30-50% losses incurred due to poor post-harvest handling. Commercially calla lily blooms are harvested at three quarters maturity. Since, the cut flowers are separated from the mother plant, the continuity of water column from roots to flower is disrupted, and this results in wilting and early start of senescence. The senescence of cut flowers of calla lily is accompanied by visible changes like gloss-loss, spadix necrosis and spathe discolouration (Paull, 1982).

The life of calla lily flowers is apparently limited due to the development of water deficit (Watson and Shirakawa, 1967). Water deficit is caused due to the drastic decrease in water absorption in the stem which is caused by microbial growth, air bubble formation, lithophytes and suberin and lignin deposition in the xylem

vessels. So, to improve the post harvest life of the flowers there are many operations carried out during export of flowers which reduce the wilt and enhance the vase life. Pre conditioning or placing in holding solutions are one such operation which can be helpful to hold the flowers for a longer duration.

Pre conditioning refers to the loading of cut stems with sucrose and chemicals for a period ranging from several hours to as long as two days. Pulsing solutions generally makes xylem vessels clean and thereby improve the solution uptake. It is one of the most important steps in the sequence of post-harvest handling of cut flowers. The use of pulsing solution is becoming common for enhancing flower vase life and to keep leaves green for longer period. Pulsing solutions are often composed of a mixture of chemicals, such as carbohydrates, plant growth regulators, ethylene inhibitors, biocides, and acidifiers.

Post-harvest life of the flowers and foliage of cultivated *Zantedeschia* cultivars are affected by several endogenous factors. It was found that the growth regulators like cytokinins and gibberellic acid, which are also referred to as ageing inhibitors, regulate the ageing process in flowers. During the ageing process, their content in plant tissues decreases, whereas the level of growth regulators, such as ethylene, salicylic acid (SA), brassinosteroids (BR), abscisic acid (ABA) and jasmonic acid (JA), increases and the ageing process accelerates. Several metabolic processes in plants like inhibition of ethylene production, sugars translocation, membrane permeability, and cell turgor pressure, the rate of respiration and transpiration, senescence delay are often related with plant growth regulators mainly GA_3 and BA. Several findings reveal that pre conditioning with (BA) delayed senescence by its effects on ethylene synthesis processes in the tissue of flowers and decreases the ethylene production within the carnation flowers and decreasing of protein hydrolytic enzymes activity lipoxygenase (Leshem *et al*., 1984) and gibberellic acid prevented leaf chlorosis, which was the major postharvest disorder in many cut flowers such as Santonia cv. Golden light flowers (Eason *et al*., 2001).

Material and Methods

The experiment was conducted at Floricultural Research Station, Rajendranagar, Hyderabad during the year 2021-22 and 2022-23. The experiment flowers were held at ambient room temperature (average mean temperature of 23 ±1%, relative humidity 75 % ± 5 % and under 40 W cool white fluorescent tubes to maintain 12 hours photoperiod. The experiment was laid out in factorial randomized block design (FRBD) with nine treatments and three replications. In this experiment harvested flower spikes and leaves of calla lily were cut to uniform length by giving a slanting cut at the basal portion. Further flower spikes and leaves were placed in pre conditioning solutions which were prepared differently for both of them. The treatments used in the experiment are as follows,

1. Flower spikes

Factor - I: Pre conditioning of flowers with Benzyladenine (T)

T_1 - Benzyladenine 100 ppm

T_2 - Benzyladenine 150 ppm

T_3 - Benzyladenine 200 ppm

T_4 - Distilled water

Factor - II: Pulsing duration (hours) (P)

P_1 - 2h

P_2 - 4h

P_3 - 8h

Treatment combinations:

T_1P_1 : Pre conditioning with Benzyladenine at 100 ppm for 2h

T_1P_2 : Pre conditioning with Benzyladenine at 100 ppm for 4h

T_1P_3 : Pre conditioning with Benzyladenine at 100 ppm for 8h

T_2P_1 : Pre conditioning with Benzyladenine at 150 ppm for 2h

T_2P_2 : Pre conditioning with Benzyladenine at 150 ppm for 4h

T_2P_3 : Pre conditioning with Benzyladenine at 150 ppm for 8h

T_3P_1 : Pre conditioning with Benzyladenine at 200 ppm for 2h

T_3P_2 : Pre conditioning with Benzyladenine at 200 ppm for 4h

T_3P_3 : Pre conditioning with Benzyladenine at 200 ppm for 8h

T_4P_1 : Pre conditioning with Distilled water for 2h

T_4P_2 : Pre conditioning with Distilled water for 4h

T_4P_3 : Pre conditioning with distilled water for 8h

2. Leaves

Factor - I: Pre conditioning of leaves with GA_3 (T)

T_1 - GA_3 at 100 ppm

T_2 - GA_3 at 200 ppm

T_3 - GA_3 at 300 ppm

T_4 - Distilled water

Factor - II: Pulsing duration (hours) (P)

P_1 - 2h

P_2 - 4h

P_3 - 8h

Treatment details:

T_1P_1 : Pre conditioning with GA_3 at 100 ppm for 2h

T_1P_2 : Pre conditioning with GA_3 at 100 ppm for 4h

T_1P_3 : Pre conditioning with GA_3 at 100 ppm for 8h

T_2P_1 : Pre conditioning with GA_3 at 200 ppm for 2h

T_2P_2 : Pre conditioning with GA_3 at 200 ppm for 4h

T_2P_3 : Pre conditioning with GA_3 at 200 ppm for 8h

T_3P_1 : Pre conditioning with GA_3 at 300 ppm for 2h

T_3P_2 : Pre conditioning with GA_3 at 300 ppm for 4h

T_3P_3 : Pre conditioning with GA_3 at 300 ppm for 8h

T_4P_1 : Pre conditioning with Distilled water for 2h

T_4P_2 : Pre conditioning with Distilled water for 4h

T_4P_3 : Pre conditioning with Distilled water for 8h

Methodology

Water uptake

Water uptake is the difference between consecutive measurements of containers + solution (without flowers recorded once in two days to measure the water uptake that particular duration of period and represented as gram per flower (Venkatarayappa *et al.*, 1981).

$$WU = \frac{\text{Initial wt. of container Without flower} - \text{Final wt. of container without flower}}{\text{No. of flowers in the bottle}}$$

Transpirational loss of water

Transpirational loss of water is the difference between consecutive measurements of container + solution + flowers recorded once in two days to measure the transpirational loss of water within that particular duration of period (Venkatarayappa *et al.*, 1981) and represented as gram /flower.

$$TLW = \frac{\text{Initial wt. of container With flower} - \text{Final wt. of container With flower}}{\text{No. of flowers in the bottle}}$$

Water balance (WB) (g/f)

Water balance in the flower tissue was calculated as the difference between water uptake and transpirational loss of water and represented as gram per flower (Venkatarayappa *et al.*,1981).

Optical density

Optical density of vase solution was measured at every alternate day by using Spectrophotometer at 480 nm.

Fresh weight change

The difference between the weight of the container + solution + flower and weight of container + solution is recorded once in two days to measure the fresh weight change of the flower during that particular period/duration of time (Venkatarayappa *et al.*, 1981). The weight of the flower stems on the first day of each experiment was assumed to be 100 per cent. Subsequent weights were referred to as percentage of the initial weight.

Results and Discussion

From the Table 1, in the interaction between preservative solutions and best of pre conditioning treatments, during different days of vase life period, on day 1 there was no significant difference in the interaction. On day 7, the highest TLW (15.67 g/f) was recorded in T_5B_1 - 4% sucrose + 200 ppm HQS + 2% $CaCl_2$ + BA - 200 ppm followed by (15.13 g/f) T_6B_1 - 6% sucrose + 300 ppm HQS + 3% $CaCl_2$ + BA - 200 ppm which was at par with (15.03 g/f) T_6B_2 - 6% sucrose + 300 ppm HQS + 3% $CaCl_2$ + BA - 150 ppm and the lowest TLW (9.14 g/f) was recorded in T_7B_2 - Distilled water + BA - 150 ppm.

Further, the results are in agreement with those of Farahat and Gaber (2009) on *Monestera deliciosa* who indicated that using $CaCl_2$ recorded the highest water uptake. Mortazavi *et al.*, (2007) reported that the addition of calcium to vase roses increased the relative water content in rose petals. Cortes *et al.*, (2011) revealed that Ca in vase water can improve water uptake and concluded that the better vase life with the addition of 'Ca' was due to improved water conductance via xylem cells, confirms the present study in calla lily. While, Sucrose helps in maintaining the water balance and turgidity and 8 HQS acts as anti microbial agent. Hence, addition of sucrose and 8 HQS to holding solution might have lead to increased uptake of the holding solution Rogers, (1973).

The transpirational loss of water differed significantly with different floral preservatives during different days of vase life period. From the Table 1, it was observed in the interaction between preservative solutions and best of pre conditioning treatments, the highest TLW (15.67 g/f) was recorded in T_5B_1 - 4% sucrose + 200 ppm HQS + 2% $CaCl_2$ + BA - 200 ppm followed by (15.13 g/f) T_6B_1 - 6% sucrose + 300 ppm HQS + 3% $CaCl_2$ + BA - 200 ppm which was at par with (15.03 g/f) T_6B_2 - 6% sucrose + 300 ppm HQS + 3% $CaCl_2$ + BA - 150 ppm and the lowest TLW (9.14 g/f) was recorded in T_7B_2 - Distilled

Table 1: Effect of pre conditioning treatments and pulsing duration on water relations during vase life period of calla lily *cv*. Captain Murano.

Treatments	Water uptake (g/f)									Transpirational loss of water (g/f)								
	1st day	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th day	1st day	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th day
BA 100 ppm + 2h	21.92	18.61	14.07	11.14	7.14	3.89	1.56	—	—	20.94	18.28	14.05	11.75	8.27	5.12	2.73	—	—
BA 100 ppm + 4h	23.33	19.18	15.63	12.49	8.49	5.24	2.87	—	—	22.07	18.66	15.55	12.45	8.83	5.91	3.69	—	—
BA 100 ppm + 8h	27.17	21.96	19.51	16.35	12.35	9.10	6.73	4.60	3.10	24.17	20.50	19.23	15.79	11.84	8.89	6.67	5.75	4.35
BA 150 ppm + 2h	22.06	16.17	14.20	11.24	7.68	3.99	1.47	—	—	20.98	15.80	14.04	11.61	8.53	5.03	3.03	—	—
BA 150 ppm + 4h	26.60	21.43	19.36	15.78	11.78	8.53	6.05	4.03	2.53	24.03	20.13	18.63	15.38	11.59	8.57	6.19	4.72	3.58
BA 150 ppm + 8h	25.27	19.87	17.34	14.40	10.41	7.16	4.73	2.66	1.16	23.27	18.96	16.62	14.29	10.64	7.57	5.36	3.24	2.43
BA 200 ppm + 2h	23.93	19.17	16.21	13.21	9.51	5.96	3.46	1.46	—	22.44	18.72	15.90	13.19	10.16	6.79	4.46	2.60	—
BA 200 ppm + 4h	25.73	20.09	17.86	14.86	10.86	7.61	5.16	3.12	1.61	23.86	19.09	16.99	14.76	11.03	7.98	5.74	3.82	2.90
BA 200 ppm + 8h	26.23	21.05	18.22	15.34	11.19	8.09	5.69	3.60	2.09	24.14	20.13	17.31	15.09	11.26	8.40	6.19	4.35	3.48
Distilled water + 2h	20.02	15.23	12.16	9.16	—	—	—	—	—	19.27	17.20	12.25	10.09	—	—	—	—	—
Distilled water + 4h	20.55	17.89	12.67	9.67	5.67	—	—	—	—	19.72	17.77	12.76	10.56	7.12	—	—	—	—
Distilled water + 8h	21.46	17.80	13.69	10.69	6.69	3.45	—	—	—	20.51	17.97	13.71	11.45	7.98	4.87	—	—	—
Pre conditioning treatment (T)	0.107	0.476	0.151	0.111	0.140	0.095	0.139	—	—	0.152	0.464	0.154	0.145	0.164	0.171	0.162	—	—
Pulsing duration (p)	0.093	0.412	0.131	0.096	0.121	0.082	0.121	—	—	0.131	0.402	0.133	0.126	0.142	0.148	0.141	—	—
T X P	0.185	0.825	0.262	0.192	0.243	0.165	0.241	—	—	0.262	0.804	0.267	0.251	0.284	0.296	0.281	—	—

water + BA - 150 ppm. However, the treatment with $CaCl_2$ in combination with sucrose and HQS resulted in better transpirational loss of water and good water conductance in flower spikes continued the vase life up to 22 days.

According to Durkin, (1979) the transpiration decrease, by using sucrose in the solution may be due the reduction in water absorption, since the flow rate is slower, when sugars are in the solution. The treatment with $CaCl_2$ + Suc + HQS maintained a greater RWC compared to the treatments with sucrose without HQS. This may be due to the effect of antibacterial properties of HQS and Cl in $CaCl_2$ prevented vascular blockage, allowing greater hydration. Combrink (2018), referred to the acidification effect of $CaCl_2$, which have positive effect on control of microbial growth. Results are in

Fig. 1: General laboratory view of the experiment on the initial day.

Table 2: Effect of pre conditioning treatments and pulsing duration on water relations during vase life period of calla lily *cv*. Captain Murano.

Treatments	Water balance (g/f)									Optical density (at 480nm)								
	1st day	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th day	1st day	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th day
BA 100 ppm + 2h	0.98	0.33	0.02	-0.64	-1.03	-1.24	-1.18	—	—	0.045	0.050	0.053	0.092	0.136	0.154	0.169	—	—
BA 100 ppm + 4h	1.26	0.53	0.08	-0.08	-0.45	-0.77	-0.84	—	—	0.034	0.045	0.048	0.054	0.066	0.086	0.094	—	—
BA 100 ppm + 8h	3.14	1.46	0.12	0.31	0.50	0.21	0.05	-1.15	-1.25	0.013	0.017	0.022	0.037	0.044	0.055	0.067	0.087	0.095
BA 150 ppm + 2h	1.08	0.37	0.16	-0.17	-0.85	-1.05	-1.56	—	—	0.035	0.040	0.043	0.064	0.066	0.075	0.086	—	—
BA 150 ppm + 4h	2.52	1.30	0.88	0.50	0.30	-0.05	-0.15	-0.69	-1.05	0.016	0.020	0.027	0.039	0.062	0.070	0.076	0.092	0.127
BA 150 ppm + 8h	1.95	0.95	0.72	0.05	-0.33	-0.54	-0.67	-0.58	-1.27	0.027	0.033	0.033	0.077	0.081	0.096	0.112	0.130	0.143
BA 200 ppm + 2h	1.50	0.45	0.31	0.02	-0.75	-0.84	-1.01	-1.14	—	0.026	0.038	0.040	0.068	0.057	0.083	0.094	0.146	—
BA 200 ppm + 4h	1.86	1.00	0.87	0.10	-0.17	-0.37	-0.59	-0.70	-1.29	0.023	0.030	0.036	0.051	0.076	0.074	0.081	0.102	0.113
BA 200 ppm + 8h	2.08	0.93	0.91	0.14	0.16	-0.04	-0.34	-0.75	-1.39	0.021	0.021	0.030	0.043	0.057	0.071	0.076	0.090	0.119
Distilled water + 2h	0.75	0.02	-0.08	-0.93	—	—	—	—	—	0.055	0.059	0.096	0.126	—	—	—	—	—
Distilled water + 4h	0.83	0.11	-0.09	-0.90	-1.45	—	—	—	—	0.055	0.056	0.076	0.112	0.157	—	—	—	—
Distilled water + 8h	0.96	0.17	-0.02	-0.76	-1.29	-1.43	—	—	—	0.050	0.053	0.065	0.097	0.144	0.109	—	—	—
Pre conditioning treatment (T)	NS	NS	0.046	0.058	NS	NS	0.069	—	—	0.013	0.001	0.002	0.003	0.003	0.003	0.003	—	—
Pulsing duration (p)	0.070	NS	0.054	0.067	0.103	0.093	0.080	—	—	NS	0.001	0.002	0.003	0.002	0.003	0.003	—	—
T X P	0.140	NS	0.093	0.116	0.178	0.150	0.139	—	—	NS	0.003	0.004	0.005	0.004	0.006	0.005	—	—

confirmation with Chethana (2011) in bird of paradise, Maitra and Roychowdhury (2002) and Harish (2012) in Anthurium.

Among the best of preservative solutions and pre conditioning treatments from the Table 2, the highest WB (8.86 g/f) was observed in T_5B_1 - 4% sucrose + 200 ppm HQS + 2% $CaCl_2$ + BA - 200 ppm followed by (8.15 g/f) T_6B_1 - 6% sucrose + 300 ppm HQS + 3% $CaCl_2$ + BA - 200 ppm and lowest WB (5.03 g/f) was observed in T_7B_2 - Distilled water + BA - 150 ppm which was at par with T_7B_1 - Distilled water + BA - 200 ppm (5.08 g/f).

Hence, the flowers kept in combination of BA, 8-HQS, Sucrose and $CaCl_2$ had been showed better water balance than those with other treatments. Water balance is a major factor influencing the quality and longevity of cut flowers. The increased water balance was due to increased in water uptake and with decreased loss of water. Further $CaCl_2$ addition in the treatment played significant role in maintaining positive water balance by acting dually as antimicrobial agent due to the presence of chlorine and aided in cell wall strengthening with calcium. The synergistic effect of Sucrose, 8 HQS, $CaCl_2$ with BA pre conditioning improved water relations and water balance.

From the Table 2, in the interaction between preservative solutions and the best of pre conditioning solutions, the lowest OD (0.022) was noticed in the interaction T_6B_1 - 6% sucrose + 300 ppm HQS + 3% $CaCl_2$ + BA - 200 ppm followed by T_6B_2 - 6% sucrose + 300 ppm HQS + 3 % $CaCl_2$ + BA - 150 ppm (0.029) and the highest OD (0.104) was noticed in T_7B_2 - Distilled water + BA - 150 ppm which was at par with T_7B_1 -

Table 3: Effect of pre conditioning treatments and pulsing duration on fresh weight change of calla lily cv. Captain Murano.

Fresh weight change (%)									
Treatments	**1st day**	**3rd day**	**5th day**	**7th day**	**9th day**	**11th day**	**13th day**	**15th day**	**17th day**
BA 100 ppm + 2h	106.58	90.15	88.71	72.41	60.00	51.10	50.01	—	—
BA 100 ppm + 4h	10.3.70	91.09	89.19	77.34	61.00	54.19	52.10	—	—
BA 100 ppm + 8h	108.69	98.76	95.85	85.85	75.12	71.10	69.13	63.65	57.27
BA 150 ppm + 2h	105.70	90.75	89.90	79.30	69.00	61.10	57.19	—	—
BA 150 ppm + 4h	108.08	98.15	95.11	87.23	73.00	67.89	65.19	62.66	56.30
BA 150 ppm + 8h	101.39	95.78	90.14	83.44	65.29	62.09	59.10	55.47	55.54
BA 200 ppm + 2h	101.40	94.13	92.13	81.07	68.00	64.98	61.34	51.90	—
BA 200 ppm + 4h	107.67	96.14	94.13	83.93	71.10	65.19	63.23	61.40	51.45
BA 200 ppm + 8h	108.14	97.16	94.89	84.18	72.36	67.00	64.98	62.19	53.55
Distilled water + 2h	100.34	86.00	83.12	62.25	—	—	—	—	—
Distilled water + 4h	100.51	89.67	86.53	69.22	52.03	—	—	—	—
Distilled water + 8h	103.44	89.98	88.27	70.54	55.67	52.19	—	—	—
Pre conditioning treatment (T)	0.195	0.210	0.133	1.481	0.525	0.467	0.366	—	—
Pulsing duration (P)	0.168	0.182	0.116	1.283	0.455	0.404	0.317	—	—
T X P	0.337	0.363	0.231	2.566	0.910	0.808	0.634	—	—

Distilled water + BA - 200 ppm (0.092).

During the vase life period of calla lily there was increase in OD values of solution. However, the increase in OD values of vase solution is steady in the treatments with addition of $CaCl_2$ with Sucrose, HQS and BA pre conditioning. This is due to better water relations maintained less turbidity of the vase solution without any leakages from spike and growth of microbes. Van *et al*., (1991) reported a positive correlation between the number of bacteria and water conductivity and the antimicrobial action of $CaCl_2$ and HQS attributed to lower OD values of vase solution. The results are in agreement with Tsegaw *et al*., (2011) in cut roses, Bhanumurthy (2013) in cut gerbera, Knee (2000) in cut rose cv. Classy and Jyothi *et al*., (2013) in gypsophila.

In the interaction between preservative solutions and the best of pre conditioning treatments, from the Table 3, the highest FWC (100.66 %) was recorded in the interaction T_5B_1 - 4% sucrose + 200 ppm HQS + 2% $CaCl_2$ + BA - 200 ppm which was at par with (100.24 %) T_6B_1 - 6% sucrose + 300 ppm HQS + 3% $CaCl_2$ + BA - 200 ppm and T_5B_2 - 4% sucrose + 200 ppm HQS + 2% $CaCl_2$ + BA - 150 ppm (100.16) followed by T_6B_2 - 6% sucrose + 300 ppm HQS + 3% $CaCl_2$ + BA - 150 ppm (97.81 %). Whereas the lowest FWC (92.14 %) was recorded in T_7B_2 - Distilled water + BA - 150 ppm.

The fresh weight of the cut flower spikes held in vase solutions gradually decreased as the vase life proceeded. The treatments in combinations with $CaCl_2$, the decrease was steady and continued upto 22 days. The maintenance of fresh weight for longer period is due to better water relations in the flower spikes. The balanced uptake and loss of water maintained turgidity of flower spikes for longer time where, $CaCl_2$ is used as one of the components of the vase solution.

Akintoye *et al*., (2018) reported that, increase in $CaCl_2$ concentration with sucrose increased relative water content in Heliconia flower spikes, which could be due to the increased permeability of the cell membranes by calcium ions. Similar results were also noticed by Nedjimi and Daoud (2009) in *Atriplex halimus* and found consistently higher RWC with $CaCl_2$ application. Along with Sucrose, HQS, BA with the addition of $CaCl_2$ maintained better water relations with additive effect of $CaCl_2$ probably due to the interference of Ca^{+2} in the permeability of the cell membrane.

This present result indicates the effectiveness of calcium in maintaining the integrity of cellular membranes and the importance of HQS as an antibacterial agent, allowing a constant hydration and thus inhibiting vascular occlusion. Adding sucrose 4 % to preservative solutions contained 8-HQS and $CaCl_2$ decreased flower weight

Fig. 2: Influence of pulsing with different concentrations of benzyl adenine and duration of pulsing on vase life of calla lily flower spikes '*cv*. Captain Murano' on 9th day

loss percentage. This may attributed to the effect of sucrose in delaying petal senescence and flower wilting (Halevy and Mayok, 1979). These results are similar to those reported by Ichimura *et al*., (2001) in Rose, Dinesh babu *et al*., (2002) in dendrobium hybrid sonia-17, Singh and Tiwari (2003) in rose.

Conclusion

Further, post - harvest studies revealed that, pre conditioning with BA and GA_3 of flower spikes and cut leaves at concentration of 100 ppm, 200 ppm and pulsing for 8 h recorded maximum water uptake (27.17 g/f), transpirational loss of water (24.17 g/f), water balance (3.14 g/f), fresh weight change (108.69 %) and lower optical density (0.013).

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