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EFFECT OF BIOCIDES ON THE FRESH WEIGHT, CHLOROPHYLL CONTENT AND MICROBIAL LOAD IN CUT CARNATION FLOWERS CV. CHARMANT

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Abstract

The vase life of cut carnation flowers were studied to determine the physiological, biochemical and microbial factors that affect the rate of senescence. Cut carnations were obtained from the commercial grower in Nujiveedu and treated with biocides at different concentrations. Longevity was determined as the number of days from the start of the experiment until the flower exhibited bent neck, petal wilting (shrinking) or petal abscission. The experimental flowers were held in the laboratory at about 25±2°C ambient room temperature, 45 to 55 per cent relative humidity (RH) and 40W cool white fluorescent tubes to maintain 12 hours photoperiod. The experiment was held in laboratory of the Department of Horticulture, College of Horticulture, A. P. Horticulture University, Venkataramannagudem, West Godavari dist, A.P. (India). The experiment extended from October 2010 to March 2011. The highest fresh weight, chlorophyll content in leaf and calyx was observed with $Al_2(SO_4)_3$ at 150 ppm treated flowers and lowest was observed in control. The microbial count in vase solution was lowest with bleach and 8-HQS vase solutions at all concentrations compared to other biocides while the highest microbial count was observed with control.

Key words : *Dianthus caryophyllus,* cut flower, biocides, chlorophyll, microbial, vase life.

Introduction

Carnation (*Dianthus caryophyllus* L.) belonging to the family Caryophyllaceae is one of the most important and an excellent cut flower crops grown in almost all the countries of the world and ranks second on global floriculture screen (Patil *et al*., 2004). Due to its excellent keeping quality, wide range forms of myriad colors, ability to withstand long distance transportation and remarkable ability to rehydrate along with its lighter weight have made carnation flowers a unique item in cut flower trade. Due to increased demand of cut flowers in domestic as well as international markets there is great scope to develop suitable post harvest technology specific to each cut flower to reach higher market price. Treatment with antimicrobial compounds shortly after harvest is beneficial for several flower species. The vase life of many cut flowers is limited by an occlusion in the stem leading to premature symptoms of water stress and finally senescence of flower (van Doorn *et al*., 1999). Use of biocides, certainly help in maintaining the better water relations.

Materials and Methods

The experiment was held in laboratory of the Department of Horticulture, College of Horticulture, A. P. Horticulture University, Venkataramannagudem, West Godavari dist (A.P.), India during October 2010 to March 2011 by using biocides in holding solutions. There are 13 treatments $Al_2(SO4)_3$ 150 ppm, $Al_2(SO4)_3$ 300 ppm, $Al_2(SO4)_3$ 500 ppm, Bleach 25 ppm, Bleach 50 ppm, Bleach 75 ppm, 8-HQS 200 ppm, 8-HQS 300 ppm, 8-HQS 400 ppm, CA 10 ppm, CA 15 ppm, CA 20 ppm, and Control (Distilled Water).

Fresh weight change (FWC)

The difference between the weight of the container + solution + flower and the weight of container + solution recorded at every alternate day to measure the fresh weight change of flower during that particular period / duration of time (Venkatarayappa *et al*., 1980). The weight of 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 value.

Table 1 : Effect of post harvest application of biocides on fresh weight change (% of initial weight) and microbial counts (cfu/ml) during vase life period of cut carnation cv. Charmant.

Treatments	Treatment Period (Days)								
	Fresh weight change (% of initial weight)							Microbial counts (cfu/ml)	
	2	4	6	8	10	Mean	12	2	10
Al2(SO4)3 150	106.3	103.8	100.6	98.35	92.81	100.40[a]	89.48	4.52×10^1 (6.72)[c]	1.43×10^4 (119.38)[d]
Al2(SO4)3 300	104.8	102.2	97.27	95.99	92.65	98.59[b]	89.99	4.04×10^1 (6.36)[c]	1.38×10^4 (117.47)[d]
Al2(SO4)3 500	105.3	102.9	99.91	97.74	92.19	99.61[a]	88.16	3.46×10^a (5.88)[c]	1.35×10^4 (116.20)[d]
CB 25	100	98.73	95.28	92.64	89.21	95.18[d]	-	0 (0.70)[d]	4.62×10^3 (67.98)[e]
CB 50	101	99.74	95.06	92.83	88.39	95.41[d]	85.74	0 (0.70)[d]	4.55×10^3 (67.49)[e]
CB 75	101.6	99.61	96.81	91.99	87.92	95.59[d]	-	0 (0.70)[d]	4.49×10^3 (67.00)[e]
8-HQS 200	106.3	102.2	97.03	94.68	92.21	98.48[b]	91.04	0 (0.70)[d]	6.07×10^3 (77.89)[e]
8-HQS 300	103.9	101.2	96.46	93.13	90.07	96.95[c]	90.09	0 (0.70)[d]	5.25×10^3 (72.43)[e]
8-HQS 400	99.61	98.96	95.64	92.91	89.61	95.35[d]	86.71	0 (0.70)[d]	4.99×10^3 (70.64)[e]
CA 10	100.3	97.26	95.42	92.57	90.48	95.21[d]	84	1.95×10^2 (13.96)[b]	3.67×10^4 (191.70)[b]
CA 15	99.87	96.25	95.11	92.44	88.08	94.35[e]	82.98	1.93×10^2 (13.88)[b]	3.36×10^4 (183.17)[b]
CA 20	97.37	95.4	94.84	92.54	88.04	93.64[f]	-	1.90×10^2 (13.80)[b]	3.05×10^4 (174.63)[c]
Control (DW)	94.94	91.34	90.01	89.52	87.84	90.73[g]	-	3.07×10^3 (55.43)[a]	4.49×10^5 (669.78)[a]
Mean	101.60[a]	99.21[b]	96.11[c]	93.64[d]	89.96[e]			9.25	153.52
	F-test	S.Em±	CD 5%				F-test	**	**
For days (D)	**	0.42	1.17				S.Em±	0.39	4.05
For treatments (T)	**	0.29	0.8				C.D at 5%	1.13	11.83
For D × T	**	1.03	2.87						

Table 2 : Effect of postharvest application of biocides on chlorophyll content in leaf & calyx (SPAD units) during vase life period of cut carnation cv. Charmant.

Treatments	Time Period (Days)													
	Chlorophyll content in leaf (SPAD units)							Chlorophyll content in calyx (SPAD units)						
	2	4	6	8	10	Mean	12	2	4	6	8	10	Mean	12
$Al_2(SO_4)_3$ 150	87.38	90.35	84.66	83.24	81.52	85.43[a]	75.36	43.88	46.85	41.16	39.74	38.02	41.93[a]	31.86
$Al_2(SO_4)_3$ 300	84.43	85.69	80.49	79.38	78.34	81.66[d]	77.44	40.93	42.19	36.99	35.88	34.84	38.16[d]	33.94
$Al_2(SO_4)_3$ 500	84.36	87.47	81.87	80.14	78.38	82.44[c]	69.71	40.86	43.97	38.37	36.64	34.88	38.94[c]	26.21
CB 25	82.8	87.29	82	81.79	80.41	82.86[c]	-	39.3	43.79	38.5	38.29	36.91	39.36[c]	-
CB 50	85.52	86.74	81.87	80.76	79.11	83.60[b]	73.93	42.02	42.24	38.37	37.26	35.61	40.10[b]	30.43
CB 75	84.26	86.46	81.64	80.26	79.42	82.41[c]	-	40.76	42.96	38.14	36.76	35.92	38.91[c]	32.48
8-HQS 200	85.18	86.62	82.41	81.13	80.17	83.10[b]	79.31	41.68	43.12	38.91	37.63	36.67	39.60[b]	-
8-HQS 300	82.61	85.07	81.26	80.47	79.16	81.72[d]	75.99	39.11	41.57	37.76	36.97	35.66	38.22[d]	32.5
8-HQS 400	86.5	88.5	81.25	79.09	77.76	82.62[c]	76.75	43	45	37.75	35.59	34.26	39.12[c]	33.25
CA 10	83.45	84.74	82.8	82.33	81.45	82.95[b]	74.08	39.95	41.24	39.3	38.83	37.95	39.45[b]	30.58
CA 15	83.69	88.34	82.3	81.17	80.76	83.25[b]	78.97	40.19	44.84	38.8	37.67	36.66	39.63[b]	35.47
CA 20	83.72	85.24	82.49	80.93	77.71	82.02[e]	-	40.22	41.74	38.99	37.43	34.21	38.52[d]	-
Control (DW)	80.81	85.18	79.57	78.6	68.42	78.52[f]	-	37.31	41.68	36.07	35.1	24.92	35.02[e]	-
Mean	84.21[b]	87.05[a]	81.89[c]	80.71[d]	78.66[e]			40.71[b]	43.55[a]	38.39[c]	37.21[d]	35.12[e]		
	F.test	S.Em±	CD 5%					S.Em±	CD 5%					
For days (D)	* *	0.35	0.98					0.35	0.98					
For treatment (T)	* *	0.24	0.66					0.34	0.66					
For D x T	* *	0.86	2.39					1.21	2.39					

** Significant at (P < 0.01), * Significant at (P < 0.05), NS : Not significant, Figures bearing same letters did not differ significantly.

Chlorophyll content in leaf and calyx

Chlorophyll was measured using chlorophyll meter SPAD-502. Amount of chlorophyll was expressed as SPAD units.

Microbial counts

Samples of vase water were collected at the beginning of experiment (on zero day) and at the end of the experiment (on the final day). After 10 fold serial dilutions, 1 ml samples were plated out on plate count agar media (standard methods agar of Himedia) by pour plate method and incubated at 37°C for 2 days and colonies formed were counted. Plates with counts between 30 to 300 were taken as reliable and used for calculation. The total colony counts, referred as colony forming units (cfu) was calculated as below:

$$cfu = \frac{Y}{dx}$$

Where,

Y = Number of colonies formed

d = dilution

x = volume of the sample taken

Results and Discussion

From table 1, the increased fresh weight compared to all other treatments was observed with $Al_2(SO4)_3$ 150 ppm (100.40%). Doorn *et al*. (1990) found that aluminium sulphate in vase water decreased the number of bacteria in the stems and increased vase life with an increase in fresh weight was reported with the same chemical in cut roses (De Stigter, 1978).

In control, lowest FW was observed during the vase life period because early water stress created during the initial stages, that might have led to disturbance in the transport of water resulting from the plugging of the conducting tissue either physically by the microorganisms entering through the vase water (Larsen and Frolich, 1969) or physiologically (Rogers, 1973).

The chlorophyll content in leaf and calyx of cut carnations slightly increased from initial day of experimentation to day 4 and then decreased gradually towards the end of the vase life period (table 2). The chlorophyll content in leaf and calyx was significantly highest with $Al_2(SO_4)_3$ 150 ppm (85.43 and 41.93 SPAD units, respectively) over the other treatments in the study. The chlorophyll content was intensified when the flower dry matter content was higher and then it has faded due to depletion and damage of the chloroplasts in the calyx and leaf at advanced senescence. These results were in the line of Misoon *et al*. (2000) findings, they observed decreased chlorophyll content in leaves of carnation at increased storage period.

Many studies have correlated an increased bacterial count in the vase water with decreased longevity of cut flowers (Clerkx *et al*., 1988; van Doorn and Perik, 1990). According to findings of Loubaud and van Doorn (2004), prevention of water uptake due to xylem blockage in several cut flowers is mainly due to the presence of bacteria in vase solution. The data given in table 1 revealed that the microbial growth in the vase solution was very less with all the biocide treatments compared to control. Both the concentrations of Bleach and 8-HQS treatments were observed free of microbial growth during day 2 of experimentation and reduced microbial growth on 10th day of experimentation. Reduced microbial growth was due to their biocidal effect in vase solution. Singh *et al*. (2003) observed least bacterial colonies in vase solutions of 8-HQS and Bleach when cut carnation was treated with these preservatives.

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