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EFFECT OF DIFFERENT CHEMICALS ON THE POST HARVEST LIFE OF ORNAMENTAL PALMS

[1]Moumita Malakar, [2]Pinaki Acharyya and [3]Sukanta Biswas

[1,2,3]Department of Horticulture, University of Calcutta, 51/2, Hazra Road, Kolkata- 700019.

ABSTRACT

Perennial, herbaceous and semi-woody plants, intrinsic part of florist industry notwithstanding of plant families are incorporated predominantly into foliage plants category, abstemious handling of which concerning their worthy post harvest features may lead implementation in both landscaping and interiorscaping. The intent of present investigation was to showcase the consequence of 50 and 100 ppm of NAA, 50 and 100 ppm of GA3, 20 and 40 ppm of AgNO3 and 4% and 8% of sucrose as vase solution for 24, 48, 96 and 120 hours durational treatment on full-grown palm leaves of Chrysalidocarpus lutescens, Raphis excelsa and Caryota mitis to sustain and extend their post harvest life. Water uptake and fresh weight increase and decrease were disproportionate with consecutive 120 hours treatment in each cut foliage except the hike of 13.1 g of fresh weight and 3.1 ml of water uptake noted in Raphis excelsa and Caryota mitis after 48 hours of imbibitions respectively. In case of Chrysalidocarpus lutescens and Caryota mitis AgNO3 at 20 ppm proved itself best for prolonging vase life of 35.1 and 54.7 days respectively while AgNO3 at 40 ppm exhibited satisfactory result of 15.6 days vase life in Caryota mitis. Surprisingly, 35.1 days of vase life obtained after GA3 at 40 ppm treatment in Chrysalidocarpus lutescens in lieu of 14.1 days vase life under control. Here, three cut foliages manifested different responses regarding increase/decrease of their chlorophyll content but significantly high amount of chlorophyll viz. 119.05 and 73.68 mg/100g were secured under control and NAA at 50 ppm treatment in Chrysalidocarpus lutescens and Caryota mitis. Water uptake and water loss in treated shoots in holding solutions were failed to establish any relation with vase life.

Keywords: Chrysalidocarpus lutescens, Raphis excelsa, Caryota mitis, Foliage, Post-harvest, Chlorophyll, Water uptake, Vase life.

ISSN: 2455-6939

Volume:02, Issue:03

INTRODUCTION

Cut foliage constitutes an important part of florist industry. A large number of plants can be potentially used for this purpose, provided they can be produced and handled economically and their leaves posses suitable post harvest characteristics. Ferns, Asparagus, palms, Aspidistra etc, are commonly sold in the local market, at the same time they have established their potentiality in the international market too. Apart from these, large numbers of ornamental plants which also include some trees, shrubs and other perennials have also got promising potentiality in the local ornamental market as well as in the international market. They have created their importance to the customer for their attractive form, color and freshness of leaves and stems beautifully furnished, sprays and with the most advantageous characteristics over cut flowers that they are not prone to rapid wilting and last long in flower arrangement. Ferns are highly valued materials for different floral arrangements. As early as 1979, Barendse studied vase life of some ferns and observed that vase life of Polystichum setiferum and Cyrtomium falcatum cv. Rochfordii lasted for longer than three weeks whereas Pteris cretica cv. Albolineata and Nephrolepis exaltata cv. Teddi Junior lasted for 2-3 weeks and 10-14 days respectively. More recently, Singh and Singh (2004) studied the vase life of Nephrolepis exaltata cv. Bostoniensis, Nephrolepis exaltata cv. Golden Boston and Blechnum gibbum had 18.6, 11.59 and 1.24 days as their normal vase life. However except the case of Blechnum gibbum, vase life of the other two species can be effectively increased by pre-treatment with chemicals.

Such variation in vase life within the genus and even within the species and possibility of enhancing their post harvest life through different treatments encouraged more scientists to work with wide varieties of species with varying treatments. So the purpose of our work was to study the effect of different biocides treatments here used as holding solution for maintaining quality and prolonging their post harvest life since extensive studies have been made on post harvest life of cut flowers but studies on cut foliage (cut greens, florist's green) are comparatively less, especially in context to our country where there is ample scope of growing tropical foliage plants.

MATERIALS AND METHODS

Collection of plant Materials and Chemicals used

The present study was conducted by three species of ornamental palms viz. Chrysalidocarpus lutescens (Wendl.), commonly known as 'Areca palm', Raphis excelsa (Thunb.), famous as 'Large Lady Palm' and Caryota mitis (Lour.), popular in 'Fishtail Palm' name, fully-grown foliage materials of which popularly used in landscaping or as potted plants for interior scaping at young stage as they have long lasting quality and 50 and 100 ppm of NAA, 50 and 100 ppm of

ISSN: 2455-6939

Volume:02, Issue:03

GA3, 20 and 40 ppm of AgNO3 and 4% and 8% of sucrose used as vase solution and tap water treated as control to investigate post harvest life of their foliages. These entire ornamental palms belong to the same family 'Palmae' having indigenous origin. 'Large Lady Palm' is a bush forming shady plant with deeply segmented palmate leaves with lanceolate leaf blade without midrib while 'Areca palm' is a cluster forming palm having pinnate arched leaves with acuminate leaflets, unequally bifid at apices. Lastly, bi-pinnate triangular arching, thick wedge shaped, loosely spaced leaves of 'Fishtail Palm' ultimately influenced its wide cultivation as ornamental palm. More or less, fresh and uniformly mature plant materials i.e leaves with stalk, length varied from16 - 46.5 cm. were collected in the early hours of the day from the garden of the National Library, grown in open condition followed by washing under running tap water and placing in clean water. They were brought to the laboratory in a wrapping condition with moistened filter paper.

Processing of Plant Materials

Regarding the preparation of collected materials, being maintained uniform size and length a slanting cut at the stalk-end under water was given to avoid air-blockage of the selected foliages followed by stripping off of lower leaflets to have clear portion for dipping into solution depending upon species.

Experimental Procedure

The experiment was carried out in the laboratory of the Department of Horticulture, Institute of Agricultural Science, University of Calcutta, Kolkata. All the prepared cut leaves were kept in 250ml. glass bottles with 200ml. of respective solutions under ambient temperature. The basal portion of stalk of all cut leaves received uniform dipping of 5.5cm. under solution. To avoid evaporational water loss, glass bottle's mouths were covered with non-permeable paper and being pierced through paper petiole of leaves were inserted into bottles. Documentation of the weight of cut stalked leaves as well as the bottles with solutions were performed before placing them into bottle. Initial chlorophyll content of the cut leaves were determined before subjecting them into different treatments following the protocol as suggested by Buzarbarua, 2000 being refrigerated one gram leaf tissue in 80% acetone for a week followed by crushing, filtering, making up of volume with fresh acetone and finally measuring optical density (O.D) of colored solution through 645 and 663 nm. wave length in a spectrophotometer against acetone.

Statistical Analysis

There were 9 treatments with 3 replications in each species. Observations were recorded on water uptake consecutively till 96 hours and change of weight of leaves consecutively till 120

ISSN: 2455-6939

Volume:02, Issue:03

hours while vase life studied up to the abscission period. Here the data were statistically analyzed in completely Randomized Design (CRD).

RESULTS AND DISCUSSION

After placing in vase solution (continuously in the solutions during their vase life) of distinct concentrations of biocides, the results revealed that except NAA with its two concentrations (50 and 100 ppm) all the treatments enhanced the vase life significantly in Chrysalidocarpus lutescens (Table.1). The same trend was also noted with 8.3 days of vase life under NAA at 50 ppm treatment failed to show effective result in Raphis excelsa as compare to control where 11.1 days vase life were recorded. But here NAA at 100 ppm performed better with 12.1 days of vase life. Surprisingly, Caryota mitis's cut foliages show satisfactory vase life of 41.1 days under 50 ppm strength of NAA but NAA at 100 ppm was found moderately good regarding this species evident from the Table.1. The maximum vase life of 35.1 days were exhibited by two treatments viz. GA3 at 50 ppm and AgNO3 at 20 ppm in Chrysalidocarpus lutescens while AgNO3 at 40 ppm proved best with 15.6 days vase life in Raphis excelsa. Patil et. al. 1996 noticed increased vase life of GA treated plants might be due to better mobilization of metabolites. Simultaneously, consequence of AgNO3 at 20 ppm treatment showcased an eye-catching extension of 54.7 days of vase life in Caryota mitis might be due to its biocidal activity (Mayak et. al.1977). Hettiarachchi and Balas (2003) observed the prolonged vase life of 31 days of Croton's (Codiaeium variegatum) foliage stems with 5-6 leaves when treated with 8-HQC as vase solution. Exogenous supply of sucrose promotes respiration, delays the onset of excessive protein degradation and thus extends the longevity of flowers and foliages (Harode et.al. 1993; Singh et. al. 2005; Skutnik et. al. 2007). Here, lower concentration (4%) of sucrose was found much better keeping Chrysalidocarpus lutescens's and Caryota mitis's foliages fresh till 32.3 and 48.4 days respectively. Sucrose in general, known to enhance the post harvest life of cut flowers and foliages by improving water uptake (Kofranek and Halevy, 1976) and reducing proteolytic breakdown (Larsen and Frolich, 1969). Slight increase of mean fresh weight irrespective of all biocidal treatment observed in all three species only after 24 hours of imbibitions while enhancement of consecutive hours were negatively correlated with the increase of mean fresh weight (Table.1). Chlorophyll content was found to reduce markedly with the treatments those were successful in enhancing the vase life. However, chlorophyll content is always not related with vase life as observed by Skutnik et. al.2007. Control (tap water) foliages of Chrysalidocarpus lutescens enhanced chlorophyll of 119.05 percent noticeably followed by GA3 at 50 ppm and 4 percent sucrose treatment of 96.29 and 91.84 percent respectively. GA3 has also been reported to enhance post harvest life along with limiting the degradation of chlorophyll in Zantedeschia elliottiona (Jonowska and Jerzy, 2003). Acute deterioration of chlorophyll was pointed out as an after-effect of AgNO3 at 20 ppm treatment in the same species. In Raphis

ISSN: 2455-6939

Volume:02, Issue:03

excelsa chlorophyll content was hiked extraordinarily with 34.85 percent chlorophyll under 8 percent sucrose solution treatment in context of its basic chlorophyll level of 8.93 percent. Astonishingly, 50 ppm strength of NAA proved itself unsurpassable with an increase of 73.68 percent chlorophyll in Caryota mitis.

When shoots were treated in vase solution, water uptake continuously decreased till 96 hours as evident from Table.2 in all three species. Highest total water uptake nothing but the difference between the consecutive weights of the glass bottles with solutions, of 21.4ml. under GA3 at 50 ppm treatment and of 24.6ml. under AgNO3 at 40 ppm treatment were noted in Chrysalidocarpus lutescens and Raphis excelsa respectively. However, 100 and 40 ppm concentration of GA3 and AgNO3 exhibited superior results by 10.2 and 10.5ml. of total water uptake in Caryota mitis. Several quality and post-harvest abnormalities like tip browning, shrinking, discoloration, bending, folding etc. were also documented since those characteristics hamper foliages ornamental value to some extent. However, the differences between the consecutive weights of the glass bottles plus solution with foliage stalks referred to as transpiration loss was observed higher here. Water uptake was positively correlated with vase life. Similar result was also obtained by Hettiarachchi and Balas et. al. (2003) in Croton (Codiaeium variegatum). In the present study, the treatment which showed greater vase life but did not maintain high water uptake and subsequently varies in water balance. The water balance in foliage was determined by deducting the total transpiration loss from total water uptake. It may indicate that, factors other than the water regime are also involved in determining a vase life.

CONCLUSION

Palms are the most fascinating group of plants and commonly used in the ornamental garden. Leaves of few species of palm whose cut foliage are enough potential as a product for the local as well as international market due to its decorative dark green leaves of pinnate or palmate form and a long case life. That's why present study was undertaken with these three ornamental palm species. In Chrysalidocarpus lutescens GA3 50 ppm and AgNO3 20 ppm were most effective as holding solution. Pinto et. al. (2007) obtained significant increase in longevity compared to control with assist of holding treatment of Benzyladenine and Gibberelic acid (250 and 500 mg L-1). While in Raphis excelsa and Caryota mitis AgNO3 40 and 20 ppm revealed utmost enhancement of post harvest life. Continuous presence of Ag+ within the holding solution facilitated the post harvest life might be due to its continual and greater anti-respiratory and anti-senescence activities (Singh et. al. 2002). Furthermore, apart from the traditional foliage plants like ferns, Asparagus sp. etc. some more plants which are grown normally in the garden have also been attempted to study their ornamental value as cut foliage. Shiau Yen et. al. (2003)

ISSN: 2455-6939

Volume:02, Issue:03

conducted an experiment to determine the vase life of 5 different such plants of Woodwardia orientalis, Liriope platyphylla, Paederia caveleiel, Lantana camera and Maesa tenera and observed the vase life of these 5 plants were 1-12 days. Sucrose 4 percent was also hastened the vase life 8 days over control in Caryota mitis. There are reports that continuous supply of sucrose (2%) was detrimental to the vase life of Eucalyptus sp. The lesser value of cut foliage life might be due to the disturbances in the transport of water resulted by microorganisms entering through the vase water (Larsen and Frolich, 1969). AgNO3 has been known as a strong biocide (Skutnik & Rabiza Swider, 2005) is found effective with sucrose for better performance. So in future investigation, biocide might be helpful if used with sucrose for better vas life.

ISSN: 2455-6939

Volume:02, Issue:03

Table.1: Fresh weight and vase life of three ornamental palm foliages as affected by different chemicals as vase solution

Chrysalidocarpus lutescens (Wendl.)								
Treatments	Initial mean fresh weight (g)	Final mean fresh weight (g)					Chlorophyll (mg/100g) of cut leaves increase/ decrease	Effective vase life (days)
		24 hrs	48 hrs	72hrs	96 hrs	120 hrs		
Control	6.4	6.5	6.4	6.2	6.1	6.1	119.05*	14.1f
NAA 50 ppm	5.7	5.8	5.7	5.5	5.3	5.2	44.44	14.3f
NAA 100 ppm	5.3	5.4	5.4	5.1	5.1	5.1	26.98	14.1f
GA3 50 ppm	7.6	7.7	7.5	7.1	7.1	7.1	96.29	35.1a
GA3 100 ppm	5.8	5.9	5.7	5.5	5.3	5.2	40.43	21.4e
AgNO3 20 ppm	7.7	7.8	7.6	7.4	7.3	7.2	8.19	35.1a
AgNO3 40 ppm	6.6	6.7	6.6	6.5	6.1	6.1	9.52	24.3d
Sucrose 4%	5.8	5.9	5.4	5.4	5.2	5.1	91.84	32.3b
Sucrose 8%	4.8	4.9	4.7	4.3	4.2	4.1	54.72	30.1c
Raphis excelsa (Thunb.)								
Treatments	Initial mean fresh weight (g)	Final mean fresh weight (g)					Chlorophyll (mg/100g) of cut leaves increase/ decrease	Effective vase life (days)
		24 hrs	48 hrs	72hrs	96 hrs	120 hrs		
Control	10.5	10.6	10.7	10.1	9.9	9.8	8.93	11.1be
NAA 50 ppm	9.7	9.9	9.4	8.9	8.3	8.2	17.3	8.3g
NAA 100 ppm	12.7	12.8	13.1	12.8	12.3	12.2	6.59	12.1cd
GA3 50 ppm	12.8	12.9	12.4	12.1	11.7	11.7	14.29	13.3b
GA3 100 ppm	13.2	13.4	12.6	12.2	11.7	11.5	4.69	10.3ef
AgNO3 20 ppm	14.9	15.1	14.5	14.8	14.5	14.4	7.94	12.3bc
AgNO3 40 ppm	14.3	14.5	14.5	14.4	14.1	14.1	3.13	15.6a
Sucrose 4%	10.7	11.1	10.6	10.1	10.1	10.1	8.14	6.3fg
Sucrose 8%	12.5	12.6	11.5	10.8	9.8	9.6	34.85*	9.7f

ISSN: 2455-6939

Volume:02, Issue:03

Table Cotnd.

Caryota mitis (Lour.)								
Treatments	Initial mean fresh weight (g)	Final mean fresh weight (g)					Chlorophyll (mg/100g) of cut leaves increase/ decrease	Effective vase life (days)
		24 hrs	48 hrs	72hrs	96 hrs	120 hrs		
Control	8.3	8.5	8.7	8.6	8.1	8.1	71.60	40.1d
NAA 50 ppm	8.2	8.5	8.7	8.4	8.1	8.1	73.68*	41.1d
NAA 100 ppm	7.2	7.3	7.3	7.1	6.9	6.8	31.03	20.3f
GA3 50 ppm	8.5	8.6	8.7	8.1	8.1	8.1	70.59*	40.1d
GA3 100 ppm	8.0	8.2	8.3	8.2	7.7	7.5	38.46	50.1b
AgNO3 20 ppm	9.3	9.6	9.8	9.6	9.2	9.1	39.09	54.7a
AgNO3 40 ppm	7.9	8.3	8.5	8.5	8.1	7.9	12.19	43.3c
Sucrose 4%	9.1	9.2	9.3	8.9	8.7	8.5	23.73	48.4b
Sucrose 8%	8.5	8.6	8.9	8.4	8.1	8.1	35.0	29.3d

*Chlorophyll content is increased of the particular treatments.

N.B. Similar words are statistically at par.

ISSN: 2455-6939

Volume:02, Issue:03

Table.2: Effect of chemicals as vase solution on water relation of three ornamental palm foliages.

Chrysalidocarpus lutescens (Wendl.)									
Treatments	Water uptake (ml.)				Total water uptake (ml)	Total transpiration loss (ml.)	Water balance (ml.) in foliage	Loss/uptake ratio	Observations
	24 hrs	48 hrs	72hrs	96 hrs					
Control	5.2	5.6	4.6	3.1	18.5b	18.8	-0.3	1.02	Yellowing, bending
NAA 50 ppm	4.8	4.1	4.1	2.4	15.4de	15.1	0.3	0.98	Tip browning
NAA 100 ppm	3.4	4.4	3.8	2.8	14.4efg	14.6	-0.2	1.01	Slight yellowing & tip browning
GA3 50 ppm	6.6	6.2	5.0	3.6	21.4a	21.6	-0.2	1.01	Yellowing, bending
GA3 100 ppm	5.0	3.8	3.6	2.6	15.1def	15.6	-0.5	1.03	Shrinking, bending
AgNO3 20 ppm	4.8	5.8	4.1	2.6	17.3c	17.6	-0.3	1.02	Yellowing, Tip browning
AgNO3 40 ppm	4.8	4.4	4.1	2.4	15.7d	17.2	-1.5	1.09	Bending, shrinking
Sucrose 4%	3.2	3.7	3.6	3.1	13.6g	13.1	0.5	0.96	Tip browning
Sucrose 8%	3.4	3.6	3.8	3.2	14.0fg	13.2	0.8	0.94	Tip browning
Raphis excelsa (Thunb.)									
Treatments	Water uptake (ml.)				Total water uptake (ml)	Total transpiration loss (ml.)	Water balance (ml.) in foliage	Loss/uptake ratio	Observations
	24 hrs	48 hrs	72hrs	96 hrs					
Control	6.8	4.8	2.8	3.4	17.8c	20.1	-2.3	1.13	Tip browning, Shrinking, Yellowing

ISSN: 2455-6939

Volume:02, Issue:03

NAA 50 ppm	5.8	3.8	2.8	3.1	15.5d	19.6	-4.1	1.26	Shrinking
NAA 100 ppm	7.6	7.1	5.2	3.4	23.3ab	23.4	-0.1	1.00	Bending, tip browning, Shrinking
GA3 50 ppm	6.2	3.2	3.1	2.6	15.1de	18.1	-3.1	1.19	Shrinking
GA3 100 ppm	7.8	3.1	3.1	2.8	16.8cd	21.6	-4.8	1.29	Shrinking, folding
AgNO3 20 ppm	6.6	4.4	6.4	4.1	21.5b	24.2	-2.7	1.13	Tip drying, shrinking
AgNO3 40 ppm	7.2	7.4	5.8	4.2	24.6a	25.1	-0.5	1.02	Shrinking
Sucrose 4%	6.1	3.1	2.2	1.6	13.1ef	17.2	-4.1	1.31	Bending, shrinking
Sucrose 8%	6.6	2.1	2.4	1.8	12.9f	22.1	-9.2	1.71	Shrinking
Caryota mitis (Lour.)									
Treatments	Water uptake (ml.)				Total water uptake (ml)	Total transpiration loss (ml.)	Water balance (ml.) in foliage	Loss/uptake ratio	Observations
	24 hrs	48 hrs	72hrs	96 hrs					
Control	2.4	2.4	3.1	1.4	9.3ab	9.6	-0.3	1.03	Discoloration, bending
NAA 50 ppm	2.4	2.8	2.2	1.4	8.8ab	9.1	-0.3	1.03	Browning, yellowing
NAA 100 ppm	2.4	2.6	2.6	1.4	9.1ab	9.4	-0.3	1.03	Browning, yellowing
GA3 50 ppm	2.6	3.1	2.8	1.2	9.7ab	10.1	-0.4	1.04	Browning, yellowing, bending
GA3 100 ppm	3.4	2.8	2.6	1.4	10.2a	10.8	-0.6	1.05	Browning, yellowing
AgNO3 20 ppm	2.6	2.6	3.1	1.1	9.4ab	10.1	-0.7	1.07	Bending, discoloration
AgNO3 40 ppm	3.1	2.8	2.8	1.8	10.5a	10.8	-0.3	1.03	Bending, base browning
Sucrose 4%	2.8	2.6	2.4	1.1	8.9ab	9.6	-0.7	1.08	Browning
Sucrose 8%	2.8	2.1	2.2	0.8	7.9b	9.1	-1.2	1.15	Greenish browning

*Percentage of chlorophyll is increased of the particular treatments.

N.B. Similar words are statistically at par.

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Volume:02, Issue:03

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ISSN: 2455-6939

Volume:02, Issue:03

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