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Impact of Pulsing and Holding Solutions on Vase Life of *Melaleuca bracteata* F. Muell Foliage

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted during the year 2019-21 at Horticulture Research Station, OUAT, Bhubaneswar laid out in factorial CRD design to check the vase life of *Melaleuca bracteata* foliage by using distilled water (control) and different pulsing, holding solutions and 6 modules, which contains different spacing, pit size, FYM, basal fertilizer dose, water soluble fertilizers and growth regulator (BAP). Pulsing solution containing Sucrose (2%) + $Al_2(SO_4)_3$ (1000 ppm) (9.89 days) resulted long vase life of foliage followed by solution containing Sucrose (2%) + BA (50 ppm) (9.10 days) in module VI. Whereas holding solution containing Sodium Benzoate (150 ppm) (9.10 days) showed long vase life of foliage followed by Sodium Benzoate (100ppm) (9.02 days) in module VI.

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Keywords: Melaleuca bracteata; pulsing solution; holding solution; sodium benzoate; sucrose.

1. INTRODUCTION

Melaleuca bracteata is commonly known as Golden Bottle Brush, Black Tea-Tree, River Tea-Tree. The genus *Melaleuca* consists of 300 species and is the third-largest angiosperm genus in Australia after *Acacia* and *Eucalyptus* [1,2]. The genus *Melaleuca* is a member of the Myrtaceae or myrtle family. There are approximately 130 genera and 3,000 species recorded in this family [3]. Family Myrtaceae consists of trees and shrubs, usually evergreen, mostly with simple leaves, commonly opposite leaves, and rarely found with alternate leaves [4]. This family is noted for its spicy, aromatic scent because of the variety of essential oils present in the oil glands on the leaves [5].

Melaleuca bracteata is a large shrub to a medium tree usually up to 15 m tall, with small, narrow, and hairy leaves, (3-12 mm long) [6]. Flowers are small bottlebrushes up to 20 mm long and occur near the end of the twigs. Their fruits are woody, small, cup-shaped capsules. *M. bracteata* the capsules are 2-3 mm long and 2.5-3 mm wide appearing on branches. Generally, *M. bracteata* can flower for the whole year, but more in spring and summer [7].

Cut foliage is used as fillers along with flowers in bouquets, floral arrangements, and floral ornaments or alone to create variability in colors, textures shapes, and forms of the foliage. The cut foliage is in demand throughout the year and comprises 10% of world floriculture trade with an annual growth rate of 4% [8] in *Melaleuca bracteata* growth and vase life studies).

2. MATERIALS AND METHODS

The freshly harvested terminal twigs of 30 cm length were used for the vase life studies during 2020 by keeping them in distilled water (control) and different pulsing, holding solutions following factorial CRD design under room temperature. Three twigs were taken in each replication and the vase life of the twigs is expressed in days. The termination of twigs was determined by checking the drying of leaves gradually. The details of chemicals used in pulsing and holding solutions are given in Table 1 and the details of different modules are given in Table 2.

Table 1. The treatment details of vase life studies of cut foliage

	Pulsing solutions		Holding solutions
T_1	BA (25ppm)	T_1	NaOCl (25ppm)
T_2	BA (50ppm)	T_2	NaOCl (50ppm)
T_3	GA_3 (25ppm)	T_3	$Al_2(SO_4)_3$ (200ppm)
T_4	GA_3 (50ppm)	T_4	$Al_2(SO_4)_3$ (300ppm)
T_5	8-HQS (100ppm)	T_5	Citric acid (200ppm)
T_6	8-HQS (200ppm)	T_6	Citric acid (300ppm)
T_7	$Al_2(SO_4)_3$ (100ppm)	T_7	Sodium Benzoate (100ppm)
T_8	$Al_2(SO_4)_3$ (200ppm)	T_8	Sodium Benzoate (150ppm)
T_9	NaOCl (50ppm)	T_9	Sucrose (2%) + NaOCl (25ppm)
T_{10}	NaOCl (100ppm)	T_{10}	Sucrose (2%) + NaOCl (50ppm)
T_{11}	Sucrose (2%) + BA (25ppm)	T_{11}	Sucrose (2%) + $Al_2(SO_4)_3$ (200ppm)
T_{12}	Sucrose (2%) + BA (50ppm)	T_{12}	Sucrose (2%) + $Al_2(SO_4)_3$ (300ppm)
T_{13}	Sucrose (2%) + GA_3 (25ppm)	T_{13}	Sucrose (2%) + Citric acid (200ppm)
T_{14}	Sucrose (2%) + GA_3 (50ppm)	T_{14}	Sucrose (2%) + Citric acid (300ppm)
T_{15}	Sucrose (2%) + 8-HQS (100ppm)	T_{15}	Sucrose (2%) + Sodium Benzoate (100ppm)
T_{16}	Sucrose (2%) + 8-HQS (200ppm)	T_{16}	Sucrose (2%) + Sodium Benzoate (150ppm)
T_{17}	Sucrose (2%) + $Al_2(SO_4)_3$ (100ppm)	T_{17}	Sucrose (2%)
T_{18}	Sucrose (2%) + $Al_2(SO_4)_3$ (200ppm)	T_{18}	Control (Distilled water)
T_{19}	Sucrose (2%) + NaOCl (50ppm)		
T_{20}	Sucrose (2%) + NaOCl (100ppm)		
T_{21}	Sucrose (2%)		
T_{22}	Control (Distilled water)		

Table 2. The treatment details of the experiment entitled…..

Cultural operations	Spacing	Pit size	FYM	Basal Fertilizer dose	Water soluble fertilizer 19:19:19 NPK Once a week	BAP (6-Benzylaminopurine)- once in a month
Module – I	90cm X 90cm	20cm x 20cm x 20cm	5Kg/pit	5:5:5 g $N:P_2O_5:K_2O$/ Plant	@0.1%	25 ppm
Module – II	120cm X 120cm	30cm x 30cm x 30cm	10Kg/pit	10:10:10 g $N:P_2O_5:K_2O$/ Plant	@0.1%	50 ppm
Module - III	150cm X 150cm	40cm x 40cm x 40cm	15Kg/pit	20:20:20 g $N:P_2O_5:K_2O$/ Plant	@0.2%	100 ppm
Module – IV	180cm X 120cm	50cm x 50cm x 50cm	20Kg/pit	30:30:30 g $N:P_2O_5:K_2O$/ Plant	@0.2%	150 ppm
Module – V	180cm X 180cm	50cm x 50cm x 50cm	20Kg/pit	30:30:30 g $N:P_2O_5:K_2O$/ Plant	@0.2%	150 ppm
Module - VI	210cm X 210cm	60cm x 60cm x 60cm	25Kg/pit	40:40:40 g $N:P_2O_5:K_2O$/ Plant	@0.2%	150 ppm

3. RESULTS AND DISCUSSION

The effect of Pulsing and holding solutions on cut foliage of different modules of *Melaleuca bracteata* are presented in Table 3 and 4.

3.1 Pulsing Solutions

Vase life of *Melaleuca* was significantly influenced by the pulsing treatments (A), but non-significant with modules (B) and interactions (AxB) (Table 3).

Among the different modules the longest vase life (8.17 days) of leaves was recorded in Module VI followed by Module V (8.09 days) and shortest in Module I (7.45 days).

The longest vase life (9.60 days) was recorded in T_{18} (Sucrose (2%) + $Al_2(SO_4)_3$@ 200ppm) followed by T_{12} (Sucrose (2%) + BA @50ppm) (8.81 days) and lowest (6.92 days) was recorded in T_{22} (distilled water) among different pulsing solutions.

Among the interactions longest vase life (9.89 days) was recorded in the treatment combination of M_6T_{18} (Module-VI with Sucrose (2%) + $Al_2(SO_4)_3$@ 200ppm) followed by the treatment M_6T_{12} (Module-VI with Sucrose (2%) + BA @50ppm) (9.10 days) and the lowest days (7.40 days) was recorded in the treatment combination M_6T_{22} (Module-VI with distilled water).

3.2 Holding Solutions

Vase life of *Melaleuca* was significantly influenced by the holding treatments (A), but non-significant with modules (B) and interactions (AxB) (Table 4).

Among the different modules the longest vase life (8.15 days) of leaves was recorded in Module VIfollowed by Module V (8.02 days) and shortest in Module I (7.24 days).

The longest vase life (8.74 days) was recorded in T_8 (Sodium Benzoate@150ppm) followed by T_7 (Sodium Benzoate@100ppm) (8.56 days) and lowest (6.87 days) was recorded in T_{18} (distilled water) among different holding solutions.

Among the interactions longest vase life (9.10 days) was recorded in the treatment combination of M_6T_8 (Module-VI + Sodium Benzoate@150ppm)) followed by the treatment M_6T_7 (Module-VI + Sodium Benzoate (100ppm)) (9.02 days) and the lowest days (7.28 days) was recorded in the treatment combination M_6T_{18} (Module-VI +distilled water).

Table 3. Effect of pulsing solution on vase life in different modules of *Melaleuca bracteata*

	Treatments (A)	Vase life (Days)						
		Modules (B)						
		M_1	M_2	M_3	M_4	M_5	M_6	Mean
T_1	BA (25ppm)	8.22	8.39	8.50	8.69	8.76	8.83	**8.57**
T_2	BA (50ppm)	8.32	8.59	8.72	8.83	8.91	8.97	**8.72**
T_3	GA_3 (25ppm)	7.00	7.06	7.12	7.30	7.38	7.46	**7.22**
T_4	GA_3 (50ppm)	6.00	6.11	7.21	7.31	7.38	7.49	**6.92**
T_5	8-HQS (100ppm)	7.11	7.26	7.40	7.48	7.54	7.65	**7.41**
T_6	8-HQS (200ppm)	6.99	7.03	7.19	7.30	7.39	7.46	**7.23**
T_7	$Al_2(SO_4)_3$ (100ppm)	7.69	7.74	7.98	8.17	8.20	8.25	**8.01**
T_8	$Al_2(SO_4)_3$ (200ppm)	7.69	7.81	7.99	8.21	8.30	8.36	**8.06**
T_9	NaOCl (50ppm)	6.71	6.87	7.04	7.18	7.29	7.39	**7.08**
T_{10}	NaOCl (100ppm)	6.82	6.91	7.06	7.28	7.34	7.40	**7.14**
T_{11}	Sucrose (2%) + BA (25ppm)	8.35	8.58	8.73	8.87	8.98	9.02	**8.76**
T_{12}	Sucrose (2%) + BA (50ppm)	8.36	8.69	8.83	8.90	9.00	**9.10**	**8.81**
T_{13}	Sucrose (2%) + GA_3 (25ppm)	6.75	6.99	7.12	7.32	7.41	7.49	**7.18**
T_{14}	Sucrose (2%) + GA_3 (50ppm)	7.02	7.20	7.35	7.45	7.50	7.59	**7.35**
T_{15}	Sucrose (2%) + 8-HQS (100ppm)	7.76	7.98	8.13	8.31	8.40	8.46	**8.17**
T_{16}	Sucrose (2%) + 8-HQS (200ppm)	7.98	8.11	8.37	8.49	8.59	8.65	**8.37**
T_{17}	Sucrose (2%) + $Al_2(SO_4)_3$ (100ppm)	8.01	8.21	8.58	8.74	8.81	8.86	**8.54**
T_{18}	Sucrose (2%) + $Al_2(SO_4)_3$ (200ppm)	9.19	9.43	9.57	9.72	9.80	**9.89**	**9.60**
T_{19}	Sucrose (2%) + NaOCl (50ppm)	7.02	7.32	7.57	7.97	8.07	8.14	**7.68**
T_{20}	Sucrose (2%) + NaOCl (100ppm)	7.01	7.20	7.42	7.61	7.70	7.79	**7.46**
T_{21}	Sucrose (2%)	7.19	7.47	7.69	7.84	7.92	8.00	**7.69**
T_{22}	Control (Distilled water)	6.67	6.87	7.05	7.24	7.33	**7.40**	**7.09**
	Mean	**7.45**	**7.63**	**7.85**	**8.01**	**8.09**	**8.17**	
		A	**B**	**A x B**				
	SE (m)±	0.354	0.238	0.868				
	CD (5%)	0.698	NA	NA				

M_6- Spacing - 210cm X 210cm; Pit size - 60 cm^3; FYM - 25Kg/pit; Basal fertilizer dose - $N:P_2O_5$: K_2O @ 40:40:40 g /plant; Fertilizer-19:19:19@0.2% and BAP- 150 ppm

Table 4. Effect of holding solution on vase life in different modules of *Melaleuca bracteata*

	Treatments (A)	Vase life (Days)						
		Modules (B)						
		M_1	M_2	M_3	M_4	M_5	M_6	Mean
T_1	NaOCl (25ppm)	6.12	6.67	6.89	7.04	7.21	7.31	**6.87**
T_2	NaOCl (50ppm)	6.52	6.69	6.83	7.00	7.20	7.29	**6.92**
T_3	$Al_2(SO_4)_3$ (200ppm)	7.64	7.80	7.89	8.01	8.14	8.22	**7.95**
T_4	$Al_2(SO_4)_3$ (300ppm)	7.39	7.58	7.76	7.93	8.03	8.17	**7.81**
T_5	Citric acid (200ppm)	6.76	6.99	7.20	7.39	7.57	7.76	**7.28**
T_6	Citric acid (300ppm)	6.53	6.80	6.99	7.17	7.39	7.53	**7.07**
T_7	Sodium Benzoate (100ppm)	7.99	8.21	8.54	8.70	8.89	**9.02**	**8.56**
T_8	Sodium Benzoate (150ppm)	8.31	8.58	8.70	8.81	8.96	**9.10**	**8.74**
T_9	Sucrose (2%) + NaOCl (25ppm)	7.03	7.35	7.59	7.77	7.90	8.08	**7.62**
T_{10}	Sucrose (2%) + NaOCl (50ppm)	7.00	7.29	7.50	7.63	7.85	8.00	**7.55**
T_{11}	Sucrose (2%) + $Al_2(SO_4)_3$ (200ppm)	7.41	7.68	7.83	8.01	8.19	8.30	**7.90**
T_{12}	Sucrose (2%) + $Al_2(SO_4)_3$ (300ppm)	8.08	8.32	8.50	8.69	8.83	8.98	**8.57**
T_{13}	Sucrose (2%) + Citric acid (200ppm)	7.67	7.81	8.04	8.15	8.31	8.47	**8.08**
T_{14}	Sucrose (2%) + Citric acid (300ppm)	7.74	8.00	8.28	8.41	8.53	8.67	**8.27**
T_{15}	Sucrose (2%) + Sodium Benzoate (100ppm)	7.42	7.75	7.98	8.10	8.26	8.34	**7.98**
T_{16}	Sucrose (2%) + Sodium Benzoate (150ppm)	7.89	8.10	8.34	8.50	8.68	8.79	**8.38**
T_{17}	Sucrose (2%)	6.40	6.69	6.95	7.07	7.21	7.35	**6.95**
T_{18}	Control (Distilled water)	6.46	6.76	6.90	7.01	7.15	**7.28**	**6.93**
	Mean	**7.24**	**7.50**	**7.71**	**7.86**	**8.02**	**8.15**	
		A	**B**	**A x B**				
	SE (m)±	0.241	0.291	0.590				
	CD (5%)	0.672	NA	NA				

M_6- Spacing - 210cm X 210cm; Pit size - 60 cm^3; FYM - 25Kg/pit; Basal fertilizer dose - $N:P_2O_5$: K_2O @ 40:40:40 g /plant; Fertilizer-19:19:19@0.2% and BAP- 150 ppm

3.3 Discussion

The longer vase life might be due to optimum availability of nutrients and higher level of potash. Since, potash enhances the synthesis metabolism and translocation of carbohydrates, synthesis of protein with rapid cell division and differentiation, which results in better postharvest life of flowers [9]. Supplementation of sucrose in the vase solution increased the carbohydrate level in the plant tissue, which helped to carry out metabolic activity thereby extending longevity of twigs.

Vase life of twigs treated with aluminiumsulphate in combination with sucrose was longer as compared to control. This might be attributed to antimicrobial property of aluminium sulphate which acidified the vase solution and reduced the microbial Growth [10]. Aluminium sulphate ($Al_2(SO_4)_3$), an antimicrobial compound has been recommended in commercial preservative solutions for increasing vase life of several cut flowers [11]. Similar results were observed in Lilium by Anil et al. [12] and in rose by Maryam et al. [13]. Sodium benzoate possesses antimicrobial properties and this can be the cause of vase life extension of *Melaleuca* twigs. Sodium benzoate as an antifungal compound reduces microorganism's activity and bacterial contamination in vase solution (Oraee et al. 2011) [14].

4. CONCLUSION

The results of the present study revealed that twigs treated with pulsing solution containing sucrose (2%) + $Al_2(SO_4)_3$ (100 ppm) and holding solution containing sodium benzoate (150 ppm) exhibited longest vase life in module VI.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Craven LA, Melaleuca (Myrtaceae) from Australia. Novon: A Journal for Botanical Nomenclature. 2009;19(4): 444-453.
2. Edwards RD, Craven LA, Crisp MD, Cook LG. Melaleuca revisited: cpDNA and morphological data confirm that Melaleuca L. (Myrtaceae) is not monophyletic. Taxonomy. 2010;59(3): 744-754.
3. Serbesoff-King K. Melaleuca in Florida: a literature review on the taxonomy, distribution, biology, ecology, economic importance and control measures. Journal of Aquatic Plant Management. 2003;41(1).
4. Mabberley DJ. Mabberley's plant-book: a portable dictionary of plants, their classifications and uses: Cambridge University Press; 2008.
5. Gentry AH. A field guide to the families and genera of woody plants of Northwest South America. Conservation International, Washington, DC. 1993; 445-452.
6. Byrnes N, A revision of Melaleuca (Myrtaceae) in northern and eastern Australia, Austrobaileya. 1986; 254-273.
7. Van T, Rayachhetry M, Center T, Pratt P. Litter dynamics and phenology of Melaleuca quinquenervia in south Florida. Journal of Aquatic Plant Management. 2002;40:22-27.
8. Nair SA, Usha Bharathi T, Sangama. Influence of Light Intensity and Seasonal Variations on Yield and Quality of Selected Cut Foliage Crops. International Journal of Current Microbiology and Applied Sciences. 2017; 6(12):1984-1994.
9. Pal A, Kumar S. Response of floral preservatives on postharvest quality of gladiolus spike cultivar 'Pink Friendship'. Advances in Plant Science. 2004;17(2): 529-532.
10. Hassanpour AM, Hatamzadeh A, Nakhai F. Study on the effect of temperature and various chemical treatments to increase vase life of cut rose flower "Baccara". Agricultural Science Research Journal of Guilan Agriculture Faculty. 2004;1(4): 121- 129.
11. Ichimura K, Taguchi M, Norikoshi R. Extention of the vase life in cut roses by treatment with glucose, isothiazolinonic germicide, citric acid and aluminium sulphate solution. Japan Agricultural Research. 2006;40(3):263-269.
12. Anil KS, Asmita, Anjana S, Pal AK, Barman K. Effect of sucrose and aluminium sulphate on postharvest life of lilium cv. Monarch. Journal of Hill Agriculture. 2016;7(2):204-208.
13. Maryam S, Ahmad K, Younes M, Roohangiz N. Study on the effect of aluminum sulfate treatment on postharvest life of the cut rose 'Boeing' (Rosa hybrida cv. Boeing) Journal of Horticulture, Forestry and Biotechnology. 2012;16(3): 128-132.

14. Reynertson KA, Yang H, Jiang B, Basile MJ, Kennelly EJ. Quantitative analysis of antiradical phenolic constituents from fourteen edible Myrtaceae fruits. Food Chemistry. 2008; 109(4):883-890.

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