

Impact of pulsing and holding solutions on vase life of *Melaleuca bracteata* F. Muell foliage

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%) + $\text{Al}_2(\text{SO}_4)_3$ (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.

Keywords: *Melaleuca bracteata*, Pulsing solution, Holding solution, Sodium Benzoate, Sucrose

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* (Craven, 2009; Edwards *et al.*, 2010). 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 (Serbesoff-King, 2003). Family Myrtaceae consists of trees and shrubs, usually evergreen, mostly with simple leaves, commonly opposite leaves, and rarely found with alternate leaves (Mabberley, 2008). This family is noted for its spicy, aromatic scent because of the variety of essential oils present in the oil glands on the leaves (Gentry, 1993).

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) (Byrnes, 1986). 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 (Van *et al.*, 2002).

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% (Nair *et al.*, 2017 in *Melaleuca bracteata* growth and vase life studies).

Material 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
T₁	BA (25ppm)	T₁	NaOCl (25ppm)
T₂	BA (50ppm)	T₂	NaOCl (50ppm)
T₃	GA ₃ (25ppm)	T₃	Al ₂ (SO ₄) ₃ (200ppm)
T₄	GA ₃ (50ppm)	T₄	Al ₂ (SO ₄) ₃ (300ppm)
T₅	8-HQS (100ppm)	T₅	Citric acid (200ppm)
T₆	8-HQS (200ppm)	T₆	Citric acid (300ppm)
T₇	Al ₂ (SO ₄) ₃ (100ppm)	T₇	Sodium Benzoate (100ppm)
T₈	Al ₂ (SO ₄) ₃ (200ppm)	T₈	Sodium Benzoate (150ppm)
T₉	NaOCl (50ppm)	T₉	Sucrose (2%) + NaOCl (25ppm)
T₁₀	NaOCl (100ppm)	T₁₀	Sucrose (2%) + NaOCl (50ppm)
T₁₁	Sucrose (2%) + BA (25ppm)	T₁₁	Sucrose (2%) + Al ₂ (SO ₄) ₃ (200ppm)
T₁₂	Sucrose (2%) + BA (50ppm)	T₁₂	Sucrose (2%) + Al ₂ (SO ₄) ₃ (300ppm)
T₁₃	Sucrose (2%) + GA ₃ (25ppm)	T₁₃	Sucrose (2%) + Citric acid (200ppm)
T₁₄	Sucrose (2%) + GA ₃ (50ppm)	T₁₄	Sucrose (2%) + Citric acid (300ppm)
T₁₅	Sucrose (2%) + 8-HQS (100ppm)	T₁₅	Sucrose (2%) + Sodium Benzoate (100ppm)
T₁₆	Sucrose (2%) + 8-HQS (200ppm)	T₁₆	Sucrose (2%) + Sodium Benzoate (150ppm)
T₁₇	Sucrose (2%) + Al ₂ (SO ₄) ₃ (100ppm)	T₁₇	Sucrose (2%)
T₁₈	Sucrose (2%) + Al ₂ (SO ₄) ₃ (200ppm)	T₁₈	Control (Distilled water)
T₁₉	Sucrose (2%) + NaOCl (50ppm)		
T₂₀	Sucrose (2%) + NaOCl (100ppm)		

T₂₁	Sucrose (2%)		
T₂₂	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 ₂ O ₅ :K ₂ O/ Plant	@0.1%	25 ppm
Module – II	120cm X 120cm	30cm x 30cm x 30cm	10Kg/pit	10:10:10 g N:P ₂ O ₅ :K ₂ O/ Plant	@0.1%	50 ppm
Module - III	150cm X 150cm	40cm x 40cm x 40cm	15Kg/pit	20:20:20 g N:P ₂ O ₅ :K ₂ O/ Plant	@0.2%	100 ppm
Module – IV	180cm X 120cm	50cm x 50cm x 50cm	20Kg/pit	30:30:30 g N:P ₂ O ₅ :K ₂ O/ Plant	@0.2%	150 ppm
Module – V	180cm X 180cm	50cm x 50cm x 50cm	20Kg/pit	30:30:30 g N:P ₂ O ₅ :K ₂ O/ Plant	@0.2%	150 ppm
Module - VI	210cm X 210cm	60cm x 60cm x 60cm	25Kg/pit	40:40:40 g N:P ₂ O ₅ :K ₂ O/ Plant	@0.2%	150 ppm

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.

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 T₁₈ (Sucrose (2%) + Al₂(SO₄)₃@ 200ppm) followed by T₁₂ (Sucrose (2%) + BA @50ppm) (8.81 days) and lowest (6.92 days) was recorded in T₂₂ (distilled water) among different pulsing solutions.

Among the interactions longest vase life (9.89 days) was recorded in the treatment combination of M₆T₁₈ (Module-VI with Sucrose (2%) + Al₂(SO₄)₃@ 200ppm) followed by the treatment M₆T₁₂ (Module-VI with Sucrose (2%) + BA @50ppm) (9.10 days) and the lowest days (7.40 days) was recorded in the treatment combination M₆T₂₂ (Module-VI with distilled water).

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 VI followed by Module V (8.02 days) and shortest in Module I (7.24 days).

The longest vase life (8.74 days) was recorded in T₈ (Sodium Benzoate@150ppm) followed by T₇ (Sodium Benzoate@100ppm) (8.56 days) and lowest (6.87 days) was recorded in T₁₈ (distilled water) among different holding solutions.

Among the interactions longest vase life (9.10 days) was recorded in the treatment combination of M₆T₈ (Module-VI + Sodium Benzoate@150ppm) followed by the treatment M₆T₇ (Module-VI + Sodium Benzoate (100ppm)) (9.02 days) and the lowest days (7.28 days) was recorded in the treatment combination M₆T₁₈ (Module-VI +distilled water)

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

	Treatments (A)	Vase life (Days)						Mean
		Modules (B)						
		M ₁	M ₂	M ₃	M ₄	M ₅	M ₆	
T ₁	BA (25ppm)	8.22	8.39	8.50	8.69	8.76	8.83	8.57

T₁	NaOCl (25ppm)	6.12	6.67	6.89	7.04	7.21	7.31	6.87
T₂	NaOCl (50ppm)	6.52	6.69	6.83	7.00	7.20	7.29	6.92
T₃	Al ₂ (SO ₄) ₃ (200ppm)	7.64	7.80	7.89	8.01	8.14	8.22	7.95
T₄	Al ₂ (SO ₄) ₃ (300ppm)	7.39	7.58	7.76	7.93	8.03	8.17	7.81
T₅	Citric acid (200ppm)	6.76	6.99	7.20	7.39	7.57	7.76	7.28
T₆	Citric acid (300ppm)	6.53	6.80	6.99	7.17	7.39	7.53	7.07
T₇	Sodium Benzoate (100ppm)	7.99	8.21	8.54	8.70	8.89	9.02	8.56
T₈	Sodium Benzoate (150ppm)	8.31	8.58	8.70	8.81	8.96	9.10	8.74
T₉	Sucrose (2%) + NaOCl (25ppm)	7.03	7.35	7.59	7.77	7.90	8.08	7.62
T₁₀	Sucrose (2%) + NaOCl (50ppm)	7.00	7.29	7.50	7.63	7.85	8.00	7.55
T₁₁	Sucrose (2%) + Al ₂ (SO ₄) ₃ (200ppm)	7.41	7.68	7.83	8.01	8.19	8.30	7.90
T₁₂	Sucrose (2%) + Al ₂ (SO ₄) ₃ (300ppm)	8.08	8.32	8.50	8.69	8.83	8.98	8.57
T₁₃	Sucrose (2%) + Citric acid (200ppm)	7.67	7.81	8.04	8.15	8.31	8.47	8.08
T₁₄	Sucrose (2%) + Citric acid (300ppm)	7.74	8.00	8.28	8.41	8.53	8.67	8.27
T₁₅	Sucrose (2%) + Sodium Benzoate (100ppm)	7.42	7.75	7.98	8.10	8.26	8.34	7.98
T₁₆	Sucrose (2%) + Sodium Benzoate (150ppm)	7.89	8.10	8.34	8.50	8.68	8.79	8.38
T₁₇	Sucrose (2%)	6.40	6.69	6.95	7.07	7.21	7.35	6.95
T₁₈	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				

M₆- Spacing - 210cm X 210cm; Pit size - 60 cm³; FYM - 25Kg/pit; Basal fertilizer dose - N:P₂O₅: K₂O @ 40:40:40 g /plant; Fertilizer-19:19:19@0.2% and BAP- 150 ppm.

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 (Pal and Kumar 2004). 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 aluminium sulphate 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 (Hassanpour *et al.* 2004). Aluminium sulphate ($\text{Al}_2(\text{SO}_4)_3$), an antimicrobial compound has been recommended in commercial preservative solutions for increasing vase life of several cut flowers (Ichimura *et al.* 2006). Similar results were observed in Liliium by Anil *et al.* (2016) and in rose by Maryam *et al.* (2012). 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).

Conclusion:

The results of the present study revealed that twigs treated with pulsing solution containing sucrose (2%) + $\text{Al}_2(\text{SO}_4)_3$ (100 ppm) and holding solution containing sodium benzoate (150 ppm) exhibited longest vase life in module VI.

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