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Influence of postharvest treatments on quality and shelf life of flowers of *Jasminum sambac* cv. Gundumalli

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Abstract
A research on standardization of method of packaging to extend shelf life of *Jasminum sambac* CV. Gundumalli was conducted in College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar during 2015-16. The experiment was laid out in FCRD with two factors in three replications, with 16 treatment combinations. Observations were recorded on the visual quality in terms of freshness index, flowers opening index, colour retention index, and shelf life of flowers and the physiological parameters associated with the postharvest quality of flowers, namely, moisture content, relative water content, physiological loss in weight. The flowers treated with 4% boric acid, packed in 60-micron polyethylene bags without ventilation and stored under 7 ^{0}C significantly extend the shelf life to 168.33 hours with highest freshness index (87.45%), maximum colour retention index of (92.68%), and lowest flower opening index (10.57%), highest moisture content of (75.82%) and lowest physiological weight loss percent (0.35%) on 48 hours after packing.

Keywords: Jasmine, sucrose, boric acid, NAA, packaging method, polythene bags, micron thickness

Introduction

Flower is the symbol of beauty, love and tranquility, flower conveys the message of love, joy and affection. Flowers are used by people to express their first feeling one for other. In beautification, flowers are one of the main ingredients since the beginning of history and its importance has not yet diminished but rather increased as time proceeds. Among the commercial flowers grown in India the most important are roses, carnation, gerbera, orchid, chrysanthemum, jasmine, marigold, aster etc. Among the different kind of flowers, Jasmines take uninumero position because of their elegant star like attractive flowers, rich fragrance, multifaceted aesthetic utilities, high exportable value and earning lucrative income for the flower growers. "Think of fragrance, think of jasmine" such is the special attraction of this white coloured and fragrant flowers that has a pride of place in the heart of every women (Mundhe,2012) [11]. Jasmine (*Jasminum sambac* Ait.) is the oldest of fragrant flowers cultivated by man and belongs to the family "Oleaceae". The genus jasminum comprises around 300 species which are dispersed throughout warmer parts of Europe, Asia, Africa, the Pacific region and many other tropical and subtropical countries. About 40 species are native of India **(**Bhattacharjee, 1980) [1]. Among the large number of Jasminum species existing, only three species (*J. sambac*, J. *grandiflorum*, *J. auriculatum*) have attained importance in commercial cultivation in India. (Rimando, 2003, Green and Miller, 2009) [5]. The cultivar Gundumalli belongs to the group *J sambac*. The flowers are used for various purposes, viz., making garlands and bouquets, for religious offerings, etc. These are also used for production of essential oils in the form of 'concrete' and 'absolute' used in cosmetic and perfumery industries. These flowers have good demand for export due to its attractive fragrance. The flowers are very delicate and show signs of wilting with abrupt loss of fragrance within 24 -36 hour after harvest. One of the major problems faced by exporters is lack of suitable packaging technology for export. Presently, Jasmines are grown for fresh flower trade with obsolete technologies and lack of improved method of harvesting, packing, storing and transporting. Under normal condition, Jasmine flowers do not retain for more than a day and show a sign of browning or rotting of petals on the second day of harvest with an abrupt loss in fragrance. Krishnamoorthy (1990) reported that packaging is a fundamental tool for post harvest management of highly perishable commodities and adequate packaging protects the produce from physical, physiological and pathological deterioration during transport and marketing and enhancing their shelf life by retaining their attractiveness. Even if two per cent wastage of horticultural produce is reduced from the production centers to the market, there will be a saving of rupees 100-200 crores per year in India (Ramana *et al.*, 1988). Therefore, a study was undertaken to assess the feasibility of Postharvest Treatments on Quality and shelf life of flowers of *Jasminum sambac* cv. Gundumalli.

Materials and Methods

The experiment was carried out at the Department of floriculture and landscaping, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar. Fully developed fresh flower buds of uniform size, shape and milky white colour, were used for the study. Fifty numbers of fresh flower buds of uniform size were treated with the chemicals and surface dried. Then the treated flowers packed in polythene bags of 40, 60-micron thickness and 20cm*12cm dimension without vents and heat sealed. These bags were stored under room temperature or cold storage conditions. The temperature and relative humidity of the cold room were 7 °C and 80-85% respectively.

The experiment design followed for this study is FCRD with two factors. So, all total 16 treatment combinations and each treatment replicated as thrice. The treatments comprised of four different Chemical

treatments (C1: Sucrose 4%, C2: Boric acid 4%, C3: NAA 100ppm, C4: Water) and packed in four different Packaging method (P1:Packed in 40micron polythene bags and Stored under 7 ^{0}C, P2:Packed in 60micron polythene bags and Stored under 7 ^{0}C, P3:Packed in 40micron polythene bags and Stored under room temperature, P4: Packed in 60micron polythene bags and Stored under room temperature) So all total 16 treatment combinations are : T1 :Sucrose 4%+ Packed in 40micron polythene bags and Stored under 7 ^{0}C T2:Sucrose 4%+Packed in 60micron polythene bags and Stored under 7 ^{0}C, T3:Sucrose 4%,+ Packed in 40micron polythene bags and Stored under room temperature, T4: Sucrose 4%,+ Packed in 60micron polythene bags and Stored under room temperature, T5: Boric acid 4% + Packed in 40micron polythene bags and Stored under 7 ^{0}C, T6:Boric acid 4% + Packed in 60micron polythene bags and Stored under 7 ^{0}C, T7:Boric acid 4%+ Packed in 40micron polythene bags and Stored under room temperature, T8: Boric acid 4% + Packed in 60micron polythene bags and Stored under room temperature, T9: NAA 100ppm+ Packed in 40micron polythene bags and Stored under 7 ^{0}C, T10: NAA 100ppm + Packed in 60micron polythene bags and Stored under 7 ^{0}C, T11: NAA 100ppm + Packed in 40micron polythene bags and Stored under room temperature, T12:NAA 100ppm+ Packed in 60micron polythene bags and Stored under room temperature, T13:Water+ Packed in 40micron polythene bags and Stored under 7 ^{0}C, T14: Water + Packed in 60micron polythene bags and Stored under 7 ^{0}C, T15: Water + Packed in 40micron polythene bags and Stored under room temperature, T16: Water+ Packed in 60micron polythene bags and Stored under 7 ^{0}C.

The visual flower quality parameters namely, freshness index, flower opening index, colour retention index, and shelf life were recorded based on hedonic scale scoring as per Madhu (1999) [8]. Physiological parameters namely moisture content (MC), relative water content (RWC), physiological loss in weight (PLW). All the observations were recorded on the 24th,48thhours after packing. Standard procedure of Sukhatme and Amble (1985) [18] was adopted for statistical scrutiny of data

Results and Discussion

Visual flower quality parameters

Data pertinent to the flower quality parameters recorded in the present study are presented in Table 1, Figures1-3. Among the different treatments imposed, treating flowers with Boric acid 4%, packed in 60micron polythene and stored under 7 ^{0}C (T6) recorded the highest freshness index (98.35, 87.45%) on the 24th, 48th hours after treatment respectively. The lowest freshness index (87.71, 55.12% respectively) was observed in (T15) i.e. flowers treated with water and packed in 40micron polythene and stored under room temperature.

The lowest flower opening index (3.59, 10.57% respectively) 24th,48th hours after treatment respectively was observed in the treatment (T6) i.e. Boric acid 4% and packed in 60-micron polythene and Stored under 7 ^{0}C. Maximum flower opening index (11.35, 33.72% respectively) was observed in (T15).

The maximum colour retention index of flowers was observed when the flowers subjected to Boric acid 4% and packed in 60micron polythene and stored under 7 ^{0}C (T6) with the values being (100, 92.68%) 24th, 48th hours after treatment respectively. The minimum colour retention index of 76.77, 49.21% respectively was observed in (T15) i.e. flowers treated with water and packed in 40micron polythene and stored under room temperature. The longest shelf life of flowers (168.33 hours) was recorded in the treatment T6i.e. Boric acid 4% and packed in 60-micron polythene and Stored under 7 ^{0}C. The shortest shelf life (60.75 hours) was observed in(T15) i.e. flowers treated with water and packed in 40micron polythene and Stored under room temperature.

Table 1: Effect of post-harvest treatments on flower quality parameters of Jasminum sambac

Treatment	Freshness index (%)		Flower opening index (%)		Colour retention index (%)		Shelf life (hours)
	24 hours after packing	48 hours after packing	24 hours after packing	48 hours after packing	24 hours after packing	48 hours after packing	
T1	93.42	82.95	6.63	17.93	100.00	81.64	140..5
T2	95.34	85.58	6.26	14.83	100.00	82.82	148.66
T3	90.31	69..66	10.69	26.08	100.00	73.65	68.5
T4	90.84	72.22	9.75	25.09	100.00	74.86	73.00
T5	97.59	85.75	4.60	12.99	100.00	91.34	158.08
T6	98.35	87.45	3.59	10.57	100.00	92.68	168.33
T7	93.02	75.95	9.86	20.39	100.00	79.22	74.16
T8	93.93	78.44	8.55	20.58	100.00	80.48	78.75

T9	96.59	83.75	6.25	13.91	100.00	89.44	144.16
T10	96.80	84.58	5.50	11.62	100.00	91.63	150.33
T11	91.74	72.88	9.55	24.55	100.00	75.84	72.75
T12	92.73	74.28	9.48	22.29	100.00	77.15	75.5
T13	91.54	74.76	9.58	21.44	100.00	79.28	120.75
T14	91.70	77.76	9.18	18.74	100.00	80.59	127.83
T15	87.71	55.12	11.35	33.72	76.77	49.21	60.75
T16	88.99	55.86	10.58	29.80	87.89	50.64	65.66
MEAN	93.16	75.96	8.21	20.28	97.79	78.15	107.98
SEm(±)	1.87	1.56	0.25	0.39	0.24	1.19	2.21
CD (0.05)	NS	4.50	0.71	1.12	0.71	3.45	6.40

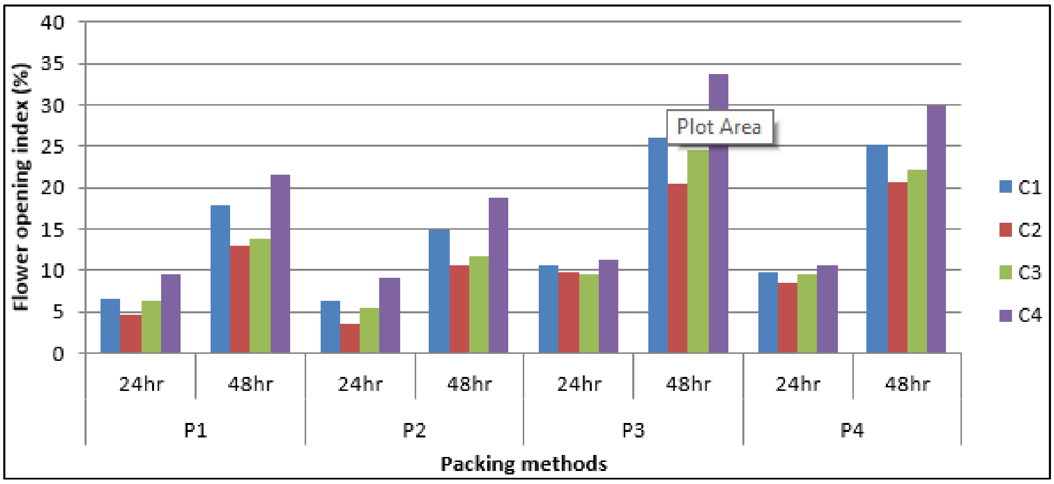

Fig 1: Influence of Postharvest Treatments on flower opening index of *Jasminum sambac*

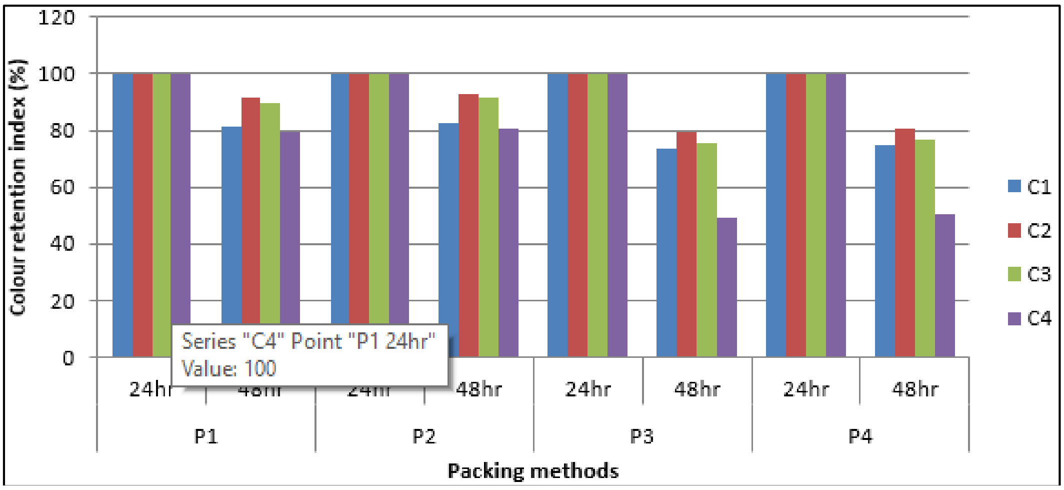

Fig 2: Influence of Postharvest Treatments on Colour retention index of *Jasminum sambac*

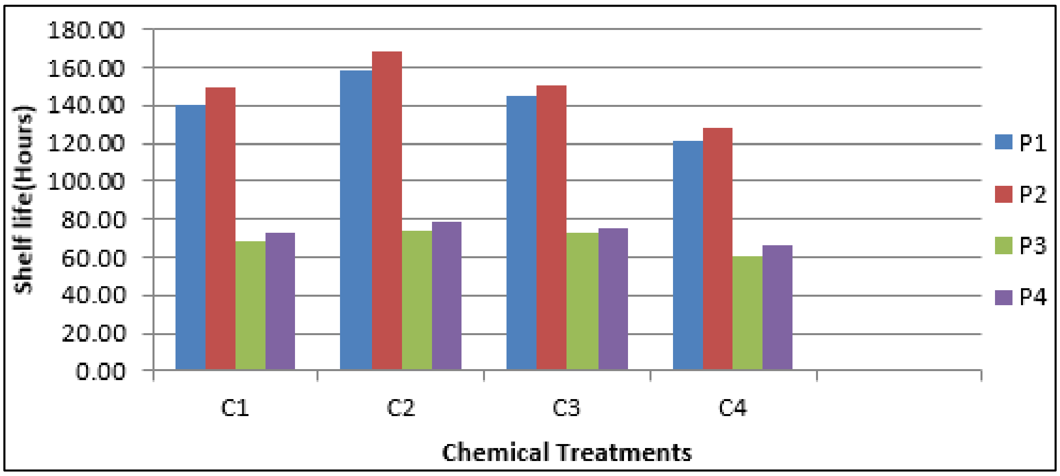

Fig 3: Influence of Postharvest Treatments on Shelf life of *Jasminum sambac*

N.B C1: Sucrose 4%, C2: Boric acid 4% C3: NAA 100ppm C4: Water

P1: Packed in 40micron polythene bags and Stored under 7 ^{0}C

P2: Packed in 60micron polythene bags and Stored under 7 ^{0}C

P3: Packed in 40micron polythene bags and Stored under room temperature

P4: Packed in 60-micron polythene bags and Stored under room temperature

The results revealed that jasmine flowers treated with Boric acid 4%, and Packed in 60micron polythene and Stored under 7 ^{0}C had highest freshness index and colour retention index with a longest shelflife (168.33 hours) while flowers treated with water and packed in 40micron polythene and stored under room temperature lost their colour, fragrance and with a shortest shelflife (60.75hrs.). Boric acid has been used as a mineral salt that could increase the osmotic concentration and pressure potential of the petal cells, thus improving their water balance and longevity in cut flowers as reported by Vanmeeteren, (1989). This might be due to treatment of boric acid is an antisense agent. Burzo *et al*. (1998) [4] reported that the brown colouration and loss of fragrance might be due to the accumulation of flavins and other phenolic substances in flower cell vacuoles. The phenol accumulation was also found to be minimum with normal colour retention and fragrance in the packed flowers than the control In agreement with the present finding, the potential of boric acid in prolonging the postharvest life of flowers has been reported earlier in jasmine by (Mukhopadhyay *et.al* 1980, Binisundar, 2011, Jawaharlal *et.al* 2012, Manimaran *et.al*, 2018) [10, 6, 9] in crossandra by Bhattacharjee, (2002) [2], in carnation by Serrano *et al*., (2006) [16].

Flower physiological parameters

The data presented in **Table 2and Figure4** revealed that the highest moisture content of flowers was observed when the flowers subjected to Boric acid 4% and packed in 60-micron polythene and stored under 7 ^{0}C (T6) with the values being (81.94, 75.82%). on the 24th,48th hours after treatment respectively. The lowest moisture content (55.13, 34.71% respectively was observed in (T15) i.e. flowers treated with water and packed in 40micron polythene and stored under room temperature. The lowest physiological weight loss percent (0.10%, 0.35% respectively) was observed in the treatment T6 i.e. Boric acid 4% and packed in 60-micron polythene and Stored under 7 ^{0}C.on the 24th,48th hours after treatment respectively. The highest physiological weight loss percent (2.69%, 6.95% respectively) was observed in (T15) i.e. flowers treated with water and packed in 40-micron polythene and stored under room temperature.

Table 2: Effect of post-harvest treatments on Flower physiological parameters of *Jasminum sambac*

Treatment	Moisture retention index(%)		Physiological weight loss (%)	
	24 hours after packing	48 hours after packing	24 hours after packing	48 hours after packing
T1	77.00	72.47	1.12	1.39
T2	78.26	73.96	0.20	0.64
T3	57.75	54.41	2.32	5.55
T4	60.20	55.49	2.15	4.71
T5	79.73	74.80	0.17	1.11
T6	81.94	75.82	0.10	0.35
T7	63.52	58.14	0.77	3.20
T8	67.14	59.30	0.55	2.13
T9	77.60	74.00	0.18	1.30
T10	79.72	75.11	0.13	0.39
T11	61.73	54.79	2.31	3.62
T12	63.05	55.77	1.61	2.57
T13	73.60	56.68	1.18	1.96
T14	74.63	58.37	0.23	0.75
T15	55.13	34.71	2.69	6.95
T16	55.54	36.27	2.52	5.87
MEAN	69.16	60.63	1.14	2.66
SEm(±)	0.76	0.60	0.05	0.06
CD(0.05)	2.20	1.74	0.15	0.17

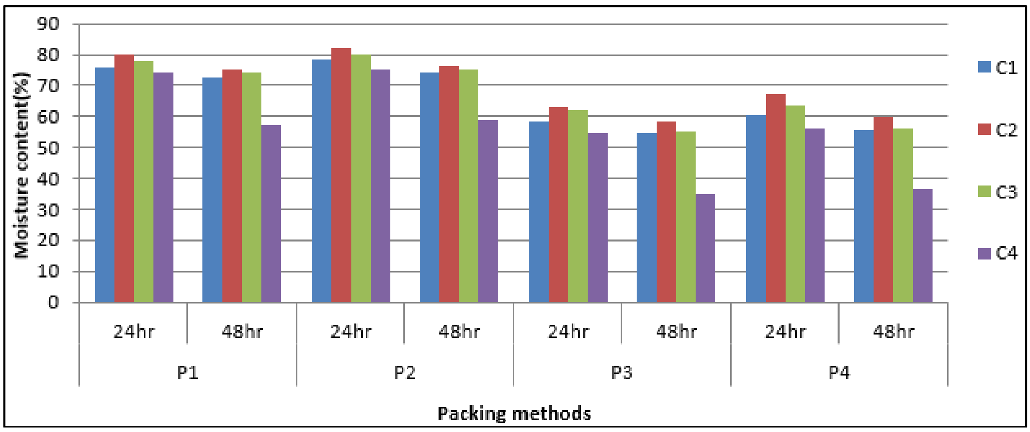

Fig 4: Influence of Postharvest Treatments on moisture content (%) of Jasminum *sambac*

N.B C1: Sucrose 4%, C2: Boric acid 4% C3: NAA 100ppm C4: Water
P1: Packed in 40micron polythene bags and Stored under 7 ^{0}C
P2: Packed in 60micron polythene bags and Stored under 7 ^{0}C
P3: Packed in 40micron polythene bags and Stored under room temperature
P4: Packed in 60-micron polythene bags and Stored under room temperature

Physiological loss in weight (PLW), moisture content, relative water content (RWC) of flowers are traits inter-related to each other. Increased PLW leads to decline in fresh weight of flowers, which expresses visually as symptoms of wilting of flowers, as reported in carnation (Nichols, 1966) [12] and Rosa damascena (Sharma, 1981) [17]. Relative water content of flowers manifests water status of petals. It is obvious that when moisture content is higher and weight loss is lower, relative water content stays high. Similar evidence has been reported in gladiolus, wherein a decrease in RWC of petals caused the dehydration of tissues and in turn wilting, as reported by Zahed Hossain *et al*., (2006) [21]. This might be due to maintenance of optimum humidity temperature and proper balance of CO_2 and O_2 concentration under refrigerated condition which in turns slows down the process of respiration and evapotranspiration and ultimately reduced the PLW. The results are in close agreement with the findings of Nirmala and Venkatesh Reddy (1993) [13] and Yathindra *et al.* (2018) [20].

Conclusion
From the present investigation, it may be concluded that post-harvest treatment of *Jasminum sambac* flowers, with 4% boric acid and Packed in 60micron polythene bags and Stored under 7 ^{0}C proved effective for improving the flower quality with a high freshness index, colour retention index, high moisture content and low physiological loss in weight. Flowers in this package can be kept fresh for a longer period with a shelf life of 168.33 hours.

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