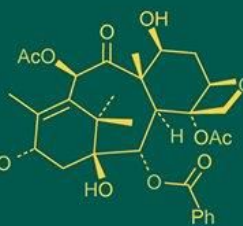
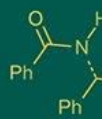


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Studies on the effect of pre-treatment and packaging material on shelf-life Jasmine (*Jasminum sambac*) cv. Gundumalli

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Abstract

The present investigation, entitled “Studies on the effect of pre-treatment and packaging material on shelf-life of Jasmine (*Jasminum sambac*) cv. Gundumalli” was conducted at the Laboratory of Floriculture and Landscaping, K.D. College of Horticulture and Research Station, Jagdalpur (C.G.) during the summer season of the year 2024-25. The experiment was designed using a Completely Randomized Design (CRD) with three replications, comprising nine treatment were as follows: T₀-Distilled Water (Control), T₁-Distilled water + 200 gauge polyethylene, T₂-Boric acid 2% + 200 gauge polyethylene, T₃-Boric acid 4% + 200 gauge polyethylene, T₄-Boric acid 6% + 200 gauge polyethylene, T₅-Salicylic acid 100 ppm + 200 gauge polyethylene, T₆-Salicylic acid 150 ppm + 200 gauge polyethylene, T₇-Salicylic acid 200 ppm + 200 gauge polyethylene, T₈-GA₃ 150 ppm + 200 gauge polyethylene.

The results showed that the combination of Boric acid 4% + 200 gauge polyethylene solution was the most effective in significantly enhancing and extending flower quality. This treatment resulted in the minimum physiological loss in weight (20.11%) and (44.11%) spoilage percentage (0.00%) and (1.30%) as well as maximum freshness index (88.30) and (64.52) relative water content (92.76) and (80.89) shelf life (2.94 day) as well as minimum browning percentage (1.77%) and (9.13%) and maximum fresh flower percentage (98.23%) and (89.57%) moisture content (76.98%) and (64.12%) also flower opening index (23.86), (45.70) and change in fresh weight after storage (9.80 g) overall vase life when compared to other treatments.

Keywords: Jasmine, chemical solution packaging and shelf-life

Introduction

Jasmine (*Jasminum sambac* L.) a member of Oleaceae and a very important fragrant loose flower consisting of about 200 species which are mainly shrubs and climbers. In South Indian states it is extensively cultivated as traditional loose flower. According to Bailey (1947) [2] the term Jasmine is probably derived from the Persian name “Yasmyn” and Arabic word “Jessamine” meaning fragrance. The white fragrant flowers of Jasmine are symbol of purity, eternal love, nobility and also symbolizes the beauty of a girl. It is usually offered to God for worship. Hence, these are preferably planted in Hindu temple gardens and Moghul gardens. Since, immemorial time, Jasmine is considered as spiritual flower of India. Jasmine is cultivated commercially for its fresh flowers and it is used for various purposes viz., decorating hair by women, religious offerings etc. It is also used for extraction of Jasmine concrete which is used in cosmetics and perfumery industries. Jasmine oil has a wide range of medicinal applications and is used in perfumery, soaps, flavoring and cosmetic industry. It is documented that, more than 2000 species are known in Jasmine and among 40 species have been identified in India. For commercial cultivation in South India 20 species are recommended and the best known species among Jasmine *Jasminum sambac* and several varieties of this species like Motia, Mogra, Malligae and Kodai Mullai, Gundumalli, Ramanthapuram Gundumalli are commercially cultivated (Bhattacharjee, 1980) [3].

In India, Jasmine is cultivated throughout the country. It is estimated that it occupies an area of about 3674.83 ha with an annual production of 22048.26 tonnes which is worth of Rs 80-100 million per year income (NHB., 2018-2019) [9].

Major regions that play a vital role in *Jasmine sambac* absolute market are North America followed by Europe and China. In India major marketing regions are Tamil Nadu with the production of 10.14 tonnes per ha. In Telangana, the area of cultivation is about 0.297 thousand ha, with the production of 1.239 tonnes (NHB., 2018-2019) [9]. Chhattisgarh covered an area of 0.031 thousand hectare with production of 0.103 thousand MT. (Directorate of Horticulture and Farm Forestry C.G. 2022-23).

In India, Jasmine absolute is a viscous clear yellowish-brown liquid possessing delicate odor of fresh Jasmine flowers. The essential oil in flowers is extracted through effleurage which is widely used for production of Jasmine attars in India. It's while intensely perfumed flowers appeals in light clusters that contain a small amount of essential oil. The essential oil of Jasmine is called "otto" or "attar of Jasmine" it contains over 100 constituents but the main chemical components responsible for the aroma. The main producers of Jasmine concrete are Egypt, Morocco, Algeria, France and Italy.

The products of Jasmine are important natural raw materials in the perfume industry. It is used in making perfumed hair oil, preparation of absolute and handkerchief perfumes. Jasmine oils are used extensively in the manufacture of cosmetics, pharmaceuticals, soaps, confectionary perfumes, perfumed tobacco, syrups, aerated water, ointments, disinfectants and detergents.

The postharvest losses in traditional flowers were estimated to be 7 to 13 percent. Most of the losses occurred at the time of plucking, packing and grading. Minimization of postharvest losses by various methods, such as application of preservatives, growth regulators and adopting technologies like packaging. The longevity of flowers depends on two distinct stages, the first stage is flower bud growth and development to full opening and the second stage is maturation, senescence and wilting. Hence, handling techniques have to first promote growth process in the first stage and retard metabolic process leading to senescence at the second stage. Measures such as harvesting at optimum maturity, handling with minimum injury, reducing microbial infection through proper sanitation, maintaining optimum storage conditions leads to enhanced shelf life and postharvest quality of flowers. Jasmine flowers are delicate and lose its elegance after harvesting, flowers are treated with different chemicals to increase shelf life, chemicals like antioxidants, biocides and floral preservatives *etc* helps in retaining membrane turgidity and impose anti senescence effects during aging thereby increases shelf life of the flowers. Boric acid, a mineral salt that increases osmotic concentration which improves water balance and longevity of flowers. Besides, Ascorbic acid an antioxidant also increases the vase life of flowers by increasing water uptake, reducing the respiration rate and ethylene production. Similarly, Salicylic acid is applied as preservative solution which delays the process of senescence in flowers by activating antioxidant enzymes and inhibition of ethylene synthesis. Benzyl adenine, can increase shelf life of flowers by improving membrane permeability, delay lipid peroxidation and decreases ions leakage in cell (Hatami *et al.*, 2010) [6].

Packaging is a tool for controlling flower quality in the distribution chain. Apart from preventing mechanical damage, the package serves as a barrier between the conditions inside and outside the package. It protects the

flowers from unfavorable outside conditions and enables a micro climate to develop inside the package. The main purpose of packing is to store long periods by maintaining keeping quality of flowers with controlled rate of transpiration during transportation and storage. Since, Jasmine flowers are delicate and highly perishable, they need great attention through advanced technologies in packaging to keep them fresh to consumer's satisfaction. Hence, the ideal packaging technology needs to be developed for Jasmine flowers to extend shelf-life (Bhattacharjee, 1997) [4].

Materials and Methods

The experiment was carried out in season 2024-25 at the Research Laboratory at K.D. College of Horticulture and Research Station, Jagdalpur (C.G.). The experiment was conducted in Completely Randomized Design (CRD) with three replications, comprising nine treatments *i.e.*, T₀-Distilled Water (Control), T₁-Distilled water + 200 gauge polyethylene, T₂-Boric acid 2% + 200 gauge polyethylene, T₃-Boric acid 4% + 200 gauge polyethylene, T₄-Boric acid 6% + 200 gauge polyethylene, T₅-Salicylic acid 100 ppm + 200 gauge polyethylene, T₆-Salicylic acid 150 ppm + 200 gauge polyethylene, T₇-Salicylic acid 200 ppm + 200 gauge polyethylene, T₈-GA₃ 150 ppm + 200 gauge polyethylene. Flower buds were harvested at tight bud stage during early hours of day in January, February and March. Good and uniform sized flower buds were sorted and pretreated with different chemicals. For each treatment about hundred flower buds were dipped in the solutions for three minutes and then surface dried for fifteen minutes. The packaging of loose flowers was done in Vase solution with packaging material. In each treatment contains ten packages and arranging it in three replications. In control treatment, loose flowers are stored without chemical treatment and packaging materials. Flowers were packaged in 200 gauge polyethylene, etc were stored under room temperature according to arrangement of treatments. Shelf life and other observations were recorded after completion of different storage duration at room temperature conditions. Five flower at random were selected from each treatment and tagged in order to record the observations on the physiological loss in weight (%), spoilage percentage (%), freshness index (%), relative water content (%), shelf life (Days), percentage of browning (%), fresh flowers percentage (%), moisture content (%), flower opening index (%) and change in fresh weight after storage (g).

Results and Discussion

Shelf life of Jasmine

The results revealed that postharvest pre-treatments and packaging material for increasing keeping quality of Jasmine flowers. Among the entire treatments Boric acid 4% + 200 gauge polyethylene maintained minimum physiological loss in weight (%), spoilage percentage (%), maximum freshness index, relative water content (%), shelf life (Days), minimum percentage of browning (%), maximum fresh flowers percentage (%), moisture content (%), flower opening index (%) and change in fresh weight after storage (g) of Jasmine flowers. The interpretations were recorded on various parameters presented in Table 1, 2 and 3.

Physiological loss in weight (%)

Among all the treatments, after first day of pretreatments and packaging material the minimum physiological loss in weight (20.11%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was closely followed by T₄ (Boric acid 6% + 200 gauge polyethylene) (21.73%). Whereas, maximum physiological loss in weight (33.17%) was observed in T₀ (Control).

After second day the minimum physiological loss in weight (44.11%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was closely followed by T₄ (Boric acid 6% + 200 gauge polyethylene) (46.01%) and maximum physiological loss in weight was recorded in T₀ (Control) (59.25%).

From the table (4.1) it was also noticed that, among all the treatments, the treatment T₃ (Boric acid 4% + 200 gauge polyethylene) was found to be better in reducing physiological loss of weight flowers. It was reported that 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. Similarly finding by Lavanya *et al.* (2016)^[8] in Jasmine.

Spoilage percentage (%)

Among all the treatments, after first day of pretreatment and packaging material the minimum spoilage percentage (0.00%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was closely followed by T₄ (Boric acid 6% + 200 gauge polyethylene) (1.16%). Whereas, maximum spoilage percentage (10.50%) was observed in T₀ Control.

After second day the minimum spoilage percentage (1.30%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was closely followed by T₄ (Boric acid 6% + 200 gauge polyethylene) (2.44%). Whereas, maximum spoilage percentage (17.27%) was observed in T₀ (Control).

In addition to this, maintenance of water balance of cells by boric acid might have added to higher moisture content of Jasmine flowers. Polyethylene gauge was found to be a better packaging material because it conserved moisture and maintained humidity due to which flowers remained fresh for longer periods. Similar results were obtained by Lavanya *et al.* (2016)^[8] in Jasmine and reported that the polyethylene decreased permeability for water and CO₂, which maintained humidity in wrapped material.

Freshness index (%)

Among all the treatments, after first day of pretreatment and packaging materials the maximum freshness index (88.30%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was statically at par with T₈ (GA₃ 150 ppm + 200 gauge polyethylene) (87.46%), T₄ (Boric acid 6% + 200 gauge polyethylene) (87.36%) and T₂ (Boric acid 2% + 200 gauge Polyethylene) (84.72) respectively. Whereas, minimum freshness index (58.30) was observed in T₀ (Control).

After second day the maximum freshness index (64.52%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was at par with T₈ (GA₃ 150 ppm + 200 gauge polyethylene) (63.68%) and T₄ (Boric acid 6% + 200 gauge polyethylene) (63.58%) respectively. Whereas, minimum freshness index (34.52%) was observed in T₀ (Control).

Boric acid treatment recorded maximum freshness index of flowers and the boric acid treatment proved to be effective in increasing their anti-oxidant activity also. The enhancement of anti-oxidant enzyme activity might have prevented the accumulation of free radicals thus preventing the wilting of Jasmine flowers. In agreement with the present finding, the potential of boric acid in prolonging the post-harvest life of flowers has been reported in Jasmine by Sushree chaudhary *et al.* (2019)^[10]. The high freshness was observed with 200-gauge PE bag with no ventilation while the unpacked flowers lost their freshness within 24 hours. Similarly finding by Karuppaiah *et al.* (2006)^[7].

Relative water content (%)

Among all the treatments, after first day of pre-treatment and packaging materials the maximum relative water content (92.76%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was statically at par with T₄ (Boric acid 6% + 200 gauge polyethylene) (90.16%), T₈ (GA₃ 150 ppm + 200 gauge polyethylene) (90.07%) and T₂ (Boric acid 4% + 200 gauge polyethylene) (88.07%) respectively. Whereas, minimum relative water content (76.09%) was observed in T₀ (Control).

After second day the maximum relative water content (80.89%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was statically at par with T₄ (Boric acid 6% + 200 gauge polyethylene) (78.89%) and T₈ (GA₃ 150 ppm + 200 gauge polyethylene) (78.29%) respectively. Whereas, minimum relative water content (64.22%) was observed in T₀ (Control).

The Jasmine flowers pre-treated with 4 percent boric acid and packed in polyethylene retained maximum higher relative humidity as compared to other packaging materials and non-packaged control flowers. Packaging of flowers resulted in the maintenance of humidity inside, since polyethylene bags are less permeable to water vapour transmission. In addition to this, maintenance of water balance of cells by boric acid 4 percent might have added to higher moisture content of Jasmine flowers. Polyethylene was found to be a better packaging material as compared to others because it conserved moisture and maintained humidity due to which flowers remained fresh for longer periods. Similar results were obtained by Lavanya *et al.* (2016)^[8] in Jasmine and reported that the polyethylene decreased permeability for water and CO₂, which maintained humidity in wrapped material.

Shelf life (days)

The harvested flowers of Jasmine were treated with T₃ (4% boric acid + 200 gauge polyethylene) significantly extended the shelf life to (2.94 days), which was closely followed by T₄ (boric acid 6% + 200 gauge polyethylene) (2.83 days) and the least shelf life (1.33 days) was recorded in T₀ (Control).

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. In this investigation, flowers packaged in 200 gauge polyethylene (PE) with 4 percent boric acid treatment proved effective in extending the post harvest life of Jasmine flowers. The results are in line with the findings by Karuppaiah *et al.* (2006)^[7] in Jasmine.

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Percentage of browning (%)

Among all the treatments, after first day of pretreatment and packaging materials the minimum percentage of browning (1.77%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was closely followed by T₄ (Boric acid 6% + 200 gauge polyethylene) (2.40%). Whereas, maximum percentage of browning (14.00%) was observed in T₀ (Control).

After second day the minimum percentage of browning (9.13%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) followed by T₄ (Boric acid 6% + 200 gauge polyethylene) (10.89%) and maximum percentage of browning was recorded in T₀ (Control) (27.40%).

The browning percentage of Jasmine (Jasmine) flowers treated with boric acid (4%) and 200-gauge polythene packaging is likely related to extending vase life and reducing browning might be due to reduce microbial growth and maintain water balance. The results are in line with the findings of Chaudhury *et al.* (2015) in Jasmine.

Fresh flower percentage (%)

Among all the treatments, after first day of pretreatment the maximum fresh flower percentage (98.23%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene), which was closely followed by treatment T₄ (Boric acid 6% + 200 gauge polyethylene) (96.44%). Whereas, minimum fresh flower percentage (75.50%) was observed in T₀ (Control).

After second day the maximum fresh flower percentage (89.57%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene), which was closely followed by T₄ (Boric acid 6% + 200 gauge polyethylene) (86.67%) and minimum fresh flower percentage was recorded in T₀ (Control) (55.33%).

In the present study Boric acid treatment resulted in maintaining the better freshness compared to other treatments might be due the fact that, boric acid enhances anti-oxidant enzyme activity and prevents the accumulation of free radicals thus prevents wilting and maintains freshness of Jasmine flowers. Similarly finding with Lavanya *et al.*, (2016)^[8] in Jasmine.

Moisture content (%)

Among all the treatments, after first day of pretreatment and packaging materials the maximum moisture content (76.98%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was at par with T₄ (Boric acid 4% + 200 gauge polyethylene) (74.38%) and T₈ (GA₃ 150 ppm + 200 gauge polyethylene) (74.29%) respectively. Whereas, minimum moisture content (60.31%) was observed in T₀ (Control).

After second day the maximum moisture content (64.12%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was at par with T₄ (Boric acid 4% + 200 gauge polyethylene) (61.52%) and T₈ (GA₃ 150 ppm + 200 gauge polyethylene) (61.43%) respectively. Whereas, minimum moisture content (47.45%) was observed in T₀

(Control).

After packaging, decline in moisture occurred simultaneously with progress in storage period. The decline in moisture content might have caused an increased PLW of flowers within two days of packaging. Packaging of flowers resulted in the maintenance of humidity inside, since polyethylene bags are less permeable to water vapour transmission. In addition to this, maintenance of water balance of cells by boric acid 4 percent might have added to higher moisture content of Jasmine flowers. Similarly finding with Thamaraiselvi *et al.*, (2010)^[11] in Jasmine.

Change in fresh weight after storage (g)

Effect of pre-treatment and packaging materials on change in fresh weight after storage (g) of Jasmine flowers was studied and the data are presented in Table 4.10 and fig. 4.10. From the Table, it is observed that the change in fresh weight after storage (g) of Jasmine flower decreased with the storage period irrespective of packaging materials and chemical treatment.

Among all the treatments, after pretreatment and packaging materials the maximum change in fresh weight after storage (9.80 g) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was at par with T₄ (Boric acid 6% + 200 gauge polyethylene) (9.20 g), Whereas, minimum change in fresh weight after storage (5.00) was observed in T₀ (Control).

From the table it was also noticed that, among all the treatments, the boric acid treatment was found to be better in reducing physiological loss of weight flowers. It was reported that 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. Similarly finding with Sushree Chaudhary *et al.* (2019)^[10] in Jasmine.

Flower opening index (%)

Among all the treatments, after first day of pretreatment and packaging materials the minimum flower opening index (23.86%) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was statically at par with T₄ (Boric acid 6% + 200 gauge polyethylene) (24.39%), T₈ (GA₃ 150 ppm + 200 gauge polyethylene) (24.34%) and T₂ (Boric acid 2% + 200 gauge Polyethylene) (25.20%) respectively. Whereas, maximum flower opening index (30.90%) was observed in T₀ (Control).

After second day the minimum flower opening index (45.70) was recorded in treatment T₃ (Boric acid 4% + 200 gauge polyethylene) which was statically at par with T₄ (Boric acid 6% + 200 gauge polyethylene) (46.73%), T₈ (GA₃ 150 ppm + 200 gauge polyethylene) (47.05%) and T₂ (Boric acid 2% + 200 gauge Polyethylene) (48.28%) respectively. Whereas, maximum flower opening index (61.25%) was observed in T₀ (Control).

Some of the earlier findings about flower opening in cut roses have been shown to be dependent on carbohydrate status in the petals. Petal growth associated with flower bud opening results from cell expansion which required the influx of water and carbohydrates into petal cells. Reduced water status of flowers is known to record the lowest flower opening under ambient conditions. Flower opening index were observed less with 200 gauge PE bag. Similarly finding with Karuppiiah *et al.*, (2006)^[7] in Jasmine.

Table 1: Effect of different solution and packaging material on physiological loss in weight (%), spoilage percentage (%), freshness index and relative water content (%)

Treatment	Treatment details	Physiological loss in weight (%)		Spoilage percentage (%)		Freshness Index (%)		Relative water content (%)	
		1 days	2 days	1 days	2 days	1 days	2 days	1 days	2 days
T ₀	Distilled Water (Control)	33.17	59.25	10.50	17.27	58.30	34.52	76.09	64.22
T ₁	Distil water + 200 gauge polyethylene	30.01	55.88	7.23	10.22	60.21	36.43	80.07	68.20
T ₂	Boric acid 2% + 200 gauge polyethylene	23.71	48.41	3.18	3.70	84.72	60.94	88.07	76.20
T ₃	Boric acid 4% + 200 gauge polyethylene	20.11	44.11	0.00	1.30	88.30	64.52	92.76	80.89
T ₄	Boric acid 6% + 200 gauge polyethylene	21.73	46.01	1.16	2.44	87.36	63.58	90.16	78.29
T ₅	Salicylic acid 100 ppm + 200 gauge polyethylene	27.13	52.51	6.20	8.85	81.33	57.55	84.73	72.86
T ₆	Salicylic acid 150 ppm + 200 gauge polyethylene	26.64	51.67	4.45	6.25	82.56	58.78	86.35	74.48
T ₇	Salicylic acid 200 ppm + 200 gauge polyethylene	24.43	49.52	4.10	4.65	83.22	59.44	89.66	77.79
T ₈	GA ₃ 150 ppm + 200 gauge polyethylene	22.81	46.88	2.88	3.58	87.46	63.68	90.07	78.20
SE(m ±)		0.52	1.14	0.09	0.15	1.86	1.35	1.82	1.58
C.D.at		1.54	3.40	0.29	0.46	5.53	4.01	5.43	4.70
CV		3.52	3.93	3.80	4.13	4.06	4.21	3.66	3.67

Table 2: Effect of different solution and packaging material on shelf life (days), percentage of browning (%), fresh flower percentage (%) and moisture content (%)

Treatment	Treatment details	Shelf life (days)	Percentage of browning (%)		Fresh flower percentage (%)		Moisture content (%)	
			1 days	2 days	1 days	2 days	1 days	2 days
T ₀	Distilled Water (Control)	1.33	14.00	27.40	75.50	55.33	60.31	47.45
T ₁	Distil water + 200 gauge polyethylene	1.66	10.60	24.90	82.17	64.88	64.29	51.43
T ₂	Boric acid 2% + 200 gauge polyethylene	2.72	4.65	12.97	92.17	83.33	72.29	59.43
T ₃	Boric acid 4% + 200 gauge polyethylene	2.94	1.77	9.13	98.23	89.57	76.98	64.12
T ₄	Boric acid 6% + 200 gauge polyethylene	2.83	2.40	10.89	96.44	86.67	74.38	61.52
T ₅	Salicylic acid 100 ppm + 200 gauge polyethylene	2.33	9.03	20.82	84.77	70.33	68.95	56.09
T ₆	Salicylic acid 150 ppm + 200 gauge polyethylene	2.46	8.12	15.15	87.43	78.60	70.57	57.71
T ₇	Salicylic acid 200 ppm + 200 gauge polyethylene	2.65	5.20	13.48	90.70	81.87	73.88	61.02
T ₈	GA ₃ 150 ppm + 200 gauge polyethylene	2.78	3.59	12.12	93.53	84.30	74.29	61.43
SE(m ±)		0.04	0.25	0.40	1.84	1.75	0.93	1.25
C.D.at		0.12	0.74	1.19	5.49	5.21	2.77	3.72
CV		2.96	2.87	4.24	3.60	3.79	2.29	3.75

Table 3: Effect of different solution and packaging material on flower opening Index (%) and change in fresh weight after storage (g)

Treatment	Treatment details	Flower opening Index (%)		Change in fresh weight after storage (g)
		1 days	2 days	
T ₀	Distilled Water (Control)	30.90	61.25	5.00
T ₁	Distil water + 200 gauge polyethylene	25.61	55.21	6.20
T ₂	Boric acid 2% + 200 gauge polyethylene	25.20	48.28	8.33
T ₃	Boric acid 4% + 200 gauge polyethylene	23.86	45.70	9.80
T ₄	Boric acid 6% + 200 gauge polyethylene	24.39	46.73	9.20
T ₅	Salicylic acid 100 ppm + 200 gauge polyethylene	27.32	56.36	6.72
T ₆	Salicylic acid 150 ppm + 200 gauge polyethylene	26.86	54.33	7.75
T ₇	Salicylic acid 200 ppm + 200 gauge polyethylene	26.27	52.21	7.92
T ₈	GA ₃ 150 ppm + 200 gauge polyethylene	24.34	47.05	8.64
SE(m ±)		0.56	1.08	0.15
C.D.at		1.67	3.23	0.46
CV		3.73	3.63	3.48

Conclusion

The flower buds pretreated with boric acid 4 percent recorded maximum shelf life. In the packaging experiment, the flower buds pretreated with boric acid 4 percent and packed in 200 gauge polyethene bag, recorded best performance for the minimum physiological loss in weight (%), spoilage percentage (%), maximum freshness index (%), relative water content (%), shelf life (day), minimum percentage of browning (%), maximum fresh flowers percentage (%), moisture content (%), minimum flower opening index (%) and change in fresh weight after storage (g).

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