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# STANDARDIZATION OF LOW TEMPERATURE STORAGE TECHNOLOGY WITH NOVEL PACKAGING TECHNIQUES IN ROSE CUT FLOWER CV. PASSION

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**ABSTRACT :** Rose cut flowers of cv. Passion were subjected to storage techniques viz., seal packaging with polypropylene (PP 24 μ), butter paper (52 μ), holding in 200 mgL$^{-1}$ $Al_2(SO_4)_3$ vase solution, holding in vase (distilled water) and without any packaging and without holding in vase water at low temperature (2°C) for 10 days. The ten days cold stored flowers were compared with fresh cut flowers for vase life and quality. The polypropylene packaged low temperature stored cut roses showed optimistic results with best postharvest flower quality at the end of 10 days storage period as compared to other treatments. The PP packaged low temperature stored rose cut flowers showed maximum water uptake, retention of fresh weight, retained higher anthocyanin pigment content in the petals and maximum bud length and diameter when held in vase (distilled water) after 10 days of low temperature storage and were at par with fresh flowers (not stored). Cut flowers held in vase solution during low temperature storage failed to retain bud stage but showed advance bud opening at the end of the storage period. PP packaged low temperature stored cut roses showed higher membrane stability index (MSI) of petal tissue. The same treatment recorded maximum score for quality test. Thus PP packed cold stored rose flowers retained best flower quality as well as showed higher vase life as compared to the rose flowers stored with other treatments.

***Keywords :*** *Rose, polypropylene, low temperature storage, anthocyanin, vase life.*

Rose (*Rosa indica* L.), belongs to family Rosaceae, is one of the oldest flowers under cultivation and most popular among all commercial flowers throughout the world. It is one of the nature's beautiful creations and is universally known as the "Queen of Flowers". Rose flowers are beautiful in shape, size, fragrance and colour and have good demand in domestic and export market. The demand of cut roses often reaches its peak followed by high prices during festival times while at times faces the problem of price crash during market gluts. Effective storage technique and long distance transportation can facilitate better market strategy for roses. However, long distance transportation of roses *via* sea shipment is further restricted due its limited vase life, deterioration in flower quality (Mor *et al.,* 8; van Doorn and D' Hont, 14) and chilling injury (Pompodakis *et al.,* 10) at low temperature storage. Further, low temperature storage has also been known to promote ethylene production that further triggers early senescence in rose (Faragher *et. al.,* 2; Devechi *et. al.,* 1). Seal packaging of cut flowers with polyfilms at low temperature is known to create modified atmospheric conditions (Farber *et al.,* 3). Considering the immense importance of rose in domestic as well as overseas market, it seemd the right way to plan the experiment to evaluate proper low temperature storage technique along novel packing material for rose cut flower cv. Passion.

## MATERIALS AND METHODS

Fresh rose cut flowers cv. Passion were obtained from greenhouse complex, Navsari Agricultural University, Navsari and were brought to the Floriculture Laboratory, College of Horticulture and Forestry, NAU Navsari at an ambient temperature (18-21°C). The experiment was conducted in completely randomized block design. There were five treatments and each treatment was repeated four times. Cut roses at uniform bud size, fresh weight (10±2 g) and stem length (50±5 cm) were selected and divided into five groups each having one hundred twenty flowers (30 in each repetition) and subjected to different treatments. Treatment combinations included seal packaging with polypropylene (PP) 24 microns ($T_1$), seal packaging with butter paper 52 microns ($T_2$), holding in 200 mg L$^{-1}$ $Al_2(SO_4)_3$ solution ($T_3$), holding in distilled water ($T_4$) and without any packaging and holding solution in CFB box ($T_5$). All bunches were stored at 2°C temperature in cold storage for 10 days. After 10 days of cold storage, the flowers were taken out from cold storage,

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unpacked and removed from respective packaging treatments and were held in distilled vase water at ambient conditions in the laboratory for recording of different observations. Fresh flowers of cv. Passion as control ($T_0$) bought from the same greenhouse complex were also held in distilled water in order to compare with treated and stored flowers. Observations regarding vase life and different postharvest parameters were recorded at different intervals during vase life. Total water uptake, fresh weight, bud length and bud diameter and bud opening were recorded on $2^{nd}$, $4^{th}$ and $6^{th}$ day of vase life. Membrane stability index was recorded on $2^{nd}$, $4^{th}$ and $6^{th}$ day of vase life. MSI was calculated on the basis of electrolyte leakage (ion leakage) of petals. Anthocyanin pigment content was analysed from the rose petals on $4^{th}$ day of vase life. Quality of the flowers in terms of colour and freshness was recorded on $2^{nd}$ $4^{th}$ and $6^{th}$ day of vase life and given score from 1 to 5 on visual basis.

## RESULTS AND DISCUSSION

Data depicted in Table 1 revealed that the maximum water uptake (60.1 ml) was observed in the cut rose flowers packed in polypropylene ($T_1$) which was at par with fresh flowers (Control, 55.3 ml) at $2^{nd}$ day of vase life. Fresh flowers ($T_0$-control) recorded maximum water up take (51.98 ml and 41.47 ml) which was at par with cut flowers that were PP packaged and cold stored (50.62 ml and 40.53 ml) at the $4^{th}$ and $6^{th}$ day of vase life. Rose flowers that were stored with other treatments showed very low water uptake. Further, maximum fresh weight retention (11.97, 4.26 and -3.23%) was observed in fresh rose flowers ($T_0$ control), which was at par with the cold stored flowers that were packaged in polypropylene ($T_1$), (10.58, 3.89 and -4.68 %) at $2^{nd}$, $4^{th}$ and $6^{th}$ day of vase life respectively. Minimum fresh weight loss in tuberose spikes packed with vented PP bags have also been reported by Mazumedar *et al.* (7) Maximum anthocyanin pigment content (8.43 mg/g fresh weight) was observed in fresh flowers ($T_0$), which was at par with cold stored rose cut flowers that were packaged with polypropylene $T_1$ (8.12 mg/g fresh weight). Seal packaging of fresh produce in poly films is known to create modified internal gaseous components passively (Farber *et al.,* 3), that helps in minimizing metabolic activities during storage and retains fresh produce in normal condition (Zeltzer *et al.,* 15). Thus, PP packaging contributed in maintaining higher water uptake as well as fresh weight retention in stored cut flowers. Packaging with poly films have been earlier known to enhance water uptake after cold storage as well as retain fresh weight in gladiolus cut spikes (Singh *et al.,* 11 and Grover *et al.*, 4), gerbera (Patel and Singh, 9) and solidago (Zeltzer *et al.,* 15). In addition to this, storage conditions including low oxygen and high relative humidity have been found to influence anthocyanin retention in different plant products (Markakis, 6). Modified atmospheric conditions with PP polyfilm packaging retained anthocyanin pigments in the low temperature stored rose petals as earlier observed in gladiolus (Singh *et al.,*12).

Data presented in the Table 2 stated that the maximum bud length (3.73 cm) was observed in fresh flowers ($T_0$-control), which was at par with cut flowers packaged in polypropylene $T_1$ (3.67 cm), cut flowers dipped in $Al_2(SO_4)_3$–$T_3$ (3.63 cm), and water–$T_4$ (3.43

**Table 1: Effect of different storage techniques (wet and dry) on quantitative parameters and pigment content of rose cv. Passion.**

| .Storage Technology | Day After Storage | | | | | | |
|---|---|---|---|---|---|---|---|
| | Water uptake (ml) | | | Fresh weight (%) | | | Anthocyanin content (mg/g fresh weight) |
| | $2^{nd}$ | $4^{th}$ | $6^{th}$ | $2^{nd}$ | $4^{th}$ | $6^{th}$ | $4^{th}$ |
| $T_0$-Control, Fresh Flowers, no storage | 55.3 | 51.98 | 41.47 | 11.97 | 4.26 | -3.23 | 8.43 |
| $T_1$-Polypropylene | 60.1 | 50.62 | 40.53 | 10.58 | 3.89 | -4.68 | 8.12 |
| $T_2$-Butter paper | 12.2 | 7.40 | 2.13 | -29.25 | -31.64 | -38.49 | 5.94 |
| $T_3$-200mg/l $Al_2(SO_4)_3$ | 46.9 | 42.94 | 25.07 | 8.64 | -7.10 | -12.87 | 7.61 |
| $T_4$-Water | 35.6 | 31.44 | 19.21 | 6.73 | -9.02 | -12.81 | 6.17 |
| $T_5$-Without any packaging | 8.4 | 5.13 | 1.83 | -40.27 | -40.78 | -46.78 | 3.99 |
| C.D. (P=0.05) | 1.53 | 0.71 | 0.58 | 0.63 | 0.59 | 0.9 | 0.38 |

cm) at 2nd DAS. On 4th and 6th DAS the maximum bud length was observed in rose cut flowers packaged in polypropylene (3.77 and 3.57 cm) respectively which was at par with fresh flowers ($T_0$) kept (3.93). roses that were PP packaged might have increased the cell-turgidity and cell enlargement leading to petal expansion as also observed earlier in gerbera (Patel and Singh, 9).

**Table 2: Effect of different storage techniques (wet and dry) on qualitative parameters and vase life of rose cv. Passion**

| Storage Technology | Day After Storage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bud length (cm) | | | Bud diameter (cm) | | | MSI (%) | | | Vase life (days) |
| | 2nd | 4th | 6th | 2nd | 4th | 6th | 2nd | 4th | 6th | |
| $T_0$-Control, Fresh Flowers, no storage | 3.73 | 3.93 | 3.83 | 4.53 | 5.33 | 5.33 | 90.03 | 63.43 | 38.63 | 5.23 |
| $T_1$-Polypropylene | 3.67 | 3.77 | 3.57 | 4.33 | 5.03 | 5.13 | 89.53 | 62.27 | 37.57 | 5.07 |
| $T_2$-Butter paper | 3.07 | 2.67 | 2.17 | 3.03 | 3.17 | 3.20 | 36.27 | 26.37 | 23.53 | 1.30 |
| $T_3$-200 mg/l $Al_2(SO_4)_3$ | 3.63 | 3.40 | 2.83 | 4.87 | 4.73 | 4.86 | 75.87 | 51.63 | 26.67 | 3.23 |
| $T_4$-Water | 3.43 | 3.13 | 2.77 | 4.50 | 4.57 | 4.62 | 68.03 | 42.13 | 23.77 | 2.33 |
| $T_5$-Without any packaging | 2.77 | 2.47 | 1.93 | 3.07 | 3.13 | 3.20 | 32.63 | 26.07 | 21.63 | 1.03 |
| C.D. (P=0.05) | 0.18 | 0.17 | 0.19 | 0.16 | 0.18 | 0.19 | 1.05 | 1.18 | 0.83 | 0.14 |

**Table 3: Effect of different storage techniques (wet and dry) on qualitative parameters of rose cv. Passion**

| Storage Technology | Day After Storage | | | | | |
|---|---|---|---|---|---|---|
| | Quality | | | Bud opening (%) | | |
| | 2nd | 4th | 6th | 2nd | 4th | 6th |
| $T_0$-Control, Fresh Flowers, no storage | 5 | 5 | 4 | 86.43 | 100.00 | 100.00 |
| $T_1$-Polypropylene | 5 | 5 | 4 | 80.23 | 100.00 | 100.00 |
| $T_2$-Butter paper | 1 | 1 | 1 | 36.34 | 39.46 | 41.00 |
| $T_3$-200mg/l $Al_2(SO_4)_3$ | 3 | 2 | 1 | 95.63 | 92.34 | 95.26 |
| $T_4$-Water | 3 | 2 | 1 | 85.00 | 86.39 | 88.67 |
| $T_5$-Without any packaging | 1 | 1 | 1 | 36.04 | 38.27 | 41.00 |
| C.D.(P=0.05) | - | - | - | 1.9 | 1.69 | 1.60 |

***Quality rating score:*** 1-Dull/Flaccid, 2-Poor, 3-Fair, 4-Very good and 5-Excellent

and 3.83 cm). The trend in the data showed increase in bud diameter in fresh flowers (4.53, 5.33 and 5.33 cm) and in stored flowers that were PP packaged (4.33, 5.03 and 5.13 cm) over all other storage techniques. Further, maximum Membrane Stability Index(MSI) of the petal tissue was observed in the fresh flowers, ($T_0$) (90.03%, 63.43% and 38.63%) which was at par with cut flowers packaged in polypropylene (PP), $T_1$ (89.53%, 62.27% and 37.57%) at 2nd, 4th and 6th DAS. Increase in bud size can be attributed to the retention of higher fresh weight and petal tissue integrity as evidenced from retained MSI level. The enhanced water uptake by fresh rose flowers and in cut

Maximum vase life was recorded in fresh flowers (control) (5.23 days) which were at par with cut flowers packaged in polypropylene–$T_1$ (5.07 days). Further, flower quality of fresh flowers (not stored) and of PP packed cold stored flowers was found to have higher quality score on visual basis in terms of colour and freshness compared to flowers cold stored with other treatments (Table 3). In terms of bud opening percentage, initially on 2nd day, it was maximum (95.63%) in cold stored flowers that were held in $Al_2(SO_4)_3$. Gradually PP packed cold stored flowers as well as fresh flowers showed 100% opening on 4th and 6th day of vase life while the untreated cold stored and butter paper packed cold stored roses showed restricted opening. Enhanced bud opening along with improved flower quality of cut roses packed with PP during low temperature (2°C) and in fresh flowers was due to availability of water through improved water uptake when held in vase water after storage. Water balance (Halevy and Mayak, 5) along with intact cell membrane of petal tissue (Torre *et al.,* 13) was suggested to improve bud opening in cut flowers. In addition to this, the retention of fresh weight, better water balance with high water uptake along alleviated MSI delayed the petal senescence and improved vase life of PP packaged low temperature stored cut roses.

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