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POST HARVEST LIFE OF ROSA HYBRIDA L. cv. NARANJA AS EFFECTED BY WRAPPING MATERIALS AND STORAGE DURATIONS

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Abstract

The effect of different wrapping materials and storage durations was assessed to study the keeping quality of cut rose cv. Naranja. The harvested flowers were immediately precooled and then pulsed with a solution of Sucrose 5% + 200 ppm 8-HQC for 24 hrs, the cut blooms were then wrapped separately in different wrapping materials, and under different storage durations various keeping quality parameters were studied. Data regarding all the parameters were collected by using standard procedures. Among different wrapping materials, LDPE (100 gauge) and LDPE (200μ) proved to be promising in augmenting the keeping quality of cut rose. Keeping quality of unpackaged cut stems deteriorated and decreased with increase in storage duration from 0 days to 12 days.

Key words: Wrapping materials, Storage duration, Rose and vase life.

Introduction

Flowers are a unique and a beautiful gift to humankind having a considerable aesthetic and medicinal importance. They are highly perishable commodities and it has been reported that most of the losses are due to poor post harvest handling techniques. Due to the poor handling there is sudden price crash which is rendering low value to the flowers. So there is an urgent need to find suitable solution to it as the Post harvest behaviour and the lasting quality of flower species and cultivar may vary considerably and these differences may be due to anatomical, physiological, physical, biochemical and genetical make up. Postharvest handling involving packaging is an appropriate solution to it as it helps to maintain flower freshness and original colour of flower for a longer period which is chiefly governed by internal mechanism that includes balance between water uptake and water loss, stem plugging, respiration rate and production of toxic substances like ethylene and external factors that include environmental conditions and microbial attack on the cut ends (Srivastava *et al*. 2015). The main principle of the packaging towards long storage and keeping quality are to lower the rate of transpiration, respiration and cell division during transportation. (Bhattacharjee 1999). There are enormous ranges of variabilities available in interior packaging material like paper, paper board, transparent films, polyethylene or other fascinating devices which needs to be studied for their appropriateness. A lot of packaging material have been advocated for different varieties growing under different conditions. However, such information on crop varieties growing under Tarai conditions is scanty. Therefore, the present investigation was undertaken to compare various packaging alternatives to keep the flowers fresh for a longer period for safe loading to the destinations.

Materials and Methods

The present investigation was carried out at Model Floriculture Centre of the University located at 29^0N latitude, 79.3^0E longitude in the Tarai belt of Himalayas during 2011-12 to 2012-13. The experimental material consist of cut rose cv. Naranja. The crop was raised under naturally ventilated poly house with uniform standard cultural practices. The stems were harvested with the help of sharp secateurs at 8:00 am in the morning at tight bud stage. The stem length of all flowers were uniformly maintained *i.e.* 60 cm. The harvested flowers were immediately precooled and then pulsed with a solution of Sucrose 5% + 200 ppm 8-HQC for 24 hrs, the cut blooms were then wrapped separately in different wrapping materials, *i.e.* $\mathbf{T_1}$ = Cellophane paper, $\mathbf{T_2}$ = PP (200 gauge), $\mathbf{T_3}$ =Newspaper, $\mathbf{T_4}$ = LDPE (100 gauge), $\mathbf{T_5}$= LDPE (200µ), $\mathbf{T_6}$ = Butter paper, $\mathbf{T_7}$ = Control. They were then tied with rubber bands and placed horizontally at a temperature of " 4^0C in CFB box for different durations. The effect of different storage durations, with $\mathbf{D_1}$= 0 days (at 24 hrs), $\mathbf{D_2}$= 3 days, $\mathbf{D_3}$= 6 days, $\mathbf{D_4}$= 9 days, $\mathbf{D_5}$= 12 days and wrapping materials on the vase life was studied in distilled water. The experiment was laid out in Factorial completely Randomized block design with three replications. Observations like flower appearance, flower diameter, water uptake, water loss and other important parameters were then recorded. Flower appearance was calculated on the basis of scoring values as given by (Jain *et al.* 2007). The total sugars were estimated at the termination of experiment on fresh weight basis by phenol sulphuric acid method (Dubois *et al.* 1952). Reducing sugar: was calculated at the termination of vase life on dry weight basis using modified Nelson Somogyi Method (Thimmaiah 1999). Water uptake and water loss by the flower stem was determined by using the method described by Venkatarayappa *et al.* 1980. The data of both the year were pooled and analyzed statistically as per the methods of Gomez and Gomez (1983).

Results and discussion

It is clear from the data presented in table 1 that the stage of bud opening was not much affected by the wrapping materials. Among the various wrapping materials used, flowers wrapped in PP, *i.e.* $\mathbf{T_2}$ had maximum score (3.1) for the stage of bud opening. Minimum score (2.6) was recorded in the flowers wrapped with cellophane paper ($\mathbf{T_1}$). Comparison of different storage durations revealed that maximum score (3.4) was obtained in the flowers that were unstored, *i.e.* $\mathbf{D_0}$. Minimum score (1.6) was obtained in the flowers stored for 12 days, *i.e.* $\mathbf{D_4}$ (table 1). The data for the interaction between storage durations and wrapping material clearly indicated that maximum score (3.9) was obtained in the flowers that were wrapped with polypropylene for 1 day and unstored and was statistically at par with all the treatments. Minimum score (1.1) was obtained for the treatment combination $\mathbf{D_4T_6}$ in which the flowers were wrapped with butter paper and stored for 12 days and was statistically at par with the treatment combinations $\mathbf{D_4T_1}$, $\mathbf{D_4T_5}$ and $\mathbf{D_4T_7}$ (table 1). Thus the results revealed that the stage of bud opening was not very much affected and remains almost same in various treatments but after a specific period of duration, the bud opening was affected and this might be due to the reason that the modified atmospheres provided by various wrapping materials remain upto a specific period of time. This is further supported by Bala *et al*. (2009) in rose cv. First Red in which the flowers were stored in polypropylene (PP) sleeves of 100 gauge thickness and stored for 18 days and the degree of bud opening decreased with the increase in storage duration.

A perusal of data presented in table 1 revealed that water uptake was significantly affected among all the treatments. Highest water uptake (31.82 g/stem) was found in the flowers which were wrapped with LDPE 100 gauge ($\mathbf{T_4}$) and was significantly higher over all other treatments except $\mathbf{T_5}$, whereas minimum water uptake (27.04 g/stem) was recorded in the flowers that were unwrapped, *i.e.* $\mathbf{T_7}$. Among various storage durations, unstored flower ($\mathbf{D_0}$) had maximum water uptake (38.61 g/stem) while minimum water uptake (24.10 g/stem) was recorded in the flowers stored for 12 days ($\mathbf{D_4}$). The interaction between storage duration and wrapping materials revealed that maximum water uptake (38.78 g/stem) was found in the flowers that were unstored and wrapped with cellophane for 1 day ($\mathbf{D_0T_1}$) and it was statistically at par with the treatment combination $\mathbf{D_0T_2}$, $\mathbf{D_0T_3}$, $\mathbf{D_0T_4}$, $\mathbf{D_0T_5}$, $\mathbf{D_0T_6}$ and $\mathbf{D_0T_7}$, whereas minimum water uptake (17.52 g/stem) was recorded in the treatment combination $\mathbf{D_4T_7}$, in which the flowers were unwrapped but stored for 12 days (table 1). Thus the results indicated that the water uptake was higher in the flower buds wrapped in LDPE (100 gauge). The ability to absorb water decreased with increase in storage duration which also affected postharvest life. Patel *et al.* (2008) also advocated the same thing in spider lily that the water absorption was higher in the flower buds wrapped in tissue paper (48.8 ml) and news paper (48.8 ml) stored for 5 days as compared to control (37.33 ml). This may be attributed to the fact that water uptake decreased in the flowers as the storage duration increased as the ability of xylem cells to absorb water continuously decreased as the duration of storage increased. In case of unpackaged flowers, undesired gaseous equilibrium might have appeared causing higher cell damage resulting in poor water uptake as also earlier observed by Van Doorn and Hont (1994) in rose. It is evident from the data presented in table 1 that maximum water loss was found in the flowers wrapped with LDPE 200 µ ($\mathbf{T_5}$), *i.e.* 31.74 g/stem, whereas, minimum water loss (23.67 g/stem) was found in the flowers that were unwrapped ($\mathbf{T_7}$). Among the different storage durations, flowers that were unstored

Table 1: Effect of wrapping materials and storage duration on the stage of bud opening, water uptake and water loss of cut rose cv. Naranja.

Treatments	STAGE OF BUD						OPENINGWATER						UPTAKEWATER LOSS					
	D_0	D_1	D_2	D_3	D_4	Mean	D_0	D_1	D_2	D_3	D_4	Mean	D_0	D_1	D_2	D_3	D_4	Mean
T_1	3.1	3.1	3.1	2.4	1.4	2.6	38.78	33.56	29.45	26.88	21.76	30.08	36.36	29.10	27.00	24.04	18.80	27.06
T_2	3.9	3.2	3.3	3.2	2.0	3.1	38.70	34.07	31.24	27.24	22.55	30.76	36.12	30.82	28.35	23.10	20.57	27.79
T_3	3.5	3.1	3.2	3.2	2.1	3.0	38.44	33.41	29.03	25.78	18.56	29.04	36.78	30.12	26.79	23.00	16.96	26.73
T_4	3.4	3.2	3.3	2.4	1.6	2.8	38.52	35.45	32.38	29.13	23.64	31.82	37.34	35.03	32.29	27.82	24.07	31.31
T_5	3.3	3.4	3.4	2.2	1.5	2.8	38.72	35.06	31.94	29.41	23.71	31.77	38.14	34.99	32.05	27.74	25.80	31.74
T_6	3.3	3.4	3.3	2.3	1.3	2.7	38.51	31.90	28.98	26.76	21.05	29.44	36.76	27.27	25.30	23.76	17.54	26.12
T_7	3.4	3.2	3.4	2.2	1.5	2.7	38.61	28.85	25.79	24.44	17.52	27.04	36.44	24.52	22.13	20.43	14.85	23.67
Mean	3.4	3.2	3.3	2.6	1.6	2.8	38.61	33.18	29.83	27.09	21.25	29.99	36.85	30.26	27.70	24.27	19.80	27.77
	Days	Treatments	Days × Treatments				Days	Treatments	Days × Treatments				Days	Treatments	Days × Treatments			
Sem ±	0.03	0.04	0.09				0.124	0.147	0.328				0.173	0.204	0.456			
CD 0.05	0.09	0.11	0.25				0.350	0.414	0.925				0.487	0.576	1.287			

Note: T_1 - Cellophane, T_2 -PP, T_3 - Newspaper T_4 - LDPE (100 gauge) T_5 – LDPE (200 μ), T_6 -Butter paper, T_7 - Control D_0- 1 day, D_1- 3 days, D_2- 6 days, D_3 -9 days, D_4 -12 days

(**D_0**) gave maximum water loss (36.85 g/stem), while the flowers stored for 12 days (**D_4**) had minimum water loss *i.e.* 19.80 g/stem (Table 1). The interaction between storage durations and wrapping material showed that maximum water loss (38.14 g/stem) was also found in the flowers which were wrapped with LDPE 200 μ for 1 day but not stored (**D_0T_5**) and it found to be statistically at par with the treatment combination **D_0T_4**. However, flowers that were unwrapped but stored for 12 days (**D_4T_7**) had minimum water loss of 14.85 g/stem (table 1). Maximum percent increase in bud size (42.86%) was found in the flowers that were wrapped in cellophane paper (**T_1**) and was found to be statistically at par with all the treatments except **T_6** and **T_7** and minimum increase in bud size (26.86%) was found in the flowers that were unwrapped, *i.e.* treatment **T_7**. Comparison between different storage durations revealed that freshly harvested flowers gave maximum increase in bud size which continues to decrease progressively with the increase in storage durations. Maximum increase in bud size *i.e.* 54.21 % was found in the flowers that were unstored (D_0), whereas, minimum increase in bud size (15.38%) was recorded in the flowers stored for 12 days duration, *i.e.* duration **D_4**. The interaction between storage durations and wrapping materials showed that maximum per cent increase in bud size (58.42%) was found in the flowers that were unstored and wrapped with newspaper for 1 day, *i.e.* **D_0T_3** and was found to be significantly at par with all other treatment combinations, whereas minimum per cent increase in bud size (- 4.03%) was found in the flowers that were stored for 12 days but unwrapped, *i.e.* **D_4T_7** (table 2). The results pertaining to percent increase in bud size revealed that the enhanced bud opening in cut flowers is associated with high cell turgidity (Torre *et al.* 1999) and up-regulation of optimum metabolic activities with high petal sugar status (Singh *et al.* 2005). The decrease in ability of buds to open and decline in vase life with increase in storage duration and improved bud opening with modified atmosphere packaging have been reported by Meir *et al.* (1995) in Gladiolus.

The data presented in table 2 showed that the effect of wrapping materials and storage duration on the flower diameter of cut rose. In general, among the wrapping materials maximum flower diameter (6.09 cm) was recorded in the flowers wrapped with LDPE 100 gauge (**T_4**) and was found to be statistically at par with the treatment **T_2** whereas,the minimum flower diameter (5.21 cm) was recorded in the treatment **T_7** in which the flowers were not wrapped. Among the different storage durations, flowers stored for 1 day (**D_0**) had maximum flower diameter *i.e.* 7.04 cm, whereas, 12 days storage (**D_4**) reduced the flower diameter upto 4.12 cm (table 2). The interaction between the storage durations (**D**) and wrapping materials (**T**) revealed that, **D_0T_3** and **D_0T_7** resulted in maximum flower diameter (7.09 cm) and it was found to be statistically at par with the treatment combinations **D_0T_1**, **D_0T_2**, **D_0T_4** and **D_0T_6**, whereas minimum flower diameter (3.33 cm) was recorded in the flowers that were unwrapped but stored

Table 2: Effect of wrapping materials and storage duration on the per cent increase in bud size, flower diameter and flower appearance of cut rose cv. Naranja

Treatments	Per Cent Incease in Bud Size (%)						Flower Diameter						Flower Appearance					
T_1	55.22	49.22	46.24	41.38	22.01	42.82	7.06	6.53	6.34	5.78	4.50	6.04	8.32	7.45	6.25	5.39	4.46	6.37
T_2	58.42	48.35	42.66	36.00	16.99	40.48	7.09	6.34	5.79	5.26	4.15	5.72	8.28	7.36	6.22	5.05	4.13	6.20
T_3	53.96	49.84	49.38	42.06	16.86	42.42	7.01	6.36	6.84	6.03	4.22	6.09	8.32	7.61	6.61	5.75	4.39	6.53
T_4	52.86	47.93	45.75	42.01	19.68	41.65	6.97	6.55	6.52	6.05	4.22	6.06	8.21	7.48	6.23	5.65	4.32	6.38
T_5	52.64	45.68	37.97	29.01	15.11	36.08	7.00	6.41	5.44	4.83	4.19	5.57	8.31	7.12	6.11	4.94	3.98	6.09
T_6	49.48	34.12	39.11	15.63	-4.03	26.86	7.09	5.67	5.76	4.21	3.33	5.21	8.32	7.54	5.90	4.26	2.96	5.79
T_7	54.21	46.74	43.74	35.05	15.38	39.02	7.04	6.33	6.11	5.38	4.12	5.79	8.29	7.42	6.23	5.16	4.06	6.24
Mean	56.92	52.06	45.04	39.28	21.02	42.86	7.06	6.47	6.06	5.49	4.24	5.86	8.32	7.43	6.32	5.13	4.20	6.28
	Days	**Treatments**	**Days × Treatments**				**Days**	**Treatments**	**Days × Treatments**				**Days**	**Treatments**	**Days × Treatments**			
Sem ±	0.833	0.986	2.204				0.049	0.057	0.129				0.041	0.048	0.108			
CD 0.05	2.350	2.780	6.217				0.137	0.162	0.363				0.116	0.137	0.306			

for 12 days, *i.e.* $\mathbf{T_7D_4}$ (table 2). Thus the results clearly indicated that wrapping of stems with LDPE 100 gauge resulted in maximum flower diameter and the possible reason for the increased flower diameter may be that LDPE retain higher moisture retention and further storing them at lower temperature which resulted in lower metabolic activities like respiration, transpiration and maintained high humidity which resulted in easy and more flower opening. Also, the beneficial effect of low temperature storage was due to the fact that it not only effect metabolic and physical activities of microbes but also reduces rate of ethylene biosynthesis. Packaged storing of cut flowers has been found effective in maintaining flower diameter as suggested by Verma *et al.* (2006) who observed that maximum flower size in chrysanthemum cv. Snowball was obtained when the flowers were wrapped in wax paper and stored for 24 hours. Nowak and Rudnicki (1984) advocated that the wrapping materials reduced the rate of respiration by creating a sort of modified atmosphere with limited oxygen and higher carbon-di-oxide concentration. The limited oxygen concentration can retard the rate of respiration which in turn, reduces depletion of stored food and helps to supply adequate energy to the flower buds for successful opening and to be larger in diameter. Under normal storage, reduced diameter and failure of flowers to further expand after prolonged storage could be due to shift in hormonal balance within the tissue of stored flowers as suggested by Goszenynska and Rudnicki (1982).

It is evident from the data presented in table 2 that in general, among the wrapping materials the flowers wrapped with LDPE 100 gauge ($\mathbf{T_4}$) gave maximum freshness and minimum colour change as the flowers obtained maximum score of 6.53 points and was found to be statistically at par with the treatments $\mathbf{T_1}$, $\mathbf{T_2}$ and $\mathbf{T_5}$. Flowers of poor appearance with maximum change in freshness and colour were observed with minimum score of 5.79 points when unwrapped but stored. Comparison of different storage durations showed that the flowers with best appearance were observed when stored for one days ($\mathbf{D_0}$) and attained a score of 8.29 points. However, with the increase in storage durations, appearance of flowers deteriorated. Flowers with maximum loss in colour, freshness were recorded after 12 days storage ($\mathbf{D_4}$) and they obtained a minimum score of 4.06 points. The interaction between storage durations and wrapping materials revealed that the flowers that were wrapped for one day with different wrapping materials and unstored ($\mathbf{D_0T_1}$, $\mathbf{D_0T_2}$, $\mathbf{D_0T_3}$, $\mathbf{D_0T_4}$, $\mathbf{D_0T_5}$, $\mathbf{D_0T_6}$, $\mathbf{D_0T_7}$) had better appearance over those which were wrapped in different wrapping materials and stored for different durations. On the contrary, flowers with poor appearance *i.e.* maximum change in colour, loss in freshness was obtained in the flowers which were unwrapped but stored for 12 days ($\mathbf{D_4T_7}$) and obtained a minimum score of 2.96 points (table 2). Thus, the results confirmed that the unwrapped and unstored flowers showed better appearance. This is because the flowers continue to age slowly even at low temperature and thereby leading to reduced keeping quality. This is in line with the findings of Halevy and Mayak, 1981. Similar results were also obtained by Jain *et al.* (2006) who reported that unwrapped and unstored flowers in rose cv. First-Red showed better appearance with maximum score of 9.61 points.

Table 3: Effect of wrapping materials and storage duration on the reducing sugar, total sugar and vase life of cut rose cv. Naranja .

Treatments	REDUCING SUGAR						TOTAL SUGAR						VASE LIFE (days)					
	D_0	D_1	D_2	D_3	D_4	Mean	D_0	D_1	D_2	D_3	D_4	Mean	D_0	D_1	D_2	D_3	D_4	Mean
T_1	34.33	27.26	21.77	18.54	8.84	22.15	37.71	32.80	25.68	24.49	17.38	27.61	12.0	8.5	6.0	4.5	3.0	6.8
T_2	35.21	27.76	22.43	15.96	11.23	22.52	37.89	34.08	25.83	21.69	19.66	27.83	12.0	10.0	8.5	4.7	4.0	7.8
T_3	35.32	27.14	20.84	15.08	11.92	22.06	37.83	32.11	23.78	20.88	19.86	26.89	12.0	7.5	8.3	5.5	4.0	7.5
T_4	35.26	31.84	27.38	21.68	15.66	26.36	37.34	34.86	29.13	25.60	21.80	29.75	12.0	12.0	10.5	7.7	5.5	9.5
T_5	35.61	29.76	26.22	19.88	14.70	25.23	37.80	33.64	27.82	24.35	21.90	29.10	12.0	9.5	8.0	7.5	5.0	8.4
T_6	35.35	26.63	22.80	16.74	11.84	22.67	37.64	31.63	26.24	22.90	21.29	27.94	12.0	6.7	6.8	5.0	3.0	6.7
T_7	34.25	25.24	17.33	11.36	5.60	18.75	37.73	31.40	22.88	18.14	16.28	25.29	12.0	5.3	4.0	3.5	1.3	5.2
Mean	35.05	27.95	22.68	17.03	11.40	22.82	37.70	32.93	25.91	22.58	19.74	27.77	12.0	8.5	7.5	5.5	3.7	7.4
	Days	Treatments	Days × Treatments				Days	Treatments	Days × Treatments				Days	Treatments	Days × Treatments			
Sem ±	0.091	0.107	0.240				0.142	0.168	0.375				0.197	0.232	0.519			
CD 0.05	0.256	0.303	0.678				0.400	0.473	1.057				0.554	0.655	1.465			

Note: T_1 - Cellophane, T_2 -PP, T_3 - Newspaper T_4 - LDPE (100 gauge) T_5 –LDPE (200 µ), T_6 -Butter paper, T_7 - Control D_0- 1 day, D_1- 3 days, D_2- 6 days, D_3 -9 days, D_4 -12 days

A perusal of data presented in table 22 indicated that in general, among the various wrapping materials, the flowers wrapped with LDPE 100 gauge (**T_4**) had the maximum total sugar content (29.75 mg/g). Minimum total sugar content were observed when flowers were unwrapped (**T_7**) and was found to be 25.29 mg/g. Comparison of different storage durations revealed that the unstored flowers (**D_0**) had maximum total sugars *viz.*, 37.70 mg/g. The flowers stored for 12 days (**D_4**) had minimum total sugars, *i.e.* 19.74 mg/g (Table 3).Storage duration to wrapping materials interaction revealed that maximum totalsugar content (37.89 mg/g) was found in the flowers which were polypropylene wrapped and unstored *i.e.* **D_0T_2** and this treatment combination was statistically at par with the treatment combinations **D_0T_1, D_0T_3, D_0T_4, D_0T_5, D_0T_6** and **D_0T_7**. On the contrary, flowers that were unwrapped and stored for 12 days (**D_4T_7**) had minimum amount of total sugar *i.e.*15.76 mg/g and 16.28 mg/g, respectively.

Data presented in table 3 indicated that in general, among the various wrapping materials, the flowers wrapped with LDPE 100 gauge (**T_4**) had the maximum amount of reducing sugars *i.e.* 26.36 mg/g. Minimum reducing sugar content was observed in the flowers which were unwrapped and was found to be 18.75 mg/g. Data of different storage durations revealed that unstored flowers (**D_0**) had maximum amount of reducing sugars 35.05 mg/g. Minimum amount of reducing sugar was recorded in the flowers stored for 12 days (**D_4**) and was found to be 11.40 mg/g (table 3). The interaction between storage durations and wrapping materials clearly indicated that maximum reducing sugar (35.61 mg/g) was found in the flowers that were LDPE 200µ wrapped for one day and unstored (**D_0T_5**) and this treatment was statistically at par with the treatment combination **D_0T_2, D_0T_3, D_0T_4** and **D_0T_6** whereas the minimum content of reducing sugar (5.60 mg/g) was found in the treatment combination **D_4T_7** in which the flowers were stored for 12 days but unwrapped. Thus, the results revealed that unstored flowers had maximum reducing sugar content in LDPE 100 gauge and 200 µ compared to those stored for different durations. This might be due to the reason that LDPE maintains high relative humidity and owing to its gas proof nature maintains high CO_2 and low O_2 level, which keeps respiration low and thus maintains high sugar content. Similar results were obtained by Bhattacharjee (1997) while studying the packaging of fresh cut flowers.

It is apparent from the data presented in the table 3 that in general amongst the wrapping materials, flowers wrapped in LDPE (100 gauge) had maximum vase life of 9.5 days. However, minimum vase life (5.2 days) was recorded for the flowers which were unwrapped (**T_7**). Amongst the different storage durations, unstored flowers (**D_0**) showed maximum vase life of 12 days. However, minimum vase life of 3.7 days was recorded when the flower stems were stored for a duration of 12 days (**D_4**). Interaction between storage durations and wrapping materials showed that the flowers wrapped with different wrapping materials and unstored

(**D_0T_1, D_0T_2, D_0T_3, D_0T_4, D_0T_5, D_0T_6, D_0T_7**) resulted in maximum vase life of 12.00 days and was statistically at par with the treatment combination **D_1T_4**. Minimum vase life was, however, 1.3 days in the flowers which were unwrapped but stored for duration of 12 days (**D_4T_7**). Thus, the results confirmed that the beneficial effect of wrapping in LDPE might be due to the reason that it helps in providing a modified atmosphere for flowers and also slows down respiration, transpiration and cell division processes, but these conditions remain only upto a specific period of time. Vase life decreased with increase in storage duration and this might be due to the fact that process pertaining to development and senescence, continue slowly, leading to rapid senescence after storage (Namita *et al.,* 2006). The findings of Mor (1989) confirmed the fact that unstored flowers have longer vase life because the stored flowers when transferred to ambient conditions show climacteric rise in ethylene production which subsequently reduces vase life.

On the basis of different quality parameters, among different wrapping materials, LDPE (100 gauge) and LDPE (200µ) proved to be promising in augmenting the keeping quality of cut rose. Keeping quality of unpackaged cut stems deteriorated and decreased with increase in storage duration from 0 days to 12 days.

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