Original Research Article

Effect of different packaging materials and various levels of Nanosilver on cut Rose

ABSTRACT

An experiment was conducted in CRD, in which two factors were evaluated viz., different wrapping materials and different levels of Silver Nano Particles were taken to observe the effect of shelf life of cut rose. Different levels of SNP were at 10,20,30, and 40 ppm along with wrapping materials such as- Butter paper, LDPE, aluminium foil and newspaper as control used in refrigerated condition. Present study concluded that cut roses had longest shelf life at 30 ppm NS (Nano Silver) and BC ratio was highest in T 16 (AF + 0 ppm NSP).

Keywords: Evaluated, Shelf life, Butter Paper

INTRODUCTION

Rose having it's origin in central Asia, also called as the queen of flower. No other flower, surpasses it for it's beauty colour and fragrance. This is the reason why it is considered as a universally favourite flower. Various gardens have been made exclusively for roses in various parts of the world for showing die respect of flower. According to APEDA, the production of roses in India is 6.87 thousand tonnes. Roses are also used as cut flower. As a cut flower rose is an important floriculture product an refer to the flowering stem ending in a single flower or bearing a number of small flowers radiating from the base. Among all the cut flower rose lead a popularity because of their beauty, variety, fragrance and long-lasting blooming season. According to APEDA, the production of cut roses in India is 2.85 thousand tonnes. Being its various major importance preservation is needed for cut roses. According to **Mehraj et. al (2013)** vase life of cut roses is 8 – 10 days. There are various ways to preserve the vase life of cut rose. One of the easiest ways is to keep the cut rose in warm water and sugar solution at room temperature and change the water regularly at two days interval. Some of the solution for preserving the cut roses are- STS, Vinegar+ Warm water, 8-HQC and aluminium sulphate. According to the **Rafi and Ramezanian (2013)** who assessed that application of Nano Silver treatment increased vase life, water uptake and reduce the number of bacteria. Nanosilver particle is an antibacterial agent which was reported by **Lauband and Van Doorn (2004)** in their experiment that blocking of xylem vessels by microorganisms that accumulate in the vase solution or the vessels themselves is the major cause of reduction in water uptake. Usually, the

bacteria that develop in the vase solution decrease the vase life by causing rotting of stem, destruction of the xylem vessel. Silver nanoparticles act as an antibacterial agent which kills the bacteria thus increasing the vase life. Mostly the roses are cultivated in the temperate region for commercial purposes. When roses are harvested and out for export the during transportation due to the climatic fluctuation it can go various kind of stresses such as – Humidity stress, Temperature stress. Being an important flower, it is essential that it's post-harvest handling is essential. Hence, Packaging of roses essential during transportation. Packaging of roses create a suitable environment for the flower parts to escape from outside environment and remain fresh for a long time. During the packaging of flowers, it is important to decide the best packaging material during transportation. There are various evidences in relation to packaging material. **Kumar *et. al*. (2019)** studied the effect of different packaging material at constant temperature and physical property and shelf life of rose and plumeria flower found that minimum reduction in size was observed in polythene pouch packed flower stored under refrigerated condition followed by Aluminium foil. Flower is more sensitive to environmental conditions. Apart from the environmental conditions roses are also affected by alternation in their harvesting stage. It is essential to harvest the rose at proper stage. If the rose is not harvested at proper stage, then there is the attack of pest and diseases that defoliate the petals as well as the leaves. On the other hand, if the flowers are not harvested at proper stage, then due to environmental stresses there is defoliation of petals and leaves which are considered as an important part in terms of value aided products and decoration factors. **Farooq *et. al.* (2004)** as per their research suggested that storage and vase life of cut rose flower can be improved by harvesting at tight bud stage. They also explained as per their research that roses retain their acceptability up to 5 days in refrigerated condition while, they spoil in 3 days in ambient condition. The following research is being purposed with the objectives such as –

1. To study the effect of different levels of nano silver on the vase life of cut roses.
2. To find out the best packaging material on vase life of cut Roses.
3. To estimate the economics of various treatments

Materials and Methods

In the present research various levels of Nanosilver particle (0 ppm, 10 ppm, 20ppm, 30ppm and 40 ppm) were used as vase solution. To control the adjustment of temperature, different types of wrapping material such as- Butter paper, Low density polyethylene and Aluminium foil were used. The whole process of the research is divided into following steps –

Packaging treatment

Packaging material like – Newspaper (control), Butter paper, LDPE and Aluminium foil were used to wrap flowers. For each packaging material 20 small stem flower and 40 large stem flowers were used. Before packaging of flowers, it's prickles and lower leaves were removed excluding the upper 2-3 leaves and fresh weight of the material is taken. After taking the fresh weight of the flowers,2cm slant cut of the stem was done and after wrapping with respective wrapping materials, the flowers were kept in the

refrigerator at 4^0C temperature for seven days to reduce the temperature as well as transportation stress. Flower selected for the research were in their mature bud stage. After 7 days, the flowers were taken out.

Conditioning

It is the second step of the research in which flowers were dipped in the solution containing 4% sucrose, 2-3 drops of citric acid and 300 ppm silver thiosulphate for pulsing treatment at room temperature overnight.

Statistical analysis

Data were subjected to analysis of variance (ANOVA) using OPISTAT Software version 9.3 SPE. Verification of the significant differences was done using CRD test at 5% significance level

Vase solution preparation

For the vase life studies, solutions of different levels of silver nanoparticle (0 ppm, 10 ppm, 20 ppm, 30 ppm and 40 ppm) were prepared. The total no. of beaker used in this research is 60. There were five treatments for each wrapping material having three replications. Three flowers were kept in each beaker. Reading of the vase life studies were taken at three days intervals. A total of 60 beakers were used in the research.

Results and Discussion

The present investigation is done to estimate the vase life of the flowers which were kept in the various wrapping material viz. Newspaper, Butter paper, Low Density Polyethylene and Aluminium foil under refrigerated condition, apart from this flower diameter, Water uptake and stem diameter were also observed.

Flower diameter

Refrigeration of wrapped flower has significant impact on diameter of flower. Flower of controlled i.e., Newspaper wrapped flower opened first while the aluminium wrapped flowers opened at the end. The maximum flower diameter was 6.83 cm which was observed in aluminum wrapped flowers at 30 ppm NS conc. This is happened because flowers that are wrapped in aluminium foil loose minimum amount of water during their refrigerated condition.

Table.1: Effect of different concentration of Nanosilver on diameter of flower (FD) in different treatments during their vase life

{vase life (days)} ➡

Treatments	Packaging Materials	Conc. Of Nanosilver	4^{th}	13^{th}	22^{nd}
T1	Control	0 ppm	6.33	4.43	2.5
T2	Control	10 ppm	6	5	3.66
T3	Control	20 ppm	5.46	3.96	3.43
T4	Control	30 ppm	6	3.53	3.16
T5	Control	40 ppm	6	3.8	4.1
T6	BP	0 ppm	5.96	6.6	4.26
T7	BP	10 ppm	4.83	5.66	3.03
T8	BP	20 ppm	4.83	5.4	3.43
T9	BP	30 ppm	5.33	5.66	5
T10	BP	40 ppm	5	6	4.33
T11	LDPE	0 ppm	6.16	6.5	4.7
T12	LDPE	10 ppm	4.83	5.16	3.03
T13	LDPE	20 ppm	5.5	5	3.46
T14	LDPE	30 ppm	6	6.33	4
T15	LDPE	40 ppm	6	6.66	4.56
T16	AF	0 ppm	6.16	6	5.16
T17	AF	10 ppm	4.83	5.66	4.16
T18	AF	20 ppm	6.5	6.66	4.16
T19	AF	30 ppm	5.83	6.83	5.9
T20	AF	40 ppm	5.16	5.66	5.43
		F-TEST	**2.159**	**5.899**	**2.003**
		SE(d)	0.539	0.580	0.882
		CV	11.698	12.854	26.508
		CD	1.092	1.177	1.790

Stem diameter

Diameter of stem is greatly influenced by the medium of the vase solution. Initially, there is enlargement of the stem due to easily and fast uptake of water due to osmosis. As a result, the stem diameter increases. In the research it is observed that flower kept as control in refrigerated condition has maximum stem diameter. The maximum stem diameter was 0.66 which was observed in T4 (control + 30 ppm NS), while the minimum was 0.16 which was observed in T5 (control + 40 ppm NS). When the flowers are kept for conditioning their all-microbial contamination are destroyed so they uptake water and expand the flower diameter but as time passes the SNP also start uptake in some case blocking the xylem vessel. That is why flower diameter decreases.

Table.2: Effect of different concentration of Nanosilver on stem diameter of flower (SD) in different treatments during their vase life

{vase life (days)} ➡

Treatments	Packaging Materials	Conc. Of Nanosilver	4^{th}	13^{th}	22^{nd}
T1	Control	0 ppm	0.23	0.43	0.33
T2	Control	10 ppm	0.23	0.43	0.33
T3	Control	20 ppm	0.33	0.53	0.43
T4	Control	30 ppm	0.46	0.66	0.56
T5	Control	40 ppm	0.23	0.43	0.16
T6	BP	0 ppm	0.23	0.43	0.33
T7	BP	10 ppm	0.23	0.43	0.36
T8	BP	20 ppm	0.4	0.63	0.46
T9	BP	30 ppm	0.3	0.5	0.4
T10	BP	40 ppm	0.33	0.53	0.43
T11	LDPE	0 ppm	0.23	0.4	0.33
T12	LDPE	10 ppm	0.3	0.5	0.4
T13	LDPE	20 ppm	0.3	0.5	0.4
T14	LDPE	30 ppm	0.23	0.43	0.26
T15	LDPE	40 ppm	0.26	0.5	0.4
T16	AF	0 ppm	0.2	0.5	0.3
T17	AF	10 ppm	0.23	0.5	0.33
T18	AF	20 ppm	0.2	0.5	0.3
T19	AF	30 ppm	0.26	0.53	0.33
T20	AF	40 ppm	0.2	0.5	0.3
		F-TEST	**2.556**	**2.362**	**2.764**

SE(d)	0.061	0.067	0.071
CV	27.709	16.062	24.781
CD	0.125	0.135	0.145

Water uptake

Uptake of water in the flower is influenced by various factors such as – Xylem occlusion, Bacterial infection etc. The microbial growth was suppressed in vase solution, while relative fresh weight (RFW), relative water content (RWC) and chlorophyll content as well as membrane stability index (MSI) were maintained as a result of using AgNPs **Hassan et. al. (2014**). Xylem occlusion is mainly caused due to the particles of Nanosilver which is up taken by the stem and stuck between the xylem vessels. In the condition of vascular occlusion cut flower wilt and floral axis bent (Bent – neck) just below the flower head. Water uptake is also influenced by the bacterial action in the water. The main cause of short vase life of cut flower is failure in water relation. One of the major forms of detoriation in cut flower is blockage of xylem vessels by air and microorganism that causes xylem occlusion **Jadrzejuk and Zakrzewski, (2009)**. In the research it is observed that flower wrapped in butter paper in refrigerated condition has maximum water uptake. The maximum water uptake was 167.66 ml which was observed in T4 (BP+ 20 ppm NS), while the minimum was 6.66 ml which was observed in T5 (BP+30ppm Ns. This was due to Flowers wrapped in butter paper loose maximum amount of water in refrigerated condition hence water uptake is more during the vase life

Table.3: Effect of different concentration of Nanosilver on water uptake(ml) by different flowers in different treatments during their vase life

{vase life (days)} ➡

Treatments	Packaging Materials	Conc. Of Nanosilver	4^{th}	13^{th}	22^{nd}
T1	Control	0 ppm	26.66	30.00	3.50
T2	Control	10 ppm	16.66	13.33	5.00
T3	Control	20 ppm	15.00	16.66	35.00
T4	Control	30 ppm	16.66	23.33	18.33
T5	Control	40 ppm	20.00	30.00	10.33
T6	BP	0 ppm	16.66	5.00	5.00
T7	BP	10 ppm	16.66	5.00	1.66
T8	BP	20 ppm	16.66	167.66	4.16
T9	BP	30 ppm	13.33	6.66	10.00
T10	BP	40 ppm	36.66	26.66	3.33
T11	LDPE	0 ppm	20.00	20.00	6.00
T12	LDPE	10 ppm	20.00	16.66	4.00
T13	LDPE	20 ppm	23.33	26.66	5.83
T14	LDPE	30 ppm	30.00	30.00	6.66
T15	LDPE	40 ppm	30.00	38.33	6.66
T16	AF	0 ppm	30.00	30.00	5.66
T17	AF	10 ppm	4.16	4.16	5.00
T18	AF	20 ppm	3.33	2.50	4.00
T19	AF	30 ppm	2.50	20.00	5.33
T20	AF	40 ppm	20.00	30.00	5.00
		F-TEST	1.99	43.31	2.721
		SE(d)	9.091	7.472	6.313
		CV	58.856	33.729	102.747
		CD	18.440	15.158	12.806

Table.4: Duration of vase life of flowers as affected by different wrapping materials

S.No.	Packaging material	Vase life (Days)
1	Control	12
2	Butter Paper	14
3	Low density polyethylene	17
4	Aluminium foil	21

Conclusion

On the basis of this experiment, it is concluded that Treatment T19 (30 ppm NS + AF) has performed to be best regarding vase life (21 days) among all the treatments. The flower which was wrapped in aluminium foil in refrigerated condition remained fresh for longer duration during the vase life. The highest B:C ratio was found in treatment T16 (AF + 0 ppm NS) which is 3.17.

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