Sci.Int.(Lahore),28(3),3035-3040,2016 ISSN 1013-5316;CODEN: SINTE 8 3035

EFFECT OF SUCROSE AND ALUMINUM SULPHATE ON VASE LIFE OF ROSE (*ROSA INDICA* L.)

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ABSTRACT: *Present study was conducted during 2015 to investigate the effect of sucrose and aluminum sulphate at various concentrations on the quality and vase life of rose flower. Rose cutting at half opened stage were collected from a commercial rose orchard near Tando Jam from randomly selected spikes of the same stage and than were brought at once at the post graduate laboratory horticulture where those cuttings were immerced in different solutions; included:* T_1*= Control (distill water),* T_2*= Sucrose (5%),* T_3*= Aluminum sulphate 50 ppm,* T_4*= Aluminum sulphate 60 ppm,* T_5*= Sucrose (5%) + Aluminum sulphate 50 ppm and* T_6*= Sucrose (5%) + Aluminum sulphate 60 ppm.The results revealed that the effect of sucrose + aluminum sulphate treatment on rose cut flowers at various concentrations on all the parameters studied was significant (*$P<0.05$*). The treatment combination of sucrose at 5% concentration + A luminum sulphate 60 ppm took 3.83 days to open flower, minimized dropping of flower petals (1.20), improving flower diameter (6.61 cm), produced heavier flowers (3.61 g), with higher water uptake (88.62 ml/spike) and considerably increased vase life (12.56 days). The sucrose at 5% concentration + Aluminum sulphate 60 ppm produced flower weight of 3.61 g as compared to 1.47 g in control; while Vase life of flower in optimum treatment was 12.56 days as compared to 2.98 days in control. It was concluded that the treatment combination of sucrose at 5% concentration + Aluminum sulphate 60 ppm took relatively more days to open flower, minimized dropping of flower petals, improving flower diameter, produced heavier flowers, with higher water uptake and considerably increased vase life. There were adverse effects on these parameters when aluminum sulphate concentration was reduced or sucrose and aluminum sulphate were applied alone. It may be suggested that for achieving high production of quality cut rose flowers with maximum vase life, the rose cut flower may be treated with combination of sucrose at 5% concentration + Aluminum sulphate 60 ppm.*

Key words: Rose, Sucrose, Aluminum sulphate and vase life

INTRODUCTION

Rose (*Rosa indica* L.) is a member of *Rosaceae* family in the genus *Rosa* that has some 150 species [1]. Cut flowers are known as silent entertainers and among cut flowers, rose has the ultimate recognition for beauty, fragrance and acceptance. The rose is also termed as the queen of the flowers having extraordinary superiority over rest of the flower species. Such position of rose is because of its extensive use for decorative purposes and it is distinctively known for its delicate nature, aroma, charm and beauty. Rose flowers have a unique role to add charm to celebrations and occasions as well as marriage ceremonies [1]. The presentation of roses is also considered as a sympathy symbol, gift on birthday, presenting at arrivals and special days referring to love among humans. Moreover, there are a number of products of medicinal values manufactured from rose flower. But, seems to be a major aspect of rose cultivation is to produce cut flower and business related to the floriculture is gaining great potential. The vase life of cut flowers is usually short. Cut flowers wilt and floral axis become bent (bent neck) just below the flower head [2]. The development of such symptoms is considered to be caused by vascular occlusion, which inhibits the water supply to the flowers. Several methods to increase the vase life of rose and keep its freshness for longer periods have been reported. Cut flowers should be free of any deterioration, as this is one of the principal entry points for decay organisms. A major form of deterioration in cut flowers is the blockage of xylem vessels by air and microorganisms that cause xylem occlusion [3]. Sucrose is one of the most effective sources to increase the vase life of cut flowers including rose. Others [2] treated cut spray carnation by different concentrations of sucrose ranging from 0 to 7.5% and found that 5.0% sucrose recorded the best vase life and delayed the climacteric ethylene in petals. Furthermore sugars with biocides have become an important commercial preservative for several cut flowers. Application of sucrose significantly increased the vase life as well as the gain of fresh weight of rose cut flowers [4]. Aluminum sulphate is also a common biocide used for improving the vase life of cut flower. However, use of aluminum sulphate separately is less effective than its application in combination with other preservatives. However, it is needed that vase life can be enhanced by using aluminum sulphate. This evidently indicates that combined effect of the chemicals could be the reason for the successful vase life extension to 17.67 days of the cut flowers via improving solution uptake [5]. In view of the facts stated above, the present study was carried out to evaluate the effect of sucrose and aluminum sulphate on vase life of rose (*Rosa indica* L.) at ambient room conditions with the objectives; to examine the effect of sucrose and aluminum sulphate at various concentrations on the growth attributes of the rose and to find out the best concentration of sucrose and aluminum sulphate for enhancing the vase life of cut rose flower.

MATERIALS AND METHODS

The experiment was conducted at the post graduate laboratory Department of Horticulture, SAU Tandojam during the year 2015. The cuttings of roses about 8 inch long at half opened flower stage were harvested from a commercial Rose Garden near Tandojam (Husri), of which the base was cut in a slanting way to facilitate more water

3036 ISSN 1013-5316;CODEN: SINTE 8 Sci.Int.(Lahore),28(3),3035-3040,2016

absorption and were kept in buckets partially filled with water in upright position. Sorting and grading was done and preservative solutions were prepared using distilled water. The cut flowers were placed in separate glass beakers keeping the bottom of the flower stem completely immersed in each treatment; T_1= Control (distilled water), T_2= Sucrose (5%), T_3= Aluminum sulphate 50 ppm, T_4= Aluminum sulphate 60 ppm, T_5= Sucrose (5%) + Aluminum sulphate 50 ppm and T_6= Sucrose (5%) + Aluminum sulphate 60 ppm. Flower stems were cut diagonally using a sharp knife prior to immersing to facilitate absorption of the vase solution. The impact of the above formed treatments was examined on days to open flower, diameter of flower (cm), weight of flower (g), number of petals dropped, water uptake (ml), vase life (days). The collected data was subjected to statistical analysis using Statistix 8.1 computer software. The LSD test was applied to compare treatments superiority, where necessary.

Following procedures were followed for recording various observations:

Days taken to open flower:

The number of days from bud initiation to opening of flower was recorded under each treatment in all replications and average was calculated.

Diameter of flower: The diameter is the distance from one side of the flower through the center of the flower and ends on the other side of the flower. The diameter was recording by measuring the flower in accordance with the above stated method for the flowers collected from all the treatments in each replication in centimeters and averages were worked out with the following formula.

$$D=4/3\pi r^2$$

Weight of flower (g): The flowers in all the labeled spikes were plucked and subjected to record their weight by means of electronic top loading balance (Hermes 22) for each treatment in all the three replicates and averages were calculated.

Number of petals dropped: The flowers in each spike were examined for dropping of petals. The dropped petals were counted carefully and averages were worked out on the basis of number of flowers used for this trait.

Water uptake (ml): For measuring water uptake a filled beaker containing distilled water without and concentrations was placed and the daily water evaporation was noticed and deducted from the treatments containing then the volume was recorded as water uptake with the following formula.

Water uptake= Total evaporated DW- Vase solution uptake day^{-1}

The volume of water uptake was calculated by substracting the volume of water evaporated from the flask of same volume without cut flower.

Vase life: The vase life was recorded on the basis of days of flower remained intact with spike in fresh state in each replication and average was worked out.

RESULTS

Number of days taken to open flower:

The opening of flower is a factor of economic importance that influences the overall performance of a flowering spike. This trait also reflects the spike's flowering response to level of management for nutrients and other inputs. The data in regards to days taken to open flower in roses as influenced by sucrose and aluminum sulphate at various concentrations are presented in Figure 1. The ANOVA describing the significance of treatment effect suggested that the days taken to open flower varied significantly ($P<0.05$) due to application of sucrose and aluminum sulphate at different levels. Supplying rose flower spikes with Sucrose at 5% concentration + Aluminum sulphate 50 ppm took maximum number of days (4.46) open flower; and rose spikes treated with Sucrose at 5% concentration + Aluminum sulphate 60 ppm took 3.83 days to open flower. The days taken to open flower reduced considerably to 2.54, 1.66 and 1.66 when the rose spikes were supplied with Aluminum sulphate 50 ppm Aluminum sulphate 60 ppm and sucrose at 5% concentration respectively. The number of days to open flower maximally decreased to 1.06 when the rose spikes was kept untreated for sucrose and aluminum sulphate and given only distilled water (Control).

The LSD test envisaged that statistically the differences in the number of days to open flower in rose spikes treated with Aluminum sulphate 60 ppm alone or Sucrose at 5% concentration alone were insignificant ($P>0.05$) and significant ($P<0.05$) for rest of the treatments. On the basis of treatment impact on rose spikes, it was assumed that sucrose at 5% concentration + Aluminum sulphate 50 ppm would be an optimum treatment for rose so far the days taken to open flower is concerned.

Number of dropped petals:

The number of dropped petals in flowers is mainly influenced by the spike vigor and level of soil management as well as feeding of spikes for nutrients and other inputs. The results in relation to the number of dropped petals of roses as influenced by sucrose and aluminum sulphate at various concentrations are shown in Figure 2. The ANOVA signifying the treatment impact on the spikes demonstrated that the number of dropped petals of rose affected significantly ($P<0.05$) due to application of sucrose and aluminum sulphate at different rates. In rose spikes treated with Sucrose at 5% concentration + Aluminum sulphate 60 ppm, the number of dropped flowers maximally reduced to 1.20; and the number of dropped petals were increased over T_6 to 1.96 and 1.86 when the rose spikes was treated with Sucrose at 5% concentration + Aluminum sulphate 50 ppm and Aluminum sulphate 60 ppm, respectively. The number of dropped petals increased further to 2.34 and 3.28, when the rose spike was treated with Aluminum sulphate 50 ppm and sucrose at 5% concentration, respectively. However, the maximum number of dropped petals (5.24) was recorded under controlled spikes, where only distilled water was supplied in absence of sucrose and aluminum sulphate.

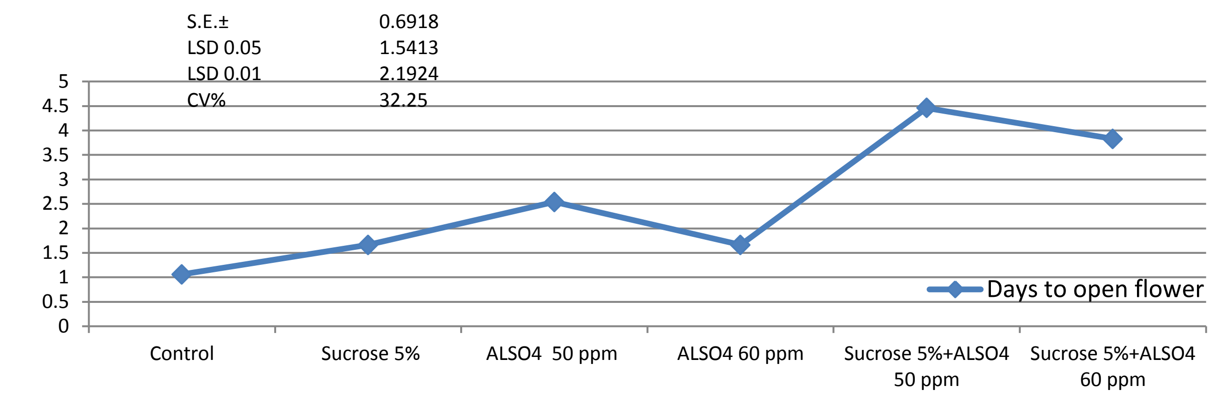

Fig. 1. Days to open flower in rose under different concentrations of sucrose and aluminum sulphate

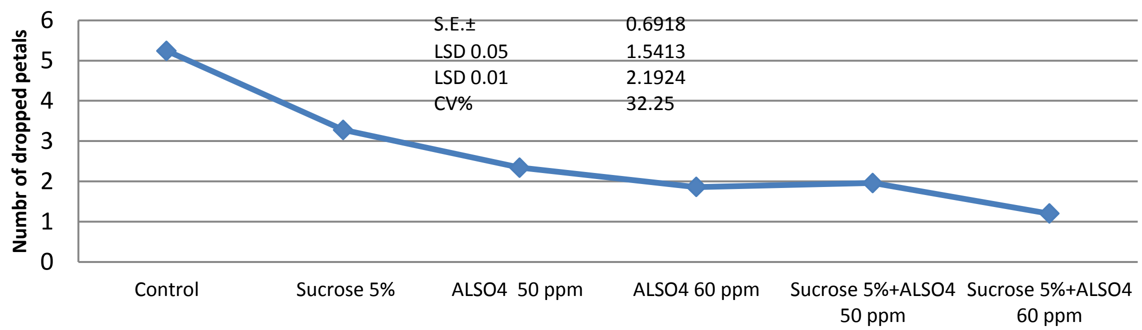

Fig. 2. Number of dropped petals in rose under different concentrations of sucrose and aluminum sulphate

Moreover, with decrease in the aluminum sulphate concentration, the petals dropping followed increasing trend; and similar spike response was recorded in absence of sucrose when aluminum sulphate was applied alone even at higher concentration. However, the dropping of petals increased considerably over T_6, T_5 and T_4 in spikes where aluminum sulphate alone was applied at lower concentration as well as sucrose application alone; while dropping of petals enhanced in control. This indicates that application of aluminum sulphate was highly effective to diminish the dropping of petals even in the absence of sucrose. It would be better is optimum, if sucrose at 5% concentration + Aluminum sulphate 60 ppm is applied; however, under any circumstances, application of Aluminum sulphate 60 ppm should not be compromised

Average diameter of flower (g):

The size of flower is known by measuring the flower diameter and the flower yield is directly proportional to flower diameter subject to the proper spike population and flowering. Different varieties may vary in flower size; but the nutrient application play vital role in the development of flower size. The data pertaining to the average flower diameter of rose as affected by various levels of sucrose and aluminum sulphate are shown in Figure 3. The ANOVA signifying the treatment impact showed that application of sucrose and aluminum sulphate at varied levels significantly affected the flower size of rose ($P<0.05$).

The results in Figure 3 showed that the rose spikes treated with Sucrose at 5% concentration + Aluminum sulphate 60 ppm produced flowers with maximum diameter (6.61 cm); while the average diameter of flower decreased over T_6 to 5.91 cm and 4.94 cm when the rose spikes was treated with Sucrose at 5% concentration + Aluminum sulphate 50 ppm and Aluminum sulphate 60 ppm, respectively. The average flower diameter decreased further to 4.41 cm and 3.50 cm, when the rose spikes were treated with Aluminum sulphate 50 ppm and sucrose at 5% concentration, respectively. However, the lowest average flower diameter (2.36 cm) was observed in control spikes, where the spikes were not given sucrose and aluminum sulphate. There was a great impact of sucrose and aluminum sulphate treatment on the flower size in rose and treatment comprised of sucrose at 5% concentration + Aluminum sulphate 60 ppm produced flowers of maximum size; and flower size decreased with the decrease in aluminum sulphate concentration

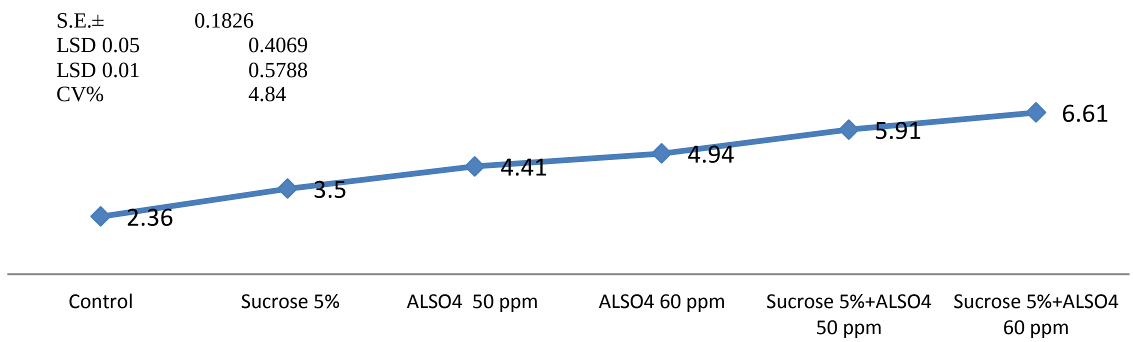

Fig. 3. Flower diameter (cm) in rose under different concentrations of sucrose and aluminum sulphate

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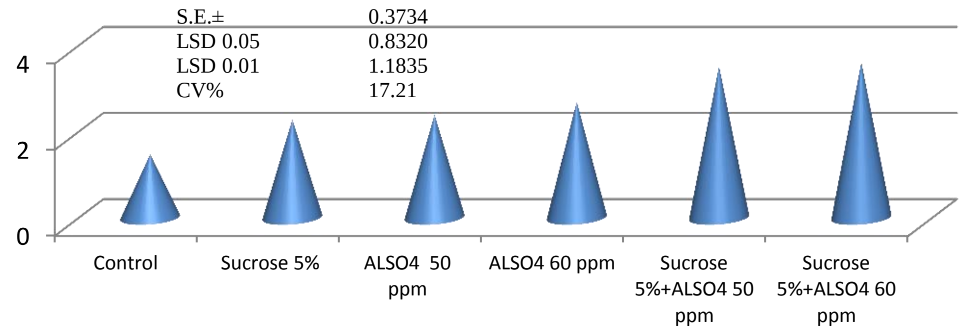

Fig. 4. Flower weight (g) in rose under different concentrations of sucrose and aluminum sulphate

Average weight of flower (g):

It is evident from the results in Figure 4 that the rose spikes treated with Sucrose at 5% concentration + Aluminum sulphate 60 ppm produced heavier flowers on average (3.61 g); while the average weight of flower decreased over T_6 to 3.51 g and 2.69 when the rose spikes was treated with Sucrose at 5% concentration + Aluminum sulphate 50 ppm and Aluminum sulphate 60 ppm, respectively. The average flower weight decreased further to 2.39 g and 2.28 g, when the rose spike was treated with Aluminum sulphate 50 ppm and sucrose at 5% concentration, respectively. However, the lowest average flower weight (1.47 g) was noted in control spikes, where the spike was not treated with sucrose and aluminum sulphate.

Water uptake (ml/spike):

The activity of water absorption by the spikes takes place through the spike roots mainly; but generally the spike absorbs water through the entire surface, stem, root as well as the leaf. The water uptake ability of a spike influences its growth rate accordingly. However, the spikes supplied with different nutritional treatments uptake more water as compared to spikes left untreated for nutrients. The results in relation to the water uptake in rose spike as affected by varying rates of sucrose and aluminum sulphate are given in Figure 5. It is obvious from the data in that the water uptake in rose spikes treated with Sucrose at 5% concentration + Aluminum sulphate 60 ppm was highest (88.62 ml/spike); while the water uptake decreased over T_6 to 80.73 ml/spike and 26.27 ml/spike in rose spikes treated with Sucrose at 5% concentration + Aluminum sulphate 50 ppm and Aluminum sulphate 60 ppm, respectively. The water uptake further declined to 24.29 ml/spike and 19.58 ml/spike, when the rose spikes were treated separately with Aluminum sulphate 50 ppm and sucrose at 5% concentration, respectively. However, the lowest water uptake (7.41 ml/spike) was determined in spikes kept untreated for sucrose and aluminum sulphate (Control). The results further showed that the water uptake was markedly higher in rose spikes treated with sucrose at 5% concentration + Aluminum sulphate 60 ppm and decreased in the aluminum sulphate concentration resulted in a significant reduction in water uptake. The water uptake on average was further decreased over T_6 and T_5 in spikes where alone sucrose was applied; while in control the water uptake was nominal. This indicates that interaction of sucrose and aluminum sulphate combined application was the major factor to influence the water uptake in rose spikes; because when sucrose or aluminum sulphate were separately applied, the both cases the water uptake was sharply decreased manifold over T_6 and T_5. Similar results have also been reported by [6] who reported that the rates of vase solution uptake differed significantly for different rose varieties and different verities possess diversified capacity to absorb solution

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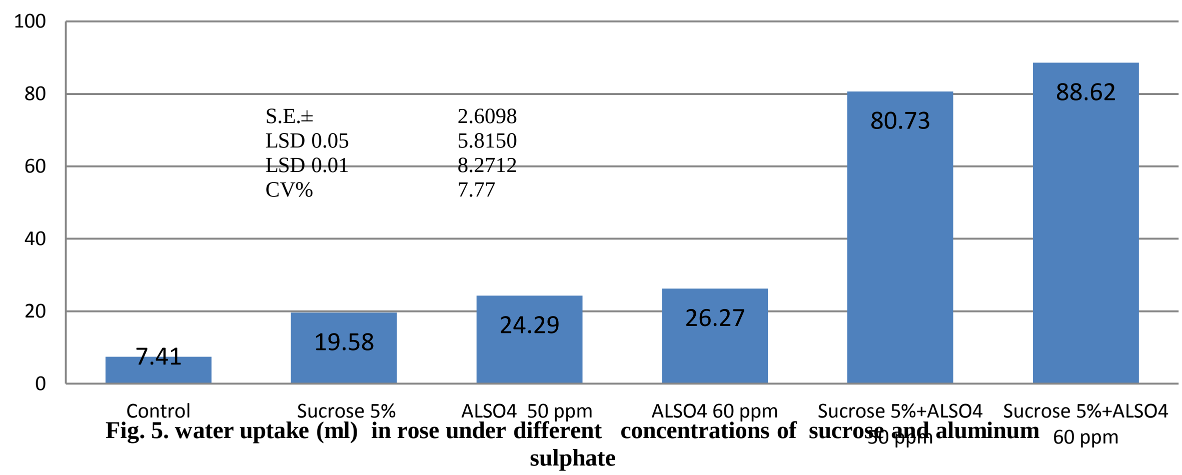

Fig. 5. water uptake (ml) in rose under different concentrations of sucrose and aluminum sulphate

Average vase life of flower (days):

Vase life or is the period of time the flower remains intact and remains fresh and its one of the most important characteristics in floriculture and most of the researches are conducted to improve the vase life of the flowers using different techniques. The vase life of rose is mainly dependent of spike nutrient contents and imbalanced flower nutrient contents may cause decrease in the flower vase life. The results pertaining to the vase life of flower in rose as influenced by varying levels of sucrose and aluminum sulphate are shown in Figure 6.

The data (Fig. 6) shows that the rose spikes treated with Sucrose at 5% concentration + Aluminum sulphate 60 ppm produced flowers with maximum vase life (12.56 days); while rose spikes treated with Sucrose at 5% concentration + Aluminum sulphate 50 ppm and Aluminum sulphate 60 ppm produced flowers of 10.38 and 7.46 days vase life, respectively. The average vase life of flower decreased further to 5.21 days and 4.76 days, when the rose spikes were treated with Aluminum sulphate 50 ppm and sucrose at 5% concentration, respectively. However, the vase life of flower declined to 2.98 days on average in controlled spikes, where the spikes were not treated with sucrose and aluminum sulphate.

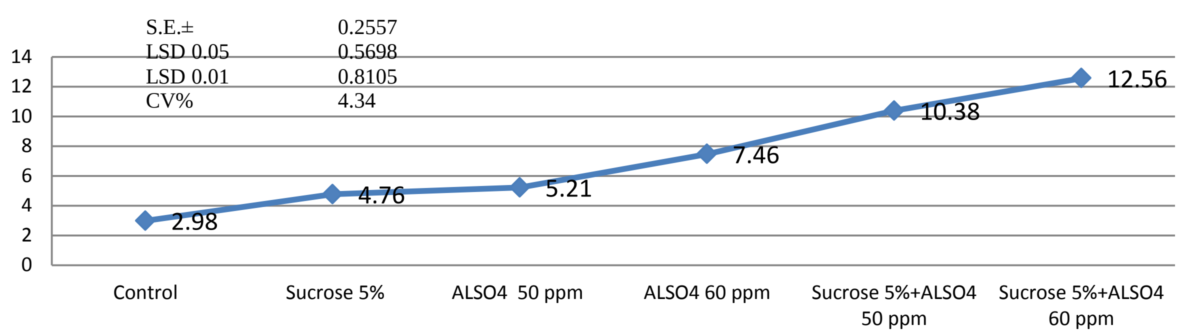

Fig. 6. Vase life of rose flower (days) under different concentrations of sucrose and aluminium sulphate

DISCUSSION

Opening of flower reflects the spike's flowering response to level of soil management for nutrients and other inputs and the results that days to open flower were significantly influenced by application of sucrose and aluminum sulphate at different levels. The treatment comprised of sucrose at 5% concentration + Aluminum sulphate 50 ppm prolonged the time period required for opening the flower; while increasing the Aluminum sulphate upto 60 ppm showed a simultaneous reduction in days to open flower either the Aluminum sulphate was applied alone or in combination with sucrose. These results are in line with those of [7] who reported that treatment of cut flowers with sucrose and Aluminum sulphate potentially affected the physiological factors of roses and with application of these solutions at higher rates the days to open flower were increased. The wilting increased and wilting completed after 10, 8 and 7 days under concentrations of 100, 200 and 300 ppm of 8-HQS, respectively [7].

It was known from the findings of the study regarding the effect of sucrose and aluminum sulphate on the number of dropped petals in rose spikes that rose spikes treated with sucrose at 5% concentration + Aluminum sulphate 60 ppm caused aremarkable reduction in dropping of petals which indicates that the sucrose and aluminum sulphate combination positively impacted the rose spikes. Some[8] reported that aluminum treated flowers of rose were intact for longer period without petal dropping. Elsewhere [9] it was assessed the influence of five preservative solutions (aluminium + ethanol, aluminium + sucrose, ethnol + sucrose, aluminium + ethanol + sucrose and water) and petal dropping and petal fresh weight were significantly influenced in treated rose spikes. Others [10] found that 50 ppm $Al_2(SO_4)_3$ + 5% sucrose reduced petal dropping considerably. Aluminum sulphate generally reduced the blockage of vessels which might be caused by the formation of bacterias and other microbes, so it generally enhanced the passage of sucrose up to petals and reduced ethylene production within petals.

These results are in similarity to those in [4], who showed an increased in flower diameter when 20 g of sucrose L^{-1} +200 mg of HQS $^{l-1}$ were used in the pulsing solution, which of course varied among the varieties tested. Al+Et+Suc treated cut flowers showed better performance in most postharvest characteristics with better flower diameter. The spikes may be treated with combination of sucrose at 5% concentration + Aluminum sulphate 60 ppm [11]. It was further perceived that rose spikes treated with sucrose at 5% concentration + Aluminum sulphate 60 ppm produced remarkable positive impact on flower weight; and decrease in the aluminum sulphate concentration caused a marginal reduction in the flower weight. The findings of the present research are in agreement with those of [8] who found that aluminum treated flowers of rose had more relative fresh weight than control. In [3] authors reported that the postharvest losses in weight of cut flower of rose were decreased with the sucrose and aluminum sulphate treatment. [5] reported that application of Aluminum sulphate improved solution uptake in cut flowers. [8] found that water absorption increased in aluminum treated flowers of rose. Those in [9] assessed the influence of five preservative solutions (aluminium + ethanol, aluminium + sucrose, ethnol + sucrose, aluminium + ethanol + sucrose and water) and there was significant effect of treatment on solution uptake.

Some [5] reported that Aluminum sulphate is a common biocide used for increasing the vase life of cut flower. They observed that combined effect of the chemicals could be successfully increase vase life upto 17.67 days. Others [12] demonstrated that the flowers which were treated with 5% of sucrose extended the vase life of cut flower from 4 to 8 days by improving the carbohydrate supply and reducing oxidative stress mediated damages during rose flower senescence. [10] reported that Aluminium sulfate at different concentrations + sucrose 5% significantly prolonged the vase life of rose cut flowers from 10.83 days with control to 14.50 days with 200 ppm Al2(SO4)3 + 5% sucrose.

CONCLUSION

It is concluded from the study that for achieving better quality of rose cut flowers with maximum vase life, the rose cut flower spikes may be treated with a combination of sucrose at 5% concentration + Aluminum sulphate 60 ppm.

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