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Review

Review on the impact of different vase solutions on the postharvest life of rose flower

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Rose belongs to family *Rosaceae* and Genus *Rosa* which contains more than150 species and 400 cultivars. Roses are recognized highly valuable for economical benefits being the best source of raw material to be used in agro-based industry especially in the cosmetics and perfumery. There are about 10-30% losses due to post harvest damage in cut flowers. The major problem of the horticulture sector in general and the floriculture industry in particular is the postharvest loss. Hence the crops are being alive for a certain period but they are liable to deterioration and loss. It is clear that unless they are preserved the ultimate fate of such produce is senescence and/or death. However it is possible to extend the postharvest life of flowers by using different preservative solutions. Sucrose, Silver Thiosulfate and Aluminum sulfate enhanced the post harvest quality of cut roses as compared to control (distilled water). Sucrose and STS have better performance when used in combination. Further the incorporation of bactericide or fungicide will upgrade the performance of these vase solutions through their action on bacteria and fungi respectively.

Keywords: Rose, *Rosaceae* and Genus *Rosa,* cultivars, postharvest life of roses,

INTRODUCTION

Rose belongs to family *Rosaceae* and Genus *Rosa,* which contains more than150 species and 1400 cultivars [12]. Flowers are considered to be silent entertainers. Rose holds superiority over all other flowers as it is being extensively used for decorative purposes and is highly prized for its delicate nature, beauty, charm and aroma. In interior decoration, cut rose flowers play an important role and add charm to different occasions such as marriage ceremonies, as a symbol of sympathy, arrival and departure of dignitaries, gift on birthdays, Valentine's Day etc. Additionally, roses play a vital role in the manufacturing of various products of medicinal and nutritional importance. However, a very peculiar aspect of rose production is to get the cut flowers, which greatly deals with the floricultural business (Butt, 2003).The cut flower industry is a US$ 2 billion industry and is an important revenue for some of the major cut flower producers in the world. The cut flower is a more complex organ that seeds, fruits and most vegetables. A seed or fruit is a single morphological unit while an inflorescence is composed of many morphological units including sepal, petal, androecium, gynoecium, and stem and often leaves. Each of these structures are complex in their own right making handling of flower more complex.

Now a day, the floriculture industry is getting popular in developed as well as developing countries. Even developing countries from Africa are highly participating in the world flower market. It is becoming the new area for growth and transformation plan of Ethiopia. But the sector has some constraints. The major problem of the horticulture sector in general and the floriculture industry in particular is the postharvest loss. Hence the crops are being alive for a certain period but they are liable to deterioration and loss. It is clear that unless they are preserved the ultimate fate of such produce is senescence and/or death. However it is possible to extend the postharvest life of flowers by using different preservative solutions. There are different vase solutions prepared to extend the life of cut flowers after harvest thereby increasing the value they are going to pleasure flower minded persons and culture. Thus this paper is initiated to review the role of different vase solution in extending the vase life of rose flower.

Postharvest/vase life of roses

When flowers are cut from the mother plant, water loss from these continues through transpiration. When cut flower absorbs water from the solution it maintains a better water balance and flower freshness is maintained for long duration increasing vase life (Reddy and Singh, 1996). Wilting is the most common reason for the termination of vase life, not their natural senescence. The important factor which causes wilting is water stress which occurs when rate of transpiration exceeds the rate of water uptake.

Vase-life of cut flower is most attractive and economic component of cut flower (Chakrabarty, 2009). The main problems of ornamental perishables usually are flowers or leaf senescence (Kazemi, M. and K. Shokri, 2011). During senescence marked changes occur in the biochemical and biophysical properties of the cell membranes. Ethylene plays a central role in the senescence of many cut flowers (Reid, 1989). Flower vase life is affected by respiration, carbohydrates deterioration, disease inoculation, water uptake etc. During vase life of cut flowers, ethylene synthesis plays a major role in senescence. Similarly carbohydrates and soluble sugars in the petals also help in quality retention of cut roses for longer period. So vases applied with adequate amount of sugars such as sucrose and an appropriate preservative such as silver thiosulfate certainly can be of great usefulness.

Effect of vase solutions on postharvest life of roses

The vase life of cut flowers and foliage is often shortened by vascular occlusions that constrict vase solution supply. Reduction in stem conductivity is typically caused by blockage of cut stem ends and xylem conduits by microbes, physiological plugging, and disruption of water columns in xylem vessels by cavitations and air emboli. Cut flower and foliage longevity can be greatly affected by the chemical composition of the vase solution. Vase life of cut rose flowers is usually short. Cut flowers wilt and floral axis become bent (bent-neck) just below the flower head.The development of such symptoms is considered to be caused by vascular occlusion, which inhibits water supply to the flowers (Reid, 1989).

The relatively brief postharvest life of most cut flowers and potted flowering plants can be extended by a range of technologies. Among these technologies the uses of different vase solutions have paramount interest. Sucrose, STS and aluminum sulfate are the major solution used in cut flower industry.

Role of sucrose on vase life of roses

Study of combined effect of abscisic acid (ABA) and sucrose on growth and senescence of rose flowers proved that sucrose retarded and ABA promoted processes associated with senescence (Borochove *et al*.1976) Figure 1 below.

Carbohydrates are necessary for turgor pressure maintenance and also they are important energy sources facilitating flower opening (Särkkä, 2005). Low carbohydrate levels in stem and leaves will reduce vase life which can be partially remedied by presence of sugar in the holding and vase solutions (Hashemabadi and Gholampour, 2006). Sugars are essential precursors for cut flower respiration. Sucrose is the main transporting form of sugar to flower bud (Särkkä , 2005).

The use of sucrose with or without certain additive and also the use of some chemicals such as silver thiosulfate and silver nitrate could be of practical significance for prolonging the life of many cultivars of cut roses (Cameron and ride, 2001). Carbohydrates and soluble sugars in the petals also help in quality retention of cut roses for longer period. So vases applied with adequate amount of sugars such as sucrose and an appropriate preservative such as silver thiosulfate certainly can be of great usefulness.

In a recent study by Sikandar Hayat (2012), maximum flower percent fading (43.75 %) was recorded for flowers retained in vases containing distilled water (control), followed by 25.0 % fading for 2.5% sucrose solution, while minimum flower fading (15.63 %) was recorded in7.5 % sucrose solution. In interaction, maximum percent fading (56.25 %) was observed for flowers in vases having distilled water (control), followed by (50 %) for 0 STS and 2.5% sucrose solution. While minimum percent fading (0.00 %) was recorded for the vase applied with 25 ppm STS and 7.5% sucrose and 25 ppm STS and 5% sucrose solution respectively.

In recent study by Bhawana et al.2013, sucrose mixed with 8-HQ give better results. He explained that 8-HQ, sucrose and CA treatments were effective in improving the vase life of cut roses when compared to control. Among the applied treatments, 8-HQ+CA+5% sucrose maintained vase life of cut flowers for longer period. Vase life was extended from 4th day and for control from 8th day from treated with preservatives containing exogenous sucrose. The supplementation of sucrose in the preservative solution resulted in enhanced substrate mobilization as well as utilization which led to prolonged vase life of the treated cut flowers. In a similar study on Bougainvillea flowers, Keeping the bracts in vase solutions containing sucrose has been shown to vase life of flowers Zhuo *et al.* (2005). And this has been proved as a results of Bougainvillea bracts treated with sucrose (200 mg/L) solution showed a longer vase life (12 days) compared to kinetin (200 mg/L) treated flower (7 days). Sucrose yielded the best result because exogenous sucrose may be acted as a continuous supply of energy retaining the turgidity of the bracts.

In another study by Moneruzzaman et al. 2010 the

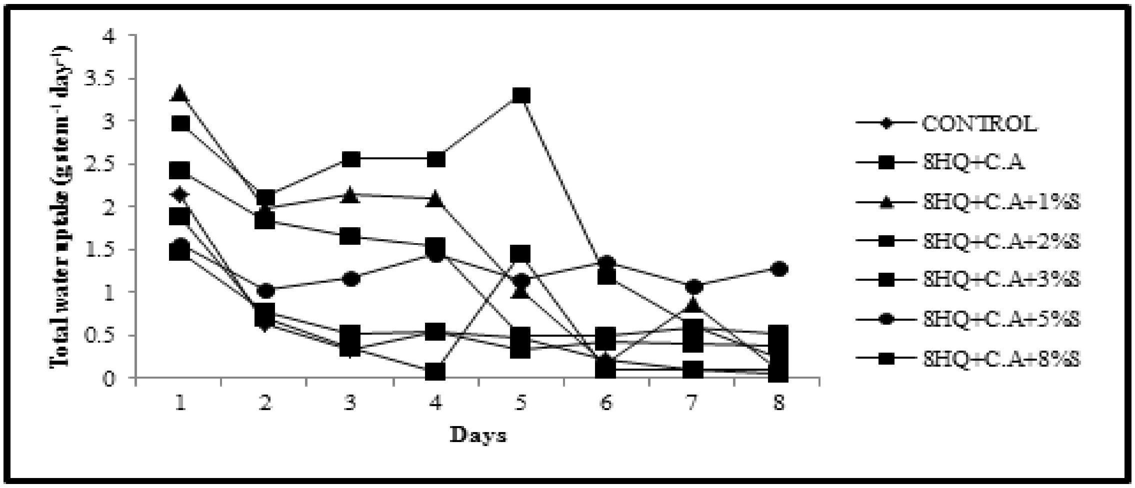

Figure 1. Effect of different preservative solutions on water uptake during vase life of yellow rose. Source (Bhawana et al. 2013)

vase life of bougainvillea bracts was significantly affected by their treatments and temperature. It was recorded that sucrose treated flowers exhibited the longest vase life compared to the control and kinetin treatments at different temperature. The longest vase life (12.8 days) was recorded in bracts with flowers containing sucrose (200ppm) solution

Role of STS in vase life of roses

Longevity of many cut flowers is negatively influenced by the presence of ethylene, which induces a variety of physiological responses, including abscission and wilting of leaves, petals and sepals. Silver thiosulphate (STS) is known to suppress autocatalytic ethylene production by inhibition of ethylene action (Da Silva, J.A.T., 2003). The cut flowers of different cultivars of rose show variation regarding vase life due to differences in genetic makeup. Rose flower stems immersed in silver thiosulphate (STS) solution doubled the vase life from 5 to 10 days (Reid *et al.,* 1980). On postharvest study of roses different concentrations of sucrose and silver thiosulfate (STS) had significantly improved the opening period of cut roses. Likewise interaction of sucrose with STS also contributes significantly.

On a study by Shaid Javed (2005), Silver in the form of silver nitrate had shown a positive impact on vase life of roses. Pulsing of cut roses for 10 and 20 min with AgNO3 improved the vase life up to 6.0 and 5.3 days, respectively (Reddy and Nagarajaiah, 1988). Similarly pulsing with AgNo3 and sucrose + citric acid solution for 16 h precooling prior to shipment, not only extended the longevity, but also prevented bent-neck of flower stems of '*Cara Mia'* rose cultivar (Halvey *et al.*, 1978). The solution of silver nitrate (2.5 mg dm3) + 8 HQS (130 mg dm3) + citric acid (200 mg dm3) + sucrose (30 g dm3) extended vase life of cut rose flowers from seven days (in deionized water) to 17 days and the flowers remained open completely (Ferreira and Swardt, 1983). Addition of bactericides and fungicides in solution of AgNo3 improved the flower size and flower bud opening.

Role of Aluminum sulfate on vase life

The role of aluminum sulfate to increase the vase life of cut flowers is not limited to lowering the pH of vase solution. Its effect is based at least in part, on its action as an antimicrobial agent in the solution (Liao et al., 2001). $Al_2(SO_4)_3$ has been recommended for maintaining the vase life of several cut flowers and is used as an antimicrobial compound in commercial preservative solutions (Ichimura et al., 2006). Aluminum sulfate acidifies vase solution, diminishes bacterial proliferation and enhances water uptake (Hassanpour Asil et al., 2004). Form a previous study effect different concentration of aluminum sulfate on solution uptake is presented in figure 2 below

In several experiments applications of aluminum sulfate alone or in combination with sucrose have kept quality and vase life of cut flowers at postharvest stage. In a study of rose postharvest life by Maryam et al.(2012)Aluminum sulfate (150, 300 mgl-1) treated flowers had higher relative fresh weight than control and sucrose contained treatments significantly at last evaluation. 150 and 300 mgl-1 aluminum sulfate treatments showed significant superiority compared with control on ninth and fifth, ninth ,11th day respectively. According to his results, aluminum sulfate extended the vase life of cut rose flower „Boeing" compared to control. The most common reason of vase life termination in cut flowers is water stress. Stem plugging is one of the main factors determining longevity and can be caused by

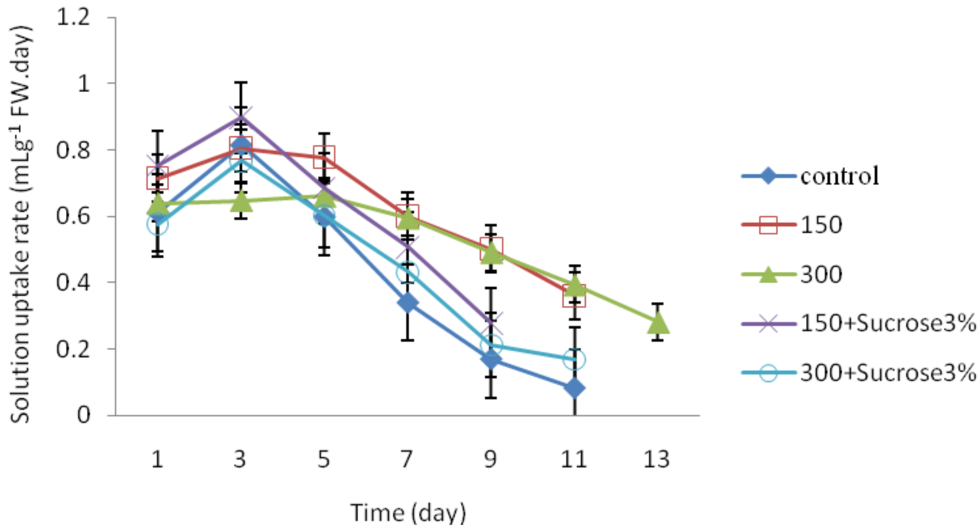

Figure 2 Effect of aluminum sulfate (0,150,300,150+sucrose 3%, 300+sucrose 3%) on solution uptake rate of cut rose „Boeing". (Maryam et al. 2012)

physiological occlusion due to plant itself, air embolism or microorganisms (Särkkä, 2005).

SUMMARY AND CONCLUSION

One of the greatest problems in postharvest flower physiology is the blockage of vascular system, due to air or bacterial growth, which reduces water uptake and this blocks xylem vessels leading to water stress. That was expressed in the form of early wilting of leaves or flowers, as a result of premature loss of cell turgidity and might appear when water uptake and transpiration are out of balance during a lasting period of time. This finally leads to an unrecoverable situation and the premature end of flower vase life. Antimicrobial compounds like metal salts prevent and slowdown bacterial growth, ensure proper water uptake and delay senescence.

Sugar supply, increases the longevity of many cut flowers, since they act as a source of nutrition for tissues approaching carbohydrate starvation. It may also act as osmotically active molecule thereby leading to the promotion of subsequent water relations. Dissolved sugars in cells of petals are osmotically active substances that are drawn into the corolla-cells making the cells turgid with hydrolyzed sugars ready for respiration.

Silver in the form of STS or AgNO3 had also a remarkable effect in extending the vase life of rose and cut flowers in general, through its effect on inhibiting the action of ripening/senescence hormone ethylene. Thus sucrose, STs and AgNO3alone or in combination with fungicide or bactericide will have a better result because the bactericide will control the growth of bacteria, and the sucrose in mediating the osmotic potential of the plant and the silver in blocking the action of ethylene.

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