Vol.2 Issue-2, OCT 2021 (e-ISSN: 2582-8223)

Enhancing Vase Life Of Alstroemeria Through Various Treatments

Mudang Monya, MM Shulee Ariina, Misunam Pertin, Yorum Anna & Vepa Lohe

School of Agricultural Sciences and Rural Development, Nagaland University

ARTICLE ID: 053

Introduction

Alstroemeria (*Alstroemeria spp*.) commonly known as the Lily of Incas or lily of Perus or Peruvian lily or red parrot beak or New Zealand Christmas bell, are lily-like flowers belonging to the flowering plants genus of the family Alstroemeriaceae. It was named in honour of Klas Van Alstroemer, who in 1754 brought rhizomes of Alstroemeria to his father Linnaeus, a plant taxonomist. Besides being native flowers of South America, it is also grown in the United States, Mexico, Australia, New Zealand, Madeira and the Canary Islands.

In India, its cultivation started around Bangalore, Pune and Hyderabad. It was also introduced in Palampur, Solan, Srinagar and Ooty to popularize the crop among growers for domestic and export markets. In the Dutch market, it is regarded as an important cut flower, gaining popularity in the International. Dwarf Alstroemeria varieties are ideal for brilliant containers, alone or mixed with other plants and they are generally preferred in the flower arrangement. The Netherlands is one of the important producers of Alstroemeria and its ranks first among the producer of Alstroemeria (Armitage and Laushman, 2003).

Alstroemeria species are found in various climatic conditions. Some winter-growing plant species of Alstroemeria are found in Chile while those of Brazil are regarded as summer-growing but it thrives well in a cool subtropical climate and needs partial shade, low humidity causes leaf scorch. Mid and high hill areas are very suitable for its growth. Alstroemeria can be grown in all types of soil from peat sandy soil to heavy clay as long as soil contains enough air and is properly drained; producing high yields of the stem is possible. Alstroemeria does well in light, well-drained and slightly acidic soil for the succulents roots to develop freely. Recommended pH is 5.5-6.5. A cool, well-drained and rich in organic matter medium is good for it. Alstroemeria cultivars are sensitive to high temperatures. So, soil temperature above 20° C must be avoided because it inhibits and reduces flower

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induction. A lower temperature causes a slower start in the production but can provide higher quality and shorter stem length. During the summer, an average of 17-22° C is an excellent temperature for its growth. Cool nights and soil temperatures between 14-17°C are desirable for high-quality results. The flower development occurs at a temperature; between 14°C to 20° C. Alstroemeria does best when humidity is between 65-85%. High humidity above 90% produced taller stems as well as larger and weaker leaves. They grow as high as two to three feet on strongly branched stems with thick roots. Flowers were reported with different markings and colours ranging from apricot, lavender, pink, rose, purple, yellow, cream, orange and white with spotted or streaked contrasting colours.

Despite its commercial importance, it is known to have some serious limitations regarding post-harvest management. Yellowing of leaves which is one of the main reasons for the poor vase life of the flower is caused mainly due to the production of ethylene. Alstroemeria is thus crops that are sensitive to ethylene. The plant itself produces ethylene and a high concentration of ethylene results in rapid senescence, which is shown as yellow leaves. To have a better keeping quality and to reduce post-harvest loss, flowers are subjected to various treatments or vase solutions.

Vase Life of Cut Flower/ cut Alstroemeria

Vase life is the post-harvest duration of a cut flower and it varies among species and cultivars. It is one of the quality traits as it represents the amount of time spent and the conditions that flowers experience while in transit from farm to end-user. The longevity of cut flowers is one of the main challenges of the floriculture industry. This is because the vase life of the cut flower has a characteristic of a quality criterion. Flower vase life depends upon many factors such as post-harvest treatments in the flower industry are mainly designed to maintain flower freshness and to extend its vase life until the final utilization by end-users. In addition to controlling and maintaining cut flower quality, keeping its longevity is another mandatory in flower markets as short postharvest vase life is one of the most important problems of the cut flowers.

Thus, the techniques of prolonging the vase-life of cut flowers have to be given special attention as they play a great role for growers, traders and final users. The use of preservative compounds in the vase solution is one of the common methods to extend the vase life of cut flowers.

Enhancing Vase Life

The cut flower continues to perform the activity of photosynthesizing even after it is removed from the mother plant, in that case, the cut flower requiresa food source for maintaining the health of cut flowers and to remain fresh for a longer time. The vase life of a cutflower is enhanced by treating with floral preservation. These floral preservatives will extend the life of the cut flower. A floral preservative is a complex mixture of sucrose (the main source of food material), an acidifier(for reducing the pH of the solution), an inhibitor of microorganisms(acts as germicide)and a respiratory inhibitor (to inhibit the effect of ethylene). A clean vase should be used.

Treatments Used For Enhancing The Vase Life

There are various treatments for enhancing the vase life of cut Alstroemeria. Only a few important treatments are described below:-

Sl. No.	Treatments
1	Silver thiosulphate
2	Hydroquinoline sulfate
3	Salicyclic acid
4	Gibberellic acid
5	Essential oil
6	Fruit extract

1. **Silver Thiosulphate**

Silver thiosulphate is one of the most commonly used chemicals in the floral industry for extending the vase life of the cut flower. The anti-ethylene properties of silver thiosulphate (STS) are reviewed. The effectiveness of silver is more when it is applied as silver thiosulphate because of its faster mobility and less phytotoxicity than silver nitrate (Van Altvorst and Bovy, 1995). STS can prevent wilting in cut flowers and petal drop in potted flowering plants and to induce sex transformations in female plants together with its relative ease of application and low cost per plant are arguments in favour of using STS in commercial horticulture. Many researchers have found that silver thiosulphate stops the biosynthesis of ethylene and enhance the vase life of cut alstroemeria.

- Chanasut*et al.* (2003) found that alstroemeria cut flower treated with STS + 1% sucrose increased the vase life by 7 days which is more than that of control.

2. HydroquinolineSulfate

The germicide 8-hydroxyquinoline sulfate (8-HQS) is one of the very important preservatives used in the floral industry (Nowak and Rudnicki, 1990), it also acts as an antimicrobial agent (Ketsa*et al.*, 1995) and increases water by reducing "physiological" stem blockage in sterile tissues uptake (Reddy *et al.*, 1996). However, this treatment was more effective when sucrose was added to 8-HQS.

According to Kabari*et al.* (2019) application of 8-HQS + 3% sucrose at the rates of 200 and 300 mg/l resulted in the longest vase life of 19.83 and 19.66 days of cut alstroemeria.

The lowest bacterial population in vase solution was observed in 200mg/h 8-HQS (Kabari*et al.*, 2019).

According to Kabari*et al.* (2019), the lowest electrolyte leakages in cut alstroemeria was found in 200mg/l.

3. Salicylic Acid

Salicylic Acid (SA), a natural plant hormone has an important role in abiotic and biotic stress. Salicylic acid is qualified as a plant hormone due to its physiological and biological roles in plants. It has also been suggested as a signal transducer or messenger under stress conditions. Salicylic acid has the potential to reduce the pH of the water and consequently, the proliferation of bacteria was reduced. It is reported that SA suppresses ACC synthase and ACC oxidase activities and biosynthesis of ethylene in kiwi fruit. Moreover, SA has been shown to restrict the biosynthesis and/ or action of ethylene in plants. The addition of SA and sucrose to the vase solution of cut roses caused a significant reduction in respiration rate, alleviation of the moisture stress and improved the vase life. Moreover, it has been shown that treatment with SA improved the postharvest life of different cut flowers.

According to Tirtashi*et al.* (2015) application of 200 mg l^{-1} salicylic acid with the highest vase life of cut alstroemeria 'Modena' compared to the other treatments , and is recommended to extend the vase life

Bayat*et al.* (2017) found that the addition of 300 mg/l SA to clean distilled water extended the vase life of *Alstroemeria peruviana*.

4. **Gibberellic Acid**

Plant growth regulators GA4+7 can reduce leaf chlorosis in Alstroemeria (Mutui*et al.* 2001).Although GA4+7 are effective in preventing leaf yellowing, the basis by which applied GAs delay leaf senescence is still not clear (Van Doorn*et al.* 1992), but they seem to control plant growth and development, at least in part, by inducing proteolysis of DELLA proteins (Olszewski *et al.* 2002; Sun and Gubler 2004).Also, bioactive GAs are perceived by a putative plasma membrane receptor and may affect both ethylene biosynthesis and response (Sun and Gubler, 2004). While leaf senescence and yellowing are under the control of many hormones (Zacarias and Reid, 1990), premature leaf yellowing seems to be associated with low concentrations of GAs in the leaves of certain cultivars of Alstroemeria (Dai and Paull, 1991).

Mutui*et al.* (2006) found that a concentration of 10 mg/l GA4+7 can be used to prolong vase life, delay leaf senescence and enhance the post-harvest quality of Alstroemeria cut flowers during their transport to market.

According to Isapareh*et al.* (2014), the concentration of50 and 100 mg L^{-1} gibberellic acid could significantly delay flower senescence with 3.33 and 3 days, respectively as compared to the other treatments. The vase life of Alstroemeria cut flowers cv. Bridal increased in both gibberellic acid treatments (50 and 100 mg L^{-1}) than other studied solutions.

5. **Essential Oil**

To increase the vase life of cut flowers, various combinations are used. Sucrose in preservative solutions improves the quality and longevity after harvest (Halvey and Mayak, 2003), but increases the growth of the microorganisms and thus occlusion the flow of water in the stem. So along with the use of sugar, the anti-microbials should be used in the preservative solutions of cut flowers (MirSaeed Ghazi *et al.*, 2013). Because of the toxicity of most chemicals and environmental pollution caused by them, the use of natural compounds that have no side effects on human health and the environment and are relatively cheap is very important (Okigbo and Ikediugwu, 2005). Such ingredients include some of the safe herbal extracts and essential oils and their antimicrobial properties increase the vase life after the harvest of horticulture products.

Bazaz*et al.* (2011) found that the greatest longevity of vase life was related to 50 mg/l of thyme essential oil treatment and this improved the inflorescence cut vase life which is 2 days longer than control.

According to Barbarabie*et al.* (2015), the highest vase life of the flower was related to the treatment of 4000 mg^{-1} thymol with 14/33 days, while control with 9 days of life had the least longevity in alstroemeria.

Babarabie*et al.* (2016) reported that *rosemary* and *peppermint* essential oils having a high antimicrobial effect reduced the number of microorganisms in the solution and increased the freshness and quality of flower colour and prevent the discolouration and reduction of pigment in the petals of *Alstroemeria* cut flowers.

According to Kabari*et al.* (2019), 20% of savoury oil shows the longest vase life in alstroemeria. The highest solution uptake was also found in 20% savoury.

6. **Fruit Extract**

The fruit extract is the extract or juice of the fruit which is used as the floral solution for extending the vase life of cut alstroemeria. Using fruit extract has been studied because they have some compounds which are needed for flower preservative solutions. Fruit extract contains many organic acids and volatile compounds. Some of the volatile compounds existing in fruit extracts are volatile esters, alcohols, acids and acetaldehydes. The main organic acids present are malic acid and citric acid.

Some researchers have reported the beneficial effects of acid application in vase solution of cut flowers. By pH reduction, an increase in vase life and vase solution absorption was observed.

According to Barbarabei*et al.* (2016), he found that the concentration of 45ml/l of apple extract gives the maximum vase life (15 days) in cut alstroemeria.

Barbarabei*et al.* (2016) also recorded the highest flower diameter in alstroemeria when apple extract(45ml/l) + Rosemary essence (2000mg/l) are added.

Conclusion

As the living standards of people are changing, demand for cut alstroemeria is also increasing day by day and to fulfil the needs of the people, new technologies are adopted. The use of various treatments as vase solutions helps in preserving the cut flower for a longer time and reduces losses in post-harvest.

Alstroemeria is considered one of the most important cut flowers and it is gaining popularity in recent days due to its diverse colours. Though being popular yet it is highly susceptible to post-harvest losses. In floriculture industries, post-harvest losses are a major issue and a worldwide problem. Proper post-harvest management can minimize the loss of the cut alstroemeria. Treating with various treatments helps in extending the vase life. In recent days, many works are conducted to find out the best way to minimize the losses. In alstroemeria yellowing of leaves is one of the main causes of poor post-harvest life. Use of anti-ethylene floral solution such as Silver thiosulphate, Gibberellic acid, Methylcyclopropene, etc is considered to be best for reducing the yellowing of leaves of cut alstroemeria and hence enhancing the vase life.

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