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EFFECT OF pH OF HOLDING SOLUTION ON THE VASELIFE AND CUTFLOWER QUALITY OF PERUVIAN LILY (Alstromeria sp. L)

ABSTRACT

This study was conducted to determine the effects of pH of holding solution on the vaselife and cutflower quality of Peruvian Lily; and to determine the best pH of holding solution that will prolong the vaselife and preserve the quality of cutflowers.

Alstromeria cutflowers harvested at 50% anthesis were held in different pH of 3.0, 3.5, 4.0, 5.0 and 6.5 of the holding solution containing tap water + 20% sucrose + 1 mL chlorox + citric acid.

Results showed that using a holding solution with a pH of 4.0 containing 20% sucrose + 1 ml chlorox + citric acid promoted the longest duration of flower opening resulting to longer vaselife of cutflowers.

Likewise, holding solutions with a pH of 3.0 and 4.0 promoted better petal quality rating of Alstromeria cutflowers while holding solutions with pH of 4.0 and 5.0 also prolonged stem freshness thus, with a higher stem quality rating.

INTRODUCTION

Peruvian lily (*Alstromeria* sp.) or lily of the Incas belongs to the family of Liliaceae, became an increasingly important part of the commercial cutflower trade. The flowers came in a variety of types and colors. All have a long postharvest life, typically terminated by petal wilting and or dropping and yellowing of leaves. The specie was subsequently named after The Swedish Consul in Spain, Clas Alstroemer.

This flower is a South American genus of about 50 species of flow-

ering plants, mainly from cool, mountainous regions in the Andes. Alstromeria flowers are similar to lilies although smaller. The plants also tend to be quite small compared to lilies. These plants grow annually from tuber and can make large groups after a few years (Glick, 2001).

The plants are tuberous or rhizomatous perennials. The young plant start growing from main rhizome, sending up, per year, between 60-80 flowering stems. They grow to a height of 50-130 cm. Each erect stem grows foliage of a few lanceolate leaves and ends in an umbel of 3-10 flowers. These have six petals with spots, striped markings and contrasting patches (Glick, 2001).

This new garden plant that is being grown for its beautiful, large infloresences of purple, lavender, red, pink, yellow, orange, white and bicolors. The flowers are delicate and trumpet like. Stems are 2-3 feet long. Since it has several flowers on one stem, it is a good flower to "fill in" the empty spots in an arrangement. In large bunch, *Alstromeria* looks lovely all by itself. Flowers of Alstromeria are highly sensitive to ethylene. Although untreated Alstromeria flowers have long vaselife, petal drop is particularly a problem if there is ethylene in the environment. In some cutflowers, leaf yellowing occurs before flower senescence. It can be delayed by a pulse treatment with a preservative containing growth regulators (gibberellins or cytokinins).

For long-distance markets, flowers are harvested when the buds are about to open and start to color. For local markets, harvest is delayed until the first three flowers have opened. Flowers are pulled off or cut depending on the variety where pulling may damage the underground parts of the plant, the stem should be cut. If flowers are cut, the remaining stem should be removed later. At least one flower per stem should be open at time of purchase.

Growing *Alstromeria* can be developed as a profitable business in Baguio-Benguet. Production of Alstromeria cutflower could also provide a good source of income. Growers of cutflowers are not yet knowledgeable on the issues concerning postharvest losses. As a result, the country's efficiency on cutflower production declines. The cutflower industry must then be quick to continually adopt to the changing market demand if it is to remain viable. This includes the need to respond to increasingly sophisticated cutflowers in terms of quality and volume.

It is hoped that this study will help *Alstromeria* growers and retailers in prolonging the postharvest life of their cutflowers and make these flowers available in the market on a year round basis.

The study was to determine the effects of different pH of holding solution on the vaselife of Peruvian Lily (*Alstromeria* sp.).

The study was conducted at the Department of Horticulture Service Laboratory, College of Agriculture, Benguet State University, La Trinidad, Benguet from December 2005 to March 2006.

MATERIALS AND METHODS

Materials

The materials used were Alstromeria cutflowers, bottles and holding solutions, stirring rod, beaker and weighing balance used in the preparation of the solution. A pH meter was utilized for determining the pH level of the preservative solutions.

The preservative or holding solutions used were the following:

1. Ascorbic acid (to replace citric acid) at different rates to vary the pH solution.
2. Sucrose - 20% by weight
3. Chlorox - 1 ml/l solution

Methods

Newly harvested Alstromeria flowers at 50% anthesis were obtained from a flower shop in Baguio City. The stem ends were cut back about 1 cm and soaked for one (1) night in tap water before being held in the different holding solutions.

The experiment was laid out following the completely randomized design (CRD) with three replications and was conducted at ambient room temperature averaging 15^0C- 16^0C. Two flowers represented one treatment replication. The following were the treatments:

Treatment	pH of the Holding Solution
T1	3.0
T2	3.5
T3	4.0
T4	5.0
T5	6.0
T6	6.5 (control) - tap water only

The data gathered were:

1. **Vaselife (Days).** The number of days covering the period from holding of the cutflower in the solution up to the termination of the aesthetic value of the flowers.

2. **Volume of solution taken-up (mL).** The final volume of solution per treatment at the termination of the postharvest life of the sample flowers was deducted from the initial volume of 200 ml per catsup bottle.

3. **Number of days from immersion to full flower opening.** This was done by recording the number of days from immersion to full flower opening.

4. **Petal quality rating.** The quality of petals of each flower was noted daily using the following index:

Rating Index	Description
1	51 - 60% open
2	61 - 80% open
3	81 - 100% open

5. **Stem quality.** The stem quality of each flower was rated using the following rating:

Rating Index	Description
1	dark green, no injury
2	dark green and rotting at the base (2.0 cm)
3	dark green and rotting at the base (2.5 cm)
4	green and rotting at the base (3.0 cm)

5	green and rotting at the base (3.5 cm)
6	yellow green and rotting at the base (4.0 cm)
7	yellow green and rotting at the base (4.5 cm)

6. **Leaf quality rating.** This was obtained by using the following rating index:

Rating Index	Description
1	1 - 20% yellowing of the leaves
2	21 - 40% yellowing of the leaves
3	51 - 60% yellowing of the leaves
4	61 - 80% yellowing of the leaves
5	81 - 100% yellowing of the leaves

7. **Documentation of the study in pictures.**

RESULTS AND DISCUSSIONS

Vaselife

Table 1 shows that Alstromeria cutflowers held in holding solutions and tapwater only with a pH of 3.5, 5.0, 6.0 and 6.5 had the longest vaselife of 18 days. Those held in 20% sucrose + 1 mL chlorox + citric acid with a pH of 4.0 had a vaselife of 17.66 days. Flowers held in solutions with 20% sucrose + 1 mL chlorox + citric acid with a pH of 3.0 had the shortest vaselife of 16.66 days.

However, statistical analysis did not show any significant differences among the different pH of the holding solutions as far as vaselife is concerned. Further, the onset of senescence may be related to some antecedent changes that occur before harvest. Senescence concerns physiology and biochemical processes (Mayak, 1987). Havey and Mayak (1979) further stated that the most obvous symptoms of the final stages of senescence is the loss of fresh weight, drying and shrivelling. Further, Rimando (1980) stated that the loss of turgidity, exposure to ethylene and shortage of respirable substances are the most decisive factor which may trigger the onset of senescence of cutflower at any stage of their development whether they are still attached or already detached from the plant. Waters (1966) concluded

that proper storage, methods and postharvest procedures can extend vaselife but if not used correctly may reduce vaselife.

Table 1. Effect of pH of holding solution on vaseline

TREATMENT	VASELIFE (DAYS)
pH 3.0	16.67a
pH 3.5	18.00a
pH 4.0	17.67a
pH 5.0	18.00a
pH 6.0	18.00a
pH 6.5 (Tap water only)	18.17a

Means with same letter are not significantly different at 5% level by DMRT

Volume of Solution Taken-up

Statistical analysis showed that there were no significant differences in the volume of solution taken-up by the alstromeria cutflowers as affected by the different pH levels of the holding solutions (Table 2). Cutflowers held in a solution with pH 4.0 had higher rate of absorption, taking up 48.33 mL of the holding solution at the termination followed by those held in solutions with pH of 6.5, 3.5, 5.0 and 6.0 whereas flowers held in solution with a pH of 3 absorbed the least.

Number of Days from Flower Immersion to Full Flower Opening

The number of days to full flower opening ranged from 6 to 9 days. Statistical analysis showed significant differences obtained on the number of days from immersion to full flower opening as affected by the different pH levels of the holding solution (Table 3). Cutflowers held in 20% sucrose + 1 ml chlorox + citric acid with a pH of 4.0 promoted the longest duration of flower opening with a mean of 9.0 days followed by those held in solutions with pH 5, 6.5 and 6.0; whereas alstromeria cutflowers held at pH 3.0 and 3.5 had the shortest duration to flower opening with full opened flowers after 6.5 and 6.6 days.

Rimando and Maralit (1980) found that in Shasta daisy with 10% sucrose resulted in the successful further opening of cutflower buds to quality

blooms which was comparable and even bigger than field opened blooms. However, 8% sucrose appeared to be the optimum sugar level as regards to vaselife irrespective of flower bud stage at harvest.

Table 2. Volume of solution taken-up (mL) as affected by pH of holding solution

TREATMENT	VOLUME OF SOLUTION ABSORBED (mL)
pH 3.0	35.83a
pH 3.5	43.50a
pH 4.0	48.33a
pH 5.0	39.67a
pH 6.0	38.33a
pH 6.5 (Tap water only)	45.33a

Means with same letter are not significantly different at 5% level by DMRT

Table 3. Number of days from immersion to full flower opening

TREATMENT	NO. OF DAYS TO FULL FLOWER OPENING
pH 3.0	6.50b
pH 3.5	6.67b
pH 4.0	8.50a
pH 5.0	7.17b
pH 6.0	7.00b
pH 6.5 (Tap water only)	7.17b

Means with same letter are not significantly different at 5% level by DMRT

Petal Quality Rating

The petal quality rating for all the cutflowers in the experiment was done every two days.

Statistical anlysis showed that there was no significant differences from day 2 to day 4 on the petal quality rating of alstromeria cutflowers held in holding solutions with different pH.

On the 6th day, Alstromeria cutflowers held in the solutions with a pH 3.0, 3.5 and 4.0 had the highest petal quality rating of 1.5, while those held in the solutions with a pH of 5.0 and 6.5 had the lowest petal quality rating of 2.33.

Table 4. Petal quality rating

DAYS	TREATMENTS					
	pH 3.0	**pH 3.5**	**pH 4.0**	**pH 5.0**	**pH 6.0**	**pH 6.5**
DAY 2	1.0a	1.0a	1.0a	1.0a	1.0a	1.0a
DAY 4	1.0a	1.0a	1.0a	1.0a	1.0a	1.0a
DAY 6	1.50a	1.50a	1.50a	2.33a	2.17a	2.33a
DAY 8	1.83a	1.83a	1.83a	2.83a	2.67a	2.83a
DAY 10	2.17a	2.33a	2.17a	3.00a	3.00a	3.00a
DAY 12	2.83a	2.83a	2.50a	3.00a	3.00a	3.00a
DAY 14	3.00a	3.00a	3.00a	3.00a	3.00a	3.00a
DAY 16	3.00a	3.00a	3.00a	3.00a	3.00a	3.00a
DAY 18	3.00a	3.00a	3.00a	3.00a	3.00a	3.00a

Means with same letter are not significantly different at 5% level by DMRT

Rating Index	*Description*
1	*51 - 60% open*
2	*61 - 80% open*
3	*81 - 100% open*

On the 8th day, there were no significant differences noted on the petal quality rating. On the 10th, cutflowers held in solutions with a pH of 3.0 and 4.0 had the highest petal quality rating of 2.17 while the lowest petal quality rating was observed in solutions with pH 5.0, 6.0 and 6.5, both had a mean of 3.0.

On the 12th day, highest petal quality rating was observed in cut-flowers held in solutions with a pH of 4.0 with a mean of 2.50 while the lowest petal quality rating was noted on the solution with a pH of 5, 6 and 6.5 with a mean of 3.0.

From day 14 to 18, cutflowers held in solutions with the different pH had all the same means of 3.0 which means that all the flower petals are fully opened.

Leaf Quality Rating

Statistical analysis showed no significant differences in the 2nd day of observations on the leaf quality rating of Alstromeria cutflowers held in solution with different pH from day 2 to day 18 (Table 5).

However, on day 6, Alstromeria cutflowers held in solution with a pH of 6.0 had the highest leaf quality rating of 1.5 while the lowest quality was observed on the cutflowers held in solution with a pH of 3.5 and 4.0 with a mean of 2.17.

Table 5. Leaf quality rating

DAYS	TREATMENTS					
	pH 3.0	**pH 3.5**	**pH 4.0**	**pH 5.0**	**pH 6.0**	**pH 6.5**
DAY 2	1.0a	1.0a	1.0a	1.0a	1.0a	1.0a
DAY 4	1.17a	1.50a	1.67a	1.67a	1.67a	1.67a
DAY 6	2.00a	2.17a	2.17a	2.00a	1.50a	1.83a
DAY 8	2.67a	2.83a	2.33a	2.33a	2.17a	2.17a
DAY 10	3.33a	3.00a	3.00a	3.33a	3.17a	3.17a
DAY 12	4.17a	3.83a	4.17a	4.33a	3.83a	4.00a
DAY 14	4.83a	4.67a	4.67a	4.67a	4.33a	4.17a
DAY 16	4.83a	5.00a	5.00a	5.00a	4.83a	4.83a
DAY 18	5.00a	5.00a	5.00a	5.00a	5.00a	5.00a

Means with same letter are not significantly different at 5% level by DMRT

Rating Index	*Description*
1	*1 - 20% yellowing of the leaves*
2	*21 - 40% yellowing of the leaves*
3	*51 - 60% yellowing of the leaves*
4	*61 - 80% yellowing of the leaves*
5	*81 - 100% yellowing of the leaves*

Stem Quality

Statistical analysis showed no significant differences on the stem quality of solution from day 2 to 18.

On day 10, Alstromeria cutflowers held in the solution with a pH

of 3.5, 4.5 and 6 had the highest mean of 1.83 while cutflowers held in the solution with a pH of 3.0 had the lowest quality rating of 2.17.

On the 12th day, highest stem quality rating was observed in the solution with a pH of 6.0 with a mean of 2.17 while cutflowers held in solution with a pH of 3 and 3.5 had the lowest stem quality rating with a mean of 3.17.

Table 6. Stem quality rating

DAYS	TREATMENTS					
	pH 3.0	pH 3.5	pH 4.0	pH 5.0	pH 6.0	pH 6.5
DAY 2	1.0a	1.0a	1.0a	1.0a	1.0a	1.0a
DAY 4	1.0a	1.0a	1.0a	1.0a	1.0a	1.0a
DAY 6	1.0a	1.0a	1.0a	1.0a	1.0a	1.0a
DAY 8	1.0a	1.0a	1.0a	1.0a	1.0a	1.0a
DAY 10	2.17a	1.83a	1.83a	1.83a	1.83a	2.00a
DAY 12	3.17a	3.17a	2.50a	2.67a	2.17a	2.33a
DAY 14	4.17a	3.83a	3.53a	3.50a	3.17a	3.17a
DAY 16	4.50a	4.33a	4.83a	4.00a	3.83a	4.33a
DAY 18	5.00a	5.00a	4.33a	4.33a	4.67a	5.17a

Means with same letter are not significantly different at 5% level by DMRT

Rating Index	*Description*
1	*dark green, no injury*
2	*dark green and rotting at the base (2.0 cm)*
3	*dark green and rotting at the base (2.5 cm)*
4	*green and rotting at the base (3.0 cm)*
5	*green and rotting at the base (3.5 cm)*
6	*yellow green and rotting at the base (4.0 cm)*
7	*yellow green and rotting at the base (4.5 cm)*

On day 14, highest stem quality rating was observed in the solution with a pH of 6.0 and 6.5 with a mean of 3.17 while the lowest stem quality rating was noted on the solution with a pH of 3.0 with a mean of 4.17 which means that the stems were still dark green.

On the 16th day, cutflowers held in the solution with a pH of 5.0 had the highest stem quality rating of 3.83 while those held in the solution with a pH of 3 had the lowest stem quality rating of 4.50.

On the last day of observation, cutflowers held in a solution with a pH of 4.0 and 5.0 had the highest stem quality rating of 4.33. Those held at pH 6.5 had the lowest stem quality with the stems were green and rotting at the base.

Other Observation

Fungal mycellia were noted at the stem ends in alstromeria cutflowers held in solutions with pH 5.0, 6.0 and 6.5 on the last day of observation.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

Alstromeria cutflowers were harvested at 50% anthesis and were held in holding solutions containing 20% sucrose + 1 ml chlorox + citric acid.

Results showed that alstromeria cutflowers harvested at 50% anthesis held in tapwater only and in holding solutions with pH 6.5, 6.0, 5.0 and 3.5 had longer vaselife compared to cutflowers held in holding solutions with pH 3.0, 4.0 and 5.0 which had the shortest vaselife.

All the cutflowers held in solutions with different pH showed different extents of stem damage and had yellowing of the leaves at the termination of observations.

The lowest cutflower quality rating were recorded in cutflowers held in solutions containing 20% sucrose + 1 mL Chlorox + citric acid with a pH of 6.0. Cutflowers held in solutions containing 20% sucrose + 1 mL Chlorox + citric acid with a pH of 4 and 5 had higher stem quality rating on the last day of observations compared to other treatments.

Conclusion

Thus, it's conculded that using holding solution with a pH of 4.0 containing 20% sucrose + 1 mL Chlorox + citric acid promoted the longest

duration of flower opening resulting in longer vaselife of Alstormeria cutflowers.

Recommendation

Based on the findings, it is recommended that using a holding solution with a pH of 4.0 containing 20% sucrose + 1 ml Chlorox + citric acid can be used to promote longer duration of flower opening, thereby promoting longer cutflower vaselife.

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