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RESEARCHES ON THE USE OF PRESERVATIVES SOLUTION IN PROLONGING THE VASE LIFE OF CUT FLOWERS IN DOMESTIC CONDITIONS

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Abstract

The decorative value of the cut flowers is defined primarily by the quality of vase life. The main features that make up this concept are the lifetime of the vase, the size and the evolution of the flowers and the maintenance of the flower color. These characteristics are decisively influenced by the use of preservative solutions. In this article, there was studied the influence of different types of solutions on flower freshness. For this, the stems were picked from a number of 4 varieties of Freesia hybrida from local commercial crops, such as: Soleil (yellow flowers), Fairy bell (red flowers), Excellent (white flowers) and Blue Nile (purple flowers), the flowers being entirely fresh and the length of the rods being 50 cm. They were distributed in vases containing different preservative solutions and placed under room conditions. The statistical analysis of data, using SPSS Base v.25, indicated that the duration of maintaining the freshness of the flowers can be influenced by both the variety used and the solution used.

Key words*: Freesia, deionized water, pH, water absorption.*

INTRODUCTION

Conservative solutions are widely used in large producing and exporting countries to help maintain the quality of the flowers after harvesting and to help with resisting changes in environmental factors. The preservative solutions act on the quality of the flowers by prolonging the life in the pot, increasing the size of the flowers and maintaining the color of the leaves and petals.

The preservative solutions are based on carbohydrates that are the main source of flower nutrition and the energy source needed to maintain all the biochemical and physiological processes that take place in the flowers after harvesting.

Glucids (sucrose, glucose or fructose) help the fundamental processes of prolonging mitochondria, improving water balance by regulating perspiration and improving water absorption (Al-Humaid,2004, Da Silva JAT,2003;Beura et al, 2001).

Thus, optimal carbohydrate concentration varies depending on the type of treatment, species or variety. The longer the exposure time of the flowers to the preservative solution, the lower the concentration is necessary. Medium concentrations are used to stimulate the flowering, and for maintenance, storage use low concentrations (Reddy et al, 1996; Ohkawa et al, 1991; Khalid, 2012).

Some studies on prolonging vessel life in the case of gladiolus cut flowers have revealed that the use of sucrose in the 6% concentration had the best results (Anserwadekar and Patil, 1986). Sucrose has been studied and recommended as an alternative to STS. Another recipe, consisting of 10% sugar, citric acid and antimicrobial agents, pulsed for 24 hours, resulted in a 13-day post-harvest life and the opening of all the cuttings of the cut stem (Armitage, 2003).

The use of preservative solutions (Bell Fleur, Floralife) on the market has shown a positive effect on the post-harvest life of Lisianthus cut flowers (Buta et al, 2000).

Studies on improving post-harvest life have also been done for Alstroemeria cut flowers. They demonstrated the positive effect of Bioplant and Chrysal preservatives that almost

doubled the flowers' durability over the control (Koszeghi andKentelky, 2013).

Antimicrobial solutions combat the development of pathogenic microorganisms that are damaging to the cut flowers causing rotting rods and blocking stems conducting the stems, producing toxins that accelerate the flowering process of flowers(Elgimabi,2009;Van Meetern et al, 2001).

The pH of the storage solutions helps to prolong the duration of maintaining the quality of the flowers. A basic pH reduces the storage period and an acidic pH prolongs the life of the flowers.

Many preservatives contain acid. The main purpose for which acids are used in solutions is to reduce the pH. However, some acids have specific functions because at the same pH they are more effective than other acids.

Citric acid is an acid that is used in 0.005% to 0.08% in the storage solutions of rose, chrysanthemum, gladiolus, etc. The citric acid in combination with potassium acid phosphate gives good results to Gerbera flowers. Citric acid favors water balance in flowers and reduces blockage of conductive vessels.

2-Acetoxybenzoic acid is effective in prolonging the maintenance of flower quality by delaying the aging of flowers.

Copper results in boosting, opening and preserving carnations and chrysanthemums, but it is toxic to roses and Gerbera.

Very effective bactericides are silver salts, especially silver nitrate. This substance is often added to preservation solutions to prolong flower life. Silver nitrate is used in concentrations of 10-200 ppm in storage solutions and 1000 ppm in the case of impregnation of floral stems for several minutes.

Silver thiosulfate made from silver nitrate and sodium thiosulphate is a strong inhibitor of the action of ethylene in plant tissues. It also has antimicrobial action inside the tissues, not in the storage water. Silver thiosulphate swiftly moves to the petals of flowers, reducing the synthesis of ethylene by the flowers. Treating the base of floral stems with silver thiosulphate in concentrations of 0.2-4 mM for 5 minutes to 24 hours gives very good results to ethylene-sensitive flowers.

The use of a preservative solution composed of 10 ppm nano silver combined with 3% sucrose has been shown to be the most effective treatment for maintaining the best quality of freesia cut stems (Hajizadeh, 2016).

The post-harvest treatment of Freesia flowers with silver sulfate prolongs the life of the pot and increases the number of buds that open on the inflorescence.

Adding cytokinins, benzylaladenine, phenylmethyltetrahydropyranpurinamine and furfuraminopurine to the silver sulfate solution prolonged the life of the flowers, but did not affect the number of openings on the floral stem (Sytsema, 1986).

The most important component that is used to make solutions is water. The water composition determines the pH of the preservation solutions and determines the quality of the flowers when used to preserve them or to make preservatives. The sensitivity of flowers cut to the salinity of the water depends on the species. Besides shortening the life of flowers, salt in water can cause damage to leaves and rods.

Low pH (3-4) water is better for flowers than high pH because low pH water prevents the growth of microorganisms and improves water absorption by flowers. In general, it is advisable to use demineralized water or distilled water.

The purpose of the research was to determine the time of keeping the freesia flowers under the conditions of using several solutions (4 experimental variants).

MATERIALS AND METHODS

Plant materials and treatments

For the proposed experience, on March 23, 2016, 4 varieties of*Freesia hybrida* from the Vitan Bucharest Greenhouses Society were harvested. The varieties harvested were Solei (yellow flowers), Fairy bell, Excellent (white flower color) and Blue Nile (the purple flowers), the flowers being entirely fresh and the length of the stems being 50 cm. The flowers were brought to the University of Agronomic Sciences and Veterinary Medicine Bucharest, Department of Floriculture, where the experience was mounted. For each variety the following variants were studied: Witness - deionized water; V_1 - deionized water + one

coin of copper + citric acid 0.016% + 0.05% sucrose; V_2 - deionized water + acetylsalicylic acid 0.015% + 0.05% sucrose + 0.005% chlorine; V_3 - deionized water + 0.010% acetic acid + + 0.05% sucrose + one copper coin; V_4 - deionized water + 0.005% nutritional solution.
For each experimental variant, deionized water was used to minimize the influence of salts in drinking water. The water used in 5 plants was 500ml. The plants before introduction into the experience were shortened with the rods under water so that the rods would not be affected by the presence of other compounds in the atmosphere.
Throughout the experience, were noted the number of buds, open flowers and blossom flowers, water consumption, chlorophyll evolution, the period of maintaining the decorative characteristics during the vase-life.

The ff indicator (freshness flowers)
Because in this article we proposed to present the analysis made taking into account the number of buds, open flowers, and past flowers, we calculated an index that takes into account these three characteristics as follows: we normalized the data for each characteristic by the min-max (see Myatt) using the formula:

$$nv = \frac{v - minvi}{maxvi - minvi} \cdot (nmax - nmin) + nmin$$

where nv - the new value, v - the initial value, minvi - the minimum of the values in the string, maxvi - the maximum values in the string, nmax = 1, nmin = 0. In the case of the data from the previous flowers, we used an inverse scoring, that optimum is given the minimum values. Under these circumstances, we have defined the index ff as given by the sum of the scores obtained in the three categories. We calculated an optimum for each day, optimally given by the maximum values corresponding to each day. We calculated the Average Index for Flower Freshness (AIFF) for each variation and comparing AIFF to these variants with optimal AIFF using the Student Test for Paired Sample (STPS) test. The differences between optimal AIFF and AIFF variant are considered to be significant when they are equal to or lower than the 5% significance threshold. (α = 0.05). Statistical data processing was performed using mainly SPSS.

RESULTS AND DISCUSSIONS

The analysis of the data was done in two directions:
a. the differences between optimal AIFF and AIFF for each variant were studied for each variety.
b. optimal AIFF was compared with AIFF of each variety for the variant.

Analysis of the varieties
The best-performing version was chosen from the "closest to optimal" variants, ie those in which the AIFF variation does not differ significantly from optimal AIFF. We will say that the higher the p-value resulting from the t-test for pairs is greater, the better is the "closest" to the optimum. The second level of selection was given by the analysis of the distribution of the ff indices for each variant.
For the ***Blue Nile*** variety (Figure 1) we obtained significant differences between AIFF optimal and AIFF V_1 (p = 0.04), respectively AIFF V_2 (p = 0.02) and respectively AIFF $_{V4}$ (p = 0.02). Significant differences between optimal AIFF and control AIFF (0.07) and AIFF V_3 (p = 0.06)

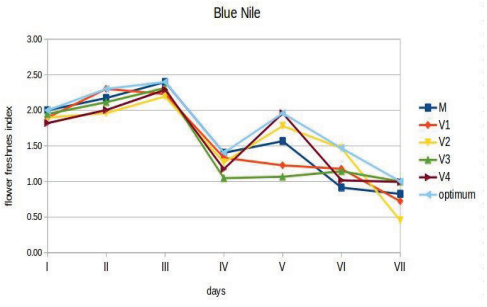

Figure 1. The *Blue Nile* varieties analysis

From the indicator distribution diagramff:it can be noticed that on days 4-6 the indicator ff drops to the V_3 (1,05; 1,07; 1,14) compared to the optimum (1,40; 1,96; 1,47), which leads to the conclusion that the variety Blue Nile behaves best for the control variant (M).
For ***Soleil*** (Figure 2) we got significant differences between AIFF optimal and AIFFV_3.

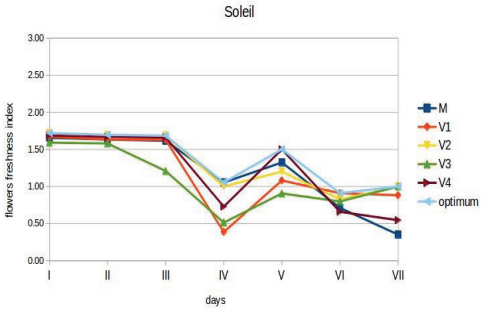

Figure 2. The *Soleil* varieties analysis

For the other variants, we obtained insignificant differences compared to the optimal AIFF. The highest P value obtained by applying STPS we obtained for V_2 (p = 0.18) the other variants presenting values between 0.06 and 0.08. From the analysis of the chart, we can see that on the 4th day we have a significant decrease of the index ff (in the case of V_1 we have the highest decrease of the index, from 1.63 to 0.39).

In the case of the ***Fairy Belle*** (Figure 3) variety following STPS, we obtained significant differences between optimal AIFF and AIFF V_1 (p = 0.02), respectively AIFF (p = 0.01). Of the variants for which we obtained AIFF insignificantly different from the optimal AIFF stands out for V_4 for which we obtained the value p = 0.14. For *Fairy Belle*, we find significant differences in the Witness (Control) and V_1 variants. From the diagram, we can see that in the first five days the optimal ff index overlaps with the ff index for V_4, which validates that for V_4 this variety has a very high index ff good.

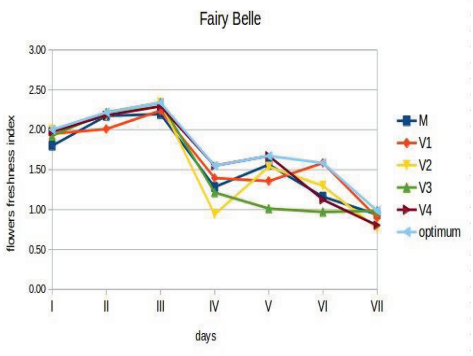

Figure 3. The *Fairy Belle* varieties analysis

In the case of the ***Excellent*** variety (Figure 4), as in the previous case, the AIFF V_4 of the ff indices is the closest to the optimal AIFF (p = 0.25). Moreover, the similarity with the *Fairy Belle* variety is obvious, because in the case of Excellent variety we also have significant differences between optimal AIFF and AIFF V_1 (p = 0.01), respectively AIFF (p = 0.02) and insignificant differences between optimal AIFF and AIFF the other V_2-V_4.

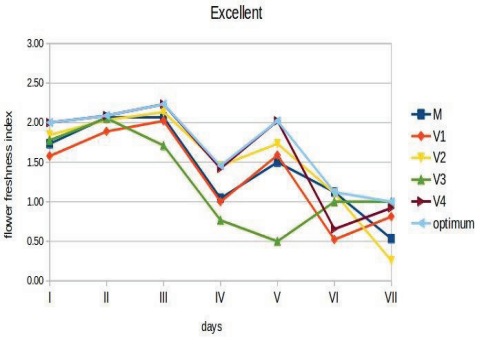

Figure 4. The *Excellent* varieties analysis

This is also validated by the diagram of the index distribution ff. However, there is a difference in this case: for V_3, the indices ff show a significant decrease on days 3-5 from the ff index corresponding to the other variants.

Analysis of variants

Control variant

Following the STPS application, significant values were obtained between AIFF optimal and AIFF of *Soleil* (p = 0.00) and *Excellent* (0,01). The highest value p was obtained for the *Blue Nile*, p = 0.21, so *Blue Nile*'s control was the best in terms of flower purity.

From this diagram you can see that in the first 5 days the *Blue Nile* variety has the optimal values, and on the 6th and 7th day *Fairy Belle* has better scores for the index ff.

Variant V_1

As in the previous case, AIFF from *Soleil* and *Excellent* differ significantly from AIFF to optimal (for both comparisons we obtained p = 0.01), but for this variant, we obtained a better score for *Fairy Belle* (p = 0.72) (Figure 5).

It can be seen that the *Blue Nile* shows optimal values in terms of the ff index in the first 4 days, but not different from the Fairfax index ff, while for days 5-7 the ff index for the *Blue Nile* is sharpened (from 1.33 on day 4 to 0.72 on day 7), while the ff index remains at odds close to the optimal index.

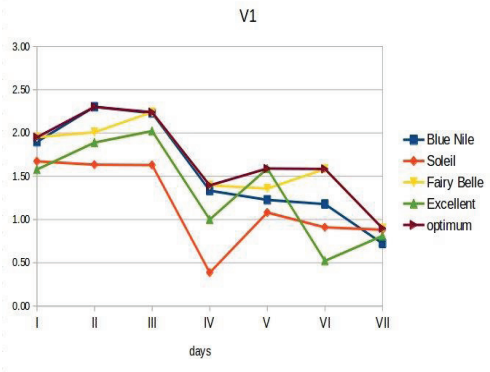

Figure 5. The V_1 experimental variant analysis

Variant V_2

For this variant, the only variety that has a distinctly optimal AIFF of optimal (p = 0.01) is the *Soleil* variety, for the other three corresponding AIFF varieties not statistically different from optimal AIFF (p between 0.19 and 0.42).

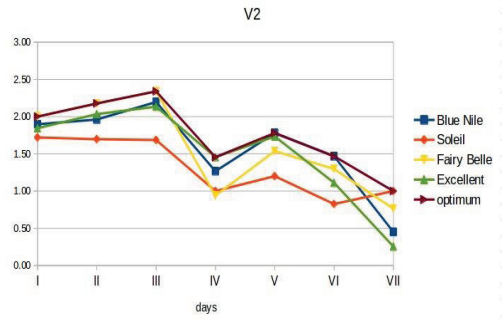

Figure 6. The V_2 experimental variant analysis

Both the p-value obtained when comparing AIFF optimally with AIFF *Blue Nile* (p = 0.42) and from the diagram (Figure 6) shows that the *Blue Nile* is the closest optimal variant for this variant.

Variant V_3

This variant is found almost in the same situation as control (M) and V_1, ie the *Soleil* and *Excellent* show significant differences between their AIFF and optimal AIFF, while for the *Blue Nile* and *Fairy Belle* there are insignificant differences between the optimal AIFF and the corresponding AIFF of these varieties. It is said that the situation is similar because in this case, the p values obtained for the varieties showing insignificant differences are lower than the other variants (p values are close to 0.10).

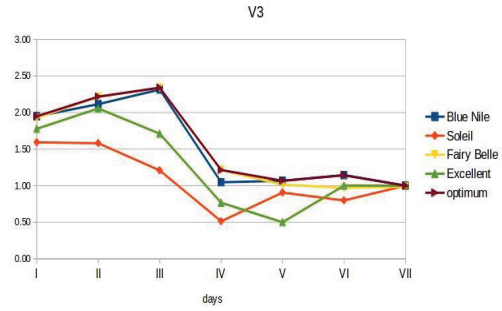

Figure 7. The V_3 experimental variant analysis

From the diagram (Figure 7), it can be easily noticed that from day 4 there is a marked decrease in the ff index for all varieties (for example, for optimal this index decreases from 2.34 on day 3 to 1.21 in day 4).

Variant V_4

For this variant (Figure 8), significant differences were obtained only between *Soleil* AIFF and optimal AIFF (p = 0.00). The other three varieties show significant optimal approaches (p results from the AIFF comparison are between 0.53 and 0.88).

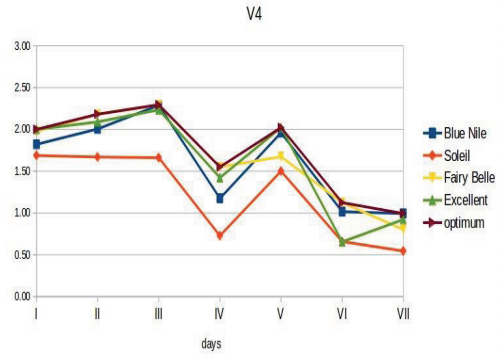

Figure 8. The V_4 experimental variant analysis

It is clear from the diagram that the *Fairy Belle* is most optimal from the point of view of ff, only on day 5 the difference is somewhat

higher between the optimum ff index and the ff index of the *Soleil* (2.02 versus 1.50).

CONCLUSIONS

From the analysis of the ff index on varieties we can observe the solutions (variants) with which we can obtain a better freshness for each variety:

• *Blue Nile* - Ionized Water (control-M)

• *Soleil* - deionized water + acetylsalicylic acid 0.015% + 0.05% sucrose + 0.005% chlorine (V_2)

• *Fairy Belle* - deionized water + 0.005% nutritional solution (V_4)

• *Excellent* - deionized water + 0.005% nutritional solution (V_4)

On the other hand, we find that the best results are for deionized water + 0,005% nutritive solution (V_4) and the weakest for deionized water + 0,010% acetic acid + + 0,05% sucrose + one coin of copper (V_3). From the variance analysis, we can see that the *Soleil* is the most sensitive, obtaining for each AIFF variant significantly different from the optimum, while the other varieties have at least for a variant AIFF close to the optimal AIFF.

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