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Effects of different pulse solutions on vase life and quality of roses (*Rosa hybrid* L.)

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Abstract

Roses from different continents travel long distances to reach the international flower market in Holland and result in them reaching the market while they have aged thus reducing vase life and quality which are vital for consumer satisfaction. An experiment was carried out to assess the effects of five different pulse solutions (distilled water, aluminium sulphate + HTH + V90, aluminium sulphate + pentakill + V90, 3% sucrose solution + aluminium sulphate + V90, and water acidified with citric acid to a hydrogen potential of 4.2) on preserving the vase life of three rose (*Rosa hybrid* L.) varieties (Amore, Escimo and Calibra). The experiment was arranged as a 3×5 factorial treatment structure laid out in a completely randomised design (CRD). There was an interaction ($p<0.001$) between the three rose varieties and the five different pulse solutions. Escimo and Amore recorded the highest vase life days in solution containing 3 % sucrose averaging 19 and 18 days respectively. Calibra recorded the least vase life (17 days) in water acidified with citric acid to a hydrogen potential of 4.2. It was concluded that pulsing solutions prolong vase life of roses.

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Introduction

Roses (*Rosa hybrid* L.) of Rosaceae family are recognised as highly value plants in art, religion, commerce and as raw materials in the cosmetic and perfumery industries (Butt, 2003). Every special moment is embraced by roses; they have great ornamental purpose on occasions such as Valentine's Day, Mother's Day and Whit Sunday among others (Butt, 2003). In Zimbabwe roses are grown for export, the main market being Europe particularly Holland. In any given rose variety, the most important single quality factor demanded by the end user is the number of vase life days (average of 18 days) as well as petal opening (Barton, 2002). Generally, pulsing solutions have a positive effect towards increasing the vase life of roses (Nowak and Rudnicki, 1991).

The term pulsing has been used by scientists to describe a technique where flower stems are placed in chemical solution to carry to the tissues through the xylem substances that may reduce senescence and subsequently increase the vase life of cutflowers (Reid *et al.*, 1980). Pulsing also prolongs flower vase life though the prevention of premature wilting through supplementing food and water reserves of the cut stems as well as inhibiting growth of microbes (Reid *et al.*, 1980). Pulsing flowers with the substances such as citric acid, sucrose, calcium sulphate is promising to achieve potential vase life for the different rose varieties (Nowak and Rudnicki, 1991). Although the production of quality product at farm level is an essential prerequisite of export sales, it is of limited value if the postharvest treatments are unable to maintain quality until the product reaches the point of sale (Perry, 1998). Postharvest changes in roses cannot be stopped but can only be slowed down within certain limits and pulsing is a valuable tool which can influence these changes. Vase life can be defined as the time taken by a flower in a vase before it starts deteriorating (Thompson, 1998). It is a very vital aspect in cut flower production as it can determine the market price since it is directly related to quality.

The present study was carried out with the main objective of assessing the effects of different pulse solutions on preserving and prolonging the vase life of roses.

Materials and Methods

Study site

The trial was conducted at Rosait Farm, located 35°17′E, 14°56′S at an altitude of 880 metres above sea level. The farm is found in the Midlands Province of Zimbabwe and falls under Natural Farming Region III with an average annual rainfall of about 600 mm and an average daily temperature of 21° C. The experiment was conducted on tables in the commercial grading shade.

Experimental design and treatments

The experiment was laid out as a 3×5 factorial structure replicated three times in a completely randomised design (CRD). Three rose varieties were used namely Amore, Escimo and Calibra. Five pulsing solutions were used in the experiment; their names and respective rates are shown on Table 1.

Flower material

The rose flowers were grown at Rosait Farm. The flowers, which were raised on ridge and furrow in commercial greenhouses, were randomly harvested at the commercial cut stage (half open cut stage) using sharp sterilised secateurs.

Roses pulsing procedure

The fresh cut stems were immediately placed into distilled water filled-buckets to a height of 8 cm to avoid embolism. The buckets were taken to the holding room for precooling for 3 hours in order to remove field heat. The roses were taken into the grading shade where they were stripped off leaves to one third of the stem. Randomly selected stems were cut to 40 cm stem length on sterilised guillotine. Sterilised vases were filled with 1.5 litres of the different pulse solutions as well as distilled water (control). Eight stems of each variety were subjected to each of the treatments.

Data collection and analysis

Days to droopy petals, bent necks, wilted leaves, burnt leaves and burnt petals were taken on daily basis to determine vase life. Data was analysed using GenStat Discovery version 3.0. Least significant difference (LSD) was used to separate means at 5% significance level.

Results and discussion

Effect of different pulse solutions and rose varieties on vase life

There was a significant interaction ($p<0.001$) between the three rose varieties and the four different pulse solutions. Escimo and Amore recorded the highest vase life days in solution containing 3% sucrose averaging 19 and 18 days respectively. Calibra recorded the greatest vase life (17 days) in water acidified with citric acid to a hydrogen potential of 4.2 (Fig. 1).

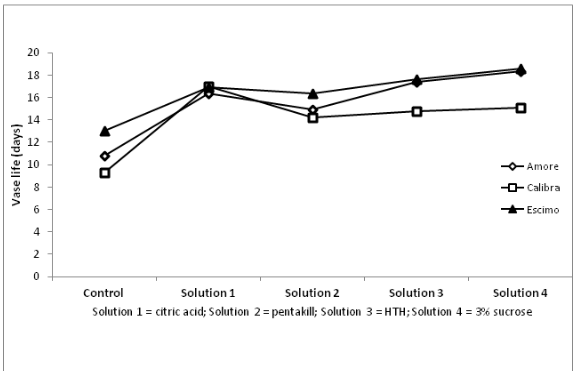

Fig. 1. Interaction effect of different pulse solutions and rose varieties on vase life.

The different rose varieties had different vase lives in all the four solutions; this is probably due to their variations in genetic makeup that influenced biochemical processes leading to deterioration occurring at different vase life spans (Perry, 1998). Nowak and Rudnicki (1991) reviewed that rose stems are living plant parts and continue to live after harvest; their vase life depends on the rate at which they use up their stored food reserves and their rate of water loss. The research findings indicate that supplementing the cut stems with additional food in the form of sucrose can increase vase life. However some varieties might respond negatively to sucrose and stress the stem. Sucrose can be a source of food for potential microbes in the pulse solutions such that they might multiply rapidly and flux with water movement. Barton and Milward (2000) reported that varieties which are more susceptible to bacteria and fungi are the most affected. This is probably what happened to Calibra in citric acid solution that might have suppressed growth of microorganisms to lower levels than other solutions such that it has great vase life in Calibra. The pentakill solution had the least number of vase life days as evidenced by early onset of phytotoxicity to the stems symptomised by burnt leaves in all the three varieties. This concurs with results by Reid *et al.*, (1980) who concluded that some pulse solutions might produce undesirable effects on the plants resulting in symptoms such as burnt leaves. HTH solution extended the vase life less by 3% compared to sucrose and citric acid solutions because it suppressed growth of microorganism and supplied only water without any source of food; pulse solutions should provide source of food, biocide and bactericide. However, it is important to note that pulsing solutions may act as food sources which might promote growth of microbes that have devastating effect varying with cultivars (Zeevart, 2001).The control treatment had the least number of vase life days because of the absence of supplementary food, biocide and bactericide in the solution to support postharvest rose life. The aluminium sulphate + 3 % sucrose + teepol solution treatment extended vase life with 8 days more compared to the control thus two days more than that reported by Zeevart (2001). The differences in the results of this study with those reported by Zeevart (2001) results could be attributed to the presence of wetting agent (teepol) in the current study.

Butt (2003) recorded 8.2 and 7.5 more vase life days compared to the control using 3 % sucrose solution in Whisk mac and Trika cultivars respectively. A solution containing silver nitrate recorded more vase life days of 9 and 7.8 with Whisk mac excelling over Trika (Borochove *et al.*, 1976). In the current work the solution containing 3 % sucrose recorded 5.5, 5.8 and 7.4 more vase life days compared to the control in Escimo, Calibra and Amore respectively. The differences with the results by Butt (2003) are most likely due to the difference in cultivars used that could have responded differently because of genetic and physiological variations. Trika and Amore recorded almost the same vase lives of 7.5 and 7.4 days respectively.

Table 1. Names and rates of chemicals used to prepare the different pulse solutions.

Chemical (Treatment)	Dilution rate
Distilled water	...
Aluminium sulphate + HTH + V90	Aluminium sulphate 250 g/1000 ℓ water, + HTH 30 g/1000 ℓ water, + V90 100 ml/1000 ℓ water
Aluminium sulphate + Pentakill +V90	Aluminium sulphate 250 g/1000 ℓ water, + Pentakill 200 ml /100 ℓ water, + V90 100 ml /1000 ℓ water
3% sucrose solution + Aluminium sulphate + V90	Aluminium sulphate 250 g/1000 ℓ water, + V90 1000 ml /100 ℓ water, + 3% sucrose solution
Water acidified with citric acid	Hydrogen potential 4.2

Conclusion

The results of the study showed that pulsing increases vase life and maintain quality in roses after harvesting. A solution containing a source of food (sucrose) benefited most varieties whilst the one with pentakill proved to be phytotoxic to them. Different rose varieties respond differently to different pulsing solutions resulting in varying vase lives.

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