Technical Article

Postharvest aspects of roses[1]

ARIANE CASTRICINI*[2], ELKA FABIANA APARECIDA ALMEIDA[3],
JOÃO BATISTA RIBEIRO DA SILVA REIS[2], LEANDRA OLIVEIRA SANTOS[2],
MARIA GERALDA VILELA RODRIGUES[2], GUILHERME STEFERSON BRITO SOUZA[2]

ABSTRACT

This study aimed to evaluate respiratory activity, color changes and fresh weight variation of 'Carola' (red), 'Avalanche' (white) and 'Avalanche Chá' (tea) roses for seven days after harvest. Respiratory activity, coloration of petals and fresh weight loss were evaluated. Treatments were composed of three rose cultivars and seven days of evaluation, in a 3 x 7 factorial and a completely randomized design with four replicates of two flowers per plot. To determine the respiratory activity, in addition to the four replicates, an "experimental control" was used as a fifth replicate without roses. 'Avalanche' and 'Avalanche Chá' roses with petals of similar luminosity showed no browning during days after harvest, but are distinct in terms of chromaticity. 'Carola' rose has less shiny petals. On harvest day, the respiratory activity is elevated and reduces later until the fourth day, in which there is elevation of this parameter again coinciding with high fresh weight loss. During days after harvest, small changes in the color of petals were observed; however, the main changes were observed in respiratory activity and fresh weight loss.

Keywords: *Rosa* sp, petal color, physiology, fresh weight loss.

RESUMO

Objetivou-se avaliar a atividade respiratória, as mudanças de cor e a variação da massa fresca de rosas 'Carola', 'Avalanche' e 'Avalanche Chá' durante sete dias após a colheita. Foram avaliadas a atividade respiratória, coloração das pétalas e perda de massa fresca. Os tratamentos foram constituidos por três cultivares de rosas e sete dias de avaliação em esquema fatorial 3 x 7, em delineamento inteiramente casualizado com quatro repetições de duas flores por parcela. Para a determinação da atividade respiratória, além das quatro repetições, utilizou-se um controle experimental constituido por uma quinta repetição sem conter as rosas. Rosas 'Avalanche' e 'Avalanche Chá'que possuem pétalas com luminosidade semelhante, mas cromaticidade distinta, não apresentaram escurecimento ao longo dos dias avaliados após a colheita. Já a rosa 'Carola' tem pétalas menos brilhantes. No dia da colheita a atividade respiratória é elevada e sofre redução posteriormente até o quarto dia, no qual volta a exibir elevação deste parâmetro de forma coincidente com a elevada perda de massa fresca. Durante os dias após a colheita ocorreram pequenas mudanças na cor das pétalas, entretanto, as principais modificações verificadas foram na atividade respiratória e na perda de massa fresca.

Palavras-chave: *Rosa* sp., coloração de pétalas, fisiologia, perda de peso fresco

1. INTRODUCTION

In the flower growing sector, the state of Minas Gerais stands out as one of the largest producing states and 70% of all products resulting from cultivation in this state are classified in the category of flower and cut foliage. As in all flower producing regions of the world, roses occupy the top position in the list of dozens of species cultivated in the state due to their simbology and popularity (LIMA JÚNIOR et al., 2015).

Among the steps for the production of quality roses, post-harvest procedures are considered paramount so that products available in the market maintain quality and have greater durability. Roses produced in Minas Gerais State are of high quality, but for the producer to reach new markets and obtain greater profitability, it is necessary to use technologies to increase the vase life of these flowers. Several factors interfere in the post-harvest quality and longevity of roses, among them, point of harvest, respiration and water loss due to transpiration are highlighted (ALMEIDA et al., 2014).

Flowers are generally classified as highly perishable products due to the ephemeral nature of the different tissues that form them, high respiratory activity and low reserve carbohydrate content (NOWAK and RUDNICKI, 1990). Studies on the physiological aspects of post-harvest roses are the basis for the preparation of floral preservatives and other technologies to increase the durability of these flowers. The aim of this study was to evaluate the respiratory pattern and color and fresh weight changes of 'Carola', 'Avalanche' and 'Avalanche Chá' roses for seven days after harvest.

DOI: http://dx.doi.org/10.14295/oh.v23i2.990

[1]Received in 24/11/2016 and accepted in 13/04/2017

[2]Empresa de Pesquisa Agropecuária de Minas Gerais (EPAMIG–Norte), Nova Porteirinha-MG, Brazil. * Corresponding author: castriciniariane08@gmail.com

[3]Universidade Federal de Minas Gerais, Instituto de Ciências Agrárias, Montes Claros-MG, Brazil.

2. MATERIAL AND METHODS

Avalanche, Carola and Avalanche Chá rose cultivars, in colors white, red and tea, respectively, were produced in greenhouse. After harvest, still in buds, they were transported dry to the Post-harvest Laboratory of the Empresa de Pesquisa Agropecuária de Minas Gerais at Nova Porteirinha, Minas Gerais, State. The transport time of stems from the field to the laboratory and application of treatments was 30 minutes. The size of stems was standardized at 20 cm and all leaves were removed in order to reduce their interference in the respiratory activity evaluation. Roses were packed in polyethylene containers (made from recycled PET bottles) containing 500 mL of potable water. A polystyrene container containing 10 ml of 0.5N NaOH was fixed inside the bottles, which fixates CO_2 released during the respiration process (Figure 1).

Figure 1. Vessel with NaOH to fix CO_2.

Thereafter, polyethylene vases were sealed with PVC film and adhesive tape to prevent / reduce gas exchanges with the external medium. Control consisted of a fifth replicate without floral stems, only vase and container containing CO_2 fixator. After 5h, the container containing CO_2 fixator was removed and the sodium hydroxide solution was transferred to an Erlenmeyer flask added of two drops of phenolphthalein and 10 ml of 0.2 N $BaCl_2$. Titration was then performed with 0.1N HCl. At the same time of the respiratory activity evaluation, the following parameters were daily evaluated after the removal of roses from pet bottles: color of petals and fresh weight variation (fresh weight loss), from harvest to the appearance of the first signs of senescence. Color determination was performed using the Minolta colorimeter, model Chroma meter CR 400, LCH system. To determine fresh weight loss, a digital scale was used. Fresh weight loss in each day was calculated in relation to the initial weight of roses.

During the experimental period, roses were kept in environment with temperature of 25 ± 1 ºC. The study had a completely randomized design in a factorial scheme composed of two factors: three rose cultivars (Carola, Avalanche and Avalanche Chá) and seven days of evaluations, corresponding to days after harvest (DAH) 0, 1, 2, 3, 4, 5 and 6. Four replicates of two roses per plot were used.

Data were submitted to analysis of variance by the F test and means were compared by the Tukey test ($p \leq 0.05$). The Sisvar software (FERREIRA, 2008) was used to perform statistical analyses.

3. RESULTS AND DISCUSSIONS

There was a significant interaction between rose cultivars and DAH in which they were evaluated. Fresh weight variation was influenced by the isolated effects of treatments. It was observed that light roses, such as Avalanche and Avalanche Chá cultivars, had greater luminosities and similar to each other, compared to red Carola cultivar (Figure 2A). The higher the amount of this color component, the lighter the color of petals.

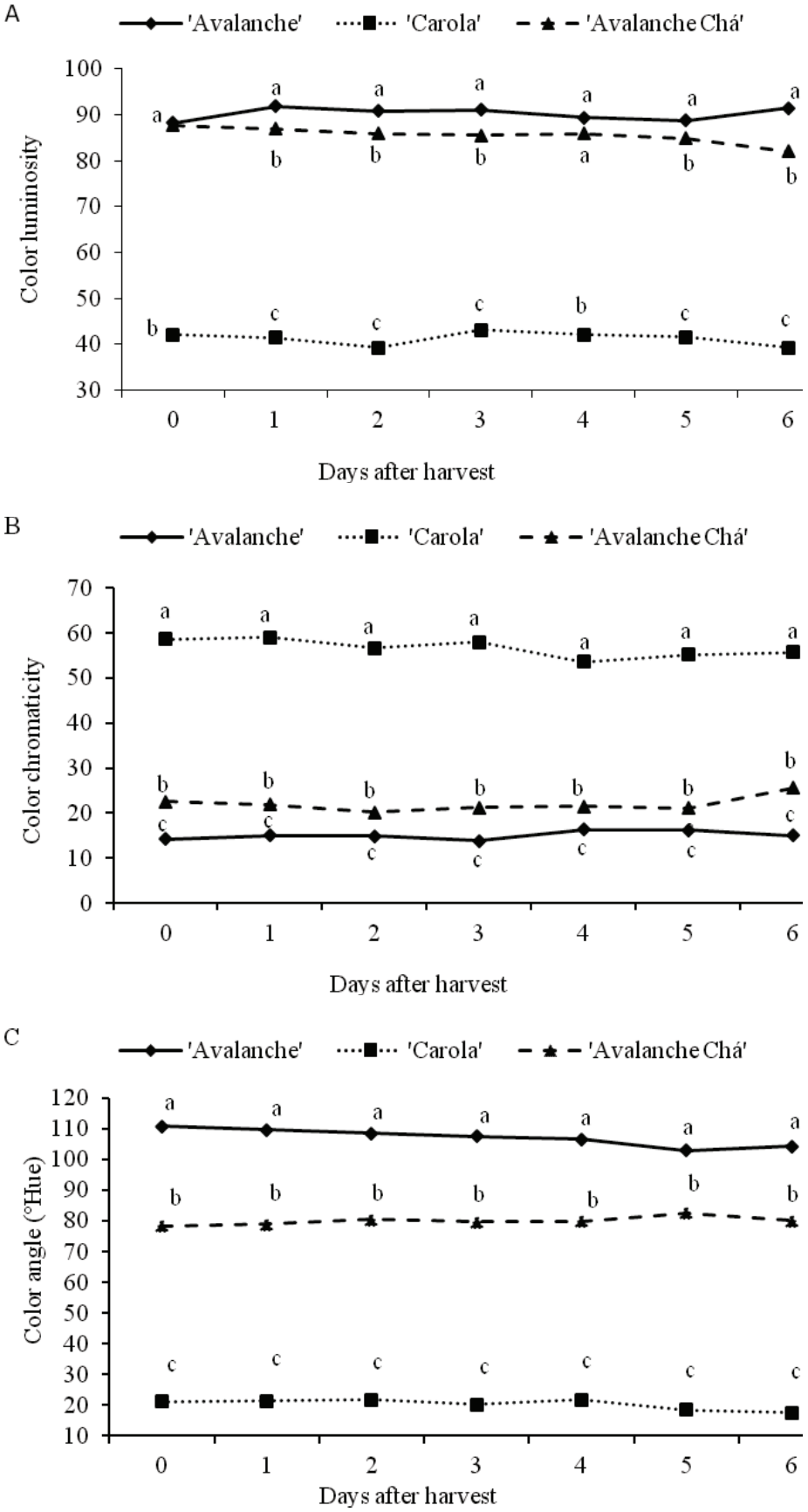

Figure 2. Luminosity, (B) Chromaticity and (C) Color Angle (color shade) of the petals color of 'Avalanche' (white), 'Carola' (red) and 'Avalanche Chá' roses. Different letters on points indicate significant difference between means.

During the experimental period of 7 days, there was no darkening in the petals of the different cultivars, although they were of different colorations. In relation to the day of harvest (0 DAH), there was a slight increase in the luminosity of 'Avalanche' rose petals (white) and a small reduction in the petals of 'Carola' (red) and 'Avalanche Chá' (tea) rose petals at the last day of evaluation. According to Pietro and collaborators (2012), the reduction of luminosity indicates a tendency to darkening, which may not have been perceived in this work due to the reduced number of evaluation days.

Chromaticity indicates saturation in terms of pigment of the given color, in this sense, lower values for lighter petal roses and higher values for red petal roses are verified (Figure 2B). However, it was verified that 'Avalanche Tea' roses have greater chromaticity than white roses and this characteristic is due to the cream pigmentation of their petals. During DAH, there was a small reduction in the chromaticity of petals of red roses, as well as a small increase in white and tea roses.

The color angle was different among the three cultivars, and the highest values were found for 'Avalanche' roses (Figure 2C) due to the absence of pigmentation, a characteristic also evidenced by the lower relative chromaticity. During DAH, there was a reduction in the color angle, probably due to the slight darkening of petals, evidenced by the small increase in chromaticity in the period, which agrees with results presented by Pietro et al. (2012) on post-harvest flowers.

Avalanche Chá' roses have petals with coloration in the yellow angular range; however, due to the high luminosity and reduced chromaticity, these assume cream coloration.

Red petal roses have lower angulation values than the other cultivars in this study, since red coloration is in the 0° angular range or near this. This cultivar showed significant reduction in color angle during DAH, indicating that petals became more intense red during the storage period.

The respiratory activity of roses is represented in Figure 3A, where higher values are verified on the first day of evaluation for all cultivars. This fact can be attributed to the physiological stress caused by the high ambient temperature at harvest, since flowers were harvested and evaluated on the same day. However, the need for cold chain during the entire productive process of roses is emphasized. In this sense, Cevallos and Reid (2001) observed that the vase life of clove, narcissus, iris, chrysanthemum, rose and tulip cut flowers was not changed when storage was made in the absence or presence of water, provided that the storage temperature is between 0 and 10 °C.

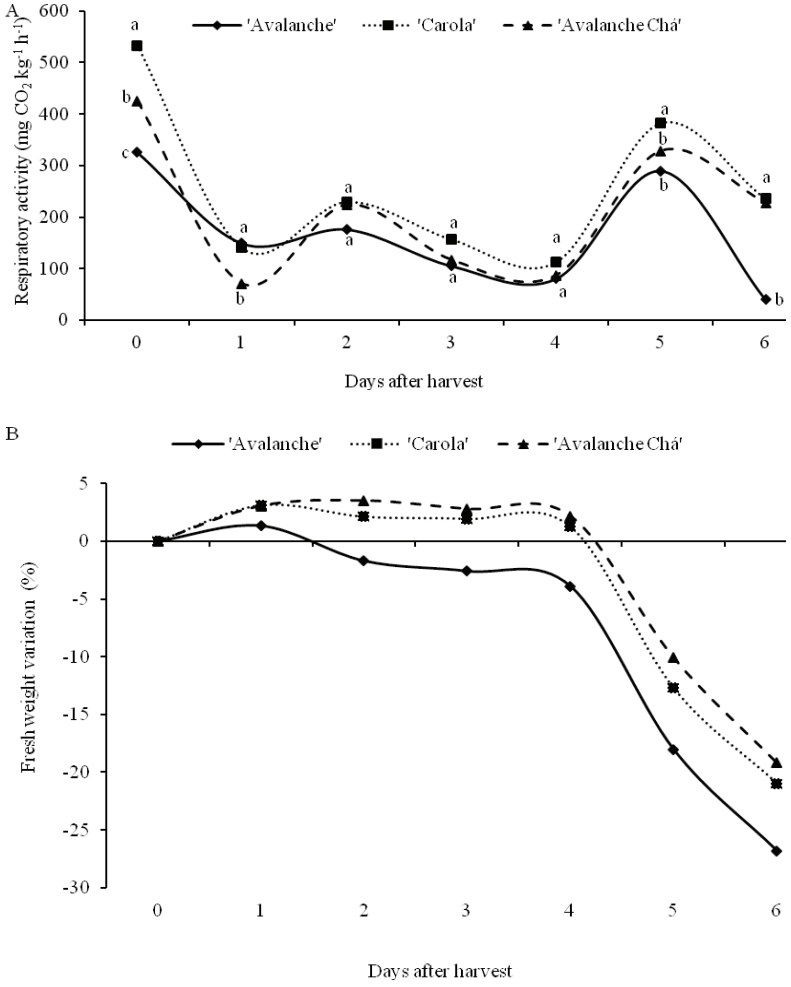

Figure 3. (A) Respiratory activity and (B) Fresh weight variation of roses 'Avalanche' (white), 'Carola' (red) and 'Avalanche Chá

According to Pietro and collaborators (2012), lower respiratory activity increases the vase life due to the lower use of reserves as respiratory substrate, positively influencing the maintenance of the qualitative characteristics of flowers for longer times after harvest.

Lower respiratory activity was verified for 'Avalanche' roses on the first and last day of evaluation. From one day until the fourth day after harvest, there was a marked decrease in respiratory activity for all cultivars, but without significant differences. On the fifth day after harvest, there was an increase in respiratory activity, followed by a decline on the sixth day, where 'Carola' and 'Avalanche Chá' roses were statistically similar.

Cultivars with lower respiratory activity after harvesting are more suitable for long-term storage, as they will have lower intakes of reserves and fresh weight loss and maintenance of appearance until marketing. According to Finger et al. (2006) in cut flowers, there appears to be a large variation in respiratory activity among species under similar storage conditions, probably reflecting the vase life of each species.

Figure 3B shows the fresh weight variation during DAH. From the day of harvest to the fourth DAH, there was a relative weight gain of about 3% in 'Avalanche Chá' and 'Carola' roses due to the rehydration of stems. For 'Avalanche' roses, the rehydration period was lower than two DAH and this cultivar showed the highest weight loss during the evaluation days; however, from the fourth day after harvest, all cultivars had a marked reduction in fresh weight.

The more marked reduction in fresh weight from the fourth day after harvest coincided with the increase in respiratory activity in the period, suggesting the relationship between this variable and the quality of roses. Acceleration of respiratory metabolism triggers and accelerates senescence and dehydration leads to wilting with loss of vigor and commercial attraction.

According to Finger and collaborators (2003), after harvest, biochemical, physiological and structural alterations that culminate with the senescence of organs occur, being, therefore, a process of irreversible nature. Depending on the species, senescence is visually perceived by wilt or alteration in the coloration of petals and sepals, and in others, abscission of floral parts (VAN DOORN and WOLTERING, 2008).

On the sixth day after harvest, fresh weight loss in relation to the first day of evaluation was 26.82%, 20.97% and 19.18% for 'Avalanche', 'Carola' and 'Avalanche Chá' roses, respectively.

4. CONCLUSIONS

Avalanche, Avalanche Chá and Carola rose cultivars did not present significant changes in the color parameters studied. However, the correlation observed between respiratory activity and fresh weight loss indicated that the senescence process is initiated at 5 days after harvest in the study cultivars.

ACKNOWLEDGMENTS

To Fapemig and CNPq for financial assistance and research scholarships to carry out this work.

AUTHORS CONTRIBUTIONS

A.C.: Design, conduction and evaluation of the laboratory experiment; tabulation and statistical analysis of data; writing of the manuscript. **E.F.A.A.**: Design, conduction and evaluation of the laboratory experiment; writing of the manuscript. **J.B.R.S.R.**: Design; contribution in writing the manuscript. **L.O.S.:** Design, conduction and evaluation of the laboratory experiment. **M.G.V.R.:** Contribution in the discussion of results. **G.S.B.S.:** Assistance in the collection of roses and laboratory activities.

REFERENCES

ALMEIDA, E.F.A.; PIVETTA, K.F.L.; PAIVA, P.D.O.; ICHINOSE, J.G.D.; GIMENES, R.; LESSA, M.A.; REIS, S.N.; CARVALHO, L.M.; RIBEIRO, M.N. O. Rosa. In: PAIVA, P.D. O; ALMEIDA, E.F.A. **Produção de Flores de Corte**. Lavras: Ed. UFLA, 2014. v. II. p.606-708.

CEVALLOS, J.C.; REID, M.S. Effect of dry and wet storage at different temperatures on vase life of cut flowers. **HortTechnology**, v.11, p.199-202, 2001.

DELIZA, R.; CASTRICINI, A.; CONEGLIAN, R.C.C.; POLIDORO, J.C. Determinação da taxa respiratória de mamão 'Golden' 2008 (**Comunicado Técnico 132** - Embrapa Agroindústria de Alimentos - RJ).

FERREIRA, D.F. SISVAR: um programa para análises e ensino de estatística. **Revista Symposium**, v.6, p.36-41, 2008.

FINGER, F.L.; BARBOSA, J.G.; GROSSI, J.A.S.; MORAES, P.J.D. Colheita, classificação e armazenamento de inflorescências de crisântemos. In: BARBOSA, J.G. **Crisântemos.** Viçosa: Aprenda Fácil. 2003. p.123-140.

FINGER, F.L.; BARBOSA, J.G.; GROSSI, J.A.S.; MORAES, P.J.D. Colheita, classificação e armazenamento de inflorescências de crisântemos. In: BARBOSA, J.G. **Crisântemos.** Viçosa: Aprenda Fácil. 2003. p.123-140.

FINGER, F.L.; SANTOS, V.R.; BARBOSA, J.G.; BARROS, R.S. Influência da temperatura na respiração, produção de etileno e longevidade de inflorescências de esporinha. **Bragantia**, v.65, n.3, p.363-368, 2006. DOI: < http://dx.doi.org/10.1590/S0006-87052006000300001>

LIMA JÚNIOR, J.C.L.; NAKATANI, J.K.; MONACO NETO, L.C.; VAZ DE LIMA, L.A.C.; KALAKI, R.B.; CAMARGO, R.B.C. In: NEVEZ, M.F.; PINTO, M.J.A. **Mapeamento e Quantificação da Cadeia de Flores e Plantas Ornamentais do Brasil**. São Paulo: OCESP, 2015. 122p.

NOWAK J; RUDNICKI, R.M. 1990. **Postharvest handling and storage of cut flowers, florist greens, and potted plants**. Portland: Timber, 210p.

PIETRO, J.; MATTIUZ, B.; MATTIUZ, C.F.M. Influência do 1-MCP na conservação pós-colheita de rosas cv. Vega. **Ciência e Agrotecnologia**, v.34, n.5, p.1176-1183, 2010. DOI: < http://dx.doi.org/10.1590/S1413-70542010000500014>

PIETRO, J.; MATTIUZ, B.; MATTIUZ, C.F.M.; RODRIGUES, T.J.D. Qualidade de rosas de corte tratadas com produtos naturais. **Ciência Rural**, v.42, n.10, p.1781-1788, 2012. DOI: <http://dx.doi.org/10.1590/S0103-84782012005000071>

SEBRAE. Flores e plantas ornamentais do Brasil – Serie estudos mercadológicos p.28. Volume 1. 2015, Disponível em: <http://www.sebraemercados.com.br/estudo-de-mercado-flores-e-plantas-ornamentais-floricultura>. Acesso em 31 de março de 2016.\

VAN DOORN, W.G.; WOLTERING, E.J. Physiology and molecular biology of petal senescence. **Journal of Experimental Botany**, v.59, n.3, p.453-480, 2008. DOI: <http://dx.doi.org/10.1093/jxb/erm356>\