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Extending vase Life of Rosa (Cv. 'Sensiro') cut Flowers with Nitric oxide

Seyyedeh Farahnaz Talebi[1], Syyed Najmaddin Mortazavi[2], Yavar Sharafi[3]

1- P.h.D Student Horticultural Science, University of Shiraz, Shiraz, Iran.
2- Department of Horticultural Science, University of Zanjan, Zanjan, Iran.
3- Department of Horticultural Science, Shahed University, Tehran, Iran.

***Corresponding author:** Seyyedeh Farahnaz Talebi

Abstract

Nitric oxide (NO*) have been shown to extend the postharvest life of a range of flowers. In the present work, we have evaluated the effect of sodium nitroprusside (SNP), as nitric oxide donor on vase life, flower diameter, relative water content and electro leakage (EL) during postharvest of cut ros flowers. Flowers were treated for 24-h at 0, 20, 40, 60 µmol L^{-1} SNP and then hold in the solution include 8- HQS at 300ppm combination with 1% sucrose. Results showed that treatment cut flower with 40 µM L^{-1} SNP increased water relative content, flower diameter and vase life. Also the results showed that the concentration of 40 µmole L^{-1} SNP the greatest effect on the reduce of electro leakage.

Keyword: nitric oxide, Postharvest, Rose, vase life.

Introduction

Rose (*Rosa hybirida*), of the family of Rosaceae, Rose cut flowers is important in agricultural industry and most people like this flowers. Vase life of cut rose flowers is usually short. Cut flowers wilt, floral axis becomes bent (bent-neck) just below the flower head and Leaf yellowing (Elgimabi and Ahmed, 2009). NO plays an important role as signal molecule in plant growth and development (Corpas *et al*., 2004). Nitric oxide can act as a signaling molecule with multiple functions in plants (Delledonne 2005). It was first characterized in plants in 1996 (Lesham and Haramaty 1996) and subsequent investigations have linked its occurrence to a range of physiological processes including modulation of ethylene (Lesham and Pinchasov 2000), in regulation of plant maturation and senescence (Guo and Crawford 2005), anthocyanin biosynthesis (Laxalt *et al*. 1997), fruit and flower formation (Lamattina *et al*. 2001). NO is also involved in plant cell senescence (Lamattina *et al*. 2001). Some researches have been shown that application of NO to be effective in extending the postharvest life of a range of flowers when used as a short term fumigation treatment at low concentration (Wills *et al*. 2000). NO has been shown to inhibited ethylene synthesis in plants (Leshem and Wills., 1998), and suggested that NO acts as a natural senescence delaying plant growth regulator primarily by regulating ethylene production. NO donors have also been shown to protect a variety of cut flowers from ethylene and increased the vaselife (Badiyan *et al*., 2004). Leshem and Haramaty (1996) found that application of a NO donor to pea leaves under senescence-promoting conditions inhibited ethylene production. Application of NO treatment extended the postharvest life of fresh horticultural produce (Soegiarto & Wills, 2004). For plant postharvest physiology, Leshem and Wills (1998) has found that exogenous NO could significantly extend the shelf life of some leaf vegetables, flowers and fruits by inhibiting the emanation of ethylene, NO might take important roles in regulating senescence process. The senescence of flower petals is connected with a series of highly regulated physiological and biochemical processes (Mayak *et al*., 1983). These include breakage of water balance, an increase in hydrolytic enzyme activity, degradation of macro molecules, increased respiration rate and loss of membrane unity and cellular compartmentation. Each postharvest physiological or handling step has a potential to either maintain or reduce the quality of fresh cut flowers (Goliáˇs and Kobza, 2003). Therefore, vase life mainly depends on development of harmful water relations, which results in a lack of flower opening, premature petal wilting and bending of the pedicel (Yamada *et al*., 2007). Some research suggesting that NO acts as an important role in raiseing the ability of water absorption and decreasing water loss during postharvest. Jasid *et al* (2009) found that rejuvenated cotyledons exhibited a lower electrolyte leakage than control cotyledons when treated with nitric oxide. Degradation of cellular structures such as membranes, caused by senescence related oxidative stress (Prochazkova *et al*, 2001). NO as an antioxidant cause and it is able to scavenge ROS, also, as a signaling molecule leading to alterations of antioxidative gene expression and thus protects plant cells from oxidative damage (Arasimowicz and Floryszak-Wieczorek, 2007). The aim of this work was to study the effect of SNP on rose cut flowers during postharvest.

Materials and Methods

Plant material and treatments

Rosa flowers (*Rosa hybrida* cv. 'Sensiro') were picked from shrub growing in commercial greenhouses, Pakdasht, in the fall of 2011 at a bending sepal stage. They were selected for uniformity of size and freedom from defects and mechanical damage. The cut flowers were then transported to the laboratory in University of Zanjan and used for experiment. The flower stems were cutted to 45 cm, and all leaves except for the upper three were removed. Three cut flowers were placed in each of 400 ml beakers, including treatments. The cut flowers were maintained at 18±2°C with natural photoperiods. Flower stems were given pulsing treatment for 24 h with sodium nitroprusside (SNP), a nitric oxide donor with concentrations of 0, 20, 40 and 60 M.L-After pulsing, flower stems were immediately transferred into the beakers with 400 ppm 8-HQS and 1% sucrose. Treatments were arranged in a completely randomized design with 3 replications and analyzed using MSTAT-C. The means were compared by Duncan's multiple range test at P≤0.05 and P≤0.01.

Measurement of Flower longevity

Longevity trait was measured by utilization of submitted method, and by attention to traits such: flower wilting, flower color change, petals number opening, bending of flower neck and flowers freshness that are due to flowers without senescence and measured on base of percent (%) (Fernando *et al*., 1999).

Measurement of water relative content

Water relative content on base of percent (%) was measured with submitted method by Lisi *et al*., (2004).

$$RWC = \frac{Fw - Dw}{Tw - Dw} \times 100$$

Fw =fresh weight , *Dw* =dry weight, *Tw* = saturate weight

Measurement of flower diameter

Flower bud diameters were measured daily with Vernier Caliper (cm) and maximum flower diameter was used to evaluate the bud size difference between the treatments. The maximum diameter of the flower buds was recorded by using the rating scale of Capdeville *et al*. (2005).

Measurement of electro leakage

Water relative content on base of percent (%) with submitted method by Lim *et al* (1998).

$$El = \frac{EC_2 - EC_1}{EC_2} \times 100$$

Result and Discussion

SNP effects on flower longevity

Pulse treatments with solutions containing SNP slightly delayed the flower senescence of cut rose flowers compared to controls and slightly increased the vase life ($P < 0.01$). The highest vase life was observed at 40 µM L^{-1} SNP-treated, while vase life at the 20 µM L^{-1} SNP and control reduced but between this two treatments doesn't show significant difference(Fig.1).

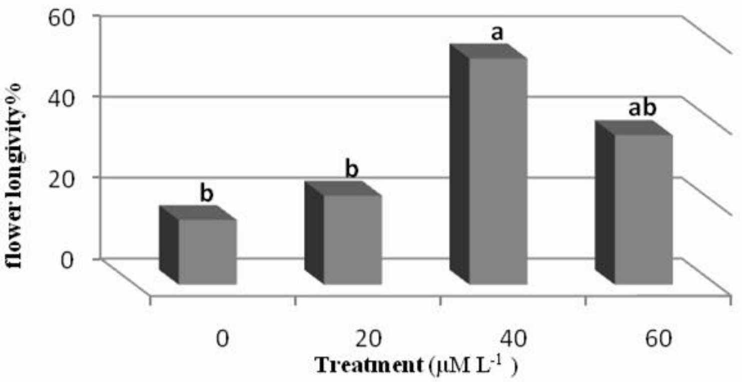

Fig. 1. Effect of sodium nitroprusside on flower longivity% in Rose flower during postharvest.

Fumigation with NO has been found to extend the postharvest life of carnation flower Compared with untreated flowers (Bowyer *et al.* 2003). NO might inhibit ethylene biosynthesis throught take down ACO activity by inhibition of ACC transport (Eum and *Lee*, 2007). Reported that fumigated kiwifruit, peach and strawberry with NO, inhibited of ethylene biosynthesis (Zhu et al., 2006; Zhu and Zhou, 2007; Flores et al., 2008). These effects are similar to the observations of (Leshem & Wills 1998).

SNP effects on water relative content

The results show that SNP treatments had significantly effeciency ($P \leq 0.05$)on relative water content. Treatment cut flowers with 40 µM L^{-1} increased relative water content, in this factor, SNP at low concentration(40 µM L^{-1} SNP), reduced relative water content in cut flowers (Fig2). Use of exogenous NO decrease the rate of water loss and enhanced the postharvest life in different horticultural produce, NO play important role in enhancing the ability of water absorption and decreasing water loss during the postharvest of horticultural produce (Ku *et al.* 2000). Vase life mainly depends on preservation of water relations, which results in a lack of flower opening, premature petal wilting and bending of the pedicel (Yamada *et al*., 2007). Wills and Bowyer (2003) founded that to low concentrations of nitric oxide in an inert atmosphere, extend the postharvest life of fruits, vegetables and cut flowers, at the effective concentration range in the low µL/L, nitric oxide was much less reactive with oxygen that expected and allows the use of nitric oxide as a fumigation in air. Maybe SNP fumigated vase solution and inhibited growth bacterial, enhanced water absorption and relative water content .In this experiment height concentration of SNP increase relative water content compared with low concentration. This result is similar to the observations of (Ku *et al.* 2000).

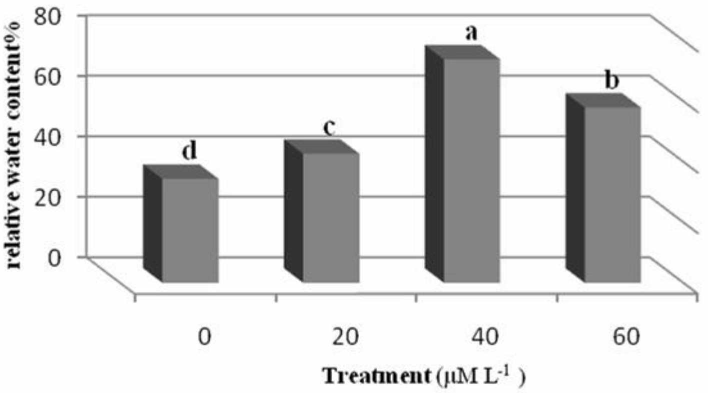

Fig. 2. Effect of sodium nitroprusside on relative water content% in Rose flower during postharvest.

SNP effects on flower diameter

Use of SNP had significant effect on the flower diameter ($P \leq 0.05$). Changes in flower diameter in the control and the SNP-treated cut flowers are shown in Fig. 3. When the flowers treated with 40 µM L^{-1} SNP increased flower diameter, that not significant effect with 60 µM L^{-1}. The Minimum flower diameter was observed at the 20 µM L^{-1} SNP and control but between this two treatments doesn’t show significant difference. In thise experiment, treatment cut flower with different concentrations of SNP had effected on flower diameter. The SNP act as vase solution disinfectants and inhibited growth pathogen, followed by increasing water uptake and TSS(Singh et al., 2009 Lazar et al., 2008). Also, Changli and Chanyou(2011) found that treatment lilium cut flowers with SNP increased vase life and flower diameter, this maybe due to decrease ethylene production and preservation the cell metabolic activity.

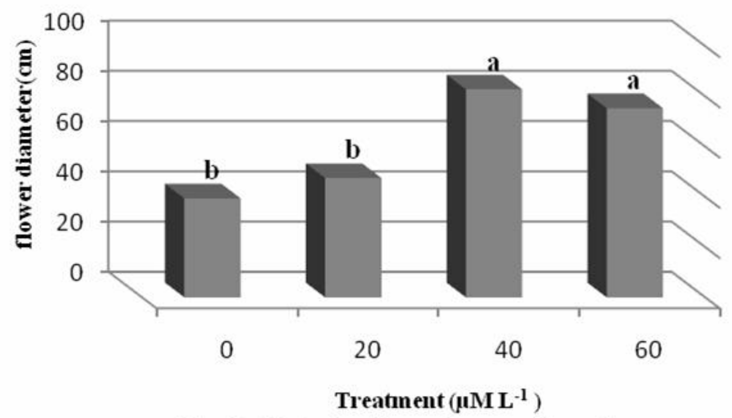

Fig. 3. Effect of sodium nitroprusside on flower diameter(cm) in Rose flower during postharvest.

SNP effects on eloctro leakage

This experiment use of 40 µM L^{-1} SNP had best affect on electro leakage and decrease cell damage, but treatment cut flower without SNP increased electro leakage that not significant difference with 20 µM L^{-1} SNP (Fig.4). NO reportedly protects membrane integrity by inhibiting lipid peroxidation, either through scavenging of lipid peroxyl radicals or inhibiting peroxidation enzymes (Hung and Kao., 2005). High concentretion of SNP increased electro leakage than to low concentretion, this result show that high concentretion not protected from member and led to damage it. Arasimowicz and Floryszak-Wieczorek (2007) show that NO as an antioxidant that able to scavenge ROS and protects plant cells from oxidative damage. This result agree with Zhang et al.,(2007) that found Nitric oxide reduces degradation of the cell membrane with degrease electrolyte leakage.

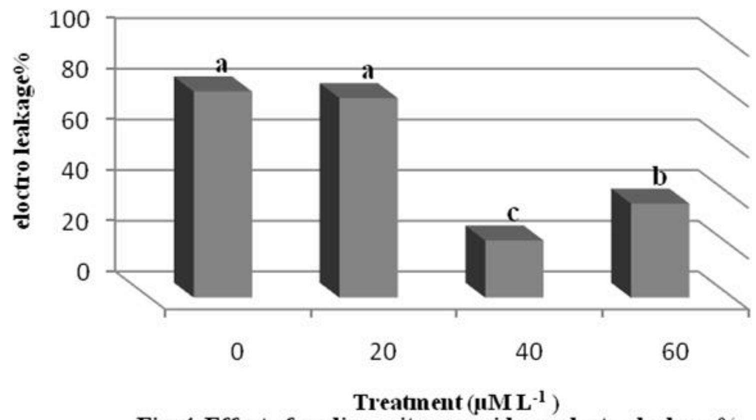

Fig. 4. Effect of sodium nitroprusside on electro leakage% in Rose flower during postharvest.

Conclusion

Finally, it was concluded that treatment with NO effected on flower longevity, water relative content, flower diameter and electro leakage. It was observed that, treating with NO at a 40 Mol.L^{-1} concentration of SNP had the best effect on characters. In this research, high concentration of SNP is toxin for flowers. It was suggested that NO increased flower longevity from decrease ethylene production and reduces degradation of the cell membrane.

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