Effects of Harvesting Stages, 8-Hydroxyquinoline Citrate, Silver Thiosulphate, Silver Nitrate on the Postharvest Life of Cut *Narcissus tazetta*

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Abstract

***Narcissus tazetta* is one of the bulbous cut flowers native in the southern regions of Iran and extensively cultivated in Shiraz. Due to its beauty, delicate fragrance, and having several florets on one stem, it is superior to other *Narcissus*-species for Iranian consumers. Experiments were performed in order to find the best harvesting stage and pulse treatment. The harvesting stages were: pencil stage, goose-neck stage, one floret open stage, and majority of florets open stage. The pulsing treatments were carried out in silver thiosulphate (0.2, 0.4 and 0.6 mM), silver nitrate (25, 50 and 75 mg l^{-1}), 8-hydroxyquinoline citrate (150, 300 and 450 mg l^{-1}), and tap water as control. The best harvesting stage was the one floret open stage, followed by the goose-neck stage. The shortest vase life belonged to the tap water and the 8-hydroxyquinoline citrate treatments. The silver nitrate and silver thiosulphate treatments increased the vase life significantly, and that of silver thiosulphate improved the appearance of dehydrated florets in the cluster and also prevented the browning reactions. The interaction of harvesting stages and pulsing treatments showed the beneficial effect of ethylene antagonist pulsing in all harvesting stages. The best treatment was the silver thiosulphate pulsing of the one floret open stage.**

INTRODUCTION

'Shiraz' Narcissus (*Narcissus tazetta* L.), a member of the Amarilidaceae family, is a perennial bulbous plant (Anonymous, 2002) native in the southern regions of Iran and most extensively in Shiraz (Anonymous, 2002). Due to its beauty, delicate fragrance, and having a multi-floret flowerhead it is superior to other *Narcissus* species.

Previous studies show the beneficial effects of ethylene antagonist treatments (Doss, 1986; Goszczynska et al., 1989; Piskornik, 1985; Piskornik and Piskornik, 1980) and the goose-neck harvesting stage as the best harvesting stage (De Hertogh, 1989; Goszczynska et al., 1989, Nicols and Tompsett, 1972; Wallis, 1966) for the one- flowered species, leaving a lack of research on the multifloret *tazetta* species. This experiment was conducted to find the best harvesting stage and pulse treatment for cut *Narcissus tazetta*.

MATERIALS AND METHODS

'Shiraz' Narcissus cut flowers were harvested at a) pencil stage, b) goose-neck stage, c) one floret open stage, d) majority of florets open stage (commercial harvesting stage) (Fig. 1) from a production field in Shiraz, Iran. The following pulse treatments were applied in darkness at ambient temperature: a) 0.2, 0.4 and 0.6 mM Silver thiosulphate (STS) with 2% sucrose, b) 25, 50 and 75 mg l^{-1}Silver nitrate ($AgNO_3$) with 2% sucrose, c) 150, 300 and 450 mg l^{-1} 8-Hydroxyquinoline citrate (8-HQC) with 2% sucrose, and d) tap water as control. The pulsing time for STS was 20 min and for 8-HQC and $AgNO_3$ it was 9 hrs. The vase life criterion was having at least two healthy and open florets. The conditions were: 180 lux light, 75 ± 5% relative humidity and the minimum and maximum temperature of 17±2ºC and 20±2ºC. A factorial experiment was conducted

at a completely randomized design, 8 replicates in each treatment. Data were analysed using SAS 6.12 software and means separated by Tukey's test at 1% level.

RESULTS

The opening of the first floret in pencil and goose-neck harvesting stages were respectively on the 3rd and 2nd days of the experiment. The best harvesting stages were: one floret open, goose-neck, pencil, and majority of florets open stage, respectively (Table1). None of the flowers harvested at the above stages showed any loss of quality. In pencil and goose-neck harvesting stages of $AgNO_3$ treatments, the first wilted floret appeared on the 7th and 8th day for the one floret open and majority of florets open stages (data not shown). Showing a significant difference with the other concentrations, 75 mg l^{-1} had the longest vase life in this group (Table 2). The interaction between pulse treatments and harvesting stages indicates that 75 mg l^{-1} $AgNO_3$ treatment of one floret open Narcissus is the best in this group (Table 3).

The first wilted floret of the STS group at the goose-neck and one floret open stages were seen on the 8th, pencil stage on the 9th and majority of florets open stage on the 7th day of the experiment (data not shown). The longest vase life of this group belonged to 0.6 mM concentration which did not have any significant difference when compared with the other treatments of this group. Besides the vase life increment, STS also caused an improvement of the appearance of florets after wilting, which was increased with the amount of STS. Wilted florets of the STS-treatment remained whiter and larger, while wilted florets of the controls shrivelled and became transparent. The harvesting stage and STS pulsing interaction show the least effect of STS at the majority of florets open and pencil stages and the strongest effect at the one floret open and goose-neck harvesting stages (Table 3). The best treatment of this experiment was 0.6 mM STS + 2% sucrose pulsing of one floret open cut *Narcissus tazetta* flowers (Table 3).

The first wilted floret of 8-HQC group at the goose-neck and majority of florets open stages were seen on the 7th, one floret open stage on the 8th and pencil stage on the 7th day of the experiment (data not shown). The longest vase life of this group which only lasted a day more than the control was the 150 mg l^{-1} 8-HQC (Table 2). The strongest and the weakest effect of this compound were in the one floret open and majority of florets open stages, respectively (Table 3).

Tap water which was used as control had the shortest vase life (Table 2). The first wilted florets in this treatment were seen on the 6th day in the pencil stage, on the 7th day in the goose-neck and majority of florets open stages and on the 8th day in the one floret open stage (data not shown). The goose-neck harvesting stage was the best stage for this treatment (Table 3).

DISCUSSION

Narcissus buds develop very quickly into open flowers even without water (Nicols and Tompsett, 1972) which results in reducing the keeping quality following dry handling and storage. The fast opening of the buds seems to remain the only barrier in the adoption of chemical pretreatments or even watering between picking and packing in one-flowered *Narcissus* species (Goszczynska et al., 1989; Nicols and Tompsett, 1972). But for 'Shiraz' *Narcissus tazetta* there is a 2 and 3 days delay in bud opening without reduction in quality which can be used for pretreatments and handling.

Although De Hertogh (1989) advised harvesting not earlier than goose-neck stage and Wallis (1966) at fat goose-neck stage, it is generally realized that the handling of cut narcissus at the bud stage is preferable, since it reduces the susceptibility of petals to mechanical damage and improves the flower quality (Nicols and Tompsett, 1972). The results of this research indicate the possibility of harvesting 'Shiraz' narcissus at the goose-neck and pencil stages (Table 1) with only 1 and 2 days vase life decrease. In contrast with the findings of Goszczynska et al. (1989), the results of this experiment also show that flowers harvested at pencil stage maintain the acceptable quality and longevity, which may improve economic marketing of cut 'Shiraz' Narcissus.

Boer and Hilhorst (1979) did not find any positive effect of commercially available floral preservatives on 'Carlton' Narcissus flowers. However, Goszcynska et al. (1989) improved the vase life of 'Carlton' flowers by one additional day, but he has stated that the effectiveness of applying chemical treatments is still controversial (1989). In the present research there was a significant increment in the vase life of 'Shiraz' Narcissus by the use of silver compounds. The same has been reported by Piskornik and Piskornik (1980). Although Nichols and Wallis (1976) reported that silver nitrate treatment with or without sucrose did not increase the keeping quality of fresh or stored cut daffodils, in our experiment silver nitrate increased the vase life by 3 days compared with the control. Goszcynska et al. (1989) also reported a one day increase by $AgNO_3$ + sucrose pulsing in 'Carlton' flowers.

Piskornik (1985) reported an increase of vase life when STS was used with sucrose, which confirms our findings on STS + sucrose pulsing. It may be concluded that the apparent improvement caused by STS on wilted florets may be due to the inhibition of browning reactions in the petals.

Although hydroxyquinoline has also been reported to have an ethylene inhibitory action besides the antimicrobial properties (Parups and Peterson, 1973; van Doorn, 1998; van Doorn and Peirik, 1990), there was only a 0.6 day increase in vase life by the use of this compound and a converse effect with an increment in its concentration. Goszcynska et al. (1989) also found a 0.6 day improvement in vase life by 8-HQC + sucrose pretreatments. This shows the ineffectiveness of this compound as an ethylene inhibitor.

According to our findings we advise the pulsing treatment of cut 'Shiraz' Narcissus (*Narcissus tazetta*) by STS + sucrose which uses less Ag^+ in the compound and is more effective than $AgNO_3$. We also recommend one floret open harvesting stage for local markets and goose-neck and pencil stage for shipment.

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Tables

Table 1. Effects of different pulse treatments on the vase life of cut *Narcissus tazetta* ('Shiraz' Narcissus).

Harvesting stages	Mean vase life (days)
Pencil stage[1]	9.0 c[2]
Goose-neck stage	9.4 b
One floret open	10.7a
Majority of florets open	8.3 d

[1] In the pencil and goose-neck harvesting stages vase life was counted after the opening of the first floret.
[2] Means followed with the same letters are not significantly different at 1% level of probability using Tukey's test.

Table 2. Effects of different pulse treatments on the vase life of cut *Narcissus tazetta* ('Shiraz' Narcissus).

Pulse treatments	Mean vase life (days)
Control (tap water)	7.2 d[1]
25 mg l^{-1} Silver nitrate +2%	9.4 c
50 mg l^{-1} Silver nitrate +2%	9.8 bc
75 mg l^{-1} Silver nitrate +2%	10.4 ab
0.2 mM Silver thiosulphate +2% sucrose	10.7 a
0.4 mM Silver thiosulphate +2% sucrose	10.7 a
0.6 mM Silver thiosulphate +2% sucrose	10.8 a
150 mg l^{-1} HQC +2% sucrose	7.8 d
300 mg l^{-1} HQC +2% sucrose	7.7 d
450 mg l^{-1} HQC +2% sucrose	7.4 d

[1] Means followed with the same letters are not significantly different at 1% level of probability using Tukey's test.

Table 3. The interaction between pulse treatments and harvesting stages on the vase life of cut *Narcissus tazetta* ('Shiraz' Narcissus).

Pulse treatments	Harvesting stages			
	Majority of florets open	One floret open	Goose-neck	Pencil
Control (tap water)	6.6 [1]lm	7.9 i-m	8.1 h-m	6.3 m
25 mg l^{-1} Silver nitrate +2% sucrose	7.6 j-m	10.0 b-h	10.1 b-g	9.5 c-j
50 mg l^{-1} Silver nitrate +2% sucrose	8.8 d-k	10.9 abc	10.3 a-f	10.0 b-h
75 mg l^{-1} Silver nitrate +2% sucrose	9.6 c-i	11.1 abc	10.6 a-d	10.5 a-e
0.2 mM Silver thiosulphate +2% sucrose	9.8 c-i	11.8 ab	10.5 a-e	10.3 a-f
0.4 mM Silver thiosulphate +2% sucrose	9.8 c-i	11.8 ab	10.9 abc	10.3 a-f
0.6 mM Silver thiosulphate +2% sucrose	10.0 b-h	12.1 a	11.1 abc	10.8 abc
150 mg l^{-1} HQC +2% sucrose	7.3 klm	8.6 e-k	8.0 i-m	7.6 j-m
300 mg l^{-1} HQC +2% sucrose	7.1 klm	8.4 f-l	7.9 i-m	7.4 klm
450 mg l^{-1} HQC +2% sucrose	6.9 klm	8.3 g-l	7.4 klm	7.3 klm

[1] Means followed with the same letters are not significantly different at 1% level of probability using Tukey's test.

Figures

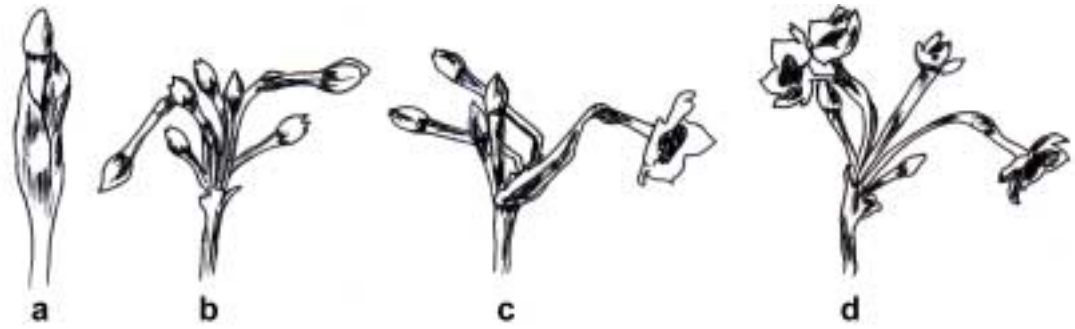

Fig. 1. Different harvesting stages, a) Pencil stage, b) Goose-neck stage, c) One floret open stage, d) Majority of florets open stage.