

Studies with thidiazuron on the vase life of cut rose flowers

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Abstract

Effects of postharvest-applied thidiazuron (TDZ) on the vase life of 7 rose cultivars (*Rosa hybrida* L.) were investigated. Cut rose flowers were pulse-treated with TDZ for 24 hours at 22 °C. Application of 20, 60 and 100 µM TDZ to 'Memoire' rose did not affect vase life when compared with the control (0 µM TDZ). Similarly, pulse treatments with 10 µM TDZ did not affect the vase life of cvs. 'Champagne', 'Laser', 'Magnum', 'Neon' and 'Tresor 2000' roses compared with their untreated controls, but did increase the vase life of 'First Red' by 2 days (+11.5 %). Lateral shoot development was a common side effect of TDZ treatment.

Key words: Postharvest, thidiazuron, vase life, *Rosa hybrida*, lateral shoot, pulse treatment, cut flower, longevity

Introduction

Rosa hybrida is among the most commercially important flowers, with an annual value of \$10 billion (Guterman *et al.*, 2002). Roses are used as cut flowers, flowering pot plants and garden plants. The vase life of cut rose flowers is relatively short (Huang *et al.*, 2002; Marisen and Benninga, 2001), and thus, postharvest technologies for improving the keeping quality of roses are sought and applied.

Increase in the postharvest life of cut flowers following cytokinin treatments has been reported (Hicklenton, 1991; Lukaszewska *et al.*, 1994; Paull and Chantrachit, 2001). Bosse and Van Staden (1989) reported that DHZ (dihydrozeatin), used as a pulse treatment for 6-24 hours at a concentration of 2×10^{-4} M, significantly delayed carnation flower senescence. An increase in the longevity of carnation flowers by 15 days was found at 4×10^{-6} M DHZ. Lukaszewska *et al.* (1994) showed that exogenous application of trans-zeatin, trans-zeatin riboside, 2iP (isopentenyladenine) and 2iPA (isopentenyladenosine) in holding solutions delayed rose senescence by 1.3-1.6-fold. Their data also showed that zeatin and zeatin riboside were most effective on roses at 1×10^{-7} M and prolonged longevity by 1.3-fold.

Thidiazuron (N-phenyl-N-1, 2, 3-thidiazol-5-ylurea) is a urea-type cytokinin that is a relatively novel compound for treating cut flowers. It is more commonly used at high concentration as a cotton defoliant (Malik *et al.*, 2002) and at low concentration for regeneration in tissue culture (Singh and Syamal, 2001). TDZ is around 50-100 times more active in inducing cytokinin-like effects than common cytokinins (Genkov and Iordanka, 1995). Treatments with TDZ delayed leaf yellowing in cut *Alstroemeria* (Ferrante *et al.*, 2002), and was most effective at 10 µM as a pulse treatment or at 1 µM as a continuous (vase) treatment. TDZ treatments of less than 50 µM also reduced flower shedding and induced additional flower buds during vase life of cut phlox inflorescences (Sankhla *et al.*, 2003). TDZ treatment of cut chrysanthemum and tulip inhibited leaf yellowing but did not enhance flower quality (Ferrante *et al.*, 2003).

The present experimentation was conducted to determine the effects of TDZ on the vase lives of seven cut rose cultivars.

Materials and methods

Rose flower stems were harvested from greenhouses at the tight bud stage and trimmed to 40 cm length and 3 leaves. Postharvest experiments were carried out under vase life evaluation room conditions of 22 ± 1 °C, 60-70 % relative humidity and 12 h photoperiod with $15 \mu\text{mol m}^{-2}\text{s}^{-1}$ irradiance from cool white fluorescent lamps. The 'Memoire' rose cultivar for experiment 1 was harvested in December 2003 from near Tehran, Iran. For experiment 2, 'Champagne', 'Neon', 'Tresor 2000', 'Laser' and 'Magnum' cultivars were harvested in February 2004 from near Brisbane, Australia. 'First Red' roses for experiment 3 (May 2004) were harvested from a different grower near Brisbane.

Vase life was recorded as the time in days after harvest (day 0) that flowers reached the end of their longevity due to bent neck or advanced signs of fading on all petals (Mayak and Halevy, 1974; Liao *et al.*, 2000).

Experiment 1: TDZ (Sigma Chemical Co.) was dissolved in 2 mL aliquots of 1M KOH, made up with distilled water to concentrations of 0, 20, 60, and 100 µM and neutralized with 2 mL 1M HCL (Ferrante *et al.*, 2002). Cut 'Memoire' flowers (white) were then pulse-treated for 24 h at 20°C. Distilled water was the control pulse treatment. The post-pulse treatment vase solution was 200 mg L⁻¹ HQS (hydroxyquinoline sulphate) in distilled water (Liao *et al.*, 2000). Flower vase life was assessed daily and recorded for each of 7 single bloom replicates per treatment. A completely randomised design was adopted. Data were analyzed by one way ANOVA with Minitab Release 13.1 for Windows (Minitab Inc.).

Experiment 2: 'Champagne' (white), 'Neon' (deep pink), 'Laser' (pink), 'Tresor 2000' (yellow) and 'Magnum' (red) were pulsed with 10 µM TDZ for 24 h at 22°C. Distilled water was the control pulse treatment. The post-pulse treatment vase solution was distilled water containing 10 µL L⁻¹ available chlorine supplied



Fig. 1. Lateral shoot development (arrowed) during vase life in cut 'Memoire' (left photograph) and 'First Red' (right photograph) roses pulse-treated with $10 \mu\text{L L}^{-1}$ TDZ.

as dichloroisocyanuric acid (DICA) (Joyce *et al.*, 2000) Vase life was assessed daily. Each replicate was 5 individual stems of each cultivar for control and TDZ treatments. A completely randomised design was adopted, and t-tests (Minitab Release 13.1) were used for data analysis for each cultivar.

Experiment 3: 'First Red' roses were treated with $10 \mu\text{M}$ TDZ, 4% w/v sucrose and both in combination as pulses for 24 h at 22°C . Distilled water was the control pulse treatment. Vase life was assessed daily. Ten replicated stems were used for each treatment. A completely randomised design was adopted, and data were analysed by ANOVA using SAS procedures (SAS Institute 1998). The least significant difference ($P = 0.05$) was calculated to allow comparisons among treatment means.

Results and discussion

Pulse-treatment with TDZ at concentrations of 0, 20, 60 and $100 \mu\text{M}$ did not differentially affect the vase life of cut 'Memoire' rose. The mean ($\pm\text{SD}$) vaselife was 14.6 ± 0.25 days. A side-effect of TDZ treatments was enhanced lateral shoot development (Fig. 1). Pulse-treatment with TDZ at $10 \mu\text{M}$ did not affect the vase lives of 'Champagne' (18 ± 1.4 days), 'Laser' (16 ± 1.3 days), 'Magnum' (19 ± 0.7 days), 'Neon' (18 ± 0.3 days) and 'Tresor 2000' (16 ± 0.3 days). As observed with cv. 'Memoire', lateral shoot development on TDZ-treated stems was observed for these 5 cultivars.

Pulse-treatment of 'First Red' roses with $10 \mu\text{M}$ TDZ did increase the vase life by 1.5 days (Fig. 1), and also encouraged lateral shoot development as in 'Memoire' (Fig. 1). Pulse-treatment with 4% (w/v) sucrose also increased flower vase life by 1 day. TDZ pulsing in combination with sugar pulsing had a synergistic effect on vase life (Fig. 2).

Paull and Chantrachit (2001) reported that different cultivars of anthurium had different vase life responses to benzyladenine treatment. The responses ranged from a 20% reduction to a 2.5-fold increase in vase life. A lack of response to benzyladenine may have been due to high natural cytokinin levels. Perhaps in cultivars with naturally low levels of cytokinin, TDZ treatment might increase vase life. Further experimentation is required to examine this proposition for cut roses.

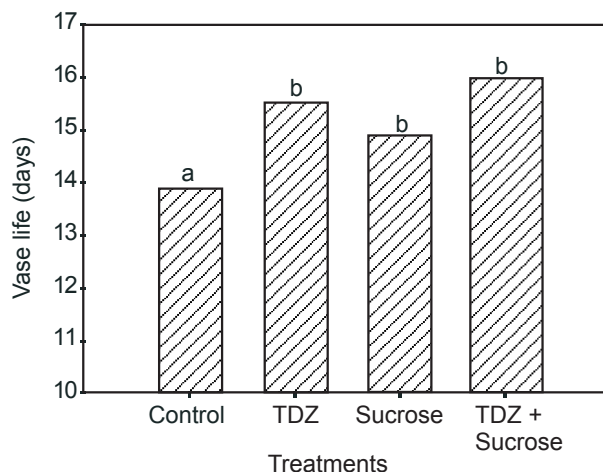


Fig. 2. Effect of TDZ ($10 \mu\text{M}$), sucrose (4% w/v), and TDZ plus sucrose in combination (all applied as pulse-treatments) on the vase life of 'First Red' rose. Bars topped with the same letter are not significantly different ($P < 0.05$).

In summary, TDZ pulse-treatments had no effect on vase life of several cut roses, but did increase the vase life of cv. 'First Red', one of the more commercially important cut rose cultivars. As a consistent side effect, TDZ treatments promoted shoot development from lateral vegetative stem buds.

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