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LONGEVITY OF *SEDUM SPECTABILE* BOREAU CUT FLOWERING SHOOTS DEPENDING ON POSTHARVEST TREATMENT

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Abstract

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In the conducted experiment postharvest longevity of cut flowering shoots of *Sedum spectabile* was assessed after 24-hour conditioning in aqueous solution of 8-hydroxyquinolinium sulphate at the concentration of 200 mg dm^{-3} and subsequently stored in either water or in gibberellic acid solutions at the concentration of 50 or 100 mg dm^{-3}, and also in solutions of 8-hydroxyquinolinium sulphate with or without the addition of 2% or 5% of sucrose. Both conditioning in 8HQS and storing flowering shoots in 8HQS with or without sucrose had an unfavourable effect onto their postharvest longevity. The highest longevity was observed in unconditioned shoots stored in gibberellic acid solution at the concentration of 100 mg dm^{-3}. The application of 8HQS to conditioning as well as storage in GA_3 or 8HQS with or without the addition of sucrose had a favourable effect onto SPAD.

Key words: postharvest longevity, 8HQS, GA_3, *Sedum spectabile*, vase life

Abbreviations: 8HQS – 8 – hydroxyquinoline sulfate; GA_3 – gibberellic acid; SPAD – Soil Plant Analyses Development

Introduction

A wide range of cut flowers is presently available for sale. However, the demand for new species suitable for cut flower production is constantly growing. Obtaining cut flowers directly from the field with no further costs of cultivating under covers is especially important.

Sedum spectabile Boreau is a perennial plant flowering in the field in August and September. Its light pink flowers are gathered in magnificent inflorescences and large oval light green leaves make an additional decorative element.

This species is recommended as cut flower. However, there is no information on its postharvest longevity in the available literature.

The purpose of the conducted experiment was to determine the postharvest longevity of this species and finding whether the most commonly used chemical substances influence its postharvest longevity.

Materials and Methods

The experiment was conducted in the period of 11 August - 14 September 2011 at the Department of Ornamental Plants of the University of Life Science in Poznań. Flowering shoots of *Sedum spectabile* were cut when 1/3 of the flowers in the inflorescence were blooming. The shoots were obtained from an opened field culture and were 34-38 cm long.

Half of the shoots were conditioned for 24 hours by placing their bases up to 10 cm in aqueous solution of **8-**hydroxyquinolinium sulphate (8HQS) at the concentration of 200 mg dm^{-3}. Both conditioned and non-conditioned shoots were placed either in water or in solutions of gibberellic acid (GA_3) at the concentration of 50 or 100 mg dm^{-3}, and also in a solution of **8-**hydroxyquinolinium sulphate (8HQS) at the concentration of 200 mg dm^{-3}. Some shoots were placed in the solution of **8-**hydroxyquinolinium sulphate with the addition of 2% or 5% of sucrose. The source of gibberellic acid was Gibrescol

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10 MG with the active substance content of 10%. The control group constituted non-conditioned shoots stored in water.

The experiment comprised twelve combinations consisting of nine shoots each. The replication was one flowering shoot. The experiment was conducted in the room at the temperature of 23 ± 1°C. The length of the ornamental value of the shoots expressed in days was assessed. The shoots were removed when over 2/3 of the flowers in the inflorescence withered. SPAD was measured every seven days by means of YARA N – tester apparatus. The first measurement was taken on the day when the experiment was commenced. The measurement was taken on the third leaf from the base of the inflorescence. After finishing the experiment the percentage change in the shoot fresh matter and also the change in the ratio of the shoot length to the weight and the primary length were calculated.

The results were analysed statistically by means of two-factor analysis of variance with the use of Statistica software and the means were grouped with the use of Duncan test at the significance level of $\alpha = 0,05$.

Results

Sedum spectabile postharvest longevity was between 18 and 30 days (Table 1). Both conditioning and postharvest treatment with chemical agents influenced the postharvest longevity of the species. Conditioning the shoot bases in the aqueous solution of 8-hydroxyquinolinium sulphate at the concentration of 200 mg dm^{-3} shortened the period of ornamental value of the shoots. The most favourable effect was obtained while storing the shoots in gibberellic acid at the concentration of 100 mg dm^{-3}. Storing the *Sedum spectabile* shoots in 8HQS with the addition of sucrose, on the other hand, resulted in the fastest loss of the ornamental value of the flowering shoots.

The interdependences of the experiment factors exhibited the highest longevity of the conditioned shoots and those which were not conditioned but stored in the gibberellic acid solution at the concentration of 100 mg dm^{-3}. The change in flowering shoots weight was solely dependent upon the way in which they were stored (Table 2). The smallest weight loss was observed in shoots stored in water. The greatest weight loss was in shoots stored in 8HQS with addition of 5% of sucrose. The non-conditioned shoots stored in water gained in weight significantly.

The change in shoot length was neither dependent on the way of conditioning nor on the storage (Table 3). The length of shoots did not change. The index of leaves greenness changed during the experiment (Figure 1). The index of leaves greenness of *Sedum spectabile* measured after seven days for non-conditioned shoots stored in water and in GA_3 at the concentration of 50 mg dm^{-3}, and conditioned shoots stored in 8HQS with addition of 2% and 5% of sucrose was relatively lower when

Table 1
Postharvest longevity of cut inflorescence shoots of *Sedum spectabile* (days)

	Holding solution						
Conditioning	Water	GA_3 50 mg·dm^{-3}	GA_3 100 mg·dm^{-3}	8HQS*	8HQS* +2% S**	8HQS* +5% S**	Mean
Water	23.11 cd	25.56 de	30.11 f	22.67 cd	18.56 a	20.56 abc	23.43 b
8HQS*	25 de	21.67 bc	27.56 ef	20.56 abc	19.22 ab	18.78 ab	22.13 a
Mean	24.06 c	23.61 c	28.83 d	21.61 b	18.89 a	19.67 a	

*8HQS at the concentration of 200 mg dm^{-3}
** S is sucrose
Mean values marked with the same letter do not differ at the significance level α=0,05 according to the Duncan's test.

Table 2
Weight change of cut inflorescence shoots of *Sedum spectabile* (%)

	Holding solution						
Conditioning	Water	GA_3 50 mg·dm^{-3}	GA_3 100 mg·dm^{-3}	8HQS*	8HQS* +2% S**	8HQS* +5% S**	Mean
Water	11.33 e	-18.39 bc	-13.81 cd	-18.46 bc	-26.67 a	-21.41 abc	-14.57 a
8HQS*	-15.36 bcd	-15.62 bcd	-14.56 bcd	-16.57 bcd	-9.4 d	-22.75 ab	-15.7 a
Mean	-2.01 c	-16.98 ab	-14.19 b	-17.52 ab	-18.03 ab	-22.06 a	

*8HQS at the concentration of 200 mg·dm^{-3}
** S is sucrose
Mean values marked with the same letter do not differ at the significance level α=0,05 according to the Duncan's test.

Table 3
The increase in length of cut inflorescence shoots of *Sedum spectabile* (%)

Holding solution							
Conditioning	Water	GA_3 50 mg·dm^{-3}	GA_3 100 mg·dm^{-3}	8HQS*	8HQS* +2% S**	8HQS* +5% S**	Mean
Water	12:00 AM	0.32 a	1.21 ab	0.62 ab	1.24 ab	1.25 ab	0.77 a
8HQS*	1.1 ab	1.07 ab	1.89 b	1.41 ab	12:00 AM	0.63 ab	1.02 a
Mean	0.55 a	0.7 a	1.55 a	1.02 a	0.62 a	0.94 a	

*8HQS at the concentration of 200 mg·dm^{-3}
** S is sucrose
Mean values marked with the same letter do not differ at the significance level α=0,05 according to the Duncan's test.

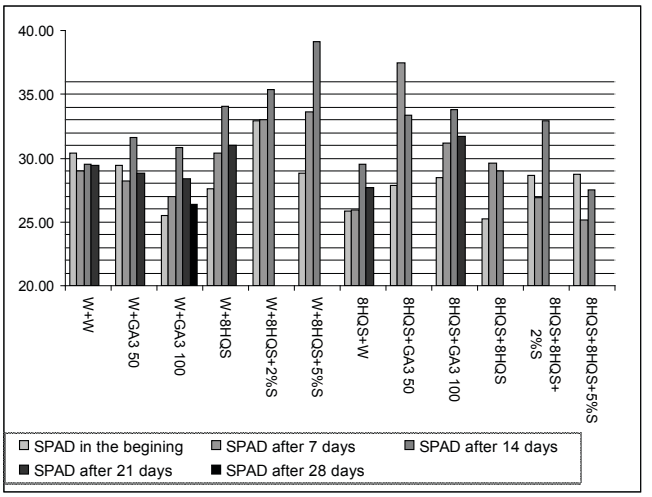

Fig. 1. Effect of index of leaf greenness (SDAP) on post harvest treatment *Sedum spectabile*
GA_3 50 is gibberellic acid at the concentration of 50 mg dm^{-3}
GA_3 100 is gibberellic acid at the concentration of 100 mg dm^{-3}
S is sucrose; W is wather
8HQS at the concentration of 200 mg dm^{-3}

compared to the first measurement taken. The index of leaves greenness determined after fourteen days (the third measurement) was higher when compared to the one taken after seven days in all combinations with the exception of the conditioned shoots which were stored in gibberellic acid at the concentration of 50 mg dm^{-3} and those stored in 8-hydroxyquinolinium sulphate. The values of the index of leaves greenness after twenty-one days of the experiment (the fourth measurement) were lower when compared with the third measurement. Due to the longevity period the fifth measurement (after twenty-eight days) was taken only for the non-conditioned shoots stored in gibberellic acid at the concentration of 100 mg dm^{-3}. The SPAD value continued to diminish and was lower when compared to the fourth measurement.

Discussion

The postharvest longevity of *Sedum spectabile* is comparable with this of other cut flowers, such as, for example *Chrysanthemum grandiflorum* (Ramat.) Kitam., *Limonium sinuatum* (L.) Mill. (Sacalis, 1998).

Conditioning the *Sedum spectabile* shoots in aqueous solution of 8-hydroxyquinolinium sulphate similarly as in the case of *Arum italicum* Mill. (Janowska and Schroeter – Zakrzewska, 2008) exhibited a negative effect onto the postharvest longevity. However, Ferrante et al. (2004) and Hettiarachchi and Balas (2005) observed no influence of 8HQS conditioning onto the postharvest longevity of *Matthiola incana* (L.) R. Br. and *Kniphofia uvaria* (L.) Oken. Cut shoots of *Hypericum* x *inodorum* Mill (Janowska and Śmigielska, 2010) and of *Allium* L. (Krzymińska, 2009) reacted in a favourable way to conditioning in the aqueous solution of 8-hydroxyquinolinium sulphate.

The conducted experiment proved that storing the shoots in different chemical solutions influences their postharvest longevity. Gibberellic acid applied in higher concentrations prolonged the period of their decorative value. Gibberellic acid applied in *Narcissus* L. (Goszczyńska et al., 1989), *Matthiola incana* (Ferrante et al., 2004), *Zantedeschia elliottiana* (W. Watson) Engl. (Janowska and Jerzy, 2004), *Curcuma alismatifolia* Gagnep. (Kjonboon and Kanlaanarat, 2005) and *Allium* (Krzymińska, 2009) had also a favourable effect. Storing cut shoots of *Sedum spectabile* in 8-hydroxyquinolinium sulphate both with and without the addition of sucrose had a negative effect onto the period of their decorative value. Similar results were obtained by Janowska and Jerzy (2003) when examining the leaf longevity of *Zantedeschia elliottiana*. Janowska and Stanecka (2011) claim that storing the flowers of *Zantedeschia* 'Albomaculata' in 8HQS with the addition of 2% of sucrose prolongs the postharvest longevity. Hassan and Schmidt (2004), on the other hand, have the opposite opinion. Storing the shoots of *Dianthus caryophyllus* in 8HQS resulted in prolonging their ornamental value period. Also the addition of sucrose had a favourable effect onto their postharvest longevity.

Conditioning the shoots of *Sedum spectabile* did not influence their weight change, however, the research into *Arum italicum* proved that conditioning in HQS results in higher weight loss. Storing both in GA_3 and in 8HQS resulted in a higher percentage weight loss in the shoots of *Sedum spectabile*. Janowska and Jerzy (2004) showed that the weight of *Zantedeschia elliottiana* 'Florex Gold' peduncles stored in gibberellic acid at the concentration of 50 mg dm^{-3} also decreased, however, in the case of the concentration of 100 mg dm^{-3} the weight of peduncles increased. In the case of the cultivar 'Black Magic' the peduncle weight increased regardless of the concentration of gibberellic acid. Hassan and Schmidt (2004) state that storing *Dianthus caryophyllus* in 8HQS results in the retardation of shoot fresh matter loss. Also Singh and Kumar (2008) proved that the addition of sucrose into the water during the storage results in the increase in the shoot weight of *Gladiolus* L.

Pisulewski et al. (1989) state that the application of gibberellic acid has a favourable effect onto the shoot length of *Tulipa* L. Janowska and Jerzy (2004) took the opposite view. While doing research into two cultivars of *Zantedeschia elliottiana*: 'Florex Gold' and 'Black Magic' they demonstrated that the peduncle length change is irrelevant, similarly as in the case of examined *Sedum spectabile*.

Conditioning *Arum italicum* in 8-hydroxyquinolinium sulphate had no influence onto the values of index of leaves greenness, Janowska and Schroeter – Zakrzewska (2008) state. Similar results were obtained while examining *Sedum spectabile*. It was proved, however, that storing the shoots in both GA_3 and in 8HQS with and without the addition of sucrose had a favourable effect onto SPAD. 8-hydroxyquinolinium sulphate delays the diminishing of the chlorophyll content in the case of *Matthiola incana* (Ferrante et al., 2004), *Hypericum* x *inodorum* (Janowska and Śmigielska, 2010), *Zantedeschia elliottiana* (Janowska and Jerzy, 2003).

Conclusions

- Cut shoots of *Sedum spectabile* turned out to be useful as cut flowers.
- Conditioning with 8 – hydroxyquinolinium sulphate at the concentration of 200 mg dm^{-3}, and also storing the flowering shoots in 8HQS with or without the addition of sucrose had an unfavourable effect onto the postharvest longevity of *Sedum spectabile.*
- Storing the cut shoots of *Sedum spectabile* in the solution of gibberellic acid had a favourable effect onto their postharvest longevity.
- Cut flowering shoots of *Sedum spectabile* that were not conditioned and were stored in gibberellic acid at the concentration of 100 mg dm^{-3} exhibited the highest postharvest longevity of thirty days.
- Both conditioning and storing the shoots of *Sedum spectabile* in various chemical solutions resulted in the shoot fresh matter loss.
- Storing the shoots of *Sedum spectabile* in various chemical solutions had a favourable effect onto the values of index of leaves greenness.

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