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EFFECT OF HYDROXYQUINOLINE SULFATE AND GIBBERELLIC ACID ON VASE LIFE OF THE CUT INFLORESCENCE STEMS OF *SEDUM AIZOON* L.

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Abstract

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The cut inflorescence stems of *Sedum aizoon* were conditioning in the water solution of 8 – hydroxyquinoline sulfate at 200 mg·dm^{-3} and after 24 hours they were placed in the water or solutions of gibberellic acid (GA_3) at 50 or 100 mg·dm^{-3}. The vase life of cut flowers of *Sedum aizoon* in water until they reached the withered flower stage was 11 days. Hydroxyquinoline sulfate used for conditioning did not increase the flower vase life of *Sedum aizoon*. Gibberellic acid brought about an increase in the flower longevity and leaves SPAD of *Sedum aizoon*.

Key words: *Sedum aizoon* L., longevity, 8HQS, GA_3

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

Introduction

Decorative plant species grown in greenhouses are often used as cut flowers. Recently, florists have used plants grown outdoors, which is a more environmentally friendly alternative to protected cultivation. *Sedum aizoon* is a species often cultivated outdoors. According to Jelitto and Schacht (1963) and Armitage (1989), it can be planted in 4 – 8 zones. Plants are 40 – 80 cm long. The irregularly toothed leaves are about 3 cm long. Flowering falls in June. The terminal yellow flowers are held on a short scape and literally sit on top of the plant. The individual flowers are about ½ across and the flat inflorescence is 3 – 4 wide.

Different chemical agents are used to extend the vase life of cut flowers. However, their effectiveness varies by species or even cultivar. In order to protect the environment, it is recommended to apply those chemical substances, which will yield the expected result. Chemicals are used in two stages. First, the stems are cut and conditioned. This often involves the use of hydroxyquinoline esters for a period of up to 24 hours. Next, the stems are kept in preservative, e.g. gibberellic acid.

The purpose of the study was to determine the vase life of *Sedum aizoon* flowers obtained from outdoor cultivation, which were cut and put in water. It was also determined which of the frequently used chemical agents could be successfully used to improve the vase life of *Sedum aizoon*.

Materials and Methods

The inflorescence stems of *Sedum aizoon* were cut on the 1st of June 2011 from the open field of the Department of Ornamental Plants at Poznan University of Life Sciences. The stems had a length of 34.5 – 37 cm. The inflorescences were open in 1/3. All leaves on the lower section of the stems (10 cm) were removed. The cut stems were conditioned in a vase solution at room temperature (23±1^{o}C) under normal day light and natural ventilation. Conditioning in the water solution of 8-hydroxyquinoline sulfate (8HQS) at 200 mg·dm^{-3} lasted 24 hours. The control stems were not conditioned and were kept in water. Subsequently the stems were placed in the water or solutions of gibberellic acid (GA_3) at 50 or 100 mg·dm^{-3}. The water and the preservative solutions

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were replaced every three days. The vase life was defined in days in two stages. The first stage was when the petals were withered, but still decorative. Loss of decorative values was indicated in the second stage, when the all inflorescences were brown.

The leaf Soil-Plant Analyses Development (SPAD) values were determined at the beginning of the experiment, after 7 days, and at the end of the stem vase life. Leaf readings were obtained using Minolta SPAD-502 Chlorophyll Meter. This measure indicates how green a leaf is, which is related to the relative amount of chlorophyll present.

The initial and final stem lengths (in the second stage) were used to calculate the increase in the stem length (%). Changes in the fresh weight were determined as a percentage of the initial weight. Three stems were used for each treatment per replicate. There were three replicates. The results were analyzed by two-way analysis of variance (ANOVA). Least significant differences (LSDs) were calculated and, on these basis, homogeneous groups were determined.

Results and Discussion

The vase life of *Sedum aizoon* in water lasted slightly over 10 days until stage I (withered flowers) (Table 1), and over 13 days until stage II (browned flowers) (Table 2). Such vase life can be described as long. A comparable vase life has been observed for other summer flowers, such as *Aconitum* and *Celosia* (Sacalis, 1998).

Cut flowers are conditioned first to disinfect the tips of their stems, which retards the microbiological disintegration of cells. Hydroxyquinoline sulfate or hydroxyquinoline citrates, which bring about a similar effect, are used for this purpose. In this experiment, the use of hydroxyquinoline sulfate (200 mg·dm^{-3}) did not affect the vase life of *Sedum aizoon*. The application of hydroxyquinoline citrate for two cultivars of *Zantedeschia elliotiana* yielded different results (Janowska and Jerzy, 2004a). Hydroxyquinoline citrate combined with sucrose did not improve the vase life of *Narcissus* 'Carlton (Goszczyńska et al., 1989) or *Tulipa* 'Apeldoorn' (Łukaszewska, 1995), but did improve that of *Narcissus tazetta* (Jowkar and Kafi, 2005). The use of hydroxyquinoline sulfate not only did not extend the vase life of *Kniphofia uvaria* (Hettiarachchi and Balas, 2005), but also adversely affected the cut leaves of *Zantedeschia elliotiana* (Janowska and Jerzy, 2003). The vase life of *Sedum aizoon* depended on its treatment. The stems put in water had a shorter vase life than those treated with gibberellic acid. The vase life until the withered flower stage was 2-3 days longer after using GA_3. In the browned flower stage, the vase life was observed to be 3-4 days longer when applying GA_3 than when keeping the flowers in water. Similar results were obtained for *Zantedeschia elliotiana* (Janowska and Jerzy, 2004a), *Gerbera jamesonii* (Emongor, 2003) *Curcuma alismatifolia* (Emongor, 2003), *Gladiolus* (Singh et al., 2008), *Alstroemeria* (Hicklenton, 1991), *Narcissus* (Goszczyńska et al., 1989) and *Matthiola incana* (Ferrante et al., 2009). The use of GA_3

Table 1
The vase life of *Sedum aizoon* flowers until petals withered stage (days)

Conditioning	Vase solution			Mean
	Water	GA_3 50 mg·dm^{-3}	GA_3 100 mg·dm^{-3}	
Water	11.6 b	13.8 a	14.4 a	13.3 a
8HQS*	10.7 c	13.9 a	14.2 a	12.9 a
Mean	11.1 b	13.8 a	14.3 a	

*8HQS conditioning 200 mg·dm^{-3}
Means followed by the same letter do not differ significantly at $\alpha = 0.05$

Table 2
The vase life of *Sedum aizoon* flowers until petals browned stage (days)

Conditioning	Vase solution			Mean
	Water	GA_3 mg·dm^{-3}	GA_3 100 mg·dm^{-3}	
Water	13.2 b	17.0 a	17.0 a	15.7 a
8HQS*	13.4 b	17.7 a	17.7 a	16.3 a
Mean	13.3 b	17.3 a	17.3 a	

*8HQS conditioning 200 mg·dm^{-3}
Means followed by the same letter do not differ significantly at $\alpha = 0.05$

in form of a spray also improved the vase life of *Anemone coronaria* (Sharifani at all 2005), whereas the stems of *Iris* x *hollandica* did not show improved vase life after the application of GA_3 (Macnish et al., 2009).

Gibberellic acid, if used for storage of cut flowers, also slows down the yellowing of leaves of *Lilium longiflorum* (Han, 1995), *Matthiola incana* (Ferrante et al., 2009) and *Alstroemeria* (Hicklenton, 1991). In the experiment concerned, 100 mg·dm^{-3} of GA_3 brought about a more intensive green coloration of leaves (Figure 1). Lower concentrations of GA_3 allowed for maintaining a similar level of green coloration of leaves at the initial stage, after 7 days and at the final stage.

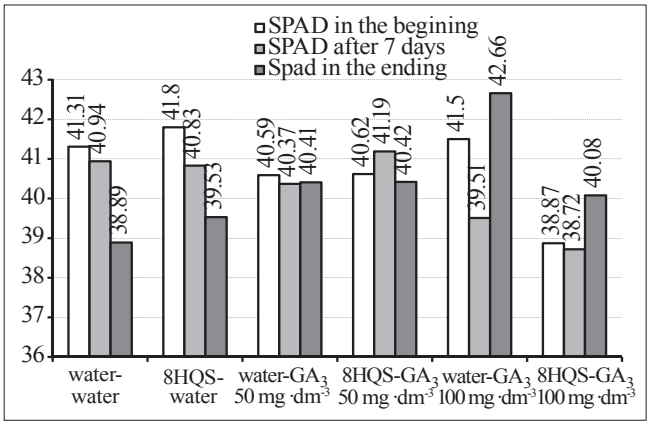

Fig. 1. SPAD of the leaves of *Sedum aizoon* L. during the experiment

The stems kept in water were more yellow at the end than at the beginning of the experiment.

Inflorescence stems kept in water often change their length and weight (Tables 3 and 4). GA_3 brought about an increase in the length of stems of *Tulipa* (Pisulewski, 1989) and *Zantedeschia elliotiana* (Janowska and Jerzy, 2004b).

During the experiment, the length of stems of *Sedum aizoon* slightly increased as compared to the initial value. However, there were no statistical differences (P>0.05) between the increase in stems treated with hydroxyquinoline sulfate or gibberellic acid and that observed for the control stems.

The weight, in turn, decreased. However, neither GA_3 nor 8HQS affected this feature.

Conclusions

The vase life of cut flowers of *Sedum aizoon* L. in water until they reached the withered flower stage was 11 days.

Hydroxyquinoline sulfate used for conditioning did not increase the flower vase life of *Sedum aizoon* L..

Gibberellic acid brought about an increase in the flower longevity and leaves SPAD of *Sedum aizoon* L..

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Table 3
The increase in the stem length of *Sedum aizoon* L. flowers until petals browned stage (%)

Conditioning	Vase solution			Mean
	Water	GA_3 50 mg·dm^{-3}	GA_3 100 mg·dm^{-3}	
Water	10.7 a	4.7 c	5.1 bc	6.9 a
8HQS*	7.6 abc	9.4 a	8.4 ab	8.5 a
Mean	9.2 a	7.1 a	6.8 a	

*8HQS conditioning 200 mg·dm^{-3}
Means followed by the same letter do not differ significantly at α = 0.05

Table 4
The decrease in the stem weight of *Sedum aizoon* L. flowers until petals browned stage (%)

Conditioning	Vase solution			Mean
	Water	GA_3 50 mg·dm^{-3}	GA_3 100 mg·dm^{-3}	
Water	7.5 a	12.0 ab	11.3 ab	10.2 a
8HQS*	12.2 b	13.1 b	10.6 ab	12.0 a
Mean	9.8 a	12.5 a	10.9 a	

*8HQS conditioning 200 mg·dm^{-3}
Means followed by the same letter do not differ significantly at α = 0.05

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