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Effect of Different Pulsing Solutions on Postharvest Life of Iris (*Iris orientalis* Mill.)

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A B S T R A C T

The investigation entitled, "Effect of different pulsing solutions on postharvest life of Iris (*Iris orientalis* Mill.)" was carried out at the experimental farm and laboratory of Department of Floriculture and Landscape Architecture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, in the year 2018. Experiment was laid out in Completely Randomized Design with 10 treatments and 3 replications. It was observed that pulsing of cut spikes with solution comprising of Sucrose (10%) + 8-HQC (400 ppm) for 16 hours resulted in best treatment for most of the postharvest parameters such as amount of pulsing solution consumed (14.13 ml), amount of vase solution consumed (91.90 ml), appearance of cut bloom (4.75), days taken for opening of floret (2.73), floret diameter (14.29 cm), vase life (11.07 days) and minimum per cent weight change/loss (15.66 %) of the cut spikes with 100 % bud opening.

Introduction

Iris orientalis Mill. is amongst species of family Iridaceae in the genus of *Iris*. It falls in the subgenus of *Limniris* and in series *Spuriae*. It is a rhizomatous perennial plant, native to Asia Minor, bearing beardless white flowers with a yellow mark or blotch. It is widely cultivated as an ornamental plant in temperate regions. Being a member of an ethylene insensitive family, it has a considerable potential to become a prized ornamental cut flower (van Doorn and Woltering, 2008; Zhong and Ciafre, 2011). The majority of the genus belongs to the rhizomatous group while only a few to the bulbous types whereas only latter types are grown commercially for cut flower use when grown under greenhouse or in the open. The international trade for cut flowers has greatly been expanded in recent years. Hence, there is an increased interest in postharvest biology and biochemistry of cut flowers. Most cut flowers have limited vase life owing to their moisture content, delicacy and tenderness. Hence, flowers and ornamentals are most susceptible to mechanical, physical damages and microbial infections during and after harvest. There are several pre and postharvest factors which affects the longevity of cut

flowers. In order to preserve the best quality flowers after harvest and making them tolerant to fluctuation in the environmental conditions, treatments with floral preservatives have been recommended. Among various post harvest manipulations, pulsing is an important technique for increasing the longevity and freshness of many cut flowers as demanded by consumer and florists. Treatment of cut flowers with sucrose is found to be beneficial in delaying senescence processes (Chung *et al.,* 1997; Yakimova *et al.,* 1996). 8-HQC has been known to possess strong anti-microbial properties that inhibit bacterial and physiological vascular blockage both and enhance water uptake in cut flowers as well (Larsen and Cromarty, 1967; Larsen and Frolich, 1969). Extension of vase life and improvement of keeping quality of cut flowers are important areas of research in the postharvest sector of floriculture industry. There is only scanty information available on postharvest handling of cut iris. Hence preservation of best quality flowers and enhancement of postharvest life of cut iris is an important area of research in the field of floriculture. Therefore present study has been undertaken with the objective to ascertain the best pulsing solution for Iris (*Iris orientalis* Mill.).

Materials and Methods

The present investigation was carried out in the laboratory of Department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan during 2018. Uniform, healthy and disease free rhizomes were selected and used further for the present study. Planting was done in beds of convenient length with a width of 1.2 m raised about 15 cm from ground level at a spacing of 20×20 cm. The cut spikes of uniform size were harvested in the morning hours (7-8 am) with the help of a sharp secateur. After harvesting, these spikes were immediately placed in a bucket containing water. The stage of harvesting for cut iris was 'pencil tip'. After harvesting, cut spikes were taken to the laboratory in the department of Floriculture and Landscape Architecture for conducting the experiment. The lower leaves from cut spikes were removed retaining 3-4 upper leaves. A slanting cut was given at the base of each cut spike in such a manner that the final cut spike length remained 55 cm. Before putting cut spikes in different pulsing solutions, firstly their fresh weights were recorded. Thereafter, these cut spikes were placed in test tubes containing 70 ml of different pulsing solutions for 12 hours at room temperature. After pulsing, a slanting cut of 1-2 cm was given to the lower end of cut spike and then held them in test tubes containing measured quantity (140 ml) of distilled water. Observations recorded were amount of pulsing solution consumed, amount of distilled water consumed, appearance, days taken for opening of floret, floret diameter, per cent unopened flower buds, vase life and weight loss.

Harvesting stage of *Iris orientalis* – 'Pencil Tip'

Results and Discussion

Amount of pulsing solution consumed (ml/stem)

It is evident from Table 1 that cut spikes consumed maximum amount of pulsing solution (14.13 ml) when pulsed with T_{10} viz. Sucrose 10 % + 8-HQC (400 ppm). However, cut spikes held in T_2 i.e. Sucrose 6 % + 8-HQC (200 ppm) consumed minimum amount of pulsing solution (8.88 ml).

Pulsing treatments have been reported to prevent vascular infections and inhibit ethylene production and thereby result in prolonged storage period and higher quality flowers with increased vase life (Sankar and Bhattacharjee, 2002). Cut spikes of Iris treated with Sucrose 10 % + 8-HQC (400 ppm) consumed maximum amount of pulsing solution. This might be due to the fact that 8-HQC is known to enhance solution uptake (Larsen and Cromarty, 1967). It improved flower longevity by decreasing microbial growth in vascular bundles and increased tendency of cut flowers to absorb more solution (Marousky, 1969; Nowak and Rudnicki, 1990). The beneficial effects of this pulsing treatment combination has assured more availability of carbohydrates for the cut iris, ensured no microbial growth. The results are in accordance with the finding of Ichimura *et al.*, (1999) as pulsing treatment using a combination of Sucrose + 8-HQC was found beneficial in different rose cultivars. The present findings also got support from the finding of Dastagiri (2013) in chincherinchee, Murry (2014) in tuberose and Prakash (2017) in China aster.

Amount of distilled water consumed (ml)

It is evident from Table 2 that cut spikes consumed maximum amount of distilled water (91.90 ml) when pulsed with T_{10} namely Sucrose 10 % + 8-HQC (400 ppm). However, cut spikes held in distilled water (T_1) consumed minimum amount of vase solution (65.47 ml).

The beneficial effects of this pulsing treatment combination has assured more availability of carbohydrates for the cut iris, ensured no microbial growth as well as uptake of sufficient water necessarily required for the maintenance of turgidity of petals besides reducing the vascular blockage of the cut spikes during holding them in the distilled water. These results are in accordance with the finding of Marousky (1969) who reported that vascular blockage was avoided by inclusion of 8-HQC and hence cut flower absorbed maximum amount of solution. The present findings got support from the finding Nagarajuna *et al.*, (2002); Hutchinson *et al.*, (2003); Murry (2014) in tuberose, Song *et al.*, (1992); Singh and Sharma (2003); Nijasure *et al.*, (2004) in gladiolus and Dastagiri (2013) in chincherinchee.

Appearance (Freshness and colour)

A perusal of Table 3 indicated the significant effect of pulsing solutions on appearance of cut flowers of iris. The cut flowers retain maximum freshness and colour with the highest score of 4.75 when pulsed with T_{10} i.e. sucrose 10 % + 8-HQC (400 ppm). On contrary, the cut flowers held in distilled water (T_1) were found with poor appearance with minimum score of 3.70.

In present studies also, a combination of sucrose and 8-HQC showed maximum retention in colour and freshness, thus improved appearance. Singh *et al.*, (2005) further reported that the optimum availability of sucrose and better retention of water in gladiolus spikes treated with 8-HQC (300 ppm) followed by sucrose (20 %) contributed towards better flower quality. Simultaneously,

treating the cut flowers with solution containing sugars delayed proteolysis (Paulin, 1986) which in turn improved the flower appearance. The present findings got support from the finding of Dastagiri (2013) in chincherinchee and Murry (2014) in tuberose.

Days taken for opening of floret (days)

It is clear from Table 4 that pulsing solutions improved days taken for opening of floret of cut spikes of iris. The cut spikes took minimum days for opening (2.73 days) when pulsed with T_{10} viz. Sucrose 10 % + 8-HQC (400 ppm) which was found statistically at par with other treatments viz. T_8 and T_9. On contrary, the cut spikes held in distilled water (T_1) took maximum days for opening of floret i.e. 4.33 days.

Flower opening is dependent on carbohydrate levels in the petal (Doorn *et al.,* 1991) and petal growth is associated with flower bud opening which results from cell expansion and this requires the influx of water and carbohydrates into petal cell (Evan and Reid, 1988). The sugars and biocide solutions are effective for opening of bud cut flowers like gladiolus, carnation, chrysanthemum and freesia (Bhattacharjee, 1999).

Flower opening in *Iris orientalis*

Floret diameter (cm)

Data presented in Table 5 revealed that pulsing solutions improved floret diameter. Largest floret diameter (14.29 cm) was recorded in cut spikes when pulsed with T_{10} i.e. Sucrose 10 % + 8-HQC (400 ppm) and it was found significantly at par with T_9. Minimum floret diameter (13.43 cm) was recorded in those cut spikes which were held in distilled water (T_1) without pulsing.

An increase in floret diameter may be due to avoidance of blockage of xylem tissues by 8-HQC and utilization of sucrose as source of energy by the cut flowers. The accumulation of carbohydrates and more water uptake had direct effect on increase in the cell volume. The petal cell of untreated flowers with poor water uptake might have been flaccid and deplasmolysed, leading to reduced size of cells and that of petals. These results got support from findings of Bhatia (2000) in carnation cvs. 'Impala' and 'Purple Choppin', Nagarajuna *et al.,* (2002) and Murry (2014) in tuberose; Song *et al.,* (1992); Singh and Sharma (2003) and Singh *et al.*,(2005) in gladiolus; Dastagiri (2013) in chincherinchee.

Per cent unopened flower buds (%)

In this experiment, 100% bud opening was recorded for each treatment.

Vase life (days)

It is clear from Table 6 that there is significant effect of pulsing solutions on vase life of iris cut flowers.

The cut flowers when pulsed in solution containing Sucrose 10 % + 8-HQC (400 ppm) i.e. T_{10} resulted in the longest vase life (11.07 days) which was found statistically at par with T_9. Minimum vase life (9.93 days) was recorded in distilled water (T_1) and found to be at par with T_2.

Cut spikes held in this treatment (T_{10}) consumed highest amount of solution that helped to stay longer in the vase, as the volume of solution absorbed is directly correlated with vase life (Joti and Balakrishnamoorthy, 1999). In general, cut spikes in pulsing solution comprising of sucrose and 8-HQC lasted significantly longer in vase. This can be justified from the fact that once vascular blockage is avoided by 8-HQC with sucrose that facilitated the higher intake of water and accumulation of total soluble sugars in the petal cells probably by enhancing the osmotic driving force for the solution uptake, resulting in longer vase life. The present findings got support from the studies of Nagarajuna *et al.,* (2002); Hutchinson *et al.,* (2003) in tuberose; Nijasure *et al.,* (2004) in gladiolus; Dastagiri (2013) in chincherinchee, Murry (2014) in tuberose, Shafiqa and Barket (2015) in iris and Prakash (2017) in china aster.

Table.1 Effect of different pulsing solutions on amount of pulsing solution consumed (ml/stem) by *Iris orientalis* Mill

Treatment	Pulsing solutions	Amount of pulsing solution consumed (ml)
T_2	Sucrose 6 % + 8-HQC (200 ppm)	8.88
T_3	Sucrose 6 % + 8-HQC (300 ppm)	9.17
T_4	Sucrose 6 % + 8-HQC (400 ppm)	9.94
T_5	Sucrose 8 % + 8-HQC (200 ppm)	10.93
T_6	Sucrose 8 % + 8-HQC (300 ppm)	11.77
T_7	Sucrose 8 % + 8-HQC (400 ppm)	12.62
T_8	Sucrose 10 % + 8-HQC (200 ppm)	12.98
T_9	Sucrose 10 % + 8-HQC (300 ppm)	13.56
T_{10}	Sucrose 10 % + 8-HQC (400 ppm)	**14.13**
$CD_{0.05}$		0.26

Table.2 Effect of different pulsing solutions on amount of distilled water consumed (ml/stem) by *Iris orientalis* Mill

Treatment	Pulsing solutions	Amount of vase solution consumed (ml)
T_1	Distilled water	65.47
T_2	Sucrose 6 % + 8-HQC (200 ppm)	69.83
T_3	Sucrose 6 % + 8-HQC (300 ppm)	72.74
T_4	Sucrose 6 % + 8-HQC (400 ppm)	74.87
T_5	Sucrose 8 % + 8-HQC (200 ppm)	78.80
T_6	Sucrose 8 % + 8-HQC (300 ppm)	80.71
T_7	Sucrose 8 % + 8-HQC (400 ppm)	83.45
T_8	Sucrose 10 % + 8-HQC (200 ppm)	86.83
T_9	Sucrose 10 % + 8-HQC (300 ppm)	89.03
T_{10}	Sucrose 10 % + 8-HQC (400 ppm)	**91.90**
$CD_{0.05}$		1.14

Table.3 Effect of different pulsing solutions on appearance (freshness and colour) of cut flowers of *Iris orientalis* Mill

Treatment	Pulsing solutions	Appearance of cut bloom
T_1	Distilled water	3.70
T_2	Sucrose 6 % + 8-HQC (200 ppm)	3.82
T_3	Sucrose 6 % + 8-HQC (300 ppm)	3.91
T_4	Sucrose 6 % + 8-HQC (400 ppm)	4.07
T_5	Sucrose 8 % + 8-HQC (200 ppm)	4.28
T_6	Sucrose 8 % + 8-HQC (300 ppm)	4.38
T_7	Sucrose 8 % + 8-HQC (400 ppm)	4.44
T_8	Sucrose 10 % + 8-HQC (200 ppm)	4.55
T_9	Sucrose 10 % + 8-HQC (300 ppm)	4.62
T_{10}	Sucrose 10 % + 8-HQC (400 ppm)	**4.75**
$CD_{0.05}$		0.06

Table.4 Effect of different pulsing solutions on days taken for opening of floret (days) in *Iris orientalis* Mill

Treatment	Pulsing solutions	Days taken for opening of floret (days)
T_1	Distilled water	4.33
T_2	Sucrose 6 % + 8-HQC (200 ppm)	3.73
T_3	Sucrose 6 % + 8-HQC (300 ppm)	3.53
T_4	Sucrose 6 % + 8-HQC (400 ppm)	3.33
T_5	Sucrose 8 % + 8-HQC (200 ppm)	3.27
T_6	Sucrose 8 % + 8-HQC (300 ppm)	3.13
T_7	Sucrose 8 % + 8-HQC (400 ppm)	3.07
T_8	Sucrose 10 % + 8-HQC (200 ppm)	2.93
T_9	Sucrose 10 % + 8-HQC (300 ppm)	2.87
T_{10}	Sucrose 10 % + 8-HQC (400 ppm)	**2.73**
$CD_{0.05}$		0.20

Table.5 Effect of different pulsing solutions on floret diameter (cm) of cut *Iris orientalis* Mill

Treatment	Pulsing solutions	Floret diameter (cm)
T_1	Distilled water	13.43
T_2	Sucrose 6 % + 8-HQC (200 ppm)	13.55
T_3	Sucrose 6 % + 8-HQC (300 ppm)	13.59
T_4	Sucrose 6 % + 8-HQC (400 ppm)	13.65
T_5	Sucrose 8 % + 8-HQC (200 ppm)	13.78
T_6	Sucrose 8 % + 8-HQC (300 ppm)	13.82
T_7	Sucrose 8 % + 8-HQC (400 ppm)	13.93
T_8	Sucrose 10 % + 8-HQC (200 ppm)	14.13
T_9	Sucrose 10 % + 8-HQC (300 ppm)	14.22
T_{10}	Sucrose 10 % + 8-HQC (400 ppm)	**14.29**
$CD_{0.05}$		0.07

Table.6 Effect of different pulsing solutions on vase life (days) of cut flowers of *Iris orientalis* Mill

Treatment	Pulsing solutions	Vase life (days)
T_1	Distilled water	9.93
T_2	Sucrose 6 % + 8-HQC (200 ppm)	10.13
T_3	Sucrose 6 % + 8-HQC (300 ppm)	10.33
T_4	Sucrose 6 % + 8-HQC (400 ppm)	10.47
T_5	Sucrose 8 % + 8-HQC (200 ppm)	10.53
T_6	Sucrose 8 % + 8-HQC (300 ppm)	10.60
T_7	Sucrose 8 % + 8-HQC (400 ppm)	10.67
T_8	Sucrose 10 % + 8-HQC (200 ppm)	10.80
T_9	Sucrose 10 % + 8-HQC (300 ppm)	10.93
T_{10}	Sucrose 10 % + 8-HQC (400 ppm)	**11.07**
$CD_{0.05}$		0.21

Table.7 Effect of different pulsing solutions on weight change/loss after termination of vase life in cut flowers (%) of *Iris orientalis* Mill

Treatment	Pulsing solutions	Weight change in cut spike (%)
T_1	Distilled water	47.42
T_2	Sucrose 6 % + 8-HQC (200 ppm)	37.28
T_3	Sucrose 6 % + 8-HQC (300 ppm)	34.58
T_4	Sucrose 6 % + 8-HQC (400 ppm)	31.71
T_5	Sucrose 8 % + 8-HQC (200 ppm)	28.01
T_6	Sucrose 8 % + 8-HQC (300 ppm)	26.26
T_7	Sucrose 8 % + 8-HQC (400 ppm)	24.43
T_8	Sucrose 10 % + 8-HQC (200 ppm)	21.27
T_9	Sucrose 10 % + 8-HQC (300 ppm)	19.49
T_{10}	Sucrose 10 % + 8-HQC (400 ppm)	**15.66**
$CD_{0.05}$		1.64

Weight change in cut spike (%)

A perusal of data presented in Table 7 indicated the significant effect of pulsing solutions on weight change. Minimum weight change/loss (15.66 %) was recorded in cut spikes when pulsed with T_{10} i.e. Sucrose 10 % + 8-HQC (400 ppm). Maximum weight change/loss (47.42 %) was observed in cut spikes held in distilled water (T_1). This might be due to the fact that sucrose is used as nutrition (Marousky, 1972), while 8-HQC prevents microbial and physiological vascular blockage as well as stimulate stomatal closure (Larsen and Frolich, 1969) that ultimately leads to less weight loss of cut spikes in iris. The result is in accordance with Rogers (1973) who reported that flower turgidity is the result of the balance between the rate of water uptake and water loss. The present results are also in accordance with the findings of Dastagiri (2013) in

chincherinchee, Murry (2014) in tuberose and Shafiqa and Barket (2015) in iris.

Keeping in view the above findings, it can be concluded that pulsing of cut iris for 12 hours in solution comprising of Sucrose (10 %) + 8-HQC (400 ppm) improved all the postharvest parameters studied.

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