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Pulsing Effect of Sucrose and Sodium Benzoate on Senescence of 'Christian Dior' Cut Roses

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ABSTRACT

'Christian Dior' cut roses at bud stage were pulsed in solutions containing sucrose and sodium benzoate alone or together for 12 or 24 hours before transferring to rain water. The pH of pulsing solutions was adjusted to 4.0 by citric acid. The solution containing 5% sucrose together with 300 ppm sodium benzoate and pulsed for 24 hours gave maximum vase life of cut roses up to 5.9 days with the least bent nect of 18.0% and slight blueing. Cut roses in the control had vase life only 2.1 days with the most bent neck of 69.0% and severe blueing.

INTRODUCTION

The vase life of roses is often reduced by water stress characterized by wilting of leaves and flowers, neck droop and incomplete bud opening (Asen *et al.*, 1971; Burdett, 1970). Such water stress represents the difference between the rate of water uptake and the rate of water loss (Halevy, 1976). Additionally, ethylene can also shorten the vase life of cut roses (De Stigter, 1981). The addition of several chemicals to preservative solutions, including some sugars, mineral solutes, germicides, ethylene inhibitors, growth regulators, have been tried with varied success in attempt to extend the vase life of cut rose (Halevy and Mayak, 1981; Marousky, 1971; Suisuwan, 1982; Venkatarayappa *et al.*, 1980; Wang and Baker, 1979). Sodium benzoate has been shown to delay senescence of broccoli (Wang, 1977) and carnations (Baker *et al.*, 1977) but not in cut roses (Wang and Baker, 1979) and snapdragons (Wang *et al.*, 1977). In this paper we herein report the improvement of vase life of 'Christian Dior' cut rose by pulsing with sucrose and sodium benzoate solutions.

MATERIALS AND METHODS

'Christian Dior' cut roses at bud stage were obtained from a local grower within 3 h after cutting. Stems were uniformly cut to 30 cm length and only 2 uppermost compound leaves were retained on the stems. The flowers were held under fluorescent lighting (1,200 lux) 12 h/day at 24°C and 69.8% RH. All pulsing solutions were prepared with rain water and their pH were adjusted to 4.0 by citric acid. Cut roses were pulsed in pulsing solutions contained sucrose and/or sodium benzoated (SB) as indicated in Table 1 – 3 for 12 or 24 h and then tranferred to rain water without pH adjustment. Flower vase life was judged on the basis of loss of petal turgor, blueing, petal desiccation, blooming and the appearance of bent neck. Each treatment had 9 cut roses. Results represented are the average of 3 replications.

RESULTS AND DISCUSSION

Blueing. Sucrose reduced blueing of rose petals, as shown in Table 1. The reduction

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of blueing by sucrose was more effective when pulsing time was extended to 24 hours but there was slight difference between 5 and 10% sucrose. The blueing of red flowers as well as 'Christian Dior' cut roses with aging is a well-known phenomenon causing by the increase in pH of vacuole which is attributed to the breakdown of proteins and the release of free ammonia (Weinstein, 1957). Sucrose reduced blueing of rose petals because it can delay proteolysis and the increase of pH (Asen *et al.*, 1971; Borochov *et al.*, 1976). Sodium benzoate slightly affected the reduction of blueing of rose petals and blueing tended to increase as pulsing time was extended to 24 hours (Table 1). It is possible that concentrations of sodium benzoate used in this experiment may be too high. More sodium benzoate might be absorbed and became toxic when pulsing time was extended to 24 hours. However, negative effect of sodium benzoate on blueing was apparently overcome when cut roses were pulsed in solutions containing both sucrose and sodium benzoate (Table 1).

Bent nect. Pulsing solutions containing sucrose was less effective than those containing sodium benzoate (Table 2). Bent nect of cut roses appeared as a result from the blockage of vascular system (Burdett, 1970). Sucrose used in pulsing or holding solutions can improve water balance and osmotic potential of cut roses (Acock and Nichols, 1979; Halvey, 1976). This enabled pulsed cut roses to absorb more water resulting in less bent nect. All pulsing solutions containing sodium benzoate together with sucrose reduced bent neck of cut roses to almost the same extent and more bent neck was reduced if pulsing time was extended to 24 hours (Table 2). Sodium benzoate is an antifungal agent and widely used in food products (Windholz, 1976). It might reduce activity of microoganisms in pulsing solutions resulted in the prevention of vascular blockage causing by microoganisms (Mayak *et al.*, 1977)

Table 1 Effect of pulsing solutions on blueing of 'Christian Dior' cut roses.

Treatment	Blueing[1/]	
	12 h pulsing	24 h pulsing
control	2.06	2.06
5% sucrose	0.53	0.36
10% sucrose	0.54	0.26
100 ppm SB	2.20	2.21
200 ppm SB	1.76	2.20
300 ppm SB	1.96	2.08
5% sucrose + 100 ppm SB	1.24	1.23
10% sucrose + 100 ppm SB	0.99	0.71
5% sucrose + 200 ppm SB	1.57	1.47
10% sucrose + 200 ppm SB	0.99	1.23
5% sucrose + 300 ppm SB	1.51	1.43
10% sucrose + 300 ppm SB	0.44	0.63

1/ Arbitrary scales of blueing : 0 = no blueing, 1 = slight blueing, 2 = moderate blueing, 3 = severe blueing.

Table 2 Effect of pulsing solutions on bent neck of 'Christian Dior' cut roses.

Treatment	% Bent neck	
	12 h pulsing	24 h pulsing
control	69.0	69.0
5% sucrose	52.5	41.8
10% sucrose	61.3	58.3
100 ppm SB	23.4	23.5
200 ppm SB	26.3	22.0
300 ppm SB	23.4	23.9
5% sucrose + 100 ppm SB	32.1	21.6
10% sucrose + 100 ppm SB	31.0	18.4
5% sucrose + 200 ppm SB	30.0	24.6
10% sucrose + 200 ppm SB	29.5	20.3
5% sucrose + 300 ppm SB	22.1	18.0
10% sucrose + 300 ppm SB	31.3	28.5

Vase life. Based on blueing, bent neck and other appearances of cut roses, solutions containing sodium benzoate gave longer vase life of cut roses than those containing sucrose alone or the control (Table 3). Cut roses were pulsed for 24 hours in the solution containing 5% sucrose together with 300 ppm sodium benzoate had maximum vase life up to 5.9 days while cut roses in the control had vase life only 2.1 days (Table 3). However, cut roses were pulsed for 12 hours in the same solution as above had vase life up to 5.7 days which was not significantly different from those pulsed for 24 hours. Therefore, 'Christian Dior' cut roses should be pulsed in this solution for 12 hours instead of pulsing for 24 hours.

Members of each of 5 groups of plant hormones have been implicated in the regulation of flower senescence. However, ethylene seems to have been dealt with most extensively because flowers can produce ethylene and ethylene shortens their vase life (Halevy and Mayak, 1981). It is not known whether sodium benzoate delayed senescence of 'Christian Dior' cut roses in this experiment is related to the inhibition of ethylene production (Baker *et al.*, 1977; Wang *et al.*, 1977; Wang and Baker, 1979).

Table 3 Effect of pulsing solutions on vase life of 'Christian Dior' cut roses.

Treatment	vase life (days)[1/] [2/]	
	12 h pulsing	24 h pulsing
control	2.1 h	2.1 h
5% sucrose	2.2 h	2.4 bh
10% sucrose	2.6 eh	2.6 eh
100 ppm SB	5.4 ed	5.2 ac
200 ppm SB	5.2 ac	5.2 ac
300 ppm SB	5.4 ad	5.3 ac
5% sucrose + 100 ppm SB	5.0 bdeg	5.8 a
10% sucrose + 100 ppm SB	4.7 ad	4.8 ad
5% sucrose + 200 ppm SB	5.3 ac	5.3 ac
10% sucrose + 200 ppm SB	5.2 ac	4.9 ad
5% sucrose + 300 ppm SB	5.7 a	5.9 a
10% sucrose + 300 ppm SB	4.1 adfg	4.7 ad

1/ Values not followed by the same letter differ significantly at P = 0.05.

2/ From the beginning of pulsing.

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