Kasetsart J. (Nat.Sci.) Vol. 21, 301-305 (2530)

Opening Bud-Cut Standard Carnations Following Truck Shipment from Highlands to Bangkok [1]

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ABSTRACT

'Red Sim' and 'White Sim' standard carnations were cut at bud stage from Chiang Mai highland production site pulsed and packed wet with silver thiosulfate or Physan-20 plus sucrose before shipping by truck to Bangkok. After arrival, they were opened in bud-opening solutions containing various concentrations of benzalkonium chloride plus sucrose. The best pulsing and bud-opening solution was found to be 200 ppm Physan-20 + 5% sucrose and 300 ppm benzalkonium chloride + 5% sucrose respectively. Use of pulsing and bud-opening solutions with bud-cut carnations produced large blooms with short opening time, high percentage of bud opening and long vase life.

INTRODUCTION

Vase life of cut carnations from highland areas under the Royal Project has not yet been improved to a satisfactory condition even when the new preservative was developed and used (Ketsa *et al*., 1987). This may be due to carnations which were cut at slightly or fully bloom stage are very sensitive to ethylene resulting in premature senescence know as sleepiness (Uota, 1968; Barden and Hanan, 1972). Bloom carnations can be easily damaged if the packing method is not good and the shipping container does not have adequate strength (Anon., 1980).

Many cut flowers including carnations have been recommended to be harvested at bud stage (Halevy and Mayak, 1981). Although flowers harvested at tight bud stage offer numerous advantages, some of them including carnations are incapable of developing to the commercial stage if they are placed in plain water (Casp *et al.*, 1980; Kofranek, 1980). Bud stage of flowers must be provided with a suitable opening solution. Many different chemicals have been used for opening carnation bud and producing opened flowers which could be kept better than freshly harvested ones (Hardenburg *et al* ., 1978; Casp et al., 1980, Aldrufeu *et al.*, 1981).

In this report we compared the effect of several bud opening solutions on the opening and longevity of carnation buds followed truck shipment from Chiang Mai to Bangkok.

MATERIALS AND METHODS

'Red Sim' and 'White Sim' carnations *(Dianthus caryophyllus L.)* grown at Intanon Research Station were cut at 3 stages of developments (Figure 1) and selected according to their development to use in individual experiments. The stems were cut to a length of 40 cm and were held in water or pulsing solutions as indicated in various tables for 16-18 hours, then they were packed wet similar to the method done by Ketsa *et al.*, 1987 . Carnation buds were bunched, wrapped and packed into corrugated cartons. They were shipped by non-refrigerated truck with other horticultural crops and arrived at Bangkok within 12 hours. Upon arrival at Bangkok packing house, one cm of stems was cut off before being placed in beakers containing 500 ml of the tested bud-opening solutions having 12 flowers per treatment. They were left at ambient temperature (29.5°C and 62.5% RH by average) with natural light. The buds were kept in these conditions until the color petals emerged and reached the paint brush stage with their outer petals almost fully expanded. Then, they were transferred to tap water (3 flowers/ vase) to determine their vase life. The room

1 The research was financially supported by ARS, USDA (Contract No. 53-32 U 4-5-4).

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conditions for vase life deter-mination were the same as those used in the test of bud opening solutions. Data represent the mean values of 12 flowers.

RESULTS AND DISCUSSION

Carnations at bud stage with petals beginning to open (Stage III) could be normally opened in the tested solutions. The solution containing 500 ppm benzalkonium chloride + 5% sucrose seemed to be the best because opened flowers had shorter opening time, larger diameter and longer vase life (Table 1). However, bud carnations had to be pulsed and packed wet with silver thiosulfate or Physan-20 before opening in the benzalkonium chloride + sucrose solution. Both silver thiousulfate and Physan-20 have been widely used as pulsing solution for many cut flowers (Reid *et al.*, 1980 b; Mor *et al.*, 1984; Reid, 1985). Casp *et al.* (1980) reported that the bud-opening solution containing 500 ppm benzalkonium chloride + 5% sucrose + 75 ppm citric acid was better than many bud-opening solutions. Our result confirms that benzalkonium chloride plus sucrose can be used for opening carnation buds. Though our bud-opening solution contained only 5% sucrose and no citric acid, this solution could improve vase life, opening speed, flower size and color of the carnations comparing with flowers naturally opened. Judging the difference between pulsing solutions containing silver thiosulfate and Physan-20, the main difference was the number of fully opened flowers. Bud carnations pulsed in Physan-20 had 100% fully opened flowers while those pulsed in silver thiousulfate had 88.9% fully opened flowers (Table 1). Furthermore, Physan-20 needs no distilled water for its preparation. Physan-20 is not toxic to human It needs no special consideration during handling. It is economical of cost (Casp *et al.*, 1980; Halevy and Mayak, 1981). Therefore, Physan-20 should be used as the pulsing solution.

When benzalkonium chloride concentration in the bud-opening solution was varied from 100 to 500 ppm plus 5% sucrose, bud carnations at Stage III normally opened with less opening time, larger diameter of opened flowers, more percentage of fully opened flowers and longer vase life comparing with those opened in tap water (Table 2) Bud carnations opened in 100 ppm benzalkonium chloride had less number of fully opened flowers and shorter vase life than those opened in higher concentrations of benzalkonium chloride. Judging the opening time and vase life of opened flowers, The solution containing 300 ppm benzalkonicim chloride + 5% sucrose seems to be the best bud-opening solution for carnations.
This effective solution contains less concentration of benzalkonium chloride and sucrose than that reported by Casp *et al.* (1980) it may be due to different in cultivars, growing and experimental conditions (Halevy and Mayak, 1981).

Both 'Red Sim' and 'White Sim' bud carnations at Stage I, II and III were pulsed in 200 ppm Physan-20 + 5% sucrose and opened in 300 ppm benzalkonium chloride + 5% sucrose. All of them were opened to a satisfactory condition (Figure 2 and 3) but younger bud flowers took longer time to reach a full bloom stage (Table 3). Benzalkonium chloride is the quaternary-ammonium salt widely used in industrial disinfection procedure and was used for the first time on flower conservation reported by Casp and Escriva (1978). This compound can be used for opening carnation buds produced in highland areas under the Royal Project. The adapted application of benzalkonium chloride will be beneficial in reducing postharvest loss of carnations during transportation. Carnations being cut at bud stage have several possible advantages in addition to the reduction of postharvest loss during transportation i.e. : reducing the sensitivity of the flowers to extreme temperature, low humidity, and ethylene during handling and transport, saving the space during shipment and storage, reducing the time that the crop remains in the field, extending the useful storage of flowers, improving the opening size, color and longevity of the flowers, and reducing the hazard of damage to field grown flowers by adverse external conditions (Halevy and Mayak, 1978). However, bud carnations at the time of cutting must be good in quality otherwise their vase life and quality can be reduced (Anon., 1980).

Table 1. Effect of pulsing and bud-opening solution on opening time, diameter, number and vase life of opened flowers (Red Sim) cut at Stage I.

Treatment		Opening time (days)	Diameter of opened flower (cm)	Percentage of opened flower	Vase life (days)
Pulsing solution	Bud-opening solution				
Water	Water	3.0 ± 1.0	7.6	60.0	5.2 ± 2.4
STS[1]	BAC[2]	2.4 ± 0.3	8.8	88.9	9.9 ± 0.3
Physan-20[3]	BAC[4]	2.1 ± 0.4	8.4	100.0	9.1 ± 0.3

1/ 68 ppm $AgNo_3$ + 794 ppm $Na_2S_2O_3 \cdot 5\ H_20$ + 5% sucrose

2/ 4/ 500 ppm benzalkonium chloride + 5% sucrose

3/ 200 ppm Physan-20 + 5% sucrose

Table 2. Effect of bud-opening solutions containing various concentrations of benzalkonium chloride (BAC) plus 5% sucrose on opening time, diameter, number and vase life of opened 'Red Sim' carnations cut at Stage I and pulsed in 200 ppm Physan-20 + 5% sucrose.

Treatment	Opening time (days)	Diameter of opened flower (cm)	Percentage of opened flower	Vase life (days)
Water[1]	3.17 ± 3.1	7.1	69.2	5.7 ± 0.9
100 ppm BAC	1.3 ± 0.5	8.2	88.9	6.4 ± 1.2
200 ppm BAC	1.3 ± 0.7	8.0	100.0	6.9 ± 0.5
300 ppm BAC	1.0 ± 0	7.8	100.0	7.8 ± 1.0
400 ppm BAC	1.1 ± 0.3	7.4	100.0	7.0 ± 1.7
500 ppm BAC	1.7 ± 2.0	8.1	100.0	7.4 ± 1.2

1/ non-pulsed carnation buds.

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Table 3. Effect of the pulsing solution containing 200 ppm Physan 20 + 5% sucrose and bud-opening solution containing 300 ppm benzalkonium chloride + 5% sucrose on opening time, diameter, number and vase life of opened carnations cut at Stage I, II and III.

Treatment	Opening time (days)	Diameter of opened flower (cm)	Percentage of opened flower	Vase life (days)
'Red Sim'				
Stage I				
Water[1/]	no opening	-	0	-
Solution	6.0 ± 0	7.9	83.3	6.3 ± 0.5
Stage II				
Water[2/]	no opening	-	0	-
Solution	5.5 ± 0.9	8.1	100.0	6.25 ± 1.5
Stage III				
Water[3/]	2.2 ± 0.8	7.1	41.7	3.4 ± 1.5
Solution	3.58 ± 1.8	8.2	100.0	6.5 ± 1.5
'White Sim'				
Stage I				
Water[4/]	6.0 ± 0	6.5	16.7	2.0 ± 0
Solution	6.0 ± 1.0	7.5	100.0	4.4 ± 1.6
Stage II				
Water[5/]	6.0 ± 0	7.1	16.7	2.0 ± 0
Solution	4.2 ± 1.5	7.50	100.0	5.75 ± 0.5
Stage III				
Water[6/]	2.3 ± 0.6	5.9	25.0	2.0 ± 1.0
Solution	3.0 ± 1.6	7.5	100.0	3.0 ± 1.2

1/-6/non-pulsed bud carnations.

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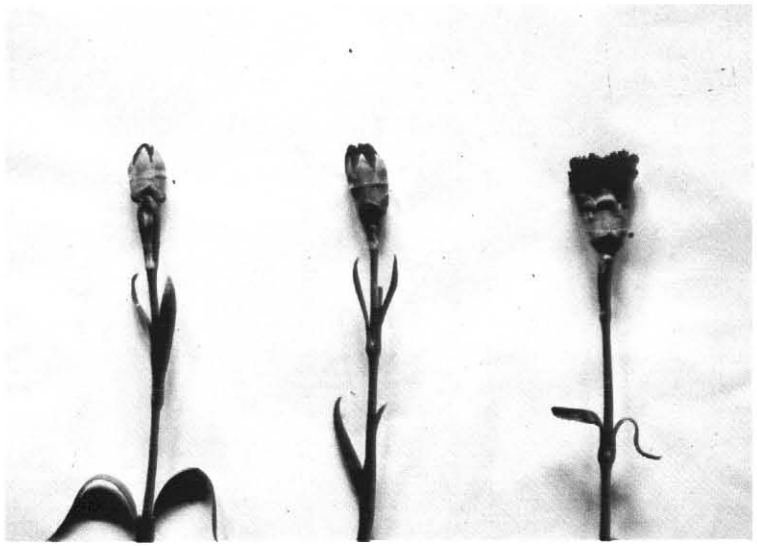

Figure 1-upper

Figure 1-lower

Figure 1. Bud Stage of 'Red Sim' (upper) and 'White Sim' (lower) carnation designated as Stage I, II and III in the experiment.

Figure 2. Opened flowers of 'Red Sim' Stage I in 300 ppm benzalkonium chloride + 5% sucrose.

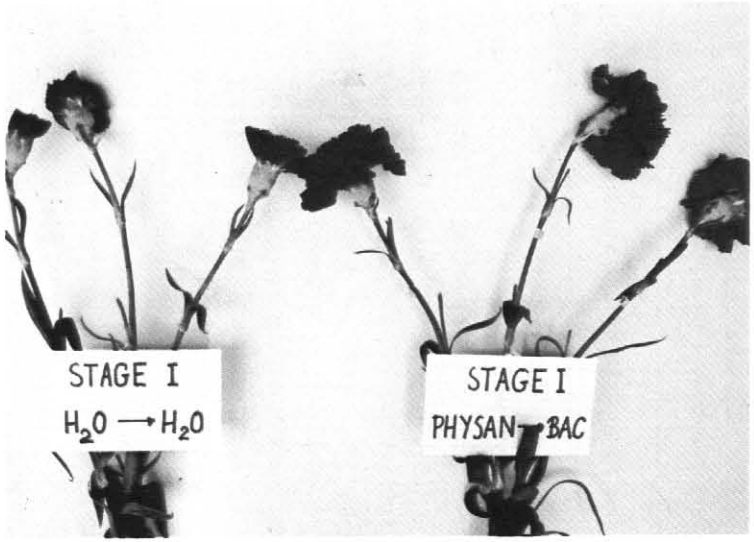

Figure 2

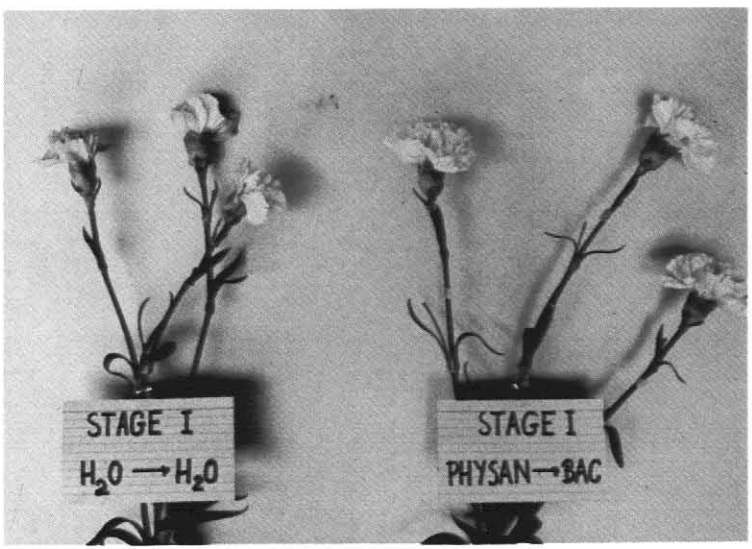

Figure 3

Figure 3. Opened flowers of 'White Sim' Stage I in 300 ppm benzalkonium chloride + 5% sucrose.