INTERACTION OF FLOWER PRESERVATIVE COMPONENTS AND LIGHT ON FRESH WEIGHT AND LONGEVITY OF SNAPDRAGON CUT FLOWERS

F. J. MAROUSKY

U. S. Dept. of Agriculture
Gulf Coast Experiment Station
Bradenton

AND

J. C. RAULSTON

Gulf Coast Experiment Station
Bradenton

ABSTRACT

'Pan American Summer Pink' snapdragon spikes were held in water or solutions containing 300 ppm 8-hydroxyquinoline citrate (8-HQC), 1.5% sucrose (S), or 300 ppm 8-HQC + 1.5% S and were subjected to either 200 ft-c light or darkness. Spikes held in 8-HQC + S in either light or darkness increased in weight and lasted longer than spikes held in any other treatment. In water spikes gained more weight and lasted longer in dark than in light. Spikes held in S alone in light or dark gained less weight and did not last as long as spikes held in water in dark. Spikes held in 8-HQC alone gained more weight and lasted longer than spikes held in water or S regardless of light or dark treatments.

Light and 8-HQC enhanced solution absorption by spikes while S and dark inhibited absorption. Percent increase (or decrease) from initial fresh weight after 5 days could be used as an objective estimate of spike longevity.

INTRODUCTION

Maintenance of adequate moisture content in cut flowers is essential for moximum vase life. When transpiration exceeds water uptake, cut flowers rapidly lose weight and wilt (2). The decrease in water uptake is due to plugging of the vascular elements in the cut flower stem (1, 2, 3, 7, 8, 11). Durkin & Kuc (3) suggested that moisture stress could be overcome by using chemicals which would inhibit or overcome stem plugging and/or "anti-desiccants" to reduce transpiration. It has been suggested that the esters of 8-hydroxyquinoline inhibit vascular blockage (2, 4, 5, 6, 7, 8, 11). Although all workers do not agree on the mechanism by which 8-hydroxyquinoline esters inhibit vascular blockage, they do agree that these esters 1) prolong cut flower life, 2) increase the rate and amount of solution absorption by cut flowers, and 3) increase fresh weight of cut flowers (2, 5, 6, 7, 8, 9, 10, 11, 13, 15).

Sucrose solutions have also been shown to increase cut flower fresh weight and longevity (1, 7, 8, 11). Recent evidence has shown that sucrose reduces moisture stress in cut flowers by decreasing the aperature size of leaf stomata (1, 7, 8, 11).

Environment as well as preservatives has an effect on cut flower vase life. Odom (13) reported that the lasting ability of cut carnation flowers decreased as the light intensity increased. Aarts (1) found that light intensity had little influence on longevity of cut carnations, stocks, or tulips but stems were weaker and more bent in the dark than in the light. Woltz and Waters (16) showed that cut chrysanthemum flowers exposed to light during refrigerated storage retained their photosynthetic capacity and sugar content of leaves at higher levels and for longer duration than cut flowers stored in darkness and at elevated temperatures.

Although cut flower fresh weight is related to moisture balance, little work has been published on the effects of water uptake, as influenced by flower preservatives on cut snapdragon longevity (5). This paper shows the relationship of fresh weight and vase life of cut snapdragon spikes when held in light or dark in water or solutions of 8-hydroxyquinoline citrate (8-HQC), sucrose (S), or 8-HQC) + S.

METHODS AND MATERIALS

'Pan American Summer Pink' snapdragons were harvested with 6-10 open florets, trimmed to 24-inch lengths and the foliage removed from the lower third of each stem. Spikes were placed in glass quart jars containing 250 ml each of

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water, 300 ppm 8-HQC, 1.5% S, or 300 ppm 8-HQC + 1.5% S (6). Distilled water was used for the control and for preparing all chemical solutions. Spikes in each solution were placed in a laboratory in darkness or in 200 ft-c light. Light was supplied continuously by fluorescent tubes. A dark chamber was constructed by covering a frame with black sateen cloth. A split-plot experimental design was used with light as the main plot and solution components as sub-plots. One spike per jar was the experimental unit and there were 3 replications per treatment.

Spike fresh weight was determined initially and after 2, 5, and 7 days. Weights were recorded as percent change from original weight. Solution absorption was determined after 2, 5, and 7 days by subtracting solution remaining in jars from original amount. Aliquots of solution were added to each jar to bring volume to original level. Jar openings were covered with aluminum foil to prevent evaporation.

Vase life was considered terminated when one-half of the florets on each spike had wilted or senesced. Vase life was recorded as the number of days from harvest to wilting.

The laboratory was maintained at 74± 2° F. Ambient relative humidity varied from 50-70% in the laboratory but differed only by 2-4% between the dark and light chambers.

Results and Discussion

Spikes held in 8-HQC + S in light or dark increased in weight and lasted longer than spikes in any other solution (Tables 1 and 2). Spikes held in 8-HQC in light or dark weighed more and lasted longer than spikes held in water or S in light or darkness. Spikes held in S in light or dark and spikes held in water in light had less increase in weight and shorter vase life than spikes subject to any other treatment. Spikes held in 8-HQC + S or 8-HQC in light or dark maintained their weight better from the 5th to 7th day than spikes held in water or sucrose.

The relationship of fresh weight at 5 days and number of days of vase life of snapdragon spikes is illustrated in Figure 1. Spikes that had the largest increase in weight at 5 days also had the longest vase life. Each 10% increase above the original weight resulted in an increase in 2.1 days of vase life. Rogers (14) reported that weight change in freshly cut snapdragons followed a typical pattern; first increased markedly, then leveled off, and finally declined. Similar patterns for weight change have also been shown in other cut floweres (1, 5, 7, 8, 9, 10, 11, 15). Rogers (14) stated that when snapdragon spikes lose about 10% of their original weight their useful vase life is terminated. Present data agree closely with Rogers findings.

This relation suggests that the change in fresh weight as 5 days could be used to predict spike longevity or vase life. Spike weight would be a more objective measurement for vase life than visual evaluation. However, other quality or aesthetic factors such as floret size and color should also be considered when evaluating vase life. Probably a combination of appearance and weight change would be best for evaluating quality and vase life. However, factors which increase or sustain cut flower weight usually improve or sustain quality (1, 5, 6, 8, 9). Spikes

Table 1. Fresh weight changes of snapdragon spikes held in water, 300 ppm 8-hydroxyquinoline citrate, 1.5% sucrose, or 300 ppm 8-hydroxyquinoline citrate plus 1.5% sucrose in light or dark.

Solution component	Light or dark	Change in weight after[1] 2 days	5 days	7 days
		%	%	%
Water (control)	dark	22.0 a[2]	20.3 b[3]	3.7 c[2]
300 ppm 8-HQC	dark	17.9 a	22.8 b	19.8 b
1.5% sucrose	dark	18.1 a	6.6 c	-10.2 d
300 ppm 8-HQC + 1.5% sucrose	dark	23.7 a	34.0 a	34.1 a
Water (control)	light	9.1 b	-11.4 d	-17.0 d
300 ppm 8-HQC	light	17.5 a	21.6 b	18.2 b
1.5% sucrose	light	3.2 b	-15.1 d	-27.7 e
300 ppm 8-HQC + 1.5% sucrose	light	24.2 a	37.9 a	41.4 a

[1]Expressed as percentage change from initial fresh weight.

[2]Means in a column followed by the same letters are not significantly different at 1% level.

[3]Means in a column followed by the same letters are not significantly different at the 5% level.

Table 2. Days of useful vase life of snapdragon spikes when held in water, 300 ppm 8-hydroxyquinoline citrate, 1.5% sucrose, or 300 ppm 8-hydroxyquinoline citrate + 1.5% sucrose in light or dark.[1]

Solution component	Vase life in Dark	Light	Solution component means
	days		
Water	9.3 d[2]	7.7 e	8.5 c
300 ppm 8-HQC	13.0 b	11.0 c	12.0 b
1.5% sucrose	7.0 e	7.0 e	7.0 d
300 ppm 8-HQC + 1.5% sucrose	19.0 a	19.3 a	19.2 a
Light or dark means	12.1 a	11.3 b	

[1]Vase life considered terminated when one-half florets on a spike had wilted or senesced.

[2]Means in a box followed by the same letters are not significantly different at 1% level.

held in light had better quality (turgidity, substance, etc.) and more intensely colored florets than spikes held in dark. This agrees with Larsen and Scholes (6).

Influence of 8-HQC, S, and 8-HQC + S on solution absorption by snapdragon spikes held in light and dark is shown in Figure 2. Light and 8-HQC greatly increased solution absorption. Spikes held in 8-HQC or 8-HQC + S in light absorbed more solution than spikes held in similar solutions in the dark. Spikes held in water or S in light absorbed more solution during the first 2 days of vase life than spikes held in the dark. However, at 5 and 7 days in light spikes in water absorbed more fluid than spikes in S. Spikes held in S in light or dark and in water in the dark had similar absorption patterns at 5 and 7 days. Similar fluid absorption patterns have been reported for gladiolus and roses held in 8-HQC, S, and 8-HQC + S in light (7, 8, 11).

Since spike longevity is directly related to fresh weight (Figure 1), it can be argued that changes in solution absorption should produce changes in spike weight and longevity. Influence of solution absorption at 7 days and changes in fresh weight of spikes in water, 8-HQC, S, and 8-HQC + S in light or dark are shown in Figure 3. Spike fresh weight is a linear function of fluid absorption and the relationship was distinct for spikes held in the light or dark. With 100-ml increase in fluid absorption fresh weight of spikes increased 35% in the dark and 14% in the light. These data suggest that transpiration rate may differ in light and dark. Darkness decreases stomatal opening and transpiration with concomitant decreases in absorption (12, 17). Burdett (2) demonstrated that when transpiration of cut roses exceeded water uptake weight decreased and roses wilted. The reduced transpiration-absorption phenomenon would partially explain the decrease in fluid absorption when spikes are held in 8-HQC in the dark.

Quinoline esters inhibit vascular blockage and increase water absorption (2, 5, 7, 8, 11). In the light, spikes held in 8-HQC, probably transpired and absorbed more fluid than similarly treated spikes held in the dark. Hence, spikes would absorb more 8-HQC and have greater inhibition of vascular blockage in light than in dark. Spikes held in 8-HQC for 2 days would have had a greater potential for fluid absorption in light than in dark. Similar reasoning can be hypothesized for reduced absorption by spikes held in S. Sucrose decreases stomatal diameters in cut flowers (1, 7, 8, 11). Spikes held in S prob-

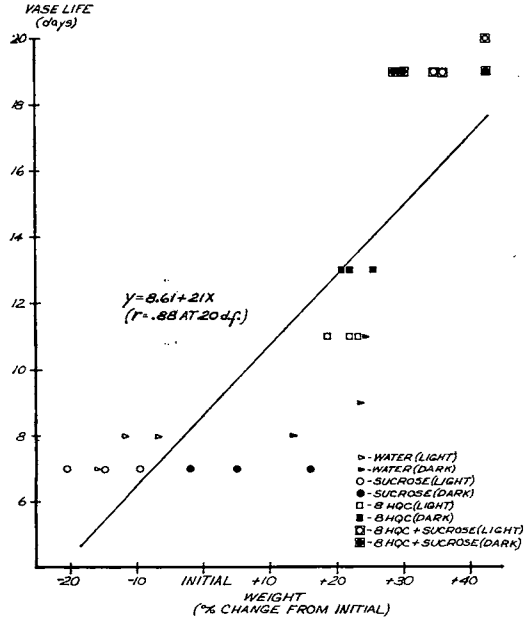

Figure 1.—Relationship of fresh weight at 5 days to vase life of cut snapdragon spikes. Points represent weight change in spikes held in water, 300 ppm 8-hydroxyquinoline citrate, 1.5% sucrose, or 300 ppm 8-hydroxyquinoline citrate + 1.5% sucrose in light or dark.

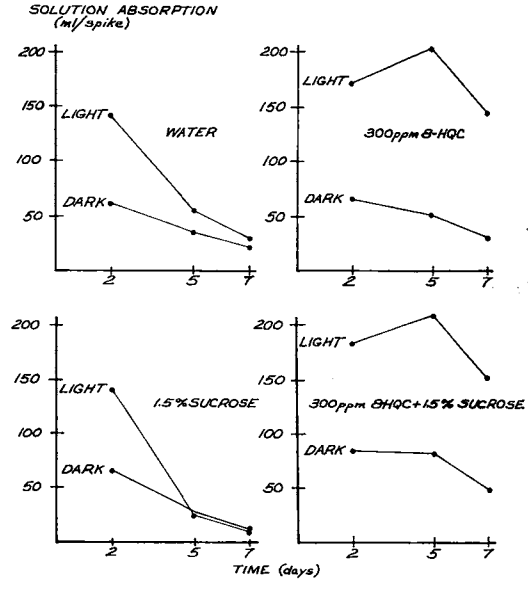

Figure 2.—Influence of 8-hydroxyquinoline citrate, sucrose and 8-hydroxyquinoline + sucrose on solution absorption by snapdragon spikes held in light or dark.

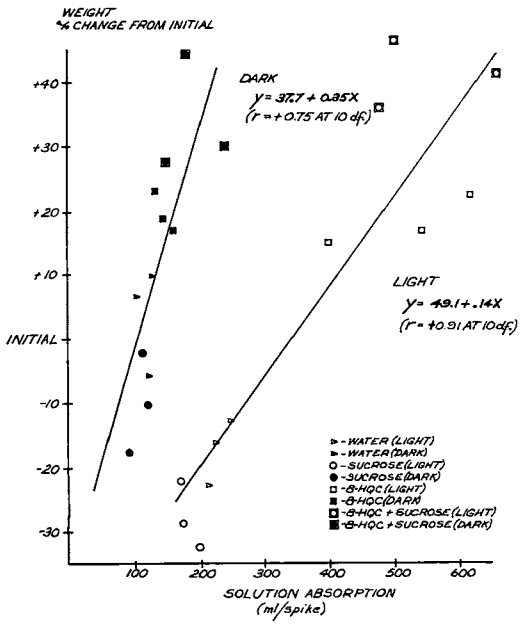

Figure 3.—Influence of solution absorption for 7 days on fresh weight of snapdragon spikes held in light or dark. Points represent weight changes produced by 7 days of cumulative solution absorption when spikes were held in water, 300 ppm 8-hydroxyquinoline citrate, 1.5% sucrose, or 300 ppm 8-hydroxyquinoline citrate +1.5% sucrose.

ably had less transpiration, which directly reduced absorption (12).

The data presented show that cut snapdragon spike weight and longevity are influenced greatly by 200 ft-c light as well as by floral preservatives. Light was detrimental to spike weight and longevity of flowers held in water. Light or darkness did not appreciably influence spike weight or longevity when spikes wehe held in 8-HQC + S. However, spikes held in 8-HQC + S in the light had superior floret color and quality compared to spikes held in the dark. Percent change in spike weight at 5 days could be used to predict potential vase life. Spike weight was influenced by solution uptake but the solution-uptake patterns differed in light and dark.

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