The Effect of Storage Temperatures on Colombian Grown Cut Rose Varieties

Terril A. Nell and Ria T. Leonard
Department of Environmental Horticulture, University of Florida
Gainesville, Florida
USA

Keywords: flower opening, postharvest, senescence, *Rosa hybrida* L., transport, vase life

Abstract

Fourteen varieties of cut roses were stored in boxes for 7 days at 2, 6 or 10°C after being commercially transported 5 days from Colombia. Varieties showed considerable variation in vase life and quality in response to storage temperatures. Vase life decreased 2 to 8 days as storage temperature increased from 2°C to 10°C. 'Saturn' and 'Charlotte' were the only varieties where vase life was unaffected by storage temperature. High temperature reduced or prevented adequate flower opening on 'Black Magic', 'Classy', 'Gabriele', 'Leonidas', 'Madame Delbard', 'Poison', 'Red Jewel' and 'Valentino' while 'Eliza', 'Charlotte', 'Orlando' and 'Saturn' opened adequately at all temperatures. 'Red Unique' and 'Marylse' had less than optimal flower opening, regardless of storage temperature. The most tolerant varieties to stressful storage conditions were 'Charlotte', 'Orlando' and 'Saturn'.

INTRODUCTION

Proper transport and storage conditions for cut roses can be difficult to maintain from the farms in Central and South America to the distribution channels throughout the United States. Some farms still transport flowers after harvest in non-refrigerated trucks. Temperature records during transit show tremendous fluctuation in temperature ranging from 2°C to 21°C. Roses are generally shipped dry in boxes and transported by air to Miami, Florida, and arrive within 24 to 48 hours after harvest. Flowers are then stored for 1-2 days at floral importers before being transported by air and/or truck to wholesale and retail stores throughout North America. Flowers can be available to the consumer within 4-6 days after harvest using this distribution system, but flowers are often being stored along the distribution channel at improper temperatures, reducing quality and vase life for the consumer.

It is well known that improper storage temperatures can reduce vase life of many cut flower species and that variety performance can differ widely within a species (Celikel and Reid, 2002; Cevallos and Reid, 2001; Leonard et al., 2001). The objective of this study was to determine how varieties response to adverse storage conditions. The study was not designed to promote the use of extended storage, but to identify tolerant varieties, provide information to breeders and demonstrate the importance of temperature on quality and vase life.

MATERIAL AND METHODS

Cut rose varieties were grown and harvested at marketable stage in Colombia and transported using the commercial distribution channel via Miami. Flowers arrived 5 days after harvest to the University of Florida. Upon arrival, the sleeved flower bunches were kept boxed and placed directly into storage coolers maintained at 2, 6, or 10°C for 7 days. After storage, stems were cut dry (not underwater) and placed in vases containing floral preservative mixed in tap water (Floralife Crystal Clear, Floralife, Inc., Walterboro, SC). A total of 16 stems were used for each treatment, using 2 replications. One vase was used per replication with 8 stems per vase. Flowers were maintained at 21°C and 10 µmol $m^{-2}s^{-1}$ (12 h/day) for evaluation. Relative humidity was maintained at 50±5%.

Vase life was calculated from the time flowers were placed in vases until decline

occurred. Flower opening was rated over time in postharvest conditions. The rating ranged from 1 (tight) to 5 (open with petals fully expanded). A rating of 3 or more was considered acceptable.

A complete randomized block design was used. Data were analyzed using analysis of variance and mean separations were determined using Duncan's Mean Separation Test at $P \leq 0.05$.

RESULTS

Vase Life

Varieties showed considerable variation in vase life and quality in response to storage temperature (Table 1). Vase life was significantly reduced for most varieties when stored at 10°C compared to 2°C (Fig. 1). The magnitude of vase life reduction was variety dependent. 'Valentino' had an 8 day reduction in vase life while 'Marylse' had a 2 day reduction. 'Saturn' and 'Charlotte' were the only varieties where vase life was unaffected by storage temperature. When stored at 6°C or below, most varieties had a vase life of 10 days or more while sensitive varieties lasted 6 days or less at 10°C. A significant reduction in vase life of 1 to 5 days occurred at 6°C compared to 2°C in 'Madame Delbard', 'Eliza', 'Poison', 'Valentino', and 'Black Magic'.

Flower Opening

Besides a significant reduction in vase life, a major consequence of long-term storage at high temperatures was the failure of the flowers to open fully. Flower opening was reduced on most varieties when stored at 10°C, except for 'Charlotte' where flower opening was greatest at 10°C (Fig. 2). The varieties 'Orlando' and Saturn' were the only varieties where storage had no effect on flower opening. In addition to these varieties, 'Eliza' and 'Charlotte' opened satisfactorily at all temperatures. The varieties 'Red Unique', and 'Marylse' had less than optimal flower opening, regardless of storage temperature. Varieties that opened adequately at storage temperatures of 6°C or below, but unable to open satisfactorily when stored at 10°C include 'Red Jewel', 'Gabriele', 'Madame Delbard', 'Poison', 'Valentino', 'Black Magic', 'Leonidas', and 'Classy'. A comparison of the differences in flower opening rate over time in postharvest conditions among four varieties is presented in Figure 3.

Varieties that withstood stressful storage without major problems include 'Charlotte', 'Orlando' and 'Saturn'.

DISCUSSION

The data demonstrates the huge variation the varieties had in response to the stress of high storage temperatures. A few varieties were quite tolerant to high temperatures, while some varieties were very sensitive and yet others, like 'Marylse' and 'Red Unique' did not perform well at any temperature. For most varieties, a reduction in postharvest quality and vase life occurred when stored at high temperatures. Genetics play a major role in variety performance and the screening of varieties that can withstand unfavorable postharvest transport and handling conditions could improve breeding programs by selecting for these traits.

Other quality problems like bent neck or disease were either not observed or very minor in this study. In contrast, earlier work with 'Classy' showed an increase in disease as storage time increased (Leonard et al., 2001). One surprising result from the present study was the performance of 'Poison'. 'Poison' had excellent longevity, but the flowers did not open satisfactorily, even at 2°C. In another evaluation of 'Poison' in our lab, storing at 6°C for 7 days had no effect on flower opening (unpublished results). This points out the need for the continued testing of varieties over several different times of the year, as variation in quality among shipments occurs.

The results show the importance of storing roses at low temperatures. The effect of high storage temperature on reduced vase life of cut roses and other cut flower species

has been correlated to an increase in flower respiration rate (Celikel and Reid, 2002; Cevallos and Reid, 2000; Cevallos and Reid, 2001). This relationship may also explain the results found in this study. The unfortunate fact remains that flowers are not always handled properly, thus selecting varieties that can tolerate unfavorable conditions is one way to help combat the problem and provide better quality for the consumer.

ACKNOWLEDGMENTS

Florida Agricultural Experiment Station Journal Series No. R-09709. This research was supported by the American Floral Endowment, Glen Carbon, Illinois, USA. Much appreciation is extended to the Colombian Association of Flower Exporters, Bogota, Colombia for their coordination of the flower shipments, Splendor El Rosal, Ltda. and Flores de Tenjo Ltda. for donation of the plant material, Armellini Express Lines, Inc., Palm City, Florida, USA for supplying cost free floral transportation services and Floralife, Inc., Walterboro, SC, USA for donation of floral preservative.

Literature Cited

Çelikel, F.G. and Reid, M.S. 2001. Temperature and the postharvest performance of rose (*Rosa hybrida* L. 'First Red') and gypsophila (*Gypsophila paniculata* L. 'Bristol Fairy') flowers. HortSci. 36(3):599.

Çelikel, F.G. and Reid, M.S. 2002. Storage temperature affects the quality of cut flowers from the Asteraceae. HortSci. 37(1):148-150.

Cevallos, J.C. and Reid, M.S. 2000. Effects of temperature on the respiration and vase life of *Narcissus* flowers. Acta Hort. 517:335-342.

Cevallos, J.C. and Reid, M.S. 2001. Effect of dry and wet storage at different temperatures on the vase life of cut flowers. Hort. Tech. 11(2):199-202.

Leonard, R.T., Nell, T.A., Suzuki, A., Barrett, J.E. and Clark, D.G. 2001. Evaluation of long term transport of Colombian grown cut flowers. Acta Hort. 543:293-297.

Tables

Table 1. Postharvest problems and overall response of Colombian grown cut rose varieties stored at 10°C for 7 days.

Variety	Postharvest problem		Overall response
	Reduced flower opening	Reduced vase life	
Black Magic	yes	yes	sensitive
Charlotte	no	no	tolerant
Classy	yes	yes	sensitive
Eliza	no	yes	moderate
Gabriele	yes	yes	moderate
Leonidas	yes	yes	sensitive
Madame DelBard	yes	yes	sensitive
Marylse	yes	yes	sensitive
Orlando	no	yes	tolerant
Poison	yes	yes	sensitive
Red Jewel	yes	yes	sensitive
Red Unique	yes	yes	sensitive
Saturn	no	no	tolerant
Valentino	yes	yes	sensitive

Figures

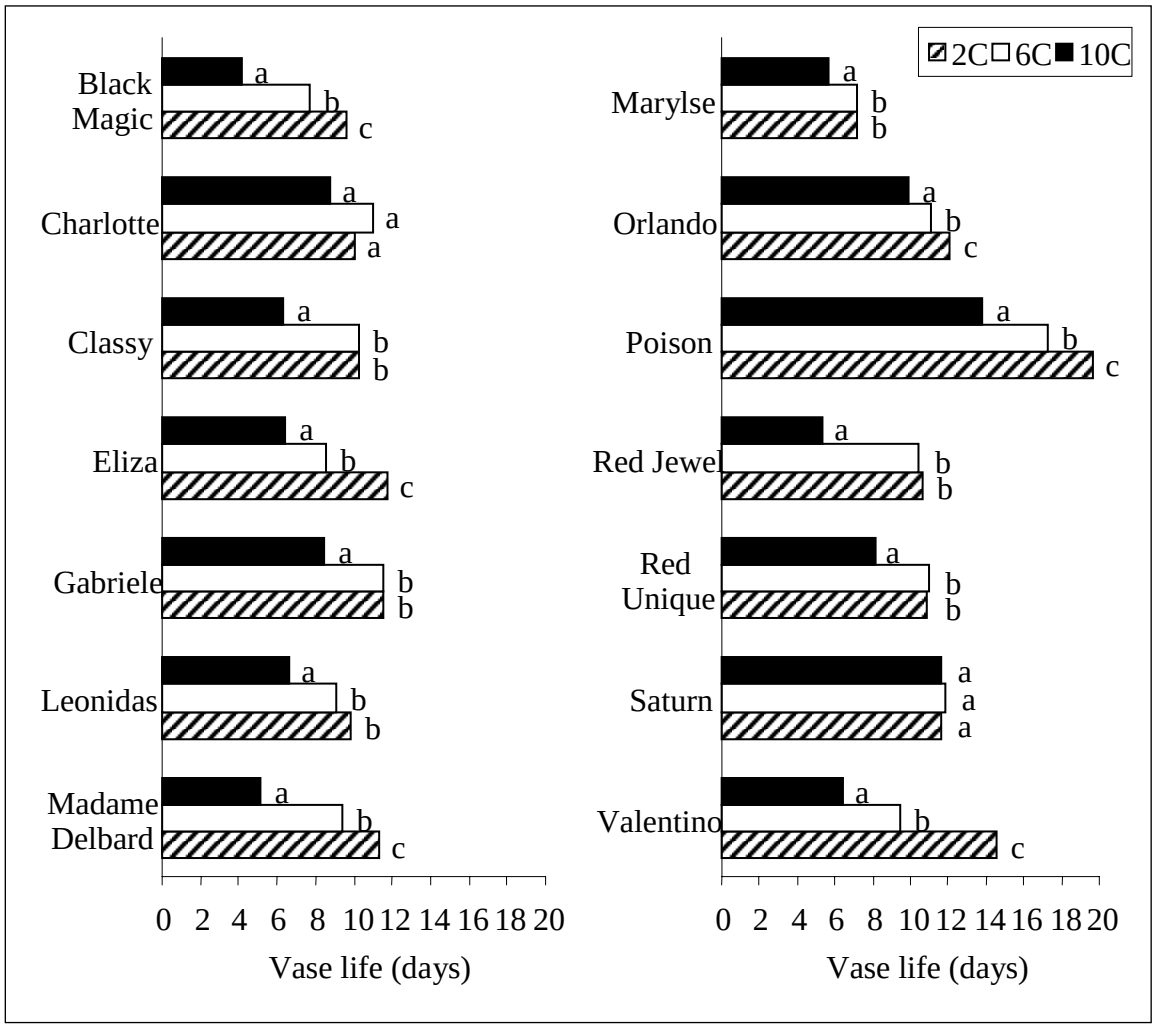

Fig. 1. Vase life of Colombian grown cut roses stored at 2, 6 or 10°C for 7 days. Means with different letters within a variety are significantly different ($P \leq 0.05$).

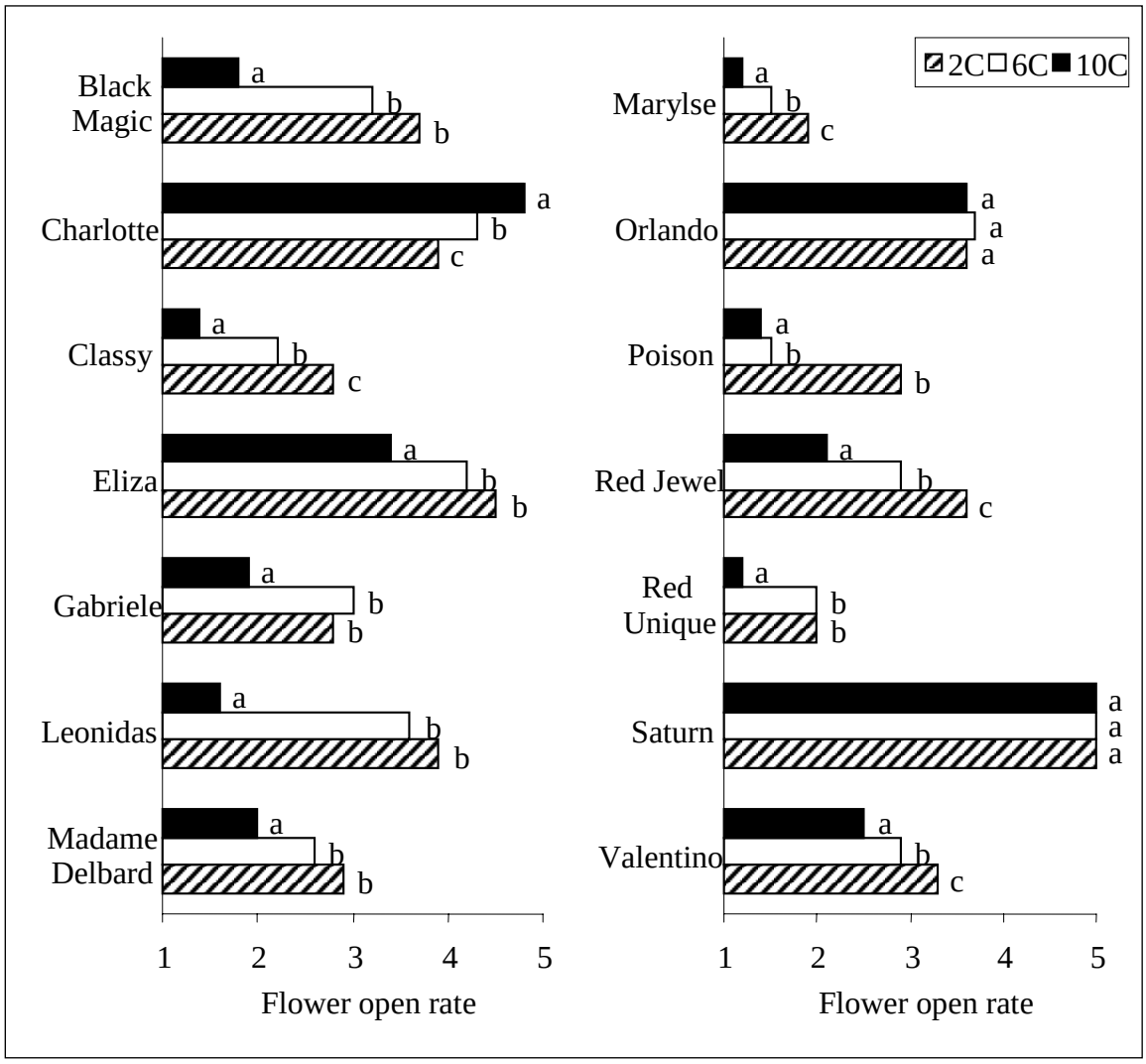

Fig. 2. Flower open rate after 7 days in postharvest conditions of Colombian grown cut roses stored at 2, 6 or 10°C for 7 days. Flower open rate ranged from 1 (tight) to 5 (open with petals fully expanded). Means with different letters within a variety are significantly different ($P \leq 0.05$).

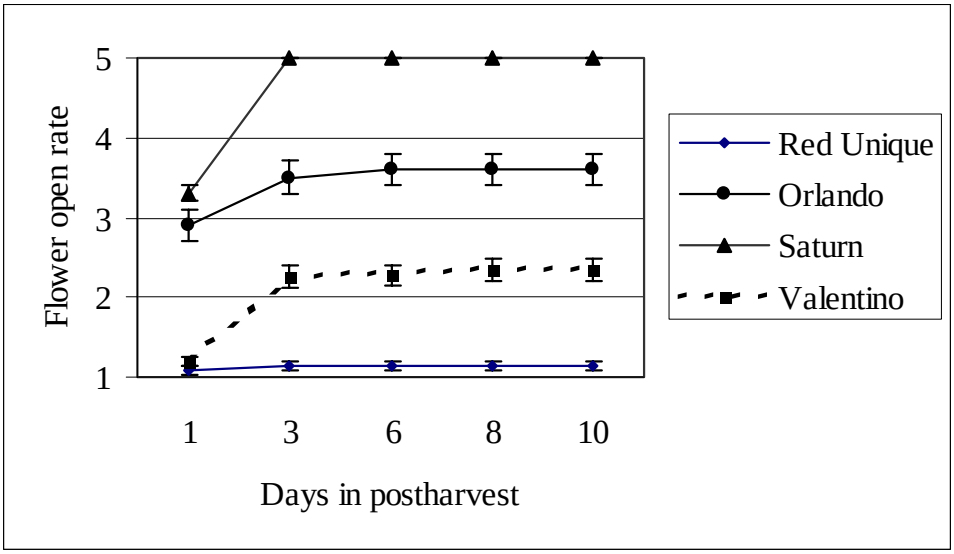

Fig. 3. Variation in flower opening rate of 4 cut rose varieties over time in postharvest conditions after being stored at 10°C for 7 days. Flower open rate ranged from 1 (tight) to 5 (open with petals fully expanded).