HortScience 27(3):239-241. 1992.

Postproduction Performance of Potted Rose under Simulated Transport and Low Irradiance Levels

Terril A. Nell
Environmental Horticulture Department, University of Florida, Gainesville, FL 32611

Cor Vonk Noordegraaf
Proefstation Voor de Bloemisterij, Aalsmeer, The Netherlands

Additional index words. light, shipping, miniature rose, abscission, postharvest, *Rosa*

Abstract. **Miniature flowering potted 'Orange Rosamini' rose plants *(Rosa × hybrida)* were placed directly from production into simulated transport (STR) for 3 days at 5C and then into a retail handling treatment for 0, 1, 2, or 4 days. In the retail handling treatment, plants placed at 1 W·m^{-2} were then moved into a final postproduction irradiance level of 4 W·m^{-2}; plants placed at 4 W·m^{-2} were then moved into a final postproduction irradiance level of 1 W·m^{-2}. Also, a no-STR control treatment, plants placed directly into final postproduction environment (no transport or retail handling treatment), was included. All plants were placed into a final postproduction irradiance level (1 or 4 W·m^{-2}) for 3 weeks to evaluate the effects of postproduction irradiance. The retail handling and postproduction environments were maintained at 20 ± 1C, 1 or 4 W·m^{-2} of irradiance (12 hours daily) from cool-white fluorescent lamps, and relative humidity (RR) of 60% ± 5% to simulate retail and/or consumer home conditions. Little difference was observed due to retail handling treatment or postproduction irradiance after 1 week. At weeks 2 and 3 of postproduction, there were 40% to 50% more open flowers on the no-STR plants maintained at 4 W·m^{-2} than on those maintained at 1 W·m^{-2} or on STR plants maintained at 1 or 4 W·m^{-2} postproduction irradiance. At week 3 of postproduction, plants with STR maintained at 1 W·m^{-2} had no buds showing color, while those maintained at 4 W·m^{-2} had three to five buds showing color. However, the no-STR control plants had one bud showing color at week 3, regardless of postproduction irradiance level. These results indicate that the detrimental effects of transport, i.e., bud drop, likely can be minimized by high postproduction irradiance levels following transport.**

Potted flowering rose plants are popular in Europe and production is increasing in the United States. Flower bud drop and yellowing of leaves often occur following transport, but have been minimized through cultivar selection, transport at 5C, and application of cytokinin [6-(benzylamino)-9-(2-tetrahydropyranyl)-9H-purine] and auxin (naphthaleneacetic acid) before transport (Clark, 1990; Halevy and Kofranek, 1976). Silver thiosulfate has been shown to extend potted rose longevity and to improve flower quality and opening under interior conditions following simulated transport (STR) for 4 days at 16C (Chen, 1990). Flowering potted roses, normally shipped to retail outlets, are displayed at irradiance levels ranging from near darkness to full sunlight for 1 to 4 days or longer before sale to the consumer. In our preliminary research, rose flower sepals began yellowing 7 to 10 days after transport at SC, and bud drop was highest at week 2 of postproduction at low irradiance levels (1 to 2

Received for publication 12 Oct. 1990. Accepted for publication 28 Aug. 1991. Florida Agr. J. Ser. no. R-01064. We are grateful to the American Floral Endowment and the D.C. Kiplinger Chair in Floriculture for support of this project, Pouw Rosen for the plants used in these studies, Ramon Littell for assistance in statistical analysis procedures, and Tanja Rosendal-Ouwerkerk and Lori A. Black for technical assistance. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

Table 1. The effect of simulated transport (STR), retail handling treatment (RHT), and final postproduction irradiance (FPI) level on the number of open flowers and buds showing color per plant on potted 'Orange Rosamini' miniature rose at weeks 1, 2, and 3 of postproduction.

Treatments		Week 1		Week 2		Week 3	
RHT[z] (days)	FPI[y] ($W \cdot m^{-2}$)	Open flowers	Buds showing color	Open flowers	Buds showing color	Open flowers	Buds showing color
0	1	9	5	6	1	0	0
	4	10	6	11	5	7	3
1	1	10	6	8	2	0	0
	4	9	6	7	4	5	5
2	1	9	5	7	2	0	0
	4	9	6	9	5	6	3
4	1	10	6	9	3	0	0
	4	8	5	5	3	3	5
No transport	1	8	6	9	3	5	1
	4	12	9	18	6	12	1
HT		NS	NS	NS	NS	**	NS
FPI		*	**	**	**	**	**
HT × FPI		*	NS	**	**	**	**
STR vs. no STR		NS	**	**	**	**	NS
FPI × STR vs. no STR		**	**	**	**	**	**
RHT, no STR		NS	NS	**	**	**	NS
HT, no STR × FPI		*	NS	**	**	**	**
$HSD_{0.05}$[x]		3.9	NS	4.4	2.8	2.9	2.1

[z]Plants were placed into simulated transport for 3 days at 5C and then placed into a retail handling treatment for 0, 1, 2, or 4 days. The retail handling treatment was as follows: plants placed at 1 $W \cdot m^{-2}$ were then moved into a final postproduction irradiance level of 4 $W \cdot m^{-2}$, plants placed at 4 $W \cdot m^{-2}$ were then moved into a final postproduction irradiance level of 1 $W \cdot m^{-2}$.

[y]The retail and postproduction environments were maintained at 20 ± 1C, an irradiance of 1 or 4 $W \cdot m^{-2}$ for 12 h daily, and RH of 60% ± 5% to simulate retail and/or consumer home conditions.

[x]HSD is for the comparison of four retail handling treatment durations including the no-transport control vs. two final postproduction irradiance levels.

*,**,NSSignificant at $P = 0.05$ or 0.01 or nonsignificant, respectively.

$W \cdot m^{-2}$) (Nell and Noordegraaf, 1991). Potted rose sensitivity to low irradiance levels suggests that bud drop may be increased by display at retail markets, even for short periods, under low irradiance levels after production and transport. This research was conducted to evaluate the effects of STR, low irradiance levels during a simulated retail environment for up to 4 days, and low irradiance levels during a final postproduction period on the performance of potted rose.

Flowering 'Orange Rosamini' miniature rose plants with a 14- to 16-cm crown diameter potted in 1.1-liter (10-cm) pots were produced by a commercial grower in Aalsmeer, The Netherlands, at a mean of 20C during June, July, and Aug. 1988. Plants were received from the grower and placed immediately into STR (3 days at 5C in closed boxes without sleeves) and then into a retail handling treatment (RHT) for 0, 1, 2, or 4 days. Also, a no transport control, plants placed directly into final postproduction environment (no transport or retail handling treatment), was included. The RI-IT was as follows: plants placed at 1 $W \cdot m^{-2}$ were then moved into a final postproduction irradiance level (FPI) of 4 $W \cdot m^{-2}$; plants placed at 4 $W \cdot m^{-2}$ were then moved in a FPI of 1 $W \cdot m^{-2}$. Eventually, all plants were placed into a FPI of either 1 or 4 $W \cdot m^{-2}$ for 3 weeks to evaluate postproduction performance. The retail handling and postproduction environments were maintained at 20 ± lC, 1 or 4 $W \cdot m^{-2}$ of irradiance (12 h daily) from cool-white fluorescent lamps, and relative humidity (RH) of 60% ± 5% to simulate retail and/or consumer home conditions. Plants of the four retail handling treatment durations and a no transport control were placed at one of two final postproduction irradiance levels (1 or 4 $W \cdot m^{-2}$); plants were arranged in a complete randomized design with eight plants per experimental unit. Data were tested using analysis of variance and Tukey's honestly significant difference (HSD) test. Plants were placed on subirrigated benches during postproduction and maintained uniformly moist with no fertilizer application throughout the evaluation. The number of open flowers and buds showing color per plant were recorded weekly, for 3 weeks, during the postproduction period.

Throughout the postproduction period, no leaf yellowing was observed. At week 1 of postproduction, there was little difference in the number of open flowers per plant among treatments (Table 1). No-STR plants maintained at 4 $W \cdot m^{-2}$ had 40% to 50% more open flowers at weeks 2 and 3 of postproduction than no-STR plants maintained at 1 $W \cdot m^{-2}$ or STR plants (Table 1). At week 3, plants that were maintained at a FPI of 4 $W \cdot m^{-2}$ had five and six open flowers when placed in RHT for 1 and 2 days, while those receiving a RHT for 4 days had only three open flowers. However, in every case, there were more open flowers on plants maintained at a FPI of 4 $W \cdot m^{-2}$ than at 1 $W \cdot m^{-2}$. Use of high (4 $W \cdot m^{-2}$) irradiance for an initial 1 to 4 days (RHT) was not sufficient to overcome detrimental effects of the subsequent 3 weeks of low (1 $W \cdot m^{-2}$) FPI.

At week 1 of postproduction, there was a significant interaction between the STR and no-STR treatments and FPI level. No-STR plants maintained at 4 $W \cdot m^{-2}$ had more buds showing color than those maintained at 1 $W \cdot m^{-2}$ or than plants with STR maintained at 1 or 4 $W \cdot m^{-2}$ FPI (Table 1). The RHT did not significantly affect the number of buds showing color at week 1 of postproduction. At week 2 of postproduction, there were consistently more buds showing color when plants were maintained at 4 $W \cdot m^{-2}$ FPI, except when plants had a 4-day RHT. Plants with a 4-day RI-IT had the same number of buds showing color per plant at week 2, regardless of FPI level. At week 3 of postproduction, plants maintained at a FPI of 4 $W \cdot m^{-2}$ had three to five buds showing color; however, no-STR plants had only one bud showing color, regardless of FPI level. Plants exposed to STR and maintained at a FPI of 1 $W \cdot m^{-2}$ had no buds showing color at week 3, while those at a FBI of 4 $W \cdot m^{-2}$ had three to five buds showing color. The RHT had no significant effect on the number of buds showing color at week 3 of postproduction. For plants maintained at a FPI level of 4 $W \cdot m^{-2}$, there were relatively few buds showing color on the no-STR control plants compared to plants that had been exposed to STR. This difference could be due to more buds showing color on the no-STR control plants that matured to the open flower stage, as evidenced by a higher number of open flowers per plant throughout the postproduction period on the no-STR plants. The absence of buds showing color at week 3 of postproduction for all plants maintained at 1 $W \cdot m^{-2}$ FPI was partially due to bud abscission.

Information relating transport conditions with postproduction irradiance for potted flowering and foliage plants is lacking. *Diffenbachia* plant quality has been reported to increase (Conover and Poole, 1981) and *Brassia* leaf drop to decrease (Braswell et al., 1982) with increased postproduction irradiance. However, plants in these studies had not been subjected to STR before postproduction evaluation. Kraszewski and Ormrod (1986) found that average number of flower clusters on *Oxalis* and *Browallia* increased while the number of flower spikes on *Crossundra* decreased when postproduction irradiance increased from 10 to 300 $\mu mol \cdot m^{-2} \cdot s^{-1}$. They also noted that *Oxalis* was very sensitive to low postproduction irradiances, while other species, such as *Crossandra* and *Browallia*, displayed some ability to adapt to low postproduction irradiances. In our studies, miniature rose partially overcame the deleterious effects of transport (3 days at 5C in closed boxes) and short periods of initial low irradiance (RHT) when subsequently placed at high (4 $W \cdot m^{-2}$) postproduction irradiance. However, initial placement at 4 $W \cdot m^{-2}$ for 1 to 4 days (RHT) did not overcome the sensitivity of miniature rose to 3 weeks postproduction at 1 $W \cdot m^{-2}$.

Simulated transport, retail handling, and postproduction irradiance level influenced postproduction performance of potted rose plants. High postproduction irradiance levels may reduce bud abscission, a problem commonly associated with the transport of flow-

ering potted plants, but it will require that optimum irradiance levels be maintained throughout the retail handling and postproduction period. If optimum irradiance levels are not maintained by the retailer, detrimental effects to flowering potted rose plants due to transport may be compounded by the handling procedures of the retailer, which may lead to decreased longevity and quality at the consumer level.

Literature Cited

Braswell, J.H., T.M. Blessington, and J.A. Price. 1982. Influence of production and postharvest light levels on the interior performance of two species of scheffleras. HortScience 17:48-50.

Chen, L.L. 1990. Growth regulator reversal of simulated high temperature shipping effects on flower senescence and leaf abscission in miniature potted rose plants. MS Thesis, Texas A&M Univ., Overton.

Clark, D.G. 1990. Postharvest handling of potted roses. MS Thesis, Clemson Univ., Clemson, S.C.

Conover, C.A. and R.T. Poole. 1981. Influence of light and fertilizer levels and fertilizer sources on foliage plants maintained under interior environments for one year. J. Amer. Soc. Hort. Sci. 106:571-574.

Halevy, A.H. and A.M. Kofranek. 1976. The prevention of flower bud and leaf abscission in pot roses during simulated transport. J. Amer. Soc. Hort. Sci. 101:658-660.

Kraszewski, R.A. and D.P. Ormrod. 1986. Utilization of response surface technique to study light acclimation of indoor flowering plants. J. Amer. Soc. Hort. Sci. 111:47-55.

Nell, T.A. and C.V. Noordegraaf. 1991. Simulated transport, postproduction irradiance influence postproduction performance of potted roses. HortScience 26:1401-1404.