Indian J. Plant Physiol., Vol. 8, No. 3 (N.S.) pp. 310-312 (July-Sept., 2003)

SHORT COMMUNICATION

INFLUENCE OF GAMMA IRRADIATION, COLD STORAGE AND PULSING ON POSTHARVEST LIFE AND RESPIRATION RATE OF 'GOLDEN GATE' CUT ROSES

[1]S. PALANIKUMAR, [2]MADAN PAL, [1]VINOD KUMAR* AND [1]S.K. BHATTACHARJEE

[1]Division of Floriculture and Lanscaping and [2]Division of Plant Physiology,
Indian Agricultural Research Institute, New Delhi – 110012

Received on 27 Aug., 2002, Revised on 27 Aug., 2003.

Gamma irradiation at 0.025 kGy increased the respiration rate of 'Golden Gate' cut roses. The irradiation followed by cold storage (at 4°C) brought down the respiration rate after storage duration of 3 days. The respiration rate was found maximum in the sucrose (3%) pulsed flowers immediately after pulsing. However, the rate of respiration is decreased in all the treatments. The irradiated flowers recorded lowest amount of respiration at senescence and the vase life was maximum in these flowers.

Key words **: Cold storage, gamma irradiation, postharvest life, pulsing, respiration, vase life.**

In agriculture, one of the peaceful uses of atomic radiation, particularly gamma rays, is in the preservation of food products such as fruits, vegetables including mushrooms, cereals, pulses, spices etc. by delaying senescence and minimizing insect infestation and microbial contamination. However, information on the effect of gamma irradiation on cut flowers regarding postharvest life and quality is negligible. Variable response of gamma irradiation in carnation and roses in different cultivars were reported by Dupuy (1975). The longevity and flower quality of rose cultivar 'Priyadarshini' with different doses of gamma irradiation were tried with some success by Bhattacharjee and Roy (1994). The objective of the present investigation was to study the effect of gamma irradiation on respiration rate and the postharvest life of cut rose cv. 'Golden Gate'.

The greenhouse grown cut rose cv. 'Golden Gate' was harvested early in the morning (9.00-10.00 A.M.) and prepared uniformly keeping 20 cm stem length and leaving two compound leaves attached with the stem. They were then irradiated with gamma rays (source is Co^{60}) at different doses ranging from 0.025 to 1.0 kGy. After irradiation the cut flowers were transferred to test tubes containing tap water and their postharvest life and quality was studied at ambient condition. In another experiment the cut flowers were irradiated at 0.025 kGy and pulsed with sucrose 3% for 24 h. They were cold stored at 4°C and relative humidity (85-90%) for 3, 4, 5, 6 and 7 days. The cold stored cut flowers were transferred to a test tube containing tap water and their postharvest life and quality were studied at ambient condition (25°C). Since the irradiation dose of 0.025 kGy, pulsing of sucrose 3% for 24 h and cold storage of 3 days at 4°C gave profound beneficial effects to the cut flowers, their respiration rate was measured with the help of a portable IRGA. The senescence stage of "Golden Gate" cut roses is marked by blackening, wilting, dropping of petals and yellowing of leaves. The experiment was laid out in completely randomized design (CRD). The number of treatments was 9, 6 and 4 in first, second and third experiment, respectively. Each treatment was replicated thrice and five cut stems were taken for each replication.

Cut rose cv. 'Golden Gate" performed well under lower doses of gamma irradiation, i.e. between 0.025 – 0.4 kGy (Table 1). A dose of 0.025 kGy however, gave the maximum vase life (14.0 days), flower diameter (7.8 cm) and water uptake (26 ml).

*Corresponding author.

The irradiated flowers (0.025 kGy) pulsed with sucrose (3%) for 24 h can be stored up to 5 days at 4°C without affecting their ultimate postharvest life and quality (Table 2). The 3 days stored flowers, however, recorded maximum vase life.

The data presented in Table 3 revealed that the respiration rate is increased in all the three treatments immediately after treatment. The control flowers also showed a rise in respiration immediately after harvest. However, at senescence lowest rate of respiration 246 cc $CO_2g^{-1}dw\ h^{-1}$ was recorded in the irradiated flowers and their vase life was maximum. Even though the sucrose pulsing gave more respiration rate at senescence (270 cc $CO_2g^{-1}dw\ h^{-1}$), because of beneficial effect of sucrose, the vase life was more than control. The respiration rate in irradiated and cold stored flowers was reduced immediately after cold storage (305 cc $CO_2g^{-1}dw\ h^{-1}$).

Irradiation of cut roses at 0.025 kGy increased the respiration rate of cut flowers after the treatment. This phenomenon was generally observed in irradiated roses. The irradiation leads to break down of carbohydrates, and hence the availability of respirable substrates might have increased which ultimately led to increase in respiration. In another treatment the irradiated cut flowers (0.025 kGy) after cold storage showed a reduction in respiration rate. This may be due to the effect of low temperature during cold storage. Palanikumar *et al.* (2000) also reported that the precooling of 'Raktagandha' cut roses by cold storage at 4°C reduced the respiration rate after the treatment. The reduction in respiration rate of cold stores cut rose cv. 'Visa' at 4°C (Serrano *et al.* 1992) and the cold stored anthurium at 4°C (Pritchard *et al.* 1991) has been reported. Pulsing of 'Golden Gate' cut roses with 3% sucrose increased the respiration rate after the treatment. Since, the sucrose is readily available source of respiratory substrate, the respiration rate might have increased in the cut rose under investigation. When compared to the irradiated (0.025 kGy) and cold stored flowers (at 4°C for 3 days), the sucrose pulsed flowers recorded more vase life (13 days). However, irrespective of the treatments, at senescence the respiration rate has decreased in all treatments. Serrano *et al.* (1992) also noted that the respiratory activity during senescence at room temperature was lower in those flowers stored at 4°C. Studies conducted on the pattern of respiration of roses and carnations revealed that on the first day after harvest there was high initial respiration rate of flowers followed by a decrease to a minimum on 3rd and 4th day. The respiration rate increased during 6th and 7th day and thereafter it again began to decline which is attributed to

Table 1. Postharvest life and quality of cut rose cv. 'Golden Gate' as influenced by gamma irradiation.

Treatments (irradiation dose in kGy)	After irradiation		At senescence		Water uptake (ml)	Flower diameter (cm)	Vase life (days)
	Fresh weight (g)	Dry weight (g)	Fresh weight (g)	Dry weight (g)			
0.025	10.6	1.8	9.8	1.7	26	7.8	14
0.05	10.7	1.8	9.9	1.6	26	7.7	13.5
0.1	10.8	1.7	9.8	1.6	24	7.2	13
0.2	10.2	1.6	9.2	1.4	21	7.1	12
0.4	11.0	2.0	10.0	1.9	19	7.1	11
0.6	10.6	2.0	9.8	1.9	19	7.0	10
0.8	10.9	1.9	10.0	2.0	18	6.8	8.0
1.0	11.0	2.0	10.0	1.9	18	6.6	7.5
Control	10.6	1.7	9.9	1.6	18	7.2	10
'F' Test	NS	**	NS	**	**	**	**
C.D. at 5%	-	0.11	-	0.12	1.0	0.4	0.8

Table 2. Influence of irradiation (0.025 kGy), pulsing with sucrose at 3% for 24 h and storage on postharvest life and quality of cut rose cv. 'Golden Gate'.

Treatments (cold storage duration)	After irradiation		At senescence		Water uptake (ml)	Flower diameter (cm)	Vase life (days)
	Fresh weight (g)	Dry weight (g)	Fresh weight (g)	Dry weight (g)			
3 days	11.0	1.9	9.9	1.8	16	7.4	12.5
4 days	11.4	2.2	10.0	2.0	15	7.2	11.5
5 days	11.9	2.5	10.6	2.3	14	7.0	10.0
6 days	12.4	2.7	11.2	2.4	12	6.2	9.0
7 days	12.8	3.0	11.6	2.6	10	5.9	8.0
Control	10.6	1.8	10.2	1.7	14	7.2	10.0
'F' Test	**	**	**	**	**	**	**
C.D. at 5%	0.26	0.16	0.23	0.13	0.7	0.13	0.64

Table 3. Influence of irradiation, cold storage and pulsing on changes in respiration rate of cut rose cv. 'Golden Gate'.

Treatments	After treatment ($ccCO_2$ g^{-1} dw h^{-1})	At senescence ($ccCO_2$ g^{-1} dw h^{-1})	Vase life (days)
Irradiation at 0.025 k Gy	335	246	14
Irradiation at 0.025 kGy + storage at 4°C for 3 days	305	255	12
Pulsing with 3% sucrose for 24 h	350	270	13
Control	320	280	10
'F' Test	**	**	**
CD at 5%	7.8	6.4	0.7

extensive protein breakdown and decomposition of amides and amino acids (Bhattacharjee 1999). Palanikumar *et al.*(2000) also found the same trend in precooled and packed flowers. They have observed a reduction in respirations rate at senescence in all precooled treatments of 'Raktagandha' cut roses.

REFERENCES

Bhattacharjee, S.K. (1999). Postharvest management of cut flowers, cut foliages and post production management of potted plants. *J. Ornam. Hort* **2**: 32-39.

Bhattacharjee, S.K. and Roy, M.K. (1994). Postharvest life of cut roses as affected by gamma irradiation. In : J. Prakash and K.R. Bhandari (eds.), Floriculture Technology, Trades and Trends, pp. 475-478. Oxford and IBH Publishing Co., Pvt Ltd., New Delhi.

Dupuy, P. (1975). Conservation des fleurs par irradiation. In : La Conservation des fleurs coupees. C.H.I.H. *Flor. Orm. Pepin. Mon. Tech.* **75**: 83-91.

Palanikumar, S., Madanpal and Bhattacharjee, S.K. (2000). Influence of precooling on postharvest life and respiration rate of 'Raktagandha' cut roses. *Indian J. Plant Physiol.* **5** : 203-204.

Pritchard, M.K., Hew, C.S. and Wang, H. (1991). Low temperature storage effects on sugar content, respiration and quality of anthurium flowers. *J. Hort. Sci.* **66**: 209-214.

Serrano, M., Martinez, G., Pretel, M.T., Riquelme, F. and Romojari, F. (1992). Cold storage of rose flowers (*Rosa hybrida* L. cultivar 'Visa') : Physiological alterations. *Scientia Hortic* **51**: 129-137.