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Short Communication

Avoidance of Electron - Irradiation Induced Injuries of Chrysanthemum Cut Flowers with Preservative

Toshiyuki DOHINO and Toru HAYASHI*

Chemical and Physical Control Laboratory, Research Division, Yokohama Plant Protection Station, Kitanaka-dori 5-57, Naka-ku, Yokohama 231, Japan

*National Food Research Institute, Kannondai 2-1-2, Tsukuba, Ibaraki 305, Japan

Abstract : Electron beam irradiation caused severe injuries to chrysanthemum cut flowers when they were placed in water after treatment. However, when they were placed in preservative containing sugar and germicides, the injuries were prevented, and both the vase-life and the flower diameter of cut flowers were positively influenced.

Key words : radiation, cut flower, preservative, *Chrysanthemum*, commodity treatment

Introduction

Chrysanthemum and rose cut flowers were highly sensitive to electron beam irradiation, and at 0.4kGy some severe injuries occurred such as leaf-chlorosis, delayed flowering and failure of flowering, in our previous study (TANABE and DOHINO, 1993). There are many floral preservatives sold to prevent chlorosis and the falling of blossoms. In the present study, we evaluated the efficacy of preservative for avoiding the irradiation induced injuries of chrysanthemum cut flowers.

Materials and Methods

1. Cut flowers

Cut flowers of *Chrysanthemum morifolium* cv. 'Shuho no Chikara' (L size, white) produced in Atsumicho, Aichi prefecture were examined. Plants were obtained at a flower market one day before irradiation.

2. Irradiation

Cut flowers were irradiated in a Dynamitron® accelerator at The Electron Beam Service and Application Research Center, Sumitomo Heavy Industries, Ltd. on June 16th, 1994 according to our previous studies (TANABE and KATO, 1992; TANABE and DOHINO, 1993; TANABE, *et al.*, 1994). After irradiation, 5cm of stem ends were cut off from plants. Plants were placed either in water or in the following preservative solution, and were stored at 25±3 ℃ and 60 ~ 80 % r.h.

Twenty plants were tested in each treatment.

3. Floral preservative

Preservative 'Iki-iki®' (Johnson Trading Co. Ltd.) was used under the prescription. This preservative consists of suger (43.8%), two type germicides (a very small amount) and distilled water (the remnant) (from Johnson Trading Co. Ltd.).

Table 1. Symptom of injuries and longevity of irradiated chrysanthemum cut flower 'Shuho-no-chikara'

Dose (kGy)	Treatment after irradiation	Days after irradiation 4 ~ 6	7 ~9	10 ~12	13 ~15	16 ~18	19 ~21	Vase-life (days)
0	Water				Browning of inflorescence core, withered leaves			18
					Chlorosis of leaves			
0.2	〃	Chlorosis of lower leaves		Slight browning of inflorescence core		–	–	10~14
			Chlorosis of lower leaves		Browning of inflorescence core, withered leaves			
0.4	〃	Chlorosis and withering of lower leaves		Browning of inflorescence core		–	–	9~13
			Chlorosis and withering of lower leaves		Browning of inflorescence core, withered leaves			
0.6	〃	Chlorosis and withering of lower leaves		–	–	–	–	9~10
			Browning of inflorescence core, flowering-inhibition					
0.8	〃	Chlorosis and withering of lower leaves		–	–	–	–	8~9
			Browning of inflorescence core, flowering-inhibition					
0	Preservative Iki-iki					Browning of inflorescence core, withering of lower leaves		21
0.2	〃			Leaf-drooping		Withering of lower leaves		
			Leaf-drooping		Recovery from leaf-drooping			20~21
0.4	〃	Chlorosis of lower leaves		Leaf-drooping		Withering of lower leaves		
			Leaf-drooping		Recovery from leaf-drooping			20~21
0.6	〃	Chlorosis of lower leaves		Leaf-drooping				
			Leaf-drooping		Recovery from leaf-drooping		Browning of inflorescence core	19~21
0.8	〃	Chlorosis of lower leaves		Leaf-drooping		Withering of lower leaves		
			Leaf-drooping		Recovery from leaf-drooping		Browning of inflorescence core	18~20

Results and Discussion

The symptoms and the longevity of irradiated cut flowers were shown in Table1. Irradiation caused severe chlorosis or yellowing in leaves, and reduced flower size and increased browning of inflorescence cores as the dose increased (Fig. 1, Plate 1). The leaves were affected to a greater extent than the flowers. In our previous study done with the same species on February

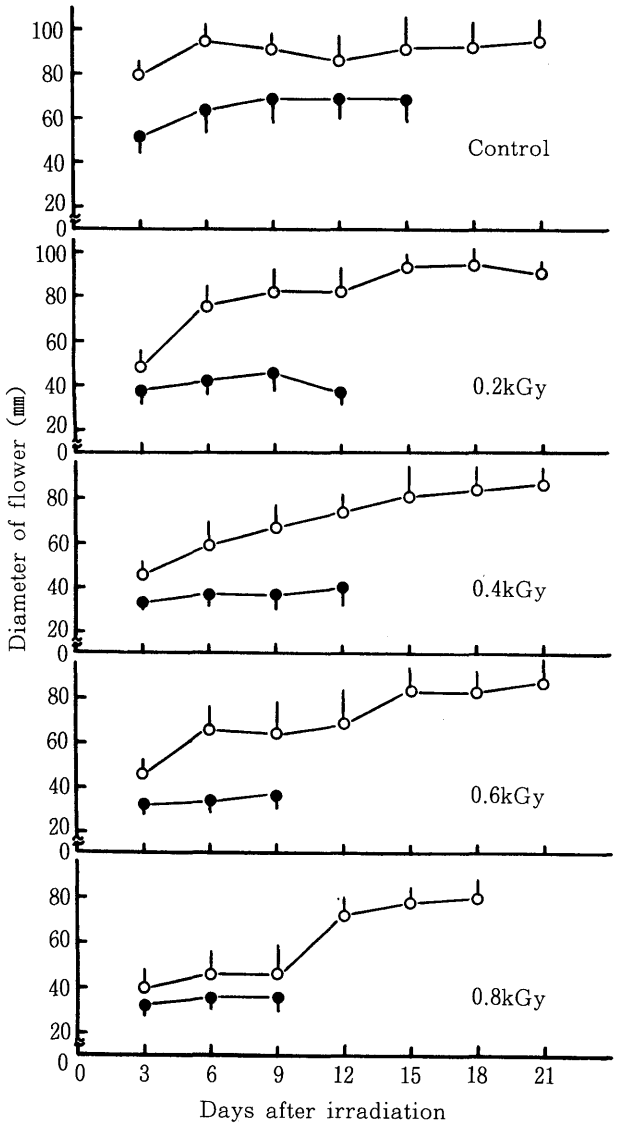

Fig. 1. Effect of electron beam irradiation on flowering of *Chrysanthemum morifolium* cv. 'Shuho no Chikara'
○ : preservative 'Iki - iki'
● : water

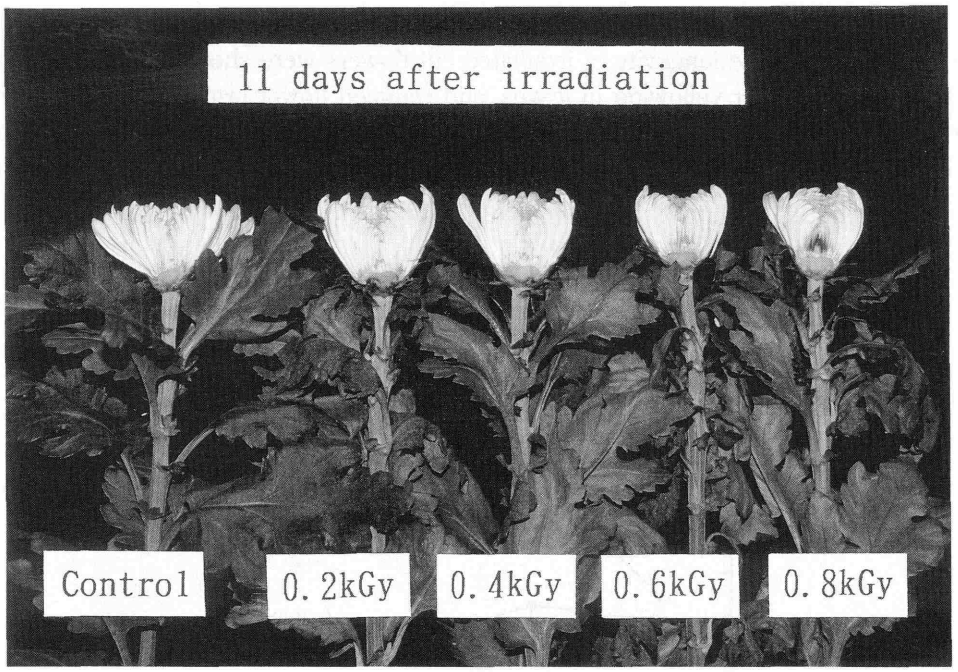

Plate 1. Irradiation injuries of leaves and flowers of *Chrysanthemum morifolium* cv. 'Shuho no Chikara' placed in water after irradiation

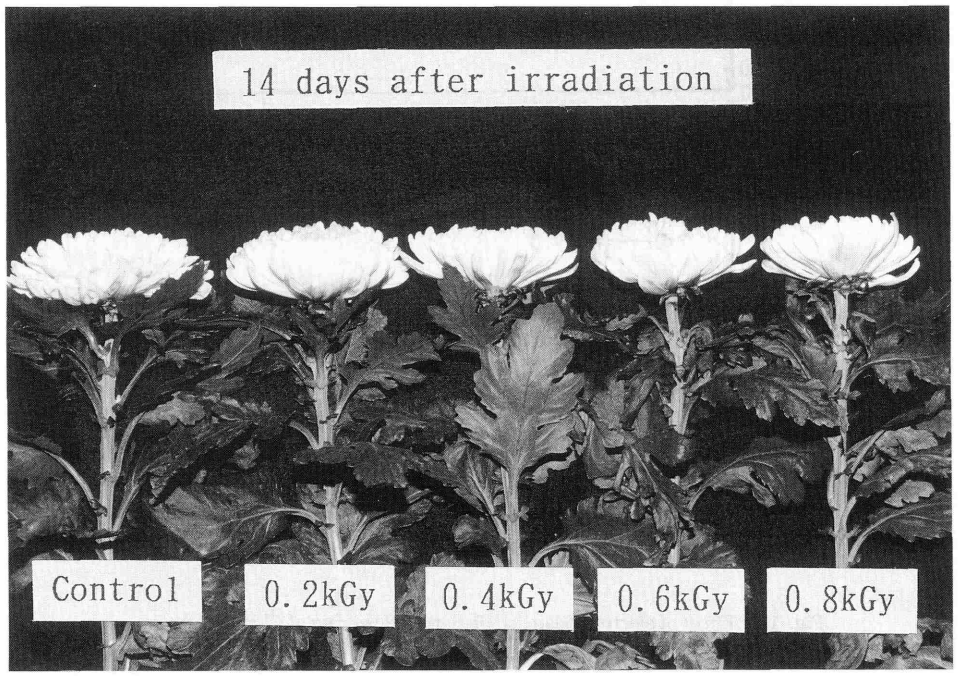

Plate 2. Avoidance of irradiation injuries of *Chrysanthemum morifolium* cv. 'Shuho no Chikara' by placing in preservative after irradiation

12th, 1992, severer damage was caused in flowers than in leaves (TANABE and DOHINO, 1993). At even 0.2kGy, flowers were affected and showed severe inhibition in flowering. The differences of damage parts and degree of damage between the previous study and this one, seemed to be supported by "a seasonal variation in sensitivity" (WIT and VRIE, 1985).

Preservative worked effectively on the irradiated cut flowers and resulted in an extension of the vase-life as well as an increase in flower diameter (Table 1, Fig. 1 and Plate 2). Diameters of the flowers irradiated and placed in water did not increase, whereas in the preservative, the diameters of the irradiated flowers were larger as days after irradiation increased. The flower diameters of irradiated flowers stood for 18 days in the preservative solution after irradiation were 93.9±10.8 mm (n = 15), 94.6±5.8 mm (n = 16), 86.0±11.3 mm (n = 17), 83.8 ±10.6 mm (n = 17) and 80.0±7.3 mm (n = 16) for 0kGy, 0.2kGy, 0.4kGy, 0.6kGy and 0.8kGy, respectively. The diameter tended to decrease as dose increased.

The preservative solution dried up 4 days after irradiation, while water still remained. This shortage of the preservative might have caused the subsequent leaf-drooping and affected flower diameter. The recutting of the stem ends of the flowers solved the problem of leaf-drooping immediately. The irradiated cut flowers consumed more preservative than unirradiated ones.

There are some substances which are used in order to maintain the quality of flowers, e.g. germicide, silver ion and sugar. Germicide depresses reproduction of bacteria and fungi in the solution, and prolongs the flower vase-life (HALEVY and MAYAK, 1981; PARUPS and CHAN, 1973). Silver ion is regarded as an inhibitor of the ethylene action which progresses the senescence of flowers (BEYER, 1976). In our previous study, the differences between carnations and roses in responses to irradiation were likely to concern susceptibility of the ethylene production system to irradiation (TANABE and DOHINO, 1994). However, since the senescence of chrysanthemum is not influenced by ethylene (ABELES, *et al.*, 1992), irradiation induced injuries are likely to be concerned not only with the susceptibility of the ethylene production system but also with the sensitivity of the plant. HALEVY and MAYAK (1979, 1981) reported that sugar was used for bud-opening and delay of senescence. Our result indicated that the preservative containing sugar worked effectively on the irradiated flower and the leaves. It is suggested that the irradiated flowers consume energy to recuperate from damages of irradiation and that they need a larger amount of sugar.

Preservative containg sugars and germicides is considered more effective on the longevity and flowering of the irradiated chrysanthemum cut flowers. Further studies are needed to clarify the mechanism of the prevention of deterioration of the irradiated cut flowers by preservative solution.

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和 文 摘 要

品質保持剤を用いたキク切花の照射障害の回避について

土肥野 利幸・林 徹*

横浜植物防疫所調査研究部
*食品総合研究所流通保全部

電子線照射（5 MeV）に対して感受性の高かったキク切花‘秀芳の力’(白)を照射後，水又は市販の品質保持剤（ジョンソントレーディング(株)，商品名‘イキイキ’）で保管し，障害発生状況に差異が生じるか調査した。

水で保管した切花には，葉の黄化・開花不全などの障害が認められた。

品質保持剤で保管したものは，障害が抑制され，開花も順調に進み，日持ち日数も大幅に延びた。

糖及び殺菌剤を含む品質保持剤は，照射されたキク切花の障害抑制に有効であると考えられた。