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Effect of gamma irradiation on growth and yield of Crossandra (*Crossandra infundibuliformis* (L.) Nees.)

S Vinodh and M Kannan

Abstract
The present experiment was carried out to determine gamma ray sensitivity in Crossandra (Nilakottai Local) to various levels of gamma rays (100, 200, 300,400 and 500Gy) on plant height, number of leaves, Internodal length, number of branches, days for first flowering, number of spikes, number of flowers per plant, 100 flower weight and flower yield. The seeds irradiated with 200Gy shows better results in Plant height (84.32cm), number of leaves (213.35), length (10.78cm) and breadth of leaf (5.26cm), internodal length (4.36cm), number of branches (28.29), length of branch (29.23cm), plant spread east–west (38.95) and plant spread north-south (33.56cm), number of spikes per plant (80.71), number of flowers per spike (37.76), number of flowers per plant (1747.76), weight of 100 flowers (6.64g) and yield of flowers per plant (86.34g) over the control.

Keywords: Crossandra, gamma irradiation, plant height, flower yield

Introduction
Crossandra (*Crossandra infundibuliformis* (L.) Nees) is an important loose flower crop, commercially grown in southern parts of India. Though it is not having any fragrance it became very popular due to its excellent color and demand in the market. According to Datta (1988) [2], mutation breeding has played a major role in the development of many new flower colour/shape mutants in ornamentals and flower crops. In order to accomplish the present need, genetic variability in crossandra can be created as the novel step of crop improvement programme. The type of mutagens and dose/concentration of the mutagens are to be standardized so as to get the highest mutagenic efficiency. In view of the above considerations, the present study was undertaken in crossandra genotypes using gamma rays at different doses for induction of mutation.

Material and Methods
The present investigation "Studies on induced mutagenesis in crossandra *(Crossandra infundibuliformis* (L.) Nees) was carried out at Department Floriculture & Landscape Architecture, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. The seeds with white endosperm were irradiated with gamma rays and sown. One hundred seeds were sown in each treatment for raising in open condition with four replications. Fourty five days old available seedlings raised by the treatments of gamma rays were transplanted in the main field at a spacing of 60x60 cm. Seedlings were planted at the rate of one seedling per hill in randomized block design with three replications for each treatment. A total of 20 seedlings were used for recording observations. Observations on growth and yield characters were made in the all the treatments at different stages of crop growth.

Result and Discussion
The LD_{50} values based on germination and survival percentage in gamma rays was 20-30 kR recorded less than 50 per cent germination/survival in all the concentrations executed in Nilakottai local. Plant height (84.32cm), number of leaves (213.35), length (10.78cm) and breadth of leaf (5.26cm), internodal length (4.36cm), number of branches (28.29), length of branch (29.23cm), plant spread east–west (38.95) and plant spread north-south (33.56cm) increase in the doses of gamma rays at 200Gy over control. The most important cellular effects was that which blocked the development of cells into mitosis and it is this effect which results in the reduction of growth in meristem exposed to mutagenic treatment. The reduction in the number of branches may be due to the direct effect of the mutagen on the meristems that

develop subsequently into branches. Some of the growing points depending upon the physiological/developmental stages might have been killed or inactivated by the dose of mutagens proving toxic and causing reduction in the number of branches. Similar results were reported that the reduction in growth in mutagen treated meristem is the cumulative expression of at least three different types of cytologically identifiable effects (Evans, 1965) [3]. Grossman and Craig (1982) [4] opined that reduced number of branches at higher doses of gamma rays was observed at *Pelargonium x hortorum*. Reddy and Bhalla (1982) [8] in *Portulaca grandiflora* noticed dichotomous branching due to EMS and gamma rays treatments.

The yield and yield components *viz.*, number of spikes per plant (80.71), number of flowers per spike (37.76), number of flowers per plant (1747.76), weight of 100 flowers (6.64g) and yield of flowers per plant (86.34g), increased mean values were observed in all the generations. However, the number of flowers per plant was increased by lower doses of gamma ray treatments and decreased by higher doses in M_1 generation. The higher doses might have affected the physiological process leading to flowering. As a result of floral initiation flower bud development were delayed and flowering phase within the crop duration was reduced. But the lower dose of mutagens might have caused a stimulated effect on physiological process of flowering and thus induced early flowering. This is in line with the findings of Kalaivani (1991) [5] and Balakrishnan (1997) [1] in chrysanthemum, Singh *et al. (*2009) [10] in Marigold, Mostafa *et al.* (2014) [6] in *Celosia argentea*, Patil (2014) [7] in gladiouls and Singh *et al.* (2015) [9] in tuberose. Number of flowers present in a spike determines the total yield per plant. Tonakanjan (1968) [11] reported increased number of flowers in candytuft at 125-1000 rad of X-ray treatments. In the present study, in all the generations increased number of flowers per spike was recorded in general and the gamma rays treatments in particular as compared to EMS.

Table 1: Effect of Gamma Rays on Growth Parameters of Crossandra in M_1 Generation

Treatments	PH	IL	NL	LL	BL	NB	LB
Control (dry)	73.20	3.66	195.43	9.75	4.35	16.81	20.70
100Gy	81.56	3.74	218.59	10.54	4.67	24.83	26.44
200Gy	84.32	4.36	213.35	10.78	5.26	28.29	29.23
300Gy	74.47	3.54	215.41	10.05	4.45	24.80	25.58
400Gy	70.43	3.45	209.57	9.98	4.34	21.30	25.56
500Gy	68.58	3.39	208.46	9.89	4.26	20.93	24.58
Mean	75.42	3.69	210.13	10.16	4.55	22.82	25.34
SEd	1.25	0.06	3.16	0.15	0.07	0.35	0.42
CD (P = 0.05)	2.59	0.13	6.55	0.33	0.15	0.73	0.87

Table 2: Effect of Gamma Rays on Floral Characteristics of Crossandra in M_1 Generation

Treatment	NSP	NFS	NFP	100 flower weight (g)	YPP
Control (dry)	36.64	26.66	1537.26	4.84	58.26
100Gy	76.73	33.94	1706.01	5.72	81.84
200Gy	80.71	37.76	1747.76	6.64	86.34
300Gy	74.59	32.30	1601.01	5.18	78.21
400Gy	73.14	30.43	1575.76	4.98	76.41
500Gy	63.51	30.06	1464.76	4.53	74.84
Mean	67.55	31.85	1605.42	5.31	75.98
SEd	0.98	0.51	25.86	0.09	1.15
CD (P = 0.05)	2.03	1.05	53.62	0.18	2.39

PH – Plant height (cm), IL – Internodal length (cm), NL- No. of Leaves, LL- Length of the leaf (cm), BL – Breadth of leaf (cm), NB- No. of Branches, LB- Length of branches (cm), DFF- Days for first flowering, NSP- No. of spikes per plant, NFS – No. of flowers per spike, NFP- No. of flowers per plant, YPP- Yield per plant (g).

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