*J. Hortl. Sci.*
**Vol. 3 (1): 68-71, 2008**

*Short communication*

# Effect of γ - irradiation on germination, growth, sensitivity and survivability of papaya cv. Kesar King

**Murlee Yadav, M. S. Kushwah, D. B. Singh, R. K. Roshan and Nongallei Pebam**
Department of Horticulture
Allahabad Agricultural Institute- Deemed University
Allahabad – 211 007, India
E-mail: murli_y@yahoo.com

## ABSTRACT

**An experiment was laid out in a 4x2 factorial design, with 4 levels of γ-irradiation (0,5,10 & 15 Krad) and two dates of sowing (15th September and 15th October) on papaya cv. Kesar King. The results indicated that germination percentage, survival percentage and plant growth increased with the increased in γ-irradiation upto 10 Krad. Early sowing of seed (15th September) showed better germination (73%), survival (70%) and plant growth as compared to late sowing (15th October). Interaction between γ-irradiation of 10 Krad and early sowing of seed (15th September) was found superior to all the other treatment combinations to obtain optimum germination percentage, survival percentage and plant growth.**

**Key words:** γ-irradiation, papaya

India stands third in papaya production, after Brazil and Nigeria with a 12% share of the total global production (F.A.O., 2004). The total area under papaya cultivation in India is about 73,000 ha and the total production is about 0.26 million tonnes (Anon, 2004). It is cultivated chiefly in Uttar Pradesh, Gujarat, Maharashtra and Tamil Nadu. Cultivation of papaya is beset with a number of problems like poor seed viability, sexual propagation, instability in sex ratio, sensitivity to water logging, frost, hot winds and susceptibility to fungal and viral diseases.

Papaya being a highly cross pollinated and polygamous fruit species, produces large variability with respect to plant characters. It is also very difficult to maintain the purity of variety and uniformity in plants. Papaya seeds exhibit poor seed viability and germ inability in stored seeds. Presently, there is a huge demand for healthy and productive seedlings among papaya farmers. Mutation by γ-irradiation is used for improvement of fruit crops, particularly in papaya.

The present investigation was carried out during 2006–2007 in the Department of Horticulture, Allahabad Agricultural Institute - Deemed University, Allahabad. The experiment was laid out in a 4 x 2 factorial CRD, comprising of four levels of γ-irradiation (0, 5, 10 and 15 Krad.) and

**Table 1. Effect of different levels of γ-irradiation and date of sowing on germination percentage and survival percentage of Papaya (*Carica papaya* L.)**

| | Germination percentage | | | Survival percentage | | |
|---|---|---|---|---|---|---|
| | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) |
| γ-Irradiation (R) | $D_1$(15th Sep.) | $D_2$(15th Oct.) | | $D_1$ (15th Sep.) | $D_2$ (15th Oct.) | |
| No irradiation | 59.40 | 55.00 | 57.20 | 57.33 | 52.00 | 54.67 |
| 5 Krad | 65.00 | 62.00 | 63.50 | 60.20 | 60.00 | 60.10 |
| 10 Krad | 73.20 | 70.00 | 71.60 | 70.00 | 65.00 | 67.50 |
| 15 Krad | 67.50 | 66.00 | 66.75 | 64.00 | 63.50 | 63.75 |
| Mean (D) | 66.27 | 63.25 | 64.76 | 62.88 | 60.13 | 61.50 |
| | R | S | RxS | R | S | RxS |
| S.Em ± | 0.33 | 0.46 | 0.46 | 0.54 | 0.77 | 0.77 |
| CD (*P=0.05*) | 0.70 | 0.99 | 0.99 | 1.17 | 1.65 | 1.65 |

two dates of sowing (15th September and 15th October) on papaya cv. Kesar King. Observations on germination percentage, survivability, and growth parameters namely, plant height, number of leaves per plant, leaf spread, diameter of stem, and petiole length were taken at 15 days interval.

The data pertaining to germination percentage and survival percentage of papaya, as influenced by different level of γ-irradiation and dates of sowing are presented in table 1. A significant increase in germination and survival percentage was recorded with γ-irradiation of 10 Krad ($R_2$). However, the minimum germination and survival percentage were recorded with no irradiation ($R_0$). Seeds sown on 15th September ($D_1$) recorded significantly higher percentage of germination (73.20%) and survival percentage (70%) as compared to (70% and 65%, respectively) 15th October sowing. Interaction effect of γ-irradiation of 10 Krad and 15th September seed sowing ($R_2$ $D_1$) recorded the highest percentage of germination (73.20%) and survival (70%), whereas the lowest germination (55%) and survival (52%) were observed with no irradiation in 15th October sowing. Bankapur and Habib (1979) reported that 5-15 Krad doses of γ-irradiation increased the germination, survival and number of male and female flowers and Hafiz *et al* (2005) also found maximum germination (87.50%) with 2.5 Krad of γ-irradiation.

The data with respect to plant height recorded at 15 days intervals is presented in table 2. Effect of γ-irradiation and date of sowing were non-significant at 15 days after sowing (DAS). Plant height was significantly influenced by γ - irradiation and date of sowing from 30 DAS. The maximum plant height at 30, 45, 60, 75, 90 DAS was recorded in 10 Krad ($R_2$), whereas minimum plant height was observed with no irradiation ($R_0$). Interaction effect of γ - irradiation of 10 Krad and sowing date of 15th September recorded the maximum plant height. However, minimum plant height was observed with the interaction between no irradiation ($R_0$) and 15th October sowing.

The data presented in table 2 revealed that number of leaves per plant was significantly influenced by different level of γ-irradiation and dates of sowing from 30 DAS. The maximum number of leaves per plant 16.06,24.00,34.33 at 60, 75, 90 DAS was recorded in 10 Krad ($R_2$) on 15th September sowing whereas it was minimum 8.23, 17.88, 21.68 with no irradiation ($R_0$) on 15th October sowing. Interaction effect of γ - irradiation of 10 Krad and sowing date of 15th September was found to have maximum number of leaves per plant at all intervals. However, minimum numbers of leaves per plant was observed with the interaction between no irradiation ($R_0$) and sowing date of 15th October at all interval.

The data pertaining to leaf spread at 15 day intervals is presented in table 3. Effect of γ-irradiation and date of sowing was found non-significant with leaf spread at 15 DAS. The leaf spread was significantly influenced by γ - irradiation and date of sowing from 30 DAS. The maximum leaf spread at 30, 45, 60, 75, 90 DAS was recorded in 10 Krad ($R_2$) at 15th Sept. sowing while minimum leaf spread was observed with no irradiation ($R_0$). Interaction effect of γ - irradiation of 10 krad and 15th September sowing was found maximum in leaf spread at all interval i.e., 60, 75, 90 DAS. While it was minimum with interaction between no irradiation ($R_0$) and 15th October sowing at all interval. Hafiz *et al* (2005) also found maximum germination (87.50%) with 2.5 Krad of γ - irradiation.

The data in respect of stem diameter at 15 day intervals is presented in table 3. Effect of γ-irradiation and date of sowing was found non-significant in stem diameter at 15 DAS, while it was significantly affected 30 days after sowing. The maximum stem diameter at 60, 75, 90 DAS were recorded in 10 Krad ($R_2$) at 15th Sept. sowing whereas minimum with no irradiation ($R_0$). Interaction effect of γ - irradiation of 10 Krad and 15th September sowing showed maximum stem diameter at all intervals. However, minimum stem diameter was observed with the interaction between no irradiation ($R_0$) and 15th October sowing.

The data presented in table 4 revealed that Petiole length was significantly influenced by different level of γ-irradiation and dates of sowing from 30 DAS. The maximum petiole length at 60, 75, 90 DAS was recorded in 10 krad ($R_2$) on 15th September sowing whereas it recorded minimum with no irradiation ($R_0$). Interaction effect of γ-irradiation of 10 Krad and 15th September sowing on petiole length was maximum at all the interval. However, it was minimum with the interaction between no irradiation ($R_0$) and 15th October sowing.

## ACKNOWLEDGEMENTS

The authors are thankful to the Head, Deptt. of Horticulture, AAI-DU for providing research facilities for the work.

**Table 2. Plant height and Number of leaves per plant as influenced by different level of γ - irradiation and dates of sowing**

| | Plant height (cm) | | | | | | | | | Number of leaves per plant | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 60 DAS | | | 75 DAS | | | 90 DAS | | | 60 DAS | | | 75 DAS | | | 90 DAS | | |
| ã-Irradiation | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) |
| (Krad) | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | |
| 0 | 5.29 | 4.62 | 4.96 | 9.44 | 8.81 | 9.13 | 12.20 | 11.70 | 11.95 | 12.20 | 8.23 | 10.22 | 18.43 | 17.88 | 18.16 | 23.60 | 21.68 | 22.64 |
| 5 | 6.24 | 6.15 | 6.20 | 13.60 | 11.17 | 12.39 | 14.20 | 15.00 | 14.60 | 14.73 | 14.50 | 14.62 | 20.69 | 19.83 | 20.26 | 25.73 | 24.80 | 25.27 |
| 10 | 13.81 | 13.30 | 13.56 | 17.57 | 17.14 | 17.36 | 21.23 | 21.16 | 21.20 | 16.06 | 15.97 | 16.01 | 24.00 | 22.07 | 23.03 | 34.33 | 28.77 | 31.55 |
| 15 | 13.12 | 12.11 | 12.62 | 16.02 | 15.69 | 15.85 | 21.12 | 20.47 | 20.79 | 15.47 | 15.00 | 15.23 | 21.05 | 20.78 | 20.92 | 27.90 | 27.38 | 27.64 |
| Mean (D) | 9.62 | 9.05 | 9.33 | 14.16 | 13.20 | 13.68 | 17.19 | 17.08 | 17.13 | 14.62 | 13.43 | 14.02 | 21.04 | 20.14 | 20.59 | 27.89 | 25.66 | 26.77 |
| | R | S | RxS | R | S | RxS | R | S | RxS | R | S | RxS | R | S | RxS | R | S | RxS |
| S.Em ± | 0.15 | 0.10 | 0.21 | 0.29 | 0.21 | 0.41 | 0.07 | 0.10 | 0.05 | 0.65 | 0.46 | 0.92 | 0.18 | 0.13 | 0.26 | 0.69 | 0.49 | 0.97 |
| CD(*P=0.05*) | 0.31 | 0.22 | 0.44 | 0.63 | 0.44 | 0.89 | 0.15 | 0.21 | 0.11 | 1.39 | 0.99 | 1.97 | 0.39 | 0.27 | 0.55 | 1.48 | 1.04 | 2.09 |

**Table 3 . Leaf spread ($cm^2$) and Stem diameter (cm) as influenced by different level of γ - irradiation and dates of sowing**

| | Leaf spread ($cm^2$) | | | | | | | | | Stem diameter (cm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 60 DAS | | | 75 DAS | | | 90 DAS | | | 60 DAS | | | 75 DAS | | | 90 DAS | | |
| ã-Irradiation | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) |
| (Krad) | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | |
| 0 | 11.73 | 10.39 | 11.06 | 21.43 | 21.10 | 21.27 | 26.27 | 25.33 | 25.80 | 0.84 | 0.84 | 0.84 | 1.13 | 1.12 | 1.13 | 1.59 | 1.48 | 1.53 |
| 5 | 12.37 | 12.17 | 12.27 | 25.13 | 23.83 | 24.48 | 29.57 | 28.73 | 29.15 | 0.86 | 0.85 | 0.86 | 1.22 | 1.21 | 1.22 | 1.76 | 1.64 | 1.70 |
| 10 | 45.00 | 41.17 | 43.08 | 58.75 | 58.37 | 58.56 | 77.37 | 69.37 | 73.37 | 1.05 | 0.90 | 0.98 | 1.32 | 1.25 | 1.28 | 1.85 | 1.83 | 1.84 |
| 15 | 41.00 | 37.80 | 39.40 | 54.03 | 51.53 | 52.78 | 69.33 | 69.07 | 69.20 | 0.90 | 0.89 | 0.90 | 1.24 | 1.23 | 1.23 | 1.83 | 1.76 | 1.80 |
| Mean (D) | 27.53 | 25.38 | 26.45 | 39.84 | 38.71 | 39.27 | 50.63 | 48.13 | 49.38 | 0.91 | 0.87 | 0.89 | 1.23 | 1.20 | 1.21 | 1.76 | 1.68 | 1.72 |
| | R | S | RxS | R | S | RxS | R | S | RxS | R | S | RxS | R | S | RxS | R | S | RxS |
| S.Em ± | 0.60 | 0.43 | 0.86 | 0.39 | 0.28 | 0.55 | 1.38 | 0.98 | 1.95 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| CD(*P=0.05*) | 1.30 | 0.92 | 1.83 | 0.84 | 0.59 | 1.18 | 2.96 | 2.09 | 4.19 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.02 | 0.04 |

**Table 4. Petiole length (cm) as influenced by different level of γ - irradiation and dates of sowing**

| | Petiole length (cm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 60 DAS | | | 75 DAS | | | 90 DAS | | |
| ã-Irradiation | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) | Date of sowing (D) | | Mean (R) |
| (krad) | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | | $D_1$ | $D_2$ | |
| 0 | 1.91 | 1.84 | 1.88 | 4.47 | 3.65 | 4.06 | 7.40 | 5.40 | 6.40 |
| 5 | 5.40 | 3.11 | 4.25 | 6.87 | 5.74 | 6.30 | 10.50 | 8.30 | 9.40 |
| 10 | 8.71 | 8.33 | 8.52 | 12.67 | 10.73 | 11.70 | 14.65 | 13.87 | 14.26 |
| 15 | 7.43 | 6.37 | 6.90 | 10.43 | 10.11 | 10.27 | 13.27 | 12.67 | 12.97 |
| Mean (D) | 5.86 | 4.91 | 5.39 | 8.61 | 7.56 | 8.08 | 11.46 | 10.06 | 10.76 |
| | R | S | RxS | R | S | RxS | R | S | RxS |
| S.Em ± | 0.16 | 0.11 | 0.22 | 0.16 | 0.11 | 0.23 | 0.19 | 0.13 | 0.26 |
| CD(*P=0.05*) | 0.34 | 0.24 | 0.48 | 0.34 | 0.24 | 0.49 | 0.40 | 0.28 | 0.57 |

## REFERENCES


Anonymous, 2005. National Horticulture Board. Horticulture data base.

Bankapur, V. M. and Habib, A. F. 1979. Mutation studies in papaya (*Carica papaya*). *Mysore J. Agril. Sci*., **13:**113-116.

Hafiz, I. A., Naveed, Anwar, Abbas, N. A. and Asi, A. A. 2005. Effect of various doses of g-radiation on the seed germination and seedling growth of mango-*S*arad. *J. Agri*., **21** : 63-567.


*(MS Received 28 September 2007, Revised 5 February 2008)*