

**Induction of genetic variability through mutagenesis for identification of high yielding, good seed quality bearing mutants in Pea (*Pisum sativum* L.) under moisture stress condition**

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**Abstract**

The present investigation was undertaken with an objective to determine the effect of gamma rays on different biological parameters (*viz.*, seed germination, seedling height, pollen sterility, LD<sub>50</sub>, and plant survival) and efficiency of mutagen. The research was conducted in three generations namely M<sub>1</sub>, M<sub>2</sub> and M<sub>3</sub> during *Rabi* 2011-12, 2012-13 and 2013-14 at Field Experimentation Centre of the Department of Genetics and Plant Breeding, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad (U.P.). The seeds of Arkel variety were irradiated with gamma rays *viz.*, (dry control), 05kR, 10kR, 15kR, 20kR, 25kR, 30kR, 35kR, 40kR (dry seeds) and pre-soaked seeds of the same was exposed to (wet control), 05kR, 10kR, 15kR, 20kR (kilo Roentgen) at National Botanical Research Institute, Lucknow (U.P.). After treatments, the treated seeds along with control were space planted for raising M<sub>1</sub> generation. Each M<sub>1</sub> plants were harvested separately and desirable M<sub>1</sub> individual plant progeny rows were laid in RBD for raising M<sub>2</sub> and M<sub>3</sub> generations except seed quality parameters recorded with harvested M<sub>1</sub> seeds stored was different packaging materials.

It was observed that higher doses of gamma rays alone which severely reduced the germination percentage, seedling height, sterility and plant survival in M<sub>1</sub> generation. Some important macro mutations like tall, dwarf, semi dwarf (plant stature), early and late maturity, bold, long and short pod, brown, light white and light seed colour, small, bold and wrinkled seed shape and high yielding mutants were isolated in M<sub>2</sub> and M<sub>3</sub> generations. Five different types of chlorophyll mutants namely, *Albina*, *Chlorina*, *Xantha* and *Viridis* were induced. *Viridis* were found more frequent followed by *Chlorina*, *Xantha* and *Albina* respectively. The effectiveness and efficiency of gamma rays on pea *cv.* Arkel were studied. A dose dependent decrease in the mutagenic effectiveness and efficiency was recorded in gamma rays treatments. The treatments of gamma rays produced more physiological damage as to the treatments of mutagens while low to moderate doses of mutagens were more effective in inducing change for characters of economic importance *viz.*, plant height, number of primary and secondary branches per plant, number of seeds per pod, number of pods per plant, 100 seed weight and seed yield per plant, whereas, its moisture stress condition parameters were more effective in change for traits *viz.*, plant height, number of primary and secondary branches per plant, number pods per plant, number of seeds per pod, relative water content, soil moisture percent, drought tolerance, membrane injury, chlorophyll content, 100 seed weight and seed yield per plant.

The means values of treated populations shifted in positive or negative direction away from the mean of the respective controls. The mean performance for the characters studied showed improvement in M<sub>2</sub> and M<sub>3</sub> generations. Induced mutations delivered fairly good

amount of genotypic coefficient of variation, phenotypic coefficient of variation, heritability and genetic advance with respect to number of primary branches per plant, plant stand per plot, number of pods per plant, number of seeds per plant, biological yield per plant, 100 seed weight, seed yield per plant indicating scope for improving pea yield by selection. In correlation studies, the mutual relationship among different variable in order to make framework for a successful crop improvement programme specially when new traits are introduced in breeding programme. Correlation (Genotypic and phenotypic) studied revealed that, in general genotypic correlation coefficient were higher in magnitude than phenotypic correlation coefficient indicating there was high genetic relationship between the traits under study. All the traits, biological yield per plant, number of pod per plant, number of seeds per pod, plant stand per plot, number of primary branches per plant, number of secondary branches per plant, pod length, days to 50 per cent flowering, 100 seed weight, plant height and days to maturity exhibited significant positive correlation with seed yield per plant at both phenotypic and genotypic levels except harvest index which had positive non significant correlation with seed yield per plant in  $M_2$  generation. Its traits *viz.*, biological yield per plant, number of seeds per pod, number of secondary branches per plant, number of pods per plant, pod length, plant stand per plot, 100 seed weight, plant height and days to maturity, depicted significant positive correlation with seed yield per plant at both phenotypic and genotypic levels except days to 50 per cent flowering which had positive non significant and number of primary branches per plant and harvest index which had negative but non- significant correlation with seed yield per plant in  $M_3$  generation.

The path coefficient (genotypic and phenotypic) revealed that number of pods per plant gave the highest direct effect on seed yield per plant followed by number seeds per pod, plant stand per plot and biological yield per plant in  $M_2$  generation. Path analysis (*i.e.* genotypic and phenotypic) of component characters on seed yield per plant on *Pisum sativum* L. in the  $M_3$  generation exerted a direct positive effect through these characters namely number of seeds per pod, number of pods per plant, harvest index and biological yield per plant.

There after that seeds at different irradiated harvested materials were stored in plastic and gunny bags for 3, 6, 9, 12, 15, 18, 21 and 24 months in the Seed Testing Laboratory, SHIATS, Allahabad. It is concluded that the plastic bag for 24 months showed significant higher per cent of seed viability, seed germination per cent, speed of germination, seed vigour index and vigour index mass as compared were stored in the gunny bags. It is also found out that the plastic bags could be the best option than normal gunny bags for seed packaging in terms of maintaining the seed quality as reflected in the varied parameters of the seed quality assessment indicators.

**Key words:** *Pisum sativum* L., gamma rays, effectiveness and efficiency, variability, correlation, path analysis, seed quality parameters.