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# EFFECT OF GAMMA RAYS ON DIFFERENT QUANTITATIVE TRAITS OF SOYBEAN JS335

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## ABSTRACT

Soybean JS-335 was treated with 200, 250 and 300 Gy doses of gamma rays to study the variability in M2 for the qualitative and quantitative traits. The experiment was conducted in the experimental farm of Samarth Agriculture College Deulgaon Raja, Buldana during kharif and rabi 2017-18. The treated material along with untreated control planted in M1 generation and individual plants were harvested separately. Harvested seeds of individual plants from M1 generation were planted in non-replicated field trial to rise M2 generation. Observations were recorded on different yield attributing characters like days to flowering, days to maturity, plant height, number of branches plant-1, length of primary root, number of pods plant-1, 100 seed weight and grain yield plant-1. In M2 generation days to flowering and days to maturity increased significantly in all the treatments. Plant height, number of branches plant and length of primary root reduced significantly in all the treatments. Number of pods plant-1 and grain yield plant significantly increased in all the treatments and 100 seed weight significantly decreased in all the treatments as compared to control. The economical and morphological mutants were isolated from the variety of JS-335.

**Keywords:** Soybean JS 335, gamma rays, mutation, quantitative traits.

## 1. INTRODUCTION

Soybean (*Glycine max* (L.) Merrill) is referred as "Golden bean" and "Miracle crop" of 21st century. It is one of the important oilseed as well as legume crop. It contributes more than 50% to the global production of edible oil. Soybean contains 20% oil and 40% protein. Soybean protein is rich in all essential amino acids, vitamin A, B and D; health promoting phytochemicals like isoflavones, hence, soybean referred as "Wonder crop" or "Golden bean". Soybean oil is used as edible oil in Indian diet. It contains low level of saturated fatty acids. Therefore, soybean oil is better for human health. Soybean is highly self pollinated crop. Taxonomically soybean belongs to the order Fabales and family "Leguminoseae" and subfamily "Papilionidae" and the genus Glycine. Global output of soybean was reported as 155.1 million metric tonnes, and the main producers were the United States, Brazil, Argentina, China, and India.

India ranked 5" position in respect to area and production. The largest soybean producing states in India are Madhya Pradesh, Maharashtra and Rajasthan. In India, Maharashtra ranks second in area and production. *Hugo de vries* (1903) first given the concept of the mutation. Gamma rays an ionizing physical mutagen capable of inducing mutation in plants. The present

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research work was therefore undertaken by using soybean cultivar JS-335 subjected to treatment of different doses of gamma rays and hence improves its yield.

## 2.MATERIALS AND METHODS

Dry healthy and genetically pure seeds of soybean cultivar JS-335 was used in this investigation. The seeds of JS-335 were irradiated by gamma rays. Equal quantity of seeds 500 g of each lot were irradiated by different dosages of gamma beams treatment. These seed were treatment by three diverse dosages of gamma beams i.e. 200 Gy, 250 Gy and 300 Gy ($Co^{60}$).

$M_1$ generation was raised in kharif 2017. The treated seeds along with the control were sown immediately after treatment to raise the $M_1$ generation at Samarth Agriculture College Deulgaon Raja Dist. Buldana. All the recommended cultural practices and management were given to raise a good crop and maximum multiplication of seed. The $M_1$ population was studied by recording observations at different growth stages. $M_1$ generation was screened for different morphological mutants. Seeds from each $M_1$ generation yielded independently and labelled with plant amount, doses and ancillary characters and stored to elevate to $M_2$ generation.

$M_2$ generation was elevated within Rabi 2017-18. By sowing seeds of each $M_1$ plants separately all the harvested seeds from each treatment were sown to raise $M_2$ population. The sowing was undertaken on the fertile and well levelled piece of land at Samarth Agriculture College Deulgaon Raja Dist. Buldana. The statistical analysis was done for Mean, Standard deviation (S.D.) and Coefficient of Variation (C.V.) by following standard formulas suggested by Singh and Choudhary (1985).

## 3.RESULTS AND DISCUSSION

Data regarding the effect of gamma rays on different quantitative traits of soybean are presented in Table 1. Maximum mean value for days to flowering was observed in 300 Gy treatments (71.24 days) and was statistically significant, while the minimum days to flowering was recorded in 200 Gy treatments (66.94 days) as compared to their respective controls (66.95 days). The coefficient of variation increased in all the treatments for days to flowering as compared to control. The maximum coefficient of variation was observed in 250 Gy treatment (7.99%) while the minimum in 200 Gy treatment (5.75%). The range of variation in treated population was 5.75% to 7.99%. It is observed in these study that increase in days to flowering resulted from gamma rays treatment as compared to control. Dhole (1999) also noticed that the flowering delayed significantly in gamma rays treated soybean as compared to control.

Mean value for days to maturity was observed to increase in all the treatments as compared to control. The maximum mean value was observed in 250 Gy treatment (118.30 days) and minimum in 300 Gy treatments (116.24 days). The days to maturity in control were (116.10 days). The coefficient of variation increased in all the treatments as compared to control. The maximum variation was found to be in 250 Gy treatment (5.60%) while the minimum in 200 Gy treatment (4.60%). The range of coefficient of variation was 4.60 % to 5.60 %. Gopinath and Pavadai (2015) also observed that in $M_1$ and $M_3$ generations mean for days to maturity increased at mutagenic treatment than control in soybean.

Plant height (cm) reduced significantly in all the treatment as compared to control. Maximum plant height was observed in 250 Gy treatments (46.09 cm) while the minimum was

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in 200 Gy treatment (41.62 cm) as compared to control treatment (55.90 cm). The coefficient of variation for the plant height increased in all the treatments as compared to the control. The maximum variation was noticed in 200 Gy treatment (31.52 %) and 300 Gy treatment (30.20 %) and minimum in 250 Gy treatment (25.56 %) as compared to control treatment (14.22 %) respectively. The range for the coefficient of variation was 25.56 % to 31.52 %. El-Demerdash (2007) studied the effect of gamma irradiation doses of 100, 150 and 200 Gy on soybean plants and found that plant height deceased by gamma irradiation. Ellyfa et. al. (2007) also observed that the lowest doses of irradiation (300 Gy) reduced the plant growth characters compared to the control in snap bean.

Data regarding number of branches plant$^{-1}$ revealed that the highest mean value for the character was recorded in 250 Gy treatment (4.95) and the lowest in 200 Gy treatment (4.19). In general the number of branches decreased in all the treatments as compared to their control treatment (5.97). The variability studies showed that the coefficient of variation increased against their control in all the treatments. The variation for the character ranged from 34.55 % to 46.06 % as compared to control treatment (27.64%). The highest variation was recorded in 200 Gy treatment (46.06%) and 300 Gy treatment (38.19%) and the lowest in 250 Gy treatment (34.55 %).It is revealed that gamma rays treatment resulted in decrease in number of branches plant' as compared to control. El-Demerdash (2007) studied the effect of gamma irradiation doses of 100, 150 and 200 Gy on soybean plants and observed that number of branches plant$^{-1}$were deceased by gamma irradiation.

The mean value for length of primary root (cm) decreased in all the treatments of gamma rays as compared to control. The maximum mean value for the characters was observed in 300 Gy treatment (15.12 cm) and minimum in 250 Gy treatments (14.73 cm). The coefficient of variation increased in all the treatments for length of primary root as compared to control. The maximum coefficient of variation was observed in 250 Gy treatment (22.00%) while the minimum in 300 Gy treatment (14.62%). The range of coefficient of variation in treated population was 14.62% to 22.00%. It is revealed from this observation that the mean length of primary root decreased in gamma rays treatment as compared to control.

Nandanwar et al. (1995) reported reduction in root and shoot length as the doses of gamma rays increased in mung bean. Ellyfa et al. (2007) also observed that increase in dosage of gamma irradiation was accompanied with decrease in height, root length, oven-dry weight of shoot and survival of snap bean.

Data on number of pods plant$^{-1}$ revealed that the mean value ranged from 200 Gy treatments (25.62) to 250 Gy treatment (35.78). The coefficient of variation for the characters augmented in all the treatments as evaluated to the control, the highest coefficient of variation was noticed in 200 Gy treatments (61.87%) and the lowest in 250 G3y treatments (44.69%). The variation for the character ranged from 44.69% to 61.87%. It is revealed that the mean number of pods plant$^{-1}$ increased in gamma rays treatment as compared to control. Waghmare and Mehra (2000) observed that the mean number of pods plant' were considerably reduced in higher doses than lower doses of gamma rays in grass pea. Soliman and Hamid (2003) also reported that the number of pods plant$^{-1}$ was significantly increased by 147.3% and 133.6% over the corresponding control by irradiation with 2.5 and 5.0 k rad respectively.

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Data regarding 100 seed weight revealed that the 100 seed weight decreased in all treatments as compared to control. The highest mean value for the character was in 200 Gy treatments (12.12 g) and lowest in 300 Gy treatments (10.94 g) as compared to their control treatment (12.98 g). The variations for the character were found to be increased in all the treatments, Maximum variation was observed in 300 Gy treatment (16.82%) followed by 250 Gy treatment (14.53%) and the minimum variation in 200Gy treatment (8.83%) as compared to controls treatment (5.16). It was found in this study that mean of 100 seed weight in general, reduced in gamma rays treatment. Waghmare and Mehra (2000) also observed the significant reduction of 100 grain weight in grass pea irradiated with gamma rays,

Data regarding grain yield plant$^{-1}$revealed that the maximum grain yield plant$^{-1}$was observed in 250 Gy treatment (6.97 g) and minimum in 200 Gy treatments (5.97 g). The variability studies showed that coefficient of variation increased in all the treatments. The maximum coefficient of variation was noticed in 200 Gy treatments (43.89%) followed by 300 Gy treatments (40.38%) and the minimum were in 250 Gy treatments (37.30%). The variation for this parameter ranged between 37.30% to 43.89%. It is revealed that mean value of grain yield plant$^{-1}$ in general, increased in gamma rays treatment as compared to control. Khan et al. (2005) also observed similar result and reported that the gamma rays irradiation increased the grain yield significantly as compared to control. Mudibu et al, (2012) studied the effects of 0.2 kGy and 0.4 kGy irradiation in $M_2$ generation and observed significant increase of grain yield and yield components in all the three soybean varieties cvs. Kitoko, Vuangi and TGX814-49D.Gopinath and Pavadai (2015) also reported that the yield parameters like number of seeds plant$^{-1}$, grain yicld plant$^{-1}$, recorded the moderate and high mean value of 0.5% of the EMS and 0.4% of the DES treated population in the 50 kR of gamma rays are relative to controlling plants in soybean.

It is inferred from the study that the gamma rays had the potential to induce variability in yield contributing characters of soybean. It was observed that gamma rays had significant effect on days to flowering, days to maturity. Plant height, number of branches plant$^{-1}$, length of primary root, number of pods plant$^{-1}$, 100 seed weight and grain yield plant$^{-1}$. The economical mutants identified needs to be observed for their breeding behavior in further generations and their utilization in improvement of soybean.

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**Table 1.Effect of gamma rays on different quantitative traits of soybean**

| Characters | Parameters | Irradiation dose (Gray) | | | |
|---|---|---|---|---|---|
| | | Control | 200 Gy | 250Gy | 300Gy |
| Days to flowering | Mean | 66.94 | 68.20 | 71.24 | 66.95 |
| | SD | 3.85 | 5.45 | 5.35 | 7.99 |
| | CV % | 5.75 | 7.99 | 7.51 | 5.60 |
| Days to maturity | Mean | 117.85 | 118.30 | 116.24 | 116.10 |
| | SD | 5.42 | 6.63 | 5.71 | 4.65 |
| | CV % | 4.60 | 5.60 | 4.91 | 4.01 |
| Plant height (cm) | Mean | 41.62 | 46.09 | 44.21 | 55.90 |
| | SD | 13.12 | 11.78 | 13.35 | 7.95 |
| | CV % | 31.52 | 25.56 | 30.20 | 14.22 |
| No. of branches plant$^{-1}$ | Mean | 4.19 | 4.95 | 4.53 | 5.97 |
| | SD | 1.93 | 1.71 | 1.73 | 1.65 |
| | CV % | 46.06 | 34.55 | 38.19 | 27.64 |
| Length of primary root (cm) | Mean | 14.97 | 14.73 | 15.12 | 15.50 |
| | SD | 2.47 | 3.24 | 2.21 | 2.08 |
| | CV % | 16.50 | 22.00 | 14.62 | 13.42 |
| No. of pod plant$^{-1}$ | Mean | 25.62 | 35.78 | 29.65 | 22.00 |
| | SD | 15.85 | 15.99 | 17.55 | 8.50 |
| | CV % | 61.87 | 44.69 | 59.19 | 38.63 |
| 100 seed weight (g) | Mean | 12.12 | 11.77 | 10.94 | 12.98 |
| | SD | 1.07 | 1.71 | 1.84 | 0.67 |
| | CV % | 8.83 | 14.53 | 16.82 | 5.16 |
| Grain yield plant$^{-1}$ | Mean | 5.97 | 6.97 | 6.24 | 5.39 |
| | SD | 2.62 | 2.60 | 2.52 | 1.26 |
| | CV% | 43.89 | 37.30 | 40.38 | 23.19 |