



REGULAR ARTICLE

GENETIC VARIATION IN QUANTITATIVE TRAITS OF BLACK GRAM (*VIGNA MUNGO* (L.) HEPPER) INDUCED BY GAMMA RAYS TREATMENT IN M₃ GENERATION

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SUMMARY

Black gram is an important pulse crop occupying unique position in Indian agriculture. The major constraints in achieving higher yield of black gram are absence of suitable ideotypes for different cropping systems, poor harvest index and susceptibility to diseases. Research on this species is lagging behind than that of cereals and other legumes. In order to improve yield and other polygenic characters, mutation breeding can be effectively utilized. However, Mutation induction has become an establishment tool in plant breeding to supplement existing germplasm and to improve cultivars in certain specific traits. In the present investigation, the attempt was made to improve some of the quantitative traits of black gram by using gamma ray irradiation. The study revealed that gamma irradiation induces and enhance the quantitative traits at 60 kR that evident to improving of black gram with genetic variation.

Keywords: Gamma rays, genetic variation, quantitative traits and black gram.

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1. Introduction

The efficiency of induced mutations in increasing genetic variability has been demonstrated in several crops and a number of varieties have been evolved [1]. Induced greater variability in polygenic traits might due to increased mutations and recombination induced by gamma rays [2]. Mutation affects a number of associated quantitative traits, which improves the yield and protein content of the mutant [3]. Increase in a polygenic character like yield could

result from changes in simply inherited traits [4]. The increased yield was may be due to cumulative effect of all yield-attributing traits [5]. In view of this, the important polygenic characters such as, plant height, number of branches per plant, number of leaves per plant, number of days taken for 50% flowering, number of fruit clusters per plant, number of pods per plant, yield per plant (g), number of seeds per pod and 100 seed weight (g) were

studied in M₃ generation to improve black gram with effect of physical gamma rays irradiation.

2. Materials and Methods

Selection of genotype

Black gram variety vamban-1 was selected for deriving chlorophyll and morphological mutants in M₂ generation. For this experiment, certified seeds were collected from Vamban Pulse Research Centre (Pudukottai), Tamilnadu, India.

Mutagen Treatment

Gamma irradiation

Gamma rays are one of the electromagnetic radiations, having the low wavelength with high penetrable power. The source of gamma rays is ⁶⁰Co, one of the labeled metals, which emit the rays. Irradiation was accomplished in Sugarcane Breeding Institute (ICAR) Coimbatore, TN, India.

Ten sets of three hundred well-matured seeds of black gram var. vamban-1 were taken for physical mutagens (Gamma rays). These sets of seeds packed in paper cover for irradiation and treated with 20, 40, 60, 80, 100 and 120 kR of gamma rays to fix and determine the 50% lethal dose (LD50) value. Irradiation was accomplished in Sugarcane Breeding Institute (ICAR) Coimbatore, TN, India. The labeled Cobalt (⁶⁰Co) was used for source of gamma rays.

Control

The three sets of two hundred dry, well-matured, healthy and uniform sizes of non-dormancy seeds were soaked in the double distilled water for eleven hours at room temperature (28 ± 2°C). These seeds were used as control (untreated) which sown along with treated seeds.

Field Observation

M₁ generation

The seeds of black gram genotype subjected with gamma rays were sown in the field along with the control. The plots were designed in randomized block with three replications. All the treatments including control were raised adopting a space of 30 cm in between rows and 10 cm between plants. All the recommended cultural practices viz., irrigation, weeding and protection measures were carried out during the growth period of the crop.

M₂ generation

The bulked seeds from the M₁ generation were used to rise the M₂ generation. It was grown in the randomized block design with three replications. All the cultural practices viz., irrigation, weeding and plant measures were carried out during the growth period of the crop.

M₃ generation

M₃ generation was raised from the seeds of M₂ generation as a randomized block design with three replications for further studies. All the control measures statistical data were carried out. After harvesting the following quantitative traits such as, plant height, number of branches per plant, number of leaves per plant, number of days taken for 50% flowering, number of fruit clusters per plant, number of pods per plant, yield per plant (g), number of seeds per pod and 100 seed weight (g).

Statistical Analysis

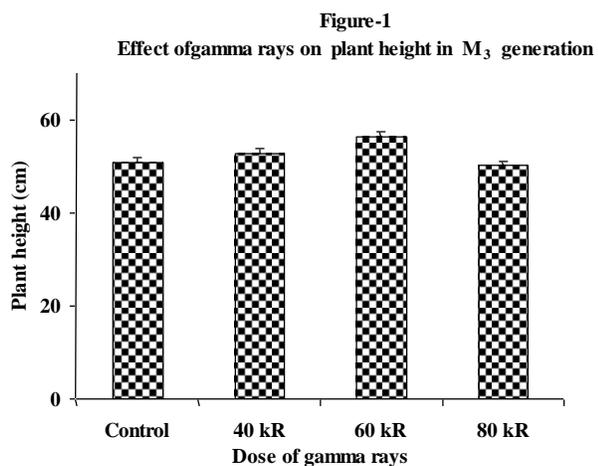
The mean values for the characters studied were calculated for each treatment and expressed as percentage of increase or decrease overall control. The data were calculated statistically by analysis of variance; significant differences were carried out among the various treatments for each character for randomized block design by ANNOVA for RBD developed

by (NPRC STAT) National Pulse Research Centre, Vamban, Pudukottai, Tamilnadu.

3. Results and Discussion

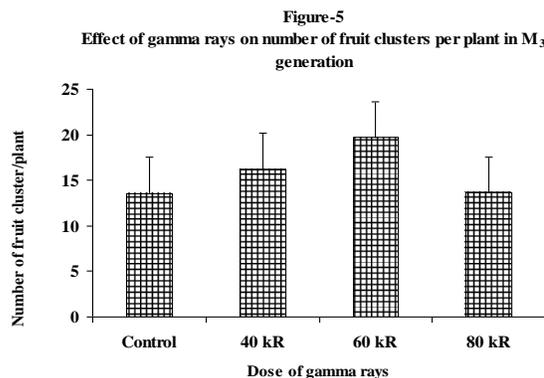
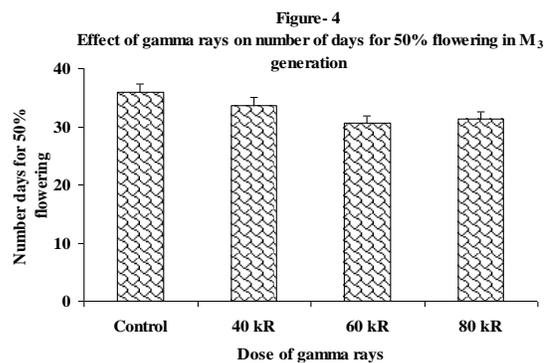
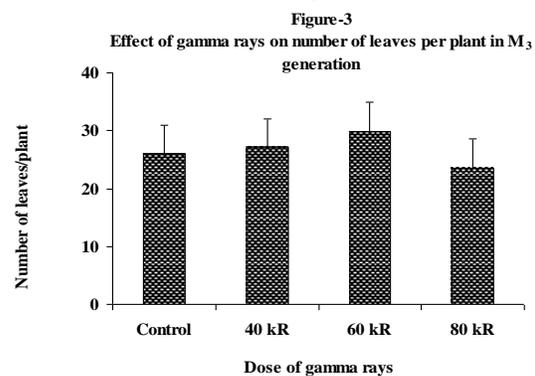
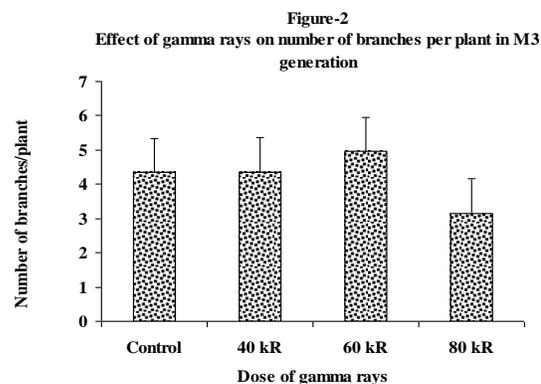
Quantitative and qualitative mean performance in M₃ generation

In M₃ generation, a significant improvement was achieved with their mutagenic treatments. A gradual enhancement was observed at increasing dose of gamma rays. Among the mutagenic dose, quantitative mean performance was high in 60 kR gamma rays compared to control.

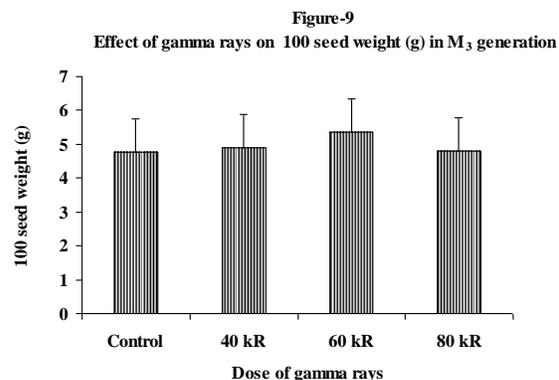
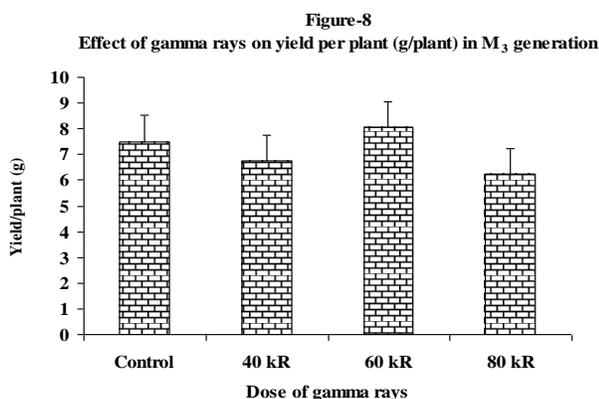
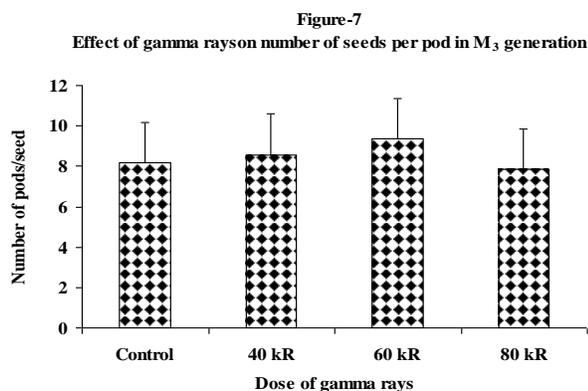
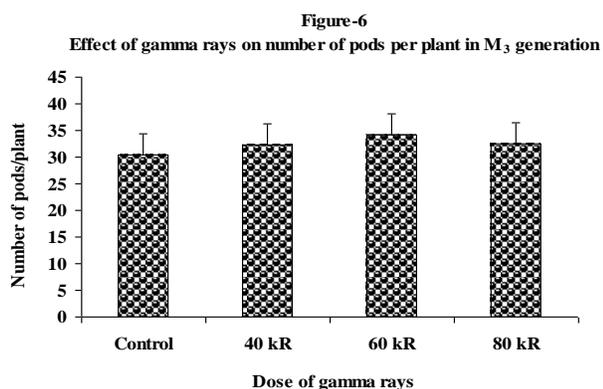


Due to the stimulatory effects of mutagens in M₃ generation quantitative and qualitative traits of mean values were increased more at 60 kR of gamma rays. The higher mean values were observed on plant height (56.55), number of branches per plant (4.96), number of leaves per plant (29.88), number of fruit cluster per plant (19.77), number of pods per plant (36.34), seeds per pod (9.63), yield per plant (8.99) and 100 seed weight (5.556) at 60 kR gamma ray treatment than control (Fig 1-3; 5-9). Whereas, days for 50% flowering (30.68) was decreased at 60 kR of gamma rays than control (Fig 4). Positive shift of mean performance in primary branches per plant, pods per plant, seeds per pod and 100 seed

weight with effect of mutagen M₃ generation of grass pea [6]. Positive shift of mean values in seeds/pod and seed protein content were recorded in M₃ generation of black gram [7].



Early flowering and high yield were observed in M₃ generation of gamma rays in *Lathyrus* [8]. Improvement of qualitative traits such as days to flowering was observed in M₃ generation of black gram with effect of gamma rays [7]. The days to 50% flowering was decreased than control in the present investigation (Fig 4) leads to early maturity of black gram. The early maturing selection could serve as candidate for short season [9].



Plant height, number of primary branches per plant showed significant improvement over the parent in M₃ generation of chickpea with effect of gamma rays and moreover, the hundred seed weight in the mutant plants was more than double in the parent on M₃ generation [10]. It is agreement with present investigation showed enhancement of these characters improve vegetative traits and facilitate to increase photosynthesis and absorption of nutrients. Significant increase in number of pods per plant and number of seeds per pod, pod length, number of seeds per pod and reduced days to maturity were recorded in M₃ generation of *Vigna radiata* with effect of gamma rays [11]. Number of branches/plant, number of pods per plant, number of seeds per pod, yield per plant and harvest index were increased in M₃ generation of black gram with effect of gamma rays [7].

The plant height, branches per plant, number of leaves per plant, number of pods per plant, number of seeds per pod, 50 seed weight and seed yield per plant were increased than control in M₃ generation of black gram with effect of gamma rays [3]. This is agreement with the present investigation (Fig 1-3; 6, 7 9). Increasing in plant height, days to flowering, number of pods per plant and pod length and grain length per plant were recorded in M₃ generation of various mutants of green gram with effect of gamma rays [12]. These traits could lead to

improved productivity of the crop [13, 14]. In the present investigation, gamma irradiation proved to be made variation in genetic level and enhance the quantitative traits at 60 kR compared to control plants.

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