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Enhancement of Genetic Variability for Yield and Component Traits through Recombination followed by Induced Mutagenesis in Greengram [*Vigna radiata* (L.) Wilczek]

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Authors' contributions

This work was carried out in collaboration among all authors.The experiment was performed and the manuscript was written by author PKM. Author SCM supervised the experiment and revised the manuscript. Author LSA helped in taking observations and data analysis. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Greengram is a self-pollinated crop which show very less variability to develop improved varieties through only hybridization or induced mutation breeding. Therefore, we have taken a new pace to create more variability by combining both recombinations with induced mutation through gamma rays irradiation. For this purpose, the F_2 seeds were irradiated with gamma rays at BARC, Mumbai and sown to grow the F_2M_1 generation and subsequently the superior mutant lines with high degree variability with high GCV and genetic advances were selected from F_2M_2 generation of the mutant population.

Methodology: The present investigation was carried out during *kharif*-2017 and *rabi-summer* 2017-18 at the experimental plot, All India Coordinated Research Projects (AICRP) on MULLaRP,

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main Agricultural Research Station, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India. The experiment was laid out in an augmented design.
Results: The mutant progenies obtained from the crosses DGGV-2 × IPM-410-3 and DGGV-2 × SML-1815 in F_2M_2 generation have shown high PCV and GCV for the characters like plant height, number of clusters per plant and number of seeds per pod etc. when irradiated with 100 kR gamma rays. The mutant breeding lines derived from the crosses DGGV-7 × V-02-709 and DGGV-7 × V-02-802 with irradiation dose of 20 kR, have shown higher number of pods per cluster and higher number of pods per plant with high heritability. More variability was observed with higher dose (100 kR) of mutation even though it showed higher mortality rate.
Conclusion: Irradiation of F_2 progeny (DGGV-2 × SML-1815) with 100 kR has generated more genetic variability for seed yield per plant (10.8 g), when compared to the check DGGV-2 (4.7 g) and SML-1815 (9.8 g). So, priority should be given to those characters which are having high heritability coupled with high genetic advance as per cent mean to get better selection gains. The breeding lines which showed higher degree of variability can be utilized in the future breeding programme for development of high yielding genotypes.

Keywords: Variability; heritability; genetic advance; mutation; gamma rays.

1. INTRODUCTION

Greengram [*Vigna radiata* (L.) Wilczek, 2n=2x=22] is an important grain legume among the major pulses with approximately 25-28% protein, 62-65% carbohydrates and 3.5-4.5% fibre on dry weight basis [1]. This crop is cultivated in the tropical and sub-tropical regions of the country mostly as a part of cereal based cropping system [2]. This crop is popular among farmers due to its early maturity, drought tolerance and ability to fix biological Nitrogen (30-40 kg ha^{-1}) which allows it to thrive in Nitrogen deficit soils [3]. Yield is a complex trait which is influenced by several factors including the environmental influence. For this reason critical selection of the yield attributing traits in greengram is important. The selection process mainly depends on the extent and amount of genetic variability present in the available breeding materials [4]. The genetic variability in greengram, is drastically reduced during the course of evolution as it is autogamous in nature [5]. There are many attempts have been made to develop improved varieties through hybridization and selection, but the yield potentiality of greengram remains static due to shortage of enough variability [6,7].

Mutation breeding is relatively easier method of crop improvement which is mainly based on the conventional breeding approach which brings novel genotypes with high yielding ability through heritable genetic changes of specific traits. A number of research evidences are available on the genetic variability study on greengram segregating materials by [8,9,10] and mutagenic variability study on different adopted varieties to create variation by several researchers [11,12] on greengram. But, it is realized that the variability developed through hybridization or by induced mutation alone is not sufficient to select the desirable variants from the population due to self-pollination nature. Thus, in the present investigation we had taken an innovative step to create sufficient amount of desirable variability in greengram by ameliorating both hybridization and induced mutation through gamma rays. Therefore, the segregating materials (F_2 seeds) were treated with gamma rays to create high variability through recombination followed by induced mutagenesis. There is a chance for improving variability in agro-morphological traits for selecting superior lines to increase their productivity and quality in greengram. With this aspiration the present investigation aimed at induction of mutation in segregating lines of greengram using gamma irradiation. The genotypic and phenotypic variability (GCV and PCV), heritability and genetic advance (GA) for yield components were assessed and the superior single cross progeny lines were selected in F_2M_2 generation of the mutant population.

2. MATERIALS AND METHODS

The field experiment was carried out during *kharif*-2017 and *rabi-summer* 2017-18 in an augmented design at Experimental plot, AICRP on MULLaRP, Main Agricultural Research Station, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India. The F_2 (Healthy and well dried) seeds derived from the following four different crosses mentioned in Table 1; were sent to Bhabha Atomic Research Centre, Trombay, Mumbai for gamma rays irradiation in *kharif*-2017 for the creation of desirable variability. Even though the LD_{50} for germination and survival of the seedlings range between 40-50 kR of gamma rays in greengram [7] but, 20-60 kR also reported [13,14]. In this study we have treated with 20 and 100 kR of gamma rays. Even though use of 100 kR is not usually practiced, but we have treated our materials expecting to get some novel mutants from the breeding lines. The pedigree, number of seeds from each cross and the dose of irradiation are stated below in Table 1.

2.1 Experimental Methodology

The gamma rays irradiated seeds were sown in augmented design during *kharif*-2017 along with their respective checks to grow the F_2M_1 generation. The individual plants were critically observed from the date of germination to the maturity. The desired variability on plant growth (7), robustness (4), maximum number of flowering branches (5), pod length (10) and seed size (5) etc. were observed in the respective number of plants and they were selected as putative mutants (as expression of dominant mutants). The mutant lines are compared with the parental lines and also with the F_3 progeny lines derived from the following crosses as check. The putative mutants selected and tagged in F_2M_1 and the seeds were harvested separately to develop the F_2M_2 mutant population in *summer*-2018. The population size maintained in F_2M_2 generation was nearly 1000 plants for each of the cross derivatives. The morphological observations for the traits mentioned in Table 2; were taken in F_2M_2 generation to study the genetic variability.

The phenotypic and genotypic coefficient of variability (PCV and GCV) for all the characters was estimated using the formulae of Burton and De Vane [15]. The GCV and PCV values were categorized as low (0-10%), moderate (10-20%) and high (> 20%) as indicated by Shiva Subramanian and Menon [16]. Heritability (broad sense) was estimated for all the characters as the ratio of genotypic variance to the total variance as suggested by Lush [17] and Hanson [18]. According to Robinson [19] heritability estimates in cultivated plants can be placed in the categories; low (0-30%), moderate (30-60%) and high (> 60%). Genetic advance for each character was estimated by using the formula of Johnson [20] and Genetic advance as per cent of mean (GAM) was categorized according to him as low (0-10%), moderate (10-20%) and high (>20%).

3. RESULTS AND DISCUSSION

The analysis of variances revealed significant variability for most of the characters in all the four mutagen treated breeding lines (Table 2). The mutant progenies of the cross derivative of DGGV-7 × V-02-709 has shown significant variation for the characters like days to 50 per cent flowering, number of pods per cluster, 100 seed weight (g) and seed yield per plant (g) with dose of 20 kR. However, significant variation was seen with 100 kR for days to plant height, number of clusters per plant, pod length, 100 seed weight and seed yield per plant for derivatives of DGGV-2 × SML-1815; whereas, non-significant variation was seen for number of seeds per pod with 100 kR. The magnitude of shift in the mean value varied with the dose of mutagen and the parent materials. Similar findings also reported by [21] in greengram.

3.1 Estimates of Variability (GCV and PCV), Heritability and Genetic Advance (GA) for Yield Components in F_2M_2 Generation

Depending upon the magnitude of genetic variability in different treatment populations, the genetic parameters like GCV, PCV, heritability and genetic advance under selection was varied. These helps in induction of micro and macro mutations and thereby increasing the scope of improvement for the desirable traits through selection. The genetic variability parameters for different yield attributing characters are presented in the Table 3.

Table 1. Research materials used for the gamma rays irradiation in the present study

Sl. no.	Pedigree	Dose of Gamma rays (kR)	Number of seeds treated
1.	DGGV-7 × V-02-709	20	500
2.	DGGV-7 × V-02-802	20	500
3.	DGGV-2 × IPM-410-3	100	492
4.	DGGV-2 × SML-1815	100	475

Table 2.ANOVA for yield and component traits of green gram breeding lines in F_2M_2 generation

Sl. no.	Characters	Crosses	Mean sum squares		
			Checks	Mutant lines	Error
1.	Degree of freedom	C1	3	19	12
		C2	3	19	12
		C3	3	19	12
		C4	3	19	12
2.	Days to 50 % flowering	C1	2.221	0.681	0.401
		C2	2.654	0.326	0.436
		C3	3.456	0.122	0.465
		C4	2.655	0.424	0.356
3.	Plant height (cm)	C1	186.514**	104.424**	52.122
		C2	88.945**	101.612**	64.114
		C3	95.915**	149.548**	55.125
		C4	468.945**	99.645**	65.112
4.	Number of branches per plant	C1	18.551**	1.625	1.526
		C2	18.231**	1.546	1.356
		C3	13.425**	1.325	1.235
		C4	19.245**	1.356	1.344
5.	Number of clusters per plant	C1	45.698**	2.365	1.456
		C2	55.446**	2.846	1.456
		C3	55.439**	2.267	1.456
		C4	53.365**	3.655	1.245
6.	Number of pods per cluster	C1	2.224	1.361	0.525
		C2	9.125	1.266	0.654
		C3	3.895	1.154	0.114
		C4	3.154	1.188	0.455
7.	Number of pods per plant	C1	128.291**	63.228	73.548
		C2	148.191**	59.568	74.569
		C3	147.255**	54.264	71.456
		C4	957.155**	48.466	74.135
8.	Pod length (cm)	C1	15.855**	1.756*	0.253
		C2	14.152**	1.125*	0.344
		C3	15.455**	1.619*	0.266
		C4	13.255**	1.565*	0.698
9.	Number of seeds per pod	C1	14.658**	2.564**	1.127
		C2	15.999**	2.645**	1.145
		C3	16.145**	2.874**	1.215
		C4	13.259**	2.459**	1.569
10.	100 seeds weight (g)	C1	3.461**	31.284**	0.193
		C2	4.445**	31.456**	0.166
		C3	3.145**	35.277**	0.236
		C4	3.357**	32.364**	0.265
11.	Seed yield per plant (g)	C1	49.451**	8.122**	0.678
		C2	52.364**	7.652**	0.463
		C3	52.225**	8.256**	0.459
		C4	55.698**	8.458**	0.187

Where, C1- DGGV-7 × V-02-709 (20 kR), C2- DGGV-7 × V-02-802 (20 kR), C3- DGGV-2 × IPM-410-3 (100 kR), C4- DGGV-2 × SML-1815 (100 kR). The values within parenthesis along with the crosses indicate the doses of Gamma rays irradiation.

**and ** - Significant at 5 % and 1 % level of probability respectively*

3.1.1 Days to 50% flowering

Days to 50 per cent flowering was observed in advance from the mutant breeding lines derived from the cross DGGV-7 × V-02-709 when treated with 20 kR gamma rays as compared to non-mutagenized lines. The average days to 50 per cent flowering was showed 41.32 days with the range between minimum and maximum days to 50 per cent flowering of 36.63 and 44.36 days. Highest heritability was also observed for the progenies of the same cross, coupled with higher genetic advance over mean. Higher PCV (3.98%) and GCV (2.42%) was observed for the cross derivative of DGGV-2 × IPM-410-3 with irradiation dose of 100 kR as compared to the other derivatives with 20 kR.

3.1.2 Number of pods per plant

The heritability 65.23% was observed for the cross derivative of DGGV-7 × V-02-802 when treated with 20 kR and it has also recorded higher mean number of pods per plant. The phenotypic coefficient of variability was recorded 57.24% in the cross derivative of DGGV-2 × SML-1815, but the heritability was moderate when treated with 100 kR.

3.1.3 Number of seeds per pod

Higher number of seeds per pod *i.e*. 12.22 was recorded in the cross derivative of DGGV-7 × V-02-802 when treated with 20 kR. The higher heritability (12.30%) with genetic advance over mean was recorded in these breeding mutant lines. Moderate GAM (10.32%) with high heritability (70.23%) was observed for the progeny of DGGV-2 × IPM-410-3.

3.1.4 100 seed weight

The mutant progenies derived from the cross DGGV-2 × SML-1815, after treatment with 100 kR g showed high PCV (23.45%) but GCV (12.64%) was low for the same cross. Moderate genetic advance under mean (18.46%) with 74.36% of heritability was shown in the mutant lines derived from the cross DGGV-7 × V-02-802 with 20 kR.

3.1.5 Seed yield per plant

The maximum range of seed yield per plant (6.95 to 23.65 g) was observed in the cross derivatives of DGGV-2 × IPM-410-3 (100 kR) with PCV (38.69%) and GCV (21.36%). The progeny lines derived from the cross DGGV-2 × SML-1815 (100 kR) has shown moderate heritability (59.87%) and high genetic advance over mean (48.96%).

The variability parameters are compared between the normal segregating population in F_3 generation [22] and in F_2M_2 generation on the same cross derivatives. It was observed higher variability for most of the yield attributing traits in greengram in F_2M_2 generation as compared to F_3 generation. In the present investigation, there was a reduction of yield per plant in higher doses, but the seed size increased with the increased dose of mutagen as compared to the checks. The increase in the variance of F_2M_2 population in a trait is a general indicator of induction of micro mutation with negative and/or positive on the trait. Similar trend in increasing variability in M_2 populations with different doses of mutagens on various yield attributing characters in greengram was earlier reported by [6,21,23]. The number of clusters per plant was increased with dwarf plant type was noticed by increased dose of mutagen [24]. Whereas, some reverse results also reported with increased dose of mutagen for seed yield per plant [25] and plant height in greengram [26]. The results reported by many other researchers on GCV and PCV are comparable with the present investigations on effect of gamma rays on greengram [27,28,29]. The heritability estimates along with genetic advance is usually more helpful than the heritability value alone in selected lines [20]. The genetic advance is an indicative of the expected genetic progress for a particular trait under suitable selection procedure. The earlier findings on heritability for different traits in greengram were also similar with the present study [13,14,29,30].

3.2 Evaluation of Irradiated Single Cross Progenies (F_2M_2) for Yield and Component Traits during *Summer*-2018

The progeny line numbers 1M-2 and 1M-5 derived from DGGV-7 × V-02-709 treated with 20 kR gave a seed yield of 7.2 g per plant. Number of pods per plant produced by these lines were 27 and 26 respectively. Seed yield per plant of 5.3 and 5.7 g were recorded for the progeny numbers 1M-14 and 1M-17. The progeny lines derived from the cross DGGV-7 × V-02-709 irradiated with 20 kR dose, revealed earliness indicated by the characters days to flowering (37 days) and maturity (84 days). 100 seeds weight of 2.6 g was recorded for the progeny numbers 2M-4, 2M-6 and 2M-18. Higher seed yield per plant was recorded 7.4 and 7.2 g in the progeny lines of 2M-11 and 2M-18 respectively from the cross derivatives of DGGV-7 × V-02-802 with 20 kR. It was recorded 6.7 and 8.3 g of seed yield per plant for the progeny number 3M-9 and 3M-15 respectively derived from the cross DGGV-2 × IPM-410-3 when treated with 100 kR gamma rays.

Table 3.Estimate of variability, heritability and genetic advance for yield components in F_2M_2

Sl. no.	Characters	Crosses	Parental mean	Progeny mean	Range		PCV (%)	GCV (%)	h^2_{bs} (%)	GA	GAM (%)
					Maximum	Minimum					
1.	Days to 50 % flowering	C1	41.24	41.32	36.63	44.36	3.65	2.29	28.33	0.57	1.39
		C2	41.32	42.13	37.99	43.38	2.25	1.44	27.25	0.50	1.21
		C3	41.25	45.33	39.25	48.23	3.98	2.42	25.36	0.44	1.09
		C4	40.00	44.29	39.45	47.17	3.74	2.16	24.55	0.41	1.03
2.	Plant height (cm)	C1	58.22	51.24	40.12	69.44	29.46	23.54	69.05	18.67	36.44
		C2	57.50	54.28	40.22	71.46	32.22	27.13	65.22	18.59	34.26
		C3	52.34	56.32	42.35	72.65	36.41	28.31	54.63	13.69	24.31
		C4	52.5	55.26	44.63	72.55	35.54	26.25	55.36	15.67	28.36
3.	Number of branches per plant	C1	4.5	5.28	3.82	6.19	26.95	21.66	46.23	1.76	33.45
		C2	4.0	5.15	3.77	6.75	28.15	22.25	55.12	1.87	36.36
		C3	4.26	5.69	3.88	7.42	32.65	31.22	78.24	3.09	54.32
		C4	5.75	6.21	3.79	7.16	33.74	30.16	76.63	3.18	51.22
4.	Number of clusters per plant	C1	8.00	7.44	5.16	17.12	39.46	24.46	88.36	4.85	65.32
		C2	7.5	7.76	5.46	18.12	39.29	23.11	82.22	4.83	62.31
		C3	8.65	8.66	5.49	20.31	43.63	17.35	68.21	4.44	51.36
		C4	8.54	8.83	4.99	18.46	42.69	16.22	64.23	4.32	48.95
5.	Days to 50 % flowering	C1	41.24	41.32	36.63	44.36	3.65	2.29	28.33	0.57	1.39
		C2	41.32	42.13	37.99	43.38	2.25	1.44	27.25	0.50	1.21
		C3	41.25	45.33	39.25	48.23	3.98	2.42	25.36	0.44	1.09
		C4	40.00	44.29	39.45	47.17	3.74	2.16	24.55	0.41	1.03
6.	Plant height (cm)	C1	58.22	51.24	40.12	69.44	29.46	23.54	69.05	18.67	36.44
		C2	57.50	54.28	40.22	71.46	32.22	27.13	65.22	18.59	34.26
		C3	52.34	56.32	42.35	72.65	36.41	28.31	54.63	13.69	24.31
		C4	52.5	55.26	44.63	72.55	35.54	26.25	55.36	15.67	28.36
7.	Number of branches per plant	C1	4.5	5.28	3.82	6.19	26.95	21.66	46.23	1.76	33.45
		C2	4.0	5.15	3.77	6.75	28.15	22.25	55.12	1.87	36.36
		C3	4.26	5.69	3.88	7.42	32.65	31.22	78.24	3.09	54.32
		C4	5.75	6.21	3.79	7.16	33.74	30.16	76.63	3.18	51.22
8.	Number of clusters per plant	C1	8.00	7.44	5.16	17.12	39.46	24.46	88.36	4.85	65.32
		C2	7.5	7.76	5.46	18.12	39.29	23.11	82.22	4.83	62.31
		C3	8.65	8.66	5.49	20.31	43.63	17.35	68.21	4.44	51.36
		C4	8.54	8.83	4.99	18.46	42.69	16.22	64.23	4.32	48.95

9.	Number of pods per clusters	C1	8.32	7.44	6.45	15.32	38.23	24.46	69.25	3.89	52.39
		C2	8.23	7.25	6.35	19.12	36.35	23.31	84.65	4.60	63.55
		C3	6.50	6.65	6.35	12.36	38.46	25.32	76.85	3.87	58.32
		C4	6.15	6.22	5.68	16.32	36.54	22.34	64.32	3.10	49.86
10.	Number of pods per plant	C1	18.64	17.45	13.09	30.65	29.36	24.52	58.23	1.50	8.65
		C2	19.45	17.69	14.22	32.52	28.54	23.31	62.53	1.70	9.66
		C3	16.55	16.35	13.64	32.14	35.65	34.26	46.98	0.91	5.62
		C4	17.29	16.88	12.36	31.21	57.24	37.84	33.64	0.83	4.96
11.	Pod length (cm)	C1	9.26	8.23	6.49	10.38	13.22	10.32	78	0.92	11.23
		C2	9.33	9.62	6.42	10.55	10.24	7.24	72	0.92	9.65
		C3	8.78	8.25	5.93	10.23	13.63	9.85	68	0.71	8.64
		C4	10.28	6.56	5.85	9.54	17.48	10.33	39	0.53	5.62
12.	Number of seeds per pod	C1	12.36	11.36	9.32	18.32	43.25	37.10	55.20	0.97	8.56
		C2	14.55	12.22	10.23	16.46	40.15	35.84	79.46	1.50	12.30
		C3	12.32	10.36	9.62	13.26	37.64	31.64	70.23	1.06	10.32
		C4	12.48	10.98	8.56	13.47	39.56	33.45	68.99	1.08	9.87
13.	100 seed weight (g)	C1	5.10	3.74	3.16	4.74	19.35	15.21	78.24	0.79	21.30
		C2	5.10	4.55	3.14	5.99	19.23	13.35	74.36	0.83	18.46
		C3	5.32	4.90	3.65	5.66	21.35	14.35	68.22	0.75	15.32
		C4	5.65	5.56	3.01	6.39	23.45	12.64	45.64	0.58	10.55
14.	Seed yield per plant (g)	C1	9.25	7.26	6.75	22.33	37.42	27.12	89.33	5.09	70.23
		C2	14.15	8.65	6.55	21.55	36.99	26.36	85.66	5.90	68.25
		C3	10.27	8.86	6.95	23.65	38.69	21.36	64.32	4.39	49.65
		C4	9.50	9.56	7.89	23.97	39.56	23.62	59.87	4.68	48.96

Where, PCV- Phenotypic coefficient of variation, GCV- Genotypic coefficient of variation, h^2(bs)- Broad sense heritability, GA- Genetic advance, GAM- Genetic advance as per cent mean, C1- DGGV-7 × V-02-709 (20 kR), C2- DGGV-7 × V-02-802 (20 kR),C3- DGGV-2 × IPM-410-3 (100 kR), C4- DGGV-2 × SML-1815 (100 kR). The values within parenthesis along with the crosses indicate the doses of Gamma rays irradiation

Table 4. Evaluation and selection of irradiated single cross progenies (F_2M_2) for yield and yield components during summer-2018

Sl. no.	Pedigree	Mutant no.	Seed yield/ Plant (g)	Days to 50 % flowering (days)	Days to maturity (days)	Number of pods per plant	100 seed weight (g)
1.	DGGV-7 × V-02-709 (20 kR)	1M-2	7.2	37	84	27	4.2
		1M-5	7.2	37	84	26	4.2
		1M-14	5.3	37	84	18	4.1
		1M-17	5.7	37	84	21	4.1
2.	DGGV-7 × V-02-802 (20 kR)	2M-4	4.2	37	84	17	2.6
		2M-6	5.5	37	84	20	2.6
		2M-11	7.4	37	84	31	2.5
		2M-18	7.2	37	84	28	2.6
3.	DGGV-2 × IPM-410-3 (100 kR)	3M-9	6.7	38	86	26	5.2
		3M-10	6.0	38	86	24	5.2
		3M-15	8.3	38	86	36	5.1
4.	DGGV-2 × SML-1815 (100 kR)	4M-5	7.9	38	86	29	5.5
		4M-9	8.3	38	86	36	5.4
		4M-18	10.8	38	86	41	5.4
		4M-20	7.9	38	86	34	5.4

26, 24 and 36 number of pods per plant were observed for the progeny numbers 3M-9, 3M-10 and 3M-15 respectively (Table 4).

Higher seed yield per plant and 100 seed weight was recorded in the progeny number 4M-9 and 4M-18 derived from DGGV-2 × SML-1815 when treated with 100 kR gamma rays. The seed yield per plant was 8.3 g and 10.8 g respectively; while the 100 seed weight was recorded as 5.4 g for both the progenies. These findings were in accordance with the earlier reports for seed yield [21,22,31,32]. From the present study, days to 50 per cent flowering and days to maturity was delayed with 100 kR dose as compared to 20 kR. But, 100 seed yield per plant was increased with 100 kR with respect to 20 kR. There are some rare alleles present in the conserved gene block, but they are usually not expressed. The result observed here may be due to these novel alleles which are expressed through higher dose of mutation. The present findings showed conformity with the results reported earlier only with irradiation [33,34,35]. If the parents have higher variability then there is a chance that the progenies will also express more variability and it will be helpful for direct selection of the traits [36]. In the present investigation, recombination followed by irradiation with gamma rays gave a better result as compared to only recombination or only mutation. The traits which revealed sufficient variability with high amount of heritability and genetic advance will favor for selection of superior recombinants in further generation.

4. CONCLUSIONS

Induced mutagenesis followed by recombination offers an opportunity to express the hidden variability in the conserved gene blocks which is very pertinent to green gram for creation of desirable variability as it is self-pollinated crop. Although, 40 kR is a lethal dose of gamma irradiation, in the current investigation irradiation of F_2 progeny (DGGV-2 × SML-1815) with 100 kR has generated more genetic variability for seed yield per plant (10.8 g), when compared to the check DGGV-2 (4.7 g) and SML-1815 (9.8 g). Further four superior progenies *viz*; 4M-5, 4M-9, 4M-18 and 4M-20 have recorded highest 100 seed weight 7.9, 8.3, 10.8 and 7.9 g respectively. Thus, it can be inferred that high yielding F_2M_2 progenies in the mutagenized populations with significant mean yield would be effective for the selection of desirable high yielding micro/macro mutants. The higher dose of gamma rays in greengram will provide enough scope to develop a wide range of variation in desirable plant attributes which may facilitate to select high yielding mutants with other desirable characteristics like long pod with larger seed size, early maturity, short-statured plant etc. These superior genotypes can be used in further breeding programmes by introgressing all the desirable traits. Further analysis of the morphological macro/micro mutants can be differentiated from the normal plants through marker assisted selection.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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