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INDUCED MUTATIONS FOR QUANTITATIVE CHARACTERS IN GROUNDNUT (*Arachis hypogaea* L.)

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The effects of mutagenic treatments, gamma irradiation, EMS and combination treatment on economic characters of groundnut cultivars, TMV 9 and Ah. 7911 were studied in M_2 and M_3 generations. While there was reduction in the mean values of different characters in the M_2 generation, they were equal to that of control in M_3 generation. Mutagenic treatments have resulted in the increase of genotypic variance, heritability and genetic advance of yield attributes. High heritability and genetic advance for pod yield at 40 krad treatment in TMV 9 and 40 m*M* of EMS treatment in Ah. 7911 have shown the possibility of genetic improvement following selection.

One of the objectives of the present investigation was to increase the spectrum and frequency of variability in qualitative and quantitative characters by employing physical and chemical mutagens and their combination in groundnut. Seed materials of groundnut cultivars, TMV 9 and Ah. 7911 were subjected to gamma irradiation and EMS individually and 80 m*M* concentrations in combination Observations on mutations for quantitative characters are presented and discussed in this paper.

MATERIAL AND METHODS

Two improved cultivars of groundnut, TMV. 9 and Ah. 7911, with bunch growth habit were chosen for the study. They are hybrid derivatives with a common male parent of Ah. 477 (Bassi). The female parents of TMV. 9 and Ah. 7911 are Ah. 3490 (Bromie-3) and Ah. 4218 (Gudiyatham) respectively. Seeds with a moisture content of 5.5 percent and retained by 21/64 inch sieve were treated with gamma rays at 20, 30 and 40 krad, EMS at 40, 60 and 80 m*M* concentration and combination of 20 krad gamma rays + 40 m*M* of EMS. The M_1, M_2 and M_3 generations were raised during 1975, 1976 and 1977 under irrigated condition, in randomised replicated block design.

Seeds obtained from 24 normal plants chosen from 24 families containing not less than 60 seeds per plant in each treatment in M_2 generation were advanced to raise progenies in the M_3 generation. Observations were recorded on five plants chosen at random in each treatment and replication in M_2 and M_3 generations on pod and kernel yield per plant. Estimates of genotypic variance and heritability

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and genetic advance under selection were calculated

RESULTS AND DISCUSSION

In M_1 generation, there was decrease in the pod and kernel of yield per plant in the treated populations except at 30 krad in TMV. 9 and 40 krad in Ah. 7911 (Table 1). Genotypic variability was lacking in M_1 generation

Induction of mutations in the quantitative characters are detected in successive generations of mutagen treated material through mean and variance comparisons In the M_2 population following mutagenic treatment, there was decrease in the mean pod and kernel yield in the present study. Such decrease in the mean values due to mutagenic treatments have been observed in grounndut (Gregory, 1968), Several explanation were given for the shift in the mean values of quantitative characters due to mutagenic treatments (Gregory, 1961, Brock, 1965 and Gaul and Astveit, 1966). Mutations in a quantitatively inherited character would depend on the number of genes involved, the relative proportion of genes with positive and negative effects and the degree to which the genes of the parental genome operate as a balanced set (Brock, 1965). This explanation of Brock might be considered appropriate. The increase in the proportion of genes with negative effects over that of positive effects arising as a result of mutagenic treatments would have caused the reduction of mean values in M_2 generation in the present observations.

There was decrease in the mean pod yield at 20 krad and 40 m*M* of EMS treatment in TMV. 9 compared to that of control (Table 2). The same trend was observed in Ah. 7911 at 20 krad, three concentrations of EMS treatments and combination treatment. There was three-fold increase in genotypic variance for this character at 40 krad in TMV. 9. Five-fold increase in GV, and highest heritability (47.8) and genetic advance (18.5) for pod yield was observed at 40 m*M* of EMS treatment in Ah. 7911.

The kernel yield per plant did not differ significantly at 40 krad and 80m*M* treatments in TMV. 9 and at 30 krad, 40 krad and combination treatment in Ah. 7911 compared to respective control (Table. 3). EMS at 40 m*M* treatment has resulted in three-fold and six-fold increase in genotypic variance for kernel yield in TMV. 9 and Ah. 7911 respectively. Highest genetic advance for this character was also observed at EMS 40 m*M* treatment in TMV. 9 and Ah. 7911.

In M_3, the mean values in the treated populations have approached that of control, for example pod and kernel yield at 40 krad in TMV 9 (Table-2 and 3). This may perhaps be due to selection exercised in M_2. Such a possibility has been indicated from selection resulting in the means approaching that of control in bread wheat, tobacco, cotton and autotetraploid barley (Swaminathan, 1963). Mutagenic treatments have resulted in increase in variability for economic characters in M_3 generation. The genotypic variance was found to increase six-fold for kernel yield and five-fold for pod yield in EMS 40 m*M* treatment of Ah. 7911. The magnitude of increase in variability in the present study was higher than that reported earlier by Gregory (1955) who observed four-times increase in variance for pod yield in the material derived from X-irradiation.

Increase in genotypic variance for quantitative characters contributing to yield in M_3 but not in M_2 might have been due to the fact that mutated genes were not homozygous in M_2 for all loci but segregated further. Such increase in variability in M_3 generation of *T. aestivum* and *T. durum* was demonstrated in irradiated population (Scossiroli, 1965) and also in M_3 generation in bread wheat, tobacco, cotton and autotetraploid barley (Swaminathan, 1963). Increase in doses of EMS was found to result in increase in genotypic variance, heritability and genetic advance for pod yield in TMV. 9 and kernel yield in Ah. 7911.

Data on heritability and genetic advance have shown high values for pod yield at 40 krad treatment in TMV. 9 and 40 m*M* of EMS treatment in Ah. 7911.

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Table 1 Effect of Mutagenic Treatments on Pod and Kernel Yield in M_2 Generation

Variety	Treatment	Pod yield g)/plant Mean ± S. E.	Kernel yield (g)/plant Mean ± S. E.
TMV. 9	Control	16.4±0.9	9.8±0.6
	Gamma 20 krad	12.3±1.3	7.7±0.7
	30 krad	14.5±2.5	9.0±1.6
	40 krad	13.2±1.8	8.1±0.9
	EMS 40 m*M*	11.6±1.1	6.9±0.8
	60 m*M*	11.5±2.0	9.1±1.9
	80 m*M*	12.3+1.1	7.7±0.8
	20 krad+40 m*M*	9.9±0.8	6.6±0.5
Ah. 7911	Control	15.8±1.2	9.2±0.8
	Gamma 20 krad	9.6∓1.8	6.1±1.5
	30 krad	12.9±1.4	7.7±0.9
	40 krad	14.2±2.2	8.2±1.8
	EMS 40 m*M*	8.8±1.1	5.7±0.4
	60 m*M*	10.4±2.9	6.3±1.7
	80 m*M*	10 7±1.3	6.4±0.9
	20 krad+40 m*M*	8 2±0.6	4.7±0.7

Source	C. D.	C. D.
Variety	0.9	0.5
Treatment	1.7	1.0
Variety x Treatment	2.4	1.4

Table 2 Effect of Mutagenic Treatments on Pod Yield (G)/Plant in M_3 Generation

Variety	Treatment		Mean ± S.E	Mean square between progenies	Genotypic variance	Heritability	Genetic advance
TMV. 9	Control		15.0 ± 1.7	4.9	1.1	18 7	5.0
	Gamma krad	20	12.2 ± 1.8	8.5	2.2	43 5	12.4
		30	13.8 ± 1.8	13.2**	1.8	35.8	8.5
		40	15.4 ± 1.8	26.0*	4.4	5[illegible].2	20.2
	EMS m*M*	40	13.6 ± 1.9	8.4	2.1	25.2	11.0
		60	13.9 ± 1.6	15.1*	1.7	34 5	11.4
		80	14.1 ± 1.4	17.9*	3.3	55.6	19.8
	20 krad+ 40 m*M*		14.1 ± 1 9	20.9*	2.3	33.2	12.8
Ah.7911	Control		16.8 ± 1.7	5.8	0.5	11.7	3.5
	Gamma krad	20	13.3 ± 1.7	16.8*	1.7	30.3	1.1
		30	15.9 ± 1.9	15 5*	0.6	26.3	7.8
		40	16.3 ± 1.7	17.2*	1.9	32 4	9.8
	EMS m*M*	40	13.6 ± 1.6	19.6*	3.1	47 8	18 5
		60	11.1 ± 1.7	10.9	0.5	14.0	5.0
		80	13 2 ± 1 9	11.1	0.9	22.8	6.8
	20 krad+ 40 m*M*		14.7 ± 2 1	13.6	1.1	24.6	7.3

Variety 0.6 Treatment 1.2 Variety x Treatment 1.6

* Significant at 5% level; ** Significant at 1% level.

Table 3. Effect of Mutagenic Treatments on Kernel Yield (G)/plant in M_2 Generation

Variety	Treatment	Mean + S.R	Mean square between progeales	Genotypic variance	Hertability	Genetic advance
TMV. 9						
	Control	10.5 ± 1.4	6.2	0.2	4.4	1.3
	Gamma 20 krad	8.8 ± 1.4	6.7	0.2	7.6	2.6
	30	9.7 ± 1.4	5.8	0.1	5.3	1.6
	40	11.6 ± 1.6	10.8	0.9	25.2	8.5
	EMS 40 mM	9.5 ± 1.6	4.8	0.9	54.7	15.0
	60	9.1 ± 1.2	5.1*	0.3	14.9	4.4
	80	10.2 ± 1.4	8.0	0.7	26.3	8.6
	20 krad + mM	9.4 ± 1.7	6.3	0.7	34.2	10.9
Ah. 7911						
	Control	11.9 ± 1.3	6.4	0.3	4.6	1.5
	Gamme 20 krad	9.5 ± 1.5	7.4	1.3	7·4	2.5
	30	11.1 ± 1.6	11.3*	1.3	33.6	12.1
	40	10.9 ± 1.5	10.7*	1 4	38.7	13.7
	EMS 40 mM	9.8 ∓ 1.3	12.5**	2.4	51.5	23.4
	60	8.2 ± 1.5	8.4	0.5	18.6	7.7
	80	9.2 ± 1.6	11.5	1.3	33.1	14.6
	20 krad + 40 mM	10.7 ± 1·7	8.3	1.1	15.9	4.0

CD Variety NS CD Treatment 2.5 * Significant at 5% level; ** Significant at 1% level
Variety x Treatment 3.5