GAU Res. J. 1997. 23 (1) : 28-31

Combined Mutagenesis in Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

To measure the degree and direction of genetic variation induced in five important quantitative characters viz. height of main axis, number of primary branches, number of secondary branches, number of matured pods and pod yield/plant due to gamma rays solo and in combination with EMS/Colchicine was studied in M_1 generation of groundnut (*Arachis hypogaea* L.). Higher variances were recorded for most of the characters. Shift in mean value was towards lower side for characters height of main axis, number of primary and secondary branches. The pod yield per plant had the shift towards higher side and towards both direction for character number of matured pods per plant. The increase in variance for character number of matured pods per plant due to mutagenesis was found to be 3.5 fold as compared to control. The combined mutagenic treatments were more effective to enlarge the variation in all the above quantitative characters.

(Received on 2nd March, 1995)

INTRODUCTION

Since groundnut has a relatively well developed embryo in the dormant kernel, direct effects of mutagenetic treatments in M_1 generation are readily observable. The central objective behind the use of mutagenesis is to increase in the magnitude and spectrum of genetic variation and appearance of novel mutants of positive values in the population. The degree and direction of variations induced are required to be investigated in M_1 generation itself as a prerogetive to use of mutagenesis for induced genetic tailoring of crop plants.

MATERIALS AND METHODS

Freshly decorticated, dry, dormant, healthy, physically and practically uniform kernels of groundnut cultivar *AK 12-24* were irradiated with five different doses 5, 10, 15, 20 and 25 Kr of gamma rays and 50 per cent of pre-irradiated kernels were soaked in freshly prepared 0.005 per cent solution of Colchicine and 0.20 per cent solution of EMS separately for 16 hours. On completion of these treatments kernels were throughly washed in distilled water for 30 minutes and air dried under shade for 8 hours. The treated samples were sown in RBD with four replications

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alongwith control. Variability induced in mutagenized population for five quantitative characters viz. height of main axis, number of primary branches, number of secondary branches, number of matured pods and pod yield per plant were studied.

RESULTS AND DISCUSSION

Height of main axis

In general, the mean value was relatively lower in treated population, except at treatment 20 Kr, where it was higher (39.7 cm). The lowest (30.6 cm) mean value amongst the treated population was recorded in treatment Colchicine 0.05 per cent and gamma rays 10 Kr + EMS 0.20 per cent (Table 1). The combined treatments have affected the plant height more than gamma rays solo. The shortening of plant height due to mutagenesis in M_1 may be mainly attributed due to distrubance or inhibition of physiological activities of plants. The present finding is amply corroborated by the similar results by Sinha (1991) in Urd bean.

Number of branches per plant

In the present experiment, treated population have registered highly significant variation in number of primary and secondary branches per plant. Amongst the treatments, higher variation for number of primary branches per plant was noticed in combined treatments of gamma rays + Colchicine. The mean value decreased in treated population as compared to that of control for the trait branches. The present finding of decrease in mean value associated with significant variation is well supported by the findings of San and Srivastava (1991) in Pea and Vandana and Dubey (1988) in *Vicia faba.*

Number of matured pods per plant

Highly significant variation was observed in number of matured pods per plant. The mean value has shifted on both direction but towards lower side in majority of the treatments (Table 1). Significant variation associated with higher mean value was more pronounced in solo treatments of gamma rays when the dose did not exceed 15 Kr. Similar trend has been reported by Patil (1972) in groundnut and Sah and Srivastava (1991) in pea.

Pod yield per plant

In the treated population, the character fresh and dry pod yield was found to be affected one or the other way by mutagenesis. The mean value was lower in the most of the treatments. Amongst treatment the combination of gamma rays with EMS was found to be more effective in creating higher variability in the character dry pod yield, followed by the treatments gamma rays + Colchicine, and then gamma rays. Decrease in pod yield due to mutagenesis has been reported by Gregory (1968) in groundnut. Increase in pod yield as a result of mutagenic treatments was reported in groundnut by Pathirama *et al.* (1986), Patil (1978) which amply corroborated the present finding in groundnut.

TABLE 1

Effects of mutagenic treatments on five quantitative characters of groundnut.

Sr. No.	Treatments	Height of main axis (cm)		Branching/plant				No. of matured pod/plant		Pod yield/plant (In g)			
				Primary		Secondary				Fresh		Dry	
		M	V	M	V	M	V	M	V	M	V	M	V
1.	Control	37.4	3.77	8.83	0.59	22.24	5.88	29.2	4.14	35.25	29.85	19.7	8.95
2.	Gamma rays 5 kr	34.2	14.66	6.24	4.37	19.63	52.08	36.6	48.75	46.10	170.39	23.1	15.05
3.	10 kr	35.3	17.51	6.05	3.76	20.77	25.08	31.0	79.00	40.59	115.94	19.6	26.31
4.	15 kr	34.1	50.07	4.86	3.70	18.26	86.92	32.4	33.60	35.21	264.52	16.3	88.26
5.	20 kr	39.7	29.89	6.28	9.62	17.58	19.08	23.8	43.92	28.30	66.84	11.3	23.11
6.	25 kr	37.6	11.89	6.01	3.35	18.84	30.98	24.3	63.40	27.36	84.14	11.9	16.30
7.	0 kr + col. 0.05%	30.6	10.56	4.94	7.04	17.72	73.73	24.6	85.94	30.04	184.19	12.6	37.92
8.	5 kr + col. 0.05%	34.1	8.26	4.87	0.76	19.81	38.08	30.5	25.10	36.89	104.39	16.2	57.65
9.	10 kr + col. 0.05%	31.8	7.80	4.27	1.25	21.12	51.17	23.8	14.02	31.23	10.04	13.0	5.27
10.	15 kr + col. 0.05%	32.1	15.18	4.87	3.37	25.71	63.57	22.2	19.89	29.75	50.84	11.8	25.63
11.	20 kr + col. 0.05%	34.1	12.77	4.26	0.91	17.89	43.80	28.8	17.41	28.96	12.30	12.8	5.07
12.	25 kr + col. 0.05%	31.3	11.45	6.78	7.06	20.44	84.82	23.6	15.70	39.65	699.04	11.2	57.29
13.	0 kr + EMS 0.20%	33.9	13.14	6.06	4.99	19.51	80.32	31.7	58.70	38.53	114.89	17.4	14.16
14.	5 kr + EMS 0.20%	33.7	11.47	5.18	3.56	18.49	39.49	27.5	10.58	29.65	20.77	14.2	20.26
15.	10 kr + EMS 0.20%	30.6	16.06	5.16	1.95	18.10	35.56	27.6	27.42	31.91	44.57	14.3	23.17
16.	15 kr + EMS 0.20%	37.2	14.58	4.72	1.00	18.40	17.34	30.1	19.38	31.43	4.95	14.3	3.24
17.	20 kr + EMS 0.20%	32.1	14.44	4.43	0.96	16.42	12.23	22.9	34.28	24.60	44.89	8.7	21.82
18.	25 kr + EMS 0.20%	34.9	10.61	4.32	0.98	18.48	12.30	23.6	85.06	27.00	175.50	10.5	33.41

Where, M = Mean and V = Variance.

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