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INDUCED GENETIC VARIABILITY IN M_2 AND EVALUATION OF PROMISING MUTANT LINES IN M_4 GENERATION OF MUNG BEAN.

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Seed of three varieties Pak 13, Pak 17 and 6601 of mung bean were treated with various exposures of gamma rays. Genetic variation regarding yield and yield components generated through irradiation treatment was studied in segregating generation. Variability for various characters occurred both in positive and negative directions. The effect of irradiation treatment on plant height was very conspicuous, but pod length was not much affected. Mutations affecting short stature and determinate growth habit were frequent in the segregating population. In M_4 generation some of the mutant lines showed better yield potential than the parental lines. The superiority in yield shown by short-statured determinate mutant lines may be attributed to their better plant type, and improved harvest index.

INTRODUCTION

Evolution of grain legume varieties having high yield potential, stability of performance and better nutritive properties will be a major step in solving the nutrition problems in the developing countries. Conventional breeding methods have so for not resulted in substantial improvement of these crops, which may partly be due to lack of adequate genetic variability pertaining to plant type and other traits required in a crop improvement programme. Induced mutation breeding procedures in the recent past have been successfully utilized for the improvement of various leguminous crops (Mujeeb 1974; Kasim *et. al.* 1977). Change in plant type and growth habit had been reported in the mutants of different field crops (Gelin 1960; Blixt 1970). Upright plant types were obtained in *Vicia faba* after mutagenic treatment (Sjodin 1962). Mutagenic treatment of mung bean resulted increase in pod number and seed weight (Tikoo and Jain, 1974). Short-statured mutants of mung bean giving higher grain yield than the parents have also been induced (Ranasamy *et. al.* 1975).

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MATERIALS AND METHODS

One thousand seeds, each of Pak 13, Pak 17 and 6601 cultivars of mung bean having 12% moisture were exposed to 10, 20, 30 and 40 kR of ^{60}Co gamma rays. The M_1 generation was grown in the field and at maturity four pods from the main shoot of about 400 M_1 plants were harvested individually. The M_2 generation was raised in the field in two replications where each plant progeny was grown in two rod rows of 3 m length. Plant and row distance was kept at 15 cm and 30 cm respectively. Ten plants were randomly selected from each plant progeny for recording data on plant height, number of pods per plant, pod length, number of grains per pod and yield per plant.

Genetic stability of mutant lines was tested in single plant progeny row test during M_3 generation. Consequently 26 true breeding lines were selected on the basis of determinate growth habit, short stature, early maturity, increased number of pods per plant and tested in a preliminary yield trail during summer 1975. The yield trial was sown in a randomized block design with three replications. Each plot consisted of five rows of 3.6 m length, having 10 cm distance between the plants and 30 cm between the adjacent rows. At maturity 10 guarded plants in each replication were selected and data were recorded on plant height, yield per plant and harvest index.

RESULTS AND DISCUSSION

Wide variation occurred in the treated material both towards positive and negative directions for different characters during M_2 generation (Table 1) Rajput (1974) also obtained change in the mean values of irradiated material for various polygenic traits except pod length in M_2 generation of mung bean. The magnitude of variation for different characters differed in different varieties and treatments. However, the specific radiation exposure inducing the higher genetic variability for various characters was different in different varieties i.e. 40 kR exposure induced higher genetic variability for plant height in varieties Pak 13 and 6601 while 20 kR exposure induced more variation in Pak 17. Varietal differences regarding effect of irradiation on various characters were observed. Pak 13 showed comparatively less variation for plant height while extent of variation for pod number was more in variety Pak 17. There was little relationship between the level of irradiation exposure and the magnitude of genetic variability in all the

Table 1. *Effect of gama irradiation on various morphological characters and yield/plant in mung bean in M_2 generation grown at NIAB, during summer, 1974*

Sr. No.	Variety	Treat-ment	Plant height (cm)	Pods/plant	Pod length (cm)	Grains/pod	Yield/plant (gm)
1.	6601	Control	88.07 ± 0.99	49.54 ± 1.31	7.02 ± 0.04	11.61 ± 0.04	14.70 ± 0.40
		10 kR	71.76 + 1.43	41.65 ± 1.97	6.80 ± 0.07	10.70 ± 0.13	10.85 ± 0.56
		20 kR	78.53 ± 1.47	42.06 ± 1.90	6.79 ± 0.07	10.35 ± 0.15	10.85 ± 0.59
		30 kR	78.33 ± 1.45	40.54 ± 1.77	7.05 ± 0.05	10.57 ± 0.11	11.11 ± 0.47
		40 kR	84.42 ± 1.63	32.93 ± 2.01	6.77 ± 0.08	10.35 ± 0.26	8.49 ± 0.47
2.	Pak 13	Control	76.03 ± 0.51	55.21 ± 1.26	6.78 ± 0.03	10.47 ± 0.06	16.20 ± 0.31
		10 kR	68.42 ± 0.72	41.35 ± 1.91	6.62 ± 0.14	10.38 ± 0.09	11.24 + 0.33
		20 kR	70.81 ± 0.99	46.32 ± 1.61	6.61 + 0.05	9.90 ± 0.25	12.66 ± 0.41
		30 kR	68.77 ± 0.70	48.35 ± 1.72	6.51 ± 0.05	10.45 ± 0.13	12.25 ± 0.41
		40 kR	73.75 ± 1.05	48.24 ± 2.26	6.62 ± 0.05	9.91 ± 0.18	12.25 ± 0.41
3.	Pak 17	Control	75.65 ± 0.65	65.70 ± 1.45	7.25 ± 0.04	10.82 ± 0.09	17.55 ± 0.45
		10 kR	69.82 ± 0.89	46.37 ± 2.12	6.66 ± 0.05	10.73 ± 0.12	12.69 ± 0.50
		20 kR	69.08 ± 1.63	42.87 ± 2.34	6.76 ± 0.08	9.69 ± 0.18	11.32 ± 0.70
		30 kR	69.31 ± 1.41	47.90 ± 3.14	6.64 ± 0.10	9.88 ± 0.23	12.15 ± 0.70
		40 kR	70.58 ± 1.30	46.09 + 2.52	6.78 ± 0.09	9.97 ± 0.19	11.58 ± 0.62

varieties. Kasim (1977) reported wide genetic differences for genetic variability in M_2 generation of gamma irradiated varieties of broad bean and could not find any relationship between irradiation dose and the amount of induced genetic variability.

The mean plant height values showed a considerable more decrease in all the treatments than the respective parents. In variety 6601 and Pak 13 irradiation exposure of 10 kR and in Pak 17 exposure of 20 kR was very effective in decreasing the plant height. The number of pods per plant, pod length, number of grains per pod and grain yield per plant also decreased in the M_2 population as compared to the control. The reduction in various plant characters could partly be due to drastic change in plant type and large frequency of deleterious mutants in population resulting after mutagenic treatment.

Data on plant height, yield per plant and harvest index of 26 mutant lines alongwith two parents are presented in Table 2. Eleven mutant lines excelled the parent Pak 17 and 6601 in grain yield per plant. The highest yielding mutant line 605 gave 23.8% increased yield and was 10% shorter in plant height than the parent Pak 17. The mutant line 1038 had compact plant type, determinate growth habit and improved harvest index (29.15%) as compared to the parent Pak 17 (20.92%).

In grain legumes, improvement in plant type associated with high harvest index is generally associated with a determinate and compact growth habit. Some of the recently developed varieties of pigeon pea in India had determinate growth habit, short maturity period and compact growth habit (Jain, 1977). In the present study two mutant lines 4048 (52.2 cm) and 1118 (52.9 cm) were short-statured and exhibited improved harvest index i.e. 29.08%, 27.99% respectively. High harvest index was obtained through rigid selection for short stature and early maturity in grain varieties of oats, (Sims, 1963).

Reconstruction of plant type in grain legumes is required to make these crops competitive with other high yielding cereals. Present investigations have shown that yield of mung bean can be increased by redesigning the plant ideotype through induced mutations.

Table 2. *Average plant height, harvest index and yield performance of the mutant lines/varieties of mung bean in a preliminary yield trial conducted during summer, 1975.*

No.	Mutant line/ variety	Plant height (cm)	Yield per hectare (Kg)	Harvest index (%)
1.	605	57.33 ± 2.40	1840.41	26.84
2.	3854	65.57 ± 2.23	1736.03	25.08
3.	3419	64.71 ± 1.99	1731.13	23.91
4.	1038	54.61 ± 1.82	1719.13	28.06
5.	1245	67.62 ± 2.63	1659.77	19.00
6.	4048	52.29 ± 1.91	1601.36	29.08
7.	1000	60.31 ± 1.82	1562.46	20.37
8.	883	58.41 ± 2.34	1555.05	25.40
9.	792	57.27 ± 3.47	1501.22	20.92
10.	1207	65.58 ± 2.52	1486.03	19.17
11.	1062	67.25 ± 2.74	1480.63	17.81
12.	Pak 17 (Parent)	63.54 ± 2.72	1419.35	20.92
13.	6601 (Parent)	76.09 ± 3.72	1399.29	16.00
14.	1140	64.33 ± 2.61	1391.13	21.08
15.	787	66.58 ± 2.39	1389.13	20.84
16.	1118	52.94 ± 2.39	1338.08	27.99
17.	3423	56.42 ± 1.94	1259.17	18.91
18.	1143	63.51 ± 2.44	1231.37	20.44
19.	954	64.47 ± 2.45	1230.51	21.10
20.	803	56.70 ± 2.17	1216.72	22.11
21.	1153	62.11 ± 2.85	1211.72	19.68
22.	3436	64.46 ± 2.97	1206.49	17.71
23.	3437	61.55 ± 2.17	1204.26	20.05
24.	1209	69.32 ± 2.99	1192.63	17.53
25.	678	60.30 ± 2.62	1160.06	21.94
26.	1238	60.83 ± 2.82	1149.57	20.44
27.	1151	62.18 ± 2.48	989.61	18.34
28.	3438	70.15 ± 2.83	972.21	16.61

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