

## BIOLOGICAL EFFECTS OF MUTAGENIC TREATMENTS IN (*Cajanus cajan* (L.) MILL. Sp.

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Experiments were carried out with two redgram varieties to study the effects of gamma rays and DES on germination, survival, plant height, pollen and seed fertility in  $M_1$  generation. The germination of seeds and survival of seedlings were gradually reduced by the increase in doses of mutagens. But the reduction was more with gamma rays than DES. The low doses of mutagens slightly increased the plant height on 30th day, while the higher doses reduced the plant height. The height reduction was more at early stage than at later stage for the same dose of mutagens. In respect of pollen fertility, more reduction was noticed with DES than with gamma rays in the variety SA. 1 and the reverse was the case in CO. 2. DES was more potent in reducing the seed fertility than gamma rays. The mutagenic sensitivity not only depends upon the genotype but also on the type of mutagens used.

Grain legumes occupy a unique position in world agriculture by virtue of their higher protein content and their capacity for fixing atmospheric nitrogen. Redgram is the major pulse crop among the grain legumes cultivated in Tamil Nadu. The use of radiation and chemical mutagen as a powerful tool for developing crop varieties with desirable characteristics has been well established. Investigations have, therefore, been taken up for induction of mutations in two redgram varieties and the biological effects of mutagenic treatments are presented here.

### MATERIALS AND METHODS

Two redgram varieties viz., SA. 1 and CO. 2 formed the material for study. Gamma irradiation was carried out using a 6J CO Gamma Cell with

the doses of 1, 5, 10, 15, 20, 25, 30 and 40 krad. Treatments with DES (diethyl sulphate) were performed by keeping the pre-water soaked seeds immersed for 6 hours in the concentration of 3, 6, 9, 12 and 15 mm of DES with intermittent shaking. After mutagenic treatments  $M_1$  generation was raised in a randomised block design with three replications adopting a spacing of 60 cm between rows and 30 cm between plants in a row. Totaly 150 hills per treatment per replication were sown using single seed per hill. The mutagenic effect in  $M_1$  generation was studied in terms of germination, survival on 30th day, plant height on 30th day and at maturity and pollen and seed fertility. The data gathered on all these characters were subjected to fitness test to find out the difference between the doses of the muta-

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genic treatments and the results are presented in Table 1.

## RESULTS AND DISCUSSION

a) *Germination* : In the present study, the germination of seeds of the two varieties gradually decreased with increase in doses of both mutagens. Significant differences in the percentage of germination were found between the doses of gamma rays as well as of DES in both the varieties. Such a dose dependence in inhibition of germination was reported by Shrivastava, (1975) in redgram and Nallathambi and Gurusamy Raja, (1983) in rice. Gamma rays were found to impair germination more than that observed after DES treatment. Similar results were reported by Ramasamy (1973) in blackgram (*Phaseolus mungo*). Reduction in germination was more in the variety *vigna mungo*(L) Heppei SA. 1 than in CO. 2 due to DES treatments.

b) *Survival on 30th day*: In both the varieties reduction in survival of plants on 30th day increased with increasing doses of mutagens. This is in agreement with the results of Kalloo (1971) in *Pisum sativum* and Rajasekaran (1973) in blackgram. Reduction in survival even at the advanced stages of growth i.e., on 30th day indicated prolonged lethal action of mutagens. The mortality rate was relatively low with chemical mutagen in both the varieties. This observation is in conformity with the previous finding by Rajasekaran (1973) in blackgram and Nallathambi and Gurusamy Raja (1983) in rice.

c) *Plant height on 30th day and at maturity* : Increase in height of

plants at the lower doses of the mutagenic treatments was noticed in both the varieties when recorded on 30th day. Such stimulatory effect on height was reported by Alikhan and Veerasamy (1974) in redgram. At higher doses the height showed reduction. The height recorded at maturity showed reduction with increase in doses of both the mutagens. The trend of height reduction was gradual with DES and irregular with Gamma rays. The results of the present study are in conformity with the observations made by Rangasamy (1973) in sesame and by Shrivastava (1975) in redgram. The irregular trend of reduction in the height of plants recorded in the present study after gamma irradiation may be attributed to the effect of diplontic selection taking place in the sporophyte after germination as reported by Bagavandoss and Madhava Menon (1970) in their studies with cotton. Reduction in plant height observed on 30th day was more drastic than at maturity which might be due to an apparent recovery of  $M_1$  plants from injury as reported by Nair (1971) in rice. The rate of recovery was more at higher doses than at lower ones. Nair (1971) reported that this could be due to the growth of uninjured meristematic cells which replaced the injured ones as growth advanced.

d) *Pollen and Seed fertility* : The sterility of pollen and seed in the  $M_1$  plants increased with doses of mutagens in both the varieties. Such dose dependent relationship was reported in the same crop by Alikhan and Veerasamy (1974) and in rice by Nallathambi and Gurusamy Raja (1983). In respect of pollen fertility, more reduction was noticed with DES in SA. 1 and with gamma rays in CO. 2. A conspicuous

Table 1. Biological effects in M<sub>1</sub> generation (Percent of control)

Mutagen and dose	Germination		Survival on 30th day		Height on 30th day		Height at maturity		Pollen fertility		Seed fertility	
	SA.1	CO.2	SA.1	CO.2	SA.1	CO.2	SA.1	CO.2	SA.1	CO.2	SA.1	CO.2
I. Control	100	100	100	100	100	100	100	100	100	100	100	100
II. Gamma rays (krad)												
1	84	86	92	81	112	106	97	105	93	95	92	90
5	78	80	70	77	115	111	93	103	87	91	86	83
10	72	66	67	65	89	78	92	93	83	77	93	92
15	67	65	62	63	85	73	95	87	51	58	93	80
20	53	49	42	38	90	68	92	95	29	40	85	92
25	34	43	29	35	81	63	87	98	32	38	87	83
30	19	22	12	17	90	61	87	85	32	33	76	84
40	15	16	10	9	77	59	79	86	24	21	80	72
III DES (mM)												
3	79	87	94	84	103	102	94	103	91	95	95	87
6	63	78	70	75	80	88	93	97	78	70	81	83
9	48	65	46	56	68	73	87	95	33	47	87	81
12	44	41	39	35	65	68	86	90	30	35	85	72
15	18	22	11	14	63	62	84	85	23	31	68	65

Note: All the differences were significant at 1% level

Table 2. LD<sub>50</sub> doses on different parameters

Sl. No.	M <sub>1</sub> effects	Gamma rays (Krad)		DES(mM)	
		SA. 1	CO.2	SA. 1	CO.2
1.	Germination	20-25	15-20	6-9	9-12
2.	Survival on 30th day	15-20	15-20	6-9	9-12
3.	Height on 30th day	Above	Above	Above	Above
		40	40	15	15
4.	Height at maturity	Above	Above	Above	Above
		40	40	15	15
5.	Pollen fertility	15-20	10-15	6-9	6-9
6.	Seed fertility	Above	Above	Above	Above
		40	40	15	15

feature noticed in the present study was that reduction in seed fertility was more with DES than with gamma rays in both the varieties. A 50 percent reduction in seed fertility was not observed in both the varieties due to mutagenic treatments.

e) *Radiosensitivity* : Instances of intervarietal radiosensitivity differences within various cultivated crops have been described by several authors (Blixt, 1972 and Swaminathan *et al.*, 1970). The variety SA. 1 was less sensitive compared to CO. 2 to treatments with gamma rays when the criteria of germination and pollen fertility were employed. To DES treatments the variety CO. 2 was less sensitive compared to SA. 1 when assessed on the basis of germination and survival. The varieties showing differential sensitivity to gamma rays, assessed by using the criteria of pollen fertility, did not show much difference to treatments with DES. The results showed that the mutagenic sensitivity not only depends upon the genotype but

also on the type of mutagens used. Levy and Ashri (1973) suggested that conclusions for one variety cannot be drawn from another in the same crop. The differences in mutagenic sensitivity within the species of *Cajanus cajan* brought out presently indicate that in mutation breeding an initial assessment of the efficiency of mutagen on different genotype is necessary.

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## NUTRIENT CONTENT OF NITROGEN, PHOSPHORUS, POTASSIUM, CALCIUM AND MAGNESIUM IN GREENGRAM (*Vigna radiata* (L) WILCZEK) AT DIFFERENT GROWTH STAGES IN RELATION TO YIELD

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The effect of the 15 genotypes of greengram with reference to content of nitrogen, phosphorus, potassium, calcium and magnesium was studied at chosen growth stages in different parts of the plant. The trend of events during the crop growth did not differ much. Nitrogen and phosphorus showed positive association with yielding ability of the genotypes, while calcium and magnesium exhibited uncertain relationship. Potassium content had favourable relationship in most of the high yielders.

Genotype variation and specificity regarding content, utilization and transport of materials is there. A comparative study of the nutritional content of genotypes at various stages of crop in different parts of the plant will be useful. On the basis of the above background and with the objective of making a comparative assessment and

evaluation, 15 genotypes of greengram were chosen for the present study which were arbitrarily grouped into three units namely high (PIMS4, Co.3, 11/99, ML 69, Pusa Baisakhi) medium (T<sub>44</sub>, 11/395, LAM GG 127, ML 73, 10/303) and low (Km 1, PH 6, ML 62, DM/2, Mill 1) yielders. In blackgram, Vijaya-lakshmi (1980) studied the distribution