

## Biological Effects of Gamma Rays and Ethyl Methane Sulphonate (EMS) in Single and Combination Treatments on Germination and Seedling Growth in Rice (*Oryza sativa* L.)

The study was taken up to find out the effect of Ethyl methane sulphonate (EMS) and gamma rays alone and in combination treatments in two cultures of paddy viz.,  $V_1$  (selection from a cross between Taichung-65 and  $S_{705}$ ) and  $V_2$  (selection from a cross between Taichung-65 and  $S_{67}$ ). Seeds were treated with gamma rays (from  $CO^{60}$  source) and EMS in single and combination treatments. Four doses of gamma rays - 10 Kr, 20 Kr, 30 Kr and 40 Kr and EMS 0.5 per cent aqueous solution for three durations - 4 hr, 6 hr and 8 hr were administered. For EMS treatments the seeds were pre-soaked for 8 hours in distilled water and treated with freshly prepared 0.5 per cent aqueous EMS solution at 28°C with constant shaking. After the treatments, the seeds were washed with distilled water and sown. For combination treatments, the seeds after irradiation were soaked in distilled water for 8 hours and treated with EMS as above. Data regarding germination were collected in different treatments from 50 seeds grown in two replications on moist filter paper.

The data on germination are presented in Table 1. Delayed germination was noticed in both the varieties in the treated seeds compared to the control. In addition, germination was also reduced in some of the treatments. However, reduction in germination was not significant and no dose dependent relationship could be drawn from the data.

Combination treatments did not affect germination in general. However, in some combination treatments the germination percentage was slightly higher than the single treatments.

The seedling height was measured on the 7th day and the data are presented in Table 2. Seedling growth was in general reduced in all the treatments. There was reduction both in the development of root and shoot and the reduction was proportional to the dosage and the duration of the mutagenic treatment. In culture  $V_2$ , reduction in growth was more pronounced than in  $V_1$ . Shoot length was reduced by 0.56 cm in 10 Kr treatment and with 20 Kr the reduction was 0.81 cm in  $V_2$ , whereas in  $V_1$ , with 10 Kr treatment the reduction was only 0.15 cm and with 20 Kr it was 0.65 cm. The sensitivity to mutagens has been found to be distinctly different in the several races and varieties of rice (Fuji, 1962; Joshua *et al.* 1965 and Kawai, 1962). Dosage required for 50% reduction in growth is between 20 and 30 Kr. In EMS treatment 50 per cent reduction in growth was observed around 6-8 hr of treatment at 0.5 per cent concentration. Combination treatments generally showed a little enhanced effect on growth reduction which may be due to synergistic effects. Sreeramulu (1970) observed greater reduction in germination percentage and seedling growth in combination treatments of gamma rays and

TABLE 1.

Germination percentage of paddy seeds following treatments with Gamma irradiation and Ethyl methane sulphonate

Variety	Radiation dose	Ethyl methane sulphonate (0.5%)			
		0 hr	4 hr	6 hr	8 hr
V <sub>1</sub>	0 Kr	90	96	88	90
	10 Kr	88	90	90	82
	20 Kr	88	86	92	86
	30 Kr	86	86	84	84
	40 Kr	92	92	90	86
V <sub>2</sub>	0 Kr	100	92	92	98
	10 Kr	94	98	96	92
	20 Kr	96	94	98	98
	30 Kr	94	96	92	94
	40 Kr	100	94	100	94

TABLE 2.

Shoot growth (in cm) in seven day old seedlings of paddy treated with Gamma rays and Ethyl methane sulphonate

Variety	Radiation dose	Ethyl methane sulphonate (0.5%)			
		0 hr	4 hr	6 hr	8 hr
V <sub>1</sub>	0 Kr	4.30 $\pm$ 0.27	3.78 $\pm$ 0.16	3.82 $\pm$ 0.16	3.75 $\pm$ 0.27
	10 Kr	4.15 $\pm$ 0.25	4.05 $\pm$ 0.20	3.58 $\pm$ 0.23	3.08 $\pm$ 0.26
	20 Kr	3.65 $\pm$ 0.10	2.60 $\pm$ 0.13	3.44 $\pm$ 0.12	2.81 $\pm$ 0.19
	30 Kr	1.39 $\pm$ 0.15	1.36 $\pm$ 0.11	1.00 $\pm$ 0.07	1.04 $\pm$ 0.19
	40 Kr	1.03 $\pm$ 0.13	0.96 $\pm$ 0.16	0.95 $\pm$ 0.06	0.99 $\pm$ 0.09
V <sub>2</sub>	0 Kr	3.03 $\pm$ 0.19	2.53 $\pm$ 0.15	2.19 $\pm$ 0.14	2.21 $\pm$ 0.14
	10 Kr	2.47 $\pm$ 0.15	2.16 $\pm$ 0.14	1.87 $\pm$ 0.09	1.82 $\pm$ 0.11
	20 Kr	2.22 $\pm$ 0.12	1.62 $\pm$ 0.11	1.65 $\pm$ 0.13	1.40 $\pm$ 0.10
	30 Kr	0.67 $\pm$ 0.07	0.81 $\pm$ 0.08	0.55 $\pm$ 0.06	0.59 $\pm$ 0.04
	40 Kr	0.57 $\pm$ 0.11	0.51 $\pm$ 0.05	0.54 $\pm$ 0.04	0.59 $\pm$ 0.04

EMS than single treatments in *Sorghum*. Goud (1968) observed lowered mutation frequency in combined treatments and attributed it to neutralization of ill effects of one mutagen by the other. Rao and Gopala Iyengar (1964) observed an increase in germination and survival in some combination treatments of fast neutrons and diethyl sulphate in rice. In the present study, a few combination treatments have shown a promotive effect on germination and seedling growth compared with the respective single treatments. This may be either due to balancing of ill effects of one mutagen by the post treatment of another or the sites that had mutated due to irradiation might have reversed to its original form by post treatment with EMS.

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K. M. D. NAYAR  
A. SEETHARAM

Cytogenetics Section,  
University of Agril. Sciences,  
Hebbal, Bangalore.

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