Table 6. Cooking quality of DPI 591

Quality characteristics	DPI 591	Bhavani	GEB 24
Milling out turn (%)	71	65	65
Bulk density	9.7	8.6	8.6
Specific gravity	0.72	0.70	0.70
Time taken for cooking (mt)	13	15	15
Cooked volume/g (ml)	3.2	3.0	3.0
Water absorption (times)	3.2	2.5	2.3
Solid loss	5.83	2.70	4.88
Grain separation after cooking	Lumps	Separated	Lumps
Protein (%)	8.6	-	6.6
Lysine (g/100 g of protein)	2.7	-	2.5

indicated its superiority over Bhavani and GEB 24 in grain yield. It recorded on an average 5827 kg/ha with an increase of 16.2 and 54.6 per cent over Bhavani and GEB 24, respectively (Table 4).

The morphological and quantitative characters of the culture DPI 591 are presented in Table 5. This culture is a semi-tall non- lodging type growing to a height of 115 to 120 cm with profuse tillering. It possesses long compact panicles with spikelets overlapping each other. It is endowed with grain type that is even finer than GEB 24. It has good cooking quality with high volume of expansion, shorter time taken for cooking and non-sticky nature. It is rich in protein with high lysine content compared to GEB 24 (Table 6). It exhibits field tolerance to blast and stem borer besides being moderately tolerant to thrips and whorl maggot. With a duration of 140-145 days from seed to seed, it is quite suitable for growing during Samba and Navarai seasons of Tamil Nadu. The high straw yield of 8.6 t/ha is an added advantage of this culture.

Based on the above desirable features, the culture DPI 591 was released by TNAU as Paiyur 1 for large scale cultivation in the North-Western region of the State.

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INDUCED MUTAGENIC EFFECTS OF QUANTITATIVE CHARACTERS IN RICE (Oryza sativa L).

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ABSTRACT

Seeds of the rice variety Co 37 were treated with gamma rays, Ethyl methane Sulphonate (EMS) and their combination treatments. The mean, range, variance and co-efficient variation were estimated in the M2 generation for five traits. In general, the mean values of the most of treatments in M2 did not substantially deviate from the control, but variability had increased in mutagenic treated populations. Mean values for productive tillers and yield per plant had shifted in a positive direction with 10 and 20 KR gamma rays than other treatments including control. Selection may be effective for productive tillers and yield per plant at lower dose of gamma rays.

KEY WORDS : Rice, Mutagenesis, Quantitative traits.

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Rice is a highly self-pollinated crop and he variability is not as much as in the cross ertilised crops. Therefore, for enlarging the ariability and to increase the scope of election for yield potential induced nutagenesis has been resorted to. The consequent changes in the quantitative characters are presented.

MATERIALS AND METHODS

Seeds of the rice variety Co 37 were subjected to radiation (gamma rays) and chemical mutagen (EMS). Five doses of gamma rays *viz.*, 10, 20, 30, 40 & 50 Krad were employed. Gamma irradiation was done by using the gamma cell at Sugarcane Breeding Institute, Coimbatore.

Twenty four hour presoaked seeds were treated with five doses of EMS, *viz*, 10, 20, 30, 40 and 50 mm. For combination treatments the irradiated seeds were soaked in distilled water for 24 hours and treated with EMS (40+10 to 40+50) by keeping immersed in aqueous solution of EMS for 6 hours. The treated and control seeds were sown as M_1. Twenty M_1 plants in each treatment and in control were advanced to M_2 generation and raised as individual progeny row in randomised block design with two replications.

Observations were recorded on 250 normal looking plants selected at random in each dose comprising 125 plants in each replication. The range, mean, standard error, variance and coefficient of variations for five quantitative characters in the M_2 generation were calculated for all the treatments and the control.

RESULTS AND DISCUSSION

In general, the mean values of most of the individual and combination treatments in M_2 generation for productive tillers, panicle length, grains per panicle, hundred seed weight and yield per plant did not deviate substantially from that of respective control populations (Tables 1 to 3). The mean productive tillers and yield per plant were increased in 10 and 20 Krad of gamma rays treated populations than other treatments including control. Gopinathan Nair (1972) reported that the mean values in respect of various quantitative characters in rice were not significantly alterned following treatments with radiations and chemicals. The mean of the treated

Table 1. Quantitative variation in M_2 Generation due to gamma rays

Mutagen Dose	Range of variation	Mean ± S.E.	Variance	Co-efficient of variation (%)
Gamma rays (Krad)		Productive tillers		
Control	2.0 - 21.0	10.88 ± 0.62	15-30	36.03
10	5.0 - 28.0	12.75 ± 0.89	31.27	43.93
20	5.0 - 25.0	12.65 ± 0.94	35.26	46.96
30	3.0 - 17.0	9.58 ± 0.68	18.48	44.89
40	5.0 - 18.0	9.95 ± 0.64	16.38	40.70
50	5.0 - 17.0	10.28 ± 0.72	20.22	43.78
		Panicle length (cm)		
Control	18.5 - 25.7	24.71 ± 0.25	2-48	6.35
10	21.0 - 26.4	23.29 ± 0.19	1.44	5.16
20	21.7 - 26.0	23.91 ± 0.20	1.64	6.86
30	20.8 - 27.0	23.48 ± 0.21	1.76	5.64
40	18.6 - 24.9	22.77 ± 0.30	3.71	8.48
50	19.9 - 24.0	22.87 ± 0.21	1.83	5.93

Mutagen Dose	Range of variation	Mean ± S.E.	Variance	Co-efficient of variation (%)
		Grains per panicle		
Control	95.0 - 149.0	117.43+2.62	274.53	14.11
10	79.0 - 180.0	119.13+4.61	848.68	24.45
20	70.0 - 170.0	132.10+3.87	600.20	18.55
30	70.0 - 167.0	102.68+3.40	462.45	20.94
40	78.0 - 183.0	114.68+4.25	722.33	23.44
50	66.0 - 136.0	99.80+3.18	404.57	20.15
		Hundred seed weight (g)		
Control	1.8 - 2.5	2.11 ± 0.02	0-01	4.74
10	1.6 - 2.5	2.03 ± 0.03	0.03	8.52
20	1.8 - 2.5	2.13 ± 0.03	0.04	9.39
30	1.9 - 2.7	2.32 ± 0.01	0.06	10.56
40	1.7 - 2.8	2.06 ± 0.03	0.03	8.40
50	1.8 - 2.6	2.09 ± 0.03	0.04	9.57
		Yield per plant (g)		
Control	9.0 - 28.5	16.31 ± 0.98	38-21	37.90
10	11.5 - 52.0	30.10 ± 1.74	120.91	36.53
20	11.5 - 55.5	24.90 ± 1.78	126.38	45.15
30	7.0 - 25.5	13.47 ± 1.57	98.24	73.58
40	7.0 - 31.0	14.03 +1.34	72.13	60.53
50	9.2 - 24.2	13.27 ± 1.27	64.21	60.38

populations tended to shift away from that of control both in the negative positive directions. Similar results have been recorded by Madhusudana Rao and Siddiq (1976).

In the present study, considerabl increase was observed in variance an coefficient of variations for all th characters following treatments wit

Table 2. Quantitative variation in M_2 Generation due to EMS

Mutagen Dose	Range of variation	Mean ± S.E.	Variance	Co-efficient of variation (%)
EMS (MM)		Productive tillers		
Control	2.0 - 21.0	10.88 ± 0.62	15-30	36.03
10	6.0 - 14.0	9.33 ± 0.62	15.35	42.02
20	5.0 - 13.0	8.88 ± 0.75	22.21	53.16
30	4.0 - 11.0	8.95 ± 0.83	27.35	58.14
40	2.0 - 12.0	8.53 ± 0.90	32.00	66.36
50	5.0 - 13.0	8.40 ± 0.45	23.21	57.38
		Panicle length (cm)		
Control	18.5 - 25.7	24.71 ± 0.25	2.48	6.35
10	20.0 - 28.4	23.18 ± 0.28	3.12	7.63
20	19.6 - 25.1	22.59 ± 0.31	3.91	8.76
30	19.5 - 25.8	22.70 ± 0.38	5.85	10.66
40	16.9 - 26.5	23.38 ± 0.28	3.19	7.64
50	20.9 - 26.2	23.25 ± 0.25	2.48	6.77

Mutagen Dose	Range of variation	Mean ± S.E.	Variance	Co-efficient of variation (%)
		Grains per panicle		
Control	95.0 - 149.0	117.43 ± 2.62	274.53	14.11
10	85.0 - 121.0	102.43 ± 1.44	82.33	7.73
20	60.0 - 130.0	98.20 ± 2.98	355.19	19.18
30	95.0 - 126.0	107.25 ± 2.37	285.11	13.99
40	88.0 - 140.0	104.86 ± 4.25	721.86	25.62
50	60.0 - 156.0	110.87 ± 4.31	741.91	24.59
		Hundred seed weight (g)		
Control	1.8 - 2.5	2.11 ± 0.02	0.01	4.74
10	1.6 - 2.8	2.15 ± 0.05	0.10	14.71
20	1.7 - 3.0	2.24 ± 0.04	0.10	14.12
30	1.0 - 2.5	1.75 ± 0.06	0.16	22.86
40	1.8 - 2.6	2.17 ± 0.06	0.17	19.00
50	1.0 - 2.5	1.83 ± 0.06	0.14	20.45
		Yield per plant (g)		
Control	9.0 - 28.5	16.31 ± 0.98	38.21	37.90
10	7.5 - 37.5	16.29 ± 1.02	42.00	39.78
20	7.5 - 26.5	14.45 ± 1.21	58.39	52.90
30	7.0 - 24.0	13.63 ± 1.22	59.35	56.52
40	7.5 - 19.0	11.35 ± 0.99	39.25	55.20
50	6.0 - 17.5	9.58 ± 0.90	32.21	59.24

gamma rays and EMS alone and their combination treatments. Increase in variance for mutagenic treated populations was a common feature observed in quantitative characters by several investigators (Sharma, 1970 and Gopinathan Nair, 1971). The variance did not increase linearly with gamma rays, EMS alone and their combination treatments, but inconsistant trend was observed. Mutations

Table 3. Quantitative variation in M_2 Generation due to combination treatments.

Mutagen Dose	Range of variation	Mean ± S.E.	Variance	Co-efficient of variation (%)
Gamma rays + EMS		Productive tillers		
Control	2.0 - 21.0	10.88 ± 0.62	15.30	36.03
40 + 10	4.0 - 19.0	9.65 ± 0.49	9.58	32.13
40 + 20	2.0 - 16.0	9.18 ± 0.49	9.49	33.56
40 + 30	2.0 - 16.0	9.55 ± 0.60	14.21	39.48
40 + 40	5.0 - 21.0	9.95 ± 0.64	16.38	40.71
40 + 50	3.0 - 17.0	10.10 ± 0.76	23.10	47.63
		Panicle length (cm)		
Control	18.5 - 25.7	24.71 ± 0.25	2.48	6.35
40 + 10	20.0 - 25.2	23.25 ± 0.23	2.11	6.25
40 + 20	21.0 - 26.0	23.37 ± 0.23	2.18	6.32
40 + 30	20.0 - 27.4	22.95 ± 0.24	2.30	6.61
40 + 40	21.8 - 28.5	25.80 ± 0.28	3.18	6.91
40 + 50	19.6 - 28.0	22.82 ± 0.26	2.69	7.19

Mutagen Dose	Range of variation	Mean ± S.E.	Variance	Co-efficient of variation (%)
		Grains per panicle		
Control	95.0 - 149.0	117.43 ± 2.62	274.53	14.11
40 + 10	91.0 - 142.0	110.23 ± 1.99	158.00	11.23
40 + 20	94.0 - 138.0	110.55 ± 2.12	179.07	12.10
40 + 30	95.0 - 126.0	105.20 ± 1.28	65.69	7.70
40 + 40	80.0 - 175.0	107.20 ± 1.57	99.00	9.28
40 + 50	73.0 - 150.0	97.78 ± 1.31	68.24	8.45
		Hundred seed weight (g)		
Control	1.8 - 2.5	2.11 ± 0.02	0.01	4.74
40 + 10	1.7 - 2.7	2.16 ± 0.03	0.03	8.02
40 + 20	1.8 - 2.6	2.21 ± 0.04	0.04	9.05
40 + 30	1.5 - 2.5	2.07 ± 0.05	0.11	16.02
40 + 40	1.6 - 2.2	1.89 ± 0.02	0.01	5.29
40 + 50	1.6 - 2.7	2.11 +0.03	0.03	8.21
		Yield per plant (g)		
Control	9.0 - 28.3	16.31 ± 0.98	38.21	37.90
40 + 10	7.8 - 21.5	15.90 ± 1.03	42.10	40.81
40 + 20	7.5 - 31.5	15.63 ± 1.09	47.34	44.02
40 + 30	6.5 - 26.5	12.68 ± 1.25	62.25	62.22
40 + 40	6.5 - 48.5	18.85 ± 1.03	43.10	34.83
40 + 50	6.0 - 27.5	14.34 ± 1.14	52.25	50.41

in polygenes governing quantitative characters have been attributed to the increase in variability. From the present results it was observed that both individual and combination treatments were equally effective in increasing the magnitude of variability. Brock (1965) observed that ionizing radiations were as effective as chemical mutagens for inducing variability.

The magnitude of variability was the highest for number of grains per panicle and other characters such as yield per plant, productive tillers, panicle length and hundred seed weight. According to Brock (1970) the theoretical expectation of inducing mutations in a quantitatively inherited character will depend upon the total number of genes involved in the relative proportion of genes with positive and negative effects and the degree to which the parental genome operates as a balanced set. In the present experiment, the treated population showed high variability as measured by range, variance and coefficient of variation as compared with control in both individual and combination treatments. The wide extent of induced variation thus generated could be exploited to develop lines with superior performance.

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