Table 1. Segregation in M_2 and F_2 of gamma ray-induced male sterile mutants of Bala variety, Manipur, India.

Line	Generation	Plants (no.) at maturity	Segregating plants				Genetic ratio[a]	χ^2 value	*P* value
			Fertile (>75%)	Partly fertile (50-75%)	Semisterile (10-49%)	Sterile (<10%)			
Bala G 3-6	M_2	24	5	8	5	6	1:2:1	0.10	0.90-0.95
				13					
Bala G 3-6-4/Bala	F_2	178	41	52	46	49	1:2:1	1.86	0.30-0.50
				98					
Bala G 3-6-7/Bala	F_2	164	40	47	38	39	1:2:1	0.23	0.80-0.90
				85					

[a]Partly fertile and semisterile pooled.

studies in the F_2. The segregating line in the M_3 also was studied.

In the 30 kR gamma-irradiated population, genetic male sterile line Bala G 3-6 had completely aborted anthers (devoid of any pollen grain). No other male sterile mutation was identified in any treatment. The monogenic recessive gene for male sterility was confirmed in the F_2 segregating pattern of Bala G 3-6-4/Bala and Bala G 3-6-7/Bala (Table 1) and in the M_3 segregating lines of Bala G 3-6 (Table 2). □

Table 2. Segregation in the M_3 of gamma ray-induced male sterile mutants of Bala variety, Manipur, India.

Line	Generation	M_3 lines observed (no.)	Nonsegregating lines (no.)	Segregating lines (no.)	Genetic ratio	χ^2 value	*P* value
Bala G 3-6	M_3	18	6	12	1:2	0.06	0.70-0.80

CNA-IRAT 5 upland rice population

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To develop a segregating population for a recurrent selection program for drought and field blast resistance, CNPAF and Institut de Recherches Agronomiques et des Cultures Vivrières (IRAT) used 27 upland rice varieties and a monogenic recessive male sterile gene obtained by mutation on IR36 by R. J. Singh and H. Ikehashi.

We crossed and backcrossed 26 varieties to male-sterile F_2 plants of Palawan/IR36 (MS +). The crosses were made to obtain a polycytoplasmic population. F_2 seeds of each backcross were bulked in different proportions to ensure a different rate of each component (see table). The bulked seeds were considered the initial population CNA-IRAT 5/0/0.

CNA-IRAT 5 initial population.

Variety	Parentage	Outcrossing rate (%)
IR36 (ms +)	Mutant of IR36	12.50
Palawan[a]	Asian germplasm	12.50
Cuiabana[a]	IAC47/SR2041-50-1	8.10
IRAT237[a]	IAC25/RS25	6.73
Beira Campo	Brazilian germplasm	5.39
CNA4097	63-83/IAC25	5.39
CNA4145	IAC47/Kinandang Patong	5.39
Cabaçu (IRAT177)	Mutant of 63-83	5.39
IREM41-1-1-4	Mutant of Makouta	5.39
Palha Murcha	Brazilian germplasm	5.39
TOx 1011-4-2	IRAT13/DP689//TOx 490-1	5.39
CNA5171	IAC47/IRAT13	2.69
IAC165[a]	Dourado Precoce/IAC1246	2.69
IREM247[a]	Mutant of IAC25	2.50
IAPAR9[a]	Batatais/IACF.3-7	1.57
IRAT112[a]	Dourado Precoce/IRAT13	1.47
CNA4135[a]	IAC47/63-83	1.36
IREM238[a]	PJ110/IAC25	1.35
Arroz de Campo[a]	Brazilian germplasm	1.25
CA 435[a]	African germplasm	0.84
Casca Branca	Brazilian germplasm	0.84
CNA5179	IAC47/IRAT13	0.84
CNA770187	Brazilian germplasm	0.84
Comum Crioulo	Brazilian germplasm	0.84
Jaguari	Brazilian germplasm	0.84
L-13		0.84
L-81-24	IAC2091/Jaguari//IRAT10	0.84
Santa America	Brazilian germplasm	0.84

[a]Cytoplasms used to form the population.

Outcrossed seeds collected on male sterile plants of the initial population were bulked to form the next population, CNA-IRAT 5/0/1. The procedure was repeated three times to obtain the CNA-IRAT 5/0/3 population.

Samples of bulk seeds harvested on self-pollinated plants of the CNA-IRAT 5/0/2 population are available to rice breeders. □

Some Indonesian restorers and maintainers of WA cytosterile lines

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We crossed Chinese CMS line V20 A as the female parent with 10 standard rice cultivars during 1987-88 wet season. Hybrids and the male parents grown in the test cross nursery in 1988 dry season were examined (12 plants each) for pollen and spikelet fertility. Male parents of the F_1 that showed 71-90% pollen fertility and higher than 80% spikelet fertility were designated restorers. Male parents showing 5-9% pollen fertility were designated prospective maintainers.

Bahbolon, Cimanuk, Batang Pane, Citanduy, Ciliwung, and Bogowonto were identified as restorers; Bahbutong, Adil, Cisokan, and S397b-40-2 as prospective maintainers (see table). The prospective maintainers need to be tested by recurrent backcrossing. □

Spikelet and pollen fertility percentages in F_1 hybrids and their male parents.

Cross and male parent	Pollen fertility (%)	Spikelet fertility (%)
V20 A/Bahbolon	79	83.2
Bahbolon	82	88.6
V20 A/Cimanuk	78	81.3
Cimanuk	83	82.5
V20 A/Batang Pane	79	83.0
Batang Pane	81	90.5
V20 A/Citanduy	77	80.0
Citanduy	80	82.9
V20 A/Ciliwung	83	84.2
Ciliwung	90	91.0
V20 A/Bogowonto	82	86.5
Bogowonto	90	92.5
V20 A/Bahbutong	6	10.5
Bahbutong	77	88.2
V20 A/Adil	5	11.5
Adil	76	86.1
V20 A/Cisokan	9	10.0
Cisokan	79	85.5
V20 A/S397b-40-2	7	12.8
S397b-40-2	75	83.0

Yield of F_1 hybrids at Tamil Nadu Rice Research Institute (TRRI), Aduthurai, India

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We evaluated 22 F_1 hybrids developed at IRRI and 2 hybrids developed at TRRI 1986-88. Single seedlings were transplanted at 15- × 15-cm spacing in 3- × 2-m plots with 3 replications. Plots were fertilized with 100-50-50 kg NPK/ha.

Many hybrids yielded less than local check ADT36. Eleven hybrids had 12 to 78% standard heterosis. The most promising were IR54752 A/IR25912-81-2-1 R and V20 A/T1154 (see table). □

Duration, grain yield, and standard heterosis of F_1 hybrids at Aduthurai, India, 1986-88.

Hybrid or check	Duration (d)	Yield (t/ha)	Standard heterosis (%)
	1986		
ADT36 (check)	110	8.4	
IR46828 A/IR13524-21-2-3-3-2-2	120	9.4	12
ZS97 A/Milyang 54	135	7.3	–12
IR46830 A/IR13292-5-3	113	6.5	–22
IR54752 A/IR54 R	129	4.5	–46
IR54752 A/IR19392-211-1	130	4.2	–50
IR54752 A/IR4422-480-2-3-3	130	4.2	–50
IR54752 A/IR20933-68-21	131	3.4	–60
IR54752 A/IR14753-120-3	131	3.1	–63
LSD (P = 0.05)	–	0.9	
	1987		
ADT36 (check)	108	6.3	
IR54752 A/IR25912-81-2-1 R	117	11.3	78
IR54752 A/IR19392-211-1 R	119	8.9	41
IR54752 A/IR28178-70-2-3 R	121	8.8	38
IR54752 A/IR19058-107-1 R	107	7.5	19
IR54752 A/IR28912-63-2-2 R	118	7.4	17
IR54752 A/IR46 R	118	7.3	14
IR54752 A/IR64 R	124	7.2	14
IR54752 A/IR29723-143-3-2-1 R	113	7.2	14
IR54752 A/IR13419-113-1 R	131	5.3	–17
IR46830 A/IR9761-19-1 R	103	4.4	–30
IR54752 A/IR21916-128-2-2-3 R	125	4.2	–34
LSD (P = 0.05)	–	0.7	
	1988		
ADT36 (check)	107	4.8	
Co 43 (check)	127	6.5	
V20 A/T1154 (ADH2)	108	7.4	57
IR54752 A/IR46 R	123	6.7	3
V20 A/IR18349-22-1-2-1-1 (ADH1)	110	3.9	–18
IR54752 A/ARC11353 R	122	2.5	–61
IR54752 A/IR54 R	128	1.6	–75
LSD (P = 0.05)	–	1.4	

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