

Evaluation of rice cultivars against bacterial blight in the field

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ABSTRACT

One hundred twenty five released rice varieties from different ecosystems of India were evaluated against bacterial blight under natural condition in the varietal garden and in the bacterial blight nursery in the field at Central Rice Research Institute, Cuttack during wet season 2009. The rice varieties Parijat and Pathara of the upland ecosystem, Rajashree, IR 36, IR 64, Indrvati, Kanchan, Manik, Pratikhya, Saket-4, Supriya, Surendra, Improved Pusa Basmati 1, Khitish of the irrigated ecosystem and improved Samba Mahsuri of the lowland ecosystem were found resistant to bacterial blight under both natural and artificial inoculation conditions.

Key words: evaluation, bacterial leaf blight, rice varieties, ecosystem

Bacterial blight disease of rice caused by the bacterium *Xanthomonas oryzae* pv. *oryzae* is a major constraint in rice production of eastern India, especially in irrigated and rainfed lowland ecosystem. If the disease occurred at maximum tillering stage and onwards, the yield loss has been estimated to be 70% in the susceptible variety TN1 and 20% in the tolerant variety IR20, but in case of post flowering occurrence of the disease, yield reduction was 22% and 9% in TN1 and IR20, respectively (Reddy, 1974). This disease is a problem of wet season due to heavy rainfall, water logging condition, high humidity (>80%) coupled with moderate temperature (28°C-30°C) (Sharma *et al.*, 1979). The effect of nitrogen, especially in inorganic form and top dressing at late stage of the crop enhances the disease severity (Have and Kauffman, 1972). The high yielding popular rice varieties are being grown in different ecosystems require heavy nitrogen fertilization for bumper yield. Therefore, a study was undertaken to evaluate the popular high yielding varieties against bacterial blight.

One hundred and twenty six high yielding varieties were grown in the "varietal garden" of Central Rice Research Institute, Cuttack under optimum agronomical conditions during wet season 2009. The same varieties were also tested artificially in the bacterial blight screening nursery to find out their resistance against heavy disease pressure.

Twenty five days old seedlings were transplanted each in micro plots (Size 15m²) in the varietal garden with a spacing of 15cm x 20cm in the second week of July 2009. NPK was applied @ 80 : 40 : 40 kg ha⁻¹. The disease incidence was monitored at different growth stages and finally recorded at the panicle initiation stage as per the SES scale (IRRI, 1996).

In the bacterial blight screening nursery, 25 days old seedlings of each variety were transplanted in a single row of 2 meter length adopting a spacing of 20 x 15cm. The nursery was flanked by two border rows of susceptible variety (TN 1). After every 100 test varieties, this susceptible check line was transplanted. Adequate nitrogen was applied @ 120kg ha⁻¹ half as basal and the remaining in two equal splits at tillering and panicle initiation stage. During maximum tillering and booting stage, the 48 hour old pure culture of the bacterium multiplied on Peptone Sucrose agar with concentration of 10⁸-10⁹ cells ml⁻¹ was inoculated on the test varieties by clipping method and 15 days after the disease incidence was recorded on the basis of affected lesion area as per the SES scale. The affected lesion area on leaf between 1-5% was recorded as score 1, between 6-12% as score 3, between 13-25% as score 5, between 26-50% as score 7 and between 51-100% as score 9. The average score of ten plants was calculated for each variety.

The observation of bacterial blight incidence on the rice varieties at booting and panicle initiation stages in the varietal garden as well as in the bacterial blight nursery is presented in Tables 1, 2 and 3.

Though the varieties were released for upland, irrigated and lowland ecosystems were all transplanted under irrigated condition with optimum agronomical practices in the varietal garden. During the active tillering and booting stages in August and September, 2009 there was prevalence of 26^o to 32^oc temperature, more than 92% relative humidity, 29 rainy days and more than 630mm total rainfall which were very congenial for the incidence of bacterial leaf blight under natural condition in the varietal garden. It has also been established by Mohiuddin *et al.* 1977 that more than 27

Since this range of meteorological factors prevailed in the active tillering and booting stage in the varietal garden, there was incidence of bacterial blight on all the varieties, though there was variation in percentage of leaf area infection between 5-50% depending on their resistance. The upland varieties Sattari, Karuna, Anjali, Dhalahaera, Heera, Vandana, the medium land (irrigated) varieties Kalinga I, Kalinga II, Neela, Samalei, Tapaswini, Tara, Jaya, TN 1, ADT36, ASD 16, IR 50, Geetanjali and low land varieties Ketekijoha, Katrani, Sugandha and CSR-27 exhibited susceptible reaction with damage of leaf area between 30-50% both under natural and artificial condition. However the upland varieties Parijat, Pathara, medium land varieties Rajashree, Kanchan (IET 4815), IR 36, IR 64, Indravati, Manik, Pratikhya, Saket 4, Supriya, Surendra, Improved

Table 1. Evaluation of rice genotypes of upland ecosystem against bacterial blight during wet season, 2009

State	Variety	Disease incidence on rice varieties					
		Natural condition			Artificial condition		
		% of leaf area affected	Score	Reaction	% of leaf area affected	Score	Reaction
Bihar	Deepa	20	5	MR	40	7	S
Madhya Pradesh	Poorva	15	5	MR	50	7	S
	Tripti	20	5	MR	30	7	S
Odisha	Anjali	30	7	S	40	7	S
	Dhalahaera	40	7	S	60	9	S
	Heera	30	7	S	50	7	S
	Ghanteswari	20	5	MR	50	7	S
	Jogesh	20	5	MR	30	7	S
	Kalinga III	15	5	MR	40	7	S
	Parijat	5	1	R	10	3	R
	Pathar	5	1	R	10	3	R
	Sattari	30	7	S	50	7	S
	Sidhanta	15	5	MR	30	7	S
	Sneha	15	5	MR	40	7	S
	Udayagiri	10	3	R	20	5	MR
Tamilnadu	Vandana	30	7	S	50	7	S
	Karuna	30	7	S	70	9	S
Uttar Pradesh	Narendra-I	20	5	MR	50	7	S
	V L Dhan 221	15	5	MR	40	7	S

rainy days in August, September and October with a total rainfall more than 200mm, there is incidence of Kreshek and bacterial blight. Chattopadhyay and Mukharjee (1975) found out that high bacterial blight incidence is associated with mean relative humidity of 79.3-92.8 % and temperature range of 22.3^o to 32.7^oc.

Pusa Basmati 1, Khitish and the low land variety Improved Samba Mahsuri showed resistant reaction showing damage of leaf area between 5-10% under both natural and artificial conditions. Laha *et al.* (2009) also identified CVRC released varieties IR 36, IR 64, Improved Pusa Basmati-1, Improved Sambhamahsuri;

Table 2. Evaluation of rice genotypes of irrigated ecosystem against bacterial blight during wet season, 2009

State	Variety	Disease incidence on rice varieties					
		Natural condition			Artificial condition		
		% of leaf area affected	Score	Reaction	% of leaf area affected	Score	Reaction
Andhra Pradesh	Abhay	15	5	MR	50	7	S
	Mahsuri	20	5	MR	40	7	S
	Saleem	20	5	MR	40	7	S
Bihar	Swarna	15	5	MR	20	5	MR
	Gautam	25	5	MR	40	7	S
	Rajshree	5	1	R	10	3	R
Gujarat	Kanchan (IET 4815)	5	5	I	R	10	3 R
	GR 4	20	5	MR	40	7	S
	Gour -3	25	5	MR	40	7	S
Haryana	Tarori Basanti	20	5	MR	50	7	S
Kerala	Bharati	15	5	MR	40	7	S
	Rohini	20	5	MR	50	7	S
	Vytilla 2	25	5	MR	50	7	S
Madhya Pradesh	Kranthi	20	5	MR	50	7	S
	Mahamaya	20	5	MR	40	7	S
	Ajay (IET 8585)	10	3	R	20	5	MR
Odisha	Bhoi	10	3	R	20	5	MR
	Daya	20	5	MR	30	7	S
	Geetanjali	30	7	S	50	7	S
	Indira	20	5	MR	50	7	S
	IR 36	5	1	R	10	3	R
	IR 64	5	1	R	10	3	R
	Jajati	20	5	MR	50	7	S
	Kalinga I	30	7	S	50	7	S
	Kalinga II	40	7	S	50	7	S
	Kanchan (IET 10016)	20	5	MR	25	5	MR
	Lalat	25	5	MR	50	7	S
	Manik	5	1	R	10	3	R
	Meher	20	5	MR	40	7	S
	Moti	25	5	MR	40	7	S
	Naveen	25	5	MR	50	7	S
	Neela	30	7	S	40	7	S
	Padmini	20	5	MR	25	5	MR
	Pratikhya	5	1	R	10	3	R
	Ramakrishna (IET 4155)	5	1	R	15	3	MR
	Ratna	20	5	MR	25	5	MR
	Saket 4	5	1	R	10	3	R
	Samalai	30	7	S	50	7	S
	Supriya	5	1	R	10	3	R
	Sarala	25	5	MR	40	7	S
	Sebati	20	5	MR	50	7	S
	Shaktiman	25	5	MR	50	7	S
	Surendra	5	1	R	10	3	R
	Tapaswini	40	7	S	60	9	HS
	Tara	30	7	S	50	7	S
	Udaya	5	5	MR	40	7	S
Punjab	Basumati 370	20	5	MR	50	7	S
	IR 8	15	5	MR	40	7	S
	Jaya	30	7	S	50	7	S
	PR 113	20	5	MR	40	7	S
	PR 114	20	5	MR	50	7	S
	PR 115	25	5	MR	40	7	S
	Pusa Basmati-I	10	3	R	20	3	MR
	Improve Pusa Basmati 1	5	1	R	10	3	R
	TN (1)	40	7	S	80	9	HS
Tamilnadu	ADT 39	25	5	MR	40	7	S
	ADT 36	30	7	S	40	7	S
	ASD 16	40	7	S	40	7	S
	IR 20	20	5	MR	50	7	S
	IR 50	30	7	S	40	7	S
	IR 72	25	5	MR	50	7	S
West Bengal	Pusa 33	20	5	MR	50	7	S
	Khitish	5	1	R	10	3	R
	Sabita	25	5	MR	40	7	S

Table 3. Evaluation of rice genotypes of low land ecosystem against bacterial blight during wet season, 2009

State	Variety	Disease incidence on rice varieties					
		Natural condition			Artificial condition		
		% of leaf area affected	Score	Reaction	% of leaf area affected	Score	Reaction
Andhra Pradesh	Sambha Masuri	20	5	MR	40	7	S
	Improved Sambha Masuri	5	1	R	10	3	R
Bihar	Kanak	15	5	MR	25	5	MR
	Katrani	30	7	S	50	7	S
	Sugandha	40	7	S	60	9	HS
Gujarat	Ambika	20	5	MR	40	7	S
Haryana	CSR 4	15	5	MR	40	7	S
	CSR 10	20	5	MR	30	7	S
	CSR 27	30	7	S	40	7	S
	CSR 30	20	5	MR	45	7	S
Kerala	Triveni	25	5	MR	40	7	S
Odisha	CR 1014	10	5	MR	30	7	S
	Dharitree	15	5	MR	35	7	S
	Nua-Dhusara	20	5	MR	45	7	S
	Dubraj	20	5	MR	40	7	S
	Durga	15	5	MR	30	7	S
	Gayatri	20	5	MR	30	7	S
	Indravati	5	1	R	10	1	R
	Jagannath	15	5	MR	35	7	S
	Nua-Kalajeera	20	5	MR	40	7	S
	Kalashree	25	5	MR	40	7	S
	Kanchan	10	3	R	20	5	MR
	Ketakijoha	30	7	S	40	7	S
	Lunishree	20	5	MR	40	7	S
	Mahalaxmi	20	5	MR	30	7	S
	Mahanadi	10	5	MR	30	7	S
	Panidhan	10	5	MR	30	7	S
	Pimpudibas	20	5	MR	40	7	S
	Pooja	15	5	MR	30	7	S
	Sarala	20	5	MR	40	7	S
	Savitri	20	5	MR	40	7	S
	Seema	15	5	MR	30	7	S
	Sonamani	20	5	MR	40	7	S
	Swarna Sub 1	10	5	MR	25	5	MR
Tulasi	20	5	MR	40	7	S	
Utkal Prava	15	5	MR	30	7	S	
Varsadhan	20	5	MR	30	7	S	
West Bengal	Dinesh	25	5	MR	40	7	S
	Jitendra	20	5	MR	40	7	S
	Mandira	25	5	MR	50	7	S
	Nalini	20	5	MR	40	7	S
	Purnendu	15	5	MR	30	7	S

Parijat, Saket-4 and Khitish as resistant to bacterial blight. Ramakrishna-a variety developed from the cross TKM 6 x IR 8 and released in 1980 in Odisha was identified as bacterial blight resistant variety has been found to be resistant under natural condition and moderately resistant under artificial condition in the present study. Thus the varieties identified having field resistance may be popularized in the bacterial blight endemic areas.

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