

Seed Quality of Rice Hybrids and their Parental Lines Produced in Different Agro-Climatic Zones of India

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ABSTRACT Forty five seed samples of hybrids and parental lines of rice (*Oryza sativa*) collected from different agro-climatic zones of India, were evaluated for their quality. Out of these samples thirteen had germination below Minimum Seed Certification Standard (MSCS), in which two A lines of hybrids 505 and 509 had very low germination of 25 and 26 per cent, respectively. Nevertheless, there was no specific pattern or relationship of seed germination to a particular type of parental line or hybrid. Ten seedborne fungi i.e. *Bipolaris oryzae*, *Alternaria padwickii*, *Curvularia lunata*, *Sarocladium oryzae*, *Fusarium moniliforme*, *Fusarium pallidoroseum*, *Alternaria alternata*, *Aspergillus* spp. *Penicillium* spp. and *Rhizopus* spp. were found to be associated with these seed lots. The most predominant among them were *Bipolaris oryzae*, *Alternaria padwickii* and *Curvularia lunata*, the incidence of which was considerably higher in R and B lines as compared to hybrids and A lines.

Keywords: Rice hybrid, seed quality, seedborne fungi

Rice (*Oryza sativa* L) is the second largest crop grown in the world in terms of both area and production. Rice is the staple food for more than half of the world's population. However, over 90 per cent of the rice in the world is produced and consumed in Asian countries. In India, rice occupies the first place, both in area (About 44 million hectares) and production (132 million tones) with a productivity of 3 t/ha [1]. Several countries such as China, India, Philippines, Thailand and Vietnam have successfully exploited the hybrid technology in rice because of its yield advantage of 15-30% over traditional rice cultivars [2, 3 and 4]. However, the parental lines in hybrids have been reported to be susceptible to many diseases [5, 6, 7, 8 and 9]. Therefore, the present study deals an array of rice hybrids and their parental lines for germination and seed health.

MATERIALS AND METHODS

Collection of seed samples: A total number of 45 seed samples of hybrids and their parental lines were collected from different agro-climatic zones of India

from the harvest of Kharif 2002 (Table 1). The seed lots were kept in cloth bags and stored at room temperature in the Division of Seed Science and Technology, I.A.R.I., New Delhi for further studies.

Determination of per cent germination and seed mycoflora: All the seed lots were subjected to germination test and mycoflora studies as per ISTA rules [10]. Seed germination of the samples was conducted between the paper (BP) and four hundred seeds in four replicates were used for the studies. After 7 days of incubation at 25°C, the seedlings were evaluated for normal, abnormal seedlings, fresh un-germinated and dead seeds. A second count of abnormal seedlings was made on completion of the test after 14 days. However, germination percentage was recorded on the basis of normal seedlings only.

In order to determine the percentage incidence of different fungi associated with the seeds, standard blotter method [10] was followed. For each sample four hundred seeds were used. Plastic plates containing 25 seeds each were incubated for 7 days at 20°C ± 1 under alternating cycles of 12h Light and Rh darkness under NUV and were examined for the incidence of associated in mycoflora (Table 2).

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Table 1. List of rice hybrids and their parental lines collected from different agro-climatic zones of India and their per cent germination.

Location	A-line	B-line	R-line	Hybrids	Mean
Andhra Pradesh					
Hyderabad	IR 58025A (69.75)	IR 58025B (79.75)	IR 40750-R (97.00)	DKRH-1 (82.00)	82.13
Maruteru	IR 62829A (89.75)	IR 62829B (86.75)	MTU 9992-R (93.25)	APHR-2 (75.00)	86.19
	CMS-16A (90.75)	CMS-16B (87.00)	SN-73R (84.50)	MTUHR 2020 (75.00)	88.75
	*	*	SN-221R (89.75)	MTU HR 2036 (87.75)	88.75
Maharashtra					
Aurangabad	505 A (25.25)	509 B (88.00)	*	505 Hybrid (94.75)	69.33
	509 A (26.25)	509 mB (97.50)	*	509 Hybrid (96.75)	73.50
Karjat-Raigad	A (73.25)	B (70.25)	BR 827-35-3-1-1-1R (87.50)	* Sahyadri	77.00
Haryana					
Karnal	Pusa-6A (91.75)	Pusa-6B (70.25)	PRR-78 (84.50)	PRH-10 (87.25)	83.44
Uchani	IR 58025A (87.00)	IR 58025B (77.75)	BR 827-35-K2 (88.50)	HKRH-1008 (65.00)	79.56
	PMS 10-A (84.00)	PMS 10-B (95.75)	*	HKRH-1059 (74.25)	84.67
Karnataka					
Mandya	IR 58025-A (84.75)	IR 58025-B (81.75)	KMR-3R (87.00)	* KRH-2	84.50
Tamil Nadu					
Coimbatore	IR 58025-A (96.25)	IR 58025-B (62.25)	IR 66-R (95.75)	* ADTHR	84.75
Uttaranchal					
Pantnagar	IR 58025-A (79.25)	IR 58025-B (83.00)	92-133-R (85.50)	PSD-1 (87.00)	84.44
Mean	74.83	81.67	88.86	82.48	81.70

* Seeds were not available

Figures in perenthesis are germination percentages.

RESULTS AND DISCUSSION

In general, no specific pattern or relationship of seed germination was found with a particular parental line or hybrid. The seed of A line collected from Hyderabad, Aurangabad, Karjat-Raigarh and Pantnagar ; that of B line from Hyderabad, Karjat-Raigarh, Karnal, Uchani and Coimbatore ; that of hybrid from Maruteru (APHR-2, MTUHR 2002) and

Uchani (HKRH 1008, HKRH 1059) was found to have germination below IMSCS (Table 1). However, all the samples of R line recorded germination above IMSCS, irrespective of locations from where the seed lots were collected. Seeds of A lines (505 and 509) collected from Aurangabad showed unprecedentedly very low germination of 25.25 and 26.25 per cent, respectively. Mostly, A lines showed lower germination percentage as compared to others.

Table 2. Incidence of seedborne fungi on rice hybrids and their parental lines

Location	Hybrids/ Parental lines	Incidence of seedborne fungi(%)										
		Ap	Bo	Cl	Rhi	Aa	Fm	Fp	So	Asp	Pen	Total
Andhra Pradesh Hyderabad	IR 58025A	0.5	15.5	10.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0
	IR 58025B	9.0	21.0	6.0	6.0	1.0	0.0	0.0	0.0	0.0	0.0	43.0
	IR 40750-R	0.0	1.5	8.0	4.5	0.0	0.0	0.0	0.0	1.5	0.0	15.5
	DRRH-11.	0	4.5	12.5	6.0	0.0	0.0	5.0	0.0	0.0	0.0	29.0
Haryana Karnal	Pusa-6-A	2.5	9.5	9.0	0.0	5.5	0.0	0.0	8.5	0.0	0.0	35.0
	Pusa-6-B	9.5	15.0	8.5	3.5	2.0	0.0	4.5	0.0	0.0	0.0	43.0
	PRR-78	10.5	15.0	6.5	0.0	5.5	0.0	5.0	0.0	0.0	0.0	42.5
	PRH-10	53.5	30.0	8.5	0.0	2.0	2.0	6.5	29.5	0.0	0.0	132.0
Maharashtra Aurangabad	505-B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	505-A	0.0	0.0	0.0	8.5	0.5	1.0	0.0	0.0	0.0	0.0	10.0
	505-hybrid	0.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.5
	509-B	0.0	1.0	2.0	6.5	0.0	1.5	0.0	0.5	0.0	0.0	11.5
	509-A	0.0	0.5	0.0	5.5	0.0	1.0	0.0	0.0	0.0	0.0	7.0
	509-hybrid	0.0	0.5	1.0	5.5	0.0	1.5	0.0	0.0	0.0	0.0	8.5
Karjat-Raigad	A (Sahyadri)	3.0	0.5	3.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	8.0
	B (Sahyadri)	2.5	1.5	11.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	16.5
	BR827-35-3-1-1R	2.0	0.5	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
Uttaranchal Pantnagar	IR58025A	0.5	0.0	6.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	8.5
	IR58025B	46.0	10.0	6.0	0.5	1.0	4.0	3.5	0.0	0.0	0.0	71.0
	92-133R	21.0	18.0	13.5	1.5	2.5	0.5	0.5	0.0	0.0	0.0	57.5
	PSD-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Karnataka Mandya	IR58025A	0.0	14.5	6.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	21.0
	IR58025B	0.5	13.5	5.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	22.0
	KMR-3R	0.0	36.5	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.0
Mean		6.97	11.2	5.93	1.3	0.5	0.2	0.6	1.22	0.1	0.2	28.6

Ap-*Alternaria padwickii*, Bo-*Bipolaris oryzae*, Cl-*Curvularia lunata*, Fp-*Fusarium pallidoroseum*, So-*Sarocladium oryzae*, Rhi-*Rhizopus*, Aa-*Alternaria alternata*, Fm-*Fusarium moniliforme*, Asp-*Aspergillus spp.*, Pen-*Penicillium spp.*

Prabhakaran and Ponnuswamy [11] observed that A lines IR 62829A and IR 58025A usually recorded higher germinability initially but deteriorated faster as compared to their respective maintainers during storage. Rame Gowda *et al.* [12] also confirmed that seed germination declined steadily and significantly in all genotypes of rice hybrid during storage. Application of GA₃ is also reported to affect the seed quality adversely during storage [13].

There are many reports of the association of these fungi with paddy seeds [14, 15, 16 and 17]. Seed lots like IR 58025 A, APHR-2 and MTUHR-2002 from Andhra Pradesh and P6 B, IR 58025 B, HKRH-1008 and HKRH-1059 from Haryana with low germination were found to be severely infected with pathogens. On the other hand female parents of 505 and 509 though had low germination but there was no incidence of the pathogen. The low germination in these seed lots may be due to natural ageing or environmental factors. In case of IR 58025 B from Uttaranchal and IR 58025 A, PMS 10 A and PRR-78 from Haryana though exhibited high germination but at the same time the association of seedborne fungi was also high. Guerroero *et al.* [18] also reported that often seed lots with high germination show a high incidence of seedborne fungi support the present observation.

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