SHORT COMMUNICATION

Rice Donors for Submergence Tolerance Collected from Super Cyclone Devastated Areas of Orissa

BC Patra and RK Sarkar
Central Rice Research Institute, Cuttack-753006 (Orissa)

One hundred and twenty accessions of rice germplasm were collected from the super cyclone devastated areas of Orissa after two months of natural calamity to salvage the landraces and the traditional varieties from the remnants of ratoon crops. The collected germplasm lines were tested for submergence tolerance. Two cultivars namely Khoda (CRRI accession no. 36470, IC no. 283020) and Khadara (CRRI accession no. 36476, IC no. 283026) were found to be tolerant and were comparable with internationally recognised tolerant check FR 13A.

Key Words : *Oryza sativa* L., Germplasm, Submergence tolerance

The Orissa coast was hit by the worst ever super cyclone in the last year of the 20th century on 29-30th October 1999 causing severe loss to human life and property. The coastal districts were completely devastated. The rice cultivation in the region, which was in the maturity stage, was completely wiped out by the wind followed by heavy downpour. In order to salvage the landraces and the traditional varieties from the remnants of ratoon crop, five rescue explorations to the worst affected districts were launched after two months of the natural calamity by this Institute in collaboration with National Bureau of Plant Genetic Resources to collect and conserve the valued germplasm getting extinct. Through this mission the senior author collected about 120 accessions of rice germplasm from the super cyclone devastated areas. In rice gene pool, getting a submergence tolerant line is very few. However, well known germplasm lines like FR 13A, FR 43B were identified long back. Due to bad combining ability and other undesirable agronomic characters, successful breeding to develop new high yielding cultivars with submergence tolerance is not yet succeeded (Mallik, 2000). Searching for alternate source for this character is in high demand. Therefore, the materials were tested for submergence tolerance.

The germplasm were grown under normal condition with recommended package of practices to characterise and document the agro-morphological traits. For screening against submergence tolerance, the seeds were direct seeded in specially designed field cement tanks (40 x 8 m) with known submergence tolerant (e.g. FR 13A) and susceptible (e.g. IR 42) cultivars as checks. In the year 2000, the submergence experiment was conducted in augmented design whereas in 2001, it was done in randomised block design. Twenty one-day-old seedlings were submerged for 12 days under 80 cm of water followed by normal conditions with 10 cm of water. Survival count was taken visually after 10 days of withdrawal of submergence.

Identification of diverse gene sources for desired traits and their incorporation into the promising cultivars are the most effective way to tackle the adverse situations. The collected germplasm were screened for their valuable traits like submergence tolerance in the experimental fields of the Institute. Almost all the cultivars succumbed to submergence except two landraces, which were collected from Cuttack district. These two cultivars having collectors' number 'PD-27' and 'PD-33' (temporarily given by the collectors' name) withstood complete submergence even if their leaf tips remained below the water surface for more than 12 days. The names of these two landraces are 'Khoda' and 'Khadara', respectively. The elongation ability of these two landraces is as good as the international submergence tolerance check 'FR 13A' (Table 1). After submergence these two landraces maintained their leaf integrity measured in terms of chlorophyll content and were like 'FR 13A' and far better than susceptible check

Table 1. Effect of submergence on elongation and survival percentage

Name of the cultivars	Plant Height (cm)			Survival
	BS	AS	Elongation	(%)
Khoda	29	68	39	100
Khadara	28	70	42	96
FR 13A (Tolerant-check)	30	72	40	100
IR 42 (Susceptible-check)	20	68	48	15

BS= before submergence; AS= after submergence

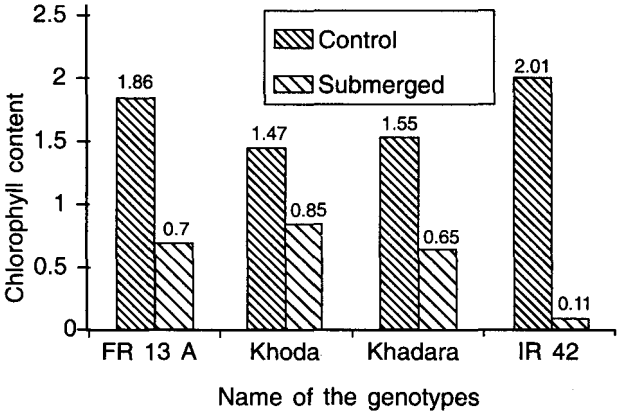

Fig.1: Effect of submergence on chlorophyll content (mg g^{-1} fresh leaves)

'IR 42' (Figure 1). Lower elongation and maintenance of higher amount of chlorophyll during submergence is associated with submergence tolerance (Sarkar and Bera 1997, Sarkar *et al.* 2001). They are better than 'FR 13A' in terms of seed quality and have no awn. 'FR 13A' was identified more than three decades ago. But developing submergence tolerant cultivars using 'FR 13A' as a parent has not yet become fruitful. These new genotypes with better seed quality and better agronomic traits would definitely improve the breeding efficiency in developing submergence tolerant cultivars. True submergence tolerant lines are not many in rice genetic stock. Identification of these two lines is given us hope and extended the scope for further research to develop high yielding submergence tolerant rice varieties.

The cv. Khoda was collected from the farmer Sri Debali Parida's field in village-Brahmanigaon of Block-Baranga whereas cv. Khadara was collected from Sri Gandharba Samal's field in village-Raghunathpur of Cuttack Sadar Block. Both the cultivars are lowland, deep-water and of long duration group. These collections have also been characterized morpho-agronomically in accordance with IRRI-IPGRI descriptor. The data show that they are similar in most of the morpho-agronomic characters like having pubescent leaf blade; blade colour and basal leaf sheath colour green; leaf angle horizontal; ligules 2-cleft, white; collar colour green; auricle colour being green; culm angle intermediate; internode's colour

Table 2. Agro-morphological traits of the landraces

Characters	PD 27 (Khoda)	PD 33 (Khadara)
Leaf length (cm)	43.4	47.4
Leaf width (cm)	0.9	1.1
Ligule length (cm)	1.9	1.9
Culm length (cm)	112.7	112.1
Culm number	7.2	8.2
Panicle length (cm)	24.5	25.9
15 days seedling height (cm)	20.5	21.4
Panicle weight (gm)	3.54	2.87
Grain length (mm)	8	9
Grain breadth (mm)	3	3
l/b ratio	2.66	3.00
1000 grain weight (gm)	26.4	28.4
Grain size	Extra long	Extra long
Grain shape	Medium	Medium
Maturity duration (days)	155	160

green; culm moderately strong; flag leaf and panicle intermediate; secondary branching low; panicle well exserted, panicle axis droopy, awning zero; apiculus, sterile lemma and stigma colour white. The mean quantitative characters of both the genotypes also show that both are almost alike (Table 2).

Required quantities of seeds have been deposited in the long-term storage of NBPGR, New Delhi as well as in the National Active Collection Centre of CRRI, Cuttack. The NBPGR has assigned the National identity to these materials with IC No. 283020 (Khoda) and IC No. 283026 (Khadara) whereas CRRI has given its own AC. No. 36470 and 36476, respectively. These two identified, valued cultivars will be submitted to the Germplasm Registration Committee of NBPGR for keeping them registered in the context of present day IPR regime etc.

References

Mallik S (2000) Rainfed lowland rice research in India-Perspectives and future projections. In Advances in Agricultural Research in India (Vol. XIII), *International Book Distributors, Dehradun, India.* 1 p.

Sarkar RK and Sandip Kumar Bera (1997) A comparison of the submergence response of elongating and non-elongating flood tolerant deep water rice. *Indian Agric.* **41(4)**: 299-303.

Sarkar RK, S Das and I Ravi (2001) Changes in certain antioxidative enzymes and growth parameters as a result of complete submergence and subsequent re-aeration of rice cultivars differing in submergence tolerance. *J. Agron. & Crop Sci.*, **187**: 69-74.