

Submergence tolerant lines for flash flood affected areas of Assam

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ABSTRACT

Submergence is one of the major abiotic stresses under rainfed lowland situation, which adversely affect the rice production and productivity. Three crosses (Pankaj / FR13 A, Mahsuri / FR13A and Manoharsali / FR13A) using FR13A, a submergence tolerant donor were made during year 1990. Nine submergence tolerant lines viz., TTB202-3, TTB202-4, TTB202-16, TTB202-22, TTB202-25, TTB202-33, TTB202-34, TTB202-43 and TTB202-45 have been developed from the cross Pankaj. Among these, three lines were selected on the basis of multilocation testing during the year 2000. These lines could be exploited to improve production and productivity of rice in flood prone areas of Assam.

Key words: Submergence tolerance, flash flood, survival percentage

Flood is the most devastating natural calamity affecting the rice production and productivity in Assam. Incessant rainfall from June to September in the catchments areas of the Brahmaputra and the Barak and their tributaries inundate low lying areas and damage the *Sali* rice (June/July to November/December) in its vegetative stage while medium duration *ahu* (Feb/March to June/July) and *boro* (November/December - May/June) are also damaged in the ripening stage of the crop. Out of 25 lakh ha of rice growing area, 5 lakh ha is chronically flood prone (Pathak *et al*, 1990) and in some years (e.g., 1988, 1998) the damage was as high as 11 lakh ha.

In majority of flood-prone rice growing fields, the crop gets submerged for 1-15 days for more than once depending on the intensity and duration of floods due to rains. Flood submergence may occur at any growth stage of the rice crop and yield loss in severe cases may be 100% (Mohanty *et al*, 1982). This has been one of the factors of low production and productivity of rice in the state. Mackill *et al* (1996) emphasised on breeding varieties that have intermediate height, stiff, non-lodging culms and moderate submergence tolerance for such growing situation.

Therefore, an attempt was made at Regional Agricultural Research Station, Titabar to develop high yielding varieties with submergence tolerance in flash flood affected areas of the state.

Three crosses with FR13A as a donor parent were attempted at RARS, Titabar in 1990. The crosses were Pankaj x FR 13 A (TTB 202); Mahsuri x FR 13A (TTB 203); Manoharsali x FR 13A (TTB 204). Progenies of the crosses were raised under shallow submergence condition (30-50cm water) at research station upto F₄ generations and selections were made for semitall plant stature, non lodgingness, white endosperm and awnlessness of grains.

Single plant selections were made for plant types and other desirable agronomic characters upto F₄ generations in flood free fields of RARS, Titabar. The cross Manoharsali x FR 13A was rejected in F₂ generation for its undesirable plant characteristics in the progenies. From F₅ to F₈, selections were made in flood prone fields of different locations for survival (%). Importance of selection under stress environment was earlier suggested by Pathak *et al* (1999).

The F₅ and F₆ progenies were screened in flood affected farmers' fields at Bonai, Naopeta and Bokakhat and single plant selection was made. In F₇, altogether 112 lines derived from single plants were finally evaluated in flood prone farmers fields of Basabhoralua and Naopeta. The crop was submerged for 12 and 15 days respectively by floodwater at vegetative stage. Altogether nine breeding lines viz., TTB 202-3, TTB 202-4, TTB 202-16, TTB 202-22, TTB 202-23, TTB 202-33, TTB 202-34, TTB 202-43 and

Table 1 Performance of submergence tolerant breeding lines under multilocation testing during 2000.

Breeding lines	Survival (%)					Yield (kg ha ⁻¹)				
	L ₁	L ₂	L ₃	L ₄	Mean	L ₁	L ₂	L ₃	L ₄	Mean
TTB 202-3	80.5	80.0	96.0	81.0	84.4	4160	4750	4215	4470	4399
TTB 202-4	80.0	78.0	96.5	80.0	83.6	4577	4700	4230	4250	4439
TTB 202-16	79.1	75.0	82.0	62.0	74.5	3595	3700	4050	4270	3904
TTB 202-22	78.2	78.0	80.0	75.0	77.8	3540	3700	3400	3250	3472
TTB 202-25	85.0	89.0	92.0	82.0	87.0	5160	4850	4950	5266	5056
TTB 202-33	78.5	79.0	90.0	76.0	80.9	3800	4500	4504	4383	4296
TTB 202-34	74.1	75.0	89.0	62.0	75.0	3560	3950	4115	4090	3929
TTB 202-43	75.0	70.0	86.0	65.0	74.0	2155	1625	2556	2833	2292
TTB 202-45	75.0	70.0	88.0	78.0	77.0	3560	2400	4120	4666	3686
FR13A(check)	78.0	79.0	99.0	85.0	85.2	3816	3800	4060	3822	3874
Mahsuri (sub check)	30.0	28.0	56.0	20.2	33.5	2518	2950	3915	4150	3383
CD (P=0.01)	2.6	5.8	2.5	6.1	-	556	378	310	216	-

L₁ : Gabharupathar Submerged for 10 days 7 DAT and 6 days at 30 DAT

L₂ : Tamulypathar Submerged for 12 days 10 DAT and 5 days at 35 DAT

L₃ : Basabharalua Submerged for 5 days 7 DAT and (weak stress)

L₄ : RARS, Titabar Submerged in artificial tank(10 days old seedling submergence for 10 days

TTB 202-45 were selected based on their survival (%) in F₈ at Basabharalua and Naopeta. In 1999, Yield trial with the selected lines along with resistant check FR 13A and a susceptible check Mahsuri were grown in farmers' field at Chintamonigarh with 3 replications in RBD.

Survival (%) under natural flood (7 days and 11 days submergence) in vegetative stage of TTB 202-3, TTB 202-4, TTB 202-25 and TTB 202-33 was more than 80% and at par with the resistant check FR 13A. Similar results were also obtained at IRRI rainfed lowland breeding programme in which progenies with tolerance level similar to that of tolerant parent in tolerant x susceptible crosses were obtained. The result suggests that one major gene is responsible for exhibiting tolerance of highly tolerant cultivars (Mackill *et al.*, 1996). Yield performances of the test lines were also high. All the test lines were also tested for survival (%) in artificial tank and for yield in flood free research station field. Grain yield of TTB 202-3, TTB 202-4, TTB 202-25 and TTB 202-43 was found to be at par with the check variety Pankaj.

Multilocation testing in flood prone and one flood free field in 2000 indicated that TTB 202-3, TTB

202-4 and TTB 202-25 are the lines with high survival (%), substantial yield and other desirable characters (Table 1). Hence, these lines can be proposed for recommendation in flash flood affected rice growing fields of Assam.

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