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Screening Improved *Aus* Rice Varieties/ Genotypes for Rainfed Aerobic Soil Conditions of Bangladesh

During the *aus* (summer rice) season in the northern districts of Bangladesh, rainfall is very low; water shortages coupled with high supplementary irrigation costs seriously affect crops. Moreover, labor shortages and high labor costs are a constraint to timely establishment of *Aus* rice.

Direct seeding of rice instead of seedling transplanting may be a better option for *aus* rice cultivation, the major advantages of direct seeding in dry soil being the avoidance of time consuming, labor intensive soil puddling-seedling transplanting operations, production cost saving and early harvest.



The dry seeding or aerobic rice cultivation technique is a new water-saving technology that keeps the

soil moist but not water saturated by using limited irrigation. This method is also climate smart in that it reduces green house gas (GHG) emission from the rice fields.



This project was designed to evaluate high-yielding, short-duration (100-105 days) *Aus* rice varieties adapted to direct seeded, aerobic conditions and appropriate agronomic management practices for direct seeded, low water requiring aerobic rice.

Selection of short duration aerobic lines

Two separate experiments were conducted in the *Aus* season of 2013-14 under direct dry seeded conditions to evaluate improved short duration (about 100 days) genotypes under aerobic soil conditions (land was prepared in dry conditions and soil was kept just moist, not water-saturated). In the first year, 4 lines were selected (IR91006-88-1-3-1,



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IR84788-40-3-3-1-1, IR90228-1-3-3-3-2 and IR92240-40-2-2-1) for high yield (3.60- 4.20 t/ha) and relatively short growth duration (105-109 days). Further, 4 top ranking lines (BR7178-2B-19-10, BR6855-3B-12, BR6848-3B-12 and BI dhan-5) with higher yield (3.55-4.50 t/ha) and shorter duration (97-101 days) were selected for primary varietal selection (PVS) trials.

Selection of aerobic lines with greater root length

Rice plants were grown in PVC pipes filled with soil. Direct seeding was done under aerobic soil conditions in the PVC pipes. IR90228-1-3-3-3-2 and IR91006-88-1-3-1 were the best aerobic rice genotypes with better phenotypic acceptance (2-3), greater root length (55-58 cm) and higher root/root-shoot (0.44-0.46) than others.

Molecular data revealed that RM302 amplified a specific allele (112 bp) in all the aerobic rice genotypes. RM302 on chromosome 1 showed linkage to deep root length. IR92240-40-2-2-1 was selected as the best aerobic rice genotype possessing a deep rooting ability.

Developing agronomic management practices for aerobic rice

Land preparation by three plowings with power tiller was found to be good enough for direct seeded *Aus* rice. A seed rate of 30 kg/ha gave the maximum yield for all the test materials. Weeds in direct seed aerobic rice could be controlled by either hand weeding or herbicide application; however, herbicide application was found to be both time and cost saving. Irrigation three days of disappearance of moisture was found to be the best water management option.

About 28% water could be saved compared with the wetland transplanting method of rice cultivation where continuous standing water is maintained.

Benefits and outcomes

The project enabled selection of three short duration (about 100 days), high-yielding (around 4 t/ha) rice genotypes, BR7178-2B-19, BINA dhan-5, BR6855-3B-12 and IR92240-40-2-2-1, suitable for growing as direct seeded *Aus* rice under aerobic conditions in the northern and northeastern regions of Bangladesh.

Table 1. Plant height, growth duration and grain yield of aerobic rice genotypes in PVS trials in the Sylhet region and Naogaon district (means of 8 locations in each area), Aus 2015

Designation	Plant height (cm)	Growth duration (days)	Mean grain yield (t/ha)	
			Naogaon	Sylhet
BR7182-2B-1-HR4	122	100	3.4	4.9
BR7178-2B-19	121	100	4.3	5.3
BR6855-3B-12	127	100	4.2	4.8
BR6848-3B-12	116	104	4.1	5.3
IR84788-40-3-3-1-1	127	115	3.1	3.9
IR90228-1-3-3-3-2	128	115	3.2	4.1
IR91006-88-1-3-1	128	114	3.3	3.8
IR92240-40-2-2-1	127	112	4.8	3.9
BINA dhan-5	99	100	3.5	5.2
BRRI dhan42 (ck)	114	102	3.4	5.2
LSD (5%)	1.67	0.455	0.898	
CV(%)	2.0	0.6	3.8	

These lines are being evaluated for release as varieties. An aerobic rice cultivation package comprising suitable tillage, seed rate, irrigation schedule and weeding method has been standardized. Sixteen farmers' training sessions on aerobic rice cultivation methods were organized. Two TV documentaries were prepared and broadcast by different TV channels.

Environmental Impact for aerobic rice cultivation

- Provide a safeguard for retention of soil structure
- Provide a safeguard in the face of occurrence of less rainfall.
- Over pumping of underground water will be reduced
- No environmental hazard for aerobic rice cultivation
- Methane elimination very low for aerobic rice cultivation

Recommendations

Aerobic rice lines selected from the experiments under this project are being evaluated in field trials by BRRI for release as varieties.

The government should take a plan to initiate a nationally coordinated project for the popularization of new aerobic rices and water-saving technologies in an attempt to increase the aus acreage, and thus, the total annual rice output of the country.

Expected Impacts

- ❖ Scope to reduce cost of rice production and conserve water resources by minimizing the use of groundwater for irrigation
- ❖ The new aerobic rice varieties may provide 0.5 to 0.8 t/ha more yield than other *Aus* varieties and thus, the aerobic rice varieties and associated technologies will help poor farmers with higher incomes
- ❖ Dry soil method of rice cultivation would be climate smart due to its ability to reduce GHG emission

This bulletin has been prepared on the basis of technical information available from a completed CGP project of KGF, the details of which are given below:

Project code and title: TF 04-C: Screening and testing of improved *Aus* rice varieties/genotypes suitable for rainfed aerobic soil conditions of Bangladesh; Principal Investigator: Dr. A S M Masduzzaman, Chief Scientific Officer, Plant Breeding Division, Bangladesh Rice Research Institute; Project duration: May 2013 to May 2016

