ANNUAL RESEARCH REVIEW WORKSHOP
2022-2023

XIX: REGIONAL STATION, RANGPUR
(February, 2024)

BANGLADESH RICE RESEARCH INSTITUTE
GAZIPUR

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Md. Khalid Hasan Tarek, *MS*, Scientific Officer**	GOB	204
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Name and designation	GOB/Project	Working days
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Mst. Shammy Akhter, Assistant Account Officer	GOB	020
Md. Rozurul Alam Ranu, Assistant Account Officer	GOB	015
Md. Jahirul Alam Khan, UDA cum Accountant	GOB	354
Shah Md. Rezwan Kabir, Driver*	GOB	192
Md. Ashraf Ali, Driver**	GOB	205
Md. Ismail Hossain, Office Asst. cum Computer Operator	GOB	365
Md. Zamiar Hossain, Guard cum Cook	GOB	365
Md. Ataur Rahman, Security Guard	GOB	111
Md. Forid Miah Shekh, Security Guard	GOB	365
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1. General information

BRRI Regional Station, Rangpur represents eight northern districts of Rangpur Division. The elevation is 33.65 meters from sea level. The latitude is 25.4145 and Longitude is 89.161. It has included 08 Districts (Rangpur, Gaibandha, Kurigram, Lalmonirhat, Nilphamari, Dinajpur, Thakurgaon and Panchagarh), 58 Upazilas, 1 City Corporation, 21 Pourasavas and 536 Union councils which is covered major 6 AEZ (1, 2, 3, 7, 25 & 27). The total geographical area of this region is 16,185 sq. kilometer which is covered 11% of total area. According to the 2011 census, the total population of Rangpur Division is 15,787,758 which are 10% of country total population. Population density is 980/km^2. 51.18% of total population is male and 48.82% is female. This region has a total of 27,39,076 agricultural household, where 24% landless, 35% marginal, 26% small, 12% medium and 3% are landlord farmer.

The main missions of this station are-

1. To develop cold tolerant rice variety at seedling stage for Boro season and flash flood submergence tolerant, drought tolerant, short duration and aromatic rice variety for T. Aman season
2. To develop location and AEZ need based variety and technology for yield improvement
3. To provide technical support and training to the extension organization (GO & NGO) for modern rice production practices
4. To extend rice related best technologies suitable for well being of the needy farmers

Basic Information about the region

Land Utilization:

- Net cultivable land: 12,44,761 ha (1.24 m ha)
- Total rice area : 10,31,800 ha (1.03 m ha)

Land Type:

- High land : 4,57,208 ha
- Medium high land: 6,86,099 ha*
- Medium low land : 1,06,167 ha*
- Low land : 32,610 ha*

*Flood prone area which is 64 % of total land. It varies from location to location (**Table 1**)

Table 1: Flood and drought prone areas of Rangpur-Dinajpur region

District	Net crop area	Flood prone area		Drought prone area	
	(ha)	(ha)	%	(ha)	%
Rangpur	2,00,000	40,000	20	25,000	13
Gaibandha	1,49,749	75,000	50	5,000	3
Kurigram	1,62,480	30,000	18	40,000	25
Lalmonirhat	91,771	13,581	15	8,410	9
Nilphamari	1,28,515	9,000	7	2,000	2
Dinajpur	2,58,259	39,402	15	66,025	26
Thakurgaon	1,41,559	21,025	15	37,000	26
Panchagarh	1,12,428	5,600	5	45,000	40
Region	12,44,761	2,33,608	19	2,28,435	18

Note: Entire eight districts are under cold prone area

Table 2: Major AEZ's in Rangpur-Dinajpur Region

District	Name of AEZ
Rangpur	**2**-Active Tista Floodplain, **3**-Tista Meander Floodplain & **27**-North-Eastern Barind Tract
Gaibandha	**2**-Active Tista Floodplain, **3**-Tista Meander Floodplain, **7**-Active Brahmaputra-Jamuna Floodplain, **25**- Level Barind Tract & 27-North-Eastern Barind Tract
Kurigram	**2**-Active Tista Floodplain, **3**-Tista Meander Floodplain & **7**-Active Brahmaputra-Jamuna Floodplain
Lalmonirhat	**2**-Active Tista Floodplain & **3**-Tista Meander Floodplain
Nilphamari	**2**-Active Tista Floodplain & **3**-Tista Meander Floodplain
Dinajpur	**1**-Old Himaloyan Piedmont plain, **3**-Tista Meander Floodplain, **25**- Level Barind Tract & 27-North-Eastern Barind Tract
Thakurgaon	**1**-Old Himaloyan Piedmont plain
Panchagarh	**1**-Old Himaloyan Piedmont plain & **3**-Tista Meander Floodplain

Climate

- Rangpur and Dinajpur region is very cold prone area (prolong winter) than other part of the country. Winter starts from mid November and continued up to March **(Fig. 1 & 2)**. In winter, temperature usually goes below the critical level (<15°C) of rice growth in 1st January/23 to 31st January/23**(Fig. 2)**.
- Maximum rainfall occurs in July 2020 **(Fig. 3)**.
- Vulnerability for sustainable crop production is occurring due to climate change day by day in Rangpur-Dinajpur region **(Fig. 4 & 5)**.

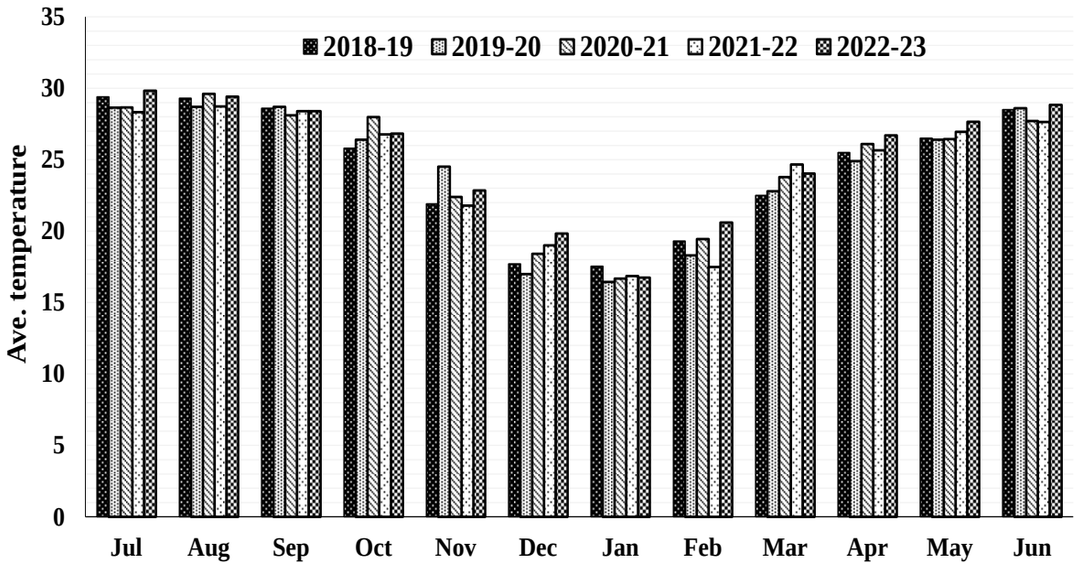

Fig. 1: Monthly Average Temperature of BRRI Rangpur from 2018-19 to 2022-23

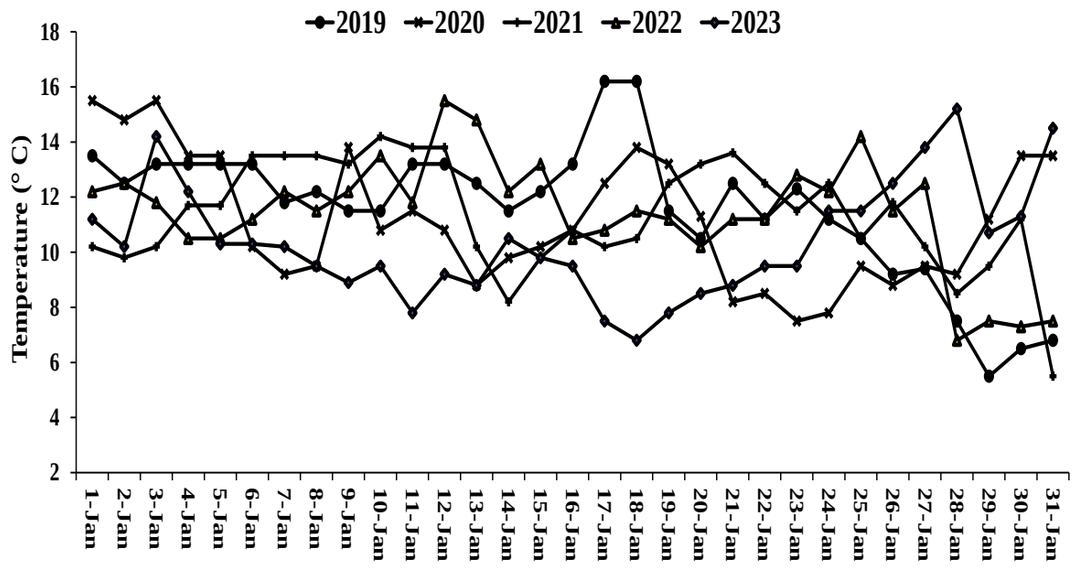

Fig. 2: Minimum temperature in the month of January at BRRI Rangpur from 2019-2023

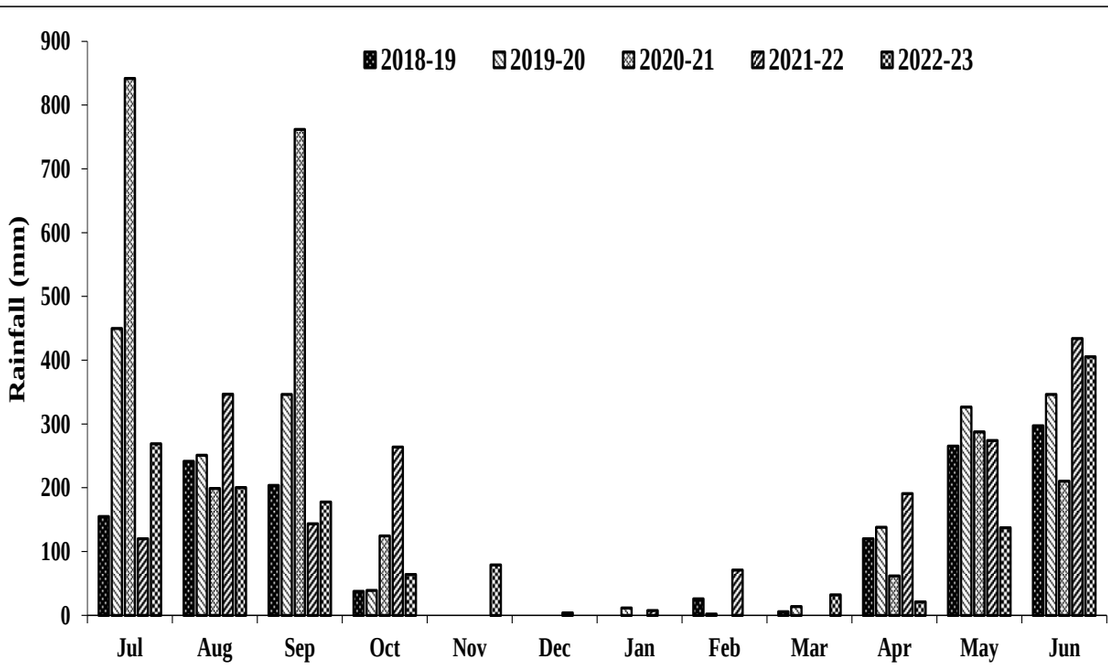

Fig. 3: Monthly total rainfall (mm) of BRRI Rangpur from 2018-19 to 2022-23

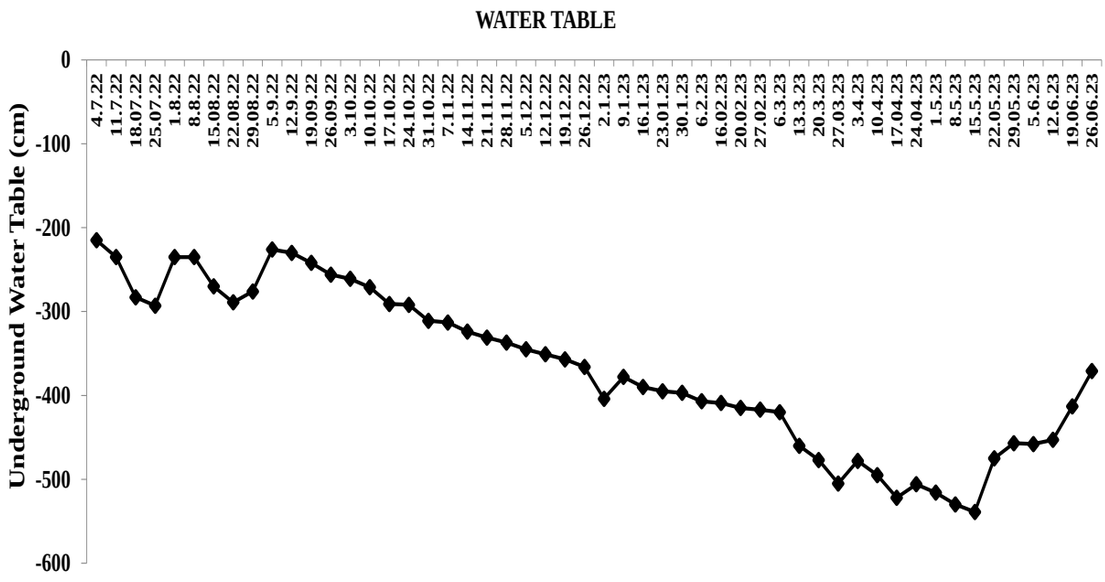

Fig. 4: Under ground water data of BRRI Rangpur during the period of July, 2022- June 2023

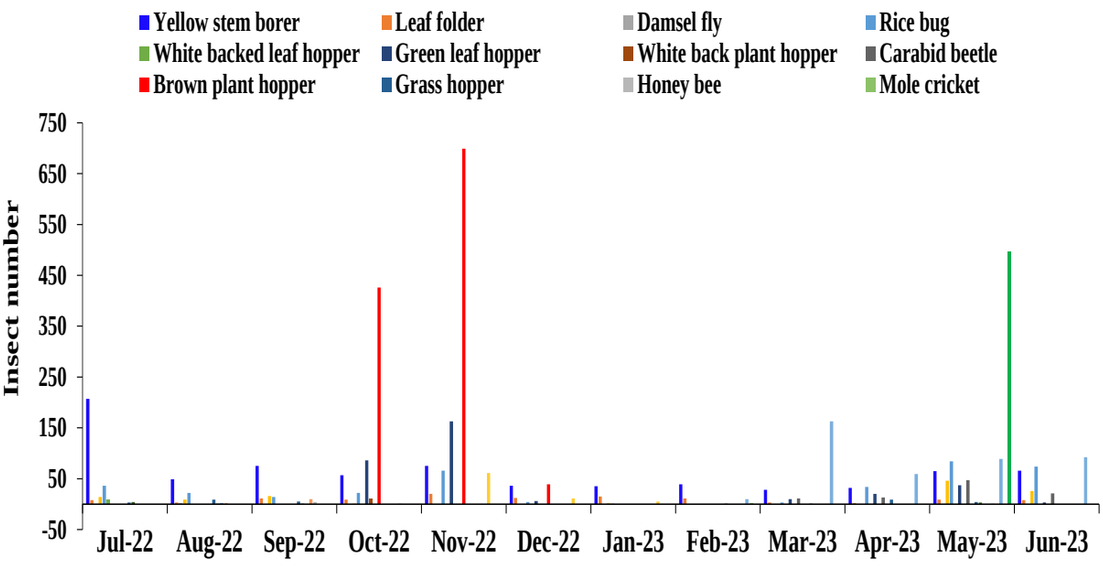

Fig. 5: Monthly Light trap insect data of BRRI Rangpur from July, 2022- June 2023

2. Summary

To develop region specific suitable modern rice varieties for Rangpur-Dinajpur region, 10 germplasms were collected from farmers' field for maintenance breeding, ten single crosses were made and 109 progenies were bulked from $4F_5$, $2F_6$ and $3F_8$ generations during 2022-23. In total, 280 individual plants and four fixed genotypes were selected from observational yield trial under the program of breeding for second generation rice. In OYT, BRrang13-RGA-1-1-3 produced 9.48 t/ha which was higher than BRRI dhan88 (7.05 t/ha). Under Basmati rice breeding program, 270 individual plants and five fixed genotypes were selected from OYT. BRrang55-RGA-3-2 gave highest yield (7.66 t/ha) over BRRI dhan50 (6.50 t/ha) in OYT. A total of 28 RYT's and 19 ALART's were conducted during this reporting period.

Under the development of hybrid rice parental lines and hybrids, in total 295 testcross F_1s were made from source nursery by testcross.

Under TRB platform, in T. Aus, 2022, in AYT trial, total 111 advanced lines with three were tested standard checks BRRI dhan48, BRRI dhan82 and BRRI dhan98 were tested and the highest yield was found in BR11866-5 R-294 (5.91 t/ha) with 107 days growth durations. In T. Aman season, in different yield trials, 357 genotypes were tested in 6 location of northern region of Bangladesh. Among the tested genotypes 194 genotypes were selected based on phenotypic acceptance, growth duration, survivability and higher yield performance. In total 488 genotypes were tested in different yield trails in Boro season and 86 genotypes were selected based on cold tolerant (SES), phenotypic acceptance, growth duration, and yield performance.

In effect of herbicide on weed infestation of rice experiment, Penoxulam controls Azolla at first stage but later stage 2,4- D Amine perform better to control Azolla.

In planting time experiment, appreciable better yield was achieved in T. Aman season when BRRI dhan87 and BRRI dhan90 transplanted on 20th of August. BRRI dhan93 gave higher yield on 20th July – 05th August. BRRI dhan75 should preferably be transplanted on 20th July- 20th August. In Boro season, grain yield was higher for BRRI dhan89 and all the varieties produced higher grain yield on 16 January and 01 February planting.

In long-term nutrient omission trial has been running in the BRRI farm, Rangpur since 2014-15 in Boro-Fallow-T. Aman cropping pattern. After eighth cropping year, it was oserved that the omission of N in T. Aman and omission of N and P in Boro season from complete fertilizer significantly reduced the grain yield of rice at BRRI Rangpur farm.

A total of 2319 varietal demonstrations were conducted in Rangpur-Dinajpur region during this reporting period. Under TRB programs, twelve Head to Head Adaptive trials were conducted in 2022-23. Fifteen field days were arranged and 20 farmers training were conducted on modern rice production technology. A total of 1,170 kg, 10,681 kg and 33,599 kg TLS were produced in T. Aus, T. Aman and Boro season, respectively. A total of 4000 kg Breeder seed was produced in T. Aman season and 5250 kg Breeder seed was also produced in Boro season. Moreover, a total of 9250 kg Breeder seed was sent to GRSD, BRRI Gazipur. In this reporting period, 35,421 kg TLS was distributed for dissemination and popularization of latest BRRI varieties in Rangpur-Dinajpur region.

3. VARIETAL DEVELOPMENT PROGRAM (VDP)
A. BRRI Regional Station Rangpur

Program 1: Development of rice varieties suitable for T. Aman season in Rangpur region

General Objectives: Development of high yielding (>=8.0 t/ha) rice varieties giving the thrust is to develop short duration varieties accompanied with tolerance to drought, resistance to major biotic stresses (insect and diseases) and acceptable grain quality.

Project Leader: M Rokebul Hasan

Experiment 3.1: Germplasm Collection and maintenance breeding
MR Hasan, MRS Ripon and KM Iftekharuddaula
Specific objectives: To collect local, cultivated and exotic germplasm for the utilization of variety development.

Methodology: Collection programs were performed for exploration of rice germplasm. For this purpose, GRSD and farmers were informed well ahead for collection. Some collections were also made directly from farmer fields.

Results: A total of 10 rice germplasm were collected and maintenance during reporting period 2022-2023 (**Table 3**). Collected germplasm will be characterized and used for breeding purpose in next T. Aman season.

Table 3: List of rice germplasms collected and maintained from different sources during reporting period 2022-2023

SL#	Name of the germplasms	Location/Division	Characteristics
01.	Pusa Basmati (Acc. No.4342)	GSRD, BRRI	Aromatic
02.	Basmati (Acc. No.4361)	Genetic Resources and Seed Division, BRRI, Gazipur	Aromatic, Slender grain
03.	PB1(Basmati)	Breeding value estimation	Aromatic, Slender grain, HYV plant type
04.	PB1509	Sadar Dinajpur	Aromatic, Slender grain
05.	Rosul bhog	Kawnia	Aromatic
06.	Kataribhog	Nageshwari, Kurigram	Aromatic
07.	Kataribhog	Sadar, Dinajpur	Aromatic
08.	Miniket (Dinajpur)	Nawabganj, Dinajpur	Premium quality
09.	Black Rice	Farmers field (Parbortipur)	Antioxidant
10.	Gainza (Red)	Nageswari, Kurigram	Photosensetive and Premium quality

Experiment 3.2: Hybridization
MR Hasan, MRS Ripon and KM Iftekharuddaula

Specific objectives: To introgress genes from diverse genetic background for earliness, tolerant to drought, sturdy stem, resistance to major biotic stresses (insect and diseases) and acceptable grain quality.

Materials and methods: Six parental varieties/lines (donors and recipients) were grown in the hybridization block of Rangpur Regional station at three dated with an interval of seven days to synchronize flowering for cross combinations. Single seedling of twenty-five days old were transplanted in 3.0 m x 2 rows plots with a spacing of 20 cm x 20 cm. Fertilizers were applied @ 225 kg Urea, 100 kg TSP, 120 kg MP, 75 kg Gypsum and 7.5 kg Zinc Sulphate/ha. Total amount of TSP, Gypsum, $ZnSO_4$ and ½ MP were applied at the time of final land preparation. Urea was applied with three equal splits at 15, 30 and 45 days after transplanting (DAT). Rest ½ MP was applied with the 2nd split of urea application. Crop management such as weeding, irrigation etc. was done in time. Pest management was done as required. Usual method of emasculation and

pollination were done. At maturity, F_1 seeds were dried and stored cautiously in paper bags with proper labeling. After hybridization, parents were maintained.

Results: Five crosses were made using ten diverse parents. F_1 seeds were harvested at maturity and preserved with proper labels **(Table 4)**.

Table 4: List of crosses made, Breeding for standard rice varieties for Rangpur region, T. Aman, 2022

SN	Cross combination	F_1 seeds	Characteristics
T. Aman, 2022-2023			
1.	BRRI dhan93/BRRI dhan34	52	Premium quality
2.	BRRI dhan87/ BRRI dhan34	35	Premium quality
3.	BRRI dhan90/ BRRI dhan34	84	Premium quality
4.	BR8415-5-4-Rang5-8-1-1-1/ BRRI dhan34	32	Premium quality
5.	BRRI dhan90/ Kataribhog (Dinajpur)	29	Premium quality

Experiment 3.3: Field Rapid Generation Advance (FRGA)

MR Hasan, MRS Ripon and KM Iftekharuddaula

Specific objective: To achieve genetic gain and rapid advancement of segregation generation for shortening breeding cycle following field RGA.

Materials and methods: A total of 9 crosses comprising 4 F_5 generation, 2 F_6 generations and 3 F_8 generations were grown. Germinated seeds were direct seeded in raised bed. Fertilizers application was limited for stimulating nutrient stress. Additional tillers from each hill were removed and kept only the mother tiller. Single panicle was harvested from each plant of each cross. Harvested seeds were proper dried and preserved with proper labeling.

Results: In total 119 progenies from F_5 (70), F_6 (20) and F_8 (39) generations were harvested at maturity and preserved with proper labels **(Table 5)**.

Table 5: List of segregating generations advanced through Field RGA, Breeding for standard rice varieties for Rangpur region, T. Aman, 2022

SN	BR No.	Cross combination	Individual progenies
F_5 Generation			
1.	BRrang34	BR8415-5-4-Rang5-8-1-1-1/Black rice	10
2.	BRrang35	BRRI dhan90/BRRI dhan70	15
3.	BRrang36	BRRI dhan87/Miniket (Dinajpur)	25
4.	BRrang37	BR8412-5-4-Rang5-8-1-1-1/Black rice	20
		Total	**70**
F_6 Generation			
1.	BRrang28	BRRI dhan87/Shompa katari	10
2.	BRrang30	BRRI dhan87/Black rice (GRSD)	10
		Total	**20**
F_8 Generation			
1.	BRrang13	Nania/Swarna5	19
2.	BRrang15	Swarna5/Minikit	10
3.	BRrang21	BRRI dhan75/ Minikit	10
		Total	**39**
		Grand Total	**119**

Experiment 3.4: Observational Trial (OT)

MR Hasan and KM Iftekharuddaula

Specific objective: Evaluation of promising breeding lines for their homogeneity, adaptability, phenotypic acceptability and high yield potentials.

Materials and methods: A total of 150 genotypes were evaluated at BRRI RS, Rangpur. BRRI dhan75 and BRRI dhan87 were used as standard checks. The unit plot size was 5.4 m x 4 rows.

Twenty-five-day-old seedlings were transplanted @ single seedling with the spacing of 20 cm x 20 cm. Fertilizers were applied @ 225 kg Urea, 100 kg TSP, 120 kg MP, 75 kg Gypsum and 7.5 kg Zinc Sulphate/ha. Total amount of TSP, Gypsum, $ZnSO_4$ and ½ MP were applied at the time of final land preparation. Urea was applied with three equal splits at 15, 30 and 45 days after transplanting (DAT). Rest ½ MP was applied with the 2nd split of urea application. Crop management such as weeding, irrigation etc. was done in time. Pest management was done as required.

Results: Five genotypes were selected based on the better performance with homogeneity in flowering, phenotypic acceptability, insect and disease reaction, earliness and grain yield **(Table 6)**. All selected genotypes performed better over all standard checks. BRrang13-RGA-5-2-5 produced 2.0 t/ha yields advantage over BRRI dhan75. Moreover, 150 individual plants were selected for further evaluation.

Table 6: Agronomic parameters of the selected materials from Observational Yield Trial (OYT), Breeding for standard rice varieties for Rangpur region, T. Aman, 2022

SL#	Designation	PHt. (cm)	Mat. (days)	Yield (t/ha)
1.	BRrang13-RGA-5-1-2	110	120	6.5
2.	BRrang13-RGA-5-1-6	108	121	6.7
3.	BRrang13-RGA-5-2-5	110	115	6.8
4.	BRrang13-RGA-8-1-1	112	119	5.9
5.	BRRI dhan75 (Ck.)	108	112	4.8
6.	BRRI dhan87 (Ck.)	125	128	5.9

D/S: 15 July, 2022; D/T: 03 August, 2022 & Spacing: 20 cm x 20 cm

Program 2: Breeding of Photoperiod-sensitive rice varieties (PSR) for Lowland and Charland ecosystem

General Objectives: To develop moderate photoperiod-sensitive climate smart rice varieties with high yield potential (≥8.0 t/ha) with acceptable grain quality.

Project Leader: M Rokebul Hasan

Experiment 3.5: Field Rapid Generation Advance (FRGA)

MR Hasan and KM Iftekharuddaula

Specific objective: To achieve genetic gain and rapid advancement of segregation generation for shortening breeding cycle following field RGA.

Materials and methods: A total of 2F_2 populations crosses were grown. Germinated seeds were direct seeded in raised bed. Fertilizers application was limited for stimulating nutrient stress. Additional tillers from each hill were removed and kept only the mother tiller. Single panicle was harvested from each plant of each cross. Harvested seeds were proper dried and preserved with proper labeling.

Results: In total 250 progenies from 2 F_2 populations were harvested at maturity and preserved with proper labels **(Table 7)**.

Table 7: List selected progenies from F_2 population, Breeding of Photoperiod-sensitive rice varieties (PSR) for Lowland and Charland ecosystem, T. Aman, 2022

SN	BR No.	Cross combination	Individual progenies
1.	BRrang43	BR8493-3-5-1-P1/Kataribhog (Dinajpur)	100
2.	BRrang50	Swarna5/Gainza	150
		Total	**250**

Experiment 3.6: Observational Trial (OT)

MR Hasan and KM Iftekharuddaula

Specific objective: Evaluation of promising breeding lines for their homogeneity, adaptability, phenotypic acceptability and high yield potentials.

Materials and methods: A total of 15 genotypes were evaluated at BRRI RS, Rangpur. BR22 and Gainja were used as standard checks. The unit plot size was 5.4 m x 4 rows. Twenty-five-day-old seedlings were transplanted @ single seedling with the spacing of 20 cm x 20 cm. Fertilizers were applied @ 225 kg Urea, 100 kg TSP, 120 kg MP, 75 kg Gypsum and 7.5 kg Zinc Sulphate/ha. Total amount of TSP, Gypsum, $ZnSO_4$ and ½ MP were applied at the time of final land preparation. Urea was applied with three equal splits at 15, 30 and 45 days after transplanting (DAT). Rest ½ MP was applied with the 2nd split of urea application. Crop management such as weeding, irrigation etc. was done in time. Pest management was done as required.

Results: Two genotypes were selected based on the better performance with homogeneity in flowering, phenotypic acceptability, insect and disease reaction, earliness and grain yield **(Table 8)**. All selected genotypes performed better over all standard checks. BRrang13-1-9-8-2 produced 2.4 t/ha yields advantage over Gainja. Moreover, five individual plants were selected for further evaluation.

Table 8: Agronomic parameters of the selected materials from Observational Yield Trial (OYT), Breeding of Photoperiod-sensitive rice varieties (PSR) for Lowland and Charland ecosystem, T. Aman, 2022

SL#	Designation	PHt. (cm)	Mat. (days)	Yield (t/ha)	Remarks
01.	BRrang13-1-9-8-2	110	147	6.2	MPPS
02.	BRrang13-1-9-8-5	108	145	6.1	MPPS
03.	BR22 (Ck.)	110	150	5.0	SPPS
04.	Gainja (Ck.)	90	141	3.8	SPPS

Here, MPPS: Moderately photoperiod sensitive; SPPS: Strongly photoperiod sensitive
D/S: 20 July, 2022; D/T: 15 August, 2022 & Spacing: 20 cm x 20 cm

Program 3: Breeding for Second Generation Rice (SGR)

General Objective: Development of high yielding (≥8.0 t/ha for T. Aman and ≥10.0 t/ha for Boro) rice varieties by modifying plant type giving the thrust is to develop short duration varieties accompanied with tolerance to drought/cold, resistance to major biotic stresses (insect and diseases) and acceptable grain quality.

Project Leader: M Rokebul Hasan

Experiment 3.7: Observational Trial (OT)
MR Hasan and KM Iftekharuddaula

Specific objective: Evaluation of promising breeding lines for their homogeneity, adaptability, phenotypic acceptability and high yield potentials

Materials and methods: A total of 180 genotypes were evaluated at BRRI RS, Rangpur. BRRI dhan88 and BRRI dhan89 were used as standard checks. The unit plot size was 5.4 m x 4 rows. Forty-five-day-old seedlings were transplanted @ single seedling with the spacing of 20 cm x 20 cm. Fertilizers were applied @ 260 kg Urea, 100 kg TSP, 120 kg MP, 110 kg Gypsum and 11 kg Zinc Sulphate/ha. Total amount of TSP, Gypsum, $ZnSO_4$ and ½ MP were applied at the time of final land preparation. Urea was applied with three equal splits at 15, 30 and 45 days after transplanting (DAT). Rest ½ MP was applied with the 2nd split of urea application. Crop management such as weeding, irrigation etc. was done in time. Pest management was done as required.

Results: Three genotypes were selected based on the better performance with homogeneity in flowering, phenotypic acceptability, insect and disease reaction, earliness and grain yield **(Table 9)**. All selected genotypes performed better over all standard checks. BRrang13-RGA-6-1-6 produced 1.37 t/ha yields advantage over BRRI dhan89. Moreover, five individual plants were selected for further evaluation.

Table 9: Agronomic parameters of the selected materials from Observational Yield Trial (OYT), Breeding for Second Generation Rice (SGR), Boro, 2022-23

SL#	Designation	PHt. (cm)	Mat. (days)	Yield (t/ha)
01.	BRrang13-RGA-5-5-1	105	150	9.44
02.	BRrang13-RGA-6-1-6	110	152	9.52
03.	BRrang13-RGA-9-3-1	108	153	9.34
04.	BRRI dhan88 (Ck.)	90	147	6.98
05.	BRRI dhan89 (Ck.)	100	161	8.15

D/S: 10 December, 2022; D/T: 22 January, 2023 & Spacing: 20 cm x 20 cm

Program 4: Breeding for Basmati Rice

General Objective: Development of high yielding (≥6.0 t/ha for T. Aman and ≥8.0 t/ha for Boro) rice varieties with improved modified plant type giving the thrust is to develop short duration varieties from diverse genetic background for tolerant to cold, sturdy stem, resistance to major biotic stresses (insect and diseases) and acceptable basmati quality.

Project Leader: M Rokebul Hasan

Experiment 3.8: Observational Trial (OT)

MR Hasan and KM Iftekharuddaula

Specific objective: Evaluation of promising breeding lines for their homogeneity, adaptability, phenotypic acceptability and high yield potentials

Materials and methods: A total of 120 genotypes were evaluated at BRRI RS, Rangpur. BRRI dhan50 were used as standard checks. The unit plot size was 5.4 m x 4 rows. Forty-five-day-old seedlings were transplanted @ single seedling with the spacing of 20 cm x 20 cm. Fertilizers were applied @ 260 kg Urea, 100 kg TSP, 120 kg MP, 110 kg Gypsum and 11 kg Zinc Sulphate/ha. Total amount of TSP, Gypsum, $ZnSO_4$ and ½ MP were applied at the time of final land preparation. Urea was applied with three equal splits at 15, 30 and 45 days after transplanting (DAT). Rest ½ MP was applied with the 2^{nd} split of urea application. Crop management such as weeding, irrigation etc. was done in time. Pest management was done as required.

Results: Two genotypes were selected based on the better performance with homogeneity in flowering, phenotypic acceptability, insect and disease reaction, earliness and grain yield **(Table 10)**. All selected genotypes performed better over all standard checks. BRrang55-RGA-5-3 produced 0.7 t/ha yields advantage over BRRI dhan50. Moreover, 224 individual plants were selected for further evaluation.

Table 10: Agronomic parameters of the selected materials from Observational Yield Trial (OYT), Breeding for Basmati Rice, Boro, 2022-23

SL#	Designation	PHt. (cm)	Mat. (days)	Yield (t/ha)
01.	BRrang55-RGA-5-1	112	152	5.6
02.	BRrang55-RGA-5-2	115	148	6.1
03.	BRrang55-RGA-5-3	109	145	6.5
04.	BRRI dhan50 (Ck.)	88	152	5.8

D/S: 10 December, 2022; D/T: 22 January, 2023 & Spacing: 20 cm x 20 cm

HYBRID RICE DEVELOPMENT
Report for T. Aman, 2022
Program 1: Development of hybrid rice parental lines and hybrids
General objective: To develop maintainer and restorer lines from diverse genetic origin
Project Leader: Anowara Akter

Experiment 3.9: Constituting of Source Nursery (SN) in T. Aman
Specific Objective: Identification of prospective maintainers and restorers from diverse genetic origin through testcross

Materials and Methods: A total of fifty five elite breeding lines with five CMS lines were constitute in source nursery during T. Aman season, 2022. Elite breeding lines and CMS lines were grown separately at seven days' interval for proper synchronization of flowering stage to make a test cross. The seeds of selected parents were raised in well-prepared wet seed beds. Twenty five days old seedling was transplanted in the field at 2 m^2 plot with the spacing of 20cm x 20cm. Fertilizers were applied @ with 150:100:70: 60:10 kg/ha Urea, TSP, MP, gypsum and $ZnSO_4$ respectively. Intercultural and agronomic practices were applied when necessary. The crosses were done by hand pollination according to the combinations required. After pollination female parents were covered with glycine bags and tagged properly. Mature seeds were collected from each crossed panicles of female parent, dried and stored separately in paper bags with proper labeling.

Results: A total two hundred and ten test crosses (F_1's) were made (**Table 11**) using five CMS lines by testcross during T. Aman, 2022.

Table 11: List of testcross F_1s during T. Aman, 2022

SL#	Combinations	Amount of seeds
01	BRRI109A/BRRI20R-MASP3	25
02	BRRI109A/BRRI10R-MASP1	28
03	BRRI109A/MAHICCO-2 (PLR)	32
04	BRRI109A/ARIZE7006 (PLR)	50
05	BRRI109A/TEJ GOLD (PLR)	45
06	BRRI109A/KAJOL LATA	80
07	BRRI109A/AD181	75
08	BRRI109A/AL73	35
09	BRRI109A/HCP245	64
10	BRRI109A/HGP197	70
11	BRRI109A/BR(Path)13800-BC3-134-96	65
12	BRRI109A/BR(Path)13800-BC3-134-252	66
13	BRRI109A/BR(Path)13800-BC3-224-12	82
14	BRRI109A/BR(Path)12454- BC_2-48-10-88-81-32	74
15	BRRI109A/BRBa-3-1-7	56
16	BRRI109A/BRBa-3-2-4	49
17	BRRI109A/IR129336:11-10	82
18	BRRI109A/IR127164-11-45	79
19	BRRI109A/IR69726-29-1-2-2-2	66
20	BRRI109A/BR11607-4R-20	88
21	BRRI109A/IR129336:11-25	95
22	BRRI109A/BRRI10R-MASP1	82
23	BRRI109A/IR129336:11-14	80
24	BRRI109A/BRRI10R-MASP1	55
25	BRRI109A/BRRI10R-MASP2	74
26	BRRI109A/BR11600-4R-82	50
27	BRRI109A/BR11600-4R-158	47
28	BRRI109A/BR11600-4R-42	60

SL#	Combinations	Amount of seeds
29	BRRI109A/BR11600-4R-46	52
30	BRRI109A/BR11600-4R-147	50
31	BRRI109A/BR11600-4R-287	25
32	BRRI109A/BRH15-24-7B	28
33	BRRI109A/BRH13-2-4-7B	32
34	BRRI109A/BRH10-1-14-6-2B	50
35	BRRI109A/BR10247-14-18-4	45
36	BRRI109A/BR10470-1-2-3-13-5	80
37	BRRI109A/BR9674-1-1-5-2-P4-HR1	75
38	BRRI109A/BR10475-1-2-3-5-5	35
39	BRRI109A/BRH11-7-17-10B	64
40	BRRI109A/BRH13-9-5-3B	70
41	BRRI109A/IR14T156	66
42	BRRI110A/BRRI31R-MASP2	80
43	BRRI110A/BRRI31R-MASP3	75
44	BRRI110A/BRRI20R-MASP3	35
45	BRRI110A/BRRI10R-MASP2	64
46	BRRI110A/MAHICCO-2 (PLR)	70
47	BRRI110A/ARIZE7006 (PLR)	66
48	BRRI110A/H-1203 (PLR)	32
49	BRRI110A/NARIYA14	50
50	BRRI110A/AD181	45
51	BRRI110A/AL73	25
52	BRRI110A/HCP245	28
53	BRRI110A/HGG205	32
54	BRRI110A/BR(Path)13800-BC3-109-181	50
55	BRRI110A/BRBa-2-5-3	45
56	BRRI110A/BRBa-3-1-7	80
57	BRRI110A/IR129336:11-10	75
58	BRRI110A/BRRI10R-MASP1	35
59	BRRI110A/IR127164-11-45	64
60	BRRI110A/T-24	70
61	BRRI110A/BR11607-4R-20	65
62	BRRI110A/IR129336:11-25	66
63	BRRI110A/IR129336:11-8	82
64	BRRI110A/IR127164-11-38	74
65	BRRI110A/IR127164-11-43	56
66	BRRI110A/IR127164-11-11	49
67	BRRI110A/IR127164-11-3	45
68	BRRI110A/IR127164-11-12	80
69	BRRI110A/IR127164-11-19	75
70	BRRI110A/BR(Path)-12454-BC2-75-32-32-1-29	35
71	BRRI110A/BRRI10R-MASP1	64
72	BRRI110A/IR79156B-MASP1	70
73	BRRI110A/IR129336:11-14	65
74	BRRI110A/IR129336:11-3	66
75	BRRI110A/IR127164-11-25	82
76	BRRI110A/IR127164-11-3	74
77	BRRI110A/BRRI10R-MASP1	56
78	BRRI110A/BRRI10R-MASP2	49
79	BRRI110A/IR79156B-MASP1	65
80	BRRI110A/BR11600-4R-158	45
81	BRRI110A/BR11600-4R-184	25

SL#	Combinations	Amount of seeds
82	BRRI110A/BR11600-4R-42	28
83	BRRI110A/BR11600-4R-46	32
84	BRRI110A/BR11600-4R-147	50
85	BRRI110A/BRH15-24-7B	75
86	BRRI110A/BRH13-1-9-7B	35
87	BRRI110A/BRH10-1-14-6-2B	64
88	BRRI110A/BR8493-3-5-1-P1	70
89	BRRI110A/BR9392-1-9-7-5B	65
90	BRRI110A/BR10247-14-18-4	66
91	BRRI110A/BR9392-40-50-1B	82
92	BRRI11A/BRRI31R-MASP3	80
93	BRRI11A/BRRI10R-MASP1	75
94	BRRI11A/BRRI10R-MASP2	35
95	BRRI11A/IR75608B-MASP12	64
96	BRRI11A/MAHICCO-2 (PLR)	70
97	BRRI11A/TEJ GOLD (PLR)	25
98	BRRI11A/H-1203 (PLR)	28
99	BRRI11A/IR79156AB-MASP1	32
100	BRRI11A/AD181	50
101	BRRI11A/AL73	45
102	BRRI11A/HGP197	80
103	BRRI11A/BR(Path)12454- BC_2-71-91-6-23-26	75
104	BRRI11A/BR(Path)12454- BC_2-13-81-88-87-HR	35
105	BRRI11A/BRBa-1-4-9	64
106	BRRI11A/IR79156B-MASP1	70
107	BRRI11A/IR129336:11-10	65
108	BRRI11A/IR129336:11-8	66
109	BRRI11A/IR127164-11-38	82
110	BRRI11A/IR127164-11-45	74
111	BRRI11A/IR127164-11-34	56
112	BRRI11A/IR127164-11-42	49
113	BRRI11A/IR127164-11-13	82
114	BRRI11A/IR127164-11-37	79
115	BRRI11A/IR127164-11-3	32
116	BRRI11A/IR127164-11-17	50
117	BRRI11A/IR127164-11-19	45
118	BRRI11A/IR127164-11-41	80
119	BRRI11A/IR127164-11-4	75
120	BRRI11A/IR127164-11-20	35
121	BRRI11A/IR127164-11-26	64
122	BRRI11A IR129337:37-93	70
123	BRRI11A/IR69726-29-1-2-2-2	65
124	BRRI11A/T-24	66
125	BRRI11A/BR11607-4R-2	82
126	BRRI11A/BR11607-4R-20	74
127	BRRI11A/BR9674-1-1-5-1-P3	25
128	BRRI11A/IR129336:11-25	28
129	BRRI11A/IR129336:11-3	32
130	BRRI11A/BRRI10R-MASP1	50
131	BRRI11A/IR129336:11-14	45
132	BRRI11A/IR129336:11-13	80
133	BRRI11A/IR129336:11-38	75
134	BRRI11A/IR129336:11-15	35

SL#	Combinations	Amount of seeds
135	BRRI11A/IR129336:11-20	64
136	BRRI11A/IR127164-11-22	70
137	BRRI11A/IR127164-11-13	65
138	BRRI11A/IR127164-11-12	66
139	BRRI11A/BRRI10R-MASP2	82
140	BRRI11A/BRRI10R-MASP1	74
141	BRRI11A/BRRI20R-MASP2	56
142	BRRI11A/BR11600-4R-158	49
143	BRRI11A/BR11600-4R-42	82
144	BRRI11A/BR11600-4R-46	79
145	BRRI11A/BR11600-4R-147	66
146	BRRI11A/BRH15-24-7B	65
147	BRRI11A/BRH13-1-9-7B	66
148	BRRI11A/BRH10-1-14-6-2B	82
149	BRRI11A/BR11874-5R-109	74
150	BRRI97A/BRRI31R-MASP2	50
151	BRRI97A/BRRI31R-MASP3	25
152	BRRI97A/BRRI20R-MASP3	28
153	BRRI97A/BRRI10R-MASP2	32
154	BRRI97A/BRRI20R-MASP2	50
155	BRRI97A/MAHICCO-2 (PLR)	45
156	BRRI97A/ARIZE7006 (PLR)	80
157	BRRI97A/TEJ GOLD (PLR)	75
158	BRRI97A/BR(Path)13800-BC3-125-143	35
159	BRRI97A/BABILON-3 (PLR)	64
160	BRRI97A/H-1203 (PLR)	70
161	BRRI97A/SL-8 (PLR)	65
162	BRRI97A/DHANI GOLD (PLR)	66
163	BRRI97A/FATEMA DHAN (PLR)	82
164	BRRI97A/KAJOL LATA (PLR)	74
165	BRRI97A/HAH210	56
166	BRRI97A/AL73	49
167	BRRI97A/HAN165	82
168	BRRI97A/New R-Rang	79
169	BRRI97A/HGB21	66
170	BRRI97A/HGK236	88
171	BRRI97A/HGP197	82
172	BRRI97A/BR(Path)13800-BC3-118-37	74
173	BRRI97A/BR(Path)13800-BC3-124-133	56
174	BRRI97A/BR(Path)13800-BC3-126-166	49
175	BRRI97A/BRBa-3-2-4	82
176	BRRI97A/BR(Path)12454- BC_2-87-24-32-1-29	79
177	BRRI97A/BR(Path)12454- BC_2-69-97-39-5-44	66
178	BRRI97A/BR(Path)12454- BC_2-75-32-31-39-7	88
179	BRRI97A/BRBa-2-5-3	65
180	BRRI97A/IR69726-29-1-2-2-2	25
181	BRRI97A/BR11607-4R-20	28
182	BRRI97A/IR129336:11-25	32
183	BRRI97A/IR129336:11-14	50
184	BRRI97A/BRRI10R-MASP2	45
185	BRRI97A/IR 129336:11-15	80
186	BRRI97A/BRRI10R-MASP1	75
187	BRRI97A/BRRI10R-MASP2	35

SL#	Combinations	Amount of seeds
188	BRRI97A/BR11600-4R-158	64
189	BRRI97A/BR11600-4R-184	70
190	BRRI97A/BR11600-4R-42	65
191	BRRI97A/BR11600-4R-46	66
192	BRRI97A/BR11600-4R-147	82
193	BRRI97A/BR11600-4R-287	74
194	BRRI97A/BRH13-2-4-7-2B	56
195	BRRI97A/BRH15-24-7B	49
196	BRRI97A/BRH13-1-9-7B	82
197	BRRI97A/ BR10538-2-1-2-32	79
198	BRRI97A/BR10540-4-1-2-41	82
199	BRRI97A/BR10470-1-2-3-13-5	74
200	BRRI97A/PVTI0049	56
201	BRRI97A/PVTI0047	49
202	BRRI97A/BRBa-3-1-7	60
203	BRRI99A/BRRI31R-MASP2	82
204	BRRI99A/NGR796-2	82
205	BRRI99A/PLS-R1	28
206	BRRI99A/BRH13-1-9-7B	32
207	BRRI99A/BRH10-1-14-6-2B	50
208	BRRI99A/BR10475-1-1-2-3-5-5	68
209	BRRI99A/PLS-R2	75
210	BRRI99A/BRH17-23-8-2-7B	35

Status of experiment:

Date of Initiation: July, 2022
Date of Completion: November, 2022
Location: BRRI RS Rangpur
Principal investigator: Anowara Akter
Co-investigators: MS Hossain, MR Hasan & MJ Hasan

Experiment 3.10: Test cross Nursery in Boro

Objectives: i. Confirmation of maintainers and restorers from the crossed entries.
ii. Selection of heterotic rice hybrids.
iii. Conversion of prospective maintainers into new CMS lines.

Materials and Methods: A total of one hundred and eighty three testcrosses (F_1s) along with their parents and BRRI hybrid dhan6, AZ7006 and Dhani gold as check variety were grown in testcross nursery during T.Aman season, 2022. The seeds of selected parents were raised in well-prepared wet seed beds. Twenty five days old seedling was transplanted in the field at 2 m^2 plot with the spacing of 20 x 20 cm. Fertilizers were applied @ with 150:100:70: 60:10 kg/ha Urea, TSP, MP, gypsum and $ZnSO_4$ respectively. Intercultural and agronomic practices were applied when necessary.

Results: None of testcrosses (F_1s) were found heterotic out of 183 but two testcrosses were found completely sterile (**Table 12**) and immediately backcrossed with their corresponding male parents regarded as BC_1 generation for conversion of new CMS lines.

Table 12: BC_1F_1s during T. Aman, 2022

SL#	Cross Combinations	Amount of seeds
01.	BRRI99A/ IR75608B-MASP3	85
02.	BRRI11A/IR75608B-MASP12	55

Status of experiment:

Date of Initiation: July, 2022
Date of Completion: November, 2022
Location: BRRI RS Rangpur
Principal investigator: Anowara Akter
Co-investigators: MS Hossain, MR Hasan & MJ Hasan

Report for Boro, 2022-23

Program 1: Development of hybrid rice parental lines and hybrids
General objective: To develop maintainer and restorer lines from diverse genetic origin.

Experiment 3.11: Constituting of source nursery for make a testcross between elite breeding lines and CMS lines in Boro

Specific Objective: Identification of prospective maintainers and restorers from diverse genetic origin through testcross

Materials and Methods: A total of one hundred and sixty seven (167) elite breeding lines with seven CMS lines were constitute in source nursery during Boro season, 2022-23. Elite breeding lines and CMS lines were grown separately at seven days' interval for proper synchronization of flowering stage to make a test cross. The seeds of selected parents were raised in well-prepared wet seed beds. Twenty five days old seedling was transplanted in the field at 2 m^2 plot with the spacing of 20cm x 20cm. Fertilizers were applied @ with 270:130:120: 70:10 kg/ha Urea, TSP, MP, gypsum and $ZnSO_4$ respectively. Intercultural and agronomic practices were applied when necessary. The crosses were done by hand pollination according to the combinations required. After pollination female parents were covered with glycine bags and tagged properly. Mature seeds were collected from each crossed panicles of female parent, dried and stored separately in paper bags with proper labeling.

Results: A total 85 testcross F_1s (**Table 13**) were made by testcross from source nursery. The testcross F_1s along with corresponding male parents and standard checks will be evaluated in testcross nursery during next T. Aman, 2023.

Table 13: List of testcross F_1's during Boro, 2022-23

SL#	Combinations	Amount of seeds
01	BRRI109A / BR11371-4R-385	55
02	BRRI109A / BR11966-4R-294	38
03	BRRI109A / NGR522-2	35
04	BRRI109A / BR11361-4R-172	50
05	BRRI109A / BR11970-4R-617	48
06	BRRI109A / BR11359-4R-267	80
07	BRRI109A / BR11363-4R-3	75
08	BRRI109A / BRRI dhan101	35
09	BRRI109A / BRH18-9-4-2-3B	64
10	BRRI109A / BR11359-4R-409	70
11	BRRI109A / Basmati (D)(3928)	65
12	BRRI109A / BRH13-5-12-2-2B	66
13	BRRI109A / BRH14-2-1-7B	82
14	BRRI109A / BR11359-4R-164	74
15	BRRI109A / NGR416-1	56
16	BRRI109A / Basmati (1230)	49
17	BRRI109A / BR11973-4R-169	82
18	BRRI109A / NGR590-2	79

SL#	Combinations	Amount of seeds
19	BRRI109A / BR11359-4R-288	66
20	BRRI109A / NGR418-1	88
21	BRRI109A / BR11966-4R-420	95
22	BRRI109A / BRRI dhan104	82
23	BRRI109A / Katari	80
24	BRRI110A/ BR11607-4R-72(BB)	55
25	BRRI110A/ BR11980-4R-3	74
26	BRRI110A/ BR11978-4R-378	50
27	BRRI110A / Basmati(6614)	47
28	BRRI110A / IR 129336:11-37	60
29	BRRI110A / Basmati 107(4501)	52
30	BRRI110A / BR11970-4R-432	50
31	BRRI110A / BR11973-4R-224	25
32	BRRI110A / BR11965-4R-21	28
33	BRRI110A / BR12096-4R-25-1	32
34	BRRI110A / BR12096-4R-124-1	50
35	BRRI110A / BR11965-4R-14	45
36	BRRI110A / BR11607-4R-116	80
37	BRRI110A / T-7	75
38	BRRI110A / IR 129336:11-4	35
39	BRRI110A / Pusha Basmati	64
40	BRRI110A / BR12839-4R-138-4	70
41	BRRI110A / BR11966-4R-181	66
42	BRRI110A / Basmati Pardnr442(4497)	80
43	BRRI110A / BR12839-4R-73	75
44	BRRI110A / BR11973-4R-365	35
45	BRRI110A / BR12839-4R-21	64
46	BRRI110A / BR11966-4R-429	70
47	BRRI110A / 128BR9942-1-2-3-1	66
48	BRRI110A / BR11607-4R-192	32
49	BRRI110A / Indian basmati	50
50	BRRI110A / BR11978-4R-318	45
51	BRRI97A / BR11969-4R-23	25
52	BRRI97A A / Lamba zira, tanor	28
53	BRRI97A / BR(Path)13800-BC3-224-28	32
54	BRRI97A / BR11866-5R-277	50
55	BRRI97A / BR12096-4R-124-1(BB)	45
56	BRRI97A / BR11972-4R-10	80
57	BRRI97A / Miniket, Ballobr	75
58	BRRI97A / Zira nachol	35
59	BRRI97A / BR11867-5R-140	64
60	BRRI97A / BR(Path)13800-BC3-8-9	
61	BRRI97A / BR11966-4R-583	65
62	BRRI97A / BR10646-3-3-3-1-4	66
63	BRRI97A / BR11966-4R-528	82
64	BRRI97A / NGR994-1	74
65	BRRI97A / BR11973-4R-75	56
66	BRRI97A / BR11968-4R-403	49
67	BRRI97A / BR11966-4R-451	45
68	BRRI97A / BR10646-3-2-2-4-4	80
69	BRRI97A / BR10648-12-1-3-4-1	75
70	BRRI97A / BR11969-4R-101	35
71	BRRI97A / BR11968-4R-432	64

SL#	Combinations	Amount of seeds
72	BRRI97A / BR11866-5R-223	70
73	BRRI97A / BR11970-4R-133	65
74	BRRI97A / BR11971-4R-129	66
75	BRRI97A / IRRI154-Pi9(Blast) (BB)	82
76	BRRI97A / BR11607-4R-258	74
77	BRRI97A / BR11607-4R-2	56
78	BRRI97A / BR(Path)13800-BC3-8-7	49
79	BRRI97A / BR11866-5R-136	65
80	BRRI97A / BR(Path)13800-BC3-109-10	45
81	BRRI97A / BR10645-6-1-8-12	35
82	BRRI97A / BR10646-3-2-2-4-3	38
83	BRRI97A / Kowshikhili	37
84	BRRI97A / BR11604-4R-24	50
85	BRRI97A / BR11966-4R-553	75

Status of experiment:

Date of Initiation: November, 2022
Date of Completion: May, 2023
Location: BRRI RS- Rangpur
Principal investigator: Anowara Akter
Co-investigators: MS Hossain, MR Hasan & MJ Hasan

Experiment 3.12: Test cross Nursery in Boro

Objectives: i. Confirmation of maintainers and restorers from the crossed entries,
ii. Selection of heterotic rice hybrids,
iii. Conversion of prospective maintainers into new CMS lines

Materials and Methods: A total of two hundred and ten test crosses (F_1s) along with their parents and four standard hybrid check variety (BRRI hybrid dhan5, SL-8H, Herra-2 and Tej gold) were grown in testcross nursery during Boro season, 2022-23. Twenty five days old seedling was transplanted in the field at 2 m^2 plot with the spacing of 20cm x 20cm. Fertilizers were applied @ with 270:130:120:70:10 kg/ha Urea, TSP, MP, gypsum and $ZnSO_4$ respectively. Intercultural and agronomic practices were applied when necessary.

Results: Out of 210, five entries have been found heterotic over check varieties (**Table 14**) and showed yield advantage ranging from 12-18% over BRRI hybrid dhan5, 18-24% over SL8H, 24-31% over Heera-2 and 22-28% over Tej Gold with growth duration apparently similar to check varieties. Pollen parents of those combinations were regarded as suspected restorers and selected for fertility restoration ability with other CMS lines in next season.

Table 14: List of entries found heterotic over check varieties during Boro, 2022-23

SL#	Designation	PHt. (cm)	Effective tiller/hill	Grain /Panicle	Spikelet fertility (%)	Mat. (days)	Yld. (t/ha)	% Yld. advantage over checks			
								Ck-1	Ck-2	Ck-3	Ck-3
01	BRRI97A /PLS-1	112.3	13	276	90	151	11.8	18	24	31	28
02	BRRI97A / BRRI10R-MASP2	102.3	13	233	88	150	11.6	16	22	26	26
03	BRRI99A / PLS-2	100.3	12	226	86	149	11.5	15	21	28	25
04	BRRI99A / PLS-3	102.3	14	210	85	148	11.5	15	21	28	25
05	BRRI11A / BRRI20R-	99.0	11	207	92	148	11.2	12	18	24	22

	MASP2						
Ck-1	BRRI hybrid dhan5	106.3	11	220	88	150	10.0
Ck-2	SL8H	96.8	9	203	83	150	9.5
Ck-3	Heera-2	105.2	9	201	81	151	9.0
Ck-4	Tej Gold	104.8	10	199	78	148	9.2
	CV	3.22	16.25	5.90	5.19	0.78	7.27
	LSD (0.05%)	2.83	1.55	10.78	3.80	1.0	0.63

Experiment 3.13: Back cross nursery (BCN) in Boro

Objective: Conversion of prospective maintainers into new CMS lines

Materials and Methods: Two BC_1 populations along with their corresponding male parents were grown in back cross nursery during Boro season, 2022-23. Twenty five days old seedling was transplanted in the field with the spacing of 20 x 20 cm. Fertilizers were applied @ with 270:130:120:70:10 kg/ha Urea, TSP, MP, gypsum and ZnSO4 respectively. Intercultural and agronomic practices were applied when necessary.

Results: Two back cross generations (BC_1) were advanced (**Table 15**) to next generations (BC_2) for conversion of prospective maintainers into new CMS lines against bacterial blight

Table 15: BC_2F_1s during Boro season, 2022-23

SL#	Cross Combinations	Amount of seeds
01	BRRI99A/ IR75608B-MASP3	95
02	BRRI11A/IR75608B-MASP5	70

Status of experiment:

Date of Initiation: November, 2022
Date of Completion: May, 2023
Location: BRRI RS Rangpur
Principal investigator: Anowara Akter
Co-investigators: MS Hossain, MR Hasan & MJ Hasan,

Experiment 3.14: Development of disease resistant (Blast) hybrid rice parental lines by molecular approach in Boro season

General Objective: Introgression of blast resistance gene, *Pi9* into bacterial blight resistant restorer and maintainer lines

Materials and Methods:
Before hybridization, selected parents of hybrid rice (BRRI31R-MAS-P2, BRRI20R-MASP3 and IR75608B-MASP3) with resistant (IRRI154Pi9) and susceptible check (BRRI dhan29) were grown in net house for the validation of molecular screening against *Pi9* by gene based marker during Boro season, 2022-23. The leaves of 21 days old seedlings were collected from selected parents of hybrid rice with resistant & susceptible check to extract DNA. The modified CTAB (Hexadecyltrimethyl ammonium bromide) method was used in the DNA extraction. Polymerase Chain Reaction (PCR) was performed for the multiplication of DNA and the molecular marker of *Pi9* genes were used to validation of polymorphic nature among the selected parents. PCR profile and details of gene-linked/specific markers were given in **Table 16** and **Table 17**, respectively. Standard lines with known genes status were used as checks during PCR amplification and gel electrophoresis. The amplified PCR product was visualized by electrophoresis on 3% agarose gel for the *Pi9* gene.

Table 16: PCR profile of bacterial blight disease resistant gene-linked /specific primers

Gene	PCR steps							Expected product size
	Step-I	Step-II	Step-III	Step-IV	Step-V	Step-VI	Step-VII	
	Initial denaturation	Denaturation	Annealing	Elongation	No. of cycles	Final Extension	Store	
Pi9	94^0C 4 min	94^0C 1 min	55^0C 1 min	72^0C 1.30 min	35 cycles	72^0C 8 min	4^0C ∞	170 bp

Table 17: Chromosome location and primer sequence of gene-linked/ specific markers of *Xa4, xa5, Xa7, xa13, Xa21 and Xa23* genes

Genes	Chr. No.	Primers name	Primer sequences (5'-3')	Type of Marker
Pi9	6	NMSMPi9-F NMSMPi9-R	CGAGAAGGACATCTGGTACG GAGATGCTTGGATTTAGAAGAC	Gene-specific

Results: The transferability and polymorphism of gene-based marker, NMSMPi9 were validated between the recurrent parents, BRRI31R-MAS-P2, BRRI20R-MASP3 and IR75608B-MASP3 and donor parent IRRI154Pi9. All pyramided restorer and maintainer lines BRRI31R-MAS-P2, BRRI20R-MASP3 and IR75608B-MASP3 were showed polymorphic nature with respect to this gene and showed susceptible allele with 280bp (**Fig. 6**) against blast resistance gene (*Pi9*).

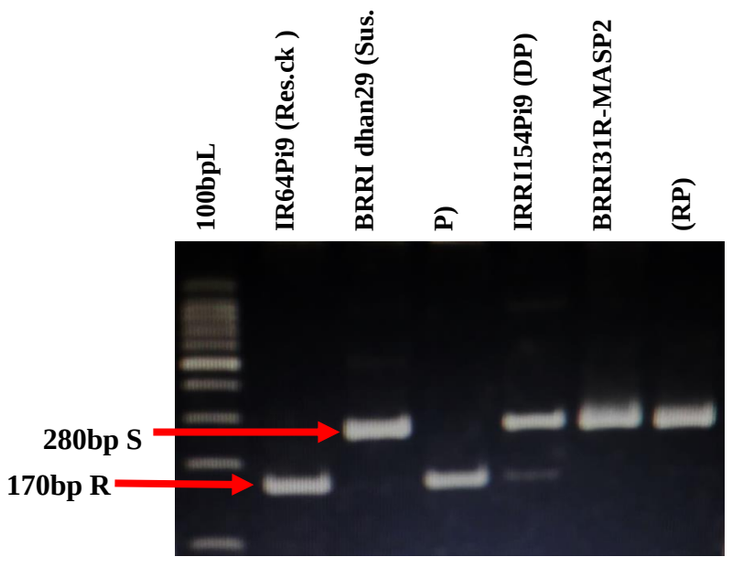

Fig. 6: Gel photographs showing banding pattern of the marker for blast resistance gene (Pi9) in the parental lines

Status of experiment:

Date of Initiation: November, 2022
Date of Completion: May, 2023
Location: BRRI RS Rangpur
Principal investigator: Anowara Akter
Co-investigators: MS Hossain, MR Hasan, MA Latif & MJ Hasan,

Experiment 3.15: Hybridization in Boro

Objective: Introgression of blast resistance gene into bacterial blight resistant restorer and maintainer lines

Materials and Methods:
Three pyramided of bacterial blight resistant restorer and maintainer lines (BRRI31R-MAS-P2, BRRI20R-MASP3 and IR75608B-MASP3) as a recurrent parent and one donor parent,

IRRI154Pi9 (**Table 18**) were used for hybridization. These parents were grown in three different sets at 7 days interval to synchronize flowering among the recipient (female) and donor (male) parents. Thirty days old seedlings were transplanted per set in the hybridization block with the spacing of 20cm x 20cm. Fertilizer dose was applied 270:130:120:70:10 kg/ha Urea- TSP-MP-Gypsum- $ZnSO_4$, respectively. Intercultural and agronomic practices were applied when necessary.

Table 18: List of parents for hybridization

SL#	Recurrent Parents	Donor parent	Target gene
1	BRRI31R-MAS-P2	IRRI154Pi9	
2	BRRI20R-MASP3		*Pi9*
3	IR75608B-MASP3		

Results: After validation hybridization was done between three recipient parents BRRI31R-MAS-P2, BRRI20R-MASP3, IR75608B-ASP3 and one donor parent IRRI154Pi9 carrying blast resistance gene *Pi9*. One hundred and twenty six F_1 seeds (naked) were found (**Table 19**) from three cross combinations. The F_1 populations will be grown in next T. Aman season, 2023.

Table 19: List of F_1s during Boro season, 2022-23

SL#	F_1 Populations	Target gene	Amount of seeds
1	BRRI31R-MASP2/ IRRI154Pi9	*Pi9*	46
2	BRRI20R-MASP3/ IRRI154Pi9	*Pi9*	33
3	IR75608B-MASP3/ IRRI154Pi9	*Pi9*	47

B. BRRI HQ Gazipur

Experiment 3.16: Regional Yield Trial (RYT), 2022-2023

MS Hossain, MR Hasan, concerned scientist of the trials and KM Iftekharuddaula

General objective: To evaluate specific and general adaptability of the advanced genotypes in on station condition

A total of 33 RYTs were conducted under T. Aman and Boro seasons to develop improved rice varieties. The results of grain yield and other parameters of different RYT's are presented in **Table 20**.

Regional Yield Trial (RYT), T. Aus, 2022

One RYT was conducted under T. Aus season.Twelve genotypes were evaluated against two standard checks; BRRI dhan48 and BRRI dhan98. BR11864-5R-31 produced highest yield (3.50 t/ha) followed by BR118607-4R-6 (3.41 t/ha) over BRRI dhan48 (2.64 t/ha) and BRRI dhan98 (3.42 t/ha).

Regional Yield Trial (RYT), T. Aman, 2022

A total of 7 RYTs were conducted under T. Aman season: one Rainfed Lowland Rice (RLR), one Short & medium Rice (SD-MD), one Zinc Enriched Rice (ZER) one Disease Resistant Rice (DDR-BB), one short slender, one Swarna and long slender and one Zirashail type against standard check varieties.

RYT#1 (RLR-1): Four genotypes along with four standard checks; BRRI dhan49, BRRI dhan71, BRRI dhan87 and BRRI dhan93 were evaluated. BR10475-1-2-3-5-5 produced highest yield (6.48 t/ha) with 117 days among all the tested entries.

RYT# 2 (SD-MD): Three genotypes along with standard checks; BRRI dhan75 and BRRI dhan87 were evaluated. IR19A7068 produced highest yield (5.39 t/ha) with 116 days among the tested entries.

RYT#3 (ZER): Four genotypes along with two standard checks; BRRI dhan72 and BRRI dhan87 were evaluated. BR10470-1-2-3-13-5 produced highest yield (5.74 t/ha) with 112 days over all checks yield; BRRI dhan72 (4.72 t/ha) and BRRI dhan87 (5.12 t/ha).

RYT#4 (DRR-BB): Three genotypes were tested along with three checks; BRRI dhan49, BRRI dhan87 and IRBB60 (Res Ck.). None of the tested genotypes were found high yielder over the check varieties.

RYT#5 (Short Slender; BRRI Rangpur): Three genotypes along with one standard check; BRRI dhan49 were evaluated. BRH13-2-14-2-1B gave highest yield (5.93t/ha) over all tested entries.

RYT#6 (Swarna and long Slender): Five genotypes along with two checks; BRRI dhan87, BRRI dhan94 were evaluated. BRH11-2-4-7B gave highest yield (5.37t/ha) over all tested entries.

RYT#7 (Zirashail type): Three genotypes along with one standard check; Zirashail were evaluated. All tested entries performed better over Zirashail (3.90 t/ha). BRH11-7-17-10B gave highest yield (4.80 t/ha) followed by BRH13-9-5-3B (4.76 t/ha).

Regional Yield Trial (RYT), Boro, 2022-2023

A total of 20 RYTs were conducted during Boro season: one Favorable Boro Rice (FBR-Barishal), one Favorable Boro Rice (FBR-SD), one Favorable Boro Rice (FBR-MD), one Favorable Boro Rice (FBR-LD), two Disease Resistant Rice (DRR), one Zinc Enriched Rice (ZER), one Salinity Tolerant Rice (STR), four Premium Quality Rice (PQR), one Balst and Bacterial Blight Resistant Rice, two Antioxidant Rice, one water savings, one Zira type (Zira), two Short Slender (SS), one Extra Long Slender (ELS) against standard check varieties.

RYT# 1 (FBR-Barishal): Nine genotypes along with two checks; BRRI dhan88 and BRRI dhan89 were evaluated. None of the entries produced higher grain over the standard check varieties.

RYT# 2 (FBR-SD): Nine genotypes along with two checks; BRRI dhan28 and BRRI dhan96 were evaluated. BR11900-5R-24 produced the highest grain yield (7.33 t/ha) followed by BR11903-5R-56 (7.09t/ha) and BR12180-5R-29 (6.94 t/ha).

RYT# 3 (FBR-MD): Nine genotypes along with two checks; BRRI dhan81 and BRRI dhan89 were evaluated. None of the entries produced higher grain over the standard check varieties.

RYT# 4 (FBR-LD): Five genotypes along with three checks; BRRI dhan81, BRRI dhan89 and BRRI dhan92 were evaluated. None of the entries produced higher grain over the standard check varieties.

RYT#5 (DRR-1): Eighteen genotypes along with four standard checks; BRRI dhan58, BRRI dhan89, BRRI dhan92 and BRRI dhan101 were evaluated. BR11604-4R-24 produced highest yield (8.33 t/ha) followed by BR(Path)13800-BC3-109-10 (8.27 t/ha), BR11867-5R-140 (8.16 t/ha) and BR11866-5R-73 (8.15 t/ha).

RYT#6 (DRR-2): Ten genotypes along with two standard checks; BRRI dhan89 and BRRI dhan92 were evaluated. All tested entries performed better than both the checks. BR(Path)13800-BC3-224-17 produced highest yield (8.92 t/ha) followed by BR(Path)13800-BC3-8-5 (8.90 t/ha), BR(Path)13800-BC3-134-25 (8.87 t/ha) and BR(Path)13800-BC3-224-44 (8.83 t/ha).

RYT#7 (ZER): Three genotypes were evaluated along with three checks; BRRI dhan29, BRRI dhan74 and BRRI dhan84. BR9674-1-4-1-3-P1 produced highest grain yield (8.39 t/ha & 164 days) followed by BRRI dhan29 (8.21 t/ha & 160 days).

RYT# 8 (STR): Seven advanced genotypes along with three standard checks; BRRI dhan67, BRRI dhan89 and BRRI dhan99 were evaluated. BR11712-4R-93 produced highest grain yield (7.79 t/ha & 159 days) followed by BRRI dhan89 (7.68 t/ha & 159 days).

RYT#9 (PQR-1): Three genotypes were evaluated along with the checks; BRRI dhan50 and BRRI dhan63. None of the tested genotypes performed better over the standard checks.

RYT#10 (PQR-2): Nine genotypes were evaluated along with two checks; BRRI dhan63 and BRRI dhan81. BR10646-3-2-2-4-3 produced highest grain yield (6.48 t/ha & 157 days) followed by BR10646-3-2-2-4-4 (7.31 t/ha & 148 days).

RYT#11 (PQR-1, Parbortipur, Dinajpur): Three genotypes were evaluated along with the checks; BRRI dhan50 and BRRI dhan63. None of the tested genotypes performed better over the standard checks.

RYT#12 (PQR-2, Parbortipur, Dinajpur): Nine genotypes were evaluated along with two checks; BRRI dhan63 and BRRI dhan81. Lomba Zira produced highest grain yield (5.92 t/ha) followed by Koushik Hilli (5.56 t/ha).

RYT#13 (Balst and Bacterial Blight): Ten genotypes were evaluated along with standard check; BRRI dhan28. BR(path)201 produced highest grain yield (7.17 t/ha & 147 days) followed by BR(path)204 (7.08 t/ha & 146 days).

RYT#14 (Antioxidant-1_Medium Duration): Eight genotypes were evaluated along with two standard checks; Indonesial Black Rice and BRRI dhan88. BR12839-4R-157-2 produced highest grain yield (6.05 t/ha & 155 days) followed by BR12839-4R-47-1 (5.99 t/ha & 155 days).

RYT#15 (Antioxidant-1_Short Duration): Three genotypes were evaluated along with standard check; BRRI dhan84. None of the tested genotypes performed better over the standard checks.

RYT#16 (Water Saving): Two genotypes were evaluated along with standard check; BRRI dhan58. BR11204-5B-224 produced highest grain yield (9.45 t/ha & 158 days) followed by BRRI dhan58 (9.06 t/ha & 154 days).

RYT#17 (Zira type): Five genotypes were evaluated along with two standard checks; BRRI dhan28 and Zirashail. BRH13-7-9-3-2B produced highest grain yield (6.94 t/ha & 152 days) followed by BRRI dhan28 (6.27 t/ha & 144 days).

RYT#18 (Short Slender): Five genotypes were evaluated along with standard check; Katari. BRH18-9-4-2-3B produced highest grain yield (7.69 t/ha & 150 days) followed by BRH13-5-12-2-2B (6.99/ha & 150 days).

RYT#19 (Short Slender, Parbortipur, Dinajpur): Five genotypes were evaluated along with standard check; Katari. BRH13-5-12-2-2B produced highest grain yield (6.55 t/ha & 146 days) followed by BRH18-9-4-2-3B (6.54/ha & 146 days).

RYT#20 (Extra Long slender): Six genotypes were evaluated along with three checks; BRRI dhan28, BRRI dhan63 and BRRI dhan86. BR7528-2R-19-16-RIL-59 gave highest grain yield (7.17t/ha; 161 days) followed by BR9945-5R-21 (7.01 t/ha; 162 days). On the otherhand, BRRI dhan50 produced grain yield (6.56 t/ha) with 154 days.

Table 20: Grain yield and other characters of different entries under Regional Yield Trials (RYTs) in T. Aus, 2022, T. Aman, 2022 and Boro, 2022-2023

SL#	Designation	Mat. (days)	PHt. (cm)	Yld. (t/ha)	Remarks
T. Aus, 2022					
RYT					
01.	BR11863-5R-82	100	100	2.41	False smut- 2%
02.	BR11863-5R-256	104	103	3.19	BLB-25%
03.	BR11864-5R-31	107	100	3.50	
04.	BR11864-5R-38	104	108	2.93	BLB-5%
05.	BR11864-5R-75	107	99	3.04	BLB-5%
06.	BR11869-5R-98	105	101	2.19	BLB-5%
07.	BR11604-5R-133	104	120	2.05	BLB-5%
08.	BR118607-4R-6	105	97	3.41	BLB-10%

09.	BR11607-4R-72	107	94	3.34	BLB-5%
10.	BR9651-15-2-1-3	107	99	3.01	BLB-5%
11.	7FBR-400	108	104	2.91	BLB-20%
12.	7FBR-416	108	92	2.82	BLB-20%
13.	BRRI dhan48(Ck.)	105	100	2.64	False smut -5%
14.	BRRI dhan98(Ck.)	108	98	3.42	
	CV	0.65	2.15	6.50	
	Lsd (0.05)	1.26	2.98	0.61	
D/S: 11 April, 2022; D/T: 27 April, 2022; Spacing: 20cm x 15cm					
T. Aman, 2022					
RYT#1 (Rainfed Lowland Rice, RLR)					
01.	BR10458-20-2-3-1-3	136	137	4.51	Lgd-100%, False Smut 5%
02.	BR10490-1-2-3-11-3	113	133	3.85	Lgd-80%
03.	BR10475-1-2-3-5-5	117	137	6.48	Lgd-100%
04.	BR10482-1-2-3-1-3	133	160	4.53	Lgd-100%
05.	BRRI dhan49 (Ck.)	129	117	3.65	Lgd- 80%, False smut 5%
06.	BRRI dhan71 (Ck.)	113	135	6.09	
07.	BRRI dhan87 (Ck.)	124	147	4.40	Lgd-100%,
08.	BRRI dhan93 (Ck.)	135	143	3.56	Lgd-100%, False Smut 5%
	CV	0.49	1.35	6.28	
	Lsd (0.05)	0.96	3.25	0.65	
D/S: 01 July, 2022; D/T: 23 July, 2022; Spacing: 20cm x 15cm; **Depression two times: 19/04/22 & 28/04/22**					
RYT#2 (SD-MD)					
01.	IR14T156	118	129	4.02	Lgd-100%, ShB -10%
02.	IR19A1788	113	144	4.14	Lgd-100%, ShB -10%
03.	IR19A7068	116	120	5.39	Lgd-30%,ShB -10%
04.	BRRI dhan75 (Ck.)	108	114	4.69	Lgd-100%, ShB -15%
05.	BRRI dhan87 (Ck.)	125	146	4.97	Lgd-100%, ShB -10%
	CV	0.84	2.50	7.45	
	Lsd (0.05)	1.87	4.98	0.40	
D/S: 03 July, 2022; D/T: 24 July, 2022; Spacing: 20cm x 15cm					
RYT#3 (Zinc Enriched Rice, ZER)					
01.	BR10490-1-2-2-8-7	110	118	5.63	Lgd:10%
02.	BR10470-1-2-3-13-5	112	140	5.74	Lgd:50%
03.	BR10471-1-2-3-15-1	114	131	5.57	
04.	BR9674-1-1-5-2-P4-HR1	117	132	5.62	Lgd:20%
05.	BRRI dhan72(Ck.)	123	134	4.72	Lgd:50%
06.	BRRI dhan87 (Ck.)	126	141	5.12	Lgd:50%
	CV	0.95	2.35	7.22	
	Lsd (0.05)	1.29	4.88	0.48	
D/S: 03 July, 2022; D/T: 23 July, 2022; Spacing: 20cm x 15cm					
RYT#4 (Disease Resistant Rice, BB)					
01.	BR11269-5R-47	128	136	3.97	Lgd.-100%,ShB-15%
02.	BR11869-5R-72	128	133	4.48	Lgd.-100%
03.	BR11874-5R-109	115	117	5.50	ShB- 10%
04.	BRRI dhan49 (Ck.)	132	118	5.00	Lgd.-100%, FS-10%
05.	BRRI dhan87 (Ck.)	124	144	5.42	Lgd.-100%, ShB- 10%
06.	IRBB60 (Res. Ck.)	118	95	5.51	
	CV	1.55	3.28	7.10	
	Lsd (0.05)	1.54	8.05	0.55	
D/S: 03 July, 2022; D/T: 24 July, 2022; Spacing: 20cm x 15cm					
RYT#5 (Short Slender)					
01.	BRH13-2-14-2-1B	120	142	5.93	Lgd:40%, ShB:10%

02.	BRH17-23-8-2-7B	105	120	4.50	Lgd:70%, ShB:5%
03.	BRH13-7-9-3-2B	116	141	4.71	Lgd:50%, ShB:10%
04.	BRRI dhan49 (Ck.)	133	118	5.38	Lgd-60%, False Smut 5%
	CV	1.29	1.85	6.49	
	Lsd (0.05)	2.59	3.53	0.85	
D/S: 27 June, 2022; D/T: 21 July, 2022; Spacing: 25cm x 15cm					
RYT#6 (Short Slender Rice, BRRI Rangpur)					
01.	BRH9392-6-2-1-3-4	136	150	4.12	Lgd: 100%
02.	BR9396-6-2-2B	140	121	1.85	Lgd: 100%
03.	BR10238-5-1-4-2	135	140	3.08	Lgd: 90%
04.	BR9392-10-20-1B	115	126	4.87	Lgd: 80%
05.	BRH11-2-4-7B	114	124	5.37	Lgd: 70%
06.	BRRI dhan94 (Ck.)	136	140	4.88	Lgd: 80%
07.	BRRI dhan87 (Ck.)	124	142	4.86	Lgd: 100%
	CV	1.29	3.80	8.15	
	Lsd (0.05)	2.62	1.83	0.45	
D/S: 28 June, 2022; D/T: 21 July, 2022; Spacing: 25cm x 15cm					
RYT#7 (Zirashail Type)					
01.	BRH11-7-17-10B	105	112	4.80	
02.	BRH13-9-5-3B	106	116	4.76	Lgd: 100%
03.	BRH9-3-14-2B	104	112	4.68	
04.	Zirashail (Ck.)	99	122	3.90	Lgd: 100%
	CV	0.30	2.10	9.00	
	Lsd (0.05)	0.41	6.12	0.55	
D/S: 04 July, 2022; D/T: 263 July, 2022; Spacing: 25cm x 15cm					
Boro, 2022-2023					
RYT#1 (FBR_Barisal)					
01.	NGR522-2	159	96	8.40	Panicle tip degeneration 60%
02.	NGR270-3	160	89	8.18	Panicle tip degeneration 100%
03.	NGR418-1	158	91	7.43	Panicle tip degeneration 100%
04.	NGR416-1	158	90	8.11	Panicle tip degeneration 100%
05.	NGR968-1	153	95	9.15	BLB-30%
06.	NGR994-1	154	96	8.97	Panicle tip degeneration 100%
07.	NGR745-2	161	85	8.81	Panicle tip degeneration 60%
08.	NGR590-2	157	95	8.22	Panicle tip degeneration 100%
09.	NGR710-1	158	90	8.34	Panicle tip degeneration 100%,
10.	BRRI dhan88 (Ck.)	144	88	6.35	
11.	BRRI dhan89 (Ck.)	162	105	9.32	Panicle tip degeneration 100%
	CV	0.276	1.095	4.346	
	Lsd (0.05)	0.738	1.727	0.632	
D/S: 07 December, 2022; D/T: 18 January, 2023; Spacing: 20cm x 20cm					
RYT#02 (FBR-SD)					
01.	BR11637-5R-140	149	111	6.48	Panicle tip degeneration- 100%
02.	BR11894-5R-376	160	106	7.05	Panicle tip degeneration- 100%
03.	BR11900-5R-24	160	97	7.37	Panicle tip degeneration- 100%
04.	BR11903-5R-56	149	97	7.03	Mixture 2-3%
05.	BR12180-5R-17	164	115	6.59	Panicle tip degeneration- 100%, Lodging- 20%
06.	BR12180-5R-29	160	104	7.00	Panicle tip degeneration- 100%, Irregular in maturity
07.	BR12208-5R-274	157	121	5.85	Panicle tip degeneration- 100%, BLB 80%, Irregular in maturity
08.	BR12208-5R-394	154	91	6.05	BLB 60%
09.	BR12208-5R-402	156	87	5.86	Irregular in maturity
10.	BRRI dhan28 (Ck.)	152	96	6.5	

11.	BRRI dhan96 (Ck.)	145	91	5.78	
	CV	1.175	2.50	3.308	
	Lsd (0.05)	3.082	4.283	0.361	
D/S: 26 November, 2022; D/T: 10 January, 2023; Spacing: 20cm x 20cm					
RYT#03 (FBR-MD)					
01.	IR17A1275	148	88	5.34	BLB 50%
02.	IR17A1694	156	858	6.27	BLB 60%
03.	IR17A1735	150	77	4.99	BLB 40%
04.	IR18A1398	158	97	7.76	Panicle tip degeneration 60%
05.	IR18A1907	157	98	6.25	Panicle tip degeneration 60%, Mix 5%
06.	IR18A2119	148	82	5.31	Panicle tip degeneration 100%, BLB-20%
07.	BR8899-14-4-1-2-2-1	151	77	5.49	Panicle tip degeneration 100%, BLB-5%
08.	BR11342-5R-23	153	98	5.58	Panicle tip degeneration 100%, BLB-20%
09.	BR12177-5R-43	164	105	6.27	BLB 20%
10.	BRRI dhan81 (Ck.)	146	86	5.15	NB-5%
11.	BRRI dhan89 (Ck.)	160	94	7.67	
	CV	0.113	2.488	4.064	
	Lsd (0.05)	0.296	3.789	0.414	
D/S: 25 November, 2022; D/T: 15 January, 2023; Spacing: 20cm x 20cm					
RYT#04 (FBR-LD)					
01.	BR11894-5R-260	162	119.0	8.68	Panicle tip degeneration 100%
02.	BR11660-5R-6	157	113.0	6.61	Panicle tip degeneration 100%
03	BR11318-5R-148	163	106.0	8.40	Panicle tip degeneration 100%, False smut 5%
04.	BR11318-5R-84	170	123.0	8.95	Panicle tip degeneration 100%, Lodging 100%
05.	BR10301-5R-89	162	114.0	9.03	Panicle tip degeneration 100%, False smut 3%
06.	BRRI dhan81 (Ck.)	148	100.0	6.67	Panicle tip degeneration 100%, NB-10%
07.	BRRI dhan89 (Ck.)	165	103.0	9.02	Panicle tip degeneration 80%
08.	BRRI dhan92 (Ck.)	166	112.0	8.37	Lodging 70%
	CV	0.197	2.878	3.741	
	Lsd (0.05)	0.557	5.503	0.535	
D/S: 23 November, 2022; D/T: 04 January, 2023; Spacing: 20cm x 20cm					
RYT#05 (Disease Resistant Rice-1)					
01.	BR11604-4R-24	160	104	8.58	Panicle tip degeneration 80%
02.	BR11607-4R-2	162	94	6.91	
03	BR11607-4R-258	155	88	8.32	Panicle tip degeneration 100%
04.	BR11866-5R-73	161	87	8.34	
05.	BR11866-5R-136	161	86	6.60	
06.	BR11866-5R-223	160	97	8.03	
07.	BR11866-5R-277	165	92	7.61	
08.	BR11867-5R-117	157	83	7.41	BLB 30%
09.	BR11867-5R-140	162	87	8.08	
10.	BR11867-5R-154	159	82	7.16	
11.	BR11867-5R-347	154	89	6.48	BLB 35%
12.	BR11868-5R-9	150	101	6.61	BLB 40%
13.	BR(Path)13800-BC3-8-1	159	94	7.21	Panicle tip degeneration 60%
14.	BR(Path)13800-BC3-8-6	162	93	8.02	
15.	BR(Path)13800-BC3-109-10	162	102	8.54	Panicle tip degeneration 100%

16.	BR(Path)13800-BC3-8-7	163	92	7.44	Panicle tip degeneration 70%, Lodging-100%
17.	BR(Path)13800-BC3-8-9	162	100	7.31	
18.	BR(Path)13800-BC3-224-28	158	99	7.01	Panicle tip degeneration 100%
19.	BRRI dhan58 (Ck.)	157	96	6.63	Panicle tip degeneration 100%
20.	BRRI dhan89 (Ck.)	163	95	7.27	Panicle tip degeneration 100%
21.	BRRI dhan92 (Ck.)	163	102	7.93	Panicle tip degeneration 80%
22.	BRRI dhan101 (Ck.)	159	101	7.01	Panicle tip degeneration 100%
	CV	1.768	3.231	3.72	
	Lsd (0.05)	1.783	3.572	1.324	

D/S: 25 November, 2022; D/T: 07 January, 2023; Spacing: 20cm x 20cm

RYT#06 (Premium Quality Rice, PQR)

01.	BR(Path)13800-BC3-8-5	164	101	8.62	Panicle tip degeneration 100%
02.	BR(Path)13800-BC3-134-8	161	98	8.69	Panicle tip degeneration 100%, BLB-30%
03	BR(Path)13800-BC3-8-11	163	98	8.80	Panicle tip degeneration 100%
04.	BR(Path)13800-BC3-110-19	163	95	8.76	Panicle tip degeneration 100%, BLB-40%
05.	BR(Path)13800-BC3-12-13	164	100	8.72	Panicle tip degeneration 70%, BLB-20%
06.	BR(Path)13800-BC3-224-17	164	101	8.99	Panicle tip degeneration 80%, BLB-30%
07.	BR(Path)13800-BC3-134-25	163	97	8.82	Panicle tip degeneration 100%, BLB-5%
08.	BR(Path)13800-BC3-8-37	165	98	8.87	Panicle tip degeneration 80%, BLB-5%
09.	BR(Path)13800-BC3-110-4	165	98	8.69	Panicle tip degeneration 80%, ShB-5%
10.	BR(Path)13800-BC3-224-44	166	103	8.75	Panicle tip degeneration 80%
11.	BRRI dhan89 (Ck.)	163	98	7.86	NB-5%
12.	BRRI dhan92 (Ck.)	165	105	8.56	
	CV	1.175	2.50	3.308	
	Lsd (0.05)	3.082	4.283	0.361	

D/S: 25 November, 2022; D/T: 07 January, 2023; Spacing: 20cm x 20cm

RYT#07 (Zinc Enriched Rice, ZER)

1	BR9674-1-4-1-3-P1	164	96	8.41	
2	BR9674-1-4-1-3-P2	163	103	7.67	Panicle tip degeneration-100%
3	BR9674-7-3-2-1-P2	165	95	6.86	Panicle tip degeneration-100%
4	BRRI dhan29 (Ck.)	160	90	8.22	Panicle tip degeneration-100%
5	BRRI dhan74 (Ck.)	145	83	6.73	Panicle tip degeneration-60%
6	BRRI dhan84 (Ck.)	142	98	6.57	
	CV	0.150	1.659	3.319	
	Lsd (0.05)	0.428	2.837	0.453	

D/S: 28 November, 2022; D/T: 12 January, 2023; Spacing: 20cm x 15cm

RYT#08 (STR)

01.	BR11712-4R-44	157	127	4.50	Panicle tip degeneration- 100%
02.	BR11712-4R-93	159	128	7.57	
03.	BR11717-4R-44	160	111	7.90	Panicle tip degeneration- 100%
04.	BR11727-4R-6	160	87	7.08	Panicle tip degeneration- 100%, Mixture-2%
05.	BR11712-4R-346	163	84	6.67	Mixture 3-4%
06.	BR11713-4R-70	156	117	7.39	Panicle tip degeneration- 100%
07.	BR11722-4R-398	165	84	6.43	Panicle tip degeneration- 100%
08.	BRRI dhan67 (Ck.)	148	109	7.03	Panicle tip degeneration- 70%
09.	BRRI dhan89 (Ck.)	159	103	7.63	Panicle tip degeneration- 100%
10	BRRI dhan99 (Ck.)	163	100	7.89	
	CV	8.448	2.686	5.894	

	Lsd (0.05)	2.304	4.805	0.708	
D/S: 23 November, 2022; D/T: 04 January, 2023; Spacing: 25cm x 15cm					
RYT#09 (PQR-1)					
01.	BR10642-4-5-1-2-1	167	92.8	6.44	Panicle tip degeneration- 60%, BLB-20%, Mix-2%
02.	Katari (Shibganj)	158	94.6	5.65	Irregular in maturity
03.	Shova (TH)	162	81.6	6.53	Irregular in maturity
04.	BRRI dhan50 (Ck.)	156	81	7.16	NB-2%
05.	BRRI dhan63 (Ck.)	149	84.2	6.07	NB-5%
	CV	0.163	1.309	7.79	
	Lsd (0.05)	0.486	2.152	0.940	
D/S: 25 November, 2022; D/T: 06 January, 2023; Spacing: 20cm x 15cm					
RYT#10 (PQR-2)					
01.	Lomba Zira	152	93	6.61	
02.	BR10645-6-4-8-1-2	150	100.2	6.17	NB-2%
03.	Zira Nachol	142	95	5.49	
04.	Miniket, Ballobpur	144	94	4.96	
05.	BR10646-3-2-2-4-3	158	105.2	6.17	SB-2%,NB-2%
06.	BR10646-3-2-2-4-4	148	95.4	5.92	
07.	BR10646-3-3-3-1-4	157	104	6.18	
08.	BR10648-12-1-3-4-1	146	98	6.05	Panicle tip degeneration 100%
09.	Koushik, Hilly	151	91	6.09	BLB 70%
10.	BRRI dhan63 (Ck.)	142	84	5.64	NB-10%
11.	BRRI dhan81 (Ck.)	141	89	5.86	NB-20%
	CV	0.479	2.786	7.299	
	Lsd (0.05)	1.211	4.486	0.752	
D/S: 03 December, 2022; D/T: 14 January, 2023; Spacing: 20cm x 15cm					
RYT#11 (PQR-1, Parbatipur, Dinajpur)					
01.	BR10642-4-5-1-2-1	158	91.00	4.78	Leaf Blast (LB)-10%
02.	Katari (Shibganj)	154	88.00	5.73	BLB-20%, NB-3%
03.	Shova (TH)	158	80.00	5.96	
04.	BRRI dhan50 (Ck.)	153	83.00	5.83	BLB-30%
05.	BRRI dhan63 (Ck.)	146	78.00	5.74	BLB-50%, NB-20%
	CV	0.178	1.546	4.341	
	Lsd (0.05)	**0.356**	**2.152**	**0.573**	
D/S: 03 December, 2022; D/T: 14 January, 2023; Spacing: 20cm x 15cm					
RYT#12 (PQR-2, Parbatipur, Dinajpur)					
01.	Lomba Zira	149	88	5.93	BLB-50%, NB-5%
02.	BR10645-6-4-8-1-2	151	100	5.01	BLB-10%, NB-5%
03.	Zira Nachol	142	98	5.57	BLB-60%, NB-10%
04	Miniket, Ballobpur	141	93	4.80	BLB-60%, NB-10%
05.	BR10646-3-2-2-4-3	155	103	5.17	NB-5%
06.	BR10646-3-2-2-4-4	148	99	5.09	BLB-60%
07.	BR10646-3-3-3-1-4	153	103	5.01	BLB-10%
08.	BR10648-12-1-3-4-1	146	96	5.39	BLB-50%, NB-20%
09.	Koushik, Hilly	152	91	5.68	BLB 60%
10	BRRI dhan63 (Ck.)	144	79	5.10	BLB-50%, NB-40%
11.	BRRI dhan81 (Ck.)	143	91	3.78	NB-50%
	CV	0.832	2.271	6.883	
	Lsd (0.05)	2.165	3.769	0.540	
D/S: 03 December, 2022; D/T: 14 January, 2023; Spacing: 20cm x 15cm					
RYT#13 (Balst and Bacterial Blight)					
01.	BR(path) 13784-BC3-5-3-8-HR4	145	87.20	6.95	Irregular flowering, NB-0%
02.	BR(path) 13784-BC3-63-6-4-HR6	146	79.20	6.65	Irregular flowering, NB-0%

03.	BR(path) 13784-BC3-34-9-10-HR9	140	79.00	6.16	Irregular flowering, NB-0%
04.	BR(path) 13784-BC3-240-6-9-HR10	142	97.20	5.88	Irregular flowering, NB-0%
05.	BR(path)201	148	102.6	7.57	Panicle tip degeneration-100%, Irregular flowering, NB-0%
06.	BR(path)202	146	84.60	6.63	Irregular flowering, NB-0%
07.	BR(path)203	146	81.00	6.48	Irregular flowering, NB-0%
08.	BR(path)204	147	98.60	7.25	Irregular flowering, NB-0%
09.	BR(path)205	144	93.60	5.92	Irregular flowering, NB-0%
10.	BR(path)206	143	93.40	5.52	Irregular flowering, NB-0%
11.	BRRI dhan28(Ck.)	146	99.00	6.66	Neck Blast- 5%
	CV	0.314	1.307	4.294	
	Lsd (0.05)	0.773	2.023	0.465	
D/S: 30 November, 2022; D/T: 17 January, 2023; Spacing: 25cm x 15cm					
RYT#14 (Antioxidant-1_Medium Duration)					
01.	BR12839-4R-157-2	155	101	6.05	Panicle tip degeneration 100%, BLB-15%, Lgd-100%
02.	BR12839-4R-5-2	125	101	5.44	Panicle tip degeneration 100%, BLB-15%, Lgd-100%
03.	BR12839-4R-93	151	94	5.53	Panicle tip degeneration 100%, BLB-10%, Lgd-100%
04.	BR12839-4R-47-1	155	99	5.99	Panicle tip degeneration 100%, BLB-10%
05.	BR12839-4R-90-1	151	99	5.41	Panicle tip degeneration 100%, BLB-10%, Lgd-100%
06	BR12839-4R-138-4	151	92	5.46	Panicle tip degeneration 100%, Lgd-100%
07.	BR12839-4R-78-1	155	101	5.17	BLB-10%
08.	BR12839-4R-21	153	100	5.62	Lgd-100%
09.	Indonesian Black Rice (Ck.)	152	108	4.64	Lgd-100%
10.	BRRI dhan88 (Ck.)	141	84	5.42	
	CV	0.87	1.48	7.69	
	Lsd (0.05)	1.68	2. 59	0.52	
D/S: 10 December, 2022; D/T: 15 January, 2023; Spacing: 20cm x 20cm					
RYT#15 (Antioxidant-2_Short Duration)					
01.	BR12839-4R-73	155	99	5.85	Lgd-100%
02.	BR12839-4R-137	140	87	5.86	Panicle tip degeneration 100%, BLB-15%
03.	BR12839-4R-72	142	85	5.59	Panicle tip degeneration 100%
04.	BRRI dhan84 (Ck.)	141	118	6.04	Panicle tip degeneration 100%
	CV	0.875	2.045	3.567	
	Lsd (0.05)	2.431	4.327	1.768	
D/S: 10 December, 2022; D/T: 12 January, 2023; Spacing: 20cm x 20cm					
RYT#16 (Water Saving Rice)					
01.	BR11206-4B-351	158	95	7.93	Panicle tip degeneration 90%
02.	BR11204-5B-224	128	98	8.96	Panicle tip degeneration 80%
03.	BRRI dhan58 (Ck.)	154	97	9.32	Panicle tip degeneration 100%
	CV	1.958	1.979	6.703	
	Lsd (0.05)	6.511	4.137	1.395	
D/S: 07 December, 2022; D/T: 18 January, 2023; Spacing: 20cm x 20cm					
RYT#17 (Zira Type)					
01.	BRH13-9-5-3B	147	88	5.20	

02.	BRH12-1-7B-P1	146	96	5.73	Panicle tip degeneration 100%, Mixture-1%
03.	BRH9-3-14-2B	146	87	5.07	
04.	BR10247-4-7-4B	151	88	5.21	Panicle tip degeneration 100%
05.	BRH13-7-9-3-2B	151	100	6.82	
06.	BRRI dhan28 (Ck.)	144	97	6.53	
07.	Zirashail (Ck.)	149	97	5.17	
	CV	0.147	1.635	6.876	
	Lsd (0.05)	0.388	2.731	0.711	
D/S: 04 December, 2022; D/T: 19 January, 2023; Spacing: 25cm x 15cm					
RYT#18 (Short Slender)					
01.	BRH18-9-4-2-3B	150	94	7.8	Lodging-100%
02.	BRH13-5-12-2-2B	150	91	6.97	Lodging-100%, BLB-10%
03.	BRH14-2-1-7B	153	87	6.69	Lodging-100%, BLB-10%
04.	BRH9-3-2B	151	94	6.26	Lodging-100%
05.	BR9392-1-7-5B	152	83	6.39	
06.	Katari (Ck.)	152	101	6.2	
	CV	0.155	1.609	2.086	
	Lsd (0.05)	0.428	2.691	0.252	
D/S: 09 December, 2022; D/T: 29 January, 2023; Spacing: 25cm x 15cm					
RYT#19 (Short Slender, Parbatipur, Dinajpur)					
01.	BRH18-9-4-2-3B	147	99	6.69	BLB-20%
02.	BRH13-5-12-2-2B	146	92	6.68	BLB-30%
03.	BRH14-2-1-7B	149	73	5.67	
04.	BRH9-3-2B	151	99	6.39	BLB-20%
05.	BR9392-1-7-5B	148	80	5.57	
06.	Katari (Ck.)	153	97	6.36	
	CV	2.138	2.975	2.032	
	Lsd (0.05)	5.795	4.832	0.228	
D/S: 09 December, 2022; D/T: 29 January, 2023; Spacing: 25cm x 15cm					
RYT#20 (Extra Long Slender)					
01.	BR9945-5R-21	162	108.8	7.03	Panicle tip degeneration 100%, Mix-3%
02.	BR10604-5R-58	156	92.80	6.48	Uniform, Panicle tip degeneration 70%
03.	IR18A2102	153	84.80	5.62	Awned
04.	BR7528-2R-19-16-RIL-52	167	102.4	5.38	Panicle tip degeneration 100%, BLB-30%, Mix-2%
05.	BR7528-2R-19-16-RIL-55	162	96.60	6.73	Panicle tip degeneration 60%, BLB-20%
06.	BR7528-2R-19-16-RIL-59	161	96.80	7.10	Panicle tip degeneration 100%, BLB-20%
07.	BRRI dhan50 (Ck.)	154	82.00	6.53	
08.	BRRI dhan63 (Ck.)	149	81.00	5.32	Panicle tip degeneration 60%, NB-3%
09	BRRI dhan86 (Ck.)	149	81	5.95	
	CV	1.212	2.094	5.471	
	Lsd (0.05)	0.576	3.349	0.587	
D/S: 25November, 2022; D/T: 11 January, 2023; Spacing: 25cm x 15cm					

Experiment 3.17: Advanced Line Adaptive Research Trial (ALART)

MS Hossain, MK Hasan, MR Hasan and MH Kabir

Rationale: Location specific high yielding variety development is the need of present time. Specifically the Rangpur region is different in weather condition and cropping pattern compared to the other parts of Bangladesh. Therefore, special research program was undertaken to conduct an ALART based on the suitability of some genotypes for Rangpur region.

A total of nineteen ALART's were conducted under T. Aman/2022 and Boro/2022-23 seasons. In T. Aman, nine ALART's and ten ALART's in Boro season were performed to develop rice varieties. In T. Aman/2022, BR8493-3-5-1P1 was performed better over standard check (BRRI dhan70) under PQR program. In Short slender program, BRH13-2-4-7-2B (5.35 t/ha) and BRH10-1-14-6-2B (5.35 t/ha) performed better over check BRRI dhan57 (4.74 t/ha). One genotype (BRBa3-1-7) from FBR_Barishal and one genotupe (BRH13-2-4-7-2B) from (SHR-1) performed better over standard checks during Boro/2022-2023 **(Table 21)**.

Table 21: Grain yield and other parameter of different entries under Advanced Line Adaptive Research Trials (ALARTs) in T. Aman, 2022 and Boro, 2022-2023

SL#	Designation	Mat. (days)	PHt. (cm)	Yld. (t/ha)	Remarks
T. Aman, 2022					
ALART#1 (SHR-1, Parbatipur, Dinajpur)					
01.	BRH15-24-7B	108	100	4.19	Mix-1%
02.	BRH13-1-9-7B	109	105	5.05	Mix-2%
03.	BRH13-2-4-7-2B	109	102	3.90	Mix-1%
04.	BRH10-1-14-6-2B	108	100	4.05	
05.	BR10247-4-7-4B	106	104	3.11	BLB-10%, Mix-3%
06.	Zirasail(Ck.)	104	107	2.88	Lgd: 100%
07.	BRRI dhan57(Ck.)	104	104	3.55	
D/S: 27 June, 2022; D/T:23 July, 2022; Spacing: 25cm x 15cm					
ALART#2 (SHR-1, Chirirbandar, Dinajpur)					
01.	BRH15-24-7B	112	96	4.98	BLB-10%, Mix-2%
02.	BRH13-1-9-7B	110	104	5.21	BLB-10%, Mix-10%
03.	BRH13-2-4-7-2B	110	102	5.35	BLB-10%,
04.	BRH10-1-14-6-2B	109	104	5.35	
05.	BR10247-4-7-4B	109	98	4.95	SB-10%, BLB-10%, ShB-10%, Mix-5%
06.	Zirasail (Ck.)	104	105	4.28	Lgd: 40%, BLB-10%, ShB-10%, Mix-2%
07.	BRRI dhan57 (Ck.)	103	104	4.74	ShB-10%,
D/S: 29 June, 2022; D/T:01 August, 2022; Spacing: 25cm x 15cm					
ALART#3 (SHR-1, Pirganj, Rangpur)					
01.	BRH15-24-7B	114	108	3.96	Mix-2%
02	BRH13-1-9-7B	114	108	3.61	Mix-2%
03.	BRH13-2-4-7-2B	112	110	4.04	
04.	BRH10-1-14-6-2B	111	103	4.61	
05.	BR10247-4-7-4B	110	99	3.64	Mix-2%
06.	Zirasail (Ck.)	106	105	3.35	Mix-2%
07.	BRRI dhan57 (Ck.)	105	105	4.43	
D/S: 27 June, 2022; D/T:24 July, 2022; Spacing: 25cm x 15cm					
ALART#4 (SHR-2, Chirirbandar, Dinajpur)					
01.	BR9392-1-9-7-5B	106	103	4.51	Mix-2%
02.	BR10247-14-18-4	109	101	3.92	Mix-10%
03.	BR9392-40-50-1B	110	103	4.67	BLB-10%

04.	IR12A-177	122	105	4.62	Mix-3%
05.	BR10238-5-1-4-2	121	106	4.30	Mix-5%
06.	BRRI dhan62(Ck.)	102	93	3.33	
07.	BRRI dhan75(Ck.)	110	100	4.10	
D/S: 29 June, 2022; D/T:01 August, 2022; Spacing: 25cm x 15cm					
ALART#5 (SHR-2, Parbatipur, Dinajpur)					
01.	BR9392-1-9-7-5B	106	119	4.50	Mix-3%
02.	BR10247-14-18-4	107	103	3.98	Mix-5%
03.	BR9392-40-50-1B	108	107	4.04	BLB-10%
04.	IR12A-177	122	112	4.10	Mix-1%
05.	BR10238-5-1-4-2	121	108	3.92	Mix-3%
06.	BRRI dhan62 (Ck.)	103	116	3.51	
07.	BRRI dhan75 (Ck.)	112	103	4.20	
D/S: 27 June, 2022; D/T:23 July, 2022; Spacing: 25cm x 15cm					
ALART#6 (SHR-2, Pirganj, Rangpur)					
01.	BR9392-1-9-7-5B	105	116	3.37	FS-1, Mix-2%
02.	BR10247-14-18-4	105	102	3.27	Mix-1%
03.	BR9392-40-50-1B	109	105	3.80	Mix-5%
04.	IR12A-177	122	105	4.02	Mix-5%
05.	BR10238-5-1-4-2	121	106	3.92	Mix-2%
06.	BRRI dhan62 (Ck.)	103	110	3.35	
07.	BRRI dhan75 (Ck.)	108	104	4.10	
D/S: 27 June, 2022; D/T:23 July, 2022; Spacing: 25cm x 15cm					
ALART#7 (DTR, Taraganj, Rangpur)					
01.	BR10538-2-1-2-32	101	111	5.41	BLB-10%, Mix-2%
02.	BR10540-4-1-2-41	103	117	5.94	FS-1%, BLB-10%
03.	BRRI dhan71 (Ck.)	114	116	5.85	
04.	BRRI dhan75 (Ck.)	106	106	4.54	FS-1%
D/S: 27 June, 2022; D/T:19 July, 2022; Spacing: 20cm x 15cm					
ALART#8 (DTR, Pirganj, Rangpur)					
01.	BR10538-2-1-2-32	103	107	3.80	BLB-10%
02.	BR10540-4-1-2-41	105	121	4.09	BLB-10%
03.	BRRI dhan71 (Ck.)	116	112	4.20	BLB-10%
04.	BRRI dhan75 (Ck.)	109	103	4.15	BLB-10%
D/S: 27 June, 2022; D/T:19 July, 2022; Spacing: 20cm x 15cm					
ALART#9 (PQR, Parbatipur, Dinajpur)					
01.	BR8493-3-5-1P1	143	104	5.17	Mix-2%
02.	BR9590-45-1-3-2-P2	144	98	3.08	ShB-5%, Mix-2%
03.	BRRI dhan34(Ck.)	151	133	3.39	ShB-10%, BLB-10%
04.	BRRI dhan70 (Ck.)	127	124	4.32	ShB-10%
D/S: 05 July, 2022; D/T:31 July, 2022; Spacing: 20cm x 15cm					
Boro, 2022-2023					
ALART#1 (FBR-SD, Sadar Rangpur)					
01.	BR11318-5R-63	149	100	6.59	SB-1%, ShB-10%
02.	BR11337-5R-72	153	88	5.87	SB-1%, ShB-10%
03.	SVIN109	151	92	6.01	SB-1%, ShB-10%
04.	IR17A1723	144	80	5.35	SB-1%, ShB-10%
05.	BRRI dhan81 (Ck.)	146	85	5.83	SB-1%,NB-10%
06.	BRRI dhan96 (Ck.)	148	80	5.08	SB-1%, ShB-10%
D/S: 05 December, 2022; D/T:18 January, 2023; Spacing: 20cm x 20cm					
ALART#2 (FBR-MD, Sadar Rangpur)					
01.	IR12A173	154	93	5.90	SB-1%, ShB-10%
02.	IR17A1694	154	90	5.20	SB-1%, ShB-10%

03.	BRRI dhan58(Ck.)	153	89	5.72	SB-1%,NB-10%
04.	BRRI dhan96(Ck.)	148	77	5.99	SB-1%, ShB-10%
D/S: 05 December, 2022; D/T:18 January, 2023; Spacing: 20cm x 20cm					
ALART#3 (FBR-Barisal, Sadar Rangpur)					
01.	BRBa1-4-9	162	103	6.53	SB-1%, ShB-5%
02.	BRB14-NGR-414-1	162	98	6.51	SB-1%, ShB-5%
03.	BRBa3-1-7	158	85	7.34	SB-1%, ShB-5%
04.	BRBa40-NGR-1255-1	158	99	7.26	SB-1%, ShB-5%
05.	BRRI dhan58(Ck.)	153	84	6.05	SB-1%, NB-5%
06.	BRRI dhan89(Ck.)	158	98	6.66	
D/S: 05 December, 2022; D/T:18 January, 2023; Spacing: 20cm x 20cm					
ALART#4 (BRR-1, Sadar, Lalmonirhat)					
01.	BR12454-BC2-56-81-27-3	157	102	8.51	BLB-40%, NB-5%, LB-20%
02.	BR12454-BC2-69-97-39-5-44	160	98	7.56	SB-1%, ShB-10%, BLB-20%, LB-30%
03.	BR12454-BC2-71-91-6-23-26	156	104	8.11	SB-1%, ShB-5%,BLB-40%,NB-5%,LB-25%
04.	BR12454-BC2-75-32-31-39-7	156	106	7.36	SB-1%, LB-30%
05.	BRRI dhan29 (Ck.)	158	94	6.66	SB-1%, NB-10%, LB-10%,ShB-10%, BLB-40%
06.	BRRI dhan89 (Ck.)	156	97	6.83	SB-1%, NB-25%, LB-30%, ShB-50%,BLB-30%
D/S: 06 December, 2022; D/T:17 January, 2023; Spacing: 25cm x 15cm					
ALART#5 (BRR-1, Sadar Rangpur)					
01.	BR12454-BC2-56-81-27-3	159	102	7.35	ShB-10%, BLB-40%, NB-10%, LB-30%
02.	BR12454-BC2-69-97-39-5-44	160	98	8.05	ShB-30%, BLB-30%, NB-10%, LB-30%
03.	BR12454-BC2-71-91-6-23-26	158	102	8.05	ShB-30%, BLB-25%, NB-8%, LB-25%
04.	BR12454-BC2-75-32-31-39-7	158	104	7.39	SB-1%,ShB-25%, BLB-30%, LB-30%
05.	BRRI dhan29 (Ck.)	159	98	7.73	ShB-10%, BLB-45%, LB-30%, NB-10%
06.	BRRI dhan89 (Ck.)	161	98	6.70	ShB-3, BLB-50%, LB-25%, NB-35%
D/S: 06 December, 2022; D/T:19 January, 2023; Spacing: 25cm x 15cm					
ALART#6 (BRR-ReALART, Sadar Rangpur)					
01.	BR(Path)12452-BC3-42-22-11-4	148	104	5.98	ShB-10%
02.	BR(Path)12452-BC3-53-21-11	154	109	5.86	ShB-5%
03.	BR(Path)13784-BC3-61-1-6-HR3	149	93	5.97	ShB-10%
04.	BR(Path)13784-BC3-63-6-4-HR6	147	85	7.49	ShB-5%
05.	BRRI dhan28 (Ck.)	148	99	5.66	NB-30%,BLB-50%, ShB-50%

06.	BRRI dhan88 (Ck.)	149	79	6.01	NB-10%,BLB-30%, ShB-30%
D/S: 05 December, 2022; D/T:19 January, 2023; Spacing: 25cm x 15cm					
ALART#7 (SHR-1, Sadar Rangpur)					
01.	BRH10-1-14-2-6	150	87	8.01	ShB-10%, BLB-25%
02.	BRH13-2-4-7-2B	150	86	7.95	ShB-10%, BLB-15%
03.	BRH15-24-7B	151	83	6.93	ShB-10%, BLB-20%
04.	BRRI dhan81 (Ck.)	147	87	5.43	ShB-10%, BLB-10%, NB-70%
D/S: 04 December, 2022; D/T:18 January, 2023; Spacing: 25cm x 15cm					
ALART#8 (SHR-1, Mithapukur Rangpur)					
01.	BRH10-1-14-2-6	151	93	8.01	ShB-10%, BLB-15%
02.	BRH13-2-4-7-2B	149	90	8.41	ShB-10%, BLB-10%
03.	BRH15-24-7B	153	82	7.55	ShB-5%, BLB-10%
04.	BRRI dhan81 (Ck.)	149	92	6.60	ShB-10%, BLB-10%, NB-25%
D/S: 04 December, 2022; D/T:16 January, 2023; Spacing: 25cm x 15cm					
ALART#9 (SHR-2, Sadar Rangpur)					
01.	BRH11-2-4-7B	152	89	5.39	SB-1%, ShB-10%
02.	BRH13-2-4-2-1B	162	104	7.31	SB-1%, ShB-10%
03.	BRH238-5-1-4-2	152	90	5.42	SB-1%, ShB-10%
04.	BRRI dhan88 (Ck.)	151	82	5.67	SB-1%, ShB-10%
D/S: 04 December, 2022; D/T:18 January, 2023; Spacing: 25cm x 15cm					
ALART#10 (SHR-2, Mithapukur Rangpur)					
01.	BRH11-2-4-7B	151	93	7.30	SB-1%, ShB-10%
02.	BRH13-2-4-2-1B	162	116	8.05	SB-1%, ShB-10%
03.	BRH238-5-1-4-2	152	98	7.88	SB-1%, ShB-10%
04.	BRRI dhan88 (Ck.)	151	99	8.14	SB-1%,ShB-10%, NB-30%
D/S: 04 December, 2022; D/T:16 January, 2023; Spacing: 25cm x 15cm					

Varietal Development Program (VDP) under TRB Project

Program 01: Development of short duration T. Aus rice varieties

The main objective of the project is development of shorter growth duration high yielding T. Aus rice varieties with better phenotypic acceptance and grain quality.

Program Leader: Mahmuda Khatun

Experiment 3.18: Observational Yield Trial (OYT)

Principal Investigator: Mahmuda Khatun

Co-investigators: Anisar Rahman, MR Hasan & Sanjoy Debsharma

Specific objectives: To select materials with higher yield potentials and shorter growth duration than the standard checks to initiate preliminary yield trial.

Materials and Methods: A total of 318 advanced lines in OYT#1 & 123 advanced lines in OYT#2 along with the check BRRI dhan48, BRRI dhan82, BRRI dhan98 and N22 were evaluated in a non-replicated trial. The field layout was augmented RCBD. Three weeks old seedlings were transplanted with single seedling per hill at a spacing of 20 × 15 cm in a 5.4m × 4 rows plot. Importantly, checks were repeated every 15-20 lines. Fertilizers were applied @ 195:50:75:40:5 kg Urea, TSP, MP, Gypsum, Zinc sulphate/ha respectively. The fertilizers other than urea were applied as basal during final land preparation. Urea was applied in three splits at final land preparation, 4-5 tillering stage (10 DAT) and 5-7 Days before PI stages (30 DAT). Insect pest control measure and other cultural management were done as and when needed.

Result: In OYT-1, the breeding lines showed a wide range of variation in growth duration (100-130 days), plant height (82-142 cm) and yield (4.02 -5.9 t/ha). The selected breeding lines showed 4.49 -5.94 t/ha grain yield with 108-114 days growth duration. Highest yield (5.94 t/ha) was observed in the line BR11851-4R-37 which was about 20% higher yield than the check variety BRRI dhan48 with similar growth duration and about 17 % yield advantage compared to the check variety BRRI dhan98 (**Table 22**).

In heat tolerant T. Aus program, 123 entries were evaluated at Darshana, Rangpur under observational yield trial (OYT#2). The selected breeding lines showed a wide range of variation in growth duration (101-131 days), plant height (86-131 cm), yield (1.1 -6.2 t/ha) and spikelet fertility (22.8-76.7). Highest yield (6.20 t/ha) was observed in the line BR11845-4R-178 which yield was higher than the check variety BRRI dhan48, BRRI dhan98 & N22 with similar growth duration (**Table 23**).

Table 22: Agronomic Performance of the selected top yielder materials from observational yield trial (OYT#1), T. Aus, 2022

SN	Designation	PHt. (cm)	Mat. (days)	Yld. (t/ha)
01	BR11991-6R-61	101	108	4.02
02	BR12616-4R-104	114	112	5.70
03	BR12109-4R-10	102	111	4.25
04	BR12603-4R-161	118	111	3.75
05	BR12616-4R-112	118	111	5.08
06	BR12589-4R-27	112	108	5.29
07	BR12603-4R-170	113	108	5.78
08	BR12603-4R-189	132	112	4.87
09	BR12598-4R-189	101	109	5.13
10	BR11863-5R-25	103	112	3.60
11	BR12597-4R-219	114	106	2.35
12	BR12593-4R-23	109	110	4.98
13	BR11851-4R-37	127	115	5.97
14	BR12088-5R-41	119	114	4.06
15	BR12599-4R-105	105	108	3.91
16	BR12590-4R-81	103	105	5.61
	BRRI dhan82 (Ck.)	105	106	4.56
	BRRI dhan48(Ck.)	103	108	3.90
	BRRI dhan98(Ck.)	105	110	4.86
	Lsd (0.05)	20.89	10.76	1.90
	H^2b	0.31	0.30	0.25

Table 23: Agronomic Performance of the selected top yielder materials from Observational yield trial (OYT#2), Heat Tolerant Rice, T. Aus, 2022

SN	Designation	Mat. (days)	PHt. (cm)	Yld. (t/ha	Spikelet Fertility (%)
01	BR11845-4R-178	101	107.0	5.6	61.3
02	BR11845-4R-1	102	99.4	5.6	61.8
03	BR11845-4R-130	105	91.8	6.2	62.7
04	BR12605-4R-298	104	106.3	6.8	60.7
05	BR12605-4R-109	109	105.7	5.3	62.4
06	BR12605-4R-240	104	111.3	7.2	70.9
07	BR12605-4R-72	115	101.1	5.1	68.1
08	BR12605-4R-275	108	113.8	6.5	75.1

09	BR12432-5R-4	108	118.9	4.2	62.2
10	BR11845-4R-69	104	93.2	6.0	59.3
11	BR12605-4R-121	106	108.1	5.7	62.7
12	BR11845-4R-50	102	94.0	5.8	58.1
13	BR11845-4R-90	104	93.9	5.2	62.1
	BRRI dhan48 (Ck.)	106	97.6	4.2	44.5
	BRRI dhan82 (Ck.)	106	101.4	4.5	58.8
	BRRI dhan98 (Ck.)	107	98.6	4.2	60.7
	N22 (Tol. Ck.)	105	105.8	1.9	64.1
	Lsd (0.05)	4.96	17.34	1.68	19.26
	H^2b	0.81	0.38	0.60	0.10

Experiment 3.19: Advanced Yield Trial (AYT)

Principal Investigator: Mahmuda Khatun

Co-investigators: Anisar Rahman, MR Hassan & Sanjoy Debsharma.
Specific objective: Initial yield evaluation and selection of desirable lines compared to standard checks.

Materials and methods: Advanced yield trial consisting of Thirty-seven genotypes for AYT#1 & AYT#2 along with the check BRRI dhan48, BRRI dhan82 and BRRI dhan98 were evaluated. Three weeks old seedlings were transplanted with single seedling per hill at a spacing of 20 X 15 cm in a 5.4m x 10 rows plot. The field layout was Latinized Row Column with three replications. Fertilizers were applied @ 195:50:75:40:5 kg Urea, TSP, MP, Gypsum, Zinc sulphate/ha respectively. The fertilizers other than urea were applied as basal during final land preparation. Urea was applied in three splits at final land preparation, 4-5 tillering stage (10 DAT) and 5-7 Days before PI stages (30 DAT). Insect pest control measure and other cultural management were done as and when needed.

Result: Fifteen advanced lines from AYT#1 and 10 from AYT#2 were selected on the basis of homogeneity with respect to plant height, phenotypic acceptability at vegetative and maturity stages and physicochemical properties. The selected breeding lines showed 4.06-5.27 t/ha with 103-120 days growth duration in AYT#1 4.02-5.35 t/ha with 104-131 days growth duration in AYT#2. Highest yield (**5.35 t/ha**) was observed in the line **BR11867-5R-442** that was 17% higher yield than the check variety BRRI dhan48 with similar growth duration (**Table 24**). In non-saline tidal ecosystem, 4 genotypes were selected along with the standard check BRRI dhan27, BRRI dhan48 and BRRI dhan98 where genotype BR11868-5R-2 had given the higher yield compared with the check (**Table 25**)

Table 24: Agronomic Performance of the selected materials from advanced yield trial (AYT#1), T. Aus, 2022

SN	DESIGNATION	Plant height (cm)	Growth duration (days)	Grain Yield (t/ha)
1	BR12102-4R-38	98.99	107	4.51
2	BR12091-4R-35	105.00	112	4.93
3	BR12087-5R-31	107.49	110	5.13
4	BR12090-5R-255	104.64	113	4.95
5	BR10969-B-3R-23	123.32	113	5.01
6	BR12087-5R-55	108.37	110	4.95
7	BR12089-5R-86	107.27	113	4.81
8	BR10969-B-3R-29	112.14	113	4.84
9	BR12101-5R-76	104.17	109	5.27
10	BR12101-5R-184	108.53	112	4.83
11	BR12088-5R-275	109.17	112	4.47
12	BR12091-4R-169	104.32	110	5.20

13	BR12087-5R-155	100.98	107	4.06
14	BR12102-4R-58	112.83	111	5.07
15	BR12090-5R-233	103.82	112	4.89
	BRRI dhan82 (Ck.)	137.59	106	4.94
	BRRI dhan48 (Ck.)	103.14	110	4.84
	BRRI dhan98 (Ck.)	106.26	112	5.61
	Lsd (0.05)	10.18	4.89	1.44
	H^2b	0.26	0.53	0.15

Table 25: Agronomic Performance of the selected materials from Advanced yield trial (AYT#2), T. Aus, 2022

SN	DESIGNATION	PH (cm)	DM (days)	Yield (t/ha)			
				Gazipur	Rajshahi	Rangpur	Pooled
1	BR11867-5R-442	111	109	6.36	4.84	4.86	**5.35**
2	BR11866-5R-68	107	110	6.91	4.41	4.42	5.25
3	BR11866-5R-109	102	114	6.03	4.43	4.85	5.11
4	BR11867-5R-356	110	118	6.33	4.98	3.72	5.02
5	BR11867-5R-292	104	106	4.74	5.04	5.25	5.01
6	BR11866-5R-351	101	106	4.85	4.58	5.31	4.92
7	7 FBR-364	106	110	5.13	4.87	4.57	4.86
8	BR11866-5R-215	101	109	5.60	5.00	3.84	4.81
9	BR11867-5R-103	109	108	4.09	5.52	4.36	4.66
10	BR11867-5R-188	98	108	5.26	3.65	5.01	4.64
	BRRI dhan48 (Ck.)	100	105	4.21	4.54	5.02	4.59
	BRRI dhan82 (Ck.)	105	104	5.20	3.05	4.41	4.22
	BRRI dhan98 (Ck.)	99	108	5.78	4.64	4.93	5.11
	Lsd (0.05)	11.78	9.32	1.32	1.00	1.02	1.44
	H2b	0,86	0.44	0.55	0.37	0.51	0.06

Program 2: Development of Submergence and Stagnant Flood Tolerant Rice Varieties
General objectives

- Development of high yielding rice varieties with two to three weeks of submergence, stagnant flood and anaerobic germination tolerances with yield target 6.0-6.5 t/ha (under stress 5.0 t/ha).
- Development of multiple stress tolerant rice varieties like submergence + stagnant flood, submergence + drought, submergence + anaerobic germination, submergence + biotic stress with yield target 6.0-6.5 t/ha (under stress 5.0 t/ha).
- Shorter growth duration

Project Leader: Khandakar Md. Iftekharuddaula

Experiment 3.20: Observational Yield Trial (OYT#1)
Principal Investigator: Sharmistha Ghosal
Co-investigators: Anisar Rahman, MR Hasan, KM Iftekharuddaula, ZA Riyadh and S Maniruzzaman.

Specific objective: Selection of materials with better phenotypic acceptance, homogeneity in the population and higher yield potentials than the standard checks under rainfed conditions.

Materials and Methods: A total of 187 advanced lines with five check varieties were evaluated in Augmented RCB design two replications of checks. The trial conducted in four locations, one in controlled BRRI Rangpur submergence tank and another one under rainfed condition in Payrabanda, Rangpur and another two at flood prone farmers' field at Kurigram and Lalmonirhat. Twenty-five to thirty days old seedling with single seedlings per hill was transplanted at a spacing of 20 cm × 20 cm in a 5.4m × 5 rows plot. For rainfed trial, Fertilizers

were applied at the rate of 200 kg urea, 70 kg TSP, 100 kg MoP, 70 kg gypsum and 6 kg zinc sulphate. Total amount of TSP, gypsum and two-third MoP were applied at the time of final land preparation. Total amount of zinc sulphate was applied at first top dressing. Urea was applied in equal three splits at 10, 25 and 40 days after transplanting. Rest of the one-third MoP was applied during second top-dressing of urea. Crop management was done as recommended for modern rice cultivation for T. Aman season. Weeding and other cultural operations were done in time.

In case of controlled submergence screening, four extra lines of susceptible genotypes were transplanted at four places at the water tank for regular checking of imposed stress at different duration of submergence starting from 12 days after submergence. At twenty-one days after transplanting, the lines were submerged with one meter of water depth for 16 days. Same basal doze of fertilizer of rainfed condition was applied during land preparation. First top dress of urea was done after 10-15 days after de-submergence and 2nd top dress of Urea and half MoP after 30-35 after de-submergence. The survivability of the seedling was counted at 10-15 days after de submergence. Under flash flood condition, first top dress of Urea was done at ten days after water recession and 2nd top dress of Urea and half MoP were applied after 20-25 days after water recession. Under flood prone farmers' field condition fertilizer management decisions were taken instantly depending on the natural submergence and de-submergence condition of the crop field following the management practice given for controlled submergence condition. Pest management and other cultural operations were done as and when necessary.

Results and Discussion: A total of 65 genotypes out of 187 genotypes were selected based on better phenotypic acceptance, homogeneity in the population, disease infestation and higher yield potentials **(Table 26)**. Among the selected genotypes the genotype BR12487-5R-88 gave the highest yield (6.9 t/ha) in controlled submergence tank with 93% survivability and in flood prone farmers field it also produced a yield of 5.7 t/ha. The genotype BR12506-5R-62 produced highest yield (5.8 t/ha) in flash flood prone farmers' field condition. In rainfed on-station trial the genotype BR12154-5R-65-2, significantly produced higher yield (6.9 t/ha) with 136 days growth duration. The other selected genotypes gave yield from 6.7 t/ha to 5.2 t/ha in controlled stress condition. The growth duration of test entries was ranged from 111 to 145 days.

Table 26: Performance of some selected entries of Observational Yield Trial#1 (OYT#1), Submergence & Medium Stagnant Tolerance Breeding, T. Aman, 2022

SL	Designation	PAcp	PH (cm)	GD (Days)	Yield (t/ha)			Survivability %
					Non stress	Farmers' field	Stress	
1	BR12487-5R-60	5	113	120	4.9	5.5	6.7	90
2	BR12487-5R-75	5	123	109	6.1	5.5	6.7	92
3	BR12487-5R-88	3	124	133	4.6	5.7	6.9	93
4	BR12487-5R-95-1-P2	5	106	121	5.0	4.5	5.2	87
5	BR12489-5R-63	7	134	114	3.8	3.1	5.6	75
6	BR12489-5R-166	5	138	125	4.6	5	5.9	78
7	BR12490-5R-110	7	145	128	4.8	3.5	5.8	83
8	BR12490-5R-175	5	128	147	5.1	5.7	6.7	91
9	BR12506-5R-62	5	144	128	5.0	5.8	5.0	77
10	BR12154-5R-65-2	5	129	136	6.9	5.6	6.7	88
11	BR11694-5R-130-PS2	7	127	110	4.8	5.5	5.8	80
12	BR10212-16-1-1	5	133	132	4.5	3.8	5.8	95
13	IR16F1243-P2	7	131	132	4.6	4.5	6.0	79
14	IR15F1869-P2	5	131	128	5.1	5	5.5	75
15	BR12497-5R-133	5	139	139	5.6	3.4	0.2	8
16	BR12506-5R-174	5	127	140	6	4.8	6.7	65
17	BR11690-5R-98	5	122	134	4.8	5	6.0	67
18	BR10211-22-9-2_4	3	121	151	6.4	5.6	6.5	85
19	BR10211-22-9-2_1-P1	5	106	145	5.6	5.5	6.2	33

SL	Designation	PAcp	PH (cm)	GD (Days)	Yield (t/ha)			Survivability %
					Non stress	Farmers' field	Stress	
20	BINA dhan11 (Ck.)	7	105	120	4.0	4.0	4.4	74
21	BRRI dhan79 (Ck.)	5	113	139	5.7	5.2	5.2	69
22	BRRI dhan52 (Ck.)	5	123	141	5.3	5.0	5.6	89
23	BRRI dhan87 (Ck.)	9	108	130	5	3.0	0.4	1
24	BR23 (Ck.)	7	129	149	4.3		3.2	34
	P value	ns	**	***	**	ns	***	****
	Lsd (0.05)	2.8	16.9	5.7	0.4	2.1	0.5	5.1
	H2b	62	87	88	64	57	89	80

Experiment 3.21: Observational Yield Trial#3 (OYT#3_ AGGRi Network Trial)

Principal Investigator: Sharmistha Ghosal
Co-investigators: Anisar Rahman, MR Hasan, ZA Riyadh, S Maniruzzaman, M Faruquee, MM Ul Islam, MR Islam and KM Iftekharuddaula

Specific objective: Selection of materials with better phenotypic acceptance, homogeneity in the population, shorter growth duration, better survivability and higher yield potentials than the standard checks varieties in controlled submergence condition as well as under rainfed conditions.

Materials and Methods: A total of 54 advanced lines with ten national and global checks were evaluated using alpha lattice design with two replications in controlled stress condition at water tank. The trial conducted in two locations, one in controlled submergence tank and another trial under rainfed condition in Rangpur. Around 23 days old seedlings with single seedlings per hill were transplanted at a spacing of 20cm × 20cm in a 5.4 m × 4 rows plot. Fertilizers were applied following the experiment 14.1. Other cultural and pest management practices were done as and when necessary.

In case of controlled submergence screening, four lines of each entry (40 seedlings each) were transplanted in the tank following 20 cm × 20 cm spacing. The field layout was alpha lattice design with two replications. At the age of twenty-six days after transplanting, the lines were submerged with 1 meter of water depth for 16 days. Same basal doze of fertilizer of rainfed condition was applied during land preparation. First top dress of urea was done after 15-20 DAS and 2nd top dress of Urea and half MoP after 35-40 DAS. The survivability of the seedling was counted at 25 days after de submergence.

Results and Discussion: Based on stressed and non-stressed performance of the trials, a total of ten genotypes were selected out of 54 genotypes. The genotypes were selected depending on the growth duration, survivability, phenotypic acceptability and yield performance. The highest grain yield was produced by the genotype IR15F1887 (5.4 t/ha) with 116 days growth duration under rainfed condition, and in controlled stress condition also produce highest yield of (6.08 t/ha) with 49% survivability. The genotype IR20LT2385 produced 6.60 t/ha with growth duration of 124 days which was 8 days earlier than BRRI dhan52 with similar yield (6.69 t/ha) in controlled submergence tank. The heritability obtained from plant height, growth duration, survivality and grain yield were varied from 69% to 99%, indicating high precision of this experiment (**Table 27**).

Table 27: Performance of selected entries in Observational Yield Trial (OYT#3: AGGRi-Network Trial), Submergence & Medium Stagnant Tolerance Breeding, T. Aman, 2022

Ent No	Designation	Non-Stress condition				Stress condition		
		GD (days)	PAcp	PH (cm)	Yield (t/ha)	Survivality (%)	PAcp	Yield (t/ha)
1	IR15F1887	116	5	116	5.4	49	3	6.08
2	IR20LT2362	112	7	108	3.8	51	3	4.87

Ent No	Designation	Non-Stress condition				Stress condition		
		GD (days)	PAcp	PH (cm)	Yield (t/ha)	Survivality (%)	PAcp	Yield (t/ha)
3	IR19LT1767	106	5	104	5.4	26	5	1.02
4	IR20LT2229	104	7	114	4.5	0	-	-
5	IR19LT1738	100	7	107	3.6	59	5	4.63
6	IR20LT2245	112	7	136	3.1	45	5	5.37
7	IR20LT1998	113	5	110	5.4	59	5	6.44
8	IR20LT2385	124	5	111	4.5	74	3	6.60
9	IR20LT2294	113	5	113	5.0	0	-	-
10	IR20LT2572	111	5	116	5.2	16	7	1.10
11	IRRI 224	126	5	114	5.1	18	5	4.92
12	IR 42	131	7	110	4.0	7	6	1.06
13	Ciherang-Sub1	109	7	119	4.5	68	5	5.25
14	IRRI 119	124	5	124	5.4	55	5	6.28
15	Swarna-Sub1 (Ck.)	135	5	101	5.0	46	5	3.67
16	BRRI dhan79 (Ck.)	126	5	115	4.7	67	5	6.10
17	BRRI dhan52 (Ck.)	132	5	120	5.5	70	5	6.69
18	BINA dhan11 (Ck.)	115	6	114	4.8	48	5	3.66
	Lsd(0.05)	2.13	1.3	7.1	0.93	11.9	0.61	1.2
	H2b	99	77	93	74	69	53	93

Experiment 3.22: Preliminary Yield Trial (PYT)

Principal Investigator: Sharmistha Ghosal

Co-investigators: Anisar Rahman, MR Hasan ZA Riyadh, S Maniruzzaman and KM Iftekharuddaula

Specific objective: Preliminary evaluation of promising submergence tolerant breeding lines in replicated trial under controlled submerged condition, flood prone farmers' fields as well as under rainfed condition.

Materials and Methods: In total, 14 entries with four checks were evaluated in this trial. The trial conducted in 4 locations, one in controlled submergence tank and another one under rainfed condition in Gazipur and Rangpur and another two at flood prone farmers' field at Kurigram and Lalmonirhat. Twenty-five to thirty days old seedling with single seedlings per hill was transplanted at a spacing of 20 cm × 12 cm in a 5.4m × 6 rows plot. For rainfed trial, fertilizers were applied following the rate given in experiment 14.1. Crop management was done as recommended for modern rice cultivation for T. Aman season. Weeding and other cultural operations were done in time.

In case of controlled submergence screening, four extra lines of susceptible genotypes were transplanted at four places at the water tank for regular checking of imposed stress at different duration of submergence starting from 10 days after submergence. At twenty-one days after transplanting, the lines were submerged with 1 meter of water depth for 16 days. Same basal doze of fertilizer of rainfed condition was applied during land preparation. First top dress of urea was done after 15-20 DAS and 2nd top dress of Urea and half MoP after 35-40 DAS. The survivability of the seedling was counted at 20 days after de submergence. Under flash flood condition, first top dress of Urea was done at ten days after water recession and 2nd top dress of Urea and half MoP were applied after 20-25 days after water recession. Under flood prone farmers' field condition fertilizer management decisions were taken instantly depending on the natural submergence and de-submergence condition of the crop field following the management practice given for

controlled submergence condition. Pest management and other cultural operations were done as and when necessary.

Results and Discussion: Both the trials under farmers' field condition were received a low to moderate level of submergence (12 days at Kurigram and 7 days Lalmonirhat with a water depth 75-100 cm at vegetative stage). Eight genotypes were selected based on stressed and non-stressed performance of the trials. Among all entries, genotype BR12506-5R-83 and BR12506-5R-91 gave highest yield (6.7 t/ha) followed by BR12502-5R-275 (6.0 t/ha) in controlled stress condition with 90%-93% survivability. The genotype BR12506-5R-83 also gave significantly highest yield (6.0 t/ha) in flood prone farmers' fields. The growth duration of tested entries was ranged from 121 to 147 days. The heritability obtained from plant height, growth duration, survivability and grain yield were varied from 57% to 90%, indicating high precision of this experiment (**Table 28**).

Table 28: Performance of top-ranking entries in Preliminary Yield Trial#1 (PYT#Early), Submergence & Medium Stagnant Tolerance Breeding, T. Aman, 2022

Ent. No.	Designation	PAcp	PH (cm)	GD (days)	Yield (t/ha)			Survivability %
					Non Stress	Farmer s' field	Stress	
1	BR12487-5R-1	5	124	124	4.6	4.7	5.3	79
2	BR12487-5R-68	7	135	144	4.2	4.8	3.3	35
3	BR12489-5R-119	5	121	133	4.3	4.2	1.1	6
4	BR12489-5R-123	6	140	132	4.5	4.2	5.6	80
5	BR12489-5R-160	5	122	143	4.6	4.6	5.1	80
6	BR12493-5R-61	7	129	135	4.1	4.4	3.1	73
7	BR12493-5R-151	6	113	123	4.9	4.2	4.8	64
8	BR12502-5R-76	6	117	135	4.8	3.8	4.7	70
9	BR12502-5R-135	7	108	147	3.7	4.0	3.8	68
10	BR12502-5R-175	6	108	130	4.1	4.4	5.5	91
11	BR12502-5R-275	7	148	123	5.5	5.3	6.0	90
12	BR12502-5R-298	5	137	144	4.3	4.1	4.0	94
13	BR12506-5R-83	5	139	146	6.0	5.0	6.7	93
14	BR12506-5R-91	6	140	129	5.4	3.5	6.7	92
15	BINA dhan11 (Ck.)	6	101	121	4.4	3.3	4.2	94
16	BRRI dhan79 (Ck.)	6	112	142	4.4	4.8	5.9	92
17	BRRI dhan52 (Ck.)	5	136	147	5.1	4.7	6.1	93
18	BRRI dhan87 (Ck.)	5	117	127	5.5	3.7	0.6	1.0
	P Value	ns	***	***	**	***	***	***
	Lsd (0.05)		5.5	8.0	1.1	0.7	1.5	12.5
	H^2b		89	90	57	77	78	80

Experiment 3.23: Advanced Yield Trial#1 (AYT_Early)

Principal Investigator: Sharmistha Ghosal

Co-investigators: Anisar Rahman, MR Hasan ZA Riyadh, S Maniruzzaman and KM Iftekharuddaula

Specific objectives: Advanced evaluation of promising submergence tolerant breeding lines in replicated trial under controlled submerged condition, flood prone farmers' fields as well as under rainfed condition.

Materials and Methods: A total of 120 entries along with seven checks were evaluated in RCB design with two replications. The trial conducted in four locations, one in controlled submergence tank, one under rainfed condition in Rangpur and another two at flood prone farmers' field at Kurigram and Lalmonirhat. Twenty-five to thirty days old seedling with single seedlings per hill was transplanted at a spacing of 20 cm × 20 cm in a 5.4m × 8 rows plot. For

rainfed trial, fertilizers were applied following the rate given in experiment 14.1. Crop management was done as recommended for modern rice cultivation for T. Aman season. Weeding and other cultural operations were done in time.

In case of controlled submergence screening, four extra lines of susceptible genotypes were transplanted at four places at the water tank for regular checking of imposed stress at different duration of submergence starting from 10 days after submergence. At twenty-one days after transplanting, the lines were submerged with 1 meter of water depth for 16 days. Same basal doze of fertilizer of rainfed condition was applied during land preparation. First top dress of urea was done after 10-15 days after de-submergence and 2nd top dress of Urea and half MoP after 30-35 after de-submergence. The survivability of the seedling was counted at 10-15 days after de submergence. Under flash flood condition, first top dress of Urea was done at ten days after water recession and 2nd top dress of Urea and half MoP were applied after 20-25 days after water recession. Under flood prone farmers' field condition fertilizer management decisions were taken instantly depending on the natural submergence and de-submergence condition of the crop field following the management practice given for controlled submergence condition. Pest management and other cultural operations were done as and when necessary.

Results and Discussion: Both the trials under farmers' field condition were received a low to moderate level of submergence (12 days at Kurigram and 7 days Lalmonirhat with a water depth 75-100cm at vegetative stage). Based on stressed and non-stressed performance of the trials, a total of eleven genotypes were selected based on the higher survivability and higher yield. The genotype IR19A1473 gave the highest yield (6.0 t/ha) both in rainfed and farmers field condition with a growth duration of 119 days only. The genotype BR11196-5R-5 and BR11196-5R-445 produced similar highest yield of 7.10 t/ha under controlled submergence condition with the 88% and 66% survivability respectively, followed by the genotype IR15F1886 (7.0 t/ha) with 95% survivability. The heritability obtained for survivability (tank), plant height, growth duration, grain yield (rainfed), grain yield (farmers' field) and yield (tank) were 88%, 55%, 76%, 47%, 49% and 89%, indicating high level of precision of this experiment **(Table 29)**.

Table 29: Performance of top-ranking entries in Advance Yield Trial#1 (AYT#1_Early), Submergence & Medium Stagnant Tolerance Breeding, T. Aman, 2022

SL No	Designation	PH (cm)	PAcp	GD (days)	Yield(t/ha)			Survivability %
					Non stress	Farmers Field	Stress	
1	IR19A1862	121	5	131	5.40	5.40	6.60	88
2	IR18T1275	114	5	126	5.00	4.99	6.75	90
3	IR16F1243	137	5	131	5.60	5.09	6.90	86
4	IR14T156	119	5	128	5.60	5.61	6.10	64
5	IR19A6666	102	7	124	4.45	4.45	5.70	72
6	IR19A1473	114	5	119	6.00	6.02	6.50	68
7	IR19A1472	118	5	119	5.20	5.20	6.45	84
8	IR18A2495	113	5	123	4.75	4.75	6.40	80
9	IR18A2496	106	6	115	4.60	4.62	5.90	73
10	IR 87959-6-2-3-1-2-BAY B-CMU 1	111	5	125	5.20	5.23	6.10	81
11	IR15F1745	114	6	125	5.10	5.10	6.10	79
12	IR15F1754	103	5	124	4.20	4.20	5.60	71
13	IR16F1065	144	5	142	4.90	4.88	6.75	75
14	IR15F1869	126	5	124	5.40	5.39	5.80	67
15	SV1179	124	5	128	5.50	5.49	6.60	95
16	SV1171	127	6	123	4.10	4.08	5.90	78
17	IR17D1089	125	5	122	4.45	4.45	6.50	68
18	IR18L1148	127	6	124	5.85	5.83	5.40	74
19	IR15F1886	112	5	123	5.25	5.24	7.00	95

SL No	Designation	PH (cm)	PAcp	GD (days)	Yield(t/ha)			Survivability %
					Non stress	Farmers Field	Stress	
20	IR15D1046	121	5	128	5.40	5.40	6.55	88
21	IR19L1046 a	120	5	126	5.35	5.35	4.40	63
22	IR18R1073 a	95	5	117	4.25	4.23	4.65	58
23	IR15A4029	121	5	131	4.85	4.84	5.60	81
24	IR17D1096	116	5	116	5.00	5.02	6.10	81
25	IR17D1067	113	5	124	4.50	4.52	6.80	60
26	IR18T1340	115	5	138	5.40	5.41	6.50	80
27	BR12154-5R-184	146	5	138	5.40	5.37	6.95	70
28	BR12162-5R-350-3	134	5	120	5.50	5.52	6.95	85
29	BR11692-5R-345	122	5	121	5.25	5.22	6.70	79
30	BR11694-5R-339	125	7	118	5.00	4.98	5.10	83
31	BR11694-5R-101	116	5	123	3.95	3.97	6.70	92
32	BR11196-5R-445	121	5	120	3.60	3.59	7.10	66
33	BR11196-5R-5	133	3	147	4.25	4.26	7.10	88
34	BR10212-10-4-1	107	5	130	4.60	4.59	6.25	93
35	IR 126968-B-23-2-1-3	111	5	145	5.80	5.79	6.15	73
36	SVIN147_WS20-FP-15	127	5	114	4.45	4.71	5.75	68
37	IR19L1016	124	5	130	4.20	4.76	5.50	83
38	IR16F1033	117	6	125	4.00	4.02	5.75	92
39	IR13F652-1-PS2	122	5	119	4.05	4.90	6.85	84
40	BR11196-5R-138	133	6	125	4.55	4.57	5.70	26
41	BR11196-5R-83	128	6	131	3.70	4.35	5.75	26
42	BINA dhan11 (Ck.)	112	6	121	4.25	4.24	5.05	82
43	BRRI dhan79 (Ck.)	107	6	141	5.75	5.70	5.70	85
44	BRRI dhan52 (Ck.)	118	7	141	5.69	5.67	6.45	85
45	BRRI dhan71 (Ck.)	122	9	119	4.85	4.87	0.70	6
46	BRRI dhan75 (Ck.)	102	9	114	3.25	3.25	1.05	16
47	BRRI dhan95 (Ck.)	133	9	141	4.90	4.89	1.25	6
48	BRRI dhan87 (Ck.)	121	9	128	5.15	5.12	0.10	5
	P Value	***	***	***	***	***	***	***
	H^2 (%)	55	68	76	47	49	89	88
	LSD (0.05)	16.4	1.1	6.9	1.0	1.1	0.9	20.1

Experiment 3.24: Advanced Yield Trial#2 (AYT#2_Late)

Principal Investigator: Sharmistha Ghosal

Co-investigators: Anisar Rahman, MR Hasan Z A Riyadh, S Maniruzzaman and KM Iftekharuddaula

Specific objectives: Advanced evaluation of promising submergence tolerant breeding lines in replicated trial under controlled submerged condition, flood prone farmers' fields as well as under rainfed condition.

Materials and Methods: In total, 35 entries with five checks were evaluated were evaluated in RCB design with two replications. The trial conducted in four locations, one in controlled submergence tank, one under rainfed condition in Rangpur and another two at flood prone farmers' field at Kurigram and Lalmonirhat. Twenty-five to thirty days old seedling with single seedlings per hill was transplanted at a spacing of 20 cm × 15cm in a 5.4m × 8 rows plot. For rainfed trial, fertilizers were applied following the rate given in experiment 14.1. Crop management was done as recommended for modern rice cultivation for T. Aman season. Weeding and other cultural operations were done in time.

In case of controlled submergence screening, four extra lines of susceptible genotypes were transplanted at four places at the water tank for regular checking of imposed stress at different

duration of submergence starting from 10 days after submergence. At twenty-one days after transplanting, the lines were submerged with 1 meter of water depth for 16 days. Same basal doze of fertilizer of rainfed condition was applied during land preparation. First top dress of urea was done after 10-15 days after de-submergence and 2nd top dress of Urea and half MoP after 30-35 after de-submergence. The survivability of the seedling was counted at 10-15 days after de submergence. Under flash flood condition, first top dress of Urea was done at ten days after water recession and 2nd top dress of Urea and half MoP were applied after 20-25 days after water recession. Under flood prone farmers' field condition fertilizer management decisions were taken instantly depending on the natural submergence and de-submergence condition of the crop field following the management practice given for controlled submergence condition. Pest management and other cultural operations were done as and when necessary.

Results and Discussion: Both the trials under farmers' field condition were received a low to moderate level of submergence (12 days at Kurigram and 7 days Lalmonirhat with a water depth 75-100cm at vegetative stage). Based on stressed and non-stressed performance of the trials, a total of 17 genotypes were selected considering higher survivability and higher yield. The genotype IR13F582 produced highest yield under all the environment evaluated. Under rainfed condition, it produced 5.9 t/ha with 131 days growth duration, under controlled stress condition, it produced yield of 7.2 t/ha with 89% survivability whereas under farmers' field condition it produced 6.8 t/ha. The yield range of other selected genotypes were 4.4 t/ha to 7.1 t/ha under controlled submergence condition, 4.3 t/ha to 6.7 t/ha under farmers field condition and 3.7 to 5.8 t/ha at rainfed condition. Under rainfed condition the yield performance was lower this is because the trial of BRRI, Gazipur was affected by storm. The heritability of all observed parameters was ranged from 67% to 93%, which indicated high level of precision of this experiment (**Table 30**).

Table 30: Performance of top-ranking entries in Advance Yield Trial#2 (AYT#Late), Submergence & Medium Stagnant Tolerance Breeding, T. Aman, 2022

Ent No	Designation	PHt. (cm)	GD (days)	PAcp	Yield (t/ha)			Survivability%
					Non stress	Farmers field	Stress	
1	IR13F582	116	131	3	5.9	6.8	7.2	89
2	IR13F652-1-P3	122	150	3	4.9	5.6	6.4	90
3	IR16F1097-P1	136	148	7	4.6	6.7	6.2	82
4	BR12162-5R-149	137	145	5	5.8	5.0	5.9	84
5	BR11686-5R-173	123	143	7	3.7	4.5	5.9	82
6	BR11196-5R-187	117	146	5	5.1	5.6	6.0	83
7	BR11196-5R-595	110	133	5	4.1	5.0	5.9	85
8	BR11690-5R-56	118	134	7	4.2	5.6	5.4	70
9	BR11690-5R-187	105	142	7	3.4	4.7	5.3	66
10	BR11690-5R-289-P1	132	133	5	-	4.6	6.2	82
11	BR11692-5R-297	130	133	5	5.8	6.1	5.7	78
12	BR10210-4-5-5	115	143	7	5.0	5.5	5.3	78
13	BR12154-5R-10	119	156	7	4.4	4.3	5.5	65
14	BR12154-5R-31	126	139	7	3.2	5.0	4.4	31
15	BR12154-5R-258-P1	122	149	7	5.3	6.2	5.4	86
16	BR12154-5R-7-2	130	145	3	5.4	6.5	6.5	86
17	BR12154-5R-219	118	152	5	5.6	5.9	6.0	74
18	BR12154-5R-219-PS1	127	153	7	3.6	6.6	6.0	69
19	BR12154-5R-371	143	157	7	3.2	4.5	5.6	49

Ent No	Designation	PHt. (cm)	GD (days)	PAcp	Yield (t/ha)			Survivability%
					Non stress	Farmers field	Stress	
20	BR10211-1-1-1-PS2	130	156	7	-	5.0	5.8	70
21	BR10211-1-2-4	130	147	7	3.9	4.9	5.7	79
22	BR10211-22-9-2_1	116	140	5	3.9	5.9	3.7	48
23	BR10211-22-9-2_1-early	115	139	5	5.7	5.7	6.1	76
24	BR10211-22-9-2_4	118	154	5	5.7	6.3	6.0	69
25	BR10212-5-5-3	133	139	5	5.4	6.6	6.6	72
26	IR16F1097	133	146	5	5.3	6.7	6.8	71
27	IR93339129-B-7-7-B-B-B-16	134	134	3	5.2	5.5	7.1	84
28	BR10212-20-1-3	117	141	5	5.4	5.5	7.1	86
29	SVIN150_WS20-FP-15	115	142	7	4.1	5.6	5.7	89
30	IR13F478-3	125	134	5	5.2	5.4	6.3	88
31	IR108042-B-B-B-4-B-B	137	143	5	5.3	5.6	6.2	86
32	BR11196-5R-38	129	140	5	5.5	6.1	6.3	85
33	IR13F652-1-P3	124	146	5	5.4	5.3	6.3	87
34	BR11185-5R-569-3	109	146	7	5.6	4.7	5.5	80
35	BR11686-5R-11	116	150	7	4.5	4.3	6.3	78
36	BRRI dhan79 (Ck.)	123	141	5	5.3	5.4	6.6	81
37	BRRI dhan52 (Ck.)	115	145	5	4.9	5.1	6.5	85
38	BRRI dhan94 (Ck.)	110	145	9	3.0	5.2	1.1	7
39	BRRI dhan87 (Ck.)	119	126	9	1.9	5.1	0.0	2
40	BR23 (Ck.)	127	149	9	2.3	4.4	1.5	14
	P Value	***	****	****	****	***	****	****
	Lsd (0.05)	7.4	5.3	1.2	1.1	1	0.5	10.5
	H^2b	77	93	89	88	67	82	84

Experiment 3.25: Participatory Variety Selection (PVS)

Principal Investigator: Sharmistha Ghosal

Co-investigators: Anisar Rahman, MR Hasan ZA Riyadh, S Maniruzzaman and KM Iftekharuddaula

Objective: Regional yield evaluation and adaptation of promising submergence tolerant breeding lines in replicated trial under controlled submerged condition, flood prone farmers' fields condition as well as under rainfed condition.

Materials and Methods: Ten submergence tolerant high yielding advanced genotypes along with four standard check varieties having submergence tolerance were evaluated in rainfed, controlled on-station and natural flash flooding conditions. The experiment was laid out in RCB design with three replications in 6 locations including one in controlled submergence tank, one in on-station rainfed condition, and four in flash flood prone farmers' fields (Kurigram, Lalmonirhat, Gangachara, and Jalalgonj). The seedbed management was done in order to raise healthy seedlings. Twenty-five to thirty days old seedlings were transplanted using 2-3 seedlings per hill with the spacing of 20cm × 20cm. The unit plot size was 5.4 m ×10 rows. Under rainfed condition, fertilizers were applied at the rate of 200 kg urea, 70 kg TSP, 100 kg MoP, 70 kg gypsum and 6 kg zinc sulphate. Total amount of TSP, gypsum and two-third MoP were applied at the time of final

land preparation. Total amount of zinc sulphate was applied at first top dressing. Urea was applied in equal three splits at 10, 25 and 40 days after transplanting. Rest of the one-third MoP was applied during second top-dressing of urea. Other cultural and pest management practices were done as and when necessary.

In case of controlled submergence screening, four extra lines of susceptible genotypes were transplanted at four places at the water tank for regular checking of imposed stress at different duration of submergence starting from 10 days after submergence. At twenty-one days after transplanting, the trial was submerged with 1 meter depth of water for 16 days. Same basal doze of fertilizer of rainfed condition was applied during land preparation. First top dress of urea was done after 10-15 days after de-submergence and 2nd top dress of Urea and half MoP after 30-35 after de-submergence. The survivability of the seedling was counted at 10-15 days after de submergence. Under flash flood condition, first top dress of Urea was done at ten days after water recession and 2nd top dress of Urea and half MoP were applied after 20-25 days after water recession. Under flood prone farmers' field condition fertilizer management decisions were taken instantly depending on the natural submergence and de-submergence condition of the crop field following the management practice given for controlled submergence condition. Pest management and other cultural operations were done as and when necessary.

Results and Discussion: Though the trial was conducted in four locations in submergence prone farmer's field in Rangpur, Kurigram and Lalmonirhat district, there was no flood in one location at Jalalgonj, Rangpur. The trial in Kurigram submerged for 12 days, in Lalmonirhat the trial submerged for seven days and the trial of Gangachara submerged for ten days with a water depth of 75-100 cm. Based on stressed and non-stressed performance of the trials one genotype was selected. The genotype BR10211-22-9-2_3 showed more stable performances over all the locations, and produced the highest average yield of 5.6 t/ha, whereas the best check variety BRRI dhan52 gave an average yield of 5.0 t/ha. The Survivability of the selected line was 83% under controlled submergence condition and the growth duration was 137 days under rainfed condition. The plant type of the selected genotype was also stronger with medium plant height. The heritability of all observed parameters was ranged from 67% to 93%, which indicated high level of precision of this experiment (**Table 31**).

Table 31: Performance of entries in Participatory Variety Selection (PVS), Breeding for Submergence and Stagnant water tolerance, T. Aman, 2022

Ent No	Designation	PH (cm)	PA cp	GD (days)	Yield(t/ha)						Yield average	Surviv ability%
					Gaz	Rang	Kuri	Ganga	Jalal	Stress		
1	BR11693-5R-274	136	7	121	3.1	5.2	2.7	3.9	6.5	6.5	4.7	71
2	IR16F1063-P1	128	5	119	4.1	5.3	4.8	4.2	5.7	6.1	5.0	94
3	IR16F1063-P2	123	6	115	4.3	5.1	4.7	3.6	5.7	6.1	4.9	87
4	IR16F1081	128	5	116	3.9	4.0	4.7	3.7	5.1	6.2	4.6	77
5	BR11686-5R-179	131	7	129	4.0	5.0	5.1	5.0	5.0	5.5	4.9	68
6	BR10211-22-9-2_3	123	5	137	4.9	6.0	5.5	5.0	6.2	5.9	5.6	83
7	BR10211-5-5-7	133	6	131	2.3	6.8	4.4	3.7	5.3	6.9	4.9	80
8	BR10211-7-5-1	136	6	137	3.2	6.5	4.0	2.1	4.5	7.2	4.6	85
9	BR9793-13-2-1	131	7	132	3.2	3.9	3.0	3.0	3.8	4.9	3.6	56
10	IR16F1201	133	5	129	3.5	3.3	0.6	4.3	5.0	5.8	3.8	74
11	BINA dhan11(Ck.)	118	6	114	3.6	4.2	4.5	2.3	5.0	4.8	4.1	78
12	BRRI dhan79 (Ck.)	128	7	128	3.9	4.3	4.5	4.0	5.6	5.6	4.7	77
13	BRRI dhan52 (Ck.)	130	5	130	3.9	5.2	4.9	4.3	5.6	5.8	5.0	75
14	BR23 (Ck.)	138		148	2.5	3.2	4.1	0.0	0.0	0.0	2.0	0.0
	P Value	***	**	****	**	***	**	***	***	***	***	***
	Lsd (0.05)	6.5	1.4	3.5	0.6	0.8	0.52	0.71	0.50	0.64	0.60	12.5
	H^2b	79	59	90	73	77	83	89	84	87	44	82

Experiment 3.26: Proposed Variety Trial (PVT)

Principal Investigator: Sharmistha Ghosal
Co-investigators: Anisar Rahman, MR Hasan ZA Riyadh, S Maniruzzaman and KM Iftekharuddaula

Specific objectives: Evaluation of advanced submergence tolerant breeding line in the real flood prone environments in the farmers' field and under controlled submergence with standard checks by NSB team for release as a new variety.

Materials and methods: The submergence tolerant genotype IR16F1148 were evaluated with one submergence tolerant check variety BINA dhan11 in PVT at three locations in Rangpur region. Around 25-30 days old seedlings were transplanted @ 2-3 seedlings per hill at a spacing of 20 x 15 cm. The unit plot size was 20 square meters (4m × 5m; 20 rows @34 hills per row) and the field layout was RCB Design with three replications. Fertilizers was applied @200 kg Urea, 70 kg TSP, 100 kg MP, 70 kg Gypsum, 6 kg $ZnSO_4$. One third urea, half MoP and all other fertilizers were applied as basal. First top dress of urea was done after 10-15 days after de-submergence and 2nd top dress of Urea and half MoP after 30-35 after de-submergence. The survivability of the seedling was counted at 10-15 days after de submergence. Under flash flood condition, first top dress of Urea was done 7 to 10 days after water recession and 2nd top dress of Urea and half MoP was applied after 20-25 days after water recession. Fertilizer doses and application date may be changed depending upon AEZ, soil fertility, soil texture and flooding time. Under flood prone farmers' field condition fertilizer management decisions had to be taken instantly depending on the natural submergence and de-submergence condition of the crop field following the management practice given for controlled submergence condition. Pest management and other cultural operations were done as and when necessary.

Results and Discussion: Though the trial was conducted in three flood prone sites of farmer's field in Rangpur, Kurigram and Lalmonirhat, there was no flood in two locations i.e. Kodalkhata-Lalmonirhat and Jalalgonj-Mithapukur. Only in Kurigram the trial submerged for 12 days with a water depth of 75-100 cm. The line IR16F1148 produced significantly higher yield in every location. In natural flooded condition at Kurigram the line produced 37.4% higher yield than standard check variety (**Table 32**). In average, the proposed line produced 5.28 t/ha yield, in contrast the check variety produced only 4.48 t/ha only. Though the proposed line produced 17.9% higher yield than check variety, the line was recommended for Re-PVT due to lesser exposure to natural flood (only in a single site).

Table 32: Performance of the line IR13F1148 in Proposed Variety Trial (PVT), Development of Submergence and water Stagnation tolerant Rice, T Aman 2022

SL	Region	Trial Location	Duration (days)		Yield (t/ha)		% Yield advantage	Remarks
			IR16F1148 (Proposed variety)	BINA dhan11 (Check variety)	IR16F1148 (Proposed variety)	BINA dhan11 (Check variety)		
1.	Rangpur	Mithapukur, Rangpur	124	121	6.65	5.95	11.76	No flood
2.		Sadar, Kurigram	124	121	4.93	3.56	38.48	Flood for 12 days
3.		Mogalhat, Lalmonirhat	122	119	5.47	5.03	8.75	No flood
		Mean	**125**	**121**	**5.26**	**4.48**	**18.29**	

Program 3: Development of drought tolerant rice (DTR)

The aim of the project is to develop drought tolerant with shorter growth duration (≤ 125 days) and high yielding (≥4.5 t/ha) T. Aman rice varieties for drought prone area of Bangladesh with better phenotypic acceptance and grain quality.
Program leader: MA Kader

Experiment 3.27: Observational Yield Trial (OYT)
Principal investigator: MA Kader
Investigators: Anisar Rahman, MR Hasan, TK Hore & RR Mazumdar

Materials and Methods: A total of 659 fixed lines from previous LST trial with dour the standard checks BRRI dhan49, BRRI dhan56 BRRI dhan57 and BRRI dhan71 were tested by following non-replicated Augmented RCB design in three OYT trial and RCB design for AYT trials in Barabari, Lalmonirhat. In OYT#1, 245 lines (GD: 100-120 days) along with BRRI dhan56 and BRRI dhan57 in OYT#2, 375 lines (GD: 121-140 days) with BRRI dhan56 and BRRI dhan71 were evaluated. Thirty days old seedlings were transplanted in a 5.4 m × 3 rows at spacing of 20 cm × 15 cm in the field. Single seedling was used for transplanting. Fertilizers @108 (234 Kg Urea): 17.4 (87 Kg TSP): 58.5 (117 Kg MP): 14 (78 Kg Gypsum): 4.3 (12 Kg Zn SO_4) Kg NPKSZn/ha were applied in the trial. All amounts of P, K, S and Zn were applied at the time of final land preparation and nitrogen was applied at three equal splits at 5-10, 20- 25 and 35- 40 days after transplanting (DAT). Crop management such as weeding, irrigation etc. were done in time. Insects, diseases and other pests will be controlled properly.During panicle initiation (PI) to hard dough stage there was no rainfall and supplementary irrigation. As a result the underground water table was below 200cm which is extreme condition for evaluating drought stress tolerant material.

Results and Discussion:
In OYT-1 (Growth duration: 100-120 days) trial, 45 advanced lines were selected among 245 fixed lines based on phenotypic acceptance, plant height, response to drought stress, growth duration and grain yield. Advanced line BR11788-5R-64 gave 6.11 t/ha grain yield with 111 days growth duration whereas BRRI dhan71 gave 5.534 t/ha grain yield **(Table 33)**. During panicle initiation (PI) to hard dough stage there was no rainfall and supplementary irrigation. As a result the underground water table was below 100 cm which is ideal condition for evaluating drought stress tolerant material **(Fig. 7)**.

In OYT-2 (Growth duration: 121-140 days) trial, 38 advanced lines were selected among 375 fixed lines based on phenotypic acceptance, plant height, response to drought stress, growth duration and grain yield. Advanced breeding lines BR11771-5R-42 gave 7.65 t/ha grain yield with 129 days growth durations. Whereas best performing check BRRI dhan71 gave 6.56 t/ha grain yield with 115 days growth durations **(Table 34)**.

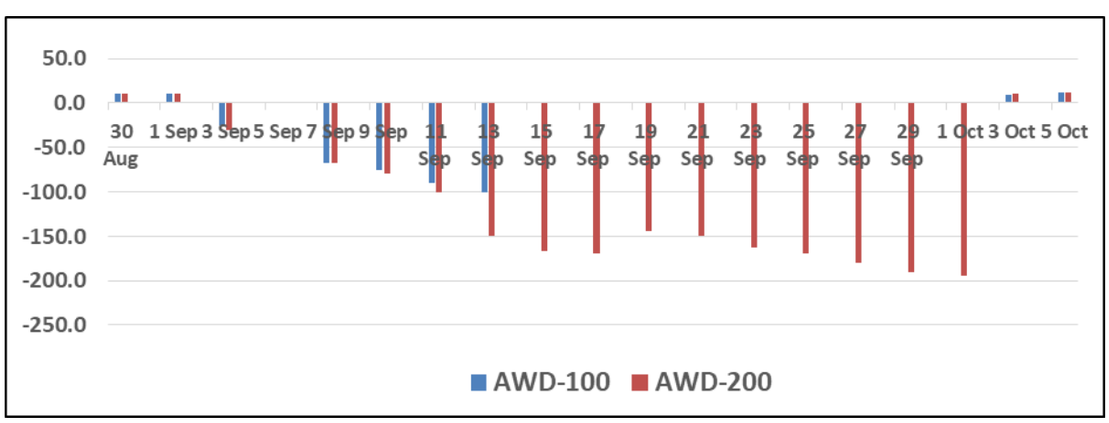

Fig.7: Underground water level in DTR, TRB experiment at Lohakuchi, Lalmonirhat during 01 August, 2022 to 10 October, 2022

Table 33: Performance of observational yield trial (OYT#1) for DTR under natural stress condition, T. Aman, 2022

Entry No	Designation	Days to maturity (80%)	Days to flowering (50%)	Plant height (cm)	PAcp (M)	Grain yield (t/ha)
1	BR12023-6R-52	118	91	107	3	3.54
2	BR12023-6R-88	118	91	111	5	3.60
3	BR12022-6R-164	117	89	107	7	3.73
4	BR12023-6R-102	116	88	117	5	3.41
5	BR12023-6R-115	117	91	112	5	3.48
6	BR12023-6R-147	117	91	115	7	3.04
7	BR12023-6R-85	116	88	111	3	3.19
8	BR12022-6R-5	116	88	111	9	3.04
9	BR12023-6R-1	116	88	108	7	3.44
10	BR12023-6R-89	117	90	111	3	3.73
11	BR12022-6R-48	116	88	111	5	3.47
12	BR12022-6R-15	116	88	111	7	3.23
13	BR12023-6R-80	117	91	105	3	2.91
14	BR12023-6R-63	117	91	107	3	3.42
15	BR12023-6R-53	117	90	108	5	3.29
16	BR12023-6R-113	116	88	107	3	3.60
17	BR12023-6R-81	116	90	109	5	3.22
18	BR12023-6R-30	116	88	109	3	3.52
19	BR12023-6R-5	116	89	103	5	3.36
20	BR12023-6R-79	116	90	110	7	3.31
21	BR12023-6R-107	116	88	109	5	3.45
22	BR12023-6R-111	116	89	108	3	3.39
23	BR12023-6R-86	116	88	102	7	2.85
24	BR12023-6R-93	116	88	114	5	3.30
25	BR12022-6R-138	116	88	99	7	3.02
26	BR12023-6R-4	118	91	107	5	3.25
27	BR12023-6R-67	119	93	111	3	3.61
28	BR12022-6R-71	116	88	100	5	4.02
29	BR12023-6R-49	119	92	106	5	3.21
30	BR12023-6R-70	115	87	115	7	3.29
31	BRRI dhan56 (Ck.)	115	87	109	7	3.04
32	BRRI dhan71 (Ck.)	117	90	114	3	3.77
	CV (%)	2.132	2.595	11.599	2.175	0.660
	Lsd (0.05)	0.374	0.455	2.033	0.381	0.116
	H2b	0.63	0.77	0.45	0.98	0.51

Table 34: Performance of best performing 80 genotypes in observational yield trial (OYT#2) for DTR under natural stress condition, T. Aman, 2022

Entry	Designation	Days to Maturity (80%)	Days to flowering (50%)	Plant height (cm)	PAcp (M)	Grain yield (t/ha)
2	BR11246-6R-222	119	92	128.6	5	3.41
7	BR11249-6R-259	117	90	118.0	3	4.72
10	BR12012-6R-25	136	103	102.2	7	3.62
14	BR11248-6R-150	117	90	122.8	5	3.07
16	BR11257-6R-116	136	104	115.2	7	3.03
19	BR11257-6R-117	134	102	128.4	5	3.87
23	IR124296-6R-10	129	101	123.4	3	4.93
34	BR11730-6R-1	120	94	126.8	5	3.23
36	IR124296-6R-141	131	103	123.8	7	3.15
45	BR11250-6R-28	120	91	128.0	5	5.98

47	BR12022-6R-93	116	90	124.8	3	3.13
51	BR11254-6R-63	121	91	112.2	3	3.27
55	BR11254-6R-169	120	93	124.4	3	4.63
78	BR11246-6R-121	124	96	143.0	7	4.57
79	BR12022-6R-70	117	90	134.6	1	4.40
99	BR12022-6R-76	115	88	120.0	7	3.06
101	BR12012-6R-42	119	92	113.6	5	3.71
109	BR10727-6R-4	128	100	112.2	7	3.08
111	BR11730-6R-8	117	91	123.4	1	3.14
119	BR11244-6R-50	126	96	125.2	7	3.15
128	BR11728-6R-90	126	97	133.0	3	3.36
134	BR12022-6R-40	119	92	128.8	3	4.02
144	BR11254-6R-111	120	94	105.6	5	3.66
146	IR124292-6R-3	140	109	114.8	5	3.13
151	BR12016-6R-151	119	91	141.2	7	3.57
154	BR12016-6R-14	139	108	137.2	7	3.08
161	BR10727-6R-46	120	93	118.2	9	3.02
184	BR10734-6R-52	119	93	133.0	7	3.57
193	BR11730-6R-26	119	92	123.2	3	3.06
196	BR12017-6R-86	136	104	107.4	5	3.01
198	BR12016-6R-208	118	91	124.8	3	3.69
199	BR12015-6R-41	140	109	139.0	7	4.16
204	BR11728-6R-63	141	110	110.2	7	3.32
211	BR12024-6R-97	127	99	118.6	5	3.45
214	BR11246-6R-185	119	92	137.2	3	3.58
229	BR11249-6R-256	118	91	106.4	3	3.09
231	BR12024-6R-78	136	105	123.6	3	3.86
234	BR10734-6R-13	140	108	144.0	7	3.06
244	BR11248-6R-212	117	90	133.4	5	3.56
254	BR11248-6R-18	130	103	143.2	5	3.27
258	IR124296-6R-31	128	101	119.8	3	3.55
263	BR11729-6R-130	127	98	116.0	3	5.33
279	BR12012-6R-132	119	93	115.6	7	5.93
286	BR12013-6R-178	136	105	106.0	5	3.33
298	BR11256-6R-142	125	97	111.6	5	3.17
299	BR11245-6R-124	115	88	107.8	7	3.57
302	IR124293-6R-134	131	104	118.6	3	4.00
309	BR11253-6R-34	121	95	108.4	5	3.48
310	BR11256-6R-102	129	102	142.0	9	3.22
311	IR124296-6R-7	129	101	116.4	7	3.46
315	IR124296-6R-163	131	102	114.2	5	3.53
320	BR12024-6R-112	141	108	125.4	7	4.18
327	BR12024-6R-40	127	99	137.4	1	4.00
332	BR12017-6R-193	135	104	125.8	3	4.60
340	BR11253-6R-230	119	93	115.0	3	3.93
343	BR11248-6R-143	118	92	125.8	7	3.47
348	BR12012-6R-51	137	106	116.0	7	3.19
352	IR124294-6R-72	135	103	115.0	1	4.64
357	BR12022-6R-139	117	90	129.6	5	3.03
368	BR10734-6R-88	136	105	125.6	7	3.01
373	BR12019-6R-57	119	93	132.0	5	3.68
383	BR11250-6R-72	120	95	107.2	5	3.04
386	BR11246-6R-67	141	111	114.2	3	5.15
387	BR11244-6R-28	124	97	124.6	7	3.88
393	BR11254-6R-44	120	93	125.8	1	3.30
395	BR12023-6R-140	117	89	111.8	5	3.32
396	IR124294-6R-130	118	91	123.0	7	3.26
414	BR11251-6R-74	118	91	132.4	5	3.18
416	BR11255-6R-113	120	95	123.2	5	3.44

418	BR12016-6R-183	118	91	107.8	5	3.86
421	BR12016-6R-111	139	106	143.4	5	3.47
428	BR12012-6R-152	131	102	101.2	7	3.06
429	IR124296-6R-30	129	102	122.4	3	4.20
431	BR11249-6R-17	120	91	141.8	7	3.20
437	BR11248-6R-121	131	103	128.8	5	3.48
445	IR124294-6R-86	128	100	115.4	5	3.14
446	BR12016-6R-145	118	91	134.8	3	4.81
453	IR124294-6R-2	134	102	114.8	5	3.54
456	BR11251-6R-10	136	110	125.2	5	3.74
462	IR124296-6R-238	124	96	118.4	3	4.38
470	BR12024-6R-95	131	100	138.8	5	3.14
check1	BRRI dhan71 (Ck.)	115	87	119.4	5	5.34
check2	BRRI dhan56 (Ck.)	118	91	115.0	5	4.46
	CV (%)	1.839	1.512	2.699	0.335	0.184
	Lsd (0.05)	0.802	0.659	1.177	0.146	0.080
	H2b	0.97	0.98	0.72	0.64	0.45

Program 4: Development of Rainfed Lowland Rice (RLR) for T. Aman

The aim of the project is to develop Favorable rice variety for T. Aman season with shorter growth duration (≤ 130 days) and high yielding potential (≥ 6.5 t/ha), better phenotypic acceptance and grain quality.

Program Leader: Dr. Md. Abdul Kader

Experiment 3.28: Observational Yield Trial (OYT)

Principal investigator: MA Kader

Investigators: Anisar Rahman, MR Hasan, TK Hore & RR Mazumdar

Materials and Methods:

A total of 575 fixed lines from previous LST and OYT trial with six standard checks BRRI dhan49, BRRI dhan57 and BRRI dhan62, BRRI dhan71, BRRI dhan75 and BRRI dhan87 were tested by following non-replicated Augmented RCB design in two OYT trial (OYT#1 and OYT#2) RCB design in AYT trial.

In OYT-1 (GD: 94-120 days) trial, 227 lines along with two check variety BRRI dhan57 and BRRI dhan62 and In OYT-2 trial (GD: 121-140 days), 290 lines with BRRI dhan57 and BRRI dhan71 were evaluated under favorable rainfed condition. For each trial, thirty days old seedlings were transplanted in a 5.4 m × 4 rows at spacing of 20 cm × 15 cm in the field. Single seedlings were used for transplanting. Fertilizers @108 (234 Kg Urea): 17.4 (87 Kg TSP): 58.5 (117 Kg MP): 14 (78 Kg Gypsum): 4.3 (12 Kg Zn SO_4) Kg NPKSZn/ha were applied in the trial. All amounts of P, K, S and Zn were applied at the time of final land preparation and nitrogen was applied at three equal splits at 5-10, 20- 25 and 35- 40 days after transplanting (DAT). Crop management such as weeding, irrigation etc. was done in time. Insects, diseases and other pests will be controlled properly.

Results and Discussion: In OYT-1 (GD: 94-120 days) trial, 20 advanced lines were selected among 227 fixed lines based on phenotypic acceptance, plant height, response to drought stress, growth duration and grain yield. The yield and growth duration range of this trial were 0.45-7.63 t/ha and 96-132 days respectively. Advanced line BR12628-5R-184 gave 7.63 t/ha grain yield with 110 days growth durations. Whereas best performing check variety BRRI dhan87 gave 6.09 t/ha grain yield with 122 days growth durations **(Table 35)**.

In OYT-2 trial (GD: 121-140 days), 16 advanced lines were selected among 290 fixed lines based on phenotypic acceptance, plant height, response to drought stress, growth duration and grain yield. The yield and growth duration range of this trial were 0.818-7.92 t/ha and 99-143 days respectively. Advanced line BR12305-5R-107 gave 7.92 t/ha grain yield with 130 days growth durations. Whereas best performing check variety BRRI dhan71 gave 5.42 t/ha grain yield with 114 days growth durations **(Table 36)**.

Table 35: Performance of genotypes in observational yield trial (OYT#1, GD: 94-120 days) for RLR, T. Aman, 2022

Entry No	Designation	Days to maturity (80%)	Days to flowering (50%)	Plant height (cm)	PAcp (M)	Grain yield (t/ha)
1	BR12662-4R-11	111	83	97	5	5.29
2	BR12662-4R-163	114	84	117	7	5.17
3	BR12665-4R-18	105	77	115	5	5.95
4	BR12665-4R-207	115	86	88	5	5.75
5	BR12292-5R-139	111	83	117	5	5.15
6	BR12293-5R-47	113	84	104	7	7.41
7	BR12294-5R-23	127	97	114	5	5.58
8	BR12294-5R-31	107	79	119	7	5.75
9	BR12294-5R-32	127	98	97	3	5.59
10	BR12296-5R-131	106	78	134	7	5.68
11	BR12298-5R-60	105	77	104	5	6.13
12	BR12300-5R-83	105	76	113	5	5.76
13	BR12300-5R-325	104	76	107	7	7.29
14	BR12300-5R-350	105	77	113	5	5.32
15	BR12301-5R-190	105	77	97	7	5.41
16	BR12301-5R-277	105	77	105	5	5.12
17	BR12301-5R-307	106	78	116	7	5.34
18	BR12301-5R-326	105	77	126	7	5.47
19	BR12302-5R-99	112	84	105	3	6.26
20	BR12302-5R-204	119	88	104	7	5.34
21	BR12303-5R-22	114	84	117	5	7.05
22	BR12303-5R-44	108	80	124	7	5.27
23	BR12303-5R-49	112	84	107	7	5.14
24	BR12303-5R-95	107	79	97	5	5.46
25	BR12303-5R-151	106	79	135	5	5.68
26	BR12303-5R-152	102	75	114	5	5.42
27	BR12303-5R-169	105	77	96	5	5.30
28	BR12303-5R-222	108	80	104	5	5.69
29	BR12303-5R-297	105	77	106	5	5.25
30	BR12303-5R-341	105	77	91	7	6.32
31	BR12628-5R-184	100	72	113	3	7.63
32	BR12628-5R-195	124	93	105	5	6.04
33	BR12630-5R-140	117	97	95	7	5.39
34	BR12631-5R-28	100	72	101	5	5.89
35	BR12631-5R-30	107	79	104	3	6.29
36	BR12631-5R-37	117	86	104	5	5.21
37	BR12631-5R-41	108	80	119	5	6.45
38	BR12631-5R-60	111	84	119	3	6.08
39	BR12631-5R-69	111	83	114	5	5.20
40	BR12631-5R-83	110	82	124	5	7.31
41	BR12631-5R-146	111	84	105	7	5.83
42	BR12633-5R-133	111	83	105	3	5.18
43	BR12634-5R-123	105	77	104	3	5.97
44	BR11730-5R-32	132	102	102	5	6.62
45	BR11730-5R-90	127	99	98	3	5.90

46	BR11730-5R-108	124	93	103	5	5.12
47	BRRI dhan49 (Ck.)	123	92	105	7	5.45
48	BRRI dhan71 (Ck.)	104	75	109	5	5.27
49	BRRI dhan87 (Ck.)	122	92	117	3	6.09
	CV (%)	16.33	5.94	13.69	0.97	1.26
	Lsd (0.05)	3.053	1.110	2.560	0.181	0.235
	H2b	0.98	0.99	0.88	0.95	0.85

D/S: 08 July, 2022; D/T: 31 July, 2022; Plot Size: 4.32 m^2

Table 36: Performance of selected genotypes in observational yield trial (OYT#2, GD: 120-140 days) for RLR, T. Aman, 2022

Entry	Designation	Days to maturity (80%)	Days to flowering (50%)	Plant height (cm)	Pacp (M)	Grain Yield (t/ha)
1	BR12304-5R-83	130	99	106	7	6.52
2	BR12305-5R-80	133	104	115	5	7.05
3	BR12305-5R-107	130	100	136	3	7.93
4	BR12632-5R-45	120	92	116	7	6.03
5	BR12635-5R-10	129	98	143	7	6.54
6	BR11728 -5R-23	131	100	114	5	7.16
7	BR11728 -5R-94	132	101	107	5	6.07
8	BR11728 -5R-112	127	99	113	3	5.60
9	BR11728 -5R-170	135	106	136	3	7.67
10	BR11728 -5R-185	124	101	124	7	7.05
11	BR11729-5R-161	133	94	125	5	6.25
12	BR11729-5R-175	133	105	107	7	6.27
13	BR11729-5R-191	131	101	107	5	6.78
14	BR11730-5R-16	127	97	133	3	5.97
15	BR11730-5R-112	134	103	124	3	6.59
16	BR11731-5R-135	133	104	125	3	6.85
17	BR11731-5R-146	134	104	119	5	6.16
18	BR11731-5R-183	134	105	119	5	6.17
19	BR11732-5R-41	133	102	115	5	6.08
20	BR11732-5R-48	132	103	122	5	6.45
21	BR11734-5R-30	131	102	134	3	7.16
22	BR11734-5R-47	123	92	106	3	6.26
23	BR11735-5R-41	130	100	132	5	6.35
24	BR11735-5R-76	135	106	115	7	5.98
25	BR11735-5R-103	132	89	105	5	7.35
26	BR11735-5R-139	135	98	108	5	6.65
27	BR11738-5R-4	130	100	127	7	7.06
28	BR11738-5R-6	132	102	115	5	6.17
29	BR11738-5R-90	128	99	124	7	6.33
30	BR11739-5R-33	134	105	124	3	6.20
31	BR11739-5R-53	131	87	122	3	6.74
32	BR11740-5R-65	130	92	106	5	5.96
33	BR11743-5R-76	128	100	134	7	6.02
34	BR11743-5R-98	127	97	133	5	6.21
35	BR11747-5R-6	133	99	107	5	7.01
36	BR11747-5R-10	132	103	114	3	6.22
37	BR11747-5R-67	133	104	118	7	6.17
38	BR11747-5R-69	135	105	121	5	7.78
39	BR11748-5R-16	134	104	123	3	7.51
40	BR11748-5R-30	135	104	114	3	7.81
41	BR11748-5R-46	127	97	136	7	5.85
42	BR11749-5R-51	125	95	124	7	6.18

43	BR11750-5R-42	133	104	143	5	6.27
44	BR11752-5R-135	129	99	114	3	5.86
45	BR11753-5R-157	130	100	114	5	6.56
46	BR11754-5R-34	130	99	114	7	6.26
47	BR11754-5R-41	134	100	108	7	6.60
48	BR11754-5R-97	127	97	115	3	6.02
49	BR11756-5R-15	135	104	96	3	6.34
50	BR11761-5R-35	133	104	124	5	6.41
51	BRRI dhan49 (Ck.)	123	92	105	7	5.34
52	BRRI dhan71 (Ck.)	104	75	109	5	5.42
53	BRRI dhan87 (Ck.)	122	92	117	3	4.49
	CV (%)	6.60	3.33	7.92	0.86	0.62
	LSD (0.05)	1.821	0.919	2.183	0.237	0.170
	H2b	0.73	0.91	0.85	0.68	0.56

D/S: 06 July, 2022; D/T: 30 July, 2022; Plot Size: 4.32 m^2

Experiment 3.29: Advanced Yield Trial (AYT)

Principal investigator: MA Kader.

Investigators: Anisar Rahman, MR Hasan, TK Hore & RR Mazumdar

Materials and Methods: A total of 68 fixed lines with six standard checks BRRI dhan49, BRRI dhan71 and BRRI dhan87, BRRI dhan71, BRRI dhan75 and BRRI dhan90 were tested by following non-replicated Augmented RCB design in two AYT trial (AYT#1 and AYT#2) RCB design in AYT trial.

In AYT-1 (GD: 101-120 days) trial, 32 lines along with two check variety BRRI dhan57 and BRRI dhan62 and In AYT-2 trial (GD: 121-140 days), 36 lines with BRRI dhan57 and BRRI dhan71 were evaluated under favorable rainfed condition. For each trial, thirty days old seedlings were transplanted in a 5.4 m × 4 rows at spacing of 20 cm × 15 cm in the field. Single seedlings were used for transplanting. Fertilizers @108 (234 Kg Urea): 17.4 (87 Kg TSP): 58.5 (117 Kg MP): 14 (78 Kg Gypsum): 4.3 (12 Kg Zn SO_4) Kg NPKSZn/ha were applied in the trial. All amounts of P, K, S and Zn were applied at the time of final land preparation and nitrogen was applied at three equal splits at 5-10, 20- 25 and 35- 40 days after transplanting (DAT). Crop management such as weeding, irrigation etc. was done in time. Insects, diseases and other pests will be controlled properly.

Results and Discussion: In AYT-1 (GD: 101-120 days) trial, 13 advanced lines were selected among 32 fixed lines based on phenotypic acceptance, plant height, response to drought stress, growth duration and grain yield. The yield range of this trial were 0.45-6.1 t/ha. Advanced line BR12007-6R-61 gave 6.1 t/ha grain yield with 111 days growth durations. Whereas best performing check variety BRRI dhan71 gave 5.31 t/ha grain yield with 114 days growth durations **(Table 37)**.

AYT-2 (GD: 121-140 days) was a photosensitive trial, 10 advanced lines were selected among 36 lines based on phenotypic acceptance, response to drought stress, photosensitivity and grain yield. The yield range of this trial were 2.84-7.75 t/ha. Advanced line BR11222-6R-92 gave 7.75 t/ha grain yield with 135 days growth durations. Whereas best performing check variety BRRI dhan49 gave 6.59 t/ha grain yield with 130 days growth durations **(Table 38)**.

Table 37: Performance of selected genotypes in Advanced yield trial (OYT#1, GD: 101-120 days) for RLR, T. Aman, 2022

Entry No	Designation	Days to maturity (80%)	Days to flowering (50%)	Plant height (cm)	Pacp (M)	Grain Yield (t/ha)
1	BR11999-6R-147	112	84	122	3	4.63
2	BR11999-6R-1	111	82	119	3	5.23
3	BR12011-6R-178	115	86	135	5	6.12
4	BR10795-6R-3	110	82	115	5	6.33
5	BR12000-6R-183	117	89	113	7	4.27

6	BR12000-6R-36	111	83	119	7	4.24
7	BR12000-6R-184	111	83	116	7	4.39
8	BR11999-6R-128	112	84	126	7	4.89
10	BR12000-6R-13	113	84	127	3	6.08
11	BR12002-6R-26	113	84	112	3	5.99
12	BR12005-6R-14	137	109	135	7	5.53
13	BR12006-6R-5	110	83	122	7	4.16
14	BR12005-6R-200	113	84	125	5	6.15
15	BR10796-6R-13	112	84	145	7	4.75
16	BR12011-6R-80	111	83	147	5	6.30
17	BR12002-6R-138	111	83	107	5	6.31
18	BR10799-6R-70	113	84	135	7	5.81
19	BR12002-6R-117	113	84	132	7	5.73
20	BR12003-6R-76	115	86	126	7	4.31
22	BR12007-6R-92	133	104	133	5	5.57
23	BR12007-6R-61	110	82	153	3	5.21
24	BR12001-6R-205	112	83	148	5	6.10
25	BR12006-6R-40	128	99	127	7	5.85
26	BR10796-6R-39	114	84	140	7	8.25
27	BR10800-6R-54	114	85	143	3	4.84
28	BR11333-6R-84	116	87	106	5	4.64
29	BRRI dhan49 (Ck.)	131	102	104	5	4.71
30	BRRI dhan71 (Ck.)	114	84	126	3	5.79
31	BRRI dhan87 (Ck.)	122	92	127	5	5.63
32	BRRI dhan90 (Ck.)	115	85	135	5	4.36
	Lsd (0.05)	1.521	0.619	2.083	0.337	0.160
	H2b	0.84	0.89	0.74	0.90	0.46

Table 38: Performance of selected genotypes in Advanced yield trial (AYT#2, GD: 121-140 days) for RLR, T. Aman, 2022

Entry	Designation	Days to maturity (80%)	Days to flowering (50%)	Plant height (cm)	Pacp (M)	Grain Yield (t/ha)
1	BR10795-6R-130	110	82	121	7	4.49
2	BR10796-6R-133	115	87	130	5	7.23
3	BR10800-6R-1	111	83	126	7	6.91
4	BR11334-6R-35	122	90	107	5	4.22
5	BR10797-6R-24	128	99	118	5	7.62
6	BR10795-6R-133	119	89	103	5	5.94
7	BR10797-6R-140	110	82	107	5	7.45
8	BR10799-6R-104	127	97	128	5	5.34
9	BR10799-6R-1	120	89	118	5	7.58
10	BR10799-6R-31	126	96	185	5	5.67
11	BR12004-6R-56	133	104	126	7	4.46
12	BR10795-6R-53	120	90	104	5	4.15
13	BR11333-6R-4	122	91	124	7	2.84
14	BR11333-6R-73	119	89	105	5	4.05
15	BR11342-6R-186	128	99	105	5	4.88
17	BR 10795-6R-46	127	97	123	5	5.88
18	BR11336-6R-10	139	78	133	7	5.50
19	BR11343-6R-64	135	104	150	7	4.49
20	BR10804-6R-105	125	94	115	5	3.78
21	BR11222-6R-92	134	103	125	5	5.63
22	BR10802-6R-66	137	106	118	7	3.82
23	BR10802-6R-1	135	104	101	5	4.33

24	BR11343-6R-78	138	107	119	7	4.18
25	BR11227-6R-162	139	108	123	3	7.58
26	BR11227-6R-98	139	108	146	7	4.48
28	BR10799-6R-151	139	108	126	5	5.47
29	BR11343-6R-51	127	97	93	7	3.87
30	BR10802-6R-242	135	106	111	3	7.75
32	BR11336-6R-96	138	108	121	7	5.30
34	BRRI dhan71 (Ck.)	110	82	135	5	5.84
35	BRRI dhan87 (Ck.)	125	94	130	5	5.39
36	BRRI dhan49 (Ck.)	128	99	103	7	5.59
	Lsd(0.05)	1.421	0.689	2.383	0.347	0.170
	H2b	0.89	0.78	0.77	0.91	0.49

Program 5: Development of Disease Resistant Rice

General objective: Development of genotypes resistant to bacterial blight (BB), blast and RTV.
Project Leader: Dr Mahmuda Khatun

Experiment 3.30: Observational Yield Trial (OYT)

Principal Investigator: M Khatun
Co-Investigators: Anisar Rahman, MR Hasan, S K Debsharma, J Ferdousy and MAI Khan

Specific objective: Selection of homogeneous breeding lines with acceptable grain quality having high yield with good plant type and resistance to BB.

Materials and Methods: A total of 60 advanced lines out of 384 in OYT during T. Aman 2022-23 and 288 in Boro 2022-23 along with the standard checks BRRI dhan49, BRRI dhan87 and IRBB60 (Res. Ck.) for T. Aman and the standard checks BRRI dhan58 and IRBB60 (Res. Ck.) for Boro were evaluated in BRRI R/S, Rangpur under development of BB resistance. Twenty five-day-old seedlings for T. Aman and thirty-five-day-old seedlings for Boro season were transplanted at a spacing of 25 cm × 15 cm. The plot size was 5.4 m × 5 rows. Single seedling was used for transplanting. In T. Aman, Fertilizers @108 (234 Kg Urea): 17.4 (87 Kg TSP): 58.5 (117 Kg MP): 14 (78 Kg Gypsum): 4.3 (12 Kg Zn SO_4) Kg NPKSZn/ha were applied in the trial. All amounts of P, K, S and Zn were applied at the time of final land preparation and nitrogen was applied at three equal splits at 5-10, 20- 25 and 35- 40 days after transplanting (DAT). For Boro season, fertilizer doses were at the rate of 120-20-60 kg NPK/ha (260-100-120 kg Urea-TSP-MoP/ha) and 100 kg/ha Gypsum and 10 kg/ha Zinc sulphate. Total amount of P, K, Gypsum and Zinc sulfate were applied at final land preparation. Urea was applied in three equal splits at 10-15 days after transplanting, maximum tillering and panicle initiation stage. Crop management such as weeding, irrigation etc. was done in time. Insects and other pests were controlled properly.

Results and Discussion: Fourteen genotypes out of 60 for OYT during T. Aman 2022-23 based on better performance with homogeneity in flowering, PAcp, tolerance to BB, and grain quality evaluation. The genotype BR12121-4R-53-1, BR12098-4R-157-1, BR11987-4R-156-1, BR12098-4R-123-1, BR12098-4R-32-1 and BR12098-4R-99-1 were selected on the basis of high yield, acceptable growth duration, high amylose (%), resistant to BB (BB score 1-3 and incorporate of BB resistant gene) (**Table 39)**. The average plant height of the materials was 86-132 cm, growth duration were about 108-135 days and yield were varied from 2.69-5.60 t/ha.

In Boro 2022-23, 12 genotypes were selected out of 288 based on growth duration, yield, BB score (1) and amylose (%). The average plant height of the materials varied from 80-140 cm and the growth duration was about 145 to 160 days. The yield range of different locations is shown in Boxplot. The genotypes BR12437-4R-53, BR12115-5R-4, BR12123-5R-11 and BR12438-5R-43 were the top yielder materials presented in **Table 40**. The promising line BR12437-4R-53 produced 6.86 t/ha with high amylose.

Table 39: Performance of the advanced lines in observational trial (OYT), Development of BB resistance, T. Aman, 2022

SN	Designation	Growth duration (days)	Plant height (cm)	Yield (t/ha)
1	BR12121-4R-53-1	115	100.6	6.97
2	BR12098-4R-157-1	111	117.2	5.58
3	BR11987-4R-156-1	124	118.1	6.87
4	BR12098-4R-123-1	114	123.5	4.49
5	BR12098-4R-32-1	120	109.4	4.04
6	BR12098-4R-99-1	112	117.7	5.04
7	BR12098-4R-120-1	117	122.1	5.11
8	BR11987-4R-161-1	117	117.5	4.19
9	BR11993-4R-2-1	112	113.5	7.21
10	BR12098-4R-69-1	121	122.3	6.02
11	BR12098-4R-119-1	117	125.5	4.85
12	BR11995-4R-1-1	119	132.3	5.58
13	BR12098-4R-45-1	112	119.5	5.67
14	BR12098-4R-199-1	113	116.2	4.56
15	BRRI dhan49 (Ck.)	135	99.6	4.36
16	BRRI dhan87 (Ck.)	125	124.8	4.71
17	IRBB60 (Ck.)	115	86.8	4.28
	Lsd (0.05)	0.14	0.19	0.36
	H^2b	0.29	0.21	0.61

Table 40: Performance of the advanced lines in the observational trial (OYT), Development of BB resistance, Boro, 2022-23

SN	Designation	Growth Duration (days)	Plant height (cm)	Grain yield (t/ha)
1	BR12115-5R-20	150	109	6.81
2	BR12115-5R-35	155	108	6.57
3	BR12115-5R-4	160	115	7.86
4	BR12116-5R-2	150	101	6.14
5	BR12116-5R-38	151	110	4.98
6	BR12123-5R-11	156	108	7.19
7	BR12437-4R-53	160	102	9.25
8	BR12438-5R-43	160	99	6.17
9	BR12439-5R-3	149	103	6.00
10	BR12440-4R-27	155	121	6.92
11	BR12609-4R-98	150	105	5.55
12	BR12624-4R-43	158	102	6.59
13	BRRI dhan58 (Ck.)	152	97	7.58
14	IRBB60 (Res Ck.)	149	95	5.88
	Lsd (0.05)	0.23	0.21	1.09
	H2b	0.82	0.78	0.62

Experiment 3.31: Preliminary Yield Trial (PYT)

Principal Investigator: M Khatun
Co-Investigators: Anisar Rahman, M R Hasan, S K Debsharma, J Ferdousy and MAI Khan

Specific objective: Initial yield evaluation of advanced lines compared to standard checks.

Materials and methods: The experiment was evaluated at Payrabanda, Rangpur. A total of forty-one advanced lines in T. Aman, 2022 along with the standard checks BRRI dhan49, BRRI dhan87 and IRBB60 (Res. Ck.) were evaluated under development of BB resistance. Twenty-five-day-old seedlings were transplanted at a spacing of 25 cm × 15 cm. The plot size was 5.4 m × 5 rows. The single seedling was used for transplanting. Fertilizer doses and application were the same as experiment no.3.30. Crop management such as weeding, irrigation etc. was done in time. Insects and other pests were controlled properly.

Results and Discussion: Two genotypes were selected based on growth duration and grain yield compared to the check varieties (**Table 41)**. The two genotypes, viz. BR11869-5R-47 and BR11874-5R-109 were selected from PYT for further trial. These materials were selected on the basis of yield, growth duration, amylose (%) and BB resistance score (1).

Table 41: Performance of the advanced lines in Preliminary yield trial (PYT), Development of BB resistance, T. Aman, 2022

SN	Designation	Mat. (days)	PHt. (cm)	Yield (t/ha)	BB Score (art.)
1	BR11869-5R-47	128	108.2	5.94	1
2	BR11874-5R-109	120	104.4	5.65	1
3	BR11869-5R-72	133	110.1	5.66	1
4	BR11869-5R-73	133	109.9	5.50	1
5	BR11866-5R-200	121	104.5	4.76	1
6	BRRI dhan49 (Sus. Ck.)	133	109.0	4.35	5
7	BRRI dhan87 (Sus. Ck.)	126	114.0	4.57	9
8	IRBB60 (Res. Ck.)	117	92.0	4.05	1
	Lsd (0.05)	8.0	7.0	0.71	
	H^2b	0.97	0.5	0.44	

Experiment 3.32: Advanced Yield Trial (AYT#2)
Principal Investigator: M Khatun
Co-investigators: Anisar Rahman, MR Hasan, SK Debsharma, J Ferdousy and MAI Khan

Specific objectives: Initial yield evaluation and selection of desirable lines as compared with standard checks in on-station condition.

Materials and methods: The experiment was evaluated at Darshana, Rangpur 40 advanced lines for AYT#2 with the standard checks BRRI dhan58, BRRI dhan88, BRRI dhan89, IRBB60 (Res. Ck.) and IRBB65 (Res. Ck.) were evaluated under development of BB resistance. The thirty-five-day-old seedlings were transplanted at a spacing of 25 cm × 15 cm. The plot size was 5.4 m × 5 rows. Single seedling was used for transplanting. Fertilizer doses and application were same as experiment no.3.30. Crop management such as weeding, irrigation etc. was done in time. Insects and other pests were controlled properly.

Results and Discussion: In AYT#2, twelve genotypes were selected out of 40 based on BB score and grain yield compared to the check varieties. The genotypes BR11866-5R-347, BR11867-5R-117, BR11867-5R-421 and BR11866-5R-5 were selected for better grain yield and resistance to BB with similar growth duration to the check varieties BRRI dhan58 and BRRI dhan89 **(Table 42)**. The average plant height of the materials varied from 90-115 cm, and the growth duration was about 150 to 162 days.

Table 42: Grain yield and agronomic parameters of the entries, AYT#2, Trait development resistant to BB, Boro, 2022-23

SN	Designation	Mat. (days)	PHt. (cm)	Rang	BB Score (art.)	Targeted BB res genes
1	BR11866-5R-347	158	96	6.94	1	Xa4, Xa21,xa5
2	BR11867-5R-117	160	101	6.68	1	-do-
3	BR11867-5R-421	162	103	5.81	1	-do-
4	BR11866-5R-5	154	100	7.00	1	-do-
5	BR11867-5R-71	160	97	7.33	1	-do-
6	BR11867-5R-474	155	94	7.62	1	-do-
7	BR11867-5R-92	156	99	8.39	1	-do-
8	BR11866-5R-223	159	100	7.10	1	-do-
9	BR11867-5R-157	155	103	7.09	1	-do-
10	BR11867-5R-118	157	102	7.32	1	-do-
11	BR11867-5R-296	156	97	5.92	1	-do-
12	BR11867-5R-140	160	95	6.53	1	-do-
	BRRI dhan58 (St. Ck.)	153	101	7.37	7	-
	BRRI dhan89 (St. Ck.)	157	104	7.01	9	-
	IRBB60 (Res Ck.)	155	94	6.62	1	-
	Lsd(0.05)	5.60	7.6	1.16		
	H2b	0.30	0.12	0.47		

Program 6: Development of Rice Varieties for Favorable Boro Environment

General objective: Development of improved genotypes with high yield potential (≥8.0 t/ha), earliness and acceptable grain quality for irrigated ecosystem in Bangladesh.
Project Leader: Partha Sarathi Biswas

Experiment 3.33: Observational Yield Trial (OYT)
Principal investigator: P S Biswas

Co-Investigators Anisar Rahman, MR Hasan, M Anisuzzaman, M Istiak Hossain Joy and KM Iftekharuddaula

Specific objective: Selection of superior lines with desired agronomic characters.

Materials and Methods: A total of 368 genotypes were evaluated at Darshana, Rangpur. A total of 368 genotypes, in which around 40% of the total genotypes were tested at each of four sites as training population. In this trial, BRRI dhan28, BRRI dhan89, BRRI dhan92 and BRRI dhan96 were used as standard check varieties. Forty-day-old seedlings of each entry were transplanted in 5.4 m × 5 rows plot using single seedling at a spacing of 20cm × 20 cm. Fertilizer doses and application method were the same as in Experiment 3.30. Data on plant height, days to flowering and maturity, yield, lodging and disease and insect infestation were recorded.

Results and Discussion: In the trial, 368 breeding lines showed a wide range of variation in growth duration starting from 137 days to 154 days with 5.2 –5.5 t/ha yield over the locations. However, the training population consisting of 368 breeding lines (a subset of 694) that were tested at four locations, showed variable yield performance. Among all, 368 the breeding lines tested at Rangpur yielded 4.2-8.7 t/ha with 147 -165 days growth duration. The trial heritability was 47.8%. Based on the predicted yield of all 368 lines 47 lines were selected for further trial (**Table 43**).

Table 43: Yield performance of the 39 selected breeding lines from 368 breeding lines tested in OYT following sparse testing model of genomic selection during Boro, 2022-23

SL#	Designation	Mat. (days)	PHt. (cm)	Grain Yield (t/ha)
1	BR13134-5R-27	140	101.55	5.48
2	BR13136-5R-164	144	104.62	7.94
3	BR13136-5R-166	142	112.05	7.85
4	BR13137-5R-107	143	117.80	7.04
5	BR13137-5R-129	149	124.80	7.82
6	BR13138-5R-134	147	100.54	7.62
7	BR13138-5R-141	145	99.81	7.39
8	BR13140-5R-113	145	111.27	7.6
9	BR13140-5R-157	146	101.22	8.26
10	BR13140-5R-21	147	97.94	8.27
11	BR13140-5R-61	147	96.42	7.03
12	BR13141-5R-103	138	108.86	6.70
13	BR13141-5R-149	144	110.89	7.04
14	BR13141-5R-22	137	106.91	6.95
15	BR13141-5R-91	145	108.29	7.61
16	BR13142-5R-51	139	125.63	6.37
17	BR13142-5R-54	145	111.29	6.73
18	BR13142-5R-63	144	107.22	6.50
19	BR13142-5R-81	139	82.88	6.62
20	BR13144-5R-137	146	114.08	8.68
21	BR13149-5R-87	137	109.37	7.52
22	BR13153-5R-136	138	94.42	7.51
23	BR13153-5R-63	148	107.94	7.65
24	BR13153-5R-86	144	98.67	8.29
25	BR13153-5R-91	139	110.05	7.53
26	BR13154-5R-118	146	111.63	8.79
27	BR13154-5R-127	150	101.96	6.29
28	BR13155-5R-110	141	102.83	4.24
29	BR13155-5R-233	144	125.67	7.90
30	BR13409-5R-26	140	114.77	8.21
31	BR13409-5R-41	140	102.43	5.10
32	BR13414-5R-6	148	110.50	5.27
33	BR13417-5R-26	138	108.21	5.71
34	BR13418-5R-103	137	88.22	7.18
35	BR13418-5R-18	149	102.53	5.61
36	BR13418-5R-51	137	83.25	5.48
37	BR13428-5R-25	147	97.24	8.34
38	BR13431-5R-168	144	98.94	6.35
39	BR13431-5R-194	139	105.82	5.96
	BRRI dhan28 (Ck.)	140	97.38	5.97
	BRRI dhan67 (Ck.)	145	108.22	6.32
	BRRI dhan89 (Ck.)	152	102.90	6.93
	BRRI dhan92 (Ck.)	154	106.43	6.65
	Lsd(0.05)	12.14	13.27	1.36
	H2b	80.62	65.7	47.8

D/S: 06.12.2022 & D/T: 29.01.2023

Experiment 3.34: Advanced Yield trial (AYT Early)
Principal investigator: PS Biswas
Co-Investigators Anisar Rahman, MR Hasan, M Anisuzzaman, M Istiak Hossain Joy and KM Iftekharuddaula
Specific objective: Initial evaluation for yield potential in replicated trial.

Materials and Methods: A total of 15 genotypes were evaluated at Darshana, Rangpur along with standard check varieties BRRI dhan28, BRRI dhan81and BRRI dhan96, respectively. Thirty five-day-old seedlings of each genotype were transplanted in a 5.4 m×6 rows plot using 2/3 seedling/hill at a spacing of 20 cm × 20 cm in two replications. Fertilizer doses were the same as in experiment no. 3.30. Data on plant height, days to flowering and maturity, yield, lodging and disease and insect infestation were recorded.

Results and Discussion: The trial heritability for yield was 48.47%. The check varieties BRRI dhan28 and BRRI dhan96 yielded 5.5 t/ha with 146 days growth duration and 5.9 t/ha with 147 days growth duration, respectively. In this trial, 3 breeding lines were selected for further evaluation as they showed 6.8 -7.5 t/ha grain yield potentiality with 149- 153 days growth duration **(Table 44)**.

Table 44: Yield performance of the selected breeding lines from 15 breeding lines tested in AYT-E during Boro, 2022-23

Designation	Growth duration (days)	Plant Height (cm)	Grain Yield (t/ha)
BR12574-5R-168	149	117	6.98
BR12574-5R-52	150	114	7.05
BR12520-5R-67	153	94	5.94
BRRI dhan28 (Ck.)	146	101	5.37
BRRI dhan81 (Ck.)	149	91	5.53
BRRI dhan96 (Ck.)	147	87	5.86
Lsd(0.05)	6.35	8.50	0.88
H2b	62.0	90.22	48.27

D/S: 27.11.2022 & D/T: 20.01.2023

Experiment 3.35: Advanced Yield trial (AYT ML)
Principal investigator: PS Biswas
Co-Investigators Anisar Rahman, MR Hasan, M Anisuzzaman, M Istiak Hossain Joy and KM Iftekharuddaula
Specific objective: Initial evaluation for yield potential in replicated trial.

Materials and Methods: A total of 21 genotypes were evaluated at Darshana, Rangpur along with standard check varieties BRRI dhan81 and BRRI dhan89. Thirty five-day-old seedlings of each genotype were transplanted in a 5.4 m×6 rows plot using 2/3 seedling/hill at a spacing of 20 cm × 20 cm in two replications. Fertilizer doses were the same as in experiment no. 3.30. Data on plant height, days to flowering and maturity, yield, lodging and disease and insect infestation were recorded.

Results and Discussion: The trial heritability for yield was 58.4%. The check varieties BRRI dhan81, BRRI dhan89, BRRI dhan92 and BRRI dhan96 yielded 4.5 t/ha with 149 days growth duration, 5.7 t/ha with 160 days growth duration, 6.4 t/ha with 161 days growth duration and 6.5 t/ha with 148 days growth duration, respectively. In this trial, six breeding lines were selected for further evaluation as they showed 5.44 -6.76 t/ha grain yield potentiality with 153- 154 days growth duration **(Table 45)**.

Table 45: Yield performance of the selected breeding lines from 21 breeding lines tested in AYT-ML during Boro, 2022-23

Designation	Growth duration (days)	Plant Height (cm)	Grain Yield (t/ha)
BR12508-5R-5	154	102	8.02
BR12517-5R-57	154	112	7.62
BR12514-5R-97	154	99	8.50
BR12520-5R-11	153	101	7.48
BR12423-6R-38	154	104	7.90
BR12514-5R-27	153	106	6.66
BRRI dhan81 (Ck.)	149	97	6.81
BRRI dhan89 (Ck.)	160	103	8.56
BRRI dhan92 (Ck.)	161	108	8.20
BRRI dhan96 (Ck.)	148	95	7.22
Lsd(0.05)	7.17	10.85	0.96
H2b	69.13	78.97	58.74

D/S:27.11.2022 & D/T: 20.01.2023

Experiment 3.36: Regional Yield Trial (RYT_Late Boro)

Investigators: Anisar Rahman, MR Hasan, PS Biswas, M Anisuzzaman, and KM Iftekharuddaula

Specific Objectives: Evaluation of genotypes for specific and general adaptability across multiple trial sites of Bangladesh

Materials and Methods: Seventeen entries including BRRI dhan28, BRRI dhan98 and BINA dhan14 as check varieties under RYT_ Late Boro were grown at five locations in potato growing areas of Rangpur, Dinajpur, Nilphamari, Kurigram and Lalmonirhat districts. Twenty five-day-old seedlings of each genotype were transplanted in 5.4 m×10 rows plot using single seedling at a spacing of 20 cm × 20 cm in three replications. Fertilizer doses and application methods were the same as in Experiment 3.30. Date of seeding, transplanting, flowering, maturity, plant height, phenotypic acceptance, disease and insect infestation score and yield per plot were recorded. Seeds were preserved from the selected entries.

Results and Discussion: BRRI dhan28 showed average yield of 6.3 t/ha with 106 days growth duration. In contrast, BRRI dhan98 and BINA dhan14 yielded 6.9 t/ha in 112 days and 5.8 t/ha in 104 days, respectively. BR11845-4R-62 yielded 7.6 t/ha in 110 days and BR12266-BC3-23-1 yielded 7.4 t/ha in 108 days. In this trial, BRRI dhan29-SC3-28-16-10-6-HR6 (Com)-HR1 (Gaz)-P11 (Hbj) yielded 6.7 t/ha with only 95 days growth duration. Therefore, these three lines were selected for evaluation in adaptive trial **(Table 46)**.

Table 46: Yield performance of the selected genotypes from RYT (Late Boro), Development of Favourable Boro rice during Boro, 2022-23

Designation	Mat. (days)	PHt. (cm)	Yield (t/ha)					
			L1	L2	L3	L4	L5	Ave
BR(Bio)9777-118-6-4	118	108	5.8	6.4	5.1	7.2	7.0	6.3
BR(Bio)9777-26-4-3	123	116	6.2	6.9	6.0	7.2	6.9	6.6
BR(Bio)9787-BC2-16-3-1 (HR-1)	117	106	6.4	6.7	6.2	5.7	7.2	6.4
BR(Bio)9787-BC2-48-4-1	119	102	6.1	5.7	5.6	6.2	6.8	6.1
BR11712-4R-218	128	100	5.7	3.9	-	4.4	-	4.6
BR11716-4R-105	125	102	6.3	5.3	-	4.7	-	5.4
BR11845-4R-62*	110	98	7.5	7.4	6.8	8.6	7.6	7.6
BR11847-4R-78	110	105	7.0	6.4	5.7	7.0	7.1	6.7
BR12098-4R-112	113	106	5.8	6.4	6.1	7.8	7.4	6.7
BR12266-BC3-23-1*	108	104	6.7	7.3	6.6	7.7	8.7	7.4

BR12266-BC3-30-14	107	105	6.0	5.9	4.8	6.9	6.7	6.1
BRRI dhan29-SC3-28-16-10	95	92	7.6	-	7.4	7.0	4.9	6.7
BRRI dhan29-SC3-28-16-10-	97	98	5.7	-	-	-	8.7	7.0
HHZ5-DT20-DT20-DT1	120	98	5.9	7.4	5.2	5.9	6.5	6.2
BINA dhan14 (Ck.)	104	99	6.1	5.2	5.8	6.9	5.2	5.8
BRRI dhan28 (Ck.)	106	106	6.7	6.9	4.9	5.8	7.3	6.3
BRRI dhan98 (Ck.)	112	103	7.5	6.7	6.2	6.3	7.8	6.9
Lsd (0.05)	4.19	8.89	0.57	0.79	0.96	0.94	0.84	0.77
H2b	99.5	88.8	84.8	86.1	50.9	84.2	85.2	84.8

Program 7: Development of Insect Resistant Rice

General objectives: Development of rice varieties resistant to brown plant hopper (BPH) and gall midge (GM)

Project Leader: Md. Ruhul Amin Sarker

Experiment 3.37: Observational Yield Trial (OYT)

Principal Investigator: MRA Sarker

Co-investigators: Anisar Rahman & MR Hasan, H Khatun and MA Rahman

Specific objectives: Selection of homozygous breeding lines with desirable grain quality having high yield and resistant to Brown Plant hopper (BPH) and Gall Midge (GM).

Materials and Methods: Total 228 and 360 advanced breeding lines for BPH and GM were grown Payrabanda, Rangpur and Darshana, Rangpur during T. Aman and Boro Seasons, respectively. BRRI dhan33 (for gall midge) was used as resistant checks and BRRI dhan49 & BRRI dhan87 used as standard checks for T. Aman season. T27A was used as resistant check for BPH and BR3, BRRI dhan88 & BRRI dhan89 were used as susceptible and standard checks for Boro season. Thirty and 45-days old seedling were transplanted in 5.4 m×5 rows plot with a spacing of 20 cm × 20 cm. Single seedling was used for transplanting. Fertilizers at the rate of 70:10:40 kg NPK/ha (150-55-80 kg/ha Urea-TSP-MOP) was applied. Also, Gypsum and Zinc Sulfate was applied at the rate of 100 kg/ha and 10 kg/ha, respectively. For Boro season, fertilizer doses were at the rate of 120-20-60 kg NPK/ha (260-100-120 kg Urea-TSP-MoP/ha) and 100 kg/ha Gypsum and 10 kg/ha Zinc sulphate. Total amount of P, K, Gypsum and Zinc sulfate were applied at final land preparation. Urea was applied in three equal splits at 10-15 days after transplanting, maximum tillering and panicle initiation stage. Hand weeding was done in time. Importantly, no insecticides were applied in this experiment.

Results and Discussion: In T. Aman season, yield of the advanced breeding lines ranged from 1.8-5.9 t/ha. The average yield ranged from 2.5-5.8 t/ha with the average of 104-136 days growth duration. Forty nine genotypes from 228 genotypes were selected for further evaluation, as they showed higher yield over the respective check varieties **(Table 47)**. One selected OYT genotypes had *bph17_1, bph17_2, bph17_2, bph32 and Gm4* SNP favorable alleles. In Boro season, yield of the advanced breeding lines ranged from 4.0-9.2 t/ha. The average yield ranged from 4.2-8.3 t/ha with the average of 144-163 days growth duration. Out of 360 genotypes, 84 were selected for further evaluation, as they showed higher yield over the respective check varieties **(Table 48)**. Selection was made based on flowerings uniformity, phenotypic acceptability and pest infestation under field condition. Three genotypes from 360 genotypes showed 5 score during artificial screening at Entomology Division, BRRI in Boro season, which considered as moderately sustable to BPH **(Table 48)**.

Table 47: Agronomic performance of the genotypes selected from observational yield trial (OYT), Development of Insect Resistant Rice (IRR), T. Aman, 2022

SL#	Designation	GD (days)	PH (cm)	Grain Yield (t/ha)	Trait of Interest (ToI)
1	BR 13088-4 R-2	112	117	4.9	*Bph32, Wx-A_group*
2	BR 13088-4 R-21	114	129	4.7	*Bph32, Wx-A_group*
3	BR 13088-4 R-94	115	116	3.3	*Bph32, Wx-A_group*

4	BR 13088-4 R-234	120	116	5.2	*Bph32, Wx-A_group*
5	BR 13088-4 R-408	104	102	4.8	*Bph32, Wx-A_group*
6	BR 13088-4 R-423	118	112	5.7	*Bph32, Wx-A_group*
7	BR 13091-4 R-7	115	131	4.9	*Wx-GBSS-ex10, Wx-A_group*
8	BR 13093-4 R-7	121	122	3.9	*Bph32, Wx-GBSS-ex10, Wx-A_group*
9	BR 13093-4 R-204	115	115	5.1	*Bph32, Wx-A_group*
10	BR 13093-4 R-227	114	111	4.3	*Bph32, Wx-A_group*
11	BR 13093-4 R-259	113	111	4.0	*Bph32, Wx-A_group*
12	BR 13094-4 R-15	114	115	3.9	*Bph32, Wx-A_group*
13	BR 13094-4 R-68	113	112	4.6	*Bph32, Wx-A_group*
14	BR 13094-4 R-83	121	113	4.2	*Bph32, Wx-A_group*
15	BR 13094-4 R-123	115	111	5.9	*Bph32, Wx-A_group*
16	BR 13094-4 R-162	112	117	4.8	*Bph32, Wx-A_group*
17	BR 13094-4 R-218	113	114	4.0	*Bph32, Wx-A_group*
18	BR 13094-4 R-238	104	109	4.2	*Bph32, Wx-A_group*
19	BR 13094-4 R-241	112	110	4.4	*Bph32, Wx-A_group*
20	BR 13094-4 R-249	7.7	3.8	126	*Bph32, Wx-A_group*
21	BR 13094-4 R-251	112	121	5.3	*Bph32, Wx-A_group*
22	BR 13096-4 R-11	117	116	5.2	*Bph32, Wx-A_group*
23	BR 13096-4 R-44	113	114	4.1	*Bph32, Wx-A_group*
24	BR 13096-4 R-46	115	110	4.9	*Bph32, Wx-A_group*
25	BR 13096-4 R-72	112	110	4.0	*Bph32, Wx-A_group*
26	BR 13096-4 R-86	113	116	5.0	*Bph32, Wx-A_group*
27	BR 13096-4 R-102	121	113	4.7	*Bph32, Wx-A_group*
28	BR 13096-4 R-108	117	111	4.6	*Bph32, Wx-A_group*
29	BR 13096-4 R-110	118	122	4.1	*Bph32, Wx-A_group*
30	BR 13096-4 R-125	126	116	4.3	*Bph32, Wx-A_group*
31	BR 13096-4 R-199	116	109	5.2	*Bph32, Wx-A_group*
32	BR 13096-4 R-203	114	110	4.1	*Bph32, Wx-A_group*
33	BR 13096-4 R-275	127	113	4.3	*Bph32, Wx-A_group*
34	BR 13097-4 R-12	118	119	4.4	*Bph32, Wx-A_group*
35	BR 13097-4 R-105	115	104	4.8	*Bph32, Gm4_3, Gm4_4*
36	BR 13097-4 R-113	114	100	5.3	*Bph32*
37	BR 13097-4 R-151	125	104	5.2	*Bph32, Gm4_3, Gm4_4*
38	BR 13098-4 R-143	117	108	5.2	*Wx-GBSS-ex10, Wx-A_group, Gm4_3, Gm4_4*
39	BR 13099-4 R-82	124	120	5.4	*Wx-A_group, Gm4_4*
40	BR 13099-4 R-166	119	121	5.4	*Wx-A_group, Gm4_4*
41	BR 13100-4 R-255	111	105	4.2	*Bph17_1, Bph17_3, Bph17_2, Bph32, Gm4_3, Gm4_4*
42	BR 13102-4 R-33	123	116	5.6	
43	SV 2020	117	125	4.7	
44	BR 12213-5 R-81	127	116	5.6	
45	BR 12213-5 R-145	120	119	4.3	
46	BR 12213-5 R-175	116	119	4.5	
47	BR 12213-5 R-187	125	119	5.5	
48	BR 12213-5 R-220	113	113	5.1	
49	BR 12213-5 R-272	119	128	4.8	
	BRRI dhan33 (Ck.)	116	110	4.3	
	BRRI dhan49 (Ck.)	125	107	4.5	

BRRI dhan87 (Ck.)	121	120	4.9
Lsd(0.05)	9.2	12.7	1.2
H2b	0.8	0.43	0.50

Table 48: Agronomic performance of the selected genotypes from observational yield trial (OYT), Development of Insect Resistant Rice (IRR), Boro, 2022-23

Sl#	Designation	GD (day)	PH (cm)	Yield (t/ha)	BPH Score (SES)	Trait of Interest (ToI)
1	BR 13219-4 R-1	149	92	7.4	9	*Bph17_all+Bph32+Wx_A group+Gm4*
2	BR 13219-4 R-2	146	98	5.8	9	*Bph32+Wx_A group+Gm4*
3	BR 13219-4 R-4	154	99	7.4	7	*Bph17_all+Wx_A group*
4	BR 13219-4 R-6	150	99	5.1	7	*Bph17_all+Wx_A group +Gm4*
5	BR 13219-4 R-31	152	104	6.8	9	*Bph32+Wx_A group+Gm4*
6	BR 13219-4 R-38	153	96	6.8	9	*Bph32+Wx_A group*
7	BR 13219-4 R-48	150	100	6.4	7	*Bph32+Wx_A group+Gm4*
8	BR 13219-4 R-85	151	101	6.8	9	*Bph32+Wx_A group+Gm4*
9	BR 13219-4 R-95	151	90	5.9	7	*Bph17_all+Wx_A group+Gm4*
10	BR 13219-4 R-96	149	101	6.2	7	*Bph32+Wx_A group+Gm4*
11	BR 13219-4 R-123	152	99	6.3	9	*Bph32+Wx_A group+Gm4*
12	BR 13219-4 R-124	150	102	6.9	7	*Bph17_all+Wx_A group*
13	BR 13219-4 R-139	150	102	7.2	7	*Bph32+Wx_A group+Gm4*
14	BR 13219-4 R-167	149	99	6.7	9	*Wx_A group*
15	BR 13219-4 R-244	147	104	7.2	9	*Bph32+Wx_A group*
16	BR 13219-4 R-249	155	92	8.8	9	*Bph17_all+Bph32+Wx_A group*
17	BR 13219-4 R-252	147	98	8.8	9	*Bph32+Wx_A group*
18	BR 13219-4 R-270	152	96	5.5	7	*Bph32+Wx_A group+Gm4*
19	BR 13219-4 R-283	152	99	7.2	7	*Bph17_all+Bph32+Wx_A group*
20	BR 13219-4 R-287	147	99	6.5	9	*Bph32+Wx_A group*
21	BR 13219-4 R-339	149	107	6.3	9	*Bph32+Wx_A group+Gm4*
22	BR 13219-4 R-366	149	102	6.0	9	*Bph32+Wx_A group+Gm4*
23	BR 13219-4 R-382	151	106	5.3	5	*Bph17_all+Bph32+Wx_A group*
24	BR 13218-4 R-18	147	106	7.1	7	*Bph32+Wx_A group*
25	BR 13218-4 R-65	149	97	7.6	9	*Bph32+Wx_A group*
26	BR 13218-4 R-110	149	95	6.2	5	*Bph32+Wx_A group*
27	BR 13218-4 R-227	148	95	6.3	9	*Wx_A group+Gm4*
28	BR 13217-4 R-135	156	113	7.6	9	*Bph17_all+BPH32+Wx_A group*
29	BR 13217-4 R-227	153	110	6.8	9	*Bph17_all+BPH32+Wx_A group*
30	BR 13221-4 R-129	149	92	7.1	9	*Wx_A group*
31	BR 13223-4 R-1	149	101	8.4	9	*Wx_A group*
32	BR 13223-4 R-53	146	102	6.8	9	*Wx_A group*
33	BR 13223-4 R-82	150	100	5.7	9	*Wx_A group*
34	BR 13223-4 R-196	148	105	7.1	7	*Wx_A group+Gm4*
35	BR 13224-4 R-54	147	108	6.5	9	*Bph32+Wx_A group*
36	BR 13224-4 R-79	151	110	6.6	7	*Bph32+Wx_A group*
37	BR 13224-4 R-101	149	97	6.8	7	*Wx_A group*
38	BR 13224-4 R-129	149	104	5.9	7	*Bph32+Wx_A group*
39	BR 13224-4 R-234	147	102	7.2	9	*Bph32+Wx_A group*
40	BR 13227-4 R-74	148	93	6.1	-	*Wx_A group*
41	BR 13228-4 R-72	151	121	7.0	-	*Bph32+Wx_A group*
42	BR 12668-4 R-34	153	92	6.8	9	
43	BR 12668-4 R-163	150	105	6.9	9	
44	BR 12669-4 R-79	153	101	7.9	7	
45	BR 12669-4 R-198	155	103	7.3	9	
46	BR 12670-4 R-43	154	98	7.3	9	
47	BR 12670-4 R-74	153	101	6.6	9	
48	BR 12670-4 R-139	153	99	8.0	9	

49	BR 12671-4 R-123	151	99	7.2	9
50	BR 12671-4 R-138	149	111	8.3	7
51	BR 12671-4 R-185	153	101	7.5	9
52	BR 12671-4 R-195	154	95	6.6	9
53	BR 12671-4 R-253	153	106	7.5	9
54	BR 12671-4 R-297	153	109	7.9	9
55	BR 12671-4 R-312	155	115	7.7	9
56	BR 12671-4 R-319	154	105	6.8	9
57	BR 12671-4 R-321	155	111	7.5	9
58	BR 12671-4 R-328	152	97	9.2	9
59	BR 12671-4 R-377	153	107	7.0	9
60	BR 12671-4 R-464	154	95	8.0	9
61	BR 12671-4 R-491	152	115	7.7	9
62	BR 12671-4 R-502	149	102	9.0	7
63	BR 12671-4 R-521	153	108	8.2	7
64	BR 12671-4 R-531	151	96	7.3	9
65	BR 12671-4 R-560	152	112	8.1	9
66	BR 12672-4 R-59	151	95	7.9	9
67	BR 12672-4 R-82	152	100	8.9	9
68	BR 12672-4 R-175	155	103	9.0	9
69	BR 12672-4 R-197	153	107	7.1	7
70	BR 12672-4 R-205	152	106	7.9	9
71	BR 12672-4 R-252	154	106	7.7	9
72	BR 12672-4 R-261	149	107	7.6	7
73	BR 12676-4 R-146	151	95	6.9	9
74	BR 12676-4 R-162	157	101	7.3	9
75	BR 12676-4 R-393	153	98	5.9	5
76	BR 12677-4 R-70	148	101	6.6	9
77	BR 12677-4 R-134	154	101	7.3	7
78	BR 12677-4 R-190	154	106	6.9	9
79	BR 12677-4 R-242	150	113	7.0	7
80	BR 12671-4 R-161	151	105	8.1	7
81	BR 12678-4 R-187	154	95	7.6	9
82	BR 12685-4 R-143	152	96	5.9	9
83	BR 12685-4 R-203	156	103	7.1	9
84	BR 12685-4 R-251	151	100	6.9	7
	BRRI dhan88 (Ck.)	146	95	6.1	7
	BRRI dhan89 (Ck.)	156	108	7.4	9
	BR3 (Ck.)	163	92	6.1	9
	T27A (Ck.)	144	127	5.1	5
	Lsd(0.05)	7.6	11.3	1.4	
	H2b	78	82	53	

Experiment 3.38: Preliminary Yield Trial (PYT)
Principal Investigator: MRA Sarker
Co-investigators: Anisar Rahman & MR Hasan, H Khatun and MA Rahman

Specific objective: Initial yield evaluation and selection of desirable lines compared to standard checks in replicated trials.

Materials and Methods: Total 100 genotypes comprising PYT-1 and PYT-1 were evaluated at Payrabanda, Rangpur in T. Aman 2022-23 against GM and BPH along with BRRI dhan33 (resistant check for GM), BRRI dhan49 (susceptible check), BRRI dhan52, BRRI dhan75 and BRRI dhan87 (Standard checks). Total 82 advanced breeding lines for BPH were grown at Darshana, Rangpur during Boro 2022-23. BRRI dhan88, BRRI dhan89 and BRRI dhan92 were used as standard checks. Twenty five and 45 days old seedling of each genotype was transplanted at the rate of 2-3 seedlings with a spacing of 20 × 20 cm following Row-Column design with two replications. The unit plot size was 5.4 m×5 rows. Fertilizer doses and

application were the same as in Experiment 19.1. Crop management such as weeding, controlling disease was done in time. Importantly, no insecticides were applied in this experiment.

Results and Discussion: In T. Aman season, yield of the advanced breeding lines ranged from 1.9-4.7 t/ha in PYT-1 and 2.2-6.2 t/ha in PYT-2 at Rangpur. The average plant height ranged from 96.0-128.0 cm in PYT-1 and 100-133 cm in PYT-2. The average yield ranged from 3.4-5.9 t/ha and 3.8-5.2 t/ha with the average of 106-126 days and 114-138 days growth duration in PYT-1 and PYT-2, respectively. Twenty four (12 in PYT-1 and 12 in PYT-2) genotypes from 100 genotypes were selected compared to check varieties for further evaluation **(Table 49 and 50)**. In Boro season, Yield of the advanced breeding lines ranged from 5.5-9.9 t/ha in Rangpur. The average plant height ranged from 80-119 cm. The average yield ranged from 5.8-8.1 t/ha with the average of 142-158 days growth duration. Thirty genotypes were selected compared to the respective check varieties for further evaluation **(Table 51)** in Boro season. Selection was done based on flowering uniformity, phenotypic acceptability, growth duration, yield and pest infestation under field condition.

Table 49: Performance of selected genotypes from PYT-1, Development of Insect Resistant Rice (IRR), T. Aman, 2022

Sl#	Designation	GD (day)	PH (cm)	Yield (t/ha)	Field BPH Score (SES)	BPH Score (SES)	Trait of Interest (ToI)
1	BR 12208-5 R-2	112	106	3.5	5	9	*Bph32, Wx-A_group*
2	BR 12208-5 R-23	113	120	3.7	3	9	*Bph32, Gm4_4, Wx-A_group*
3	BR 12208-5 R-30	112	108	4.2	5	7	*Bph32, Wx-A_group*
4	BR 12208-5 R-42	113	104	3.1	5	7	*Gm4, Wx-A_group*
5	BR 12208-5 R-69	112	119	3.2	3	7	*Bph32, Wx-A_grou*
6	BR 12208-5 R-110	112	108	3.2	5	7	*Bph32, Wx-A_group*
7	BR 12208-5 R-310	112	104	2.9	5	9	*Gm4, Wx-A_group*
8	BR 12208-5 R-344	112	108	3.6	3	9	*Bph32, Wx-A_group*
9	BR 12211-5 R-179	126	110	3.0	7	9	*Bph32, Gm4*
10	BR 12216-5 R-28	126	97	3.1	5	9	*Bph17, Wx-A_group*
11	BR 12229-5 R-162	121	124	3.1	5	9	*Bph32, Gm4*
12	BR 12183-5 R-28	113	111	3.4	5	9	*Wx-A_group*
	BRRI dhan33 (Ck.)	113	103	3.0	9	7	
	BRRI dhan75 (Ck.)	112	103	3.3	7	7	
	Lsd(0.05)	3	9	0.5			
	H2b	72	82	64			

Table 50: Performance of selected genotypes from PYT-2, Development of Insect Resistant Rice (IRR), T. Aman, 2022

Sl#	Designation	GD (day)	PH (cm)	Grain Yield (t/ha)	Field BPH Score (SES)	BPH Score (SES)	Trait of Interest (ToI)
1	BR 12180-5 R-43	136	118	3.8	3	7	*Bph32, Wx-A_group*
2	BR 12180-5 R-62	134	118	4.8	5	7	*Bph32, Gm4, Wx-A_group*
3	BR 12186-5 R-35	123	125	3.3	5	7	*Bph32, Gm4*
4	BR 12193-5 R-54	130	100	4.3	3	7	*Bph9, Bph17_all, Wx-A_group*

5	BR 12208-5 R-80	124	124	3.4	5	7	*Bph32, Wx-A_group*
6	BR 12214-5 R-39	136	118	5.0	3	7	*Bph32, Wx-A_group*
7	BR 12214-5 R-70	137	117	3.9	3	9	*Gm4, Wx-A_group*
8	BR 12214-5 R-195	136	116	4.7	3	7	*Wx-A_group, Gm4*
9	BR 12216-5 R-31	132	117	3.3	5	7	*Bph17_all*
10	BR 12229-5 R-2	131	108	3.0	5	9	*Bph32, Gm4, Wx-A_group*
11	BR 12208-5 R-19	124	132	4.1	5	7	
12	BR 12208-5 R-215	130	127	3.4	5	7	
	BRRI dhan49 (Ck.)	133	104	3.1	7	7	
	BRRI dhan52 (Ck.)	138	114	3.1	7	7	
	BRRI dhan87 (Ck.)	127	120	3.3	7	7	
	Lsd(0.05)	6.7	12.2	0.5			
	H2b	54	56	75			

Table 51: Performance of selected genotypes from PYT, Development of Insect Resistant Rice (IRR), Boro, 2022-23

Sl#	Designation	GD (days)	PH (cm)	Yield (t/ha)	BPH Score (SES)	Trait of Interest (ToI)
1	BR 12667-4 R-86	147	97	8.5	7	*Bph17_all+WX-A_Group+Gm4*
2	BR 12669-4 R-161	143	109	7.8	7	*Bph17_all+WX-A_Group*
3	BR 12670-4 R-20	151	109	9.3	7	*WX-A_Group*
4	BR 12671-4 R-29	153	98	8.1	9	*WX-A_Group*
5	BR 12671-4 R-88	152	102	8.8	9	*WX-A_Group*
6	BR 12671-4 R-95	148	117	9.9	9	*WX-A_Group+fgr-1+BAHD1*
7	BR 12671-4 R-154	151	113	8.6	9	*WX-A_Group+Gm4+fgr-1*
8	BR 12675-4 R-125	149	99	8.1	9	*WX-A_Group+Gm4+fgr-1+BAHD1*
9	BR 12675-4 R-216	150	101	6.4	7	*Bph17_all+WX-A_Group+Gm4+Bph9*
10	BR 12676-4 R-148	155	94	7.0	**5**	*Bph17_all+WX-A_Group+Gm4+fgr-1+BAHD1*
11	BR 12676-4 R-192	152	101	7.7	9	*WX-A_Group+Gm4+fgr-1+BAHD1+Bph9*
12	BR 12676-4 R-237	147	85	6.9	9	*Bph17_al+WX-A_Group+Gm4+fgr1+BAHD1*
13	BR 12676-4 R-256	147	89	8.4	9	*WX-A_Group+Gm4+fgr-1+BAHD1*
14	BR 12676-4 R-392	145	88	7.8	**5**	*WX-A_Grroup+Gm4*
15	BR 12677-4 R-60	153	111	7.7	-	*WX-A_Group+Gm4+fgr-1+BAHD1*
16	BR 12677-4 R-286	152	105	8.6	9	*WX-A_Group*
17	BR 12679-4 R-2	153	98	9.2	-	*WX-A_Group+Gm4+fgr-1+BAHD1*
18	BR 12679-4 R-6	151	103	8.7	9	*WX-A_Group+Gm4+fgr-1+BAHD1*
19	BR 12679-4 R-36	155	105	8.3	9	*WX-A_Group*
20	BR 12679-4 R-41	153	110	8.1	9	*WX-A_Group+Gm4+fgr-1+BAHD1*
21	BR 12679-4 R-63	152	91	8.3	7	*WX-A_Group+Gm4+fgr-1+BAHD1*
22	BR 12679-4 R-67	153	105	8.0	-	*WX-A_Group+Gm4*

23	BR 12679-4 R-70	151	102	7.8	-	*WX-A_Group+Gm4*
24	BR 12679-4 R-98	151	106	8.7	-	*WX-A_Group+Gm4*
25	BR 12679-4 R-168	152	88	8.4	-	*WX-A_Group+Gm4*
26	BR 12679-4 R-173	152	96	8.8	-	*WX-A_Group+Gm4 +fgr-1+BAHD1*
27	BR 12679-4 R-187	150	90	9.0	-	*WX-A_Group+Gm4 +fgr-1+BAHD1*
28	BR 12681-4 R-135	143	91	7.3	9	*WX-A_Group*
29	BR 12682-4 R-50	148	111	9.3	7	*WX-A_Group*
30	BR 12685-4 R-159	152	110	8.4	-	*WX-A_Group*
	BRRI dhan88 (Ck.)	146	93	7.7	7	
	BRRI dhan89 (Ck.)	153	107	9.9	9	
	BRRI dhan92 (Ck.)	157	109	8.9	9	
	Lsd(0.05)	7.6	7.9	0.8		
	H2b	87	66	65		

Experiment 3.39: Advanced Yield Trial (AYT)
Principal Investigator: M R A Sarker
Co-investigators: Anisar Rahman & M R Hasan, H Khatun and M A Rahman
Specific objective: Confirmatory yield evaluation and selection of desirable lines compared to standard checks.

Materials and Methods: Twenty eight genotypes were evaluated at Darshana, Rangpur in T. Aman season against GM and BPH along with BRRI dhan33 (resistant check for GM), BRRI dhan49 (susceptible check) and BRRI dhan87 (Standard check). Total 30 genotypes were evaluated against BPH along with the checks BRRI dhan88, BRRI dhan89 and BRRI dhan92 in Boro season. Twenty five and 45 days old seedling of each genotype were transplanted at the rate of 2-3 seedlings with a spacing of 20 × 20 cm following Row-Column design with two replications. The unit plot size was 5.4 m×5 rows. Fertilizer doses and application were the same as in Experiment 19.1. Crop management such as weeding, controlling disease was done in time. Importantly, no insecticides were applied in this experiment.

Results and Discussion: In T. Aman season, yield of the advanced breeding lines ranged from 2.4-5.3 t/ha. The average plant height ranged from 107.2-126.9 cm. The average yield ranged from 3.7-5.4 t/ha with the average of 112-140 days growth duration. Ten genotypes from 28 genotypes were selected compared to check varieties for further evaluation **(Table 52)**. In Boro season, yield of the advanced breeding lines ranged from 4.5-9.2 t/ha. The average plant height ranged from 91-113 cm. The average yield ranged from 5.9-8.0 t/ha with average 145-158 days growth duration. Out of 30 genotypes, 14 were selected for further evaluation, as they showed higher yield over the respective check varieties **(Table 53)**.

Table 52: Performance of selected genotypes from AYT, Development of Insect Resistant Rice (IRR), T. Aman, 2022

Sl#	Designation	GD (days)	PH (cm)	Grain yield (t/ha)	Field BPH Score (SES)	BPH Score (SES)	Trait of Interest (ToI)
1	BR 11296-4 R -74	128	119	5.1	3	7	*Bph32, Wx-A_group*
2	BR 11296-4 R -74	128	119	5.1	3	5	*Bph32, Wx-A_group*
3	BR 11044-4 R -47	117	115	5.0	5	5	*Bph17_all, Gm4, Wx-A_group*
4	BR 11295-4 R -387	130	126	4.8	5	7	*Bph32, Gm4*
5	BR 11035-4 R -101	114	123	5.3	5	5	*Bph17_all, Bph32, Gm4, Wx-A_group*
6	BR 11052-4 R -234	119	114	5.1	7	9	*Bph17_all, Bph32, Wx-A_group*
7	BR 11295-4 R -486	122	114	4.8	5	7	*Bph32*

8	IRBPHN-SVIN013-18	117	123	5.0	5	5	*Bph17_all, Bph32*
9	BR 11040-4 R -137	123	123	5.3	3	7	*Bph32, Wx-A_group*
10	BR 11033-4 R -33	126	126	4.9	6	5	*Gm4, Wx-A_group*
	BRRI dhan33 (Ck.)	112	112	4.6	9	9	
	BRRI dhan49 (Ck.)	131	108	5.4	5	7	
	BRRI dhan87 (Ck.)	123	121	5.3	7	7	
	Lsd(0.05)	5.8	7.2	0.5			
	H2b	73	77	76			

Table 53: Performance of selected genotypes from AYT, Development of Insect Resistant Rice (IRR), Boro, 2022-23

Sl#	Designation	GD (days)	PH (cm)	Yield (t/ha)	BPH Score (SES)	Trait of Interest (ToI)
1	BR 12177-5 R-1	155	113	6.9	9	*Wx-A_Group+Gm4*
2	BR 12208-5 R-19	149	107	7.1	9	*Wx-A_Group*
3	BR 12208-5 R-87	148	100	8.9	9	*Bph32+Wx-A_Group +BAHD1*
4	BR 12208-5 R-31	147	92	8.3	7	*Bph32+Wx-A_Group*
5	BR 12208-5 R-107	147	91	8.6	9	*Bph32+Wx-A_Group*
6	BR 12208-5 R-227	149	93	7.6	7	*Bph32+Wx-A_Group*
7	BR 12208-5 R-278	147	93	8.9	9	*Bph32+Wx-A_Group*
8	BR 12208-5 R-326	148	93	8.2	9	*Bph32+Wx-A_Group*
9	BR 12208-5 R-330	148	92	8.9	9	*Bph32+Wx-A_Group*
10	BR 12208-5 R-403	149	91	9.0	9	*Bph32+Wx-A_Group*
11	BR 12279-4 R-10	153	107	7.1	5	*Wx-A_Group*
12	BR 11948-4 R-162	153	107	6.9	7	*Wx-A_Group*
13	BR 11949-4 R-39	146	101	6.7	9	*Bph32+Wx-A_Group*
14	BR 11949-4 R-137	148	111	8.4	9	*Wx-A_Group*
	BRRI dhan88 (Ck.)	145	95	8.5		
	BRRI dhan89 (Ck.)	155	105	8.9		
	BRRI dhan92 (Ck.)	158	108	8.3		
	Lsd(0.05)	6.4	7.2	1.0		
	H2b	69	71	56		

4. CROP-SOIL-WATER MANAGEMENT

Experiment 4.1: Effect of Herbicide on Azolla Infestation in Rice Field

MM Mahbub, MKA Bhuiyan, S Zahan & MKH Tarek

Rice is one of the most important food crops in Bangladesh. Most of the farmers in Bangladesh are rely on rice cultivation. Azolla is a fern from Salviniaceae family, which have ability to fix nitrogen and helps the farmers to fertile their land. When Azolla was incorporated into the soil than it added 70 kg N ha^{-1} (Pallavolu *et al*., 2002). On the other hand, *Azolla* has a remarkable ability to multiply that form mats on the water's surface can be 30cm thick, and during hot weather, can double in size in just 4 or 5 days. As a result, farmers have to face some problems like, block irrigation cannels (DiTomaso, 2013), excess growth over younger seedlings and felt problems during intercultural operation and fertilizer or pesticide applications. Sometimes, it is difficult to control Azolla by hand pulling due to labour shortage. DiTomaso, 2013 have used the herbicides; Penoxsulam, Bispyribac sodium, Glyphosate, Diquat for control Azolla.

Objective: To reduce the abundance of Azolla from rice fields.

Materials and Methods: The experiment was conducted at the Bangladesh Rice Research Institute (BRRI) farm, Rangpur, during T. Aman, 2022 and Boro, 2022-23 to find out the effect

of herbicide on weed infestation of rice. The treatments were; i) T_1: Remove water from the plot (Farmers' practice), ii) T_2: Granite 240 SC (Penoxsulam)@ 93 ml/ha, iii) T_3: Nomini gold 10 SC (Bispyribac sodium) @ 150 ml/ha, iv) T_4: Nazat 72 SL (2,4-D Amine)@ 2L/ha , v) T_5: Incorporation of Azolla after full mat formation in the field); and vi) T_6: Control. The treatments were distributed in RCB design with three replications. Twenty-eight days-old seedlings of BRRI dhan87 and Thirty-five day old seedlings of BRRI dhan89 were transplanted at 20- x 20-cm spacing. All fertilizers except urea were applied during final land preparation. Irrigation, weeding, disease and insect control were done as and when necessary. Yield data were recorded during harvesting. Statistical analysis was done by CropStat program.

Results and Discussion: The highest grain yield 5.29 t/ha found in T_5 treatment during T Aman season and consequently panicle/ m^2 and grains/panicle also found highest in this treatment **(Table 54)**. During Boro season the highest grain yield 6.62 found in T_5 treatment and panicle/ m^2 and grains/panicle found highest in this treatment **(Table 55)**. The highest Azolla dry wt found in control treatment at 7 DAS (Days after spray), 14 DAS and 21 DAS both Aman and Boro season. Penoxulam treated plot showed that at 7 DAS Azolla was decreased but after 7 DAS it increased gradually both Aman and Boro season. 2,4-D Amine treated plot showed that at 7 DAS Azolla was higher but after that it gradually decreased. 2,4-D Amine is a slow acting herbicide which effect also slow in Azolla. Other weed dry wt found highest at T_1 and T_6 treatment. Penoxulam control Azolla at first stage but later stage 2,4- D Amine perform better to control Azolla which is similar to the findings of DiTomaso *et al*., 2013.

Table 54: Effect of herbicide on Azolla infestation in rice field during T. Aman, 2022 at BRRI farm, Rangpur

Treatments	Panicle number/ m^2	Grains/ panicle	1000 grain wt (g)	Grain yield (t/ha)	Weed dry wt. (g)	Azolla dry wt. 7 Days after spray (g)	Azolla dry wt. 14 Days after spray (g)	Azolla dry wt. 21 Days after spray (g)
T_1	219	103	24.56	5.02	11.66	20. 05	13.24	7.93
T_2	223	101	24.86	5.03	2.70	5.07	7.33	9.13
T_3	202	100	24.23	4.55	1.30	7.86	8.73	12.73
T_4	238	105	24.66	5.23	2.13	13.96	11.93	9.76
T_5	240	106	24.97	5.29	6.26	7.20	10.24	15.31
T_6	168	100	24.16	3.57	10.80	24.13	30.73	34.93
$Lsd_{0.05}$	19.45	16.82	1.75	0.66	5.06	4.29	4.59	3.66
CV (%)	5.9	9.2	3.9	7.6	16.1	14.1	15.4	17.3

T_1: Remove water from the plot (Farmers' practice), T_2: Granite 240 SC (Penoxsulam)@ 93 ml/ha, T_3: Nomini gold 10 SC (Bispyribac sodium) @ 150 ml/ha, T_4: Nazat 72 SL (2,4-D Amine)@ 2L/ha , T_5: Incorporation of Azolla after full mat formation in the field); and T_6: Control.

Table 55: Effect of herbicide on Azolla infestation in rice field during Boro, 2022-23 at BRRI farm, Rangpur

Treatments	Panicle number/ m^2	Grains/ panicle	1000 grain wt (g)	Grain yield (t/ha)	Weed dry wt. (g)	Azolla dry wt. 7 Days after spray (g)	Azolla dry wt. 14 Days after spray (g)	Azolla dry wt. 21 Days after spray (g)
T_1	238	108	24.09	5.61	9.67	18.73	14.30	8.30
T_2	254	112	24.23	6.05	2.01	6.23	7.95	10.24
T_3	266	115	24.66	6.53	2.26	6.96	10.63	15.52
T_4	244	116	24.01	5.80	3.16	10.66	9.41	7.24
T_5	271	117	24.18	6.62	3.03	9.16	12.35	15.67
T_6	176	110	24.36	3.60	9.50	20.65	27.46	31.53
$Lsd_{0.05}$	22.16	12.27	1.28	1.16	3.26	3.65	9.24	8.49
CV (%)	7.1	6.5	2.8	11.3	36.4	19.3	14.5	19.5

T_1: Remove water from the plot (Farmers' practice), T_2: Granite 240 SC (Penoxsulam)@ 93 ml/ha, T_3: Nomini gold 10 SC (Bispyribac sodium) @ 150 ml/ha, T_4: Nazat 72 SL (2,4-D Amine)@ 2L/ha , T_5: Incorporation of Azolla after full mat formation in the field); and T_6: Control.

Experiment 4.2: Effect of Time of Planting of Newly Developed BRRI Varieties in Different Regional Stations

MS Zahan, MKH Tarek, MR Hasan & MS Islam

Establishment of crop at the right time plays vital role in the performance of rice. Specific agro-climatic conditions of different regions influence the planting time of a variety. So, experiments were conducted at the BRRI Farm, Rangpur both in T. Aman and Boro seasons, 2022-2023 for newly released varieties for transplanting under specific agro-climatic conditions.

T. Aman, 2022

The experiment was conducted at BRRI regional station farm, Rangpur aimed to identify a suitable planting window of BRRI dhan75, BRRI dhan87, BRRI dhan90 and BRRI dhan93 duration cultivars to maximize grain yield. The selected varieties were planted at five different dates at 15 days' interval from July 05th to September 05th. Twenty-five days-old seedlings were transplanted following split-plot design, placing planting date in the main plots and varieties in the sub-plots with three replications. All agronomic practices were performed uniformly for all the treatments. Data of agronomic parameters i.e. panicle number m^{-2}, grains panicle^{-1} and yield were collected at harvest. Results showed that there was a significant effect of date of transplanting on the yield of potential of the tested varieties in T. Aman **(Table 56 & 57)**. Early transplanting of BRRI dhan75 (05th July to 20th of August) gave greater number of Panicles m^{-2}, grains/panicle and grain yield than the delayed transplanting. BRRI dhan87 and BRRI dhan90 transplanted on 20th of August produced higher grain yield **(Table 56)**. BRRI dhan93 gave higher yield on 20th July to 05 august**.** In conclusion, to achieve appreciable better yield in the Rangpur region, BRRI dhan75 should preferably be transplanted on 20th July- 20th August, BRRI dhan87 & BRRI dhan90 on 20th of August and BRRI dhan93 on 20th July- 05th August.

Table 56: Effect of planting time on the Panicles m^{-2} and number of Grains panicle^{-1}of rice in Aman, 2022

Variety	Date of transplanting									
	Panicles m^{-2}					Grains panicle^{-1}				
	05th July	20th July	05th Aug	20th Aug	05th Sep	05th July	20th July	05th Aug	20th Aug	05th Sep
BRRI dhan75	283	257	275	267	175	218	187	176	174	200
BRRI dhan87	250	242	258	233	200	154	171	198	160	163
BRRI dhan90	258	258	242	258	250	322	338	336	386	341
BRRI dhan93	292	267	267	248	258	255	229	210	216	161
CV (%)		12.7					9.0			
CV (%)		10.5					6.7			
Lsd(0.05)		45					25.7			

Table 57: Effect of planting time on the GDD accumulation and yield of rice in T. Aman, 2022

Variety	Date of transplanting									
	GDD					GY				
	05th July	20th July	05th Aug	20th Aug	05th Sep	05th July	20th July	05th Aug	20th Aug	05th Sep
BRRI dhan75	1950.7	2011.9	1928.8	1962.5	1941.5	3.01**	5.38	5.37	5.43	4.67
BRRI dhan87	2315.7	2285.3	2294.2	2264.4	2192.5	4.14*	4.06*	4.53*	6.05	4.79
BRRI dhan90	2309.9	2193.5	2125.4	2049.7	1856.8	2.57*	3.60	3.65	4.81	4.13
BRRI dhan93	2441.7	2385.3	2353.3	2299.5	2180.5	2.51*	5.46	5.42	4.83	1.97**
CV (%)		1.2						9.1		
CV (%)		0.9						6.2		
Lsd(0.05)		9.2						1.01		

*Lodging **Bird damage

Boro, 2022-23

In Boro season, Varieties BRRI dhan88, BRRI dhan89 and BRRI dhan92 tested to find out the optimum planting date. Forty-five days old seedling was transplanted during 16 December to 16 February at 15-days interval. Single seedlings were transplanted at 20cm x 20cm spacing. The treatments were distributed in a split-plot design, placing planting date in the main plots and varieties in the sub-plots with three replications. Results indicated that grain yield of rice was higher for BRRI dhan89 and all the varieties produced higher grain yield on 16 January and 01th February planting **(Table 58 & 59)**.

Table 58: Effect of planting time on the panicles m^{-2} and number of grains $panicle^{-1}$ of rice in Boro, 2022-23

Variety	Date of transplanting									
	Panicles m^{-2}					Grains $panicle^{-1}$				
	16th Dec	01th Jan	16th Jan	01th Feb	16th Feb	16th Dec	01th Jan	16th Jan	01th Feb	16th Feb
BRRI dhan88	328	297	220	300	402	118	120	177	153	104
BRRI dhan89	280	291	248	271	288	167	124	163	155	150
BRRI dhan92	287	293	251	325	315	141	121	134	147	126
CV (%)			13.1					14.4		
CV (%)			9.5					8.9		
Lsd (0.05)			53.6					26.4		

Table 59: Effect of planting time on the GDD accumulation and yield of rice in Boro, 2022-23

Variety	Date of transplanting									
	GDD					GY				
	16th Dec	01th Jan	16th Jan	01th Feb	16th Feb	16th Dec	01th Jan	16th Jan	01th Feb	16th Feb
BRRI dhan88	1701	1675	1631	1619	1679	5.4	5.2	5.2	6.7	5.2
BRRI dhan89	2041	1942	1927	1937	1967	5.6	5.5	7.6	7.7	5.3
BRRI dhan92	2047	1965	1966	1992	2012	6.0	5.4	7.0	7.4	5.1
CV (%)		1.7						9.2		
CV (%)		2.1						7.6		
Lsd (0.05)		1.4						0.83		

Experiment 4.3: Long-term Missing Element Trial

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Nitrogen, P, K, S and Zn are five essential plant nutrients of which the first three are the most important in terms of their deficiencies in soils and potential to increase or decrease crop yield (Shah et al., 2008). Nitrogen is the most yield limiting nutrient elements in the many paddy soils (Savant and Datta, 1982) including Bangladesh. Many rice soils of Bangladesh are also becoming deficient in P, K, S and Zn (BARC, 2018). To study the effect of long-term nutrient omission on rice yield, a long-term missing element trial has been conducted at BRRI regional station farm, Rangpur.

Materials and Methods: The experiment was initiated in a permanent layout at BRRI farm Rangpur during Boro, 2014-15 combining 7 treatments T_1= Control, T_2= NPKSZn, T_3= PKSZn (-N), T_4= NKSZn (-P), T_5= NPSZn (-K), T_6= NPKZn (-S), T_7=NPKS (-Zn) in RCB design with 3 replicates. Fertilizer nutrients i.e., N-P-K-S-Zn rate was 95-8-40-12-1 kg ha^{-1} and 145-10-60-15-2 kg ha^{-1} in T. Aman and Boro seasons, respectively. Urea-N was applied into three equal

splits at final land preparation, active tillering and 5-7 days before panicle initiation (PI) stage. Rests of the fertilizers were applied at final land preparation. BRRI dhan87 in T. Aman and BRRI dhan89 in Boro seasons were cultivated as test rice varieties. The tiller and panicle number per meter square and grain and straw yield data were obtained. Grain yield was recorded from 5 m^2 areas at the center of each plot and 16 hills were collected for straw yield. The grain yield was recorded at 14% moisture content and straw yield as oven dry basis. Data were analyzed statistically by the software STAR.

Results and Discussion:

T. Aman 2022

In T. Aman 2022 season, the omission of nutrients significantly reduced the yield and yield contributing parameters of rice **(Table 60)**. The highest tiller (267) and panicle (254) production per meter square were observed in complete fertilized plot followed by Zn and S omitted plot. The fertilizer control (176 & 166) and N (203 & 195) control treatments produced significantly lowest tiller and panicle number respectively, than other treatments. The N and P omission from complete fertilizer significantly reduced the grain yield of BRRI dhan87 by 32% and 4% respectively. The highest grain yield reduction was found in T_3, which was N omission plot from complete fertilizer. The omission of P, K, S and Zn gave statistically similar grain yield like complete fertilizer treatment in T. Aman season. Similar trend was found in straw yield.

Boro 2022-23

In Boro 2022-23, omissions of different nutrient from complete fertilizer have significant influence on tiller-panicle production and grain-straw yield of BRRI dhan89 **(Table 61)**. Except the fertilizer control plot and N control plot, the tiller and panicle number per meter square increased significantly in all treatments. The highest tiller (224) and panicle (214) production were found in complete fertilizer treatment and the lowest tiller (126) and panicle (120) production were recorded in fertilizer control treatment. Omission of P, K, S and Zn produced statistically similar tiller and panicle per meter square. The omission of N, P, K and S from complete fertilizer significantly reduced the grain yield of BRRI dhan89 by 47%, 24%, 6% and 3% respectively in Boro season. The omission of K (6%) and S (3%) have less yield reduction compared to N and P omission, although slightly lower yield obtained in K (6.32 tha^{-1}) and S (6.51 tha^{-1}) omission plots than complete treatment (6.71 tha^{-1}). Like K and S, the Zn omission have no significant effect on yield reduction in BRRI Rangpur farm yet. Similar result was found in case of straw yield.

Conclusion: The omission of N in T. Aman and omission of N and P in Boro season from complete fertilizer significantly reduced the grain yield of rice at BRRI Rangpur farm. Among the major nutrient elements, omission of N appeared as the most yield limiting nutrient followed by P and K omission for rice in both seasons. The S and Zn omission have no significant effect on yield reduction at BRRI regional station Rangpur farm yet.

Table 60: Effect of long-term missing element on the tiller, panicle, grain and straw yield of BRRI dhan87 at BRRI farm, Rangpur in T. Aman, 2022

Treatments	Tiller per m^2	Panicle per m^2	Grain yield ($t\ ha^{-1}$)	Straw yield ($t\ ha^{-1}$)	(%) Grain yield decreased due to nutrient omission
T_1	176 b	166 b	3.37 c	3.10 c	-
T_2	267 a	254 a	5.82 a	6.05 a	-
T_3	203 b	195 b	3.95 b	4.36 b	32
T_4	257 a	240 a	5.59 a	5.94 a	4
T_5	261 a	245 a	5.70 a	5.99 a	2
T_6	262 a	249 a	5.65 a	6.04 a	3
T_7	265 a	252 a	5.74 a	6.10 a	1.5
LSD (0.05)	46	44	0.40	0.53	
CV (%)	6.7	6.71	2.72	3.45	

N.B. T_1= Control, T_2= NPKSZn, T_3= PKSZn (-N), T_4= NKSZn (-P), T_5= NPSZn (-K), T_6= NPKZn (-S), T_7=NPKS (-Zn)

Table 61: Effect of long-term missing element on the tiller, panicle, grain and straw yield of BRRI dhan89 at BRRI farm, Rangpur in Boro, 2022-23

Treatments	Tiller/m^2	Panicle/m^2	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	(%) Grain yield decreased due to nutrient omission
T_1	126 b	120 b	3.04 c	2.75 c	-
T_2	224 a	214 a	6.71 a	6.18 a	-
T_3	141 b	135 b	3.54 c	3.22 c	47
T_4	199 a	189 a	5.10 b	4.65 b	24
T_5	206 a	191 a	6.32 a	5.88 a	6
T_6	208 a	198 a	6.51 a	6.06 a	3
T_7	209 a	199 a	6.53 a	6.10 a	2.5
LSD (0.05)	31	30	0.82	0.48	
CV (%)	*5.77*	*5.91*	*5.3*	*3.39*	

N.B. T_1= Control, T_2= NPKSZn, T_3= PKSZn (-N), T_4= NKSZn (-P), T_5= NPSZn (-K), T_6= NPKZn (-S), T_7=NPKS (-Zn)

5. SOCIO-ECONOMIC

5.1: Stability analysis of BRRI varieties at BRRI Rangpur in T. Aus, T. Aman and Boro season during 2022-2023

In total 109 of BRRI developed varieties were evaluated during T. Aus (13), T. Aman (47) and Boro (49) season at BRRI RS following RCBD with three replications. BRRI dhan98 gave highest yield (4.4 t/ha) followed by BRRI dhan42 (3.60 t/ha) and BRRI dhan48 (3.60 t/ha during T. Aus season. In T. Aman, BRRI dhan71 (6.28 t/ha) produced highest yield followed by BRRI dhan73 (5.33 t/ha) and BRRI dhan53 (5.17 t/ha) in short duration; BRRI dhan51 (6.32 t/ha) produced highest yield followed by BRRI dhan78 (6.04 t/ha) and BRRI dhan79 (5.46 t/ha) in medium duration. In long duration, BR22 (3.94 t/ha) gave highest yield followed by BRRI dhan46 (3.46 t/ha). During Boro season, BRRI hybrid dhan5 showed highest yield (9.76 t/ha) followed by BRRI hybrid dhan3 (9.41 t/ha) and BRRI hybrid dhan2 (9.21 t/ha) in short duration group. In long duration group, BR15 produced highest yield (9.77 t/ha) followed by BRRI dhan89 (9.34 t/ha) and BRRI dhan29 (9.27 t/ha).

6. TECHNOLOGY TRANSFER

6.1: Demonstration: A total of 2331 demonstration under different project were conducted in Rangpur-Dinajpur region during the reporting period.

RS Rangpur (GOB): A total of 2319 (2319 bighas) varietal demonstrations were conducted at different locations of Rangpur-Dinajpur region. In T. Aus season (111 Bighas), BRRI dhan48, BRRI dhan82, BRRI dhan98, BRRI hybrid dhan7 were used and maximum yield was observed 5.50 t/ha in BRRI dhan82 followed by 5.12 t/ha in BRRI dhan98 at Ranisankail, Thakurgaon and minimum yield was observed 3.29 in case of BRRI dhan98 at Hatibandha, Lalmonirhat. In T. Aman sesson (728 bighas), BRRI dhan70, BRRI dhan71, BRRI dhan75, BRRI dhan79, BRRI dhan87, BRRI dhan90, BRRI dhan93, BRRI dhan94, BRRI dhan95, BRRI dhan103, BRRI hybrid dhan4 and BRRI hybrid dhan6 were used. Maximum yield was observed 6.97 t/ha in BRRI dhan75 at Palichora, Sadar, Rangpur followed by 6.62 t/ha in BRRI hybrid dhan6 at Palichora, Sadar, Rangpur and minimum was 4.09 in BRRI dhan79 at Gokunda, Sadar, Lalmonirhat. In Boro season (1480 bighas), BRRI dhan74, BRRI dhan89, BRRI dhan92, BRRI dhan96, Bangabandhu dhan100, BRRI dhan102, BRRI hybrid dhan3 as well as BRRI hybrid dhan5 were used. Yield range was 6.0 to 9.0 t/ha. Maximum yield was observed 9.0t/ha in BRRI dhan89 at Atowari, Panchagarh and minimum was 6.0 in BRRI dhan74 in Sundorganj, Gaibandha.

TRB Project: Twelve Head to Head Adaptive trails were conducted in twelve upazilas under seven districts in Rangpur-Dinajpur region during the reporting period. Nine varieties viz. BR11, BRRI dhan52, BRRI dhan72, BRRI dhan87, Katribhog, BRRI dhan34, BRRI dhan70, BRRI dhan80 and BRRI dhan90 were used in T. Aman season. Eleven varieties viz. BRRI dhan28,

BRRI dhan29, BRRI dhan74, BRRI dhan88, BRRI dhan89, BRRI dhan92, Bangabandhu dhan100, BRRI dhan102, BINA dhan24, BINA dhan25 and BAU dhan3 were used in Boro season. In T. Aman season, BR11, BRRI dhan52, BRRI dhan70, BRRI dhan87 and BRRI dhan90 (**Table 62 & 63**); and in Boro season BRRI dhan74, BRRI dhan92, Bangabandhu dhan100, BRRI dhan102, BINA dhan24 and BINA dhan25 were choosen by the farmers due to grain appearance, high yield and less disease incidence (**Table 64 & 65**).

Table 62: Grain yield of Head to Head Adaptive trials for medium duration under TRB project in Rangpur region, T. Aman, 2022

Location	Yield (t/ha)			
	BR11	BRRI dhan52	BRRI dhann72	BRRI dhan87
Mithapukur, Rangpur	5.11	5.00	4.33	5.08
Taraganj, Rangpur	5.20	4.83	4.46	5.39
Kawnia, Rangpur	5.37	4.99	4.46	5.56
Sadar, Kurigram	6.55	5.80	5.44	6.16

Table 63: Grain yield of Head to Head Adaptive trials for Premium Quality Rice under TRB project in Rangpur region, T. Aman, 2022

Location	Yield (t/ha)				
	BRRI dhan34	BRRI dhan70	BRRI dhann80	BRRI dhan90	Kataribhog
Parbortipur, Dinajpur	3.60	4.58	4.61	4.48	3.39
Bochaganj, Dinajpur	3.53	4.49	4.70	4.48	3.29
Chirirbondor, Dinajpur	3.60	4.40	4.40	4.34	3.01

Table 64: Grain yield of Head to Head Adaptive trials for Long duration under TRB project in Rangpur-Dinajpur region, Boro, 2022-23

Location	Yield (t/ha)				
	BRRI dhan29	BRRI dhan89	BRRI dhann92	BRRI dhan102	BINA dhan24
Boda, Panchagarh	8.53	8.04	9.18	7.60	8.47
Parbortipur, Dinajpur	8.26	7.57	8.57	8.01	8.06
Sadar, Rangpur	8.47	8.40	8.92	8.33	8.33

Table 65: Grain yield of Head to Head Adaptive trials for short duration under TRB project in Rangpur-Dinajpur region, Boro, 2022-23

Location	Yield (t/ha)					
	BRRI dhan28	BRRI dhan74	BRRI dhann88	Bangabandhu dhan100	BINA dhan25	BAU dhan3
Mithapukur, Rangpur	6.37	7.33	6.69	6.74	6.59	6.53
Sadar, Lalmonirhat	5.94	6.75	6.49	6.52	6.26	6.23

6.2: Training and Field Day: Twenty farmers training on modern rice production technology was conducted at different upazilas of Rangpur-Dinajpur region in collaboration with DAE. A total of 600 farmers were trained through this program. A total of 50 womens were present in farmers training program. It was very much helpful to minimize knowledge gap on modern Rice production technologies. Twelve in-house training were arranged at the programs BRRI regional station to improve the capability in office management of the office staff. Fifteen field days were arranged at different demonstration sites in collaboration with DAE during 2022-2023. A total of 1000 farmers, local leaders and DAE personnel attended those field day programs.

6.3: Seeds and Seedling distribution among the flood affected farmers: BRRI RS, Rangpur arranged special programs for the flood affected farmers. Different photosensitive varieties viz. BR22, BRRI dhan34, Nizarsail and Gainja were distributed among the flood affected farmers in Sadar-Gaibandha, Rajarhat-Kurigram, Kawnia-Sadar-Rangpur, Sadar-Lalmonirhat, Payrabandh-Mithapukur-Rangpur and Dharmadas- Metro-Rangpur.

6.4: Promotional activities for the former enclave's farmer: BRRI RS Rangpur conducted 20 demonstration programs for the dissemination of BRRI developed popular and latest varieties (BRRI dhan75, BRRI dhan90, BRRI dhan93, BRRI dhan89, BRRI dhan92 and Bangabandhu dhan100) in Dashiarchora, Fulbari, Kurigram (Former enclave).

6.5: Seed production and dissemination in July 2022-June 2023

A total of 1,170 kg, 10,681 kg and 33,599 kg TLS were produced in T. Aus, T. Aman and Boro season respectively. A total of 4000 kg Breeder seed (BRRI dhan93 and BRRI dhan95) was produced in T. Aman season and 5250 kg Breeder seed (BRRI dhan74 and BRRI dhan89) was also produced in Boro season. Moreover, a total of 9250 kg Breeder seed was sent to the GRS Division, BRRI Gazipur. In three seasons, 35,421 kg TLS was distributed among the farmers for dissemination in Rangpur-Dinajpur region (**Table 66**).

Table 66: Variety-wise seed production and distribution during T. Aus, 2022, T. Aman, 2022 and Boro, 2022-23

Variety	Amount (kg)		Send to GRS	Sold	Distribution of
	TLS	Breeder seed	(Breeder-kg)	(TLS-kg)	TLS(kg)
T. Aus, 2022					
BRRI dhan48	283	-	-	123	160
BRRI dhan82	140	-	-	40	100
BRRI dhan98	747	-	-	197	550
BRRI hybrid dhan7	-	-	-	-	500
Total	**1,170**	**-**	**-**	**360**	**1,310**
T. Aman, 2022					
BR22	470	-	-	70	400
BRRI dhan34	621	-	-	500	121
BRRI dhan49	100	-	-	100	-
BRRI dhan51	60			60	-
BRRI dhan52	284	-	-	204	80
BRRI dhan70	226	-	-	176	50
BRRI dhan71	368	-	-	268	100
BRRI dhan75	2076	-	-	1076	1040
BRRI dhan79	405	-	-	205	200
BRRI dhan80	203	-	-	83	120
BRRI dhan87	1141	-	-	241	900
BRRI dhan93	2967	2000	2000	367	2600
BRRI dhan95	1357	2000	2000	357	1000
BRRI dhan103	178	-	-	78	100
Naizarsail	73	-	-	73	-
Gainja	152	-	-	152	-
BRRI hybrid dhan4 & 6	-	-	-	-	1000
Total	**10,681**	**4,000**	**4,000**	**3,970**	**7,711**
Boro, 2022-2023					
BR16	47	-	-	47	-
BRRI dhan28	66	-	-	66	-

BRRI dhan29	81			81	-
BRRI dhan50	200	-	-	-	200
BRRI dhan58	213	-	-	213	-
BRRI dhan67	114	-	-	14	100
BRRI dhan74	6,149	2,500	2,500	1,049	5,100
BRRI dhan81	529	-	-	29	500
BRRI dhan84	675	-	-	175	500
BRRI dhan86	66	-	-	66	-
BRRI dhan88	581	-	-	281	300
BRRI dhan89	5,076	2,750	2,750	1,576	3,500
BRRI dhan92	15,497	-	-	1,497	14,000
BRRI dhan96	302			102	200
Bangabandhu dhan100	4,003			503	3500
BRRI hybrid dhan3 & 5	-	-	-	-	1000
Total	**33,599**	**5,250**	**5,250**	**5,699**	**28,900**
Grand Total	**45,450**	**9,250**	**9,250**	**10,029**	**35,421**