

BRRI ANNUAL REPORT

2024-2025



BANGLADESH RICE RESEARCH INSTITUTE

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Preface

The present volume of BRRI Annual Report is a summary of research works carried out by 19 research divisions and 11 regional stations of the institute during July 2024 to June 2025. This document consists of the significant portions of the research covering eight programme areas.

The programme areas such as variety development, crop-soil-water management, rice farming systems, pest management, socio-economics and policy, farm mechanization, technology transfer and regional stations representing the broader conceptual frameworks of BRRI activities.

With a target to sustain Bangladesh's achievements as a rice surplus country, BRRI scientists have been engaged in developing various location specific, climate smart, stress tolerant rice varieties and some nutritionally enriched premium quality ones.

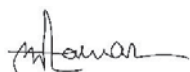
Another group of BRRI scientists dedicated their time to develop and disseminate resource-saving profitable environment friendly technologies along with some management tools such as alternate wetting and drying (AWD) techniques, low cost water distribution system, rice transplanter, low cost machinery like harvester, weeder etc., integrated crop management (ICM) practices, rice based farming systems and popularization of BRRI machinery to the end users.

Furthermore, BRRI developed high yielding rice varieties along with management technologies were demonstrated in different agro-ecological zones of the country.

Above all, the present report includes various research results out of activities that attempted to minimize yield gap. It also includes research initiatives dedicated to finding out coping strategies to face the effects of changing climate like increased flash floods, salinity, excessive heat and drought as well as severe cold.

I acknowledge all the efforts that helped bring out the publication and special thanks for those who contributed with different capacities.

I hope the report will be useful for the scientists, extension agents, policy makers and other partners home and abroad to be updated on continuous research activities at BRRI.



(Dr Mohammad Khalequzzaman)

Director General

BRRI

Personnel

Director General's Office

Md Shahjahan Kabir, *PhD*

Director General

Mohammad Khalequzzaman, *PhD**

Director General

** From 20 August 2024*

Research Wing

Mohammad Khalequzzaman, *PhD**

Director (Research)

Md. Rafiqul Islam, *PhD***

Director (Research)

Munnujan Khanam, *PhD*

Coordinator for Advanced Studies and Research, TOC

** 8 September 2021 to 8 January 2025*

*** From 9 January 2025*

Administrative Wing

Md. Abdul Latif, *PhD**

Director (Administration and Common Service)

Md. Anwarul Haque, *PhD***

Director (Administration and Common Service)

Munnujan Khanam, *PhD****

Director (Administration and Common Service)

Emran Hossain, *MS (BAU)*

Deputy Director (Administration and Common Service)

Kawsar Ahmad, *BSS (Hons), MSS (RU)*

Assistant Director (Procurement)

Md Harunur Rashid, *BA*

Assistant Director (Common Service)

Muhammad Aminur Rashid

Assistant Director (Store)

Shyamal Chandra Das

Assistant Director (Administration)

Md Munzur Kadir

Assistant Director (Administration)

Sayed Nahida Akter

Assistant Director: Administration (Additional Charge)

Shimul Barua

Assistant Director: Store (Additional Charge)

** 11 June 2024 to 29 December 2024*

*** 9 January 2025 to 8 March 2025*

**** From 20 March 2025*

Accounts and Finance

Md Golam Rashid, *Mcom (Acct) CMA (Int)*

Deputy Director (Accounts and Finance)

Tarique Sala Uddin, *Bcom (Hons), MCom*

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Assistant Director (Finance)

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Audit Officer

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Executive Engineer

Md Hasan Mahamud, *Dip-in-Engg (Civil)*

Assistant Engineer

Md Motiur Rahman

Assistant Engineer

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Cartographer

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Principal Planning Officer

Md Saidul Islam, *MSAg (Econ)*

Senior Planning Officer

Md Firoz Hossain, *MSS*

Planning Officer

Dispensary

Dr Habiba Sultana, *MBBS*

Resident Physician

Dr Rasel Faruk, *MBBS*

Resident Physician

Library

Mahbubur Rashid Talukder, *MA*

(Information Sc and Lib Management)

Senior Librarian

Tahmina Ahmed, *MA*

(Information Sc and Lib Management)

Librarian

Plant Breeding Division

Khandakar Md Iftekharuddaula, *PhD*

Chief Scientific Officer and Head

Md Abdul Kader, *PhD*

Chief Scientific Officer

Mohammad Akhlasur Rahman, *PhD*

Chief Scientific Officer

Mahmuda Khatun, *PhD*

Principal Scientific Officer

Md Ruhul Amin Sarker, *PhD*

Principal Scientific Officer

Sharmistha Ghosal, *PhD*

Principal Scientific Officer

Md Rafiqul Islam, *PhD*

Senior Scientific Officer

Ratna Rani Majumder, *MS*

Senior Scientific Officer

Md Anisuzzaman, *PhD***

Senior Scientific Officer

Hasina Khatun, *PhD***

Senior Scientific Officer

Md Abu Syed, *PhD*
Senior Scientific Officer
 Md Adil, *PhD*
Senior Scientific Officer
 Tapas Kumer Hore, *PhD***
Senior Scientific Officer
 Sheikh Maniruzzaman, *PhD*
Senior Scientific Officer
 M M Emam Ahmed, *MS**
Senior Scientific Officer
 Fahamida Akter, *MS*
Senior Scientific Officer
 Nusrat Jahan, *MS*
Senior Scientific Officer
 Armin Akter Setu, *MS*
Scientific Officer
 Atiqur Rahman, *MS*
Scientific Officer
 Sadia Sultana Chaity, *MS*
Scientific Officer
 Sanjana Tabassum Tuba, *MS*
Scientific Officer
 Anisar Rahman, *MS*
Senior Scientific Officer
 Ribed Farzana Disha, *MS*
Scientific Officer (CRCIL-BRRI Project)
 Mahmuda Maliha Yasmin, *MS*
Scientific Officer (CRCIL BRRI Project)
 Md Ferdous Rezwana Khan Prince, *MS*
Scientific Officer (CRCIL -BRRI Project)
 Nishat Tamanna, *MS*
Scientific Officer (TRB-BRRI Project)
 Istiak Hossain Joy, *MS*
Scientific Officer (PARTNER-BRRI Project)
 Fayshal Mahmood, *MS*
Scientific Officer, RCGS Project
 Md Faisalul Karim, *MS*
Scientific Officer, RCGS Project
 Maisha Maliha, *MS*
Scientific Officer, RCGS Project
 Hammadullah Al Mashuk, *MS*
Scientific Officer, RCGS Project
**Deputation for higher study in abroad*
*** Transferred to R/S BRRI*

Biotechnology Division

Shahanaaz Sultana, *Ph D*
Chief Scientific Officer and Head (CC)
 Jannatul Ferdous, *Ph D*
Senior Scientific Officer
 Nilufar Yasmin Shaikh, *Ph D**
Senior Scientific Officer
 S M Hisam Al Rabbi, *Ph D*
Senior Scientific Officer
 Ripon Kumar Roy, *MS*

Senior Scientific Officer
 Md Arafat Hossain, *MS**
Scientific Officer, BRRI
 Shampa Das Joya, *MS**
Scientific Officer
 Md Sentu Rahman, *MS***
Scientific Officer
** Deputation*
*** Transferred*

Genetic Resources and Seed Division

Partha Sarathi Biswas, *PhD**
Chief Scientific Officer and Head
 Mir Sharf Uddin Ahmed, *PhD*
Chief Scientific Officer and Head
 Ebna Syod Md Harunur Rashid, *PhD*
Senior Scientific Officer
 Md Abubakar Siddique, *MS*
Senior Scientific Officer
 Armin Bhuiya, *PhD ***
Senior Scientific Officer
 Mohammad Zahidul Islam, *PhD*
Senior Scientific Officer
 Md Humayun Kabir Baktiar, *PhD****
Senior Scientific Officer
 Tonmoy Chakraborty, *BS(Ag)*
Senior Plant Breeder
 Nadia Akter, *PhD*
Senior Scientific Officer
 Nashirum Monir, *BScAg(Hons)*
Senior Scientific Officer
 Md Ashiqur Rahman, *BSc Ag(Hons) *****
Scientific Officer
 Md Manwar Hossain, *MS*
Scientific Officer

** Transferred to BRRI RS, Habiganj on 18 May 2025*
***Transferred to BRRI RS, Sonagazi on 05 September 2024*
****Transferred to BRRI RS, Gopalganj on 19 January 2025*
*****Abroad for higher Studies*

Grain Quality and Nutrition Division

Md Anwarul Haque, *PhD*
Chief Scientific Officer and Head
 Sharifa Sultana Dipti, *PhD*
Chief Scientific Officer and Head
 Nilufa Ferdous, *PhD*
Principal Scientific Officer
 Tapash Kumar Sarkar, *PhD*
Senior Scientific Officer
 Habibul Bari Shozib, *PhD*
Senior Scientific Officer
 Shakir Hosen, *MS*
Senior Scientific Officer
 Md. Rubel Akanda, *MS*
Scientific Officer

Hybrid Rice Division

Md Jamil Hasan, PhD

Chief Scientific Officer and Head

Md Shafiqul Islam, PhD***

Principal Scientific Officer

Ashish Kumar Paul, MSc Ag

Principal Scientific Officer

Priya Lal Biswas, PhD

Senior Scientific Officer

Mosammat Umma Kulsum, PhD

Senior Scientific Officer

Afsana Ansari, PhD

Senior Scientific Officer

Anowara Akter, PhD

Senior Scientific Officer

Md Hafizar Rahman, PhD

Senior Scientific Officer

Laila Ferdousi Lipi, MS**

Senior Scientific Officer

Md Ruhul Quddus, MS**

Scientific Officer

Farhana Rahman Surovi, MS

Scientific Officer

Md Mustafizur Rahman, MS

Scientific Officer

* Expired on 29 June 2025

** Deputation for in-country PhD programme

*** Transferred to BRRI RS Dinajpur

Agronomy Division

Md. Shahidul Islam, PhD

Ex. Chief Scientific Officer and Head

Md Abu Bakar Siddique Sarker, PhD

Principal Scientific Officer and Head

Md. Khairul Alam Bhuiyan, PhD

Principal Scientific Officer

Md. Adil Badshah, PhD

Principal Scientific Officer

Shah Ashadul Islam

Senior Scientific Officer

Rakiba Shultana, PhD

Senior Scientific Officer

Md. Iftekhar Mahmud Akand

Senior Scientific Officer

Amena Sultana, PhD

Senior Scientific Officer

Nasima Akter, PhD

Senior Scientific Officer

Md. Masud Rana, PhD

Senior Scientific Officer

Zakaria Ibne Baki, PhD

Senior Scientific Officer

Mrs. Romana Akter

Scientific Officer

Sohel Mia

Scientific Officer

Md. Monir Hossain

Scientific Assistant

Md. Saiful Islam

Scientific Assistant

Md Momen

Scientific Assistant

Mst Sumaiya Akter Bristy

Scientific Assistant

Soil Science Division

Md Rafiqul Islam, PhD*

Chief Scientific Officer and Head

Aminul Islam, PhD

Chief Scientific Officer

Umme Aminun Naher, PhD

Principal Scientific Officer

A T M Sakhawat Hossain, PhD

Principal Scientific Officer

Fahmida Rahman, PhD

Senior Scientific Officer

Md. Mozammel Haque, PhD

Senior Scientific Officer

Masuda Akter, PhD

Senior Scientific Officer

S M Mofijul Islam, PhD

Senior Scientific Officer

Mosud Iqbal, PhD

Senior Scientific Officer

Md. Nazrul Islam, PhD

Senior Scientific Officer

Md Imran Ullah Sarker, MS**

Senior Scientific Officer

Afsana Jahan, MS

Scientific Officer

Tanjina Islam, MS

Scientific Officer

Mehedi Hasan Khan

Scientific Officer

* Appointed as Director (Research), BRRI

**On deputation for higher studies

Irrigation And Water Management

Md Mahbubul Alam, PhD

Principal Scientific Officer and Head

Shahana Parveen, PhD

Senior Scientific Officer

ABM Zahid Hossain, PhD

Senior Scientific Officer

Debjit Roy, PhD

Senior Scientific Officer

Mir Nurul Hasan Mahmud, PhD*

Senior Scientific Officer

Priya Lal Chandra Paul, *PhD*

Senior Scientific Officer

Md Belal Hossain, *MS***

Senior Scientific Officer

Mst Shetara Yesmin, *MS***

Senior Scientific Officer

Palash Kumar Kundu, *MS***

Senior Scientific Officer

Jinat Sharmin***

Senior Scientific Officer

**On deputation to Training Operation Cell (TOC)*

*** On deputation for higher studies*

**** Just joined*

Plant Physiology Personnel

Mst Salma Pervin, *PhD*

Chief Scientific Officer and Head

Md Sazzadur Rahman, *PhD*

Chief Scientific Officer

Hirendra Nath Barman, *PhD*

Principal Scientific Officer

Salma Akter, *PhD*

Senior Scientific Officer

Tuhin Halder, *MS*

Senior Scientific Officer

Sadia Afrin Shupta, *MS*

Scientific Officer

Farzana Akter, *MS*

Scientific Officer

Mst. Jinnuraine Jannaty, *MS*

Scientific Officer

Afroza Awal Shoily, *MS*

Scientific Officer (CRCIL)

Entomology Division

Sheikh Shamiul Haque, *PhD*

Chief Scientific Officer and Head

Md Mofazzel Hossain, *PhD**

Chief Scientific Officer

Md Mosaddeque Hossain, *MS*

Principal Scientific Officer

Md Nazmul Bari, *PhD*

Principal Scientific Officer

Mir Md Moniruzzaman Kabir

Senior Scientific Officer

Farzana Nowrin, *MS***

Senior Scientific Officer

Sanjida Akter, *MS*

Scientific Officer

Tapon Kumar Roy

Scientific Officer

** Deputed for PD on 5 July 2023 (LSTD, BRRI)*

*** Deputed for PhD (abroad) on 21 Sep 2023*

Plant Pathology Division

Tahmid Hossain Ansari, *PhD*

Chief Scientific Officer and Head

Quazi Shireen Akhter Jahan, *PhD*

Principal Scientific Officer

Mohammad Hossain, *PhD*

Principal Scientific Officer

Mohammad Salim Mian, *PhD*

Principal Scientific Officer

Mohammad Ashik Iqbal Khan, *PhD*

Principal Scientific Officer

Shamima Akter, *PhD*

Principal Scientific Officer

Monsur Ahmad, *PhD*

Senior Scientific Officer

Md Rejwan Bhuiwan, *PhD*

Senior Scientific Officer

Bodrun Nessa, *PhD*

Senior Scientific Officer

Anjuman Ara, *MS*

Senior Scientific Officer

Sheikh Arafat Islam Nihad, *MS*

Senior Scientific Officer

Md Hasibur Rahaman Hera, *MS*

Scientific Officer

Rumana Akter, *MS*

Scientific Officer

Hosne Ara Dilzahan, *MS*

Scientific Officer

Fabeeha Tarannum, *MS*

Scientific Officer

Support Service Personnel

Mohammad Majibar Rahaman, *Dip-in-Ag., SA*

A K M Shahjada Habib, *Dip-in-Ag., SA*

Rice Farming Systems Division

Md Ibrahim, *PhD*

Chief Scientific Officer

Amina Khatun, *PhD*

*Chief Scientific Officer**

Md Harun-Ar-Rashid, *PhD*

*Principal Scientific Officer***

Md Khairul Quais, *PhD*

Principal Scientific Officer

S M Shahidullah, *PhD*

Principal Scientific Officer^a

Nargis Parvin, *PhD*

Senior Scientific Officer

ABM Jamiul Islam, *MS*
Senior Scientific Officer
 Md Amanut Ullah Razu, *PhD*
Scientific Officer
 Deluwar Hossen Payel, *B. Sc. Ag (Hons)*
Scientific Officer
 Tasnima Husna, *MS*
Scientific Officer
 Tafsir Araf, *MS*
Scientific Officer
 * *Transferred to BRRI R/S, Gopalganj*
 * * *Transferred to BRRI R/S, Rajshahi*

Agricultural Economics Division

Md Saiful Islam, *MS*
Chief Scientific Officer and Head
 Mohammad Ariful Islam, *PhD*
Principal Scientific Officer
 Md Imran Omar, *MS**
Principal Scientific Officer
 Md Abdur Rouf Sarkar, *MS**
Senior Scientific Officer
 Mohammad Chhiddikur Rahman, *PhD*
Senior Scientific Officer
 Afroza Chowdhury, *MS**
Senior Scientific Officer
 Md Shajedur Rahaman, *MS**
Senior Scientific Officer
 Limon Deb, *MS**
Senior Scientific Officer
 S M Mehedy Hasan Noman, *MS***
Scientific Officer
 Saida Akter Jui, *MS*
Scientific Officer
 Md. Salman, *MS*
Scientific Officer
 Sadia Akter Mou, *MS*
Scientific Officer
 Most. Nopur Akter
Scientific Officer
 **Deputed to higher studies (PhD)*
 ** *Deputed to MS study in abroad*

Agricultural Statistics Division

Md Ismail Hossain, *PhD*
Chief Scientific Officer and Head
 Niaz Md Farhat Rahman, *MS*
Principal Scientific Officer
 Md Abdul Qayum, *M. Phil*
Senior Scientific Officer

Md Abdullah Aziz, *MS*
Senior Scientific Officer
 Md Abdullah Al Mamun, *MSc*
Senior Scientific Officer
ICT Cell
 S M Mostafizur Rahman, *BSc (Engg.)*
System Analyst
 Md Mahfuz Bin Wahab, *MS*
Programmer
 Kabita, *MSc*
Assistant Programmer
 Md Asadullah, *MSc*
Data Analyst
 Nuraiya Kulsum, *BSS*
Senior Data Entry Control Operator

Farm Management Division

Md Sirajul Islam, *MS**
Chief Scientific Officer and Head
 Md Manunur Rahman, *PhD***
Principal Scientific Officer and Head
 Mohammad Rezaul Manir
Principal Scientific Officer
 Md Manunur Rashid, *MS****
Senior Scientific Officer
 Afia Sultana Ruma, *MS****
Scientific Officer
 Mohammad Zahirul Haque
Farm Manager
 Mohammad Jahurul Haque Shamim
Farm Manager
 **Transferred to BRRI RS Khagrachari on 8 August 2024*
 ***Transferred to BRRI Haed Quarter, Gazipur on 8 August 2024*
 ****Transferred to BRRI RS Rangpur on 9 September 2024*
 *****On deputation for PhD since 06.09.2025*

Farm Machinery and Postharvest Technology Division

Md Durrul Huda, *PhD*
Chief Scientific Officer and Head
 AKM Saiful Islam, *PhD*
Chief Scientific Officer
 Md Golam Kibria Bhuiyan, *PhD*
Principal Scientific Officer
 Md Anwar Hossen, *PhD*
Principal Scientific Officer
 Bidhan Chandra Nath, *PhD*
Senior Scientific Officer
 Mohammad Kamruzzaman Milion, *PhD.*
Senior Scientific officer
 Subrata Paul, *M. Engg.*
Senior Scientific officer

Md Kamruzzaman Pintu, *MS*

Senior Scientific officer

Md Monirul Islam, *MS*

Senior Scientific Officer

Sharmin Islam, *MS*

Agriculture Engineer

Haimonti Paul, *MS*

Agriculture Engineer

Md Mizanur Rahman, *MS*

Scientific Officer

Md Mahir Shahriyar, *MS*

Scientific Officer

Arafat Ullah Khan, *MS*

Scientific Officer

Workshop Machinery and Maintenance Division

Mohammad Afzal Hossain, *PhD*

Principal Scientific Officer and Head

Hafijur Rahaman, *MS **

Senior Scientific Officer

Md Moudud Ahmmed, *MS*

Agricultural Engineer

**Deputed to Higher Studies*

Adaptive Research Division

Md. Humayun Kabir, *PhD*

Chief Scientific Officer

Md. Rafiqul Islam, *PhD*

Principal Scientific Officer

Biswajit Karmakar, *PhD*

Principal Scientific Officer

Md. Humayun Kabir, *PhD*

Principal Scientific Officer

Mohammad Habibur Rahman Mukul, *PhD*

Principal Scientific Officer

Shamsunnaher, *Ph*

Senior Scientific Officer

Afroz Zahan, *PhD*

Senior Scientific Officer

Mir Mehedi Hasan, *MS*

Senior Scientific Officer

Md. Niaz Morshed, *MS*

Scientific Officer

Khandoker Khalid Ahmed, *MS*

Scientific Officer

Md. Said Hossain, *MS*

Scientific Officer

Training Division

Md Shahadat Hossain, *PhD*

Chief Scientific Officer and Head

Shahnaz Parveen, *PhD*

Senior Scientific Officer

Mohammad Abdul Momin, *PhD*

Senior Liaison Officer

BRRI RS, Barishal

Mohammad Ashik Iqbal Khan, *PhD*

Principal Scientific Officer and Head

PriyaLal Biswas, *PhD**

Senior Scientific Officer

Hasina Khatun, *PhD*

Senior Scientific Officer

Tusher Chakrobarty, *MS***

Senior Scientific Officer

Aishik Debnath***

Scientific Officer

Mohammad Rezoan Bin Hafiz Pranto, *MS*

Scientific Officer

Tomalika Saha, *MS*****

Scientific Officer

Suhel Mia, *MS******

Scientific Officer

Transferred to HQ, Gazipur; **Deputation for PhD programme in abroad; *Deputation for MS programme in abroad; ****Transferred to BRRI regional station, Camilla; *****Transferred to HQ, Gazipur*

BRRI RS, Bhanga, Faridpur

Md. Zakaria Ibne Baki, *PhD*

Senior Scientific Officer & Head

A. B. M. Mostafizur, *MS*

Senior Scientific Officer

Urmi Rani Shaha, *MS*

Scientific Officer

Sifat-E-Jerin, *MS*

Scientific Officer

BRRI RS, Cumilla

Dr. Md. Rafiqul Islam

Director (Research)

Md. Sirajul Islam

Chief Scientific Officer and Head

Dr. Mohammad Akhlasur Rahman

Chief Scientific Officer and Head

Dr. Shila Pramanik

Principal Scientific Officer

Md. Mamunur Rashid

Senior Scientific Officer

AKM Shalahuddin

Senior Scientific Officer

Tasnia Ferdous

Scientific Officer

Bijoya Saha

Scientific Officer

Tomalika Saha

Scientific Officer

Most Tanziatul Husna

Scientific Officer

BRRI RS, Habiganj

Md. Mamunur Rashid, *PhD*

*Principal Scientific Officer and Head **

Hirendra Nath Barman, *PhD*

*Principal Scientific Officer and Head ***

Partha Sarathi Biswas, *PhD*

*Chief Scientific Officer and Head ****

Md. Abu Sayed, *PhD*

*Senior Scientific Officer *****

Mohammad Anisuzzamman, *PhD*

Senior Scientific Officer

Avijit Biswas, *MS*

*Senior Scientific Officer******

Most. Mahamuda Khatun, *BSc Ag (Hons)*

Scientific Officer

Md. Shahin Alam, *MS*

*Scientific Officer******

Oli Ahmed

*Scientific Assistant******

Abdullah

Scientific Assistant

Md. Feroj Kabir

*Scientific Assistant ******

** Transferred to BRRI HQ Gazipur on 08/08/2024*

***Served as a head from 11/08/2024 to 31/05/2025*

****Joined as a head on 01/06/2025*

***** Transferred to BRRI HQ Gazipur on 08/08/2024*

****** On deputation for higher studies*

****** Transferred to BRRI HQ Gazipur*

****** Resigned the job from BRRI, Habiganj*

BRRI RS, Rajshahi

Mohammad Hossain, *PhD*

Chief Scientific Officer and Head

Md. Fazlul Islam, *PhD***

Principal Scientific Officer

Md. Harun-Ar-Rashid, *PhD****

Principal Scientific Officer

Md. Rafiqul Islam, *PhD*****

Senior Scientific Officer

Md. Hannan Ali, *PhD*

Senior Scientific Officer

Tapos Kumar Hore, *PhD******

Senior Scientific Officer

Lipiara Khatun, *MS*

Senior Scientific Officer

Sumona Haque, *MS*

Scientific Officer

Sadia Abedin, *MS, MPhil*

Scientific Officer (CRCIL)

** Transferred from Plant Pathology Division, BRRI on 15 May 2025*

*** Transferred to BRRI RS Bhanga on 8 August 2024*

****Transferred to BRRI Head Quarter on 7 July 2025*

*****Transferred to BRRI Head Quarter, Gazipur on 8 August 2024*

******Joined from Plant Breeding Division, BRRI on 6 October 2024*

BRRI RS, Rangpur

Md. Rokebul Hasan, *PhD*

Principal Scientific Officer and Head

Mst. Selima Zahan, *PhD*

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Md. Mamunur Roshid, *MS*

Senior Scientific Officer

Rowmika Jahan Promee, *MS*

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Md. Shoriful Islam, *Dip. in Ag*

Scientific Assistant

Md. Abdus Sattar, *Dip. in Ag*

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Scientific Assistant

Md. Moniruzzaman, *Dip. in Ag*

Assistant Seed Technologist

Md. Nazmul Khan, *Dip. in Ag*

Scientific Assistant (PARTNER)

BRRI RS, Satkhira

Md. Sazzadur Rahman, *PhD **

Chief Scientific Officer

Biswajit Karmakar, *PhD***

Principal Scientific Officer

Md. Mamunur Rahman, *PhD****

Principal Scientific Officer

Romana Akter****

Senior Scientific Officer

Tamal Patra Shuvo, *MS******

Scientific Officer

Wazifa Afrin, *PhD******

Scientific Officer

Tahmina Akter, *MS ******

Scientific Officer

Md. Liakat Hossen Mondol, *MS*

Scientific Officer

Ashim Kumar Biswas, *Dip. in Agriculture******

Farm Manager

Md. Ruhul Amin, *Dip. in Agriculture ******

Assistant Farm Manager

Sohail Mohammad, *Dip. in Agriculture ******

Assistant Farm Manager

Md. Azim Uddin, *Dip. in Agriculture* *****
Fieldman (Scientific Assistant)
 Md. Rasheduzzaman, *Dip. in Agriculture*
Scientific Assistant
 Ripon Kumar Sarker, *Dip. in Agriculture******
Scientific Assistant (PARTNER Project)
 * Joined in 30/09/2024, ** Joined in 11/08/2024 and
 transferred in 29/09/2024, *** Transferred in 10/08/2024
 **** Joined in 18/05/2025, ***** Abroad for higher
 studies since January and March 2025, ***** Joined in
 25/11/2024, ***** Transferred in 12/09/2024,
 ***** Joined in 24/09/2024, ***** Joined in
 15/04/2025, ***** Transferred in 11/03/2025
 ***** PARTNER Project personnel

BRRRI RS, Sonagazi, Feni

Aminul Islam, *PhD*
Chief Scientific Officer & Head
 Biswajit Karmakar, *PhD*
Principal Scientific Officer & Head
 Humayon Kabir, *PhD*
Principal Scientific Officer
 Armin Bhuiya, *PhD*
Senior Scientific Officer
 Md. Nayeem Ahmed, *MS*
Senior Scientific Officer
 Md. Adil, *PhD*
Senior Scientific Officer
 Md. Asib Biswas, *MS*
Scientific Officer
 Md. Ariful Islam Khalid, *MS*
Scientific Officer
 Sania Tamanna, *B. Sc. (Ag.)*
Scientific Officer
 Tajmery Khan Jebin, *MS*
Scientific Officer
 Md. Nibir Hasan, *MS*
Scientific Officer
 Md. Zahirul Haque,
Farm Manager
 Ashim Kumar Biswas
Farm Manager

BRRRI RS, Kushtia

Md. Mahbubur Rahman Dewan, *MS*
Principal Scientific Officer and Head
 Md. Asif Rahman, *MS**
Senior Scientific Officer
 Kh. Dil Afroze, *MS*
Scientific Officer
 Nahida Akter, *MS*
Scientific Officer

Md. Sumon Hossen**
Scientific Assistant
 Khurshid Jahan Sihab
Store Officer
 Md. Mohabbot Ali
UDA cum Accountant
 *Transferred to Gazipur on 15-05-2025 ** Transferred to
 Bhanga, Faridpur on 15-09-2024

BRRRI RS, Sirajganj

Md. Adil Badshah, *PhD*
*Principal Scientific Officer and Head **
 Shamima Akter, *PhD*
*Principal Scientific Officer and Head ***
 Laila Ferdousi Lipi, *MS*
*Senior Scientific Officer ****
 S.M.M. Shahriar Tonmoy, *MS*
*Scientific Officer ****
 Md. Sentu Rahman, *MS*
Scientific Officer
 Samia Lutfi Hasan, *MS*
Scientific Officer
 Aziz Ullah
*Scientific Assistant*****
 Md. Jobaidur Rahman
Scientific Assistant
 * Transferred to BRRRI HQ on 15/07/2024
 **Served as a head from 16/07/2024 to 13/09/2025
 ***On deputation for higher studies.
 ***** Transferred to BRRRI Regional Station, Sonagazi.

BRRRI RS, Gopalganj

Amina Khatun, *PhD*
Chief Scientific Officer & Head
 S M Shahidullah, *PhD*
Principal Scientific Officer
 Mohammad Zahidul Islam, *PhD*
Senior Scientific Officer & Head
 Md. Romel Biswash, *PhD*
Senior Scientific Officer
 Md. Humayun Kabir Baktier, *PhD*
Senior Scientific Officer
 Faruk Hossain Khan
Scientific Officer
 Srijan Chandra Das
Scientific Officer
 Md. Abdullah-Al-Momin
Scientific Assistant

Weather information

Introduction: Weather refers to the condition of the atmosphere, characterized by factors such as temperature (hot or cold), moisture levels (wet or dry), and atmospheric activity (calm or stormy, clear or cloudy). It plays a significant role in crop growth, development, and the prevalence of pests and diseases. During the reporting period (July 2024 to June 2025), weather data were collected and recorded at BRFI headquarters in Gazipur and seven regional stations (Rangpur, Cumilla, Bhanga, Habiganj, Barishal, Rajshahi, and Sonagazi). The recorded parameters included maximum and minimum temperatures ($^{\circ}\text{C}$), rainfall (mm), humidity (at 9 am and 2 pm), sunshine hours (hr), and solar radiation ($\text{gm-cal/cm}^2/\text{day}$). A summarized overview of the collected data is presented below:

Temperature: Among the eight weather stations, the highest monthly mean maximum temperature

was recorded at Gazipur (43.9°C) in March 2025, followed by Cumilla (36°C) in September 2024 and Rajshahi (35.8°C) in July 2024. Specifically, in March 2025, Gazipur experienced the highest temperature (43.9°C). In September 2024, the highest monthly mean maximum temperatures were observed at Cumilla (36°C), Habiganj (33.7°C), and Bhanga (33.6°C). Other notable peak temperatures include Barishal (35.5°C) in May 2025, Rajshahi (35.8°C) in July 2024, Sonagazi (34.3°C) in October 2024, and Rangpur (32.95°C) in June 2025. Rajshahi station recorded the lowest average minimum temperature among all stations, with 11.6°C in January, followed by Rangpur at 12.8°C in December. In January, most stations also recorded their lowest monthly average minimum temperatures, including Barishal and Bhanga (13.5°C), Sonagazi (13.9°C), Gazipur (14.4°C), Cumilla (15.2°C), and Habiganj (15.6°C). (Fig. 1).

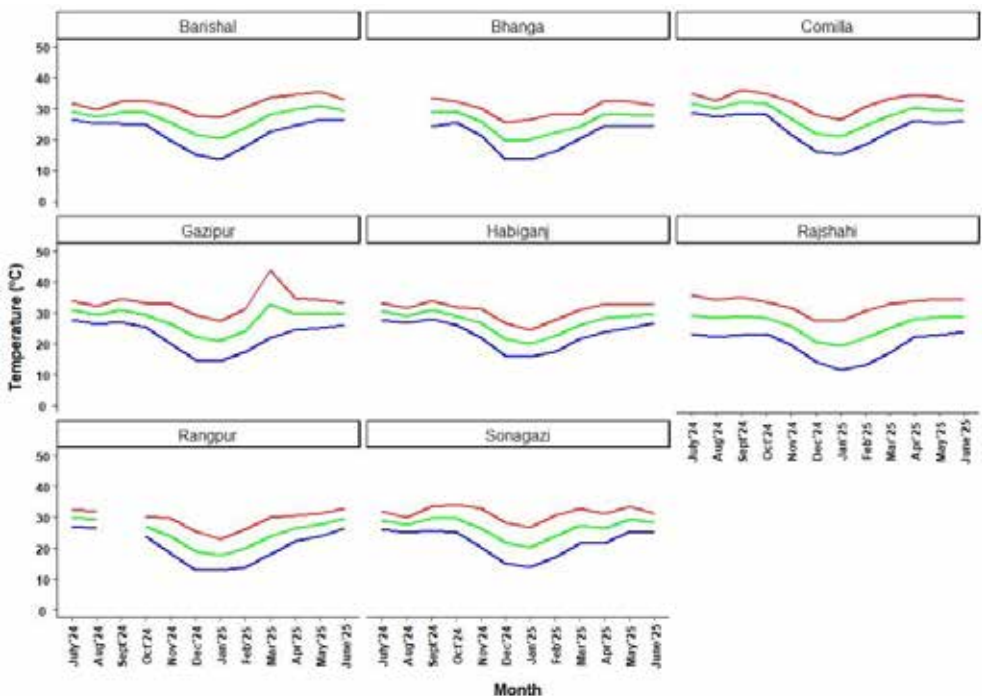


Fig. 1: Monthly mean maximum (T_{Max}), minimum (T_{Min}) and mean (T_{Mean}) temperature of BRFI Gazipur and seven regional stations during July'2024 to June'2025.

Rainfall: During the reporting year highest rainfall was received by Sonagazi (3089 mm) followed by Barishal (2613 mm), Cumilla (2544 mm) Habiganj (2176 mm) and Gazipur (1904 mm) while the lowest about 1212 mm rainfall was recorded at Rajshahi (Fig. 2). The highest amount of rainfall

(1074 mm) was recorded at Sonagazi in August 2024 followed by Cumilla (895 mm), Barishal (786 mm) and Habiganj (608.2mm) in the same month (Fig. 3). However, during the months of November, December, January, and February, most stations recorded no rainfall.

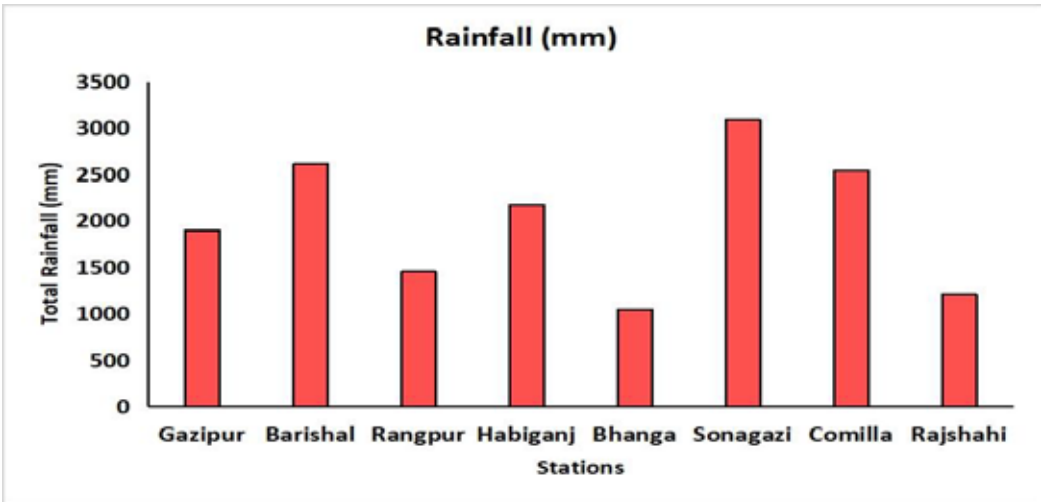


Fig. 2: Total rainfall received by BRRI Gazipur and seven regional stations during July'2024 to June'2025.

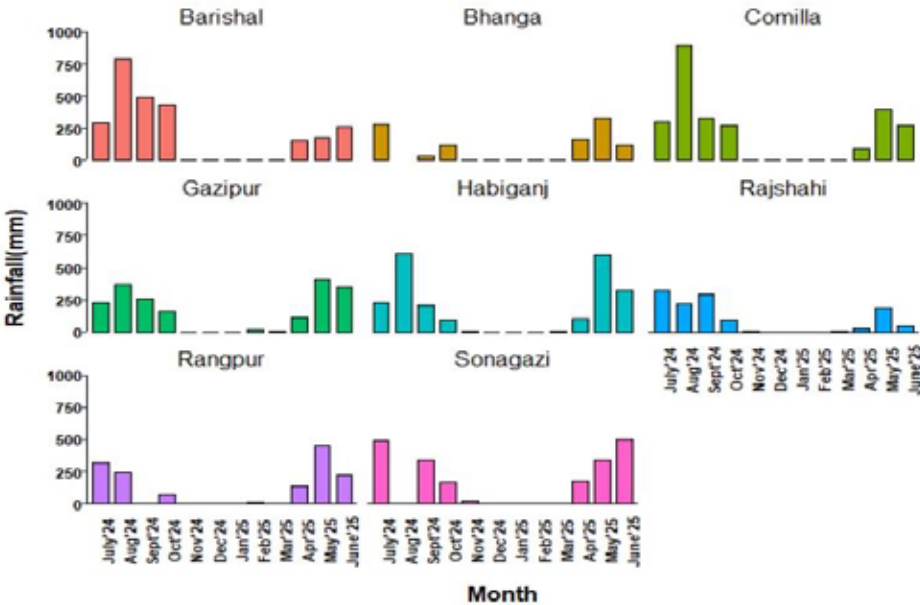


Fig. 3: Monthly total rainfall of BRRI Gazipur and seven regional stations during July'2024 to June'2025.

Relative Humidity (RH): Relative humidity was recorded twice daily i.e. 9 am and 2 pm. Mean monthly relative humidity was recorded highest and lowest in Sonagazi (100 %) and Bhanga (58.7 %) at 9 am, respectively. However, at 2 pm, it was highest in Cumilla (96 %) and lowest in Gazipur (48.2 %). In general, relative humidity was recorded relatively higher at the morning irrespective of stations and gradually declined at noon. At 9:00 AM, the highest mean monthly relative humidity was recorded in August 2024 at Sonagazi (100%), Barishal (94.5%), Habiganj

(94.1%), Rajshahi (91%), and Gazipur (84.8%). Additionally, Cumilla recorded 93.6% in April 2025, while Rangpur (89.9%) and Bhanga (86.7%) showed peak values in October 2024.

At 2:00 PM, the highest relative humidity was observed in August 2024 at Cumilla (96%), Sonagazi (95.6%), Habiganj (90.1%), Barishal (87.1%), Rajshahi (84%), and Rangpur (77.7%). Gazipur recorded a peak of 74.7% in June 2025, and Bhanga recorded 74% in September 2024. (Fig. 4).

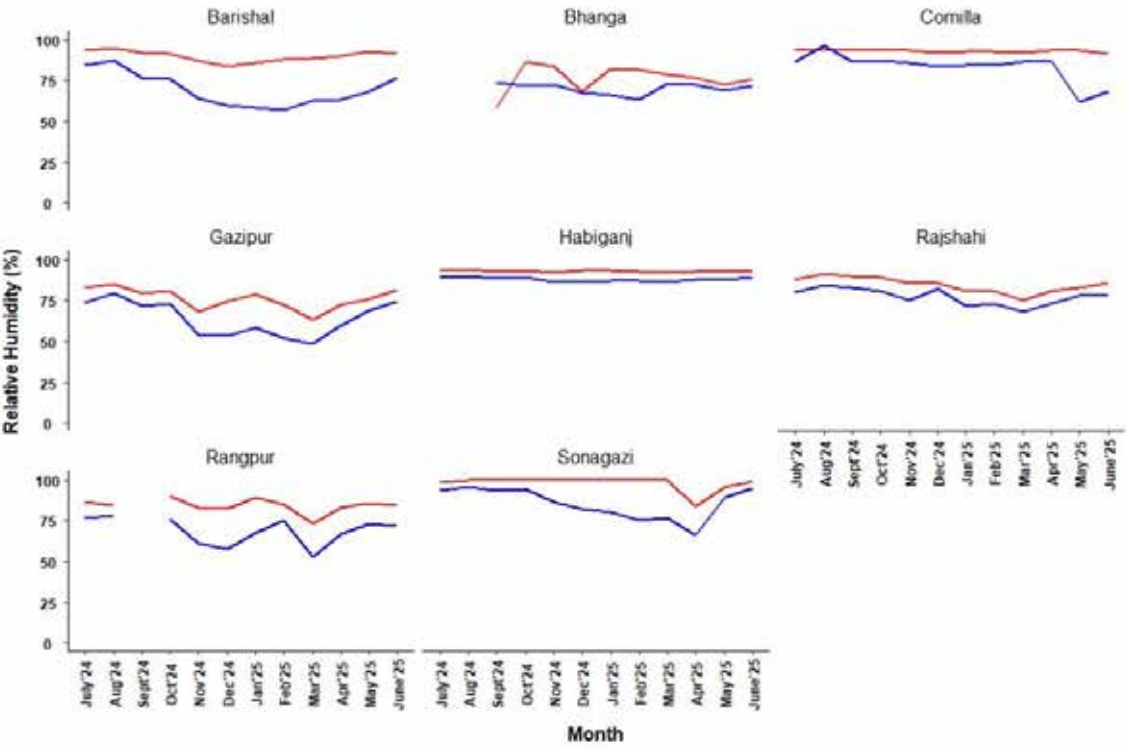


Fig. 4: Monthly mean Relative Humidity (%) of BRRI Gazipur and Seven regional stations during July'2024 to June'2025.

Solar radiation and sunshine hours: Mean monthly solar radiation ranged from 107.4 to 709.4 cal/cm²/day. The highest mean monthly solar radiation prevailed in Cumilla in September (709.5 cal/cm²/day), August (627.8 cal/cm²/day), July (597 cal/cm²/day), October (580.3 cal/cm²/day) and November (439.2 cal/cm²/day), respectively. While on other stations, Bhanga (420.6 cal/cm²/day) in July, Barishal (386 cal/cm²/day) in April, Rangpur (380.5 cal/cm²/day) in October, Gazipur (378

cal/cm²/day) and Rajshahi (377 cal/cm²/day) in March, respectively.

Mean monthly Sunshine hour ranged from 7.38 to 2.08 hour, respectively. The highest mean monthly sunshine hour obtained from Habiganj (7.38 hour) and Gazipur (7.05 hour) in November followed by Barishal and Gazipur (6.9 hour in both) in March, while the lowest amount of sunshine hour recorded from Sonagazi (2.08) in June (Fig. 5).

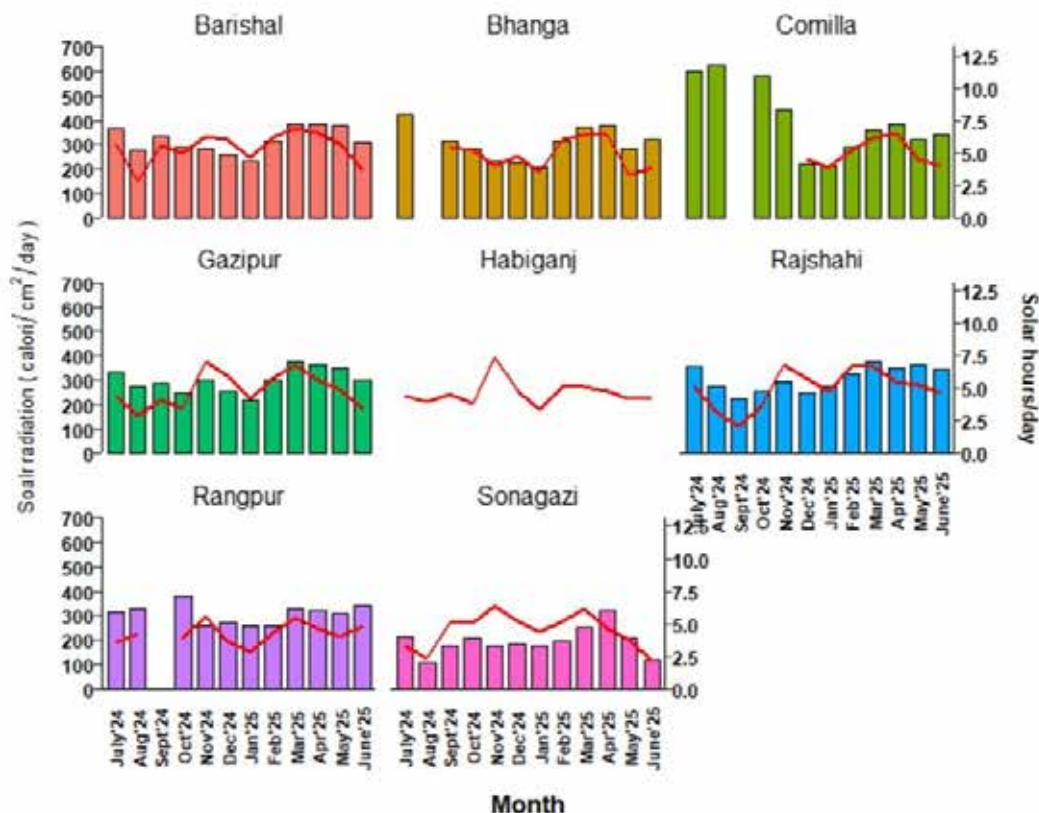


Fig. 5: Monthly mean solar radiation and sunshine hours of BRRI Gazipur and six regional stations during July'2024 to June'2025.

Abbreviation and acronyms

AEZ	= agroecological zone
ALART	= advanced line adaptive research trial
ARIMA	= auto regressive integrated moving average
As	= arsenic
AT	= active tillering
AWD	= alternate wetting and drying
AYT	= advanced yield trial
B. Aman	= broadcast Aman
BADC	= Bangladesh Agricultural Development Corporation
B. Aus	= broadcast Aus (upland rice)
Bak	= bakanae
BARI	= Bangladesh Agriculture Research Institute
BB	= bacterial blight
B	= Blast
BC	= back cross
BCR	= benefit-cost-ratio
BI	= blast
BLB	= bacterial leaf blight
BINA	= Bangladesh Institute of Nuclear Agriculture
BMDA	= Barind Multi Purpose Development Authority
BPH	= brown plant hopper
BR	= Bangladesh rice
BS	= breeder seed
BRRI	= Bangladesh Rice Research Institute
BWDB	= Bangladesh Water Development Board
BShB	= bacterial sheath blight
CAB	= Commonwealth Agriculture Bureau
ck	= check
cm	= centimetre
CDB	= Carabid beetle
CMS	= cytoplasmic male sterile
CV	= common variance, co-efficient of variation
DAE	= Department of Agricultural Extension (Bangladesh)
DAP	= drought animal power
DAS	= days after seeding
DAT	= days after transplanting
DH	= dead heart
DHB	= dark-headed borer
DMRT	= Duncan's multiple range test
DNA	= deoxyribonucleic acid
DNI	= Direct normal irradiance
DHI	= Diffuse horizontal irradiance
DTF	= days to flowering
DWSR	= Direct wet seeded rice
DWR	= deepwater rice
ET	= evapotranspiration
FS	= foundation seed

FMPHT	= Farm Machinery and Postharvest Technology
GABA	= gamma amino buteric acid
GH	= grasshopper
GM	= gall midge
GMB	= green mirid bug
GLH	= green leafhopper
GoB	= Government of Bangladesh
GRS	= Genetic Resources and Seed
GSR	= green super rice
GQN	= Grain Quality and Nutrition
HA	= Habiganj Aman
HAT	= hours after treatment
HB	= Habiganj Boro
HNRP	= Hill Nerica Rice Productivity
ht	= height
IIRON	= International Irrigated Rice Observational Nursery
INGER	= International Network for Genetic Evaluation of Rice
INM	= integrated nutrient management
IPM	= integrated pest management
IPNS	= integrated plant nutrition system
IRRI	= International Rice Research Institute (Philippines)
IRSSTN	= International Rice Soil Stress Tolerance Nursery
IURON	= International Upland Rice Observational Nursery
LCC	= leaf colour chart
LBB	= lady bird beetle
LHC	= long-horned cricket
Lit/ha	= litre per hectare
LR	= leaf roller
LSc	= leaf scald
LSD	= least significant difference
LV	= local variety
LIV	= local improved variety
MAS	= marker assisted selection
MER	= micronutrient enriched rice
ML	= monogenic line
MLT	= multi-location trial
MMT	= million metric tons
MR	= moderately resistant
MT	= maximum tillering
MV	= modern variety
meq	= milli equivalent
NGO	= non-government organization
NIL	= near isogenic line
NIR	= net irrigation requirement
NSB	= National Seed Board (Bangladesh)
OC	= oil cake
OHLH	= orange headed leafhopper
OT	= observational trial
OYT	= observational yield trial

PAcp	=	phenotypic acceptance
PI	=	panicle initiation
PQR	=	premium quality rice
PVART	=	proposed variety adaptive research trial
PVS	=	participatory varietal selection
PVT	=	proposed variety trial
PYT	=	preliminary yield trial
QTL	=	quantitative trait loci
RCB design	=	randomized complete block design
RF	=	rainfall
RH	=	rice hispa
RLF	=	rice leaf folder
RLR	=	rice leaf roller
RPT	=	rice production training
RS	=	Regional station
RTV	=	rice tungro virus
RWM	=	rice whorl maggot
RWS	=	relative water supply
RYT	=	regional yield trial
SAAO	=	Sub Assistant Agricultural Officer
SB	=	stem borer
SCA	=	Seed Certification Agency (Bangladesh)
SD	=	standard deviation
SES	=	standard evaluation system
ShB	=	sheath blight
ShR	=	sheath rot
SPDP	=	seed production and dissemination trial
SPIRA	=	Strengthening Physical Infrastructure and Research Activities
SR	=	solar radiation, stem rot
STB	=	soil test based
STPD	=	staphylinid
SYT	=	secondary yield trial
T. Aman	=	transplanted Aman
T. Aus	=	transplanted Aus
TGW	=	1000-grain weight
TLS	=	truthfully labelled seed
TOC	=	Training and operation cell
TRB	=	Transforming Rice Breeding
TSP	=	triple super phosphate
USG	=	urea super granule
WMM	=	Workshop Machinery and Maintenance
WBPH	=	white-backed plant hopper
WS	=	wet season
WSR	=	wet-seeded rice
WTR	=	weed tolerant rice
wt	=	weight
YSB	=	yellow stem borer

Plant Breeding Division

2 Summary

2 Varietal Development

SUMMARY

For the development of rice varieties under different ecosystems, 887 crosses were made and 682 crosses were confirmed during 2024-25. A total of 6,02,451 individual plants were advanced from F₂₋₆ generation following single seed decent (SSD) method under rapid generation advance (RGA) condition. From line-stage testing (LST), 11,488 genotypes were selected based on yield and other agronomic performances. A total of 1,271 genotypes from observational yield trial (OYT) and 551 advanced breeding lines were selected from different yield trials (PYT, AYT, RYT, ALART and PVT). A total of 614 germplasm were maintained during T. Aman and Boro season to use as parents in the breeding programme.

National Seed Board (NSB) of Bangladesh has released four varieties for T. Aman season and two varieties for Boro season in the reporting year. The T. Aman varieties are – BR9158-19-9-6-50-2-HR1 was released as BRRI dhan109 for tidal submergence prone environment of Barishal region, IR16F1148 was released as BRRI dhan110 for submergence prone areas of Bangladesh, BR10260-5-15-21-6B was released as BRRI dhan111 for shallow flooded condition (80-100 cm water depths) of tidal flood prone coastal region and shallow flood prone haor region of Bangladesh and BR11716-4R-102 was released as BRRI dhan112 for salinity prone areas of Bangladesh. The average yield of BRRI dhan109 was 6.0 t/ha and growth duration 147 days, but it can produce 6.5 t/ha yield with proper management. It has high protein content (10.6 %) and high amylose content (25.4%). BRRI dhan110 can tolerate two to three weeks of complete submergence or flash flood and produce yield 5.0 t/ha. Under rainfed condition, the average yield was 6.0 t/ha with 123 days growth duration. It can produce 6.5 t/ha yield with proper management. Plant height of BRRI dhan111 was tall but strong, having photosensitivity and growth duration was 146-160 days. The variety can produce 4.7 t/ha yield under shallow flooded condition but it can produce 5.7 t/ha yield under non stress condition. The average yield of BRRI dhan112 was 5.0 t/ha and growth duration 121 days. Yield advantage of BRRI dhan112 was 22.0% over the check variety BRRI

dhan73. BRRI dhan112 showed relatively higher level of salinity tolerance than the check variety BRRI dhan73.

In Boro season the promising genotypes viz. BR11337-5R-72 and BR12454 (Path)-BC2-69-97-39-5-44 were released as BRRI dhan113 and BRRI dhan114 respectively, for cultivation throughout the country. The yield of BRRI dhan113 was 8.2 t/ha whereas, average yield of the check variety BRRI dhan88 was 7.3 t/ha. BRRI dhan113 produced 12.3% higher yield than the check variety BRRI dhan88. It has high amylose content (28.0%) and cooked rice is non-sticky. BRRI dhan114 is a long duration blast resistant variety and it shows highly resistant reaction to blast (Blast score-1) under artificial inoculation by blast pathogen. The results of SNP QTL fingerprinting showed that the blast resistant proposed variety possessed blast resistant dominant genes *Pi9* and *Pb1*. The average yield of BRRI dhan114 was 7.8 t/ha with 149 days growth duration, its potential yield can be attained up to 10.17 t/ha with proper management. It has high amylose content (27.0%) and cooked rice is non-sticky.

VARIETAL DEVELOPMENT

Development of upland rice (B. Aus). A research initiative is focused on the development of novel upland rice varieties engineered with multiple advantageous traits. The primary objectives for these varieties encompass enhanced adaptability to drought-prone upland ecosystems, a reduced growth duration targeting around hundred days from emergence to maturity, and accelerated seedling emergence with high vigour and a robust plant architecture designed to confer tolerance to lodging. The overarching goal for this breeding programme is to achieve a sustainable grain yield within the range of 4.0 to 4.5 tha⁻¹.

In 2024-25, 24 crosses were made using 30 parents. Twenty crosses were confirmed as true F₁s through hybridity test. In total 3,008 segregating progenies from 18 crosses (F₂-F₅ generation) were harvested from FRGA nursery and grown in the subsequent generation. In LST trial, 245 lines out of 1,161 lines were selected on the basis of desirable

plant type, grain quality and uniformity at flowering under field condition. A total of 19 entries were selected considering growth duration, yield, uniformity of morpho-agronomic traits and superiority over the three standard checks BRRI dhan65, BRRI dhan89 and Hasikalmi from 301 advanced breeding lines in OYT. Fifteen genotypes were selected from 34 tested entries on the basis of yield and short growth duration in PYT. In AYT,

eight genotypes were selected from 16 tested entries. In RYT, four genotypes such as BR12248-5R-22, BR12248-5R-37, BR10756-2B-8-72 and BR12860-5R-79 promoted to ALART for next season among 11 tested entries. Root characteristics of RYT genotypes compared to deep rooting *Aus* landrace Morichboti (Table 1) shows that the selected four genotypes were promising for drought tolerance.

Table 1. Root characteristics of RYT genotypes compared to deep rooting *Aus* variety Morichboti.

Designation	Root length (cm)	CRL UP30 (cm)	CRLB30 (cm)	Total CRL (cm)	Root weight (mg)	RSR (mg/g)
BR12236-5R-6	54.0	846.7	287.0	1133.7	181.11	147.7
BR12248-5R-22	61.7	951.7	262.3	1214.0	172.22	131.7
BR12248-5R-37	59.0	821.7	221.3	1043.0	77.78	86.7
BR12248-5R-122	68.7	957.0	323.3	1280.3	153.33	131.8
BR12263-5R-75	66.7	1144.7	314.3	1459.0	123.33	122.0
BR10756-2B-8-72	63.0	1445.0	328.7	1773.7	155.56	136.4
BR12857-5R-55	54.0	1056.3	333.0	1389.3	175.56	148.9
BR12859-5R-31	74.0	946.3	326.0	1272.3	215.56	193.1
BR12860-5R-79	70.7	1017.0	481.7	1498.7	234.44	202.8
BR12862-5R-3	70.0	1112.0	336.3	1448.3	178.89	126.2
BR12867-5R-125	60.0	961.7	273.7	1235.3	140.0	102.4
BRRI dhan83 (ck)	72.3	989.0	311.3	1300.3	137.78	127.6
Morich boti	82.3	1292.3	558.7	1851.0	400.0	198.4
LSD<0.05	12.1	432.8	256.5	532.0	141.81	106.3
CV (%)	10.9	24.7	45.4	22.9	46.6	44.2

*CRL: Cumulative root length; CRLUP30: CRL up to 30 cm; CRLB30: CRL below 30 cm; RSR: Root shoot ratio; LSD: Least significant difference; CV: Coefficient of variation

M Akhlasur Rahman, Nusrat Jahan, Armin Akter Setu, Ribed Farzana Disha and Mst. Salma Pervin

Development of Jhum rice. The Jhum Rice breeding program aims to develop high-yielding (≥ 3.5 tha⁻¹) drought-tolerant varieties with variable grain amylose content (10-19% and >25%) and good eating quality, suitable for jhum cultivation and acceptable to the tribal population of Chattogram hill districts. Thirty crosses were made using 17 parental genotypes from local Jhum cultivars, exotic varieties, single BRRI variety, promising advanced breeding lines having low to high level of apparent amylose content. Six crosses were confirmed as true F₁. Total 5,222 segregating

progenies from 23 crosses (F₂-F₅ generation) were harvested from FRGA nursery and grown in the subsequent generation. Two AYT₁ were conducted in 2024. In AYT₁, none of the entries were selected. In AYT₂, two advanced breeding lines, three area-specific popular jhum landraces and three inbred BRRI varieties were evaluated in hotspot condition. Finally, three genotypes were selected from five tested entries in AYT₂. Among all the entries, despite heterogeneity in climatic condition and topographic situation, BRRI dhan66, BRRI dhan71 and BRRI dhan83, were the top yielder entries and selected for hotspot jhum ALART in the next season (Table 2).

Table 2. Performance of the genotypes in AYT-2, Development of Jhum Rice 2024-25.

Genotype	PH (cm)	GD (day)	L1	L2	L3	L4	L5	L6	Yield (tha ⁻¹)
BR12239-5R-93	109	141	2.4	1.9	2	1.6	1.2	1.4	1.8
Luyin-46	117	89	2.9	2.7	2.2	1.7	3.4	3.2	2.7
BRR1 dhan66	121	112	3.4	3.9	3.2	3	3.3	4.2	3.5
BRR1 dhan71	110	111	3.4	4.1	2.5	3.3	3.3	4.1	3.5
BRR1 dhan83	104	105	2.9	3.3	2.7	2.8	2.8	3.7	3.0
Ranqui	113	103	2.4	1.5	0.9	1.5	2.1	2.4	1.8
Chibingshee	108	106	2.2	3.4	2.4	1.8	2.8	2.6	2.6
Gallong	112	93	2.5	3.5	2	1.7	2.1	3.2	2.5
LSD<0.05	2.32	2.90	0.21	0.32	0.22	0.33	0.45	0.44	0.19
H ² b	0.91	0.78	0.88	0.94	0.84	0.90	0.82	0.89	0.92

* PH: Plant height(cm); GD: Growth duration (day); L1: Bandarban Sadar 1; L2: Bandarban Sadar 2; L3: Kaptai, Rangamati; L4: Sadar, Khagrachori; L5: Matiranga, Khagrachori; L6: Rowangchori, Bandarban; LSD: Least significant difference; H²b: Heritability (broad sense)

M Akhlaur Rahman, Nusrat Jahan, Armin Akter Setu and Ribed Farzana Disha

Development of transplanted Aus rice (T. Aus).

The objective of this project was to develop transplanted Aus rice (T. Aus) varieties with multiple desirable traits, including short growth duration (95–115 days), high yield potential (5.5–6.5 t/ha), tolerance to lodging and heat stress (particularly during the reproductive phase), resistance to pre-harvest sprouting, and improved grain quality. A total of 25 crosses were made using 43 parent lines, yielding 1,353 F₁ seeds. Twenty crosses were confirmed as true F₁s. Around 74,600 progenies from 143 crosses were advanced using FRGA method during T. Aus season. Three hundred twelve uniform lines were selected from 5,200 lines of 17 crosses in line stage testing (LST). In observational yield trial (OYT), 20 genotypes from 256 were selected based on growth duration, yield performance, morpho-agronomic uniformity, and superiority over two standard checks. In advanced yield trial (AYT#1), four genotypes were selected

from 38 entries compared to three standard checks. In advanced yield trial (AYT#2), nine entries were selected from 20 lines, showing superior performance over four standard checks. In AYT#3, which focused on Aus-based cropping patterns in non-saline tidal areas, eight entries were selected from 18 tested lines compared to the check varieties BRR1 dhan27, BRR1 dhan106, and Gota IRRI. From RYT#1, two genotypes were selected out of ten and from RYT#2 (RTV resistance), one genotype was selected from nine entries along with the check varieties BRR1 dhan48, BRR1 dhan85, and BRR1 dhan98. An advanced line adaptive research trial (ALART) for BB was conducted at eight BB hotspot areas using three breeding lines viz BR11866-5R-147, BR11867-5R-103 and BR11867-5R-442 (Table 3). The breeding lines showed similar yield with the standard check varieties. Therefore, the genotypes were not recommended for further trial. In total, 160 parental lines were maintained in T. Aus programme for using parents and check in LST programme.

Table 3. List of the materials under advanced line adaptive research trial (ALART# BB), T Aus 2024-25.

Designation	PH (cm)	DM (day)	Yield (t/ha)										BB score (art)	Trait of interest	
			L1	L2	L3	L4	L5	L6	L7	L8	Mean				
BR11866-5R-147	97	110	4.78	3.45	5.45	4.13	3.70	3.36	3.46	3.63	4.0	3	<i>Xa21, WxaA</i>		
BR 11867-5R-103	100	110	5.73	3.95	5.64	5.14	3.64	3.23	3.47	3.31	4.3	1	<i>Xa21, Pbl1, WxaA, fgr</i>		
BR 11867-5R-442	102	112	4.61	4.11	5.75	5.25	3.54	4.06	3.54	3.45	4.3	3	<i>Xa21, Pbl1, WxaA</i>		
BRR1 dhan48 (Std. ck)	107	109	4.51	4.28	6.01	4.27	4.17	3.40	3.47	3.31	4.2	9	-		
BRR1 dhan98 (Std. ck)	100	110	5.51	3.79	5.85	4.66	3.82	4.38	4.76	3.46	4.5	7	-		
LSD (0.05)			0.57									0.20			

Locations: L1= Dev, Cumilla; L2= Habiganj; L3= Khoksha, Kushtia; L4= Paba, Rajshahi; L5= Mithapukur, Rangpur; L6= Satkhira; L7= BRRI, Gazipur; L8= Bhola, Barishal

A genetic trend analysis was performed using data from 1,794 advanced breeding lines of transplanted Aus rice evaluated across six locations (Gazipur, Rajshahi, Cumilla, Sonagazi, Kushtia, and Rangpur) between 2020 and 2024. The results indicate a genetic gain of 1.67% per year, corresponding to a yield increase of 56.0 kg/ha/year, demonstrating promising progress in breeding high-yielding transplanted Aus rice genotypes (Fig. 1).

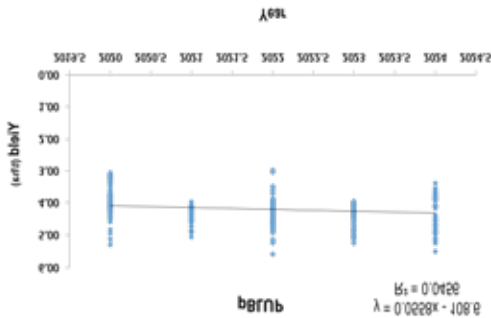


Fig.1. Line graph is showing the genetic gain of BRRI-developed RGA derived transplanted Aus (T. Aus) rice advanced lines.

M Khatun, S K Debsharma, A Rahman and N Tamanna

Development of heat tolerant rice (HTR). The project aims to develop high yielding varieties/lines tolerant to heat stress with quality grains in T. Aus season. Sixteen crosses were made using 20 parents

for the development of heat tolerant rice (HTR) from Boro 2023-24 and 2,269 F₁ seeds were collected. Fourteen F₁s were confirmed as true crosses for heat tolerant rice development. Heat tolerant rice (HTR) breeding program consisting 12,000 progenies of 24 crosses in Boro season was advanced through modified FRGA. Out of 986 lines of four crosses, 104 uniform lines were selected from LST based on uniformity in heading, plant height and acceptable grain type under the field condition. Selection intensity applied for selecting LST lines was 10%. Three genotypes out of 14 from advanced yield trial (AYT#1), two advanced lines out of 17 from AYT#2; and three advanced lines out of 11 were selected from AYT#3. Two advanced lines from RYT#1 and two advanced lines from RYT#2 were selected on the basis of homogeneity with respect to plant height, phenotypic acceptability at maturity stages.

M Khatun, S K Debsharma, A Rahman and N Tamanna

Improvement of rice for shallow flooded and deep-water environment. The major objectives of the project were to develop high yielding (4.0-5.0 t/ha) rice varieties for deep (>1.0 m), shallow flooded area (up to 1.0 m depth), shallow deep area (30 cm water) and medium deep area (50-60 cm water) along

with submergence, facultative elongation and hypoxia tolerance. In total, 14 crosses were made by using 14 parents and produced 630 F₁ seeds. In total five F₁s were confirmed through QC SNP panel analysis. A total of 12,743 progenies of 61 crosses (8,376 progenies of 22 crosses, 2,128 progenies of seven crosses, 1,075 progenies of 15 crosses, 1,164 progenies of 19 crosses) from F₂₋₅ were advanced through RGA. From LST population, 1,122 lines from 20 crosses were genotyped with trait markers using custom SNP panel among which 232 lines were selected based on uniformity and presence of desirable traits markers. In yield trial, 420 genotypes were tested and 88 genotypes were selected based on phenotypic acceptance, growth duration, survivability and higher yield performance. In OYT the genotype BR12932-5R-18 produced the highest yield (3.6 t/ha) which was significantly higher than the check variety BRRI dhan91 (1.9 t/ha) while in PYT the genotype BR12485-5R-42 (3.28 t/h) produced the highest yield which was significantly higher than the check variety BRRI dhan91 (1.85 t/ha). In AYT#1

the genotype BR10260-7-19-2B (3.73 t/h) produced the highest yield which was significantly higher than the check variety BRRI dhan91 (2.59 t/ha). The heritability obtained for growth duration and plant height were 87% to 89% respectively, and grain yield was ranging from 88 % to 97% indicating acceptable level of precision in these experiments. In AYT_Special, the genotype BR11186-5R-119 (2.94 t/h) produced the highest yield, which was significantly higher than the check variety BRRI dhan91 (2.09 t/ha). The heritability obtained for growth duration and plant height were 83% to 89% respectively, indicating acceptable level of precision in these experiments. Twenty shallow flood tolerant genotypes and land races were grown and maintained for future use in maintenance breeding. BR10260-5-15-21-6B was released as BRRI dhan111 for the shallow flooded condition (80-100 cm water depths) of tidal flood prone coastal region and shallow flood prone beel region of Bangladesh (Table 4).

Table 4. Yield and agronomic performance of BRRI dhan111 in the proposed variety trial (PVT), T. Aman 2023-24 with its grain characteristics.

Designation	PH	GD	GY	MO (%)	HR (%)	L/B ratio	Size & shape	AAC (%)	Protein (%)	TGW (g)
BRRI dhan111	165	146	4.2	72	67	2.2	Medium bold	27.5	7.9	27.5
BRRI dhan91 (ck)	180	149	3.2	70	67	2.5	Medium bold	26.2	8.2	26.0

* PH: Plant height (cm); GD: Growth duration (day); GY: Grain yield (tha⁻¹) as mean of ten locations; MO (%): Percentage of milling outturn; HR (%): Percentage of head rice recovery; L/B ratio: Ratio of length to breadth; AAC (%): Percentage of apparent amylose content; TGW (g): Thousand grain weight in gram

S Maniruzzaman, Sharmistha Ghosal, A S M Masuduzzaman and K M Iftekharuddaula

Development of rainfed lowland rice (RLR). The project aims to develop genotypes superior to standard varieties and adaptable to rainfed lowland environment in T. Aman season. In T. Aman 2024-25, a total of 26 crosses using 27 parents for forward breeding, nine crosses for photosensitivity and four back crosses were made, and 30 crosses were

confirmed as true hybrids using 10-SNP *indica* QC panel. In Boro 2024-25, in total 30 crosses for forward breeding and 14 crosses for heat tolerance were made, and 25 crosses were confirmed as true hybrids using 10-SNP *indica* QC panel. A total of 13,657 individual progenies from 66 crosses of F₂ and F₅ generations and 14,712 progenies from 55 crosses of F₂₋₃ generations were advanced during T. Aman and Boro seasons, respectively through field

RGA method. Out of 7,210 F_{5:6} LST lines derived from 23 different crosses, 1,028 genotypes were selected with selection intensity of 14.3%. Figures 2 and 3 present the selection intensity and trait marker profile of the genotypes of LST. Most of the selected materials from LST contained genes of high amylose as well as the presence of the favourable alleles of *xa5*, *xa13* and *Xa21* for bacterial leaf blight (BLB), *BPH32* for BPH, and *Gm4* for gall midge (GM). A total of 64 genotypes were evaluated in observation yield trials (OYT) at Gazipur, Cumilla and Rangpur. Among the tested genotypes, 40 genotypes were

selected and forwarded in advanced yield trial (AYT). In AYT, 40 genotypes were evaluated in two trials at Gazipur, Cumilla and Rangpur, and 13 genotypes were found promising to advance. Among the 35 tested genotypes under regional yield trials (RYTs), three were selected for re-trial. Genetic trend of the genotypes from 2016 to 2024 showed the pBLUP (grain yield) in respect of trial year indicated an annual 93.84 kg/ha equivalent to about 2.23% increase in grain yield per year based on yield of 2016 (4.19 t/ha).

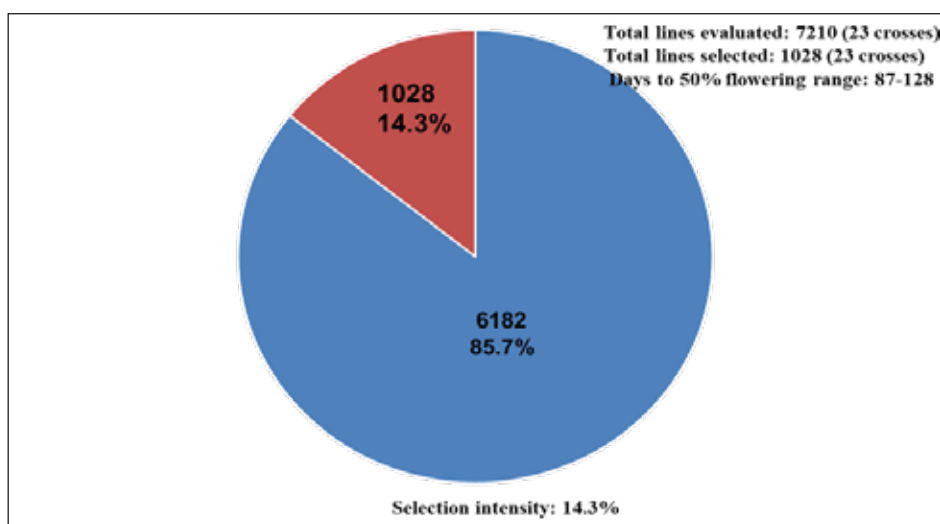


Fig. 2. Selection intensity of genotypes under LST, RLR, T. Aman 2024-25.

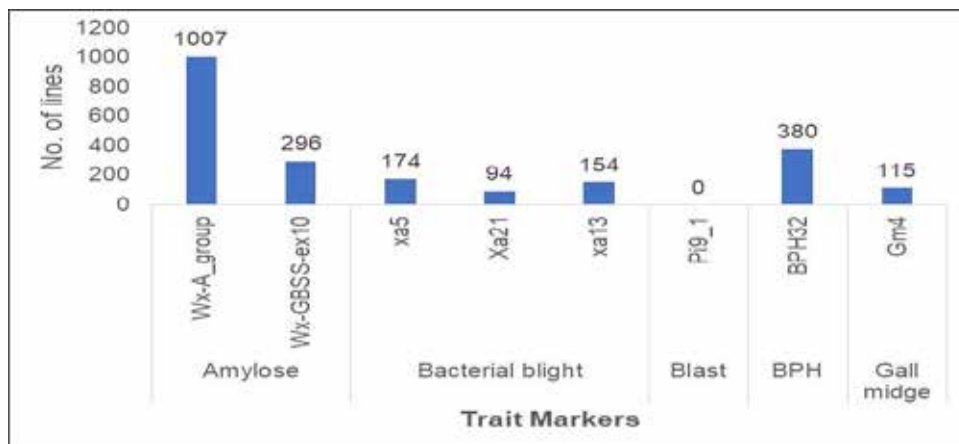


Fig. 3. Trait marker profile of genotypes under LST, RLR, T. Aman 2024-25.

M R A Sarker, M Adil, R R Majumder and M A Kader

Development of rice varieties for favourable Boro environment.

The aim of this project was to develop improved genotypes with high yield potential (≥ 8.0 t/ha), earliness (135-145 days) and acceptable grain quality for favourable irrigated ecosystem in Bangladesh. To address the objectives, a total of 57 single crosses and 19 backcrosses were made using 41 breeding lines/varieties as parents targeting to develop high yielding breeding lines enriched with favourable alleles of key target traits, viz disease resistance (blast and BLB), insect resistance (BPH) and acceptable grain quality (amylose, chalkiness, palatability, zinc content, etc.). Sixty-nine crosses were confirmed as true F_1 through a hybridity test using KASP based QC SNP genotyping. Out of 24,947 segregating progenies of 69 crosses grown in the RGA nurseries, seeds from 9,090 individual progenies were harvested and panicles from 12,960 progenies will be collected soon. In F_2 generation, 11,880 F_2 progenies of 22 crosses were grown which aren't harvested yet. Under F_3 generation, 8,621 progenies of 24 crosses were grown and 6,019 were harvested. In F_4 generation, 1,758 progenies grown from 14 crosses and harvested 1,263 progenies. In case of Backcross segregating population, 540 BC1F2 progenies of one cross were grown, yet not harvested; 2,148 BC1F3 progenies of eight crosses

were grown while 1,808 progenies were harvested. Out of 19,901 lines of 169 crosses tested in LST, 2,172 uniform lines in terms of plant height, days to flowering, grain size and shape and 244 single plants were selected for genotyping to track the favourable alleles of key target genes for BB (*xa5*, *xa13* and *Xa21*), blast (*Pi9*, *Pita*, *Pita2* and *Pb1*) and BPH (*Bph17* and *BPH32*) resistance and grain quality (*Wx-a*, *Wx-10*, *chalk5*, *BADH2*). A total of 2,810 breeding lines were evaluated under different yield trials. Among them, 34 breeding lines were tested in RYT, 141 lines in AYT, 2,048 breeding lines in OYT and 587 breeding lines in IRRI NARES Network trial. In total 143 breeding lines including five from RYT, 18 from AYT, 99 lines from OYT and 21 breeding lines from IRRI NARES Network trials were selected for further advancement. A proposed variety trial with a long duration line was evaluated along with BRRI dhan92 as standard check variety at 10 locations across the country. The candidate variety BR11318-5R-94 yielded 12.91% higher than BRRI dhan92 over the locations with more than 10% yield advantage at six locations individually. The yield of BRRI dhan113 (BR11337-5R-72) was 8.2 t/ha whereas, average yield of the check variety BRRI dhan88 was 7.3 t/ha. BRRI dhan113 produced 12.3% higher yield than the check variety BRRI dhan88 (Table 5).

Table 5. Yield and agronomic performance of BRRI dhan113 in the Proposed Variety Trial (PVT), Boro 2023-24 with its grain characteristics.

Designation	PH	GD	GY	MO (%)	HR (%)	L/B ratio	Size and shape	AAC (%)	Protein (%)	TGW (g)
BRRI dhan113	102	143	8.2	70.4	61.4	3.3	Medium slender	28.0	8.4	19.4
BRRI dhan88 (ck)	100	138	7.3	72.8	68.4	3.1	Medium slender	26.3	8.2	20.3

* PH: Plant height (cm); GD: Growth duration (day); GY: Grain yield (tha^{-1}) as mean of ten locations; MO (%): Percentage of milling outturn; HR (%): Percentage of head rice recovery; L/B ratio: Ratio of length to breadth; AAC (%): Percentage of apparent amylose content; TGW (g): Thousand grain weight in gram

Investigators: P S Biswas, A Syed, F Akter, M F R Khan Prince, F Mahmood

Development of cold tolerant rice. The major objective of the project was to develop high yielding and short duration (6.0-7.0 t/ha yield and 135-145 days growth duration for haor areas) and high yielding medium duration (6.5-7.5 t/ha yield with 145-150 days growth duration for Northern regions) rice varieties tolerant to cold stress at seedling and reproductive stage. To address the above objectives, four single crosses and 36 backcrosses were made using 27 lines/varieties including six cold tolerant donors as parents targeting to develop high yielding and cold tolerant breeding lines enriched with favourable alleles of disease resistance (blast and BLB), insect resistance (BPH) and acceptable grain quality (amylose, chalkiness, palatability, zinc content, etc.). Fifty-eight crosses were confirmed as true F1 through a hybridity test using KASP based QC SNP genotyping. From segregating RGA nurseries, 16,876 individual plants were harvested from 95 cross combinations of F₂₋₄, BC1F2, BC1F3, BC1F4, BC2F3, and BC2F4 generations following SSD method of breeding. Out of 7,069 lines under 73 crosses tested in LST, 492 uniform lines in terms of plant height, days to flowering, grain size and shape were selected from 59 crosses for genotyping with trait markers for cold tolerance (*SCT1*, *qPSST6*, *qPSST3*, *qPSST7* and *qPSST9*), blast resistance (*Pi9*, *Pita*, *Pita2*, *pb1*), BB resistance (*xa5*, *xa13*, *Xa21*) and grain quality traits (*Wx-a*, *Wx-10*). A total of 392 breeding lines were evaluated under different yield trials. Among them, 28 breeding lines were tested in RYT, 70 lines in AYT, 284 breeding lines in OYT. In total, 52 breeding lines including two from RYT, 11 from AYT and 39 lines from OYT were selected for further advancement. A proposed variety trial with a short duration cold tolerant line was evaluated along with BRRI dhan28 and BRRI dhan67 as check varieties at 10 locations in the haor areas. The candidate variety BR11894-R-R-R-R-169 yielded 20.22% higher than BRRI dhan28 (Cold susceptible check) and 6.54% higher than BRRI dhan67 (Moderately cold tolerant check varieties) across the

10 locations with more than 10% yield advantage at six locations individually.

P S Biswas, A Syed, F Akter, M F R Khan Prince, F Mahmood

Development of salt tolerant rice (STR).

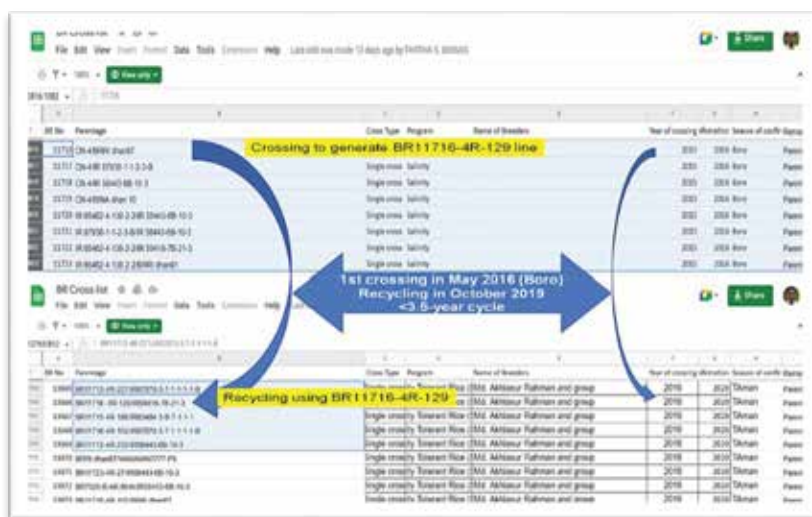
This project aims to develop high-yielding, salt-tolerant rice genotypes, aligning with a defined product profile. Salinity poses a significant abiotic stress, severely limiting rice productivity in the rainfed lowland and Boro rice (dry season) ecosystems prevalent in the southern coastal zone of Bangladesh. The successful development and deployment of these genotypes are crucial for enhancing food security and agricultural sustainability in the region. The salinity breeding programme employs rapid recycling as a faster product development and cyclic breeding strategy. This allows new, elite parental sources to be developed in less than three and a half years, Fig. 4, thereby ensuring a reduced timeframe for varietal development. Also, yield (pBLUP) trends of different lines developed since 2012 were analyzed. Regression of yield versus year of development indicates an annual gain in rice yield of 69 kg ha⁻¹ in T. Aman (Fig. 5) and 181 kg ha⁻¹ in Boro (Fig. 6), equivalent to about 1.73% (in T. Aman) and 2.5% (in Boro) increase in yield per year based on yield of genotype of baseline year 2012. Trends in genetic gain for the salt tolerant rice (STR) breeding programme in T. Aman and Boro seasons, based on 12 years of breeding trials, are shown in Figures 5 and 6, respectively.

In T. Aman 2024-25, 62 crosses were made using 42 well characterized elite parents with higher genetic merit/breeding values and various alleles of interest. A total of 29 F₁s were confirmed as true hybrids through hybridity test via F₁ verification by quality check (QC) genotyping with purity SNP panel during T. Aman season. In T. Aman season, 34,172 segregating progenies derived from 153 crosses were advanced from F₂₋₅ generations using FRGA technique (Fig. 7). Yield trials were carried out in Gazipur, Debhata, Kaliganj and BRRI RS Farm, Satkhira in T. Aman season. In LST, out of

4,633 breeding lines derived from 21 crosses, all genotypes were damaged due to flood. Out of 745 genotypes, 266 genotypes were selected from OYT. Two PYTs (PYT-1 to PYT-2) were conducted using 141 breeding lines following alpha lattice design. In total 58 genotypes were selected from these trials depending on grain yield, salinity tolerance and phenotypic acceptability. Out of 69 genotypes, 32 genotypes were selected from AYT-1 and AYT-2 (Fig. 8). In RYT-1 and RYT-2, 23 and 24 genotypes respectively, were evaluated. Fifteen lines were evaluated under RYT-3 (Photosensitive-STR lines), and three lines BR12465-4R-61, BR12465-4R-231, and BR12459-4R-113 were promoted to ALART in T. Aman 2025-26 (Table 6).

In Boro Season, 96 crosses were made using 60 elite parents. A total of 32 F_1 s was confirmed as true hybrid through F_1 confirmation by quality check (QC) genotyping with purity SNP panel. In total 36,270 segregating progenies from 140 crosses of F_{2-5} generation were harvested from FRGA nursery and grown in the subsequent generation. In LST trial, 619 lines out of 5,796 lines were selected on the basis of desirable plant type, grain quality and uniformity at flowering under field condition. Among the trial sites, the level of salinity at Kaliganj was the highest; up to 14.3 dSm⁻¹ (Fig. 9). A total of 182 genotypes selected out of 442 from

OYT based on growth duration, grain yield, and homogeneity in different morpho-agronomic traits. A total of 246 genotypes were tested under three PYTs, 82 genotypes in each PYT. A total of 32, 25, 38 genotypes were selected from PYT-1, PYT-2 and PYT-3 respectively. In AYT, 44, 52, 48 genotypes were evaluated under AYT-1, AYT-2, and AYT-3 respectively. Among them 28, 32, and 27 lines were selected from three AYT's respectively. In case of RYT, five genotypes were selected out of 20 tested entries in RYT-1 (Table 7) and six genotypes were selected out of 15 tested entries in RYT-2 (Table 8). In ALART-1, two genotypes such as BR13113-4R-63 and BR13113-4R-116 (Short duration) were evaluated and in ALART-2, three test entries; BR13106-4R-184, BR13113-4R-185 and BR13122-4R-136 (Mid duration) were evaluated. A PVT trial was conducted by SCA to release as variety for the breeding line (BR11712-4R-44) having salinity tolerance (7.34 to 18.18 dSm⁻¹) at both seedling and reproductive stages during Boro 2024-25 (Fig. 10). The average yield of BRRI dhan112 (BR11716-4R-102) was 5.0 t/ha and growth duration 121 days. Yield advantages of BRRI dhan112 was 22.0% over the check variety BRRI dhan73. BRRI dhan112 showed relatively higher level of salinity tolerance than the check variety BRRI dhan73. (Table 9 and Fig. 11)



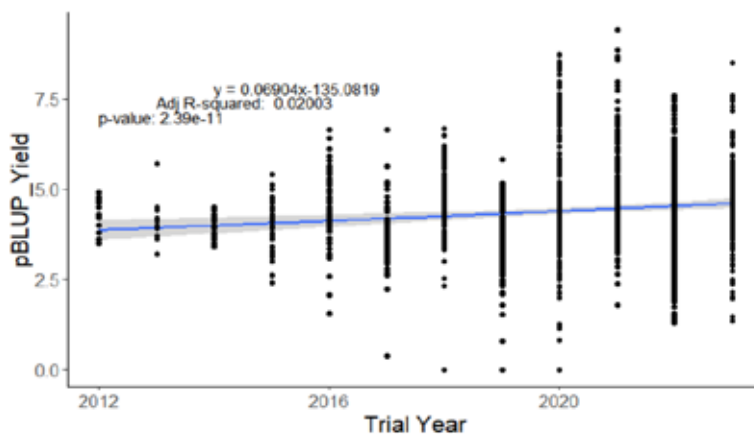


Fig. 5. Trends in genetic gain from BRRI's salinity T. Aman breeding programme comprising 12 years of breeding trials 2012 to 2023.

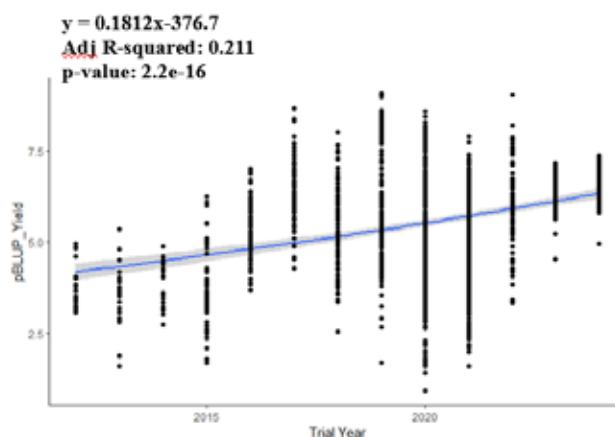


Fig. 6: Trends in genetic gain from BRRI's salinity Boro breeding programme comprising 12 years of breeding trials 2012 to 2024.

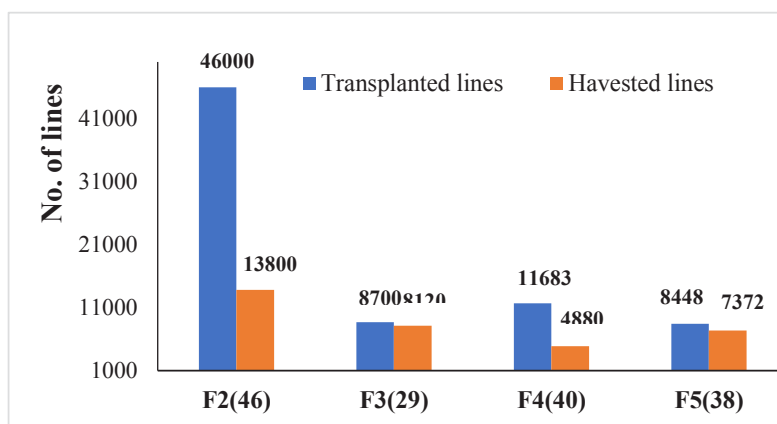


Fig. 7. Number of lines of FRGA population, T. Aman 2024-25.



Fig. 8. Field view of flooded LST field at BRRI RS Satkhira farm and trial plot at BRRI HQ, Gazipur, T. Aman 2024-25.

Table 6. Performance of RYT-3 lines, STR T. Aman 2024-25.

Designation	PH	GD	L1	L2	L3	L4	L5	BLUE	BLUP	Survival rate (%) at 12 dSm ⁻¹
BR12465-4R-61	119	132	5.2	5.7	6.4	3.9	5.2	5.3	5.1	
BR12465-4R-132	116	137	1.7	4.9	4.1	3.3	1.9	3.2	3.3	
BR12465-4R-26	111	132	3.9	4.4	4.9	3.4	3.9	4.1	4.1	
BR12465-4R-100	121	129	5.1	5.1	5.4	4.5	5.1	5.0	4.9	55
BR12465-4R-130	108	140	3.3	4.1	5.1	3.4	2.8	3.8	3.8	
BR12465-4R-231	117	128	4.1	6.0	5.8	4.7	4.1	4.9	4.8	21
BR12477-4R-186	126	131	1.2	5.0	5.5	3.4	1.2	3.2	3.4	65
BR12466-4R-167	126	131	3.5	5.5	7.0	3.4	3.5	4.6	4.5	82
BR12466-4R-317	109	123	3.4	3.6	5.3	4.5	3.4	4.0	4.1	50
BR12459-4R-277	126	130	2.7	6.2	6.6	5.0	2.5	4.6	4.5	73
BR12459-4R-113	118	130	4.2	5.2	5.9	4.5	3.2	4.6	4.5	55
BR12459-4R-241	125	128	2.6	3.5	6.0	4.6	2.6	3.9	3.9	94
BR12459-4R-117	131	131	2.2	5.0	6.2	3.9	2.2	3.9	3.9	65
BR12465-4R-223	110	131	3.0	5.1	5.3	4.0	3.0	4.1	4.1	48
BR12477-4R-371	122	128	2.5	3.4	6.2	5.1	2.5	3.9	4.0	34
BR23 (ck)	129	146	2.1	4.1	2.3	4.5	2.1	3.0	3.2	
BRRI dhan30 (ck)	124	137	2.4	5.7	5.9	4.7	2.4	4.2	4.2	
LSD<0.05	7.4	3.5	0.96	0.37	1.45	0.31	1.02	1.00		
H2b	0.89	0.94	0.91	0.7	0.76	0.8	0.88	0.71		

* PH=Plant height (cm); GD= Growth duration (day); L1: Gazipur; L2: Gopalganj; L3: Rajshahi; L4: Rangpur; L5: Satkhira

Table 7. Performance of RYT-1, STR Boro 2024-25.

Designation	PH	GD	L1	L2	L3	L4	L5	L6	L7	L8	L9	BLUE	BLUP
BR13205-4R-190	98.8	150	9.1	9.3	6.9	8.8	8.1	6.3	6.0	9.4	6.4	7.8	7.7
BR12274-4R-193	109.5	148	8.4	7.8	6.8	8.5	7.2	6.1	6.5	9.2	5.5	7.3	7.0
BRI11276-4R-139	122.8	152	8.2	7.8	4.6	9.2	6.8	7.2	8.2	8.6	4.4	7.2	6.6
BRI13201-4R-15	104.6	148	9.6	8.9	7.3	8.3	8.1	6.0	7.2	8.9	7.6	8.0	7.5
BR11276-4R-196	117.4	148	7.2	8.1	7.5	8.9	6.2	5.4	5.2	9.2	6.6	7.1	7.0
BR13201-4R-298	105.9	147	9.1	9.0	6.8	9.2	7.7	6.0	5.9	8.7	7.2	7.7	7.5

Designation	PH	GD	L1	L2	L3	L4	L5	L6	L7	L8	L9	BLUE	BLUP
BR13201-4R-225	99.9	149	8.9	8.9	8.1	9.6	7.5	6.0	5.6	9.1	7.9	7.9	7.1
BR11276-4R-104	127.2	152	8.3	6.5	7.5	8.9	6.0	6.5	6.6	8.7	4.5	7.0	7.6
BR111720-4R-89	120.4	149	8.3	8.7	7.6	7.8	6.0	5.4	7.2	9.4	7.0	7.5	6.9
BR12650-4R-77	119.8	146	8.4	8.2	6.8	7.6	5.9	5.7	5.8	9.1	5.1	6.9	7.2
BR12265-4R-71	117.3	145	7.8	7.4	6.6	7.2	5.6	2.8	5.8	8.2	5.8	6.4	7.3
BR13207-4R-28	116.0	148	7.5	8.7	7.0	7.3	6.8	6.4	6.9	10.3	7.4	7.6	7.3
BR13201-4R-268	105.3	145	8.4	6.7	7.0	7.1	7.1	5.3	6.1	8.2	6.5	6.9	7.4
BR13201-4R-299	100.5	146	9.1	8.0	7.0	7.9	7.5	5.7	6.4	9.5	7.2	7.6	6.8
BR11718-4R-92	123.1	150	8.5	8.3	5.9	8.3	6.8	6.0	6.0	9.3	4.6	7.1	7.0
BR13201-4R-219	110.0	148	9.1	9.2	7.7	7.6	7.3	5.4	6.3	9.1	7.6	7.7	7.1
BR12640-4R-250	118.8	149	9.0	6.9	7.2	7.2	6.6	4.0	6.8	9.3	4.1	6.8	7.1
BR11276-4R-67	124.8	149	8.8	7.4	6.7	7.9	6.4	6.2	6.8	9.4	4.6	7.1	7.2
BR12661-4R-33	107.2	144	8.9	8.9	7.7	6.4	6.1	5.9	6.7	8.5	6.2	7.3	7.8
BR13201-4R-103	105.4	143	9.1	8.4	7.4	6.7	5.7	6.5	5.9	9.8	7.4	7.4	7.2
BRRI dhan67 (ck)	108.8	141	6.5	6.5	6.5	6.9	6.0	6.0	5.7	8.3	6.9	6.6	7.6
BRRI dhan89 (ck)	106.1	144	8.3	8.3	6.1	7.9	6.1	6.1	5.8	8.4	5.0	6.9	7.8
BRRI dhan97 (ck)	109.8	144	7.4	7.2	7.0	7.3	6.9	5.6	7.5	9.3	5.3	7.0	7.1
BRRI dhan99 (ck)	105.2	146	6.3	7.2	6.5	8.3	6.9	6.8	6.1	9.8	5.8	7.1	7.4
LSD<0.05	2.79	2.1	0.41	0.62	1.2	0.77	0.54	0.41	0.35	0.4	0.98	0.3	
H2b	0.9	0.58	0.88	0.74	0.66	0.59	0.73	0.7	0.87	0.73	0.66	0.59	

* PH=Plant height(cm); GD= Growth duration (day); L1:Bhanga; L2:Cumilla; L3:Gazipur; L4:Gopalganj; L5:Kustia; L6:Rajshahi; L7:Rangpur; L8:Satkhira; L9:Sonagazi

Table 8. Performance of RYT-2, STR Boro 2024-25.

Designation	PH	GD	L1	L2	L3	L4	L5	L6	L7	L8	L9	BLUE	BLUP
BR13197-4R-24	112.9	144	9.3	7.8	6.9	10.1	6.3	6.0	7.6	8.4	5.7	7.6	7.4
BR13201-4R-30	104.0	140	8.1	8.4	6.4	9.6	6.7	5.9	9.7	9.3	6.8	7.9	7.6
BR13201-4R-249	114.9	144	8.1	9.4	6.3	10.0	6.9	7.1	7.6	9.5	5.3	7.8	7.6
BR12650-4R-55	115.6	140	8.0	6.4	6.8	10.0	4.7	6.2	5.9	9.0	5.2	6.9	7.0
BR13201-4R-196	102.9	142	9.5	7.5	7.6	10.0	6.1	6.8	6.3	8.7	6.9	7.7	7.5
BR12658-4R-255	115.0	140	7.0	5.7	7.1	10.2	5.0	5.6	5.4	8.5	5.4	6.7	6.8
BR13206-4R-50	110.6	145	8.8	6.9	6.5	9.1	4.7	5.1	4.5	8.3	5.4	6.6	6.8
BR12274-4R-310	115.2	142	9.0	8.5	6.3	8.9	6.4	6.7	8.0	7.5	3.8	7.2	7.2
BR11276-4R-150	106.5	147	6.6	7.2	6.5	8.8	5.9	5.0	7.4	8.5	3.4	6.6	6.8
BR11718-4R-110	102.7	141	6.2	7.2	5.3	8.0	5.4	5.4	6.6	9.0	4.4	6.4	6.6
BR11718-4R-125	127.8	149	8.0	8.2	4.7	10.0	6.3	6.7	7.7	7.5	3.4	6.9	7.0
BR12274-4R-255	104.1	143	6.6	8.4	5.7	10.0	6.4	6.6	8.3	9.9	4.6	7.4	7.3
BR13113-4R-121	107.8	141	7.6	8.6	6.1	10.3	6.7	6.6	7.3	7.8	5.5	7.4	7.3
BR13106-4R-168	98.6	139	8.5	8.9	5.1	9.7	6.0	6.2	7.7	8.4	5.4	7.3	7.3
BR11718-4R-230	113.3	148	8.4	7.7	6.8	10.1	5.1	5.6	6.7	7.9	3.2	6.8	6.9
BRRI dhan67	113.5	135	6.7	7.3	5.9	10.5	5.3	6.4	5.6	8.7	5.0	6.8	6.9
BRRI dhan89	112.2	143	8.4	7.3	5.1	10.9	6.6	6.8	7.2	8.2	5.1	7.3	7.2

Designation	PH	GD	L1	L2	L3	L4	L5	L6	L7	L8	L9	BLUE	BLUP
BRRI dhan99	106.3	145	7.6	7.9	6.8	10.6	6.9	6.7	8.1	8.2	5.6	7.6	7.5
LSD<0.05	2.44	2.82	0.34	0.92	0.79	0.71	0.4	0.42	0.63	0.38	0.65	0.37	
H2b	0.95	0.65	0.94	0.49	0.5	0.49	0.86	0.78	0.87	0.83	0.81	0.74	

*PH=Plant Height(cm); GD= Growth duration (day); L1:Bhanga; L2:Cumilla; L3:Gazipur; L4:Gopalganj; L5:Kustia; L6:Rajshahi; L7:Rangpur; L8:Satkhira; L9:Sonagazi

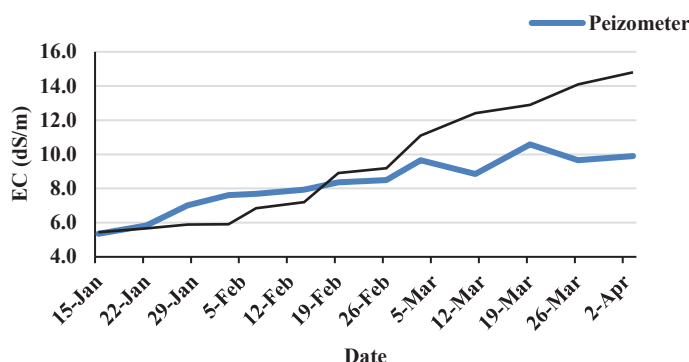


Fig.9. Dynamics of soil salinity at the Kaliganj trial site during Boro (2024-25).



Fig. 10. Salinity tolerant promising genotypes BR11712-4R-44, PVT, Boro 2024-25.

Table 9. Yield and agronomic performance of BRRI dhan112 in the proposed variety trial (PVT), T. Aman 2023-24 with its grain characteristics.

Designation	PH	GD	GY	MO (%)	HR (%)	L/B ratio	Size and shape	AAC (%)	Protein (%)	TGW (g)
BRRI dhan112	103	121	5.0	70	56	3.1	Long slender	28.1	8.4	21.5
BRRI dhan73 (ck)	127	118	4.1	69	57	2.9	Medium bold	27	8.4	20.9

* PH: Plant height (cm); GD: Growth duration (day); GY: Grain yield (tha⁻¹) as mean of ten locations; MO (%): Percentage of milling outturn; HR (%): Percentage of head rice recovery; L/B ratio: Ratio of length to breadth; AAC (%): Percentage of apparent amylose content; TGW (g): Thousand grain weight in gram



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Development of premium quality rice (PQR)

T. Aman. During T. Aman 2024-25, significant efforts were made for the development of high yielding (>3.5 t/ha) national grade aromatic rice varieties (BRRRI dhan34, Kalizira, Chinigura, Kataribhog, Radhunipagol, Tulshimala and Bashful type) for domestic consumption. A total of 32 crosses (30 single crosses and two backcrosses) were made using 17 parents. A total of 26 crosses (17 single crosses and nine backcrosses) were confirmed as true hybrids using 10 SNP *indica* QC genotyping panel. Overall, 13,868 progenies from 112 crosses (7,704 progenies of 19 F₂ crosses, 1,062 progenies of 17 F₃ crosses, 1,325 progenies of 18 F₄ crosses, 3,050 progenies of 47 F₅ crosses, 105 Progenies from BC1F4, 404 progenies from four BC2F4, 102 progenies from BC3F4, 336 progenies from four BC1F4, and 140 progenies from BC2F5) were harvested from FRGA. In line stage testing (LST) Trial, 393 genetically fixed lines of 30 crosses were selected out of 5,753 progenies through the combination of visual phenotypic assessment and trait genotyping with the progenies 2,063 (6.38%) selection intensity. In observational yield trial (OYT), 66 genotypes out of 148 were selected based on homogeneity, phenotypic acceptance (PAcp), grain type, presence of aroma, and grain yield. where yield was ranged from 1.27 t/ha to 5.43 t/ha with 67%, 88%, 78% and 72% heritability for plant height (cm), days to maturity PAcp and grain yield respectively. In this trial, tested breeding lines BR14189-5R-49 produced the highest yield (5.43 t/ha) with 134 days growth duration and presence of aroma where the best performing aromatic check variety produced 3.81 t/ha

grain yield with 130 days growth duration. In T. Aman 2024-25, two PYT (PYT#1 and PYT#2) trials were conducted in BRRRI, HQ. A total of 21 advanced lines out of 52 (17 from PYT#1 and 4 from PYT#2) were selected based on PAcp, grain type, presence of aroma, and grain yield. Among the selected advanced lines BR13943-3R-64 produced 4.62 t/ha grain yield with 128 days growth duration, whereas similar grain type aromatic standard check variety produced 4.06 t/ha grain yield with 132 days growth duration in PYT#1. Heritability estimates were 96% for plant height (cm), 96% for days to maturity, and 70% for yield in PYT#1. In advanced yield trial (AYT), six advanced lines (three from AYT#1 and three from AYT#2) out of 23 genotypes were selected based on the presence of aroma, phenotypic acceptance (PAcp) and grain yield. The advanced line BR10812-8-4-3-2-P2 produced the highest grain yield (3.91 t/ha) with 122 days growth duration and aroma in AYT#1 whereas best performing check variety BRRRI dhan80 produced 3.58 t/ha grain yield with 124 days growth duration with 93% for plant height (cm), 94% for days to maturity, and 73% for grain yield heritability. In AYT#2, advanced lines BR10824-5-6-4-1 produced 3.05 t/ha grain yield with 141 days growth duration, whereas the check variety BRRRI dhan34 produced 2.21 t/ha grain yield with 136 days growth duration. Under maintenance breeding programme, 442 genotypes, including 135 aromatic rice landraces, were evaluated and purified using systematic arrangement of panicle-to-row method to be maintained as nucleus stock for future use.

S Maniruzzaman, Sharmistha Ghosal, M M Yasmin and K M Iftekharuddaula.

Boro. The project aims to develop aromatic and non-aromatic fine quality rice with international (Basmati/Banglamati/SoruBalam type) standards in Boro season for domestic use and export quality. Totally 1,011 F₁ seeds were obtained from 15 crosses. Eleven F₁s were confirmed as true hybrid using 10-SNP *indica* QC panel. In total, 27,178 progenies of 89 crosses from F₂ to F₄ generations were advanced through RGA method. A total of 541 genotypes were selected from 6,502 progenies of 18 crosses of LST trial. Fig was 12 and 13 present selection intensity

(8.32%) and trait marker profile of the genotypes of LST. Most of the selected materials from LST obtained the favourable allele of high amylose, aroma and high grain no. per panicle. Frequency of the lines with disease and insect tolerance genes were limited. A total of 370 genotypes were evaluated in two OYT_s in Gazipur, Rajshahi and Rangpur and among them 70 genotypes were selected to forward in AYT based on the performance. From the two AYT_s, among the 40 tested genotypes only seven genotypes were selected for RYT. In RYT four genotypes were selected from 14 lines to forward in ALART. Two genotypes in ALART were evaluated under re-ALART.

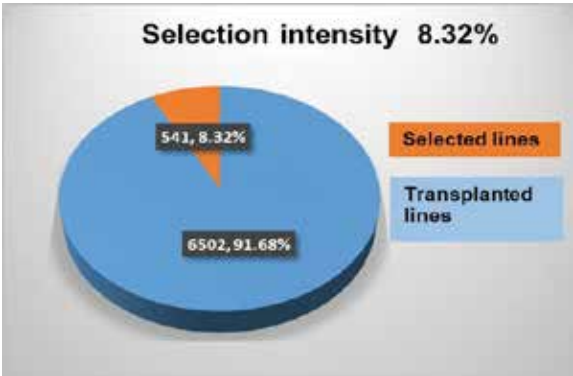


Fig. 12. Selection intensity in LST, PQR, Boro 2024-25.

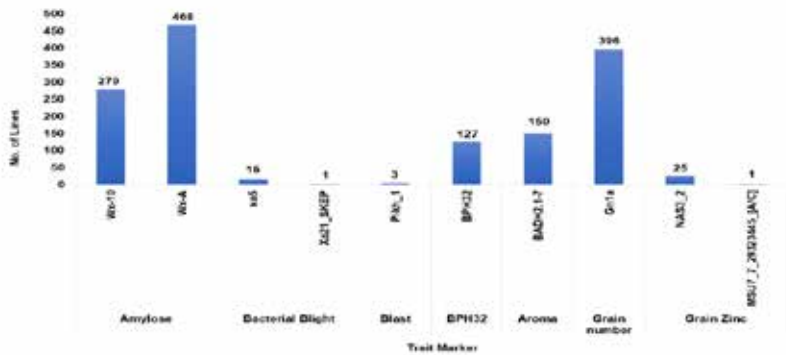


Fig. 13. Trait marker profile of the genotypes of LST, PQR, Boro 2024-25.

M A Kader, R R Majumder, S S Chaity and M I H Joy

Development of pigmented rice with nutraceutical properties. The main objective of this project was to develop anthocyanin-enriched,

value-added rice genotypes with high yield potential for both rainfed and irrigated ecosystems in Bangladesh. During T. Aman 2024-25, a total of 14 crosses were made using 16 parental lines. From

these crosses, 1,236 F1 seeds were obtained. Subsequently, from 31 crosses, 27 single crosses were selected and confirmed as true F1 hybrids through QC SNP panel analysis. A total of 26,694 progenies were advanced through rapid generation advance (RGA) from 80 crosses. From LST, 2,167 fixed lines of 10 crosses were grown and 196 fixed lines were selected, representing 9.04% selection intensity. In observational yield trial (OYT), 16 black pericarp genotypes were selected out of 152 genotypes. In preliminary yield trial (PYT#1), 5 genotypes were selected out of 23 and one genotype was selected out of 20 from PYT#2. Although the yields of these selected genotypes were slightly low than the checks, they were chosen based on phenotypic acceptance and the presence of black

pericarp. One genotype was selected out of 11 in advanced yield trial (AYT#1), and two out of 13 genotypes were selected in AYT#2. In regional yield trial (RYT), two advanced breeding lines were selected out of 10. In RYT, the highest yielding genotype was BR12839-4R-106, producing 3.33 t/ha grain yield with 130 days growth duration and a total antioxidant capacity (TAC) was 615.61 μ M. This was followed by the genotype BR12839-4R-137, which produced 3.25 t/ha yield with 123 days growth duration and a TAC was 609.05 μ M. In PVT, the proposed line BR12836-4R-63 produced 9.29% higher yield having higher C3G contents which was 492.27 mg/kg, ensuring its suitability as a variety to be released (Table 10)

Table 10. Performance of the genotype BR12836-4R-63 in PVT (proposed variety trial) ten locations.

Region	Trial	Trial location	Grain yield (t/ha)		% Yield advantage	Remarks
			BR12836-4R-63 (Proposed variety)	BRRI dhan70 (Check variety)		
Dhaka	1	BRRI HQ, Gazipur	3.00	2.49	17.0	BLB
	2	BRRI Bhanga	3.60	3.15	12.5	Rat attack
Chottogram	3	BRRI Sonagazi	4.93	5.30	-7.5	Flooding
	4	BRRI Cumilla	4.48	2.73	39.1	
Rajshahi	5	BRRI Rajshahi	4.70	4.47	4.9	
	6	Bogura	2.98	2.67	10.4	BLB
Rangpur	7	BRRI-Rangpur	2.29	2.61	-14.0	
	8	Dinajpur	5.84	5.38	7.9	
Khulna	9	Khulna	2.96	2.72	8.1	Two times submergence
	10	Jessore	5.49	4.69	14.6	
		Mean	4.03	3.62	9.29	

In Boro 2024-25, a total of 12 crosses were made using 12 parents and 400 F₁ seeds were obtained, and six single crosses among 10 crosses were confirmed and selected through QC SNP panel analysis. Panicles of 25,464 progenies from 81 crosses (5,924 progenies of 27 F₂ crosses, 10,316 progenies of 26 F₃ crosses, 8,006 progenies of 22 F₄ crosses and 1,218 progenies of six F₅ crosses) were advanced through RGA. The harvested panicles were labeled, dried and preserved properly. A total of 402 fixed lines from 3,828 of 23 crosses were selected from LST based on phenotypic acceptance, uniformity in

flowering, plant height, grain size and shape, lodging tolerance, pigmentation, higher predicted yield and presence of expected trait markers. A total of 25 genotypes were selected out of 200 genotypes in OYT. The yield range of the selected genotypes were 5.0 to 6.5 t/ha. The highest yield was found in BR14568-4R-41 which produced 6.5 t/ha yield with 119 days growth duration. Two genotypes were selected out of 33 genotypes and re-trial in AYT. Six materials in RYT were evaluated in eight locations. The genotype BR12839-4R-138-4 and BR12839-4R-106 produced similar yield (5.5 t/ha) to the check

variety. The total antioxidant capacity of these two genotypes was 654.22 and 609.05 μM AAE/100g. The check variety BRRI dhan88 produced 5.9 t/ha and BRRI dhan89 produced 6.6 t/ha yield but total antioxidant capacity of these two popular varieties was very low. Two genotypes with medium growth duration and one for short growth duration were evaluated in ALART.

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Development of photosensitive rice for charland.

During T. Aman 2024-25, a total of 22 crosses were made using 21 parent lines. A total of 13 crosses were confirmed out of 16 as true hybrids using 10 SNP *indica* QC genotyping panel. In FRGA, 6,869 progenies from 48 crosses (2,984 progenies of 10 F_2 crosses, 2,497 progenies of 23 F_3 crosses, 1,109 progenies of 10 F_4 crosses, 279 progenies of five F_5 crosses) were harvested for further advancement. In line stage testing (LST), 62 genetically fixed lines from 13 crosses were selected out of 1,749 progenies through the combination of visual phenotypic assessment and trait genotyping. In preliminary yield trial (PYT), four advanced lines were selected out of 10 genotypes whereas the advanced line BR11764-5R-124 produced the highest yield (4.56 t/ha) with 130 days growth duration and best performing check variety BR23 produced 4.29 t/ha yield with 131 days growth duration. In advanced yield trial (AYT), four advanced lines were selected out of nine genotypes. The advanced line BR8845-21-1-10-3-3 produced the highest yield (4.18 t/ha) and which was 9.4% higher than the check variety BR23 with similar growth duration (126 days). Estimated heritability of AYT were 99% for plant height, 92% for growth duration, and 52% for grain yield. In ALART_Photosensitive trial, the advanced breeding line BR10212-5-5-3 produced 4.86 t/ha grain yield being 12.5% higher yield than the check variety and this was recommended for PVT.

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Development of disease resistant rice. Efforts were made for developing varieties resistant to bacterial

blight (BB), rice tungro virus (RTV) and blast diseases. The experiments were conducted in both T. Aman and Boro seasons. Thirty-nine crosses for BB and blast in T. Aman and 66 crosses for BB, blast, tungro, false smut and bakanae were made in Boro season. Twenty-one crosses for BB and blast in T. Aman and 58 for BB, blast, tungro, false smut and bakanae were confirmed in Boro season as true F_1 . A total of 26,300 progenies for BB and 39,950 progenies for blast were advanced from F_{2-6} generation through field rapid generation advanced (FRGA). 637 uniform lines were isolated from 4,550 LST lines in T. Aman and 1,040 out of 6,654 lines were identified from LST in Boro season based on uniformity in heading, plant height, and grain type. Twenty genotypes were selected from observational yield trial (OYT) in T. Aman season whereas 30 entries out of 400 for BB during Boro season showed better yield potential and agronomic performance over the check varieties and tolerance to BB. From AYT, three advanced lines were promoted based on growth duration, grain yield, and BB score compared to the check varieties in T. Aman season and six genotypes out of 43 from AYT#1 and five genotypes out of 48 from AYT#2 for BB were selected in Boro season. In the regional yield trial (RYT), two genotypes for BB were selected in T. Aman season and three genotypes for Boro performed better considering yield, growth duration, BB resistance, and grain quality characters. In total, 180 parental lines were maintained in disease resistant maintenance breeding programme. The genotype BR12454 (Path)-BC2-69-97-39-5-44 was released as blast resistant long duration variety BRRI dhan114 comparing the check variety BRRI dhan89 for cultivation throughout the country in Boro season (Table 11). BRRI dhan114 shows highly resistant reaction to blast (Blast score-1) in artificial inoculation by blast pathogen. The results of SNP QTL fingerprinting showed that the blast resistant proposed variety obtained blast resistant dominant genes *Pi9* and *Pb1*. The average yield of BRRI dhan114 was 7.8 t/ha with 149 days growth duration, its potential yield can be attained up to 10.17 t/ha with proper management.

Table 11. Yield and agronomic performance of BRRI dhan114 in the proposed variety trial (PVT), Boro 2023-24 with its grain characteristics.

Designation	PH	GD	GY	MO (%)	HR (%)	L/B ratio	Size and shape	AAC (%)	Protein (%)	TGW (g)
BRRI dhan114	101	149	7.8	69.0	65.0	2.5	Medium bold	27.0	7.7	17.4
BRRI dhan89 (ck)	103	149	7.7	70.0	61.7	2.8	Medium bold	27.5	7.5	24.8

* PH: Plant height (cm); GD: Growth duration (day); GY: Grain yield (tha⁻¹) as mean of ten locations; MO (%): Percentage of milling outturn; HR (%): Percentage of head rice recovery; L/B ratio: Ratio of length to breadth; AAC (%): Percentage of apparent amylose content; TGW (g): Thousand grain weight in gram

M Khatun, A Rahman, N Tamanna, H A Mashuk, T H Ansari and M A Latif

Development of insect resistant rice. The main thrust of the project was to develop varieties resistant to gall midge (GM), brown plant hopper (BPH) and white backed plant hopper (WBPH). The experiments were conducted in both T. Aman and Boro seasons. In T. Aman 2024-25, 33 crosses for forward breeding, 10 crosses for pre breeding, three F₁ crosses for line augmentation were made, and 25 crosses were confirmed as true hybrids using quality check (QC) genotyping with purity SNP panel. In total 17,286 segregating progenies from 109 crosses of F₂₋₅ generations were advanced through field rapid generation advanced (FRGA) technique. Out of 2032 F_{5.6} LST lines derived from 21 different crosses, 358 genotypes were selected based on strong plant architecture, grain type and uniformity in heading under field condition as well as the presence of the favorable alleles of key target genes for BPH (*bph9*, *bph17_1*, *bph17_2*, *bph17_3* and *bph32*), Gm (*Gm4_3* and *Gm4_4*) and grain quality (*Wx-A* and *Wx-10*). The yield trials (OYT, PYT and AYT) were conducted at three locations of BRRI HQ Gazipur, BRRI RS Cumilla and Rangpur. A total of Sixty-two genotypes were selected from 318 breeding lines in OYT. Twenty-five genotypes were selected from 81 genotypes in PYT. Ten genotypes were selected from 25 lines in AYT for further evaluation. In Boro 2024-25, 26 crosses for forward breeding, three crosses for pre-breeding and three F₁ crosses for line augmentation were made, and 41 crosses were confirmed as true hybrids through F₁ verification using quality check (QC) genotyping with purity SNP panel. A total of 27,128 individual

segregating plants were advanced from 112 crosses in F₂₋₅ generations by FRGA technique. In LST, 778 lines having strong plant architecture, grain quality, uniformity in heading under field condition were selected from 5,167 F_{5.6} breeding lines that are the descendants of 26 crosses. Sixty-two genotypes, out of 318 were selected from OYT#1 that tested at three locations of BRRI Gazipur, Cumilla and Rangpur. In OYT#2, 35 genotypes were selected from 96 genotypes at BRRI Gazipur. Twenty-eight lines were selected from 72 lines in PYT. Out of 39 genotypes, 11 were selected from AYT for further evaluation. In total 765 genotypes from OYT, PYT, AYT, hybridization parents were screened at natural field condition in BPH hot spot area, Tarash, Sirajganj and ‘hopper burn’ symptom was not found due to low abundance of BPH population. In total 119 parental lines were maintained in insect resistant maintenance breeding programme.

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Development of submergence and water stagnation tolerant rice varieties. The project aims for the development of high yielding rice varieties tolerant to submergence (flash flooding) and medium stagnant water (MSW) stresses. During T. Aman 2024-25, a total of 38 single crosses were made and 1,515 F₁ seeds were produced. A total of 30 single crosses were confirmed and selected through QC SNP panel analysis. A total of 20,644 progenies from 104 crosses (3,320 from 17 F₂ crosses, 9,248 from 43 F₃, 2,472 from 10 F₄ crosses and 5,604 from 34 F₅ crosses) were harvested at the time of maturity, processed with proper labels and preserved. In Boro 2024-25, only generation advancement was done and

a total of 29,987 progenies were advanced from 110 single crosses (3,940 progenies from 6 F₂ crosses, 10,418 progenies from 32 F₃ crosses, 4,238 progenies from 17 F₄ progenies and 9,591 from 45 F₅ crosses and 1,800 progenies from 10 F₆ crosses). The ranges of mortality percentage of different RGA generations were around 25-29%. From LST population, 4,796 lines from 21 crosses were genotyped with trait markers using custom SNP panel among which 144 lines were selected based on uniformity and traits markers like *Sub1*, *Wx-A group*, *Wx-A₁NB*, *xa13*, *Xa21* etc. In yield trial, 426 genotypes were tested out of which 93 genotypes were selected based on phenotypic acceptance, growth duration, survivability and higher yield performance. From OYT#1, 28 genotypes out of 246 genotypes, from OYT#2, 29 genotypes out of 76 genotypes, from AYT#1, 12 genotypes out of 53 genotypes, from AYT#2, 11 genotypes out of 16 genotypes, from AYT_Early, seven genotypes out of 18 genotypes, from AYT_Late, six genotypes out of 17 genotypes were selected. In AYT#1, the genotype BR14161-4R-21 produced the highest yield (6.5 t/ha) followed by BR12484-5R-44 (6.0 t/ha) and BR12950-5R-120 (6.0 t/ha) under controlled condition with the survivability 96%, 96% and 84% respectively. In AYT#2, the genotype BR12506-5R-174 produced the highest yield of 6.47 t/ha with 94% survivability in

tank followed by the genotype BR12490-5R-175 (6.2 t/ha) with 86% survivability. The yield range of other selected genotypes were 5.0 t/ha to 5.9 t/ha under controlled submergence condition and 5.0 to 6.2 t/ha under rainfed conditions. In AYT_Early, the genotype BR11692-5R-345 produced the highest yield (6.5 t/ha) followed by IR16F1065 (6.4 t/ha) and BR12162-5R-350-1-P1 (5.8 t/ha) under tank condition with the survivability of 99%, 99% and 81% respectively. In AYT_Late, the genotype IR16F1201 produced the highest yield (5.78 t/ha) with 98% survivability in tank followed by the genotype IR13F478-3 (5.58 t/ha) with 99% survivability. The yield range of other selected genotypes were 5.08 t/ha to 5.54 t/ha. In PVS, the trial was conducted in four locations of submergence prone farmer's field in Rangpur, Kurigram, Lalmonirhat and Gaibandha district. There was no flood in any locations, therefore, the trial will be repeated. The heritability obtained for plant height, growth duration, grain yield was ranged from 59% to 98% indicating medium to high level of precision of these experiments. The genotype BR9158-19-9-6-50-2-HR1 was released as BRRI dhan109 for tidal submergence prone environment of Barishal region (Table 12) and IR16F1148 was released as BRRI dhan110 for submergence prone areas of Bangladesh (Table13).

Table 12. Yield and agronomic performance of BRRI dhan109 in the proposed variety trial (PVT), T. Aman 2023-24 with its grain characteristics.

Designation	PH	GD	GY	MO (%)	HR (%)	L/B ratio	Size and shape	AAC (%)	Protein (%)	TGW (g)
BRRI dhan109	128	147	5.49	72	61	2.4	Medium bold	25.4	10.6	31.0
BRRI dhan44 (ck)	131	121	4.52	72	61	2.4	Medium bold	26.7	8.9	30.0

Table 13. Yield and agronomic performance of BRRI dhan110 in the proposed variety trial (PVT), T. Aman 2023-24 with its grain characteristics.

Designation	PH	GD	GY	MO (%)	HR (%)	L/B ratio	Size & shape	AAC (%)	Protein (%)	TGW (g)
BRRI dhan110	120	125	5.29	70	64	2.9	Medium slender	24.3	8.8	19.9
BINA dhan11 (Ck)	111	121	4.39	72	63	3.1	Medium bold	24.0	8.2	22.0

* PH: Plant height (cm); GD: Growth duration (days); GY: Grain yield (tha⁻¹) as mean of ten locations; MO (%): Percentage of milling outturn; HR (%): Percentage of head rice recovery; L/B ratio: Ratio of length to breadth; AAC (%): Percentage of apparent amylose content; TGW (g): Thousand grain weight in gram

Investigators: S Ghosal, S Maniruzzaman, A Rahman, R Hassan and K M Iftekharuddaula.

Development of drought tolerant rice (DTR). The project aims to develop high yielding drought tolerant rice varieties under rainfed lowland rice ecosystem in T. Aman season. In T. Aman 2024-25, a total of 781 F₁ seeds were obtained from 24 crosses using 15 parents and 25 crosses were confirmed as true hybrids using 10-SNP *indica* QC panel. A total of 14,930 individual progenies from 39 crosses of F₂₋₅ generation were harvested through RGA. From line stage testing (LST), 398 lines were selected from 4,243 progenies of 19 crosses. Figure 14 and 15 present selection intensity (938%) and trait marker profile. The most of the selected materials from LST contained genes/QTLs of drought tolerance along with high amylose (*Wx-A*), *xa5*, *BPH32* and gall midge. A total of 43 genotypes were evaluated in two AYT in Gazipur, Rajshahi and Rangpur. Among the tested genotypes, seven promising genotypes were selected and forwarded to RYT. During flowering

stage, the least drought stress was observed in Rajshahi as it was rained frequently (Fig. 16) and moderate drought was at Gazipur (Fig.17) in AYT. In Rangpur no drought stress was observed. Two genotypes were forwarded from RYT to ALART due to its yield and drought tolerance ability. Genetic trend of the genotypes from 2016 to 2024 showed the pBLUP (grain yield) in respect of trial year yield increase of 84.77 kg/ha/year equivalent to about 2.1% increase in grain yield per year based on yield of 2016 (Fig. 18).

In Boro 2024-25, a total of 281 F₁ seeds were obtained from 17 crosses using 14 parents and 19 crosses were confirmed as true hybrids using 10-SNP *indica* QC panel. The RGA materials were advanced in the Boro 2024-25 from T. Aman season and 15,465 progenies of 50 crosses from F₂ and F₃ generations were harvested through RGA method. Under CRCIL drought programme five three-way crosses and four backcrosses were made in Boro 2024-25.

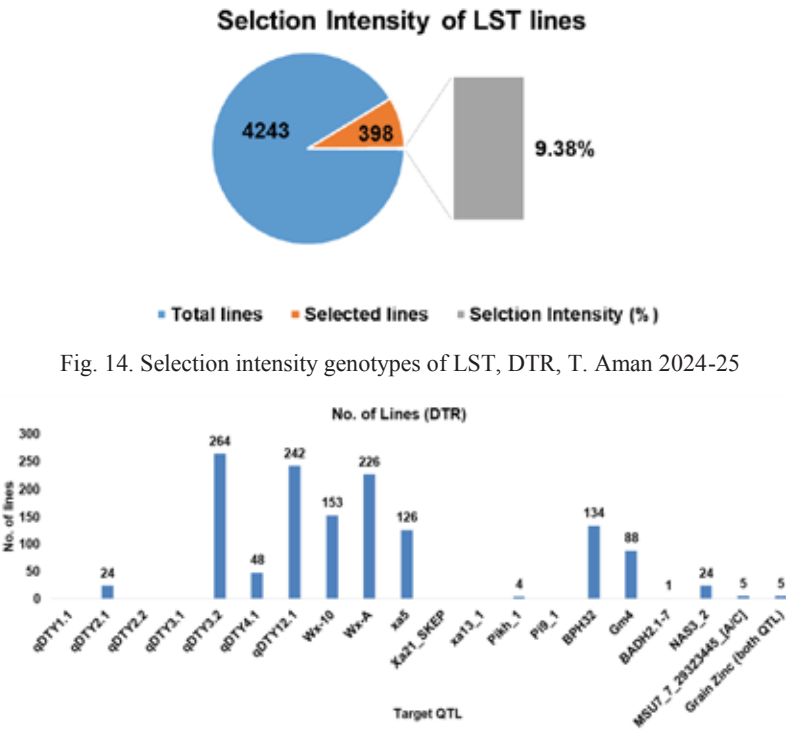


Fig. 14. Selection intensity genotypes of LST, DTR, T. Aman 2024-25

Fig. 15. Trait marker profile of the genotypes of LST, DTR, TA 2024-25.

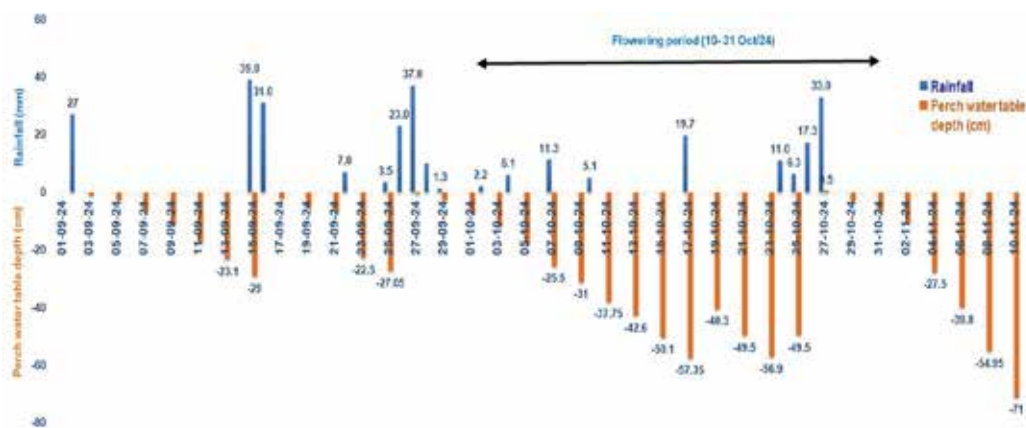


Fig. 16. Perch water table depth in the experimental field of Rajshahi, T. Aman 2024-25.

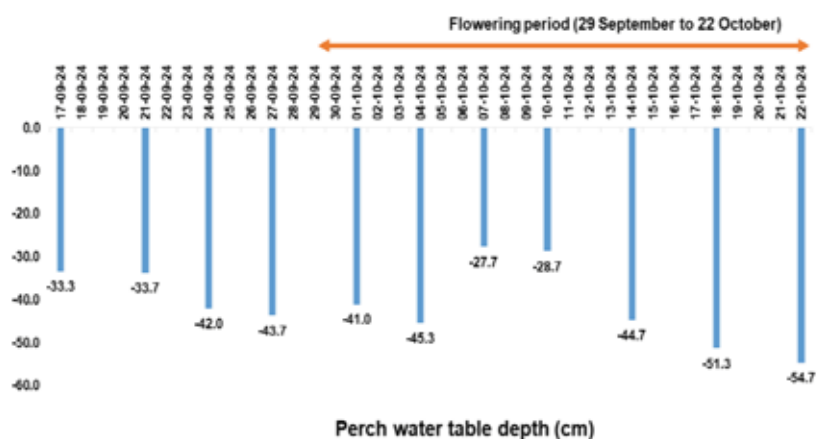


Fig. 17. Perch water table depth in the experimental field of Gazipur, T. Aman 2024-25.

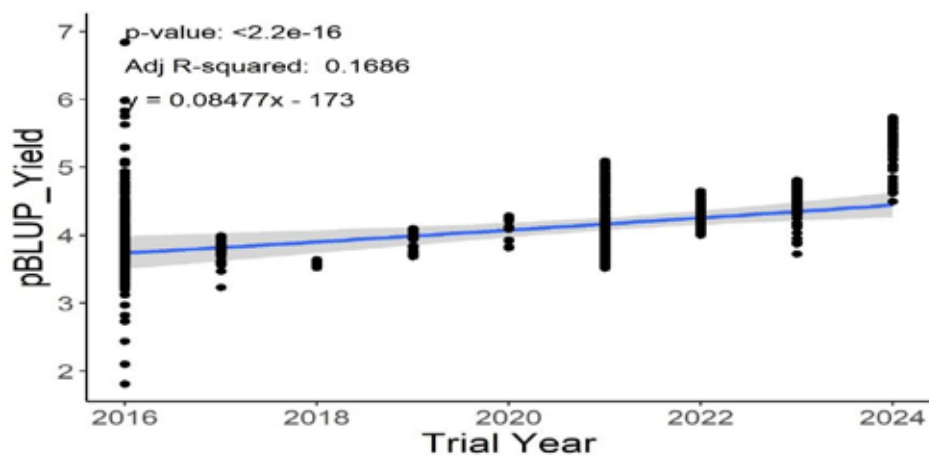


Fig. 18. Genetic trend of pBLUP in respect of trial year based on yield of 2016, DTR, T. Aman 2024-25.

M A Kader, R R Majumder, S S Chaity and M I H Joy

Development of water saving and aerobic rice varieties. The objective of the project was to develop short duration water-use-efficient rice genotypes with 10% more yield than the check varieties under transplanted alternate wetting and drying (AWD) and aerobic conditions. A total of 20 crosses were made using 20 parents and 1,350 F₁ seeds were obtained, and 15 single crosses were selected and confirmed through QC SNP panel analysis. A total of 10,377 individual panicles were selected from 59 crosses (1,540 progenies of six crosses from F₂, 5276 progenies of 26 crosses from F₃, 1,596 progenies of 13 crosses from F₄, and 1,965 progenies of 13 crosses from F₅) were harvested through RGA. From yield trial, four genotypes were selected out of 40 genotypes. In OYT, four genotypes were selected from 40 genotypes. From AYT, 10 genotypes were selected out of 19 genotypes. In OYT, among all selected genotypes the line BR13400-5R-16 produced the highest yield (7.2 t/ha) having growth duration 143 days. In AYT the genotype IR18R1133, produced the highest yield (7.4 t/ha) with growth duration 143 days. The heritability obtained for growth duration and grain yield of the trials conducted was ranging from 84 % to 95%, and 48 % to 94% respectively, indicating acceptable level of precision in these experiments.

Sharmistha Ghosal, S Maniruzzaman, M M Yasmin and K M Iftekharuddaula.

Development of zinc enriched rice (ZER). The project aims to develop high yielding rice varieties with improved nutritional quality with high zinc ($Zn \geq 24$ mg/kg) in polished grain. The project also prioritizes development of stress tolerant zinc enriched rice varieties in a combination of submergence and zinc, drought and zinc, salinity and zinc along with cold and zinc enriched rice with improved grain yield. The experiments were conducted in both T. Aman and Boro seasons. In T. Aman season, 23 single crosses were made that produced 2,218 seeds. A total of 19 crosses were selected and confirmed as true F₁ using 10-SNP *indica* QC panel. In RGA method, 29,268 segregating progenies were harvested from F₂₋₅ generations of 110 crosses. A total of 372 uniform lines out of 4,494 lines were harvested based on visual observation on homogeneity in flowering, plant height and grain size and shape. Figures 19 and 20 present selection intensity and trait marker profile of the genotypes of LST. Most of the selected materials from LST contained genes/QTLs of high amylose, high zinc content and drought tolerance. From the OYT, 91 genotypes were selected from 363 genotypes. A total of eight genotypes were selected out of 56 genotypes from the AYT based on yield performances. Only one genotype out of nine genotypes was selected for re-trial in RYT.

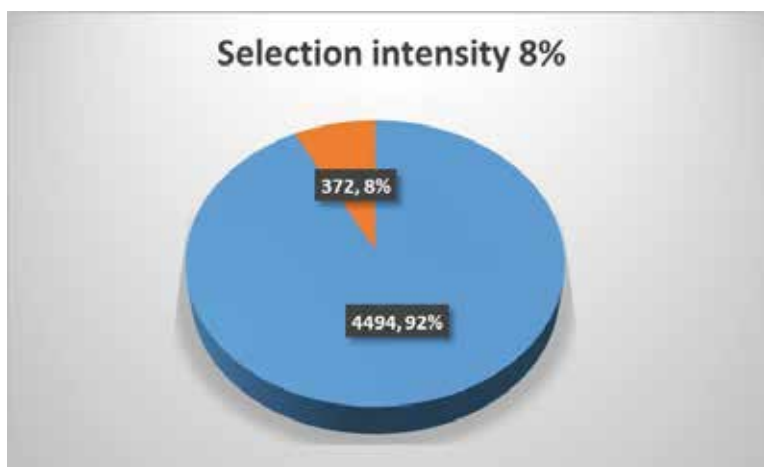


Fig. 19. Selection intensity genotypes of LST, ZER, T. Aman 2024-25

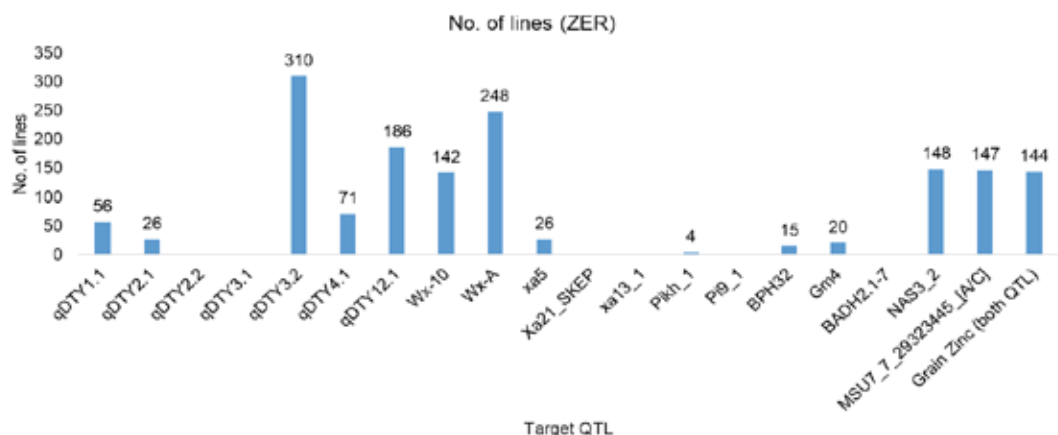


Fig. 20. Trait marker profile of the genotypes of LST, ZER, T. Aman 2024-25.

In Boro 2024-25, a total of 21 single crosses were made that produced 4,699 seeds. fourteen crosses were selected and confirmed as true F₁. In RGA method, 22,148 segregating progenies were harvested from F₂₋₄ generations from 81 crosses. From LST, a total of 963 uniform lines out of 15,046 lines were harvested based on visual observation on homogeneity in flowering, plant height as well as grain size and shape. Figures 21 presents and 22 Selection intensity and trait marker profile of the genotypes of LST. Most of the selected materials from LST contained genes of high amylose, high

zinc content, and some lines contained genes of aroma and few lines had insect resistance genes. From two OYT_s, a total of 68 genotypes were selected from 531. Among them, 30 genotypes out of 244 from OYT#1 and 38 genotypes out of 287 from OYT#2 were selected. A total of ten genotypes were selected from two AYT_s out of 50 genotypes. From the two AYT_s, ten genotypes were selected from 50 genotypes. Out of four genotypes, one entry was selected for favourable Boro and one entry was recommended for promoting to RYT.

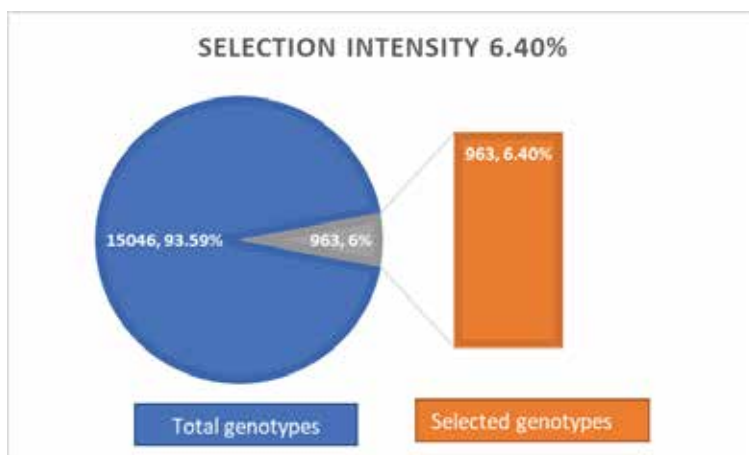


Fig.21. Selection intensity for the genotypes of LST, ZER, Boro 2024-25

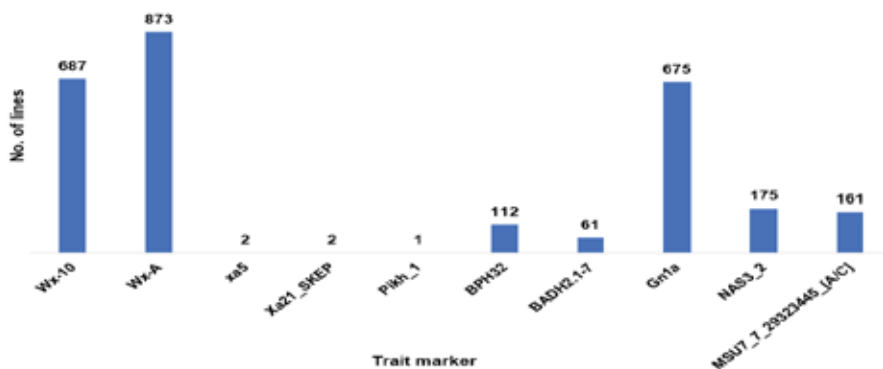


Fig. 22. Trait marker profile of the genotypes of LST, ZER, Boro 2024-25

Investigators: M A Kader, R R Majumder, S S Chaity and M I H Joy

Development of transgenic high beta-carotene rice and high iron and zinc rice (Healthier Rice). The main objective of the project was to develop high yielding transgenic rice varieties with enhanced pro-vitamin-A, iron and zinc content in polished rice grain. In T. Aman 2024-25, with a view to developing high iron and zinc enriched rice, five backcrosses were made where 135 seeds were

produced in total. BC1F1 generation was produced utilizing BR11712-4R-93, BRRI dhan98, BRRI dhan103 and BRRI dhan107 as recipient genotypes and BC3F1 was produced in the background of BRRI dhan87. Eleven hemizygous plants (H-type) were found from BC2F1 generation (BRRI dhan87*3/ IR 135160 TR-3-B-19). After confirmation of BC2F1 in the background of BRRI dhan87 backcrossing was accomplished. Gel picture shows the BC2F1 plants for zygosity detection specific to high iron and zinc genes in the background of BRRI dhan87 (Fig. 23).

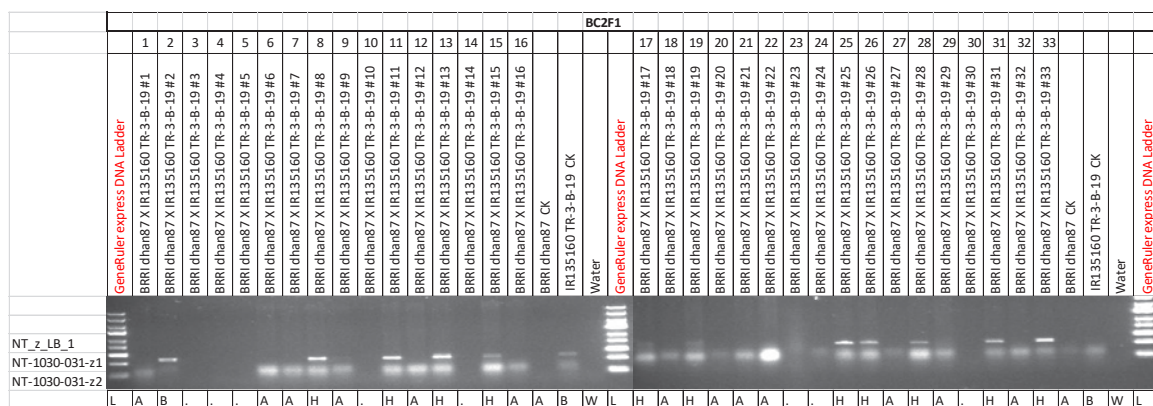


Fig. 23. Gel picture of BC2F1 plants of high iron and zinc gene in the background of BRRI dhan87, healthier rice, T. Aman 2024-25.

In Boro 2024-25, a total of 688 seeds of BC2F1 generation were harvested from three backcrosses to develop high iron and zinc enriched rice in the

background of BR11712-4R-93, BRRI dhan98 and BRRI dhan103. Plants of BC1F1 in the background of BRRI dhan103, BR11712-4R-93, BRRI dhan98 were

hemizygous plants were identified (Fig. 24). F₁ plants were confirmed for the cross of BRRI dhan105 and IR 135160 TR-3-B-19.

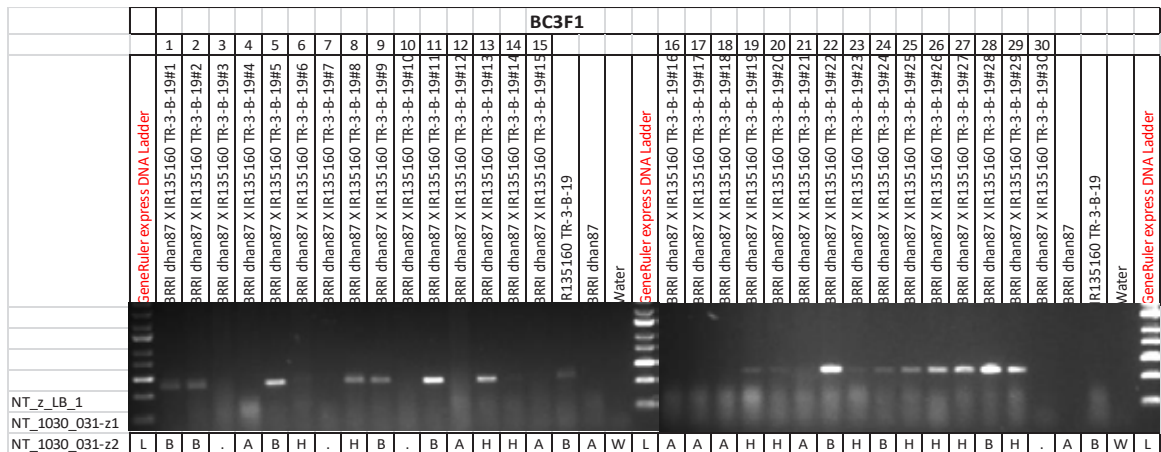


Fig. 24. Gel picture of BC3F1 plants specific to high iron and zinc genes in the background of BRRI dhan87, healthier rice, Boro 2024-25.

M A Kader, R R Majumder, S S Chaity and M I H Joy

Biotechnology Division

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SUMMARY

A total of 31 experiments were reported during the year 2024-25. For developing high yielding aromatic rice variety fifteen anther culture derived lines of BRRI dhan50/ Bashful (Acc. No. 3954) cross were evaluated in Boro 2024-25 as PYT along with check BRRI dhan50. Among them nine lines were selected. During Boro 2024-25, a vitamin E and antioxidant enriched doubled haploid black rice line was evaluated with one check variety as Proposed Variety Trial (PVT) by SCA. Besides, seven and 66 antioxidant enriched black rice lines were evaluated as SYT and OT respectively. Among them three and 14 lines were selected from SYT and OT respectively. Moreover, during Boro 2024-25, seven antioxidant enriched black rice and four intermediate-amylose content lines developed using anther culture were evaluated in six locations viz Shitakunda and Rangunia of Chattagram, Upper parachora and Sabujbag of Khagrachori, Kutukchari and Naniyar chor of Rangamati District as Multilocation Trial (MLT). Among them three lines were selected for ALART. For the development of Aus rice variety fifteen 15 advanced lines were grown as a preliminary yield trial (PYT-1) in Aus 2024. Among them, nine lines were selected based on plant type, yield, and growth duration. During T. aman 2024, thirty advanced lines were grown in the BRRI RS, Barishal as observational trial (OT) including three check varieties. These lines also have taller seedling capabilities. Among them 12 lines were selected for the development of photosensitive rice varieties. Besides, one regional yield trial (RYT) including four advanced lines and three standard checks was conducted in T. Aman 2024, where two lines were selected for ALART. For the development of Aman rice for the favourable ecosystem one preliminary yield trial was conducted where 28 lines were grown and 11 lines were selected for SYT. Another PYT was conducted during T. Aman 2024 with seven lines including the check variety and three lines were

selected. One regional preliminary yield trial (RYT) was conducted in Aman 2024, where three advanced lines were grown with two standard checks and one line was selected for advanced line adaptive research trial (ALART).

For the development of Boro Rice for the favourable ecosystem one observational trial (OT) was conducted with 14 lines and 12 lines were selected. Besides, One preliminary yield trial was conducted with 16 lines and 13 lines were selected. On the other hands, one SYT was conducted with nine lines and six lines were selected for RYT. Two multilocation trials (MLTs) were conducted to evaluate the salt tolerance and resistance to neck and panicle blast of eight test entries, with the goal of developing rice varieties having both the salt tolerant and blast resistant traits. In the salt tolerance trial, four entries viz BR (Bio)9787-BC2-16-3-1(HR-1), BR (Bio)9787-BC2-203-1-3, BR (Bio)9787-BC2-102-1-4, and BRRI dhan96 were performed better than the performance of the tolerant checks BRRI dhan67 and BRRI dhan97. The line BR (Bio)9787-BC2-35-4-1 also produced a higher yield than BRRI dhan67 and comparable yield to BRRI dhan97. All the tested lines showed similar performance as tolerant checks and better performance than the susceptible check. Based on combined performance from both the trials five entries namely BR (Bio)9787-BC2-16-3-1(HR-1), BR (Bio)9787-BC2-203-1-3, BR (Bio)9787-BC2-102-1-4, BR (Bio)9787-BC2-35-4-2, and BRRI dhan96 were selected for further evaluation. Seventy six antioxidant enriched somaclonal variants of black were evaluated as OT and among them 11 lines were selected for further evaluation. A total of 326 lines of somaclonal variants (SCV₄) of Kalijira were grown in T. Aman 2024. Thirty-six fixed lines and 441 plants were selected for the development of aromatic rice varieties. In total, 195 backcross progenies (BC₂F₅) from wide hybridization were evaluated in T. Aman 2024. Among them 91 plants were selected for generation advancement. Besides, five embryo-

rescued BC₂F₃ populations (developed by using HYV (BR11, BRRI dhan33, BRRI dhan39 BRRI dhan52, BRRI dhan66) and *Oryza rufipogon* (Acc. no. 103404) were grown in T. Aman 2024. Among them, 2,526 plants and 39 homozygous lines were selected. For the development of high yielding Boro rice varieties using EMS, 12 fixed mutant lines of BR11 were evaluated as PYT and five lines were selected. Besides, during Boro 2024-25, a total of 18 fixed mutant lines of BR11 were evaluated as OT with four standard check and 10 lines were selected for further evaluation. 46 homozygous lines developed from a cross between BRRI dhan87 and Kalijira were evaluated. Among them nine lines were selected on the basis of aroma, growth duration and plant height. All the tested aromatic lines were confirmed by using functional marker of fragrance gene *BADH2* in early generation. A three-way cross, two doubled crosses and six crosses were done for the development of aromatic and tidal submergence tolerance rice genotype. Aromatic progenies were identified with functional marker of *BADH2* gene. Seeds from 38 lines of different crosses were harvested from F₂ generation. 166 lines were selected. To develop multiple disease resistant (blast and bacterial blight) rice varieties F₃ plants of four crosses such as BR (Bio)11447-1-28-14-3/IR64Pi9 (L), BR (Bio)11447-1-28-14-3/IR64Pi9 (E), BR (Bio)11447-3-10-7-1/IR64Pi9 (L), BR (Bio)11447-3-10-7-1/IR64Pi9 (E) were screened with *Xa21* and *xa13* primer and F₄ seeds from 676 plants having both *Xa21* and *xa13* genes were harvested. An association mapping panel of 158 accessions including varieties, landraces, and

DEVELOPMENT OF DOUBLE HAPLOID RICE THROUGH ANTHER CULTURE

Premium quality rice variety through anther culture

Doubled haploid plants from the BRRI dhan90/Kataribhog cross were evaluated during T.

advanced breeding lines was used in Genome wide association mapping for photosensitivity of rice study. Heading data were collected over two years under short-day conditions and two years under long-day conditions. During this period, photosensitive accessions were screened, and the germplasm was genetically purified. To evaluate the degree of photosensitivity, the accessions were grown last year under a controlled shading facility at the Plant Physiology Division of BRRI. The findings will be further refined this year using the same facility. *AeMDHAR* salt tolerant gene (from mangrove plant) containing transgenic plants was crossed with BRRI dhan28 to introgress *AeMDHAR* gene. A total of 126 BC₂F₄ plants of BRRI dhan28 were grown in Transgenic net house and 28 plants were selected for further evaluation. To identify genomic regions associated with photosensitivity in Bangladeshi rice, a panel of 158 diverse germplasm was phenotyped based on heading data over four years. The first two years focused on purifying the germplasm and screening for photosensitivity by growing the lines under contrasting short-day and long-day conditions. In the following two years, the degree of photosensitivity was evaluated under the shading facility of the Plant Physiology Division. To identify genomic regions linked to C₄ photosynthetic traits, 1,100 M₄ generation plants of BARI Kaoun 3 were screened for loss of C₄ characteristics, resulting in the identification of 26 promising lines for further study. Additionally, 500 M₂ mutant plants of BARI Kaoun 4 were developed for the same purpose.

Aman 2024. Among them, 65 lines were selected. Besides, 15 anther culture derived lines of BRRI dhan50/ Bashful (Acc no. 3954) cross were evaluated in Boro 2024-25 as PYT along with check BRRI dhan50. Among them nine lines (Table 1) were selected for SYT.

Table 1. Agronomic characteristics of anther culture derived lines from BRRI dhan50/Bashful (Acc. no. 3954) evaluated as PYT, Boro 2024-25.

Designation	PH (cm)	GD (day)	Yield (t/ha)
BR (Bio) 16417-AC2-3-5	85	140	5.72
BR (Bio) 16417-AC2-1-6	97	148	6.01
BR (Bio) 16417-AC3-1-3	86	141	5.43
BR (Bio) 16417-AC3-7-4	85	139	5.08
BR (Bio) 16417-AC4-3-2	84	140	5.42
BR (Bio) 16417-AC4-1-1	83	140	5.13
BR (Bio) 16417-AC6-4-1	104	138	5.51
BR (Bio) 16417-AC6-5-3	92	145	6.18
BR (Bio) 16417-AC7-1-3	88	145	5.50
BR (Bio) 16417-AC7-5-4	89	142	6.11
BR (Bio) 16417-AC8-1-1	99	150	6.26
BR (Bio) 16417-AC8-3-3	91	142	5.35
BR (Bio) 16417-AC9-2-1	101	137	6.46
BR (Bio) 16417-AC9-6-5	87	142	5.35
BR (Bio) 16417-AC10-1-1	107	140	5.81
BRRI dhan50 (ck)	93	151	5.71
CV	3.31	2.69	7.33
LSD	1.40	2.14	0.51

Bold= Selected, PH= plants height, GD= Growth duration

Nilufar Yasmin Shaikh, Ripon Kumar Roy, S M Hisam Al Rabbi

Antioxidant enriched black rice variety

During Boro 2024-25, an antioxidant enriched doubled haploid black rice line was evaluated with one check variety as proposed variety trial (PVT) by SCA (Table 2, Fig. 1). Moreover,

seven and 73 antioxidant enriched black rice lines were evaluated as SYT and OT respectively. Among them three and 14 lines were selected from SYT and OT respectively (Table 3, 4 and 5).

Jannatul Ferdous and Shahanaz Sultana

Table 2. Performance of the proposed variety at on farm trial, Boro 2024-25.

Location	Proposed variety		Check variety	
	BR (Bio)13028-AC24-2-3		BRRI dhan86	
	Growth duration (day)	Grain yield (t/ha)	Growth duration (day)	Grain yield (t/ha)
Feni		8.23		6.906
Dinajpur				
Cumilla		7.26		6.74
Jessore		7.46		7.27
Faridpur		6.96		7.77

Location	Proposed variety		Check variety	
	BR (Bio)13028-AC24-2-3		BRRI dhan86	
	Growth duration (day)	Grain yield (t/ha)	Growth duration (day)	Grain yield (t/ha)
Rajshahi		8.12		7.48
Barishal		6.36		5.70
Rangpur		6.64		6.88
Bogura		7.30		7.30
Gazipur		8.60		7.76
Mean		7.43		7.08



Figure 1. Field view of BR (Bio) 13028-AC24-2-3 during Boro 2024-25.

Table 3. Agronomic characteristics of selected anther culture derived materials. SYT, Boro 2024-25.

Designation	PH (cm)	GD (day)	Yield(t/ha)
BR (Bio) 13028-AC11-2-1-1	124	145	5.85
BR (Bio) 13028-AC11-2-2-3	99	147	4.69
BR (Bio) 13028-AC15-3-1-2	109	149	6.57
BR (Bio) 13028-AC24-3-5-1	106	145	6.20
BR (Bio) 13028-AC24-4-2-2	106	143	5.77
BR (Bio) 13028-AC24-5-2-4	101	146	3.87
BR (Bio) 13028-AC24-5-2-4	100	145	2.69
BRRI dhan86 (ck)	90	142	5.74
BRRI dhan96(ck)	82	143	4.12

Bold= Selected, PH= plants height, GD= Growth duration

Table 4. Agronomic characteristics of selected anther culture derived materials. OT-1, Boro 2024-25.

Designation	PH (cm)	GD (day)	Yield (t/ha)
BR (Bio) 13029-AC2-2-3	119	136	7.57
BR (Bio) 13030-AC1-1-2	82	145	6.93
BR (Bio) 13028-AC21-3-2	94	144	8.14
BR (Bio) 13028-AC21-3-13	103	144	7.08
BR (Bio) 13030-AC10-6-7	102	145	8.23
BR (Bio) 13030-AC10-6-9	105	141	7.95
BRRRI dhan86 (ck)	92	142	6.72
BRRRI dhan96 (ck)	85	141	6.16

PH= plants height, GD= Growth duration

Table 5. Agronomic characteristics of selected anther culture derived materials. OT-2, Boro 2024-25.

Designation	PH (cm)	GD (day)	Yield (t/ha)
BRRRI dhan 48 /Lansan-1-4-1-1-2	110	163	7.02
BRRRI dhan 48 /Lansan-1-4-1-6	134	158	7.01
BRRRI dhan87/Selasih-1-1-2-1-3	126	160	10.47
BRRRI dhan87/Selasih-1-3-1-2-1	100	150	7.16
BRRRI dhan87/Selasih-1-3-1-2-2	102	151	7.13
BRRRI dhan87/Selasih-1-3-1-4-1	100	148	7.27
BRRRI dhan87/Selasih-1-3-1-5-1	96	146	7.01
BRRRI dhan87/Selasih-1-3-1-6-1	99	145	6.99
BRRRI dhan86 (ck)	89	140	7.04
BRRRI dhan96 (ck)	89	142	7.98

PH= plants height, GD= Growth duration

Development of high-yielding colored and intermediate-amylose content rice for hill ecosystem

During Boro 2024-25, seven antioxidant enriched black rice and four intermediate-amylose content lines developed using anther culture were evaluated in six locations viz Shitakunda and

Rangunia of Chattagram, upper parachora and Sabujbag of Khagrachori, Kutukchari and Naniyar chor of Rangamati district as multilocation trial (MLT). Among them three lines were selected for ALART (Table 6).

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Table 6. Agronomic characteristics of selected anther culture derived materials in multi-location trial (MLT), Boro 2024-25.

Line	PH (cm)	GD (day)	Yield (t/h)	Amylose (%)	SS
BR (Bio) 13028-AC24-1-2	118	139	6.06	21.0	LS
BR (Bio) 13029-AC6-2-6	105	135	5.51	20.1	LB
BR (Bio) 13028-AC1-2-3	117	136	6.38	24.9	MS
BR (Bio) 13028-AC1-2-4	110	136	6.39	25.2	MB
BR (Bio) 13028-AC1-2-7	108	139	6.05	24.6	MB
BR (Bio) 13028-AC2-2-2-3	128	135	4.54	25.2	MS
BR (Bio) 13030-AC13-2-2	136	147	5.25	25.6	LS
BR (Bio) 10368-AC6-1-1	117	154	6.03	22.0	LS
BR (Bio) 10368-AC17-2-2	111	153	6.57	23.2	LS
BR (Bio) 10368-AC22-2-2	114	154	7.10	22.9	LS
BR (Bio) 10368-AC30-2-3	118	154	5.83	23.9	LS
BRRRI dhan86	96	139	6.12	25.0	LS
BRRRI dhan96	91	137	5.85	27.0	MB

Bold= Selected, PH= plants height, GD= Growth duration, SS= Size and Shape

Development of Aus rice variety through anther culture

Fifteen (15) advanced lines were grown as a preliminary yield trial (PYT-1) in Aus 2024.

Among them, nine lines were selected (Table 7) based on plant type, yield, and growth duration for the secondary yield trial (SYT).

Table 7. Agronomic characteristics of selected anther culture derived lines in PYT-1, Aus 2023

Designation	PH (cm)	GD (days)	Yield (t/ha)
BR (Bio) 15085-AC6-6	117	106	4.12
BR (Bio) 15086-AC6-10	118	110	4.11
BR (Bio) 15086-AC6-12	112	107	4.67
BR (Bio) 15086-AC15-5	113	112	4.23
BR (Bio) 15086-AC15-6	104	109	4.7
BR (Bio) 15086-AC15-4	104	106	4.13
BR (Bio) 15086-AC15-4-1	107	106	4.13
BR (Bio) 15086-AC11-5	108	100	3.75
BR (Bio) 15086-AC11-7	108	100	3.79
BRRRI dhan48 (CK)	101	106	3.53
BRRRI dhan98 (CK)	103	110	4.05
CV	1.13	3.25	7.73
LSD	2.22	1.98	0.48

Bold= Selected, PH= plants height, GD= Growth duration

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Development of Photosensitive Rice through anther culture

During T. aman 2024, thirty advanced lines were grown in the BRRI RS, Barishal as observational

trial (OT) including three check varieties. These lines also have taller seedling capabilities. Among them 12 lines were selected for PYT (Table 8).

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Table 8. Agronomic performance of the selected lines in OT, T. Aman, 2024, BRRI regional Station, Barishal.

Designation	SH (cm)	PH (cm)	Yield (t/ha)
BR (Bio) 8033-AC18-3	82	135	3.40
BR (Bio) 8033-AC23-2	78	133	3.75
BR (Bio) 8033-AC27-1	78	133	3.29
BR (Bio) 8033-AC33-6	82	123	3.21
BR (Bio) 8033-AC40-3	79	125	3.03
BR (Bio) 8033-AC41-9	82	121	3.06
BR (Bio) 8033-AC44-7	74	123	3.00
BR (Bio) 8033-AC51-2	81	127	3.28
BR (Bio) 8033-AC56-3	85	119	3.00
BR (Bio) 8033-AC60-6	86	120	3.23
BR (Bio) 8033-AC65-3	81	125	3.70
BR (Bio) 8033-AC74-2	63	124	3.72
BR23 (CK)	73	119	4.05
BRRI dhan76 (CK)	75	135	5.06
Sadamota (CK)	93	135	3.05
CV	2.74	0.31	7.47
LSD	4.65	0.83	0.33

SH= Seedling height, PH= plants height

One Regional Yield Trial (RYT) including four advanced lines and three standard checks was conducted in T Aman 2024, where two (2) lines were selected for ALART (Table 9).

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Table 9. Agronomic characteristics of selected anther culture derived lines in RYT, Aman 2024.

Designation	PH	GD	Yield (t/ha)								% IN BR22	% IN BR23	% IN BR46
			Gaz	Rng	Cum	B.Bar	Gpl	Hbj	Snt	Avg			
BR (Bio) 8033-AC5-1-1-HR1	120	135	4.88	3.52	4.46	2.82	3.54	3.45	3.68	3.92	-1.76	7.98	0.00
BR (Bio) 8033-AC5-1-1-HR2	125	135	4.69	3.28	5.2	3.23	3.33	3.71	4.46	4.11	3.75	13.00	4.84
BR (Bio) 8033-AC5-1-2-HR1	119	135	4.86	3.83	5.37	2.83	3.58	3.38	3.76	4.13	3.53	13.77	1.80
BR (Bio) 8033-AC7-1-1-HR2	123	136	4.27	2.88	4.75	2.51	4.38	3.98	3.66	3.99	0.75	9.910	1.78
BR22 (ck)	132	142	4.48	2.55	4.79	2.93	3.91	3.81	4.21	3.96			
BR23 (ck)	121	149	3.85	2.35	3.66	3.18	4.3	3.31	4.3	3.63			
BRR1 dhan 46 (ck)	122	139	4.88	3.52	4.46	2.82	3.54	3.45	3.68	3.92			
CV	2.1	1.52	6.52	6.88	6.81	7.52	-	7.42	5.32	5.78			
LSD	1.3	1.06	0.38	0.48	0.32	0.42	-	0.47	0.36	0.35			

Development of Aman Rice for the favorable ecosystem through anther culture

One Preliminary Yield Trial was conducted where twenty-eight lines were grown and eleven lines were selected for SYT (Table 10).

Table 10. Agronomic characteristics of selected anther culture derived lines in PYT-1, Aman/2024

Designation	PH (cm)	GD (day)	Yield (t/ha)
BR (Bio) 15086-AC12-2	126	129	5.95
BR (Bio) 15086-AC13-1	130	130	5.94
BR (Bio) 15086-AC13-2	126	127	5.99
BR (Bio) 15086-AC14-7	132	130	5.88
BR (Bio) 15086-AC14-8	126	130	5.77
BR (Bio) 15086-AC16-7	131	127	6.10
BR (Bio) 15086-AC16-8	125	129	6.13
BR (Bio) 15086-AC17-4	141	129	6.16
BR (Bio) 15086-AC18-5	125	130	5.98
BR (Bio) 15086-AC18-5	127	130	5.77
BR (Bio) 15086-AC18-6	148	131	5.90
BRR1 dhan87(ck)	124	128	5.25
BRR1 dhan103 (ck)	129	133	5.60
CV	1.44	0.44	6.98
LSD	3.88	1.17	0.37

PH= plants height, GD= Growth duration

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Another PYT was conducted during T Aman 2024 with seven lines including check variety. Three lines were selected for RYT (Table 11).

Table 11. Agronomic characteristics of selected anther culture derived lines in PYT-2, Aman/2024

Designation	PH (cm)	GD (day)	Yield (t/ha)	Observation
BR (Bio) 15085-AC37-5	122	117	5.75	No false smut
BR (Bio) 15085-AC46-2	123	120	5.83	No false smut
BR (Bio) 15085-AC14-3	118	115	5.65	No false smut
BRRRI dhan75 (CK)	112	115	4.58	Severe false smut
CV	1.03	3.56	6.53	
LSD	0.78	1.92	0.53	

PH= plants height, GD= Growth duration

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One regional preliminary yield trial (RYT) was conducted in Aman 2024, where three advanced lines were grown with two standard checks. One line was selected (Table 12) for advanced line adaptive research trial (ALART).

Table 12. Agronomic characteristics of selected anther culture derived lines in RYT, Aman 2024.

Designation	PH	GD	Yield (t/ha)									
			Gaz	Raj	Rng	Srj	Ntk	Kus	Gpl	Cum	Bar	Avg
BR (Bio) 15086-AC114-8-1	123	118	5.03	4.14	4.37	5.15	4.64	4.54	3.03	4.57	3.72	4.52
BR (Bio) 15086-AC119-16	125	117	5.36	4.28	3.59	6.02	5.21	4.88	2.96	4.38	3.84	4.69
BR (Bio) 15086-AC120-18	125	117	5.98	4.51	4.53	6.00	4.93	4.96	2.71	4.84	4.55	5.34
BRRRI dhan71 (ck)	122	117	4.97	5.23	4.62	5.04	4.67	4.84	3.31	4.44	4.24	4.75
BBRI dhan75 (ck)	110	113	3.64	4.08	4.29	5.53	4.82	4.57	3.49	3.86	4.61	4.43
CV	1.73	1.21	6.64	6.01	5.55	8.05	6.23	5.22		7.46	3.2	6.05
LSD	3.89	1.43	0.56	0.49	0.45	0.84	0.56	0.46		0.63	0.24	0.53

*= Except GPL, Bold = Selected, PH= plants height, GD= Growth duration

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Development of Boro Rice for the favourable ecosystem using anther culture techniques

One observational trial (OT) was conducted with 14 lines and two standard checks. Twelve lines were selected (Table 13) for the preliminary yield trial (PYT).

Table 13. Agronomic performance of anther culture derived lines in OT, Boro 2024-25.

Designation	PH (cm)	GD (Day)	Yield (t/ha)
BR (Bio) 15086-AC254-4	100	142	7.02
BR (Bio) 15086-AC255-1	103	145	6.73
BR (Bio) 15086-AC256-1	103	145	7.37
BR (Bio) 15086-AC257-3	115	145	7.24
BR (Bio) 15086-AC258-1	105	140	6.93
BR (Bio) 15086-AC258-2	102	144	7.86
BR (Bio) 15086-AC260-1	112	156	8.85
BR (Bio) 15086-AC261-3	114	145	6.15
BR (Bio) 15086-AC263-2	111	146	6.34
BR (Bio) 15086-AC264-1	112	147	7.40
BR (Bio) 15086-AC1265-5	113	146	8.04
BR (Bio) 15086-AC266-4	113	149	6.96
BR (Bio) 15086-AC266-5	112	147	7.46
BR (Bio) 15086-AC267-1	104	143	6.77
BRRI dhan58 (ck)	99	152	7.23
BRRI dhan96 (ck)	89	140	6.24

Bold = Selected, PH= plants height, GD= Growth duration

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One preliminary yield trial (PYT-1) was conducted with sixteen lines and two standard checks.

Thirteen lines were selected (Table 14) for secondary yield trial (SYT).

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Table 14. Agronomic performance of selected anther culture derived lines in PYT-1, Boro 2024-25.

Designation	PH (cm)	GD (day)	Yield (t/ha)
BR (Bio) 15085-AC3-10	110	144	8.17
BR (Bio) 15085-AC8-1	116	144	7.30
BR (Bio) 15085-AC19-2	124	153	7.61*
BR (Bio) 15085-AC20-3	124	150	8.68*
BR (Bio) 15085-AC20-4	125	152	8.17*
BR (Bio) 15085-AC25-6	113	144	7.94
BR (Bio) 15085-AC28-3	115	144	7.48
BR (Bio) 15085-AC28-10	107	148	8.81
BR (Bio) 15085-AC35-3	108	149	8.61

Designation	PH (cm)	GD (day)	Yield (t/ha)
BR (Bio) 15085-AC36-2	107	148	7.99
BR (Bio) 15085-AC37-1	110	147	8.21
BR (Bio) 15085-AC37-4	113	148	8.41
BR (Bio) 15085-AC38-2	108	144	7.58
BR (Bio) 15085-AC38-3	109	146	7.65
BR (Bio) 15085-AC38-5	113	148	7.27
BR (Bio) 15085-AC40-3	103	142	7.44
BRRRI dhan58 (ck)	100	150	7.67
BRRRI dhan88 (ck)	93	141	6.62
BRRRI dhan96 (ck)	90	140	6.69
CV	1.81	2.86	2.97
LSD	1.85	2.63	0.48

Bold = Selected, PH= plants height, GD= Growth duration

*Higher plant height and lodging

One secondary yield trial (SYT-1) was conducted with nine lines and one standard check. Six lines were selected for RYT (Table 15).

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Table 15. Agronomic performance of selected anther culture derived lines in SYT-1, Boro 2024-25.

Designation	PH (cm)	GD (Day)	Yield (t/ha)
BR (Bio) 15086-AC11-1	113	152	8.32
BR (Bio) 15086-AC12-1	112	151	8.25
BR (Bio) 15086-AC13-2	110	152	9.20
BR (Bio) 15086-AC14-6	110	151	9.46
BR (Bio) 15086-AC16-4	113	148	9.05
BR (Bio) 15085-AC27-2	115	150	9.09
BR (Bio) 15085-AC28-2	114	150	8.22
BR (Bio) 15085-AC38-1	110	153	9.02
BR (Bio) 15085-AC62-1	108	149	8.59
BRRRI dhan89 (ck)	107	156	7.97
CV	0.89	0.79	5.08
LSD	1.65	2.01	0.59

Bold = Selected, PH= plants height, GD= Growth duration

Multi-location trial for the development of salt-tolerant and blast-resistant rice

Two multilocation trials (MLTs) were conducted to evaluate the salt tolerance and resistance to neck

and panicle blast of eight test entries, with the goal of developing rice varieties having both the salt tolerant and blast resistant traits. For salt tolerance two trails were conducted at Satkhira Regional Station Farm and Debhata, Satkhira during Boro

season 2024-25 including seven advanced lines, BRRi dhan96, two tolerant and three susceptible checks. Whereas trial for blast resistance was conducted at seven blast prone areas. These trials were conducted with the same test entries used in salt tolerance trial except the checks. The blast resistant trial included two tolerant (BRRi dhan74, BRRi dhan114) and two susceptible checks (BRRi dhan81, BRRi dhan88). In the salt tolerance trial, four entries viz BR (Bio) 9787-BC2-16-3-1(HR-1), BR (Bio) 9787-BC2-203-1-3, BR (Bio) 9787-BC2-102-1-4, and BRRi dhan96 performed better than the performance of the tolerant checks BRRi dhan67 and BRRi dhan97. The line BR(Bio)9787-BC2-35-4-1 also produced a higher yield than BRRi dhan67 and comparable yield to BRRi

dhan97 (Table 16). salinity status at RS, Satkhira and Debhata Satkhira shows respectively.

All the tested lines showed similar performance as tolerant checks and better performance than susceptible check (Table 18). Based on combined performance from both the trials five entries namely BR (Bio)9787-BC2-16-3-1(HR-1), BR (Bio)9787-BC2-203-1-3, BR (Bio)9787-BC2-102-1-4, BR (Bio)9787-BC2-35-4-2, and BRRi dhan96 were selected for further evaluation.

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Table 16. Agronomic performance of advanced lines at BRRi RS, Satkhira and Debhata, Satkhira during Boro 2024-25.

Designation	PH (cm)		ET (No.)		GD (day)		Yield (t/ha)	
	RSS	DEB	RSS	DEB	RSS	DEB	RSS	DEB
BR (Bio) 9787-BC2-16-3-1(HR-1)	108	95	11	9	141	137	8.19	1.10
BR (Bio) 9787-BC2-203-1-3	102	92	11	8	140	135	8.35	1.76
BR (Bio) 9787-BC2-48-4-1	101	90	10	9	141	141	7.77	0.94
BR (Bio) 9787-BC2-35-4-1	103	91	10	9	140	141	7.96	0.98
BR (Bio) 9787-BC2-102-1-4	93	88	10	9	134	134	7.58	1.77
BR (Bio) 9787-BC2-53-4-1	102	93	10	9	143	148	8.10	0.46
BR (Bio) 9787-BC2-51-9-1	97	89	10	9	143	145	7.68	0.60
BRRi dhan96	86	80	11	10	135	127	6.96	1.58
BRRi dhan67 (Tol. ck)	103	94	10	10	138	135	6.68	0.56
BRRi dhan97 (Tol. ck)	111	100	11	11	140	143	7.53	1.22
BRRi dhan58 (Susc. ck)	100	91	10	9	142	137	6.77	0.04
BRRi dhan74 (Susc. ck)	102	94	11	9	138	135	7.39	0.08
BRRi dhan81 (Susc. ck)	99	82	10	9	131	132	5.45	0.00
CV	0.97	1.45	4.34	5.86	3.47	4.50	4.70	8.50
LSD	1.64	2.21	0.76	0.91	3.44	1.16	0.59	0.36

Bold= selected, PH (cm): Plant height, ET: Effective tiller, GD (days): Growth duration, RSS: Regional Station Satkhira, DEB: Debhata, Satkhira

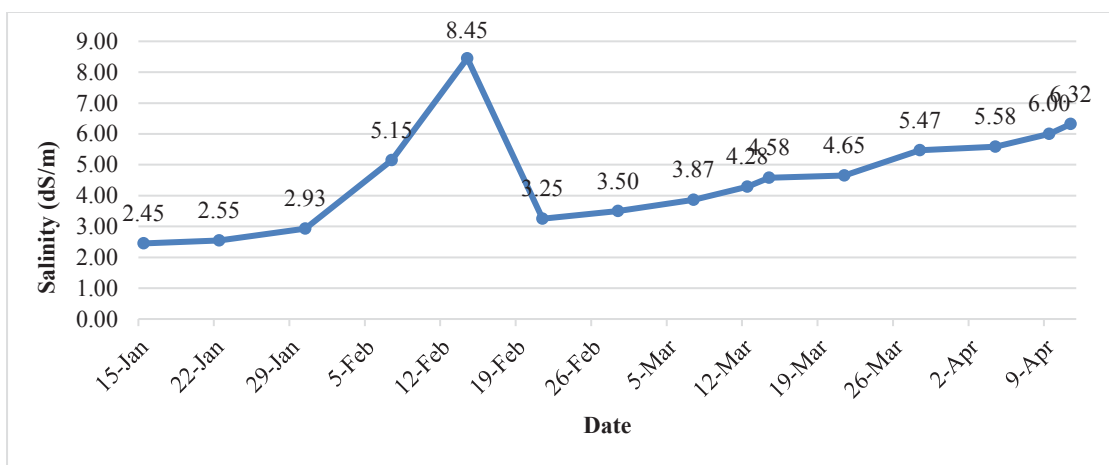
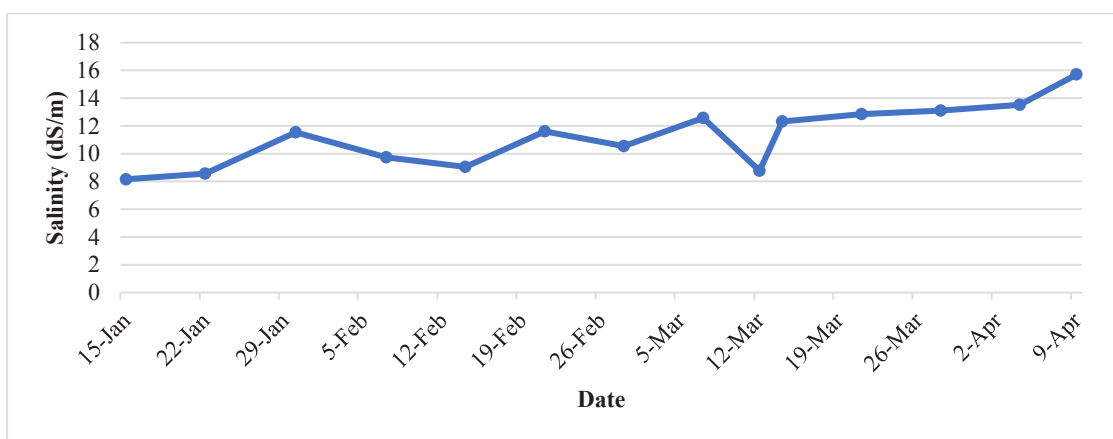


Fig. 2. Salinity status at BRRI RS Satkhira.



Heading starts: 8 Mar 2025

Fig. 3. Salinity status at Debhata, Satkhira.

Table 17. Agronomic performance of advanced lines for blast tolerance in a multilocation trial during Boro season 2024-25.

Designation	PH (cm)	GD (day)	Yield (t/ha)								
			GHS1	GHS2	HBG	SG	CUD	CURS	RP	DHN	Avg.
BR (Bio) 9787-BC2-16-3-1(HR-1)	101	145	8.23	8.46	7.23	7.52	8.43	7.85	7.34	8.69	7.97
BR (Bio) 9787-BC2-203-1-3	98	145	8.41	8.19	7.61	7.44	8.17	7.66	7.54	8.56	7.95
BR (Bio) 9787-BC2-48-4-1	101	146	8.45	8.28	7.81	7.40	7.86	8.02	7.61	8.26	7.96
BR (Bio) 9787-BC2-35-4-2	102	146	8.91	8.08	7.55	6.70	9.71	7.70	7.28	8.32	8.03
BR (Bio) 9787-BC2-102-1-4	98	143	7.98	7.95	7.41	7.23	8.33	7.55	7.69	8.45	7.82
BR (Bio) 9787-BC2-53-4-1	106	147	7.97	8.25	7.47	7.54	9.16	7.94	7.49	8.40	8.03
BR (Bio) 9787-BC2-51-9-1	99	147	8.76	8.59	7.72	7.43	9.47	8.44	8.05	7.74	8.27

Designation	PH (cm)	GD (day)	Yield (t/ha)								
			GHS1	GHS2	HBG	SG	CUD	CURS	RP	DHN	Avg.
BRR1 dhan96	90	139	7.55	7.46	6.70	6.49	7.49	7.21	6.88	8.01	7.22
BRR1 dhan74 (Tol. ck)	96	145	8.28	8.50	7.41	7.30	8.56	7.19	8.80	8.30	8.04
BRR1 dhan114 (Tol. ck)	102	156	9.27	8.98	7.69	7.85	8.56	7.92	7.81	7.60	8.21
BRR1 dhan81 (Sus. ck)	98	139	6.13	5.95	6.13	6.05	7.33	6.31	6.63	7.75	6.53
BRR1 dhan88 (Sus. ck)	97	139	7.00	6.95	6.52	6.41	7.54	7.11	6.82	8.16	7.06
CV	2.13	3.00	4.89	5.72	4.49	5.80	5.23	6.49	5.85		5.50
LSD	1.73	1.76	0.57	0.47	0.41	0.45	0.39	0.43	0.35		0.44

PH (cm): Plant height, GD (days): Growth duration, PH (cm), GHS1: Hankata, Gazipur Set-1, GHS1: Hankata, Gazipur Set-2, AHBG: Ajmiriganj, Habiganj, CURS: BRR1 RS Cumilla, CUD: Debidwer, Cumilla, RP: Rangpur, DHN, Dingapota Haor, Netrokona

Table 18. Blast resistant score of advanced lines in multilocation trial.

Designation	Neck blast (%)									SR
	GHS1	GHS2	HB G	SG	CU D	CURS	RP	DH N	RSF S	
BR (Bio) 9787-BC2-16-3-1(HR-1)	<1	<1	0	<1	0	#	#	#	0	5-9
BR (Bio) 9787-BC2-203-1-3	<1	<1	0	<1	0	#	#	#	0	5-9
BR (Bio) 9787-BC2-48-4-1	<1	<1	0	2	0	#	#	#	0	5-9
BR (Bio) 9787-BC2-35-4-2	<1	<1	0	1	0	#	#	#	0	5-9
BR (Bio) 9787-BC2-102-1-4	<1	<1	0	0	0	#	#	#	0	5-9
BR (Bio) 9787-BC2-53-4-1	<1	<1	0	4	5	#	#	#	0	5-9
BR (Bio) 9787-BC2-51-9-1	<1	<1	0	5	0	#	#	#	0	5-9
BRR1 dhan96	<1	<1	0	<1	0	#	#	#	0	5-9
BRR1 dhan74 (Tol. ck)	1	1	0	2	0	#	#	#	0	5-9
BRR1 dhan114 (Tol. ck)	<1	<1	0	11	0	#	#	#	0	5-9
BRR1 dhan81 (Sus. ck)	30	30	12	25	7	#	#	#	**	5-9
BRR1 dhan88 (Sus. ck)	8	8	7	16	7	#	#	#	**	5-9
BRR1 dhan58 (ck)	**	**	**	**	**	**	**	**	3	9
BRR1 dhan67 (ck)	**	**	**	**	**	**	**	**	1	9
BRR1 dhan97 (ck)	**	**	**	**	**	**	**	**	5	9

GHS1: Hankata Gazipur Set-1, GHS1: Hankata, Gazipur Set-2, AHBG: Ajmiriganj, Habiganj, CURS: BRR1 RS, Cumilla, CUD: Debidwer, Cumilla, RP: BRR1 RS, Rangpur, DHN, Dingapota Haor, Netrokona, RSFS: Regional Station Satkhira Farm, SR: Severity Score (lower the better), ** Not tested in that location, # No disease development

DEVELOPMENT OF RICE VARIETY THROUGH SOMACLONAL VARIATION

Antioxidant enriched black rice variety development through somaclonal variation

Sixty-six antioxidant enriched somaclonal variants

of black were evaluated as OT. Among them, 11 lines were selected for further evaluation (Table 19).

Jannatul Ferdous and Shahanaz Sultana

Table 19: Agronomic characteristics of somaclonal variants. OT, Boro 2024-25

Designation	PH (cm)	GD (day)	Yield (t/ha)
Padi chelum-SCV7-1-3-1-1-1	110	150	7.88
Padi chelum-SCV7-1-3-1-1-3	112	149	7.35
Padi chelum-SCV7-1-3-1-2-1	108	147	6.69
Padi chelum-SCV7-1-3-1-2-2	112	150	7.95
Padi chelum-SCV7-1-3-1-3-1	112	150	7.67
Padi chelum-SCV7-1-3-1-3-2	108	155	6.87
Padi kool-SCV2-5-1-2-1-2	107	143	7.56
Padi kool-SCV2-5-1-2-2-1	102	143	7.39
Padi kool-SCV2-8-1-1-1-1	101	142	7.16
Padi kool-SCV2-8-1-1-1-4	107	139	7.21
Padi kool-SCV2-8-1-3-3-1	90	144	7.14
BRRI dhan86 (ck)	94	141	6.52
BRRI dhan 96 (ck)	84	140	6.62

Development of premium quality rice (Kalijira type) through somaclonal variation

A total of 326 lines somaclonal variants (SCV₄) of Kalijira were grown in T. Aman 2024. Thirty six fixed line and 441 plants were selected for further evaluation.

Investigator: Shahanaz Sultana, Jannatul Ferdous Md Sentu Rahman and Maria Chowdhury

DEVELOPMENT OF RICE VARIETY THROUGH WIDE HYBRIDIZATION

Wide hybridization followed by embryo rescue

In a total, 195 backcross progenies (BC₂F₅) from wide hybridization were evaluated in T. Aman 2024. Among them 91 plants were selected for generation advancement (Table-20).

Table 20. Pedigree selection from wide hybridization.

Designation (Generation: BC ₂ F ₅)	Cross number	No. of plants evaluated	No. of Selected plants
BRRIdhan28/ O. glaberrima IRGC105190	BR (Bio)13037	70	26
BRRIdhan87/ O. glaberrima IRGC105190	BR (Bio)13040	26	4
BRRIdhan48/ O. glaberrima IRGC105190	BR (Bio)13036	18	26
	BR (Bio)13039	81	35
Total		195	91

Nilufar Yasmin Shaikh, Ripon Kumar Roy, S M Hisam Al Rabbi

Development of Aman rice through wide hybridization

Five embryo-rescued BC₂F₃ populations (developed by using HYV (BR11, BRRI dhan33,

BRRI dhan39 BRRI dhan52, BRRI dhan66) and *Oryza rufipogon* (Acc No. 103404) were grown in T. Aman 2024. Among them, 2526 plants and 39 homozygous lines were selected (Table 21).

Table 21. List of wide crosses and their status.

Designation	Generation	Selected plants (No.)	Homozygous lines (No.)
BR (Bio)15863 BR33*2/O. rufipogon (103404)	ERBC ₂ F ₄	930	-
BR (Bio)15864 BR11*2/O. rufipogon (103404)	ERBC ₂ F ₄	335	-
BR (Bio)15865 BR52*2/O. rufipogon (103404)	ERBC ₂ F ₄	393	-
BR (Bio)15866 BR66*2/O. rufipogon (105190)	ERBC ₂ F ₄	98	39
BR (Bio)15867 BR39*2/O. officinalis (106174)	ERBC ₂ F ₄	770	-
Total		2526	39

Ripon Kumar Roy, S M Hisam Al Rabbi, Nilufar Yasmin Shaikh, Md Arafat Hossain, Shampa Das Joya, Maria Chowdhury

DEVELOPMENT OF RICE VARIETY THROUGH MUTATION BREEDING

Development of high yielding Boro rice varieties using EMS

During Boro 2024-25, 12 fixed mutant lines of BR11 were evaluated as PYT and five lines were selected for further evaluation (Table 22). Besides,

during Boro 2024-25, 18 fixed mutant lines of BR11 were evaluated as OT with four standard check and 10 lines were selected for further evaluation (Table 23).

Investigator: Shahanaz Sultana, Jannatul Ferdous, Md Sentu Rahman and Maria Chowdhury

Table 22. Agronomic characteristics of selected lines in PYT, Boro 2024-25.

Designation	PH (cm)	GD (days)	Yield (t/h)
BR11(M)-4-1-1	125	159	9.00
BR11(M)-7-1-1	119	158	8.10
BR11(M)-53-1-1	123	157	8.28
BR11(M)-53-1-2	127	156	8.58
BR11(M)-104-23-8-3	123	156	9.11
BRRI dhan89 (ck)	119	158	8.50
BRRI dhan92 (ck)	117	160	8.64
CV	2.35	0.39	4.78
LSD	5.10	1.09	-

PH= plants height, GD= Growth duration

Table 22. Agronomic performance of mutant lines of BR11 as OT, Boro 2024-25.

Designation	PH (cm)	GD (day)	Yield (t/ha)
BR11(M)-19-3-5-1	116	153	8.53
BR11(M)-15-1-51-2	114	154	8.47
BR11(M)-19-19-4-52-1	115	154	8.38
BR11(M)-19-4-52-2	116	152	8.17
BR11(M)-19-5-53-1	112	152	8.48
BR11(M)-19-5-53-2	104	153	7.13
BR11(M)-19-6-54-1	114	156	8.24
BR11(M)-32-1-62-2	110	156	8.10
BR11(M)-37-1-65-1	110	156	7.13
BR11(M)-81-1-80-4	127	155	7.73
R11(M)-81-1-90-5	126	154	7.71
BR11(M)-82-1-82-2	125	148	8.59
BR11(M)-96-1-93-2	108	153	7.16
BR11(M)-96-3-95-1	106	152	7.28
BR11(M)-97-1-99-3	107	153	8.10
BR11(M)-99-101-1	106	153	7.36
BR11(M)-999-107-2	125	154	9.33
BRRi dhan74 (Ck)	96	138	7.64
BRRi dhan89 (Ck)	104	157	7.53
BRRi dhan92 (Ck)	108	159	8.65
BRRi dhan96 (Ck)	92	142	6.90

Bold= Selected, Ph= Plant height, GD= Growth duration

Development of Kilijira type rice variety through mutation by NMU

Seed from 271 M₄ Kilijira lines were transplanted in T Aman 2024 along with check. Forty-four plants were selected for further evaluation.

Shahanaz Sultana, Jannatul Ferdous, Md Sentu Rahman and Maria Chowdhury

Development of premium quality rice variety using gamma radiations

Seed from seven rice genotypes were treated with 350Gy and 450Gy Gamma radiation. A total 50 and 41 M₃ plants from 350Gy and 450Gy were

grown in T. Aman 2024. Among them 62 plant were selected for further evaluation

Shahanaz Sultana, Jannatul Ferdous, Md Sentu Rahman and Maria Chowdhury

DEVELOPMENT OF RICE VARIETY THROUGH MARKER ASSISTED SELECTION

Marker assisted selection for fragrance gene *BADH2*

46 homozygous lines developed from a cross between BRRi dhan87 and Kalijira were evaluated. Among them 9 lines were selected on the basis of aroma, growth duration and plant height. All the tested aromatic lines were confirmed

by using functional marker of fragrance gene *BADH2* in early generation. The primers combination of ESP and IFAP amplified the fragrance specific allele at 257 bp. On the other hand, the primers combination of INSP and EAP amplified the expected non-fragrance-specific allele (355 bp).

Jannatul Ferdous and Shahanaz Sultana

Marker assisted selection for aromatic and tidal submergence tolerance rice genotype

A three-way cross, two doubled crosses and six crosses were done. Aromatic progenies were identified with functional marker of *BADH2* gene. Seeds from 38 lines of different crosses were harvested from F₂ generation. Out of them 166 lines were selected.

Jannatul Ferdous and Shahanaz Sultana

Development of multiple disease resistant (blast and bacterial blight) rice varieties using marker assisted selection

To develop multiple disease resistant (blast and bacterial blight) rice varieties F₄ plants of four crosses such as BR(Bio)11447-1-28-14-3/IR64Pi9 (L), BR(Bio)11447-1-28-14-3/IR64Pi9 (E), BR(Bio)11447-3-10-7-1/IR64Pi9 (L), BR(Bio)11447-3-10-7-1/IR64Pi9 (E) were screened with *Xa21* and *xa13* primer and F₄ seeds from 676 plants having both *Xa21* and *xa13* genes were harvested.

Jannatul Ferdous, Shahanaz Sultana and Ashik Ikbal Khan.

Genome wide association mapping for photosensitivity of rice

An association mapping panel of 158 accessions including varieties, landraces, and advanced breeding lines from the was used in this study. Heading data were collected over two years under short-day conditions and two years under long-day conditions. During this period, photosensitive

accessions were screened, and the germplasm was genetically purified. To evaluate the degree of photosensitivity, the accessions were grown last year under a controlled shading facility at the Plant Physiology Division of BRRI. The findings will be further refined this year using the same facility.

S M Hisam Al Rabbi, Ripon Kumar Roy, Md Arafat Hossain, Md Sentu Rahman, and Sadia Ahmed Shupta

RICE TRANSFORMATION

Introgression of salt tolerant gene

AeMDHAR salt tolerant gene (from mangrove plant) containing transgenic plants was crossed with BRRI dhan28 to introgress *AeMDHAR* gene. A total 126 BC₂F₄ plants of BRRI dhan28 were grown in Transgenic net house and 28 plants were selected for further evaluation.

Shahanaz Sultana and Jannatul Ferdous

C4 RICE DEVELOPMENT

Identification of *Setaria* mutants losing C4 properties

A total of 7,000 M4 mutant lines of Kaoun (*Setaria italica*) have been developed for further research. These lines are being gradually grown and exposed to low CO₂ conditions (20 ppm) in a controlled chamber for 72 hours to screen for loss of C₄ photosynthetic function. High-throughput screening of 1,100 mutant lines identified 26 lines with impaired C₄ traits, which are now being preserved for future studies.

Additionally, around 500 M2 mutant plants of BARI Kaoun 4 treated with 300 and 700 Gy were grown in the transgenic net house of the Biotechnology Division. Selection pressure will be applied to identify plants with noticeable morphological deviations, indicating possible genetic changes.

S M Hisam Al Rabbi, Ripon Kumar Roy, Munnujan Khanam, Sazzadur Rahman

Genetic Resources and Seed Division

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SUMMARY

In total, 632 rice germplasm of which 12 in Aus, 566 in T. Aman, 52 in Boro seasons and two wild rice were collected from different districts of Bangladesh. The morphologically characterization of 59 germplasm accessions were completed in Boro 2024-25 using Rice Germplasm Descriptors and Evaluation Form.

Rejuvenation of 2,901 accessions including 556 accessions in T. Aus 2024, 1508 in T. Aman 2024 and 837 in Boro 2024-25 seasons was completed. In total 2,154 entries comprising 470 entries/samples of T. Aus 2024 season, 939 entries of T. Aman 2024 and 939 entries of Boro 2024-25 were processed and stored in short-term storage. At the same time, 75 entries of T. Aus 2024, 506 entries of T. Aman 2024 and 439 entries of Boro 2024-25 were processed and stored in medium-term storage. Similarly, 56 entries of T. Aus 2024, 371 entries of T. Aman season and 49 entries of Boro season were processed and stored in long-term storage. Besides, 46 new germplasm were registered as new accessions (from accession number 9,007 to 9,052) in the BRRI Genebank. As a germplasm sharing activity, a total of 2,748 samples were supplied to 45 different users in the reporting year. In screening trial, rice germplasm namely AUS DHAN(2), KHATO MALA, KATAK TARA, MINIKIT, BASHFUL IRRI and BRRI JHUM DHAN LOWAS showed moderately susceptible reaction against Sheath Blight disease and 34 germplasm were found resistant to pre harvest sprouting.

One hundred and thirty BRRI developed and recommended rice varieties were maintained and nucleus seed (NS) was produced. Besides, nucleus seeds of 73 BRRI varieties were produced as the source of breeder seed (BS). In total, 232.47 tons of breeder seed with tags of which 154.54 tons of 27 Boro varieties, 14.84 tons of nine Aus varieties and 63.09 tons of 35 T. Aman varieties were produced during 2024-25. At the same time, 196.336 tons of breeder seed of which 120.673 tons of 27 Boro varieties, 14.192 tons of seven Aus varieties and 61.471 tons of 35 T. Aman varieties were distributed among 662 partners (GO, NGO and PS) of 'BRRI Rice Seed Network'. Besides, BS production plots at BRRI RSs and foundation seed (FS) production

farms were visited to observe the varietal purity and performance of the respective classes of seeds.

RICE GERmplasm CONSERVATION AND MANAGEMENT

Germplasm collection and acquisition. Four collection missions were made during the reporting year and in total 632 rice germplasm including 12 in Aus, 566 in T. Aman, 52 in Boro seasons and two wild rice were collected from Barisal, B Baria, Bhola, Khulna, Netrokona, Mymensingh, Bandarban, Chapainawabganj and Rangpur districts of Bangladesh.

Investigators: Partha Sarathi Biswas (PI), Md Abubakar Siddique, Armin Bhuiya, Nashirum Monir and Md Ashiqur Rahman

Germplasm rejuvenation, purification, processing and storage. A total of 2,901 rice germplasm were rejuvenated to increase the seed for safe storage in the Genebank. The experiment was carried out under transplanted conditions using double rows of 5.4 m long plots per accession with 20 × 20 cm spacing between rows and plants respectively. Fertilizers were applied @ 60:20:40 kg NPK/ha in T. Aus and T. Aman and @ 80:20:40 kg NPK/ha in Boro seasons.

During 2024-25, a total of 2,901 germplasm of which 556 accessions (between Acc. 6001 to 9006) in T. Aus; 1,508 accessions (between Acc. 2001 to 3104) in T. Aman and 837 accessions (between Acc. 4701 to 7000) in Boro were rejuvenated in field (Fig. 1) for obtaining fresh seed and on average 500 g of seeds per accession were produced.

Besides, in total 2,154 entries of germplasm were processed and conserved with respective accession number in different storages of BRRI Genebank during the reporting year. The germplasm were cleaned and dried with a seed moisture content of less than 9% for short-term storage. A total of 470 entries/samples of T. Aus 2024 season, 939 entries of T. Aman 2024 and 745 entries of Boro 2024-25 were processed and stored in short-term storage. At the same time, 75 entries of T. Aus 2024, 506 entries of T. Aman 2024 and 439 entries of Boro 2024-25 were processed and stored in medium-term storage. Similarly, 56 entries of T. Aus 2024, 371 entries of T. Aman season and 49 entries of Boro season were

processed and stored in long-term storage. Besides, a total of 46 new germplasm was registered as new accessions (from accession number 9,007 to 9,052) in the BRRI Genebank.

Investigators: Partha Sarathi Biswas (PI), Armin Bhuiya (Co-PI), Mir Sharf Uddin Ahmed, Ebna Syod Md Harunur Rashid, Md Abubakar Siddique, Armin Bhuiya, Md Humyun Kabir Baktiar, Tonmoy Chakrabarty, Nashirum Monir and Md Ashiqur Rahman



Fig. 1. Pictorial view of rejuvenation of rice germplasm at BRRI HQ during T Aman 2024-25 season.

Morphological characterization of germplasm.

Two experiments were conducted to characterize 50 rice germplasm in T. Aus 2024 and 59 rice germplasm in Boro 2024-25 seasons. The 53 agromorphological traits (both 20 quantitative and 33 qualitative characters) of the Rice Germplasm Descriptors and Evaluation Form (2018), GRSD, BRRI were used for characterization. The experiments were conducted using a single row of 5.4 m long plot for each entry/accession with 20×20 cm spacing between rows and plants respectively. Fertilizers were applied @ 60:20:40 kg NPK/ha in T. Aus and T. Aman and @ 80:20:40 kg NPK/ha in Boro seasons. Appropriate control measures were taken for insect, pests, diseases and weeds when necessary. The data analysis of T. Aus 2024 is ongoing.

In Boro 2024-25, 59 germplasm were characterized. Among them, 29 had medium (135-145 days) and 29 had long (>145) growth duration (Table 1). Similarly, 38 germplasm were found with short (<110 cm), 18 medium (110-130 cm) and 3 with

long (130) plant height. In case of panicle length, 10 germplasm had short (<20 cm), 36 had medium (20-25 cm) and 13 germplasm had long (26-30 cm) panicle. For titter number, 59 germplasm possessed intermediate (<10) number of effective tillers per hill. For 1000-grain weight (TGW), 10 had very low (<15 g), 26 had medium (15-19 g) and 11 had high (24-27g) TGW. For yield, 31 germplasm possessed moderate (5-10 g/hill) and 28 had higher (>10 g/hill) yield. The shortest growth duration (130 days) was observed in Tepu (Acc. 7382). The shortest plant height (73 cm) was observed in Kali Boro (Acc. 7657) and the longest (137 cm) in Lakhain (Acc. 7670). Minikit, Khaiya Boro (Acc. 7364, Acc. 7671) had the lowest (10.8 g) and Ponchog had the highest (28.1 g) TGW. The highest yield per hill was observed in Nerica-10 (awned) (Acc. 7361). In conclusion, the variety having higher yield would be utilized in a crossing programme, if other characters satisfy the breeder's objectives.

Investigator:PI: Nashirum Monir

Table 1. Some important features of characterized germplasm during Boro 2024-25.

Growth duration (days)		Plant height (cm)		Panicle length (cm)		No. of effective tiller/hill		Days to 50% flowering		Decorticated Grain Length Breadth Ratio		1000-grain weight (g)		Yield/hill (g)	
Range	No. of entries	Range	No. of entries	Range	No. of entries	Range	No. of entries	Range	No. of entries	Range	No. of entries	Range	No. of entries	Range	No. of entries
<135	1	<110	38	<20	10	<10	59	<116	24	>3.0	5	<15	10	<5	0
135-145	29	110-130	18	20-25	36	10-15	0	116-120	16	2.1-3.0	50	15-19	26	5-10	31
>145	29	>130	3	26-30	13	>15	0	>120	19	1.1-2.0	4	20-23	10	>10	28
				>30	0					<1.1	0	24-27	11		
												>27	2		
Shortest (130)	(Tepu) Acc. 7382	Shortest (73)	(Kali Boro) Acc. 7657	Shortest (16)	(Khaiyel e Boro, (5) Pabdafor) Acc. 6856, Acc. 7668	Lowest (Rata) Acc. 7676	Lowest (101)	(Tepu) Acc. 7382	Lowest (1.45)	(Unknown) Acc. 7293	Lowest (10.8)	(Minikit, Lowest (5.16)	(Amania) Acc. 7669		
Longest (159)	(Kali Boro) Acc. 7657	Longest (137)	(Lakhaim) Acc. 7670	Longest (30)	(Begun Bitchi) Acc. 7358	Highest (9)	(Begun Bitchi) Acc. 7358	Highest (131)	(Sungwa la Dhan, Kali Boro) Acc. 7378, Acc. 7657	Highest (3.91)	(Lafiya) Acc. 7296	Highest (28.1)	(Ponchog) Acc. 7372	Highest (18.63)	{Nerica-10 (awned)} Acc. 7361
Mean	145.83		106.27		22.58		6.85		117.46		2.45		19.24		9.91
Std. Dev.	6.15		15.15		3.40		0.66		6.36		0.44		4.57		3.33
CV	4.22		14.26		15.08		9.71		5.42		18.10		23.76		33.56
LSD	1.57		3.87		0.87		0.17		1.62		0.11		1.17		0.85

Germplasm distribution and exchange. A total of 2,748 samples were supplied to 45 different requestors in the reporting year. Among the samples, 2,665 germplasm accessions were supplied to 33 users for research purpose and 83 samples of BRRI developed rice varieties were supplied to the researchers, Department of Agricultural Extension (DAE) personnel and university students for research, demonstration as well as other purposes.

Investigators: Partha Sarathi Biswas and Armin Bhuiyan

SEED PRODUCTION AND VARIETY MAINTENANCE

Nucleus seed production and variety maintenance. One hundred and thirty BRRI developed and recommended rice varieties including 18 locally improved varieties (LIVs) were maintained through using panicle to row method, implementing time isolation and performing thorough roguing (Table 2 and Fig. 2). After harvest, both the intact panicles and nucleus seed of each variety were stored (20°C with 40% RH) for variety maintenance and distribution to researchers, DAE personnel and students respectively.

Investigators: Ebna Syod Md Harunur Rashid (PI), Md. Humayun Kabir Baktiar and Partha Sarathi Biswas

Table 2. List of BRRI developed and recommended rice varieties maintained during 2024-25.

Season	Type	Number	Variety
T. Aman	MV	59	BR4, BR5, BR10, BR11, BR21, BR22, BR23, BR24, BR25, BRRI dhan27, BRRI dhan30, BRRI dhan31, BRRI dhan32, BRRI dhan33, BRRI dhan34, BRRI dhan37, BRRI dhan38, BRRI dhan39, BRRI dhan40, BRRI dhan41, BRRI dhan42, BRRI dhan43, BRRI dhan44, BRRI dhan46, BRRI dhan48, BRRI dhan49, BRRI dhan51, BRRI dhan52, BRRI dhan53, BRRI dhan54, BRRI dhan56, BRRI dhan57, BRRI dhan62, BRRI dhan66, BRRI dhan70, BRRI dhan71, BRRI dhan72, BRRI dhan73, BRRI dhan75, BRRI dhan76, BRRI dhan77, BRRI dhan78, BRRI dhan79, BRRI dhan80, BRRI dhan82, BRRI dhan83, BRRI dhan85, BRRI dhan87, BRRI dhan90,

			BRRI dhan91, BRRI dhan93, BRRI dhan94, BRRI dhan95, BRRI dhan98, BRRI dhan103, BRRI dhan109, BRRI dhan110, BRRI dhan111.
	LIV	10	Nizersail, Latisail, Rajasail, Kalijira, Kataribhog, Basmati-D, Patnai23, Tilockkachari, DA29, DA31
Boro	MV	53	BR1, BR2, BR3, BR6, BR7, BR8, BR9, BR12, BR14, BR15, BR16, BR17, BR18, BR19, BR26, BRRI dhan28, BRRI dhan29, BRRI dhan35, BRRI dhan36, BRRI dhan45, BRRI dhan47, BRRI dhan50, BRRI dhan55, BRRI dhan58, BRRI dhan59, BRRI dhan60, BRRI dhan61, BRRI dhan63, BRRI dhan64, BRRI dhan65, BRRI dhan67, BRRI dhan68, BRRI dhan69, BRRI dhan74, BRRI dhan81, BRRI dhan84, BRRI dhan86, BRRI dhan88, BRRI dhan89, BRRI dhan92, BRRI dhan96, BRRI dhan97, BRRI dhan98, BRRI dhan99, BRRI dhan100, BRRI dhan101, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107, BRRI dhan108, BRRI dhan113, BRRI dhan114.
	LIV	8	Hbj Boro II, Hbj Boro IV, Hbj Boro VI, Hbj Boro VIII, Purbachi, IR8, IR20, IR64
Total		130	



Fig. 2. Pictorial view of variety maintenance and nucleus seed production at West Baid, BRRI HQ in T Aman 2024-25 season.

Production of Nucleus seed stock. Seventy-three BRRI developed rice varieties comprising 45 in T. Aman and 28 in Boro were grown following panicle to row method to produce nucleus seed stocks as panicles for breeder seed production. The objective for nucleus seed production was to maintain genetic purity and homogeneity of morphological characteristics of each variety and subsequently to produce and maintain the seed standard of breeder seed.

‘Panicle to row’ method was used to maintain nucleus seed stock, where the intact panicles were sown instead of threshed seeds of each variety. If off-type plant was identified in a row, then the whole row was discarded or rogued out for maintaining the

varietal purity. At maturity, 500 to 50,000 panicles from ‘true to type’ plants of all the varieties were harvested and both intact panicles for BRRI HQ, Gazipur and nucleus seed stocks for BRRI regional stations were stored in controlled temperature (20°C with 40% RH).

Investigators: Md Abubakar Siddique (PI), Mir Sharf Uddin Ahmed, Ebna Syod Md Harunur Rashid, Armin Bhuiya, Md Humyun Kabir Baktia, Tonmoy Chakrabarty, Nashirum Monir and Md Ashiqur Rahman

Breeder and Foundation seed production and distribution. GRS Division, Farm Management Division and eleven regional stations of BRRI were

engaged in breeder seed production as per national demand. ‘Panicle to row’ method was also used to produce all breeder seed, where the intact panicles were sown instead of threshed seeds for each variety. Off-type plants were identified and rogued out in every growth stage. The quality of the breeder seed was maintained through 2-3 times visits of the breeder seeds plots of eleven BRRI regional stations (RSs) at Rangpur, Rajshahi, Cumilla, Barishal, Sonagazi, Bhanga, Kushtia, Gopalganj, Sirajganj, Satkhira and Habiganj throughout whole growth stage by the assigned scientists of GRS Division (Table 3).

The foundation seed production farms of Momota Seed at Rangpur was also visited upon request for inspection. During the visit, no major insect-pest damage, varietal impurity (<1%) and no obnoxious weeds were observed. Isolation distances and crop conditions were satisfactory. The seed producers were advised for thorough roguing by themselves for one more time before harvesting.

After harvesting a variety, the seeds were separately threshed, dried, cleaned and stored in controlled temperature (20°C with about 40% RH) at BRRI HQ and other BRRI RS. Seeds from RSs were

transported to HQ after pre-processing and necessary documentation. The harvested seeds were then offered as seed lot after necessary processing for getting green ‘breeder seed tag’ from Seed Certification Agency (SCA) for its distribution.

In total 232.47 tons of breeder seed with tags in which 154.54 tons of 27 Boro varieties, 14.84 tons of nine Aus varieties and 63.09 tons of 35 T. Aman varieties were produced during 2023-24 (Table 4, 5 and 6). Besides, a total of 196.336 tons of breeder seed of which 120.673 tons of 27 Boro varieties, 14.192 tons of seven Aus varieties and 61.471 tons of 35 T. Aman varieties were distributed among 662 partners (GO, NGO and PS) of ‘BRRI Rice Seed Network’ upon approval by the BRRI authority. Text message (SMS) with variety name, allotted quantity of breeder seed, date of BS collection from GRS Division, amount of money need to be deposited and bank account number was sent through mobile apps to 402, 36 and 263 SeedNet partners before commencing of Boro 2024-25, Aus 2025 and T. Aman 2025 seasons for distributing allocated amount of breeder seed.

Investigators: Ebna Syod Md Harunur Rashid (PI), Md Mamunur Rahman (PSO & Head, FMD), Head and Assigned Scientists of All BRRI RS.

Table 3. List of scientists for monitoring breeder seed plot at different BRRI RS

SI No	Name of Responsible Scientist	Name of BRRI RS
1	Mir Sharf Uddin Ahmed	Cumilla
2	Ebna Syod Md. Harunur Rashid	Rangpur, Satkhira
3	Md Abubakar Siddique	Barishal, Bhanga
4	Armin Bhuiya	Sonagazi
5	Mohammad Zahidul Islam	Rajshahi, Habiganj
6	Md Humayun Kabir Baktiar	Gopalganj
7	Tonmoy Chakraborti	Sirajganj
8	Nasirum Monir	Kushtia

Table 4. Production and distribution of rice breeder seed on Boro 2024-25.

Variety	Production (with tag) (kg)		Distribution (kg)		
	Favourable Variety	Stress tolerant variety	Favourable variety	Stress tolerant variety	Free of cost
BR16	960		950		
BR26	1130		890		
BRRI DHAN28	11710		10810		70
BRRI DHAN29	23770		22940		48
BRRI DHAN36		380		320	1
BRRI DHAN47		220		10	1

Variety	Production (with tag) (kg)		Distribution (kg)		
	Favourable Variety	Stress tolerant variety	Favourable variety	Stress tolerant variety	Free of cost
BRRI DHAN50	4830		2800		39
BRRI DHAN58	9190		7740		11
BRRI DHAN63	2960		1760		2
BRRI DHAN67		4560		1640	25
BRRI DHAN74	11700		9730		102
BRRI DHAN81	4080		560		17
BRRI DHAN84	1750		250		30
BRRI DHAN86	360		20		2
BRRI DHAN88	10320		10070		80
BRRI DHAN89	22510		13090		146
BRRI DHAN92	14450		11250		56
BRRI DHAN96	2460		1300		37
BRRI DHAN97		2000		500	54
BRRI DHAN99		500		500	6
BRRI DHAN100	11740		11700		14
BRRI DHAN101	2020		1630		21
BRRI DHAN102	4640		4510		148
BRRI DHAN104	3890		2310		54
BRRI DHAN105	1390		1350		35
BRRI DHAN107	660		630		45
BRRI DHAN108	360		350		19
Total	146880	7660	116640	2970	1063
Grand total	154540		120673		

Table 5. Production and distribution of rice breeder seed on Aus 2024-25.

Variety	Production (with tag) (kg)	Distribution (kg)
BRRI dhan 42	20	0
BRRI dhan 43	10	0
BRRI dhan 48	4340	4330
BRRI dhan 65	280	265
BRRI dhan 82	50	50
BRRI dhan 83	20	6
BRRI dhan85	1340	800
BRRI dhan98	8130	8101
BRRI dhan106	650	640
Total	14,840	14,192

Table 6. Production and distribution of rice breeder seed on T. Aman 2024-25.

Variety	Production (with tag) (kg)		Distribution (kg)		
	Favourable Variety	Stress tolerant variety	Favourable variety	Stress tolerant variety	Free of cost
BR10	260	-	260	-	
BR11	6410	-	6410	-	11
BR22	4320	-	4310	-	10
BR23	2650	-	2640	-	6
BRRI dhan30	1380	-	1110	-	6
BRRI dhan32	510	-	510	-	5

Variety	Production (with tag) (kg)		Distribution (kg)		
	Favourable Variety	Stress tolerant variety	Favourable variety	Stress tolerant variety	Free of cost
BRRi dhan33	280	-	280	-	
BRRi dhan34	4340	-	4340	-	12
BRRi dhan39	120	-	120	-	
BRRi dhan41		20		20	
BRRi dhan44	50	-	40	-	
BRRi dhan46	120	-	120	-	
BRRi dhan49	8530	-	8530	-	10
BRRi dhan51		7850		7850	17
BRRi dhan52		2980		2970	10
BRRi dhan66		50		20	5
BRRi dhan70	110	-	20	-	21
BRRi dhan71		190		190	20
BRRi dhan72	70	-	10	-	
BRRi dhan75	5950	-	5950	-	38
BRRi dhan76	950	-	690	-	1
BRRi dhan77	130	-	0	-	
BRRi dhan79	40	-	40	-	
BRRi dhan80	130	-	60	-	
BRRi dhan87	7930	-	7920	-	7
BRRi dhan90	1560	-	710	-	1
BRRi dhan91		110		10	
BRRi dhan93	3230	-	3230	-	
BRRi dhan94	150	-	150	-	
BRRi dhan95	170	-	170	-	
BRRi dhan103	1930	-	1930	-	95
BRRi dhan109	180	-	180	-	5
BRRi dhan110	150	-	150	-	5
BRRi dhan111	160	-	160	-	6
NIZERSAIL	80	-	80	-	
Total	51890	11200	50120	11060	291
Grand total	63090		61471		



Fig. 3. Pictorial views of monitoring the BS plots in BRRi regional stations at Rangpur and Rajshahi during 2024-25.

EXPLORATORY AND GENETIC STUDIES

Evaluation of Nazirsail group of rice germplasm.

In total, 33 similar named Nazirsail group of germplasm accessions including 29 Nazirsail TAPL (Transplanted Aman Pure Line) from BRRI Genebank along with BR4, BR22, Nizersail (DA25) and BRRI dhan49 were grown at GRS division, BRRI in T. Aman 2024 for evaluating different

quantitative and qualitative traits. The extent of variability of 11 quantitative characters for 37 rice genotypes including 33 similar named Nazirsail rice germplasm for different seed and yield characters is shown in Table 7. The yield ranged from 0.74 to 2.61 t/ha.

Table 7. Summary statistics of 37 rice genotypes including 33 similar named Nazirsail group of rice germplasm for different seed and yield characters

Subject	Fill grain number	Un-fill grain number	Grain length (mm)	Grain width (mm)	LB Ratio	Decorticated (DG) grain length (mm)	Decorticated grain width (mm)	DG LB Ratio	1000 grain weight (g)	Grain Yield (g/hill)	Grain Yield (t/ha)
Min	45	9	6.72	2.14	1.30	5.08	1.84	2.27	18.42	2.99	0.74
Mean	93	13	8.25	2.54	3.35	5.80	2.07	2.81	26.08	8.22	2.04
Max	133	17	11.15	6.39	4.55	7.98	2.44	3.71	33.04	10.51	2.61
CV	20.1	15.8	10.9	26.6	15.5	10.9	6.5	9.9	16.0	14.7	14.7

The extent of variability of 33 qualitative traits for 37 rice genotypes (Fig. 4) revealed that 12 main characters (Intermediate type blade pubescence, green color leaf blade, two-cleft type ligule shape, no culm anthocyanin color, green color internode, heavy secondary branching, droopy axis, straw colour lemma and palea, short hairs lemma and palea

pubescence, straw color sterile lemma, medium sterile lemma length and decorticated grain: Non scented/ non-aroma) showed no variation, nine main characters were the most diversified, 12 main characters were the most dominant (97.3%) and 16 genotypes showed the most unique or rare traits among the studied germplasm.



Legend: All from left to right; 1st row contains NS1 to NS10, 2nd row contains NS11 to NS20, 3rd row contains NS21 to NS30 and 4th row contains NS31 to NS33 along with then BR4, BR22, DA25 and BRRI dhan49.

Fig. 4. Grain diversity of Nazirsail group of rice germplasm

Investigator: PI: Mir Sharf Uddin Ahmed

Evaluation of Rata group of rice germplasm for agronomic and aroma quality. Seventeen similar named Rata Boro group of rice germplasm accessions from BRRI Genebank along with BRRI

dhan28, BRRI dhan34, BRRI dhan50, BRRI dhan104, Habiganj Boro VI, Kalizira (acc. 1589), Bangladesh Kalijira (acc. 247), Tepu IRRI (acc. 6213) and Topa (Tepi) Boro (acc. 4373) were

characterized and evaluated through qualitative characters, yield contributing traits and aroma quality by 16 SSR molecular makers including RM282 (for QTL aro3.1), RM273 (for QTL aro4) and RM223 (for QTL aro8.1 represented by badh2 gene) at GRS division BRRI in Boro 2024-25.

The extent of variability of 18 quantitative yield contributing characters for 26 rice genotypes including 17 similar named Rata Boro group of rice germplasm for different seed and yield characters is shown in Table 8. Rata Boro (acc. 8208) showed the maximum yield (4.12 t/ha) followed by BRRI

dhan28 as 4.06 t/ha. The extent of variability of 33 qualitative traits for 26 rice genotypes also revealed that five main characters (Intermediate type blade pubescence, two-cleft type ligule shape, heavy secondary branching, droopy axis and short hairs lemma and palea pubescence) showed no variation, 15 main characters were the most diversified (divided into 3 or more sub-characters), 12 main characters were the most dominant (each characters contain more than 75% genotypes) and 20 genotypes showed the most unique or rare trait(s) among the studied germplasm.

Table 8. Summary statistics of 26 rice genotypes including 17 similar named Rata Boro group of rice germplasm for 18 yield contributing characters

Sl. No.	Variety Name	Acc. No	Leaf length (cm)	Leaf width (cm)	Culm diameter (cm)	Effective tiller	Panicle length (cm)	Plant height (cm)	Days to maturity 80%	Filled Spikelet	Unfilled Spikelet	Spikelet sterility (%)	1000 Grain Wt (g)	Grain length (mm)	Grain width (mm)	DGL (mm)	DGW (mm)	Seed shape (L/W ratio)	Yield (g/hill)	Yield (t/ha)
1	Raital	1564	40.8	1.08	4.18	8	21.4	103.6	118	75	6	7.7	18.9	7.71	2.9	5.31	2.51	2.12	12.39	2.97
2	Raitul	8066	51.6	1.06	4.5	7.4	20.8	114.2	129	108	13	11.9	21.8	8.89	3.23	6.11	2.76	2.21	16.18	3.88
3	Rata	3999	55.8	1.06	3.62	6.2	22.2	134.2	143	116	18	15.7	16.1	7.77	2.85	5.28	2.51	2.10	12.96	3.11
4	Rata	4965	36.4	1.08	4.46	8	24.2	102	152	78	15	19.2	21.9	9.46	2.46	6.67	2.21	3.02	12.87	3.09
5	Rata	7676	55.2	1.04	4.16	9.6	24.8	141.4	141	93	21	22.5	15.5	7.84	2.73	5.21	2.37	2.20	13.25	3.18
6	Rata	4524	51.4	1.06	4.3	7	20.4	131.2	143	76	16	20.7	13.7	7.34	2.69	5.08	2.41	2.11	7.67	1.84
7	Rata	3987	55.6	1.06	5.08	6.6	21.4	156.4	143	69	15	22.3	18.8	7.25	2.85	4.9	2.45	2.00	7.81	1.87
8	Rata Boro	3959	56.6	1.06	4.44	8.8	21.4	135	135	62	10	16.7	17.1	7.74	3.06	5.49	2.61	2.10	9.23	2.22
9	Rata Topa	4016	61.4	1.04	4.34	9	21.6	131.8	136	70	12	16.9	14.9	7.21	2.65	5.05	2.31	2.19	7.93	1.90
10	Rata Boro	4376	56	1.04	3.74	6.6	21.4	126.8	137	75	14	18.8	19.4	7.82	2.77	5.23	2.41	2.17	9.97	2.39
11	Rata Boro	8208	37	1.04	4.26	7.8	18.6	91.2	150	109	14	12.9	19.5	8.65	2.91	6.3	2.68	2.35	17.16	4.12
12	Rata Sail	71	55.6	1.04	5.2	6.8	25	150.2	145	96	14	14.2	17.5	7.1	2.42	5.12	2.1	2.44	11.66	2.80
13	Rateil	7852	51	1.2	3.64	6.6	21.6	122	135	71	8	11.8	23.4	8.16	2.96	5.6	2.6	2.15	10.94	2.63
14	Rathail	4047	46.6	1.04	4.3	7.4	24.4	130	147	89	12	13.3	14	8.73	3.2	6.16	1.72	3.58	15.45	3.71
15	Rathuheenati	8046	38	1.12	4.16	7	21.6	121.4	137	71	13	17.9	13.7	9.37	3.15	6.46	2.61	2.48	11.59	2.78
16	Rati Sail	876	51.6	0.86	3.58	7.6	21.4	113.8	147	75	11	14.1	14.1	7.14	2.41	5.1	2.13	2.39	8.4	2.02
17	Ratisail	4724	63	1.04	4.14	8	26.6	130.8	145	84	12	13.9	24.3	8.91	2.82	6.3	2.4	2.63	16.32	3.92
18	BRRI dhan28	4409	44.6	1.52	4.7	8.8	24	96.8	153	91	10	10.5	20.3	8.12	2.72	6.11	2.32	2.63	16.92	4.06
19	BRRI Dhan34	7093	36.2	0.94	4.06	8	21.6	105.4	143	97	11	11.4	8.7	5.81	2.11	3.8	1.7	2.24	7.09	1.70
20	BRRI Dhan50	6882	43.8	1.42	4.68	7.6	21	90.4	145	102	11	10.4	14.5	10.91	1.9	7.12	1.61	4.42	13.05	3.13
21	BRRI dhan104		42	1.04	4.74	7.6	22.2	95.4	147	108	11	10.0	20.5	10.37	2.4	7.63	1.93	3.95	15.4	3.70
22	HBj B. V1	8786	40.8	1.04	5.14	6.4	22.6	122.4	143	85	12	13.9	23.4	7.48	3.4	5.4	2.72	1.99	13.43	3.22
23	Kalizira	1589	46.2	1.04	4.18	6.8	25.4	135.8	143	73	16	21.8	11.6	6.39	2.52	4.33	2.23	1.94	5.39	1.29
24	Kali Jira(3)	247	40.8	1.04	4.16	7.4	23	121.6	136	134	19	14.5	9.9	6.81	2.36	4.52	1.93	2.34	8.69	2.09
25	Tepu Irri	6213	53.6	1.06	4.38	7.2	22.4	126	153	76	12	16.3	17.1	7.56	3.05	5.36	2.51	2.14	10	2.40
26	Topa Boro	4373	53.8	1.06	4.08	7	21.8	126.8	138	84	12	14.1	20.1	7.35	3.1	4.92	2.46	2.00	13	3.12
	Min		36.2	0.86	3.58	6.2	18.6	90.4	118	62.4	5.8	7.7	8.7	5.81	1.9	3.8	1.61	1.94	5.39	1.29
	Mean		48.21	1.07	4.29	7.5	22.27	120.26	141	86	13	14.85	17.01	7.91	2.72	5.49	2.29	2.44	11.49	2.76
	Max		63	1.52	5.2	9.6	26.6	156.4	153	134.2	21	22.48	24.3	10.91	3.4	7.63	2.76	4.42	17.16	4.12
	Std.Dev.		8.35	0.15	0.46	0.93	2.00	18.76	8.82	19.19	3.76	4.26	4.45	1.30	0.40	0.97	0.34	0.70	3.52	0.85
	CV		17.3	14.3	10.8	12.5	9.0	15.6	6.3	22.3	29.7	28.7	26.2	16.4	14.5	17.6	14.9	28.7	30.7	30.7
	LSD		23.72	0.43	1.31	2.65	5.69	53.30	25.05	54.52	10.68	12.11	12.65	3.68	1.12	2.74	0.97	1.99	10.01	2.40

Besides, the 26 rice genotypes including 17 similar named Rata Boro group of rice germplasm were also evaluated for aroma quality by 16 SSR molecular makers including RM282 (for QTL aro3.1), RM273 (for QTL aro4) and RM223 (for QTL aro8.1 represented by badh2 gene) at GRS division BRRI in Boro 2024-25. The analysis of molecular data for 26 rice genotypes is ongoing.

Investigator: PI: Mir Sharf Uddin Ahmed

Purification of Balam rice germplasm. A Balam rice germplasm (acc. 516) was grown for purification through head to row method during T. Aman 2024. Previously, the studied Balam genotype showed mixture of two types of grain seed coat (bran) color (White and red) from its harvested panicles (Fig. 5). But using head or panicle to row method in the last two consequent years, all the transplanted seedlings from panicles with white grain seed coat (bran) color yielded the same

panicles of white grain seed coat (bran) color along with uniformity in all other traits in T. Aman 2024. Similarly, all the transplanted seedlings from panicles with red grain seed coat (bran) color also

yielded the same panicles of red grain seed coat (bran) color along with unique uniformity for all other traits.

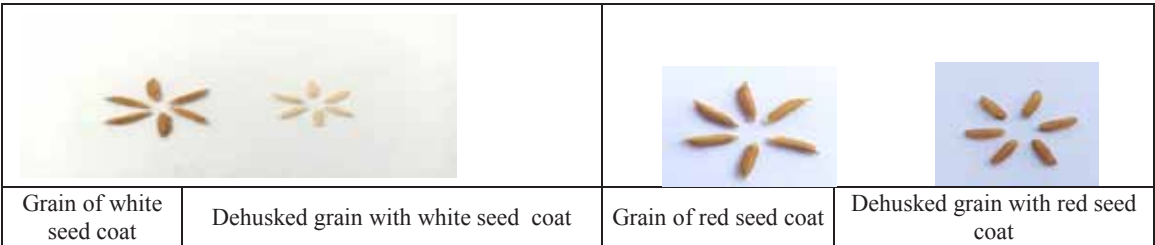


Fig. 5. Grain diversity of Balam (acc. 516) rice germplasm

Investigator: PI: Mir Sharf Uddin Ahmed

Trait-based selection and Agronomic Performance Analysis of Aus Germplasm from all over Bangladesh. Three replications were placed with 100 Aus accessions in GRS division experiment plot for measuring prime traits viz. plant height, yield ability, tillering intensity, panicle length, grain LB ratio, growth duration and phenotypic appearance. Scoring of major diseases (BLB, Blast, Tungro, Sheath blight), scoring of major insects' infestation (BPH, SB), drought, heat, anaerobic germination, pre-harvest sprouting and lodging tolerance, protein content, amylose content and alkali spreading value will be measured by respective divisions.

In Aus 2024-25, all 100 germplasm were characterized under the selected traits. Among them, DHAKAIA IRRI had the shortest (81.80 cm) whereas HIJULI had the highest (133.70 cm) plant height as showed in Table 9. Panicle length was found longest (29.81 cm) for SODEY AUS and shortest (15.25 cm) for JAI MORI. The highest (11) effective tiller number per hill was found for RAJASAIL IRRI and lowest (1) for JAI MORI, NATUL (AWNED LAL)), KHAIR MONI and ABDULLAH. In case of days to 50% flowering (days) and days to maturity (days), AUS DHAN was the lowest in both the cases and KUCHMUCH was the highest in both the cases.

Table 9. Trait based agronomic performance of Aus germplasm

Traits	Range	Mean $\pm$ SE	Skewness	CV (%)	LSD (99.0%)
Plant Height (cm)	81.8-133.7	114.90 $\pm$ 1.05	-0.75	9.13	2.76
Panicle Length (cm)	15.25-29.81	23.93 $\pm$ 0.32	-0.67	13.39	0.84
Effective Tiller (no/hill)	1-10	4.36 $\pm$ 0.21	0.29	47.07	0.54
Days to 50% Flowering (days)	71-105	92.52 $\pm$ 0.71	-0.72	7.70	1.87
Days to Maturity (days)	98-129	118.81 $\pm$ 0.69	-0.76	5.77	1.80
Grain Length (mm)	7.13-10.42	8.59 $\pm$ 0.07	0.15	8.25	0.19
Grain Breadth (mm)	2.12-3.28	2.70 $\pm$ 0.03	0.13	9.94	0.07
Dehulled Grain Length (mm)	5.11-7.91	6.17 $\pm$ 0.06	0.69	8.94	0.14
Dehulled Grain Breadth (mm)	1.68-2.95	2.37 $\pm$ 0.02	-0.01	10.18	0.06
Dehulled Grain Ratio	1.97-4.71	2.64 $\pm$ 0.04	1.54	16.67	0.12
Grain Yield (g/hill)	2.36-21.40	8.27 $\pm$ 0.51	0.97	62.05	1.34

Among the 100 Aus germplasm substantial amount of diversity was displayed. Leaf sheath anthocyanin was present in 84 germplasm and absent in 16 germplasm. Most of the germplasm represented

green (84) basal leaf sheath color and others were light purple (9) and purple (7). White colored ligule was present in 88 germplasm whereas purple lined ligule was found in 12 germplasm. Auricle color was

Pale green for 89 germplasm and Purple for 11 germplasm. Culm anthocyanin was present in 98 germplasm. Intermediate type (62) panicle was found in most number of the germplasm followed by open (31) and compact (7). Well exerted panicle exertion was found in 43 germplasm, followed by just exerted (35) and moderately well exerted (22). Low shattering of grain was found in 48 germplasm, others were moderate (49%), high (1) and very high (2). Straw colored lemma and palea was found in 60 germplasm, followed by black (21), gold and gold furrows on straw (18) and brown (1). In total, 44 germplasm exhibited white colored seed coat, others were brown (28), red (18), and speckled brown (9) and light brown (1). Additionally, flag leaf angle,

culm angle, panicle exertion, grain awn, awn color and seed coat (bran) color showed high diversity index (1.00-1.99) and rest of the traits showed low diversity index (<1.00).

Germplasms were also screened against Sheath Blight (ShB) under the supervision of Plant Pathology division of BRRI. The response of the rice germplasm is presented in Table 10. In this trial AUS DHAN (2), KHATO MALA, KATAK TARA, MINIKIT, BASHFUL IRRI and BRRI JHUM DHAN LOWAS showed moderately susceptible reaction against ShB, and rest of the germplasm showed susceptible reaction against ShB pathogen.

Table 10. Reaction of rice germplasm against sheath blight pathogen

Acc. No.	Germplasm Name	Score
6618	AUS DHAN (2)	Moderately Susceptible
6622	KHATO MALA	Moderately Susceptible
7260	KATAK TARA	Moderately Susceptible
7303	MINIKIT	Moderately Susceptible
7418	BASHFUL IRRI	Moderately Susceptible
8795	BRRI JHUM DHAN LOWAS	Moderately Susceptible
Rest of the germplasm showed susceptible reaction		

The 100 accessions showed huge variation for the measured anaerobic germination tolerance (AGT) traits. Based on the screening result, we were able to identify 14 AGT accessions from Bangladeshi

landraces (Table 11) comparing with checks (Lal Aman and Shisumati), which can be used as donor parents for future breeding program.

Table 11. Screening and identification of anaerobic germination (AG) tolerant rice germplasm

Germplasm Name	% Seedling Survival at 21 DAS
Sada Aus	76.6
Aus (Awned)	76.0
Kala Boro	75.5
Sanda Moni	75.5
Kala Boyei (2)	74.0
Jai Mori	74.0
Aus Dhan	73.3
Dighi Bauhal	73.3
Hijuli	73.0
Benasuri	73.0
Kuchmuch	72.6
Sirampuri Hatia	72.5
Moisor	71.3
RayRay	70.0
Lal Aman (Ck)	70.0
Shisumati (Ck)	75.0

Investigators: PI: Tonmoy Chakrabarty and Md Zahidul Islam

Assessment of morphological characters and physico-chemical properties of long slender garin rice germplasm of Bangladesh. A total of 64 Boro rice germplasm from BRRI Genebank that were not characterized yet; evaluated in research plots, BRRI, Gazipur in T. Aman 2024-25 season along with three standard check varieties i.e. BRRI dhan70, BRRI dhan87 and BRRI dhan103. A total of 13 quantitative traits of 64 genotypes were studied. Analysis of

variance (ANOVA) of 13 quantitative traits showed highly significant differences at $p < 0.01$ among the long slender genotypes for all of the traits studied (Table 12). It indicated the existence of a wide range of genetic variations among the genotypes. Again, it also showed insignificant for different replications for all of the traits. Therefore, means of 13 morphological traits need to be separated for further study to discriminate the genotypes.

Table 12. Analysis of variance for yield and it's attributing 13 quantitative traits of 64 rice genotypes.

Traits	Min	Max	Mean	StDev	CV	MSS		
						Rep. (df-2)	Genotype (df-63)	Error (df-126)
Leaf length (cm)	38.00	79.67	57.65	10.05	5.56	9.54	303.17***	10.26
Culm length (cm)	54.00	150.33	104.28	19.35	2.72	22.55	1111.98***	8.01
Ligule length (mm)	0.83	1.70	1.29	0.20	10.41	0.06	0.12***	0.02
Effective tiller number	5.67	12.00	8.72	1.51	11.13	19.32	6.81***	0.94
Panicle length (cm)	20	33	26.76	2.92	3.36	0.79	24.23***	0.81
Filled grain per panicle	52.00	137.33	76.79	14.88	6.34	11.41	664.64***	23.71
1000 grain weight (g)	11.00	33.00	22.72	6.20	1.43	0.00	115.47***	0.00
Grain length (mm)	6.82	11.36	8.95	1.01	1.43	0.05	3.08***	0.02
Grain breadth (mm)	1.85	3.57	2.47	0.40	2.94	0.02	0.48***	0.02
Dehulled grain length (mm)	2.60	8.25	6.32	0.83	2.03	0.03	2.04***	0.02
Dehulled grain breadth (mm)	1.59	5.82	2.16	0.57	3.05	0.01	0.98***	0.01
Days to maturity	132	157	142.75	6.37	2.95	1.45	87.66***	1772
Yield per hill (g)	7.00	28.00	16.14	4.69	-	0.00	65.99***	0.00

NB: *** indicated significant at 0.1% level of probability. StDev - Standard deviation, CV - Coefficient of variation, Rep. - Replication.

Screening of rice germplasm against pre harvest sprouting (PHS). A total of 100 rice germplasm were screened against pre harvest sprouting during Boro 2024-25 season following standard protocol.

Among them, six germplasm were found very sensitive and 34 germplasm were found resistant to pre harvest sprouting (Table 13 and Fig. 6).

Table 13. Reaction of rice germplasm against pre harvest sprouting.

SI No	Germplasm Name	Accession Number	% of PHS
1	95010-TR 1644-4-1-1	6449	80
2	STEJAREE 45	6500	90
3	LAL DHAN	6853	80
4	LHECHEO	8825	80
5	UNKNOWN (469544)	6963	80
6	GOBISAIL	4532	80



Fig. 6. Photograph showing pre harvest sprouting of rice germplasm.

Investigator: PI: ESM Harunur Rashid

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SUMMARY

A total of 1,957 breeding lines were analyzed for milling outturn, with 78.1% (1,528 lines) achieving $\geq 68\%$ milling outturn, and 61% of the 1,950 lines had HRR below 50%, while only 9.8% had good HRR ($>60\%$). Grain length and shape were evaluated in 2,280 breeding lines. About 74.2% (1,692 lines) had grain length >6.0 mm, and 21.5% were 5.0–6.0 mm. Among 1,667 lines assessed for length-to-breadth (L/B) ratio, 50.1% had slender shapes (L/B >3.0). Further classification by size and shape showed that 84.3% of 3,038 lines fell into commercially valuable categories (LS, LB, MS), with 37.1% (1,128 lines) being long slender types. Chalkiness, a negative quality trait, was analyzed in 151 samples. A significant 129 lines had chalk levels $>20\%$, which could affect marketability. Amylose content, a key determinant of texture, was assessed in 2,369 lines. High amylose ($>25.0\%$), was found in 23.6% of breeding lines (558 lines), while 56.7% had intermediate levels (20.0–25.0%). Protein content was measured in 1,611 lines: 42.3% had $>9.0\%$, while 57.7% had 7.0–9.0%, indicating generally good nutritional quality. Alkali spreading value (ASV measured in 1,364 lines. A large majority (80.6%) had intermediate GT (ASV 3.1–5.9), desirable for balanced cooking quality. Cooking time, was analyzed in 1,826 lines. Most (75.2%) cooked within 15–20 minutes. Only 4.5% took longer than 20 minutes, while 20.3% cooked in under 15 minutes. 93.4% of 1,845 lines had ER ≥ 1.3 . Volume expansion was also promising: 51.9% of 1,800 lines had a ratio >4.0 , indicating good water absorption and texture.

In the both situations (after one month and three months' interval), milling outturn and head rice percentage were gradually decreased with increasing storage period (from 0 day to 6 months). Whereas moisture content, 1000 grains wt., amylose content, cooked rice length and imbibition ratio were gradually increased with increasing storage period (from 0 day to 6 months in the both situations after one month and three months' interval). Most of the properties have shown better performance at three months' interval after harvesting than one-month interval after harvesting except head rice recovery, which have shown similar performance at one- and three-months interval after harvesting.

Superior eating quality of BRRI Hybrid rice are identified by the sensory evaluation under different parboiling treatment. The sensory characterization undoubtedly provides a more complete and accurate information than the instrumental one.

This report presents an in-depth analysis of rice consumption behaviors and varietal preferences across diverse agroecological zones of southeastern Bangladesh. Drawing on field surveys conducted in Chattogram, Cox's Bazar, and Bandarban, the study explores the cultural, agricultural, and nutritional factors shaping the widespread preference for unparboiled rice. It highlights the interplay between traditional landrace cultivation, limited milling infrastructure, and sensory expectations, while identifying knowledge gaps in nutritional awareness and health implications. The findings offer valuable guidance for future breeding programs, nutrition education, and culturally responsive food policy.

The conceptual design of a continuous heat-treatment plant for rice bran stabilization has been completed, consisting of a husk-fired furnace and a heat exchanger system. A prototype furnace with partial heat exchanger has been designed and fabricated, demonstrating progress toward an energy-efficient and continuous stabilization process. Ongoing work focuses on integrating the components, refining heat control, and testing to ensure improved rice bran quality and extended shelf life.

BALB/c mice were treated with 2.5% DSS over 15 cycles to induce chronic colitis, replicating key features of human ulcerative colitis. Histopathology revealed epithelial erosion and crypt damage, while RT-PCR showed elevated IL-6, IL-10, and IL-23 levels. Metagenomic analysis confirmed gut dysbiosis, with increased pro-inflammatory bacteria and reduced protective species. This validated model will be used to test the anti-inflammatory effects of C3G-enriched rice-based cookies (ASRBC).

Bangladesh's progress in rice self-sufficiency, driven by high-yielding varieties during the BORO season, has improved food availability but introduced nutritional challenges. The widespread consumption of parboiled polished white rice—especially in rural areas—has led to significant losses of iron, zinc, phosphorus, fiber, and B-complex vitamins due to industrial milling. With rice providing over 70% of daily caloric intake, micronutrient deficiencies and

non-communicable diseases (NCDs) are rising. Integrating nutrient-rich traditional cultivars into BORO season production and prioritizing high-mineral parental lines in breeding programs offers a strategic solution to enhance dietary quality, support public health, and promote sustainable agriculture.

Most of the opaque grain cultivars have shown the lower amylose content and lower elongation. But Habiganj-VIII has shown the exceptional case, which has intermediate amylose and higher elongation. Among the procedures, superior texture and taste both have shown in the 1st day and gradually decrease in the 2nd day for traditional procedure (Rice flour dough in boiled water) of roti from Pukky. Among the procedures, superior texture both have shown in the 1st day and 2nd day but superior taste has shown in the 1st day and gradually decrease in the 2nd day for traditional procedure (Rice flour dough in boiled water) of roti from Rata Boro. Among the procedures, superior texture both have shown in the 1st day and 2nd day but superior taste has shown in the 1st day and gradually decrease in the 2nd day for traditional procedure (Rice flour dough in boiled water) of roti from Habiganj-VIII.

A prototype mechanical system for rice vermicelli (chutki semai) production was designed and fabricated. Initial trials revealed issues such as material clogging and insufficient internal pressure, which affected extrusion performance. In response, a new extruder and die design will be developed to improve flow, ensure uniform product size, and produce fine semai extrudates. Further refinements will focus on enhancing machine efficiency and overall product quality.

GRAIN QUALITY CHARACTER

Determination of physicochemical and cooking properties of breeding lines

Investigators: M A Haque, S S Dipti, N Ferdous, T K Sarkar, H B Shozib, S Hosen and M R Akanda

Rice (*Oryza sativa* L.) is the staple food for over half the world's population. Beyond yield, the economic value and consumer acceptance of rice are overwhelmingly determined by its quality characteristics. These qualities are complex and multifactorial, encompassing both physical attributes, which affect appearance and milling

yield, and chemical properties, which dictate cooking and eating behavior. Breeding for quality is a challenging endeavor, often involving trade-offs between yield, disease resistance, and these nuanced quality traits. A total of Three Thousand Thirty-Eight (3038) samples were provided from different division of BRRI to find out the desirable characteristics. In Bangladesh, long slender type translucent grains prefer by consumers as premium quality rice with higher price. Total 1957 breeding lines were analyzed for milling outturn. A combined 78.1% (1,528 lines) of the breeding lines achieve a milling outturn of 68% or higher (Table 1). This indicates that the husk is not overly thick, and the bran layer is efficiently removed without excessive loss of endosperm material. Head Rice Recovery (HRR) is the single most important economic trait in rice. Premium prices are paid for high head rice. Out of 1950 breeding lines analyzed, a staggering 61% of the breeding lines have an HRR below 50%, a level considered commercially unacceptable in virtually all markets. Only a meager 9.8% (192 lines) demonstrate a truly good HRR above 60%. Low HRR is typically caused by genetic susceptibility to fissuring-the development of internal cracks in the kernel due of imperfect drying, or inherent weakness in the kernel structure. Long grain rice is highly preferred in South Asian, Middle Eastern, Western, and many African markets due to its non-sticky cooking behavior. The fact that 74.2% (1692 lines) of lines were found having grain length more than 6.0 mm while grain length of 490 lines were between 5.0-6.0 mm (21.5%) out of 2280 lines analyzed. The L/B ratio further defines the grain shape, categorizing them as slender, bold, or round. 836 lines (50.1%) out of 1667 lines analyzed were having L/B ratio more than 3.0. On the other hand, 772 lines (46.3%) have an L/B ratio above 2.0, meaning they are neither round nor overly coarse. Size and Shape is a more detailed phenotypic classification that combines length and L/B ratio. A total of 3038 breeding lines were analyzed. The commercially most valuable categories (LS, LB, MS) constitute 84.3% of the total lines analyzed. 37.1% (1128) lines were found having long slender grains. Chalkiness is the opaque appearance of parts of the milled grain caused by loose packing of starch granules. It is a major grading factor; even small amounts can downgrade a rice lot and deter consumers who associate it with inferior quality. Chalkiness is

influenced by genetics but can be exacerbated by high temperatures during grain filling. A total of 151 lines were analyzed for chalkiness (Table 1).

Amylose content is the most important chemical determinant of cooked rice texture. It is the linear component of starch that re-associates after cooking, leading to firmness and non-stickiness. The intermediate amylose range (20-25%) is the most versatile and widely consumed globally, resulting in rice that is soft, moist, and fluffy yet distinct after cooking. In our country, high amylose containing rice is more preferable. 558 breeding lines (23.6%) were found having >25.0% amylose content and 1343 lines (56.7%) 20.0-25.0% amylose content out of 2369 lines analyzed (Table 2). While often secondary to starch properties, protein content contributes to the nutritional value and can slightly affect water absorption and texture. Total 1611 breeding lines were measured and 681 lines were found having more than 9.0% protein. On the other hand, 930 lines were in 7.0-9.0% protein content and rest 46 (2.9%) lines were found having less than 7.0% protein. Alkali Spreading value (ASV) is an indirect measure of the gelatinization temperature (GT) of starch. Low ASV (1-3) indicates high GT (longer cooking time), while high ASV (6-7) indicates low GT (shorter cooking time). Among

1364 lines analyzed the vast majority of lines (80.6%) possess an intermediate GT. This is highly desirable as it correlates well with intermediate amylose content to produce the preferred cooking and eating quality. 208 lines had more than 6.0 ASV while 1099 lines were found having 3.1-5.9 ASV. Cooking time measures the practical time required to cook the rice to an edible state. A total of 1826 lines were analyzed and 75.2% of lines (1373 lines) fall within the standard 15-20 minutes cooking range (Table 2). 82 lines (4.5%) were found to have more than 20 minutes cooking time. And rest 371 lines had less than 15 minutes cooking time. This is a highly prized trait, particularly in Basmati and similar types, where the grain elongates significantly upon cooking. Total 1845 breeding lines were analyzed. A remarkable 93.4% of lines show good to excellent elongation (<1.5 and 1.3-1.5 ER). This measures the increase in volume upon cooking, which is related to water uptake and final texture. Out of 1800 lines analyzed 935 lines (51.9%) had, more than 4.0 volume expansion ratio while 681 lines (37.8%) had 3.5 - 4.0 volume expansion ratio.

Some of the promising breeding lines were identified for higher milling outturn, head rice recovery, amylose content, protein content, elongation ratio and acceptable other physicochemical properties.

Table 1: Physical properties of breeding lines.

Range	Properties and Sample number
	Milling outturn (%) (Total Sample 1957)
>70.0	619
68.0-70.0	909
<68.0	429
	Head rice recovery (%) (Total Sample 1950)
>60.0	192
50-60	569
<50.0	1189
	Length (mm) (Total Sample 2280)
>6.0	1692
5.0-6.0	490
<5.0	98
	L/B ratio (Total Sample 1667)
>3.0	836
2.0-3.0	772
<2.0	59
	Size and shape (Total Sample 3038)
ELS	17
LS	1128
LB	521
MS	913
MB	363
SS	0
SB	55
SR	41
	Chalk (%) (Total Sample 151)
0 (To)	12
<10.0	0
10.0-20.0	10
>20	129
Opaque	0

Table 2: Chemical properties of breeding lines.

Range	Properties and Sample number
	Amylose content (%) (Total Sample 2369)
>25.0	558
20.0-25.0	1343
≤20.0	468
	Protein content (%) (Total Sample 1611)
>9.0	681
7.0-9.0	930
≤7.0	46
	Alkali spreading value (Total Sample 1364)
1-3	57
3.1-5.9	1099
>6.0	208
	Cooking time (minute) (Total Sample 1826)
>20.0	82
15.0-20.0	1373
≤15.0	371
	Elongation ratio (Total Sample 1845)
>1.5	810
1.3-1.5	914
≤1.3	121
	Volume expansion ratio (Total Sample 1800)
>4.0	935
3.5-4.0	681
≤3.5	184

Effect of storage condition on physicochemical properties of proposed BRRI line

Investigators: N Ferdous (PI), M A Haque and S S Dipti

Rice is best stored as paddy because the husk provides some protection against insects and helps prevent grain quality deterioration. Storage effect of paddy is a complicated process, which involves changes in milling, physical, chemical and cooking properties of the rice grain. We have used different types of paddy storage systems. But only daily consumption of rice, we use three months, six months and maximum one-year storage rice. The grain quality characteristics of BRRI line IR16F1148 (BRRI dhan110) were studied at 0 day to 6 months after harvesting. Changes of different parameters of proposed BRRI line up to 6 months after 0 day and 3 months' interval of harvesting are shown in below.

Storage effect of physical and milling properties on proposed BRRI line IR16F1148 (BRRI dhan110): The range of milling outturn is (70.20-71.00) % from

0 day to 6 months after harvesting. Highest milling outturn was shown at 0 day after harvesting but lowest milling outturn was shown at 2 and 5 months after harvesting. The range of head rice percentage is (67.11- 68.30) % from 0 day to 6 months after harvesting. Highest head rice percentage was shown at 0 day after harvesting but lowest head rice percentage was shown at 5 months after harvesting. The range of moisture content is (10.60-14.00) % from 0 day to 6 months after harvesting. Highest moisture content was shown at 0 day after harvesting but lowest moisture content was shown at 6 months after harvesting. The range of 1000 grains wt. is (21.12-22.97) g from 0 day to 6 months after harvesting. Highest 1000 grains wt. was shown at 0 day after harvesting but lowest 1000 grains wt. was shown at 6 months after harvesting. The range of length, breadth and L/B ratio of milled rice are (5.70-6.02) mm, (2.11-2.27) mm and (2.65-2.85) mm respectively. Proposed BRRI line IR16F1148 (BRRI dhan110) is medium bold type (MB) translucent (Tr) grain with good appearance (Table-3).

Storage effect of chemical and cooking properties on proposed BRRi line IR16F1148 (BRRi dhan110): The range of alkali spreading value is (3.00-3.67) from 0 day to 6 months after harvesting. Highest alkali spreading value was shown at 3 months after harvesting but lowest alkali spreading value was shown at 5 months after harvesting. The range of amylose content is (18.50-20.48) % from 0 day to 6 months after harvesting. Highest amylose content was shown at 6 months after harvesting but lowest amylose content was shown at 0 day after harvesting. The range of cooking time is (17.30-20.00) min from 0 day to 6 months after harvesting. Highest cooking time was shown at 5 months after harvesting but lowest cooking time was shown at 1 month after harvesting. The range of cooked rice length is (7.00-8.12) mm from 0 day to 6 months after harvesting. Highest cooked rice length was shown at 4 months after harvesting but lowest cooked rice length was shown at 1 month after harvesting. The range of elongation ratio is (1.16-1.38) from 0 day to 6 months after harvesting. Highest elongation ratio was shown at 4 months and 6 months after harvesting but lowest elongation ratio was shown at 1 month after harvesting. The range of imbibition ratio is (3.42-4.30) from 0 day to 6 months after harvesting. Highest imbibition ratio was shown at 6 months after harvesting but lowest imbibition ratio was shown at 0 day after harvesting (Table-4).

In the both situations (after one month and three months' interval), milling outturn and head rice percentage were gradually decreased with increasing storage period (from 0 day to 6 months). Whereas moisture content, 1000 grains wt., amylose content, cooked rice length and imbibition ratio were gradually increased with increasing storage period (from 0 day to 6 months in the both situations after one month and three months' interval) (Figure-1). R^2 is a statistical measure in a regression model. Value of R^2 indicates the variation in the dependent variable that can explained by the independent variable. In the case of Milling outturn, R^2 value

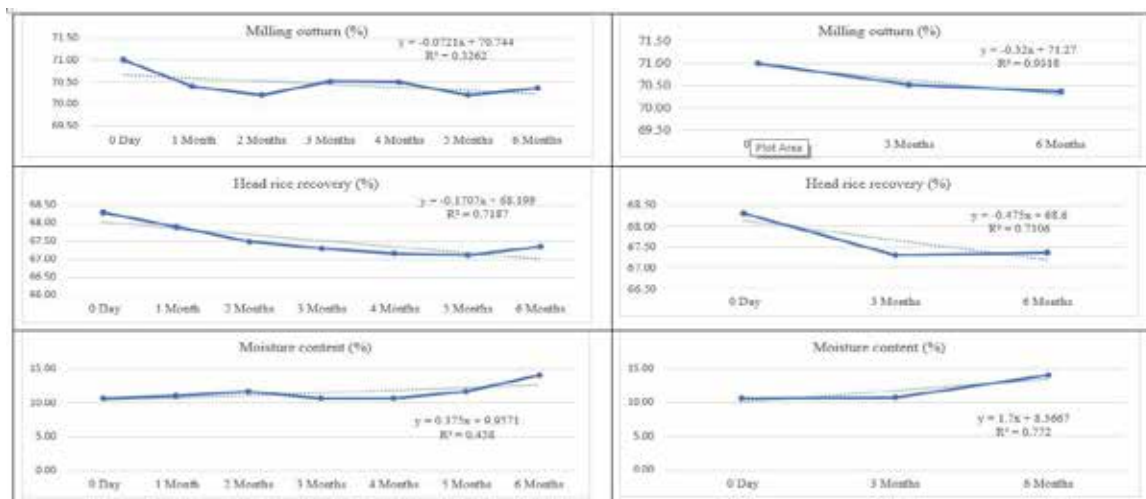
(0.9318) in three months' interval is better than the R^2 value (0.3262) in one-month interval of storage period. Here, 93% variation of milling outturn in the three months' interval is explained whereas 33% variation of milling outturn in one-month interval (Figure-1). In the case of head rice recovery, R^2 value (0.7106) in three months' interval is almost similar to the R^2 value (0.7187) in one-month interval of storage period. Here, 71% variation of head rice recovery in the three months' interval is explained whereas 72% variation of head rice recovery in one-month interval (Figure-1). In the case of moisture content, R^2 value (0.772) in three months' interval is better than the R^2 value (0.458) in one-month interval of storage period. Here, 77% variation of milling outturn in the three months' interval is explained whereas 46% variation of milling outturn in one-month interval (Figure-1). In the case of 1000 grains wt., R^2 value (0.9771) in three months' interval is better than the R^2 value (0.5642) in one-month interval of storage period. Here, 98% variation of 1000 grains wt. in the three months' interval is explained whereas 56% variation of 1000 grains wt. in one-month interval (Figure-1). In the case of amylose content, R^2 value (0.8358) in three months' interval is better than the R^2 value (0.7832) in one-month interval of storage period. Here, 84% variation of amylose content in the three months' interval is explained whereas 78% variation of amylose content in one-month interval (Figure-1). In the case of cooked rice length, R^2 value (0.8232) in three months' interval is better than the R^2 value (0.7098) in one-month interval of storage period. Here, 82% variation of cooked rice length in the three months' interval is explained whereas 71% variation of cooked rice length in one-month interval (Figure-1). In the case of imbibition ratio, R^2 value (0.858) in three months' interval is better than the R^2 value (0.4226) in one-month interval of storage period. Here, 86% variation of imbibition ratio in the three months' interval is explained whereas 42% variation of imbibition ratio in one-month interval (Figure-1).

Table-3: Storage effect of Physical and Milling properties on proposed BRRI line IR16F1148 (BRRI dhan110)

Sl. No. (AC# 21473)	Date	Line / Variety	Milling outturn (%)	Head rice recovery (%)	Appear ance	Chalki ness (%)	Milled rice length (mm)	Milled rice breadth (mm)	L/B ratio	Size & Shape	Moisture Content (%)	1000 grains wt. (g)	
1	After harvesting (0 day) 01.12.2024	IR16F1148 (Proposed BRRI dhan110)	71.00	68.30	Good	Tr	5.70	2.14	2.66	MB	10.6	21.12	
2	After harvesting (1 month) 01.01.2025		70.40	67.90	Good	Tr	6.02	2.11	2.85	MB	11.0	22.30	
3	After harvesting (2 month) 02.02.2025		70.20	67.50	Good	Tr	5.79	2.15	2.69	MB	11.6	22.30	
4	After harvesting (3 month) 02.03.2025		70.53	67.30	Good	Tr	6.01	2.27	2.65	MB	10.7	21.80	
5	After harvesting (4 month) 06.04.2025		70.50	67.15	Good	Tr	5.90	2.17	2.72	MB	10.7	22.12	
6	After harvesting (5 month) 06.05.2025		70.20	67.11	Good	Tr	5.80	2.16	2.68	MB	11.6	22.4	
7	After harvesting (6 month) 01.06.2025		70.36	67.35	Good	Tr	5.74	2.15	2.67	MB	14.0	22.97	
Range %			(70.20-71.00)	(67.11-68.30)			(5.70-6.02)	(2.11-2.27)	(2.65-2.85)		(10.60-14.00)	(21.12-22.97)	
Mean ± SD			70.46±0.27	67.52±0.44			5.85±0.13	2.16±0.05	2.70±0.07		11.46±1.20	22.14±0.57	
SE			0.32	0.53			0.15	0.07	0.17		0.24	0.31	
CV %			1	1			3	4	8		3	2	
LSD (0.05)			0.69	1.14			0.32	0.15	0.36		0.79	0.67	

Table-4: Storage effect of Chemical and Cooking properties on proposed BRRI line IR16F1148 (BRRI dhan110)

Sl. No. (AC# 21473)	Date	Variety/ Line	Alkali Spreading Value	Amylose content (%)	Cooking time (min.)	Cooked rice Length (mm)	Elongation Ratio	Imbibition Ratio
1	After harvesting (0 day) 01.12.2024	IR16F1148 (Proposed BRRI dhan110)	3.58	18.50	19:30	7.24	1.34	3.42
2	After harvesting (1 month) 01.01.2025		3.25	19.63	17:30	7.00	1.16	3.43
3	After harvesting (2 month) 02.02.2025		3.33	19.70	19:00	7.40	1.28	4.17
4	After harvesting (3 month) 02.03.2025		3.67	20.25	19:30	7.31	1.22	4.17
5	After harvesting (4 month) 06.04.2025		3.42	20.30	19:30	8.12	1.38	4.17
6	After harvesting (5 month) 06.05.2025		3.00	20.33	20:00	7.89	1.36	3.71
7	After harvesting (6 month) 01.06.2025		3.33	20.48	19:00	7.95	1.38	4.30
Range %			(3.00-3.67)	(18.50-20.48)	(17.30-20.00)	(7.00-8.12)	(1.16-1.38)	(3.42-4.30)
Mean ± SD			3.37±0.22	19.88±0.69	19.03±0.83	7.56±0.42	1.30±0.09	3.91±0.38
SE			0.13	0.17	0.18	0.14	0.15	0.18
CV %		5	1	1	2	14	6	
LSD (0.05)		0.28	0.36	0.38	0.30	0.33	0.40	



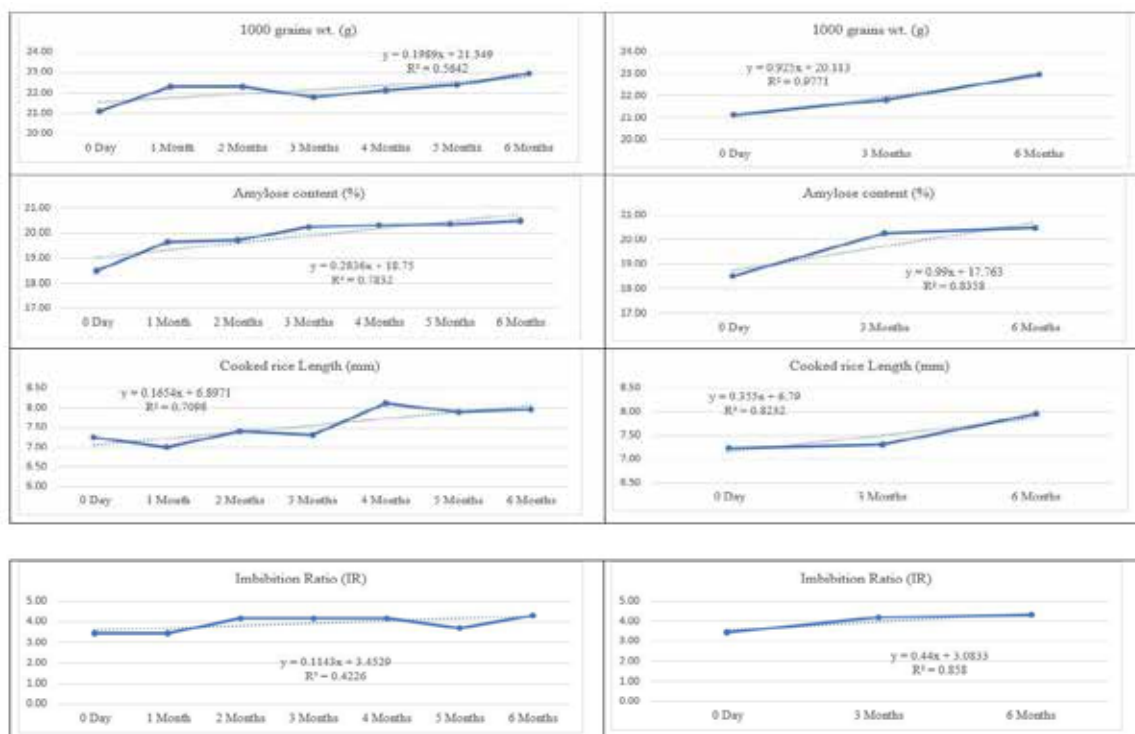


Figure-1: Storage effect on milling, physical, chemical and cooking properties after one- and three-months interval

Sl. No. (AC# 21473)Storage	Milling outturn (%)	Head rice recovery (%)	Milled rice length (mm)	Milled rice breadth (mm)	L/B ratio	Moisture Content (%)	1000 grains wt. (g)
0 Day	71.0A	68.30A	5.70A	2.14AB	2.66A	10.60C	21.12B
1 Month	70.40A	67.90AB	6.02A	2.11B	2.85A	11.00C	22.30A
2 Months	70.20A	67.50AB	5.79A	2.15AB	2.69A	11.60B	22.30A
3 Months	70.53A	67.30B	6.01A	2.27A	2.65A	10.70C	21.80B
4 Months	70.50A	67.15AB	5.90A	2.17AB	2.72A	10.70C	22.12A
5 Months	70.20A	67.11B	5.80A	2.16AB	2.68A	11.60B	22.40A
6 Months	70.36A	67.35AB	5.74A	2.15AB	2.67A	14.00A	22.97A

Chemical and Cooking properties of ALART materials 2024 (Submergence)

Sl. No. (AC# 21473)	Date	Variety/ Line	Alkali Spreading Value	Amylose content (%)	Protein content (%)	Cooking time (min.)	Cooked rice Length (mm)	ER	IR
1	After harvesting (0 day) 01.12.2024	IR-671148 (Proposed ESRI char-110)	3.58	18.8+18.4+17.8+18.6+ 18.9=18.5+2.0=20.5	10.31 (NIR)	19:30	7.24	1.34	3.42
2	After harvesting (1 month) 01.01.2025		3.25	18.8+19.1+18.9+18.5+ 19.3=18.92+2.0=20.92	9.95 (NIR)	17:30	7.00	1.16	3.43
3	After harvesting (2 month) 02.02.2025		3.33	19.1+18.9+19.3+18.1+ 18.9=18.86+2.0=20.86	10.01 (NIR)	19:00	7.40	1.28	4.17
4	After harvesting (3 month) 02.03.2025		3.67	19.9+19.5+19.9+19.6+ 19.8=19.74+2.0=21.74	9.75 (NIR)	19:30	7.31	1.22	4.17
5	After harvesting (4 month) 06.04.2025		3.42	19.0+18.6+18.8+18.4+ 18.8=18.7+2.0=20.71	10.41 (NIR)	19:30	8.12	1.38	4.17
6	After harvesting (5 month) 06.05.2025		3.00	19.1+19.3+19.6+19.4+ 19.2=19.32	9.94 (NIR)	20:00	7.89	1.36	3.71
7	After harvesting (6 month) 01.06.2025		3.33	20.6+20.4+20.7+20.3+ 20.5=20.5	9.88 (NIR)	19:00	7.95	1.38	4.3

Physical properties of ALART materials 2024

Type of line	Variety/Line	Milling outturn (%)	Head rice recovery (%)	Appearance	Chalkiness %	Milled rice length (mm)	Milled rice breadth (mm)	L/B ratio	Size & Shape	1000 grains wt. (g)
DWR, 2020	BR10260-5-15-21-6B	72	62	Good	73.3	5.4	1.9	2.8	MB	25.4
Submergence 2021-22	IR16F1148	70	53	Good	84.1	5.8	1.7	3.4	MS	20.9
	BR9158-19-9-6-50-2-HR1	71	64	Good	72.2	6.1	2.0	3.05	LS	29.5

Chemical and cooking properties of ALART materials 2024

Type of line	Variety/Line	Alkali Spreading Value	Amylose content (%)	Protein content (%)	Cooking time (min.)	FR	IR
DWR, 2020	BR10260-5-15-21-6B	4.5	23.7	5.70	17:30	1.5	3.5
Submergence 2021-22	IR16F1148	3.0	13.4	7.46	19:00	1.3	3.5
	BR9158-19-9-6-50-2-HR1	4.7	22.8	5.34	18:30	1.3	3.8

GRAIN QUALITY PARAMETER FOR CONSUMER PREFERENCES

A study on the different BRRI hybrid rice varieties for superior eating quality of cooked rice

Investigators: N Ferdous (PI), U Kulsum (Hybrid) , M A Haque and S S Dipti

Normally, parboiling consists of three different actions, that is soaking in water, steaming to complete gelatinization of the starch granules and finally drying to control the moisture content of the paddy. Whereas un-parboiling is free from these operations in initial stage.

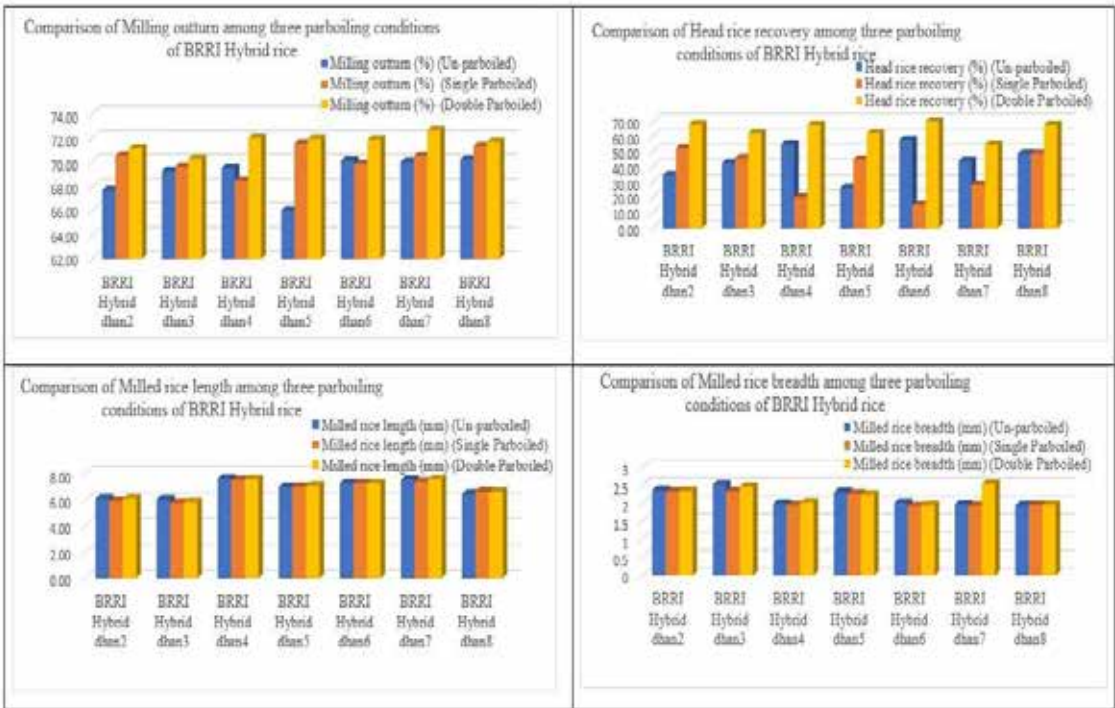
Parboiling effect on physicochemical properties of BRRI Hybrid rice : There are 3 parboiling conditions like un-parboiled, single parboiled and double parboiled. Physicochemical properties of BRRI Hybrid rice like BRRI Hybrid dhan2, BRRI Hybrid dhan3, BRRI Hybrid dhan4, BRRI Hybrid dhan5, BRRI Hybrid dhan6, BRRI Hybrid dhan7 and BRRI Hybrid dhan8, which have affected by different types of parboiling. Highest milling outturn has shown in all double parboiled BRRI Hybrid rice, followed by single parboiled BRRI Hybrid rice than the un-parboiled BRRI Hybrid rice. With the exception of single parboiled BRRI Hybrid dhan4 and single parboiled BRRI Hybrid dhan6, which have lowest milling outturn (Figure-2). Highest head rice recovery has shown in all double parboiled BRRI Hybrid rice followed by single parboiled BRRI Hybrid rice than the un-parboiled BRRI Hybrid rice. With the exception of single parboiled BRRI Hybrid dhan4, single parboiled BRRI Hybrid dhan6 and single parboiled BRRI Hybrid dhan7, which have lowest head rice recovery. On the other,

un-parboiled BRRI Hybrid dhan8 and single parboiled BRRI Hybrid dhan8 which have similar head rice recovery (Figure-2). All most similar milled rice length of BRRI Hybrid rice has shown in all parboiling conditions (Figure-2). All most similar milled rice breadth of BRRI Hybrid rice has shown in all parboiling conditions except BRRI Hybrid dhan7 (Figure-2). All most similar milled rice L/B ratio of BRRI Hybrid rice has shown in all parboiling conditions except BRRI Hybrid dhan7 (Figure-2). All most similar 1000 grains wt. of BRRI Hybrid rice has shown in all parboiling conditions (Figure-2). Highest alkali spreading value has shown in double parboiled BRRI Hybrid dhan2 and BRRI Hybrid dhan6; these 2 varieties follow the normal trend. Highest alkali spreading value has shown in un-parboiled BRRI Hybrid dhan7; this variety follows the invers trend. Most of the highest alkali spreading value has shown in single parboiled BRRI Hybrid dhan3, single parboiled BRRI Hybrid dhan4, single parboiled BRRI Hybrid dhan5 and single parboiled BRRI Hybrid dhan8 (Figure-3). Highest amylose content has shown in double parboiled BRRI Hybrid dhan2, double parboiled BRRI Hybrid dhan4, double parboiled BRRI Hybrid dhan6 and double parboiled BRRI Hybrid dhan8. On the other hand, highest amylose content has shown in single parboiled BRRI Hybrid dhan3, single parboiled BRRI Hybrid dhan5 and single parboiled BRRI Hybrid dhan7 (Figure-3). Almost similar higher moisture content has shown in all single and double parboiled BRRI Hybrid rice than the all un-parboiled BRRI Hybrid rice (Figure-3). All double parboiled BRRI Hybrid rice has highest cooking time, followed by all single parboiled BRRI Hybrid rice than the all un-parboiled BRRI Hybrid rice. With the

exception of double and single parboiled BRRi Hybrid dhan4 as well as double and single parboiled BRRi Hybrid dhan6, which have similar cooking time (Figure-3). Highest elongation has shown in single BRRi Hybrid dhan2, BRRi Hybrid dhan5, BRRi Hybrid dhan6 and BRRi Hybrid dhan8. But, others variety like BRRi Hybrid dhan3, BRRi Hybrid dhan4 and BRRi Hybrid dhan7 indicate the increasing trend gradually from un-parboiled to double parboiled (Figure-3). Most of the un-parboiled BRRi Hybrid rice have shown the highest volume expansion than the single and double parboiled BRRi Hybrid rice. With the exception of BRRi Hybrid dhan5 which has shown the highest volume expansion but BRRi Hybrid dhan6 which has shown the lowest volume expansion (Figure-3).

Parboiling effect on BRRi Hybrid rice through sensory evaluation: Varieties of excellent appearance are selected by the sensory evaluation. Five varieties (such as single and double parboiled BRRi Hybrid dhan6, double parboiled BRRi Hybrid dhan4, double parboiled BRRi Hybrid dhan7 as well as un-parboiled BRRi Hybrid dhan6) have excellent

taste among all the varieties (Figure-4). Varieties of excellent taste are selected by the sensory evaluation. Eight varieties (such as double and single parboiled BRRi Hybrid dhan6, double parboiled BRRi Hybrid dhan7, double parboiled BRRi Hybrid dhan8, un-parboiled, single parboiled and double parboiled BRRi Hybrid dhan4 as well as double parboiled BRRi Hybrid dhan5) have excellent taste among all the varieties (Figure-4). Most of the un-parboiled BRRi Hybrid rice are soft and sticky texture than the single and double parboiled BRRi Hybrid rice. They are hard and fluffy texture (Figure-4). Under different parboiling conditions, almost all BRRi Hybrid rice are non-aromatic, except un-parboiled BRRi Hybrid dhan4 (Figure-3). Under different parboiling conditions, there are 5 BRRi Hybrid rice among 21 BRRi Hybrid rice are highly acceptable by the sensory evaluation. They are double parboiled BRRi Hybrid dhan4, single parboiled BRRi Hybrid dhan6, un-parboiled BRRi Hybrid dhan4, double parboiled BRRi Hybrid dhan6 and double parboiled BRRi Hybrid dhan7 (Figure-4).



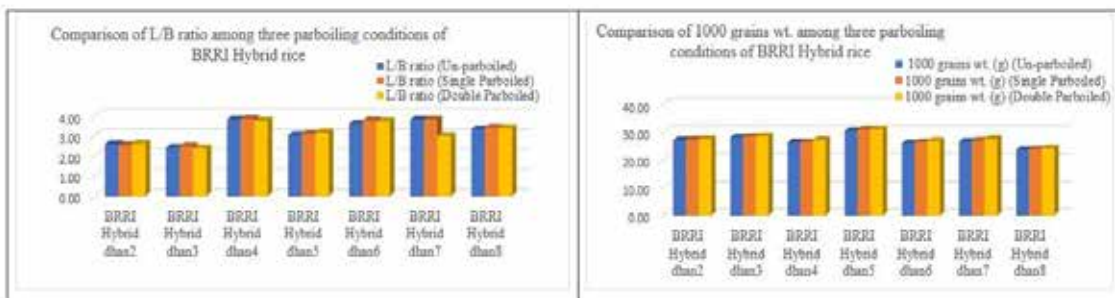


Figure-2: Comparison of milling and physical properties among three parboiling conditions of BRRI hybrid rice

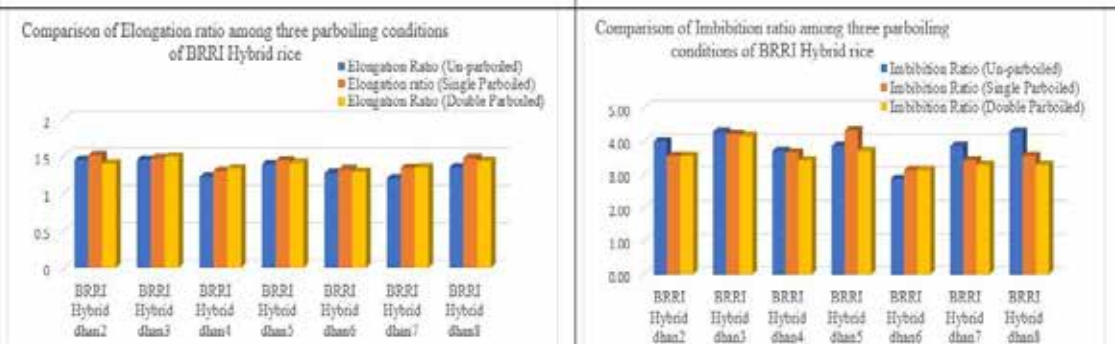
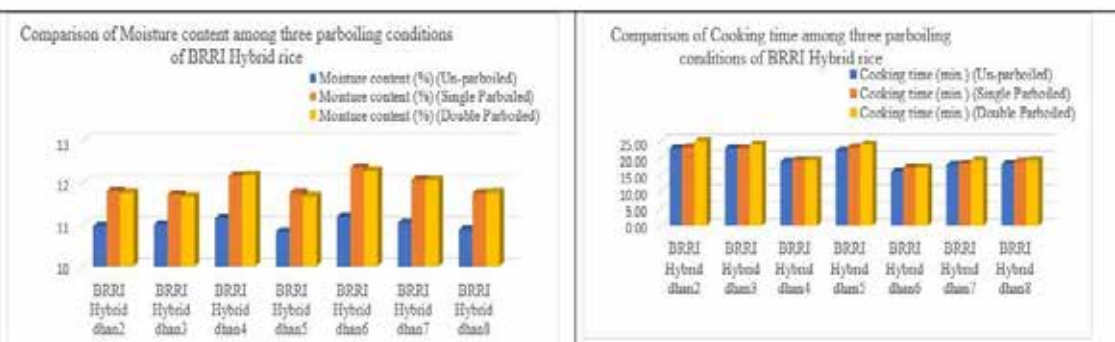
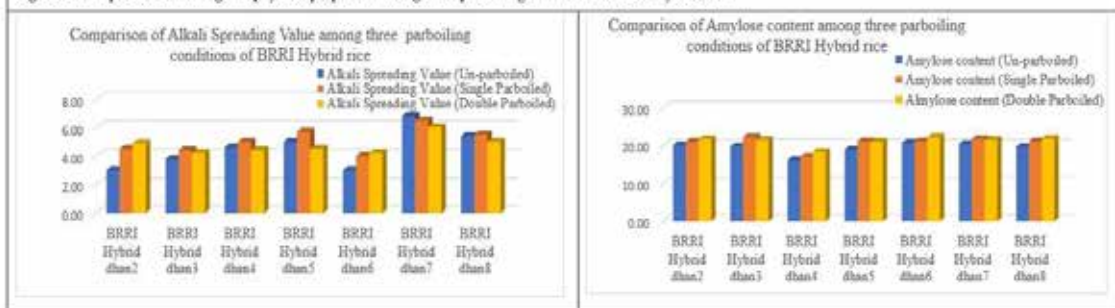
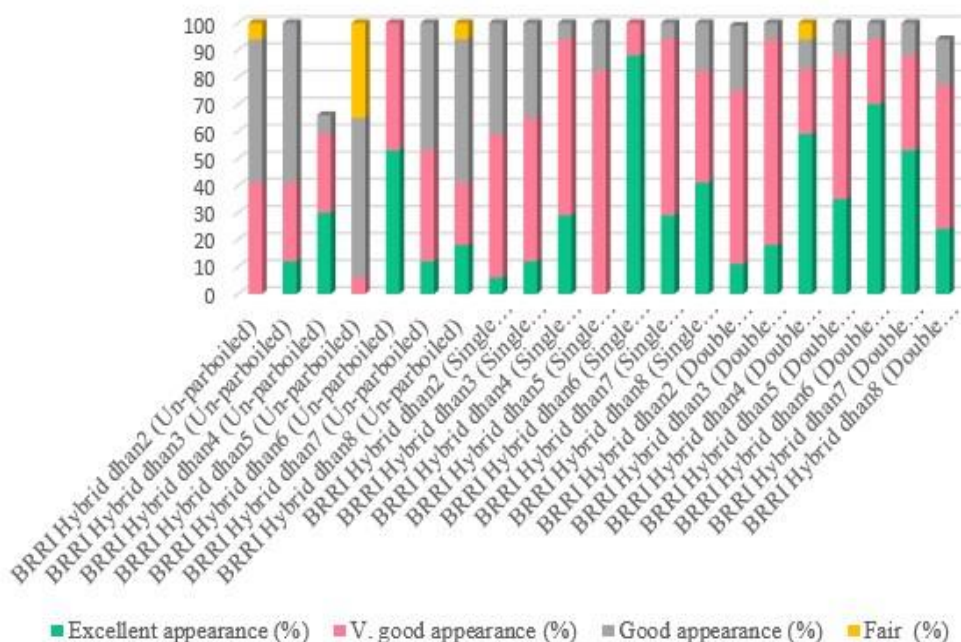


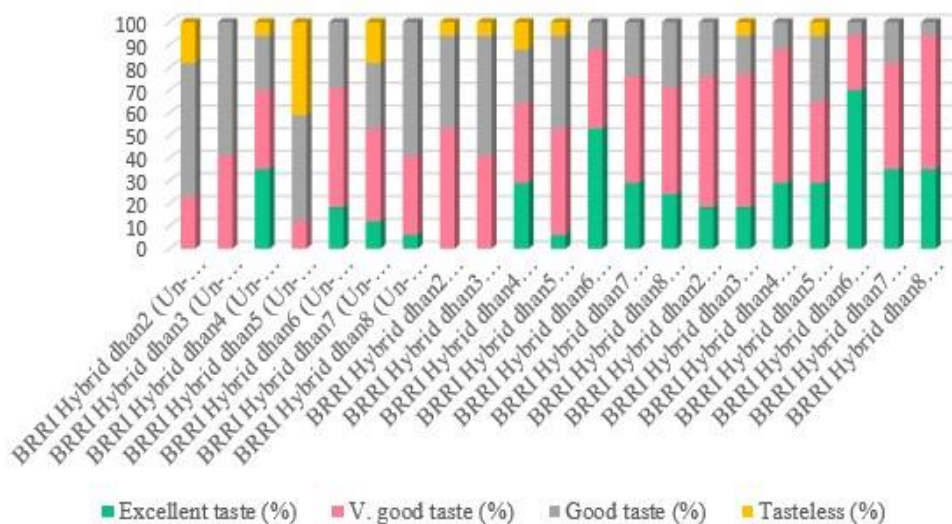
Figure-3: Comparison of chemical and cooking properties among three parboiling conditions of BRRI hybrid rice



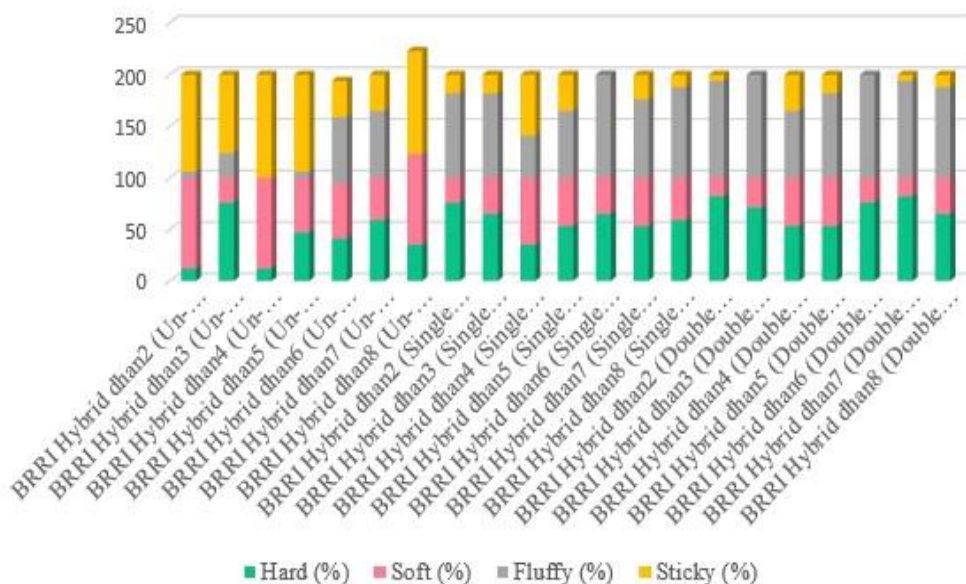
Appearance of BRRI Hybrid Cooked rice



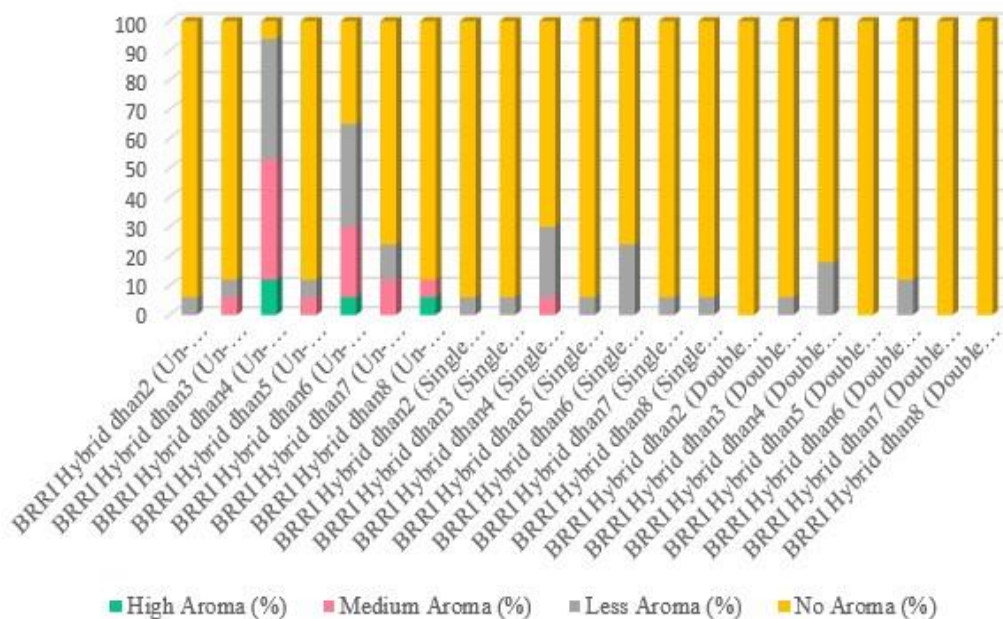
Taste of BRRI Hybrid Cooked rice

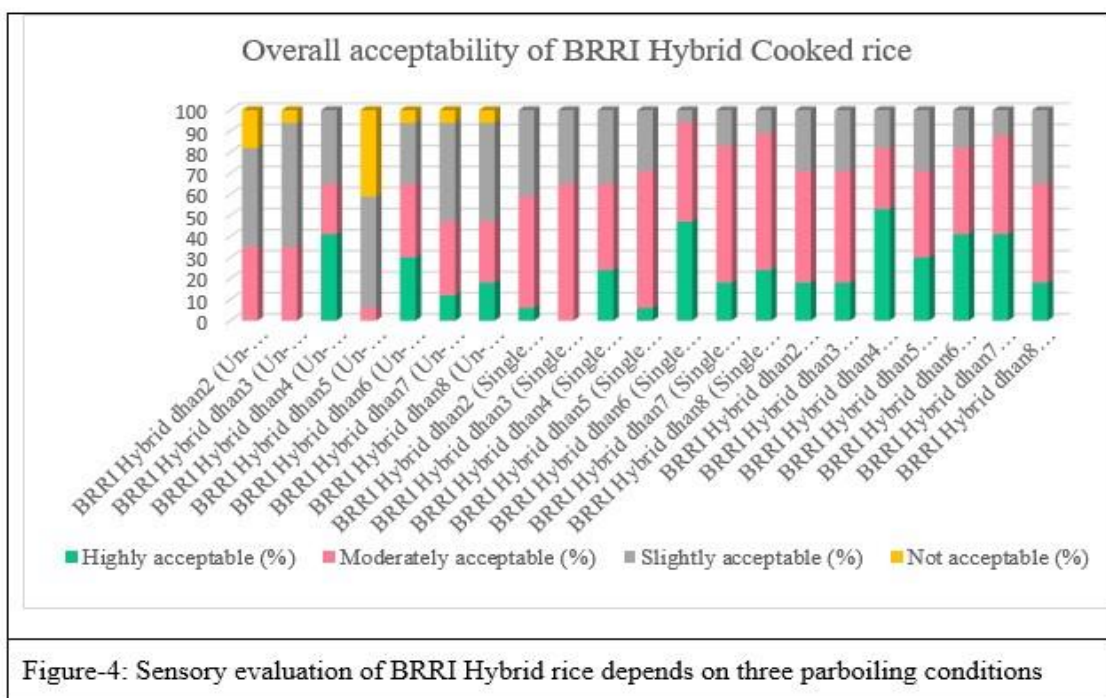


Texture of BRRI Hybrid Cooked rice



Aroma of BRRI Hybrid Cooked rice





Dietary Patterns and Consumer Preferences for Unparboiled Rice in Southeastern Bangladesh: Insights from Chattogram, Cox’s Bazar, and Bandarban

Investigators: S S Dipti, N Ferdous, T K Sarkar, H B Shozib, S Hosen and M R Akanda

The southeastern region of Bangladesh—comprising Chattogram, Cox’s Bazar, Khagrachhari, Rangamati, and Bandarban—represents a rich mosaic of coastal plains, hill tracts, and riverine ecosystems. This landscape supports a wide array of ethnic communities, agricultural systems, and food traditions that collectively shape regional dietary habits. While rice remains the staple food across Bangladesh, its mode of consumption particularly the preference for parboiled versus unparboiled forms varies significantly due to geographic, cultural, and occupational factors. This study investigates the consumption patterns and varietal preferences for unparboiled rice across selected upazilas in Chattogram, Cox’s Bazar, and Bandarban. It examines how ecological conditions, cultural heritage, farming practices, and market

access influence consumer choices, and evaluates the nutritional awareness and health implications associated with these preferences.

Survey Area and Cultivation Practices : Chattogram Region (Sitakunda, Satkania, Mirsharai). Farmers in these areas cultivate a diverse mix of rice varieties, including indigenous landraces such as *Modhumala*, *Begun Bichi*, and *Chikon Balam*, alongside high-yielding varieties (HYVs) like *BRRI dhan28*, *BRRI dhan29*, *BR11*, *BR21*, *BR22*, *BR23*, *BRRI dhan48*, and *BRRI dhan49*. The recent adoption of hybrid cultivars (*Hira*, *Laltir Gold*, *Ispahani Gold*) reflects a shift toward yield-maximizing strategies, especially in peri-urban zones.

Cox’s Bazar Region (Boyalia, Kurushkol) : In Cox’s Bazar, both southern lowlands (Boyalia) and northern regions (Kurushkol) exhibit similar varietal layering. Traditional cultivars such as *Lal Binni*, *Balam*, *Kumri*, *Khondaila Chihon*, and *Paijam* remain integral to local diets and farming systems, coexisting with a wide spectrum of HYVs (*BRRI dhan28*, *BRRI dhan29*, *BR11*, *BR21*, *BR22*, *BRRI dhan48*, *BRRI dhan49*, *BRRI dhan70*, *BRRI*

dhan75, BRRI dhan 100) and increasingly popular hybrids. This mix of traditional and modern rice varieties shows how farmers are keeping their cultural practices while also improving crop yields with new methods.

Bandarban Region (Sadar, Tigerpara, Nilachal) : Ethnic communities including the Marma, Tripura, and Chakma practice *jhum* cultivation—a rotational method involving forest clearing. Here, upland landraces such as *Jhum Bhat*, *Mro Bhat*, *Uro Dhan*, *Binni*, *Kala Binni*, *Patkhobi*, *Rangoi*, *Kilon*, *Landorare*, and *Kamboi* are grown primarily for subsistence. These varieties are typically consumed in unparboiled form, reflecting deep-rooted cultural habits and limited access to mechanized rice mills. People in these areas usually eat these rice types without parboiling, mainly because of strong cultural habits and not having easy access to modern rice mills.

Consumption Preferences and Market Availability: Survey data reveal strong household reliance on self-cultivated rice, especially in rural and upland areas. 85% of respondents cultivate rice for household use, favoring a mix of landraces and HYVs in Cox's Bazar (Boyalia, Khuruskul). 95% rely on traditional *jum* rice suited to local conditions in Bandarban (Tigerpara, Nilachal). Chattogram (Satkania): 65% consume rice they grow themselves, mostly in its unparboiled form in Chattogram (Satkania). 35% purchase rice or store paddy, also preferring the raw form Chattogram (Sitakunda and Mirsharai). This pattern underscores the importance of ethnobotanical knowledge, food sovereignty, and subsistence farming in shaping consumption behavior.

Awareness and Health Implications: Despite its popularity, nutritional awareness regarding rice processing methods remains limited. Over 90% of respondents were unaware of the health benefits of parboiled rice, including its higher resistant starch content and improved glycemic response. Taste, tradition, and digestibility were the primary reasons cited for choosing unparboiled rice. A small subset (5%) mainly sitting workers reported digestive discomfort, such as constipation, following regular intake of raw rice. Physically active individuals (farmers, fishermen, laborers) rarely experienced

such issues, suggesting that physical activity may mitigate digestive effects.

Migration and Cultural Influence: An interesting trend was observed along the Chattogram City Gate to Dhaka highway corridor, where parboiled rice consumption was more common. This aligns with the presence of migrants from Feni, Noakhali, and Laxmipur, regions traditionally associated with parboiled rice. Their dietary habits differ from native Chattogram residents, highlighting the role of migration and cultural background in shaping food choices.

Further Study and Recommendations: To build a comprehensive understanding of rice consumption in southeastern Bangladesh, the following steps are recommended: Include adjacent hill districts such as Rangamati and Khagrachhari, which possess distinct agroecological and cultural profiles. Perform comparative analysis of protein content, mineral concentrations, and amino acid profiles in parboiled vs. unparboiled rice. Develop community-based programs to raise awareness about the digestive and metabolic benefits of parboiled rice. Encourage participatory breeding and genetic conservation of culturally significant landraces. Use findings to guide culturally sensitive food policies, nutrition planning, and sustainable agriculture strategies.

Conclusion: This survey reveals a strong and persistent preference for unparboiled rice across Chattogram, Cox's Bazar, and Bandarban, rooted in cultural identity, taste expectations, and subsistence farming practices. While modern varieties and hybrids are gaining ground, traditional landraces continue to play a central role in local diets. Addressing the nutritional knowledge gap and integrating cultural preferences into food system planning will be essential for promoting resilient, diverse, and health-conscious dietary practices in southeastern Bangladesh.

Design and development of a continuous heat-treatment plant for rice bran stabilization

Investigators: T K Sarkar (PI), M R Akanda, S Hosen, H B Shozib, N Ferdous, and S S Dipti.

A continuous heat-treatment plant layout was developed, including the heat exchanger and treatment chamber, with a focus on continuous

operation and energy efficiency. An innovative husk-fired furnace was designed and fabricated, incorporating a feeding mechanism, combustion chamber, and air circulation system to ensure efficient fuel utilization. The partial heat exchanger system was fabricated and tested, with CAD-based design support. Ongoing efforts focus on integrating the furnace with the heat exchanger, refining heat flow, and exploring process control mechanisms for

stable operation. Successfully completed the conceptual design of the continuous heat-treatment plant. Fabricated a husk-fired furnace prototype with a feeding system, combustion chamber, and air circulation unit (Fig. 5a, 5b). Partially developed and fabricated the heat exchanger section (Fig. 5c). Progressed toward integrating the furnace and heat exchanger.

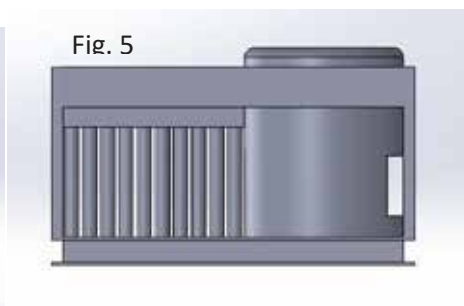
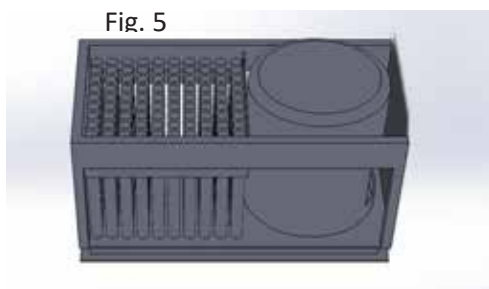


Figure: Design 5 (a), 5 (b) and prototype fabrication of a husk-fired furnace with heat exchanger 5 (c) for rice bran stabilization.

The next steps include completing the fabrication and testing of the full heat exchanger system, integrating the furnace with the heat treatment chamber for continuous operation, conducting a performance evaluation to optimize energy efficiency and stabilization effectiveness, and incorporating advanced process control technologies to ensure consistent heat treatment and improved shelf life of rice bran. The conceptual design and prototype development of a continuous

heat-treatment plant for rice bran stabilization has been successfully completed. The fabrication of a husk-fired furnace and partial heat exchanger demonstrates significant progress toward achieving an energy-efficient and sustainable system. Ongoing integration and refinement efforts are expected to ensure precise temperature control, uniform heating, and improved bran quality, ultimately extending the shelf life of rice bran.

NUTRITIONAL QUALITY ASSESMENT OF RICE

Anthocyanidin (C3G) supplemented rice-based cookies (ASRBC) attenuates chronic

Inflammation in DSS-induced colitis mouse model by modulating the gut microbiota.

Investigators: H B Shozib (PI), M Hasan (MS Thesis, PSTU), S A Islam (RAL & Agronomy), M M Islam (RAL, BRRI), M R Akanda, S Hosen, N Ferdous and S S Dipti.

A chronic colitis model was successfully established in BALB/c mice using repeated cycles of 2.5% DSS administration, mimicking key features of human ulcerative colitis at Animal facilities of GQN Division, BRRRI. Over 15 cycles, mice showed progressive symptoms including weight loss, diarrhea, rectal bleeding, shortened colon length, epithelial erosion, and crypt damage. RT-PCR confirmed elevated levels of IL-6, IL-10, and IL-23, indicating a strong inflammatory response. Metagenomic analysis revealed gut dysbiosis, with increased *Eggerthella sinensis* and *Muribaculum intestinale*, and reduced protective species like *Lactobacillus hominis* and *Leuconostoc pseudomesenteroides*. This validated model will be used to assess the anti-inflammatory effects of C3G-enriched rice-based cookies (ASRBC) and their role in restoring gut homeostasis.

To develop a DSS-induced colitis mouse model. BALB/c mice were used to develop a chronic colitis model through repeated administration of 2.5% dextran sulfate sodium (DSS) in drinking water for 5 days followed by 2 days of recovery, repeated over

15 cycles. Throughout the study, mice were monitored daily for body weight, stool consistency, and rectal bleeding. At the endpoint, colon tissues were collected for histopathological analysis using Hematoxylin and Eosin (H&E) staining to assess epithelial damage and inflammatory infiltration. Fecal samples were subjected to 16S rRNA-based metagenomic sequencing using Illumina® technology to evaluate microbial shifts. RT-PCR was performed on distal colon tissues to quantify expression of IL-6, IL-10, IL-23, and 18s RNA using the QuantStudio™ 5 system. The validated colitis model will be used to assess the therapeutic effects of anthocyanidin (cyanidin-3-glucoside, C3G)-enriched rice-based cookies (ASRBC) in modulating gut microbiota and reducing inflammation

In order to histopathology examination of distal colon of both control and DSS treated BALB/C mice we used Hematoxylin & Eosin (H&E) staining as it is ideal for assessing epithelial damage, crypt architecture, and inflammatory cell infiltration and comparing BALB/c control vs. DSS-treated colon tissue.

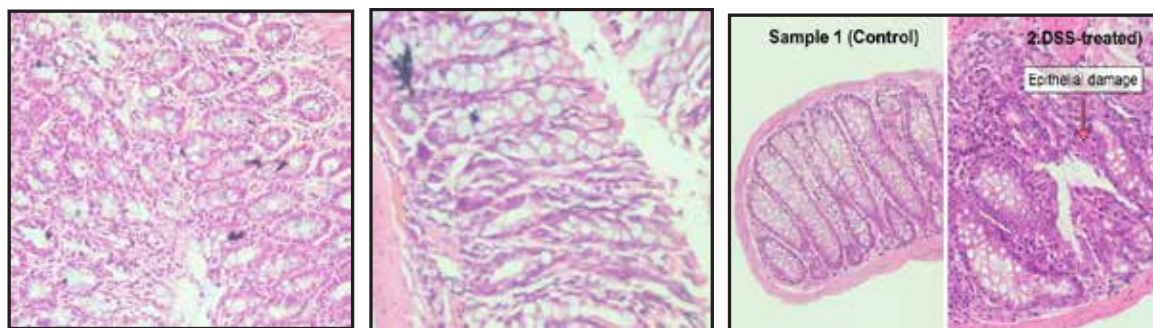


Fig.6: Distal colon (Control) Fig.7: Distal colon (DSS treated) Fig.8: Epithelial damage (Comparison).

In comparing the two histological samples, Fig.6 (Control) shows normal mucosal architecture with well-organized crypts and minimal lymphoid cell infiltration, indicating a healthy intestinal environment. In contrast, Fig.7 (DSS-treated) exhibits pronounced lymphoid hyperplasia, characterized by dense clusters of lymphoid cells within the lamina propria, disrupted crypt structure,

and signs of epithelial damage which is the hallmarks of DSS-induced chronic colitis (Fig. 8).

Metagenomics Study: In order to focus on bacteria Implicated in Gut Inflammation, we had analyzed two fecal samples such as RGMS (DSS-treated) vs RGMC (Control) for metagenomics study in Illumina® 16S Metagenomics Lab v1.0.0.

Table 5: Species-Level Abundance (% of Total Reads) in metagenomics study in gut of both Control and DSS treated mice.

Species	RGMC	RGMS	Interpretation
<i>Eggerthella sinensis</i>	0.13%	0.28%	↑ Elevated in DSS; linked to epithelial disruption
<i>Muribaculum intestinale</i>	0.18%	0.26%	↑ DSS-associated; mucin degradation
<i>Pseudoflavonifractor phocaeensis</i>	0.16%	0.20%	↑ Butyrate producer; role in inflammation context-dependent
<i>Lactobacillus hominis</i>	—	0.13%	↓ Protective; upregulated in probiotic responses
<i>Leuconostoc pseudomesenteroides</i>	0.10%	—	↓ Decreased in DSS; supports gut homeostasis

Our metagenomics data reveals that pro-inflammatory taxa (*Eggerthella*, *Flavonifractor*) are significantly elevated in the DSS-treated sample (RGMS), consistent with colitis-like dysbiosis. Protective and probiotic genera (*Lactobacillus*, *Leuconostoc*, *Weissella*) are reduced or absent in RGMS, indicating DSS-induced microbial imbalance. Species-level shifts reinforce epithelial stress and mucin degradation in RGMS, with *Muribaculum intestinale* and *Eggerthella sinensis* notably increased (Table 5).

Cytokine assay by RTPCR: Gene expression analysis of IL-6, IL-10, IL-23, and 18s RNA

(housekeeping gene) was performed on colon samples from control and DSS-treated BALB/C mice using RT-PCR Quantsudio 5 at the Rice Analytical Laboratory (RAL). The data revealed elevated expression of pro-inflammatory cytokines IL-6, IL-10 and IL-23 in DSS-treated tissues, particularly in the distal colon, as indicated by lower Ct values. The 18s RNA levels remained stable across all samples, validating assay consistency and RNA integrity. These findings confirm DSS-induced colonic inflammation and support its utility as a model for studying mucosal immune responses.

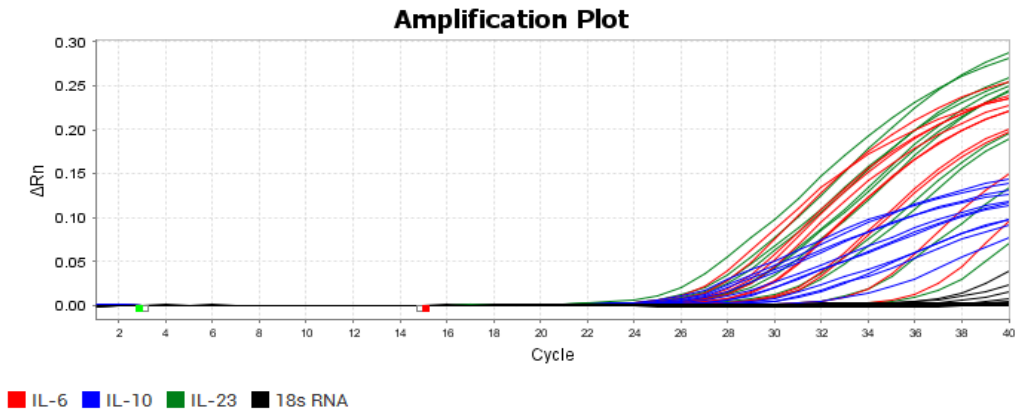


Fig. 9: Amplification plot of IL-6, IL-10, IL-23 and 18s RNA (Housekeeping Gene) genes.

The RT-PCR data reveals distinct expression patterns of inflammation-related genes in DSS-treated versus control BALB/C mice. Pro-

inflammatory cytokines IL-6, IL-10 and IL-23 show lower Ct values in DSS-treated than control samples especially in the distal colon indicating elevated

expression and a heightened inflammatory response (Fig.9 and Fig 10). The 18s RNA levels remain consistent across all groups, validating the assay’s reliability. Overall, the data reflects a DSS-induced

shift toward pro-inflammatory gene expression, with regional variation in the colon, supporting its role as a model for colitis and mucosal inflammation.

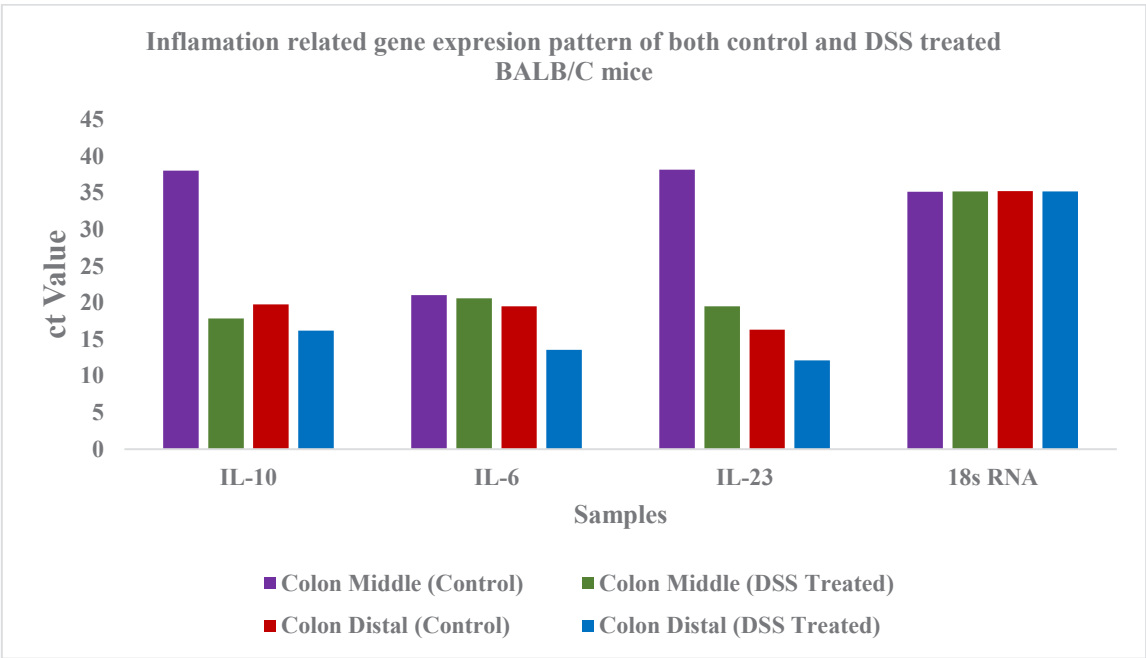


Fig. 10 : Gene expression pattern of IL-6, IL-10, IL-23 and 18s RNA (Housekeeping Gene) genes (ct values).

Conclusion: The combined histopathological, metagenomic, and molecular analyses confirm that DSS treatment induces significant colonic inflammation in BALB/C mice, particularly in the distal region. H&E staining revealed hallmark features of chronic colitis, including epithelial damage, crypt distortion, and lymphoid hyperplasia. Metagenomic profiling further supported this pathology, showing a shift toward pro-inflammatory bacterial taxa such as *Eggerthella sinensis* and *Muribaculum intestinale*, alongside a reduction in protective genera like *Lactobacillus hominis* and *Leuconostoc pseudomesenteroides*, indicating DSS-induced dysbiosis. RT-PCR cytokine assays demonstrated elevated expression of IL-6, IL-10, and IL-23 in DSS-treated samples, with consistent 18s RNA levels validating assay integrity. Collectively, these findings establish DSS-treated Bangladesh has achieved rice self-sufficiency through the widespread adoption of high-yielding varieties (HYVs), especially during the BORO season—the country’s most productive rice-growing

BALB/C mice as a robust model for studying gut inflammation, epithelial disruption, and host-microbiota interactions in colitis.

Future study: The validated colitis model is currently used to assess the therapeutic effects of anthocyanidin (cyanidin-3-glucoside, C3G)-enriched rice-based cookies (ASRBC) in modulating gut microbiota and reducing inflammation at GQN Division BRRI. Details results will be reported and published while completing the experiment.

Nutritional Profiling of Traditional pigmented BORO Rice Cultivars in Bangladesh—A Strategic Response to Micronutrient Deficiency and NCDs

Investigators: S Hosen (PI), H B Shozib, N Ferdous, T K Sarkar and S S Dipti.

period. While this has improved food security, it has also led to nutritional challenges. The dominance of parboiled olished white rice, particularly in rural diets, results in significant losses of iron, zinc,

phosphorus, fiber, and B-complex vitamins due to industrial milling. With rice contributing over 70% of daily caloric intake, micronutrient deficiencies and non-communicable diseases (NCDs) are rising. Addressing this dual burden requires nutrition-sensitive agricultural strategies. Integrating nutrient-rich traditional cultivars into BORO season production and prioritizing high-mineral parental lines in breeding programs can enhance rice's nutritional value. This approach supports public health, sustainable agriculture, and national resilience against diet-related health challenges.

Seventeen traditional BORO rice cultivars namely Ausha Boro, Bali Boro, Kali Boro, Rata Boro, Ghagu Boro, Topa Boro, Jaista Boro, Tepi Boro, Sada Boro, Tulsi Boro, Ghuni Boro, Bhatuari,

Dudsaita, Kumri Boro, Cunai, Dhali Boro, Boro, and Jagli Boro were obtained from the Genetic Resources and Seed (GRS) Division of the Bangladesh Rice Research Institute (BRRI). Elemental analysis of these cultivars was conducted at the Rice Analytical Laboratory (RAL) using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES9820), following standardized protocols for multi-element quantification.

The elemental profiling of seventeen traditional BORO rice cultivars revealed substantial variation in micronutrient accumulation, underscoring the genetic diversity and differential nutrient uptake capacities among landraces.

Cultivars	Fe (mg/kg)	K (mg/kg)	Na(mg/kg)	Zn (mg/kg)	P (g/Kg)
<u>Ausha Boro</u>	7.7	720	112	11.85	1.59
<u>Bali boro</u>	15.64	745	116.5	13	1.63
<u>Kali Boro</u>	7.36	710	110.5	11.2	1.52
<u>Rata Boro</u>	7.76	690	103.5	11.8	1.53
<u>Ghugu Boro</u>	12	730	98	11.8	1.78
<u>Topa Boro</u>	8.42	640	104	13.15	1.63
<u>Jaista Boro</u>	13.98	655	80.5	11.6	1.69
<u>Tepi Boro</u>	22.8	610	90.5	14.8	1.58
<u>Sada Boro</u>	14.44	650	103	16.15	1.63
<u>Tulsi Boro</u>	8.28	675	67.5	11.45	1.65
<u>Ghuni Boro</u>	9.4	600	79.5	12.3	1.53
<u>Bhatuari</u>	5.4	635	129.5	12.35	1.56
<u>Dudsaita</u>	4.42	665	70	12.25	1.55
<u>Kuonri Boro</u>	4.1	590	68.5	12.55	1.52
<u>Cunail</u>	5.54	700	76.5	11.8	1.69
<u>Dhali Boro</u>	8.2	630	137.5	11.1	1.49
<u>Jagli Boro</u>	6.32	655	75.5	10.25	1.65

Iron (Fe) concentrations varied markedly across cultivars, with Tulsi Boro(14.98 mg/kg) and Sada Boro (12.44 mg/kg) exhibiting the highest levels. These cultivars may serve as promising candidates for iron biofortification, particularly in the context of addressing iron-deficiency anemia

prevalent in rice-dependent populations. In contrast, Kumri Boro(5.32 mg/kg), Ghuni, and Dudsaita (5.44 mg/kg each) recorded the lowest Fe concentrations, indicating limited iron translocation or accumulation in grain tissues. Potassium (K) levels were notably elevated in *Tulsi* (870 mg/kg) and *Sada* (845 mg/kg),

suggesting enhanced osmotic regulation and potential resilience to abiotic stress conditions such as drought or salinity. These cultivars may possess superior potassium transport mechanisms or root architecture conducive to K uptake. Conversely, cultivars like *Kumri* (590 mg/kg) and *Dudsaita* (600 mg/kg) demonstrated comparatively lower K content, which may reflect either genetic limitations or environmental constraints during cultivation. Sodium (Na) concentrations displayed the widest range among all elements analyzed. *Jagli* recorded the lowest Na content (75.5 mg/kg), which may indicate inherent salinity tolerance or restricted Na uptake pathways. In contrast, *Cunai* (135.5 mg/kg) showed the highest Na accumulation, potentially reflecting either high soil salinity exposure or cultivar-specific ion transport dynamics. The variation in Na levels is particularly relevant for breeding programs targeting salt-affected regions. Phosphorus (P) was measured in g/kg due to its higher abundance and agronomic relevance. The cultivars *Ghuni*, *Dudsaita*, and *Cunai* each exhibited the highest P concentrations (1.65 g/kg), suggesting efficient phosphorus uptake and translocation mechanisms. These cultivars may be well-suited for low-input farming systems where phosphorus availability is limited, thereby contributing to sustainable nutrient management strategies. Zinc (Zn) concentrations were relatively uniform across cultivars, ranging from 10.25 to 11.80 mg/kg. *Bali* demonstrated the highest Zn content (11.80 ppm), while *Ghuni*, *Dudsaita*, and *Cunai* recorded the lowest (10.25 mg/kg). Although the variation was modest, even small differences in Zn accumulation can have significant implications for human nutrition, particularly in regions where zinc deficiency is prevalent.

The elemental characterization of traditional BORO rice cultivars using ICP-OES9820 revealed substantial macro- and micronutrient variability, highlighting the genetic richness inherent in Bangladesh's indigenous rice germplasm. Cultivars such as Tulsī Boro and Sada Boro, exhibiting elevated iron concentrations (14.98 ppm and 12.44 ppm, respectively), demonstrate strong potential for biofortification initiatives or utilization as donor parents in breeding programs targeting iron-deficiency anemia. Similarly, *Ghuni* Boro and *Cunail*, with superior phosphorus content (1.65

g/kg), offer agronomic advantages for nutrient-efficient cultivation under low-input conditions. These findings substantiate the nutritional relevance of traditional BORO cultivars and emphasize their strategic role in mitigating the escalating prevalence of non-communicable diseases (NCDs) in Bangladesh through sustainable, food-based interventions. The integration of nutrient-dense landraces into large-scale BORO season production systems presents a viable pathway to improve dietary quality, enhance public health outcomes, and support environmentally resilient agriculture.

COMMERCIAL RICE BASED PRODUCTS

A study on the ruti and pitha through different level of amylose containing rice samples that are responsible for palatability

Investigators: N Ferdous (PI), M R Akanda, S Hosen, N Ferdous and S S Dipti.

To identify popular tasty roti and pitha (chittoi pitha) of high, intermediate and V. low amylose containing rice varieties and cultivars in relation to the palatability. Intermediate amylose containing three local rice cultivars (Pukky, Rata Boro and Habiganj-VIII) were collected from BRRI farm. All analysis was done as per GQN manual and traditional methods in Grain Quality and Nutrition division.

There are three (3) local rice cultivars (Pukky, Rata Boro and Habiganj -VIII) with intermediate amylose content (20.0-23.0) % based on different size and shape (MB, SB and SR). Medium Bold (MB) type Pukky has shown the translucent chalkiness (Tr) with good appearance grain, which have 70% milling outturn, 62% head rice recovery and 21.8g thousand grain wt. (Table-6) as well as 5.8 ASV, 22.6% amylose content, 20:00 min. cooking time, 1.4 ER and 4.2 IR (Table-7). Short Bold (SB) type (Rata Boro) has shown the translucent, white center and opaque chalkiness (Tr<Wc5 & Opaque) with good appearance grain, which have 69% milling outturn, 24% head rice recovery and 20.5g thousand grain wt. (Table-6) as well as 4.0 ASV, 23.0% amylose content, 18:30 min. cooking time, 1.3 ER and 4.2 IR (Table-7). Short Round (SR) type (Habiganj -VIII) has shown the opaque chalkiness (Opaque) with good appearance grain, which have 71% milling outturn, 65% head rice recovery and 21.8g thousand grain wt. (Table-6)

as well as 5.2 ASV, 20.4% amylose content, 15:30 min. cooking time, 1.8 ER and 4.2 IR (Table-7).

Result for sensory evaluation (Figure-11): Roti was made in rice flour of Pukky in three methods (Table-8). These methods were Traditional procedure: (Rice flour dough in boiled water), Electric Roti Maker: (Rice flour dough in normal water) and Electric Roti Maker: (Rice flour dough in boiled water). Again, all procedures were divided into two classes like Roti without oil and Roti with oil. In the case of traditional procedure (Rice flour dough in boiled water): In the 1st day 100% panelists have preferred soft roti (without oil) and 91% panelists have preferred soft roti (with oil) but 9% panelists have preferred soft roti in both situation (without oil & with oil) in the 2nd day. In the 1st day 55% panelists have preferred excellent taste (without oil) and 91% panelists have preferred excellent taste (with oil) but 46% panelists have preferred excellent taste in both situation (without oil & with oil) in the 2nd day. Electric Roti Maker (Rice flour dough in normal water): In the 1st day 36% panelists have preferred medium soft roti (without oil) and 9% panelists have preferred medium soft roti (with oil) but 55% panelists have preferred medium soft roti (without oil) and 9% panelists have preferred medium soft roti (with oil) in the 2nd day. In the 1st day 9% panelists have preferred medium taste (without oil) and 18% panelists have preferred medium taste (with oil) but no panelists have preferred medium taste (without oil) and 18% panelists have preferred medium taste (with oil) in the 2nd day. Electric Roti Maker (Rice flour dough in boiled water): In the 1st day 27% panelists have preferred soft roti (without oil) and 9% panelists have preferred soft roti (with oil) but 9% panelists have preferred soft roti (without oil) and no panelists have preferred soft roti (with oil) in the 2nd day. In the 1st day 46% panelists have preferred excellent taste (without oil) and no panelists have preferred excellent taste (with oil) but 9% panelists have preferred excellent taste (without oil) and no panelists have preferred excellent taste (with oil) in the 2nd day.

Roti was made in rice flour of Rata Boro in three methods (Table-9). These methods were Traditional procedure: (Rice flour dough in boiled water), Electric Roti Maker: (Rice flour dough in normal water) and Electric Roti Maker: (Rice flour

dough in boiled water). Again, all procedures were divided into two classes like Roti without oil and Roti with oil.

In the case of traditional procedure (Rice flour dough in boiled water): In the 1st day and in the 2nd day, 100% panelists both have preferred soft roti (without oil and with oil). In the 1st day 45% panelists have preferred excellent taste (without oil) and 91% panelists have preferred excellent taste (with oil) but 9% panelists have preferred excellent taste (without oil) and 18% panelists have preferred excellent taste (with oil) in the 2nd day.

Electric Roti Maker (Rice flour dough in normal water): In the 1st day 9% panelists both have preferred medium soft roti (without oil & with oil) but no panelists both have preferred medium soft roti (without oil & with oil) in the 2nd day. In the 1st day no panelists have preferred medium taste (without oil) but 27% panelists have preferred medium taste (with oil). In the 2nd day no panelists both have preferred medium taste (without oil & with oil).

Electric Roti Maker (Rice flour dough in boiled water): In the 1st day 27% panelists have preferred medium soft roti (without oil) and 91% panelists have preferred medium soft roti (with oil) but no panelists have preferred medium soft roti (without oil) and 100% panelists have preferred medium soft roti (with oil) in the 2nd day. In the 1st day 37% panelists have preferred medium taste (without oil) and 27% panelists have preferred medium taste (with oil) but no panelists both have preferred medium taste (without oil & with oil) in the 2nd day.

Roti was made in rice flour of Habiganj-VIII in three methods (Table-10). These methods were Traditional procedure: (Rice flour dough in boiled water), Electric Roti Maker: (Rice flour dough in normal water) and Electric Roti Maker: (Rice flour dough in boiled water). Again, all procedures were divided into two classes like Roti without oil and Roti with oil.

In the case of traditional procedure (Rice flour dough in boiled water): In the 1st day and in the 2nd day, 100% panelists both have preferred soft roti (without oil and with oil). In the 1st day 100% panelists both have preferred excellent taste (without oil & with oil) but 9% panelists both have preferred excellent

taste (without oil & with oil) in the 2nd day. Electric Roti Maker (Rice flour dough in normal water): In the 1st day 27% panelists have preferred medium soft roti (without oil) and 9% panelists have preferred soft roti (with oil) but 91% panelists have preferred medium soft roti (without oil) and 9% panelists have preferred soft roti (with oil) in the 2nd day. In the 1st day 9% panelists both have preferred excellent taste (without oil and with oil) but no panelists both have preferred excellent taste (without oil and with oil) in the 2nd day.

Electric Roti Maker (Rice flour dough in boiled water): In the 1st day 91% panelists have preferred medium soft roti (without oil) but 9% panelists have preferred soft roti (with oil). In the 2nd day 73% panelists have preferred medium soft roti (without oil) and 45% panelists have preferred medium soft roti (with oil). In the 1st day no panelists have preferred excellent taste (without oil) but 9% panelists have preferred excellent taste (with oil) but no panelists both have preferred excellent taste (without oil & with oil) in the 2nd day.



Traditional Method



Electric roti maker



Hobigoanj-VIII
Traditional procedure: Roti without oil

Figure-11: Preparation of roti through different method

Table-6: Physical properties of Genotypes, provided by GQN Division for Roti

AC #	Variety/Line	Milling outturn (%)	Head rice recovery (%)	Appearance	Chalkiness	Milled rice length (mm)	Milled rice breadth (mm)	L/B ratio	Size & Shape	1000 grain wt. (g)
22825	<u>Pukky</u>	70	62	Good	Tr	5.4	2.4	2.3	MB	21.8
22826	Rata Boro	69	24	Good	Tr<Wc5 & Opaque	5.0	2.3	2.2	SB	20.5
22827	<u>Hobigoanj</u> -VIII	71	65	Good	Opaque	4.8	2.6	1.8	SR	21.8

Table-7: Chemical and cooking properties of Genotypes, provided by GQN Division for Roti

AC #	Variety/Line	Alkali Spreading Value	Amylose content (%)	Protein content (%)	Cooking time (min.)	ER	IR
22825	<u>Pukky</u>	5.8	22.6	10.98 (NIR)	20:00	1.4	4.2
22826	Rata Boro	4.0	23.0	9.23 (NIR)	18:30	1.3	4.2
22827	<u>Hobigoanj</u> -VIII	5.2	20.4	8.00 (NIR)	15:30	1.8	4.2

Table-8: Sensory evaluation of roti from Pukky

Procedure of Roti	Ingredient	Shelf-life of Roti (22825, Pukky)													
		1 st day							2 nd day						
		Texture			Taste				Texture			Taste			
		Soft	Medium Soft	Hard	Excellent Taste	Medium Taste	Slightly Taste	No Taste	Soft	Medium Soft	Hard	Excellent Taste	Medium Taste	Slightly Taste	No Taste
Traditional procedure: (Rice flour dough in boiled water)	Roti without oil	100			55	36	9		9	91		46	18	36	
	Roti with oil	91		9	91		9		9	91		46	9	45	
Electric Roti Maker: (Rice flour dough in normal water)	Roti without oil		36	64		9	64	27		55	45			55	45
	Roti with oil		9	91		18	36	46		9	91		18	27	55
Electric Roti Maker: (Rice flour dough in boiled water)	Roti without oil	27	55	18	46	27	18	9	9	73	18	9		64	27
	Roti with oil	9	64	27		27	55	18		64	36			55	45

Table-9: Sensory evaluation of roti from Rata Boro

Procedure of Roti	Ingredient	Shelf-life of Roti (22826, Rata Boro)													
		1 st day							2 nd day						
		Texture			Taste				Texture			Taste			
		Soft	Medium Soft	Hard	Excellent Taste	Medium Taste	Slightly Taste	No Taste	Soft	Medium Soft	Hard	Excellent Taste	Medium Taste	Slightly Taste	No Taste
Traditional procedure: (Rice flour dough in boiled water)	Roti without oil	100			45	55			100			9	18	73	
	Roti with oil	100			91	9			100			18	27	46	9
Electric Roti Maker: (Rice flour dough in normal water)	Roti without oil		9	91			9	91			100				100
	Roti with oil		9	91		27	18	55			100			9	91
Electric Roti Maker: (Rice flour dough in boiled water)	Roti without oil		27	73		37	36	27			100			64	36
	Roti with oil		91	9		27	37	36		100				73	27

Table-10: Sensory evaluation of roti from Habiganj-VIII

Procedure of roti	Ingredient	Shelf-life of roti (22827, Habiganj-VIII)													
		1 st day							2 nd day						
		Texture			Taste				Texture			Taste			
		Soft	Medium Soft	Hard	Excellent Taste	Medium Taste	Slightly Taste	No Taste	Soft	Medium Soft	Hard	Excellent Taste	Medium Taste	Slightly Taste	No Taste
Traditional procedure: (Rice flour dough in boiled water)	Roti without oil	100			100				100			9	37	27	27
	Roti with oil	100			100				100			9	46	18	27
Electric Roti Maker: (Rice flour dough in normal water)	Roti without oil		27	73	9	18	18	55		91	9			27	73
	Roti with oil	9		91	9	9	55	27	9		91		9	27	64
Electric Roti Maker: (Rice flour dough in boiled water)	Roti without oil		91	9		18	82			73	27			45	55
	Roti with oil	9	36	55	9	27	9	55		45	5		9	73	18

Design and development of a mechanical system for chutki semai (rice vermicelli) production

Investigators: T K Sarkar (PI), M R Akanda, S Hosen, H B Shozib, N Ferdous, and S S Dipti.

A prototype mechanical system for rice vermicelli production was designed and fabricated as part of the initial development phase (Fig. 1 & 2). To evaluate

its performance, a series of preliminary trials were conducted. Based on observations during these trials, issues related to material flow and insufficient internal pressure were identified. As a result, the extruder and die will be redesigned to address these specific challenges and improve overall functionality.

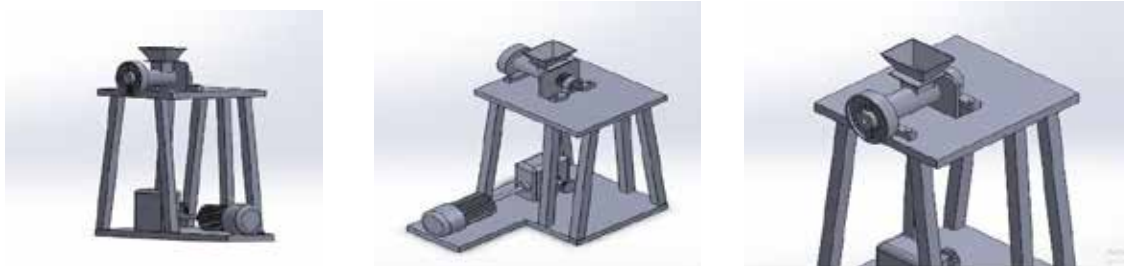


Figure 12. Prototype mechanical system for rice vermicelli production.



Figure 13. Performance evaluation of the fabricated rice vermicelli machine.

The initial prototype of the rice vermicelli machine showed several operational issues during testing. The most significant problems were material clogging and inadequate internal pressure, which disrupted smooth extrusion and consistent product formation. To resolve these issues, a new extruder design will be developed to improve material flow and pressure generation. In addition, a redesigned die will be introduced to ensure uniform product size and the formation of fine semai strands. Further refinements will also be made to enhance the overall efficiency of the machine and the quality of the final product.

In conclusion, the design and initial fabrication of a mechanical system for chutki semai production successfully established a functional prototype. Preliminary trials identified operational

challenges, including material clogging and insufficient internal pressure, which affected extrusion consistency and product quality. To address these issues, the extruder and die will be redesigned to improve material flow, pressure generation, and uniformity of semai strands. Further refinements will focus on enhancing machine efficiency and ensuring high-quality, standardized rice vermicelli production.

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Hybrid Rice Division

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SUMMARY

In T. Aman season 2024, a total of 116 test crosses and 456 ($A \times R$) crosses were made from source nursery. Eighty-nine test crosses (F_1 s) were evaluated for their pollen fertility status of which two entries have been found heterotic over check varieties. Pollen parent of this combination was regarded as suspected restorer and selected for fertility restoration ability with other CMS lines in the next season. None of the testcross entries was found completely sterile. All backcross generations were advanced to next generations except for four BC_3 and one BC_1 generations. It was discarded due to fluctuation in pollen fertility, disease susceptibility and repeatability of parent. One hundred-thirteen CMS lines along with their respective maintainer lines were maintained by hand crossing. A total of 274 test crosses and 230 ($A \times R$) crosses were made using 14 CMS lines in Boro season 2024-25. Sixty-eight test crosses (F_1 s) were evaluated for their pollen fertility status. Among them four entries showed complete sterility and immediately backcrossed with their corresponding male parents for conversion. On the other hand, none of the entries found heterotic over check varieties. Nine BC_6 generations were advanced as new CMS lines and shifted to CMS maintenance and evaluation nursery. Other entries were advanced for next generations except two BC_2 generation were discarded due to pollen fertility fluctuation. One hundred sixty-two CMS lines along with their respective maintainer lines were maintained by hand crossing in CMS maintenance and evaluation nursery for their genetic purity.

In T. Aman, out of 549 test hybrids under observational trials, nine hybrid combinations were selected based on yield, duration and grain type and expressed more than 7-23% yield advantage over the check variety BRR1 hybrid dhan6, 5-21% over AZ7006, 2-17

% over Dhanny Gold and 8-25% over Bayer hybrid dhan8. The heritability obtained from growth duration and grain yield were 92 % and 74 % respectively indicating high level of precision in this experiment. Upon commercial seed production feasibility of these selected hybrid combinations, PYT and MLT trials will be conducted based on satisfactory yield advantage over the check, hybrid combination will be submitted to SCA trials.

In Boro, Out of 39 hybrids nine hybrid combinations were selected based on yield, growth duration and other desired characters. The selected entries showed yield potential at least 8.4 t/ha. The selected hybrid combinations expressed 1-12% yield advantage over BRR1 hybrid dhan8, 35-67% over Tej Gold, 6-31% over SL8H and 1-18% over Heera-21. Upon commercial seed production feasibility of these selected hybrid combinations, PYT and MLT trials will be conducted based on satisfactory yield advantage over the check, hybrid combination will be submitted to SCA trials. Under parental line improvement programme ($B \times B$ and $R \times R$), thirteen ($B \times B$) and Thirty ($R \times R$) crosses were confirmed as true hybrid. True F_1 Plants were selected comparing with respective parents. Disease free seeds were collected from ($B \times B$) and ($R \times R$) crosses. Under field rapid generation advancement programme, 47,000 progenies of F_2 , F_3 , F_4 and F_5 from 94 crosses were advanced to next generation using field rapid generation advance (FRGA) technique and harvested of 13,886 progenies of $B \times B$, $R \times R$ and $A \times R$ crosses in T Aman 2024. In Boro, eight ($B \times B$) and 12 ($R \times R$) crosses were confirmed as true hybrid. True F_1 Plants were selected comparing with respective parents. Disease free seeds were collected from ($B \times B$) and ($R \times R$) crosses. A total of 58750 progenies of F_2 , F_3 , F_4 , F_5 and F_6 from 127 crosses were advanced to next generation using field rapid generation advance (FRGA) technique and harvested 27,320 progenies in

Boro 2024-25. In T. Aman preliminary yield trials, two hybrids were selected out of 13 and showed yield advantage 10-19 % over BRRI hybrid dhan6, 15-24 % over AZ7006 and 4-12 % over Dhanny Gold. Under multi-location trials two hybrids were selected and expressed yield advantage 31-32% over BRRI hybrid dhan6, 29-30 % over AZ7006, 19-21 % over check variety Dhanny Gold and 27-28% over Bayer hybrid dhan8. In Boro, twelve hybrids were found performed 4-23% higher yield over the lowest yielded check Tej Gold (7.85t/ha) and 2-20% higher yield over check Heera-19 (8.04t/ha) whereas nine hybrids showed 1-12% higher yield on the check Suborno-3 (8.60t/ha). None of the hybrids was found out yielded over the check BRRI hybrid dhan8 (9.91t/ha). Growth duration (GD) and number of effective tillers (ET) of the tested entries were similar with the check varieties except Suborno-3 (136 days). In Boro, multi-location yield trials comprised 15 hybrids with four checks. Three hybrids were selected based on average yield of five locations over check varieties and expressed 7-9% yield advantage over BRRI hybrid dhan8, 22-24 % over Suborno-3, 15-17% over Heera-21 and 22-24 % over Tej Gold.

Twelve CMS lines including promising and released hybrids were multiplied during T. Aman 2024 in small to medium scale and got total seed yield of 175 kg. It was ranging from 0.7 kg to 55 kg/plot. CMS line multiplication of BRRI hybrid dhan3 and BRRI hybrid dhan8 was conducted and seed yield got 100 kg and 650 kg respectively, which was equivalent to 0.5 and 1.3 t/ha respectively. Experimental F₁ seed production was made using 14 CMS with seven different restorer lines and seed yield was ranging 0.05-30.3 kg/plot from selected promising hybrid combinations during T. Aman 2024, which was equivalent to 0.0025 to 1.5 t/ha. Seventy-two experimental hybrids were evaluated in augmented design during T. Aman 2024 and

selected five hybrids expressed yield advantage 8-30% over all check varieties. In Boro 2024-25, a total of 103 experimental hybrids were evaluated in augmented design and selected six hybrids based on yield, growth duration and grain quality and showed at least 5% yield advantage over the highest yielded check variety. In Boro 2024-25, CMS seed yield 200 kg (1.0 t/ha) from BRRI hybrid dhan2, 1590 kg (1.7 t/ha) from BRRI hybrid dhan3, 358 kg (1.4 t/ha) from BRRI hybrid dhan5, 1622 kg (2.4 t/ha) from BRRI hybrid dhan6 and 4,706 kg (2.04 t/ha) from BRRI hybrid dhan8 were obtained. Hybrid seed yield 192 kg (2.2 t/ha) from BRRI hybrid dhan5, 455 kg (1.8 t/ha) from BRRI hybrid dhan6, 648 kg (2.5 t/ha) from BRRI hybrid dhan7 and 252 kg (1.08 t/ha) from BRRI hybrid dhan8 were obtained from Gazipur. From production side (Ishwardi) 522 kg (2.18 t/ha) from BRRI hybrid dhan2, 10,175 kg (2.54 t/ha) from BRRI hybrid dhna3, 1,300 kg (2.3 t/ha) from BRRI hybrid dhan4, 4,500 kg (2.3 t/ha) from BRRI hybrid dhan5, 10,000 kg (2.78 t/ha) from BRRI hybrid dhan6, 7,740 kg (2.76 t/ha) from BRRI hybrid dhan7 and 27,000 kg (1.98 t/ha) of BRRI hybrid dhan8 F₁ seeds have been obtained. In T Aman 2024, Hybrid Rice Division supplied 8,850 kg F₁ seeds to 83 farmers, 13 seed companies, scientists, extension people, projects and staffs of BRRI. In Boro 2024-25, This Division supplied 19,575 kg F₁ seeds to 130 farmers, 22 seed companies, scientists, extension people, projects and staffs of BRRI. In T Aus 2025, 5,550 kg F₁ seeds of BRRI hybrid dhan7 have been distributed free of cost among farmers through different regional stations of BRRI and department of agricultural extension. Nineteen stake holders produced more than 600 MT F₁ seeds using BRRI developed hybrid rice parental lines during Boro 2024-25.

DEVELOPMENT OF PARENTAL MATERIALS

Source nursery

One hundred and sixteen test crosses and 456 ($A \times R$) crosses were made during T. Aman season 2024. In total 274 test crosses and 230 ($A \times R$) crosses were made using 14 CMS lines during Boro season 2024-25.

Test cross nursery

In T. Aman 2024, eighty-nine test crosses (F_1 s) were evaluated for their pollen fertility status of which two entries have been found heterotic over check varieties. Pollen parents of those combinations were regarded as suspected restorers and selected for fertility restoration ability with other CMS lines in the next season. None of the entries was found completely sterile.

In Boro 2024-25, sixty-eight test crosses (F_1 s) were evaluated for their pollen fertility status. Among them, four entries showed complete sterility and immediately backcrossed with their corresponding male parents for conversion. None of the test cross entries was found heterotic over the check varieties.

Back cross nursery

In T. Aman 2024, all the backcross generations were advanced to next generations except for four BC_3 and one BC_1 generations. It was discarded due to fluctuation in pollen fertility, disease susceptibility and repeatability of parent. In Boro 2024-25, nine BC_6 generations were advanced as new CMS lines and shifted to CMS maintenance and evaluation nursery. Other entries were advanced for next generations except two BC_2 generation discarded due to pollen fertility fluctuation.

CMS maintenance and evaluation nursery

One hundred-thirteen CMS lines along with their respective maintainer lines were maintained by

hand crossing for seed increase and genetic purity in T. Aman 2024 and in Boro 2024-25, a total of 162 CMS lines along with their respective maintainer lines were maintained by hand crossing in CMS maintenance and evaluation nursery for their genetic purity and seed increase.

EVALUATION OF PARENTAL LINES AND HYBRIDS

In T. Aman 2024, out of 549 test hybrids under observational trials, nine hybrid combinations were selected based on yield, duration and grain type and expressed more than 7-23% yield advantage over the check variety BRRI hybrid dhan6, 5-21% over AZ7006, 2-17% over Dhanny Gold and 8-25% over Bayer hybrid dhan8. The heritability obtained from growth duration and grain yield were 92% and 74% respectively indicating high level of precision in this experiment (Table 1). Upon commercial seed production feasibility of these selected hybrid combinations and grain quality assessment it will be tested under preliminary yield trial (PYT), multi-location yield trials (MLT) and ALART. Upon satisfactory yield advantage over check variety it is subjected to registration under National Hybrid Rice Yield Trial (NHRYT) for releasing as new hybrid rice of BRRI. In Boro, out of 39 hybrids nine hybrid combinations were selected based on yield, growth duration and other desired characters. The selected entries showed yield potentiality at least 8.4 t/ha. The selected hybrid combinations expressed 1-12% yield advantage over BRRI hybrid dhan8, 35-67% over Tej Gold, 6-31% over SL8H and 1-18% over Heera-21. Upon commercial seed production feasibility of these selected hybrid combinations, PYT and MLT trials will be conducted and based on satisfactory yield advantage over the check, hybrid combination will be submitted to SCA trials (Table 2).

Table 1. List of experimental hybrids found heterotic over check varieties during T. Aman 2024.

Trial	Designation	DTM	GSS	Plot yield (kg/plot)	Yield (t/h)	Heterosis (%)			
						ck-1	ck-2	ck-3	ck-4
OT-274	BRR1110A/IR101999-31-1-2R	126	LS	1.44	7.2	18	16	13	20
OT-368	BRR1125A/S-1203R	128	LS	1.48	7.4	21	19	16	23
OT-452	IR79125A/BRR156R	129	LS	1.38	6.9	13	11	8	15
OT-482	IR102758A/BRR142R	130	MS	1.4	7.0	15	13	9	17
OT-483	IR102758A/BRR143R	131	MS	1.36	6.8	11	10	6	13
OT-490	IR102758A/BRR156R	125	MS	1.5	7.5	23	21	17	25
OT-507	IR102758A/IR101999-31-1-2R	127	MS	1.32	6.6	8	6	3	10
OT-536	IR80151A/BRR136R	120	LS	1.48	7.4	21	19	16	23
OT-548	IR102758A/BR9159-8-5-40-13-8R	129	LS	1.3	6.5	7	5	2	8
Ck-1	BRR1 hybrid dhan6	118	MS	1.22	6.1				
CK-2	AZ7006	125	MS	1.24	6.2				
CK-3	Dhanny Gold	127	MS	1.28	6.4				
Ck-4	INH16019 (Bayer hybrid8)	127	LS	1.2	6.0				
Heritability		0.85	-	78					
LSD		17.2	-	1.91					

Yield data counted from 30 hills per entry, spacing was 20cm×15cm (R × P)

DS: July 14 2024; DT: 06 August 2024; **Legend:** DTM = Days to maturity; GSS= Grain size and shape

Table 2. Performance of test hybrids under observational nursery (OT) during Boro 2024-25.

Trial	Designation	DTM	GSS	Plot yield (kg/plot)	Yield (t/ha)	Yield adv over cks			
						ck-1	ck-2	ck-3	ck-4
2	BRR197A/LST-3	151	LS	1.92	9.6	4	55	22	9
11	BRR199A/ASM-3R	140	LS	2.07	10.34	12	67	31	18
17	BRR1110A/CHH67R	145	MS	1.68	8.4	-	35	6	-
18	BRR1110A/S-1203R	144	MS	1.74	8.7	-	40	10	-
19	BRR1110A/EL-160R	150	MS	1.86	9.3	1	50	18	6
27	BRR1110A/IR85503-3-3-A-1-1-1-1-1R	150	MB	1.72	8.6	-	39	9	-
30	BRR1110AIR112867-28-1-1R	146	MB	1.78	8.9	-	44	13	1
31	BRR1110A/IR112899-11-2-1R	151	MS	1.76	8.8	-	42	11	-
37	BRR1125A/BR11712-4R-1	146	MS	2.04	10.22	11	65	29	16
BRR1 hybrid dhan8		146	LS	1.84	9.2				
Tej Gold		137	LS	1.24	6.2				
SL8H		144	LS	1.58	7.9				
Heera-21		148	LS	1.76	8.8				

DS: 14 Dec 2024; DT: 12 Jan 2025; Unit plot size= 2m²

Legend: DTM=Days to maturity, PY= Plot yield, GSS= Grain size and shape; MS=Medium slender; LS= Long slender; MB= Medium bold

Preliminary yield trials of promising hybrids

In T. Aman 2024, two hybrids were selected out of 13 and showed yield advantage 10-19 % over BRR1 hybrid dhan6, 15-24 % over AZ7006 and

4-12 % over Dhanny Gold. Under multi-location trials two hybrids were selected and expressed yield advantage 31-32% over BRR1 hybrid dhan6, 29-30 % over AZ7006, 19-21 % over check variety Dhanny Gold and 27-28% over Bayer hybrid dhan8 (Table 3). In Boro, 12 hybrids were found performed 4-23% higher yield over the lowest yielded check Tej Gold

(7.85t/ha) and 2-20% higher yield over check Heera-19 (8.04t/ha) whereas nine hybrids showed 1-12% higher yield on the check Suborno-3 (8.60t/ha). None of the hybrids was found out yielded the check BRR1 hybrid dhan8 (9.91t/ha).

Growth duration (GD) and number of effective tillers (ET) of the tested entries were similar with the check varieties except Suborno-3 (136 days) (Table 4).

Table 3. Results of preliminary yield trials in T. Aman 2024.

Designation	PHT (cm)	GD (day)	GSS	SF (%)	Amy (%)	Yield (t/h)	Heterosis (%)		
							ck-1	ck-2	ck-3
BRR199A/BRR132R	112	119	S	78.3	23.4	7.3	5.8	10.6	-
BRR1109A/BRR132R	110	121	S	82.2	23.6	7.6	10	15	4
IR79156A/BRR132R	115	123	S	80.5	23.5	6.9	-	4.5	-
IR58025A/BRR132R	117	105	S	77.6	24.1	7.4	7.2	12	1.4
BRR174A/BRR138R	111	107	S	76.5	23.7	6.8	-	3	-
BRR1109A/BRR138R	110	110	S	75.3	23.7	6.6	-	-	-
IR58025A/BRR138R	115	118	S	77.6	23.5	7.4	7.2	12	1.4
BRR1110A/BRR142R	112	120	S	80.2	22.8	8.2	18.8	24	12.3
IR58025A/BRR142R	116	104	S	76.3	23.6	6.6	-	-	-
BRR1110A/BRR154R	113	112	S	75.4	23.3	6.8	-	3	-
BRR1125A/BRR154R	111	111	S	74.4	22.8	6.1	-	-	-
BRR1110A/BRR155R	115	110	S	74.0	24.0	5.8	-	-	-
IR79156A/BRR155R	114	106	S	73.6	23.3	5.8	-	-	-
BRR1 hybrid dhan6	109	118	S	76.0	24.0	6.9	-	4.5	-
AZ7006	112	131	S	76.5	-	6.6	-	-	-
Dhanny Gold	108	135	MS	77.1	-	7.3	5.8	10.6	-
Mean	110	115.4			77.5	23.5	7.0		
CV (%)	3.0	7.9			3.7	1.7	10.4		
LSD (0.05%)	2.1	5.9			1.8	0.3	0.5		

DS: 14 Jul 2024; DT: 04 Aug 2024; Plot size=10 m²; PHT (cm) = Plant height (cm); GD = Growth duration; GSS= Grain shape and size; S=Slender, MS=Medium slender; SF (%) = Spikelet fertility; Amy (%) = Amylose.

Table 4. Result of preliminary yield trial (PYT) during Boro 2024-25.

Designation	GD (day)	PH (cm)	ET (no.)	GSS	Yield (t/h)	Heterosis (%)			
						ck-1	ck-2	ck-3	ck-4
BRR174A/BRR138R	149	108	8	M	8.92	-10	4	11	14
BRR1110A/BRR138	146	105	8	S	8.94	-10	4	11	14
BRR197A/BRR154R	142	106	7	S	8.48	-15	-1	5	8
BRR1109A/BRR154R	140	108	8	S	8.74	-12	2	9	11
BRR1120A/BRR154R	143	103	8	M	8.72	-12	1	8	11
BRR197A/BRR141R	142	105	9	S	9.64	-3	12	20	23
BRR1110A/BRR141R	145	105	8	S	8.98	-9	4	12	14
IR79156A/BRR141R	146	104	9	S	8.60	-13	0	7	9
IR102571A/BRR141R	141	94	8	S	8.18	-18	-5	2	4

Designation	GD (day)	PH (cm)	ET (no.)	GSS	Yield (t/h)	Heterosis (%)			
						ck-1	ck-2	ck-3	ck-4
BRR172A/BRR132R	149	108	9	M	8.69	-12	1	8	11
IR102758A/BRR150R	146	102	8	S	8.65	-13	1	8	10
BRR1120A/BRR157R	150	108	7	M	8.75	-12	2	9	11
IR99792A/BRR158R	136	91	8	M	6.89	-31	-20	-14	-12
BRR1 hybrid dhan8 (Ck-1)	144	100	9	S	9.91	-	15	23	26
Suborno-3 (Ck-2)	136	104	8	S	8.60	-13	-	7	10
Heera-19 (Ck-3)	146	100	9	S	8.04	-19	-7	-	2
Tej Gold (Ck-4)	141	110	9	S	7.85	-21	-9	-2	-
Mean	144	104	8.24		8.62				
CV	2.61	4.98	9.53		8.22				
Lsd (0.05%)	6.16	8.47	1.27		1.16				

DS: 08 Dec 2024; DT: 15 Jan 2025; Plot size: 22.80 m²

Multi-location yield trials of promising hybrids

In T. Aman 2024, under multi-location trials two hybrids were selected and expressed yield advantage 31-32% over BRR1 hybrid dhan6, 29-30 % over AZ7006, 19-21 % over check variety Dhanny Gold and 27-28% over Bayer hybrid dhan8 (Table 5). In Boro 2024-25, multi-location

yield trials comprised 15 hybrids with four checks. Three hybrids were selected based on average yield of five locations over check varieties and expressed 7-9% yield advantage over BRR1 hybrid dhan8, 22-24 % over Suborno-3, 15-17% over Heera-21 and 22-24 % over Tej Gold (Table 6).

Table 5. Results of multi-location yield trials during T. Aman 2024.

Hybrid	PH (cm)	DTM	Yield (t/ha)						SF (%)	GT	Amy (%)	Yld adv over ck var				
			Gaz	Ish	Bari	Ran	Son	Av				ck-1	ck-2	ck-3	ck-4	
BRR197A/BRR132R	112	111	5.8	6.2	5.8	5.8	5.8	5.9	76.3	S	-	-	-	-	-	
BRR1125A/BRR132R	110	117	7.6	8.0	7.9	7.1	7.6	7.6	78.6	MS	23.4	22.6	20.6	11.8	18.8	
IR102758A/BRR132R	113	121	8.2	8.5	8.3	7.8	8.1	8.2	84.0	S	23.2	32.3	30.2	20.6	28.1	
BRR199A/BRR138R	111	118	6.8	7.3	8.0	6.5	7.9	7.3	83.2	S	23.5	17.7	15.9	7.4	14.1	
BRR174A/BRR131R	112	114	6.8	7.7	6.9	6.0	6.7	6.8	80.3	MS	23.6	9.7	7.9	-	6.3	
BRR199A/BRR142R	111	122	8.4	8.5	8.3	7.5	7.8	8.1	82.5	MS	24.2	30.6	28.6	19.1	26.7	
IR79156A/BRR142R	110	118	6.0	7.9	6.9	6.5	6.3	6.7	77.8	MS	23.4	8.1	6.3	-	4.7	
IR102758A/BRR142R	113	119	7.5	7.7	6.6	6.1	6.8	6.9	78.0	MS	23.4	11.3	9.5	1.5	7.8	
BRR197A/BRR154R	109	117	6.8	7.5	7.3	6.6	6.3	6.9	77.6	S	24.0	11.3	9.5	1.5	7.8	
BRR199A/BRR154R	111	118	7.4	7.1	7.8	5.8	7.0	7.0	79.8	S	23.7	12.9	11.1	2.9	9.4	
IR79156A/BRR154R	113	119	6.7	6.8	7.2	5.5	6.8	6.6	76.7	MS	23.6	6.5	4.8	-	3.1	
BRR199A/BRR155R	109	116	7.6	7.8	7.0	7.1	6.9	7.3	83.3	M	24.0	17.7	15.9	7.4	14.1	
IR102758A/BRR155R	115	118	6.4	6.7	6.2	5.8	6.6	6.3	75.2	MS	23.6	1.6	-	-	-	
BRR1125A/BRR156R	112	121	6.6	7.0	7.8	6.3	6.7	6.9	76.8	MS	23.0	11.3	9.5	1.5	7.8	
IR58025A/BRR156R	116	123	6.3	6.0	5.8	5.7	5.5	5.9	75.7	S	23.3	-	-	-	-	
Ck-1	BRR1 hybrid dhan6	112	118	5.8	7.3	5.8	6.1	6.2	6.2	75.0	S	24.0	-	-	-	-
Ck-2	AZ 7006	116	128	5.6	7.8	6.2	6.4	5.4	6.3	75.1	S	1.6	-	-	-	
Ck-3	Dhanny Gold	115	133	6.3	7.0	7.8	6.5	6.6	6.8	75.8	S	9.7	7.9	-	6.3	

Hybrid		PH (cm)	DTM	Yield (t/ha)						SF (%)	GT	Amy (%)	Yld adv over ck var			
				Gaz	Ish	Bari	Ran	Son	Av				ck-1	ck-2	ck-3	ck-4
Ck-4	Bayer Hybrid-8	116	132	6.5	6.8	5.9	6.2	6.6	6.4	74.8	M	3.2	1.6	-	-	
Mean		112.4	120.2	6.8	7.3	7.0	6.4	6.7	6.8	78.2						
CV (%)		2.0	4.7	11.8	9.4	12.6	9.8	11.2	9.4	3.9						
LSD (0.05%)		1.36	3.31	0.47	0.41	0.53	0.37	0.44	0.38	1.82						

DS: 17 Jul 2024; DT: 11 Aug 2024; Unit plot size: 30 m²

Legend: PH (cm) = Plant height; DTM= Days to maturity; SF (%) = Spikelet fertility; GSS= Grain size and shape; Amy (%) = Content of amylose in percentage; Gaz = Gazipur; Ish = Ishwardi; Bari = Barishal; Ran = Rangpur; Son = Sonagazi

Table 6. Results of multi-location yield trials during Boro 2024-25.

Sl. No	Hybrids	PH(cm)	DTM	Yield (t/ha)						SF (%)	GSS	Amy (%)	Aver yield Advantage over Ck (%)			
				Gaz	Ish	Bar	Ran	Son	Av					Ck-2	Ck-3	Ck-4
1	BRR199A/BRR138R	110	146	11.5	10.4	10.5	10.6	10.7	10.7	87.3	S	23.6	7	21.6	15	21.6
2	IR58025A/BRR138R	114	147	10.3	9.6	9.3	9.2	9.3	9.5	84.6	S	23.4	-	8	2.2	8
3	BRR111A/BRR154R	108	144	10.8	11.4	10.4	9.7	10.6	10.6	87.0	S	23.6	6	20.5	14	20.5
4	BRR199A/BRR154R	109	147	11.3	10.8	10.7	10.3	11.6	10.9	88.2	S	24.0	9	23.9	17.2	23.9
5	BRR1110A/BRR154R	112	144	9.8	9.3	10.8	9.4	10.7	10.0	85.3	MS	23.4	-	13.6	7.5	13.6
6	IR79156A/BRR154R	115	145	10.7	10.3	9.8	8.5	9.4	9.7	84.5	MS	24.2	-	10.2	4.3	10.2
7	IR102571A/BRR154R	110	146	9.3	10.1	9.1	9.2	10.0	9.5	84.1	M	23.5	-	8	2.2	8
8	BRR199A/BRR141R	109	144	11.3	11.1	10.7	10.4	10.8	10.9	88.3	S	23.5	9	23.9	17.2	23.9
9	BRR1109A/BRR141R	113	145	10.7	10.5	10.9	10.1	10.3	10.5	87.6	S	24.0	5	19.3	13	19.3
10	BRR199A/BRR132R	111	143	10.8	10.6	11.0	10.6	10.4	10.7	87.8	S	23.7	7	21.6	15	21.6
11	IR102571A/BRR132R	113	143	9.3	9.4	10.2	8.4	8.8	9.2	83.7	S	23.6	-	4.5	-	4.5
12	BRR199A/BRR157R	112	144	9.5	9.1	9.2	9.7	8.8	9.3	83.8	MS	23.3	-	5.7	-	5.7
13	IR79156A/BRR158R	117	144	8.7	9.5	9.3	8.4	8.7	8.9	81.0	MS	23.4	-	1.1	-	1.1
14	IR79156A/BRR120R	110	144	9.8	10.0	10.3	8.6	8.9	9.5	84.6	S	24.0	-	8	2.2	8
15	BRR174A/BRR156R	113	145	8.9	9.3	9.5	8.2	8.8	8.9	80.5	M	23.4	-	1.1	-	1.1
Ck-1	BRR1 hybrid dhan8	108	145	10.7	10.5	9.7	9.4	9.7	10.0	85.2	S	24.0				
Ck-2	Suborno-3	111	137	9.3	8.8	9.4	8.2	8.4	8.8	80.4	S					
Ck-3	Heera-21	113	148	9.6	9.4	10.4	8.6	8.5	9.3	83.6	MS					
Ck-4	Tej Gold	115	141	8.4	9.3	8.8	8.2	9.4	8.8	79.7	S					
Mean		111.6	144.5	10.1	10.0	10.1	9.3	9.7	9.8	84.9						
CV (%)		2.3	1.7	9.3	7.4	7.1	9.3	9.8	7.6	3.2						
LSD (0.05%)		1.49	1.42	0.56	0.44	0.42	0.51	0.56	0.44	1.61						

DS: 04 Dec 2024; DT: 08 Jan 2025; Unit plot size: 30 m²

Legend: PH (cm) = Plant height (cm); DTM= Days to maturity; SF (%) = Spikelet fertility (%); GSS= Grain shape and size; S=Slender; MS= Medium Slender; M=Medium; AC (%) = Amylose (%)

Development of maintainer and restorer lines through (B×B) and (R×R) crosses

Under parental line improvement programme (B×B and R×R), Thirteen (B×B) and thirty (R×R) crosses were confirmed as true hybrid (Table 7 and 8). True F₁ Plants were selected after comparing with respective parents. Disease free seeds were collected from (B×B) and (R×R) crosses in T. Aman 2024 and in Boro, eight (B×B) and twelve (R×R) crosses were confirmed as true hybrid (Table 9 and 10). True F₁ Plants were selected comparing with respective parents.

Disease free seeds were collected from (B×B) and (R×R) crosses. Under field rapid generation advancement programme, 47000 progenies of F₂, F₃, F₄ and F₅ from 94 crosses were advanced to next generation using field rapid generation advance (FRGA) technique and harvested of 13,886 progenies of B×B, R×R and A×R crosses in T. Aman 24 (Table 11) and 58750 progenies of F₂, F₃, F₄, F₅ and F₆ from 127 crosses were advanced to next generation using field rapid generation advance (FRGA) technique and harvested 27,320 progenies in Boro 2024-25 (Table 12).

Table 7. F₁ confirmation for (B × B) improvement, T. Aman 2024.

Genotype	F ₂ seeds harvested
IR68888B × You1B	200g
D ShanB × BRR132B	200g
BRR172B×BRR174B	200g
BRR175B×BRR1101B	200g
BRR194B×BRR195B	200g
BRR1103B×IR68888B	200g
IR102571B×IR102760B	200g
Jin23B × IR79156B	200g
IR75608B × IR102759B	200g
BRR1147B×BRR1148B	200g
IR102758B×IR75596B	200g
BRR1159B×BRR1143B	200g
IR68897B×IR79125B	200g

DS: 12 Jul 2024; DT: 29 Jul 2024

Table 8. F₁ Confirmation for (R × R) improvement, T. Aman 2024.

Designation	Number of seeds harvested
BRR132R×BRR137R	200g
BRR138R×CHH6	200g
EL175R×BR9942-1-2-1-1-B2	200g
BRR143R×BRR145R	200g
BRR150R×BRR151R	-
BU3R×BAU521R	200g
EL108R×Win3R	200g
EL144R×EL168R	200g
BRR136R×BRR149R	200g
BRR144R×R-2800	200g
BRR154R×PR595R	200g
EL220R×IR69712-154-2-3-1-3R	200g
Basmati L Ind × R Line7	200g
B.I. Rice × BasmatiR	200g

Designation	Number of seeds harvested
BRR143R×BRR132R	200g
BRR156R×CHH67R	200g
Bogura4R×BADC NewR	200g
IR86417-26-1-1-1-1×IR06N162R	200g
IR05N162R×IR69712-154-2-3-1-3R	200g
BRR135R×BRR112R	200g
IR112899-3-1-1-R x IR84675-58-4-1-B-B	200g
IR17M1656R x IR86526-1-8-1-1-2-1-1-1-R	200g
IR85503-3-3-7-1-1-1-1R x IR86526-23-1-1-1-1-1-1R	200g
IR86522-12-12-1-1-1-1R× BRR115R	200g
IR86522-15-2-1-1-1-1R x BRR121R	200g
BRR150R x BRR127R	200g
IR85538-2-1-1-1-1-1-1R x BRR118R	200g
IR85538-3-1-1-1-1-1-1-1R x BRR137R	200g
IR86403-22-3-1-1-1-1-1R x BR7011-37-1-2R	-
CHH67R x BR1736R	200g

DS: 12 Jul 2024; DT: 29 Jul 2024

Table 9. F₁ Confirmation of (B×B) crosses, Boro 2024-25.

Cross combination	Amount of harvested F ₂ seeds
IR77809B × IR77801B	200g
IR77811B ×BRR120B	200g
BRR125B × PMS8B	200g
BRR142B ×BRR125B	200g
PMS8B x BRR125B	200g
IR102573B ×IR79125B	200g
IR102569B ×IR58025B	200g
IR102760B ×IR80559B	200g

DS: 08 Dec 2024; DT: 10 Jan 2025

Table 10. F₁ Confirmation of (R×R) crosses Boro 2024-25.

Cross combination	Amount of harvested F ₂ seeds
BRR132R ×BRR141R	200g
BRR150R × BRR157R	200g
BRR151R ×BRR158R	200g
BR1543-1-1-1-1R ×BasmatiR	200g
R Line7 × PAN809R	200g
New R Babla ×Basmati L India	200g
S-1203R ×MZ-3R	200g
IR85503-3-3-A-1-1-1-1R ×EL168R	200g
IR101921-Bk-Bk-Bk-17-1-1 ×BR11716-4R-105	200g
IR98155-68-1-1-1-2-1R ×BRR146R	200g
IR96532-29-1-1-1-2-1-1R ×CHH-35R	200g
IR98206-13-1-1-1-1-1 ×ASM-3	200g

DS: 08 Dec 2024; DT: 10 Jan 2025

Table 11. Progenies selected through field RGA during T. Aman 2024.

Cross type	No. of crosses				Transplanted	Harvested
	F ₂	F ₃	F ₄	F ₅		
B × B	11	13	05	07	47000	13886
R × R	18	19	10	22		
Total	94					

DS: 12 Jul 2024; DT: 17 Aug 2024

Table 12. Progenies selected through field RGA, during Boro 2024-25.

Cross Type	No. of crosses					Transplanted	Harvested
	F ₂	F ₃	F ₄	F ₅	F ₆		
B×B	13	11	13	5	7	58750	27320
R×R	28	18	10	11	11		
Total	127						

DS: 11 Dec 2024; DT: 17 Jan 2025

SEED PRODUCTION OF PARENTAL LINES AND HYBRIDS

CMS line multiplication of released and promising hybrids

CMS line multiplication of BRRI hybrid dhan3 and BRRI hybrid dhan8 was done and seed yield got 100 kg and 650 kg respectively which was equivalent to 0.5 and 1.3 t/ha respectively (Table 13). Seed yield was poor due to continuous rain at flowering time. Eight promising CMS lines were multiplied during T. Aman 2024 in small to medium scale. Seed yield was obtaining ranging from 13 kg to 90 kg/plot (Table 14). In Boro 2024-25, CMS seed yield 200 kg (1.0 t/ha) from

BRRI hybrid dhan2, 1,590 kg (1.7 t/ha) from BRRI hybrid dhan3, 358 kg (1.4 t/ha) from BRRI hybrid dhan5, 1,622 kg (2.4 t/ha) from BRRI hybrid dhan6 and 4,706 kg (2.04 t/ha) from BRRI hybrid dhan8 were obtained (Table 15). Some CMS lines seed yield was poor due to hail storm at maturity stage causing serious shattering. Seed amount got from selected promising CMS lines ranging from 0.66 to 1.87 t/ha during Boro 2024-25 (Table 16). Seed amount varied CMS line to CMS line due to hail storm causing shattering at maturity stage and it was happened in particular entries due to sowing time difference for making time isolation in flowering.

Table 13. CMS lines multiplication of BRRI11A and IR79156A in T. Aman 2024.

Combination	Plant height (cm)		50% flowering date		PER (%)	OCR (%)	Yield		Remark
	A line	B line	A line	B line			Kg/plot	(t/ha)	
BRRI11A/B	89	93	81	79	77	24	100	0.5	Poor seed yield due to rainfall during supplementary pollination
BRRI99A/B	96	98	87	85	77	34	650	1.3	

DS: B₁=01 Jul 2024, A/B₂=04 Jul 2024, B₃=07 Jul 2024; DT: A/B=24 Jul 2024

DS: B₁= 02 Jul 2024, A/B₂=05 Jul 2024, B₃=08 Jul 2024; DT: A/B=28 Jul 2024

PER=Panicle exertion rate, OCR= Out crossing rate.

Table 14. Seed production of promising CMS lines during T. Aman 2024.

Combination	Plant height (cm)		50% flowering date		PER (%)	OCR (%)	Yield		
	A line	B line	A line	B line			Plot area (m ²)	Kg/plot	t/ha
BRR172A/B	93	96	85	82	73	28.5	1500	70	0.47
BRR174A/B	91	94	81	78	71	28.0	1000	45	0.45
BRR197A/B	87	91	77	75	72	27.3	2000	85	0.43
BRR1110A/B	92	95	83	81	77	29	800	55	0.68
BRR1120A/B	90	94	85	83	75	28.4	200	13	0.65
BRR1125A/B	90	93	83	80	69	28.4	200	13	0.65
IR99792A/B	83	86	76	74	70	28.7	600	30	0.5
IR102571A/B	91	95	82	80	71	30.2	1500	90	0.6

DS: B₁=08 June 2024, B₂/A=11 June 2024, B₃=14 June 2024; DT: A/B=02 July 2024.

DS: B₁=15 June 2024, B₂/A=18 June 2024, B₃=21 June 2024; DT: A/B=13 July 2024.

PER=Panicle Exertion Rate, OCR= Out Crossing Rate.

Table 15. CMS multiplication of BRRI hybrid dhan2, BRRI hybrid dhan3, BRRI hybrid dhan5, BRRI hybrid dhan6 and BRRI hybrid dhan8 during Boro, 2024-25.

Designation	Plant height (cm)		50% flowering (day)		PER (%)		OCR (%)	Plot area (m ²)	Yield (kg/plot)	Seed yield (t/ha)
	A line	B line	A line	B line	A line	A line				
BRR110A/B	87	89	124	121	77.0	31.0	2000	200	1.00	
BRR111A/B	97	99	121	118	76.5	37.0	12000	1590	1.33	
BRR17A/B	94	97	120	117	78.0	31.1	2500	358	1.43	
IR79156A/B	100	103	123	121	83.0	53.5	8000	1622	2.03	
BRR199A/B	87	90	124	121	84.3	45.4	23100	4706	2.04	
Mean	93	95.6	122.4	119.6	79.76	39.6	9520	1695.2	1.6	
SD	5.9	6.0	1.8	1.9	3.6	9.7	8641.6	1810.0	0.5	
CV (%)	6.3	6.3	1.5	1.6	4.5	24.6	90.8	106.8	29.2	
LSd 0.05%	6.8	6.9	2.1	2.2	4.2	11.2	9970.8	2088.5	0.5	

DS: B₁ =02 Dec 2024; A/B₂ = 05 Dec 2024; B₃ = 08 Dec 2024; DT: A/B = 13 Jan 2025; DS: B₁ =07 Dec 2024; A/B₂ =10 Dec 2024; B₃ =13 Dec 2024; DT: A/B =11 Jan 2025; DS: B₁ =05 Dec 2024; A/B₂ =08 Dec 2024; B₃ =11 Dec 2024; DT: A/B=08 Jan 2025; DS: B₁=30 Nov 2024; A/B₂=03 Dec 2024; B₃=06 Dec 2024; DT: A/B=05 Jan 2025; DS: B₁=10 Dec 2024; B₂/A =13 Dec 2024; B₃=16 Dec 2024; DT: A/B= 17 Jan 2025; PER=Panicle exertion rate, OCR= Out crossing rate.

Table 16. Seed amount got from selected promising CMS lines during Boro, 2024-25.

Designation	Plant height (cm)		D50% flowering		PER (%)	OCR (%)	Plot area (m ²)	Yield (kg/plot)	Seed yield (t/ha)
	A line	B line	A line	B line					
BRR172A/B	97	102	110	112	78	31	1200	80	0.66
BRR197A/B	95.0	97.0	119	116	77.3	47.2	2200	311	1.41
BRR1109A/B	104.0	107.0	120	117	68.5	34.3	600	64.6	1.08
BRR1120A/B	91.0	94.0	117	114	76.0	43.5	1000	172	1.72
BRR1125A/B	105.0	108.0	127	124	71.6	41.2	1500	280	1.87

Designation	Plant height (cm)		D50% flowering		PER (%)	OCR (%)	Plot area (m ²)	Yield (kg/plot)	Seed yield (t/ha)
	A line	B line	A line	B line					
BRRI147A/B	93.0	96.0	125	122	76.5	35.3	500	46.5	0.93
Average	97.5	100.7	119.7	117.5	74.7	38.8	1166.7	159.02	1.3
SD	5.8	5.9	6.1	4.6	3.8	6.2	628.2	114.6	0.5
Lsd (0.05)	6.1	6.2	6.4	4.9	4.0	6.5	661.7	120.8	0.5
CV (%)	5.9	5.9	5.1	3.9	5.0	16.0	53.8	72.1	36.8

DS: B₁/A=10 Dec 2024; B₂=13 Dec 2024; B₃=16 Dec 2024; DT: 14 Jan 2025; DS: B₁/A=10 Dec 2024; B₂=13 Dec 2024; B₃=16 Dec 2024; DT: 19 Jan 2025; DS: B₁/A=01 Dec 2024; B₂=04 Dec 2024; B₃=07 Dec 2024; DT: 11 Jan 2025; DS: B₁/A=07 Dec 2024; B₂=10 Dec 2024; B₃=13 Dec 2024; DT: 22 Jan 2025; DS: B₁/A=01 Dec 2024; B₂=04 Dec 2024; B₃=07 Dec 2024; DT: 03 Jan 2025; DS B₁/A=10 Dec 2024; B₂=13 Dec 2024; B₃=16 Dec 2024; DT: 12 Jan 2025; PER (%) = panicle exertion rate, OCR (%) = Out crossing rate

F₁ seed production of BRRI hybrid dhan5, BRRI hybrid dhan6, BRRI hybrid dhan7 and BRRI hybrid dhan8 in Boro 2024-25

A total of 192 kg (2.22 t/ha) from BRRI hybrid dhan5, 455 kg (1.82 t/ha) from BRRI hybrid

dhan6, 648 kg (2.50 t/ha) from BRRI hybrid dhan7 and 252 kg (1.08 t/ha) from BRRI hybrid dhan8 was obtained (Table 17). Seed yield of BRRI hybrid dhan8 was poor due to hail storm at maturity stage causing serious shattering.

Table 17. F₁ seed production of BRRI hybrid dhan5, BRRI hybrid dhan6, BRRI hybrid dhan7 and BRRI hybrid dhan8 during Boro 2024-25.

Hybrid	Plant height (cm)		50% flowering date		PER (%)	OCR (%)	Yield	
	A line	R line	A line	R line			kg/plot	t/ha
BRRI hybrid dhan5	88	99	124	140	81	30	192	2.22
BRRI hybrid dhan6	98	102	118	133	80	33	455	1.82
BRRI hybrid dhan7	91	101	123	130	88	32	648	2.50
BRRI hybrid dhan8	99	104	122	126	81	51	252	1.08
Mean	94	101.5	121.8	132.3	82.5	36.5	386.8	1.9
SD	5.4	2.1	2.6	5.9	3.7	9.7	207.4	0.6
CV (%)	5.7	2.1	2.2	4.5	4.5	26.7	53.6	32.4
Lsd 0.05%	6.2	2.4	3.0	6.8	4.3	11.2	239.3	0.7

DS: R₁ = 26 Nov 2024; R₂ = 03 Dec 2024; A = 22 Dec 2024; DT: R = 02 Jan 2025; A = 21 Jan 2025
DS: R₁ = 28 Nov 2024; R₂ = 03 Dec 2024; A = 12 Dec 2024; DT: R & A = 11 Jan 2025
DS: R₁ = 27 Nov 2024; R₂ = 30 Nov 2024; A = 06 Dec 2024; DT: R=02 Jan 2025; A = 09 Jan 2025
DS: R₁ = 27 Nov 2024; R₂ = 02 Dec 2024; A = 07 Dec 2024; DT: R & A = 05 Jan 2025
PER (%) = Panicle exertion rate, OCR (%) = Out crossing rate

Experimental F₁ seed production of promising and Saltol hybrid during Boro 2024-25.

Seed yield was obtained 140 kg/plot (1.56 t/ha) from IR102571A/BRRI42R (Table 18). Seed yield was poor due to lack of proper flowering synchronization.

Table 18. Experimental F₁ seed production of promising Saltol hybrid during Boro 2024-25.

Combination	Plant height (cm)		50% flowering date		PER (%)	OCR (%)	Yield		
	A line	R line	A line	R line			Kg/plot	Plot size (m ²)	t/ha
IR102571A/BRRI42R (Promising hybrid)	98	108	118	127	77	30	140	1000	1.56

DS: R₁ =07 Dec 2024; R₂ = 11 Dec 2024; A = 16 Dec 2024; DT: R/A=23 Jan 2025

F₁ seed production through contract growers

During Boro 2024-25, we got 522 kg (2.18 t/ha) of BRRI hybrid dhan2, 10175 kg (2.54 t/ha) of BRRI hybrid dhan3, 1300 kg (2.32 t/ha) of BRRI hybrid dhan4, 4450 kg (2.30 t/ha) of BRRI hybrid

dhan5, 10,000 kg (2.78 t/ha) of BRRI hybrid dhan6, 7740 kg (2.76 t/ha) of BRRI hybrid dhan7 and 27,000 kg (1.98 t/ha) seeds of BRRI hybrid dhan8 from Ishwardi, Pabna (Table 19).

Table 19. F₁ seed production of BRRI developed hybrids through contract grower during Boro 2024-25

Combinations	Contract growers	Location	Seed yield (kg)	Area (m ²)	Seed yield (t/ha)	Remarks
BRRI hybrid dhan2	AUS Bangla Agro	Ishwardi	522	2400	2.18	Satisfactory seed yield was obtained due to prevail congenial seed production environment
BRRI hybrid dhan3	AUS Bangla Agro	Ishwardi	10175	40000	2.54	
BRRI hybrid dhan4	AUS Bangla Agro	Ishwardi	1300	5600	2.32	
BRRI hybrid dhan5	AUS Bangla Agro +Mazil seed	Ishwardi	4500	20000	2.30	
BRRI hybrid dhan6	AUS Bangla Agro	Ishwardi	10000	36000	2.78	
BRRI hybrid dhan7	AUS Bangla Agro	Ishwardi	7740	28000	2.76	
BRRI hybrid dhan8	AUS Bangla Agro+ Mazil seed	Ishwardi	27000	140000	1.98	
Total =		61237	272000 (68 Acre)			

DISSEMINATION OF HYBRID RICE TECHNOLOGY

In T Aman 2024, Hybrid Rice Division supplied 8850 kg F₁ seeds along with 95 kg parental line seeds to 80 farmers, 13 seed companies, scientists, extension people, projects and staffs of BRRI and during T Aus 2024, 4229 kg hybrid seeds of BRRI hybrid dhan7 distributed among BRRI R/Ss,

department of agricultural extension and farmers (Table 20). In Boro 2024-25 this division supplied 27,831 kg of parental lines and F₁ seeds to 130 farmers, 23 seed companies, scientists, extension people, projects and staffs of BRRI (Table 21). Nineteen stake holders produced more than 603 MT F₁ seeds using BRRI developed hybrid rice parental lines (Table 22).

Table 20. Amount of parental line and hybrid seeds supplied to different organization during T Aman 2024

Recipient	No	F ₁ (kg)	A line (kg)	B line (kg)	R line (kg)
Seed companies	13	850	70	-	25
Farmers	83	1690	-	-	-
BRRI scientists + staffs	30	1450	-	-	-
BRRI, R/S(5) +DAE	25	4860	-	-	-
Total	151	8850	70	-	25
T. Aus (BRRI hybrid dhan7)					
BRRI, RS (5) +DAE		4229			

Table 21. Amount of parental line and hybrid seeds supplied to different organizations during Boro 2024-25.

Recipient	Nos.	F ₁ (kg)	A line (kg)	B line (kg)	R line (kg)
Seed Companies	23	1250.0	5760	-	1818
Farmers	130	1800.0	620	-	58
BRRI Scientists + staffs	25	2025.0	-	-	-
BRRI R/S (11) +DAE	14	14500.0	-	-	-
Total	192	19575	6380	0.00	1876
Grand Total		27831.0			

Table 22. Seed production activities of BRRI developed hybrids during Boro 2024-25 both at private and public sectors.

Organization/ person	Location	Var	Supplied Parental line (Kg)		Area (acre)	Yield achieved (ton)	Remark
			A line	R line			
JF Agro Private Ltd. Savar, Dhaka. Md. Jamaluddin, Chairman. Mob. 0196877336	Sherpur, Bogura	BHD3	150	50	20	19.0	Experienced
		BHD5	80	24	10	7.0	
		BHD6	80	24	10	9.0	
Seed Care Crop Science proprietor: Md. Juwel, D-09, Bank Colony, Savar Mob. 01968773337	Sherpur Bogura	BHD3	150	50	20	19	Experienced
		BHD5	80	24	10	7.0	
		BHD8	80	24	10	9.0	
Babylon Agro & Dairy Ltd. 2B/1, Mob. 01710327720	Ishwardi, Pabna	BHD3	500	165	62	61	Experienced
		BHD8	150	50	20	19	
American advanced Agro Ltd. Proprietor Kbd Kamrul Haque Mob. 01720053768	Muktaghacha, Mymensingh	BHD6	160	75	20	21.0	Experienced
		BHD7	40	15	05	4.0	
Bagro Company Ltd. House No# 17, R#09, Utra Proprietor: M R Ibne Aziz Managing Director Mob. 01711479884	Muktaghacha, Mymensingh	BHD6	1200	300	120	100	Experienced
Thailand Agro Seeds Vite Proprietor: Md. Alamin Hoque. Kandi, Fulpur, Mymensingh Mob. 01719464815	Muktaghacha, Mymensingh	BHD2	45	15	5	4.5	Experienced
		BHD6	45	15	5	4.5	
Abdur Rahman Agro Company. Muktagasha Proprietor: Md. Abdur Barek Mob. 01978424141/ 01766688323	Muktaghacha, Mymensingh	BHD3	96	36	12	10	Experienced
Mirtika Agro Vision Proprietor: Mirthonjoy Roy Executive Director Rangpur. Mob. 01752084181	Sherpur, Bogura	BHD3	40	15	05	4.2	Experienced
Aus Bangla Agro Gohail Road, Mission gate, Bogura. Kbd. Mosharrof Hossain, PM Mob. 01716444502	Ishwardi, Pabna	BHD3	500	150	62	55	Experienced
		BHD8	300	100	38	35	

Bangladesh Agricultural Development Corporation	Meherpur Chaudanga	BHD7 BHD8	160 80	48 24	20 10	27.3 8.0	Experienced
Ahasan seeds & Agrotech Gaffargaon, Mymensingh Mob. 01734414647	Muktaghacha, Mymensingh	BHD2 BHD3 BHD4 BHD6 BHD7	18 18 09 150 09	06 06 03 45 03	02 02 01 15 01	1.5 2.2 0.5 13.5 0.8	Experienced
Lal Teer Seed Ltd. Bashon, Gazipur	Muktaghacha, Mymensingh	BHD3 BHD8	80 160	24 48	10 20	8.0 18	Experienced
Krishibid seed Ltd	Muktaghacha, Mymensingh	BHD3 BHD8	80 160	24 48	10 20	8.0 17	Experienced
Jalal Akand, Babuganj Mob. 01770674655	Babuganj Barishal	BHD8	32	12	04	0.6	Experienced
Monjil Seed Company Ishwardi, Pabna Mob. 01733137743	Ishwardi Pabna	BHD8	160	48	20	13.0	Experienced
Aus Bangla Agro Gohail Road, Mission gate, Bogura. Mob. 01716444502 Contract growers	Patirajpur, Ishwardi, Pabna	BHD2 BHD3 BHD4 BHD5 BHD6 BHD7 BHD8	10 80 12 40 72 56 120	03 30 05 15 27 21 45	0.5 10 1.5 05 09 07 15	0.5 10.0 1.3 4.5 10.0 7.4 14.0	Experienced
Hybrid Rice Division, BRRI	Gazipur	BHD5 BHD6 BHD7 BHD8	07 07 07 07	03 03 03 03	0.6 0.3 0.3 0.4	0.2 0.3 0.3 0.4	Experienced
Explore Business Ltd. Mob. 01713041395	Sherpur Bogura	BHD6	80	30	10	8.0	Experienced
Metal Seeds Ltd. PBL Tower; Gulshan, Circle-2, Dhaka-1212	Sreepur, Gazipur	BHD8	160	60	20	15.0	Experienced
JR Agro, Mahiganj, Rangpur	Sherpur, Bogura	BHD3 BHD8	40 40	15 15	05 05	4.0 4.0	Experienced
Krishok Bandhu Biz vander, Natore	Natore	BHD3 BHD5	10 10	03 03	01 01	0.5 0.5	Experimental
Rupom Seeds, Proprietor: Md. Shadad Hossain Bhuiyan, Feni, Mob: 01716755531	Feni	BHD3 BHD8	20 40	06 15	2.0 5.0	1.6 3.5	Experimental
Integrated Crop solution	Jamalpur	BHD8	40	15	05	4.0	Experienced
BRRI R/S Sonagazi	Sonagazi	BHD8	30	09	03	2.4	Experienced
BRRI R/S Gopalganj	Gopalganj	BHD8	10	03	01	0.8	Experienced
BRRI R/S, Barishal	Barishal	BHD3 BHD8	10 10	03 03	01 01	0.7 0.8	Experienced
BRRI R/S, Cumilla	Cumilla	BHD8	10	03	01	0.7	Experimental
Arafat Agro Farm, Shingra, natore	Natore	BHD3 BHD8	10 10	03 03	01 01	0.5 0.6	Experimental
Total =			5760	1818	681.6	603.1	

Legend: BHD1= BRRI hybrid dhan1, BHD2 = BRRI hybrid dhan2, BHD3 = BRRI hybrid dhan3, BHD4 = BRRI hybrid dhan4, BHD5 = BRRI hybrid dhan5, BHD6 = BRRI hybrid dhan6, BHD7= BRRI hybrid dhan7, BHD8= BRRI hybrid dhan8

Agronomy Division

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SUMMARY

In the T. Aman season, BRRI dhan75 and BRRI dhan87 yielded higher during transplanting on 5 August. The highest yields of medium-duration varieties BRRI dhan52, BRRI dhan79 and BRRI dhna93 were observed during transplanting from 20 July to 5 August. The highest yield of long-duration varieties BRRI dhan89, BRRI dhan92, and BRRI dhan102 were observed during transplanting on 10 January. Ratooning of BRRI dhan88 was affected by cutting height and nitrogen fertilizer doses. In ratoon, crop cutting height of culm above 30 cm was found to be favourable for ratooning ability and grain yield. The highest grain yield (1.395 t ha^{-1}) was recorded from 30 cm cutting height along with 60 kg ha^{-1} nitrogen fertilizer application. Screened three cultivars (BRRI dhan28, BRRI dhan88, Bangabandhu dhan100) showed ratooning potentiality at 30 cm cutting height. To maximize the yield of BRRI hybrid dhan7, it is recommended to transplant 15-day-old seedlings and apply nitrogen (90 kg N ha^{-1}) in split doses, with 33 % at basal, 33% at 4-5 tillering, and 33% at the panicle initiation stage. The highest grain yield of BRRI dhan70 (5.89 t ha^{-1}) was obtained from the agronomic-based treatment combination of soil test-based fertilizer application, $25 \times 25 \text{ cm}$ spacing, 15-day-old seedlings and 15 July seeding. The highest grain yield of BRRI dhan92 (8.06 t ha^{-1}) was obtained from the treatment combination of soil test-based fertilizer application, $25 \times 25 \text{ cm}$ spacing and 15-day-old seedling. The highest grain yield was observed in BRRI dhan100×GAPs (8.46 t ha^{-1}) followed by BRRI hybrid dhan8 with BRPs (8.25 t ha^{-1}). Most of the tested herbicides performed more than 80% weed control efficiency. The grain yield of BRRI dhan103 was higher in the integrated application of urea and herbicide applied plot

compared to those treated with herbicides alone. The salt-tolerance and plant growth-promoting traits revealed that KB1, KB3, KB5, KB6, KB7, KB9, KB11, KB13 and KB14 are potential salt-tolerant PGPR strains. Among the nine tested PGPR strains, KB1, KB5, KB7, KB9 and KB11 could be considered salt-tolerant PGPR which can significantly contribute to reducing the salinity effect on rice at the seedling stage.

SCIENTIFIC INFORMATION

1. Planting Practice

1.1 Effect of planting time on growth duration and yield of newly released BRRI varieties

The experiment was conducted at BRRI HQ farm, Gazipur during Boro 2024-25 season. The 40-day-old seedlings of BRRI dhan88, BRRI dhan96, BRRI dhan101, BRRI dhan89, BRRI dhan92 and BRRI dhan102 were transplanted in the field on six scheduled times at a 15-day interval, starting on 10 December 2024. It was a factorial experiment conducted in a split-plot design with three replications.

All short duration varieties yielded higher when transplanting on 10th January and then gradually decreased with advancement of time and BRRI dhan96 gave higher yield followed by BRRI dhan88 (Table 1).

All long duration varieties yielded higher when transplanting on 25th December to 10th January and then gradually decreased with advancement of time and BRRI dhan92 gave higher yield followed by BRRI dhan102 (Table 2).

Table 1: Effect of planting time on the yield and growth duration of short duration rice varieties at BRRI, Gazipur during Boro 2024-25

Variety	Grain yield and growth duration											
	10 th Dec.		25 th Dec.		10 th Jan.		25 th Jan.		10 th Feb.		25 th Feb.	
	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)
BRRI dhan88	4.12	154	5.84	148	7.78	145	6.23	139	5.89	126	5.33	125
BRRI dhan96	5.34	152	6.32	147	7.91	143	7.15	137	6.11	131	5.36	127
BRRI dhan101	6.89	165	7.69	158	7.70	154	6.71	145	6.67	140	3.48	139
Lsd _(0.05)	1.4	4.6	1.1	2.0	0.79	3.0	0.77	2.5	0.97	2.4	0.50	0.75
CV (%)	13.6	1.2	8.2	0.0	5.9	0.0	6.1	0.0	9.4	0.0	6.1	0.3

Table 2: Effect of planting time on the yield and growth duration of long duration rice varieties at BRRI, Gazipur during Boro 2024-25

Variety	Grain yield and growth duration											
	10 th Dec.		25 th Dec.		10 th Jan.		25 th Jan.		10 th Feb.		25 th Feb.	
	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)	Yield (t/ha)	GD (day)
BRRI dhan89	5.80	168	7.53	164	7.57	155	7.44	147	6.44	142	5.31	139
BRRI dhan92	6.40	167	7.55	165	7.79	156	7.78	147	5.15	143	3.74	139
BRRI dhan102	6.42	168	7.57	168	7.58	159	6.11	148	3.87	143	3.63	139
Lsd _(0.05)	3.00	0.75	2.38	1.02	0.89	3.5	1.93	2.00	2.11	3.0	1.07	2.7
CV (%)	13.3	0.1	17.2	0.2	5.0	0.3	11.9	0.3	12.9	3.0	0.2	0.2

Effect of planting time on growth duration and yield of advanced breeding lines

The experiment was conducted at BRRI HQ farm, Gazipur during Boro 2024-25 season. The 40-day-old seedlings was transplanted in the field on six scheduled times at a 15-day interval, starting on 25th December 2024. It was a factorial experiment conducted in a spilt-plot design with three replications. In case of PVT-FBR, BR11318-5R-84 was evaluated with check variety BRRI dhan92. In case of PVT-CTR, BR11894-R-R-R-R-169 was evaluated with check varieties, BRRI dhan28 & BRRI dhan67. In case of PVT- Disease Resistant

Rice (BB & BB + Blast), BR (path)13800-BC3-8-9 and BR (path)13800-BC3-134-25 were evaluated with check variety BRRI dhan89.

There was no significant difference among planting time and genotypes in respect of grain yield and growth duration in case of PVT-FBR. CTR line (PVT) BR11894-R-R-R-R-169 gave higher yield when planted on 10th February but not significant with check varieties. Disease resistant line, BR (path)13800-BC3-134-25 gave significantly higher yield in all planting time than check variety, BRRI dhan89 (Table 3-5).

Table 3. Effect of planting time of advance breeding line (PVT-FBR) on grain yield and growth duration at BRRI HQ, Gazipur during Boro 2024-25

	Date of transplanting									
	Grain yield (t ha ⁻¹)					Growth duration (days)				
Genotypes	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb
BR11318-5R-84	6.22	6.51	6.20	6.34	4.3	162	155	148	141	135
BRRI dhan92 (ck)	5.89	6.22	6.00	5.93	4.0	165	157	149	143	137
Lsd (0.05)	ns					ns				
CV (%)	2.94					0.41				

Table 4. Effect of planting time of advance breeding line (PVT-CTR) on grain yield and growth duration at BRRI HQ, Gazipur during Boro 2024-25

	Date of transplanting									
	Grain yield (t ha ⁻¹)					Growth duration (days)				
Genotypes	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb
BR11894-R-R-R-169	5.99	6.20	4.97	6.35	4.98	150	145	141	139	132
BRRI dhan28 (ck)	5.72	6.32	5.46	5.84	4.73	145	142	138	136	129
BRRI dhan67 (ck)	6.0	6.20	5.35	6.15	5.12	150	145	140	138	131
Lsd (0.05)	ns					0.95				
CV (%)	4.28					0.40				

Table 5. Effect of planting time of PVT-Disease Resistant Rice (BB & BB+Blast) on grain yield and growth duration at BRRI HQ, Gazipur during Boro 2024-25

	Date of transplanting									
	Grain yield (t ha ⁻¹)					Growth duration (days)				
Genotypes	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb
BR (path)13800-BC3-8-9	8.18	7.07	0.0*	0.0*	5.02	157	147	0.0*	0.0*	131
BR (path)13800-BC3-134-25	8.78	8.08	7.52	7.73	0.0*	159	149	141	136	0.0*
BRRI dhan89 (ck)	7.65	7.63	7.48	7.23	5.58	160	153	145	140	135
Lsd (0.05)	0.32					0.72				
CV (%)	3.19					0.36				

* No germination

Screening inbred and hybrid rice for ratooning ability

Boro 2024-25 season, seventeen (17) inbred varieties and ten (10) popular BRRI & company hybrid varieties were tested for ratooning ability using 30 cm stubble cutting height at BRRI farm,

Gazipur and BRRI regional station, Rangpur. The thirty-five-day-old seedlings of the tested rice cultivars were transplanted in the field maintaining 20×20 cm spacing.

In case of inbred rice, higher yield was obtained from BRRI dhan89 and BRRI dhan92 in both the sites. Among the tested hybrid varieties, BRRI hybrid dhan8 gave higher yield followed by ACI hybrid dhan6 (Table 6 & 7).

In case of ratooning, four inbred varieties (BRRI dhan28, BRRI dhan74, BRRI dhan88 and BRRI dhan100) perform better in respect of grain yield and among them, BRRI dhan88 produced more than 1.0 t/ha at Rangpur side but BRRI dhan100 at Gazipur site with 30 cm cutting height (Table 8). In case of hybrid varieties, only BRRI hybrid dhan8 gave about

1.40 t/ha grain yield at Gazipur but BRRI hybrid dhan5 and BRRI hybrid dhan8 at Rangpur side (Table 9). At R/S Bhanga side, crop was damaged by heavy rain.

High temperature during reproductive and ripening phase fastens the ratoon crop growth and reduced the grain yield of inbred rice. In case of hybrid ratoon, days to time for heading is longer than inbred rice. So, there is a chance for improving productivity of hybrid ratoon by applying different management (cutting height and fertilizer management etc.) (Table 4 and Fig. 1, 2, 3 & 4).

Table 6. Ratoon performance of the tested hybrid rice cultivars at different locations, Boro 2024-25

Variety	30 cm cutting height					
	BRRI H/Q			BRRI R/S Rangpur		
	Ratoon ability	GD (days)	Yield (t ha ⁻¹)	Ratoon ability	GD (days)	Yield (t ha ⁻¹)
BRRI dhan28	0.77	40	0.78	0.81	43	0.99
BRRI dhan29	-	-	-	-	-	-
BRRI dhan50	-	-	-	-	-	-
BRRI dhan58	-	-	-	-	-	-
BRRI dhan67	-	-	-	-	-	-
BRRI dhan74	0.72	42	0.42	0.77	41	0.63
BRRI dhan75	-	-	-	-	-	-
BRRI dhan88	0.75	41	0.75	0.88	45	1.12
BRRI dhan89	-	-	-	-	-	-
BRRI dhan92	-	-	-	-	-	-
BRRI dhan100	0.93	47	1.13	0.91	48	1.01
BRRI dhan101	-	-	-	-	-	-
BRRI dhan102	-	-	-	-	-	-
BRRI dhan104	-	-	-	-	-	-
BRRI dhan105	-	-	-	-	-	-
Tata Miniket	-	-	-	-	-	-
BINA dhan25	-	-	-	-	-	-
CV (%)	-	-	-	-	-	-
Lsd (0.05)	-	-	-	-	-	-

Table 7. Ratoon performance of the tested hybrid rice cultivars at different locations, Boro 2024-25

Variety	30 cm cutting height								
	BRRI H/Q			BRRI R/S Rangpur			BRRI R/S Bhanga*		
	Ratoon ability	GD (days)	Yield (t ha ⁻¹)	Ratoon ability	GD (days)	Yield (t ha ⁻¹)	Ratoon ability	GD (days)	Yield (t ha ⁻¹)
BRRI hybrid dhan3	-	-	-	-	-	-	-	-	-
BRRI hybrid dhan5	-	-	-	0.70	55	1.30	-	-	-
BRRI hybrid dhan8	0.73	56	1.41	0.71	55	1.40	-	-	-
Ispahani-9	-	-	-	-	-	-	-	-	-
ACI hybrid dhan 6	-	-	-	-	-	-	-	-	-
Janak Raj	-	-	-	-	-	-	-	-	-
Moyna	-	-	-	-	-	-	-	-	-
Sathi (BRAC)	-	-	-	-	-	-	-	-	-
Syngenta S1205	-	-	-	-	-	-	-	-	-
Supreme hybrid hira-9	-	-	-	-	-	-	-	-	-
CV (%)	-	-	-	-	-	-	-	-	-
Lsd (0.05)	-	-	-	-	-	-	-	-	-

BRRI R/S Bhanga* = Early flash flood damage

Increasing productivity of ratoon rice

Optimizing both cutting height and nitrogen fertilizer management practices is essential for maximizing ratoon rice yields. To develop suitable agronomic management practices for productivity enhancement of ratoon rice, an experiment was conducted at BRRI R/S farm, Rangpur during Boro season 2024-25. The treatments of the experiment were included three levels of cutting height (10, 20, and 30 cm) and four levels of nitrogen fertilizer rates (0, 25, 50 and 75% N of main crop). It was a factorial experiment conducted in a spilt-plot design with

three replications. The 35-day-old seedlings of BRRI dhan88 were transplanted in the field maintaining 20×20 cm spacing. The BRRI recommended fertilizer doses for N, P, K, S, Zn were applied @ 120, 18, 75, 38 and 3.5 kg ha⁻¹, respectively. Results showed that, growth duration decrease with increasing cutting height irrespective of nitrogen level. In case of grain yield, similar result was observed with Gazipur, 2023-24. (Table 10 & Fig. 6). The yield and ratooning ability were lower and field duration was also shorter in ratoon crop due to high temperature during harvesting period in the last week of April.

Table 8. Effect of cutting height and nitrogen fertilizer doses on growth duration and yield of BRRI dhan88, Rangpur, Boro 2024-25

N fertilizer (% of main crop)	Cutting height (cm)	Growth duration (days)	Grain yield (t/ha)
F ₁	CH ₁	50	1.23
	CH ₂	48	1.42
	CH ₃	47	1.54
F ₂	CH ₁	70	1.56

N fertilizer (% of main crop)	Cutting height (cm)	Growth duration (days)	Grain yield (t/ha)
F ₃	CH ₂	49	1.41
	CH ₃	45	1.61
	CH ₁	71	1.67
F ₄	CH ₂	48	1.69
	CH ₃	45	1.71
	CH ₁	75	1.44
F ₄	CH ₂	75	1.50
	CH ₃	48	1.62
CV (%)		1.23	11.4
Lsd		1.19	0.31

F₁=No nitrogen, F₂=25% of main crop, F₃=50% of main crop, F₄=75% of main crop

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three replications. The 35-day-old seedlings of BRRI dhan88 were transplanted in the field maintaining 20×20 cm spacing. The BRRI recommended fertilizer doses for N, P, K, S, Zn were applied @ 120, 18, 75, 38 and 3.5 kg ha⁻¹, respectively. Results showed that, growth duration decrease with increasing cutting height irrespective of nitrogen level. In case of grain yield, similar result was observed with Gazipur, 2023-24. (Table 10 & Fig. 6). The yield and ratooning ability were lower and field duration was also shorter in ratoon crop due to high temperature during harvesting period in the last week of April.

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N fertilizer (% of main crop)	Cutting height (cm)	Growth duration (days)	Grain yield (t/ha)
F ₁	CH ₁	50	1.23
	CH ₂	48	1.42
	CH ₃	47	1.54
F ₂	CH ₁	70	1.56
	CH ₂	49	1.41
	CH ₃	45	1.61
F ₃	CH ₁	71	1.67
	CH ₂	48	1.69
	CH ₃	45	1.71
F ₄	CH ₁	75	1.44
	CH ₂	75	1.50
	CH ₃	48	1.62
CV (%)		1.23	11.4
Lsd		1.19	0.31

F₁ = No nitrogen, F₂ = 25% of main crop, F₃ = 50% of main crop, F₄ = 75% of main crop

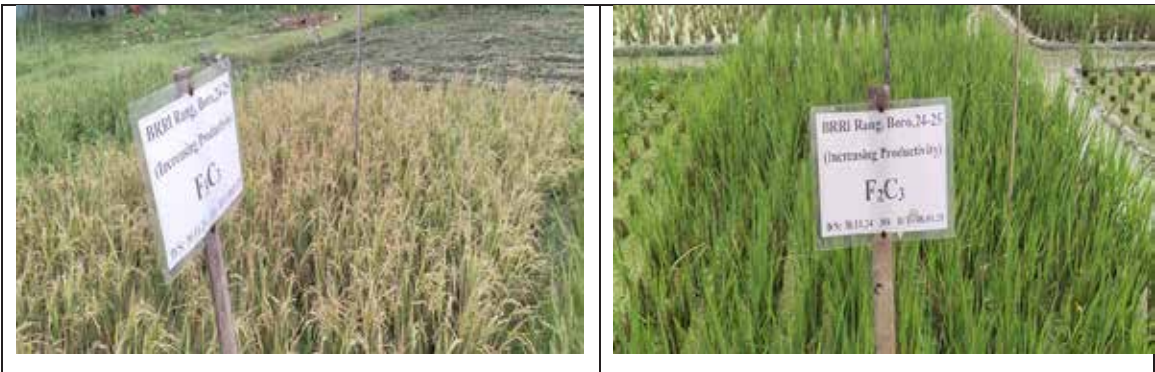


Fig. 6: Ratooning of BRRI dhan88 affected by cutting height & nitrogen fertilizer dose at BRRI R/S, Rangpur, Boro 2024-25

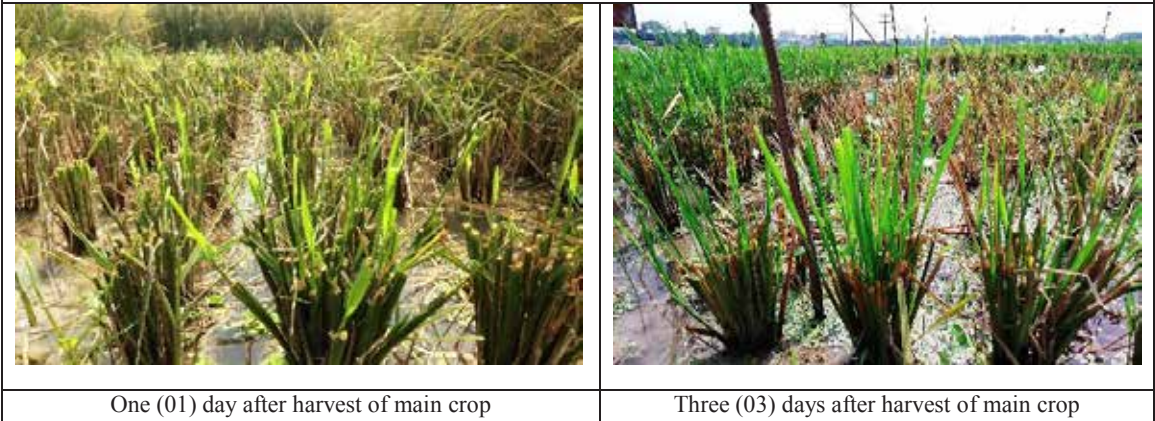


Fig. 2: Effect of high temperature on the growth and yield of inbred ratoon rice, BRRI Gazipur, 2024



FERTILIZER MANAGEMENT

Comparative study of different fertilizer management options for yield maximization of BRRI Hybrid dhan8 at variable time of planting

The experiment was conducted at BRRI HQ farm, Gazipur during Boro, 2024-25 season. Fertilizer management options were i) Soil test-based fertilizer dose (Urea 300 kg ha⁻¹, TSP 110 kg ha⁻¹, MoP 153 kg ha⁻¹, Gypsum 80 kg ha⁻¹, ZnSO₄ 5 kg ha⁻¹), ii) BRRI recommended fertilizer dose (Urea 247 kg ha⁻¹, TSP 90 kg ha⁻¹, MoP 148 kg ha⁻¹, Gypsum 110 kg ha⁻¹, ZnSO₄ 11 kg ha⁻¹) iii) Khamari apps (BARC)

(Urea 365 kg ha⁻¹, TSP 113.4 kg ha⁻¹, MoP 131.8 kg ha⁻¹, Gypsum 77.9 kg ha⁻¹, ZnSO₄ 5.3 kg ha⁻¹) and iv) Control (No fertilizer). Forty-day-old seedlings were transplanted in the field on four scheduled times at a 15-days interval, starting on 25 December 2024. It was conducted in a factorial RCB design with three replications. There was no significant difference between planting time and fertilizer management options in case of panicle m⁻². The panicle m⁻² of STB dose and Khamari apps was found maximum on 25th January planting. The grain yield of BRRI recommended dose was significantly higher from other management options but

statistically similar with Khamari apps on 25th December planting. On 25 January planting, the grain yield of STB dose was significantly higher but statistically similar with Khamari apps The grain

yield of Khamari apps was significantly higher from other treatments and statistically similar to BRRI recommended dose on 10th February planting.

Table 4. Effect of different fertilizer management of BRRI Hybrid dhan8 at variable planting time at BRRI HQ, Gazipur during Boro 2024-25

Date of transplanting								
Treatments	Panicle m ⁻²				Grain yield (t ha ⁻¹)			
	25 th	10 th	25 th	10 th	25 th	10 th	25 th	10 th
	Dec	Jan	Jan	Feb	Dec	Jan	Jan	Feb
STB dose	288	273	306	278	8.19	7.90	8.19	7.48
BRRI recommended. dose	284	267	298	298	8.89	7.91	7.81	7.71
Khamari apps (BARC)	279	266	302	294	8.73	7.60	7.98	7.98
Control (No fertilizer)	251	246	273	271	7.83	6.64	6.94	6.85
Lsd (0.05)	ns				0.35			
CV (%)	3.1				2.7			

YIELD MAXIMIZATION

WEED MANAGEMENT

Evaluation of candidate herbicide for weed control efficiency in T. Aman 2023 and Boro 2023-24 season

Field trials were conducted at the Bangladesh Rice Research Institute, Gazipur from T. Aman 2023 and Boro 2023-24 seasons. Most of the herbicides performed more than 80% weed control efficiency in

different weed populations observed in the field (Table 9). Only *cynodon dactylon* cannot be controlled >80% by some herbicides in most cases. Among the herbicides, six herbicides did not control weed effectively and their weed control efficiency was less than 80%. post-emergence herbicides are dominant and most of the herbicides contain more effective combination chemicals. Among the herbicide groups, some new molecule herbicides and their efficacy were given below.

Table 9. Herbicide chemical name, dose and weed control efficiency of different herbicides evaluated during T. Aman 20223 and Boro 2023-24 at BRRI HQ farm, Gazipur

Chemical	Dose (ha ⁻¹)	Season	Weed control efficiency (%)				
			Cynodon dactylon	Echinochloa crus-galli	Monochoria vaginalis	Scirpus maritimus	Cyperus difformis
Haloxypop-R-methyl 7.5% + Clethodim 15%	150 ml	Aman	58.50	82.50	84.50	80.30	81.40
		Boro	74.54	86.60	86.32	81.40	83.50
	1200 ml	Aman	59.00	85.60	82.65	80.90	83.00

Pretilachlor 38.5% + Penoxsulam 1.5%		Boro	77.80	83.00	80.60	82.00	80.75
Penoxulam + Butachlor	2000 ml	Aman	60.50	82.50	81.00	83.20	81.50
		Boro	77.50	83.00	83.00	81.40	82.84
Quinclorac 30% + Bispyribac sodium 5%	600 g	Aman	80.00	81.00	83.00	80.25	80.00
		Boro	81.20	82.00	87.00	80.00	82.00
Pretilachlor 36% + Bensulfuron metyl 4%	1000 g	Aman	80.80	81.00	82.00	80.00	80.00
		Boro	77.20	82.00	84.60	80.80	84.50
Flumioxazim 50 WP	500 g	Aman	70.00	81.00	83.00	83.70	87.00
		Boro	76.20	85.00	80.50	88.00	86.00
Bentazone 400% + MCPA 60% SL	1.8 L	Aman	70.00	80.00	80.00	82.80	80.00
		Boro	76.00	81.50	81.00	90.80	80.00
2,4-D Amine	2.0 L	Aman	70.80	65.00	62.00	73.00	70.00
		Boro	76.0	63.00	72.00	74.00	71.00
Bispyribac sodium 20% + Pyrazosulfuron Ethyl 10%	150 g	Aman	70.00	81.00	83.00	83.70	87.00
		Boro	76.20	85.00	80.50	88.00	86.00

Effect of adding urea with herbicides for controlling weeds and the growth and yield of transplanted rice

The study aims to determine whether integrating urea with herbicides enhances weed suppression, improves rice growth, and ultimately increases grain yield. The treatments of the experiment were Bensulfuron methyl+acetachlor @ 750g ha⁻¹ fb 1HW(T1), Penoxsulam@ 93.7 ml ha⁻¹ fb 1HW(T2), Bispyribac sodiumSC @ 150 ml ha⁻¹ fb 1HW(T3), Bensulfuron methyl+ acetachlor @ 750g ha⁻¹ with 1% urea tank mix fb 1HW(T4), Penoxsulam@ 93.7 ml ha⁻¹ with 1% urea tank mix fb 1HW(T5), Bispyribac sodium SC @ 150 ml ha⁻¹ with 1% urea tank mix fb 1HW(T6), Bensulfuron methyl+ acetachlor @ 750 g ha⁻¹ broadcast with urea (5 kg urea /33 decimal) fb 1HW(T7), Penoxsulam@ 93.7 ml ha⁻¹ broadcast with urea(5kg urea/33 decimal) fb

1HW(T8), Bispyribac sodium SC @ 150 ml ha⁻¹ broadcast with urea(5kg urea/33 decimal) fb 1HW(T9), un-weeded (T10) and weed free by three hand weeding (T11). The experiment followed the RCBD design with three replications. BRRI dhan103 was used as a variety. The combination of urea with herbicides significantly improved weed control compared to the application of herbicides alone (Table 10). The herbicide-urea combination resulted in a reduced weed density m⁻²(10,12) and dry weight g m⁻² (4.55 5.25, contributing to a cleaner field environment throughout the rice-growing period, resulting in higher grain yield. The treatment Penoxsulam @ 93.7 ml ha⁻¹ broadcast with urea (5kg urea/33 decimal) produced the highest grain (7.19 t ha⁻¹) yield (Table 10). The study indicates that integrating urea with herbicides offers a dual advantage of improved weed management and enhanced rice growth, leading to higher yields.

Table 10. Weed number, weight weed control efficiency (%) and yield loss (%) of different weed management treatments during T. Aman 2023.

Treatment	Weed dry-weight g m ⁻²)	WCE (%)	GY(t ha ⁻¹)	Yield loss%
T1	6.89	79	6.13	15
T2	6.81	79	6.41	11
T3	6.74	80	6.32	12
T4	6.67	80	6.43	11
T5	6.59	80	6.58	8
T6	6.62	80	6.65	7
T7	5.86	82	7.12	1
T8	4.55	86	7.19	
T9	5.25	84	7.04	2
T10	32.91		3.51	51
T11	5.51	83	7.00	3
LSD (.05)	1.99	-	0.55	-
CV (%)	16.1	-	5.10	-

SOIL HEALTH MANAGEMENT

Isolation and characterization of stress-tolerant plant growth-promoting rhizobacteria (ST-PGPR) from salt-affected areas of Patuakhali district in Bangladesh

The experiment was conducted at the soil microbiology laboratory, Agronomy Division. The soil was collected from six different locations in the Patuakhali district, viz. Mostafapur, Kolapara; Umedpur, Kolapara; Kumirmara, Kolapara; Ghutabasa, Kolapara; Kollanpur, Amtoli; Baubazar, Amtoli. GPS coordinates and soil characteristics of the collection sites are summarized in Table 1.

A total of twenty bacterial strains were isolated from the soil samples based on their distinct shapes, sizes, and colors. These isolates were preserved in slant agar media at a temperature of 40°C to maintain viability. The isolated bacterial strains were inoculated in media containing different NaCl concentrations (0, 0.5, 1, 1.5, and 2M) to evaluate their tolerance to salinity. Out of the twenty isolated strains, ten displayed significant survival at NaCl

concentrations of 1.5M and above. The considered salt-tolerance characters were floc yield production, exopolysaccharide production and uptake of sodium. Besides, plant growth-promoting traits included phosphate solubilization (PSB) and indole acetic acid (IAA) and ammonia production. The generated data were analyzed following Analysis of Variance (ANOVA) using R-4.1.1 software. The treatment means were compared by Least Significant Difference. The results of the study indicate a diverse range of biological characteristics exhibited by the bacterial strains evaluated. Specifically, the strain PB-5 demonstrated the highest exopolysaccharide (EPS) production, yielding 16 g L⁻¹, closely followed by PB-11 with 15 g L⁻¹. In terms of floc yield, strain PB-3 excelled with an impressive production of 92 g L⁻¹. When it comes to sodium uptake, strain PB-16 showed the highest capacity with a measurement of 552.38 ppm, which is in close competition with other strains such as PB-1 (527.32 g L⁻¹), PB-3 (477.19 g L⁻¹), PB-11 (529.82 g L⁻¹), and PB-14 (472.18 g L⁻¹). Plant growth-promoting traits were also assessed, revealing that

strain PB-8 produced the highest level of indole-3-acetic acid (IAA) at 7.99 $\mu\text{g ml}^{-1}$, followed closely by PB-4 at 7.75 $\mu\text{g ml}^{-1}$. Additionally, strain PB-12 recorded the highest ammonia concentration at 57.07 ppm, a significant finding for nitrogen availability. Qualitative assessments of phosphate solubilization highlighted the potential of multiple strains, with PB-2, PB-3, PB-4, PB-5, PB-6, PB-7, PB-8, PB-9,

PB-15, and PB-16 all showing the ability to solubilize phosphate, an important trait for enhancing soil fertility and plant growth (Table 2). Based on the observations regarding salinity tolerance and the plant growth-promoting traits of the PGPR strains, PB-1, PB-3, PB-4, PB-5, PB-8, PB-8, PB-11, PB-12, PB-14, and PB-16 will be considered for further plant inoculation studies.

Table 1: The soil characteristics of different sampling sites

Location	Latitude	Longitude	EC (dSm^{-1})	pH	Cfu g^{-1} dry soil
Mostafapur, Kolapara	21.930106 N	90.161757E	31.3	7.84	1.8×10^5
Umedpur, Kolapara	21.923241 N	90.156144E	20.7	8.18	1.7×10^5
Kumirmara, Kolapara	21.946530 N	90.181586E	19.4	8.09	6×10^8
Ghutabasa, Kolapara	21.961281 N	90.193732E	13.6	6.11	5.6×10^6
Kollanpur, Amtoli	22.044134 N	90.244401E	6.8	6.36	4.3×10^7
Baubazar, Amtoli	22.040981 N	90.241676E	4.7	5.05	8×10^6

Table 2. The salt-tolerance and plant growth-promoting characters of the isolated bacterial strains

PGPR strains	EPS (gL^{-1})	Floc yield (gL^{-1})	Na Uptake (ppm)	IAA ($\mu\text{g ml}^{-1}$)	Ammonia (ppm)	Phosphate solubilization
PB-1	9	73	527.3	6.99	40.9	-
PB-2	10	66	402.0	5.60	42.3	++
PB-3	10	92	477.2	6.37	44.0	++
PB-4	15.5	62	351.9	7.75	36.5	-
PB-5	16	63.5	201.5	5.54	34.9	++
PB-6	9.5	69.5	402.0	6.25	51.4	+++
PB-7	5	73.5	477.2	6.98	30.0	++
PB-8	9.5	65	251.6	7.99	44.3	+++
PB-9	8.5	68	402.0	6.12	26.6	+++
PB-10	12	63	201.5	6.25	28.2	-
PB-11	15	73	529.8	6.40	38.7	-
PB-12	13.5	70	452.1	5.32	57.1	-
PB-13	5	63.5	402.0	6.4	35.3	-
PB-14	13.5	69	472.2	6.4	35.8	-

PGPR strains	EPS (g L ⁻¹)	Floc yield (g L ⁻¹)	Na Uptake (ppm)	IAA (µg ml ⁻¹)	Ammonia (ppm)	Phosphate solubilization
PB-15	10.5	65.5	201.5	6.3	42.0	+++
PB-16	10	74.5	552.4	6.3	25.1	+
CV (%)	13.	4.0	12.8	4.5	6.6	
Lsd (0.05)	2.4	4.6	84.1	0.50	4.2	

Coactive role of Zinc oxide nanoparticles and Stress-tolerant plant growth-promoting rhizobacteria (ST-PGPR) on reclamation of drought stress in rice

The experiment conducted at the Rain out shelter of the Bangladesh Rice Research Institute aimed to evaluate the individual and combined effects of nano zinc oxide (ZnO) and plant growth-promoting rhizobacteria (PGPR) on the growth, grain yield, and zinc content of two BRRI rice varieties, BRRI dhan71 and BRRI dhan87. The study involved four treatment groups: a control group, a group treated with ST-PGPR, a group treated with ZnONPs, and a group treated with both ST-PGPR and ZnONPs. Drought conditions were applied at two critical growth stages: the tillering stage (DTS) and the reproductive stage (DRS), for 12 days. Germinated seeds were initially soaked in the ST-PGPR consortium and reapplied at 14 days post-seeding. Nano ZnO was sprayed at a concentration of 100 ppm five days before the onset of drought stress, during both the tillering and reproductive stages. Various growth parameters were measured, including plant height, tiller number, relative water content (RWC), electrolyte leakage (EL), total

chlorophyll content, total grain yield, and zinc content in the grains. Data analysis was performed using ANOVA through R-4.1.1, with the Least Significant Difference (LSD) employed to compare treatment means at a significance level of 0.05. Findings indicated that under non-drought conditions, BRRI dhan87 exhibited the highest grain yield, reaching 9.81g per plant with the combined application of ZnONPs and ST-PGPR. This was closely followed by BRRI dhan71, which achieved 9.31g per plant under drought conditions at the tillering stage when treated with the same combination (Figure 1). In terms of zinc content, the highest concentration of 20.20 ppm was found in BRRI dhan71 under drought-free conditions with ST-PGPR and ZnONPs. This was comparable to the zinc content observed in BRRI dhan87 treated with the same combination under tillering stage drought (19.15 ppm) and BRRI dhan71 under reproductive stage drought with ZnONPs (Figure 2). In summary, the study concluded that the combined application of ST-PGPR and ZnONPs represents the most effective treatment strategy for enhancing both yield and zinc content in grains, particularly during drought conditions at the tillering stage.

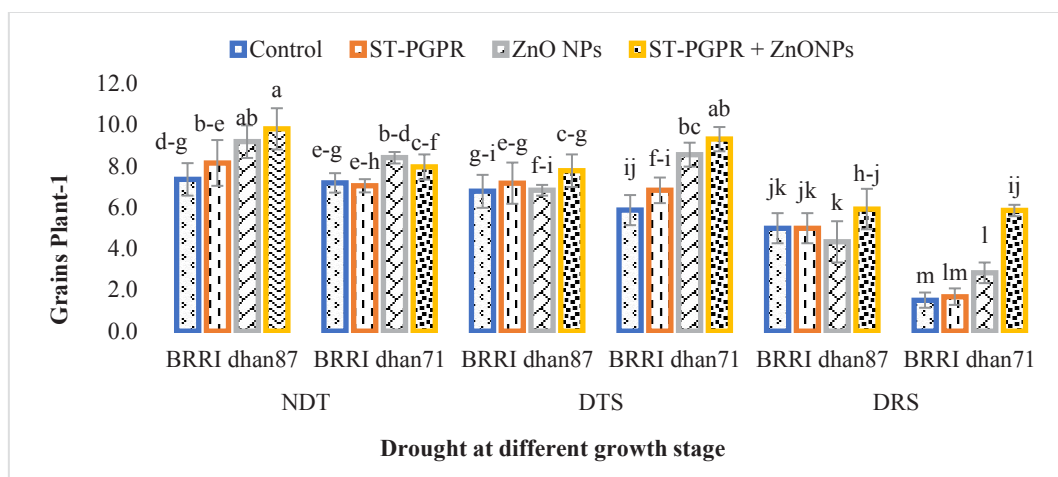


Figure 1. Effect of ST-PGPR and ZnONPs on the grain yield of rice under drought conditions

Means with the same letter in each column do not differ significantly using Lsd at $p > 0.05$

NDT: No drought; DTS: Drought at tillering stage; DRS: Drought at reproductive stage

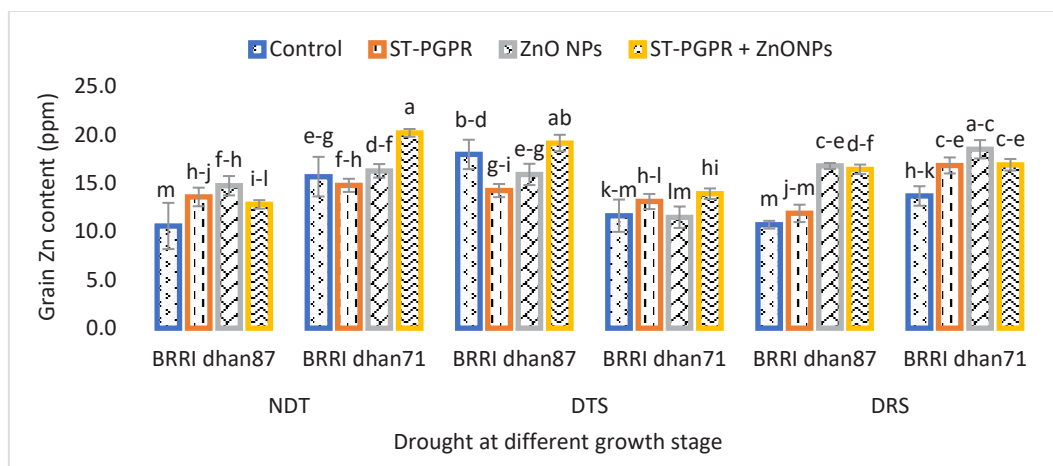


Figure 2. Effect of ST-PGPR and ZnONPs on the grain zinc content of rice under drought conditions

Means with the same letter in each column do not differ significantly using Lsd at $p > 0.05$

NDT: No drought; DTS: Drought at tillering stage; DRS: Drought at reproductive stage

Identification of BRRI-developed Boro rice varieties efficient with nitrogen fertilizer

The experiment conducted at the Bangladesh Rice Research Institute in Gazipur aimed to assess the performance of various rice varieties under reduced nitrogen conditions during the Boro 2024-25 season. The study included four rice varieties: BRRI

dhan104, BRRI dhan105, BRRI dhan107, and BRRI dhan108, alongside different nitrogen application rates of 0 (control), 100, 150, and 200 kg/ha. All non-nitrogen fertilizers were applied according to BRRI's recommendations. Key parameters measured included plant height, tiller number, nitrogen concentration in both straw and grains, and nitrogen use efficiency metrics (such as Agronomic

Efficiency (AE), Physiological Efficiency (PE), Apparent Recovery Efficiency (ARE), Utilization Efficiency (UE), and Partial Factor Productivity (PFP)). Yield and yield components were also documented. Data analysis was conducted through ANOVA using R-4.1.1, with treatment means compared using the Least Significant Difference (LSD) at a significance level of 0.05. The results indicated that yield and yield components varied significantly with different nitrogen application rates. Notably, the highest number of panicles per square meter was produced by BRRI dhan107 when treated with 150 kg N/ha (350 panicles/m²). Moreover, the highest grain count per panicle was

observed in BRRI dhan108, both at control (179 grains/panicle) and with 60 kg N/ha (180 grains/panicle). The highest 1000-grain weight was also recorded for BRRI dhan107 at control (24.9 g) and 150 kg N/ha (25.2 g). Interestingly, BRRI dhan108 yielded the highest overall grain yield at 7.68 t/ha when treated with 60 kg N/ha, closely followed by BRRI dhan105 at 7.28 t/ha with 90 kg N/ha (Table 1). These findings suggest that BRRI dhan108 has a strong potential for high yield performance under reduced nitrogen conditions, highlighting its viability for sustainable rice production in resource-limited scenarios.

Table 1: The effect of nitrogen fertilizers on the yield and yield components of BRRI rice varieties in the Boro season

Variety	Panicle m ⁻²	Grains panicle ⁻¹	1000gwt	Yield (t ha ⁻¹)
0 kg N ha⁻¹				
BRRI dhan104	213	78	22.2	3.63
BRRI dhan105	206	113	21.9	4.66
BRRI dhan107	198	97	24.9	3.71
BRRI dhan108	200	179	18.1	4.29
60 kg N ha⁻¹				
BRRI dhan104	224	113	22.2	5.61
BRRI dhan105	214	107	23.5	5.42
BRRI dhan107	215	113	23.7	5.97
BRRI dhan108	221	180	19.4	7.68
90 kg N ha⁻¹				
BRRI dhan104	238	130	22.8	7.17
BRRI dhan105	237	139	22.2	7.28
BRRI dhan107	240	111	23.2	6.19
BRRI dhan108	228	164	18.1	6.76
120 kg N ha⁻¹				
BRRI dhan104	310	87	22.9	6.16
BRRI dhan105	250	116	21.2	6.22
BRRI dhan107	255	100	24.1	6.32
BRRI dhan108	258	155	15.1	6.04
150 kg N ha⁻¹				
BRRI dhan104	317	77	21.6	5.29
BRRI dhan105	292	81	22.1	5.16
BRRI dhan107	350	57	25.2	5.09
BRRI dhan108	250	140	18.6	5.82
CV (%)	4.95	6.53	2.04	4.42
Lsd (0.05)	20.13	12.63	0.73	0.42

Mitigation of heavy metals bio-accumulation in rice varieties through agronomic management under polluted soils of Gazipur

Introduction

Soil contamination with heavy metals represents a global environmental issue with adverse

consequences for the environment and human health. Long-term use of wastewater on agricultural lands contributes significantly to the build-up of the elevated levels of these metals in soils and plants (Mapanda *et al.*, 2005; Sharma *et al.*, 2007) which is of serious concern. High concentration of different heavy metals in soils of industrial areas may cause reduction in crop yields as well as long term risks to ecosystems and humans health.

In Bangladesh, industrial wastes and effluents are released into the soil, canals, and rivers without treatment. Heavy metals like arsenic, lead, cadmium, and chromium are non-biodegradable toxic chemicals found in natural mineral deposits and industrial wastes (Qin *et al.*, 2021). Heavy metals are the most prevalent contaminants in Bangladesh's ecosystems, which include agricultural land, foodstuffs, urban soil, and rivers (Proshad *et al.*, 2020; Hasan *et al.*, 2021). Rapid population growth, economic demand, an industrial revolution, the textile and composite industries, had been occurred in Bangladesh during the last decade, at the same time industrial pollution or waste-water pollution had been producing massive amounts. The waste-water from industries and municipalities has various negative impacts on the surrounding ecosystem due to the lack of effluent treatment plants, improper disposal and management practices for waste-water and presence of toxic substances in waste-water in deleterious amounts (Makino *et al.*, 2006).

Tongi-Gazipur is considered as one of the most important industrial areas in Bangladesh. Different types of industrial units in this area such as dyeing and textile, garments, pharmaceutical industries, chemical industries, etc. Especially in some blocks like Bonomala, Tongi, the water channels surrounded the farmlands where factories discharged waste materials into the canals. The water of the canals is almost blackish in color, dirty smelled and

polluted with heavy metals. The dominant cropping pattern of these areas is rice based and huge water is needed to irrigate for rice cultivation. In Boro season no option is left for farmers other than to use the polluted canal waters for irrigation. Except for the Boro seasons, most of the time lands remain inundated by this polluted canal's water. In Boro season most of the farmers are using that contaminated canal water for irrigation in rice field. Applications of different organic materials transform into stable forms of carbon with high adsorption sites which might help heavy metal adsorption and ultimately helps in environmental amelioration. It is hypothesized that agronomic management practices (liming, cowdung, water hyacinth-compost, etc.) can improve soil resilience, reduce heavy metal uptake and increase its productive capacity in the polluted areas and therefore study are needed in these issues.

Objectives

- i. To characterize the chemical properties of soil in heavy metal polluted areas of Tongi, Gazipur
- ii. To determine the effects of liming and compost amendment on As, Pb, Cd, Cr immobilization on contaminated soil of Tongi, Gazipur and to determine the metal concentrations in rice.
- iii. To determine the effect of organic materials on crop growth and yield.

Materials and Methods

This experiment was carried out at farmers field, Bonomala, Tongi (23°91'N, 90°40'E) Gazipur, during December to May, 2024-25. The soil samples were collected from a depth of 15 cm in a zig-zag manner before land preparation to analyze the textural class and inherent physicochemical status. The soil characteristics of the experimental fields were acidic nature having pH: 5.5, organic carbon: 2.10 %, total N = 0.21%, available P = 5.38 ppm, exchangeable K = 0.29 me/100g, available S = 57.20 ppm, Zn = 0.89 ppm, Fe = 210 ppm, Cu = 6.01 ppm, Mn = 35 ppm, As = 3.8 ppm, Pb = 30.1 ppm, Cd = 6.12 ppm, Cr = 24.3 ppm, Hg = 0.015 ppm. The 39-day-old seedlings of rice cultivars, BRRI dhan84, BRRI dhan100, BRRI dhan29 and BRRI dhan89 were transplanted on 1 January, 2025 in the field

maintaining 25×25 cm spacing. The treatments were included T₁ = Unfertilized soil treatment (control), T₂ = RDF (100%), T₃ = Lime 1.5 t ha⁻¹ + RDF (75%), T₄ = Compost 1.5 t ha⁻¹ (water hyacinth compost) + RDF (75%), T₅ = Farmer's practice (only MoP). The experiment was conducted in two-factorial randomized complete block design with three replications. The BRRI recommended fertilizer doses for N, P, K, S, Zn were applied @ 120, 18, 80, 38 and 4.0 kg ha⁻¹, respectively. At maturity time, samples were harvested separately and the fresh samples were oven-dried at 72° C for 24 h and then weighed as dry weight. Cold vapor method (Aqua regia solution, hydroxyl amine hydrochloride, potassium permanganate and stannous chloride) was used for mercury analysis and di-acid extraction method, HNO₃: HClO₄ was used for Pd, Cd, Cr, As analysis. For mercury analysis, mercury vapor unit along with AA-7000 atomic absorption spectrophotometer was used. AA-7000 atomic absorption spectrophotometer (Shimadzu) was used to determine the concentration of all metals Zn, Fe, Cu, Mn, Pd, Cd, Cr, As and Hg.

Results and Discussion

Tillering pattern

Tiller number was recorded from active tillering and continued up to maturity. Tiller number varied significantly among the variety at all crop growth stages. Maximum tiller number (35-43 hill⁻¹) was observed at heading stage for all varieties. Irrespective of treatments, the highest no. of tiller

was observed in BRRI dhan29 followed by BRRI dhan100, BRRI dhan89 and BRRI dhan84. All varieties produced higher number of tillers up to heading and then declined sharply for all management (Fig. 1).

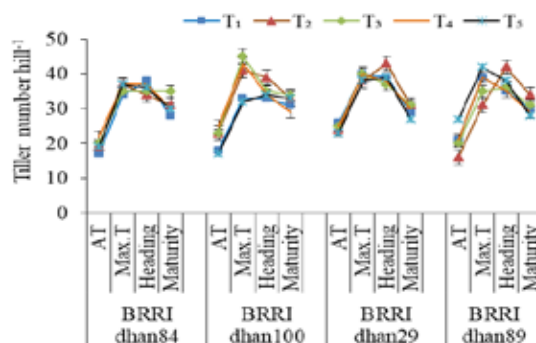


Fig. 1 Tillering pattern of tested varieties with different crop management, Vertical bars represent standard error (SE).

Yield and yield components

The soils of the experimental sites of Bonomala, Tongi contained high organic matter. The study result showed that organic amendment, WH compost + 50% RDF gave higher grain yield (7.17 t ha⁻¹) than BRRI recommended practice (6.89 t ha⁻¹) and other crop management. Irrespective of treatments, BRRI dhan29 gave the highest yield, higher TSW among the variety. Irrespective of treatments, BRRI dhan100 gave the higher panicle m⁻², grains panicle⁻¹ than other variety (Table 1).

Table 1. Yield and yield components of BRRI dhan84, BRRI dhan100, BRRI dhan29 and BRRI dhan89 as affected by different crop management at farmer's field, Bonamala, Tongi, Gazipur

Variety	Panicle m ⁻²	Grains panicle ⁻¹	1000 GW (g)	Grain yield (t ha ⁻¹)
BRRI dhan84	285	97	21.01	5.8
BRRI dhan100	323	112	18.03	6.4
BRRI dhan29	308	107	22.6	7.4
BRRI dhan89	310	100	20.5	6.3
Crop Management (CM)				
Control	290	102	20.7	6.1
BRF (100%)	326	105	20.4	6.89
Lime + 50% RDF	328	100	20.8	6.72

WH compost + 50% RDF	319	111	20.4	7.17
FP	272	103	20.1	5.59
LSD _(0.05) for variety	34.6	10.8	0.97	0.71
LSD _(0.05) for CM	38.7	NS	NS	0.79
CV (%)	15.2	14.2	6.4	14.7

Heavy metal concentration in polished rice, rice husk and straw

The results of the heavy metal content in rice plant of the wastewater- irrigation are presented in Figure 2. It is well known that the biomass uptakes trace metals naturally available to them through soil and stores them in their tissues. Absorption and accumulation of heavy metals in plant tissue depend upon many factors, which include temperature, pH, and nutrient availability. From the figure 2. It is seen that in polished rice, rice husk and straw Pb and Cd has the first and second highest enrichment in plant bodies followed by Cr and As indicating that these metals are mostly accumulated due to irrigation with waste water. Among the organic amendments,

application of Lime + 50% RDF reduced As, Cd and Cr uptake in polished rice, rice husk and straw of BRRI dhan84, BRRI dhan29 and BRRI dhan89. Among the variety BRRI dhan29 and BRRI dhan89 showed significantly lower uptake in As, Pb, Cd and Cr. Organic amendments application has no significant difference in Pb and Cd uptake in all varieties except BRRI dhan29. Irrespective of treatments, the lowest uptake of As and Cr was found in clean rice, rice husk and straw of BRRI dhan29, BRRI dhan89. Accumulation of Pb (1.76-22.05 ppm) and (Cd 0.75-6.56 ppm) concentrations are much higher than the concentrations of As (0.09-1.01 ppm), Cr (0.02-0.83 ppm) metals in the rice husk than polished rice and straw (Fig. 2).

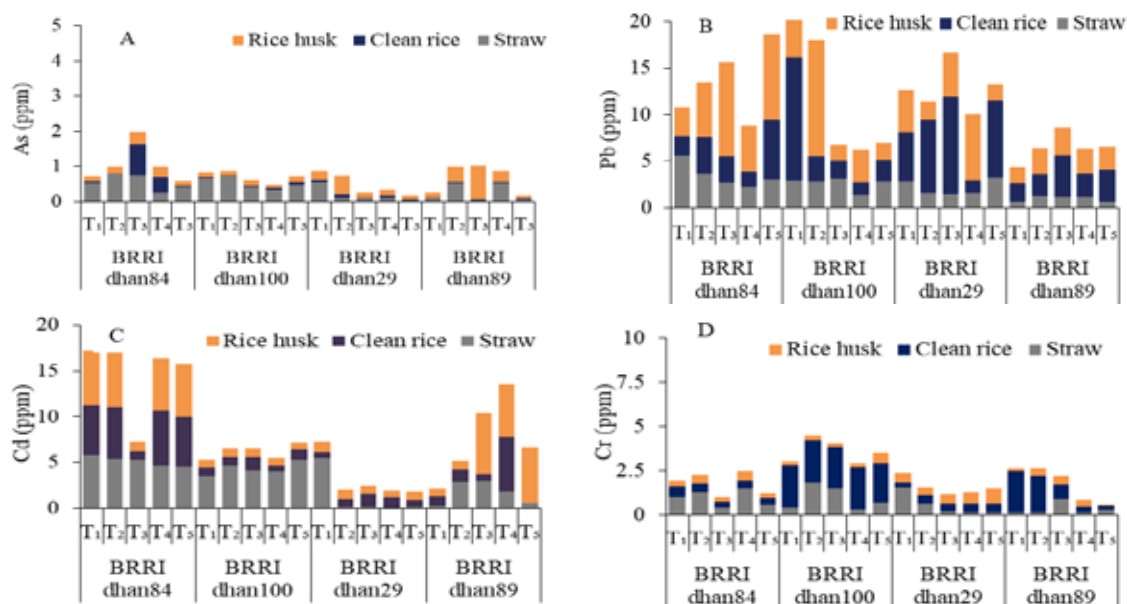


Fig. 2. Heavy metals concentration (As, Pb, Cd and Cr) in polished rice, rice husk and straw of BRRI dhan84, BRRI dhan100, BRRI dhan29 and BRRI dhan89 under different crop management. Vertical bars represent SE.

Conclusion

This study indicates that contaminated soil was rich in nutrients but loaded with different heavy metals beyond the permissible limit for crop production (WHO). The plant's inability to absorb enough nutrients from waste water has a significant impact on rice growth and yield. When water hyacinth compost and 50% RDF were applied, BRRI dhan29 produced the highest yield. This study was based on selected spot of major industrial areas, and the background values of different heavy metals were different; therefore, the presence of their contents in the environment does not represent the proper pollution level in a particular area. However, environmental protection laws should be properly maintained to reduce environmental pollution, and more attention should be paid to minimizing contamination in the studied areas.

Exp. 2. Mitigation of heavy metals bio-accumulation in rice varieties through agronomic management under polluted soils of Sripur, Gazipur

In Bangladesh, the accumulation of toxic metals in crops such as rice is a major concern. Crops grown in contaminated soil can accumulate large amounts of heavy metals in their tissues. The study area includes many textiles, garment and food industries. A large portion of these effluents is discharged directly into water streams that contaminate soil and crops. In the study area is located 25 Meter distance from contaminated irrigation channel. In T Aman season no option is left for farmers other than to use the polluted canal waters for irrigation. In T Aman season most of the farmers are using that contaminated canal water for irrigation in rice field. It is hypothesized that agronomic management practices (liming, cowdung, vermi-compost, etc.) can improve soil resilience, reduce heavy metal uptake and increase its productive capacity in the polluted areas and therefore study are needed in these issues.

Objectives

i. To characterize the chemical properties of soil in heavy metal polluted areas of Sripur, Gazipur

ii. To determine the effects of liming and compost amendment on As, Pb, Cd, Cr immobilization on contaminated soil of Sripur, Gazipur and to determine the metal concentrations in rice.

iii. To determine the effect of organic materials on crop growth and yield.

Materials and methods

This experiment was carried out at farmers field, Chakpara, Sripur, Gazipur, during July to November, 2024. The soil samples were collected from a depth of 15 cm in a zig-zag manner before land preparation to analyze the textural class and inherent physicochemical status. The soil characteristics of the experimental fields were acidic nature having pH: 6.1, organic carbon: 1.70 %, total N = 0.16%, available P = 6.08 ppm, exchangeable K = 0.25 me/100g, available S = 46.01 ppm, Zn = 2.13 ppm, Fe = 231 ppm, Cu = 5.04 ppm, Mn = 29 ppm, As = 1.3 ppm, Pb = 20.11 ppm, Cd = 4.16 ppm, Cr = 12.5 ppm. The 25-day-old seedlings of rice cultivars, BRRI dhan84, BRRI dhan100, BRRI dhan90 and BRRI dhan103 were transplanted on 31 July, 2024 in the field maintaining 20×20 cm spacing. The treatments were included T_1 = Unfertilized soil treatment (control), T_2 = RDF (100%), T_3 = Lime 1.5 t ha⁻¹ + RDF (75%), T_4 = Compost 1.5 t ha⁻¹ (Vermi compost) + RDF (75%), T_5 = Farmer's practice (Urea, TSP and MoP @15 kg bigha⁻¹). The experiment was conducted in two-factorial randomized complete block design with three replications. The BRRI recommended fertilizer doses for N, P, K, S, Zn were applied @ 90, 18, 80, 38 and 4.0 kg ha⁻¹, respectively. At maturity time, samples were harvested separately and the fresh samples were oven-dried at 72° C for 24 h and then weighed as dry weight. Cold vapor method (Aqua regia solution, hydroxyl amine hydrochloride, potassium permanganate and stannous chloride) was used for mercury analysis and di-acid extraction method, HNO₃: HClO₄ was used for Pd, Cd, Cr, As analysis. For mercury analysis, mercury vapor unit along with AA-7000 atomic absorption spectrophotometer was used. AA-7000 atomic absorption spectrophotometer (Shimadzu) was used to determine the concentration of all metals Zn, Fe, Cu, Mn, Pd, Cd, Cr, and As.

Results and Discussions

Yield and yield components

Study result showed that organic amendments increased grain yield among the variety and different crop management treatments. Irrespective of treatments, BRRI dhan103 gave higher yield (5.10 t ha⁻¹) than BRRI dhan90 (4.02 t ha⁻¹). Maximum

increase in yield was noted with vermicompost 1.5 t ha⁻¹ + 50% RDF in both varieties. Lowest yield was found at control treatment and statistically identical result was observed between BRRI recommended practice and Lime + 50% RDF treatment (Table 2). The higher number of panicle m⁻², Grains panicle⁻¹ was found in Vermicompost 1.5 t ha⁻¹ + 50% RDF treated plot.

Table 2. Yield and yield components of BRRI dhan90 and BRRI dhan103 as affected by different crop management at farmer's field, Sripur, Gazipur

Variety	Panicle m ⁻²	Grains panicle ⁻¹	1000 GW (g)	Grain yield (t ha ⁻¹)
BRRI dhan90	254	145	10.7	4.02
BRRI dhan103	280	85	21.06	5.10
Crop Management (CM)				
Control	220	109	15.6	3.58
BRF (100%)	286	117	16.2	4.76
Lime + 50% RDF	285	119	15.6	4.83
Vermicompost 1.5 t ha ⁻¹ + 50% RDF	298	121	15.8	5.22
FP	253	111	16.2	4.17
LSD _(0.05) for variety	14.4	9.05	0.56	0.20
LSD _(0.05) for CM	22.8	14.3	0.88	0.33
CV (%)	7.1	10.2	4.6	6.0

Heavy metal concentration in polished rice, rice husk and straw

The results of the heavy metal content in rice plant of the wastewater- irrigation are presented in Figure 3. From the figure 3. It was seen that in polished rice, rice husk and straw Pb and Cr has the first and second highest enrichment in plant bodies followed by Cd and As indicating that these metals are mostly accumulated due to irrigation with waste water. Among the organic amendments, application of Lime + 50% RDF reduced Pb, As, Cd and Cr uptake

in polished rice, rice husk and straw of BRRI dhan90, and BRRI dhan103.

BRRI dhan90 and BRRI dhan103 showed significantly higher uptake in Pb, Cr, Cd and As metal. Organic amendments application has no significant difference in Pb and Cr uptake in polished rice and rice husk. Accumulation of Pb (0.87-3.69 ppm) and (Cr 0.98-2.02 ppm) concentrations are much higher than the concentrations of Cd (0.13-0.967 ppm), As (0.012-0.67 ppm), metals in the in polished rice, rice husk than straw and straw (Fig. 3).

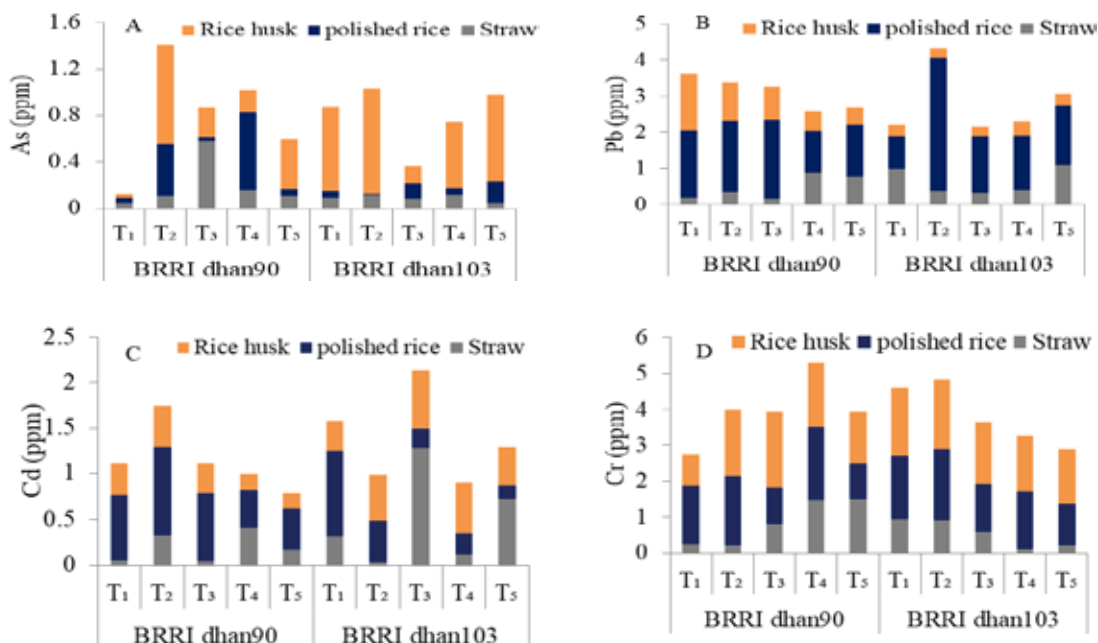


Fig. 3. Heavy metals concentration (As, Pb, Cd and Cr) in polished rice, rice husk and straw of BRRI dhan90 and BRRI dhan103 under different crop management. Vertical bars represent SE.

Exp. 3. Residue analysis of herbicide, insecticide and fungicide in soil and rice under irrigated ecosystem

Introduction:

Rice is one of the most consumed grains in the world. As its consumption has increased in accordance with population growth, the use of pesticides, including pre-and post-emergence herbicides, insecticides, and fungicides, consequently improving its production during the various stages of cultivation (Pareja *et al.* 2011). In Bangladesh, the use of pesticides in agricultural products has a significant impact on increasing yield products and improving product quality to meet the growing food demand (Abdollahzadeh *et al.*, 2015). Bensulfuron methyl + acetachlor is a new herbicide combination reported to provide effective control of broad-leaved weeds, sedges and grasses in rice when applied at 3-6 DAT. The use of pesticides in irrigated rice has intensified in recent years due to the higher

incidence of foliar diseases and insect pests and the residues of these pesticides (herbicide, fungicide and insecticide) may contaminate and accumulate in rice (Furlong, 2000). Due to widely use of pesticides has risen over in agricultural practice; it has become food safety issue. The study of pesticides residues in rice is very important to protect consumer's health. So far, little is known about which proportion of the pesticide originally applied in the field could be found in various types of rice and rice straw, which necessitates residue analysis.

Objectives:

To analyze the maximum residue level (MRL) of pesticides in soil, rice and straw.

Materials and methods:

The experiment was conducted at BRRI farm, Gazipur in T. Aman, 2024. The experiment was followed by RCB design with three replications. Twenty-five (T. Aman) days old seedlings were

transplanted having 20×20 cm spacing with two seedlings per hill. BRR1 dhan103 was used as for T. Aman variety. The treatments were: T_1 = Control (Untreated), T_2 = Bensulfuron methyl + Acetachlore (Recommended dose @ 750 g/ha) T_3 = Bensulfuron methyl + Acetachlore (Double the recommended dose), T_4 = Thiamethoxam + Chlorantraniliprole (Recommended dose Recommended dose @75 g ha⁻¹), T_5 = Thiamethoxam + Chlorantraniliprole (Double the recommended dose), T_6 = Tricyclazole 75%WP (Recommended dose @400 g ha⁻¹), T_7 = Tricyclazole 75%WP (Double the recommended dose). Fertilizers were applied (N-P-K-S-Zn @ 120-18-75-40-4 kg ha⁻¹) for all treated plot. All fertilizers were applied as basal during final land preparation except nitrogenous fertilizer. Nitrogen was applied as top dress in three equal splits at 15, 30 and 50 DAT (days after transplanting). Herbicide was sprayed one time after rice transplanting and other pesticides were sprayed 30 DAT and at heading stage. Representative 0.5 kg paddy soil and 250 mL water samples were collected randomly in each plot at 0 (2 h post-treatment), 5, 10, 20, 30, 40, 80 days and pre-harvest interval (PHI) of 7 days after herbicides application. The representative 0.5 kg rice samples were randomly collected at pre-harvest interval (PHI) of 7 days. All the collected paddy soil, water, and rice samples were stored at -20°C , respectively.

Collection and preparation of standard solutions

Certified pesticide standards (>90%) of bensulfuron methyl + acetachlore, thiamethoxam, chlorantraniliprole, tricyclazole, solvents and reagents including acetonitrile and formic acid of LC-MS- grade were obtained from Sigma Aldrich. Magnesium sulphate and anhydrous sodium chloride, Primary secondary amine (PSA) and graphitized carbon black (GCB) were purchased from Sigma Aldrich. Merck Millipore system was used to collect ultra-pure water. Nylon filters (0.2

μm) from Sigma Aldrich were used to filter the sample extracts.

Preparation of standard solutions

Stock solutions (1000 $\mu\text{g mL}^{-1}$) of the five pesticide (herbicide, pesticide and fungicide) compounds were prepared individually by dissolving the technical-grade material in acetonitrile (v/v) separately. These were labeled and stored in a freezer at -20°C . From the stock solution, intermediate stock and working standard solutions were prepared as mixes.

Sample preparation and analysis by LC-MS-MS 8050

The rice grain, rice straw and soil samples were collected from fields. Rice grains were homogenized into fine powder using grinder. Rice straws were milled into coarse powders using a grinder and were used after passing through 0.1 mm metal sieves. The chromatographic separation was carried out in a LC-MS-MS 8050 system using C18, 5 μm (4.8×250 mm) column with a mobile phase of acetonitrile: water acidified with 0.5% formic acid (50:50, v/v) at 0.5 mL min⁻¹ flow rate. With these conditions, all the five analytes were detected in 10.0 min. Confirmation was done utilizing Acquity (LC-MS-MS 8050, Shimadzu, Japan). Tandem Quadrupole mass Detector (TQD) with Electrospray ionization (ESI) interface. All the five analytes were ionized in positive polarity.

The QuEChERS method (Anastassiades et al. 2003) with following modifications was employed for extraction and clean-up process. Homogenized rice whole grain powder (10 g) and soil was weighed out into a 50-mL centrifuge tube. After adding 20 ml of acetonitrile, the centrifuge tube was capped and vortex shaken for 1 min. To this, 4 g anhydrous magnesium sulphate and 1 g of sodium chloride was added and again vortex shaken for 1 min to mix the sample thoroughly. The samples were centrifuged

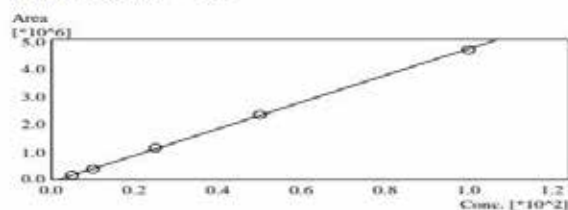
for 10 min at 8000 rpm. From this, 9 mL of supernatant was passed through 4 g of anhydrous sodium sulphate to remove moisture and out of this, 6 mL of extract was transferred into centrifuge tube containing 100 mg PSA and 600 mg anhydrous magnesium sulphate. The samples were mixed thoroughly by vortexing for 1 min and centrifuged for 10 min at 4000 rpm. Finally, 4 mL of acetonitrile layer was transferred into a clean glass test tube. The final volume was reconstituted to 1 mL using acetonitrile and transferred into a 1.5 mL glass auto sampler vial for LC/MS-MS analysis after filtering through a 0.2 µm filter membrane. For straw sample analysis, additionally 10 mg GCB powder was taken into a 50 mL centrifuge tube.

Results and Discussion

The performance of the developed method was validated with linearity, limit of detection (LOD), and limit of quantitation (LOQ). In order to obtain realistic and accurate results, linearity was evaluated by using the matrix-matched standard calibrations method to eliminate matrix effects. Excellent linearities were acquired with all the determination

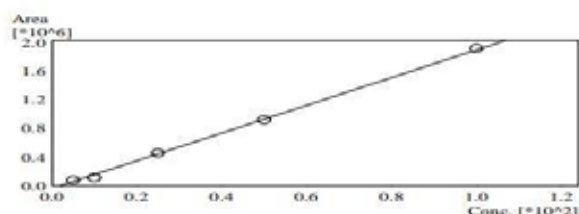
coefficients (R_2) higher than 0.98 to 0.99 in the range of 0.005-0.5 mg/L with three to five calibration points for bensulfuron-methyl and 0.025-1 mg/L for thiamethoxam, chlorantraniliprole and tricyclazole, respectively. Quantification was calculated using the calibration curve constructed by linear regression of pesticide concentrations against peak areas. Result shows that the retention time of bensulfuron-methyl, thiamethoxam, chlorantraniliprole and tricyclazole were 2.14-2.25, 1.667-1.85, 2.01-2.10 min, individually. Retention time varies from different pesticide detection. Among the 21 samples from different matrix (clean rice, straw and soil), Thiamethoxam (m/z 292.0 > 211.10), and Tricyclazole (m/z 190.0 > 136.0) pesticide residues were found only in 10 soil, grain and straw samples from recommended dose and double dose of pesticides treated plot. No residues were found in soil matrix, clean rice and straw in control treated plot. Bensulfuron methyl (m/z 411.25 > 149.20) only detected in soil at 0-15 DAT. At harvest the residues of pesticides were found to be below MRL fixed by FSSAI for pesticides in polished rice and straw (FSSAI, 2018) (Table 3).

ID# : 2 m/z : 411.2500-149.2000
 Name : Bensulfuron-methyl
 Quantitative Method : External Standard
 Function : $f(x) = 48502.9 * x - 86631.3$
 $R^2_1 = 0.9998251$ $R^2_2 = 0.9996503$
 MeanRP: 4.209215e+004 RF SD: 6.977341e+003 RF %RSD: 16.576347
 FitType : Linear
 ZeroThrough : Not Through
 Weighted Regression : 1/C



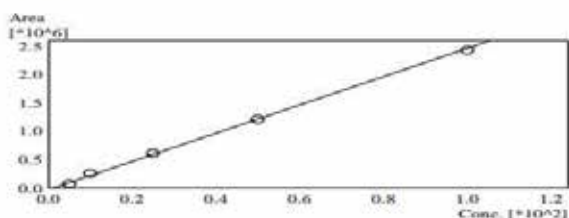
#	Conc.(Ratio)	MeanArea	Area
1	5	138750	138750
2	10	379468	379468
3	25	1156972	1156972
4	50	2461470	2461470
5	100	4725779	4725779

ID# : 4 m/z : 482.0000-283.9500
 Name : Chlorantraniliprole
 Quantitative Method : External Standard
 Function : $f(x) = 19441.5 * x - 36423.4$
 $R^2_1 = 0.9969456$ $R^2_2 = 0.9930006$
 MeanRP: 1.674619e+004 RF SD: 3.236842e+003 RF %RSD: 19.328834
 FitType : Linear
 ZeroThrough : Not Through
 Weighted Regression : 1/C



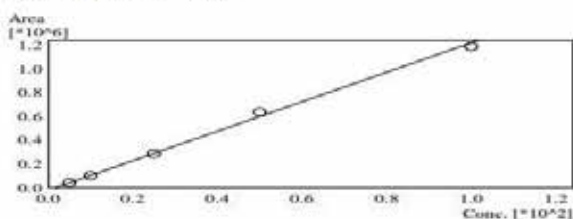
#	Conc.(Ratio)	MeanArea	Area
1	5	89145	89145
2	10	173766	173766
3	25	461374	461374
4	50	926747	926747
5	100	1929539	1929539

ID# : 15 m/z : 292.0000-211.1000
 Name : Thiamethoxam
 Quantitative Method : External Standard
 Function : $f(x) = 24943.4 * x - 28299.7$
 $R^2_1 = 0.9983900$ $R^2_2 = 0.9967826$
 MeanRP: 2.284919e+004 RF SD: 4.316026e+003 RF %RSD: 18.889189
 FitType : Linear
 ZeroThrough : Not Through
 Weighted Regression : 1/C



#	Conc.(Ratio)	MeanArea	Area
1	5	76007	76007
2	10	257497	257497
3	25	617114	617114
4	50	1219907	1219907
5	100	2433216	2433216

ID# : 16 m/z : 190.0000-136.0000
 Name : Tricvclazole
 Quantitative Method : External Standard
 Function : $f(x) = 12391.1 * x - 20651.5$
 $R^2_1 = 0.9989933$ $R^2_2 = 0.9979875$
 MeanRP: 1.086292e+004 RF SD: 1.795749e+003 RF %RSD: 16.530999
 FitType : Linear
 ZeroThrough : Not Through
 Weighted Regression : 1/C



#	Conc.(Ratio)	MeanArea	Area
1	5	40577	40577
2	10	101592	101592
3	25	286796	286796
4	50	615682	615682
5	100	1186461	1186461

Figure 1. The calibration curve of the four pesticides

Table 3. The retention time and concentrations (ppb) of four pesticides in soil, polished rice and rice straw

Treatments	Rice grain (clean rice)		Straw		Soil (0 DAT to 15 DAT)	
	Retention time (min)	Concentration (ppb)	Retention time (min)	Concentration (ppb)	Retention time (min)	Concentration (ppb)
T ₁ =Control (Untreated)	-	Not found	-	Not found	-	Not found
T ₂ =Bensulfuron methyl (Recommended dose @ 750 g/ha)	2.32	Not found	-	Not found	2.32	0.98
T ₃ =Bensulfuron methyl (Double the recommended dose)	2.34	Not found	-	Not found	2.34	2.05
T ₄ =Thiamethoxam + Chlorantraniliprole (Recommended dose @75 g ha ⁻¹)	1.817	3.05	1.717	2.27	1.716	2.18
T ₅ =Thiamethoxam + Chlorantraniliprole (Double the recommended dose)	1.667	3.04	1.667	2.501	2.34	1.78
T ₆ = Tricyclazole 75%WP (Recommended dose @400 g ha ⁻¹)	2.03	2.14	2.01	1.15	2.054	3.15
T ₇ = Tricyclazole 75%WP (Double the recommended dose)	2.09	5.13	2.10	3.08	2.05	1.04

Soil Science Division

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SUMMARY

An application rate of 40 kg K ha⁻¹ seems sufficient for BRRI hybrid dhan6 to reach optimal rice yield during the Aman season, while in the Boro season, an application rate of 80 kg K ha⁻¹ appears adequate for BRRI dhan102 to achieve optimal rice yield in Madhupur Tract soil.

The optimal economic dose of N for the cold-tolerance advanced line BR11894-R-R-R-R-169 was 155 kg N ha⁻¹. Similarly, the optimal economic N doses for PQR ALART material BR11359-4 R-181 and BR11359-4 R-279 were 150 kg and 155 kg N ha⁻¹ respectively.

The calculated economic optimum N dose of PQR-Path ALART material was 155 kg N ha⁻¹, and for the check varieties BRRI dhan50 and BRRI dhan104 the doses were 150 and 158 kg N ha⁻¹ respectively. Similarly, the calculated economic optimum N dose of favourable Boro ALART material was 165 kg N ha⁻¹, and for the check variety BRRI dhan92 the dose was 160 kg N ha⁻¹ respectively.

Urea deep placement significantly increased rice yield by 13% under AWD and 16% under CSW conditions compared to broadcast application of prilled urea.

The values of soil pH-H₂O and available K obtained through soil sensors and laboratory measurements were almost identical. The selected BRRI RS, Sonagazi farm has wide spatial variation in key soil properties like pH, OC, total N, and available K, making it suitable for research on variable rates of N and K fertilizers instead of uniform applications. Further verification requires using higher-quality soil sensors for soil OC, total N, and available P and K.

The highest average SOC content (1.37%) was found in Joypurhat, followed by Natore (1.33%) and Pabna (1.30%). The interpolated map of SOC indicates that most of Rajshahi Division has medium levels of organic C (0.99-1.97%). A higher organic C content in soils suggests increased soil fertility, which can lead to higher crop yields.

Sulphur and Zinc are not limiting nutrients yet and have shown similar grain yield compared to complete fertilizer in both T. Aman and Boro

seasons. In case of annual yield, organic with Integrated Plant Nutrition System (IPNS) based chemical fertilizer treatment shows an increasing trend compared to complete chemical fertilizer treatment.

Among the major nutrient elements, the omission of N was the most yield-limiting factor, followed by P and K omission across all locations in the Boro season.

The response to added phosphorus is lower during the wet season than in the dry season. However, applying the recommended dose of P fertilizer may be helpful for better rice yield regardless of the season.

Complete fertilization can restore soil productivity even after many years of rice cultivation. Adding Zn and Cu once a year along with NPKS increased the annual grain yield by more than about 1.0 t ha⁻¹ compared to applying NPKS alone.

During the study period 100% STB fertilization and 50% STB with mixed manure fertilization showed significantly higher grain yield compared to other treatments.

Use of integrated nutrient management (INM) can produce similar or equal grain yield in compared full doses of chemical fertilizer which can sustain rice yield and soil health.

Liquid nano-urea had a significant impact on rice yields in Gazipur and Barishal. However, no extra yield advantage was seen from using Zeolite in any of the locations.

In Gazipur, nano urea significantly reduced CH₄ emissions compared to the recommended prilled urea, whereas it had no significant effect on CH₄ emissions in Cumilla.

Grain yields were similar between AWD and CSW irrigation. The AWD 15 cm and AWD, 25 cm treatments reduce the total CH₄ flux by approximately 34-36% and 32-38%, respectively, compared to CSW at Gazipur and Kushtia.

The use of bio-coated urea reduced the N requirement by 40% in rice cultivation.

In conclusion, we found that applying 0.5 t ha⁻¹ BRRI organic fertilizer replaced 100% TSP/DAP and reduced urea use by 30% in rice cultivation, providing financial benefits.

SOIL FERTILITY AND PLANT NUTRITION

Influence of potassium on the performance of modern rice. The study was conducted to observe the effect of potassium (K) on the yield of modern rice at BRRI HQ farm, Gazipur during Aman 2024 and Boro 2024-25 seasons. The experiment was laid out in a RCBD design with three replications assigning the five rates of K. The application rate of K was 0, 40, 80, 120 and 160 kg ha⁻¹ in both the seasons. Recommended doses of N, P, S and Zn (90, 9, 7 and 1 kg ha⁻¹ in Aman season and 174, 18, 18 and 2 kg ha⁻¹ in Boro season respectively) were applied to all the plots. The test varieties were BRRI hybrid dhan6 and BRRI dhan102 in Aman and Boro seasons respectively. The pH of the experiment field soil was 6.02 and the mean conc. of soil K was 0.12 meq 100g⁻¹.

Grain yield. The effect of K rates in rice yield was significant in Aman 2024 and Boro 2024-25 (Table 1). In Aman 2024, K fertilizer increased grain yield compared to the K-control plot. However, no significant yield improvement was observed beyond 40 kg K ha⁻¹ (Table 1). Therefore, an application rate of 40 kg K ha⁻¹ appears sufficient for BRRI hybrid dhan6 to achieve optimum rice yield during the Aman season. However, considering continuous mining of K from the agricultural soils of Bangladesh, 60-80 kg K ha⁻¹ should be recommended as a maintenance dose for modern Aman rice varieties. In Boro 2024-25, K fertilizer also increased grain yield compared to the K-control plot. However, no significant yield improvement was observed beyond 80 kg K ha⁻¹ (Table 1). Therefore, an application rate of 80 kg K ha⁻¹ appears sufficient for BRRI dhan102 to achieve optimum rice yield during the Boro season in Madhupur Tract soil.

Table 1. Effect of K rates on the grain yield of MV rice in Aman 2024 and Boro 2024-25 at BRRI HQ farm, Gazipur.

K rate (kg ha ⁻¹)	Grain yield (t ha ⁻¹)	
	T. Aman 2024	Boro 2024-25
0	3.32b	3.67 c
40	3.84a	5.11 b
80	4.01a	6.17 a
120	3.89a	6.65 a
160	3.99a	6.54 a
<i>p</i> -values	<0.01	<0.001
CV	4.07	4.77

Values followed by the same letter are not significantly different at the 5% level of probability.

Determining N requirement of cold tolerant ALART materials. N requirement is significant as N is the most limiting nutrients for rice production. Field trial was conducted at BRRI farm, Gazipur in Boro 2024-25 season to determine the N requirement of cold tolerant rice advanced line. One cold tolerant advanced line V₁= BR11894-R-R-R-169 was

compared with two check varieties V₂= BRRI dhan28 and V₃= BRRI dhan67 in Boro. Six N rates (kg ha⁻¹): N₀, N₄₀, N₈₀, N₁₂₀, N₁₆₀ and N₂₀₀ were applied for the experiment following split-plot design with three replications, where N rates were assigned in main-plot and rice genotypes in sub-plot.

Grain yield and N requirements. Grain yield of most genotypes increased with the increasing of N rates up to 160 kg ha⁻¹ and then decreased. The cold tolerant line BR11894-R-R-R-

R-169 produced similar grain yield than the check variety BRRI dhan67. The calculated economic optimum dose of N for advanced line BR11894-R-R-R-169 was 155 kg Nha⁻¹ (Fig. 1).

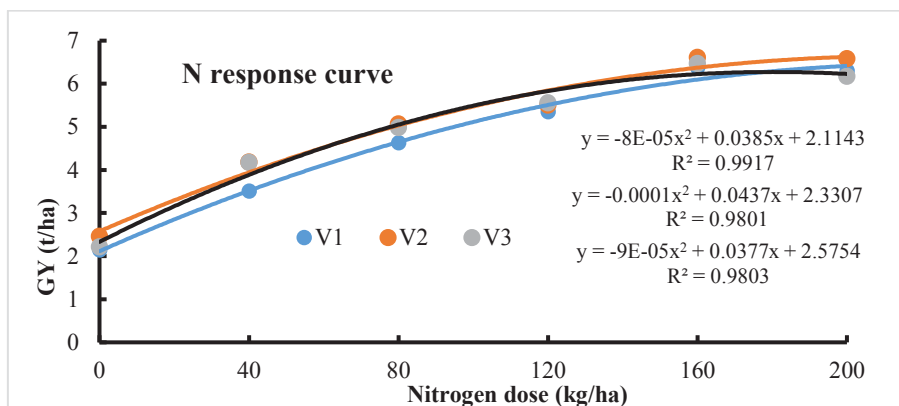


Fig. 1. Nitrogen response curve of cold tolerance ALART materials in Boro 2024-25, BRRI, Gazipur.

Determining N requirement of premium quality (PQR) Boro ALART materials. N requirement comes first as it is the most limiting nutrients for rice production. Field trial was conducted at BRRI HQ farm, Gazipur in Boro 2024-25 season to determine the N requirement of PQR Boro advanced lines. Two PQR advanced line V₁= BR11359-4R-181 and V₂= BR11359-4R-279 were compared with two check varieties V₃ = BRRI dhan104 and V₄= BRRI dhan107 in Boro. Six N rates (kg ha⁻¹): N₀, N₄₀, N₈₀, N₁₂₀, N₁₆₀ and N₂₀₀ were applied for the experiment

following split-plot design with three replications, where N rates were assigned in main-plot and rice genotypes in sub-plot.

Grain yield and N requirements. Grain yield of most genotypes increased with the increasing of N rates up to 160 kg ha⁻¹ and then decreased. The calculated economic optimum N dose of PQR ALART material BR11359-4R-181 was 150 kg and for BR11359-4R-279 it was 155 kg N ha⁻¹, respectively (Fig. 2).

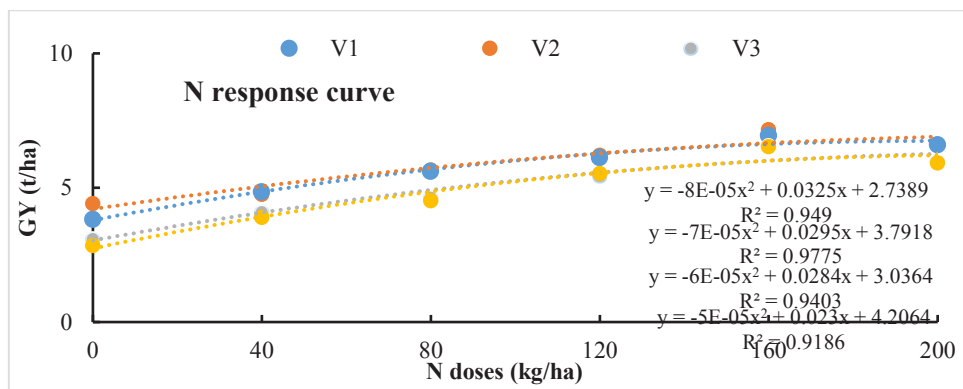


Fig. 2. Nitrogen response curve of PQR ALART materials in Boro 2024-25, BRRI, Gazipur.

Determining the N requirement of premium quality rice-Path (PQR-Path) Boro ALART

materials. N requirement as N is the most limiting nutrient for rice production. A field trial was

conducted at the BRRI farm in Gazipur during the Boro 2024-25 season to determine the N requirement of PQR-Path Boro advanced line. One PQR-Path advanced line was compared with two check varieties BRRI dhan50 and BRRI dhan104, in Boro. Six N rates (kg ha^{-1}): N_0 , N_{40} , N_{80} , N_{120} , N_{160} , and N_{200} were applied for the experiment following a split-plot design with three replications, where N rates were assigned in the main-plot and rice genotypes in the sub-plot.

Grain yield and N requirements. Grain yield of most genotypes increased with the increase in N rates up to 160 kg ha^{-1} and then decreased. The calculated economic optimum N dose of PQR-Path ALART material was 155 kg N ha^{-1} , and for the check varieties BRRI dhan50 and BRRI dhan104 the doses were 150 and 158 kg N ha^{-1} , respectively (Fig. 3).

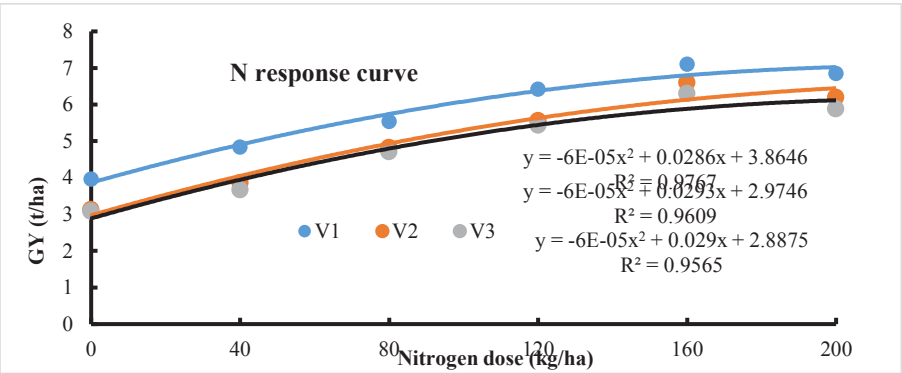


Fig. 3. Nitrogen response curve of PQR-Path ALART materials in Boro 2024-25, BRRI HQ, Gazipur.

Determining N requirement of Favourable Boro ALART materials. N requirement needs to be met as N is the most limiting nutrients for rice production. Field trial was conducted at BRRI farm, Gazipur in Boro 2024-25 season to determine the N requirement of favorable Boro advanced line. One favorable Boro advanced line was compared with one check variety BRRI dhan92 in Boro season. Six N rates (kg ha^{-1}): N_0 , N_{40} , N_{80} , N_{120} , N_{160} and N_{200} were applied for the experiment following split-plot

design with 3 replications, where N rates were assigned in the main-plot and rice genotypes in sub-plot.

Grain yield and N requirements. The calculated economic optimum N dose of favourable Boro ALART material was 165 kg N ha^{-1} , and for the check variety BRRI dhan92 the dose was 160 kg N ha^{-1} respectively (Fig. 4).

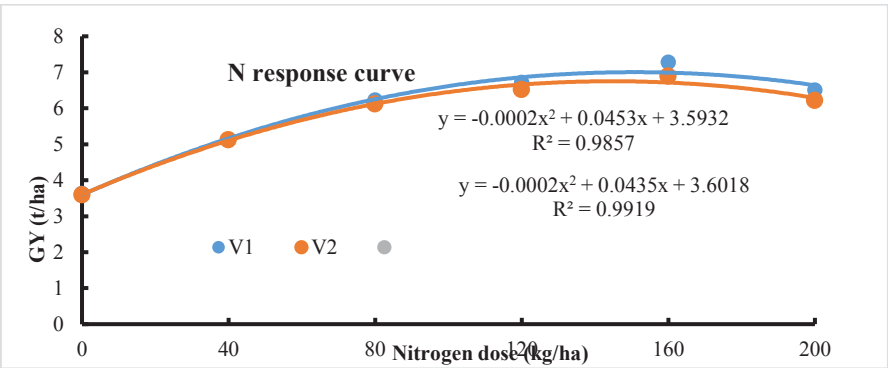


Fig. 4. Nitrogen response curve of favourable Boro ALART materials in Boro 2024-25, BRRI HQ, Gazipur.

The Impact of water and nitrogen management practices on rice yield and nitrogen losses in paddy field. The experiment was carried out in Boro 2024-25 season at BRRI-Gazipur farm to investigate the effect of nitrogen and water management practices on rice yield as well as to quantify the nitrogen loss and use efficiency. The experiment was comprised of seven treatments: T₁= 100% broadcast urea (378 kg ha⁻¹), T₂= 100% deep placement urea (378 kg ha⁻¹), T₃= 75% broadcast urea (284 kg ha⁻¹), T₄= 75% deep placement urea (284 kg ha⁻¹), T₅= 50% broadcast urea (189 kg ha⁻¹), T₆= 50% deep placement urea (189 kg ha⁻¹) and T₇= N control. The treatments were applied under alternate wetting drying and continuous standing water conditions following randomized complete block design with three replications. All treatments received a blanket dose of P-K-S-Zn @ 18-80-18-2 kg ha⁻¹ respectively. All fertilizers except urea were applied at final land preparation. For treatment

T₂, T₃ and T₆, urea was applied in three equal splits as basal, active tillering and seven days before panicle initiation. In treatment T₂, T₄ and T₆, full dose of prilled urea were applied after 10 days of transplanting by applicators.

Grain yield. Urea deep placement showed significant yield increase both under AWD and CSW conditions, particularly when 100% of the urea was deep placed (Fig. 5). Deep placement of 100% urea (T₂) resulted in 13% and 16% yield increase over the 100% (T₁) urea broadcast in AWD and CSW respectively. Moreover, when 75% urea of the recommended dose (T₄) was applied as deep placement it produced statistically similar yield to that of 100% urea as broadcast (T₁) under both AWD and CSW conditions. These results indicate that urea deep placement can increase rice yield by minimizing urea loss under both AWD and CSW conditions (Fig.5).

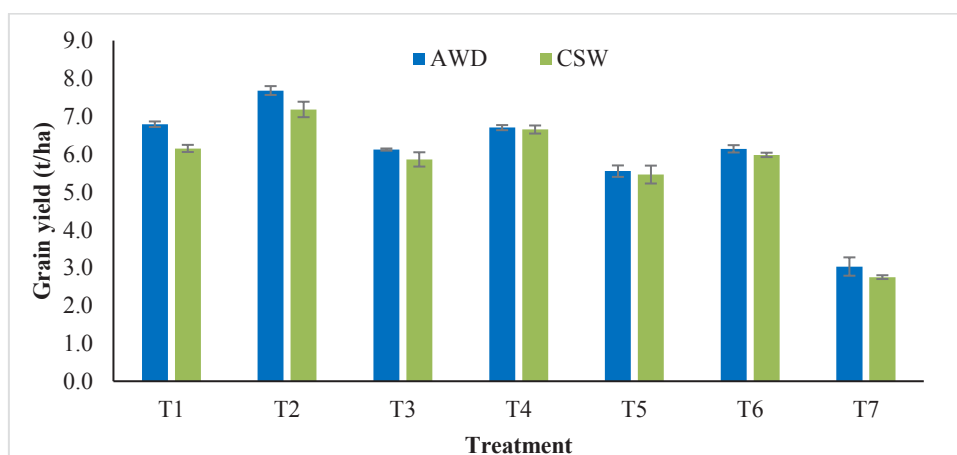


Fig. 5. Effect of nitrogen fertilizer management under different water management practices in BRRI HQ, Gazipur during Boro 2024-25.

Assessment of soil properties in paddy field with spatial variability by sensor and lab methods. Traditional measurement of soil moisture, pH, electrical conductivity (EC), mineral nitrogen (N), available P and K accurately for paddy field with wide spatial variation are time-consuming, costly and difficult. Recent use of portable soil sensor allows to generate quick results on these multiple soil properties. In December 2024, 141 soil samples (0-15 cm) were collected in 50 m×50 m grid system covering 37ha rice growing area of BRRI RS

Sonagazi 1°to assess spatial variability of soil pH, organic carbon (OC), total N, C:N, available phosphorus (P) and potassium (K); 2°to compare the outcomes on soil pH, EC, mineral N, available P and K measured by soil sensor and standard lab methods. The collected soil samples were air dried, ground and sieved by 2mm mesh sieve, and used for laboratory analysis of soil OC, pH, total N, available P and K. Ordinary kriged maps of spatial distribution for soil properties were produced using surfer11 software. Table 2 shows the descriptive statistics for

soil pH-H₂O (1:2.5), OC, total N, C:N and available K. Mean and median values of all soil properties were identical and had skewness values ranged from -0.1 to 0.5 indicating approximately symmetrical or close to normal distributions of the data. Across soil properties the coefficients of variation (CV) (%) ranged from 8.3 (for soil pH-H₂O) to 15.6 (for available K). Soil pH-H₂O varied in a narrow range of 5.3 to 7.6 with a mean value of 6.1 (Table 2 and Fig. 6). While the soil OC (0.9-1.8%), total N (0.1-

0.2%) and C:N (8-16) varied a factor 2 within the field but overall had coefficient of variations of 14.1, 13.4 and 13.0 respectively (Table 2, Fig. 6 and Fig. 7). The available K (meq 100⁻¹ g soil) ranged from (2 to 6.1) with mean/median value of 0.4 indicating its noticeable variation (varied by factor 2.5) within BRRI RS Sonagazi farm soil. Overall, the values of soil pH-H₂O and available K attained via soil sensor and laboratory measurement were almost analogous (Fig. 8).

Table 2. Descriptive statistics for studied chemical properties of soil collected during pre-harvest Boro season 2025 in BRRI RS Sonagazi farm.

Property	Min	Max.	Mean	Median	Std. Dev.	Std. error	CV (%)	Skewness
SOC (%)	0.9	1.8	1.4	1.4	0.2	0.0	14.1	-0.1
Total N (%)	0.1	0.2	0.1	0.1	0.0	0.0	13.4	0.3
C:N	8	16	11	11	1.0	0.1	13.0	0.4
pH-H ₂ O (1:2.5)	5.3	7.6	6.1	6.1	0.5	0.0	8.3	0.5
Available K (meq 100g ⁻¹)	0.2	0.6	0.4	0.4	0.1	0.0	15.6	0.1

So, the selected BRRI Sonagazi farm has wide spatial variation in the most important soil properties like pH, OC, total N and available K, hence could be suitable to do research on identifying variable rates of N and K fertilizers instead of their uniform rates. Further verification requires using better quality soil sensor for soil OC, total N, available P and K.

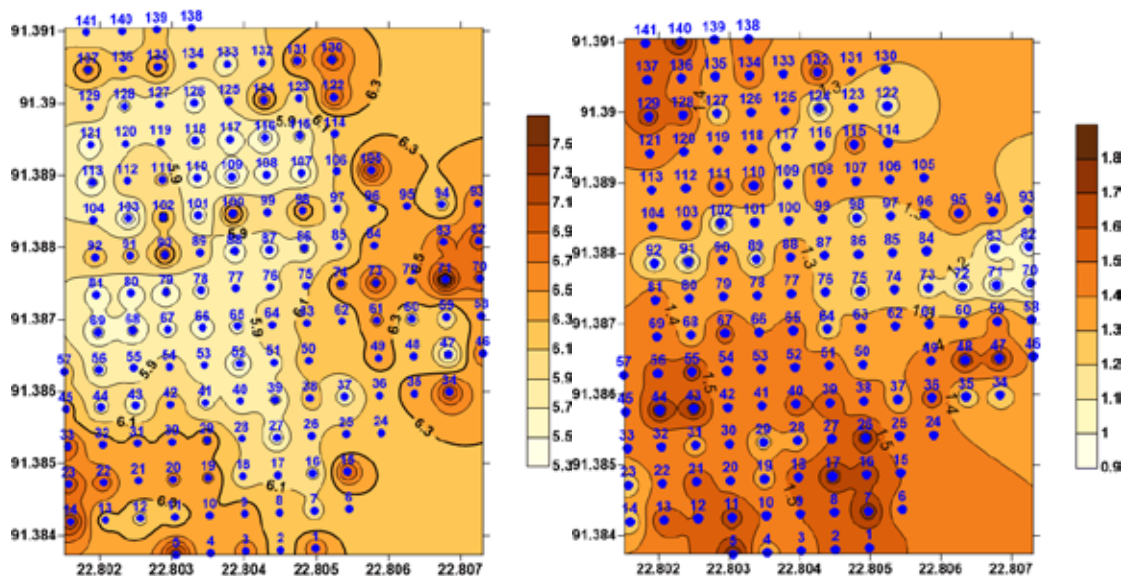


Fig. 6. Interpolated map showing spatial variability of pH-H₂O (left) and OC (right) across soil collected during pre-harvest Boro season 2025 in BRRI RS, Sonagazi farm.

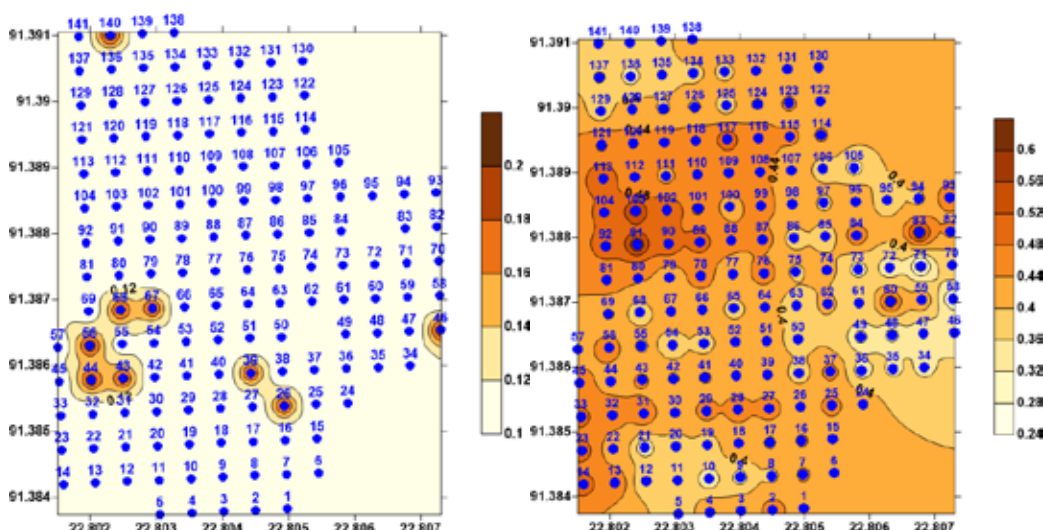


Fig. 7. Interpolated map showing spatial variability of total N (left) and exchangeable K (right) across soil collected during pre-harvest Boro season 2025 in BRRI RS, Sonagazi farm.

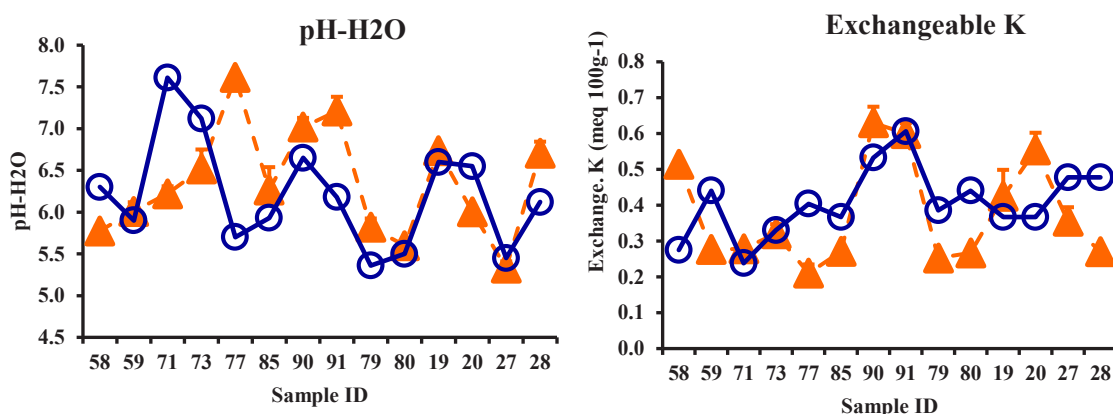


Fig. 8. Soil pH-H₂O (1:2.5) (left) and exchangeable K (right) measured in by lab methods (circle) and soil sensor (triangle).

Delineating productivity of rice soils in the ecologically constrained areas of Bangladesh through digital soil mapping (DSM). This study was initiated during 2023-24 to determine the productivity of rice soils in the ecologically constraint areas of Bangladesh through development of DSM and applying site specific nutrient management (SSNM). Soil sampling locations were selected from the Barind tract and drought prone areas under Rajshahi region. A total of 159 locations covering all the eight districts of Rajshahi Division were sampled based on AEZ, land type and cropping

pattern. Soil samples were dried, crushed and analysed for basic soil properties following standard protocols.

Soil pH ranged from 4.43 (very strongly acidic) in Joypurhat district to as high as 8.32 (slightly alkaline) in Chapai Nawabganj (Table 3). The highest mean soil pH was 7.57 in Pabna district which was statistically equal to those of Rajshahi, Natore and Chapai Nawabganj districts. On the contrary, the lowest mean soil pH was observed in Joypurhat district (5.34) which was similar to those

of Naogaon and Bogura districts. Thus, there was significant variation in soil pH among the districts of Rajshahi region (Table 3). The data of soil pH were normally distributed in most of the cases, as observed by their low and insignificant values of skewness and kurtosis (Table 3). The interpolated map shows that the northern part of Rajshahi region

had acidic pH while the southern and western part shows high soil pH (Fig. 9). The alkaline pH of soils implies a decreased availability of micronutrients in the studied soils while the strongly acidic soil pH indicates a possible deficiency of phosphorus in the soils.

Table 3. Distribution of soil pH in different districts of Rajshahi Division during 2023-24.

District	No of obs.	Mean*	SD	Min	Max	Skewness	Kurtosis
Bogura	26	5.97 bc	0.63	4.76	7.39	0.44	0.06
Ch. Nawabganj	11	7.07 a	0.82	5.56	8.32	-0.19	-0.29
Joypurhat	10	5.34 c	0.46	4.43	6.16	-0.45	1.41
Naogaon	28	5.76 bc	0.61	4.98	7.27	0.80	-0.06
Natore	14	7.48 a	0.41	6.98	8.09	0.34	-1.67
Pabna	17	7.57 a	0.51	6.45	8.20	-0.68	-0.25
Rajshahi	30	7.51 a	0.71	5.90	8.30	-0.76	-0.32
Sirajganj	23	6.12 b	0.35	5.48	6.71	-0.12	-0.48

* Values followed by same letter in a column are not significantly different at the 5% significance level.

The content of SOC ranged from 0.52% in Rajshahi district to as high as 2.13% in Natore (Table 4). The data were normally distributed in all the districts as observed by the low skewness values. The mean SOC contents of all the studied districts of Rajshahi division were statistically similar (Table 4).

The highest mean SOC content (1.37%) was observed in Joypurhat followed by Natore (1.33%) and Pabna (1.30%). The interpolated map of SOC shows that major part of Rajshahi Division contained medium level of organic C (0.99-1.97%) (Fig. 9). A higher organic C content of the soils implies a higher soil fertility and hence, higher crop yield is expected.

Table 4. Distribution of soil org. C (%) in the districts of Rajshahi Division during 2023-24.

District	No. of obs.	Mean*	SD	Min	Max	Skewness	Kurtosis
Bogura	26	1.28 a	0.36	0.67	1.94	0.16	-0.79
Ch. Nawabganj	11	1.16 a	0.22	0.95	1.58	0.71	-0.82
Joypurhat	10	1.37 a	0.33	0.81	1.92	-0.23	0.01
Naogaon	28	1.23 a	0.31	0.58	1.8	-0.05	-0.75
Natore	14	1.33 a	0.37	0.79	2.13	0.72	0.28
Pabna	17	1.30 a	0.32	0.91	1.97	0.52	-0.73
Rajshahi	30	1.18 a	0.27	0.52	1.74	0.19	0.42
Sirajganj	23	1.23 a	0.32	0.64	2.06	0.19	1.07

*Values followed by same letter in a column are not significantly different at the 5% significance level.

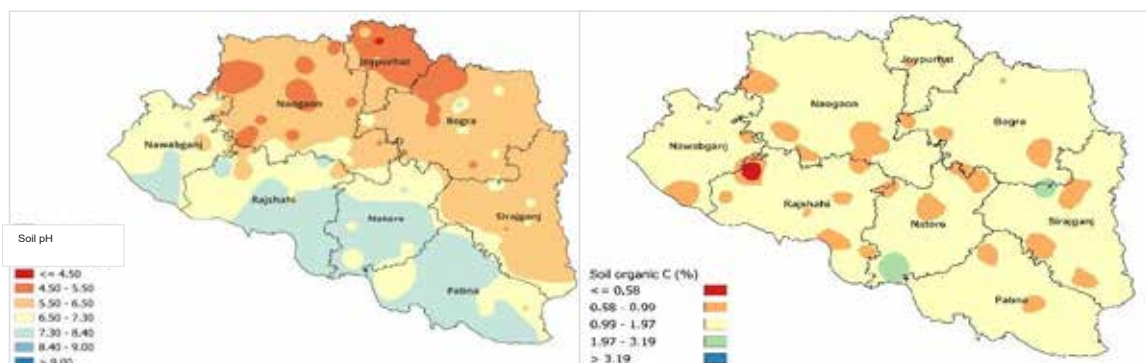


Fig. 9. Interpolated surface showing soil pH and organic C in different districts of Rajshahi Division during 2023-24.

IDENTIFICATION AND MANAGEMENT OF NUTRITIONAL DISORDER

Long-term use of organic and inorganic nutrients in Boro-Fallow-T. Aman rice. A long-term experiment was initiated on a permanent layout at BRRI HQ farm, Gazipur, in 1985 Boro season, having 12 treatments assigned in RCB design with four replications. The objective of the study was to find out the impact of long-term nutrient management on grain yield and soil health. The treatments were revised according to needs (see BRRI 2016 and BRRI 2019). The recent STB doses of NPKSZn were 160-12-80-10-2 kg ha⁻¹ and 100-10-60-8-1 kg ha⁻¹ for Boro and T. Aman rice respectively. In T. Aman 2024, the variety was BRRI dhan87 and in Boro 2024-25, it was BRRI dhan92.

Grain yield. Full omission of N, P and K decreased rice grain yield significantly compared to complete fertilizer treatment in both the seasons. Among the organic treatments, applications of PM, CD and VC as IPNS produced slightly higher grain yield as compared to complete fertilizer (Table 5). Increased K rates (kg ha⁻¹) from 40 to 80 have significant impact on grain yield. Sulphur and zinc are not limiting nutrients yet and have shown similar grain yield compared to complete fertilizer in both T. Aman and Boro seasons. In case of annual yield, organic with IPNS based chemical fertilizer treatment shows an increasing trend compared to complete chemical fertilizer treatment (Fig. 10).

Table 5. Effect of organic and inorganic amendments on rice grain yield (t ha⁻¹) of BRRI dhan87 and BRRI dhan92 at BRRI HQ Gazipur in 2024-25.

Treatment	Grain yield (t ha ⁻¹)	
	T. Aman 2024	Boro 2024-25
T ₁ = NPKSZn@150/100-12/10-80-5-2 kg ha ⁻¹	5.34 a	6.80 a
T ₂ = NPSZn (-K)	4.67 c	4.08 c
T ₃ = NKSZn (-P)	4.79 bc	5.23 b
T ₄ = PKSZn (-N)	3.62 d	2.76 d
T ₅ = CD (3 t ha ⁻¹) + IPNS	5.52 a	6.85 a
T ₆ = NPKS (-Zn)	5.20 ab	6.49 a
T ₇ = NPKZn (-S)	5.28 ab	6.45 a
T ₈ = PM (2 t ha ⁻¹) + IPNS	5.58 a	7.22 a
T ₉ = NPKSZn @150/100-12/10-60-5-2 kg ha ⁻¹	5.25 ab	6.82 a
T ₁₀ = VC (2 t ha ⁻¹) + IPNS	5.21 ab	6.45 a
T ₁₁ = NPKSZn@150/100-12/10-40-5-2 kg ha ⁻¹	5.12 abc	6.55 a
T ₁₂ = Control (native nutrients)	3.45 d	2.01 d
CV (%)	4.06	7.74

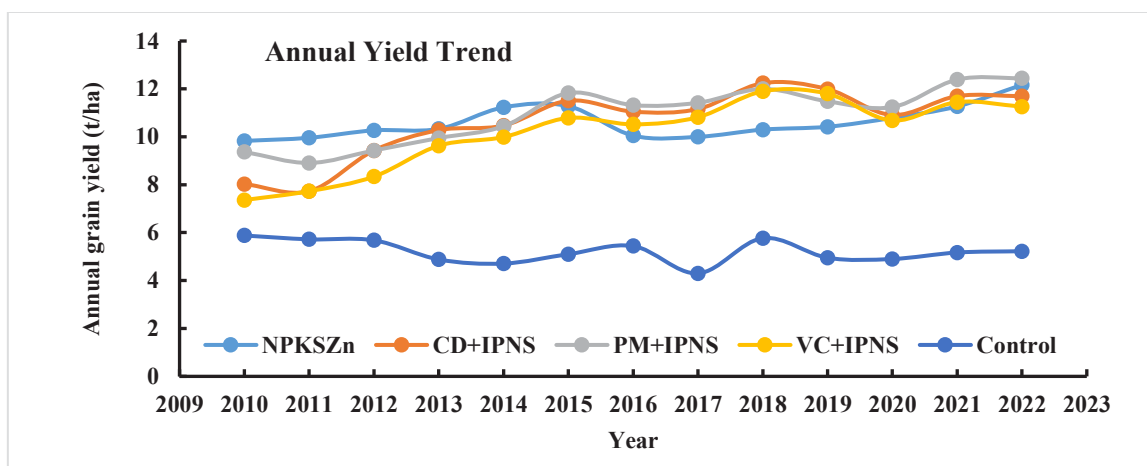


Fig. 10. Annual yield trend of IPNS-based treatment compared with complete chemical fertilizer and control treatment, 2024-25, BRRI, Gazipur

Long-term missing element trial at BRRI Regional Stations (RS) farm, Boro 2024-25: The field experiments were initiated in a permanent layout at seven (7) BRRI RS farms during Boro, 2024-25, combining seven treatments: T₁= Control, T₂= NPKSZn, T₃= PKSZn (-N), T₄= NKSZn (-P), T₅= NPSZn (-K), T₆= NPKZn (-S), T₇=NPKS (-Zn) in RCB design with three replications. Fertilizer was applied based on soil test (STB). Urea-N was applied into three equal splits at final land preparation, active tillering, and 5-7 days before panicle initiation (PI) stage. The remaining fertilizers were applied at final land preparation as a basal application.

Grain yield and limiting nutrient. In the first crop of Boro season and in all locations complete fertilizer (NPKSZn) treatment gave significantly higher yield than omission nutrient plots. The omission of N and P in Boro season from complete fertilizer significantly reduced the grain yield of rice at all BRRI RS farm (Table 6). Among the major nutrient elements, the omission of N appeared as the most yield-limiting nutrient followed by P and K omission for rice at all locations in Boro season. Yet the S and Zn omission have less effect on yield reduction at all BRRI RS farm, except Habiganj farm where S and Zn omission had a little effect on grain yield in Boro season.

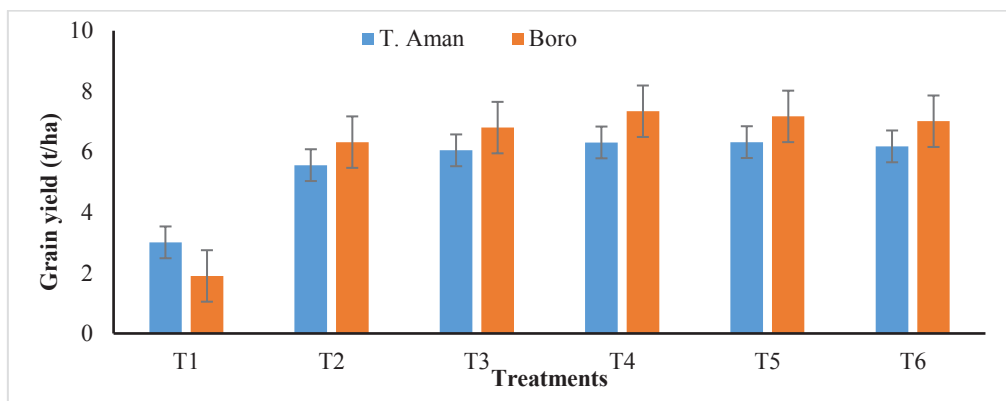
Table 6. Effect of long-term missing element on grain yield at different BRRI RS farm, Boro, 2024-25

Treatment	Rangpur (BRRI dhan89)	Sonagazi (BRRI dhan102)	Habiganj (BRRI dhan102)	Sirajganj (BRRI dhan102)	Rajshahi (BRRI dhan102)	Kushtia (BRRI dhan100)	Barishal (BRRI dhan74)
T ₁	2.82 d	4.50 c	5.13 d	4.35 c	2.28	2.26	3.01c
T ₂	7.38 a	7.48 a	8.39 a	8.57 a	6.02	6.20	7.19 a
T ₃	3.05 d	4.84 c	6.18 c	4.94 b	4.36	2.32	3.31 b
T ₄	5.75 c	6.61 b	8.32 a	8.35 a	5.39	6.10	7.11 a
T ₅	6.94 b	6.80 ab	8.04 ab	8.14 a	5.79	6.17	7.13 a
T ₆	7.33 a	6.93 ab	7.73 b	8.49 a	5.43	6.02	6.76 a
T ₇	7.23 ab	6.71 ab	7.84 ab	8.38 a	5.80	5.99	6.97 a
CV%	2.20	5.78	2.63	2.20	4.53	5.08	5.60

N.B. T₁= Control, T₂= NPKSZn, T₃= PKSZn (-N), T₄= NKSZn (-P), T₅= NPSZn (-K), T₆= NPKZn (-S), T₇=NPKS (-Zn)

Performance of rice variety under P-deficient conditions. Acute P deficiency reduces rice yield depending on internal and/or external mechanisms that allow greater soil P extraction. The experiments were conducted at BRRI HQ farm, Gazipur during T. Aman 2024 and Boro 2024-25 seasons having deficit soil available P condition. In both seasons, six P doses 0, 50%, 75%, 100% 125% and 150% of STB P were evaluated with BRRI hybrid dhan6 in T. Aman while BRRI hybrid dhan3 in Boro season. Each plot received a flat dose of N-K-S-Zn (kg ha⁻¹) @ 100-60-10-1 in T. Aman and 160-80-12-2 in Boro season

Grain yield of T. Aman and Boro. Soil P deficit conditions largely influence grain yield of rice in both the seasons. Soil available P levels can decrease tremendously if P fertilizer is not applied for a long period of time. Rice yield increased sharply due to P fertilizer application. BRRI hybrid dhan6 in T. Aman and BRRI hybrid dhan3 in Boro season showed better result at 100% of STB P condition (Fig. 11). Response of added phosphorus is lower in wet season than in dry season. However, application of recommended dose of P fertilizer might be useful for better rice yield irrespective of season.



T₁ = 0, T₂ = 11, T₃ = 16.5, T₄ = 22, T₅ = 27.5, T₆ = 33 kg Pha⁻¹, respectively.

Fig. 11. Effect of different doses of phosphorus on grain yield of T. Aman and Boro rice, 2024-25, BRRI Gazipur.

Effect of intensive rice cropping on rice yield under continuous wetland conditions. The experiment was designed to harvest three rice crops per year with evaluation of the consequences of intensive rice cropping under continuous wet land conditions and to monitor soil fertility changes over time. This experiment was initiated in 1971 in a permanent layout with NPK fertilizer application. Since Boro 2000, the experiment was modified to accommodate six treatments viz control (native nutrient), reverse control (NPKSZnCu), NPK, NPKS, NPKSZn and NPKSZnCu after several revisions 1982, 1984 and 1991. In Boro 2020-21, the N and K fertilizer were revised again from 140 to 160 and 80 to 100 kg ha⁻¹ respectively. The varieties tested in T. Aus, T. Aman and Boro seasons were BRRI dhan48, BRRI dhan87 and BRRI dhan84, respectively. The NPK doses used were 160-25-100, 60-15-80 and 60-10-60 kg ha⁻¹ for Boro, T. Aman

and T. Aus, respectively. Sulfur, Zn and Cu were applied at 10, 4 and 1 kg ha⁻¹ in Boro season only.

Grain yield and yield trend. The annual rice production trend from 1981 to 2024 was decreasing because of continuous rice cultivation with no fertilizer application. However, from 2001 the reverse control treatment produced grain yield almost similar to complete fertilized treatment (Fig. 12). In 2024, annual rice production in control plot was 5.27 t ha⁻¹, while its reversed management (addition of NPKSZnCu fertilizer) resulted in 13.05 t ha⁻¹yr⁻¹ grain production, which was close to complete fertilizer treatment (14.01 t ha⁻¹yr⁻¹). It indicates that complete fertilization can recuperate soil productivity even after a long period of rice cultivation. Results indicate that additional use of Zn and Cu once in a year with NPKS increased annual grain yield by more than about 1.0 t ha⁻¹ than the application of NPKS alone.

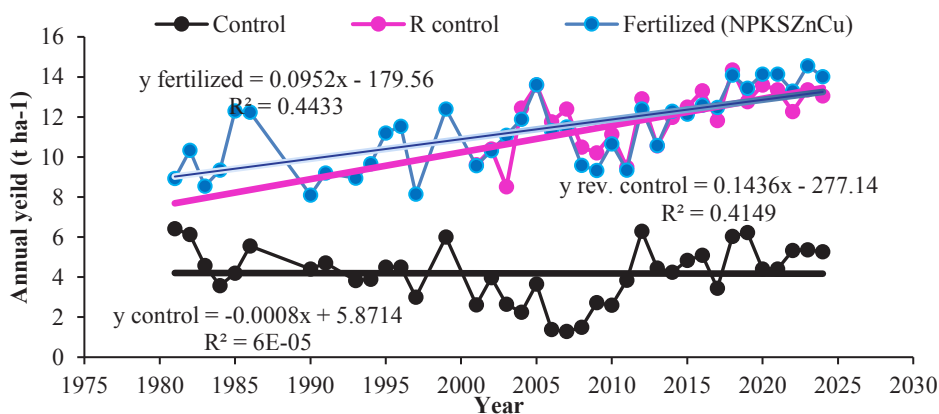


Fig. 12. Annual rice production trend under intensive wetland conditions in BRRI HQ, Gazipur, during 1981-2024.

INTEGRATED NUTRIENT MANAGEMENT

Integrated nutrient management for double and triple rice cropping for maximizing productivity.

The experiment was initiated in Boro 2008-09 at BRRI HQ farm, Gazipur clay loam soil. Initially in double cropping pattern (Boro–Fallow–T. Aman), BRRI dhan29 and BRRI dhan49 and in triple cropping pattern (Boro–T. Aus–T. Aman) BRRI dhan29, BRRI dhan43 and BR22 were used as test variety. After 2020-21, BRRI dhan89 and BRRI dhan87 were used under Boro–Fallow–T. Aman pattern. In Boro–T. Aus–T. Aman pattern, BRRI dhan96, BRRI dhan98 and BRRI dhan87 were included as test variety respectively. Four treatment combinations were tested viz: T_1 = control, T_2 = STB dose (NPKS @ 160-25-60-20 kg ha⁻¹ for Boro, 70-12-48-10 kg ha⁻¹ for T. Aus and 84-15-54-14 kg ha⁻¹

for T. Aman), T_3 = STB (50%) + Mixed manure (MM) (cow dung 2 t ha⁻¹ + ash 1 t ha⁻¹ as oven dry basis), T_4 = Farmers' practice (FP) (NPKS @ 80-10-20-10 kg ha⁻¹ for Boro, 70-10-15-0 kg ha⁻¹ for T. Aus and 70-10-15-0 kg/ha for T. Aman). The experiment was laid out in a RCB design with three replications.

Grain yield. Figs. 13a and b show the changes of grain yields during 2008-2024 under double and triple cropping systems. Control and farmers practices (FP) showed a decreasing yield trend with the increment of time under both the cropping systems. However, 100% STB fertilization and 50% STB with mixed manure fertilization showed significantly higher grain yield compared to the other treatments during the study period (Fig. 13a, b).

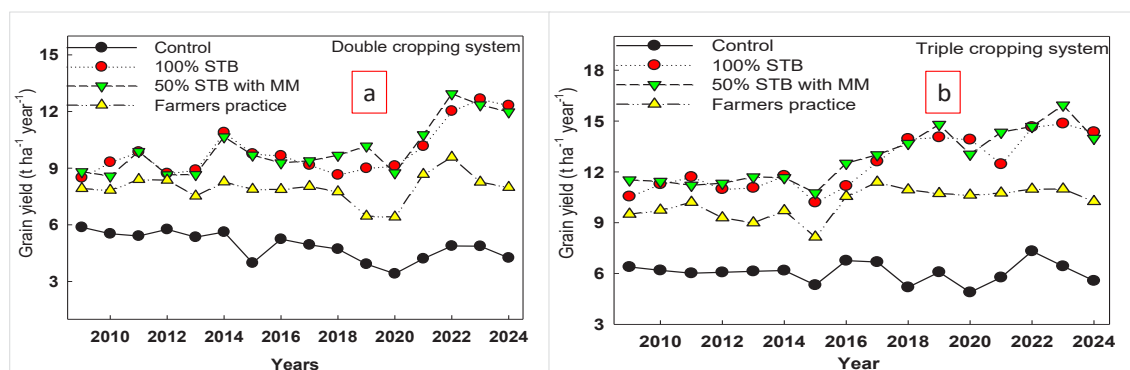


Fig. 13. Annual rice production trend under integrated nutrient management for double (a) and triple (b) rice cropping for maximizing productivity during 2009-2024 in BRRI, Gazipur.

Best soil management practices to sustain rice productivity. The experiment was conducted at BRRI farm, Gazipur during T. Aman and Boro 2024-25. Eight different treatments of inorganic and organic combinations, calculated from soil test value (STB), were assigned to investigate the best nutrient management combinations for sustaining rice productivity. The treatments were T₁: Fertilizer control, T₂: 100% STB dose (fully inorganic), T₃: 125% STB dose (fully inorganic), T₄: 75% STB + CD @ 2 t ha⁻¹, T₅: 75% STB + PM @ 1 t ha⁻¹, T₆: 50% STB + CD @ 3 t ha⁻¹, T₇: 50% STB + PM @ 2 t ha⁻¹ and T₈: CD @ 3 t ha⁻¹+ mustard oil cake @ 2 t ha⁻¹ (fully organic). BRRI dhan90 and BRRI dhan50

were used as test varieties in both T. Aman and Boro seasons respectively.

Grain yield of T. Aman and Boro 2024-

25. All the organic and inorganic treatment combinations, except fertilizer control produced significantly higher grain yield in T. Aman season using the rice variety BRRI dhan90. Similarly, in Boro season using the BRRI dhan50 rice variety all treatment combinations produced higher yield than the control (Fig. 14). The result prevailed that use of integrated nutrient management (INM) can produce similar or equal grain yield in compared to full doses of chemical fertilizer, which can sustain rice yield and soil health.

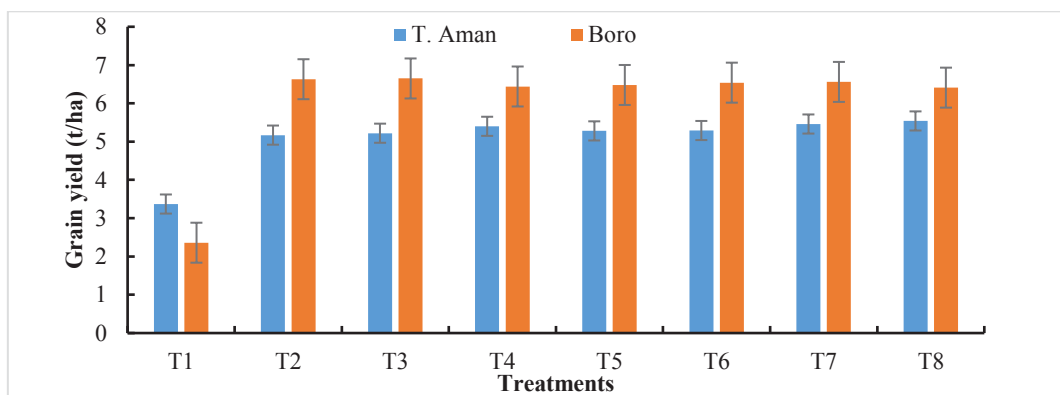


Fig. 14. Effect of different organic and inorganic fertilizer combinations on T. Aman (BRRI dhan90) and Boro rice (BRRI dhan50) yield in 2024-25, BRRI HQ, Gazipur.

{T₁: Fertilizer control, T₂: 100% STB dose (inorganic), T₃: 125% STB dose (inorganic), T₄: 75% STB + CD @ 2 t ha⁻¹, T₅: 75% STB + PM @ 1 t ha⁻¹, T₆: 50% STB + CD @ 3 t ha⁻¹, T₇: 50% STB + PM @ 2 t ha⁻¹, T₈: CD @ 3 t ha⁻¹+ Mustard oil cake @ 2 t ha⁻¹ (organic)}

SOIL AND ENVIRONMENTAL PROBLEMS

Improving rice yield and mitigating greenhouse gas emissions using nano-urea and zeolite in rice cultivation. The field experiments were conducted in the BRRI farms, Gazipur, Cumilla, Barishal and Satkhira. BRRI dhan102 was used for conducting the experiment. Six fertilizer treatments were tested: (T1) N control, (T2) 66% of recommended prilled urea (RPU) (33% at basal and 33% at 25 DAT), (T3) 66% of RPU (22% at Basal, 22% at 25 DAT and 22% at before panicle initiation (BPI), (T4) 66% of RPU (22% at Basal, 22% at 25 DAT and 22% at BPI) + Zeolite (4 t/ha), (T5) 66% of RPU (33% at Basal and 33% at 25 DAT) + liquid nano-urea (LNU) (1235 ml/ha; BPI and flowering), and (T6) 100% of RPU (33% at Basal, 33% at 25 DAT and 33% at

BPI). Nutrients viz N, P, K, S and Zn were used as basal at the recommended rate to all plots and the rates were 174 kg N/ha 18 kg P/ha, 80 kg K/ha, 18 kg S/ha, and 1 kg Zn/ha, respectively. PU was applied in three equal splits. The crop was harvested at full maturity of the crops. After harvest, the plot-wise crop was bundled separately and brought to the threshing floor; threshing was done manually. The rice grains were cleaned and weighed. Then, sundry grain weight was recorded for every plot and the weight in g plot⁻¹ was adjusted at 14% moisture and finally expressed in t ha⁻¹. The sundry weight of straw was also recorded plot-wise and expressed as t ha⁻¹.

CH₄ emissions were measured using a closed gas chamber technique and their emission rates were

determined from the slope of the linear regression curves of CH₄ concentration against chamber closer time. Cumulative CH₄ and N₂O emissions were estimated by summing up the daily emissions. Emission rates between two sampling days were estimated by linear interpolation of two consecutive measurements. The current report presents CH₄ emissions data from Gazipur and Cumilla, while data analysis for Satkhira and Barishal is still underway.

Rice yield. The application of N significantly increased grain yield compared to the

T1 treatment in Gazipur, Cumilla, and Barishal (Fig. 15a). The highest yield was recorded in the T5 treatment. The lowest was observed in the T1 treatment in Gazipur and Barishal. In contrast, the highest yield in Cumilla was found in the T6 treatment (Fig. 15b). The variation in yield may be linked to differences in soil properties and climatic conditions. Liquid nano-urea had a notable impact on rice yield in Gazipur and Barishal. However, no additional yield benefit was observed from using Zeolite in any of the locations (Fig. 15a and b).

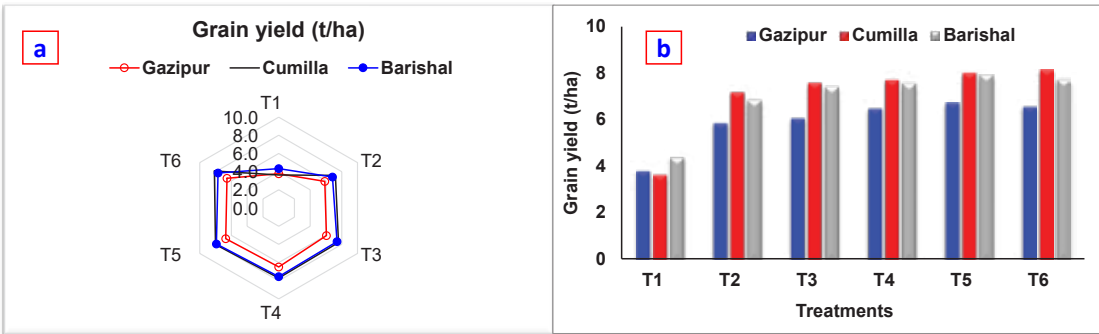


Fig 15. Effects of N fertilizer rates and sources on grain yield during Boro 2024-25 at BRRRI farm, Gazipur and Cumilla.

(T1, T2, T3, T4, T5, and T6 correspond to N control, 66% of recommended prilled urea (RPU) (33% at basal and 33% at 25 DAT), 66% of RPU (22% at Basal, 22% at 25 DAT and 22% at before panicle initiation (BPI), 66% of RPU (22% at Basal, 22% at 25 DAT and 22% at BPI) + Zeolite (4 t/ha), 66% of RPU (33% at Basal and 33% at 25 DAT) + liquid nano-urea, and 100% of RPU (33% at Basal, 33% at 25 DAT and 33% at BPI) respectively).

Greenhouse gas emissions. The CH₄ emissions were measured at the Gazipur and

Barishal sites for six treatments (Fig. 16). The highest total CH₄ emissions were observed in the T6 treatment, while the lowest were found in T1 at both the locations. In Gazipur, nano urea (T5) significantly reduced CH₄ emissions compared to the recommended prilled urea (RPU) (T6), whereas it had no significant effect on CH₄ emissions in Cumilla. The application of zeolite (T4) showed no significant impact on CH₄ emissions at either site in the current study (Fig. 16). The data reported here are preliminary and based on only one Boro season.

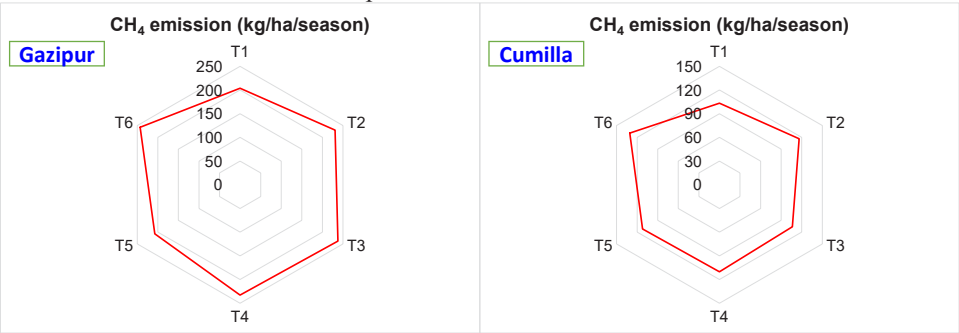


Fig 16. Effects of N fertilizer rates and sources on CH₄ emissions during Boro 2024-25 at BRRRI farm, Gazipur and Cumilla.

Effect of water management on mitigating of greenhouse gas emission at Gazipur and Kushtia.

The study was undertaken to find out the suitable water management options based on GHG emission and sustainable rice production. The study was conducted in BRRI farm, Gazipur during and farmer's field at Kushtia during Boro, 2025. The experiment involved randomized complete block design (RCBD) with four replications. In Boro season, the experiment was carried out with three irrigation management treatments as T_1 = Continuous standing water (CSW), T_2 = AWD (Supplemental irrigation when water level goes 15 cm below ground surface), T_3 = AWD (Supplemental irrigation when water level goes 25 cm below ground surface). The amount of applied irrigation was measured with a flow meter and was documented. We have followed standard gas sampling techniques for recording N_2O and CH_4

emission patterns. The grain yield and yield contributing parameters of each treatment were recorded for statistical analysis.

Yield in Boro season. Yield of Boro rice varied insignificantly in different water management options at Gazipur and Kushtia (Table 7). Statistically insignificant grain yield (ranged from 6.40 to 6.70 t ha⁻¹ and 6.75 to 7.00 t ha⁻¹) were found among the treatments and location.

GHG and GWP during Boro season. The total CH_4 flux was not significant different because of two AWD condition at different location. However, the AWD, 15 cm and AWD, 25 cm treatment reduce about 34-36% and 32-38% of total CH_4 flux than CSW at Gazipur and Kushtia. The GWP reduces about 33-35% and 30-36% by AWD than CSW (Table 7).

Table 7. Total GHG and GWP under varying irrigation management during Boro 2025.

Treatment	Location							
	Gazipur				Kushtia			
	GHG emission (kg ha ⁻¹)			Grain Yield (t ha ⁻¹)	GHG emission (kg ha ⁻¹)			Grain Yield (t ha ⁻¹)
	CH ₄	GWP	GHGI		CH ₄	GWP	GHGI	
CSW	174	5075	0.77	6.70	175	5046	0.72	7.00
AWD, 15 cm	127	3805	0.60	6.50	119	3531	0.51	6.90
AWD, 25 cm	113	3507	0.56	6.40	108	3236	0.48	6.75
LSD _{0.05}	30	311	0.10	0.32	20	250	0.10	0.26

Bio-coated urea to improve N fertilizer use efficiency (NUE) and crop yield. Bio-inoculant coated with commercial prilled urea (PU) might trigger more N fertilizer use efficiency (NUE) and reduce amount of urea in rice cultivation. Present study was conducted to evaluate the efficacy of formulated bio-coated urea (BCU) in rice production. A field study was conducted in BRRI HQ farm Gazipur to evaluate the efficacy of formulated BCU over PU. Treatment combinations were as; T_1 (fertilizer control), T_2 (N_0 + PKS), T_3 ($N_{100\%}$ PU + PKS), T_4 ($N_{100\%}$ BCU + PKS), T_5 ($N_{60\%}$ BCU + PKS) and T_6 ($N_{60\%}$ PU + PKS). Experiment was designed in RCB with three replications. Standard fertilizer doses for NPKS (kg ha⁻¹) were 80-15-60-10 in T. Aman and 170-20-80-10 in Boro

season respectively. Prilled urea and BCU were applied in three equal splits.

Grain yield. BRRI dhan87 was cultivated in the T. Aman season. Study result shows that there were no significant grain yield difference obtained due to the reduction of 40% N from Bio-coated urea with 100% (recommended) applied prilled urea. Significantly, the lowest grain yield was recorded in both $T_1=N_0$ + PKS (2.70 t ha⁻¹) and full fertilizer control (T_2) treatment (2.95 t ha⁻¹) (Fig. 17). Reduction of 40% N from the standard N fertilizer dose (T_3) reduced 27.36% grain yield in the T_5 treatment. On the other hand, same reduction (40%N) produced 32.58% yield benefit in bio-inoculant coated urea treatment (T_6).

In the Boro season BRRI dhan89 was grown. The highest grain yield (6.51 t ha^{-1}) was recorded in the 100% BCU+PKS applied treatment (T_4) and it was statistically similar with 60% BCU+PKS (T_6) and 100% PU+PKS (T_3) treatment (T_3). The 40% reduction of prilled urea produced 5.84 t ha^{-1} grain yield in T_5 treatment. The lowest 2.46 t ha^{-1} grain

yield obtained in the fertilizer control treatment (T_1). Reduction of 40% N from standard N fertilizer dose (T_3) reduced 10.61% grain yield in T_5 treatment. On the other hand, same reduction (40%N) produced 10.21% yield benefit in bio-inoculant coated urea treatment (T_6).

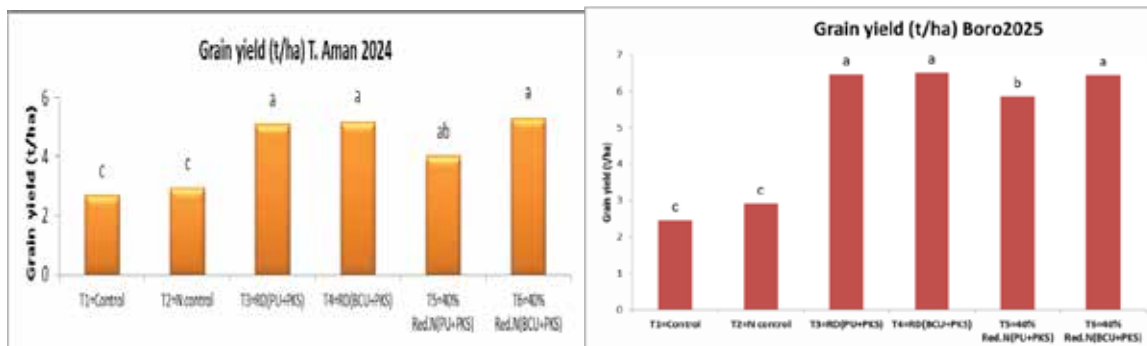


Fig. 17. Effect of Bio-coated urea and prilled urea on rice grain yield in T. Aman 2024 and Boro 2024-25 at BRRI HQ, Gazipur.

Field evaluation of BRRI organic fertilizer. BRRI organic fertilizer was developed with the objective to reduce synthetic N and P fertilizer use in rice cultivation and improve soil health. To evaluate its field performance, field experiments were conducted at BRRI HQ in both the seasons of T. Aman 2024 and Boro 2024-25. The treatment combinations were T_1 =NPKS 100%, T_2 =N (70%) + P (0) + KS (100%), T_3 =BoF (0.5 t ha^{-1}) + N (70%) + P (0) + KS (100%), T_4 = BoF (0.75 t ha^{-1}) + N (70%) + P (0) + KS (100%), T_5 = BoF (1.0 t ha^{-1}) + N (70%) + P (0) + KS (100%), T_6 = BoF (2.0 t ha^{-1}), and T_7 = fertilizer control. Recommendation rates of chemical fertilizers for T. Aman and Boro were (kg ha^{-1}) N-P-K-S @ 80-15-50-10 and 140-20-50-10 respectively. BRRI dhan92 at T. Aman and BRRI dhan89 was grown in the Boro season.

Grain yield. Study results proved that BRRI organic fertilizer (0.5 t ha^{-1}) has the potential to supplement 30% N and 100% P requirement for HYV rice without sacrificing yield. In the T. Aman season, the highest grain yield 4.16 t ha^{-1} was recorded in the treatment (T_5) where BRRI organic fertilizer was applied 0.1 t ha^{-1} along with 30% less

urea and 0% TSP fertilizer. However, grain yield of T_5 was statistically similar with full dose of chemical fertilizer (T_1) and 0.5 t ha^{-1} BRRI organic fertilizer (T_3) treatment. Application of 2.0 t ha^{-1} BRRI organic (T_6) without any chemical fertilizer produced comparable grain yield with T_2 treatment, where, 30% N and P omitted from standard dose. The significantly lowest grain yield was recorded in the control plot (2.49 t ha^{-1}).

In the Boro season, different dosages of BRRI-organic and chemical fertilizer also affected grain and straw yield of BRRI dhan89. The highest grain yield 7.64 t ha^{-1} was obtained in the 0.5 t ha^{-1} BRRI organic fertilizer applied treatment (T_3), and it was statistically similar with full dose application of chemical fertilizer (7.56 t ha^{-1}), T_1 and 1.0 t ha^{-1} BRRI organic treatment (T_5). The lowest grain yield has obtained in the control plot. The result proved that omission of TSP along with 30% reduction of urea fertilizer did not impact grain yield. In conclusion we found application, of 0.5 t ha^{-1} BRRI organic fertilizer saved 100% TSP/DAP and 30% urea in rice cultivation with financial benefit.

Irrigation and Water Management

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SUMMARY

Soil characterization studies in Satkhira, Natore, and Manikganj revealed wide variability in soil texture, bulk density, available water content, and hydraulic conductivity, which were compiled into a reference database for irrigation planning. Loam soils of Satkhira and Natore were found more favorable for crop water supply compared to clay soils in Manikganj. An IoT-based Automated AWD irrigation system, using LoRa communication technology, was developed and field-tested. Results showed that automated AWD achieved grain yields (7.93 t/ha) comparable to manual AWD (7.90 t/ha), and both outperformed continuous flooding, confirming the reliability of automation in reducing labor while maintaining yield. Subirrigation experiments further demonstrated 25% higher water use efficiency and about 10% yield advantage over conventional irrigation, highlighting its potential in water-scarce regions. Water stress tolerance evaluation of advanced rice genotypes indicated that several PVT and ALART lines sustained yields with minimal reduction under AWD at -10 kPa, aligning with water-saving irrigation practices. However, most lines were sensitive under moderate to severe stress. Eleven advanced lines and BRRI dhan92 were tested under four water management treatments to identify water saving varieties. Six advanced lines performed better under AWD while three advanced line performed better with WSR and flooding during fertilizer applications. In hilly valleys of the Chattogram Hill Tracts, integrated minor irrigation schemes covering 300 bigha supported BRRI varieties dhan100, dhan102, and dhan105, achieving 7.3–7.7 t/ha yields. Farmers preferred BRRI dhan100 for its fine grain and adaptability. A separate study on establishment methods revealed that traditional transplanting maximized yield (8.2 t/ha), while wet-direct seeded non-puddled (WDSNP) method offered the highest water productivity, underscoring trade-offs between yield and efficiency. Smart card-operated irrigation systems tested in Feni showed potential to reduce costs and improve equitable water distribution, especially when combined with AWD. In coastal environments, experiments with saline irrigation and amendments confirmed that straw with gypsum (25% above recommended) effectively reduced soil salinity and sustained yields under moderate saline

conditions (≤ 4 dS/m). Beyond this threshold, productivity sharply declined. Trials with hybrid and inbred rice across saline zones revealed hybrids' superiority in low-salinity areas (8–10 t/ha), while salt-tolerant inbreds like BRRI dhan99 performed better in high-salinity regions. Long-term groundwater monitoring highlighted alarming declines in northwestern zones, posing risks for irrigation security. Climate trend analysis in Rajshahi indicated rising minimum temperatures, declining solar radiation, and increasing humidity, with important implications for rice productivity.

WATER USE EFFICIENCY IMPROVEMENT IN IRRIGATED AGRICULTURE

Determination of physical and hydraulic properties in different soil types

Soil textural classes, parameters of soil water release curves for respective soil depths, available water content in the soil profile, drainable porosity as well as saturated hydraulic conductivity (near saturated constant infiltration rates) information have been determined through different testing and analysis methods in this study for the soils collected from an ongoing study in Kolaroa upazila of Satkhira, Lalpur upazila of Natore and Ghior upazila of Manikganj. Soil samples were collected from different soil profiles at 0-15, 15-30, and 30-60 cm using standard protocols. In total, 36 samples were collected for bulk density measurements and 108 soil samples were collected for soil texture analysis. The dominant soil texture throughout the soil profile (0-50 cm) is loam in Satkhira, loam in Natore when it is clay in Manikganj (Table 1). The average bulk densities for 0-15 cm soil profile were 1.44 gm/cc in Satkhira, 1.43 gm/cc in Natore and 1.24 gm/cc in Manikganj (Table 2). For the same depth of soil profile, the average saturated water content, average water content at field capacity and average water content at wilting point were 45.50%, 27.98%, 14.72%, respectively in Satkhira; 45.68%, 24.97%, 11.18% respectively in Natore; 45.68%, 24.97%, 11.18% respectively in Manikganj. The average available water content and average drainable porosity were 30.78% and 17.52 respectively in Satkhira; 34.51% and 20.72% respectively in Natore; 21.99% and 9.45% respectively in Manikganj. The average saturated hydraulic conductivity was 34.62 cm/day in Satkhira, 58.91

cm/day in Natore and 5.20 cm/day in Manikganj. The soils of Natore and Satkhira would have sufficient soil moisture to meet up the crop water requirement. The loam soil profile would have enough aeration for root respiration and better microbial activity in nutrient uptake. The saturated hydraulic conductivity indicated that water in the root zone moved faster in loam soils of Natore and Satkhira compared to clay soils of Manikganj. Those data and relevant information are documented in a database which can serve as observed/field data source in future.

Development of automated alternate wetting and drying (AWD) irrigation system for rice production

The study focused on enhancing the efficiency of water management in rice field through the adoption of a sensor-based technique in the Alternate Wetting and Drying (AWD) irrigation system. During the Boro season 2024-25, the field setup was divided into three main stages, each utilizing LoRa technology for communication between various modules. These stages included the LoRa Field Module, the LoRa Motor Section Module, and the LoRaWAN Gateway to establish the functionality of each module and communications to achieve effective and efficient irrigation control. The LoRa Field Module was designed to monitor water levels in rural or urban fields for irrigation purposes. The module utilized the LoRa E32 900M30S Signal Module, which offered long-range communication capabilities. The device could transmit signals up to 10 km in rural areas and 3-4 km in urban areas. Once the LoRa Field Module detected that the water level threshold was below the threshold limit, the signal was forwarded to the LoRa Motor Section Module. The motor-section controlled opening and closing of the gate valve for irrigation. The LoRaWAN Gateway served as the communication bridge between the field devices and the server. It received signals from the field device and forwards them to the PythonAnywhere server for further processing. The system was evaluated with an field experiment. The treatments were: T1 = Maintaining continuous standing water, T2 = Irrigation application manually using AWD method; and T3 = Irrigation application by automated AWD system with four replications. The experimental design was RCBD. BRRI dhan92 was used as the test variety for this experiment. The yield and other agronomic parameter of the IoT

based automated AWD irrigation system is presented in Table 3. The average yields were 7.67 t/ha for T1 (maintaining continuous standing water), 7.90 t/ha for T2 (irrigation application manually using AWD method), and 7.93 t/ha for T3 (irrigation application by automated AWD system). The yield performance of treatment T2 and T3 were nearly same, indicating that automated AWD irrigation system did not hamper the yield. There was no such difference between manual AWD irrigation system and automated AWD system in terms of yield contributing parameters. Due to higher tiller and panicle numbers as well as grain per panicle, both T2 and T3 treatments performed higher yield than that of T1.

Study on water stress tolerance for different advanced rice genotypes of BRRI

The study was conducted at BRRI farm, Gazipur during the Boro 2024–25 season to evaluate water stress tolerance capacity (WSTC) of advanced breeding lines, PVT and ALART materials, along with standard check varieties. Four water regimes were imposed: continuous standing water (control), AWD at –10 kPa, AWD at –30 kPa, and AWD at –60 kPa, with soil moisture monitored using tensiometers. Grain yield reduction below 5% under stress was considered the tolerance threshold. Results revealed that PVT-FBR line BR11318-5R-84 had a tolerance capacity at –10 kPa, yielding 7.42 t/ha under AWD (–10 kPa), a reduction of only 3.89% compared to control. However, yield declined by 14.51% and 27.2% under –30 and –60 kPa, respectively. The check BRRI dhan92 showed greater resilience, although with higher yield reduction under severe stress. PVT-CTR line BR11894-R-R-R-R-169 also demonstrated tolerance at –10 kPa, yielding 6.51 t/ha, which was 7.1% higher than the control. Its yield reduction at –30 and –60 kPa reached 9.7% and 16.6%, respectively. Among disease-resistant PVT materials, BR(path)13800-BC3-8-9 and BR(path)13800-BC3-134-25 showed no clear tolerance, as yield reductions exceeded 5% even at –10 kPa. BR(path)13800-BC3-134-25, though yielding 7.0 t/ha in control, declined by 14.14% under –10 kPa. ALART lines BR(path)13802-54-12, BR(path)13802-BC3-62-14, and BR(path)13802-BC3-73-13 showed tolerance at –10 kPa. For example, BR(path)13802-54-12 recorded only

1.29% yield reduction at -10 kPa, though performance declined sharply under higher stress. Overall, a few advanced lines showed tolerance at -10 kPa, aligning with recommended AWD irrigation, while most declined significantly under moderate to severe stress. This highlights their suitability for water-saving irrigation without substantial yield penalty.

Performance evaluation of the rice genotypes under different water regimes

Eleven advanced genotypes along with BRRI dhan92 (check variety) were tested under four water management treatments during Boro season 2024-25 at BRRI farm, Gazipur. The genotypes were: V₁-BR 12837-5R-89; V₂- IR 129391-B-35-B-1-1; V₃- IR 16L1478; V₄- IR 121147-B-B-CMU 11-1-2; V₅- IR 18R1133 a; V₆- IR 14L545; V₇- BR11710-5B-351-Color; V₈- IR 126968-B-23-2-1-3; V₉- IR 15A2407; V₁₀- IR93339129-B-7-7-B-B-B-16; V₁₁- BR11708-5B-224 and V₁₂- BRRI dhan92 (ck). The cultivars were grown in plots under different water regimes. The treatments were: T₁- Transplanted Rice (TPR) with maintaining continuous standing water from +5 to +1 cm, T₂- TPR with AWD irrigation practice from +5 to -15 cm, T₃- TPR with thin irrigation practice +2 to -20 cm and T₄- Wet direct-seeded rice (WSR) with flooding (upto 5 cm) before and after fertilizer application. Continuous flooding was maintained for 15 days since heading of the varieties. The experiment was conducted in plots having boundaries of wall to protect the seepage loss. There was no replication due to shortage of seeds. Seeding was done on 14th December 2024. Forty days old seedlings were transplanted on 23rd January 2025 in three experimental plots. Sprouted seeds were seeded in lines after puddling. Each plot size was 2.4 m x 0.6 m. In direct seeded plot line to line spacing was 20 cm. In the transplanted plots spacing was 20 cm x 20 cm. BRRI recommended fertilizers and other management practices were followed. Whole plot were harvested for yield data. Fig. 1 shows the daily rainfall during the growing period. No rainfall occurred till 15th March 2025. Total rainfall recorded in was recorded 2.6 mm only. It means that most of growth duration was about rainless. Therefore, a lot of irrigations were applied. Sufficient rainfall occurred during the ripening phase. The total number of irrigations in T₁, T₂, T₃, and T₄ are 15, 11,

12 and 10 respectively. The total amount of irrigations in T₁, T₂, T₃, and T₄ are 888 mm, 788 mm, 706 mm and 651 mm, respectively. The irrigation water saving under treatments T₂, T₃, and T₄ were 11.3, 20.5 and 26.7 per cent, respectively compared to treatment T₁. This amount would be higher in real field condition i.e. field without wall boundaries. Irrespective of treatments, the total amount of rainfall during the field duration for the genotypes were varied from 144.6 mm to 182.0 mm. Fig. 2 shows the grain yield of the genotypes under different treatments. Highest yield was obtained under treatment T₁ (CSW) from the genotypes IR129391-B-35-B-1-1 (8.47 t/ha), IR16L1478 (10.81 t/ha), IR126968-B-23-2-1-3 (9.19 t/ha) and BR11708-5B-224 (9.84 t/ha). Highest yield was obtained under treatment T₂ (AWD) from the genotypes IR121147-B-B-CMU 11-1-2 (10.22 t/ha), IR14L545 (9.21 t/ha), IR181133a (9.21 t/ha), BR11710-5B-351-Color (8.64 t/ha), IR15A2407 (9.50 t/ha) and IR93339129-B-7-7-B-B-B-16 (9.93 t/ha). Highest yields were obtained from BR12837-5R-89 (9.39 t/ha) and BRRI dhan92 (9.63 t/ha) under treatment T₄ (Wet direct-seeded rice). The above results indicate that IR121147-B-B-CMU 11-1-2, IR14L545, IR181133a, BR11710-5B-351-Color, IR15A2407, IR93339129-B-7-7-B-B-B-16 and BRRI dhna92 performed best under alternate wetting and drying (AWD) condition. But BR12837-5R-89, IR93339129-B-7-7-B-B-B-16 and IR14L545 have the potential to perform better with wet-direct seeded method under flood irrigation during fertilizer application. To confirm the study results this experiment will be repeated in the next Boro season.

Optimization of water use efficiency through subirrigation system in different soils of Bangladesh

A subirrigation system was designed and installed at the Bangladesh Rice Research Institute (BRRI) research field to evaluate its performance in transplanted rice during the 2024-2025 irrigated season (Boro). The experimental plot measured 10 m in length and 6 m in width, covering a total area of 60 m². For design purposes, the soil's physical and hydraulic properties were determined, and the lateral (drain) spacing along with lateral and main pipe sizes were calculated using standard models and equations, including the Hooghoudt equation and the

DRAIN CALCULATOR. The optimum design spacing was 1.2 m, with a design depth of 30 cm below the ground surface. Both lateral and main pipes were made of 4-inch diameter PVC. To supply water to the crop root zone, a 1000 L overhead tank was installed, and a 4-inch flowmeter was placed at the inlet to monitor water application. The system was carefully observed throughout the season to ensure smooth operation. No major challenges were encountered except for a few minor technical issues, which were promptly resolved. The results showed that the subirrigation system was 25.41% more water-efficient compared to the conventional flooding method (Table 4). In terms of crop performance, the high-yielding BRRI-developed variety BRRI dhan89 produced about 10% higher grain yield under subirrigation (7.24 t/ha) compared to conventional irrigation (6.58 t/ha). Moreover, the number of tillers and panicles per square meter was higher in the subirrigation-managed field than in the conventionally irrigated field.

Increasing land productivity in valley area of hilly region through integrated minor irrigation system

In the Boro season of 2024–25, a total of 300 bigha of land was cultivated under integrated minor irrigation schemes across three upazilas in the Chattogram Hill Tracts. Of this area, 125 bigha were in Panchari upazila of Khagrachari, 100 bigha in Dighinala upazila of Khagrachari, and 75 bigha in Kawkhali upazila of Rangamati. For design purposes, 25 bigha was considered the standard coverage for a single integrated irrigation scheme. To supply irrigation water, seven diesel-driven low lift pumps (LLPs) were installed, supported by approximately 9,000 feet of distribution piping to deliver water from the source to the rice fields. In total, 119 farmers participated in the study, including 101 farmers from Khagrachari and 18 from Rangamati. Three BRRI-developed rice varieties, BRRI dhan100, BRRI dhan102, and BRRI dhan105, were grown across the project area. The average grain yields were 7.5 t/ha for BRRI dhan100, 7.7 t/ha for BRRI dhan102, and 7.3 t/ha for BRRI dhan105 (Fig. 3). While BRRI dhan102 produced the highest yield in the hilly regions, BRRI dhan100 was the most preferred variety among farmers due to its fine grain quality and its relatively higher yield compared to other available varieties.

Establishment methods and irrigation effects on crop performance and water productivity of Boro rice

A field experiment was conducted at BRRI Gazipur to evaluate the interaction of establishment methods and irrigation regimes on crop performance and water productivity. Four establishment methods were tested: traditional transplanting (TT), wet-direct seeded puddled (WDSP), wet-direct seeded non-puddled (WDSNP), and dry-direct seeded (DDS). Irrigation regimes included alternate wetting and drying (AWD), water balance, and saturation. Results demonstrated that establishment method strongly influenced yield, while irrigation regime had little effect. TT consistently produced the highest yield, averaging 8.2 t/ha, which was about 1.0 t/ha higher than direct-seeded methods. WDSP and WDSNP performed similarly, yielding 7.4–7.6 t/ha, whereas DDS lagged behind at 6.0 t/ha. Yield advantages of TT were attributed to higher grain filling per panicle despite fewer tillers per square meter compared to direct-seeded methods. Water productivity, however, was maximized under WDSNP (Table 5). Although its yield was slightly lower than TT, WDSNP required significantly less irrigation water, resulting in the highest water productivity (10.0 kg/ha-mm). TT recorded a lower water productivity of 8.5 kg/ha-mm despite superior yield. Irrigation regimes themselves did not cause significant differences in yield or water productivity, underscoring that establishment method plays the decisive role. The results suggest that TT remains optimal for yield maximization, but WDSNP offers the best balance of yield and water efficiency under water-scarce conditions. DDS, while less productive, may still be considered where labor or transplanting resources are limiting.

Performance evaluation of smart card operated irrigation management of rice field in Muhuri project areas of Feni district

The conventional water management methods in rice production inside the Muhuri Irrigation Project in Sonagazi, Feni, are characterized by inefficiencies and susceptibilities. Water wastage, inequitable distribution, seasonal scarcity, and maintenance difficulties are significant negatives. Irrigation water payment scheme based on per unit land area raises the production cost of rice farming. Hence, AWD technology does not work effectively in the farmer's

field. In the face of climate change, technology improvements, smart card-operated systems, could give solutions to these difficulties, boosting agricultural output and sustainability in the region. AWD technology has the potential to completely transform rice farming in Bangladesh by enhancing water efficiency, cutting expenses, raising production, and fostering sustainability if it is combined with smart card-operated irrigation systems. Therefore, a smart card with an AWD system can cut irrigation costs by around half compared to a farmer's traditional system. For smallholder farmers who struggle with resource allocation and water management, this technology is very helpful. Farmers may improve their standard of living and support sustainable farming methods by utilizing technology.

LAND PRODUCTIVITY IMPROVEMENT IN THE COSTAL ENVIRONMENT

Impact of saline water irrigation with rice straw and gypsum amendment on soil physicochemical properties and rice yield in the coastal saline area

This study was conducted in Batiaghata, Khulna, to assess the effects of saline irrigation water and soil amendments on rice yield and soil properties. The experiment tested four irrigation salinity levels (1–2, 4, 6, and 8 dS/m) combined with six amendment treatments: no amendment, rice straw incorporation, gypsum at 25% and 50% above recommended rates, and combinations of straw with gypsum. BRRI dhan67 was transplanted on 5 January 2025, and saline irrigation began 25 days after transplanting. Plot water salinity increased with both irrigation salinity and season progression, peaking at 12–14 dS/m under the highest salinity treatment (8 dS/m). Soil salinity trends mirrored water salinity, with untreated plots recording the highest values. The best soil conditions were maintained by treatment T4 (straw + 25% higher gypsum), which consistently lowered salinity. Rice yield declined as irrigation salinity increased, from 6.5 t/ha at 1–2 dS/m to 3.2 t/ha at 8 dS/m (Table 6). Soil amendments helped mitigate yield loss. T4 achieved the highest yield (5.6 t/ha), while no amendment resulted in the lowest (5.0 t/ha). Irrigation water salinity up to 4 dS/m had only a limited impact on yield when combined with proper amendments, whereas 6–8 dS/m salinity severely reduced productivity.

Performance of hybrid and inbred Boro rice under different saline environment in the coastal area of Bangladesh

Field trials were conducted across four locations in Barishal and Khulna regions to compare hybrid and inbred Boro rice under different saline conditions. Irrigation water salinity varied substantially, remaining below 1 dS/m in Barishal Sadar and Pathorghata but increasing to 4–6.5 dS/m in Kalapara and Batiaghata. Ten rice varieties, including both BRRI inbreds and hybrids, as well as commercial hybrids, were evaluated using RCBD with three replications. The results revealed clear differences in varietal performance across environments (Fig. 4). In low-salinity zones, hybrids significantly outperformed inbreds, producing yields between 8.0 and 10.7 t/ha, compared with 7.5–8.5 t/ha for inbreds. BRRI hybrid dhan8 and Hybrid SL-8 were the top performers in these environments. In high-salinity zones, however, inbred varieties demonstrated greater resilience. BRRI dhan67 and BRRI dhan99 maintained yields of 6.5–6.7 t/ha, comparable to hybrids such as BRRI hybrid dhan5 and Hybrid Aftab-70. The performance of BRRI dhan74 and BRRI dhan67 was comparatively weaker under higher saline conditions, averaging around 6.0 t/ha. The findings highlight the importance of location-specific varietal selection. Hybrids are well suited for low-to-moderate saline areas, offering yield advantages of up to 2.0 t/ha over inbreds. In contrast, salt-tolerant inbreds remain valuable in high-salinity regions where hybrids often lose their advantage. BRRI dhan99 emerged as a particularly adaptable option, bridging the yield gap between hybrids and inbreds in harsher environments. Despite the promise of BRRI hybrid dhan8, adoption remains limited due to inadequate seed supply.

SUSTAINABLE MANAGEMENT OF WATER RESOURCES

Monitoring of groundwater fluctuation and safe utilization in different geo-hydrological regions

This study monitored groundwater (GW) fluctuations at BRRI headquarters (Gazipur) and nine regional stations during 2024–25. Water levels were measured weekly using automatic recorders and averaged monthly. Historical data since 1979 were also analyzed to assess long-term trends. At

BRRI Gazipur, groundwater depth in 2024–25 fluctuated between 50.09 m (July) and 51.07 m (June), a seasonal variation of only 0.8 m. Long-term data revealed alarming declines: the GW depth was 9.61 m in 1979, but 51.70 m in 2025, indicating a lowering of 42.09 m over 46 years. The rate of decline accelerated after 2000, with 36.75 m of lowering in just 25 years. At regional stations, groundwater fell below the suction limit (>8 m) of shallow tube wells during the Boro season in Cumilla, Kushtia, Rajshahi, and Habiganj, while other regions remained within operational limits. This indicates localized water stress risks, especially in rice-intensive northwestern zones. The results highlight the unsustainable abstraction of groundwater for irrigation in rice systems. Without proper management, continued declines could threaten long-term irrigation security and food production. Immediate measures, including adoption of water-saving technologies such as AWD irrigation, diversification of cropping patterns, and expansion of surface water use, are urgently required.

CLIMATE CHANGE IMPACT ASSESSMENT AND ADAPTATION TECHNIQUES DEVELOPMENT

Study on trend and variability analysis of climatic parameters in Rajshahi region of Bangladesh

This study assessed long-term variability and trends of climate parameters in Rajshahi region using 30 years of NASA POWER data (1994–2024). Parameters included maximum and minimum temperatures, relative humidity, solar radiation, and

rainfall. Mann-Kendall and Sen's slope tests were applied at 5% significance. Seasonal divisions were pre-monsoon (Feb–Apr), monsoon (May–Oct), and winter (Nov–Jan). Maximum temperature trends revealed a mixed pattern. Significant decreases were found in January, February, March, May, June, and December, while other months increased (Table 7). May exhibited the highest significant decline (-0.131 °C/year). Minimum temperatures showed overall increasing trends, particularly in September ($+0.036$ °C/year, highly significant), suggesting rising night-time temperatures. Relative humidity increased significantly from December to June, indicating a more humid growing season, though September displayed a slight decline. Solar radiation showed a significant downward trend in December and January, reducing by 3.46 and 3.44 MJ/m² per year, respectively. Rainfall showed increasing annual and winter trends, with winter rainfall rising by 19.53 mm/year (highly significant). Pre-monsoon and monsoon rainfall trends were mostly stable, though some decreasing slopes were noted in February, March, June, and August. These findings suggest a warming night-time climate, greater seasonal humidity, reduced solar radiation in critical months, and modest increases in rainfall, particularly in winter. Such trends have important implications for rice-based systems in drought-prone Rajshahi, where reduced pre-monsoon rainfall may exacerbate irrigation needs, while rising minimum temperature may affect crop phenology.

Table 1. The soil particle size (sand, silt and clay percentage) and soil texture of collected soil samples from Satkhira, Natore and Manikganj.

DEPTH cm	Satkhira				Natore				Manikganj			
	Sand %	Silt %	Clay %	Texture	Sand %	Silt %	Clay %	Texture	Sand %	Silt %	Clay %	Texture
0-15	46	30	24	Loam	38	46	16	Loam	40	20	40	Clay
	48	28	24	Loam	43	37	20	Loam	38	18	44	Clay
	43	34	23	Loam	44	40	16	Loam	38	21	41	Clay
	48	32	20	Loam	48	40	12	Loam	38	22	40	Clay Loam
	45	37	18	Loam	42	42	16	Loam	36	22	42	Clay
	46	40	14	Loam	42	44	14	Loam	34	24	42	Clay
	42	35	23	Loam	50	38	12	Loam	36	24	40	Clay
	45	32	23	Loam	49	40	11	Sandy Clay	37	24	39	Clay Loam
	46	32	22	Loam	43	38	19	Loam	36	22	42	Clay
	39	36	25	Loam	50	38	13	Loam	41	24	35	Clay Loam

DEPTH cm	Satkhira				Natore				Manikganj			
	Sand %	Silt %	Clay %	Texture	Sand %	Silt %	Clay %	Texture	Sand %	Silt %	Clay %	Texture
15-30	40	35	24	Loam	42	40	18	Loam	36	26	38	Clay Loam
	42	33	25	Loam	46	36	18	Loam	37	24	39	Clay Loam
	44	30	26	Loam	42	42	16	Loam	38	17	45	Clay
	42	29	29	Clay Loam	44	41	15	Loam	36	18	46	Clay
	42	26	32	Clay Loam	44	44	12	Loam	36	20	44	Clay
	38	39	23	Loam	42	38	20	Loam	36	21	43	Clay
	47	35	18	Loam	49	37	14	Loam	36	20	44	Clay
	46	36	18	Loam	44	44	12	Loam	36	19	45	Clay
	38	38	24	Loam	61	36	3	Sandy Loam	38	17	45	Clay
	39	26	35	Clay Loam	54	40	5	Sandy Loam	34	20	46	Clay
	42	26	32	Clay Loam	50	38	12	Loam	40	20	40	Clay Loam
	38	26	36	Clay Loam	49	38	13	Loam	38	23	40	Clay Loam
	36	26	38	Clay Loam	63	30	7	Sandy Loam	35	20	45	Clay
	38	28	34	Clay Loam	00	00	00	Missing	32	25	43	Clay
30-50	41	25	33	Clay Loam	40	42	18	Loam	38	18	44	Clay
	41	21	38	Clay Loam	42	38	20	Loam	39	21	40	Clay
	38	26	37	Clay Loam	40	37	22	Loam	36	22	42	Clay
	46	32	22	Loam	40	38	22	Loam	36	22	42	Clay
	46	38	15	Loam	44	38	18	Loam	36	25	40	Clay Loam
	50	37	13	Loam	47	38	15	Loam	36	22	42	Clay
	43	35	22	Loam	49	40	11	Loam	38	22	40	Clay
	42	28	30	Clay Loam	52	40	8	Loam	36	24	40	Clay
	37	27	36	Clay Loam	42	38	20	Loam	41	23	36	Clay Loam
	36	23	40	Clay	43	44	13	Loam	39	25	36	Clay Loam
	36	23	41	Clay	42	37	22	Loam	34	26	40	Clay
	44	34	22	Loam	00	00	00	Missing	37	29	35	Clay Loam

Table 2. The SWC and hydraulic properties estimated by SPAW tool for Satkhira, Natore and Manikganj.

Location	Texture	Bulk Density (g/cm ³)	Saturation %	Field Capacity %	Wilting Point %	Available Water Content %	Drainable Porosity%	Saturated Hydraulic Conductivity (cm/day)
Satkhira	Loam	1.47	45.30	26.80	13.70	31.6	18.5	39.72
	Loam	1.46	45.20	28.60	15.90	29.3	16.6	27.768
	Loam	1.45	45.50	29.10	15.90	29.6	16.4	27.24
	Loam	1.41	45.10	26.40	13.70	31.4	18.7	40.584
	Loam	1.46	45.50	26.10	12.60	32.9	19.4	46.392
	Loam	1.43	45.60	24.10	10.40	35.2	21.5	64.728
	Loam	1.46	45.70	28.90	15.40	30.3	16.8	29.544
	Loam	1.45	45.30	28.30	15.40	29.9	17	30.24
	Loam	1.45	45.20	27.70	14.80	30.4	17.5	33.336
	Loam	1.41	46.00	30.30	16.40	29.6	15.7	24.384
	Loam	1.40	45.90	29.70	15.90	30	16.2	26.736
	Loam	1.43	45.70	29.80	16.50	29.2	15.9	24.768
Natore	Loam	1.40	46.20	26.70	11.50	34.7	19.5	49.128
	Loam	1.43	45.60	27.40	13.70	31.9	18.2	38.448
	Loam	1.45	45.70	25.40	11.50	34.2	20.3	53.712
	Loam	1.39	45.60	22.70	9.30	36.3	22.9	78.144
	Loam	1.42	45.80	25.80	11.50	34.3	20	52.152

Location	Texture	Bulk Density (g/cm ³)	Saturation %	Field Capacity %	Wilting Point %	Available Water Content %	Drainable Porosity%	Saturated Hydraulic Conductivity (cm/day)
	Loam	1.40	45.90	25.00	10.40	35.5	20.9	60.72
	Loam	1.42	45.50	22.30	9.30	36.2	23.2	80.784
	Sandy Clay	1.53	45.60	22.10	8.70	36.9	23.5	85.92
	Loam	1.41	45.70	26.90	13.20	32.5	18.8	41.712
	Loam	1.46	45.40	22.70	9.80	35.6	22.7	74.616
	Loam	1.43	45.80	26.70	12.60	33.2	19.1	44.64
	Loam	1.40	45.40	25.90	12.60	32.8	19.5	46.992
Manikganj	Clay	1.17	46.20	37.00	24.70	21.5	9.2	4.704
	Clay	1.23	46.80	39.00	26.80	20	7.8	2.784
	Clay	1.17	46.60	37.60	25.20	21.4	9	4.392
	Clay Loam	1.31	46.60	37.10	24.60	22	9.5	5.04
	Clay	1.15	47.00	38.20	25.70	21.3	8.8	4.128
	Clay	1.19	47.40	38.30	25.70	21.7	9.1	4.464
	Clay	1.22	46.90	37.30	24.60	22.3	9.6	5.352
	Clay Loam	1.30	46.70	36.80	24.10	22.6	9.9	5.904
	Clay	1.20	47.00	38.20	25.70	21.3	8.8	4.128
	Clay Loam	1.32	45.90	34.50	22.00	23.9	11.4	8.832
	Clay Loam	1.33	46.80	36.40	23.50	23.3	10.4	6.816
	Clay Loam	1.36	46.70	36.80	24.10	22.6	9.9	5.904

Table 3. Yield and other agronomic parameters of Automated AWD experiment, Boro 2024-2025 season.

Treatment	Plant height (cm)	Tiller/m ²	Panicle/m ²	Filled grain/panicle	1000 grain (gm)	Yield (kg/ha)
T1R1	99	283	278	98	24.11	7.97
T1R2	98	272	267	126	25.44	7.72
T1R3	101	274	271	106	25.34	7.73
T1R4	100	267	259	118	27.37	7.24
T2R1	104	280	275	131	24.05	8.28
T2R2	97.5	298	292	92	25.46	7.93
T2R3	101	292	288	118	27.24	7.90
T2R4	100	258	252	146	24.89	7.50
T3R1	99	265	259	142	24.94	8.11
T3R2	108	263	258	128	24.67	7.61
T3R3	98	204	201	93	25.26	7.86
T3R4	100	274	269	104	25.24	8.12

Table 4. Subirrigation system performance evaluation in Boro 2024-25 at BRRI farm Gazipur.

Treatment	Plant height (cm)	Tiller/m ²	Panicle/m ²	Yield (t/ha)	Irrigation water (mm)
Subirrigation	97.6	260	247	7.24	1350
Conventional	97.0	235	231	6.58	1810

Table 5. Effect of establishment methods on water requirements and productivity

Treatment	ET (mm)	S&P (mm)	Land preparation (mm)	Total water required (mm)	Total water applied (mm)	Yield (kg/ha)	Water productivity (kg/ha-mm)
TT	344	430	250	1024	964	8200	8.5 ^b
WDSP	360	405	150	915	855	7400	8.6 ^b
WDSNP	360	395	60	815	755	7600	10.0 ^a
DDS	360	380	0	740	680	6000	8.8 ^b

Table 6. Effect of water salinity and amendments on rice yield at Batiaghata, Khulna in 2024.

Amendments	Irrigation				Mean
	I1	I2	I3	I4	
T1	6.3d	6.1c	5.0c	3.0b	5.1
T2	6.8ab	6.5a	5.3ab	3.3a	5.4
T3	6.4cd	5.8c	5.0bc	3.2ab	5.1
T4	6.7a	6.6a	5.4a	3.5a	5.6
T5	6.4bc	6.1b	4.9bc	3.3ab	5.2
T6	6.7ab	6.5a	5.4a	3.4a	5.5
Mean	6.5	6.2	5.1	3.2	
CV (%)	6.5				

Table 7. Summery of Mann-Kendall test and Sen's slope for the monthly trends of maximum temperature, minimum temperature, relative humidity, solar radiation and rainfall in Rajshahi from 1994 to 2024

Month	Temp.°C(max.)		Temp.°C(min.)		Relative humidity (%)		Solar Radiation (MJ/m ²)		Rainfall (mm)	
	Man-Kendall test	Sen's rate of change, mm year ⁻¹	Man-Kendall test	Sen's rate of change, mm year ⁻¹	Man-Kendall test	Sen's rate of change, mm year ⁻¹	Man-Kendall test	Sen's rate of change, mm year ⁻¹	Man-Kendall test	Sen's rate of change, mm year ⁻¹
Jan	-2.79**	-0.085	0.10	0.00.03	4.18***	0.812	- 3.88***	-3.464	1.70 ⁺	2.062
Feb	-2.55*	-0.068	0.58	0.010	3.94***	0.628	-2.45*	-1.648	-0.31	-0.200
Mar	-2.28*	-0.087	0.54	0.011	3.57***	0.574	-2.99**	-2.218	-0.88	-0.978
Apr	-1.19	-0.057	0.14	0.002	2.52*	0.464	-1.63	-1.458	0.68	0.763
May	-3.43***	-0.131	-1.87 ⁺	-0.022	3.47***	0.547	-1.97*	-1.902	1.33	1.126
Jun	-2.82**	-0.060	-0.14	-0.001	3.43***	0.298	-0.17	-0.113	-0.41	-0.560
Jul	0.20	0.002	0.78	0.004	0.27	0.013	0.82	0.767	0.54	0.602
Aug	0.10	0.001	2.14 [*]	0.012	0.61	0.019	-0.48	-0.349	-0.44	-0.598
Sep	2.65**	0.031	4.05***	0.036	-0.14	-0.003	-0.71	-0.467	1.02	0.992
Oct	-0.70	-0.007	0.95	0.021	2.14*	0.125	-2.31*	-1.930	0.07	0.158
Nov	-0.82	-0.015	-0.07	0.000	1.80 ⁺	0.129	-2.31*	-1.390	1.36	5.063
Dec	-2.01*	-0.055	1.90 ⁺	0.024	3.03**	0.431	- 3.54***	-3.443	2.07 [*]	6.766

⁺, *, ** and *** represents 10%, 5%, 1% and 0.1% significant level, respectively

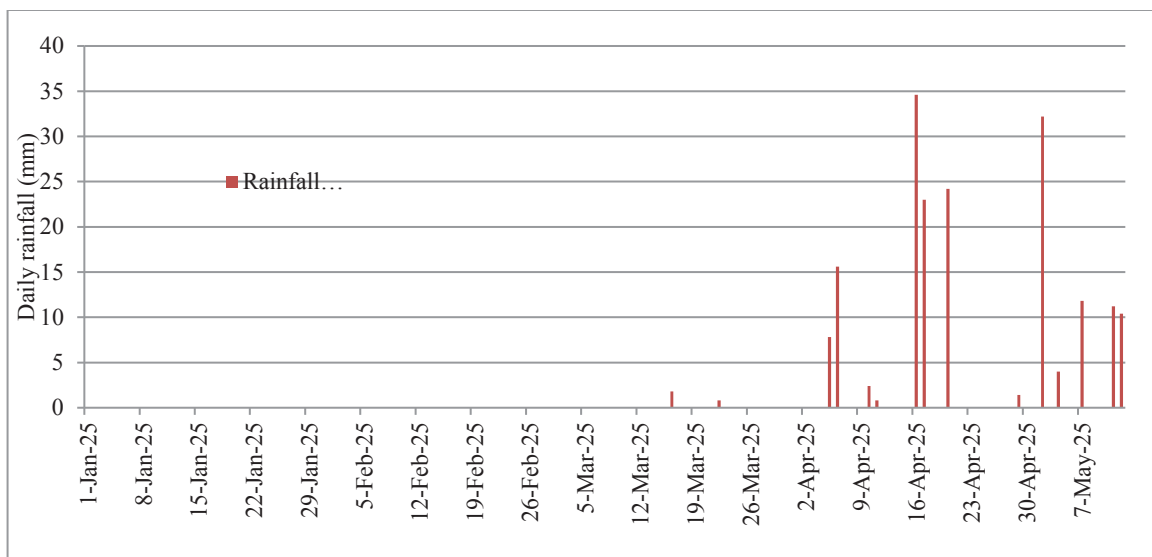


Fig.1: Daily rainfall (mm) distribution at BRRI farm, Gazipur during Boro season 2024-25.

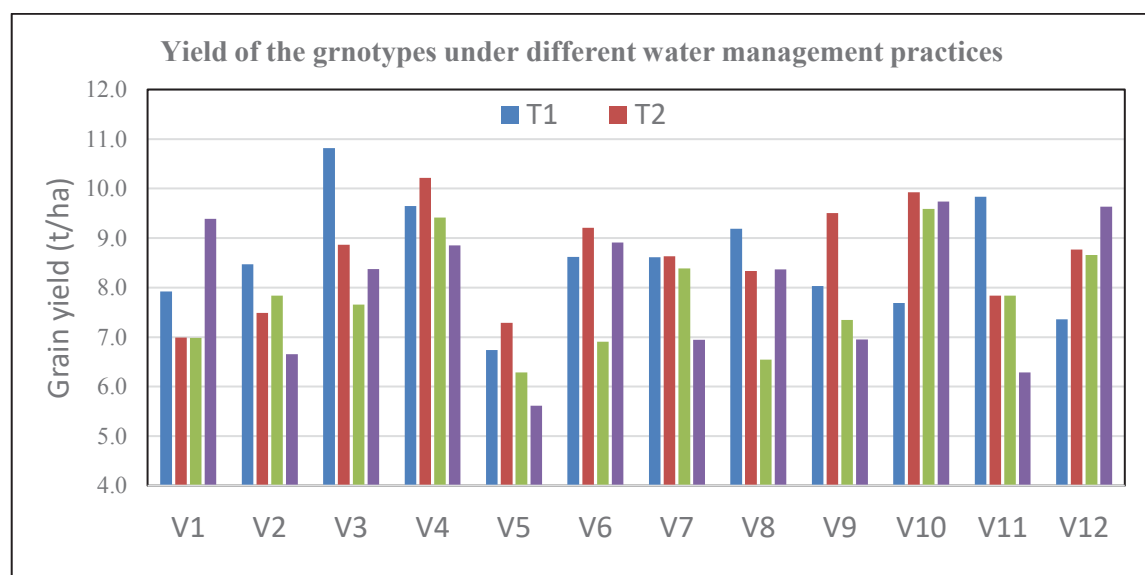


Fig. 2: Yield of the genotypes under different water management treatments at BRRI farm, Gazipur during Boro season 2024-25.

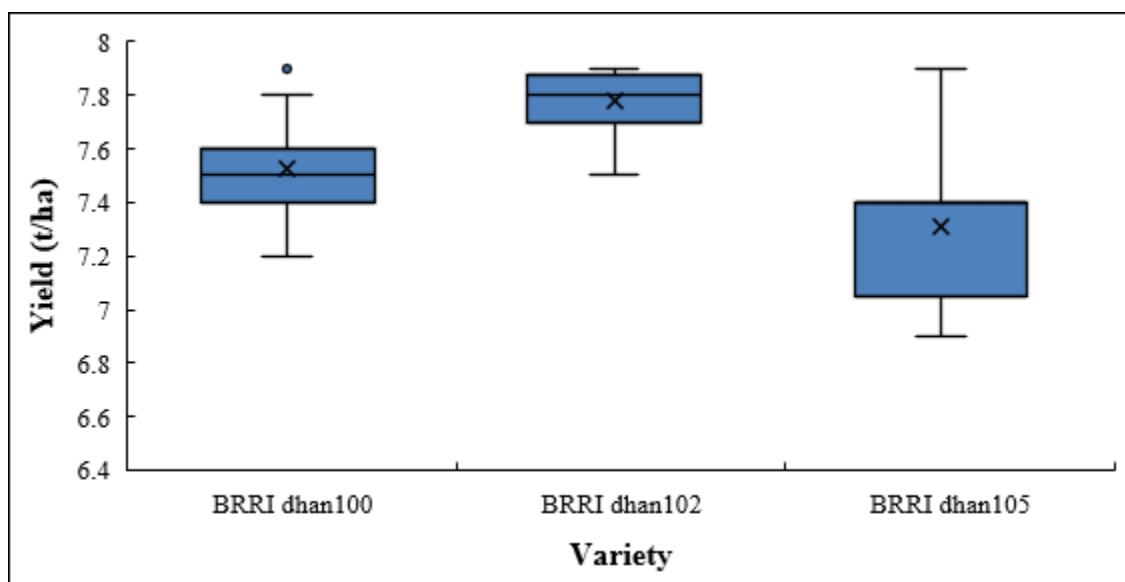


Fig. 3. Yield performance of different BRRi developed HYVs in Hilly region during Boro 2024-25 season.

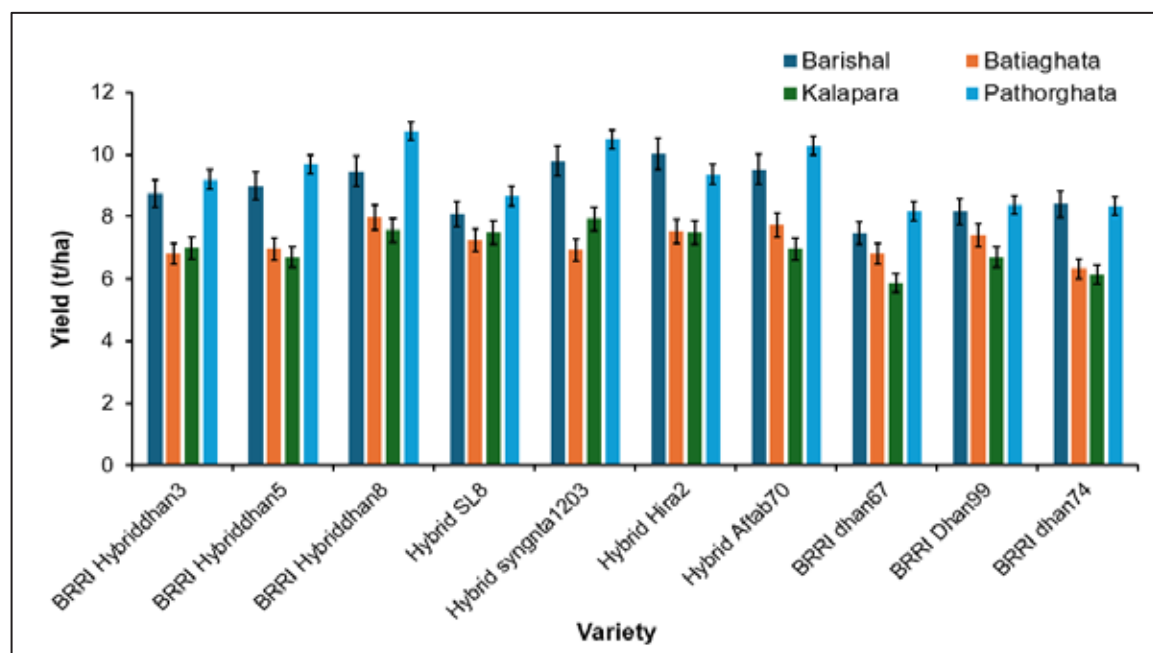


Fig. 4. Impact of low and high saline environment on yield, Boro 2024-2025

Plant Physiology Division

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SUMMARY

A total of 26 experiment under six different projects have been carried out during 2024-25 in Plant Physiology Division of BRRRI. A total of 320 advanced rice breeding lines were evaluated for salinity tolerance at 12 dS/m during the seedling stage, among which 17 lines such as BR13331-4R-288, BR13336-4R-155, BR13339-4R-286, BR13131-4R-62, BR13122-4R-56, BR13107-4R-34, BR13123-4R-229, BR12274-4R-193, BR11276-4R-105, BR12650-4R-77, BR12645-4R-71, BR13206-4R-50, BR11276-4R-150, BR11718-4R-110, BR12274-4R-255, BR11718-4R-230 and BR11712-4R-44 were identified as tolerant. However, at whole growth period the genotypes Goreswar and Dhulabiz exhibited moderate salinity tolerance, showing lower yield reductions up to 8 dS/m, while IR58443-6B-10-3 demonstrated the highest level of tolerance across all stress levels, making them valuable resources for breeding programs. Furthermore, five BRRRI hybrid rice varieties (BRRRI hybrid dhan2, dhan3, dhan5, dhan7, and dhan8) were assessed under salinity levels of 0, 6, 8, 10, and 12 dS/m throughout their entire growth period. BRRRI hybrid dhan7 performed best at 6 dS/m, and BRRRI hybrid dhan2 showed superior yield performance at higher salinity levels (8, 10, and 12 dS/m). In case of the genotypes of the CRCIL-464 panel, 32 entries were found tolerant, while 25 entries were identified as moderately tolerant. BRRRI dhan110 was classified as moderately tolerant, with a score of 5.0. Based on yield reduction and filled grain weight genotypes like BR1257-5R-80(835), BR11715-4R-13, and BR11921-4R-100 alongside tolerant check showed the lowest reductions (46.04%–64.45%) and highest grain weights (above 8 g/plant), indicating strong salinity tolerance. Among two hundred and nineteen (219) BRRRI Genebank germplasms accession number 2430 and 2585 performed better having SES score 7 for flash flood submergence tolerance. Out of two hundred and twenty-seven (227) BRRRI Genebank germplasms, four grmplasms namely accession

number 2337, 2546, 2589, 2596 and 2598 were produced higher tiller/hill (>5) compare to check varieties BR10 and BRRRI dhan30 under water stagnant condition. The submergence screening of the CRCIL-464 panel revealed considerable variation in flood tolerance among genotypes. Thirty-two entries, including four checks, showed survivability ranging from 8.33% to 100%, with SES scores between 1 and 9. Notably, IR14T156 demonstrated full survivability with all six plants recovered, while a few other genotypes also showed 100% survival but with fewer plants, indicating the need for further validation. Out of 310 genotypes, 34 germplasm and BRRRI dhan71 showed better performance in relation to yield under rainfed condition at reproductive phase, which were selected for further confirmation under controlled drought condition in rainout shelter. Out of 47, 5 germplasm namely BRRRI Genebank Acc. No. 3469, 3483, 3542, 3544 and 3561 were confirmed as drought tolerant under controlled drought condition in the rain-out shelter which could be useful as donor parent in hybridization program. The sterility percentage of these genotypes was less than 50. Out of 12 RYT, genotype BR11795-5R-51 performed better showing the yield reduction below 50% followed by BR11788-5R-27 and BR12314-5R-180. The sterility percentage was also less than 50%. Among 11 RYT Aus materials, BR12860-5R-79 produced the highest amount of root (202.8 mg/ g of shoot) followed by BR12859-5R-31 (193.1 mg/ g of shoot) which were comparable with the check variety Morich Boti (198.4 mg/ g of shoot). The evaluation of 600 BRRRI Genebank rice germplasms for seedling-stage cold tolerance revealed that Acc. no. 2363, 2369, 2371, 2289 and 2293 showed promising tolerance with SES scores of 3 and relatively high recovery survival (above 30%). Some accessions also had SES score 3 but with low survival, indicating partial tolerance. The evaluation of advanced breeding lines (RYT # 1) for reproductive stage cold tolerance resulted 6 advanced lines BR12421-4R-171, BR13027-BC1-3R-108(1),

BR12570-5R-33-2, BR13027-BC1-3R-149, BR13027-BC1-3R-108(2), and BR11894-R-R-R-R-59-Phy for further evaluation. Additionally, based on the yield performance (RYT # 2), 10 advanced lines BR11894-R-R-R-R-59-Haor, BR13152-5R-118-Haor, BR13152-5R-137-Haor, BR13152-5R-324-Hob, BR13152-5R-333-Gaz, BR13152-5R-377-Hab, BR13152-5R-398-Hbj, BR14006-2R-94-Gaz, IR100722-B-B-B-11 and IR100722-B-B-B-61 were selected for further evaluation. In the cold screening of the CRCIL-464 panel at seedling stage, high survivability (83.3%) was obtained with genotypes SVIN 297 and IRR154-Hd9+Pi9 representing good cold tolerance. Furthermore, several genotypes, including BR10540-4-1-2-4-1, BR12557-5R-80 (835), BR10317-5R-25, and BR12902-4R-48, displayed moderate survivability (50–67%) with SES scores of 3 or 5 and potential for further evaluation. In photoperiod sensitivity test of rice genotypes, out of 190 tested genotype, 126 genotype were found strongly photoperiod sensitive, 38 genotype found photoperiod insensitive and 26 were found weakly photoperiod sensitive. At the evaluation for lodging resistant capacity in different time of transplanting date at T. Aman season among the tested varieties BRRI dhan91, BRRI dhan93, BRRI dhan94, BRRI dhan103 were identified as lodging susceptible. But BRRI dhan90, BRRI dhan95, BRRI hybrid dhan4 and BRRI hybrid dhan6 showed lodging resistant. However, Babar baba, Kala Ghura local germplasm has the bending tendency due to their morphology like highest culm length and highest bending moment, longer lower internode length etc. Characterization of lodging tolerant for latest BRRI released varieties at Boro season revealed that BRRI dhan102, BRRI dhan104, BRRI dhan108 were lodging resistant compared to susceptible check variety BRRI dhan28 and tolerant check variety BRRI dhan29. BRRI dhan101 had lodging tendency due to higher plant height, comparatively lower wrapping score, low lignin content, high air space compared to check varieties. BRRI dhan105, BRRI dhan107 were identified as

lodging susceptible variety. Screening for lodging tolerance of advanced breeding lines at Boro season under PQR, ZER program resulted that out of 14 advanced lines, 4 lines (BR11966-4R-313, BR11971-4R-1, BR11971-4R-228, BR11978-4R-112) were identified as lodging tolerant. Some 3 advanced breeding line (BR11973-4R-224, BR11966-4R-406, BR11973-4R-363) had lodging tolerant tendency due to strong stem bending strength, higher wrapping score and the lodging index was equal or less than 5.00%. Under premium quality rice (PQR) for ALART materials both the line BR11359-4R-181, BR11359-4R-279 were lodging susceptible. For PQR pathology ALART materials, BRRI (Path)-Premium-1 was lodging tolerant. Among the three zinc-enriched rice RYT lines BR11401-1-2-4-1, BR11401-8-3-1-1, and BR12038-65-2-1 all were found to be susceptible to lodging alongside check variety BRRI dhan89, BRRI dhan100. Lodging index was 19.66% and 15.83%, respectively for BRRI dhan89, BRRI dhan100. Screening for lodging tolerance of advanced breeding lines at Boro season under FBR, CRT program reported that 4 lines were identified as lodging susceptible compared to check variety BRRI dhan88, BRRI dhan102, BRRI dhan97. These 4 advanced lines (BR12574-5R-52, BR11894-5R-260, BR12508-5R-5 and BR12517-5R-57) showed visual lodging rate 55% to 90%. Under disease resistance long duration (LD) for ALART materials both lines BR(Path)15855-BC2-3HR-23 and BR(Path)15680-BC2-3HR-47 were identified as lodging susceptible and lodging rate was less than 50%. For medium duration ALART materials BR(Path)15855-BC3-2HR-5, BR(Path)15860-BC2-3HR-48 showed visual lodging rate 30% and 5%, respectively. Under short duration ALART materials both of them BR (Path)15641-3HR-15, BR (Path) 15641-3HR-45 were identified as lodging resistant and visual lodging rate was zero. Aman varieties exhibit prolonged dormancy compared to Aus and Boro varieties, likely due to prevailing climatic conditions during seed development. Lodging in

BRRI dhan87 is being addressed by introgression of strong culm QTLs (SCM1 and SCM2) from Habataki through marker-assisted backcrossing. Fifteen F₁ plants led to 73 BC₁F₁ lines, with synchronized flowering ensuring successful hybridization. Molecular screening is ongoing to confirm QTL introgression and selected the lines for BC₂ advancement. In case of CRISPR-Cas9 mutagenesis of the *OsRR22* gene for improving salinity tolerance of rice, screening was done using T1 plants and found tolerant at 12 dS/m compare to its background variety BRRI dhan81. Further validation of T2 plants was done for confirmation of salinity tolerance. The selected plants were transplanted for seed multiplication and sequencing will be done for mutation confirmation.

PROJECT 1: SALINITY TOLERANCE

Screening of rice advanced breeding lines for salinity tolerance at seedling stage in Aman 2024 season.

About 278 (two hundred and seventy-eight) rice advanced breeding lines along with two checks (IR58443-6B-10-3, T. CK and IR154, S. CK) were

evaluated under salinity stress at seedling stage to identify salt tolerant rice advanced lines for Aman season. Screening was carried out by following method described by Gregorio et al., (1997) at seedling stage in the Plant Physiology Net house, BRRI. The screening was conducted using hydroponic culture with Yoshida solution. Salinity stress was imposed at 9–12 days after seedling emergence, starting at 8 dS/m. After three days, the salinity level was increased to 12 dS/m and maintained until the susceptible check variety (IR154) reached an SES score of 9. The experiment was conducted in RCB design following 3 replications. Out of 278 rice advanced breeding lines, 7 genotypes (seven) namely BR13331-4R-288, BR13336-4R-155, BR13339-4R-286, BR13131-4R-62, BR13122-4R-56, BR13107-4R-34, BR13123-4R-229 with the tolerant check IR58443-6B-10-3 showed tolerant (SES score 3) to 12dS/m salinity stress with the survivability range of 75 to 100 % (Table 1). Additionally, 37 (thirty-seven) advanced breeding had been found moderately tolerant (SES score 5) and rest of the lines were found moderately susceptible to susceptible type (Fig. 1).

Table 1: List of advanced breeding lines with SES score and survivability percentage under 12dS/m salinity stress at seedling stage

Advanced Breeding lines	SES Score	Survivability (%)
BR13331-4R-288	3	100
BR13336-4R-155	3	93
BR13339-4R-286	3	100
BR13131-4R-62	3	95
BR13122-4R-56	3	80
BR13107-4R-34	3	94
BR13123-4R-229	3	75
IR58443 (Tolerant Check)	3	100
IR154 (Susceptible Check)	9	0

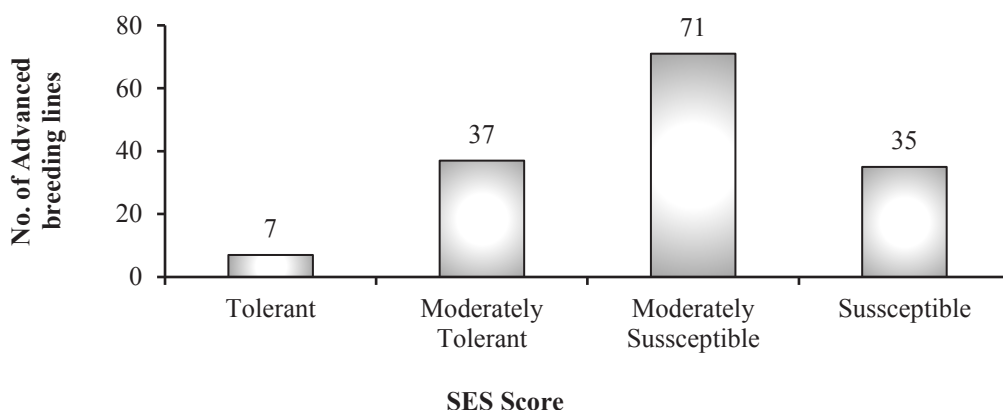


Fig. 1: Distribution of tested rice advanced breeding lines according to the SES score under 12dS/m salinity stress at seedling stage. (N.B. Seeds of 128 advanced breeding lines failed to germinate).

Screening of rice advanced breeding lines for salinity tolerance at seedling stage in Boro 2024-25 season.

A total of 42 rice advanced breeding lines along with two checks (IR58443-6B-10-3, T. CK and IR154, S. CK) were evaluated under salinity stress at seedling stage to identify salt tolerant rice advanced lines for Aman season. Screening was carried out by following the method described Gregorio et al., (1997) at seedling stage in the Plant Physiology Net house, BRRI. The screening was conducted using hydroponic culture with Yoshida solution. Salinity stress was imposed at 9–12 days after seedling emergence, starting at 8 dS/m. After three days, the

salinity level was increased to 12 dS/m and maintained until the susceptible check variety (IR154) reached an SES score of 9. The experiment was conducted in RCB design following 3 replications. Among the advanced breeding lines 10 (Ten) lines namely BR12274-4R-193, BR11276-4R-105, BR12650-4R-77, BR12645-4R-71, BR13206-4R-50, BR11276-4R-150, BR11718-4R-110, BR12274-4R-255, BR11718-4R-230, BR11712-4R-44 with tolerant check IR58443 were found tolerant (SES score 3) to 12dS/m salinity stress (Table 2). Moreover, 6 (six) advanced breeding lines had been found moderately tolerant (SES score 5) and rest of the lines were found moderately susceptible to susceptible type (Fig. 2).

Table 2: List of advanced breeding lines with SES score under 12dS/m salinity stress at seedling stage

Advanced Breeding lines	SES Score
BR12274-4R-193	3
BR11276-4R-105	3
BR12650-4R-77	3
BR12645-4R-71	3
BR13206-4R-50	3
BR11276-4R-150	3
BR11718-4R-110	3

Advanced Breeding lines	SES Score
BR12274-4R-255	3
BR11718-4R-230	3
BR11712-4R-44	3
BRR1 dhan67	3
IR58443	3

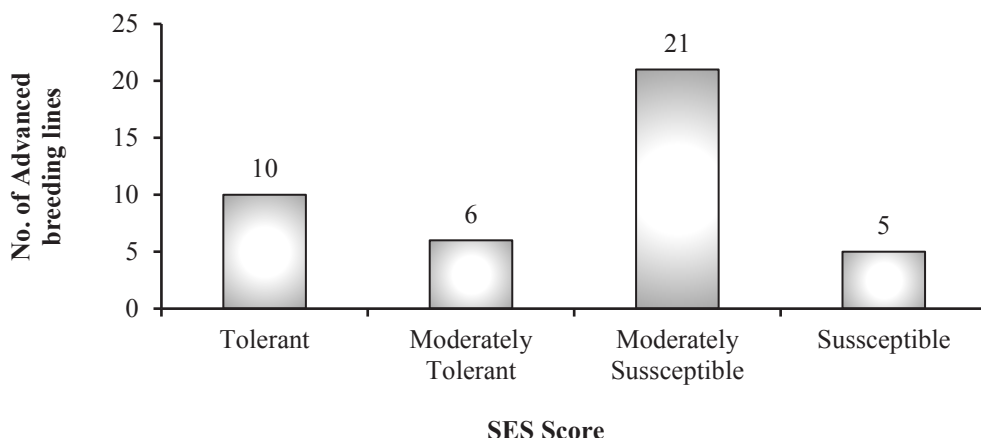


Fig. 2: Distribution of evaluated rice advanced breeding lines according to the SES score under 12dS/m salinity stress at seedling stage.

Characterization of rice germplasm for whole growth period under different salinity stress

An experiment was conducted to know the level of salinity tolerance of some rice germplasm under different salinity stresses. Four rice germplasm collected from BRR1 Genebank were used along with IR58443-6B-10-3 and IR154 as tolerant and susceptible check. Soil-based methods described by Gregorio et al. (1997) were followed to conduct the experiment. Salinity stress was maintained as 0, 6, 8 and 12 dS/m after 37 days of sowing. A general decline in performance is observed across all genotypes with rising salinity, indicating the detrimental effect of salt stress (Fig. 3). Among the genotypes, Goreswar and Dhulabiz exhibited relatively higher tolerance, maintaining better performance even under moderate to high salinity. The tolerant check, IR58443-6B-10-3, also exhibited

a stable response, confirming its adaptability under saline conditions. In contrast, Dalkatra and Birion were highly sensitive, displaying sharp reductions even at lower salinity levels. Yield reduction compared to the control emerged as a critical indicator for assessing tolerance. In this sense, the graph shows a consistent increase in yield reduction with rising salinity across all genotypes (Fig. 4). All the tested genotypes reduced sharply at 12 dS/m salinity stress. In contrast, IR58443-6B-10-3 showed the lowest reduction across all stress levels, indicating strong salinity tolerance. Goreswar and Dhulabiz also showed relatively lower yield reductions up to 8 dS/m, indicating their potential as salt-tolerant germplasm. These findings highlight Goreswar and Dhulabiz along with tolerant check IR58443-6B-10-3 may serve as potential genetic resources for developing salinity-tolerant rice varieties.

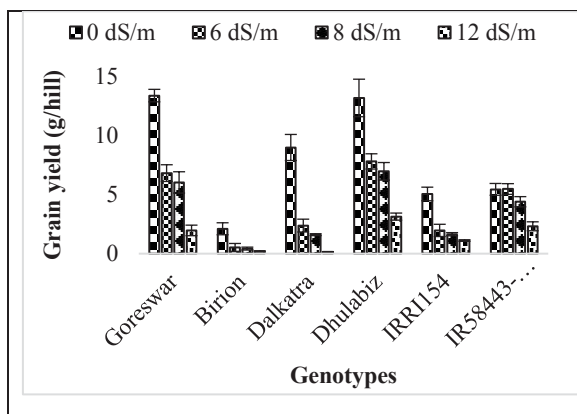


Fig. 3: Grain yield for six genotypes under different salinity levels.

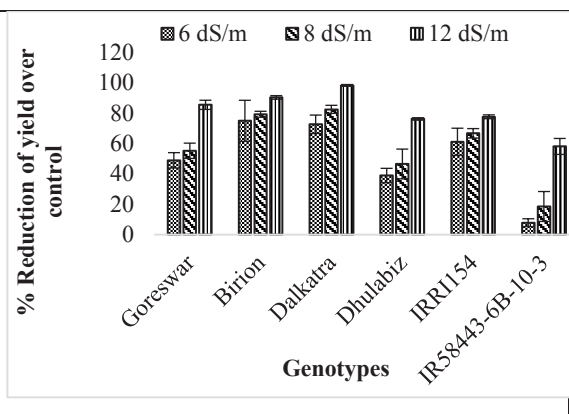


Fig. 4: Reduction of yield over control for six genotypes under different salinity levels.

Characterization of hybrid varieties for whole growth period at different salinity stress

Five hybrid rice varieties namely BRRI hybrid dhan2, BRRI hybrid dhan3, BRRI hybrid dhan5, BRRI hybrid dhan7 and BRRI hybrid dhan8 with tolerant and susceptible check variety i.e., IR58443-6B-10-3 and IRR1154 were tested for salinity tolerance at whole growth period to confirm their salt tolerance. The experiment was conducted in the Plant Physiology Net-house, BRRI. Plants were grown in the perforated plastic pots filled with grinded soil and the pots were placed inside a plastic bowl serving as water bath. Salt stress was applied 40 days after sowing; stress was made by adding NaCl in the bucket at 0, 6, 8, 10 and 12 dS/m salinity levels. The experiment was laid out in RCBD design with 3 replications. At maturity, grain yield and yield components were recorded. Water salinity levels were monitored daily throughout the growth period. BRRI hybrid dhan8 recorded the highest grain yield under control conditions (0 dS/m), whereas BRRI hybrid dhan7 performed best at a moderate salinity

level of 6 dS/m. At higher salinity stresses (8, 10, and 12 dS/m), BRRI hybrid dhan2 exhibited superior yield performance compared to the other hybrids (Fig. 5). Regarding total dry matter, BRRI hybrid dhan8 produced the highest value at 0 dS/m, BRRI hybrid dhan3 at 6 and 8 dS/m, and BRRI hybrid dhan2 at 10 and 12 dS/m. Tiller production was maximized in BRRI hybrid dhan2 under 6, 10, and 12 dS/m, while BRRI hybrid dhan8 and BRRI hybrid dhan3 recorded the highest tiller numbers at 0 and 8 dS/m, respectively. Panicle number was greatest in BRRI hybrid dhan8 at 0 and 6 dS/m, in BRRI hybrid dhan3 at 8 and 10 dS/m, and in BRRI hybrid dhan2 at 12 dS/m. Most yield-related traits differed significantly ($p \leq 0.05$) among varieties and salinity levels, except for panicle length and unfilled grain weight, which were not significantly affected. From the above findings it could be concluded that BRRI hybrid dhan8 performed better under non-stress, BRRI hybrid dhan7 at moderate stress, while BRRI hybrid dhan2 showed superior performance under high salinity.

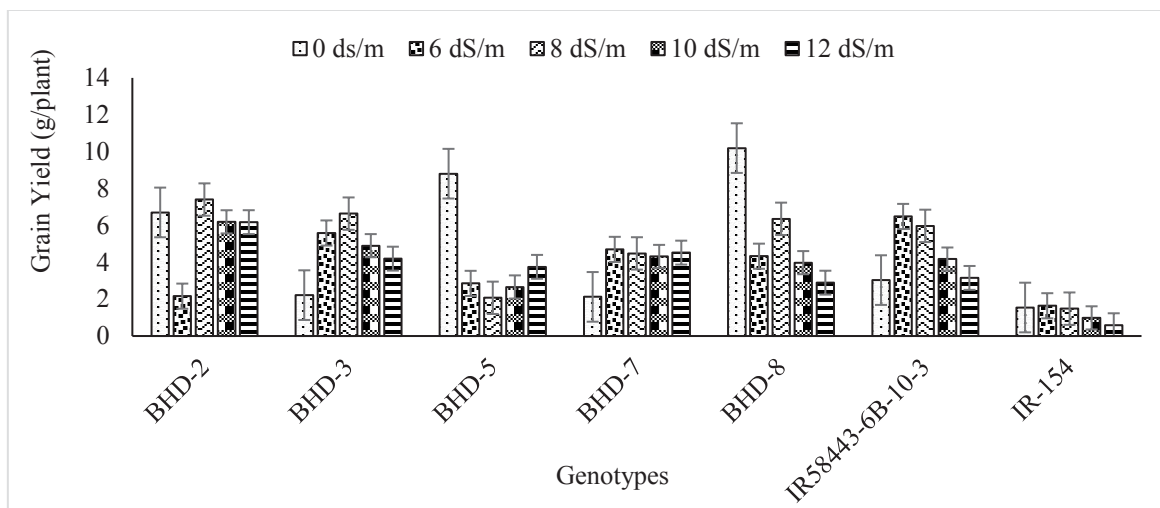


Fig. 5: Grain yield for seven genotypes under different salinity levels.

Phenotypic characterization of CRCIL-464 panel for seedling stage salinity tolerance during T. Aman 2024

Sprouted seeds of the CRCIL-464 panel, along with tolerant and sensitive checks, were sown on a nylon net attached to a Styrofoam sheet, floating on Yoshida's full-strength culture solution, as described by Gregorio et al. (1997). The experiment was conducted in an RCB design with three replications. Application of salt stress started at 18 days after sowing with a level of EC 6 dS/m and increased by 2 dS/m each day until reaching a maximum of 12 dS/m. The Yoshida solution was replaced weekly throughout the experiment. The pH and electrical conductivity (EC) of the solution were monitored daily and maintained at 5.0 and 12 dS/m, respectively. Each tray block included IRRI154 and IR58443-6B-10-3 as sensitive and tolerant checks, respectively. Visual scoring was conducted using IRRI's SES system when the sensitive check reached a score of >7.0. Based on the scoring system the genotype having average score <4.4 were treated as tolerant and average score 4.5-5.8 were treated as moderately tolerant. In the CRCIL-464 panel, 57 entries exhibited salinity tolerance at the seedling stage based on SES (Standard Evaluation System) scores. Among these, 32 entries were classified as tolerant (SES 3.0–4.8), including genotypes such as

1630, IR13F478, BR12567-5R-91, BR12459-4R-214, BR11715-4R-13, BR12459-4R-3, and IR16F1148 (check), with SES scores mainly between 3.0 and 4.4. Another 25 entries were identified as moderately tolerant (SES 4.5–5.8), including BR11714-4R-74, TP30649, IR96184-24-1-1-AJY2, BR11920-4R-521, IR13F478-3, BRRI dhan33, BR11921-4R-100, Pokkali, and BRRI dhan74 (check). The susceptible check IRRI154 recorded a high SES score of 7.12, validating the classification of the tested germplasm.

Re-evaluation at seedling stage salinity tolerance of BRRI dhan110 during Boro 2024-25

The salinity tolerance of BRRI dhan110 was re-evaluated in hydroponic culture at 12 dS/m salinity stress (Gregorio et al., 1997), alongside eight BRRI high-yielding salt-tolerant varieties, three local tolerant accessions, and two standard checks. Salt stress was initiated 11 days after sowing at 6 dS/m and increased by 2 dS/m daily until reaching 12 dS/m. SES and SPAD scores were recorded to assess the entries. Based on SES, BRRI dhan110 was classified as moderately tolerant with a score of 5.0. The reduction in leaf greenness (SPAD value) under salinity stress was minimal for BRRI dhan110 compared to IR58443-6B-10-3.

Assessment of seedling stage salinity tolerant germplasms from the CRCIL-464 diversity panel under reproductive phase salinity stress, Boro 2024-25

A total of 34 seedling stage salinity tolerant lines along with 2 checks were evaluated for reproductive stage tolerance under soil-based system. Filled grains weight and several other parameters were taken for evaluation. Salinity level was applied 10 dS/m after 21 DAS till maturity.

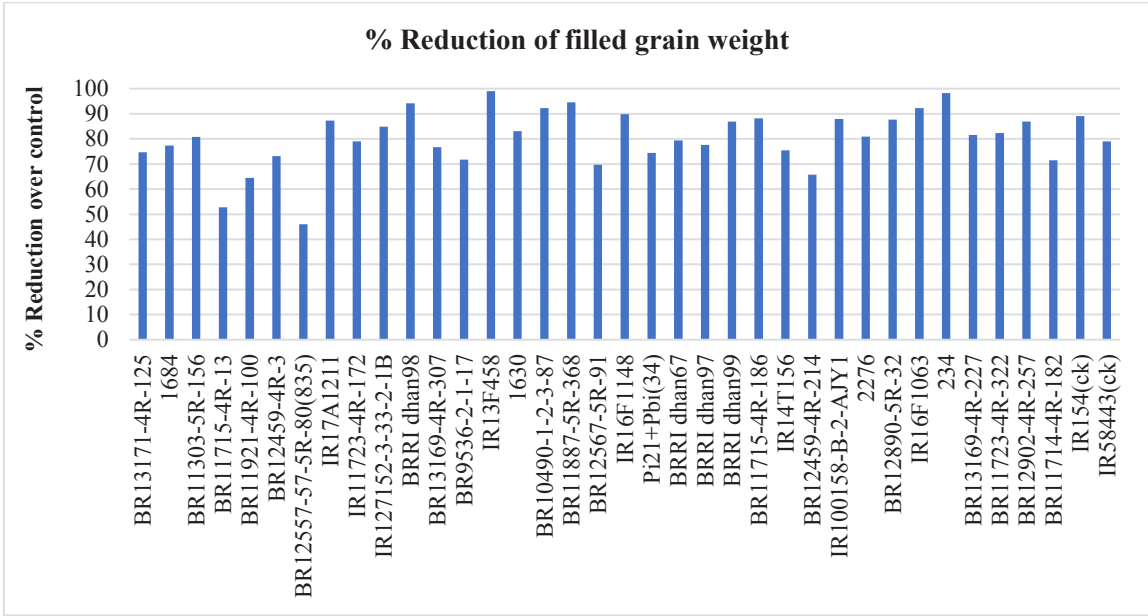


Fig. 6: Reduction of yields over control (%) among the tested genotypes and checks.

The bar graph illustrates the percentage reduction in filled grain weight across different rice genotypes under salinity stress compared to control conditions (Fig. 6). The data reveal a wide range of reductions, from as low as 46.04% to as high as 99%, highlighting significant variability in salinity tolerance among the genotypes. Genotypes such as **BR1257-5R-80(835)** (46.04%), **BR11715-4R-13** (52.72%), and **BR11921-4R-100** (64.45%) exhibited the lowest percentage reductions, indicating superior performance and tolerance under

saline conditions. In contrast, genotypes like **IR13F458** (99%), **234** (98.21%), **BR11887-5R-368** (94.59%), **IR16F1063** (92.26%), **BR10490-1-2-3-87** (92.29%) and **BRR1 dhan98** (94.15%), showed extremely high reductions, reflecting high susceptibility to salinity. Among the checks, **IR58443-6B-10-3 (ck)** demonstrated a relatively low reduction (79.04%), consistent with its role as a salt-tolerant check, whereas **IRRI154 (ck)** had a much higher reduction (89.14%), aligning with its known sensitivity.

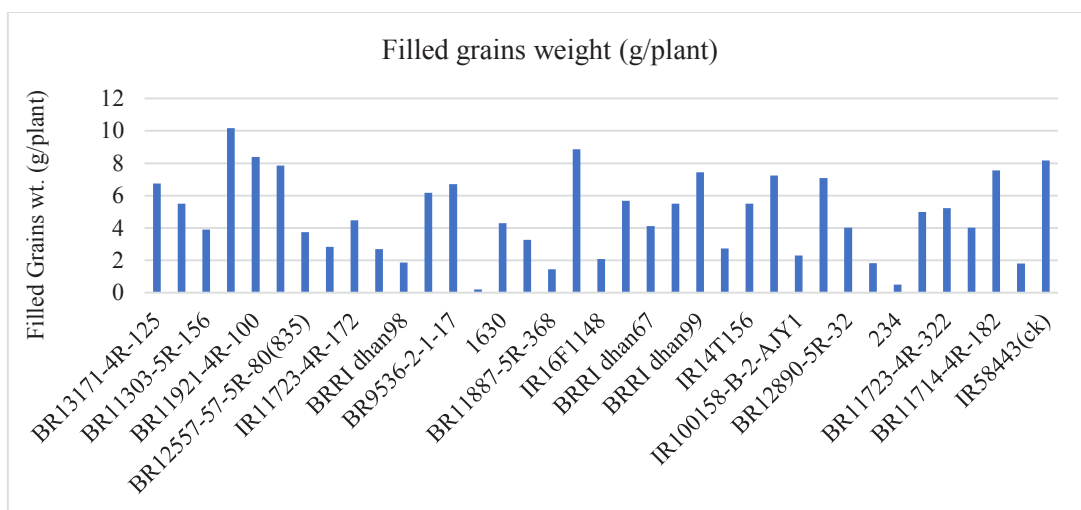


Fig. 7: Yield potential of the tested genotypes and checks.

The bar graph displays the filled grain weight (g/plant) of various rice genotypes under salinity stress, revealing substantial variation in performance (Fig.7). Several genotypes stood out with high filled grain weights, including **BR11715-4R-13 (10.16 g/plant)**, **BR12567-5R-91 (8.87 g/plant)**, **BR11921-4R-100 (8.38 g/plant)**, and the salt-tolerant check **IR58443 (8.17 g/plant)**, indicating strong resilience and productivity under saline conditions. Other genotypes such as **BR12459-4R-3**, **BR11714-4R-182**, and **BRR1 dhan99** also showed relatively high filled grain weights (above 7 g/plant). In contrast, some genotypes performed poorly, with filled grain weights below 1 g/plant, including **IR13F458 (0.195 g/plant)**, **234 (0.495 g/plant)** suggesting high sensitivity to salinity stress. The salt-sensitive check **IRRI154** yielded only **1.81 g/plant**, consistent with its expected poor performance.

PROJECT 2: SUBMERGENCE TOLERANCE

Identification of rice germplasm for two weeks flash flood submergence tolerance

Two hundred and nineteen (219) BRR1 Genebank germplasms along with tolerant checks FR13A and sensitive checks BR5 were used to identify the tolerant germplasm for two weeks under complete

submerged condition at vegetative phase. Nine seedlings (9 hills $\times$ 1rows) with 20 cm $\times$ 20 cm spacing of seventeen days old for each germplasm were transplanted in a concrete submergence tank. Two weeks after transplanting, plants were submerged completely at 100 cm water level and kept submerged condition for 14 days. The results showed that most of the germplasm were elongating type and percent elongation was ranged from 13.30 to 193.37%. Survivability of the tolerant check varieties FR13A had 100% whereas susceptible check BR5 did not survive. On the basis of survivability, the BRR1 Genebank accession number 2430 and 2585 performed better having SES score 7. The average water pH, temperature and dissolve O₂ of the submergence tank were 7.15, 31.38 °C and 3.64 mg/L, respectively. The average turbidity of the water tank was 124.32 and 345.49 FNU (Formazin Nephelometric Units) before and after made turbid, respectively during submergence.

Screening of local germplasms for Anaerobic tillering ability under water stagnant condition at T. Aman season

Two hundred and twenty-seven (227) BRR1 Genebank germplasms along with two check varieties BR10 and BRR1 dhan30 were used to observe the anaerobic tillering ability under water

stagnant condition. Twenty-four days old seedlings were transplanted using 20 cm × 20 cm spacing in a concrete tank. The water pressure @ 30 cm was given just after transplanting and @ 5 cm/week water was applied until 60 cm water depth. The stagnant water was maintained up to maturity. The plant height, tiller/hill and survivability were found to ranges from 110.75 - 266.50 cm, 1.6 - 7.6 tillers/hill and 100%, respectively. Four grmplasms namely BRRI Genebank accession number 2337, 2546, 2589, 2596 and 2598 were produced higher tiller/hill (>5) compare to check varieties BR10 and BRRI dhan30 under water stagnant condition.

Phenotypic characterization of CRCIL-464 panel for tolerance to flash flood submergence, T. Aman 2024

The CRCIL-464 panel germplasm, including checks (BRRI dhan79, BRRI dhan87, BRRI dhan110, BRRI dhan111) were sown in a standard seedbed to raise seedlings on 28/07/2024. Twenty-one-day-old seedlings from each entry were transplanted into the submergence tank of the Plant Breeding Division on 19/08/2024. Each entry consisted of 6 seedlings per line, with two lines per entry, arranged randomly. A single seedling was planted per hill with a spacing of 20 cm x 20 cm. Fourteen days after transplanting, the tank was filled with normal tap water to a height of 1 meter above the soil surface, ensuring complete submergence of the plants. To replicate the turbidity of floodwater in Bangladesh, muddy soil was mixed into the tank water daily. Water quality data, recorded before and after creating turbidity. Recovery and survivability scores were noted 7 days after recovery. Among the CRCIL-464 germplasm, 32 genotypes, including 4 checks, exhibited a survivability range of 8.33% to 100% after recovery, with SES scores ranging from 1 to 9. One genotype, IR14T156, had six planted plants, all of which survived, achieving 100% survivability. However, four other genotypes IR107976-BRGA-337, BR12899-4R-109, HCP-245, BRRI dhan100 also showed 100% survivability, but with only 1-2 plants per entry. These genotypes require further evaluation. Four entries BR10211-5-5-7, 2006,

BINA dhan25 and IR16F1148 (Ck) received an SES score of 7 with 50% survivability while the remaining scored 9.

PROJECT 3: DROUGHT TOLERANCE

Screening of rice germplasm for drought tolerance at reproductive phase, T. Aman 2024

Some total of 310 genotypes including 305 rice germplasm collected from BRRI Genebank N22, Kasalath, Kaliboro along with the check varieties BRRI dhan71 and IR64 were tested during T. Aman season 2024 at farmer's field in Edulpur, Godagari, Rajshahi following Field-managed screening protocol (IRRI, 2008). Thirty-day-old seedlings were transplanted at a spacing of 20 cm x 20 cm. The experiment was laid out in Alpha lattice design with two replications. Standard agronomic management practices were followed. Irrigation was withheld four weeks after transplanting and the field was drained out properly for not allowing any standing water until maturity. Out of 310 genotypes, 34 germplasm and BRRI dhan71 showed better performance in relation to yield under rainfed condition at reproductive phase, which were selected for further confirmation under controlled drought condition in rainout shelter.

Evaluation of previously selected germplasm under drought stress at reproductive phase in the rain-out shelter

This experiment was conducted in the rain-out shelter, Plant Physiology Division at BRRI HQ, Gazipur during T. Aman 2024 to evaluate previously selected 47 germplasm with the check varieties BRRI dhan71 and IR64. Thirty-day-old seedlings were transplanted in puddled soil at a spacing of 20 cm x 20 cm. Standard agronomic management practices were followed. Weeds were controlled when needed. Four weeks after transplanting, the plots were drained out for inducing drought stress at reproductive phase. The water table depth was below 1 m and soil moisture was around 20%. Out of 47, 5 germplasm namely BRRI Genebank Acc. No. 3469, 3483, 3542, 3544 and 3561 were confirmed as drought tolerant under controlled drought condition

in the rain-out shelter which could be useful as donor parent in hybridization program. The sterility percentage of these genotypes was less than 50.

Confirmation of performance for RYT materials under drought stress at reproductive stage

Twelve advanced breeding lines (RYT materials) along with the check varieties BRRI dhan75, BRRI dhan71 and IR64 were evaluated under controlled drought condition in the rain-out shelter in Plant Physiology net house shaded by polythene sheet at BRRI HQ, Gazipur during T. Aman season 2024. Twenty-five day old seedlings were transplanted in drum (56 cm x 43 cm) containing 110 kg puddled soil in two sets where the 1st set was grown in well-watered conditions and the 2nd set under stress

condition. At panicle initiation stage water was drained out from the 2nd set so that the plants experiences drought stress from the reduction division stage. The water table depth and soil moisture were recorded. At severe drought stress some lifesaving water was applied and calculated as follows: $= \pi r^2 h$, Where, $r = 56/2 = 28$ cm (The radius of the circumference of pot at the base of the hill.) $h = 0.5$ cm/day (the approximate evapotranspiration at the period of November to December. Out of 12 RYT, genotype BR11795-5R-51 performed better showing the yield reduction below 50% followed by BR11788-5R-27 and BR12314-5R-180. The sterility percentage was also less than 50% (Table 3).

Table 3: Grain yield, filled grain number, and % Sterility of 12 tested genotypes as affected by water stress at reproductive phase (T. Aman'2024)

Designation	Grain yield (g/plant)			Filled grain no./plant		%Sterility	
	Control	Stress	% Reduction	Control	Stress	Control	Stress
BR10317-4R-11	27.13	9.84	63.7	1280.6	504.8	18.0	51.3
BR13018-4R-31	29.98	14.40	52.0	1358.5	694.5	17.5	36.1
BR13018-4R-117	24.60	7.40	69.9	1120.2	364.5	18.7	65.6
BR13023-4R-33	21.51	7.16	66.7	1129.8	365.0	18.5	40.3
BR11788-5R-27	28.77	16.76	41.7	1418.2	915.1	17.1	37.0
BR12306-5R-14	20.58	10.95	46.8	1066.3	653.3	23.0	38.8
BR13.24-4R-24	21.59	10.91	49.5	1091.4	624.6	23.3	59.8
BR12307-5R-226	21.18	10.40	50.9	1185.8	582.1	24.2	48.2
BR12311-5R-69	30.62	15.96	47.9	1522.5	1017.8	25.3	36.9
BR12314-5R-180	26.15	14.30	45.7	1358.3	1061.3	27.6	39.7
BR12316-5R-133	32.94	14.22	56.8	1618.6	809.6	27.7	59.1
BR11795-5R-51	28.19	19.51	30.8	1396.6	1063.1	29.0	45.1
BRRI dhan71	27.52	17.70	35.7	1337.6	988.1	22.3	34.0
BRRI dhan75	25.75	9.59	62.8	1325.8	509.6	28.4	63.7
IR64	35.17	8.72	75.2	1469.8	391.6	21.3	66.2
LSD (5%)	5.06		-	229.6		10.0	
CV (%)	18.3		-	16.2		20.1	

Performance of Aus materials under drought stress, Aus 2024

Eleven advanced breeding lines (RYT Aus materials) along with the check varieties BRRI

dhan83 were evaluated under controlled drought condition in the rain-out shelter in Plant Physiology net house shaded by polythene sheet at BRRI HQ, Gazipur during Aus season 2024. Twenty-five day old seedlings were transplanted in drum (56 cm x 43

cm) containing 110 kg puddled soil in two sets where the 1st set was grown in well-watered conditions and the 2nd sets under drought stress condition where at active tillering stage water was drained out so that the plants experienced drought stress both vegetative and reproductive stage. The water table depth and soil moisture were recorded. For root study, another experiment was conducted following the “Protocol for studying deep rooting ability (BRRI, 2005)” with the deep rooted Aus variety Morich boti. Due to drought stress grain yield reduced drastically. Under well-watered condition the genotypes BR12263-5R-75 produced highest grain yield (38.81 g/plant).

However, under stress condition, highest grain yield was produced in advanced line BR12857-5R-55 (13.99 g/plant) followed by BR12860-5R-79 (13.11 g/plant). Lowest percent sterility was found in BR12860-5R-79 (29.0 %) (Table 4). The breeding line BR12859-5R-31, BR12860-5R-79 and BR12862-5R-3 produced more than 70 cm long root. Among these, BR12860-5R-79 produced the highest amount of root (202.8 mg/ g of shoot) followed by BR12859-5R-31 (193.1 mg/ g of shoot) which were comparable with the check variety Morich Boti (198.4 mg/ g of shoot) (Table 5).

Table 4: Grain yield, Filled grain number, and % Sterility of 12 tested genotypes as affected by water stress’ Aus 2024

Designation	Grain yield (g/plant)		Filled grain no./plant		%Sterility	
	Control	Stress	Control	Stress	Control	Stress
BR12236-5R-6	26.91	8.65	1294.1	551.2	27.7	45.9
BR12248-5R-22	34.68	11.73	1701.9	695.3	38.5	45.7
BR12248-5R-37	19.84	9.57	925.7	490.8	22.5	48.3
BR12248-5R-122	29.57	6.38	1253.5	346.5	18.6	64.4
BR12263-5R-75	38.81	2.88	1630.3	181.6	8.9	69.5
BR10756-2B-8-72	27.67	6.71	1239.8	376.8	20.5	59.4
BR12857-5R-55	14.49	13.99	719.4	686.3	47.1	51.2
BR12859-5R-31	35.36	6.83	1608.3	478.7	17.0	47.4
BR12860-5R-79	35.17	13.11	1733.9	813.1	21.7	29.0
BR12862-5R-3	30.82	9.97	1398.9	605.6	28.0	41.5
BR12867-5R-125	18.59	12.36	914.4	706.7	35.0	40.9
BRRI dhan83(CK)	31.96	13.22	1402.1	807.7	12.4	37.1
LSD (5%)	7.5		341.4		11.6	
CV (%)	23.9		22.1		19.4	

Table 5: Root characteristics (root length, cumulative root length, root weight and root shoot ratio) of 12 tested Aus genotypes with deep rooting Aus variety Morich boti

Designation	Root Length (cm)	CRL UP30 (cm)	CRLB30 (cm)	Total CRL (cm)	Root weight (mg)	RSR (mg/g)
BR12236-5R-6	54.0	846.7	287.0	1133.7	181.11	147.7
BR12248-5R-22	61.7	951.7	262.3	1214.0	172.22	131.7
BR12248-5R-37	59.0	821.7	221.3	1043.0	77.78	86.7

BR12248-5R-122	68.7	957.0	323.3	1280.3	153.33	131.8
BR12263-5R-75	66.7	1144.7	314.3	1459.0	123.33	122.0
BR10756-2B-8-72	63.0	1445.0	328.7	1773.7	155.56	136.4
BR12857-5R-55	54.0	1056.3	333.0	1389.3	175.56	148.9
BR12859-5R-31	74.0	946.3	326.0	1272.3	215.56	193.1
BR12860-5R-79	70.7	1017.0	481.7	1498.7	234.44	202.8
BR12862-5R-3	70.0	1112.0	336.3	1448.3	178.89	126.2
BR12867-5R-125	60.0	961.7	273.7	1235.3	140.0	102.4
BRRI dhan83(CK)	72.3	989.0	311.3	1300.3	137.78	127.6
Morich boti	82.3	1292.3	558.7	1851.0	400.0	198.4
LSD (5%)	12.1	432.8	256.5	532.0	141.81	106.3
CV (%)	10.9	24.7	45.4	22.9	46.6	44.2

CRL: Cumulative root length, RSR: Root shoot ratio, CRLUP30: CRL upto 30 cm, CRLB30: CRL below 30 cm

PROJECT 4: COLD TOLERANCE

Exploring new sources of cold tolerance from BRRI Genebank collections at seedling stage

The experiment was conducted to identify low temperature tolerant rice germplasms at seedling stage. A total of 600 BRRI Genebank germplasm along with four check varieties namely BRRI dhan28, BRRI dhan36, Bhutan and HbjB -VI were tested for seedling stage cold tolerance in cold water tanks under artificial condition. Among the tested germplasms, BRRI Genebank Acc. no. 2363, 2369, 2371, 2289, 2292 and 2293 had SES score 3 with their recovery survival 48.6%, 47.2%, 38.2%, 35.6%, 34.1% and 33.8%, respectively. However, Acc. no. 2351, 2354, 2356 and 2770 also had SES score 3 but their recovery survival percentage were mostly below 20%. BRRI Genebank Acc.no.2286, 2287, 2290, 2294, 2312, 2335, 2336, 2337, 2344, 2350, 2359, 2361, 2701, 2787 and 2832 had SES score 4 and recovery survival 0-37.5%. Other genotypes showed 5 to 9 score that is moderately tolerant to susceptible genotypes.

Evaluation of Advanced breeding lines (RYT # 1) under Natural Field Condition for reproductive stage cold tolerance

Some 13 advanced breeding lines along with BR11894-R-R-R-R-169, BRRI dhan28, BRRI dhan67 and BRRI dhan102 as check varieties were evaluated for reproductive stage cold tolerance under natural field condition. There were three seeding times 15 October, 30 October and 15 November. Thirty-day-old seedlings were transplanted in main field. Early planting was done with a view to falling rice reproductive phase at cold stress. For reproductive phase cold tolerance, we mainly focus on spikelet sterility. Changes in different parameters of rice in early planted set due to natural cold temperature were compared with normal planting set. Irrespective of genotypes, grain yield was significantly higher in 30 October and 15 November sowing than 15 October sowing. In 1st seeding date of early sowing/planting, none of the genotypes produced significantly higher grain yield than BR11894-R-R-R-R-169, BRRI dhan28, BRRI dhan67 and BRRI dhan102. In 30 October sowing, the advanced line BR13027-BC1-3R-149 produced highest yield (8.56 t/ha) followed by BR11894-R-R-R-R-59-Phy (8.45 t/ha) and BR13027-BC1-3R-108 (8.41 t/ha) where the check variety BR11894-R-R-R-R-169, BRRI dhan28, BRRI dhan67 and BRRI dhan102 produced 7.44, 5.25, 6.49 and 8.18 t/ha respectively (Table 6). Sterility percentage differed significantly among different varieties sown in

different sowing times. Percent sterility was increased significantly in 15 October sowing over 15 November with some exception. So based on the yield data, 6 advanced lines BR12421-4R-171,

BR13027-BC1-3R-108(1), BR12570-5R-33-2, BR13027-BC1-3R-149, BR13027-BC1-3R-108(2), and BR11894-R-R-R-R-59-Phy were selected for further evaluation.

Table 6: Grain yield and spikelet sterility of 13 tested genotypes (RYT # 1)

Genotypes	Yield (t/ha)			Sterility (%)		
	15 Oct	30 Oct	15 Nov	15 Oct	30 Oct	15 Nov
BR11894-R-R-R-R-228	1.27	5.40	6.36	71.1	57.8	22.1
BR13027-BC1-3R-109	3.54	6.52	9.69	39.0	25.1	18.2
BR12421-4R-171	2.15	7.46	7.67	25.8	16.5	13.6
BR12570-5R-146-1	3.62	6.27	6.69	57.3	29.5	33.6
BR13027-BC1-3R-102	1.37	4.98	8.04	45.1	36.0	11.9
BR13027-BC1-3R-108(1)	1.77	8.41	6.72	33.8	27.9	26.4
BR13027-BC1-3R-164	1.31	6.35	7.51	49.9	22.6	13.9
BR13027-BC1-3R-52	2.46	5.28	7.21	54.9	22.8	25.2
BR12570-5R-33-2	3.30	7.22	6.62	28.1	41.7	33.1
BR13027-BC1-3R-149	2.51	8.56	6.32	62.7	28.6	12.7
BR13026-BC1-3R-209	2.25	5.73	5.23	23.4	26.3	19.6
BR13027-BC1-3R-108(2)	1.51	7.62	8.39	59.0	23.4	29.9
BR11894-R-R-R-R-59-Phy	3.21	8.45	9.99	14.9	26.4	29.5
BR11894-R-R-R-R-169-(CK)	2.43	7.44	7.58	36.4	35.4	35.5
BRR1 dhan28 (ck)	1.03	5.25	9.97	63.6	45.5	20.5
BRR1 dhan67 (CK)	3.09	6.49	8.67	35.3	27.3	7.6
BRR1 dhan102 (CK)	3.60	8.18	6.92	52.0	35.0	27.2
LSD (5%)		3.6			19.1	
CV (%)		38.1			48.1	

Evaluation of Advanced breeding lines (RYT # 2) under Natural Field Condition for reproductive stage cold tolerance

Some 14 advanced breeding lines along with BRR1 dhan28, BRR1 dhan67 and BRR1 dhan102 as check varieties were evaluated for reproductive stage cold tolerance under natural field condition. There were three seeding times 15 October, 30 October and 15 November. Thirty-day-old seedlings were transplanted in main field. Early planting was done with a view to falling rice reproductive phase at cold stress. For reproductive phase cold tolerance, we mainly focus on spikelet sterility. Changes in

different parameters of rice in early planted set due to natural cold temperature were compared with normal planting set.

In early planting, all rice genotypes experienced moderately cold stress at the reproductive phase. Cold stress caused longer growth duration, shorter last internode length as well as plant height, poor panicle exertion and higher percentage of sterility over control treatment in all rice genotypes. Irrespective of genotypes, grain yield was significantly higher in 30 October and 15 November sowing than 15 October sowing. In 1st seeding date of early sowing/planting, the genotypes BR13152-

5R-324-Hab (6.15 t/ha) produced highest grain yield which is statistically similar with BRRI dhan67 and BRRI dhan102 (7.83 and 6.55 t/ha). However, the breeding line BR13152-5R-118-Haor, BR13152-5R-137-Haor, BR13152-5R-377-Hab, BR13152-5R-398-Hbj, BR14006-2R-94-Gaz, IR100722-B-B-B-11 produced more than 5 t/ha grain yield in 1st seeding date. Moreover, these breeding line along with BR11894-R-R-R-R-59-Haor, BR13152-5R-

333-Gaz and IR100722-B-B-B-61 produced more than 7 t/ha grain yield in 2nd seeding date. So based on the yield performance, 10 advanced lines BR11894-R-R-R-R-59-Haor, BR13152-5R-118-Haor, BR13152-5R-137-Haor, BR13152-5R-324-Hob, BR13152-5R-333-Gaz, BR13152-5R-377-Hab, BR13152-5R-398-Hbj, BR14006-2R-94-Gaz, IR100722-B-B-B-11 and IR100722-B-B-B-61 were selected for further evaluation (Table. 7).

Table 7: Grain yield of 14 tested genotypes (RYT # 2)

Genotypes	Yield (t/ha)		
	15 Oct	30 Oct	15 Nov
BR11894-R-R-R-R-59-Haor	4.91	7.88	7.09
BR12570-5R-33-2-Haor	3.73	6.46	9.10
BR13152-5R-118-Haor	5.38	8.28	7.27
BR13152-5R-137-Haor	5.75	5.86	7.48
BR13152-5R-324-Hab	6.15	7.43	6.99
BR13152-5R-333-Gaz	4.86	7.96	11.21
BR13152-5R-334-Haor	3.38	6.44	5.32
BR13152-5R-377-Hab	5.45	5.99	7.71
BR13152-5R-398-Hab	5.12	6.85	6.74
BR14001-2R-19-Gaz	3.86	5.76	8.24
BR14006-2R-94-Gaz	5.54	5.31	7.62
BR14624-4R-204-Gaz	4.28	6.19	6.73
IR100722-B-B-B-11	5.25	5.17	6.32
IR100722-B-B-B-61	2.75	7.21	7.15
BRRI dhan28 (CK)	2.37	5.14	7.07
BRRI dhan67 (CK)	7.83	5.90	7.12
BRRI dhan102(CK)	6.55	7.02	6.81
LSD (5%)	2.9		
CV (%)	26.2		

Phenotypic characterization of CRCIL-464 panel for seedling stage cold tolerance, T. Aman 2024

Seeding was carried out on 26th October 2024 of the CRCIL-464 panel with standard checks (4) in cold water tank at artificial condition. Seedlings were allowed to grow until three leaf stage which required about 10 days. After 10 days of germination seedling

were transferred in cold tank on 05/11/24. A total of six trays were placed in each tank. The cold-water tanks were adjusted to constant temperature at 13°C. One week after cold treatment the seedlings were scored for leaf discoloration and survivability. Leaf area damage score was given through SES and Percent survival was taken. Leaf discoloration score was recorded at 10 days after cold water treatment

using the scale of 1 to 9. Recovery ability of rice seedlings after two weeks of releasing from cold water tank was also recorded. Among the CRCIL-464 germplasm, 62 genotypes, exhibited a survivability range of 16.7% to 83.3% after recovery, with SES scores ranging from 1 to 9. Two genotypes like SVIN 297 and IRRI154-Hd9+Pi9 showed high survivability (83.3%) representing good tolerance. These genotypes require further evaluation. Some entries such as BR10540-4-1-2-4-1, BR12557-5R-80 (835), BR10317-5R-25, and BR12902-4R-48 showed moderate survivability around 50-67% with SES scores of 3 or 5. Poor survivability (16.7% or less) is seen in genotypes like BRRI dhan92, Binashail, BRRI dhan81, and BRRI dhan52, all with SES scores of 7, reflecting lower tolerance. Three checks, BRRI dhan28, BRRI dhan67, and Hbj-B-VI, showed 0% survivability with the highest SES score of 9, indicating very poor cold tolerance. These genotypes are considered promising but require further evaluation to confirm their potential performance under stress conditions.

PROJECT 5: GROWTH STUDIES AND YIELD POTENTIAL

Photoperiod sensitivity test of different type of rice genotypes

The experiment was conducted to know the photoperiod sensitivity level of tested genotype. In order to achieve the objectives seeds of sixty-four advanced breeding lines with Gainza and Nizersail as check variety were directly sown to the well-prepared plot at East byde of Plant Physiology division on 04 April 2024. After emergence the plants were thinned and 5 healthy plants were maintained for each entry. Ten-hour photoperiodic treatment (7.00 AM to 5.00 PM) was started from seed sowing by using black cloth covered. One set were grown at natural day length. Observations were made on seeding date and heading date to determine the Basic Vegetative Phase (BVP), Photoperiod Sensitive Phase (PSP) and Relative Photoperiod

Sensitivity (RPS). Result indicated that the BVP and PSP varied greatly among the tested lines. The PSP or lag phase is an indicative of the rice plants sensitivity to photoperiod. Out of 190 tested genotypes, 126 genotypes were found strongly photoperiod sensitive, 38 genotypes found photoperiod insensitive and 26 were found weakly photoperiod sensitive.

Evaluation for lodging resistant capacity in different time of transplanting date at T. Aman season

An experiment was conducted to determine the lodging resistant capacity of BRRI varieties at west byde, Plant Physiology division, Gazipur, during T. Aman season. Thirty days old seedlings of BRRI dhan90, BRRI dhan91, BRRI dhan93, BRRI dhan94, BRRI dhan95, BRRI dhan103 varieties with check variety BRRI dhan32, BR11 were transplanted using 20 cm X 20 cm spacing at 08/08/2024, 22/08/2024 and 05/09/2024. Experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Visual lodging rate depends on whether condition, location, soil texture etc. At this season 2024-25 T. Aman at Gazipur during this experiment no extreme weather like cyclone, heavy storm not experienced. Among the tested varieties BRRI dhan91, BRRI dhan93, BRRI dhan94 identified as lodging susceptible. But BRRI dhan90, BRRI dhan95, BRRI hybrid dhan4 and BRRI hybrid dhan6 showed lodging resistant. Might be the reason of lodging resistant was short culm length, low bending moment, higher wrapping score etc. In case local germplasm Babar baba, Kala Ghura has lodging susceptibility due to their morphology like highest culm length, higher bending moment, larger lower internode length etc. (Table 8). According to field data transplanting at 05/09/2024 no BRRI varieties lodged including susceptible check, but transplanted at 08/08/2024, 22/08/2024 some of the varieties showed visual lodged at the field (Table 9).

Table 8: Culm stiffness of BRRI rice varieties at T. Aman season (average of three replications)

Designation	Culm length (cm)	Culm diameter (mm)	Culm thickness (mm)	Bending moment (gm.cm)	Wrapping score
BRRI dhan90	79.55	5.33	1.87	1264.34	29.77
BRRI dhan91	144.56	6.22	1.93	3181.06	29.33
BRRI dhan93	97.44	5.44	1.97	2244.60	29.55
BRRI dhan94	94.11	5.78	1.67	1825.93	31.67
BRRI dhan95	91.89	6.44	2.00	1605.29	32.78
BRRI dhan103	97.33	5.89	1.67	2121.04	31.11
BRRI hybrid dhan4	79.78	5.78	2.00	1419.77	29.33
BRRI hybrid dhan6	82.11	6.00	2.03	1595.81	31.67
Babar baba	110.11	5.89	2.00	1772.22	25.56
Kala Gura	135.00	5.99	1.93	2047.80	28.22
BRRI dhan32 (Sus. Ck.)	99.67	5.77	1.63	2040.30	28.56
BR 11 (Tol. Ck.)	91.89	6.67	1.83	1729.73	30.45
LSD (5%)	9.85	0.62	0.82	408.63	2.47

Table 9: Visual lodging rate of tested varieties at different date of transplanting (DAT) in T. Aman season (average of three replications)

Designation	08/08/24	22/08/24	05/09/24
	Lodging rate (%)	Lodging rate (%)	Lodging rate (%)
BRRI dhan90	0	0	0
BRRI dhan91	30	35	0
BRRI dhan93	80	0	0
BRRI dhan94	85	0	0
BRRI dhan95	0	0	0
BRRI dhan103	56.67	20	0
BRRI hybrid dhan4	0	0	0
BRRI hybrid dhan6	0	0	0
Babar baba	100	100	100
Kala Ghura	100	100	100
BRRI dhan32 (Sus. Ck.)	40	25	0
BR 11 (Tol. Ck.)	0	0	0

Study on characterization of lodging tolerant for latest BRRI released varieties at Boro season

An experiment was conducted to determine the lodging tolerant capacity of advanced breeding lines at West byde, Plant Physiology division, Gazipur, during Boro season 2024-25. Forty-day-old-

seedlings of total BRRI dhan101, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107, BRRI dhan108, varieties with check varieties BRRI dhan28, BRRI dhan29 were transplanted using 20 cm × 20 cm spacing at January/2025. Experiment was laid out in Randomized Complete Block Design

(RCBD) with three replications. Among the tested varieties BRRI dhan102, BRRI dhan104, BRRI dhan108 were identified as lodging resistant compared with susceptible check variety BRRI dhan28 and tolerant check variety BRRI dhan29. Might be the reason was lower plant height, higher hill strength per cm, lower bending moment, comparatively higher wrapping score and lower air space in the stem. BRRI dhan101 has lodging tendency due to higher plant height, comparatively lower wrapping score, low lignin content, high air space compared with check varieties. BRRI dhan105, BRRI dhan107 were identified as lodging susceptible variety in this location. However, BRRI dhan105, BRRI dhan107 has short plant height but

wrapping score was not high, comparatively higher air space in the stem than vascular bundle and lower lignin content in stem. Higher air space, lower vascular bundle, lower lignin content makes rice stem susceptible to lodging (Table 10 and Table 11). Lodging has a significant negative impact on grain yield. When plants lodge, the yield is drastically reduced. In the susceptible variety BRRI dhan28, the yield loss due to lodging was the highest compared to other tested varieties. Similarly, lodging-susceptible varieties such as BRRI dhan101, BRRI dhan105, and BRRI dhan107 also showed considerable yield reduction as a result of lodging (Table. 12)

Table 10: Morphological characters concerning lodging resistant of tested varieties (Average of three replications)

Name of the variety	Plant height (cm)	Bending Strength/hill (N/cm)	3 rd Internode length (cm)	4 th Internode length (cm)	Wrapping score
BRRI dhan101	117.67	8.12	12.67	7.33	28.41
BRRI dhan102	104.00	10.34	11.33	6.33	30.37
BRRI dhan104	102.33	9.75	11.67	6.00	30.29
BRRI dhan105	104.00	8.45	13.33	8.33	27.56
BRRI dhan107	105.33	7.91	11.67	6.33	29.67
BRRI dhan108	101.33	9.71	9.33	4.67	31.00
BRRI dhan28 (Sus. Ck.)	101.00	7.96	14.00	7.33	26.81
BRRI dhan29 (Tol. Ck.)	103.67	9.40	10.33	6.00	29.11
LSD (5%)	2.61	0.61	1.15	0.93	1.37

Table 11: Anatomical and biochemical analysis of rice stem (Average of three replications)

Variety	No. Air Space	No. of Large Vascular Bundle	No. of Small Vascular Bundle	Lignin content (%)
BRRI dhan101	6.67	30.11	32.11	5.97
BRRI dhan102	0.00	30.33	29.89	6.95
BRRI dhan104	0.00	29.67	30.56	6.88
BRRI dhan105	13.33	28.00	30.33	5.35
BRRI dhan107	4.00	29.00	28.67	5.47

Variety	No. Air Space	No. of Large Vascular Bundle	No. of Small Vascular Bundle	Lignin content (%)
BRRI dhan108	4.00	29.33	30.67	6.56
BRRI dhan28 (Sus. Ck.)	9.00	23.89	27.67	5.81
BRRI dhan29 (Tol. Ck.)	0.00	26.48	29.89	6.36
LSD (5%)	0.79	1.54	1.38	0.98

Table 12: Combined effect of lodging rate (%), bending moment (gm.cm) on yield (gm) of tested varieties (Average of three replication)

Name of the variety	Lodging rate (%)	Yield (gm) at 14% Moisture	Bending moment (gm.cm)
BRRI dhan101	11.67	642.29	3371.21
BRRI dhan102	0	532.14	1818.28
BRRI dhan104	0	574.74	1595.33
BRRI dhan105	33.33	378.69	2478.11
BRRI dhan107	36.67	465.48	2437.88
BRRI dhan108	0	581	2193.72
BRRI dhan28(Sus. Ck)	55	386.96	2310.2
BRRI dhan29(Tol. Ck)	0	570.71	2191.25
LSD (5%)	9.63	131.89	239.55

Screening for lodging incidence of supplied advanced breeding lines at Boro season under PQR, ZER program

Lodging is the bending of the stems near ground level, which makes them very difficult to harvest, and can dramatically reduce yield. An experiment was conducted to determine the lodging tolerant capacity of advanced breeding lines at West byde, Plant Physiology division, Gazipur, during Boro season 2024-25. Forty-day-old-seedlings of total 20 advanced breeding lines under premium quality rice (PQR) for RYT, ALART, zinc enriched rice (ZER) for regional yield trial, from Plant Breeding Division were transplanted using 20 cm × 20 cm spacing at January/2025. Experiment was laid out in RCBD with three replications. Out of 14 advanced lines 4 lines (BR11966-4R-313, BR11971-4R-1, BR11971-4R-228, BR11978-4R-112) of premium quality rice (PQR) for regional yield trial (RYT) were identified as lodging tolerant due to short plant height, higher

wrapping score and higher hill bending strength compared to BRRI dhan50, BRRI dhan104 and BRRI dhan107 check variety. Some 3 advanced breeding line (BR11973-4R-224, BR11966-4R-406, BR11973-4R-363) had lodging tolerant tendency due to strong stem bending strength, higher wrapping score and the lodging rate was equal or less than 5.00%. In case check variety BRRI dhan107 was identified as lodging susceptible due to weak stem bending strength at hard dough stage and lodging rate was 17.5%. Under premium quality rice (PQR) for ALART materials both of the line BR11359-4R-181, BR11359-4R-279 were lodging susceptible. For PQR pathology ALART materials BRRI (Path)-Premium-1 was lodging tolerant due to strong stem bending strength and higher wrapping score. Among the three zinc-enriched rice RYT lines BR11401-1-2-4-1, BR11401-8-3-1-1, and BR12038-65-2-1 all were found to be susceptible to lodging alongside check variety BRRI dhan89,

BRRi dhan100. Lodging rate was 19.66% and 15.83% respectively for BRRi dhan89, BRRi dhan100.

Screening against lodging tolerance of advanced breeding lines at Boro season under FBR, CRT program

An experiment was conducted to determine the lodging tolerant capacity of advanced breeding lines at West byde, Plant Physiology division, Gazipur, during Boro season 2024-25. Forty-day-old seedlings of total 10 advanced breeding lines under favorable Boro rice (FBR) and cold tolerant rice (CTR), disease resistance for ALART materials from Plant Breeding Division were transplanted using 20 cm × 20 cm spacing at January/2025. Experiment was laid out in RCBD with three replications. In case favorable Boro rice and cold tolerant rice, 4 lines were identified as lodging susceptible compared to check variety BRRi dhan88, BRRi dhan102, BRRi dhan97. These 4 advanced lines (BR12574-5R-52, BR11894-5R-260, BR12508-5R-5 and BR12517-5R-57) showed visual lodging rate 55% to 90%. The higher plant height (cm), higher 3rd internode length (cm), comparatively lower bending strength (N/cm) might be made the lines vulnerable to lodging. Under disease resistance long duration (LD) for ALART materials both of them BR(Path)15855-BC2-3HR-23 and BR(Path)15680-BC2-3HR-47 were identified as lodging susceptible and lodging rate was less than 50%. This susceptibility to lodging might be attributed to their greater plant height (cm) and longer lower internode length (cm) compared to the check variety BRRi dhan29. For medium duration ALART materials BR(Path)15855-BC3-2HR-5, BR(Path)15860-BC2-3HR-48 showed visual lodging rate 30% and 5%, respectively. Though BR(Path)15855-BC3-2HR-5 has 5% visual lodging rate, it has moderate lodging resistance capacity due to lower plant height (cm), minimum internode length (cm) and higher wrapping score compared with check variety BRRi dhan58. Under

short duration ALART materials both the lines, BR (Path)15641-3HR-15, BR (Path) 15641-3HR-45 were identified as lodging resistant and visual lodging rate was zero. This might be due to their shorter plant height (cm), higher hill bending strength (N/cm), and higher wrapping score compared to the check variety BRRi dhan88.

Dormancy and viability test of BRRi varieties grown in Aus, Aman and Boro season.

The experiment was conducted to determine seed dormancy and viability period of BRRi rice varieties cultivated in Aus, Aman, and Boro seasons. A total of 14 BRRi released rice varieties—six Aman (BRRi dhan51, BRRi dhan52, BRRi dhan53, BRRi dhan54, BRRi dhan56 and BRRi dhan57), six Boro (BRRi dhan55, BRRi dhan60, BRRi dhan61, BRRi dhan64, BRRi dhan68 and BRRi dhan69) and two Aus (BRRi dhan98 and BRRi dhan106) were grown under standard agronomic practices. Seeds were harvested at maturity, dried to 10–11% moisture content, and tested at 7-day intervals for dormancy until germination reached 80% or higher. Following dormancy break, seeds were stored under four conditions: polythene packets, gunny bags, refrigerated storage, and air-conditioned room conditions. Viability was assessed at 30-day intervals in a completely randomized design (CRD) under in vitro conditions. Dormancy duration varied by season and genotype, with Aman varieties exhibiting significantly longer dormancy (21–71 days) than Boro (8–28 days) and Aus (14–28 days) varieties. The extended dormancy observed in Aman varieties may be attributed to reduced humidity and lower solar radiation during the growing season. These findings provide insight into varietal and seasonal variation in seed dormancy and viability, which is critical for optimizing post-harvest handling and seed storage strategies.

Introgression of Strong Culm Genes for Improvement of Lodging Tolerance of BRRi dhan87

Lodging is a critical constraint to the yield and stability of high-yielding rice varieties such as BRRI dhan87, particularly under wind, rain, or excessive nitrogen application. The project aims to improve lodging tolerance in BRRI dhan87 by introgression of strong culm-associated QTLs, SCM1 and SCM2, from the donor variety Habataki through marker-assisted backcross breeding. F₁ plants were developed through hybridization between BRRI dhan87 (recurrent parent) and Habataki (donor parent) during July–December 2024. A total of 15 confirmed F₁ plants were evaluated both phenotypically and at the molecular level using gene-specific markers for SCM1 and SCM2. DNA was extracted and screened to confirm the presence of the target QTLs in these F₁ individuals. Subsequently, backcrossing was conducted using BRRI dhan87 as the recurrent parent, resulting in the development of 73 BC₁F₁ backcross lines from the 15 F₁ plants. To facilitate successful hybridization in subsequent generations, parental materials were sown and transplanted in three sequential sets at 10-day intervals. This ensured synchronization of flowering time between parents and backcross progenies. The 73 BC₁ lines were established in the experimental field for further evaluation. In parallel, systematic leaf sampling was conducted from both parental lines and BC₁ individuals. DNA extraction and marker-assisted selection (MAS) are ongoing to confirm the introgression of SCM1 and SCM2, and to track the desired alleles in the backcrossed

population. This will help select suitable individuals for advancement to the BC₂ generation.

PROJECT 6: GENOME EDITING

CRISPR-Cas9 mutagenesis of the *OsRR22* gene for improving salinity tolerance of rice

The *OsRR22* gene encodes a 696–amino acid B-type response regulator transcription factor that is involved in both cytokinin signal transduction and metabolism; its loss of function has been reported to significantly increase salt tolerance. To design a CRISPR/Cas9 targeting the *OsRR22* gene in rice, a 19bp guide sequence (5'-AGAGGGATCAATTCCCCGT-3') was a protospacer adjacent motif lying within the *OsRR22* coding sequence (*LOC_Os06g08440*). The guide sequence was properly cloned into the binary vector pC1300-Cas9. The binary vector pC1300-Cas9 harboring Cas9/*OsRR22* sgRNA was mobilized into *Agrobacterium tumefaciens* LBA4404 by freeze-thaw method and confirmed through PCR-gel electrophoresis. Plants were regenerated through *Agrobacterium*-mediated transformation. Mutation was detected from regenerated plants and two nucleotides deletion was found at the target site. Salinity screening was done using T1 plants and found tolerant at 12 dS/m compare to its background variety BRRI dhan81. Further validation of T2 plants was done for confirmation of salinity tolerance. The selected plants were transplanted for seed multiplication and sequencing will be done for mutation confirmation.

Entomology Division

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SUMMARY

Short horned grasshopper (SHG), green leafhopper (GLH) and white leafhopper (WLH) were the most abundant pests and found in all habitats (seedbed, ratoon, grass fallow, grass bund, irrigated rice, rice bund and upland rice) during reporting year. Survey of insect pests of rice in Sylhet, Rangpur, Cumilla, Barishal, Rajshahi and Habiganj region during T. Aman 2023, Khulna, Rangpur, Cumilla, Habiganj and Jashore during Boro 2023-24 season revealed that insect pests infestation was below the ETL in all region. Yellow stem borer (YSB), Leafroller (LR), green leaf Hopper (GLH), short horned grasshopper (SHG) were the major insect pests and found highest in Barishal, Sylhet, Rangpur and Sylhet respectively. Among the natural enemies spider, carabid beetle (CBB), Damsel fly, Green mirid bug (GMB), lady bird beetle (LBB), Dragon fly and parasitic wasp (PW) were found highest in Rajshahi, Rangpur, Rajshahi, Sylhet, Rangpur, Barishal and Sylhet respectively. The range of Fall Armyworm (FAW) moth catches was 0.02 to 0.33/trap/day and YSB catches was 0.04 to 0.74/trap/day in pheromone trap placed in different locations of Bangladesh. Highest FAW moth catches were observed 0.33 moths/trap /day at the farmers field of Kaliganj, Jhenaidha. Highest YSB moths and damages were observed at Batiaghata, Khulna. The growth duration of different developmental stages of rice leafroller (RLR), *Cnaphalocrosis medinalis* from egg to adult has shown differences in changing temperature in the growth chamber. Overall, in lowest temperature (20°C), egg incubation period to adult longevity duration was higher compared to 25°C and 30°C and they completed their life cycle for 34 days which was higher from 25°C and 30°C. Species composition of stem borer species at BRRI HQ farm, Gazipur during T. Aus and T. Aman 2023 showed that in Aus dark headed borer (DHB) was the dominant species followed by striped stem borer (SSB). In Aman yellow stemborer (YSB) was the dominant species followed by SSB and DHB. Insect pests status remained below the economic threshold level (ETL) both in Eco-engineering plots (T₁) and insecticide treated plots (T₂). Highest beneficial insects, predator and parasitoid were observed in rice field with nectar-rich flowering plants on bunds (Eco-engineering). However, least natural enemies and parasitism were found in farmer's practice rice field

where 3-4 times insecticides were applied. Moreover, rice equivalent yield (REY) was higher in eco-engineering field compared to farmer's practice field (insecticide application). Attempts have been made to rear green mirid bug on different hosts e.g., *Corcyra* egg and larva, flowers of bottle gourd and other flowering plants but without success.

A total of 188, 45 and 14 commercial formulations of insecticides were evaluated and 96, 13 and 09 were found effective against BPH, YSB and rice weevil respectively.

Silica (SiO₂) nanoparticles showed 74.0% and 73.0% mortality against BPH nymph at 94 and 72 hours after spray (HAS) respectively in 1000 ppm concentration. Mortality rates increased over time, with higher concentrations exhibiting the highest rates of mortality.

Highest rice weevil insect mortality was found in neem oil (85%), followed by biskatali plants powder (75%), neem leaf powder (61.67%) and mahogany seed kernel powder (60%).

Temperature effect on the growth and survival rates of *Sitophilus oryzae* showed that hundred percent mortality of rice weevil were found in -80°C, -20°C, 4°C and 50°C treatments. There was no mortality observed in 25°C treatments.

To determine the susceptibility of more than eighteen generations greenhouse GLH population to six insecticides, a bioassay was conducted with six different concentrations for each insecticide. The lethal dose LD₅₀ values were found 48.44 for Mipcin 75 WP, 360.32 for Dursban 20 EC, 8.19 for Confidor 70 WG, 216.41 for Suntap 50 SP, 24.78 for Award 40 SC, and 0.91 for Nitro 505 EC.

Total number of natural enemy (NE) and other non-pest, comparable with control were found highest in fipronil, cartap, tetranilprole+ fipronil, Abamectin and *Celastrus angulatus* among eight commercially registered insecticides. So, these insecticides may be considered as safer for NE.

Insecticide residue tests on polished rice grain showed no pesticide presence or were below the detection level when applied with standard dose of chlorantranilprole and imidacloprid. The detection concentration for double dose application was 0.018 mg kg⁻¹ for chlorantranilprole and 0.029

mg kg⁻¹ for imidacloprid, which was below the Maximum Residue Limit (MRL: 0.4 mg kg⁻¹ for chlorantraniliprole and 0.6 mg kg⁻¹ for thiamethoxam, EU).

Multiple insecticide residue tests in polished rice found no residues or were below detection level.

A total of 15 insecticides determination methods namely carbofuran, chlorantraniliprole, chlorpyrifos, isoprocarb and thiamethoxam, malathion, diazinon, dinotefuran, imidacloprid, pymetrozine, nitenpyram, carbaryl, carbosulfan, cypermethrin, and fipronil were standardized by Shimadzu LCMSMS 8050.

Analysis of 16 rice samples collected from different regions of the country showed that no pesticide residue was found in any sample other than Chinigura rice samples.

Among the 100 germplasms, three germplasms Munsur, Dighi baul and Kalosaitta showed moderately susceptible reaction (score 5) against BPH in T. Aman 2023 season.

All of the 20 RYT advanced breeding lines of rainfed lowland rice (RLR) showed susceptible reaction (score 7 and 9) against BPH.

In drought tolerant rice (DTR) trial, one breeding lines IR127009-B-8-2-1-2, out of eight showed moderately susceptible (score 5) reaction against BPH.

All of the eight zinc enriched (ZER) lines of RYT during the evaluation at green house showed susceptible reaction (score 7 and 9) against BPH.

Among four ALART Antioxidant enriched rice materials one ALART material BR12836-4R-312 showed moderately susceptible reaction (score 5) against BPH.

Most of the entries of three ALART (SD) favourable Boro rice (FBR), two ALART (LD) FBR, six ALART (LB) FBR, four ALART cold tolerant rice (CTR), three PVT (Fertilizer Management) FBR breeding lines showed susceptible reaction (score 7 and 9).

In FBR cold tolerant rice, one entry IR17A2922 showed moderately resistant reaction (score 3) and four entries BR12676-4R-392,

BR13138-5R-141, IR17A2917 and IR12A173 out of 188 entries showed moderately susceptible reaction (score 5) against BPH.

All of 12 ALART Boro lines, 15 disease resistant rice, nine RYT-1 of premium quality rice (PQR), eight RYT-2 PQR, 13 RYT-3 PQR, nine RYT zinc enriched rice (ZER) entries showed susceptible reaction (score 7 and 9) against BPH.

Among 76 FBR (BPH 17 and BPH 32) BPH gene rice, two entries BR13418-5R-81 and BR13418-5R-93 showed moderately resistant reaction (score 3) and 13 entries BR13418-5R-3, BR13418-5R-6, BR13418-5R-8, BR13418-5R-26, BR13418-5R-37, BR13418-5R-40, BR13418-5R-47, BR13418-5R-51, BR13418-5R-53, BR13418-5R-76, BR13418-5R-78, BR13418-5R-82 and BR13418-5R-100 showed moderately susceptible reaction (score 5) against BPH.

Among 62 FBR lodging tolerance trial, one entry IR17A2922 showed moderately resistant reaction (score 3) and three entries BR12676-4R-392, BR7528-2R-19-16-RIL-59 and IR12A173 showed moderately susceptible reaction (score 5) against BPH.

One entry IR17A2922 out of 20 showed moderately resistant reaction (score 3) against BPH.

Among 352 OYT insect resistant rice (IRR) lines, one entry BR13482-4R-202 showed moderately resistant reaction (score 3) and ten entries BR13466-4R-10, BR13466-4R-42, BR13467-4R-208, BR13471-4R-88, BR13472-4R-1, BR13472-4R-6, BR13472-4R-124, BR13480-4R-29, BR13482-4R-54 and BR13482-4R-115 showed moderately susceptible reaction (score 5) against BPH.

Two entries out of 84 PYT insect resistant rice lines, BR12678-4 R-187 and BR12685-4 R-251 showed moderately susceptible reaction (score 5) against BPH.

All of 45 AYT insect resistant rice (IRR) entries showed susceptible reaction (score 7 and 9) against BPH.

Irrespective of locations and rice varieties the insect pests were remain below the economic threshold level (ETL) both in IPM practiced (T₁) and farmers practice i.e., insecticide application (T₂)

during Boro 2023-24. Benefit cost ratio (BCR) analysis was done on full cost basis and were found always higher in T₁ compared to T₂.

Newly developed burrows became inactive (dead) surrounding the 50 m dia of watching tower set in BRRI, Gazipur field indicating activity of owl at night to control rat in rice.

SURVEY AND MONITORING OF RICE ARTHROPODS

Pest and natural enemy incidence at BRRI farm, Gazipur

Populations of rice insect pests, their natural enemies and crop damage intensities in seven habitats (seedbed, ratoon, grass fallow, grass bund, irrigated rice, rice bund and upland rice) were monitored weekly at BRRI HQ farm, Gazipur. Overall insect

pest incidence was low in the reporting year. Green leafhopper (GLH), white leafhopper (WLH) and short horned grasshoppers (SHG) were the most abundant pests and found almost in all habitats. Highest number of SHG was found in seedbed followed by grass fallow, transplanted rice, grass bund and broadcast rice (Fig. 1).

Higher numbers of natural enemies were found in the seedbed, grass fallow and ratoon. Green mirid bug (GMB), ladybird beetle, spider, damsel fly (Dam. fly), spider and carabid beetle (CDB) were the dominant predators in almost all the habitats of the reporting year (Fig. 2).

P.I: Mir Md Moniruzzaman Kabir C.I: Tapon Kumar Roy PL: Sheikh Shamiul Haque

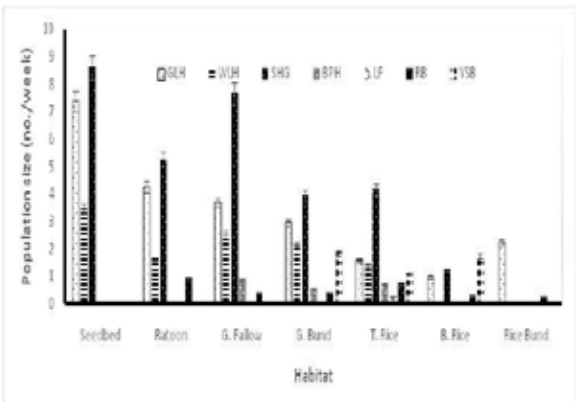


Fig. 1. Incidence of insect pest in different habitats at BRRI farm, Gazipur.

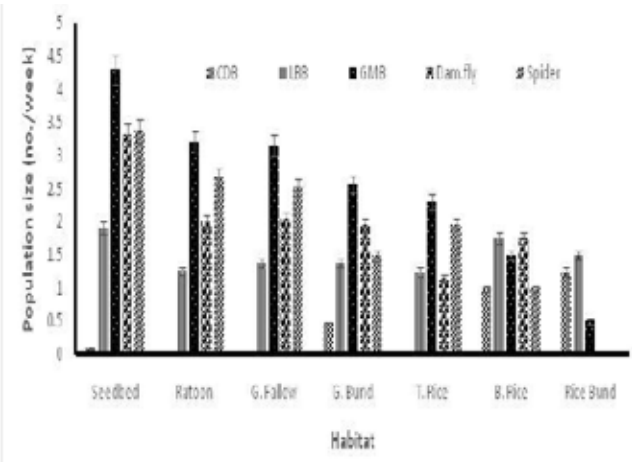


Fig. 2. Incidence of natural enemies in different habitats at BRRI HQ farm, Gazipur.

Incidence of insect pests and natural enemies in light trap

Rice insect pests and their natural enemies were monitored throughout the year by Pennsylvanian light trap from dusk to dawn at BRRI HQ, Gazipur and six BRRI regional stations. The highest number

of insect pests were observed at Habiganj followed by Gazipur, Barishal, Cumilla, Rangpur, Rajshahi and Sonagazi respectively (Fig. 3). In case of natural enemies, the highest catch of natural enemies in light trap was recorded at Gazipur followed by Barishal and Habiganj.

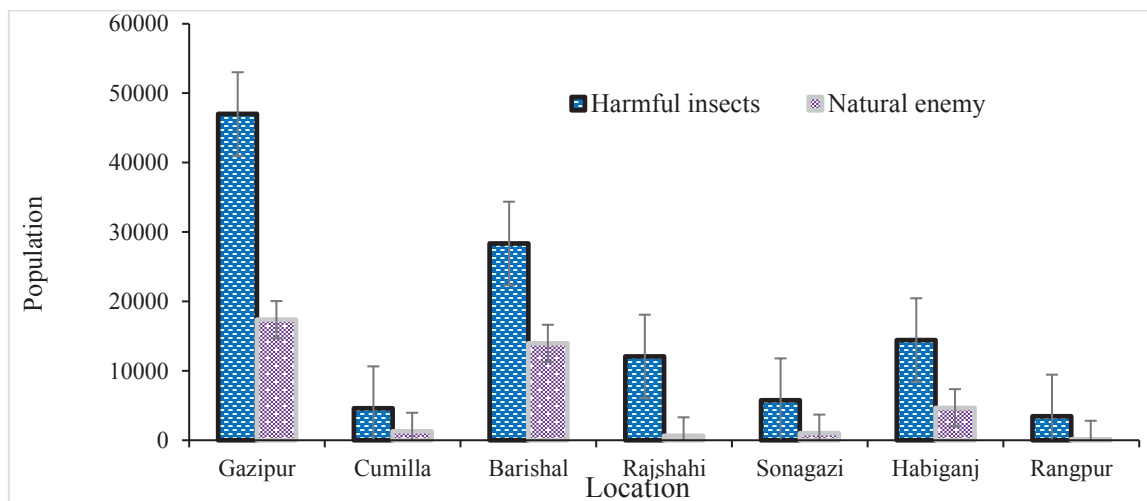


Fig. 3. Insect pests and natural enemies at BRRI HQ, Gazipur and regional stations (RS).

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Survey of rice insect pests in selected Agro-ecological zones (AEZ's) of Bangladesh

The insect pest population, their damage intensities and abundance of the natural enemies were surveyed in Sylhet, Rangpur, Cumilla, Barishal, Rajshahi and Habiganj region during T. Aman 2023 and Khulna, Rangpur, Cumilla, Habiganj and Jashore during Boro 2023-24. Twenty complete sweeps were taken randomly in 27 locations of each AEZ. The insect pests were below the ETL in both of T. Aman and Boro season.

Highest population of yellow stem borer (YSB) was found in Barishal (5.03/20 sweep) followed by Rangpur (1.59/20 sweep) and Sylhet (1.44/20 sweep) and Rajshahi (1.41/20 sweep) during T. Aman season. The lowest was observed in Cumilla 0.17/20 sweep (Fig. 1). Leafroller (LR) population was found the highest at Sylhet (4.74/20sweep) followed by Barishal

(2.02/20sweep) and Rangpur (1.47/20 sweep). Abundance of GLH was found highest in Rangpur (3.87/20 sweep) followed by Cumilla (3.55/20 sweep) and Sylhet (2.37/20 sweep) during T. Aman season (Fig. 4). Among the all-insect pests short horned grasshopper (SHG) was found the highest in Sylhet (10.85/ 20 sweep) followed by Barishal and Cumilla (each of 5.50 /20sweep) and Rangpur (5.05/20sweep) and the lowest SHG was observed in Rajshahi, 1.69/20 sweep (Fig. 4). Highest number of spider (8.56/20 sweep) was found in Rajshahi followed by Sylhet (7.52/20 sweep), Barishal (2.93/20 sweep) and the lowest was in Cumilla (1.68/20 sweep). Among the natural enemies carabid beetle (CBB) and staphylinid beetle (STPD) were remarkably highest in Rangpur (27.42 and 3.7/ 20 sweep respectively) than other locations (Fig. 5). Damsel fly (Dam.fly) was found highest in Rajshahi (3.84/20 sweep) followed by Sylhet (2.85/20 sweep) and Rangpur (1.2/20 sweep). Green mirid bug (GMB) and parasitic wasp (PW) were found highest in Sylhet, lady bird beetle (LBB) in Rangpur and

Dragon fly (Drag. fly) in Barishal during T. Aman 2023 (Fig. 5). Highest YSB) was found in Khulna (3.5/20 sweep) followed by Jashore (0.83/ 20 sweep). The range of other insect pests were (0 to 0.67/20 sweep) during Boro season (Fig. 6). Rice leafroller (RLR) population found highest in Khulna (1.33/ 20sweep) followed by Jashore (1.0/20sweep). Abundance of GLH was found highest in Cumilla (3.80/20 sweep) followed by Habiganj (2.75/20 sweep). Among the all-insect pests SHG found highest in Cumilla (19.22/ 20 sweep) followed by Habiganj and Rangpur (3.5 and 2.03/20sweep) and lowest was observed in Khulna and Jashore each of

1.50/20 sweep (Fig. 6). BPH and WBPH were found highest in Cumilla and Khulna 4.22 and 1.83/20 sweep respectively (Fig. 6). Highest spider (5.75/20 sweep) was found in Habiganj followed by Cumilla (4.22/20 sweep) and Khulna (3.33/20 sweep) and lowest in Jashore (2.83/ 20 sweep). Other natural enemies i.e., parasitic wasp (PW) and STB were found highest 5.67 and 3.47/ 20 sweep respectively in Rangpur region and Dam. fly in Habiganj (3.27/20 sweep) during Boro 2023-24 season (Fig. 7).
 PI: Md. Nazmul Bari, CI: All entomologist, PL: Sheikh Shamiul Haque.

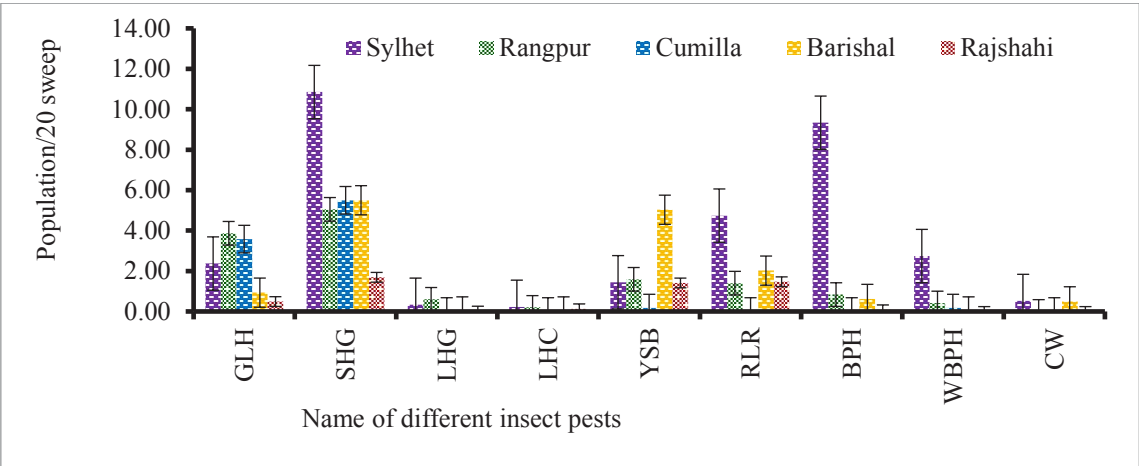


Fig. 4. Rice insect pests status in different AEZ's of Bangladesh during T. Aman 2023.

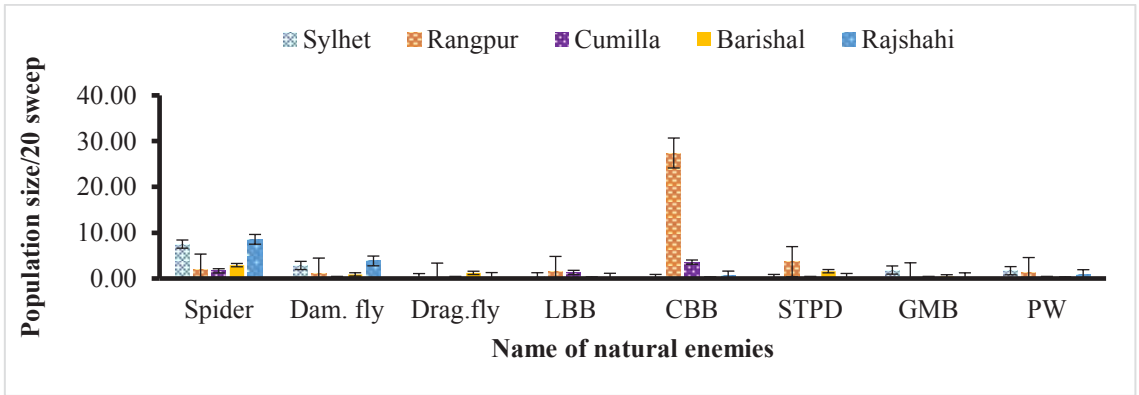


Fig. 5. Natural enemies of rice insect pests in different AEZ's of Bangladesh, T. Aman 2023.

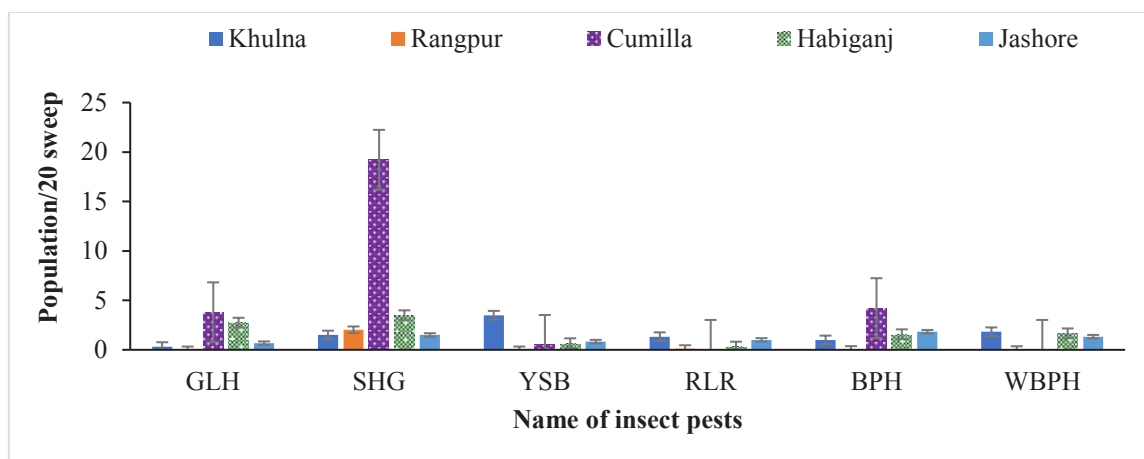


Fig. 6. Rice insect pests status in different AEZ's of Bangladesh during Boro 2023-24.

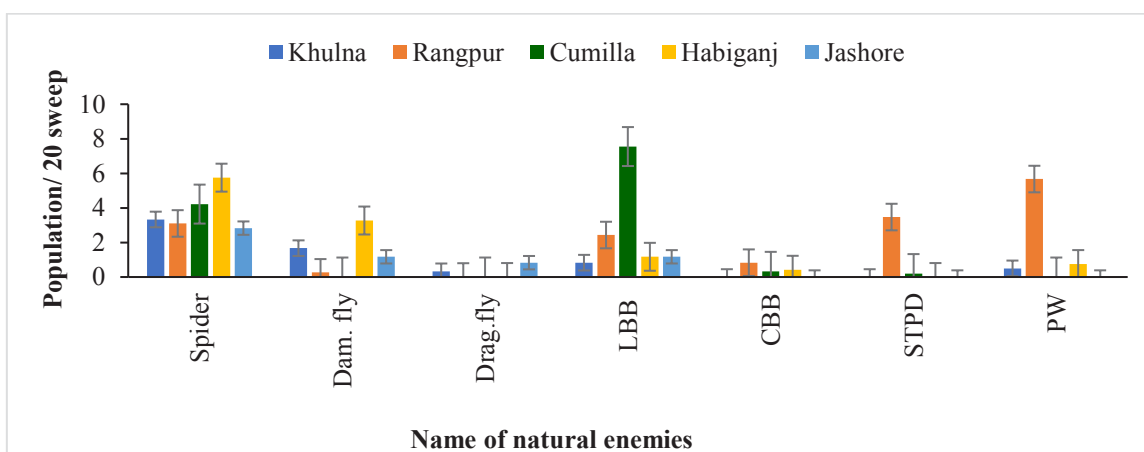


Fig. 7. Natural enemies of rice insect pests in different AEZ's of Bangladesh, Boro 2023-24.

Fall armyworm (FAW) and Yellow stem borer (YSB) monitoring through pheromone trap

Each of four FAW and YSB pheromone trap were set up in all seven experimental plots for monitoring and control purpose respectively. FAW pheromone traps were set 100 m between traps in each of the seven locations. YSB pheromone traps were set @40/ha. Trapped catch data were taken on an average of eight weeks in all seven locations during Boro 2023-24 season. In each of the field, BRRI Scientists/Scientific Assistance or SAAOs carefully examined 10 rice leaves for signs of new Fall Armyworm damage for Fresh Windowpanes (FW) (Fresh pinholes, window panes, leave damage etc.)

or Infested Plants (IW) (infested stem, infested panicle, fresh frass etc.). Every Monday the trap catch and field scouting data were collected and recorded. The average trap catch and field scouting data were recorded. The ranged of FAW catches was 0.02 to 0.33/trap/day and YSB catches was 0.04 to 0.74/trap/day (Fig. 8). Highest FAW moth catches were observed 0.33/trap /day at the farmers field of Kaliganj, Jhenaidha (Fig. 8). That might be happened as maize field was remained adjacent to the trial field. In case of FAW, no fresh window panes (WP) and infested plants (WP) were found during scouting. Again, no dead hearts and white heads were observed in case of YSB except Batiaghata, Khulna. Highest YSB populations and

damages were observed at Batiaghata, Khulna and it is obvious that YSB status remain highest in the coastal belt of Khulna, Bangladesh due to vast fallow areas remain in those areas after T. Aman

cultivation. So, diapausing YSB remain highest in that areas

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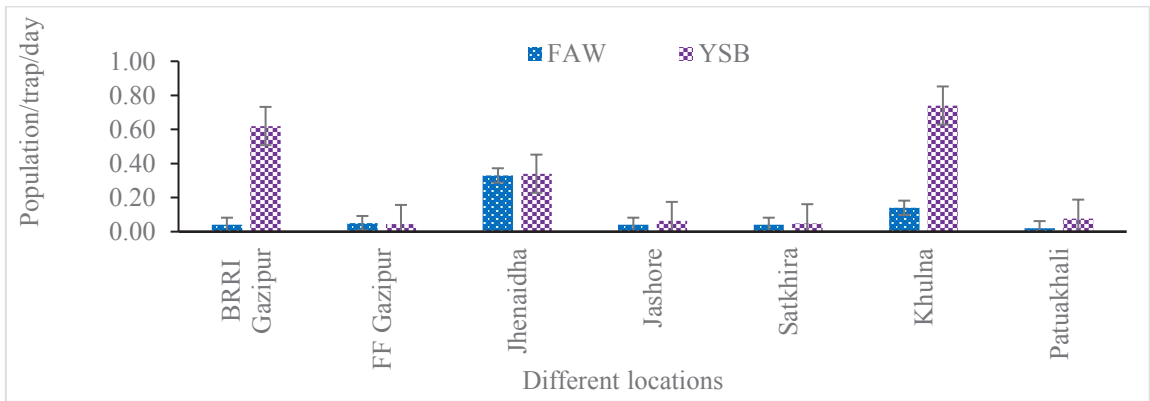


Fig. 8. Catches of FAW and YSB status in pheromone trap at different locations of Bangladesh, Boro 2023-24.

BIO-ECOLOGY OF RICE INSECT PEST AND NATURAL ENEMY

Effect of temperature on the biology and life cycle of rice leafroller, *Cnaphalocrosis medinalis*

Rice leafroller colony was maintained on BR3 plants under greenhouse conditions at BRRI HQ, Gazipur to know the impact of elevated temperature on the development of rice leafroller. Egg incubation period was significantly higher in 20°C compared to 25°C and 30°C. Larval period was significantly

different in three different temperatures. In lowest temperature (20°C), the duration was higher compared to 25°C and 30°C. Pupal duration was completed quickly at 30°C than 20°C and 25°C (Fig. 9). Adult longevity was found highest at 25°C followed by 30 and 20°C (Fig. 10). Total growth duration was found highest at 20°C that was decreases with increases temperature 25 to 30°C (Fig. 11).

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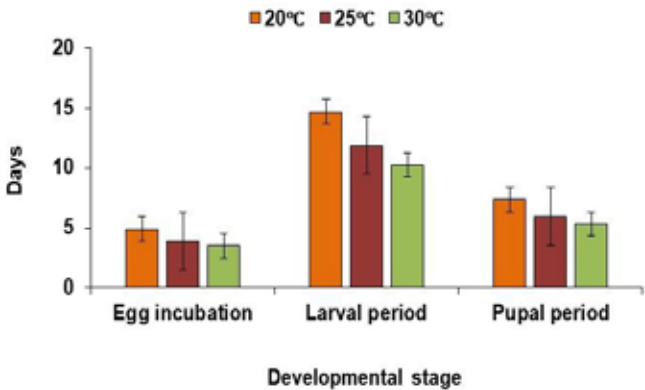


Fig. 9. Effect of temperature on the growth duration of rice leafroller.

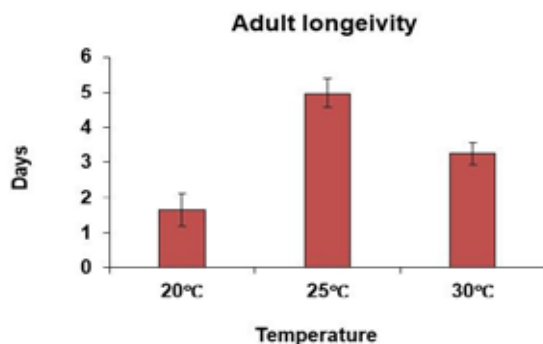


Fig. 10. Adult longevity of rice leafroller in different temperature.

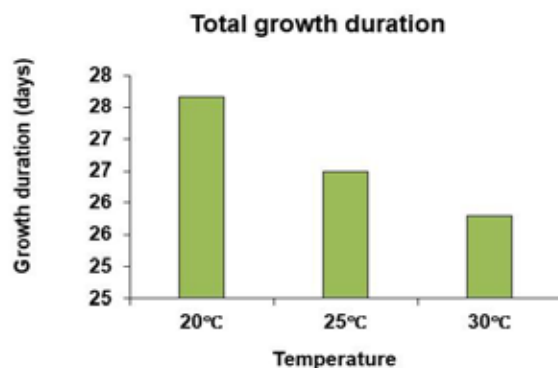


Fig. 11. Total growth duration of rice leafroller in different temperatures.

Stem borer species abundance and assessing yield losses in rice

In Aus, dark headed borer (DHB) was the dominant species followed by striped stem borer (SSB). In Aman, YSB was the dominant species followed by SSB and DHB (Fig. 12). In total 37 stem borer larvae

were found from 93 tiller dissection in Aus and 167 stem borer larvae were found from 506 tiller dissection in Aman season. The filled grain number was reduced in infested hill than uninfested hill. Thus 42% yield loss was occurred in stem borer treated plot (Fig. 13).

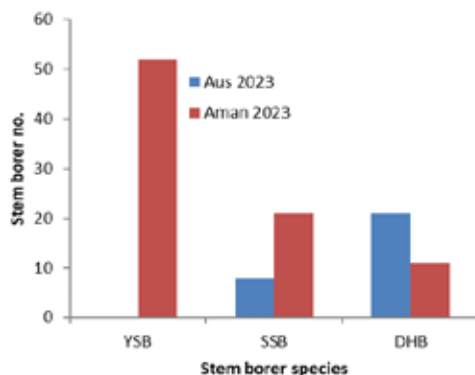


Fig. 12. Stem borer species abundances in Aus 2023 and T. Aman 2023 at BRRI HQ, Gazipur.

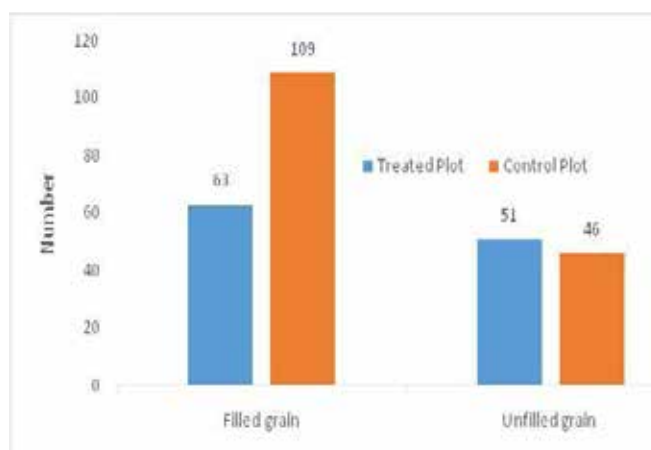


Fig. 13. Filled and unfilled grain number in stem borer infested rice hill at BRRI HQ, Gazipur.

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BIOLOGICAL CONTROL OF RICE INSECT PESTS

Conservation of natural enemies through eco-engineering

The experiment was conducted with BRRI dhan103 at BRRI HQ farm, Gazipur during T. Aman 2023 season. A large field (one acre) was divided into two blocks for two treatments. The treatments were T₁=Rice field with flowering plants (sesame and cosmos) on bunds (to provide food and shelter for different parasitoids). T₂=Farmers practice i.e. prophylactic insecticide use. Insecticide applied three times Vayego Superb 1.0 GR (tetraniliprole + fipronil) @ 10.0 kg/ha for one time and Virtako 40WG (chlorantraniliprole+thiamethoxam) @ 75g/ha for two times in T₂ at 15 days interval after Vayego superb 1.0 GR used. Vayego superb 1.0G was used with 1st top dressing of urea fertilizer followed by Virtako 40WG at 15 days interval. Twenty complete sweeps were taken from both the blocks three days after insecticide used in T₂. Insect pests and natural enemies' number of all sweeps from both blocks were counted and recorded separately. Egg parasitism of yellow stem borer (YSB) was determined through retrieval method and natural parasitism of rice leafroller (RLR) larvae was also determined. Insect pests' status remained below the economic threshold level (ETL) in both the

treatments. Highest number of SHG was found in T₁ (5.83/20 sweep) followed by green leafhopper (2.0/20 sweep) and whorl maggot (1.17/20 sweep) during T. Aman 2023 (Fig. 14). The range of other insect pests like, YSB, BPH, WBPH, RB and RLR was found (0.33 to 0.67/20 sweep) in T₁ (Fig. 14). Short horned grasshopper was also found highest (4.17/20 sweep) in T₂ followed by GLH (1.33/20 sweep) and WLH and WM both of 1.0/20 sweep in T₂. The range of other insect pests were (0.5 to 0.83/20 sweep) in T₂ at BRRI Gazipur (Fig. 14). Among the natural enemies highest numbers of natural enemies were found in T₁ where insecticide was not used. Number of lady bird beetle (LBB), spider (SPD), damsel fly (Dam. fly) and parasitic wasp (PW) were found highest 2.33, 2.17, 1.67 and 1.00 per 20 complete sweep respectively in T₁ compared to T₂ (0.0 to 1.0 /20 sweep) at BRRI farm, Gazipur (Fig. 15). Rice leafroller larval parasitism and YSB egg parasitism observed highest in T₁ (27.5 and 44.31 % respectively) compared to T₂ (2.26 and 6.87 % respectively). Though grain yield was observed similar both in T₁ and T₂ (5.88 and 5.9 t/ha respectively) but additional sesame was produced in T₁ which increase the rice equivalent yield (REY) to 6.13 t/ha. As a result, 3.75 % additional yield obtained in T₁ compared to T₂ (Fig. 16).

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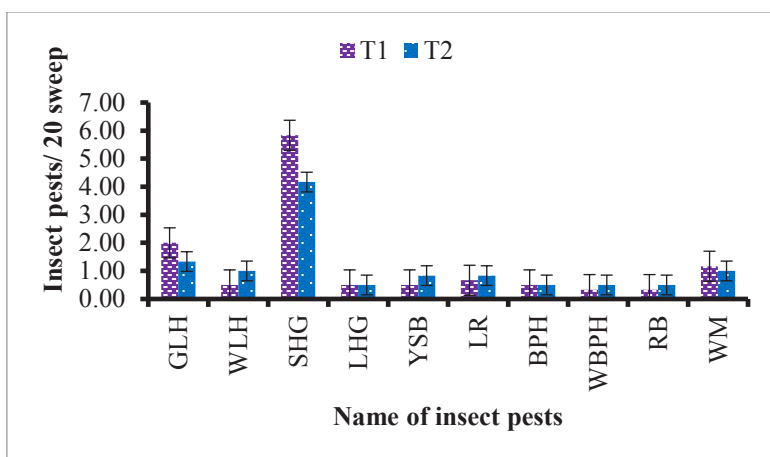


Fig. 14. Insect pests number per 20 sweep in different treatments during T. Aman 2023, BRRI, Gazipur (T₁=Rice field with flowering plant on bunds, T₂= Farmers Practice i.e., insecticide application).

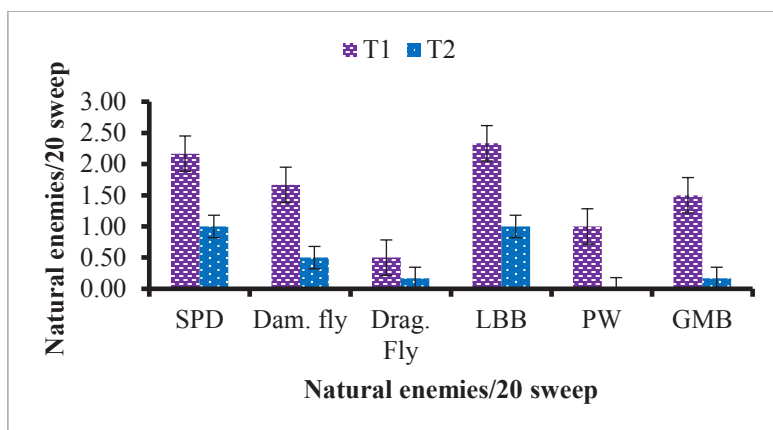


Fig. 15. Natural enemies number per 20 sweep during T. Aman 2023, BRRI, Gazipur. (T₁=Rice field with flowering plants on bunds, T₂= Farmers practice i.e., insecticide application).

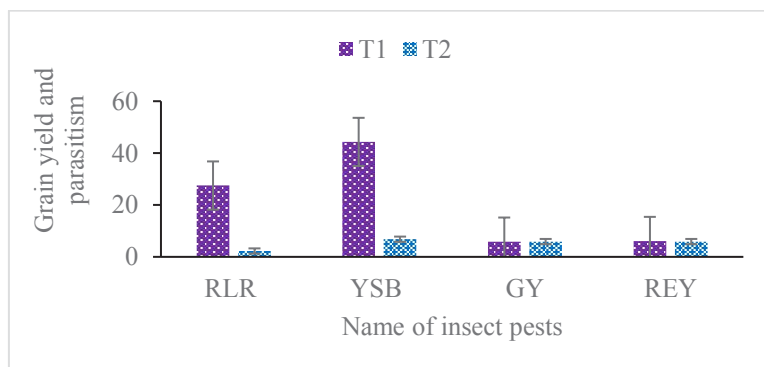


Fig. 16. Grain yield, REY and % parasitism of YSB egg and RLR larvae during T. Aman 2023, BRRI Gazipur. (T₁=Rice field with flowering plant on bunds, T₂= Farmers Practice i.e., insecticide application).

Study on the biology of green mirid bug, an egg predator of BPH

The mirid bug, *Cyrtorhinus lividipennis*, is a plant-feeding and predatory insect, preferring plant and leafhopper eggs and young nymphs. It is now one of the important predators of brown planthopper (BPH) *Nilaparvata lugens* and white backed planthopper (WBPH) *Sogatella furcifera*. Adult green mirid bugs was collected from light trap, vegetable flowers and BPH infested fields. Initially the population was reared in caged rice plants having BPH eggs-and adults. After having a good number of population, attempts was taken to determine the food habit of the insect. The test food materials was different vegetable flowers, nectar honey solutions, sugar solutions and eggs of moths specially the *Corcyra cephalonica*. Attempts were made to rear green mirid bug on different hosts eg., *Corcyra* egg and larva, flowers of bottle gourd and other flowering

plants but no success found. GMB didn't complete life cycle.

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EVALUATION OF CHEMICALS AND BOTANICALS AGAINST RICE INSECT PESTS

Test of different insecticides against major insect pests of rice

The effectiveness of commercial formulations of different insecticides against major insect pests of rice was evaluated in field and storage condition. A total of 188, 45 and 14 commercial formulations of insecticides were evaluated against brown planthopper (BPH), yellow stem borer (YSB) and rice weevil (RW) respectively. Among them 96, 13 and nine insecticides were found effective against BPH, YSB and RW respectively (Fig. 17).

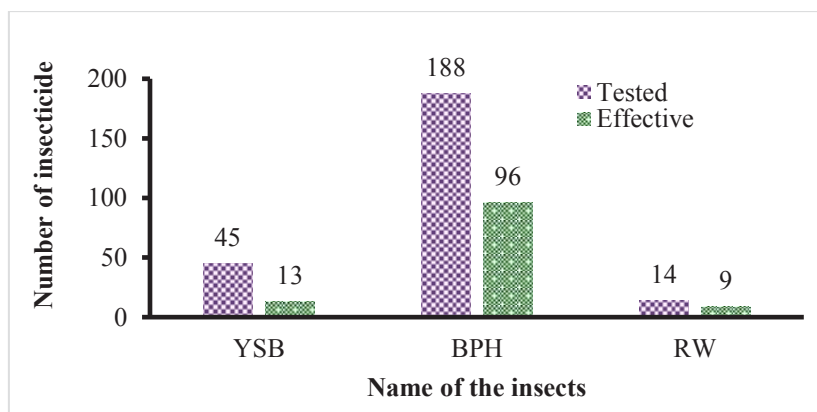


Fig. 17. No. of tested insecticides against major insect pests.

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Use of nanoparticle to control rice insect pests

The effectiveness of biosynthesized silica (SiO₂) nanoparticles against BPH was evaluated at four concentrations (1000, 750, 500, and 250 ppm). The nanoparticle solutions at different concentrations were sprayed on 15-day-old rice seedlings. Twenty 2nd to 3rd instar nymphs of BPH were introduced into each treatment and maintained at room temperature within separate Mylar film cages. Insect mortality was recorded at 24, 48, 72 and 96 hours post-spray. The percentage of insect mortality was

calculated using the corrected Abbott's formula. Silica (SiO₂) nanoparticles demonstrated significant efficacy against BPH nymphs, with 74% mortality observed at a concentration of 1000 ppm after 96 hours of application, followed by 73% mortality at 72 hours post-application (Fig. 18). Conversely, the control group showed the lowest mortality at 24 hours post-application. Mortality rates increased over time, with higher concentrations exhibiting the highest rates of mortality. Silica (SiO₂) nanoparticles demonstrated significant efficacy against rice weevil, with 67% mortality observed at a concentration of 1000 ppm after 120 hours of

application, followed by 59% mortality at 96 hours post-application (Fig. 19). Conversely, the control group showed the lowest mortality at 24 hours post-application. Mortality rates increased over time, with

higher concentrations exhibiting the highest rates of mortality.

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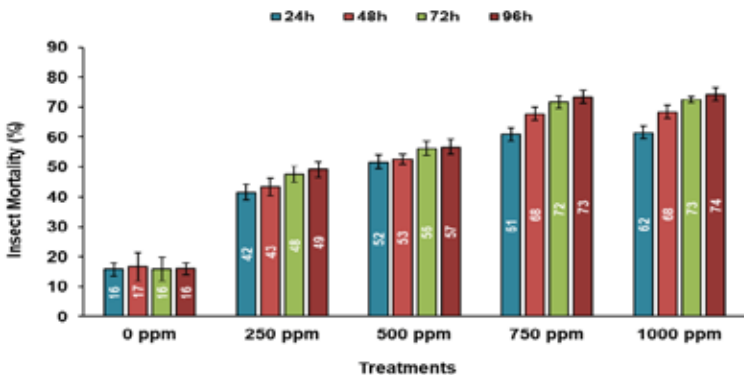


Fig. 18. Effect of SiO₂ nanoparticle on the mortality of brown planthopper (BPH).

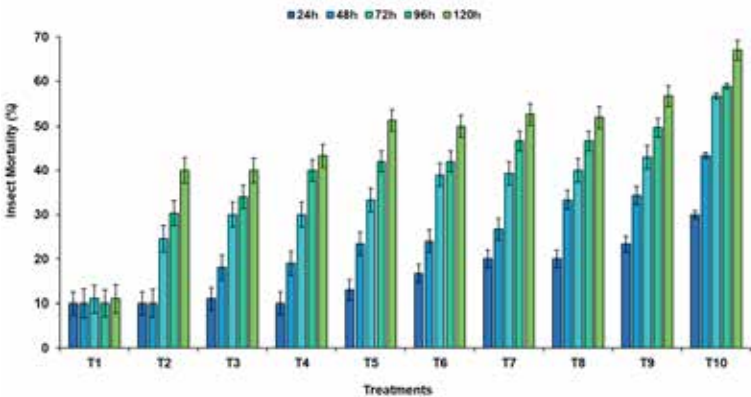


Fig. 19. Effect of SiO₂ nanoparticle on the mortality of rice weevil.

Pesticidal effect of different botanicals against rice weevil (*Sitophilus oryzae* L)

This experiment was conducted in Entomology Division BRRI following a CRD design with three replications. The treatments were included T₁=Neem oil, T₂=Mahogany seed kernel powder, T₃=Neem leaf powder, T₄=Biskatali plants powder and T₀=Control (untreated). Fresh leaves of neem and biskatali, along with mahogany fruits, were collected and prepared by washing, drying, and grinding into powder. Sterilized BRRI dhan87 rice was placed in containers, treated with the extracts, and then infested with 10 pairs of adult weevils per container. The containers were covered with netting to ensure

proper aeration, and the conditions were maintained at 65±5% relative humidity and 25±2°C temperature. Insects mortality data were taken at 24, 48, 72 and 96 HAT. Number of adult emergence, weight loss percentage and germination percentage data were also recorded. All data were subjected to statistical analysis separately by using the analysis of variance technique by R software (versions 2024.04.1). The results showed that the highest insect mortality was found in T₁ (85%), followed by T₄ (75%), T₃ (61.67%) and T₂ (60%) (Fig. 20). The highest mortality in T₁ resulted in the lowest emergence of F1 progeny compared to the other treatments, indicating its effectiveness in reducing

the reproductive capacity of rice weevils (Fig. 21). Additionally, T₁ exhibited the least weight loss of grain, followed by T₂, T₄, T₃, and T₀ (Table 1). Regarding seed germination, T₄ had the highest germination rate (94%), followed by T₃ (90%), T₂

(89.67%), T₁ (88%), and T₀ (80.67%). The findings indicated that the use of neem oil and biskatali plant powder can effectively control rice weevil in stored rice.

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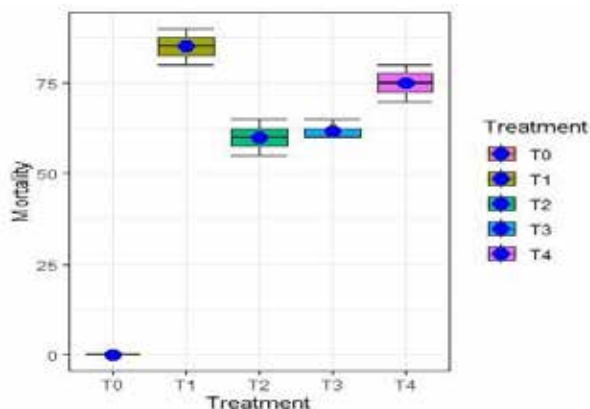


Fig. 20. Effect of SiO₂ nanoparticle on the mortality of rice weevil.

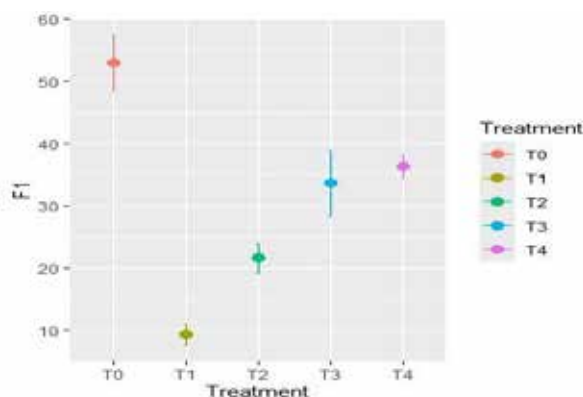


Fig. 21. Effects of botanicals on number of F₁ adult emergence of rice weevil.

Table 1. Effects of botanicals on weight loss of and germination grain against rice weevil

Treat.	% weight loss of grains	% seeds germination	% germination over control
T ₀	32.97 a	80.67 c	-
T ₁	11.03 d	88.00 b	9.08
T ₂	19.14 c	89.67 b	11.16
T ₃	21.81 b	90.00 b	11.56
T ₄	21.41 bc	94.00 a	16.52
LS	***	***	-
LSD	2.54	3.79	-
CV%	6.56	2.35	-

Effect of temperature on growth and development of *Sitophilus oryzae* L. on polished rice

This experiment was conducted in the laboratory of Entomology Division, BRRI from October to December 2023 by using a complete randomized design (CRD), with three replications. The experiment consisting of eight treatments i.e., T₁= -80°C, T₂= -20°C, T₃=4°C, T₄=20°C, T₅=25°C, T₆=35°C, T₇=40°C and T₈=50°C. Twenty grams of fresh rice was taken in Petri dishes. Ten pairs of rice weevils then introduced in each replication of each treatment. Then the petri dishes were kept at room temperature for seven days for mating and egg laying. After seven days, treatments were applied according to design. Weevil mortality was recorded after 24 hours and the adult weevils were removed and treated as designed treatments for 24 hours. All data were subjected to statistical analysis separately

by using the analysis of variance technique by R software (versions 2024.04.1).

Hundred percent mortality of rice weevil were found in T₁, T₂, T₃ and T₈ treatments. There was no mortality observed in T₅ treatments (Table 2). Rice weevils could not sustain at very high temperature as well as low temperature. Although there was 100% mortality observed in T₃ and T₈ treatments but F₁ adult's emergence found there. A indicates that, this temperature could be lethal for adult rice weevils but egg could survive. The highest number of F₁ adult were emerged in T₅ treatments which was statistically different from others followed by T₄. There were no single F₁ adult emerged in T₁ and T₂. The highest (%) of weight loss was observed in T₆ and the lowest was in T₁, T₂ and T₈.

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Table 2. Mortality, F₁ adult emergence of rice weevils and weight loss of grain in different treatments

Treatment	Mortality (%)	F ₁ adult emergence	Weight loss (%)
T ₁ (-80°C)	100 a	0.00 e	2.71 e
T ₂ (-20°C)	100 a	0.00 e	3.79 e
T ₃ (4°C)	100 a	3.33 de	16.81 d
T ₄ (20°C)	5.00 c	24.67 b	29.20 b
T ₅ (25°C)	0.00 d	44.33 a	32.83 a
T ₆ (35°C)	6.67 c	9.00 c	30.79 ab
T ₇ (40°C)	86.67 b	5.00 cd	19.07 c
T ₈ (50°C)	100 a	1.33 de	3.42 e
LS	***	***	***
LSD	4.99	4.34	2.23
CV	4.63	22.89	7.44

Effect of different insecticides on susceptibility of green leafhopper (GLH)

More than 18 generations mass rearing GLH population were used for the experiment in laboratory of Entomology Division, BRRI. International resistance action committee (IRAC) susceptible test method 005 was followed (IRAC, 2022) in lab condition with 25°C temperature and 70% humidity. Treatments: T₁= Mipcin 75 WP, T₂ = Durshban 20 EC, T₃ = Confidor 70WG, T₄= Suntap 50 SP, T₅= Award 40 SC, T₆= Nitro 505 EC. Design was CRD with three replication. Six concentrations of each six-group insecticide solution were used in

this experiments. Mortality data were recorded to Carbamate and Organophosphate group after 24 and 48 hours of treatment, Neonicotinoids and Neristoxin analogue group after 72 hours of treatment and Orghanophospate and Pyrethroid combinations after 24, 48, and 72 hours after treatment (IRAC, 2022). In Mipcin 75WP, highest mortality (100%) was found at double of the recommended dose @ 3450 ppm, followed by 1725 ppm, 864 ppm, 432 ppm, 216 ppm and control. More than 80% or above mortality was found with recommended dose 1,725 ppm at 24 hours after spray (HAS). Mortality above 80% was also found

@ 864 ppm and 432 ppm and 216 ppm. The percent mortality increases with higher concentration and over time up to 72 HAS (Fig. 22). In Dursban 20 EC, none of the concentrations, including recommended dose 400 ppm even 8-fold of the recommended dose 3200 ppm failed to show mortality 80% or above at 24 hours after spray (HAS). The highest mortality of greenhouse GLH was found 86.66% @ 3200 ppm at 72 HAS (Fig. 23). The recommended dose showed 53, 62, and 64% mortality at 24, 48, and 72 hours after treatment respectively. This indicated that the insecticide Dursban 20EC did not work well in the field to control the GLH. GLH might be resistant to Dursban 20EC. The insecticide Confidor 70 WG showed GLH mortality more than 80% at recommended dose 49 ppm and 98 ppm after 24 HAT ((Fig. 24). Recommended dose of Nereistoxin analogue group insecticide Suntap 50SP showed more than 80% mortality at 48 HAT at the same time (Fig. 25). Award 40SC recommended dose showed more than eighty percent mortality at 72 hours after

treatment (Fig. 26). Nitro 505EC is a combination formulation consists of Organophosphate and Synthetic Pyrethroids group insecticides. Synthetic Pyrethroids group insecticides are not recommended to use in rice field. But it is widely used to control rice insect pests. In these circumstances, we have included in the experiments for bioassay test. The recommended dose of Nitro 505EC is 500 ppm for field crops except rice. It was found that more than 80% mortality occurred @ 8.0 ppm at 24 hours after treatment (Fig. 25). But it is widely used in the rice field @500 ppm (extreme dose). As a result it kills all living organisms both in the terrestrial and aquatic rice ecosystems. A disrupts the faunal biodiversity in the ecosystem as well as it creates negative impact on environment. It is urgently needed to ban such type of insecticide use in the rice field.

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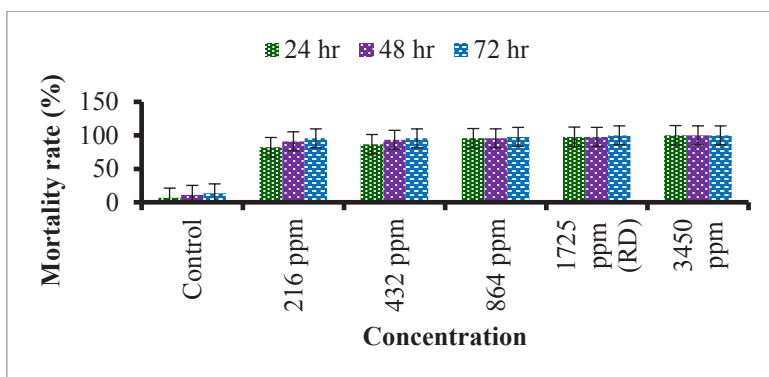


Fig. 22. Mortality of GLH after the application of Mipcin 75WP in different doses.

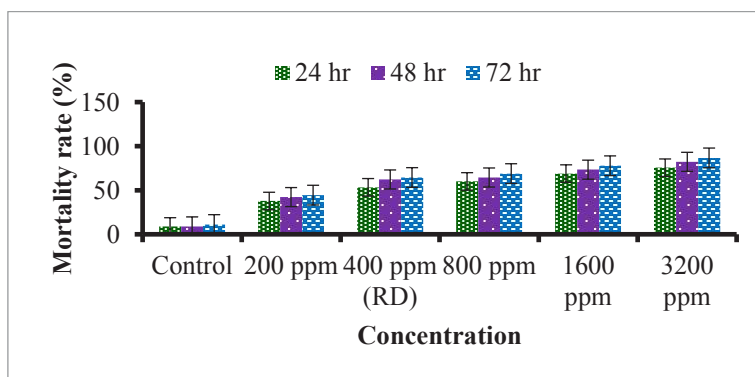


Fig. 23. Mortality of GLH after the application of Dursban 20EC in different doses.

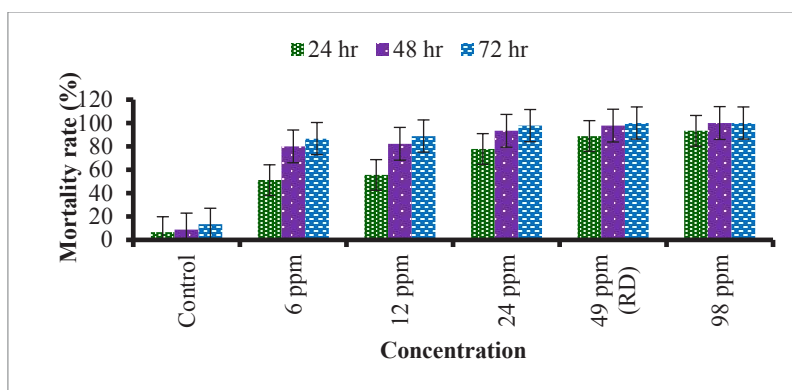


Fig. 24. Mortality of GLH after the application of Confidor 70WG in different doses.

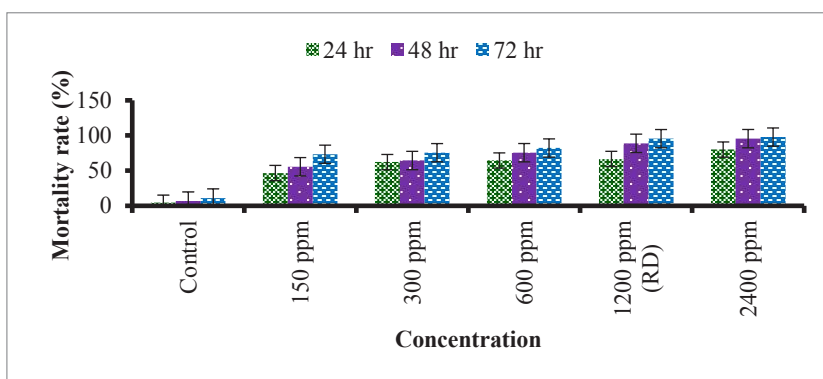


Fig. 25. Mortality of GLH after the application of Suntap 50SP in different doses.

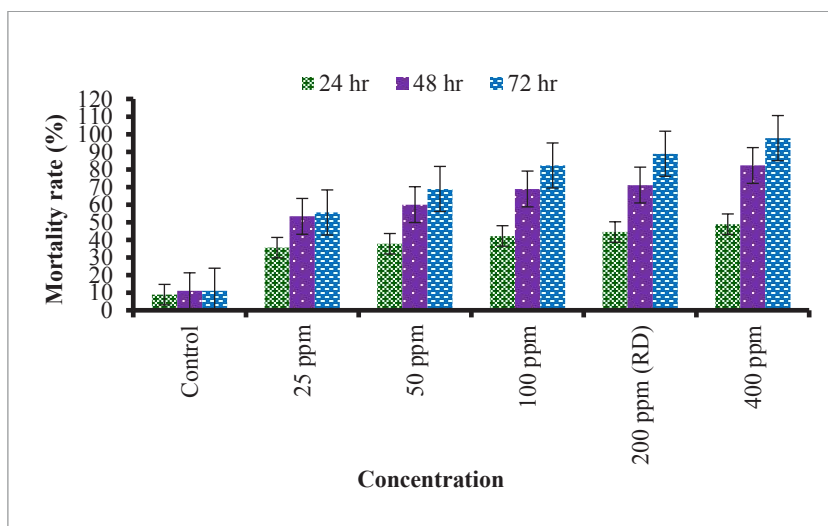


Fig. 26. Mortality of GLH after the application of Award 40SC in different doses.

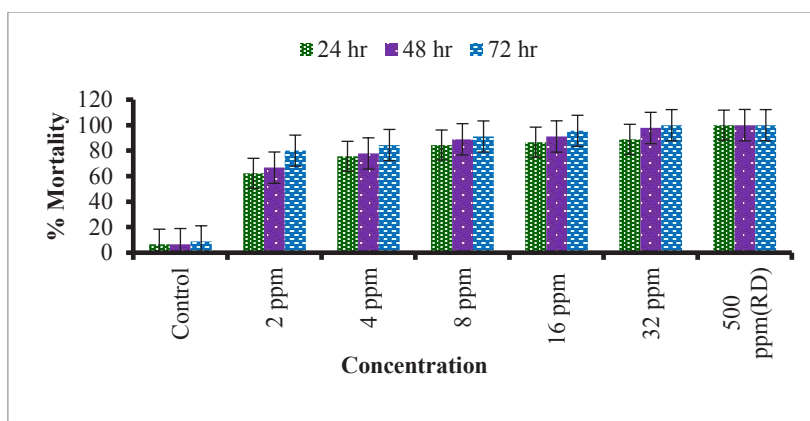


Fig. 27. Mortality of GLH after the application of Nitro 505EC in different doses.

Effect of different doses of Mipcin 75WP on resurgence development to Green Leafhopper (GLH)

A laboratory experiment was carried out at the Entomology Division, BRRI, to determine the insecticide doses that cause resurgence of the GLH. Rice seedlings with four tillers were grown in pots. The GLH population was developed in a net house mass rearing box. Subsequently 25 third instar nymphs were released per treatment. After 48 hours, Mipcin 75WP was applied at the following doses: T₁ = low (3450 ppm), T₂ = recommended (1725 ppm), T₃ = low (864 ppm), and T₄ = Control (water). The experiment was laid out on CRD with four replications. The number of dead and alive GLH was recorded 48 hours after treatment (HAT). The first-generation GLH population was also recorded 30 days after the initial data collection. The resurgence ratio was calculated as the population one month after the first generation divided by the control population. Two days after the application of Mipcin 75 WP insecticide, the survival rates of the green leafhopper (GLH) in treatments T₁, T₂, T₃, and T₄ were found to be 0, 1.25, 1.50, and 19.75 respectively. Statistically significant differences were observed among the four treatments 48 hours after insecticide application and one month after the first generation at the 5% level of significance. One month after the insecticide application, first-generation GLH (1st or 2nd instar) emerged from the surviving population. The number of first-generation nymphs was recorded as 0.00, 2.75, 44.25, and 129.5

in treatments T₁, T₂, T₃, and T₄, respectively. The highest resurgence ratio of 0.34 was found in the low dose treatment (T₃), followed by the recommended dose (T₂) with 0.02, and the high dose (T₁) with 0.00. The highest mortality (100%) was observed in treatment T₁, followed by 95% in T₂, 94% in T₃, and the lowest mortality (21%) in T₄, 48 hours after insecticide application.

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Effect of insecticides on natural enemies of rice insect pests

Eight commercially registered insecticides for rice of different chemical group were evaluated at BRRI, Gazipur in T. Aman 2023 and Boro 2023-24 with popular BRRI variety. The generic name of eight insecticides were *Celastrus angulatus*, tetraniliprole+ fipronil (vayego), abamectin, cyantraniliprole+lufenuron (Minectoextra 40SC), clothianidin, isocycloserum, cartap and Fipronil. These insecticides were sprayed in rice at vegetative stage with three replicated trial and control plot remain free of insecticides. Recommended dose was used for each insecticide. Insects and natural enemy population were collected after 48 hours after spraying (HAS) by 20 complete sweeps.

The data of natural enemy populations were counted and recorded. Different natural enemies were found lower in all the insecticide treated plots than the

control plot at 48 after spraying. Spider, damsel fly, dragon fly, green mirid bug, carabid beetle, chironomids, parasitoids and dipteran flies were the major natural enemies (NE) found in the counted sweep sample. Total number of NE and other non-pest, comparable with control were found highest in fipronil, cartap, tetraniliprole+ fipronil, Abamectin

and *Celastrus angulatus* (Fig. 28). So, these insecticides may be considered as comparatively safer for NE.

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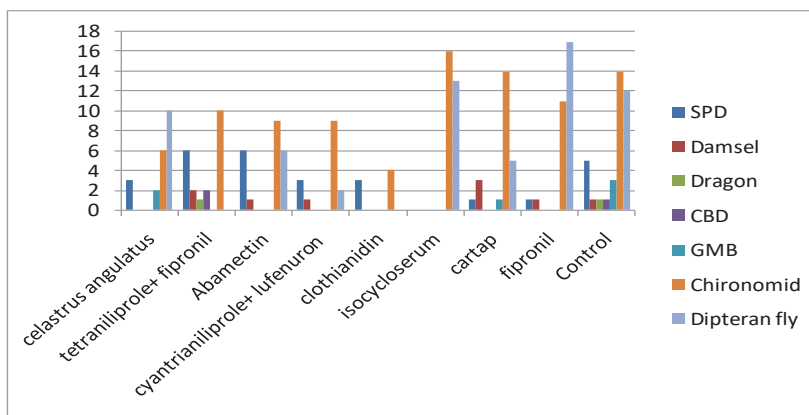


Fig. 28. Total natural enemies and non-pest rice insects per 20 sweeps from different insecticides treated plots.

INSECTICIDE TOXICOLOGY

Residue analysis of different insecticide in rice by LCMS

The field study was carried out at BRRI HQ, Gazipur during Boro 2023-24 season in three adjacent field plots with complete randomized block design (CRD), each with an area of $5 \times 4 = 20 \text{ m}^2$ for a particular insecticide. Most popular selected insecticide was applied at doses. Four treatments were used i.e., T_1 =chlorantraniliprole (3 times) with standard dose, T_2 = chlorantraniliprole (3 times) double of standard dose, T_3 =imidacloprid (3 times) with standard dose, and T_4 = imidacloprid (3 times) @ double dose and T_5 = Control. After harvest, a homogenous sample 1.0 kg was separated for each treatment. The collected samples were then stored in a freezer at -20°C during 30 day period until extraction for pesticide residues analysis. The concentrations of chlorantraniliprole (CTP), and imidacloprid (IMIDA) were analyzed separately by the developed method of LCMS. The insecticide residues in different treatments were below the detection level so, that was not detected (n.d.) by the

LCMS except CTP in T_2 and IMIDA in T_4 where insecticide was used double of the recommended doses. The detection concentration of chlorantraniliprole was found 0.018 mg kg^{-1} only in T_2 and imidacloprid was 0.029 mg kg^{-1} in T_4 , which were below the Maximum Residue Limit (MRL: 0.4 mg kg^{-1} for chlorantraniliprole and 0.6 mg kg^{-1} for thiamethoxam, EU).

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Multiple residue analysis of different insecticide in rice ecosystem

The field study was carried out at BRRI HQ, Gazipur during Boro 2023-24 as describe in experiment 6.1. Most popular selected insecticide was applied at the recommended doses or with different combination in different growth stages of the rice plant. Three treatments were used in the experiments i.e., T_1 = chlorantraniliprole (2 times), T_2 = T_1 + imidacloprid (1 times) and T_3 = T_1 + T_2 +thiamethoxam (1 times). Three plots were remained untreated (not sprayed) as a control (T_4). After harvest, a homogenous

sample 1.0 kg was separated for each treatment. The collected samples were then stored in a freezer at -20°C during 30 day period until extraction for pesticide residues analysis. Insecticide residues were detected using a LC-MS2020 fitted with electrospray ionization (ESI) probe operated in the positive ion mode. The concentrations of chlorantraniliprole (CTP), imidacloprid (IMIDA) and thiamethoxam (THM) were analyzed separately by the developed method of LCMS. The concentration of the insecticide residues in different treatments were below the detection level. So, that was not detected (n.d.) by the LCMS except T₃. The concentration of the insecticide residues was below the detection level so, that was not detected (n.d.) by the LCMS. The concentration of thiamethoxam were found 0.022 mg kg⁻¹ only in T₃, which were below the Maximum Residue Limit (MRL: 0.6 mg kg⁻¹ for thiamethoxam, EU).

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Development and validation of analytical methods for multiple pesticide residue determination in rice grain using LC-MS/MS

Method development for multiple pesticide residue determination in rice grain was carried out by using Liquid Chromatography with Tandem Mass Spectrometry (LCMS/MS8050, SHIMADZU) fitted with electrospray ionization (ESI) probe operated in the positive ion mode. The methods were developed for the determination of carbofuran, chlorantraniliprole, chlorpyrifos, isoprocarb, thiamethoxam, malathion, diazinon, dinotefuran, imidacloprid, pymetrozine, nitenpyram, carbaryl, carbosulfan, cypermethrin and fipronil. The pesticide residue database of the LCMS/MS system was used for the data analysis. QuEChERS Method for Pesticide Residue Analysis (Method AOAC 2007.01) was applied for sample preparation. A total of 15 insecticides determination methods namely carbofuran (m/z 222.2500>123.1000 and RT 1.81 mins), chlorantraniliprole (m/z 482.0000>283.9500 and RT 1.41 mins), chlorpyrifos (m/z 350.0000>97.1000 and RT 2.73 mins), isoprocarb (m/z 194.1000>95.0000 and RT 1.51 mins) and thiamethoxam (m/z 292.0000>211.1000 and RT

1.96 mins), malathion (m/z 331.0000>97.0000 and RT 5.44 mins), diazinon (m/z 305.1000>169.1000 and RT 2.08 mins), dinotefuran (m/z 203.1000>114.2000, RT 9.62 mins), imidacloprid (m/z 256.15000>175.2000 and RT 1.36 mins), pymetrozine (m/z 218.1000>105.000 and RT 1.16 mins), nitenpyram (m/z 270.8000>225.0000), carbaryl (m/z 202.2000>127.1000 RT 3.50 mins), carbosulfan (m/z 381.2000>118.1000), cypermethrin (m/z 433.1000>191.1000), and fipronil (m/z 435.0000>330.000 and RT 4.21 mins) were standardized by Shimadzu LCMSMS 8050. The ranged of LoD were 0.04 to 7.45 ppb and LoQ were 0.13 to 22.58 ppb. In the method file, ESI interface, Desolvation temperature, DL temperature, nebulizing gas flow, heating gas flow, and drying gas flow were set at 300°C, 526°C, 250°C, 2.00 L/min, 10.00 L/min and 10.00 L/min respectively. Detection was carried out in multiple reactions monitoring (MRM).

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Determination of insecticide residues in rice grain samples collected from different locations of Bangladesh

Forty rice sample were collected randomly from Dinajpur, Rangpur, Chattogram, Khulna and Cox's bazar. A homogenous sample 0.5 kg amount of 8 to 12 different rice varieties from each of the locations were collected. The collected samples were then stored in a freezer at -20°C during 30-day period until extraction for pesticide residues analysis. Different popular rice samples i.e., Shampa Katari, Siddho Katari, Dhekichata Shampa Katari, Nizershail, Chinigura, Summon Swarna, Ranjit Swarna, Anowarapajam, Radhuniijira, Rajbhog, Amin Minikit, Jirashail, JahuraMinikit, Kumragore, Ranisalute and Gobindobhogwere collected from local popular market of Dinajpur, Rangpur and Khulna region. Among the collected 40 samples, 16 were analyzed to determine 10 different insecticides i.e., chlorantraniliprole (ctp), imidacloprid (imida), thiamethoxam (thm), carbofuran (carbo), diazinon (diazi), dinotefuran (dinote), fipronil (fipro), iso procarb (isop), malathion (mala) and carbaryl (cabryl). The

concentrations of different insecticides were determined by the developed multi-residue analysis methods. Insecticides residues were not found in all the samples (not detected) except Chinigura. Among the tested 10 different insecticides three insecticide residues were determined in Chinigura rice. The concentrations of chlorantraniliprole (ctp), imidacloprid (imida) and isoprocarb (isop) were found in the chinigura rice samples 0.012, 0.021 and 0.19 mg kg⁻¹ respectively. The maximum residue limit of the insecticides is 0.4, 0.5 and 0.3 mg kg⁻¹ respectively. The retention time of the tested insecticides were 1.67 to 33.22 minutes. The highest (33.22 minutes) and lowest (1.67 minutes) retention time were observed in diazinon and dinotefuran respectively.

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HOST PLANT RESISTANCE

Screening of rice germplasms against major rice insect pests

Seeds of one hundred germplasms was collected from GRS Division, BRRRI and tested against BPH. Each test line was seeded in 20-cm-long rows in a seed box (60 × 45 × 10 cm). Rows were 5 cm apart. A row of the susceptible check variety (BR3) and a resistant check variety (T27A) was planted randomly in the seed boxes. Among the one hundred germplasm, three germplasm showed moderately susceptible reaction (score 5) against BPH in T. Aman 2023 season. The three germplasm are Munsur, Dighi baual and Kalosaitta.

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Screening of rice advanced lines against major rice insect pests

Twenty RYT advanced breeding lines of rainfed lowland rice (RLR) were screened in T. Aman 2023. Most of the entries showed susceptible reaction (score 7 and 9). Eight advanced breeding lines of drought tolerant rice (DTR) were screened in T. Aman 2023. One drought tolerant rice (DTR) IR127009-B-8-2-1-2 showed moderately susceptible reaction (score 5) against BPH. Eight advanced breeding lines of zinc enriched rice (ZER)

were screened in T. Aman 2023. Most of the entries showed susceptible reaction (score 7 and 9). Four ALART Antioxidant enriched rice materials were screened in T. Aman 2023. One ALART antioxidant enriched rice BR12836-4R-312 showed moderately susceptible reaction (score 5) against BPH in T. Aman 2023 season. Three ALART (SD) favourable Boro rice (FBR), two ALART (LD) FBR, six ALART (LB) FBR, four ALART cold tolerant rice (CTR), three PVT (Fertilizer Management) FBR breeding lines were screened in Boro 2023-24 season. Most of the entries showed susceptible reaction (score 7 and 9). One hundred eighty-eight FBR cold tolerant rice (CTR) were screened against BPH in Boro 2023-24 season. Among the FBR cold tolerant rice, one entry IR17A2922 showed moderately resistant reaction (score 3) and four entries BR12676-4R-392, BR13138-5R-141, IR17A2917 and IR12A173 showed moderately susceptible reaction (score 5) against BPH. Twelve ALART Boro, 15 disease resistant rice, nine RYT-1 of premium quality rice (PQR), eight RYT-2 PQR, 13 RYT-3 PQR, nine RYT zinc enriched rice (ZER) were screened in Boro 2023-24 season. Most of the entries showed susceptible reaction (score 7 and 9) against BPH. Seventy-six FBR (BPH 17 and BPH 32) materials were screened against BPH in Boro 2023-24 season. Among FBR (BPH 17 and BPH 32) BPH gene rice, two entries BR13418-5R-81 and BR13418-5R-93 showed moderately resistant reaction (score 3) and 13 entries BR13418-5R-3, BR13418-5R-6, BR13418-5R-8, BR13418-5R-26, BR13418-5R-37, BR13418-5R-40, BR13418-5R-47, BR13418-5R-51, BR13418-5R-53, BR13418-5R-76, BR13418-5R-78, BR13418-5R-82 and BR13418-5R-100 showed moderately susceptible reaction (score 5) against BPH. Sixty-two FBR lodging tolerance rice were screened against BPH in Boro 2023-24 season. Among FBR lodging tolerance trial, one entry IR17A2922 showed moderately resistant reaction (score 3) and three entries BR12676-4R-392, BR7528-2R-19-16-RIL-59 and IR12A173 showed moderately susceptible reaction (score 5) against BPH. Twenty RYT_CS1 on cold tolerant rice were screened against BPH in Boro 2023-24 season. Among RYT_CS1 cold tolerant rice one entry IR17A2922 showed

moderately resistant reaction (score 3). Twenty-one RYT_CS2 on cold tolerant rice were screened against BPH in Boro 2023-24 season. Among RYT_CS2 cold tolerant rice, one entry IR17A2922 showed moderately resistant reaction (score 3). Three hundred fifty-two OYT insect resistant rice (IRR) were screened against BPH in Boro 2023-24 season. Among OYT insect resistant rice, one entry BR13482-4R-202 showed moderately resistant reaction (score 3) and ten entries BR13466-4R-10, BR13466-4R-42, BR13467-4R-208, BR13471-4R-88, BR13472-4R-1, BR13472-4R-6, BR13472-4R-124, BR13480-4R-29, BR13482-4R-54 and BR13482-4R-115 showed moderately susceptible reaction (score 5) against BPH. Eighty-four PYT insect resistant rice (IRR) were screened against BPH in Boro 2023-24 season. Among PYT insect resistant rice, two entries BR12678-4 R-187 and BR12685-4 R-251 showed moderately susceptible reaction (score 5) against BPH. Forty-five AYT insect resistant rice (IRR) were evaluated against brown plant hopper (BPH) in Boro 2023-24 season. Most of the entries showed susceptible reaction (score 7 and 9) against BPH.

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INTEGRATED PEST MANAGEMENT

Scale up trials on develop IPM package for rice during Boro 2023-24 season in different locations of Bangladesh

Seven experiments were conducted in seven different locations i.e., i) BRRI HQ farm, Gazipur ii) Farmers field at Kaliganj, Gazipur iii. Farmers field at Kaliganj, Jhenaidha iv). Farmers field at Jhikargacha, Jashore v) Farmers field at Tala, Satkhira vi) Farmers field at Batiaghata, Khulna and vii) Farmers field at Patuakhali Sadar during Boro 2023-24 season to validate IPM packages for pest management in farmers field with conserving natural enemies in rice eco system. Each of the fields was divided in to two blocks for two treatments. The treatments were T₁= Integrated pest management (IPM) practice and T₂ = Farmers' practice i.e. prophylactic insecticide use. In T₁, flowering plants (Marigold, cosmos and sunflower) were grown on

bunds surroundings of the rice crop (to serve as nectar and pollen sources and shelter for different parasitoids and predators). Irrespective of location and rice variety the insect pests were remained below the economic threshold level (ETL) both in IPM practiced (T₁) and farmers practiced field (T₂) during Boro 2023-24 season. Among the insect pests short horned grasshopper (SHG) and green leafhopper (GLH) were found in all the locations except GLH in T₁ at Khulna. No significant differences were observed in case of SHG, YSB and BPH between IPM practiced plot (T₁) and farmers practiced plots (T₂) i.e., insecticide application plots. Another two major pests, white backed planthopper (WBPH) and rice leafroller (RLR) were found significantly higher in T₂, where insecticide was applied three times. Four common natural enemies i.e., spider (SPD), damselfly (Dam. fly), lady bird beetle (LBB) and parasitic wasp (PW) were found in all locations. Among the natural enemies spider (SPD) population was found highest in all the locations. The range of grain yield were 6.19 to 12.72 t/ha in T₁ and 5.97 to 12.77 t/ha in T₂ (Table 5). Neither insecticide nor herbicide or fungicide was used in T₁ in all locations. But herbicide one time, insecticide thrice and fungicides were used twice in T₂ (Farmers' practice) which indicate that pesticides were applied six times in farmer' practiced field (T₂) in a season. But no significant difference of yield was observed in T₁ and T₂ in three locations. In the other three locations highest yield was obtained in T₁ and significantly the highest yield was obtained only one location in T₂ at Tala, Satkhira. Moreover, on average 0.16 t/ha i.e., 1.99% yield reduction was found in T₂. Irrespective of location and variety on average 8.04 t/ha yield was obtained in IPM practiced field (T₁) and 7.88 t/ha in farmers practiced field (T₂) and the average BCR 1.39 and 1.32 were observed in T₁ and T₂ respectively.

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VERTEBRATE PEST MANAGEMENT

Use of owl Watch Tower to manage rice rats

The study on rat damage around the watch tower was conducted at BRRI HQ, Gazipur experimental field. Ten owl Watch Tower were installed in the field.

Watch Towers having 3.5m long pole prepared by bamboo or iron with cross (X) shaped top for seating owl on it and perching and searching rat in crop field. Rat damaged by rat was assessed around the watch tower areas. Rat damage assessment around the owl Watch Tower was done by two ways. One- number of active burrow count methods and another- crop damage assessment method. Active burrow count and crop damage was done three 0-25, 26-50 and 51-

75 meters apart around the owl Watch Tower. Newly developed burrows became inactive (dead) surrounding the 50 m dia of Watch Tower. The collected and observed pellets of Owl from watch tower confirmed the rat predation.

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Plant Pathology Division

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SUMMARY

National Seed Board (NSB) of Bangladesh has released one promising genotype BR12454(Path)-BC2-69-97-39-5-44 (17 June, 2025), as blast resistant variety having growth duration of 149 days with yield potential of 7.8 t/ha and might be up to 10.0 t/ha if get better management for cultivating in Boro season throughout the country. Two comprehensive disease survey (T. Aman2024, & Boro 2024-25) were conducted at different eco-systems of Bangladesh revealed that rice diseases are both location and as well as variety specific. Specific regions like Sirajgonj and Cumilla are found as hotspots for bacterial leaf blight (BB) and tungro. From the survey report it was demonstrated that. BRRI dhan28 and BRRI dhan29 were highly susceptible to multiple diseases. Thus, suggests that disease prevalence is driven by both environmental conditions and varietal susceptibility. To better understand the diversity and population structure of key rice pathogens, a total of 28 purified isolates of *Rhizoctonia solani* (causal agent of rice sheath blight) and 42 *Ustilaginoidea virens* (causal agent of false smut) and 22 *Fusarium fujikuroi* (causal agent of bakanae) were isolated from infected samples collected from across the country and preserved. In a study under disease resistance trail, 660 local rice germplasms were screened against sheath blight and 42 of them showed a moderately resistant reaction. However, in a separate study conducted on 65 advanced breeding lines found none was resistant or moderately resistant to sheath blight disease. In another study, a total of 92 BRRI varieties were evaluated, including 15 T. Aman and 3 Boro varieties showed only three were moderately susceptible reaction, while the rest were susceptible to sheath blight disease. Screening for blast resistance was conducted on multiple fronts. Among seven tested advance lines in different growth stages i.e., short, medium and long duration two short duration lines showed low levels of leaf blast symptoms, and two long-duration lines showed high yields with no disease incidence. Out of 464 multi-trait lines screened, 71 showed resistance and 73 were moderately resistant to leaf blast in nursery with artificially inoculation whereas, under natural conditions in a farmer's field, 271 lines were found

as resistant to panicle/neck blast. A total of 380 high-yielding elite lines with major blast resistance genes (*Pita2*, *Pi9*, *Pb1*) were evaluated in blast nursery and at four hotspot locations (Hankata, Cumilla, Jashore, and Rangpur). Many lines were resistant to both leaf and neck blast, with the highest disease severity in Hankata and the lowest was in Rangpur. Overall, 274 lines were resistant to leaf blast whereas 280 showed resistance to neck blast. In a separate study, 22 hybrid rice varieties were tested and eight of them showed resistance to leaf blast. Among the 288 advanced lines 72 showed resistant reaction and 29 showed moderately resistant reaction to leaf blast. In addition to this, 06 germplasms showed moderately resistant reaction (MR) against BB, and this resistance will be further confirmed through both genotyping and phenotyping. Eighty-one germplasms were screened against tungro disease and one of them showed resistant reaction and 17 showed moderate resistant reaction. A molecular study was initiated to develop sheath blight resistance using CRISPR-Cas9 genome editing. The goal was to knock out the *OsSWEET11* gene, and a designed gRNA has already been successfully ligated into a vector, marking an important step in this research. Ligation of vector construct was confirmed through PCR band as well as commercial sequencing. For Identification of blast resistant QTLs in BRRI dhan33 and BR16 a cross between BRRI dhan33 or BR16 and universal susceptible line US2 were done to produce F1. Then three and two back crosses respectively for BRRI dhan33 and BR16 were done by US2 and developed recombinant inbred lines (RIL) by single seed descent at BRRI. This population was established for genetic mapping of blast resistance. Three hundred seventy-one population for BRRI dhan33 and 353 population for BR16 were evaluated against blast isolates. DNA from all the samples were sent to IRRI for genotyping all the samples for 1k-RiCA version 4. The genotyping data is now under analysis.

An investigation under disease epidemiology showed that yield parameters such as grain number, panicle weight, and panicle length declined significantly with increasing sheath blight disease severity during T. Aman 2024. Healthy plants yielded best, while highly susceptible ones had the

lowest yields and the highest percentage of unfilled grains. This information highlights the substantial negative impact of sheath blight on rice productivity. A survey in the Tungro-endemic Nangolkot Upzilla of Cumilla demonstrated a significant disease incidence (90-100%) and severity (8-9) in most varieties, leading to a drastic yield loss of 92-98%. However, the BRRI dhan46 variety showed notable resistance, with only 10% disease incidence and a severity score of 3. It was found that the economic threshold for managing blast disease depends on the plant's growth stage, and timely fungicide application can significantly reduce disease incidence and increase yield. An experiment on different rice varieties and planting times showed very low-neck blast incidence, revealed that high temperatures and low humidity were unfavorable for blast disease development. Nutrient solutions did not show any significant effect on the incidence of rice sheath blight or grain yield.

Two bacterial biopesticides were found effective in managing sheath blight under disease management by keeping the relative lesion height below risk levels, which led to higher filled grain weight compared to the control. While, in another study, another bacterial biopesticide also showed promising results in managing leaf folder pest, with efficacy on larval death in comparable to the tested chemical insecticide. Experiments using Tricho-compost demonstrated its potentiality as a source of potash fertilizer and disease management that contributed on increase rice yield. Another experiment using Tricho-compost made from corn stalks confirmed as an alternative component of Trichocompost preparation where water hyacinth is not available and found its potentiality by increasing yield and disease management. In a field trial for managing bakanae disease at later growth stage on BRRI dhan104, a bacterial biopesticide resulted in the highest yield (3.35 t/ha) and the most filled grains/ panicle, outperforming traditional fungicides and potash fertilizer. In an evaluation of commercially available nanoparticles against bacterial blight, zinc (Zn) nanoparticles were found the most effective to inhibit bacterial growth. Copper (Cu) nanoparticles were found as the most effective to inhibit of *Magnaporthe oryzae* at concentrations

of 200 ppm and above. A study is currently underway to determine the residual effects of fungicides like Pyraclostrobin and Tebuconazole on BR11 rice grain and stems to ensure safer disease management practices. An evaluation of 25 new fungicides against rice sheath were executed and none of them were recommended based on artificial inoculation process. An investigation on the effect of the fungicide Amistar Top on microbial communities in rice rhizosphere soil found that bacterial colonies decreased immediately after application but reached to base line level within 28 days.

A study on seed health status found that BRRI hybrid varieties had a higher incidence of seed-borne pathogens (11 different types) compared to imported company hybrids (6 types), which were likely pre-treated with chemicals. An "Ankuri" device was successfully used to standardize the protocol for developing rice sheath blight disease development in controlled environment and demonstrated its potentiality for sheath blight disease screening. A total of 10.16 tons seeds of blast resistant BRRI dhan114 were produced in Rangpur, Satkhira, and Sunamgonj for distribution to farmers in the upcoming Boro season. Four advanced lines adaptation trials (ALART) were conducted, and two blast-resistant lines, BR(path)13802-BC3-73-13 and BR(path)13802-BC3-73-14, were selected for further advancement due to their higher yields and lower susceptibility. A total of 480 farmers in 16 batches participated in one day-long training sessions on integrated rice disease management to enhance their skills and awareness against disease identification and management. Ten field trials were conducted in different districts to demonstrate the effectiveness of BRRI's technology for neck blast management. The results showed that this technology was significantly more effective than traditional farmer practices and saved 9.5% - 86.4% of yield losses. A participatory field demonstration in Jamalpur highlighted that an integrated disease management approach could lead to good yields, but also emphasized that sheath blight remains a significant threat, requiring a continued focus on developing resistant varieties. An investigation on integrated sheath blight management at the farmer's

field level in Cumilla found that a strategy combining the removal of floating debris with MoP and fungicide applications was the most effective treatment, leading to the lowest disease incidence and higher yield.

TRANSFERABLE TECHNOLOGY

Blast resistant variety BRRI dhan114

National Seed Board (NSB) of Bangladesh has released one promising genotype BR12454(Path)-BC2-69-97-39-5-44 (17 June, 2025), as blast resistant variety for cultivation throughout the country in Boro season. BRRI dhan114 belongs special character blast resistant *pi* gene with *TSV1* and *Wx-A* gene. Rice grain colour golden and growth duration 156 days, 1000 grain weight 17.4g. Milled grain medium bold, white colour. Amylose content 27% and protein content 7.7%. Yield 7.00-8.00t/ha. This new variety is suitable in blast prone areas of Bangladesh.

■ TH Ansari, MS Mian, QSA Jahan, M Hossain, S Akter, MA Monsur &MR Bhuiyan

SURVEY AND MONITORING OF RICE DISEASE

A comprehensive disease survey was conducted across different ecosystems in Bangladesh during the 2024 T. Aman season to assess the incidence (DI) and severity (DS) of major rice diseases aiming to monitor disease status and trace possible sources of infection. The survey assessed the incidence patterns and severity of major rice diseases across different locations and varieties. Following the SES (IRRI, 2013) protocol, disease incidence (DI) and severity (DS) were recorded from three upazilas in each district. Findings revealed that both DI and DS were markedly higher in the T. Aman 2024 season than in the Boro 2024–25 season. The survey focused on bacterial leaf blight (BB), bacterial leaf streak (BLS), sheath blight (ShB), Blast, false smut (FS), brown spot (BS), and tungro diseases. The findings revealed a significant location effect, with certain regions acting as hotspots for specific diseases; for instance, Sirajgonj showed the highest DI for bacterial leaf blight (69.2) and brown spot (86.5), while Cumilla was mostly affected by tungro (66.4) (Fig. 1). Overall, the most prevalent diseases were bacterial leaf blight (28.9% average DI); sheath blight (26.7% average DI), and brown spot (26.4% average DI), in the reported year.

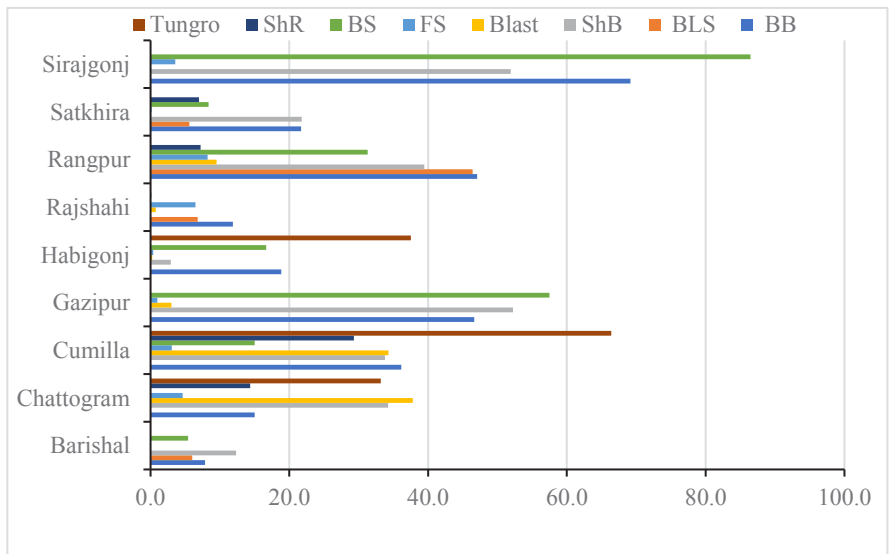


Fig. 1. Prevalence of different rice diseases at different regions of Bangladesh in T. Aman24

While in Boro 2024-25 season, among the locations, Gazipur, Satkhira, Cumilla and Sirajgonj identified as disease hotspots of Blast, BB, ShB, while Habiganj as for Bakanae disease (Fig. 2). Both location-specific hotspots and varietal susceptibility are driving multiple disease pressures, and an urgent

need for integrated disease management and breeding programs targeting multi-disease resistance is necessary to sustain rice production in Bangladesh. These findings provide a basis for further research into specific environmental factors influencing on disease dynamics.

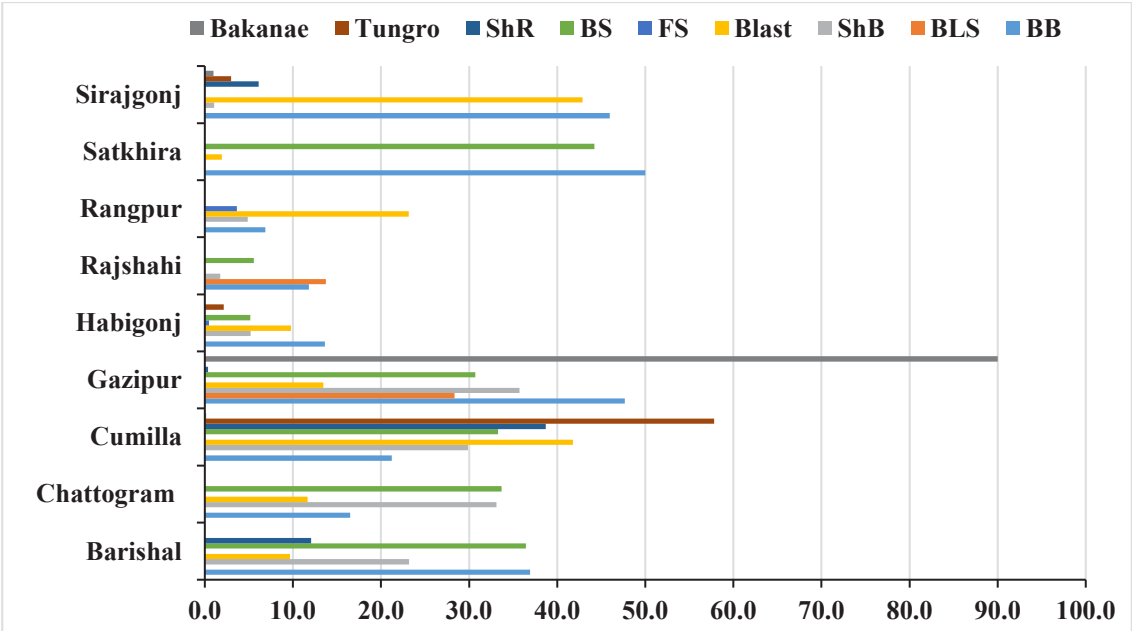


Fig. 2. Prevalence of different rice diseases at different regions of Bangladesh in Boro 2024-25.

■ T H Ansari, QSA Jahan, M Hossain, MS Mian, S Akter, MA Monsur, MR Bhuiyan, B Nesa, MM Rashid, HA Dilzahan

PATHOGEN POPULATION STRUCTURE and BIOLOGY OF MAJOR PATHOGEN

Preservation of isolates of rice sheath blight pathogen from diverse locations

Population biology of *Rhizoctonia solani* for Sheath blight resistance: To study the population structure of *R. solani* in Bangladesh around 22 and 30 Sheath blight disease samples were collected from Habiganj and Rajshahi during T. Aman 2024 and Boro 2024-25, respectively. Out of 22 T. Aman samples 13 were purified, kept in eppendorf tube containing silica gel and preserved in refrigerator with box. Similarly, 15 samples were purified and preserved from 30 Sheath

blight Boro samples. A register note book was maintained for future reference including Plot ID, Latitude, Longitude, Altitude, Precision, Variety, Location, Disease incidence (% RLH), Severity scale and storage serial number.

■ M Hossain, MR Bhuiyan, HA Dilzahan, QSA Jahan

Preservation of isolates of rice false smut pathogen from diverse locations

To explore the pathogen diversity of rice false smut disease. During T. Aman 2024, in total 36 samples were collected from Rajshahi, Rangpur and Gazipur district (Fig. 3). Isolation of the collected samples were done and pure cultures of 42 isolates were preserved in slants and in petri dishes.

■ B Nesa, QSA Jahan

Variability of *Fusarium* sp. associated with bakanae disease

This study was taken to determine the morphological, pathological, and molecular diversity, of the *F. fujikuroi* population isolated from symptomatic bakanae-diseased rice plants in Bangladesh. Bakanae symptom showing diseased plant samples were collected from Habigonj (four upzilla: Bahubol, Shayestgonj, Chunarughat and Habigonj sadar) and Moulivibazar (three upzilla: Sreemongol, komolgonj, baralekha) districts. From the infected plant samples **sixteen isolates were** isolated and preserved for further analysis.

■ QSA Jahan, F Tarannum, T Zebin

DISEASE RESISTANCE AND MOLECULAR STUDIES

Phenotypic characterization of local germplasms against rice Sheath blight disease

A total of six hundred and sixty local germplasms were phenotypically screened against rice sheath blight disease in T. Aman 2024 to detect resistant source/s. Thirty-day-old seedlings were transplanted, maintaining three replications. Fertilizer and other intercultural operations were done as and when necessary. All the germplasms along with the respective check materials were inoculated with virulent *Rhizoctonia solani* isolates when the plants had attained at maximum tillering stage. Data on relative lesion height (RLH%) were measured at 21 days after inoculation following SES, IRRI (0-9 scale). Out of 660 germplasms, only 42 entries showed a moderately resistant reaction against rice sheath blight disease. Further investigation among the 42 moderate resistant germplasms is needed to identify the resistance source against rice sheath blight disease.

■ MR Bhuiyan, HA Dilzahan, M Hossain, PS Biswas, QSA Jahan

Evaluation of advanced breeding lines against rice sheath blight disease, T Aman 2024

A total of sixty-five advanced breeding lines were phenotypically screened during T. Aman 2024 to

evaluate their resistance levels against rice sheath blight disease. Thirty-day-old seedlings were transplanted, maintaining three replications. Fertilizer and other intercultural operations were done as and when necessary. All the advanced breeding lines, along with the respective check materials (BR22, BR23, BRRI dhan46, BRRI dhan49, BRRI dhan71, BRRI dhan75, BRRI dhan87), were inoculated with virulent *Rhizoctonia solani* isolates at maximum tillering stage. Data on relative lesion height (RLH%) were measured at 21 days after inoculation following SES, IRRI (0-9 scale). Among the tested breeding lines, none of the material was found as resistant or moderately resistant against rice sheath blight disease.

■ MR Bhuiyan, HR Dilzahan, M Hossain, QSA Jahan

Assessment of resistance reaction to sheath blight in BRRI released and other HYVs rice

BRRI developed different rice varieties i.e. T. Aman (48) and Boro (44) were evaluated to identify resistance source(s) against sheath blight disease. Only 15 varieties viz. BR22, BR23, BR25, BRRI dhan38, BRRI dhan40, BRRI dhan56, BRRI dhan76, BRRI dhan77, BRRI dhan90, BRRI dhan103, BRRI dhan39, BRRI dhan41, BRRI dhan44, BRRI dhan46 and BRRI dhan70 were observed as moderately susceptible in T. Aman 2024 against sheath blight pathogen. Tested other T. Aman varieties were found susceptible to highly susceptible to sheath blight disease. On the other hand, only 3 varieties viz. BR9, BR17, BRRI dhan106 were identified as moderately susceptible (31 to 45% RLH) against sheath blight pathogen. Tested other Boro varieties were found as susceptible to sheath blight disease.

■ M. Hossain, MR Bhuiyan, HA Dilzahan

Blast disease status in advanced lines in hotspot area

Blast disease resistance performance was observed in inductive agro-ecosystem. Seven advanced lines in different growth stages i.e., short, medium and long duration along with 4 check variety, BRRI dhan50, BRRI dhan88, BRRI dhan29 and BRRI dhan58 were

grown at sutiakhali under Mymensingh Sadar upazila. About sixty-five days old seedlings of each genotype were transplanted @ one seedlings with spacing of 25 cm x 15 cm. The unit plot size was 2 m x 3 m. The field layout followed RCB design with three replications. Data were collected on blast disease incidence and on yield contributing characters. Leaf blast symptom was found in 2 advanced lines BR (Path)15641-3HR-15 and Rod miniket-1 along with check variety BRRI dhan50, BRRI dhan88 and BRRI dhan29. In this hotspot area, disease pressure was comparatively lower in susceptible check variety and tested lines in the reported year. The yield was recorded higher in two long duration lines BR(Path)15855-BC2-3HR-48 (7.55t/ha) and BR(Path)15855-BC2-3HR-47 (7.62t/ha) compared to BRRI dhan29 (7.2 t/ha). Furthermore, disease severity was 0 in line BR(Path)15855-BC2-3HR-48 and BR(Path)15855-BC2-3HR-47, whereas, disease severity was 3 in check variety BRRI dhan29. In case of, medium duration line BR (Path)15641-3HR-45 (7.1t/ha) and BR (Path)15641-3HR-15 (6.8t/ha) gave higher yield than check variety BRRI dhan50 (5.6t/ha) and BRRI dhan88 (6.2t/ha).

■ MA Monsur, MS Mian, Th Ansari, QSA Jahan

Screening of 464 multi trait lines against blast disease in blast nursery and Hankata, Gazipur

464 lines were selected based on different trait, growing season and region. Phenotypic reaction of 464 diverse lines against blast disease was observed. All diverse lines were grown in Blast Nursery in Plant Pathology Division, BRRI for artificial screening. In other cases, this panel were grown in hotspot condition, Hankata during Boro season 2024-25 to check blast disease reactions. Universal susceptible variety US2, and newly developed blast resistant variety BRRI dhan114 were planted as check in blast nursery and natural fields. US2 were grown in border side in blast nursery. Artificial inoculation was done at the age of 21 days seedlings. Seedlings (45 days old) were transplanted to check the blast disease level in the hotspots at the farmers' fields. In nursery leaf blast data was recorded whereas in field conditions, neck/panicle blast data

were collected during hard dough to ripening stage following Standard Evaluation System scale (0-9) (IRRI, 2014). Among the tested lines 71 showed resistant, 73 showed moderately resistant and 197 were highly susceptible against leaf blast disease. On the other hand, 271 lines showed resistant, 42 moderately resistant and 84 were highly susceptible against panicle /neck blast at natural condition in farmer's field.

■ MA Monsur, MS Mian, Nur ashraf, Th Ansari, QSA Jahan

Phenotyping reaction of 380 elite blast resistant lines in different hotspot areas in Bangladesh

A total of 380 lines were selected from blast disease resistant high yielding putative lines, which contain major R gene like *Pita2*, *Pi9* and *Pb1*. The phenotypic reaction on 380 elite lines against blast disease was observed under artificial inoculation and natural condition. The tested lines were grown in Blast Nursery of Plant Pathology Division, BRRI for artificial screening. In other cases, four blast prone hotspot areas were selected namely Hankata, Cumilla, Jashore and Rangpur in Boro season 2024-25 to check disease reactions on these elite lines in natural condition. As resistant and susceptible checks, universal susceptible variety US2, and five BRRI-developed rice varieties viz. BRRI dhan88, BRRI dhan89, BRRI dhan92 and BRRI dhan114 were planted in blast nursery and in natural fields. US2 were grown in border side in blast nursery as susceptible check. Leaf blast data were collected followed by JIRCAS (0-5) scale (Hayashi *et al*, 2009) at seven days after inoculation. Under field conditions, mainly neck/panicle blast data were collected during hard dough to ripening stage followed by Standard Evaluation System scale (0-9) (IRRI, 2014). Among 380 elite lines neck blast incidence and severity were highest in the location Hankata and followed by in Cumilla, Jashore and Rangpur. Many resistant lines were obtained from both artificial inoculation and natural conditions. In case of leaf blast symptom, 92 lines were recorded as highly susceptible, nine lines were moderately resistant and 274 lines were as resistant. With respect to neck blast symptoms, 96 lines showed highly

susceptible and 284 lines showed resistant reactions at Hankata under Gazipur district. In Hakata the field was lowland and more fertile for that reason many lines/accessions were lodged after flowering. In Cumilla, 130 lines were obtained as highly susceptible, 190 lines showed resistant reaction (0) and only five genotypes showed moderate resistant (3-5) reactions. In this site the accessions that had early flowering characters showed higher blast infection compared to late flowering accessions. In Jessore, 77 lines showed susceptible reaction (5-9) and 290 lines were found as resistant (0) reaction. In this site, disease was not developed as much higher as Gazipur and Cumilla. In Rangpur 335 lines showed resistant reaction (0), 21 lines were susceptible (5-9) and 25 lines were moderately resistant. Minimum disease was developed in this site compared to other locations in the tested lines.

■ MA Monsur, MS Mian, Nur Ashraf, QSA Jahan

Study on blast disease status in commercially cultivated hybrid rice variety

Blast disease performance in commercial hybrid rice varieties was investigated. Popular hybrid rice varieties that are available in market was collected to set up the experiment. A total of 22 hybrid varieties including BRRI hybrid and imported hybrid from China were collected. BRRI dhan81, BRRI dhan28, BRRI dhan49 and US2 were used as susceptible check. Out of 22 hybrid varieties, 8 showed resistant, 6 moderately resistant and 7 observed as highly susceptible to leaf blast disease.

■ MA Monsur, H Rahaman, J Islam. MS Mian, Th Ansari, QSA Jahan

Screening of advanced breeding lines against leaf blast disease in Blast nursery

Leaf blast disease severity and incidence level were observed in 288 advanced lines of multi trait characters like cold, drought, flood, and heat in blast nursery of Plant Pathology Division, BRRI. Among the tested lines 72 were found resistant, 29 moderately resistant and 151 highly susceptible. A total of 6 breeding lines (ALART_FBR, PVT_FBR, PVT_CTR) including 6 check varieties were received from plant breeding divisions, BRRI,

Gazipur. Lines and check varieties were tested against leaf blast disease in blast nursery, BRRI, Gazipur. BRRI dhan28 and BRRI dhan33 were used as local susceptible and resistant checks. Disease scores were recorded following the SES, IRRI. Among the tested lines, 4 lines showed susceptible reaction(S) and two lines (BR12508-5R-5 and BR11338-5R-84) showed moderate susceptible (MS) reaction against leaf blast disease.

■ MS Mian, MA Monsur, Nur ashraf, QSA Jahan

Dissecting novel source of BB resistance in rice germplasm

Out of 300 hundred materials six germplasms were found as moderately resistant against BB after phenotypic screening in both Boro and T Aman seasons. Moderately resistant germplasm will be confirmed by phenotyping and DNA fingerprinting along with more MR germplasm those were previously tested in plant pathology division.

■ A Ara, TH Ansari, QSA Jahan

Screening of germplasms against Tungro disease of rice, T Aman, 2024

An experiment was set up to evaluate the resistance against Tungro disease of rice, in Plant Pathology Net House, BRRI, Gazipur. Eighty-one (81) Germplasms were collected from GRS division, BRRI, Gazipur for testing their reaction against rice tungro virus disease. Matatag-1 was used as resistant check whereas BR3 and Purbachi were used as susceptible check. The standard protocol was followed and disease scores were recorded following the SES, IRRI 2013. Among the tested materials, 1 entry (Acc-7475) showed resistant (R) and 17 entries exhibited moderate resistant (MR). Rest of the entries showed moderate susceptible (MS) to susceptible (S). The identified resistant germplasms will be needed further testing to confirm the resistance against tungro disease.

■ MS Mian, QSA Jahan, TH Ansari

Sheath blight disease resistance in rice through Crispr-Cas9 genome editing:

The rice sugar transporter gene OsSWEET11 was selected for completely and permanently silences the gene at the DNA level through Crispr-Cas9 knockout system. Targeted sites of OsSWEET11 were on chromosome 8 and the locus id LOC_Os08g42350 were identified by using the web-based tool such as “Rice Genome Annotation Project” (<http://rice.uga.edu/index.shtml>) and rap-db (<https://rapdb.dna.affrc.go.jp>). Our designed 21 nucleotide bases of gRNA of SWEET11 gene were synthesized from the company. Plasmid extracted from binary vector pRGEB31 and digested with BsaI restriction enzyme. Guide RNA was ligated with digested plasmid through T4 DNA ligase enzyme. Ligated plasmid was transferred into E-coli (DH5α cell). Ligation of vector construct was confirmed through PCR band as well as commercial sequencing.

■ HA Dilzahan, MR Bhuiyan, M Hossain, HN Barman, SA Islam, TH Ansari, QSA Jahan

Identification of blast resistant QTLs in BRRI dhan33 and BR16

The cross between BRRI dhan33 or BR16 and universal susceptible line US2 were done to produce F1. Then three and two back crosses respectively for BRRI dhan33 and BR16 were done by US2 and developed recombinant inbred lines (RIL) by single seed descent at the Bangladesh Rice Research Institute (BRRI). This population was established for genetic mapping of blast resistance. Three hundred seventy-one population for BRRI dhan33 and 353 population for BR16 were evaluated against blast isolates. One percent of gelatin solution was added to the inoculum at a 1:1 ratio. Leaves of twenty-one-day old seedlings were inoculated by spraying. The nursery bed was covered at night and open around the bed at day period. Leaf samples of 21 days old seedling were collected from each recombinant lines including resistant and susceptible checks. All the samples were extracted for DNA isolation following the CTAB method disrupting the leaf tissue, lysing the cells to release DNA, separating the DNA from cellular debris, and then purifying and collecting the DNA. All DNA samples were sent to IRRI for genotyping all the samples

for 1k-RiCA version 4. The genotyping data is now under analysis.

■ TH Ansari, MS Mian, MA Monsur, QSA Jahan,

EPIDEMIOLOGY, YIELD LOSS AND GRAIN QUALITY STUDIES

Quantifying yield losses caused by rice sheath blight disease

An investigation was conducted during T. Aman 2024 to evaluate the extent of yield losses caused by rice sheath blight under artificial inoculation conditions. The findings revealed a strong negative relationship between yield parameters and disease severity. Healthy plants exhibited the best performance, with the highest grain number (157.0), panicle weight (3.3 g), and panicle length (23.8 cm), while highly susceptible (HS) plants recorded the lowest grain number (85.0), panicle weight (2.5 g), and the highest proportion of unfilled grains (47.0) obtained from average of 100 panicles. Moderately resistant (MR) and moderately susceptible (MS) entries performed better than susceptible (S) and HS categories, but did not reach the yield level of healthy plants. These results underscore the significant adverse effects of sheath blight on rice productivity, particularly in terms of grain formation and grain filling. As this is the first-year report, the experiment will be continued in the succeeding years to find out more precisely yield losses associated with sheath blight disease severity gradients that will support to attain targeted breeding and management strategies.

■ MR Bhuiyan, HR Dilzahan, M Hossain, QSA Jahan

Identify economic threshold level of rice blast disease at field condition

The economic cut point for sustainable yield against blast disease was estimated. Four zira katari rice variety fields infected with leaf blast disease at booting stage were selected in pubail, Gazipur sadar. Disease score in these four-rice fields was different. In each field 3 spots were divided by bamboo sticks. Each spot area was 9 m² (3m x 3m) and was considered as one replication. Standard dose of

Trooper (6gm in 10L H₂O/ 5 decimal) was applied twice 7 days after interval in highly infected field whereas applied at 10 days interval in lower infected field. Disease data were recorded 7 days interval. In field -1, recommended fungicide (trooper) were applied at flowering (milking) stage, where disease severity was 5 and incidence was 70%. At maturity stage it was observed that disease incidence was reduced to 87% over control. In field-2 and in field-3 where disease severity was low (3) and incidence was 20% and 15%, respectively at booting stage. After fungicide spray, disease incidence was found reduced to 66 and 60 percent, respectively over control. So, disease management or economic threshold level of rice blast disease depends on plant growing stage and as well as severity. Furthermore, in field-2 and-3, where disease status was minimum at 1st time fungicide application, it was observed that disease incidence was not reduced significantly at maturity stages. Yield was increased 42% (3.5t/ha) and 48% (3.9 t/ha) over controlled plot in field-2 and field-3, respectively. It was also observed that yield was increased 69 percent when fungicide applied at milking stage (Field-1) and yield was recorded highest 4.2 t/ha. From this finding it is understood that disease severity is correlated with yield loss. If management is done at early stage of blast disease infection with low severity, then disease will be controlled with lower yield loss. On the other hand, higher yield loss observed at later stage infection with high severity, management is done properly as soon as the disease appeared at booting stage no later after milking stage.

■ MA Monsur, F Tarannum, QSA Jahan

Genotype and environmental interaction on neck blast incidence

The experiment was conducted with variety and planting time against blast disease under natural conditions at BRRI HQ, Gazipur during Boro 2024-25. Four varieties were transplanted: V1= BRRI dhan29, V2= BRRI dhan89, V3= BRRI dhan28 (optimum planting) and V4= BRRI dhan28 (Late planting) at first planting time (Set A -Optimum planting date, T1= 19 December, 2024). V4 (Late planting) was transplanted at 20 days later after first transplanting to synchronize the flowering time with

BRRI dhan29 and BRRI dhan89. The same varieties were transplanted at the second planting time (Set B- Late planting, T2= 9 January 2025). Neck blast disease incidence was about 5.5% in V1, V2, and V4 varieties whereas the V3 variety showed 7% disease incidence. Neck blast disease incidence was very low due to high temperature and low humidity (below 72%) in month of April.

■ MS Mian, MA Monsur & TH Ansari

Effect of land elevation on rice disease development

This experiment was set up using BRRI dhan49 in T Aman, 2024 in farmer's field at Kapasia upazila, Gazipur, where three distinct land elevation – high, medium and low – was present. Data on the incidence of rice sheath blight disease was taken from 6 samples from each of the three land elevations (total 18 dataset). The disease incidence was expressed as percentage of the infected tillers. The incidence of the rice sheath blight disease decreased progressively and significantly with the decrease in land elevation. In case of the incidence of rice false smut disease, a reverse trend was observed in relation to land elevation (Nessa et al., 2015). The present results indicate land elevation is one of the sources of the rice sheath blight disease, which has not been recognized and recorded previously. The experiment will be evaluated further to get conclusive result for disease management.

■ B Nesa, MS Mian, QSA Jahan

Effect of nutrients on rice disease development.

This experiment was set up to find out the usefulness of macro and micro nutrients against major rice diseases. Two nutrient solutions – DPN (Disease Preventive Nutrient, also known as 'magic solution' solution, composed of MoP = 60g, 80% S = 30g, and Zn = 3g in 10 litre of water) and Siliforce (composed of Si = 68.4 micro g, B = 9 micro g and CaO = 717.3 micro g in 10 litre of water) were used as nutrient solutions to combat rice diseases. The performance of the solutions were tested against control. Essentially, DPN is macro-nutrient based, whereas Siliforce is micro-nutrient based solution. Two rice

varieties (BRRI dhan49 and BRRI dhan51) were tested under two transplanting time (13 and 26 July) in the T. Aman season of 2024 in farmers field at Kapasia upazila, Gazipur. The performance of the nutrient solutions was evaluated against rice sheath blight disease and grain yield. Whether it was variety or transplanting time, none of the nutrient solutions (DPN or Siliforce), significantly affected the incidence of rice sheath blight disease. The same was observed in case of yield response.

■ B Nesa, MS Mian, QSA Jahan

Estimation of Tungro virus incidence and its impact on rice cultivation, Aman 2024

A survey was conducted at Nangolkot Upzilla of Cumilla district at maximum tillering to ripening stage of rice during Aman season, 2024 for assessment the yield loss, disease incidence and varietal response to Tungro disease. Predicted yield data were made by eye estimation and 10 crop cut (healthy and infected) were carried out at different locations. RTD scores were recorded following the SES, IRRI. The disease incidence and severity were observed ranged from 90-100% and 8-9 respectively in BRRI dhan51, BRRI dhan75, BINA dhan17, BRRI dhan49 and BRRI dhan103. On the other hand, among the varieties, the reaction of BRRI dhan46 was observed the lowest disease incidence (10%) and severity (3) to rice tungro disease at farmer's field of surveyed area. The yield data of all rice cultivars unaffected by tungro disease was recorded from 2.5 – 3 t/ha, whereas the yield data of BRRI dhan51 and BINA dhan17 affected by severe tungro disease was recorded from 0- 0.1t/ha. The estimated yield of BRRI dhan75 and BRRI dhan103 by the crop cut of 10 m² was 2.5 and 5.8 t/ha respectively in the farmer's rice field where there is no rice tungro disease. Under sever outbreaks of rice tungro disease, the estimated yield of BRRI dhan75 and BRRI dhan103 were 0.18 to 0.1 t/ha respectively. The loss in yield from tungro disease under sever incidence was calculated. The estimated loss was from 92 to 98% for both of the varieties at farmer's field.

■ MS Mian, MM Rashid, TH Ansari

DISEASE MANAGEMENT

Efficacy of bacterial biopesticide to manage sheath blight disease

This experiment was set up at net house of Plant pathology division, BRRI, Gazipur. Six treatments: T1= Bacteria 1 (three days after inoculation), T2=Bacteria 1 (three days before inoculation), T3=Bacteria 2 (three days after inoculation), T4= Bacteria 2 (three days before inoculation), T5= Disease control, T6= Healthy control) were used. This study was conducted during the T. Aman 2024 season using BR3 transplanted in plastic pot. There were two hills per pot and each treatment was replicated thrice. The pots were watered daily and recommended dose of fertilizers were applied following BRRI guideline. At T1 and T3 plants were inoculated with *Rhizoctonia solani* first and bacterial biopesticide- 1 and 2 was sprayed on plants after three days of inoculation. At T2 and T4 treatments, plants were sprayed with bacterial biopesticide- 1 and 2 first and after three days plants were inoculated with *Rhizoctonia solani*. Plants of T5 treatments were inoculated with *Rhizoctonia solani* and kept as diseased control. Plants of T6 treatments were used as healthy control without any inoculation. The plants were inoculated at maximum tillering stage. Bacterial biopesticide was formulated at Plant Pathology Laboratory, BRRI Gazipur before spraying. Data was recorded on total tiller/hill, percentage of sheath blight infestation (%RLH), filled grain weight, non-filled grain weight at harvest. Higher tiller number was obtained in diseased control treatment (T5) where plants were inoculated with *Rhizoctonia solani* and none disease management was applied. Lower tiller was found in T3 and T1 treatments where biopesticide was applied and similar result was obtained as in healthy control (T6). In case of sheath blight disease (%RLH) was observed lower in T3 (15.98%) followed by T4 (21.91%), T1 (25.59%) and T2 (25.68%) where biopesticide was applied before or after inoculation. Although some disease symptom expressed in biopesticide treated plants but all were under risk level (<35 % RLH) and in this RLH no fungicide is required to spray. Highest %RLH was observed in T5 (47.20) where no disease

management was done. Highest filled grain weight has been found in T4 (12.82g/plant) and lowest followed by T2 (11.38g/plant) where bacterial biopesticide was sprayed first before inoculation. Both bacterial biopesticide had showed better performance and among the two tested biopesticides bacterial biopesticide- 2 performed better to manage sheath blight disease. Further investigation is required to get a concrete outcome.

■ QSA Jahan, F tarannum, T Zebin

Evaluation of biopesticides for rice insect pest management

An experiment was set up at net house of Entomology division, BRRI, Gazipur to find out the activity of bacterial biopesticide on leaf folder management. Four treatments: T1= bacterial biopesticide @25 mL/L (before infestation), T2= bacterial biopesticide @25 mL/L (after Infestation), and T3=Insecticide (Stinoset 45SC) @ 0.5 ml/ha, T4= control were used. Variety: BR3 was used for this experiment and transplanted in earthen pot in T. Aman 2024. At T1, bacterial biopesticide was sprayed first on the plants at maximum tillering stage and covered with Myler cages and thereafter; insect larvae were released on plants on next day. In case of T2, insect larvae were released first on plants and then bacterial biopesticide was sprayed on next day. There were three hills/pot and five insect larvae in a vial was kept in a pot. Entomo-pathogenic bacterial biopesticide was formulated at Plant Pathology Laboratory, BRRI Gazipur before spray. Data was recorded on folded leaves per hill, alive insects per hill, percentage of alive and dead insect after 7 days and 14 days after infestation. At T1 and T2, the result showed that folded leaves count has increased at 14 days in T1, T2 and in T4 whereas, decreased in T3 where insecticide was sprayed. Dead larvae (%) count was found similar in T1, T2 and in T3 compared to T4 at 14 days which was a promising sign. It revealed that bacterial biopesticide can reduce alive insect number which will prevent further attack. For getting concrete result this experiment will be investigated further.

■ QSA Jahan, F tarannum

Effect of Tricho-compost on nutrient and disease management in rice

Three experiments were conducted during the Boro 2024–25 season at three locations: Birgonj (Dinajpur), Atwari (Panchagarh), and in blast nursery, Plant Pathology Division, BRRI Gazipur. These experiments were set up to find out the efficacy of Trichocompost for potash supplement along with major rice disease management. Different doses of potash combination with Trichocompost were used in different treatments. Six treatments using BRRI dhan29 trailed in Birgonj, Dinajpur whereas BRRI dhan58 was in Atwari, Panchagarh and BRRI dhan89 was used in BRRI Gazipur. Recommended spacing (20 cm × 20 cm) was maintained during transplanting. The treatments were as follows: T1: Trichocompost @ 1.5 t/ha (NPSZn full dose and without potash), T2: Trichocompost @ 1.5 t/ha + 43 kg/ha MOP (NPSZn full dose + over rest amount of MOP), T3: Trichocompost @ 1.0 t/ha + 50 kg/ha MOP (NPSZn full dose + 15% increase over rest amount of MOP), T4: Trichocompost @ 0.5 t/ha + 75 kg/ha MOP (NPSZn full dose + 30% increase over rest amount of MOP), T5: Control with recommended dose of chemical fertilizer, T6: Absolute control (no fertilizer). Trichocompost was prepared with Water hyacinth: Cowdung: Trichoderma inoculum= 4: 1: 0.25 (v/v) at Plant Pathology net house, BRRI and applied during final land preparation. Grain yield varied significantly across treatments and locations. The highest yield was recorded in T3, with 7.25 t/ha (BRRI dhan29) in Birgonj and 7.46 t/ha (BRRI dhan58) in Atwari whereas highest yield was found in T4 (9.25t/ha) and was similar to T5 (9.24t/ha) where BRRI recommended fertilizers were applied at BRRI Gazipur for BRRI dhan89 respectively. These T3 and T4 treatments involved a lower rate of Tricho-compost (0.5-1.0 t/ha) with slightly elevated MOP, indicating enhanced nutrient uptake and yield potential of these treatments. The lowest yield was observed in T6, where no fertilizers were applied. No major disease incidence was observed during the trial period in any location. Minor stem borer infestations were noted and effectively managed with appropriate insecticide applications. These findings suggested that Trichocompost is a source of

potash fertilizer and thus played a role for disease eliminator. Farmers can use any combination of potash with Trichocompost (depends on availability) used in this trail to supply nutrient (potash) and disease management.

■ QSA Jahan, F tarannum, T zebin

Effect of Trichocompost (Corn stalk) on Nutrient and Disease Management in Rice

This experiment was set up at BRRI blast nursery, Gazipur sadar in Boro 2024-25 to find out the efficacy of corn stalk as a component of Trichocompost preparation and find out its effect on nutrient supply and disease management as well. Six treatments (T1= Trichocompost application rate @ 1.5 t/ha (NPSZn full dose without MOP), T2= Trichocompost @ 1.5 t/ha + 43 kg/ha MOP (NPSZn full dose+ rest amount MOP), T3= Trichocompost @ 1.0 t/ha + 50 kg/ha MOP (NPSZn full dose+ 15% increase over rest amount of MOP), T4= Trichocompost @ 0.5 t/ha + 75 kg/ha MOP (NPSZn full dose+ 30% increase over rest amount of MOP), T5= Control 1 (Fertilizers @ recommended dose), T6= Control 2 (No fertilizer) were used. Trichocompost was prepared with Corn stalk:Cowdung:Trichoderma inoculum= 4: 1: 0.25 (v/v) in piles at Plant Pathology net house, BRRI and was applied during final land preparation. BRRI dhan89 was used in this trial with 20 cm X 20 cm spacing. This experiment was set up using three replications for each treatment following RCB design. Tiller and panicle number is almost similar in all treatments. Panicle length is higher in T3 compared to others where trichocompost @ 1.0 t/ha + 50 kg/ha MOP (NPSZn full dose+ 15% increase over rest amount of MOP) were used. Highest yield was observed in T4 (9.25 t/ha) where Trichocompost @0.5t/ha with 75 kg/ha MoP (NPSZn full dose+ 30% increase over rest amount of MOP) was applied and was similar as T5 (9.24 t/ha), where recommended doses of fertilizers were applied. Among the treatments, T4 performed better than others with higher yield and 1000 grain weight. No major disease was observed except sheath blight with a very limited scale (0.01%). Corn stalk could be used for Trichocompost preparation where water hyacinth is unavailable especially in the northern

part of Bangladesh. This finding revealed that any combination of Trichocompost prepared with corn stalk can be suggested for potash supplement and also rice disease management.

■ QSA Jahan, F tarannum, T Zebin

Efficacy of commercial nanoparticles against rice bacterial blight diseases *in vitro*

This experiment was set up to find out the effectiveness of commercially available nanoparticles for bacterial blight disease management. In *in-vitro* investigation explored the effectiveness of different nanoparticles at different ratios against bacterial blight disease development in comparison to control treatments. Bacterial culture of *Xoo* was previously isolated and cultured on PSA (Pentose Sucrose Agar) media and virulent *Xoo* was cultured and used for inoculation. The agar well diffusion assay was utilized to assess the antibacterial activity of different nanoparticles (Cu, CuO, Zn, ZnO NPs) at different concentration against *Xoo*, as elucidated by Monteiro et al (2013). Nanoparticles were purchased from Sigma-Aldrich, USA. Particle size maintained in this experiment was less than 100 nm. Plates inoculated with *Xoo* were incubated at 28°C±1 for 48 hours. The inhibition zone produced for each culture was assessed at 48 and 72 hours intervals in both control and nanoparticle-treated plates. A series of data were collected every 7days interval up to 30 days to observe how long it can inhibit the bacteria. Among all the nanoparticles Zn nanoparticles showed best result as produced inhibition zone 16.0-39.0mm at all concentration used compared to other nanoparticles.

■ R Akter, QSA Jahan

Efficacy of commercial nanoparticles against blast diseases *in vitro*

The efficacy of different commercially available nanoparticles against blast disease was assed. Nanoparticles were purchased from Sigma-Aldrich,USA. Different nanoparticles (Ag, Cu, CuO, Zn, ZnO NPs) and their precursor salt at different concentrations (200, 400 and 800 ppm) were weighed and making suspension in sterile deionized

water and sonicate them for 30 minutes. Stock solutions were preserved at 4°C to maintain the quality. Trooper 75 WP, tricyclazole group fungicide which is registered for controlling rice blast disease was used as chemical control. One absolute control (only sterilized water) was used for comparison. Conidia of *M. oryzae* were grown on oat meal medium and suspended in sterilized distilled water. Each replicate was examined under a microscope (Carl Zeiss AG, Germany) at 100× magnification. The number of germinated, ungerminated, as well as developmental differences in the appressoria, were evaluated. Among all the nanoparticles CuNPs showed complete inhibition (100%, not germinated) at 200ppm and above concentration and ZnNPs (100%, not germinated) at 800ppm concentration. Other treatments were also showed inhibition at different levels. On conidial suspension, the inhibition of germination of *M. oryzae* conidia by Ag-NPs was evaluated. After 24 hours of incubation, each treatment showed no conidial germination except CuONPs and ZnONPs (2-3%) @ 200 ppm compared to control. The germination rate of conidia in the control suspension (where conidia were dispersed only in water) was 80.97% and among the germinated conidia, 12.50% produced appressoria.

■ R Akter

Determination of residual effect of Sheath blight controlling fungicides in rice grain, stem, and soil

The experiment was conducted using the BR11 rice variety to evaluate the residual effects of Pyraclostrobin, Tebuconazole, Tricyclazole, Propiconazole, Cyproconazole, and Azoxystrobin in rice grain and stem. A randomized complete block design (RCBD) with three replications was followed, and standard agronomic practices were maintained. Fungicides were applied at recommended doses using a knapsack sprayer at the booting stage of the plant. Samples were already sent to RAL (Rice Analytical Laboratory, BRRI), and residue analysis would be performed using high-performance liquid chromatography (HPLC) or gas chromatography-mass spectrometry (GC-MS) following standard extraction and quantification protocols at RAL, BRRI. The results provide

insights into the persistence of these fungicides, supporting safer application strategies for rice disease management.

■ MR Bhuiyan, HR Dilzahan, M Hossain, QSA Jahan

Management of Bakanae disease through integrated control approach at Farmer's Field

This experiment was set up to find out the effective control measures of bakanae disease at later growth stage of rice plant in natural field condition. This experiment was set up at pabur, Kapasia, Gazipur in Boro 2024-25. Four treatments (T1=Carbendazim (2.5g/10L), T2= Potash fertilizer (60g/10L), T3= Bio-pesticide (Bacterial), T4= Control) were used for bakanae disease management on BRRI dhan104 at flowering stage where disease incidence was 60%. Then the treatments were applied on the randomly selected infected 2m x 3m plots each. Disease severity and disease incidence data were recorded at harvest. Total tiller number and infected tiller number was counted per 20 hills at flowering stage and after 2 weeks of applying treatment. Disease data were recorded from randomly 10 hills/ plot and yield data from 10 m² crop cut area. Plant height, panicle length, stem elongation length, grain/panicle, filled grain, unfilled grain, moisture, weight, 1000 grain weight data were collected. The result showed that disease incidence was almost similar in all treated plots after treatment application. This was happened due to the experiment was set up at flowering stage and after this stage no new infected tiller was produced in the plants. Plant height, panicle length and stem elongation length were found highest in T2 where MOP was applied compared to other treatments. Elongation of internodes of stem was lowest at T1 (Carbendazim). Highest grain/panicle and grain weight/panicle was observed in T3(231.6; 3.27) where bacterial bio-pesticide was sprayed followed by MOP sprayed (228.0; 3.19) and in T1 (206.4; 2.95) whereas lowest was found in T4 (165.8; 2.35) (Fig. 4). Filled grain per panicle was highest in number in bacterial biopesticide treatment (T3: 183.4g/panicle). Unfilled grain per panicle was also lowest in T3 (48.2g/panicle) than other treatments. From crop cut yield was recorded highest in T3 (3.35t/ha) where bacterial bio-pesticide treatment applied followed by

T2 (3.22 t/ha) and T1 (2.95 t/ha) and lowest was in control T4 (2.40 t/ha) (Figure 1). From the findings, it was observed that bacterial biopesticide and MOP had positive role for bakanae disease management not minimizing the plant height but increased yield potential by hindering pathogen infection further.

This experiment is also indicated that bacterial bio-pesticide treatment has a promising impact on managing bakanae disease at field condition at later growth stage. To get more conclusive result this experiment should be continued further.

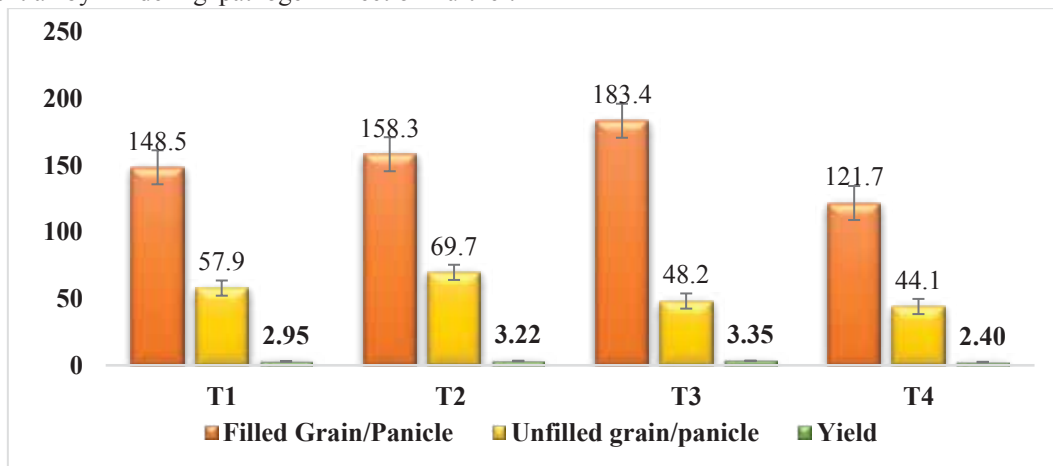


Fig. 4. Effect of different treatments on Bakanae disease at farmers field in Boro 2024-25 season.

■ F. Tarannum, MA Monsur, QSA Jahan

Seed health status and seed standard of rice in Bangladesh

Seeds of eight BRRI hybrid and 17 company hybrids were collected. Seed borne pathogens were evaluated following blotter test methods (ISTA, 2023). Eleven different seed borne pathogens viz. *Alternaria padwickii*, *Alternaria tenuis*, *Cladosporium oryzae*, *Curvularia lunata*, *Fusarium moniliforme*, *Fusarium oxysporum*, *Sarocladium oryzae*, *Tilletia barclaiana*, *Nigrospora* sp., bacteria and unknown were observed in BRRI developed hybrid varieties. Whereas only 6 seed borne pathogens viz. *Alternaria tenuis*, *Sarocladium oryzae*, *Tilletia barclaiana*, *Nigrospora* sp., bacteria and unknown were recorded in different Company imported hybrid varieties. Among them *Tilletia barclaiana* incidence was higher followed by *bacteria* and *Alternaria tenuis* whereas the lowest incidence was recorded with *Nigrospora* sp. in BRRI hybrid and *Sarocladium oryzae* in company hybrid. Incidence of seed borne pathogens were highest in BRRI developed inbred varieties (identified in previous year) followed by BRRI hybrid whereas the

lowest incidence was recorded in company imported hybrid. Those company imported hybrid seeds were treated with seed treating chemical which might be the cause of lower incidence of seed borne pathogens.

■ M. Hossain, MR Bhuiyan, HA Dilzahan

Evaluation of new fungicides against sheath blight disease of rice

A total of 25 new fungicides were evaluated against sheath blight disease. BRRI dhan98 in T. Aus and BR11 in T. Aman at BRRI Gazipur while BR23 in T. Aman at BRRI Cumilla were used for this trail. Rice plants were inoculated at the tillering stage with mycelial plug of *Rhizoctonia solani* grown on PDA at BRRI Gazipur in both the seasons. Natural condition was followed at BRRI Cumilla without any inoculation. Out of 25 tested fungicides none of them performed satisfactorily ($\leq 80\%$ disease reduction) in both the seasons compared to the control treatment against rice sheath blight disease experiment at BRRI Gazipur. But at BRRI Cumilla, in T. Aman 2004, 12 new chemicals reduced disease

by $\geq 80\%$ where natural condition was maintained. Results under artificial inoculation could be suggested and therefore results obtained from Cumilla were not accepted and all the tested fungicides didn't recommend for sheath blight management.

■ M. Hossain, MR Bhuiyan, MM Rashid and HA Dilzahan

Development of sheath blight screening protocol using Ankuri device

Ankuri is a seed germination and disinfection device developed by Ansari and Ahmed, 2016 and was used for standardization for sheath blight disease

development. Rice sheath blight pathogen, *Rhizoctonia solani*, was grown on PDA media and allowed to grow sclerotia. After 6 days of incubation young but well developed 2 sclerotia was placed separately under leaf sheath of rice plants. Inoculated rice plant was placed in test tube containing water. After that, the Test tubes were kept in a holding rack and placed it in Ankuri device where controlled temperature (30-32°C) and moisture (>90% relative humidity) were maintained. After 72 hr of incubation sheath blight symptom was developed where the sclerotia were placed (Fig. 5). The device needs more fine tuning to keep the rice plant green.



Fig. 5: Ankuri protocol: left to right-sclerotia on PDA plate, inoculation, tube holding rack and Ankuri device (primitive).

■ M. Hossain, MR Bhuiyan, TH Ansari and HA Dilzahan

Effect of Fungicide on Microbial Community in Rhizosphere of Rice

For the enumeration of bacterial population in the soil samples serial soil dilution was done. The slimy, colorless and colored bacterial colonies appeared in the NA medium after 72 h incubation (Fig. 6). Maximum number of colonies found 3 days before

fungicide spray in all treatments (Fig. 7). The number of colonies significantly reduced after spraying Amister top. The toxic effects of the fungicides were more pronounced immediately after the application of fungicides. On the other hand, with an increasing incubation period, the bacterial population tended to increase. After 28 days it became stagnant and there is no significant difference with before Amister top spray

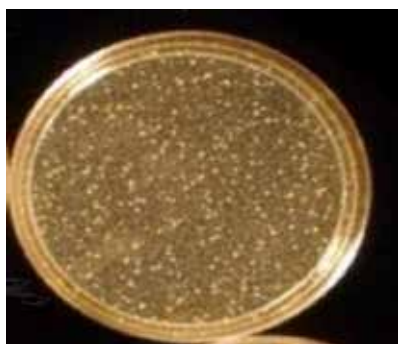


Fig. 6: Bacterial colonies in the NA medium after 72 h of incubation

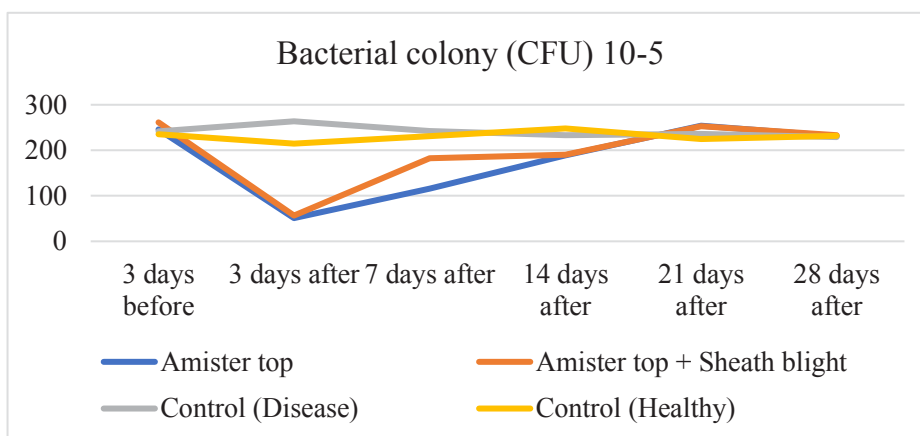


Fig. 7: Bacterial colony found in NA medium from sampled soil

■ HA Dilzahan, MR Bhuiyan, M Hossain and QSA Jahan

TECHNOLOGY TRANSFER

Blast resistant variety BRRI dhan114

National Seed Board (NSB) of Bangladesh has released one promising genotype BR12454(Path)-BC2-69-97-39-5-44 (17 June, 2025), as blast resistant variety for cultivation throughout the country in Boro season. BRRI dhan114 belongs special character blast resistant *pi* gene with *TSV1* and *Wx-A* gene. Rice grain colour golden and growth duration 156 days, 1000 grain weight 17.4g. Milled grain medium bold, white colour. Amylose content 27% and protein content 7.7%. Yield 7.00-8.00t/ha. This new variety is suitable in blast prone areas of Bangladesh.

■ TH Ansari, MS Mian, QSA Jahan, MA Monsur, MR Bhuiyan

ALART: Four ALART trial was conducted by ARD in different locations

ALART-1: Short Duration for Blast Resistant Rice (BRR-SD) conducted in Boro 2024-25 at different 10 locations. Genotype: V1= BR (Path)15641-3HR-15 V3= BRRI dhan88 (Ck) V2= BR (Path)15641-3HR-45 were used. Considering yield, disease score, and all other parameters, none of the tested lines were suitable for PVT.

ALART-2: Medium Duration for Blast Resistant Rice (BRR-MD) conducted in boro 2024-25 at different 10 locations. Genotype: V1=BR(Path)15855-BC3-2HR-5, V2=BR(Path)15860-BC2-3HR-48 and V3= BRRI dhan58 (Ck) were used. Considering yield, disease score, and all other parameters, none of the tested lines were suitable for PVT.

ALART-3: Blast Resistant Rice for Long Duration (BRR-LD) conducted in Boro 2024-25 at different 10 locations. Genotype: V1=BR(Path)15855-BC2-3HR-23, V2=BR(Path)15860-BC2-3HR-47 and V3= BRRI dhan29 (Ck) were used. Considering yield, disease score, and all other parameters, Monitoring report, none of the tested lines were suitable for PVT.

ALART-4: BB + Blast Resistant rice was conducted in boro 2024-25 at different 10 locations. Genotype: V1= BR (path)13802-BC3-54-12, V2= BR (path)13802-BC3-73-13, V3= BR (path)13802-BC3-62-14 and V4= BRRI dhan88 (Ck) were used. Considering yield, growth duration, and all other parameters, V2= BR (path)13802-BC3-73-13 and V3= BR (path)13802-BC3-73-14 lines could be advanced for PVT. Yield of the tested lines were recorded statistically higher in V2= BR (path)13802-BC3-73-13 (7.44t/ha) and in V3= BR (path)13802-BC3-73-14 (7.75t/ha) than the check variety (7.04t/ha). Average growth duration of V2= BR (path) 13802-BC3-73-13 and V3= BR (path)13802-

BC3-73-14 lines were 1 days less than the check variety. Moreover, V2= BR (path)13802-BC3-73-13 and V3= BR (path)13802-BC3-73-14 lines were less susceptible to other disease than the others.

■ TH Ansari, QSA Jahan, M Hossain, MS Mian, S Akter, MA Monsur, MR Bhuiyan, B Nesa, MM Rashid, HA Dilzahan.

Seed production of blast resistant variety BRRI dhan114

Seed production of newly released blast resistant BRRI dhan114 variety was done at Rangpur, Satkhira and Sunamgonj district under supervision of respective regional stations and Plant Pathology Division. In Rangpur 2.2 ton, in Sunamgonj 2.5 ton produced in on farm whereas 5.46-ton seed was produced in Satkhira in on farm and on station. The produced seeds will be used for expansion of the variety at farmer's field in next boro season.

■ TH Ansari, MS Mian, MR Bhuiyan, QSA Jahan

Farmers training on integrated rice disease management.

Sixteen batches of a 'day-long' training programme on integrated rice disease management were conducted. Each training programme consisted of 30 farmers having both male and female participants. Therefore, altogether 480 farmers were trained on identification of different rice diseases and their management technique under the financial support of PARTNER and LSTD project in changing climatic condition of Bangladesh.

■ TH Ansari, Q S A Jahan, M Hossain, M S Mian, S Akter, MA Monsur, MR Bhuiyan, B Nesa, M M Rashid, A Ara, R Akter, HA Dilzahan

Upscaling of blast disease management at farmer's field during Boro 2024-25.

Upscaling of blast disease management validation trial was conducted in the farmer's field of different districts (Gazipur, Brahmanbaria, Habigonj, Cumilla, Netrokona, Rangpur, Sylhet and Dinajpur). Ten trials of upscaling of blast disease management were conducted in 3 bigha of land for each trial at different locations of the above-mentioned districts during Boro 2024-25. Each plot was divided into two sections: (1)

treated with the BRRI technology and (2) treated with the Farmers practice. Neck blast disease incidence, severity, and yield loss data were recorded from the BRRI Practice (BP) and Farmers Practice (FP) plots. Among the locations, the highest neck blast disease incidence (DI) was observed in the farmer's practice plot (DI-90%) with severity 9 at BRRI dhan81 field, Debidwar, Cumilla where the same variety showed 0.5% DI with severity 3 and 86.4% yield loss was saved by using BRRI developed technology. In the farmer's practice, the lowest disease incidence (3%) was observed in the plot of BRRI dhan89 in Sylhet, on the other hand in the BRRI practice plot, no DI was found. The yield loss was saved by 9.5% by applying BRRI technology in the field of BRRI dhan89. In the rest of the trials, the yield losses saved ranged from 85.1% to 30% at different varieties by using BRRI technology.

■ TH Ansari, MS Mian, QSA Jahan, M Hossain, S Akter, MA Monsur, MR Bhuiyan, B Nesa, M M Rashid, A Ara, R Akter, H A Dilzahan

Improved disease management technology validation at LSTD project site, Sadar, Jamalpur, Aman 2024

The participatory field demonstration was done under the LSTD, BRRI project during T. Aman 2024 in Jamalpur Sadar involved 13 farmers cultivating BRRI dhan87, dhan93, and dhan94 across varied land areas (around 3 acres of land). Among the tested varieties, BRRI dhan94 recorded the highest yield (6.30 t/ha), while BRRI dhan87 generally showed moderate yields due to low fertility of the soils (Char land). Disease assessment revealed that sheath blight posed the most significant threat, especially in BRRI dhan94 and dhan93, with up to 15% incidence and severity scores as high as 6. Bacterial blight and brown spot were also present relatively at moderate levels. Overall, the integrated disease management approach supported good yields, but continued emphasis on disease-resistant varieties and farmer awareness is necessary to mitigate the impact of sheath blight and ensure sustainable rice production.

■ MR Bhuiyan, TH Ansari, QSA Jahan

Upscaling of integrated rice sheath blight disease management at the farmers' field conditions:

An investigation was carried out to evaluate the efficacy of integrated sheath blight disease management techniques under farmers' field conditions. The study was executed at Debiddar, Cumilla in the last T. Aman 2024. The study compared five different treatments for sheath blight management in rice. T1 involved the removal of floating debris (RFD), while T2 and T3 combined RFD with MoP and fungicides at different growth stages (MT and Booting). T4 included RFD with MoP and fungicides applied at both MT and Booting stages, and T5 served as a control. Results indicated that T4 was the most effective one, showing the

lowest disease incidence (10%) and severity, and obtained highest rice yield (6.5 t/ha). Conversely, Treatment T5 had the highest disease levels (80% incidence and severity was around 7), resulting in the lowest yield (3.3 t/ha), indicating poor disease control. Treatments T2 and T3 offered moderate control and yields, while Treatment T1 was less effective. Overall, the findings suggest that adopting integrated management strategies similar to T4 can significantly reduce sheath blight and enhance rice productivity in the disease-prone areas.

■ MR Bhuiyan, MM Rashid, M Hossain, MR Islam, TH Ansari, QSA Jahan

Rice Farming Systems Division

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SUMMARY

In four crops cropping patterns trial, the highest rice equivalent yield (REY) of 30.39 t/ha, gross margin (GM) of 5,72,000 Tk/ha and MBCR (3.01) were found in Tomato-Mungbean-T. Aus-T. Aman cropping pattern.

In three crops cropping pattern trial, the highest REY (35.56 t/ha), GM (8,11,000 Tk/ha) and MBCR (9.89) was found in Onion-Jute-T. Aman (CP₃) cropping pattern followed by Potato-Boro -T. Aman (CP₃) cropping pattern (REY 17.81 t/ha, GM= Tk. 393000 and MBCR 3.41).

There was no remarkable difference in grain yield of BRRI dhan74 and BRRI dhan98 between the recommended dose and pattern-based dose. But grain yield was comparatively lower in BARC Khamari app dose. Regarding nitrogen application timing, applying a portion of the nitrogen (25%-33%) as a basal treatment significantly improved the grain yield compared to the recommended practice.

Older seedlings and or with laddering performed better than younger seedlings in BRRI dhan71 and just opposite scenario had been found in BRRI dhan75. BRRI dhan71 yielded better in both 30-day old seedling & 40-day old seedling; BRRI dhan75 only in 20-day old seedling.

BRRI hybrid dhan8-Fallow-BRRI dhan95 sequences turned out 13.41 t ha⁻¹ grain yield, which was 23.71% higher than the existing crop sequence.

Inclusion of T. Aus in Watermelon-Fallow-T. Aman cropping pattern increase the total rice productivity (TRP) by 104.0%.

A study at BRRI HQ, Gazipur transformed waterlogged fallow land into an integrated agroforestry and fishery system using vegetables, fruit trees, and fish. In the Rabi season, 188.89 kg/dec. of vegetables were harvested, yielding a gross return of Tk. 8861, with tomato being the highest-yielding crop. Mango and jujube were the top-performing fruits, producing 90 kg and 75 kg, respectively. Fish cultivation in ditches showed the highest yields in ditch 6 (38 kg) and ditch 3 (32 kg). The system demonstrated the economic potential of utilizing waterlogged lands for year-round production.

A waterlogged was transformed into a three-tier integrated system consisting of a dyke, shallow pond, and canal to support rice, fish, vegetable, and fruit cultivation. High-yield rice varieties were grown in the lowland, while vegetables and papaya thrived on the dykes. Monosex tilapia, sorputi, and mirror carp were reared in canals, though most escaped due to flooding. Grain yields reached 9.65 t/ha, with gross margins up to Tk 1,88,750 in CP₂. The Tomato-Okra pattern produced the highest vegetable return.

In Charamoddi, Barishal, improved cropping patterns—Boro, Mungbean, or Sweet Gourd followed by fallow and T. Aman—were tested against the existing Fallow-Fallow-T. Aman system. The Sweet Gourd-Fallow-T. Aman pattern proved most profitable, yielding a rice equivalent of 16.4 t/ha and a gross margin of Tk 4,27,690 /ha. T. Aman yields from improved varieties were significantly higher than local ones. The inclusion of rabi crops boosted both productivity and profitability.

A study in Vorpasha, Barishal introduced Aus rice into the traditional Mungbean-Fallow-T. Aman system, creating a new Mungbean-Aus-T. Aman pattern. This improved system yielded higher rice equivalent output (13.71 t/ha) and a gross margin of Tk 1,72,260/ha, with an MBCR of 2. Aus varieties BRRI dhan98 and dhan48 outperformed BRRI dhan83. Improved T. Aman varieties also yielded more than the local Dudhkolom, increasing cropping intensity and farm income.

A trial of 60 bigha land in fringe land were conducted in Borkol, Rangamati district to find out the suitable Boro rice varieties. Among the tested five varieties, BRRI dhan74 gave significantly higher yield (6.06 t/ha) and farmers are highly satisfied with this variety. BRRI dhan100 showed less performance in the fringe land.

A total of 30 trials in Jhum cultivation system were conducted in different upazilas of Khagrachhari, Rangamati and Bandarban districts under Chittagong Hill Tracts. The highest grain yield obtained from BRRI dhan83 (3.89 t/ha) in the Jhum system of different upazilas of CHT.

The introduction of short-duration, high-yielding varieties BARI Sarisha-14 and BARI Sarisha-17 into the Boro-Fallow-T. Aman cropping pattern was demonstrated in Dhanbari (Tangail), Kaliganj (Gazipur), Sadar (Rangpur) and Horinakundo (Jhenaidah) to improve productivity, profitability, and cropping intensity. Additionally, BARI Surjomukhi-3 was introduced into Boro-Fallow-T. Aman cropping pattern in Kaliganj, Gazipur. During the Aman season, BRRI dhan71, 75, and 103 were cultivated; while BRRI dhan74, 98, 100, 102, 104, 105, 107, and 108 were used in the Boro season under improved crop management practices. These interventions resulted in 20-59% higher REY and 08-40% higher gross margin compared to the existing cropping pattern

A trial was conducted at Beltoli, Sadar Upazila of Mymensingh district to intensify the Boro-Fallow-T. Aman cropping pattern with Aus rice inclusion. The highest grain yield (19.09 t/ha) was obtained from BRRI dhan100-BRRI dhan98-BRRI dhan103 and BRRI dhan102-BRRI dhan98-BRRI dhan103 (19.06) which is 69% higher than existing two-rice system. Inclusion of Aus rice and replacement of existing Boro and T. Aman varieties generated an MBCR of 2.86.

A trial was conducted in Moulavipara, Sadar, Panchagarh to improve the existing cropping pattern by introducing new (pair row) cropping system. It is found that potato at rabi and maize at kharif season yielded better total productivity than traditional maize cultivation.

The study was conducted involving three trials in Kamolganj upazila of Moulavibazar district. In activity I, Fallow-BRRI dhan98-BRRI dhan103 gave the highest system yield (11.09 t/ha), while CP₅ (Fallow-Fallow-T. Aman) had the lowest system yield (4.35 t/ha). In another activity, among the eight cropping patterns, BARI Sarisha18-BRRI dhan98-BRRI dhan103 provided the maximum turnout of 15.32 t/ha; the existing CP₉: Fallow-Fallow-Ranjit Swarna yielded the lowest system yield (4.32 t/ha). In the Kandigaon site, the (ICP) improved cropping pattern, BARI Sarish-14-Fallow-BRRI dhan103 gave 9.67 t/ha system yield, with an MBCR 2.96.

In Kaliganj, Gazipur, trials on the introduction of new BRRI rice varieties were conducted to enhance double and single rice-based cropping systems. In

the double rice system, using BRRI dhan100, 102, 105 for Boro and BRRI dhan71, 103 for T. Aman yielded a gross margin of Tk 1,42,000/ha and an MBCR of 5.07. For the single rice system, BRRI dhan92, 102, 114 achieved a gross margin of Tk 89,000/ha and a higher MBCR of 5.80. These results indicate that integrating improved rice varieties significantly boosts productivity and profitability, with the single rice system showing particularly high-cost efficiency. Moreover, the productivity of the mixed orchard was increased with the introduction of vegetables and spices. Different crops, homestead vegetables, livestock, fisheries and agroforestry interventions were made with ten small and marginal category farmers to monitor the whole farm activities of the intervened farmers.

CROPPING PATTERN DEVELOPMENT FOR FAVORABLE ECOSYSTEM

Performance evaluation of four-cropped cropping pattern for irrigated medium-high land ecosystem

An experiment was conducted at the BRRI research farm, Gazipur during 2024-25 to compare the yield and profitability of four-cropped cropping patterns viz. CP₁: Tomato (BARI Tomato-14)-Mungbean (BARI Mung-6)-T. Aus (BRRI dhan98)-T. Aman (BRRI dhan75), CP₂: Mustard (BARI Sarisha-14)-Boro (BRRI dhan88)-T. Jute (BJRI Tossa Pat-8)-T. Aman (BRRI dhan71), CP₃: Mustard (BARI Sarisha-14)-Mungbean (BARI Mung-6)-T. Aus (BRRI dhan98)-T. Aman (BRRI dhan71), CP₄: Potato (Asterix)\Pumpkin (Hybrid)-T. Aus (BRRI dhan98)-T. Aman (BRRI dhan90), CP₅: Potato (Asterix)+Maize (BARI Hybrid Maize-16)-T. Aus (BRRI dhan98)-T. Aman (BRRI dhan71), CP₆: Mustard (BARI Sarisha-14)-Vegetable (Indian spinach)-T. Aus (BRRI dhan98)-T. Aman (BRRI dhan71) against the CP₇: Mustard (BARI Sarisha-14)-Boro (BRRI dhan88)-T. Aman (BRRI dhan75) cropping pattern. The yield of each crop was converted to rice equivalent yield (REY) for computing the system productivity. MBCR (Marginal Benefit Cost Ratio) was calculated using following equation:

$$\text{MBCR} = \frac{GR(\text{Improved}) - GR(\text{Existing})}{TVC(\text{Improved}) - TVC(\text{Existing})}$$

Among the tested cropping patterns, the highest rice equivalent yield (REY) of 30.39 t/ha, gross margin (GM) of 5,72,000 Tk/ha and MBCR of 3.01 were found in Tomato-Mungbean-T. Aus-T. Aman cropping pattern

Performance of three-cropped cropping patterns for irrigated medium high land ecosystem

The experiment was conducted at BRRI research farm, Gazipur to evaluate the agronomic and economic performance of three-cropped cropping patterns. Eight cropping patterns of CP₁: Boro (BRRI dhan88)-T. Aus (BRRI dhan98)-T. Aman (BRRI dhan75), CP₂: Mustard (BARI Sarisha-14)-Boro (BRRI dhan88)-T. Aman (BRRI dhan75), CP₃: Potato (Asterix)-Boro (BRRI dhan88)-T. Aman (BRRI dhan95), CP₄: Wheat (BARI Gom-33)-Mungbean (BARI Mung-6)-T. Aman (BRRI dhan75), CP₅: Sunflower (BARI Surjamukhi-3)-T. Aus (BRRI dhan98)-T. Aman (BRRI dhan75), CP₆: Onion (BARI Pij-4)-Jute (BJRI Tossa Pat-8)-T. Aman (BRRI dhan103), CP₇: Lentil (BARI Mashur-8)-T. Aus (BRRI dhan98)-T. Aman (BRRI hybrid dhan6) and CP₈: Boro (BRRI dhan92)-Fallow-T. Aman (BRRI dhan49) (check) were tested. The highest REY (35.56 t/ha), GM (8,11,000 Tk/ha) and MBCR (9.89) was found in Onion-Jute-T. Aman (CP₃) cropping pattern followed by Potato-Boro -T. Aman (CP₃) cropping pattern (REY 17.81 t/ha, GM= Tk. 393000 and MBCR 3.41).

Determination of optimum planting window of newly released rice varieties in Mustard-Boro-T. Aman cropping system

Effect of fertilizer management of late Boro rice under Potato -Boro -T. Aman/Mustard-Boro-T. Aman cropping Pattern

An experiment was conducted at East Byde in Boro season, 2025 at BRRI farm, Gazipur. The experiment was laid on a split-plot design with fertilizer management options (F₁ = Recommended dose, F₂ = Pattern based dose, F₃ = BARC Khamari App dose) as the main plot and nitrogen fertilizer application schedule (N₁= $\frac{1}{4}$ N basal + $\frac{1}{4}$ N top dress at active tillering + $\frac{1}{4}$ N top dress at maximum tillering + $\frac{1}{4}$ N top dress before 5 days at PI, N₂= $\frac{1}{3}$ N basal + $\frac{1}{3}$ N top dress at maximum tillering + $\frac{1}{3}$ N top dress before 5 days at PI, N₃= $\frac{1}{3}$ N top dress at 7 DAT + $\frac{1}{3}$ N top dress at maximum tillering + $\frac{1}{3}$ N top dress before 5 days at PI) as subplots. The results showed that there was no statistical variation in the recommended dose (F₁) and pattern-based dose (F₂) of fertilizer on grain yield of BRRI dhan74 under Potato-Boro-T. Aman cropping pattern. (Table 1). But grain yield reduced in case of BARC Khamari app dose (F₃). In case of Mustard-Boro-T. Aman cropping pattern, recommended dose performed better compared with pattern based and Khamari App treatment (Table 2). In case of nitrogen fertilizer application schedule, for both variety grain yield more or less similar for N₁ & N₂. For both varieties, grain yield appears to be higher in case of N₁ & N₂ but less in N₃. Applying a split of basal nitrogen is economically fruitful for both varieties. According to the experimental findings, it may be concluded that use of pattern-based fertilizer dose with splitting of basal nitrogen is economically viable for late boro rice

Table 1. Effect of fertilizer managements on grain yield of late Boro rice under Potato-Boro-T. Aman cropping pattern, BRRI, Gazipur, 2025

Treatments	Grain Yield (t/ha)					
	BRRI dhan74			BRRI dhan98		
	N ₁	N ₂	N ₃	N ₁	N ₂	N ₃
F ₁	5.67 a	5.58 a	5.56 b	5.58 b	5.74 a	5.57 b
F ₂	5.61 a	5.15 b	6.45 a	5.78 a	5.65 a	5.97 a
F ₃	5.12 b	5.11 b	5.24 c	5.65 ab	4.62 b	5.63 b
CV (%)	5.5			5.58		

*Means with the same letter are not significantly different at P<0.05

Table 02. Effect of fertilizer managements on grain yield of late Boro rice under Mustard-Boro-T. Aman cropping pattern , BRRI, Gazipur, 2025

Treatments	Grain Yield (t/ha)		
	BRRI dhan74		
	N ₁	N ₂	N ₃
F ₁	6.23 a	6.08 a	5.38 a
F ₂	5.66 b	5.76 c	5.22 b
F ₃	5.54 b	5.92 b	5.10 b
CV (%)	5.66		

*Means with the same letter are not significantly different at P<0.05

Management of aged seedling to minimize the yield loss of T. Aman rice

The experiment was conducted with two rice varieties of BRRI dhan71 and BRRI dhan75 at East Byde and West Byde in T. Aman season, 2024 at BRRI farm, Gazipur. The experiment was set up using a split plot design with three replications, with the main plots fertilizer management (F₁= Recommended dose, F₂= Recommended dose + 20% Nitrogen, F₃= Recommended dose + 40% Nitrogen) and the subplots seedling age (S₁ = 20-day old seedling, S₂ = 30-day old seedling, S₃ = 40-day old seedling, S₄ = 30-day old seedling + laddering at 10 DAT, S₅ = 40-day old seedling + laddering at 10 DAT). The grain yield of BRRI dhan71 and BRRI dhan75 was shown to be non-significant by fertilizer management treatment. In both varieties grain yield was significantly impacted by seedling age

treatment. The result showed that BRRI dhan71 gave the significantly higher grain yield (4.66 t/ha) in in S₅ treatment (40-day-old seedlings with laddering at 10 DAT (Table 3). The result also showed that S₃ and S₄ gave identical grain yield where both the treatment gave higher yield than S₁ and S₂. The scenario was changed in case of BRRI dhan75. In BRRI dhan75, laddering practice showed no statistical significance on grain yield but seedling age affected on grain yield. Twenty days old seedling (S₁) performed higher yield (4.55 t/ha) followed by 30 days old seedling (4.22 t/ha) plus laddering at 10 DAT treatment (S₄) (Table 4). The lowest grain yield of BRRI dhan75 was found in 30 days old seedling (S₂) treatment which is also statistically differ from S₄ treatment indicated that older seedlings with puddling have some positive effect on grain yield of rice.

Table 03. The yield performance of BRRI dhan71 aged seedlings using crop management techniques and nitrogen fertilizer, BRRI, Gazipur, 2024

Treatment	Grain Yield (t/ha)
S ₁ = 20-day old seedling	3.70 c
S ₂ = 30-day old seedling	3.65 c
S ₃ = 40-day old seedling	4.10 b
S ₄ = 30-day old seedling + laddering at 10 DAT	4.31 b
S ₅ = 40-day old seedling + laddering at 10 DAT	4.66 a
CV%	9.3

*Means with the same letter are not significantly different at P<0.05

S₁ = 20-day old seedling, S₂ = 30-day old seedling, S₃ = 40-day old seedling, S₄ = 30-day old seedling + laddering at 10 DAT, S₅ = 40-day old seedling + laddering at 10 DAT

Table 04. The yield performance of BRRI dhan75 aged seedlings using crop management techniques and nitrogen fertilizer, BRRI, Gazipur, 2024

Treatment	Grain Yield (t/ha)
S ₁ = 20-day old seedling	4.55 a
S ₂ = 30-day old seedling	3.64 c
S ₃ = 40-day old seedling	3.98 bc
S ₄ = 30-day old seedling + laddering at 10 DAT	4.22 ab
S ₅ = 40-day old seedling + laddering at 10 DAT	4.17 ab
CV%	7.3

*Means with the same letter are not significantly different at P<0.05

S₁ = 20-day old seedling, S₂ = 30-day old seedling, S₃ = 40-day old seedling, S₄ = 30-day old seedling + laddering at 10 DAT, S₅ = 40-day old seedling + laddering at 10 DAT

Evaluation of newly released BRRI varieties under Boro-Fallow-T. Aman cropping pattern

A study was conducted to determine the suitable crop sequence with newly released BRRI rice varieties in Boro-Fallow-T. Aman cropping pattern at BRRI, Gazipur. Five T. Aman varieties and five Boro varieties, viz. BRRI dhan71, BRRI dhan75, BRRI dhan87, BRRI dhan95 and BRRI dhan103 in T. Aman season and BRRI dhan98, BRRI dhan100, BRRI dhan107, BRRI hybrid dhan7 and BRRI hybrid dhan8 were transplanted in Boro season. Twenty five combinations of cropping patterns (CP) of CP₁: BRRI dhan71-Fallow-BRRI dhan98, CP₂: BRRI dhan71-Fallow-BRRI dhan100, CP₃: BRRI dhan71-Fallow-BRRI dhan107, CP₄: BRRI dhan71-Fallow-BRRI hybrid dhan7, CP₅: BRRI dhan71-Fallow-BRRI hybrid dhan8, CP₆: BRRI dhan75-Fallow-BRRI dhan98, CP₇: BRRI dhan75-Fallow-BRRI dhan100, CP₈: BRRI dhan75-Fallow-BRRI dhan107, CP₉: BRRI dhan75-Fallow-BRRI hybrid dhan7, CP₁₀: BRRI dhan75-Fallow-BRRI hybrid dhan8, CP₁₁: BRRI dhan87-Fallow-BRRI dhan98, CP₁₂: BRRI dhan87-Fallow-BRRI dhan100, CP₁₃: BRRI dhan87-Fallow-BRRI dhan107, CP₁₄: BRRI dhan87-Fallow-BRRI hybrid dhan7, CP₁₅: BRRI dhan87-Fallow-BRRI hybrid dhan8, CP₁₆: BRRI dhan95-Fallow-BRRI dhan98, CP₁₇: BRRI dhan95-Fallow-BRRI dhan100, CP₁₈: BRRI dhan95-Fallow-BRRI dhan107, CP₁₉: BRRI dhan95-Fallow-BRRI hybrid dhan7, CP₂₀: BRRI dhan95-Fallow-BRRI hybrid dhan8, CP₂₁: BRRI dhan103-Fallow-BRRI dhan98, CP₂₂: BRRI dhan103-Fallow-BRRI

dhan100, CP₂₃: BRRI dhan103-Fallow-BRRI dhan107, CP₂₄: BRRI dhan103-Fallow-BRRI hybrid dhan7 and CP₂₅: BRRI dhan103-Fallow-BRRI hybrid dhan8 were tested in this experiment. BRRI dhan49-Fallow-BRRI dhan29 (CP₂₆) cropping pattern was considered as the control pattern. Among the twenty-six combinations of Boro and T. Aman varieties, the highest total grain yield (13.41 t/ha) was attained from CP₂₀ followed by CP₂₅ (12.80 t/ha). The lowest total grain yield was attained from CP₄ (9.67 t/ha), statistically similar total grain yield was found from CP₁₄ (9.74 t/ha) and CP₉ (9.84 t/ha). Cost and return analysis showed that CP₂₀ had the maximum GM (2,27,643 Tk/ha) with the highest MBCR (86.32). And the lowest MBCR (-118.68) was recorded in CP₁₀. Whereas the minimum gross margin was recorded in CP₄ (91,990 Tk ha⁻¹), followed by CP₁₄ (95,433 Tk/ha)

DEVELOPMENT OF CROPPING PATTERN FOR STRESS PRONE ENVIRONMENT

Improvement of Boro-Fallow-T. Aman cropping pattern with BRRI newly released rice varieties

The study was conducted in the farmers' field of Batiaghata upazila of Khulna district during 2024-2025. The proposed cropping pattern Boro-Fallow-T. Aman was improved with BRRI newly released rice varieties to maximize the productivity and farm income with ten replicated farmers. Salt tolerant modern Boro variety and HYV Aman variety were included to construct the cropping pattern treatments are Proposed (CP₁): Boro (BRRI dhan99)-Fallow-T.

Aman (BRRI dhan103) and Existing (CP₂): Boro (BRRI dhan28/hybrid)-Fallow-T. Aman (local Ranisalute)

Ten different farmers' fields were used in the trial where each field was considered as one replication.

The average grain yield of salt tolerant Boro variety BRRI dhan99 was 7.41 t/ha against BRRI dhan28 (5.07 t/ha). On the other hand, the average grain yield of BRRI dhan103 was 5.01 t/ha against the local variety Ranisalute (2.22 t/ha). The results showed that maximum gross margin (179,000 Tk/ha) and MBCR (2.09) obtained from the cropping pattern BRRI dhan99-Fallow-BRRI dhan103 cropping pattern against the existing BRRI dhan28-Fallow-Ranisalute cropping pattern

Intensification of Watermelon-Fallow-T. Aman cropping pattern by inclusion of Aus rice

The study was conducted in the farmers' field of Batiaghata upazila in Khulna district during 2024-25 to evaluate the performance and profitability of Aus variety in Watermelon-Fallow-T. Aman cropping pattern. The treatments were evaluated as improved cropping pattern (ICP): Watermelon-T. Aus (BRRI dhan98)-T. Aman (BR10) and existing cropping pattern (ECP): Watermelon-Fallow-T. Aman (BR10)

Ten different farmers' fields were used in the trial where each field was considered as one replication.

In T. Aman season, the average yield of BR10 was 6.10 t/ha under Watermelon-T. Aus -T. Aman

cropping pattern. Yield of watermelon was extremely poor because of very less fruit setting. Yield of T. Aus rice (BRRI dhan98) in improved cropping pattern was 5.25 t/ha which caused increased the total rice productivity (TRP) of 104.0%. Total rice productivity (TRP), Gross Margin and MBCR were (10.7 t/ha), 1,29,760 (tk/ha) and (1.82) respectively in the Watermelon-T. Aus-T. Aman cropping pattern.

Modification of waterlogged fallow land into integrated agroforestry and fishery production system

A study was conducted at BRRI HQ, Gazipur to bring waterlogged fallow land under year-round integrated production system with six different combinations of crops and vegetables, fruit trees and fishes. A total of 188.89 kg/dec. vegetables in rabi season were produced, from which the gross return of Tk. 8861 was obtained (Table 5). The highest production was obtained from tomato (74.57 kg/dec.) during Rabi season. In the kharif season, there was no crop due to field development. Among the various fruit trees, the highest production was obtained from Mango (90 kg), followed by Jujube (75 kg), achieving a gross return of Tk. 9000 and Tk. 5250 respectively (Table 6). There were no crops on the trellis as well. In the ditches, different combinations of fish species were introduced with different stocking densities. Though some fish got away due to inundation, among the rest of the fish species (Silver carp + Sorputi + Tilapia + Rui), ditch 6 contained the highest production (38 kg), followed by ditch 3 (32 kg)

Table 5. Productivity and profitability scenario of year-round vegetables production at dykes under integrated agroforestry and fishery production system, BRRI, Gazipur, 2024-25

Rabi crops	Production (Kg/decimal)	Gross return (Tk/decimal)
Red amaranth	18.72	842
Spinach	18.32	733
Tomato	74.57	3729
Coriander leaf	7.78	1167
Cabbage	64.34	1287
Field pea	11.75	1175
Total	188.89	8861

Price (Tk/Kg): Red amaranth=45, Spinach=40, Tomato=50, Coriander leaf=150, cabbage=20, Field pea=100

Table 6. Productivity and profitability scenario of fruits production at dykes under integrated agroforestry and fishery production system, BRRI, Gazipur, 2024-25

Pattern	Fruit	Production (kg)	No. of trees	Production (kg/tree)	GR (Tk.)
1	Dragon Fruit	5*	30	-	750
2	Malta	**	25	-	-
3	Guava	26*	25	-	1300
4	Custard apple	**	25	-	-
5	Jujube	75	25	3.00	5250
6	Mango	90	25	3.60	9000
7	Lemon	6*	25	-	
Total		202	180	6.60	16300

*Fruits are not completely harvested. **Fruit was not harvested during the reporting period. Planting date: 12-20 June 2022, Price (Tk./kg): Dragon Fruit=150, Guava=50, Jujube=70, Mango=100, Lemon=80

Transformation of waterlogged wetland into three-tier production system for integrated rice-fish, vegetables and fruit cultivation

A Waterlogged marshy fallow land (12.02 decimal) was converted to a three-tier production system, i.e., dyke (3.64 decimal), shallow pond (4.83 decimal) and canal around the pond (3.57 decimal) for integrated rice+fish, vegetables, and fruit cultivation. In the lowland area, BR23 and BRRI dhan30 were cultivated in T. Aman season and BRRI dhan92 in the Boro season. Different rabi and kharif vegetables and year-round papaya were cultivated in the dykes (Papaya plants died due to waterlogging).

Monosex tilapia, sorputi, and mirror carp were reared in the canal. From the shallow pond, the CP₁ and CP₂ cropping patterns yielded 9.30 to 9.65 t ha⁻¹ of grain with a gross margin of 1,67,000 Tk. ha⁻¹ and 1,88,750 Tk. ha⁻¹, respectively. From cost and return analysis, BCR 1.11 was found from CP₂, whereas CP₁ showed 1.02 (Table 7). Overall, 676 kg of rabi and 369.42 kg of kharif vegetables per decimal were obtained from the dykes. The highest gross return (14,800 Tk) was obtained from the Tomato-Okra pattern. Thirty fingerlings of monosex tilapia, sorputi and mirror carp were released per decimal area, but due to inundation, they escaped.

Table 7. Yield and profitability of Boro-Fallow-T. Aman cropping patterns in waterlogged wetland ecosystem, BRRI, Gazipur, 2023-24

Treatment	Boro	T. Aman	Total grain Yield (t ha ⁻¹)	TVC ('000 Tk. ha ⁻¹)	GM ('000 Tk. ha ⁻¹)	BCR
CP ₁ : BRRI dhan92 -Fallow-BRRI dhan30	6.10	3.2	9.30	167	171.3	1.02
CP ₂ : BRRI dhan92 -Fallow-BR23	6.15	3.5	9.65	170	188.75	1.11
CV (%)	1.63	11.17	3.95			

Mean difference was non-significant. Price (Tk./kg): Rice=30, Straw: Boro=2, Aman=6

Improvement of Fallow-Fallow-T. Aman cropping pattern by inclusion of Boro rice/Mungbean/Sweet

Gourd in non-saline tidal ecosystem

The study was conducted in the farmers' field of Charamoddi, Bakerganj, Barishal during 2024-25. The improved cropping pattern Boro/Mungbean/Sweet Gourd-Fallow-T. Aman was compared to the existing Fallow-Fallow-T. Aman cropping pattern to maximize the productivity and farm income in the non-saline tidal ecosystem. In T. Aman season, the average yield of BR30 and BRRI

dhan52 was 4.37 t/ha against the local variety (Moulota) (2.13 t/ha). This yield was slightly lower due to insect attack. The average yield of Boro rice, Mungbean, and Sweet gourd were 6.36, 1.40, and 14.23 t/ha which were cultivated in fallow period. The maximum Rice Equivalent Yield (REY) (16.4 t/ha), Gross Margin (4,27,690 Tk/ha) and MBCR (4.5) were obtained from the Sweet gourd-Fallow-T. Aman cropping pattern against the existing one (Table 8).

Table 8. Yields and economic analysis of different crops under Boro/Mungbean/Sweet Gourd-Fallow-T. Aman cropping pattern Charamoddi, Bakerganj, Barishal, 2024-2025

Cropping pattern	Yield (t/ha)				REY (t/ha)	TVC ('000 Tk/ha)	GR ('000 Tk/ha)	GM ('000 Tk/ha)	MB CR
	Boro	Mug bean	Sweet gourd	T. Aman					
ICP 1: Boro (BRRI dhan74)-Fallow-T. Aman (BR23/BRRI dhan52)	6.36	-	-	4.35 a	10.7 b	212.00	392.85	180.85	1.64
ICP 2: Mungbean (BARI Mung-6)-Fallow-T. Aman (BR23/BRRI dhan52)	-	1.40	-	4.36 a	9.65 b	208.08	336.96	171.12	1.35
ICP 3: Sweet gourd (Victoria black/Victoria Super)-Fallow-T. Aman (BR23/BRRI dhan52)	-	-	14.23	4.40 a	16.4 a	136.92	564.61	427.69	4.5
ECP: Fallow-Fallow-T. Aman (Moulota)	-	-	-	2.13 b	2.67 c	36.45	104.37	67.92	-
CV (%)				3.47	10.97				

Means with the same letter(s) are not significantly different.

ICP=Improved Cropping Pattern, ECP=Existing Cropping Pattern, REY=Rice Equivalent Yield, TVC=Total Variable Cost, GR=Gross Return, GM=Gross Margin, MBCR=Marginal Benefit Cost Ratio

Price (Tk/kg): Rice = 32, Rice (Moulota)=40; Mungbean = 113; Sweet gourd = 27; Straw: Aman=6, Boro=2

Improvement of Mungbean-Fallow-T. Aman cropping pattern by the inclusion of Aus rice in non-saline tidal ecosystem

The study was conducted in the farmers' field of Vorpasha, Bakerganj, Barishal during 2024-25. The improved cropping pattern Mungbean-Aus-T. Aman was compared to the existing Mungbean-Fallow-T. Aman cropping pattern. In case of Aus rice, BRRI dhan98 (4.17 t/ha) and BRRI dhan48 (4.08 t/ha) performed better than BRRI dhan83 (3.21 t/ha). In T. Aman season, the average yield of BR23 was 4.38 t/ha against the local variety (Dudhkolom) (1.92 t/ha). The average yield of Mungbean is 1.46 t/ha. The Rice Equivalent Yield (REY) (13.71 t/ha) and Gross Margin (1,72,260 Tk/ha) were obtained higher from the Mungbean-Aus-T. Aman cropping pattern (MBCR 2) against the existing one (Table 9).

Table 9. Yields and economic analysis of different crops under Mungbean-Aus-T. Aman cropping pattern Vorpasha, Bakerganj, Barishal, 2024-2025

Cropping pattern	Yield (t/ha)			REY (t/ha)	TVC (‘000 Tk/ha)	GR (‘000 Tk/ha)	GM (‘000 Tk/ha)	MB CR
	Mungbean	Aus	T. Aman					
ICP : Mungbean (BARI Mung-6)- Aus (BRRI dhan48/ BRRI dhan83/ BRRI dhan98)-T. Aman (BR23)	1.46 a	3.82	4.38 a	13.71 a	306	478.26	172.26	2
ECP: Mungbean (Local)-Fallow-T. Aman (Dudhkolom)	0.75 b	-	1.92 b	5.04 b	150	178.83	28.83	-
CV (%)	9.27		18	7.8				

Means with the same letter(s) are not significantly different.

ICP=Improved Cropping Pattern, ECP=Existing Cropping Pattern, REY=Rice Equivalent Yield, TVC=Total Variable Cost, GR=Gross Return, GM=Gross Margin, MB CR=Marginal Benefit Cost Ratio

Price (Tk/kg): Rice = 32, Rice (Dudhkalom)=40; Mungbean = 113; Straw: Boro=2, Aus=2, Aman=6

DEVELOPMENT OF CROPPING SYSTEM TECHNOLOGIES FOR HILL ECOSYSTEM

Exploring the hills for rice research: Feasibility of Boro rice cultivation in fringe land at Rangamati district

A trial of 60 bigha land in fringe land cultivation system were conducted in Borkol upazila of Rangamati district in Boro 2024-25. Promising modern rice varieties like BRRI dhan74, BRRI dhan92, BRRI dhan96, BRRI dhan100 and BRRI dhan102 were evaluated in culturable waste of fringe land of Kaptai Lake. Here varieties indicate treatment and each variety replicated to twelve farmers. The varietal effect in term of grain yield is statistically significant. Among the five varieties BRRI dhan74 performed the highest grain yield (6.06 t/ha). There is no statistical significance among BRRI dhan92 (5.16 t/ha), BRRI dhan96 (5.09 t/ha) and BRRI dhan102 (5.20 t/ha) while the grain yield was significantly lower in BRRI dhan100 (4.86 t/ha).

Improvement of Jhum production system through the introduction of modern HYV Aus varieties in hilly areas

A study was conducted in different upazilas of Khagrachhari (Sadar and Panchhari), Rangamati (Baghaichhari and Naniarchor) and Bandarban (Sadar and Rma) districts in Aus 2024 to evaluate the yield performance of high yielding Aus (BRRI

dhan48, BRRI dhan82 and BRRI dhan83) varieties against farmers adopted local rice varieties for jhum system. The average grain yields of BRRI dhan48, BRRI dhan82 and BRRI dhan83 were 3.74 t/ha, 3.55 t/ha and 3.89 t/ha, respectively. Mongthongno, Ranqui, and Kanbui yielded better among the local varieties.

VALIDATION AND DELIVERY OF CROPPING SYSTEM TECHNOLOGY

Intensification of Boro-Fallow-T. Aman cropping pattern through integration of mustard/sunflower

The introduction of short-duration, high-yielding varieties BARI Sarisha-14 and BARI Sarisha-17 into the Boro-Fallow-T. Aman cropping pattern was demonstrated in Dhanbari (Tangail), Kaliganj (Gazipur), Sadar (Rangpur) and Horinakundo (Jhenaidah) to improve productivity, profitability, and cropping intensity. Additionally, BARI Surjomukhi-3 was introduced into Boro-Fallow-T. Aman cropping pattern in Kaliganj, Gazipur. During the Aman season, BRRI dhan71, 75, and 103 were cultivated; while BRRI dhan74, 98, 100, 102, 104, 105, 107, and 108 were used in the Boro season under improved crop management practices. These interventions resulted in 20-59% higher REY and 08-40% higher gross margin compared to the existing cropping pattern (Table 10).

Table 10. Grain yield and profitability of different cropping patterns, 2024-25

Location		Grain yield (t/ha)				REY (t/ha)	TVC	GM	MBCR
		Mustard/	Sunflower	Boro	T. Aman		(‘000 Tk/ha)	(‘000 Tk/ha)	
Mustard-Boro-T. Aman									
Dhanbari, Tangail	ICP	1.52		7.60	6.37	18.82a	276	194	1.47
	ECP	-		6.27	5.58	11.85b	157	139	-
Kaliganj, Gazipur	ICP	1.53		5.96	5.04	15.09a	376	171	1.20
	ECP	-		6.81	5.73	12.54b	306	157	-
Sadar, Rangpur	ICP	1.27		7.36	5.48	16.25a	370	165	1.17
	ECP	-		7.69	5.90	13.59b	300	153	-
Horinakundo, Jhenaidah	ICP	1.55		6.70	5.68	15.82a	346	256	2.47
	ECP			6.46	6.23	12.69b	302	191	-
Sunflower-Boro-T. Aman									
Kaliganj, Gazipur	ICP	2.34		5.66	4.99	16.21a	441	112	1.21
	ECP	-		6.75	3.98	10.70b	299	83	-

Price (Tk/Kg): Boro = 25 to 35, T. Aman = 25 to 32.5, Boro straw= 2-3, T. Aman straw= 5-7, Mustard= 80, Sunflower= 80, Stover (mustard and sunflower) = 2-3

Intensification of Boro-Fallow-T. Aman cropping pattern through the inclusion of mustard in irrigated ecosystem of Madhupur Tract

This study was conducted at three different villages of Madhupur Tract during 2024-25. BRRI dhan75, and BRRI dhan103 were cultivated in T. Aman season where BRRI dhan102, BRRI dhan104, BRRI dhan105 and BRRI dhan108 were grown in Boro season under improved cropping patterns. The tested cropping patterns (CP) were CP1: BRRI dhan75-Mustard-BRRI dhan102, CP2: BRRI dhan75-Mustard-BRRI dhan104, CP3: BRRI dhan75-Mustard-BRRI dhan105, CP4: BRRI dhan75-Mustard-BRRI dhan108, CP5: BRRI dhan103-Mustard-BRRI dhan102, CP6: BRRI dhan103-Mustard-BRRI dhan104, CP7: BRRI dhan103-Mustard-BRRI dhan105, CP8: BRRI dhan103-Mustard-BRRI dhan108 and CP9: BRRI dhan49-Fallow-BRRI dhan28 (ck). The highest rice equivalent yield (REY) (19.67 t/ha) was observed in CP4 followed by the pattern CP8 (19.30 t/ha), CP1 (19.14 t/ha) and CP (19.07 t/ha) (Table 14). The lowest REY was observed in CP9 (11.85 t/ha). The

REY was statistically similar for the patterns CP3, CP6 and CP7. The highest gross margin (GM) was obtained from CP4 (2,15,400 Tk/ha) followed by CP8 (2,06,300 Tk/ha), CP1 (2,02,100 Tk/ha) and CP5 (2,00,400 Tk/ha). The lowest GM was observed in CP9 (1,39,100 Tk/ha). Findings revealed that crop productivity and profitability increased due to inclusion of mustard in lands those remain fallow after harvesting of T. Aman rice.

Improvement of Boro-Fallow-T. Aman cropping system through Aus inclusion and varietal replacement in irrigated ecosystem in Mymensingh region

The study was conducted in farmers' fields at Beltoli, Sadar, Mymensingh during 2024-25. BRRI released high-yielding rice varieties that were tested under proposed Boro-T. Aus-T. Aman cropping pattern against existing Boro-Fallow-T. Aman cropping system. During T. Aman season BRRI dhan71 and BRRI dhan103; during Boro season BRRI dhan100, BRRI dhan102 and BRRI dhan105 and in Aus season BRRI dhan98 were tested. Aus

rice was cultivated following farmers' practice with their existing varieties (Boro: Chokka (Hybrid) and T. Aman: BRRI dhan49). Individual crop yield and total grain yield (t/ha) of the cropping patterns are presented in Table 11. In Boro season, the highest grain yield was obtained from BRRI dhan102 (7.83 t/ha) in CP₄ cropping pattern while the lowest yield was found from the variety Chokka (Hybrid) (6.07 t/ha) in control treatment. In T. Aman season, the highest yield was obtained from BRRI dhan103 under CP₂ followed by BRRI dhan103 under CP₆ and CP₄. The lowest yield was obtained from BRRI dhan49 (5.21 t/ha) which is usually used by farmers under Boro-Fallow-T. Aman cropping pattern in the

study area BRRI dhan71 (5.13 t/ha). In consideration of the productivity, the highest grain yield (19.09 t/ha) was observed in CP₂ (BRRI dhan100-BRRI dhan98-BRRI dhan103) which is statistically similar with CP₄ (19.06 t/ha). Significantly the lowest total productivity (11.28 t/ha) was found from CP₇ (Check). In Aus season BRRI dhan98 yielded different grain in different cropping pattern treatment. Significantly highest grain yield was found in CP₃ (5.84 t/ha) and lowest in CP₁ (5.21 t/ha). The highest and lowest total productivity was found from CP₄ (19.09 t/ha) and CP₇ (11.28 t/ha) (Check).

Table 11. Yield of different rice varieties under specific cropping system, Beltoli, Sadar, Mymensingh, 2024-25

Cropping Pattern	Grain Yield (t/ha)			
	Boro	T. Aus	T. Aman	Total
CP ₁ : BRRI dhan100-BRRI dhan98-BRRI dhan71	7.51 b	5.21 d	5.13 f	17.85 e
CP ₂ :BRRI dhan100-BRRI dhan98-BRRI dhan103	7.12 c	5.54 c	6.43 a	19.09 a
CP ₃ : BRRI dhan102-BRRI dhan98-BRRI dhan71	7.54 b	5.84 a	5.39 d	18.77 b
CP ₄ :BRRI dhan102-BRRI dhan98-BRRI dhan103	7.83 a	5.70 b	5.53 c	19.06 a
CP ₅ : BRRI dhan105-BRRI dhan98-BRRI dhan71	6.93 e	5.71 b	5.28 de	17.92 d
CP ₆ :BRRI dhan105-BRRI dhan98-BRRI dhan103	6.81 e	5.69 b	6.19 b	18.69 c
CP ₇ :Chokka(Hybrid)-Fallow-BRRI dhan49 (Check)	6.07 f	-	5.21 ef	11.28 f
CV (%)	7.11	5.61	5.59	17.52

*Means with the same letter are not significantly different at P<0.05

From the cost and return analysis it was observed that the highest gross margin (GM) was obtained from CP₄ (2,87,000 Tk/ha) followed by CP₂ (2,81,000 Tk/ha) and CP₃ (2,73,000 Tk/ha) (Table 12). The lowest GM was observed in CP₇ (1,18,000 Tk/ha). The highest MBCR was obtained from CP₄ (2.86) followed by CP₂ (2.68). BRRI dhan103 in T. Aman season, BRRI dhan102 in Boro season and BRRI dhan98 in Aus

season were quite high yielders and cropping patterns with these varieties provided the higher yield and produced higher economic returns. Suitable rice varieties in Boro, Aus and T. Aman season along with recommended management practices, contributed to increased rice yield in improved cropping patterns that considerably maximized the system productivity. The straw price of Aman rice was higher than Boro and Aus straw.

Table 12. Cost-return analysis of different crops combinations under improved and existing cropping pattern, Beltoli, Sadar, Mymensingh, 2024-25

Cropping Pattern	GR (‘000 Tk/ha)	TVC (‘000 Tk/ha)	GM (‘000 Tk/ha)	MBCR
CP ₁ : BRRI dhan100-BRRI dhan98-BRRI dhan71	590	341	249	2.47
CP ₂ : BRRI dhan100-BRRI dhan98-BRRI dhan103	630	349	281	2.68
CP ₃ : BRRI dhan102-BRRI dhan98-BRRI dhan71	620	347	273	2.63
CP ₄ : BRRI dhan102-BRRI dhan98-BRRI dhan103	630	343	287	2.86
CP ₅ : BRRI dhan105-BRRI dhan98-BRRI dhan71	590	345	245	2.37
CP ₆ : BRRI dhan105-BRRI dhan98-BRRI dhan103	618	348	270	2.58
CP ₇ : Chokka(Hybrid)-Fallow-BRRI dhan4(Check)	370	252	118	0.00

*Price (Tk/kg): Rice = 32, Boro straw=5, Aus straw=5, Aman straw=8

Validation of Pair Row Potato + Pair Row Maize-T. Aus-T. Aman cropping pattern in Sadar, Panchagarh

A trial was conducted in farmers’ fields at Moulavipara, Sadar, Panchagarh during 2024-25 to improve the existing cropping pattern. The existing Maize-Fallow-T. Aman (CP₃) cropping pattern is modified to improved Pair row Potato + Pair row Maize –T. Aus-T. Aman (CP₁) and Potato-Maize-T. Aman (CP₂) cropping pattern. BRRI dhan103 in T. Aman season, BARI Alu-25 (Asterix) in rabi season, Raja 55 (Hybrid Maize) in kharif season and BRRI dhan98 in Aus season were tested in the improved cropping pattern. In pair row system T. Aus was

damaged due to extreme drought condition. The yield of individual potato and REY could not perform statistical analysis due to unbalanced data. But it is clear that individual potato yield is higher in CP₂ than pair row system and total productivity was also higher in CP₂. In case of maize yield, the scenario was changed. The yield of Maize statistically significant among the CP₁, CP₂ and CP₃. Highest yield was obtained in pair row system (15.19 t/ha) and lowest in CP₂ (13 t/ha). Consideration of time interval and further intervention of the cropping system, pair row system is a potential system. As the T. Aus did not perform, further trial may be conducted with suitable kharif crop in pair row system (Table 13).

Table 13. Yield of crops under different cropping patterns in Sadar, Panchagarh 2024-2025

Cropping Pattern	Yield (t/ha)			
	Potato	Maize	T. Aman	REY
CP ₁ : Pair Row Potato + Pair Row Maize-T. Aus-T. Aman (BRRI dhan103)	13.2	15.19 a	5.54 a	25.88
CP ₂ : Potato-Maize-T. Aman	27.9	13.00 c	5.35 b	30.62
CP ₃ : Maize-Fallow-T. Aman (Local)(ck)	-	14.37 b	3.67 c	17.14
CV (%)		14.19	4.86	

*Price (TK/kg): Rice=32, Straw=8, Potato=15, Maize=30, REY=Rice Equivalent Ratio

From the cost return analysis it was observed that the highest gross margin (GM) was obtained from CP₂ (7,50,000 Tk/ha) followed by CP₁ (6,18,00 Tk/ha. The lowest GM was observed in CP₃ (4,51,000 Tk/ha). The highest MBCR was obtained from CP₂ (3.77) followed by CP₁ (2.43).

Piloting of improved cropping pattern in rainfed lowland ecosystem in Sylhet region

(Utilization of fallow land to intensify the single T. Aman area and boost up the productivity in the Sylhet region)

A total of three trials were conducted in farmers' fields of Kamolganj, Moulovibazar. The first trial was conducted in sixty farmers' fields, in collaboration with DAE. The study was initiated to improve the single T. Aman cropping pattern in the Sylhet region. There are two ways for this improvement. One is the utilization of the fallow period through the inclusion of MV T. Aus and rabi crop, viz. mustard in kharif-I season and at the end of T. Aman season, respectively. The other way is the replacement of the existing T. Aman variety by high yielding modern variety. Two activities were done in the Konagaon village of the Adampur union. In activity-I, four cropping patterns (CP), viz. CP₁: Fallow-BRRI dhan98-BRRI dhan71, CP₂: Fallow-

BRRI dhan98-BRRI dhan75, CP₃: Fallow-BRRI dhan98-BRRI dhan95 and CP₄: Fallow-BRRI dhan98-BRRI dhan103 were tested against the existing CP₅: Fallow-Fallow-Ranjit swarna cropping pattern. BRRI dhan98 yielded 4.71 to 4.98 t/ha of rice during Aus season. In T. Aman season, BRRI dhan103 gave a significantly higher grain yield (6.18 t/ha) and the other four varieties produced statistically similar yields, ranging from 4.27 to 4.96 t/ha in CP₁ to CP₃. CP₄ gave the highest total grain yield (11.09 t/ha) followed by CP₁ (9.71 t/ha). The existing Fallow-Fallow-Ranjit swarna (CP₅) produced the lowest system yield (4.35 t/ha). Cost and return analysis showed that CP₄ had the maximum GM (2,57,287 Tk/ha) with the highest MBCR (3.02). The lowest MBCR (2.07) was recorded in CP₂ with a gross margin of 1,78,389 Tk/ha. Existing CP₅ gave the minimum gross margin (94,433 Tk/ha) (Table 14).

Table 14. Yield and profitability of the Fallow-T. Aus-T. Aman cropping pattern compared to the existing single T. Aman rice, Kamolgonj, Moulovibazar district, 2024-25

Cropping patterns	Yield (t/ha)			TVC (‘000	GM (‘000	MBCR
	T. Aus	T. Aman	Total rice yield	Tk/ha)	Tk/ha)	
CP ₁	4.75	4.96 b	9.71 b	156.81	203.38	2.34
CP ₂	4.74	4.27 b	9.01 b	154.47	178.39	2.07
CP ₃	4.71	4.41 b	9.13 b	155.88	181.75	2.09
CP ₄	4.91	6.18 a	11.09 a	156.20	257.29	3.02
CP ₅ (control)	-	4.35 b	4.35 c	75.65	94.43	-
CV (%)	9.18	11.77	8.56	-	-	-

Means with the same letter(s) are not significantly different. Price (Tk./kg): Rice=35, Straw; Aman=4

In activity-II, eight cropping patterns (CP) of CP₁: BARI Sarisha-17-BRRI dhan98-BRRI dhan71, CP₂: BARI Sarisha-17-BRRI dhan98-BRRI dhan75, CP₃: BARI Sarisha-17-BRRI dhan98-BRRI dhan95, CP₄: BARI Sarisha-17-BRRI dhan98-BRRI dhan103, CP₅: BARI Sarisha-18-BRRI dhan98-BRRI dhan71, CP₆: BARI Sarisha-18-BRRI dhan98-BRRI dhan75, CP₇: BARI Sarisha-18-BRRI dhan98-BRRI dhan95 and CP₈: BARI Sarisha-18-BRRI dhan98-BRRI dhan103 were tested with the existing cropping Fallow-

Fallow-Ranjit swarna (CP₉). BRRI dhan98 produced statistically similar grain yield during Aus season, ranging from 4.34 to 4.97 t/ha. In T. Aman season, BRRI dhan103 yielded the highest grain (6.60 t/ha) in CP₈, followed by CP₄ (6.38 t/ha). BRRI dhan75 gave the lowest grain yield (4.07 t/ha) in CP₆. In rabi season, BARI Sarisha-18 gave the higher yield (1.57 t/ha) in CP₅, whereas BARI Sarisha 17 gave the lowest yield (1.32 t/ha) in CP₃. Highest Rice equivalent yield (REY) was attained from CP₈ (15.32 t/ha) followed by CP₄ (14.95

t/ha). Existing cropping pattern (CP9) gave the lowest REY (4.32 t/ha). Cost and return analysis showed that CP8 had the maximum GM (3,50,663

Tk/ha) with the highest MBCR (2.87). The lowest GM was recorded from CP9 (93,692 Tk/ha) (Table 15).

Table 15. Yield and profitability of the Mustard-T. Aus-T. Aman cropping pattern compared to the existing single T. Aman rice, Kamolgonj, Moulovibazar, 2024-25

Cropping pattern	Yield (t/ha)				TVC	GM	MBCR
	T. Aus	T. Aman	Mustard	REY	(‘000 Tk/ha)	(‘000 Tk/ha)	
CP ₁	4.81	4.73 bc	1.46 ab	13.30 bc	213.86	271.50	2.29
CP ₂	4.87	4.31 d	1.51 ab	13.07 bc	211.52	264.03	2.25
CP ₃	4.34	4.31 d	1.32 b	12.04 d	212.94	226.57	1.97
CP ₄	4.97	6.38 a	1.40 ab	14.95 a	213.26	336.79	2.77
CP ₅	4.72	4.90 b	1.57a	13.64 b	213.86	284.12	2.38
CP ₆	4.72	4.07 d	1.50 ab	12.63 cd	211.52	247.62	2.13
CP ₇	4.59	4.41 cd	1.52 ab	12.92 c	212.94	257.79	2.20
CP ₈	4.81	6.60 a	1.52b	15.32 a	213.26	350.66	2.87
CP ₉ (control)	-	4.32 d	-	4.32 e	75.65	93.69	-
CV (%)	8.79	4.26	8.54	3.6	-	-	-

Means with the same letter(s) are not significantly different. Price (Tk./kg): Rice=35, Straw; Aman=4, Mustard=90

Another trial was conducted at the Kandigaon village of the Adampur union. In the T. Aman season, the existing Ranjit swarna was replaced by BRRI dhan103 and after harvesting of T. Aman

rice, BARI Sarisha-14 was introduced. The highest grain yield (6.55 t/ha) was obtained from BRRI dhan103. The highest REY (9.67 t/ha) was obtained from CP1, with the MBCR 2.96 (Table 16).

Table 16. Yield and profitability of the Mustard-Fallow-T. Aman cropping pattern compared to the existing single T. Aman rice, Kamolgonj, Moulovibazar district, 2024-25

Cropping pattern	Yield (t/ha)			TVC	GM	MBCR
	T. Aman	Mustard	REY	(‘000 Tk/ha)	(‘000 Tk/ha)	
BARI Sarisha-14-Fallow-BRRI dhan103 (CP ₁)	6.55 a	1.21	9.67 a	135.35	229.95	2.96
Fallow-Fallow-Ranjit swarna (CP ₂)	4.83 b	-	4.83 b	75.65	113.20	-
CV (%)	4.76		4.52	-	-	-

Means with the same letter(s) are not significantly different. Price (Tk./kg): Rice=35, Straw; Aman=4, Mustard=90.

Improvement of Fallow-Fallow-T. Aman Cropping system through Rabi crop inclusion

Fallow-Fallow-T. Aman is the 3rd most dominant cropping pattern in Bangladesh which occupy significantly higher percentage (5.95%) of net cropped area. In Chattogram district, it is the 2nd most dominant cropping pattern covering 19.15% of the cropped area. BARI Surjomukhi-3, BARI Felon-1, and BARI hybrid Maize-16 was introduced in this pattern after the T. Aman harvesting to increase productivity, profitability and cropping intensity. This study was conducted at foradpur village in Sitakundu upazilla during 2024-25. BRRI dhan22, were cultivated in T. Aman season where BRRI dhan46 were grown in Aman season under improved cropping patterns. The tested cropping patterns (CP) were CP₁: BARI

Surjomukhi-3- Fallow- BRRI dhan46, CP₂: BARI Felon-1- Fallow- BRRI dhan46, CP₃: BARI hybrid Maize-16 - Fallow- BRRI dhan46, CP₄: Fallow-Fallow-BRRI dhan22. The highest rice equivalent yield (REY) (11.13 t/ha) was observed in CP₃ followed by the pattern CP₂ (9.37 t/ha), and CP₁ (7.43 t/ha) (Table 14). The lowest REY was observed in CP₄ (4.46 t/ha). The highest gross margin (GM) was obtained from CP₂ (1,55,133 Tk/ha) followed by CP₃ (1,35,744 Tk/ha), CP₁ (57,780 Tk/ha) and CP₆ (1,91,800 Tk/ha) (Table 17). The lowest GM was observed in CP₄ (47,933Tk/ha). The highest MBCR was noted from CP₂ (3.14) which was followed by the CP₃ (1.82), and CP₁ (1.11). Findings revealed that crop productivity was higher with Maize inclusion but profitability increased due to inclusion of felon beacause of its less input cost.

Table 17. Yield and profitability of different crops combination under Rabi crop-Fallow-T.Aman cropping pattern, Sitakundu, Chattogram, 2024-25

Cropping pattern	Yield (t/ha)				REY (t/ha)	TVC ('000 Tk/ha)	GM ('000 Tk/ha)	MBCR
	Sunflower	Cowpea	Maize	T. Aman				
CP ₁	1.28	-	-	4.62	7.43 c	180	57	1.11
CP ₂	-	1.13	-	4.45	9.37 b	145	155	3.14
CP ₃	-	-	7.19	4.4	11.13 a	201	135	1.82
CP ₄	-	-	-	4.47	4.46 d	95	47	
CV (%)					5.75			

Price (Tk/kg): Rice=32, Sunflower=70, Felon=140, Maize=30, Rice straw=4

INTEGRATED FARMING SYSTEMS RESEARCH AND DEVELOPMENT

Crops and Cropping Pattern

Introducing newly released BRRI rice varieties for the improvement of major cropping patterns in FSRD site, Kaliganj, Gazipur

Two trials were conducted in Kaliganj, Gazipur to increase productivity of Boro-Fallow-T. Aman and Boro-Fallow-Fallow cropping pattern. In the double rice ecosystem, BRRI dhan100, 102, 105 in Boro and BRRI dhan71, 103 in T. Aman season led to a gross margin (GM) of 1,42,000 Tk/ha with a MBCR of 5.07. While, BRRI dhan92, 102, 114 in the single rice ecosystem resulted in a GM of 89,000 Tk/ha and MBCR of 5.80 (ICP) (Table 18).

Table 18. Grain yield and profitability of double and single rice-based cropping patterns, Kaliganj, Gazipur, 2024-25

Cropping pattern		Yield (t/ha)			TVC ('000 Tk/ha)	GM ('000 Tk/ha)	MBCR
		Boro	T. Aman	Total productivity			
Double rice	ICP	7.88	4.98	12.86a	323	142	5.07
	ECP	5.64	3.98	9.62b	301	49	-
Single rice	ICP	7.32a	-	8.52a	189	89	5.80
	ECP	6.90b	-	7.28b	182	58	-

Double-rice based cropping Pattern: ICP=BRRI dhan100/102/105-Fallow-BRRI dhan71/103, ECP=BRRI dhan28-Fallow-Ranjit (ck.); Single rice-based cropping pattern: ICP= BRRI dhan92/102/114-Fallow-Fallow, ECP=BRRI dhan29-Fallow-Fallow (ck.), MBCR=Marginal Benefit Cost Ratio; Price (Tk/Kg): Boro = 30, T. Aman = 32.5 to 35, Boro straw= 2-3, T. Aman straw= 5-7

Farmers' participatory evaluation of recently released BRRI varieties for Boro and T. Aman season

A study was conducted to assess suitable T. Aman and Boro rice varieties for the FSRD site. During the Aman season, Farmers are highly satisfied with the yield and growth duration of BRRI dhan95 and 71. In the Boro season, Farmers expressed a preference for BRRI dhan92, 100, 102, and 108. They chose BRRI dhan92 for its high yield and good taste, while BRRI dhan100 and BRRI dhan108 were appreciated for their early maturity and superior grain quality. However, they noted a higher incidence of unfilled grains in BRRI dhan108. BRRI dhan102 was also well-liked due to its high yield and good taste. Although the hybrid variety Gazi produced an outstanding yield, farmers were not satisfied with its coarse grain and poor taste.

AGROFORESTRY SYSTEM

Evaluation of intercropping under mixed orchard in Madhupur tract

The experiment was conducted at FSRD site of Kaliganj, Gazipur during 2024-25 to generate additional income for farmers. Five farmers' orchards were used for field trials where different vegetables and spices crops were intercropped (Table 26). The average size of the orchard was 8.61 decimals for each farmer. The overall total production derived from the Agroforestry system is 217.39 kg/10 dec./yr. where vegetables and spices contributed 67.8 and 32.19 %, respectively. Among the patterns, maximum total production was obtained from pattern 1 (295.83 kg/dec./yr.), followed by pattern 1 (215.32 kg/dec./yr.). Overall average gross benefit obtained from the agroforestry system was 44483.53 BDT/dec./yr. and pattern 1 is the most profitable as it produced maximum gross benefit (57791.09 BDT/dec./yr.), followed by pattern 2 (45777.65 BDT/dec./yr.).

Table 26. Patterns followed for intercropping under mixed orchards, Kaliganj, Gazipur, 2024-25

Orchard pattern	Fruit trees	Vegetables		Spice crops	Orchard area (dec)		
		Rabi	Kharif		Vegetables	Spices	Total
1	Guava, Mango	Tomato, Brinjal, Chili, Pumpkin	Okra, Malabar spinach, Stem amaranth, Kangkong, Pumpkin	Turmeric	10	0.43	10.43
2	Mango, Litchi, Malta	Tomato, Cauliflower,	Okra, Malabar spinach, Stem amaranth, Kangkong, Pumpkin	Turmeric	6	0.30	6.30

Orchard pattern	Fruit trees	Vegetables		Spice crops	Orchard area (dec)		
		Rabi	Kharif		Vegetables	Spices	Total
		Cabbage, Chili, Pumpkin					
3	Mango, Jujube	Pumpkin	Okra, Malabar spinach, Kangkong, Pumpkin	Turmeric, Ginger	10	0.54	10.54
4	Mango, Litchi	Tomato, Spinach, Red Amaranth, Brinjal, Pumpkin, Cabbage	Okra, Malabar spinach, Stem amaranth, Kangkong, Pumpkin	Turmeric, Ginger	10	0.26	10.26
5	Mango	Tomato, Cauliflower, Chili	Okra, Malabar spinach, Stem amaranth, Kangkong	Turmeric, Ginger	5	0.5	5.5
Average					8.10	0.41	8.61

Vegetables production

Among the patterns, maximum vegetables production was obtained from orchard-1 (154.85 kg/9.5 dec./yr.) where various year-round vegetables along with spices were cultivated. Among the vegetables in all gardens, the highest production was obtained from Cabbage (79.17 kg/9.5 dec./yr.) and Malabar spinach (24 kg/9.5 dec./yr.) in Rabi and Kharif seasons, respectively. The average consumption, distribution and sell from the produced vegetables were 115 kg/yr, 7.88 kg/yr. and 2.39 kg/yr., respectively. The average gross benefit obtained from vegetables production was Tk. 4184.35/9.5 dec./yr. and patterns followed at orchard-4 is the most profitable as it produced maximum gross benefit (Tk. 5403.26/9.5 dec./yr.) followed by orchard-1 (Tk. 4531.50/9.5 dec./yr.).

Spices production

Among the patterns, maximum spices production was obtained from patterns followed at orchard-2 (95.33 kg/0.5 dec./yr.) where turmeric along with various year-round vegetables along with spices were cultivated. Between turmeric and ginger in all the patterns, the highest production was obtained from turmeric (58 kg/0.5 dec./yr.). The average consumption and sell from the produced spices were 7 kg/yr and 70 kg/yr., respectively. The average gross benefit obtained from spices production was Tk. 3857/0.5 dec./yr. and patterns followed at orchard-3 is the most profitable with

maximum gross benefit (Tk. 5434.8/0.5 dec./yr.) followed by orchard-2 (Tk. 5297.8/dec./yr.).

Homestead Production System

The experiment was conducted at FSRD site at Kaliganj, Gazipur during 2024-25 to generate additional income for farmers. Ten homestead area were used as experimental plots where different year-round vegetables and spices crops were grown. The average size of the orchard was 7.05 decimals. The overall average production derived from the homestead production system is 357 kg/9.5 dec./yr. where vegetables and spices contributed 9 and 91%, respectively. Among the patterns, maximum total production was obtained from pattern 5 (171 kg/9.5 dec./yr.), followed by pattern 1 (166 kg/9.5 dec./yr.). The overall average gross benefit obtained from the homestead production system was Tk. 14547/9.5 dec./yr. and patterns followed at garden-7 is most profitable as it produced maximum gross benefit (Tk. 18351/9.5 dec./yr.), followed by pattern 1 (Tk. 15501/9.5 dec./yr.).

Vegetables production

Year-round vegetables production in homestead area

Among the patterns, maximum vegetables production by the marginal and small farmers was obtained from patterns followed at garden-1 (384 kg/9.5 dec./yr.) and garden-10 (376 kg/9.5 dec./yr.), where various Rabi and Kharif vegetables

were cultivated along with turmeric and ginger, respectively. The average consumption, distribution and sell from the produced vegetables of all patterns were 308, 7 and 42 kg/9.5 dec./yr., respectively. The average gross benefit obtained from vegetables production was Tk. 14547/dec./yr. and patterns followed at garden-6 is most profitable as it produced maximum gross benefit (Tk. 18351/9.5 dec./yr.) followed by garden-10 (Tk. 15943/9.5 dec./yr.).

Spices production

Performance of turmeric and ginger in shady places of homestead area

Between turmeric and ginger, the highest production of was obtained from turmeric by both the marginal and small farmers as 80 and 85 kg/0.5 dec./yr., respectively. The annual average consumption and sell from the produced spices by both marginal and small groups of farmers were 37 and 80 kg/yr., respectively. The average gross benefit obtained from spices production was Tk. 9516/0.5 dec./yr. and patterns followed at garden-10 is most profitable as it produced maximum gross benefit (Tk. 15420/0.5 dec./yr.) followed by garden-6 (Tk. 14205/0.5 dec./yr.).

Compost production

Compost was produced by the farmers by using household waste, vegetable waste, cow dung, poultry litter and other living materials. The annual average amount of compost produced by the marginal and small farmers was 47 and 50 kg/pit/yr, respectively. The compost was used for vegetables, spices, rice and fish cultivation.

Aquaculture System

Semi-aquatic production system of vegetables and fish in derelict mini pond

The program was conducted at the FSRD site, Muktarpur, Kaliganj, Gazipur during 2023-24 to increase productivity of the existing ponds and to increase farm income. One farmer's pond among the nine cooperative farmers was selected for the mixed fish cultivation. The size of the pond was about 30 decimals. Three species of fish namely Tilapia, Thai puti and Mirror Carp were stocked to the farmers' pond after seven days of fertilization.

After three months of fingerling release water taro was planted accordingly. The overall average fish and vegetable (water taro) production from this system were 48 and 1450 kg/10 dec./yr., respectively. The average gross benefit obtained from this production system was Tk. 37594/10 dec./yr.

Livestock Production System

The activity was conducted at FSRD site of RFSD at Kaliganj, Gazipur during 2024-25 to generate additional income for farmers. Nine homesteads small and marginal farmers were used expl. plots where chicken, pigeon and goat were reared. Twenty chicks, 4 pigeons and 1 doeling of goat were distributed to each farm family. The average gross benefit obtained from livestock production system was Tk. 6636.41/household/yr.

Chicken rearing

Production performance of Sonali chicken at FSRD site, Muktarpur, Kaliganj, Gazipur

Average egg production per chicken upto 11 months from distribution (no./piece/month) was 9 and 10 for marginal and small farmers, respectively. Average body weight gain per chicken was 1665.68 and 1562.87 grams for marginal and small farmers, respectively. The average gross return of chicken rearing was Tk. 1225/piece/yr. with gross benefit of Tk. 1071.28/piece/yr.

Pigeon rearing

Small scale pigeon rearing in farmer's household

Average squab production upto 32.27 months from distribution (no./piece) was 24 for both marginal and small farmers. Average body weight per pigeon during sell was 322.75 and 330.50 grams for marginal and small farmers, respectively. The average gross return of pigeon rearing was Tk. 897.3/piece/yr. with gross benefit of Tk. 877.8/piece/yr.

Goat rearing

Goat rearing in homestead area at FSR&D site, Muktarpur, Kaliganj, Gazipur

On average 3 kids were produced from individual she goat upto 31.13 months from distribution. The average gross return of goat rearing was Tk. 5000/piece/yr. with gross benefit of Tk. 4687.33/piece/yr.

Overall scenario of household components under integrated farming systems at FSRD site, Kaliganj, Gazipur, 2024-25

Overall scenario of profitability of farmers cultivating various year-round vegetables and spices in 10 decimals of homestead area and rearing livestock (goat) and poultry birds (chicken, pigeon) in household at FSRD site, Kaliganj, Gazipur during 2024-25 is presented in Figure 1. It was observed that, livestock contributes 41% of the overall profitability, followed by fish (36%), vegetables (14%) and spices make up the remaining 9%. This distribution highlights the significant role of livestock and fish as well as vegetables in the profitability of integrated farming systems in the region.

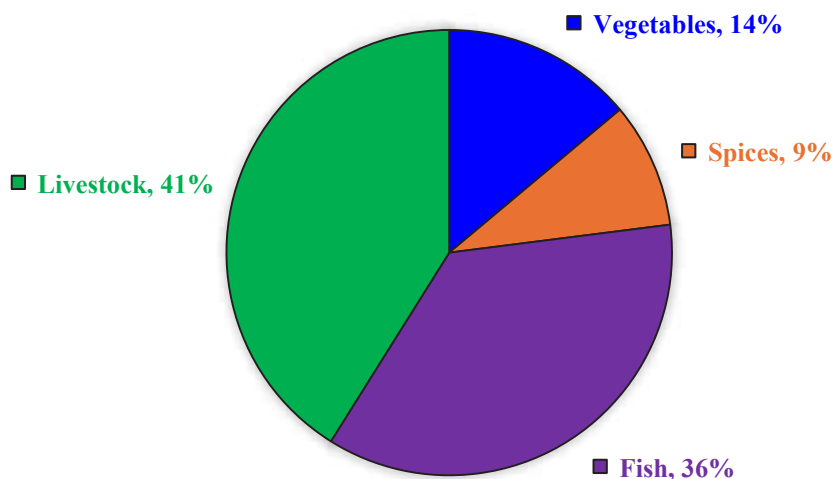


Fig. 1. Profitability of integrated farming systems at FSRD site, Kaliganj, Gazipur, 2024-25

Agricultural Economics Division

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SUMMARY

The study assesses socio-economic vulnerability to climate change in saline-prone coastal districts of Bangladesh—Satkhira and Patuakhali—using the LVI-IPCC framework. While Satkhira exhibits higher overall exposure and sensitivity to climate-induced hazards, its adaptive capacity benefits from active NGO and governmental engagement. Patuakhali, though less exposed, suffers from infrastructural deficits and limited livelihood diversification, resulting in higher LVI-IPCC vulnerability. These findings underscore the need for region-specific policy interventions to enhance climate resilience.

The study findings reveal that strategies for reducing rural poverty in Bangladesh through agricultural production must be highly tailored to farm size and are sensitive to temporal shifts in markets, policies, or environmental conditions. Relying on a single crop type or strategy across all farm sizes or time periods is ineffective. The significant volatility, particularly the unique profile of 2015 and the new developments in 2018-19, underscores the need for adaptive policies.

The study findings revealed that it is needed to increase rice yield more than 10% both for T. Aman and Boro rice. Farmers want disease and insect resistance free/less susceptible rice variety, higher market price. Lodging free T. Aman variety is a crying need for all over Bangladesh. While consumers prefer good taste, stays fresh longer time after cooking, require less time for cooking, and good appearance. Millers demand is higher milling outturn, higher head rice recovery as well as higher market price.

Per hectare variable costs were highest for MV Boro rice compared to MV T. Aman and Aus. MV Boro also yielded the highest gross margin (Tk 86,076.5), followed by MV T. Aman (Tk. 84,891) and MV Aus (Tk 53,244). However, MV T. Aman achieved the highest full-cost BCR (1.23 vs. Boro's

1.21 and Aus's 1.04). Its significantly higher gross profit ratio (43%) suggests favourable selling prices made T. Aman cultivation the most profitable season.

SOCIO-ECONOMIC VULNERABILITY TO CLIMATE CHANGE IN THE SALINE PRONE COASTAL AREAS OF BANGLADESH

Introduction

The impact of climate change is already being felt by different countries across the world. The socioeconomic vulnerability of households to climate change differs from region to region in Bangladesh. The country frequently experiences extreme climatic hazards, such as floods, droughts, riverbank erosion, salinity intrusion, waterlogging, and cyclonic storm surges in different vulnerable areas. Therefore, this study emphasizes to estimate LVI based on the primary data collected from the vulnerable saline prone coastal areas of Bangladesh.

Objective. The objective of this study is to estimate the households' socio-economic vulnerability in the saline prone coastal areas of the country.

Methodology

A multistage sampling technique was employed for selecting the sample households from the saline and tidal submerge prone Satkhira and Patuakhali districts. A well-structured questionnaire was used to conduct face-to-face interviews among the 200 selected households. The well-known LVI-IPCC approach was used to analyze the collected data for vulnerability assessment.

Results and discussion

The estimated results show that the study areas are highly vulnerable to climate change induced events (LVI: 0.402). Whereas, Satkhira is more vulnerable (LVI: 0.415) than Patuakhali (0.390). Satkhira faced multiple climate related hazards, such as- salinity, water logging, river erosion, cyclone, etc. Availability of drinking water and fresh irrigation

water in the dry season are the core socio-economic vulnerable items in Satkhira. The social conflict regarding shrimp culture without considering the living environment is another constraint to multiple crop cultivation and it also causes water logging by restricting the water flow through the canals. On the other hand, Patuakhali is relatively less prone to salinity. The major socio-economic constraints in Patuakhali are under developed infrastructure, low income generating activities, lack of irrigation water in dry season, and cyclone (Fig. 1). Considering the

IPCC contributing factors, Satkhira has higher sensitivity and exposure than Patuakhali. The GOs and NGOs are relatively less active in Patuakhali. The vulnerable communities in Satkhira are having multiple adaptation measures against climate change induced hazards. Many NGOs with GOs are working for community development, awareness building, and facility development in Satkhira. Therefore, the adaptive capacity of Patuakhali is less than Satkhira (Fig. 2). The LVI-IPCC index shows that Patuakhali is more vulnerable than Satkhira (Table 1).

Table 1. IPCC contributing factors to the LVI.

IPCC contributing factor	IPCC contributing factor value		
	Patuakhali	Satkhira	Overall
Adaptive capacity	0.333	0.369	0.351
Sensitivity	0.362	0.374	0.368
Exposure	0.587	0.606	0.596
LVI	0.390	0.415	0.402
LVI-IPCC	0.092	0.089	0.090

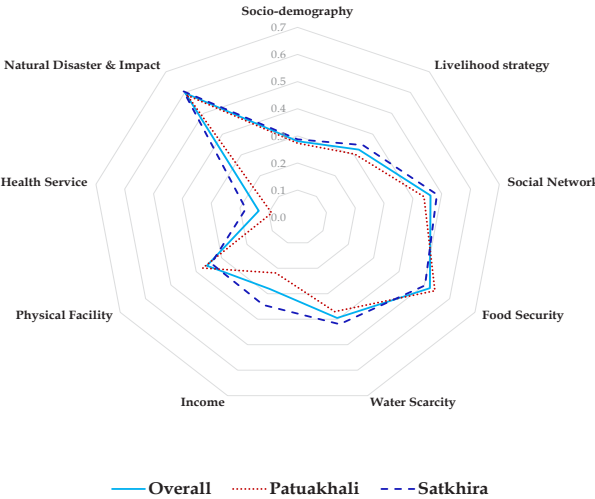


Fig 1. Spider diagram of the major components of the livelihood vulnerability index (LVI) for the households in the selected coastal areas of Bangladesh.

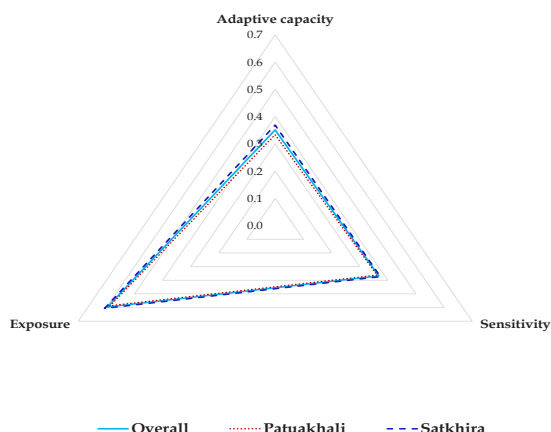


Fig 2. Triangle diagram of the vulnerability of the saline prone coastal areas of Bangladesh based on LVI-IPCC scores.

Conclusion

This study investigated the livelihood vulnerability to flood among the Satkhira and Patuakhali districts of Bangladesh. The LVI values show that Satkhira is more vulnerable than Patuakhali. However, considering the adaptive capacity, LVI-IPCC values show that Patuakhali is more vulnerable than Satkhira. The major vulnerable items in Satkhira are water logging and social conflict. Whereas, Patuakhali is vulnerable to income diversification, infrastructure, and social network. Both the areas are vulnerable to salinity, dry season irrigation facility, and cyclone. The GOs and NGOs involvement in the concerned districts made a difference in the community's adaptation ability. The findings of this study would help to identify the causes of household vulnerability in the study areas and plan for drawing policy options for suitable adaptation to reduce vulnerability.

M C Rahman, M A Islam, M Khanam, M S Islam

IMPACT OF RICE PRODUCTION ON
POVERTY REDUCTION IN RURAL
BANGLADESH: A PANEL DATA ANALYSIS

Introduction

Rice is the important staple food in Bangladesh. More than three-fourth of the country's total cropped land is devoted to rice production, contributing more

than 87.06% to the total cereal supply (Year book of agricultural statistics, 2024). It is estimated that over 48% of the daily calorie intake is derived from rice, with an average per capita consumption of about 120 kg per year (HIES, 2022). In Bangladesh, since independence in 1971, the government has been spending huge amount of money for research and development (R and D) of agricultural technologies (with the management packages) and has also been trying to disseminate those technologies to the farmers for alleviating poverty and raising their incomes. At present, the country has achieved remarkable progress in rice self-sufficiency, but poverty is still a major problem. With this back drop, The present study aims to investigate whether rice production can decrease poverty level in rural farm families like marginal, small, medium and large farmers in Bangladesh.

Methodology

In this study, three-period balanced panel data were used and data were also collected from the International Food Policy Research Institute (IFPRI). IFPRI conducted three periods (2011-12, 2015 and 2018-19) surveys covering 6,500 rural households in each, which were nationally representative sample in Bangladesh. Out of 6,500 rural households, we selected 2,186 rural households in each period to achieve the goal of the study.

Poverty measurement

In the context of measuring poverty in a population the indices in Foster et al. (1984) are commonly used which is expressed as:

1. Head count ratio (HCR),
2. Poverty gap index, Square poverty gap index.

$$P_{\alpha} = \frac{1}{N} \sum_{i=1}^N \left[\frac{Z - y_i}{Z} \right]^{\alpha} \quad (\alpha > 0) \text{ and } (y_i < Z)$$

where Z is the agreed-upon poverty line (US\$ 2.15/capita/day), N is the total household population, y_i is household income per capita PPP basis for the i^{th} person, and α is a poverty aversion (sensitivity) parameter. When $\alpha = 1$, it is a measure of the poverty gap. When $\alpha = 2$, P equals the squared poverty gap, which is used as a measure of the severity of poverty.

Analytical technique

Panel probit regression model was used.

Results and discussion

The Table 2 presents descriptive statistics across three time periods: 2011-12, 2015, and 2018-19,

focusing on household agricultural production, income, and poverty metrics using a \$2.15 per capita per day poverty line (PPP adjusted). The significant income growth, especially the surge between 2015 and 2018-19, aligns strongly with the accelerated decline in poverty incidence (HCR) during that period. The mixed trends in agricultural production, particularly the significant and sustained decline in vegetables/fruits, contrast with the robust income growth, suggesting a diversification of income sources beyond crop production (e.g., wages, remittances, non-farm enterprises) and/or favourable price movements. The year 2015 stands out as an anomaly: despite a slight decrease in the poverty headcount (HCR), both the depth (PGI) and severity (SPGI) of poverty worsened significantly, indicating a shock that disproportionately affected the poorest households. The subsequent period (2015 to 2018-19) shows a remarkable recovery, with strong income gains driving improvements across all poverty metrics. The data underscore that focusing solely on the poverty headcount (HCR) can mask important changes in the depth and severity of poverty experienced by those remaining below the line, as evidenced by the 2015 results.

Table 2. Descriptive statistics.

Particulars	2011-12	2015	2018-19
Household rice production (kg)	2062.269	2366.178	2261.469
Household all non-rice crops production (kg)	665.435	722.356	755.516
Household vegetables and fruits production (kg)	394.116	309.063	344.753
Household real annual income (PPP basis \$)	3517.138	4082.797	5106.474
Per capita real household income (PPP basis \$)	880.651	919.291	1052.587
Poverty category: (Poverty line: 2.15 US \$ per capita/day)			
Head count ratio (HCR) (%)	56.8	54.8	46.8
Poverty gap index (PGI) (%)	25.9	27.5	24.3
Square poverty gap index (SPGI) (%)	16.4	18.1	17.0

Source: Own calculation

The Table 3 presents the estimated change in poverty incidence (Head Count Ratio - HCR, measured in percentage points) associated with a unit increase in agricultural production, broken down by farm size (small, medium, large) and crop type (rice, non-Rice crops, vegetables and fruits) for three distinct time periods. Covariates are controlled in all the models.

Table 3. Effect of household food production on poverty of rural Bangladesh.

Particular ^a	2011-12		2015		2018-19	
	HCR	z- value	HCR	z- value	HCR	z- value
Log of household rice production X small farm size dummy	-0.021**	-2.320	-0.005	-0.400	-0.039***	-2.910
Log of household rice production X Medium farm size dummy	-0.064***	-3.740	-0.029	-1.640	-0.054***	-2.760
Log of household rice production X large farm size dummy	-0.158**	-2.440	-0.276***	-2.770	-0.142*	-1.930
Log of household all non-rice crops production X small farm size dummy	-0.005	-0.600	-0.024***	-2.470	-0.009	-0.950
Log of household all non-rice crops production X medium farm size dummy	-0.006	-0.560	-0.051***	-4.260	-0.021*	-1.770
Log of household all non-rice crops production X large farm size dummy	-0.045	-0.710	-0.016	-0.430	-0.009	-0.330
Log of household vegetables and fruits production X small farm size dummy	0.002	0.180	0.011	0.710	-0.016	-1.090
Log of household vegetables and fruits production X medium farm size dummy	-0.002	-0.130	0.001	0.050	-0.033*	-1.750
Log of household vegetables and fruits production X large farm size dummy	0.001	0.010	-0.016	-0.470	-	-
Covariates considered	Yes	-	Yes	-	Yes	-

Source: ^aBase farm size: Marginal farm; Statistical significance is indicated by asterisks (* p<0.10, ** p<0.05, *** p<0.01);

Rice consistently reduces poverty, especially for large farms. Small and medium farms lost significant benefits in 2015 but regained them by 2018-19, with small farms seeing a stronger effect than before. Large farms experienced extreme volatility, with a massive spike in effectiveness in 2015. Non-rice crops emerged as a crucial poverty reduction tool for small and medium farms specifically in 2015. This effect faded by 2018-19, becoming only marginal for medium farms and disappearing for small farms. Large farms never benefited significantly. Vegetables and fruits showed virtually no impact on poverty for any farm size in 2011-12 or 2015. The only significant effect appeared marginally for medium farms in 2018-19, suggesting a potential late shift in their importance for this group.

Conclusion

The findings reveal that strategies for reducing rural poverty in Bangladesh through agricultural production must be highly tailored to farm size and are sensitive to temporal shifts in markets, policies, or environmental conditions. Relying on a single crop type or strategy across all farm sizes or time periods is ineffective. The significant volatility, particularly the unique profile of 2015 and the new developments in 2018-19, underscores the need for adaptive policies. Further research is needed for better understanding.

M A Islam, M C Rahman and M S Islam

PRODUCT PROFILE DEVELOPMENT OF LSTD PROJECT LOCATIONS (TECHNOLOGY VILLAGES)

Introduction

Rice plays a vital role in sustaining food security and generating income for the rural poor in Bangladesh. So far, Bangladesh Rice Research Institute (BRRI) has developed 113 inbred and eight hybrid rice varieties targeting favourable to stress environments (BRRI, 2025). In addition, the Bangladesh Institute of Nuclear Agriculture (BINA) has also developed 24 modern rice varieties (BINA website accessed on 12/06/2025). However, the varietal adoption is slow, a few mega varieties are still covering all three seasons. The popularity of adopting newly released rice varieties is very slow at the farm level. The unavailability of appropriate product concepts and quality traits is the main constraint for the varietal replacement plan which is not considered in earlier breeding pipelines. An insufficient database of rice consumers, farmers, market preferences and market segments for developing product profiles is also another reason. Therefore, an emergency approach is needed to reformulate BRRI's breeding programmes to generate market and farmer-demanded varieties. The proposed project aims to help BRRI to increase the rate of genetic gain generated and delivered to farmers by 1.5% per year from the current rate, which is likely less than 0.5% annually. Besides, more focused and effective variety development will ensure that breeding pipelines are driven by market demand, targeted towards product development, and properly managed to deliver an increased rate of genetic gain. Market segments and target environments will be precisely characterized to provide the essential information needed to develop various product profiles that reflect consumers, producers and other value chain actors' preferences, as well as specific stress tolerances and characteristics needed for each breeding pipeline.

Objectives of the study

- To develop product profiles by project locations.

Methodology

Selection of the study location

The study area was selected based on the project objectives. Based on preliminary information, five project locations namely Tangail, district was selected for this study.

Stakeholder types and selection criteria:

The sample stakeholders, Rice producer cum Consumers were selected and categorized based on operated land

- Small farmers (50-249 decimals)
- Medium farmers (250-749 decimals)
- Large farmers (750 and above decimals)

The criteria for selecting other respondents are Faria/bepari, Aratdar, Miller, Wholesaler and Retailer in the study locations.

Millers were classified as

- Automatic rice mills
- Semi-automatic rice mills

Wholesaler and retailers

- Wholesaler and wholesaler-cum-retailers in rural and urban areas;
- Retailers who solely purchased rice and retailers who purchased rice with other groceries in rural and urban areas.

Results and Discussion

Product profile development

Table 4 shows that, this profile outlines ambitious targets for developing new rice varieties tailored to each season's specific challenges in Dhanbari upazila under Tangail district. **T. Aman** requires a fundamental shift in grain type and introduction of critical lodging/disease resistance. **Boro** builds on a stronger base but needs significant boosts in tillering, milling quality, and specific disease resistance. Both the seasons demand higher yields, shorter duration, better milling recovery, longer-lasting cooked rice, and new insect resistance, while

maintaining preferred cooking quality and grain colour. Current high fertilizer inputs, especially in Boro, are documented but not yet targeted for reduction.

T. Aman Season:

Benchmark variety: Ronjit Pajam

Existing yield: 5,928 kg/ha

Target yield: >10% increase (>6,520 kg/ha)

Key Targets and Challenges:

Grain Quality: Shift from Medium Bold (MB) to medium slender (MS) grain shape. Maintain non-sticky but soft cooking quality (Amylose) and white colour.

Lodging: Currently no tolerance. Critical target: Develop varieties with lodging tolerance.

Growth duration: Reduce from 150-155 days to 140-145 days (Earlier maturity).

Plant Architecture: Maintain height (90-95 cm), but increase tillering from 10-12/hill to 12-14/hill.

Milling quality: Significantly improve milling outturn (>65% vs 64-65%) and head rice recovery - HRR (>64% vs. 58-60%).

Leftover rice: Improve keeping quality after cooking from 7-8 hours to 9-10 hours.

Disease resistance: Critical Need. Move from susceptibility to resistance against Blast, Sheath Blight, and Sheath Rot.

Insect resistance: Critical Need. Introduce resistance against Stem Borer and Brown Plant Hopper (BPH) where none exists currently.

Game changer traits: Resistance to sheath blight, sheath rot, and BPH is highlighted as transformative.

Current fertilizer use (kg/ha): Urea (226), DAP (58), TSP (58), MoP (83), Gypsum (45), ZnSO₄ (8), MgSO₄ (6).

Boro Season

Benchmark variety. BRRI dhan29

Existing yield. 6,538 kg/ha

Target yield. >10% increase (>7,191 kg/ha)

Key Targets and Challenges.

Grain quality: Maintain Medium Slender (MS) grain shape, non-sticky but soft cooking quality (Amylose), and white colour.

Lodging: Existing tolerance (Yes) must be maintained.

Growth duration. Reduce from 150-155 days to 140-145 days (Earlier maturity).

Plant architecture. Maintain height (95-100 cm), but significantly increase tillering from 13-14/hill to 15-16/hill.

Milling quality. Improve milling outturn (>66% vs. 65-66%) and Head Rice Recovery - HRR (>65% vs. 61-62%).

Leftover rice. Improve keeping quality after cooking from 8-9 hours to 10-11 hours.

Disease resistance. Critical Need. Move from susceptibility to resistance against blast and bacterial leaf blight (BLB).

Insect resistance. Critical need. Introduce resistance against stem borer and brown plant hopper (BPH) where none exists currently.

Game changer traits. Resistance to blast and BLB is highlighted as transformative.

Current Fertilizer Use (kg/ha): Higher than T. Aman: Urea (268), DAP (92), TSP (83), MoP (108), gypsum (54), ZnSO₄ (10), MgSO₄ (6).

Table 4. Product profile for project technology village in Dhanbari upazila under Tangail district in T. Aman and Boro seasons.

Target Location: Dhanbari, Tangail		Benchmark variety: Ronjit Pajam		Benchmark variety: BRRI dhan29	
Season		T. Aman		Boro	
Major cropping Pattern:	Boro – Fallow – T. Aman				
Trait	Trait specification	Existing trait	Expected trait	Existing trait	Expected trait
Basic	Average yield (kg/ha)	5928	>10%	6538	>10%
Basic	Grain size and shape	MB	MS	MS	MS
Basic	Amylose	Non-sticky but soft	Non-sticky but soft	Non-sticky but soft	Non-sticky but soft
Basic	Lodging tolerant	None	Yes	Yes	Yes
Basic	Shattering tolerant	Yes	Yes	Yes	Yes
Basic	Grain color	White	White	White	White
Range	Growth duration (day)	150-155	140-145	150-155	140-145
Range	Plant height (cm)	90-95	90-95	95-100	95-100
Range	Tillering (no./hill)	10-12	12-14	13-14	15-16
Range	Milling outrun (%)	64-65	>65	65-66	>66
Range	HRR (%)	58-60	>64	61-62	>65
Range	Leftover rice (hours)	7-8	9-10	8-9	10-11
Future value added	Disease resistance	Susceptible to blast, Sheath Blight and Sheath rot	Blast resistance, Sheath Blight and Sheath rot	Susceptible to blast and BLB	Blast resistance and BLB
Future value added	Insect resistance	None	Stem borer and BPH	None	Stem borer and BPH
Game changer	Disease and insect resistance	-	Sheath Blight, Sheath rot, BPH	-	Blast resistance, BLB
Average chemical fertilizers used (kg/ha):					
	Urea	226	-	268	-
	DAP	58	-	92	-
	TSP	58	-	83	-
	MoP	83	-	108	-
	Gypsum	45	-	54	-
	ZnSO ₄	08		10	
	MgSO ₄	06		06	

Source: Field survey

Conclusion.

For both rice seasons, it is needing a solid 10% yield jump. But it's not just about quantity. Farmers struggle with diseases and pests wiping out crops, while consumers want rice that cooks perfectly, looks good, and stays fresh longer after cooking. Milling losses also eat into profits. Overcoming disease/insect susceptibility (like Blast, Sheath Rot, BPH) is the biggest game-changer for stable harvests. It also needs T. Aman rice to stand strong against lodging and both seasons' rice to mature 10 days earlier.

Recommendations (Prioritized):

1. **Build tough rice first:** Pour resources into breeding **strong resistance against Stem Borer, BPH, and the major diseases** (sheath blight/rot for Aman; Blast/BLB for Boro). This is foundational – no point in higher yields if pests destroy them.
2. **Speed up and bush out:** Breed varieties that **mature 10 days faster (140-145 days) AND produce significantly more tillers per plant** without getting taller. This means more rice, quicker.
3. **Boost Quality and Value.** Rigorously select for **better grain shape (especially shifting Aman to medium slender), improved milling yields**, and rice that **stays palatable for 2+ extra hours** after cooking. This meets market demands and reduces waste.
4. **Fortify and fertilize smart.** Ensure Aman rice **stands up to weather (lodging tolerance)**. Review the **higher Boro fertilizer use** – can we maintain yields smarter, perhaps more efficient, nutrient management alongside these new tough varieties?

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ESTIMATION OF COSTS AND RETURN OF MV RICE CULTIVATION AT THE FARM LEVEL

Economic decisions are primarily concerned with determining the most profitable level of input use in the production process. The viability of a technology is largely dependent on its cost and returns. Therefore, it is essential to understand the cost and return of rice cultivation where farmers use different types of technologies. Through cost and return analysis, researchers and planners can develop technologies that increase farmers' returns while reducing costs. This study has been undertaken to assess the profitability of rice cultivation in Bangladesh with the following specific objectives:

- To determine the level of inputs used in modern rice production in different seasons.
- To estimate the cost of MV rice cultivation at the farm level across different seasons.
- To evaluate the profitability of MV Aus, MV T. Aman, and MV Boro rice cultivation at the farm level.

Methodology

A multistage random sampling technique was adopted to select farmers from all 14 agricultural regions of Bangladesh. Data on input use patterns, prices of inputs and outputs, and yields were collected from 120, 200, and 200 farmers for the Aus, T. Aman, and Boro seasons respectively. This resulted in 520 rice-growing farmers being surveyed. Data were collected through face-to-face interviews using structured questionnaire. Descriptive statistical techniques were primarily used for data analysis, and the results were presented using tabular formats.

Results and Discussion

Input Use Patterns:

Farmers primarily hired contractual labor for three major labour-intensive intercultural operations: transplanting, harvesting, and carrying. They also hired labour on a daily wage basis for other

operations such as land preparation, weeding, and post-harvest processing. Most farmers used power threshers on a custom-hired basis for threshing rice.

The analysis of input use patterns for MV rice cultivation across different seasons—Aus, T. Aman, and Boro—highlights significant variations in labor use, seed rates, and fertilizer application. The highest use of human labour was recorded in MV Boro rice cultivation, where 114 man-days per hectare were employed, followed by MV T. Aman (104 man-days/ha) and MV Aus (112 man-days/ha). Labour was divided into hired, family, and contractual labor, with MV Aus showing the highest reliance on hired contract labour for transplanting,

weeding, and harvesting operations (63 man-days/ha).

Seed use across all seasons exceeded BRRI recommendations, with farmers using 38 kg/ha for Aus, 42 kg/ha for T. Aman, and 35 kg/ha for Boro, against the recommended rate of 25–30 kg/ha. Fertilizer usage was also generally higher than recommended levels. For instance, the use of urea during Aus season was 155 kg/ha compared to the recommended 125 kg/ha. Similarly, the application of TSP, MoP, and DAP fertilizers was notably higher in all seasons except Boro, reflecting the farmers' tendency to over-use of fertilizer (Table 5).

Table 5. Per hectare input used for MV rice cultivation in different seasons of Bangladesh, 2024-25.

Input Item	Season		
	T. Aman	Aus	Boro
Human labour (man-day/ha):	104	112	114
Hired	36	34	44
Family	14	15	15
Hired contract (transplanting, weeding and harvesting)	54	63	55
Seed (kg/ha):	42	38	35
Fertilizer (kg/ha):			
Urea	150	155	219
TSP	70	66	85
MoP	100	88	105
DAP	95	83	67
Gypsum	33	34	41
ZnSo4	4	5	6
MgSo4	2	1	3

Source: Field survey 2024-25

Cultivation Costs

The per-hectare costs for human labour were highest for MV T. Aman cultivation at Tk. 72800 followed by MV Aus at Tk 67,200 and MV Boro at Tk 65,550. Fertilizer costs were also the highest for Boro cultivation at Tk 15,509/ha, followed by T. Aman (Tk 14,941/ha) and Aus (Tk. 13025/ha). The

increase in fertilizer costs can be attributed to rising fertilizer prices.

Irrigation costs were significantly higher for MV Boro cultivation at Tk 17,114 /ha, primarily due to the heavy reliance on irrigation during the dry season. In contrast, MV T. Aman and MV Aus required much lower irrigation costs (supplementary irrigation), at Tk 6,309 /ha and Tk 6,091 /ha

respectively. This increase in irrigation costs, especially during the Boro season was due to a lack of rainfall and higher fuel prices. Total variable costs per hectare were highest for Boro at Tk 1,22,576 followed by T. Aman (Tk 1,12,946) and Aus (Tk. 1,06,764) (Table 6).

Profitability

Per hectare yield of Boro paddy was the highest at 6,521 kg, followed by T. Aman season at 5,389 kg and Aus season at 5,088 kg. The favourable climate, low pest and disease infestation, and availability of irrigation contributed to the higher yields during the Boro season.

The gross margin per hectare for Boro season rice cultivation was Tk 86,076.5 followed by

T. Aman (Tk 84,891) and Aus (Tk 53,244). The benefit-cost ratio (BCR) based on full-cost calculation was for Boro (1.21) and T. Aman (1.23) and Aus (1.04) reflecting the profitability of rice cultivation in all three seasons.

Moreover, gross profit ratios were 43%, 33%, and 41% for, T. Aman, Aus and Boro seasons respectively, indicating that farmers earned substantial profits, especially during the T. Aman season. The cost of production per kilogram of rice was similar across the seasons at Tk 26.46/kg for Boro, Tk 30.16/kg for Aus, and Tk 28.88/kg for T. Aman, while the selling price of grain was Tk. 29.50/kg for Boro, Tk 33/kg for T. Aman, and Tk 28.50/kg for Aus (Table 7).

Table 6: Per hectare cost of MV rice cultivation in different seasons in Bangladesh, 2024-25

Input-wise cost	Season (Tk./ha)		
	T. Aman	Aus	Boro
Seed	3150	2280	6825
Seedling development	3257	3715	4526
Land preparation (ploughing and laddering)	11526	14360	12388
Human labour:	72800	67200	65550
Hired	25200	20400	25300
Family	9800	9000	8625
Hired contract (transplanting, weeding, and harvesting)	37800	37800	31625
Fertilizer cost	14941	13025	15509
Irrigation	6309	6091	17114
Pesticide:	5024	4437	4705
Herbicide	1353	1239	1145
Insecticide and fungicide	3671	3198	3560
Power thresher	5739	4656	4584
Total variable cost	112946	106764	122576
Interest on operating capital	2823.65	2669.1	3064.4
Land rent	35466	35000	38250
Total fixed cost	48089.65	46669.1	49939.4
Total cost	161035.65	153433.1	172515.4

Source: Field survey 2024-25

Table 7. Per hectare profitability of MV rice cultivation in different seasons in Bangladesh, 2024-25.

Item	Season		
	T. Aman	Aus	Boro
Total costs (Tk/ha) (2+3)	161035.65	153433.1	172515.4
Total variable costs (Tk/ha)	112946	106764	122576
Total fixed cost (Tk/ha)	48089.65	46669.1	49939.4
Yield (kg/ha)	5389	5088	6521
Market value of paddy (Tk/ha) (4*11)	177837	145008	192369.5
Market value of straw (Tk/ha)	20000	15000	16283
Gross benefit (GB) (Tk/ha) (5+6)	197837	160008	208652.5
Gross margin (GM) (Tk/ha (7-2)	84891	53244	86076.5
Gross profit ratio ((GM*100)/GB)	42.91	33.3	41.25352
Net return (Tk/ha) (7-1)	36801.35	15000	36137.1
Cost of production (Tk/kg)	29.88	30.16	26.46
Selling price of grain (Tk/kg)	33	28.50	29.50
BCR (full cost basis) (7/1)	1.23	1.04	1.21
BCR (cash cost basis) (7/2)	1.75	1.50	1.70

Source: Field survey 2024-25

Conclusion

Per hectare total variable costs for **MV** Boro rice **were** higher than those for **MV** T. Aman and **MV** Aus rice. Similarly, the gross margin per hectare was the highest for **MV** Boro rice (Tk 86,076.5), followed by **MV** T. Aman (Tk 84,891) and **MV** Aus (Tk 53,244). The BCR on a full-cost basis was the highest for MV T. Aman (1.23),

followed by MV Boro (1.21) and MV Aus (1.04). The higher gross profit ratio during the T. Aman season (43%) indicates that farmers were able to sell their produce at favourable prices, making rice cultivation **more** profitable **in that season**.

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S A Mou

Agricultural Statistics Division

260	Summary
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261	Genotype × environment interaction of BRRI varieties
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263	Suitability mapping of BRRI released varieties
264	Climatic Mapping of temperature and rainfall of Bangladesh
265	Projected climatic factors (2050) maps of Bangladesh
265	Season Wise Rice Area Mapping of Bangladesh
266	Suitability mapping of various cropping pattern
267	Rice yield forecasting using satellite image and machine learning in Habiganj district
267	Delineation of rice area changes in coastal area of Bangladesh using remote sensing data and machine learning approach
268	Capacity building through training
269	Develop an Online Integrated Platform for Collecting Rice Mapping Data
269	Digitalized Tour Bill Management System for Brri HQ
270	Information and communication technology (ICT) activities
274	Support services

SUMMARY

T. Aman varieties, BRRI dhan87 and BRRI dhan103 were found stable. The variety BRRI dhan91 were found to be unstable during T. Aman season. Among the aromatic rice BR5, BRRI dhan34, BRRI dhan37, BRRI dhan38 and BRRI dhan90 were found as below average stable in T. Aman season.

The highly significant genotype $\times$ environment interaction effects for grain yield confirmed that genotypes responded differently to the variation in environmental conditions for long, medium and short-duration Aman varieties. The greater portion of the total variation was explained by the environmental main effect, indicating that the environments were diverse and a major part of the variation in grain yield was reflected by environmental changes. In the Aman season, BR11 and BRRI dhan44 recorded the highest average grain yielder and ideal genotypes among long-duration varieties. BRRI dhan103, BRRI dhan94, and BRRI dhan93 were the most stable genotypes with above-average yield in medium duration, where BRRI dhan87, BRRI dhan72, and BRRI hybrid dhan6 were the most stable genotypes and above average yielder for short duration.

Rice area increased about more than one folds but the production increased about four folds during 1971-72 to 2023-24. Although the growth rate of rice area was 3.96 in the year 1972-73 but in 2023-24 is 0.23. Similarly, growth rate of rice production was 1.30 in the year 1972-73 but in 2023-24 is 4.10.

BRRI dhan103 is appropriate for north-west, BRRI dhan104 suitable in all over the country, BRRI dhan105 is suitable in north-east part and BRRI dhan106 is appropriate for north-east of Bangladesh.

More or less throughout the year eastern side of Bangladesh is high rainfall and low temperature area and western side is low rainfall and high temperature area. Spatial distribution of minimum temperature and total rainfall are more or less same.

About 5.63 Mha of rice were farmed overall in 2024 during Aman season and highest Aman production district was Naogaon. In 2023 total Aman area was 5.91 Mha. Thus, total Aman area has been decreased a little bit in 2024 because of sudden flood in cumilla region. In 2024-25 total Boro area

was about 4.93 Mha in Bangladesh. Naogaon district produced the highest Boro production in 2024-25.

Average total precipitation (average by RCP 2.6, 4.5, 6.0, and 8.5 models) of Bangladesh of August month in 2050 will be decreased in comparison to average total precipitation of 2010-2018 period, only exceptions are Khulna, Rajshahi, Mymensingh divisions.

Boro-Fallow-Fallow cropping pattern total suitable area is 3.01 Mha. Mustard-Boro-Fallow cropping pattern cover total suitable area 1.96 Mha. Onion-Jute-T.Aman is suitable area having 1.60 Mha.

Though among the random-forest, support vector, linear-regression and ensemble model we found linear regression model is the best fitted model for yield prediction but still it is not good fitted model due to lack of sufficient GPS data. So, the study should continue to improve the model.

The continuous rice farming stayed steady, there was a notable increase in the more recent rice cultivation zones, which were mostly homesteads, urban areas, non-rice crops, and fallow areas. This impressive expansion indicates that despite socioeconomic and environmental constraints, rice farming has become more popular in the area.

Ten (10) activities have been done in the reporting year 2024-25 under the project Computer programming, Software Development and Digitization. A new web application has been developed for Tour Bill Management System for BRRI HQ and Developed an online integrated platform for collecting rice mapping data. Eight web applications have been maintained, updated and continuously run in the whole reporting year named (1) Developed a dynamic web application for visualizing and analyzing the rice disease surveillance data (2) Developed a web application to calculate the Stability Index for BRRI Stability Model (3) Developed a Platform for BRRI Developed Management Information System (MIS) (4) Digitalized Budget Management System of BRRI (5) Digitalized Quota Management System of BRRI (6) Digitalized Salary Management System for BRRI HQ (7) Digitalized Labour Management System for BRRI HQ and (8) Digitalized Casual Leave Application System.

ICT cell of this division has developed ‘Rice profile’ mobile app for smart profiling of rice varieties in disaster-prone zones of Bangladesh and Sensor-based rice pest management through artificial intelligence (AI) technology “ধান সুরক্ষা (Rice Solution)” mobile App. Also, developed ‘BRRI Rice doctor’ mobile and web apps both English and Bengali version with the help of different divisions of BRRI. It has developed new website named Glory and Success of 50 Years (<https://gsfy.brri.gov.bd>) for national and international seminars and symposiums of BRRI. Dynamic view connectivity, Bangla search and inner banner system for BRKB web apps. Besides, it has modified the RKB mobile apps and disseminate of modern rice technology and its management information at the farmer door step through RKB Mobile Apps. We developed Vehicle Requisition Management System (VRMS) of BRRI. So that, the requester informed through SMS on basis of demanding vehicle for official or personal purpose as well as drivers get confirmation SMS for their upcoming duties. Also, we developed “BRRI Alapon” Telephone Directory Mobile App. We organized five day-long, two day-long, day-long ‘Public Service Innovation’ training workshops in the reporting year. A total of 400 participants were trained through the innovation, SPS trainings and e-Nothi in-house trainings.

STABILITY ANALYSIS OF BRRI VARIETIES

PI: M I H, **CI:** N M F R, M A Q, M A A, M A A M, M A, M S R, K M I, M H K One Scientist from each RS

The main objectives of the study were to determine the stability index of BRRI released varieties, maintain season, year and location-wise database and identify the bio-physical and socio-economic factors causing instability. Experiments are being conducted in T. Aman season with BRRI released rice varieties since 2001-2024 at Gazipur and different regional stations. The collaborative regional stations in the T. Aman season are Rajshahi, Rangpur, Cumilla, Sonagazi, Barishal, Satkhira and Kushtia. The numbers of varieties are 48 T. Aman. The design was RCB with three replications and the effective plot size (harvest area) was $3 \times 2 \text{ m}^2$, leaving the two-border row from each side. Recommended crop management practices were followed. Stability analyses of the experimental data

were performed by using a newly developed model. The model deals with the performance of the genotypes across the geographical locations differing in land, soil and other biotic and abiotic factors over the years characterizing fluctuation of weather variable, floods, drought etc.

Among T. Aman varieties, BRRI dhan87 and BRRI dhan103 were found stable with stability index 2.037 and 2.347 respectively. While BR4, BR10, BR11, BR22, BRRI dhan30, BRRI dhan31, BRRI dhan32, BRRI dhan40, BRRI dhan41, BRRI dhan44, BRRI dhan49, BRRI dhan51, BRRI dhan52, BRRI dhan53, BRRI dhan54, BRRI dhan66, BRRI dhan71, BRRI dhan72, BRRI dhan73, BRRI dhan78, BRRI dhan79, BRRI dhan80, BRRI dhan93, BRRI dhan94, BRRI dhan95, BRRI hybrid dhan4 and BRRI hybrid dhan6 were found having average stability. BR3, BR23, BR25, BRRI dhan33, BRRI dhan39, BRRI dhan46, BRRI dhan56, BRRI dhan57, BRRI dhan62, BRRI dhan70, BRRI dhan75, BRRI dhan76, and BRRI dhan7 appeared to be below average stable among T. Aman varieties. Among the aromatic rice BR5, BRRI dhan34, BRRI dhan37, BRRI dhan38 and BRRI dhan90 were found as below average stable. Only the variety BRRI dhan91 was found to be unstable during T. Aman season.

GENOTYPE $\times$ ENVIRONMENT INTERACTION OF BRRI VARIETIES

PI: MAAM, **CI:** MIH, MAQ, MAA and MA

The major objective of the study was to identify BRRI released rice genotypes that have both high mean yield and stable yield performance across different environments for different ecosystem of Bangladesh. The experiment was conducted in multi-environment trials for T. Aman 2024. Forty-eight (48) BRRI released T. Aman rice varieties were evaluated in nine environmental conditions of Bangladesh, such as Barishal, Bhanga, Gazipur, Kushtia, Rajshahi, and Rangpur. The experimental sites covered all ecosystems of Bangladesh. The experiments were carried out in randomized complete block design (RCBD) with three replications and evaluated for rice grain yield. Each experimental plot comprised of $3\text{m} \times 2\text{m}$. Standard agronomic practices were followed and plant protection measures were taken according to Adhunik Dhaner Chash, BRRI (2024). AMMI

model was used to quantify the effect of different factors (genotype, location) of the experiment. The model further provides graphical representation of the numerical results (GGE biplot analysis) with a straight-forward interpretation of the underlying causes of $G \times E$.

ANOVA of combined analysis

The combined analysis revealed that the yield of rice genotypes was significantly influenced by the environment and contributed 53.47, 27.76, and 21.67% of the total variation for medium, short, and long duration respectively, in the Aman season. Additionally, the relative contribution of the genotype sum of squares was found to be 41.36, 32.7, and 16.8% for short, long, and medium duration respectively. Genotype by environment ($G \times E$) contributed the most 30.18% to the total variation for short duration, followed by 25.69% and 19.26% for long and medium duration. Greater portion of the total variation was explained by the environmental main effect, indicating that the environments were diverse and a major part of the variation in grain yield was reflected by environmental changes. The highly significant genotype $\times$ environment interaction effects for grain yield confirmed that genotypes responded differently to the variation in environmental conditions.

Performance and stability of rice genotypes across tested environments

The GGE biplot explained 85.27%, 84.08%, and 73.97% of the total variation of the environments for long, medium and short duration respectively. In long duration, BRRI dhan44 recorded the highest average grain yield (4.59 t/ha), with BR11 and BR22 identified as the most stable and ideal genotypes. For medium duration, genotypes like BRRI dhan103, BRRI dhan93 and BRRI dhan94 were highly stable, producing above-average yields. In short duration, BRRI dhan87, BRRI Hybrid dhan6 and BRRI dhan72 showed high yields and stability, making

them the most suitable genotypes for these conditions. (Fig. 1).

Identification of which-won-where and mega-environment

One of the most attractive features of a GGE biplot is its ability to show the Which-Won-Where pattern of a genotype by environment dataset. This plot consists of a polygon with perpendicular lines, called equality lines, drawn onto its sides. These lines divide the polygon into various sectors. Genotypes located on the vertices of the polygon are the best performers in one or more environments falling within a particular sector. The GGE biplot revealed distinct mega-environments for each duration type. In long duration, two mega-environments were identified, where BRRI dhan44, BR11 and BR10 were the top-performing genotypes. For medium duration, the analysis divided the environments into three mega-environments, with BRRI dhan94, BRRI dhan103, and BRRI dhan52 as the winning genotypes in different regions. For short duration, three mega-environments emerged, with BRRI dhan72, BRRI dhan87, BRRI dhan66, and BRRI hybrid dhan6 leading in performance across various locations.

Evaluation of test environments

For long duration, Rajshahi was identified as the most representative and ideal testing environment. In medium duration, Rajshahi and Kushtia stood out as optimal environments for genotype evaluation due to their discriminating ability and representativeness. In short duration, Kushtia and Cumilla were considered highly representative, making them ideal environments for testing short-duration genotypes. The analysis highlighted that environments like Rangpur and Kushtia, with longer vectors, were more discriminating, offering valuable insights into genotype performance.

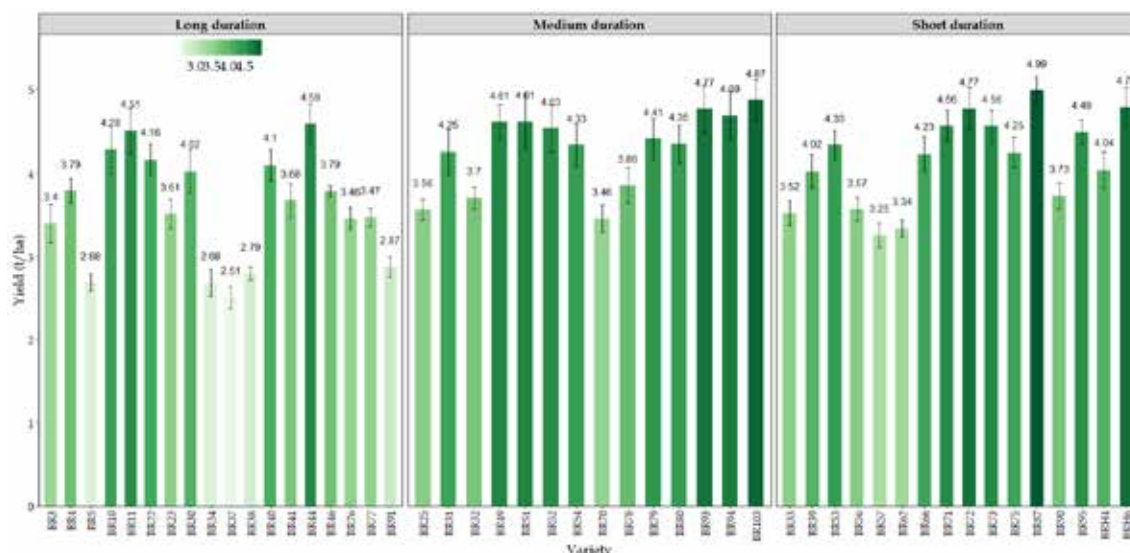


Fig. 1: Grain yield performance of BRRi released T. Aman rice varieties during 2024.

MAINTENANCE OF RICE AND RELATED DATABASE

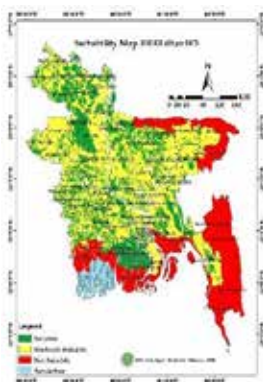
PI: M I H, **CI:** M A Q, M A A, M A A M and M A

Secondary data of rice and other important crops are collected periodically from Bangladesh Bureau of Statistics (BBS), Agricultural Marketing Directorate, Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), Bangladesh Agricultural Development Corporation (BADC) and other sources periodically and recorded accordingly. Databases are being updated regularly and uploaded at BRRi website. Rice area increased about more than one folds but the production increased about four folds during 1971-72 to 2023-24. Although the growth rate of rice area was 3.96 in year 1972-73 but in 2023-24 is 0.23. Similarly, growth rate of rice production was 1.30 in year 1972-73 but in 2023-24 is 4.10.

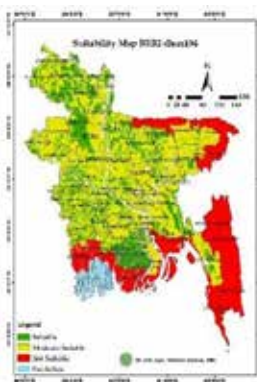
SUITABILITY MAPPING OF BRRi RELEASED VARIETIES

PI: M A A, **CI:** M A, B K, M I H, M A Q and M A A M

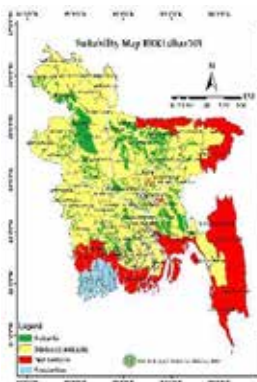
The objectives of the study were to construct edaphic suitability maps for newly released BRRi varieties and also find out variety wise suitable areas for production. Soil physical properties namely, land type, top soil texture, relief, soil consistency, soil moisture, soil permeability, soil reaction, soil salinity, drainage and slope were considered to determine areas suitable for growing respective rice varieties. So, proactivity will increase if we cultivate rice varieties according to their suitable area. In Boro season, suitable area for BRRi dhan104 is higher than BRRi dhan105. BRRi dhan104 variety mainly suitable in all over of Bangladesh but BRRi dhan105 is suitable in north-east part. Map 2 and Map 3 shows the suitability map of BRRi dhan104 and BRRi dhan105 respectively. In Aman season, BRRi dhan103 is appropriate for north-west and some part of central southern area. Map. 1 shows the suitability map of BRRi dhan103. In Aus season, BRRi dhan106 is appropriate for north-east part of Bangladesh. Map 4 shows the suitability areas of BRRi dhan106.



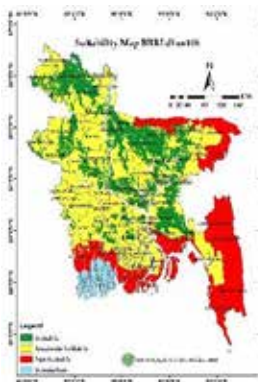
Map 1. Suitability map of BRR1 dhan103.



Map 2. Suitability map of BRR1 dhan104.



Map 3. Suitability map of BRR1 dhan105.



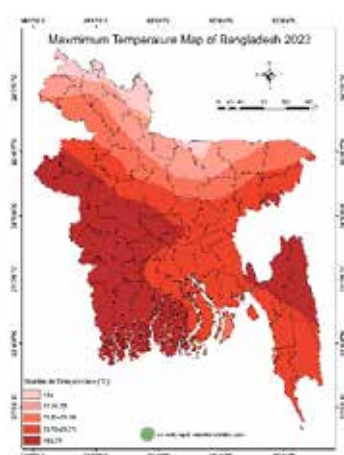
Map 4. Suitability map of BRR1 dhan106.

CLIMATE MAPPING TEMPERATURE AND RAINFALL OF BANGLADESH

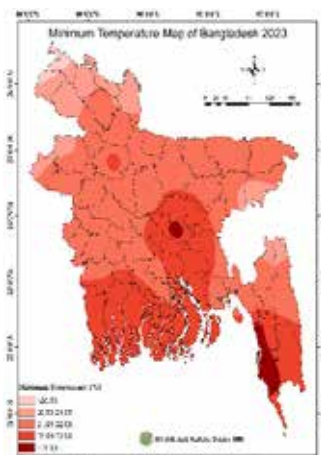
PI: MAA, **CI:** MA, MIH, MAQ and MAAM

Data on daily maximum and minimum temperature and rainfall of 42 weather stations of BMD for the years 2023 were used for the study. Year and station wise maximum value of maximum temperature and minimum value of minimum temperature and total rainfall were determined. Then by using geo-statistical tools of Arc GIS10.8 software maps were prepared in 2023, maximum temperature was high in

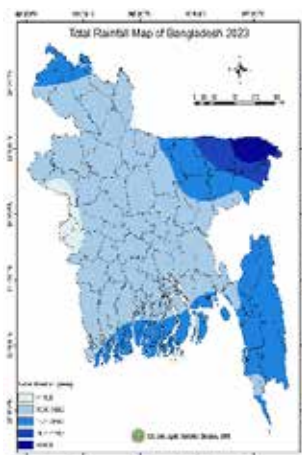
central western part of Bangladesh and lower in north-eastern regions. Map 5 shows the maximum temperature areas of Bangladesh for 2023. Minimum temperature was lower in north-western and high was in south-east and south-west region. Map 6 shows the minimum temperature areas of Bangladesh for 2023. Total rainfall was the highest in north-east corner and south-east and the lowest were in central and western parts of Bangladesh. Map 7 shows the total rainfall areas of Bangladesh for 2023.



Map 5. Max. temp. of Bangladesh in 2023.



Map 6. Min. temp. of Bangladesh in 2023.



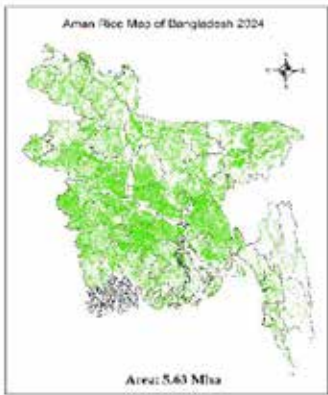
Map 7. Total rainfall of Bangladesh in 2023.

SEASON WISE RICE AREA MAPPING OF BANGLADESH

PI: M A A, **CI:** M I H, M A Q and M A A M

Remote sensing and GIS are considering as powerful tools for crop mapping, monitoring and yield forecasting. Identification of crop types and mapping are the first steps of satellite remote sensing-based crop monitoring and yield forecasting system. Satellite Images were collected from MODIS data portal of NASA. Time series and level 03 product image of Normalized Difference of Vegetation Index (NDVI), Effective vegetation index (EVI) and Land Surface Water Index (LSWI) were collected

according to the respective rice growing season. Whenever rice crop is initial stage i.e. transplanting time its vegetation index is very low and peak vegetative stage i.e. PI or booting stage its vegetation index is very high and in ripening or harvest time its vegetation index becomes again low. This algorithm was applied in agriculture area of Bangladesh and threshold value developed by ground truth data collected through GPS reading of various rice fields all over the Bangladesh. Then Aman 2024 and Boro 2024-25 season rice map (Map 8 and 9) were prepared. The total area of rice grown in Aman in 2024 was about 5.63 Mha. The total area of rice grown in Boro in 2023-24 was about 4.93 Mha.



Map 8. Aman 2024 cultivated areas of Bangladesh



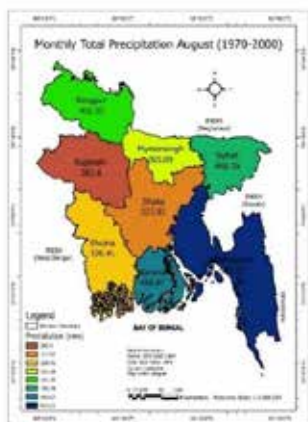
Map 9. Boro 2024-25 Area areas of Bangladesh

PROJECTED CLIMATIC FACTORS (2050) MAPS OF BANGLADESH

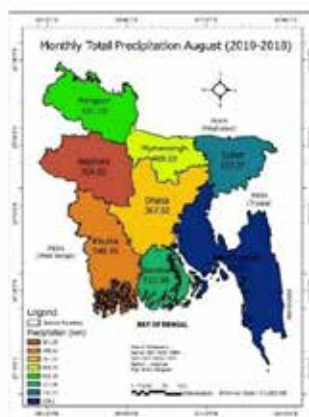
PI: M A A, **CI:** M I H, B K, N M F, M A Q and M A A M

In this study, we used the most recurrently used source of freely available, high resolution, downscaled, bias-corrected, and long-term climate raster dataset with global coverage, WORLDCLIM

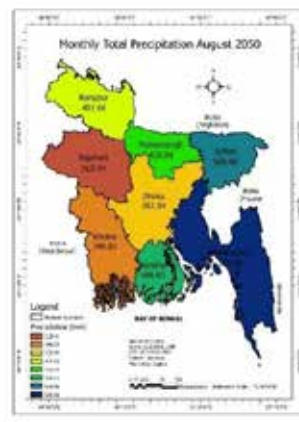
1.4, for past (1970-2000) and future (2040-2060 or 2050), its updated version 2.1 Fick and Hijmans 2017 present (2010-2018) for precipitation. All the data are in raster with a high spatial resolution of 2.5 arc minutes. Whole country and division-wise precipitation map Map. 10 to Map. 15 for the past (1970-2000), present (2000-2018) and future (2040-2060 or 2050) prepared using Arc GIS software.



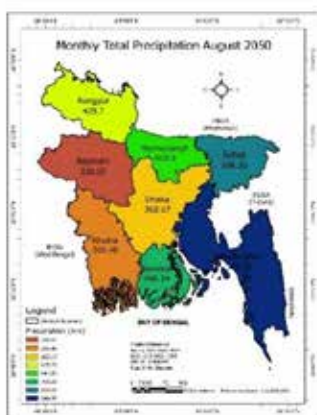
Map 10. August month average of total precipitation from 1970-2000.



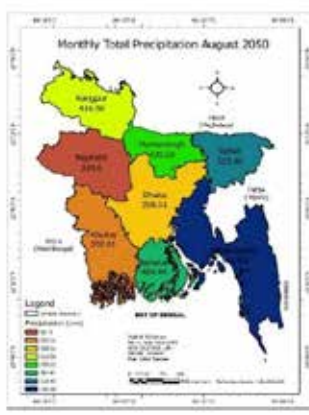
Map 11. August month average of total precipitation from 2010-2018.



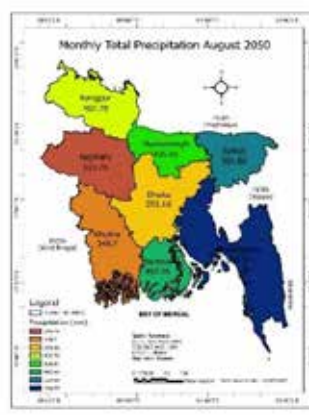
Map 12. August month average of total precipitation for the year 2050 according to RCP 2.6.



Map 13. August month average of total precipitation for the year 2050 according to RCP 4.5.



Map 14. August month average of total precipitation for the year 2050 according to RCP 6.0.



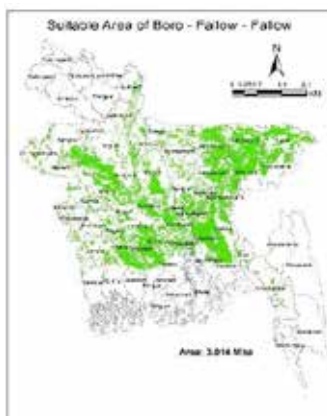
Map 15. August month average of total precipitation for the year 2050 according to RCP 6.0.

SUITABILITY MAPPING OF VARIOUS CROPPING PATTERN

PI: M A A, **CI:** R A, B K, M I H, M A Q and M A A M

Cropping pattern is important in agricultural system. Various physical and chemical properties of soil vary spatially; on the other hand, various cropping pattern are suitable for some specific physical condition. As we need to high production with limited land, so it will be very helpful if we have cropping pattern wise suitability map based on soil properties. Soil physical properties and climatic parameter maps (shape file) were considered to determine suitable growing area for particular cropping pattern. Arc GIS software was used to prepare suitability maps.

The suitability scale category 1 to 3 will be assigned to each soil and climate characteristic in relation to particular cropping pattern cultivation by the recommendation of relevant expert. Suitable areas from different soil and climatic properties will be intersected. Finally, the suitability map was generated. Boro-Fallow-Fallow cropping pattern is suitable in north-eastern part of Bangladesh (Map. 16) and total suitable area is 3.01 Mha. Mustard-Boro-Fallow cropping pattern cover total suitable areas 1.96 Mha and these suitable area in north-eastern side of Bangladesh (Map 17). Onion-Jute-T. Aman is suitable in north-western side of Bangladesh (Map 18) and total suitable area is 1.60 Mha.



Map 16. Suitability Map of Boro-Fallow-Fallow.



Map 17. Suitability Map of Mustard-Boro-Fallow.



Map 18. Suitability Map of Onion-Jute-T. Aman .

RICE YIELD FORECASTING USING SATELLITE IMAGE AND MACHINE LEARNING IN HABIGANG DISTRICT

PI: M A A, **CI:** M I H, M M M K, R A, A D, M A Q and M A A M

Using remote sensing and machine learning to estimate the crop yield is less expensive and time-consuming than traditional methods, and it is ideal yield forecast with the least amount of effort. Hence the objectives of this study are to forecasting rice yields using satellite image and machine learning methods that takes less time, labour, and cost. Satellite images give timely and spatially comprehensive information on crop health and vegetation indices, which have a significant impact on rice yields. GIS information and yield data were

collected about 15 places of Habiganj district in Boro season in 2024. Then collected NDVI collected from sentinel-2 satellite image and processed the image to collect necessary information. Here, we collected NDVI values and it helped us for yield forecasting. We used python from Google colab to run machine learning algorithm. Here, 80% data were used as training sample and rest of the data used for model validation. Finally, validated of the model. Among the linear regression (LR), random forest (RF), Support vector regressor (SVR), and ensemble model (EM) mean square error (MSE) are 0.662, 3.9206, 6.3783 and 1.8489 respectively. Thus, we have chosen linear regression model for yield prediction.

Table 1. ML Model Performance

Algorithm name	Mean square error
LR	0.662
RF	3.9206
SVR	6.3783
EM	1.8489

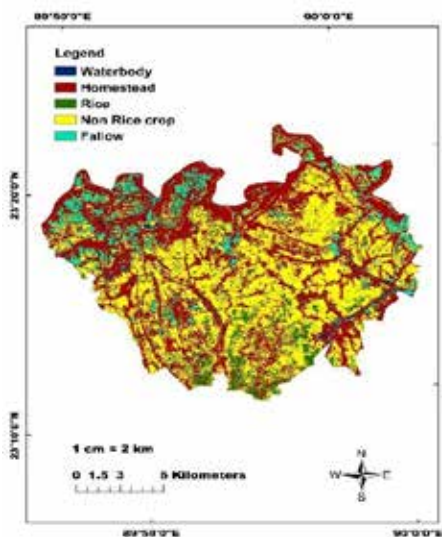
DELINEATION OF RICE AREA CHANGES IN COASTAL AREA OF BANGLADESH USING REMOTE SENSING DATA AND MACHINE LEARNING APPROACH

PI: M A A, **CI:** M I H, M M M K, R A, A D, M A Q and M A A M

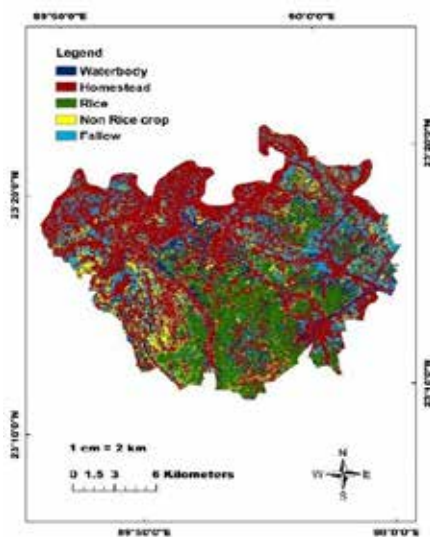
The Rice area of Bangladesh is not the same over time. Various environmental and socio-economic causes of the rice area vary over time. Moreover, recently governments have many interventions to increase the rice area, especially in coastal regions. Thus, it is important to know the effect of their programme through delineating the rice area changes over time. Muksudpur upazila is in the

northern part of Gopalganj District of Bangladesh. For this study, sentinel 2A, 10m spatial resolution satellite imagery data were utilized to assess the land use land cover (LULC) changes during the Boro season in Maksudpur upazila of the Gopalganj district. In Bangladesh Boro rice is cultivated from December to May. In March Boro rice comes in peak vegetative stages i.e., maximum tillering/booting stages. The collected images were stacked together to form an RGB image, which was then used to produce a preliminary land use land cover map (LULC) for each year (2018 and 2024). To achieve more accurate and detailed classification, the images were analysed and training data were produced based on colour, texture, tone, and structure, which

allowed for the identification of different land cover types. Then Maximum Likelihood supervised image classification was used to prepare final land use land cover maps. From land use land cover map of 2018 and 2024 (Map19 and Map 20) the land cover changes can be detected precisely. The rice area has increased sufficiently in 2024. The biggest change was in the area of non-rice crops, which decreased by 78.46 percent. The second biggest change was in the area of rice, which increased by 307.17 percent. This is likely due to many factors, including the increasing demand for food, the expansion of irrigation systems, and the development of new agricultural technologies.



Map 19. Land use land cover of Maksudpur upazila 2018.



Map 20. Land use land cover of Maksudpur upazila 2024.

CAPACITY BUILDING THROUGH TRAINING

PI: M I H, CI: M A A M, M A Q, N M F R and M A A

To set up the experiments, collecting, compiling, reporting, analyzing and presenting of the experimental data and increase the accuracy of the findings and developing skills on research two types of training programmes were conducted in 2024-25. The topics were planning experiments, problem data, field experimentation, experimental design, factorial experiment, CRD, RCBD, LSD, SPD, Strip PD, SSPD, Strip SPD and augmented design in the training of 'Experimental Data Analysis'. Another

topic was the 'Experimental field layout, data collection and data preparation' under this training programme.

A total of 50 participants were trained through the training programmes. Through the training on 'Experimental Data Analysis' 10 participants were trained. The participants were PSO, SSO and SO of BRRI. The second training programme was 'Experimental field layout, data collection and data preparation'. A total of 40 participants including FA, AFM and SA were trained through this training.

DEVELOP AN ONLINE INTEGRATED
PLATFORM FOR COLLECTING RICE
MAPPING DATA

PI: M A Q CI: M I H, S M M R and M A

Information is power and the main source for decision making to the policy makers. Sustainable policy is highly depended on the accuracy of information. It is very hard to accumulate the real time information on rice land and stage live information. 4IR technologies can help to obtain the better information from big data. For collecting land

position data, GPS machine is commonly used. But to collect field observation with position data for rice mapping in online, we need to develop an integrated platform.

Methodology: An integrated system using Kobo toolbox server (free), ODK mobile app, Questionnaire programming and the system integration were developed. Fig 21 shows the flowchart of the integrated platform is shown in the following ((Fig. 21).

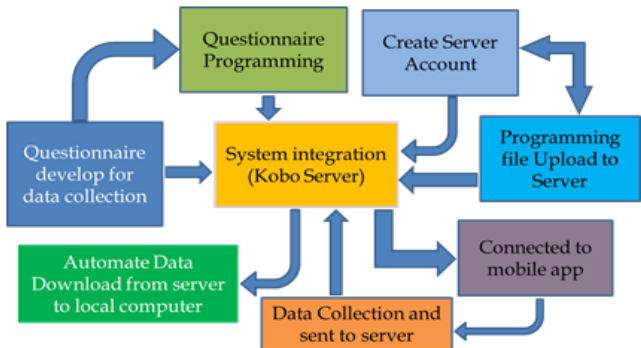


Fig. 21. Flow chart of integrated system

DIGITALIZED TOUR BILL MANAGEMENT
SYSTEM FOR BRRI HQ

PI: M A Q, CI: M I H, S M M R and M A

All the service needs to digitalize for the execution of the election manifesto (Digital Bangladesh) of the government of Bangladesh. Now tour bills are were prepared using tour distance matrix. But in the distance finding system was quite time, cost, visit and labour consuming. So that tour distance

calculation system needs to make digitalized. Under this activity we will develop a web application for calculation of tour distance system from BRRI HQ.

Methodology

Develop a web application using XAMPP server, MySQL Database, HTML, PHP, JQuery and JavaScript programming languages. The architect and design of the web application were completed. The system is not hosted yet. Figure 22 shows the Login page, home page, Menu bar with some view.

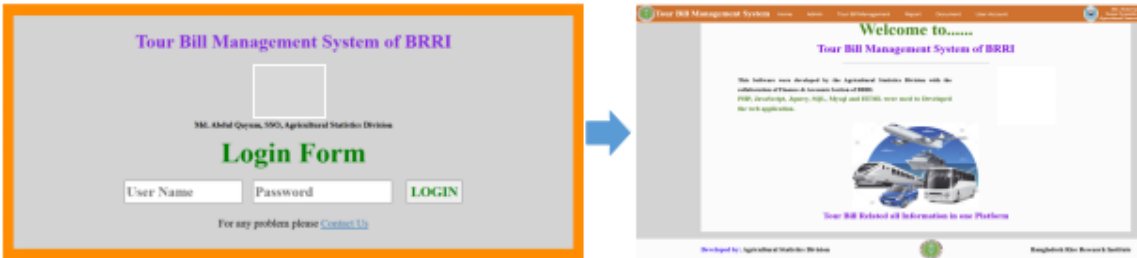


Fig. 22. Pictorial view of the tour bill management system

Besides the above two activity in Computer programming, Software Development and Digitization project, Eight web applications have been maintained, updated and continuously run in the whole reporting year which are as follows
 Developed a dynamic web application for visualizing and analyzing the rice disease surveillance data (2) Develop a web application to calculate the Stability Index for BRRi Stability Model (3) Developed a Platform for BRRi Developed Management Information System (MIS) (4) Budget Management System of BRRi (5) Quota Management System of BRRi (6) Salary Management System for BRRi HQ (7) Labour Management System (V2) and (8) Casual Leave Application System.

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ACTIVITIES

REAL TIME DASHBOARD-BASED MONITORING SYSTEM FOR LOCATION-SPECIFIC INSECT AND DISEASE USING ARTIFICIAL INTELLIGENCE (AI) AND MACHINE LEARNING

PI: M M B W, CI: M I H, S M M R, M U S and M A U

BRRi has already developed a sensor-based rice pest management mobile application named “ধান সুরক্ষা (Rice Solution)” mobile app with the aim of identifying diseases easily. It is a platform where a user uploads an image or information related to any insect and disease on the app, it automatically

diagnoses the matter and provide specific management advice based on the accuracy rate. As a result, the problems that arise in the field can be solved immediately and it saves time and money at the farmer level. Now based on the image analysis data of mobile apps, AI and ML based real time dashboard monitoring system has developed for insect and disease considering several locations of Bangladesh. Therefore, an electronic tool developed to explore a smart decision support system for accessing variety information.

SMART PROFILING OF RICE FOR DISASTER-PRONE ZONES OF BANGLADESH

PI: M M B W, CI: M I H, K M H, M U S and M A A

The ‘Rice Profile’ mobile app is delivering the detail information of suitable variety for selected areas using ‘Select suitable rice variety’ menu of ‘Rice Profile’ mobile app providing desired individual information of division, district and upazila as input. Already we are including seven rice type information out of 17 rice type into the mobile app. Also prepared location-specific map using remote sensing and GIS. It has a capacity to develop an easy comparison of the varieties for a specific environment and quickly picking up the preferred one (s). The information of 14 regions under DAE with districts and upazilas of Bangladesh has also included (Fig. 23).



Fig. 23. Rice profile mobile app

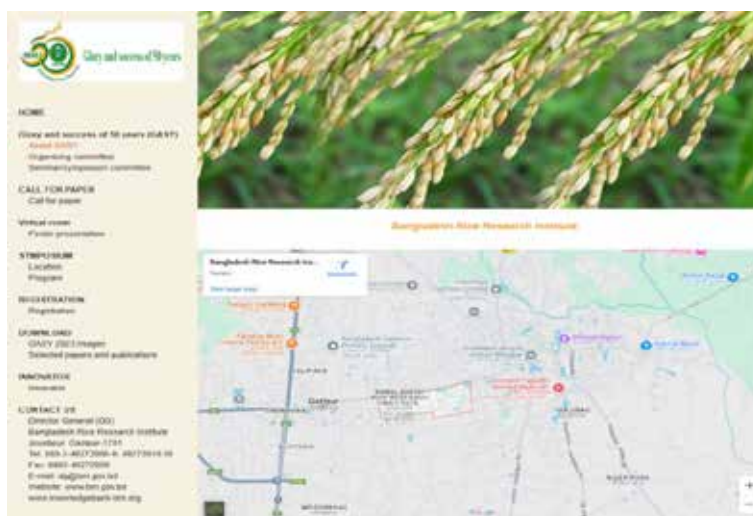


Fig. 25. Glory and success of 50 years website for BRRI.

“BRRI ALAPON” TELEPHONE DIRECTORY MOBILE APP

PI: M M B W, **CI:** M I H, S M M R, M K, M A and N K

The BRRI Telephone Directory Mobile app named as “*BRRI Alapon*” according to the monthly progress review meeting of innovation team in September 2020. This mobile app developed for BRRI officials to communicate with each other through this app like imo, Telegram, WhatsApp etc. The app has features like chat, online calls, group messaging and location sharing. ‘BRRI Alapon’ is available in Apple’s App Store (*iStore*) and Google play store for *Android* phone user. Anybody can call and exchange messages more securely using this app. App to app call, email and SMS is completely free for users. Database already been developed for this app. All types of data have been collected from divisions, sections and regional stations of BRRI for developing the telephone directory mobile app.

VEHICLE MANAGEMENT SYSTEM OF BRRI

PI: M M B W, **CI:** M I H, S M M R, M K, M A and N K

Vehicle Management System (VMS) is a transportation pool management activity of BRRI are complex and updating the allottee individually in time which is tedious work. The designated official of Transport division is needed to work after office to manage the official vehicle requests and to convey

the confirmation to the requester and driver over the phone. VMS ease the allotment work using a simple requisition management system that doesn’t require any advanced computing skills and the confirmation sent using SMS and email. So that, the requester informed through SMS on basis of demanding vehicle for official or personal purpose as well as driver get confirmation SMS for their upcoming duties. The VMS has already developed. The Application Programming Interface (API) sharing with other system is continuing.

BRRI WEB PORTAL MANAGEMENT

PI : N K, **CI s :** M I H, S M M R, M M B W, M K, M A, M A and M A H

BRRI web portal (www.portal.gov.bd) is developed, managed and updated by ICT Cell of Agricultural Statistics Division. BRRI web portal/website is being updated regularly by providing latest information. BRRI web portal is in Bangla and English languages. In this reporting year, we updated more than 1,580 pages and uploaded more than 6,994 (six thousand nine hundred and ninety-four) documents like PDF, JPG, report, Word and other files on the BRRI website.

BRKB Website Management of BRRI

PI : S M M R, **CI s :** M I H, M M B W, M K, M A, N K, M A and M A H

We have developed eighteen web and mobile-based fact sheets. And all the fact sheets have been uploaded to the BRKB website. BRKB updated with the latest information of Aman, Aus and Boro rice varieties, included the latest variety of BRRI dhan114, BRRI dhan113, BRRI dhan112 and BRRI dhan111. All types of information i.e., soil and fertilizer management, insects and rice diseases management etc also are being updated regularly. A total of 4,83,645 users have been visited the website so far.

BRRI networks update, maintenance and extension

PI: M M B W, **CI:** M I H, S M M R, M K, M A and N K

BRRI Networks Facebook group is a big forum for all the scientists, officers and staffs of BRRI. ICT Cell created this Facebook group to post research related work for noble work of rice and related activities, various problems and their solutions, official interactions in this forum. The Facebook group of “*BRRI Networks*” link is <https://www.facebook.com/groups/1409267722690061/>. Thus, the *BRRI Network* is continuing with regular updating posted by everybody of this group. At present, more than 4,200 individuals have joined this group. It is increasing gradually. It has stored at least 2,000 and more photos of all national programme and research activities of head quarters and all regional stations. It has also uploaded around 250 necessary pdf and word file document for all members.

Personal data sheet database

PI : M K , **CI s :** M I H, S M M R, M M B W, M A, N K, M A and M A H

We have created personal data sheet (PDS) database for all scientists, officers, staffs as per requirement of the Ministry of Agriculture (MoA). It has been increased up to 339 users in the BRRI PDS database. In this reporting year, we have approved more than 2,366 information and general information also updated by personal user without help of administration approval. PDS database is updated regularly with the latest information.

ICT and related fair

ICT Cell of Agricultural Statistics Division has participated in several ICT and related fairs such as Digital World Fair, Development Fair, Tathay Mela, Innovation showcasing and World Food Fair etc.

Support services

The scientists of this division are also engaged in helping scientists of other disciplines in planning experiments, statistical data analysis and interpretation of results. Fifty-five different types of analyses were performed during the reporting period. A number of maps were prepared using GIS and supplied to the scientists of other divisions whenever required. Overall, ICT cell of Agricultural Statistics Division has taken initiative in accordance with government perspectives but BRRI Networks Facebook group is first introduced among all National Agricultural Research System (NARS) and also first among all research institutes. The ICT cell of Agricultural Statistics Division provides D-Nothi management system, online recruitment management, APA and e-Governance, e-GP and other internet related support services to other divisions and sections.

Farm Management Division

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280	Rice seed production
280	Support service

SUMMARY

Different kinds of research and development as well as management activities conducted by Farm Management Division can be discussed under three broad headings namely research, seed production and support services. Summary of these activities are described as follows-

An experiment was conducted at the West Byde of BRRI HQ farm, Gazipur during T. Aman 2024 season to find out the best planting time of fine rice varieties for higher yield and quality. Transplanting on 15 August produced the best results for filled grains per panicle, grain yield, milling quality (milling outturn and head rice recovery), and protein content across the tested fine rice varieties except on plant height, LAI, SDWT and RDWT were highest in 15 July transplanting. Transplanting between 30 July and 30 August consistently yielded strong performance in all those characteristics.

The experiment was conducted at the East Byde of BRRI farm, Gazipur during Boro 2024-25 seasons to find out best and profitable weed inference period for maximizing yield. There were no significant differences among treatments in terms of relative density, dry weight, and summed dominance ratio—except at 45 days after transplanting (DAT), where weeding methods altered weed number and dry weight. The control (no weeding) recorded the highest weed species count (299) and dry weight (63.84 g m^{-2}), while the combination of pre emergence herbicides (Bensulfuron methyl + acetachlor) at 3–4 DAT + 1 hand weeding at 45 DAT produced the lowest (6.33 weed number, 3.07 g m^{-2}). Pree emergence herbicides (Bensulfuron methyl + Actachlor) also showed the highest relative density (100 %), matched only by Pree emergence herbicides (Butachlor) at 3-4 days after rice transplanting and Post emergence herbicides (Bispyribac sodium) and the weed free condition, whereas the lowest relative density occurred in the control (no weeding). For relative dry weight, Post emergence herbicides

(Phenoxlum240 SC) + 1 hand weeding at 45 DAT had the highest value (109.42 %) followed by Pree emergence herbicides (Bensulfuron methyl + acetachlor) at 3–4 DAT + 1 hand weeding at 45 DAT, while the control had the lowest (99.97 %), and summed dominance ratio peaked in the weed free treatment, with Post emergence herbicides (Phenoxlum240 SC) + 1 hand weeding at 45 DAT and Pree emergence herbicides (Bensulfuron methyl + acetachlor) at 3–4 DAT + 1 hand weeding at 45 DAT also outperforming the control. Notably, weed control treatments did not significantly affect panicle number, filled grains per panicle, 1000-grain weight, or yield—though Pree emergence herbicides (Bensulfuron methyl + acetachlor) at 3–4 DAT + 1 hand weeding at 45 DAT yielded the highest grain yield (5.77 t ha^{-1}), exceeding Pree emergence herbicides (Butachlor) + Post emergence herbicides (Bispyribac sodium), Weed free condition, and the control (4.34 t ha^{-1}).

The average wage rate per day (8.0 hrs) was Tk. 579-663 at different locations around BRRI HQ and regional stations by conducted a survey of labourers' wage rate throughout the year. The highest wage rate of labourers was in May (Tk. 750-850 per day) due to harvesting and post-harvest operations of Boro rice and transplanting of Aus rice.

An experiment was conducted at the East Byde of BRRI farm, Gazipur during Boro 2024-25 to identify performances of different seed production practices and paddy production practice of some boro varieties. Four BRRI developed four rice varieties (BRRI dhan100, BRRI dhan104, BRRI dhan105 and BRRI dhan108) were evaluated with three production techniques in RCB design with three replications. Significant differences in yield were found among different seed and paddy production systems. Breeder seed production plots showed significantly lower yield compared to both paddy production and TLS production plots. On the other hand, among different varieties, BRRI

dhani100 showed the highest yield followed BRRIdhani104, BRRIdhani108 and BRRIdhani101.

Farm Management division produced 7,689 kg TLS was produced in T. Aman and Boro seasons, respectively. In addition, 1,630 kg mixed rice were produced during this period.

In total 16,266 kg breeder seed was produced under supervision of FMD during 2024-25.

In total 27,143 kg seed was distributed by FMD during the reporting period.

Total labour utilization in different divisions and sections of BRRIdhani HQ was 1,57,626 man days of which 60.73 % and 39.27 % were utilized for research and support service, respectively.

In total Tk7,78,96,825 was paid to the labourers as labour wage in which Tk5,63,20,975 and Tk2,85,06,250 were for research work and support service works, respectively.

BRRIdhani has 284.40 ha of land of which 190.68 ha in research purposes, 51.44 ha in general cultivable and 42.28 ha in an office and residential area. In total 77.75 ha of land were utilized by different research divisions in different seasons at BRRIdhani HQ.

Including regional stations, BRRIdhani had 656 labors of which 617 regular, 36 irregular and 3 seasonal labors. In BRRIdhani HQ, total number of laborers was 418 of which 400 regular and 15 irregular and 3 seasonal labors.

Including regional stations of BRRIdhani in total Tk.54,22,329 was given to 10 laborers as financial benefits for retirement and also Tk32,864 was given to 06 laborers as medical financial benefits for injury in working time during the fiscal year 2024-2025.

This division manages the BRRIdhani flower garden to maintain the aesthetic view. This division effectively carried out activities of mosquito control, graveyard management and playground management and helped in other support services and management activities of BRRIdhani.

DETAILED ACTIVITIES

The Farm Management Division (FMD) was established at the inception of BRRIdhani in 1970. This division is one of the components of the Socio-economics and Policy Programme Area of BRRIdhani and carries out research as well as management and support services for the institute, such as, HYV rice seed production (breeder seed and truthfully labelled seed), fixing of labour wages, weed management methods and economics, water management (irrigation and drainage), maintenance of the BRRIdhani office premises and field management, garden management and beautification of BRRIdhani office areas, graveyard management, land and labour management for smooth conduct of field research at BRRIdhani etc.

Rice Production Management

Influence of different dates of transplanting on growth, yield performance and quality of fine rice varieties

This experiment was conducted at the West Byde of BRRIdhani farm, Gazipur during T. Aman 2023 season to find out the best planting time of fine rice varieties for higher yield and quality. The treatments were A. Transplanting dates: T₁ = 15 July, T₂ = 30 July, T₃ = 15 August, T₄ = 30 August, T₅ = 15 September, T₆ = 30 September; and B. Varieties: V₁ = BRRIdhani dhan34, V₂ = BRRIdhani dhan90 and V₃ = Binadhan-13. The treatments were distributed in strip-plot design with three replications (Transplanting dates in main plot and variety in sub plot) and spacing 20 cm × 20 cm. Twenty-day-old seedlings were transplanted on selected dates. All other intercultural operations were done as and when necessary. Yield and yield components data were taken at maturity stage. The collected data were analyzed using Statistix10 Software.

Yield and Yield components in T. Aman

Plant height and filled grain/panicles of tested varieties showed significant difference irrespective of transplanting date. The highest plant height was observed in 15 July transplanting of all tested varieties than the other transplanting dates (30 July,

15 August, 30 August, 15 September and 30 September) (Table 1). The highest number of panicles hill⁻¹ were found in BRRI dhan34, BRRI dhan90 and Binadhan-13 at 15 August transplanting followed by 30 August transplanting. The lowest was found in 30 September transplanting except BRRI dhan34. The highest filled grain panicles⁻¹ was observed in BRRI dhan34, BRRI dhan90 and Binadhan-13 at 15 August transplanting and the lowest were in 30 September transplanting at all tested varieties (Table 1).

Transplanting of 15 August produced the highest grain yield in BRRI dhan34, BRRI dhan90 and Binadhan-13 followed by 30 August and 30 July transplanting and the lowest in 15 July transplanting. After 30 August and before 30 July the yield of all the tested fine rice varieties was decreasing. The highest harvest index (HI) was present in BRRI dhan34, BRRI dhan90 and Binadhan-13 at 30 August transplanting and the lowest in 15 July transplanting. The highest growth duration was present in 15 July transplanting in all the tested varieties and the lowest in 30 September. Binadhan-13 produced the highest growth durations in all transplanting dates followed by BRRI dhan34 and the lowest was in BRRI dhan90 (Table 2).

Leaf area index (LAI), Shoot dry weight (SDWT) and Root dry weight (RDWT) had no significant differences of transplanting dates and varieties in booting and flowering stages except varieties in LAI at booting stage and RDWT at flowering stage. The highest LAI, SDWT and RDWT were present in 15 July transplanting in all the tested varieties and the lowest in 30 September (Table 3).

Milling outturn and head rice recovery percentage had significant differences of transplanting dates and varieties. BRRI dhan34 produced the highest milling outturn (72.55%) and head rice recovery percentage (67.83%) followed by BRRI dhan90 with 30 August transplanting.

The lowest milling outturn and head rice recovery percentage were present in 15 July and 30 September transplanting at all tested varieties especially Binadhan-13. 15 to 30 August transplanting, BRRI dhan34 produced the highest protein content (10.06%) than BRRI dhan90 (9.80%) and the lowest in Binadhan-13 at different transplanting dates (Table 4).

From the above results, it may be concluded that during T. Aman season, for tested fine rice varieties 15 August to 30 August transplanting produced statistically identical yield. Milling outturn (%), head rice (%) and protein content (%) produced higher in 15 August to 30 August transplanting

Expt. 2: Influence of weed inference period on the performance and profitability of BRRI dhan89

The experiment was conducted at the East Byde of BRRI farm, Gazipur during Boro 2024-25 seasons to find out best and profitable weed inference period for maximizing yield. The treatments were W₁ = No weeding (control), W₂ = Weed free condition (at 12-15 DAT/25-30 DAT/40-45 DAT), W₃ = Pree emergence herbicides (Bensulfuran methyl + Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress), W₄ = Post emergence herbicides (Phenoxlum 240 SC) a spraying after 1-2 leaves of weeds + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress), W₅ = Pree emergence herbicides (Pretilachlor 50% EC) at 3-4 days after rice transplanting + Post emergence herbicides (Bispyribac sodium) at spraying after 1-2 leaves of weeds and W₆ = BRRI mechanical weeder at 15 DAT + 1 hand weeding (HW) at 45 DAT. The treatments were distributed in RCBD with three replications and spacing 20 cm × 20 cm. The plot size 20 m × 20 m and variety was used BRRI dhan89. Thirty-five-day-old seedlings were transplanted on selected plots. All other intercultural operations were done as and when necessary. Data on weed population were collected from each plot at vegetative growth stage of the rice plants by using 1 m² quadrat as per method. The

quadrant was placed in three spots at random outside 1 m² central areas, kept for taking yield data. The weeds within the quadrant were counted species-wise. Yield and yield components data were taken at maturity stage. The collected data were analyzed using Statistix10 Software.

Weed inference period had no significantly differences of relative density, relative dry weight and summed dominance ratio except number of weed and weed dry weight at 45 DAT. The maximum number of weeds species (299) and weed dry weight (63.84 gm⁻²) were found in control treatment (no weeding) (W₁) followed by BRRI mechanical weeder at 15 DAT + 1 hand weeding (HW) at 45 DAT (W₆) and Post emergence herbicides (Phenoxlum240 SC) a spraying after 1-2 leaves of weeds + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₄) and the minimum (6.33 and 3.07 gm⁻²) one recorded from Pree emergence herbicides (Bensulfuran methyl + Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₃). The highest relative density weight (100%) was found in Pree emergence herbicides (Bensulfuran methyl + Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₃) and Pree emergence herbicides (Pretilachlor 50% EC) at 3-4 days after rice transplanting + Post emergence herbicides (Bispyribac sodium) at spraying after 1-2 leaves of weeds (W₅) followed by Weed free condition (at 12-15 DAT/25-30 DAT/40-45 DAT) (W₂) and BRRI mechanical weeder at 15 DAT + 1 hand weeding (HW) at 45 DAT (W₆). The lowest relative density of weed was obtained from Post emergence herbicides (Phenoxlum240 SC) a spraying after 1-2 leaves of weeds + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₄) followed by No weeding (control) (W₁). The maximum relative dry weight of weed (109.42%) was found in Post emergence herbicides (Phenoxlum240 SC) a spraying after 1-2 leaves of weeds + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₄) followed by Pree emergence

herbicides (Bensulfuran methyl + Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₃) and the minimum (99.97%) was one recorded in No weeding (control) (W₁). The highest summed dominance ratio (133.32%) was found in Weed free condition (at 12-15 DAT/25-30 DAT/40-45 DAT) (W₂) followed by Post emergence herbicides (Phenoxlum240 SC) a spraying after 1-2 leaves of weeds + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₄) and Pree emergence herbicides (Bensulfuran methyl + Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₃) and the lowest one (99.93%) in No weeding (control) (W₁).

Weed inference period were not significantly influence the number of panicles hill⁻¹, number of filled grain panicles⁻¹, 1000-grain weight and grain yield. The highest number of panicles hill⁻¹ (11.16) and number of filled grain panicles⁻¹ (130.73) were found in Pree emergence herbicides (Bensulfuran methyl + Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₃) followed by Pree emergence herbicides (Pretilachlor 50% EC) at 3-4 days after rice transplanting + Post emergence herbicides (Bispyribac sodium) at spraying after 1-2 leaves of weeds (W₅) and Weed free condition (at 12-15 DAT/25-30 DAT/40-45 DAT) (W₂) and the lowest (9.83 and 93.43) one No weeding (control) (W₁). The highest grain yield (5.77 t ha⁻¹) was obtained in Pree emergence herbicides (Bensulfuran methyl + Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₃) followed by Pree emergence herbicides (Pretilachlor 50% EC) at 3-4 days after rice transplanting + Post emergence herbicides (Bispyribac sodium) at spraying after 1-2 leaves of weeds (W₅) and Weed free condition (at 12-15 DAT/25-30 DAT/40-45 DAT) (W₂). The lowest grain yield (4.34 t ha⁻¹) was found in No weeding (control) (W₁).

From the above results, it may be concluded that effective weed control method Pree emergence

herbicides (Bensulfuran methyl +Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress) (W₃) treatment was the most effective in terms of weed suppression and maximize rice yield.

Labour Management System

Monitoring labor wage rate at different locations of Bangladesh.

A survey was conducted throughout the year to find out the labourers' wage rate at different locations around BRRI HQ such as Joydebpur, Chowrasta, Salna, Board Bazar and Konabari, Tongi areas. Labourers' wage rate differs according to the location of the work. It was observed that the average wage rate per day (8.0 hrs) was Tk 579-663 (Table 5). The average labour wage rate with food varied between Tk 521-596. The lowest wage rate with food was found (450-500 Tk per day) in Satkhira, Habiganj, Rangpur, Gopalganj and Sirajganj areas (Table 6)

Rice Seed Production

Comparative study on breeder seed, TLS and rice production system

The experiment was conducted at the East Byde of BRRI farm, Gazipur during Boro 2024-25 to identify performances of different seed production practices and paddy production practice of some boro varieties. In breeder seed and TLS production plots the yield are not similar compared to rice production plots due to different management practices, such as, use of different number of seedlings per hill, row and logo system, rouging, harvesting time etc. Four BRRI developed four rice varieties (BRRI dhan100, BRRI dhan104, BRRI dhan105 and BRRI dhan108) were evaluated with three production techniques in RCB design with three replications. The plot size was 4m *3m with hill to hill distance of 20 cm. All the intercultural operations were carried out according to the prescribed recommendation of BRRI.

It was found that significant differences in yield were found among different seed and paddy

production systems (Figure 1). Breeder seed production plots showed significantly lower yield compared to both paddy production and TLS production plots. On the other hand, among different varieties, BRRI dhan100 showed the highest yield followed BRRI dhan104, BRRI dhan108 and BRRI dhan101 (Figure 2).

Performance of different rice varieties in seed production plots during 2024-25

In total 3 and 4 varieties were cultivated in BRRI research field for the purpose of TLS production during T. Aman and Boro seasons, respectively in 2024-25. The varieties were harvested at 80-90% maturity and yields (t ha⁻¹) were adjusted to 14% moisture content (Table 7-9).

Truthfully Labeled Seed (TLS) and Breeder Seed Production

In different rice seasons of the reporting period, FMD produced about 7689 kg TLS (Table 10) and total 16266 kg breeder seed (Table 11).

Seed Distribution

Total 27,143 kg truthfully labeled seed was distributed by FMD during the reporting period (Table 12).

SUPPORT SERVICES

FMD carries out research as well as management and support services for the institute, such as, HYV rice seed production (breeder seed and truthfully labelled seed), fixing of labour wages, weed management methods and economics, water management (irrigation and drainage), maintenance of the BRRI office premises and field management, garden management and beautification of BRRI office areas, graveyard management, land and labour management for smooth conduct of field research at BRRI etc (Table 13-17)

Table1. Effect of transplanting dates and varieties on plant height (cm), number of panicles hill⁻¹ and filled grain panicles⁻¹ in T. Aman 2024 at BRRI HQ farm, Gazipur.

Trait	Variety	Transplanting dates					
		15 th July	30 th July	15 th August	30 th August	15 th September	30 th September
Plant height (cm)	BRRI dhan34	161.67	148.255	135.69	127.17	113.67	113.51
	BRRI dhan90	116.17	114.00	111.75	96.17	94.22	93.89
	Binadhan-13	165.50	158.36	154.83	153.50	111.00	110.33
Number of panicles hill ⁻¹	BRRI dhan34	6.75	7.08	9.50	9.16	8.83	8.755500
	BRRI dhan90	8.33	8.67	9.91	9.0	7.66	7.411167
	Binadhan-13	7.25	7.50	7.58	7.41	7.33	7.1667
Filled grain panicles ⁻¹	BRRI dhan34	141.40	142.87	210.00	195.67	134.40	129.73
	BRRI dhan90	168.47	186.57	253.13	238.07	114.40	111.79
	Binadhan-13	79.80	85.70	103.50	91.43	82.90	81.80

Trait	Treatment	CV (%)	LSD _{0.05}
Plant height (cm)	Variety	1.25	1.46
	Time	1.34	1.78
	Variety × Time	1.12	2.62
Number of panicles hill ⁻¹	Variety	10.81	0.86
	Time	6.89	0.57
	Variety × Time	6.64	1.21
Filled grain panicles ⁻¹	Variety	8.82	12.44 6
	Time	16.82	19.96 4
	Variety × Time	13.81	25.86 1

Table 2. Effect of transplanting dates and varieties on grain yield (tha⁻¹), harvest index (%) and growth duration in T. Aman 2024 at BRRI HQ farm, Gazipur.

Trait	Variety	Transplanting dates					
		15 th July	30 th July	15 th August	30 th August	15 th September	30 th September
Grain yield (tha ⁻¹)	BRRIdhan34	2.47	3.40	3.47	3.38	3.28	2.79
	BRRIdhan90	3.11	3.55	4.00	3.93	3.67	3.62
	Binadhan-13	2.24	2.58	3.06	2.98	2.46	2.24
Harvest index (%)	BRRIdhan34	0.22	0.34	0.37	0.38	0.37	0.34
	BRRIdhan90	0.35	0.37	0.37	0.38	0.36	0.35
	Binadhan-13	0.20	0.23	0.27	0.29	0.25	0.24

Trait	Variety	Transplanting dates					
		15 th July	30 th July	15 th August	30 th August	15 th September	30 th September
Growth durations	BRRIdhan34	151.67	134.33	123.67	121.33	117.67	115.67
	BRRIdhan90	117.33	112.33	111.33	109.67	109.33	108.67
	Binadhan-13	165.00	149.33	136.33	130.33	123.67	120.67

Trait	Treatment	CV (%)	LSD _{0.05}
Grain yield (tha ⁻¹)	Variety	3.06	0.08
	Time	6.49	0.21
	Variety × Time	5.62	0.31
Harvest index (%)	Variety	5.61	0.016
	Time	7.10	0.023
	Variety × Time	6.61	0.036
Growth durations	Variety	0.60	0.70
	Time	0.54	0.71
	Variety × Time	0.45	1.20

Table 3. Effect of transplanting dates and varieties on Leaf area index (LAI), Shoot dry weight (SDWT) and Root dry weight (RDWT) in T. Aman 2024 at BRRI HQ farm, Gazipur.

Trait	Variety	Transplanting dates											
		15 th July		30 th July		15 th Aug.		30 th Aug.		15 th Sep.		30 th Sep.	
		BS	FS	BS	FS	BS	FS	BS	FS	BS	FS	BS	FS
LAI	BRRIdhan34	6414	2950	4424	3270	3411	2181	2499	1606	2355	1977	1306	997
	BRRIdhan90	5339	3797	4980	3546	4602	3119	4503	2430	3251	2544	2264	1423
	Binadhan-13	2654	2358	2745	2047	2386	1917	2420	1666	2165	1469	1452	1195
SDWT	BRRIdhan34	48.1	57.5	22.6	51.14	25.76	45.12	31.04	54.47	29.61	34.63	15.92	25.68
	BRRIdhan90	31.23	40.8	32.1	34.89	30.26	42.81	32.94	45.20	25.37	31.46	24.92	32.75
	Binadhan-13	57.12	47.9	38.2	78.46	44.86	56.27	36.72	46.65	33.91	44.41	21.35	47.76
RDWT	BRRIdhan34	41.45	19.9	15.2	8.09	16.06	9.22	16.42	8.25	5.24	2.17	2.51	1.70
	BRRIdhan90	14.97	6.40	14.5	6.49	13.15	5.41	7.45	4.77	4.48	2.83	2.94	2.45
	Binadhan-13	28.35	6.78	16.5	10.18	13.07	7.39	10.93	5.4	7.11	3.97	5.64	2.61

BS = Booting stage, FS = Flowering stage, Aug. = August & Sep. = September

Trait	Treatment	CV (%)		LSD _{0.05}	
		BS	FS	BS	FS
LAI	Variety	5.70	22.77	173.58	474.17
	Time	10.66	21.35	367.95	504.49
	Variety × Time	12.84	21.08	649.53	891.99

Trait	Treatment	CV (%)		LSD _{0.05}	
		BS	FS	BS	FS
SDWT	Variety	14.14	17.36	8.83	7.38
	Time	26.00	23.01	4.23	10.98
	Variety × Time	19.00	19.56	12.23	16.91
RDWT	Variety	31.02	13.14	3.76	0.77
	Time	82.98	45.65	11.43	3.03
	Variety × Time	33.39	48.84	13.12	4.86

Table 4. Effect of transplanting dates and varieties on grain qualities in fine rice (T. Aman) 2024 at BRRI HQ farm, Gazipur.

Trait	Variety	Transplanting dates					
		15 th July	30 th July	15 th Aug.	30 th Aug.	15 th Sep.	30 th Sep.
Milling outturn (%)	BRRI dhan34	72.16	72.36	72.50	72.55	72.35	71.21
	BRRI dhan90	68.80	69.85	70.23	70.66	69.93	69.20
	Binadhan-13	68.46	68.87	69.06	69.70	68.22	67.92
Head rice (%)	BRRI dhan34	66.43	66.86	67.81	67.83	67.65	66.05
	BRRI dhan90	66.05	67.04	67.29	67.39	66.22	67.22
	Binadhan-13	54.09	54.66	55.57	55.92	55.58	55.12
Protein content (%)	BRRI dhan34	10.00	10.01	10.06	10.06	9.97	9.93
	BRRI dhan90	9.76	9.76	9.80	9.80	9.66	9.56
	Binadhan-13	8.21	8.21	8.38	8.62	8.42	8.25

Aug. = August & Sep. = September

Trait	Treatment	CV (%)	LSD _{0.05}
Milling outturn (%)	Variety	0.73	0.47
	Time	0.51	0.37
	Variety × Time	0.67	0.82
Head rice (%)	Variety	0.78	0.45
	Time	1.12	0.74
	Variety × Time	0.77	1.04
Protein content (%)	Variety	1.66	0.14
	Time	0.98	0.09
	Variety × Time	1.21	0.21

Table 5. Effect of weed inference period on number of weed, weed dry weight (g m⁻²), relative density (%), relative dry weight (%), summed dominance ratio (%) at 45 DAT and yield and yield contributing characters of BRRI dhan89.

WIP	No. of weed	WDWT (g m ⁻²)	RD (%)	RDW (%)	SDR (%)	No. of panicles hill ⁻¹	No. of filled grain panicles ⁻¹	TGWT (g)	GY (t ha ⁻¹)
W ₁	299	63.84	99.89	99.97	99.93	9.83	93.43	22.45	4.34
W ₂	16.67	3.19	99.99	99.99	133.32	10.66	116.90	22.97	5.73
W ₃	6.33	3.07	100.0	100.00	100.00	11.16	130.73	23.38	5.77
W ₄	24.33	16.60	99.85	109.42	104.64	10.25	105.90	22.65	5.67
W ₅	7.00	8.61	100.0	99.99	99.99	10.75	123.39	23.03	5.75
W ₆	148.67	45.20	99.96	99.98	99.97	9.91	98.77	22.70	5.64
CV (%)	51.56	58.52	0.12	6.57	22.68	9.03	18.71	2.22	11.51
LSD _{0.05}	78.47	24.93	0.21	12.14	43.87	1.71	37.96	0.92	1.14

WIP = Weed inference period, WDWT = Weed dry weight, RD = Relative density of weed, RDW = Relative dry weight of weed, SDR = Summed dominance ratio, W₁ = No weeding (control), W₂ = Weed free condition (at 12-15 DAT/25-30 DAT/40-45 DAT), W₃ = Pree emergence herbicides (Bensulfuran methyl + Actachlor) at 3-4 days after rice transplanting + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress), W₄ = Post

emergence herbicides (Phenoxlum240 SC) a spraying after 1-2 leaves of weeds + 1 hand weeding (HW) at 45 DAT (After 2nd urea top dress), W₅ = Pree emergence herbicides (Pretilachlor 50% EC) at 3-4 days after rice transplanting + Post emergence herbicides (Bispyribac sodium) at spraying after 1-2 leaves of weeds and W₆ = BRRI mechanical weeder at 15 DAT + 1 hand weeding (HW) at 45 DAT

Table 6. Labourers' wage rate at different places around BRRI, Gazipur during 2023-24.

Month	Wage rate (Tk)*	Remark
April	550-600	Normal period
May	750-850	Peak period. Harvesting and post-harvest operation of Boro rice and transplanting of Aus rice.
June	550-650	Normal period
July	650-750	Peak period. Harvesting and post-harvest operation of Aus rice and transplanting of Aman rice.
August	600-700	
September	520-600	Normal period
October	500-560	
November	550-600	
December	600-750	Peak period. Harvesting and post-harvest operation of Aman rice and transplanting of Boro rice.
January	620-700	
February	560-650	
March	500-550	Normal period
Average	579-663	

*Wage rate of each month is the average rate of different places such as Joydebpur, Chowrasta, salna, Board Bazar, Konabari area.

Table 7. Laborers' wage rate with food and without food at different locations of Bangladesh during 2023-24.

Location	Average wage rate (Tk) with food	Average wage rate (Tk) without food	Working time
Gazipur	500-600	700-750	6.0am - 3.0pm
Habiganj	450-500	750-800	7.0am - 2.0pm
Rangpur	450-500	500-600	8.0am - 4.0pm
Rajshahi	600-700	750-850	6.0am - 2.0pm
Barishal	650-750	750-850	8.0am - 5.0pm
Sonagazi	450-500	500-600	6.0am - 2.0pm
Cumilla	650-750	800-900	6.0 am - 4.0pm
Satkhira	450-500	500-600	7.0am - 12.0pm
Kushtia	550-650	650-800	6.0am - 2.0pm
Bhanga	600-700	700-850	6.0am - 2.0pm
Gopalganj	450-500	550-700	6.0am - 2.0pm
Sirajganj	450-500	500-600	6.0am - 2.0pm
Average	521-596	637-741	-

Table 8. Yield of different BRRI varieties in the TLS production plots under FMD during T. Aman 2024

Variety	Plant Height (cm)	Tiller m ⁻² (no.)	Grain Panicle ⁻¹ (no.)	Sterility Percentage (%)	TGW (g)	Yield (t ha ⁻¹)
BRRI dhan75	101±1.17	12±1.04	101±7.82	24	28.29	7.45
BRRI dhan103	114±0.87	12±0.89	100±5.92	16	13.43	10.41
BRRI dhan112	93±0.98	11±0.79	70±7.00	18	27.00	3.89

TLS = Truthfully Labeled Seed

Table 9. Yield of different BRRI varieties in Seed production plots under FMD during Boro 2024-2025

Variety	Plant Height (cm)	Tiller m ⁻² (no.)	Grain Panicle ⁻¹ (no.)	Sterility Percentage (%)	TGW (g)	Yield (t ha ⁻¹)
BRRI dhan92	101±1.17	12±1.04	90±7.82	24	28.29	7.45
BRRI dhan100	110±1.04	12±0.62	165±9.23	14	21.93	6.60
BRRI dhan114	87±1.14	7±0.31	130±9.57	8	19.00	5.06
BRRI dhan115	91±1.09	8±0.35	75±6.39	7	22.18	8.17

Table 10. TLS seed production of different varieties during 2024-2025

Variety	Season			Total (kg)
	Aus	T. Aman	Boro	
BRRi dhan34	-	210	-	210
BRRi dhan48	205	-	-	205
BRRi dhan51	-	330	-	330
BRRi dhan52	-	180	-	180
BRRi dhan70	-	90	-	90
BRRi dhan80	-	302	-	302
BRRi dhan82	-	165	-	165
BRRi dhan83	-	260	-	260
BRRi dhan89	-	-	220	220
BRRi dhan92	-	-	20	20
BRRi dhan95	-	305	-	305
BRRi dhan98	2125	-	-	2125
BRRi dhan100	-	-	55	55
BRRi dhan104	-	-	55	55
BRRi dhan105	-	-	55	55
BRRi dhan106	202	-	-	202
BRRi dhan108	210	-	60	270
BRRi dhan109	-	360	-	360
BRRi dhan110	-	280	-	280
BRRi dhan112	-	-	160	160
BRRi dhan114	-	-	60	60
BRRi dhan115	-	-	150	150
Mixed rice (kg)	-	-	-	1630
Total	2742	2482	835	7689

TLS = Truthfully Labeled Seed

Table 11. Breeder production of different rice varieties during 2024-2025

Variety	Season			Total (kg)
	Aus	T. Aman	Boro	
BRRi dhan30	-	1420	-	1420
BRRi dhan75	-	1530	5500	5500
BRRi dhan92	-	-	2093	2093
BRRi dhan93	-	905	-	905
BRRi dhan98	-	3393	-	3393
BRRi dhan100	-	-	1505	1505
BRRi dhan103	-	-	-	1450
Grand total(kg)	-	7248	9098	16266

Table 12. TLS distribution of different varieties during 2024-2025.

Variety	Season			Total (kg)
	Aus	T. Aman	Boro	
BRRi dhan28	-	-	132	132
BRRi dhan29	-	-	80	80
BRRi dhan34	-	150	-	150
BRRi dhan48	170	-	-	170
BRRi dhan50	-	-	39	39
BRRi dhan51	-	320	-	320
BRRi dhan52	-	170	-	170
BRRi dhan67	-	-	16	16
BRRi dhan70	-	90	-	90
BRRi dhan80	-	285	-	285
BRRi dhan81	-	-	46	46
BRRi dhan82	65	-	-	65
BRRi dhan83	365	-	-	365
BRRi dhan84	-	-	30	30
BRRi dhan88	-	-	148	148
BRRi dhan89	-	-	98	98
BRRi dhan92	-	-	174	174
BRRi dhan95	-	305	-	305
BRRi dhan96	-	-	112	112
BRRi dhan98	2890	-	-	2890
BRRi dhan100	-	-	76	76
BRRi dhan101	-	-	40	40
BRRi dhan102	-	-	154	154
BRRi dhan103	-	-	8000	8000
BRRi dhan105	-	-	7990	7990
BRRi dhan106	502	-	-	502
BRRi dhan107	-	-	3983	3989
BRRi dhan108	-	-	177	177
BRRi dhan109	-	310	-	310
BRRi dhan110	-	220	-	220
Seed (Total) (kg)	3992	1850	21295	27143

Table 13. Division wise labour utilization, wages and land utilization

Division	Number of labour days utilized		Wages Incurred (Tk.)	Land area used (ha)			
	Total	Percentage (%)		Aus	T. Aman	Boro	Total
(A) Research							
Plant Breeding	12627	8.01	7557700	1.79	13.62	11.72	27.12
Hybrid Rice	5358	3.40	3214800		5.70	5.99	11.68
Biotechnology	4201	2.67	2364000	0.31	1.41	1.18	2.89

Genetic Resources and Seed	7364	4.67	4399975	0.31	2.38	2.20	4.88
Entomology	4554	2.89	2732100	0.24	0.74	0.77	1.75
Plant Pathology	3511	2.23	2070625		0.61	0.61	1.21
Agronomy	4293	2.72	2542775		2.86	3.51	6.37
Plant Physiology	4891	3.10	2934300	0.24	1.36	1.53	3.14
Soil Science	5337	3.39	3270750		1.42	1.42	2.84
Rice Farming System	3462	2.20	2077200	0.40	1.25	1.25	2.90
Grain Quality and Nutrition	644	0.41	2132100	0.08	1.07	0.40	1.55
Adaptive Research	3328	2.11	911100	0.06	0.56	0.50	1.12
Training	1519	0.96	669900		0.32	0.55	0.87
Agricultural Economics	1117	0.71	4107350		0.69	0.69	1.37
Farm Machinery and Post-Harvest Technology	6855	4.35	1896600	0.31	0.48	0.48	1.28
Workshop Machinery and Maintenance	3171	2.01	1539000		0.08	0.06	0.14
Irrigation and Water Management	2565	1.63	1160100		3.57	3.06	6.63
Agricultural Statistics	1934	1.23	7557700	1.79	13.62	11.72	27.12
Farm Management	9000	5.71	648700		5.70	5.99	11.68
a) Research							
b) Seed production	10000	6.34	550300	0.31	1.41	1.18	2.89
Total	95731	60.73	56320975				
(B) Support Services							
Farm Management							
a) Common Services	7056	4.48	838500	-	-	-	-
b) Garden Management	8480	5.38	557300	-	-	-	-
Building and Construction	16143	10.24	9639775	-	-	-	-
Publication and Public Relation	715	0.45	428700	-	-	-	-
Director General Office	867	0.55	520200	-	-	-	-
Director Research Office	791	0.50	474600	-	-	-	-
Administration and Support Service							
a) Administration	5395	3.42	3236700	-	-	-	-
b) Audit	638	0.40	520200	-	-	-	-
c)Transport	6171	3.92	474600	-	-	-	-
d) Store	1823	1.16	382500	-	-	-	-
e) Hostel/Dormitory	4865	3.09	3673375	-	-	-	-
f) Security	5857	3.72	1093500	-	-	-	-
g) Planning and Evaluation	390	0.25	2918700	-	-	-	-
h) Medical	1112	0.71	3513900	-	-	-	-
Accounts and Finance	1592	1.01	233700	-	-	-	-
Total	61895	39.27	28506250				
Grand Total (A+B)	157626	100	77896825	3.73	38.10	35.91	77.75

Table 14. Land and labour strength of BRRI, in the date of 1 July 2024.

Stations Name	Total land (ha)	Research purposes land (ha)	General cultivable land (ha)	Office & residential land (ha)	Labour (no.)									Total
					Regular			Irregular			Seasonal			
					M	F	Total	M	F	Total	M	F	Total	
BRRI HQ, Gazipur	76.83	55.00	9.83	12.00	326	74	400	12	3	15	3	0	3	418
Cumilla	24.68	18.95	3.00	2.73	17	2	19	3	0	3	0	0	0	22
Habiganj	35.03	20.03	9.00	6.00	24	2	26	6	0	6	0	0	0	32
Sonagazi	45.77	31.22	10.50	4.05	29	2	31	0	0	0	0	0	0	31
Barishal	39.17	27.59	8.60	2.98	21	2	23	0	0	0	0	0	0	23
Rajshahi	13.24	6.00	2.00	5.24	22	4	26	3	0	3	0	0	0	29
Bhanga	11.46	8.04	2.00	1.42	18	2	20	0	0	0	0	0	0	20
Rangpur	6.07	3.34	0.50	2.23	32	1	33	0	0	0	0	0	0	33
Satkhira	20.00	12.86	4.51	2.63	21	1	22	0	0	0	0	0	0	22
Kushtia	4.05	2.55	0.50	1.00	11	0	11	0	0	0	0	0	0	11
Sirajganj	4.05	2.55	0.50	1.00	4	1	5	5	0	5	0	0	0	10
Gopalganj	4.05	2.55	0.50	1.00	1	0	1	4	0	4	0	0	0	5
Total	284.4	190.68	51.44	42.28	526	91	617	33	3	36	3	0	3	656

M = Male, F = Female

Table 15. Retirement benefits of labourers during 2024-25.

Working place	Male	Female	Amount (Tk.)
BRRI HQ	5	1	30,79,329
BRRI R/S	4	-	23,43,000
Total	9	1	54,22,329

Table 16. Medical financial benefits of labourers in working time injury during 2024-25.

Working place	Male	Female	Amount (Tk.)
BRRI HQ	6	-	32,864
BRRI R/S	0	-	00
Total	6	-	32,864

Table 17. Sale proceeds of FMD during 2024-25

Items	Amount (Tk)
Green Coconut	360
Plam shells	1,200
Straw	48,670
Truthful level seed	45,800
Total	96,030

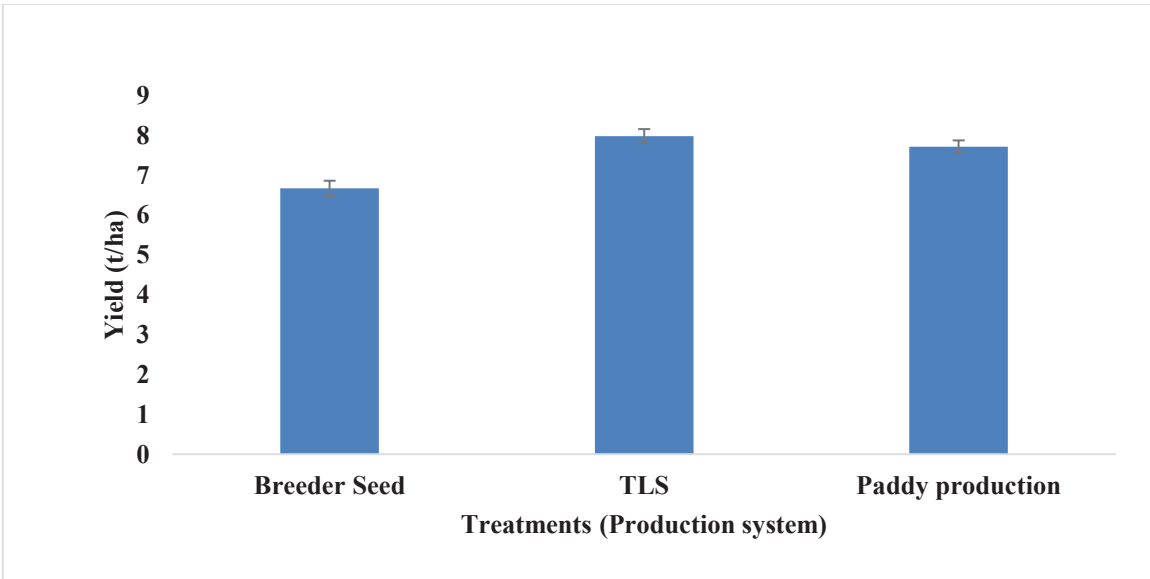


Fig.1: Yield of different seed production and paddy production system

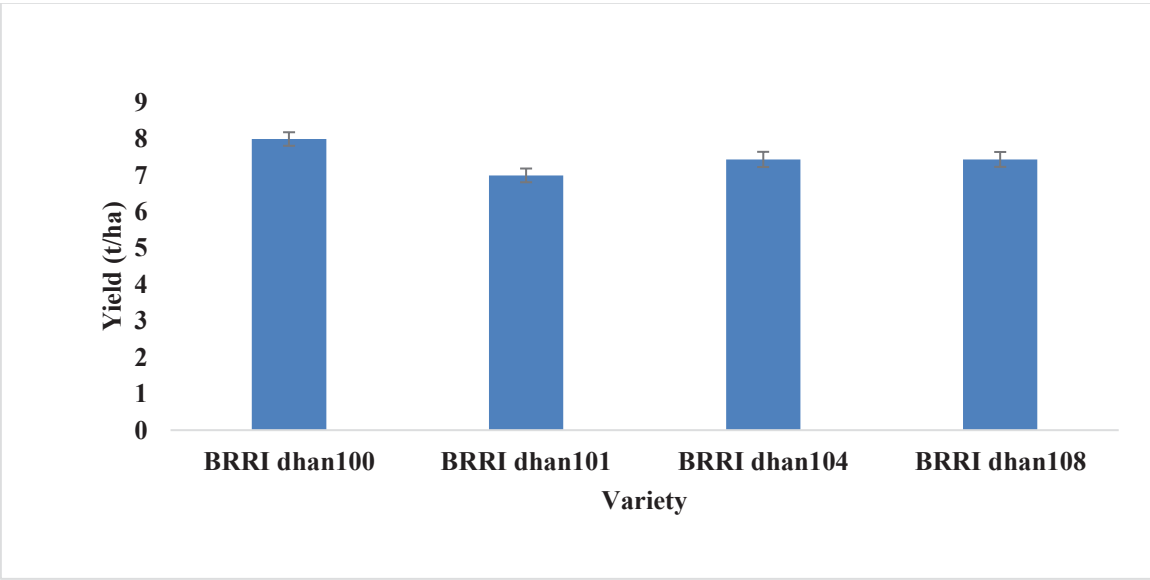


Fig.2: Yield of different varieties under seed and paddy production system.

Farm Machinery and Postharvest Technology Division

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SUMMARY

Bird-induced crop damage remains a constant threat to agricultural productivity, especially during the grain-filling and harvesting phases. This study introduces a solar-powered, AI-based smart bird repellent system utilizing the YOLOv8n deep learning model on a Raspberry Pi 4. The system combines a USB camera, stereo audio amplifier, motorized camera mount, and solar panel within a weather-resistant enclosure, ensuring autonomous operation in remote fields. A dataset containing native Bangladeshi bird species was used to train and validate the model, achieving a precision of 0.85, a recall of 0.80, an F1-score of 0.825, and a mean Average Precision (mAP) at 0.5 of 0.764. Field tests in real-world conditions confirmed its effectiveness, with detections triggering predator sounds and mechanical deterrents. A comparative analysis showed that YOLOv8n outperformed earlier YOLO variants, making it suitable for low-power, resource-limited environments. This research highlights the potential of edge AI and renewable energy integration for affordable and sustainable crop protection.

The mechanical grain collector, built at the FMPHT Workshop, BRRI, features a mild steel chassis and grain-contact surfaces, a nylon brush reel for paddy pickup, and a stainless steel screw conveyor that transports grains to a 35 L hopper. It can be powered by a 6.5hp petrol engine, with power transmitted through a belt-pulley system. Field trials on concrete surfaces showed an average collection rate of 1212 kg/h, filling a standard gunny bag in 1.98 minutes, while cutting labor and operational costs by about 50% compared to manual collection. Soft nylon bristles, adjustable reel height, and an ergonomic handle minimized kernel breakage and operator fatigue. However, some minor breakage occurred at higher brush speeds, and the hopper capacity limited continuous operation. Overall, the collector provided efficient, uniform, and reliable grain collection, improving throughput and labor productivity.

Recommendations include adding variable speed control, increasing hopper size, and improving traction for wet surfaces, with its modular petrol-compatible design offering flexibility for small- and medium-scale farms.

A head-feed thresher was fabricated at Arafat Engineering Workshop, Dinajpur, using locally available materials under a public-private partnership (PPP) financed by the “PARTNER” project (BRRI component). The objective was to develop a prototype of a high-capacity head-feed thresher. Initial testing during the Aman 2024–25 season at BRRI’s FMPHT Division and the Bangladesh Agricultural Research Institute (BARI) assessed mechanical performance, capacity, and cleaning efficiency. The machine showed no major faults, though minor modifications were made. Its capacity was recorded as 300.6 kg/h for Tulshimala (17.7% moisture) and 469.2 kg/h for BRRI dhan87 (22.5% moisture), with acceptable cleaning performance. Further improvements have been incorporated, and a comprehensive evaluation is planned for the next season.

The Farm Machinery and Postharvest Technology (FMPHT) Division fabricate a paddy de-husker to improve milling efficiency and head rice recovery. Husker is operated with 5hp motor and two rubber rolls each diameter and length is 152.4 mm and 101.4 mm respectively. Average fixed and adjustable rubber roll rpm was found 1300 and 900 respectively. Adjustable rubber roll rotates 30 % less rpm than the fixed rubber roll. The average de-husking capacity of the husker was ranged from 500-600 kg/h and husking efficiency was about 80% that’s found promising for paddy processing. The paddy husker may be suitable for rural area for shifting engelberg huller to rubber roll rice processing.

The use of unmanned aerial vehicles (UAVs) in agriculture is rapidly expanding worldwide for tasks

such as precise application of fertilizers and pesticides, as well as crop monitoring. In Bangladesh, an agricultural spraying drone was developed and assembled at S Agro Drone BD in Dinajpur, using materials obtained through a public-private partnership (PPP) funded by the “PARTNER” project (BRRI component). Initial testing showed that both the flight and spraying systems were fully functional, demonstrating stable lift, good adjustability, and efficient liquid discharge under local field conditions. A comprehensive evaluation is planned for the upcoming season.

Bangladesh is highly vulnerable to climate extremes, with both flood and drought risks posing serious threats to agriculture. Using monthly rainfall data from 1981 to 2018, this study employed the Effective Drought Index (EDI) to evaluate drought severity, duration, and frequency. These findings were combined into a Drought Hazard Index (DHI) to assess spatial and seasonal drought risk nationwide. Annual rainfall showed substantial spatial variation, ranging from less than 1,500 mm in the northwest to over 4,000 mm in the northeast. The DHI identified the northwestern districts as the most drought-prone areas, with the Boro (December–April) season experiencing particularly severe hazards. Quantitatively, 30-40% of districts faced recurrent moderate to severe droughts. These results underscore the pressing need for drought-resistant cropping strategies and effective water management to ensure food security in Bangladesh.

The adoption of an auger-based metering mechanism, combined with a full stainless steel and fiber-reinforced composite construction, results in a significant enhancement of the BRRI Prilled Urea Applicator. The redesigned unit delivers improved precision, durability, and field adaptability, fully aligning with BRRI’s objectives for practical, farmer-focused mechanization in rice fertilization.

Training is vital to developing skilled personnel capable of operating, maintaining, and repairing agricultural machinery effectively. Well-trained

operators enhance machine performance, extend service life, and reduce downtime, thereby increasing productivity and enabling greater income-generating opportunities. To build such capacity, the Farm Machinery and Postharvest Technology Division of BRRI organized a 15-day residential training program at BRRI headquarters in Gazipur under the PARTNER project. The program emphasized practical skills and technical knowledge of farm machinery, fostering mechanization and sustainability across Bangladesh’s agricultural sector.

AGRICULTURAL MACHINERY DEVELOPMENT AND TESTING

Design and Development of a Solar-Powered AI-Based Smart Bird Repellent System for Sustainable Crop Protection

Bird infestations remain a significant agricultural challenge worldwide, causing yield losses ranging from 10% to 50%, depending on the species and crop type. In Bangladesh, common species such as sparrows, mynas, and parakeets frequently attack rice during the milky and ripening stages, posing a threat to food security and farmer livelihoods. Farmers rely on scarecrows, firecrackers, nets, and ultrasonic devices, but these methods are labor-intensive, costly, and often lose effectiveness as birds adapt. Modern approaches, such as UAV-based deterrents, intelligent audio repellents, and laser systems, offer improvements but are limited by scalability, cost, and adaptability. With advancements in deep learning, lightweight object detection models such as YOLO provide real-time identification of pests and animals in field conditions. YOLOv8n, optimized for speed and memory efficiency, is particularly suited for embedded devices like Raspberry Pi. Combining this with solar power enables low-cost, autonomous solutions for smallholder farmers. This study develops and validates a solar-powered, AI-driven bird repellent system that integrates detection,

deterrence, and energy autonomy into a single platform.

The system comprises a YOLOv8n-based bird detection model on a Raspberry Pi 4, a Camera module for real-time monitoring; Dual-response deterrents (predator/distress sounds via a stereo amplifier and mechanical motion via a stepper motor), and a Solar PV unit with a battery for off-grid power. All components were enclosed in a weatherproof casing mounted on a pole for field deployment. A Kaggle dataset of ~2,700 images of 18 native Bangladeshi bird species was used, resized to 640×640 pixels, and augmented (flips, rotations, brightness/contrast variations, and Gaussian noise). Manual annotation was performed using LabelImg in YOLO format. The dataset was split into training (70%) and validation (30%). YOLOv8n, chosen for its lightweight architecture, was fine-tuned for 20 epochs using transfer learning. Evaluation metrics included precision, recall, F1-score, and mAP@0.5. The repellent consists of an Audio deterrent, where predator calls are played via a TDA2030-based stereo amplifier and speaker system, a Mechanical

deterrent utilizing camera rotation with a 28BYJ-48 stepper motor controlled by Raspberry Pi GPIO, and Trigger logic that activates the deterrents only when bird detection confidence exceeds 0.32, thereby minimizing false alarms and power waste. System loads were calculated to determine the optimal sizes of PV modules, batteries, and charge controllers. A deep-cycle battery ensured nighttime and cloudy-day operation. The setup was optimized for low power consumption, with efficient DC-DC converters regulating input voltage.

On the test dataset, YOLOv8n achieved: Precision: 0.85, Recall: 0.80, F1-score: 0.825, Specificity: 0.90, and mAP@0.5: 0.764. Cross-validation on YouTube video frames of native birds yielded improved results (Precision: 0.923, Recall: 0.915, F1-score: 0.919, mAP@0.5: 0.931). The model converged rapidly within 20 epochs, with stable loss reduction trends. Fig. 1 shows the assembled CAD views of the bird repellent system. The system integrates a camera, solar panel, control unit, sound box, and battery on a stable pole-mounted structure designed for field deployment.

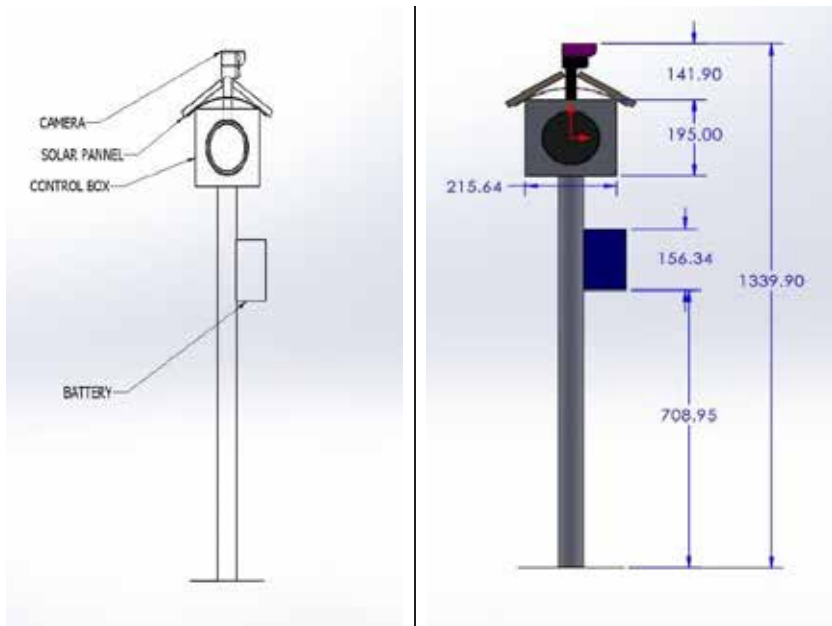


Fig. 1. Assembled CAD views of the bird repellent system.

Fig. 2 shows the real-time bird detection results using YOLOv8n on a Raspberry Pi 4. On Raspberry Pi 4, inference speed reached 10-15 FPS with low latency. The system successfully detected and deterred birds under varied lighting and weather conditions. Predator sound deterrents and camera oscillation were triggered only upon confident detections, ensuring energy efficiency.



Fig. 2. Real-time bird detection results using YOLOv8n on a Raspberry Pi 4. Each image shows the bounding box and confidence score for detected birds.

YOLOv8n outperformed YOLOv5, YOLOv6, and YOLOv7 in balancing accuracy and speed for embedded applications. Its compact size (~5.6M parameters) enabled reliable performance on resource-constrained hardware.

This study demonstrates the successful design and validation of a solar-powered, AI-enabled bird repellent system. Compared to traditional methods, the system offers higher detection accuracy with real-time adaptability, energy autonomy through solar integration, cost-effectiveness suitable for smallholder farmers, and a field-ready, weather-resistant design. Limitations include its focus on a single class (birds) and reliance on Raspberry Pi's limited processing power. Future improvements could include multi-pest detection, model quantization, reinforcement learning for adaptive deterrence, and advanced embedded devices. Overall, the system bridges the gap between AI research and practical farm deployment, providing a scalable, eco-friendly, and autonomous solution for sustainable agriculture.

Design and Development of Grain Collector

The mechanical grain collector was designed using SolidWorks CAD software to optimize dimensions and component alignment (Fig. 3). Field trials were conducted on concrete floor of BRRI drying yard to

evaluate collection efficiency, throughput, uniformity of bag weights, and ease of operation

The grain collector operates by sweeping scattered paddy using a rotating nylon brush reel. As the brush rotates close to the ground, it gently lifts and directs the grains toward the intake section, where they fall into a screw conveyor. The conveyor transports the grains and discharges them by moving collecting elevator into the hopper for collection. The motor/engine powers the reel and conveyor through a pulley-belt system, while the operator pushes the unit forward. Reel height and rotation speed can be adjusted depending on the surface, minimizing kernel loss and breakage.

The mechanical grain collector features soft nylon bristles to minimize grain breakage, along with an adjustable reel height and skid to accommodate various surfaces (Table 1). All parts that contact the grain are made from durable mild steel, and removable panels facilitate easy cleaning and maintenance. Safety is improved by guarding the moving parts, while an ergonomic handlebar height of 1100 mm helps reduce operator fatigue. The modular design supports both electric and petrol drive options, and using locally available pulley, belt, and bearing parts makes repairs easier and keeps costs down.

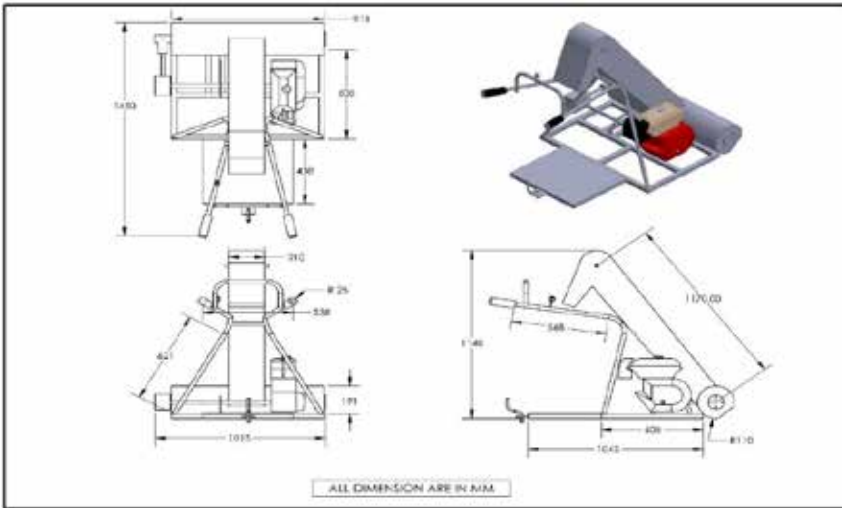


Fig 3. Layout of the grain collector

Table 1. Function of main components

Component	Material	Function
Chassis	Mild steel (MS)	Provides structural support and stability for all components
Brush reel	Nylon bristles	Sweeps and lifts scattered paddy toward the intake
Screw conveyor	Stainless steel (SS-304)	Transports collected grains from ground to the moving elevator into hopper
Hopper	Stainless steel (SS-304)	Stores grains temporarily during collection
Engine	Petrol 6.5 hp	Powers brush reel, screw conveyor and collecting elevator
Transmission	belt–pulley	Transfers power from the engine to the moving parts
Handle	MS tubular	Allows the operator to push and maneuver the machine ergonomically
Wheels	Rubber	Maintains ground clearance and enables smooth movement on different surfaces

Performance Evaluation

The mechanical grain collector was evaluated at the BRRI drying floor under actual working conditions (Figs. 4 and 5). Necessary data, including bag filling time, collected grain weight, and throughput, were

recorded. The machine demonstrated an average collection capacity of 20.2 kg/min (approximately 1212 kg/h) with uniform bag weights of 39.6 kg. Compared to manual collection, it reduced labor requirements and operational costs while improving efficiency.

**Fig. 4** Developed grain collector**Fig. 5** Operation of grain collector

Table 2. presents the performance data of the mechanical grain collector across eight trials. The time required to fill a standard gunny bag ranged from 1.8 to 2.1 minutes, with an average of 1.98 minutes per bag. The average capacity of the machine was 20.2 kg/min, equivalent to

approximately 1212 kg/h, demonstrating consistent performance under field conditions. The collected bag weights were fairly uniform, averaging 39.6 kg, which indicates reliable collection efficiency across multiple operations.

Table 2. Performance of Mechanical Grain Collector

Obs. No.	Grain to fill a gunny bag (kg)	Time to fill a gunny bag (min)	Capacity (kg/min)
1	40.0	2.0	20.0
	38.5	1.8	21.4
	39.0	1.9	20.5
2	41.0	2.1	19.5
	39.5	2.0	19.8
	40.5	2.0	20.3
3	38.0	1.85	20.5
	39.0	1.95	20.0
	38.5	1.92	19.6
Average	39.6	1.98	20.2

Table 3 compares the mechanical grain collector with the traditional manual collection system. The mechanical collector required only one laborer per bag, whereas the manual system required two (**Table 4**). It reduced the time to fill a gunny bag by approximately 60% and nearly doubled throughput,

achieving 1212 kg/h compared to 472 kg/h for manual collection. The operational cost per bag and per ton was about 50% lower for the mechanical collector. Overall, the data highlights the advantages of mechanization in terms of labor efficiency, time saving, throughput, and cost-effectiveness.

Table 3. Comparison with Manual paddy collector

Items	Mechanical Grain Collector	Manual grain collector
Labor required to fill a gunny bag (no.)	1	2
Time required to fill a gunny bag (min)	1.98	5.0
Bags per hour (bags/h)	30.3	12.0
Throughput (kg/h)	1212	472
Operational cost (Taka/bag)	4.0	8.0
Cost per tonne (Taka/t)	101	203
Labor productivity (kg per labor-hour)	1212	236
Time saving per bag vs manual	60%	—
Cost saving per ton vs manual	50%	—

Table 4. Features of the grain collector

Parameter	Specification
Overall dimensions (L×W×H)	1450 x 1015 x 1140 mm
Pick-up width	1000 mm
Brush	Ø300 mm, nylon bristles, 180–220 rpm
Screw conveyor	Ø100 mm SS, pitch 80 mm, 120–160 rpm
Hopper capacity	35 kg paddy
Power source	6.5 hp petrol engine
Transmission	belt–pulley system

Parameter	Specification
Forward speed	3.0 km/h
Field capacity	0.06 ha/h
Collection capacity	400 kg/h
Noise at handle	≤78 dB(A) at 2.5 m
Ground clearance	40 mm (adjustable ±10 mm)

The mechanical grain collector performs less effectively on wet or uneven surfaces due to brush reel slippage, and small kernel breakage may happen at high brush speeds. Its limited hopper capacity requires frequent emptying during large-scale operations, while the fixed forward speed can limit its adaptability in large or sloped fields. Additionally, the machine's relatively high weight demands a skilled operator for safe and efficient handling. Suggested improvements include increasing hopper capacity or adding a continuous collection bin, installing rubberized or adjustable wheels to improve traction, conducting long-term durability tests on the nylon bristles and stainless steel conveyor, and exploring solar-assisted electric drives for more sustainable operation.

Design and Development of High-Capacity Head Feed Thresher

A head-feed power thresher was built at Arafat Engineering Workshop in Dinajpur through a public-private partnership (PPP), using locally available materials such as MS sheets, flat and angle

bars, shaft bars, GI pipes, nuts and bolts, gears, belts, pulleys, a wire-loop threshing drum, a feeding mechanism, and a belt-pulley/gear system for engine power transmission. The machine was designed to thresh traditional bundled paddy easily, operate efficiently with two workers, deliver higher capacity than current threshers in Bangladesh, and ensure simple, reliable operation and maintenance with a self-starting system. Using locally available materials aimed to lower fabrication costs, while capacity and ease of use were tailored to farmers' needs. The high-capacity head-feed paddy thresher includes several key components: a Feeding Unit for crop input, a Threshing Unit with a high-speed rotating cylinder for grain-straw separation, a Cleaning Unit to remove chaff and impurities, a Grain Conveying Unit to transport grain to storage, a Power Transmission system, a Main Frame for structural support, and a Transport Unit for mobility. The machine also allows half-feed operation to improve grain-straw separation efficiency (Fig. 6 and Table 5).



Fig. 6. Head Feed Thresher and its functional parts

Table 5: The general features of the head feed thresher

Item	Features	Item	Features
Engine type	25 hp Diesel engine	Horizontal auger length	213.0 cm
Operator requirement	Two nos.	Horizontal auger diameter	15.7 cm
Operation	Head feed and whole feed	Clean grain delivery output length	180.0 cm
Cleaning facility	Blower	Clean grain delivery output width	14.0 cm
Movement of the thresher	Three rubber wheels	Extra straw outlet length and width	34.0 cm and 23.0 cm
Grain collector	Auger/screw, cup-type belt conveyor	Grain delivery belt conveyor length	185.0 cm
Power transmission system	Belt pulley, chain-sprocket, and gearbox	Feeding chain length	540.0 cm
Threshing teeth	loop type	Feeding chain width	6.0 cm
Main threshing drum length	160.0 cm	Teeth per feet	Nine nos
Main threshing drum dia.	82.0 cm	Feeding height	127.0 cm
2 nd and 3 rd threshing drum length	148.0 cm	Machine height	235.0 cm
Blower length	126.0 cm	Machine width	175.0 cm
Blower diameter	38.0 cm	Machine length	370.0 cm

The initial performance test was performed at the BARI West research field and the BRRRI threshing yard. Results indicated that increasing the drum speed improved threshing and cleaning efficiency by applying greater stripping and impact pressure on the grains.

Table 6. Comparative performance of head-feed thresher

Parameter	Tulshimala (Avg.)	BRRRI dhan87 (Avg.)
Moisture Content (%)	17.7	22.5
Threshed Grain Weight (kg)	102.3	159.7
Time (min)	20.5	20.4
Threshing Capacity (kg/h)	300.6	469.2

For the Tulshimala variety (small grain size), the average moisture content was 17.7%, with an average threshed grain weight of 102.3 kg obtained in 20.5 minutes, resulting in a threshing capacity of 300.6 kg/h (Table 6). In contrast, the BRRRI dhan87 variety had a higher average moisture content of 22.5%. It produced a significantly greater threshed grain weight of 159.7 kg in 20.4 minutes, achieving

a much higher threshing capacity of 469.2 kg/h. The notable difference in capacity between the two varieties is due to variations in grain properties and moisture content, which directly affect threshing efficiency. More thorough testing is needed in the upcoming season to evaluate improvements and identify remaining issues.

Design and development a paddy de-husker for a two-stage rice mill

Farm Machinery and Postharvest Technology (FMPHT) Division has successfully designed and developed a paddy de-husker for two-stage rice milling system at the Salam Engineering Workshop, Kushtia to improve milling efficiency and head rice recovery. FMPHT division provide technical (drawing and design) and financial support to the

workshop. The paddy de-husker was designed using SolidWorks CAD software to optimize dimensions and component alignment. The overall dimension (H x W x B) of the husker is 2134 x 1410 x 457mm and the base dimension is 1410 x 528 x 457mm. The base of the machine is fabricated with 76 x 38mm angle bar. De-husker dimension is 1590 x 528 x 457mm. The pictorial view of the husker is shown in Fig. 7.

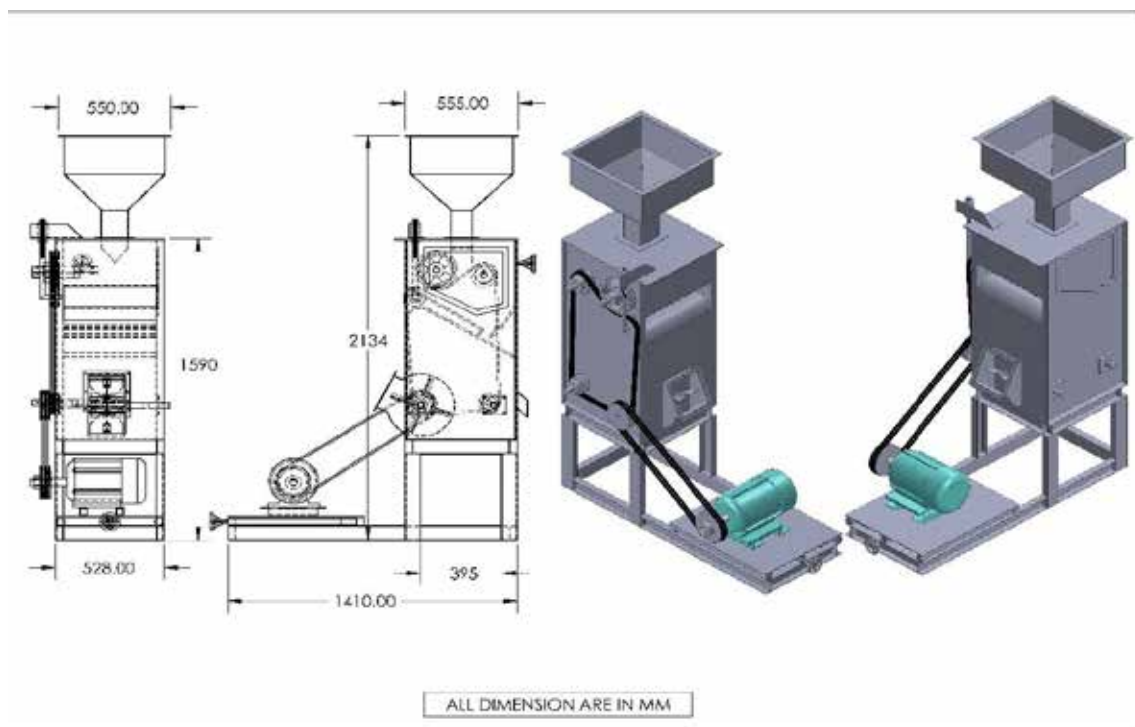


Fig 7. SolidWorks CAD drawing of developed Paddy de-husker

Developed rubber roll de-husker operates with 5hp (3-phase 4 wire 1450 rpm) electric motor. Fixed rubber roll diameter and length is 152.4 mm and 101.4 mm respectively. The RPM of the fixed rubber roll is about 1300 rpm. The adjustable rubber roll diameter and length are also same as fixed rubber roll. The RPM of the adjustable rubber roll is about 900 rpm. Elevator will be used to carry the paddy in the hopper. The blower diameter 300mm and it is runs at 2000 rpm and the bottom end of the de-husker

connected with a pipe (dia. 152.4mm). A cyclone separator attached in the de-husker for collecting husk that keeps working area free from dust and husk. In the first stage, paddy grains are fed into the hopper and directed to the de-husker, where rubber rollers apply pressure and friction to remove the husk, producing a mixture of brown rice, husk, and un-hulled paddy. The husk is separated using a cyclone separator, while the un-hulled grains are recirculated for reprocessing. Rubber roll de-husker

does not damage the aleuronic layer of paddy. An airstream is blown over the grains and immature grains drop into the separate hopper for discharge. The operating condition of the machine showed in Fig. 7. BRRI dhan28 (un-parboiled) was used in this experiment. The moisture content was 12.2% (wb.) and each sample size was 20 kg.

The percentage of total mass of milled rice (head and broken rice) recovered from the mass of the corresponding input paddy to the rice mill (husker or huller and whitener). It is also called total milling recovery.

$$\text{Husking efficiency(\%)} = \frac{\text{Weight of milled rice}}{\text{Weight of rough rice}} \times 100$$



Fig 8. Pictorial view of de-husker



Fig 9. Operating condition of de-husker

The major component of husker and their function and technical specification showed in Table 7 and 8.

Table 7. Major components of the de-husker and their functions

Component	Function
Hopper	Holds and feeds paddy into the rubber rolls for processing.
Bucket Elevator	Lifts and transfers paddy from the hopper to the husker.
Husker	Removes the outer husk from paddy using rubber rollers.
Blower	Creates airflow to carry away husk.
Cyclone Separator	Separates husk from brown rice using centrifugal action.
Motor (5 hp)	Provides power to operate all units through a belt and pulley system.
Bucket	Collects and discharges processed rice and by-products separately.

Table 8. Technical Specifications of de-husker for two-stage rice mill

<i>Particulars</i>	<i>Specifications</i>
<i>Type of Mill</i>	<i>De-husker</i>
<i>Frame Material</i>	<i>Mild Steel sheet, angle bar</i>
<i>Overall Dimensions (H x W x B)</i>	<i>2134 x 1410 x 457mm</i>
<i>Motor Power</i>	<i>5 hp (1450 rpm) electric motor</i>
<i>Power Transmission</i>	<i>Belt and pulley drive system</i>
<i>Feeding System</i>	<i>Hopper (capacity: 25 kg) with bucket elevator</i>
<i>Husker</i>	<i>Rubber roller type, 2 rollers (152.4 mm diameter and 101.4 mm length)</i>
<i>Processing Capacity</i>	<i>500 – 600 kg paddy/hour</i>
<i>Operating Voltage</i>	<i>440 V, 3-phase AC</i>

The average de-husking capacity of the husker was ranged from 500-600 kg/h and husking efficiency was about 80%. Husking efficiency can be increased by closing the adjustable roller which increases the broken rice (brown rice). The brown rice and paddy were collected from discharge chute and husk was collected from cyclone separator. Average fixed and adjustable rubber roll rpm was found 1300 and 900 respectively. Adjustable rubber roll rotates 30 % less rpm than the fixed rubber roll. The difference in peripheral speed subjects the paddy grain falling between the rolls to a shearing action that strips off the husk. The clearance between the rolls is adjustable and it should be less than the thickness of the grain.

Development and Utilization of a Drone in Agriculture

The adoption of unmanned aerial vehicle (UAV) technology in agriculture is rapidly expanding worldwide, with applications in crop monitoring and precision spraying of fertilizers and pesticides. In Bangladesh, where farming remains largely labor-intensive, drone-operated sprayers offer a transformative solution to challenges such as labor shortages, uneven spraying, and high operational time, particularly in large paddy fields. This study aimed to develop a multi-rotor agricultural drone by procuring necessary components and integrating

propulsion, control, and spraying subsystems into a single functional unit. Initial field tests were conducted to verify the drone's flight performance and spraying capability under local conditions.

An agricultural spraying drone was developed and assembled at S Agro Drone BD, Dinajpur, under a public-private partnership (PPP) funded by the "PARTNER" project (BRR component). Components were procured individually to strike a balance between performance and cost. The drone's frame, made from lightweight materials such as carbon fiber, provides structural support for propellers, motors, batteries, and equipment while maintaining balance and stability (Table 9). Brushless motors power the propellers to generate lift and directional control, with their efficiency directly influencing flight performance. Electronic Speed Controllers (ESCs) regulate motor speed for stable flight and precise maneuvering, particularly when carrying payloads. A lithium-polymer (LiPo) battery serves as the primary power source, supporting approximately 20 minutes of flight while powering all electrical components. The flight controller integrates sensors, GPS, and motors to accurately manage speed, direction, and task execution. The spraying system delivers fertilizers, pesticides, and other liquids precisely, ensuring efficient crop management, minimizing waste, and reducing environmental impact.

Table 9. Different parts of the drone

		
Landing-gear	4 4-axis top plate and bottom plate	Shell Cover
		
Power distribution board and XT-60 socket	K++v2 Flight controller + GPS+ Power module +LED light +USB link cable + GPS stand	XT90T Mounting socket
		
Arm (Carbon-Tube)	Sky-droid T12 remote, receiver, and camera	Hobby-wing X8 motor and propeller
		
Herwin-6s-16000mah-lipo-battery	SKYRC-PC1080-Dual-Channel-6s-LiPo-Battery-Charger	Battery Plate
		
10-Liter-tank	5L Brushless Water Pump + Spray System with Pressure Nozzles	Amass-XT90-S-Anti-Spark-Connector
		
Tank-inlet-filter	40mm Aluminum arm pipe	Silicone Wire

The drone assembly was carried out systematically to ensure mechanical stability and electrical safety. The frame was assembled by attaching the arms and landing gear, securing all parts, and verifying the balance for smooth flight (Fig. 10). Motors were

mounted with vibration-dampening supports, and propellers were installed in the correct orientation to ensure balanced thrust and smooth rotation. Electrical wiring connected the ESCs to the motors and flight controller, with GPS integration for

navigation, and all connections were verified. The spraying mechanism, including the liquid tank, pump, and hoses, was firmly mounted to ensure even distribution and prevent leaks. The control system was configured by pairing the transmitter and receiver, tuning the flight controller for stable take-

off, hovering, and accurate navigation, and testing all inputs. A final pre-flight inspection confirmed that all bolts were tightened, connections were secure, and the setup met safety standards before operation.



Fig. 10. Assembly process of the drone

Initial testing was conducted under typical field conditions during the last Aman season, with calm winds, high humidity, and a cloudy sky. Water loads of 5, 7, and 10 liters were used to ensure safety and controlled conditions (Fig. 11). The drone was first flown briefly to verify take-off, balance, and control, achieving smooth lift and stable flight. The spraying

pump was then activated to confirm nozzle operation and even liquid distribution, with inspections for leaks or blockages. The drone's movement was monitored during simultaneous flight and spraying, demonstrating that its basic flying and spraying functions operated effectively.





Fig. 11. Initial test of the drone after assembling

The assembled drone-operated sprayer completed its initial test, demonstrating stable takeoff, hovering, and responsive control. The liquid discharge from all nozzles was smooth and continuous, with no blockages or leaks, while the system exhibited no abnormal vibrations, electrical faults, or mechanical instability. Motor and pump noise remained consistent, and the battery supplied stable power throughout the test. The transmitter–receiver connection was strong and uninterrupted, and the spray coverage was uniform, without gaps or oversaturation. Temperature checks revealed no overheating of the motors, ESCs, or pump. These results confirm that both the flight and spraying systems are operational, showing stable lift, good maneuverability, and practical liquid application under local field conditions. To ensure optimal coverage, efficiency, and economic viability for Bangladeshi farmers, further systematic field trials, spray-rate calibration, and the implementation of GPS-guided autonomous spraying patterns are recommended.

Drought Hazard Variability in Bangladesh (1981–2018)

Bangladesh's agricultural sector is profoundly influenced by rainfall variability and the occurrence of hydroclimatic extremes. While the summer monsoon accounts for approximately 70–80% of the annual rainfall, interannual variability exposes the country to alternating periods of floods and droughts. Droughts are particularly severe in

northwestern Bangladesh, where seasonal rainfall deficits frequently constrain rice production. Previous studies have examined drought using indices such as the Standardized Precipitation Index (SPI) or Palmer Drought Severity Index (PDSI), but these approaches often underrepresent short-term variability important for agricultural planning.

The Effective Drought Index (EDI) addresses this gap by incorporating drought onset, duration, and intensity into a single framework. This study applies the EDI to Bangladesh rainfall data (1981–2018) and integrates results into a Drought Hazard Index (DHI), following established hazard mapping approaches. The aim is to provide a comprehensive spatiotemporal assessment of drought hazard, with particular emphasis on the three major rice seasons: Aus, Aman, and Boro.

Rainfall data: High-resolution (0.05°) gridded rainfall data for Bangladesh, covering 1981–2018.

Drought Index: The Effective Drought Index (EDI) was calculated every month. EDI has been widely used for drought monitoring in monsoon climates because it captures both drought intensity and persistence.

Drought Characterization

For each grid cell, drought events were identified when $EDI \leq -1.0$. Three attributes were derived:

- Frequency (F): Ratio of drought months to total months.

- Duration (D): Average length of drought episodes in months.
- Severity (S): Mean cumulative deficit below the EDI threshold.

Drought Hazard Index (DHI)

The drought hazard was quantified using the following normalized composite index:

$DHI_i = (F_i \times D_i \times S_i) / \max(F \times D \times S)$
 where F_i , D_i , and S_i represent the frequency, duration, and severity of droughts at location i .
 Normalization ensures that DHI values range

between 0 (no hazard) and 1 (highest hazard), allowing for spatial comparison across Bangladesh.

Rainfall Variability (1981–2018)

Annual rainfall in Bangladesh shows strong spatial heterogeneity (Fig. 12). Northwestern and western districts (Rajshahi, Naogaon, Dinajpur) typically receive <1,500 mm annually, while northeastern and southeastern districts (Sylhet, Cox's Bazar) exceed 3,500–4,000 mm. Such disparities create a hydroclimatic divide between surplus and deficit regions (Shahid, 2010).

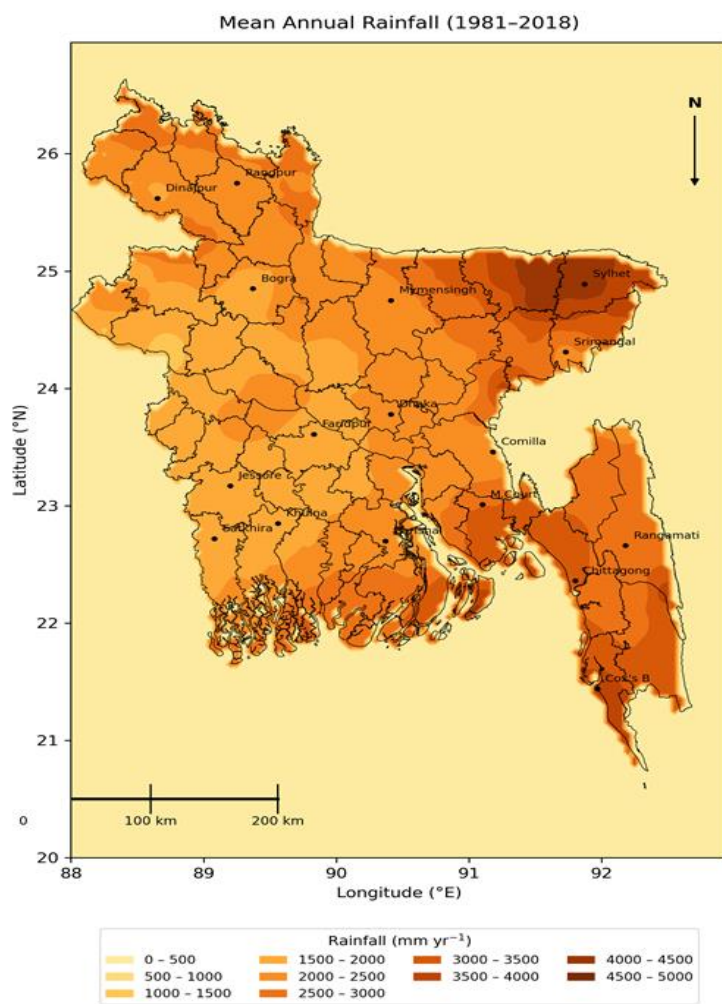


Fig. 12. Mean annual rainfall distribution in Bangladesh, 1981–2018.

Annual Drought Hazard

The annual DHI analysis reveals that northwestern Bangladesh (Rajshahi, Bogura, Naogaon) experiences the highest hazard (DHI = 0.62–0.78; high–very high class), with 6–8 drought events per decade lasting 3–5 months (Fig. 13). In contrast, the

northeast (Sylhet, Moulvibazar) records low hazard (DHI = 0.18–0.25) due to rainfall > 3,800 mm. Central districts such as Dhaka and Comilla fall in the moderate range (0.30–0.45). A clear west–east gradient is evident, with the northwest facing up to threefold higher hazard than the northeast, consistent with earlier studies.

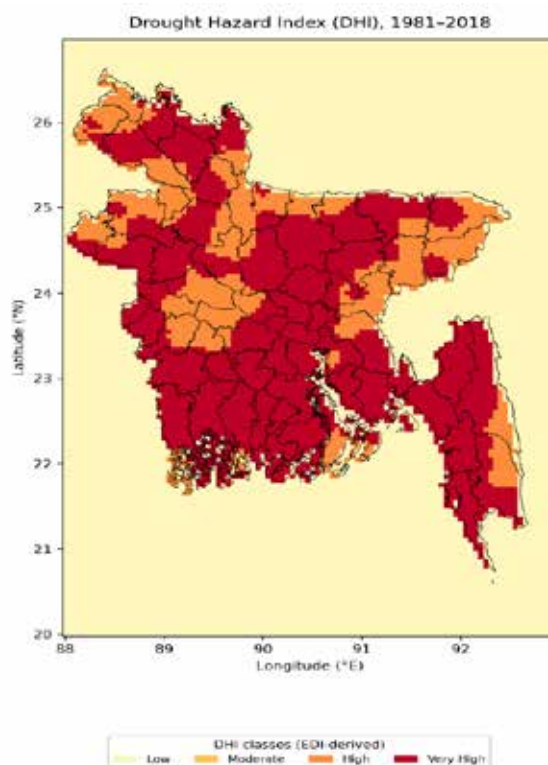


Fig. 13. Spatial pattern of the Drought Hazard Index (DHI) in Bangladesh, 1981–2018.

Seasonal Drought Hazard

The seasonal DHI (Fig. 14) highlights differential vulnerability across rice seasons. During the **Aus season (March–May)**, moderate hazard appears in western districts, coinciding with pre-monsoon rainfall deficits. The **Aman season (June–November)**, dependent on monsoon rains, shows relatively lower hazard, though late-season droughts occasionally reduce yields. The **Boro season (December–April)** exhibits the highest drought hazard, particularly in Rajshahi, Rangpur, and the

northwestern regions, where irrigation dependency is high. Quantitatively, more than 40% of northwestern districts fall under the “high hazard” category in Boro, compared to less than 20% during Aman. These results align with earlier findings that winter and pre-monsoon droughts are most critical for Bangladesh agriculture (Shahid, 2011; Tigkas et al., 2015). The concentration of drought hazards in the northwest suggests priority intervention zones for irrigation modernization and the deployment of drought-tolerant rice.

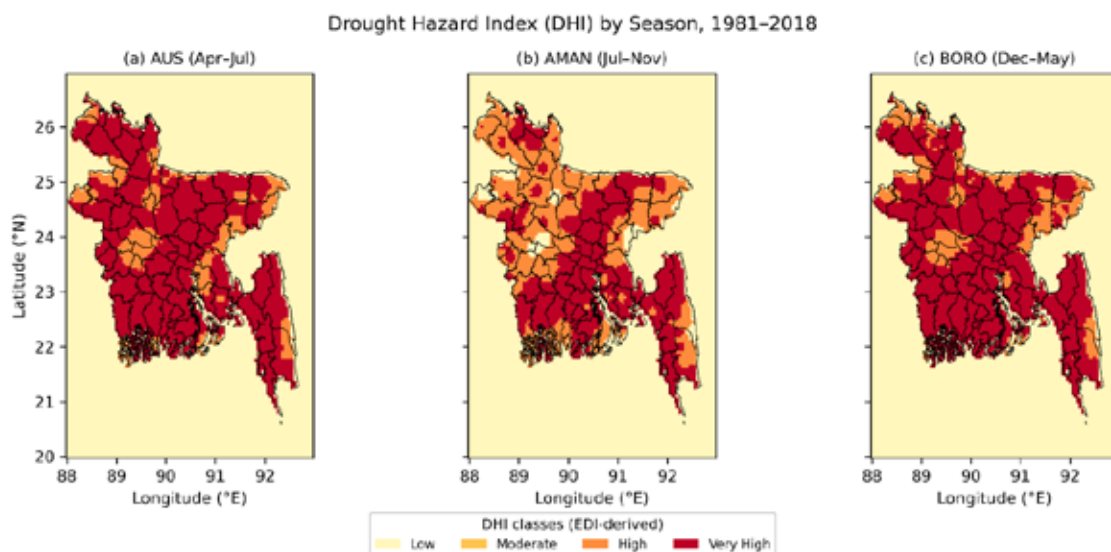


Fig. 14. Seasonal Drought Hazard Index (DHI) for Bangladesh during 1981–2018: (a) Aus, (b) Aman, (c) Boro.

This study demonstrates that northwestern and western Bangladesh face the highest drought hazard due to rainfall scarcity and high interannual variability. The seasonal assessment highlights the Boro season as particularly vulnerable, requiring extensive irrigation support. The DHI framework, integrating drought frequency, duration, and severity, provides a robust basis for identifying drought-prone hotspots. The findings are directly relevant for climate-smart agricultural planning and water resource management. Targeted interventions, such as drought-resistant rice varieties, groundwater management, and supplemental irrigation strategies, are essential for mitigating the impacts of drought.

Modification of the BRRI Prilled Urea Applicator (PUA)

The initial design of the BRRI Prilled Urea Applicator (PUA) faced challenges in maintaining consistent metering accuracy and long-term durability under field conditions (Fig. 15). Farmers frequently reported difficulties in achieving uniform application rates, particularly in muddy and high-silt

environments. To address these issues, BRRI initiated a comprehensive redesign aimed at enhancing precision, reliability, and user-friendliness.

The fundamental modification replaced the conventional fluted roller system with an auger (helical screw) mechanism. This innovation allows fine-tuned control of fertilizer flow through adjustable pitch and rotation, ensuring more accurate and efficient nutrient delivery. In parallel, the applicator's structural components—including the body and skids—were upgraded from lightweight aluminum and plastic materials to stainless steel and fiber-reinforced composites. These enhancements significantly improved durability, reduced maintenance frequency, and extended field life, even under demanding operating conditions. Together, these modifications represent a strategic step toward developing a farmer-centric mechanization solution that minimizes input losses, increases efficiency, and strengthens the long-term sustainability of rice cultivation in Bangladesh.



Fig. 15. Original BRRl Prilled Urea Applicator (9 kg model).

To enhance the performance of the Prilled Urea Applicator, BRRl implemented targeted improvements to the metering mechanism, construction materials, and flow adjustment system. The conventional fluted roller was replaced with an adjustable auger, providing continuous and precise control of fertilizer flow (Table 10 and Fig. 16).

Structural components, including the body and skids, were upgraded to stainless steel and fiber-reinforced composites, improving durability under wet and muddy conditions. Additionally, an integrated agitator was installed within the auger housing to prevent clogging and ensure smooth, reliable operation.

Table 10. Key Modifications and Improvements in the BRRl Prilled Urea Applicator

Component	Previous Design	Enhanced Design
Metering Mechanism	Fluted roller / star-wheel	Adjustable auger (helical screw) with manual control lever
Materials	Aluminium & HDPE	Full stainless steel and fiber-reinforced composites
Anti-Clogging Feature	Internal agitator (spring fingers)	Integrated agitator within auger housing
Flow Adjustment	Fixed geometry + gate	Direct auger pitch/rotation tuning and variable gate

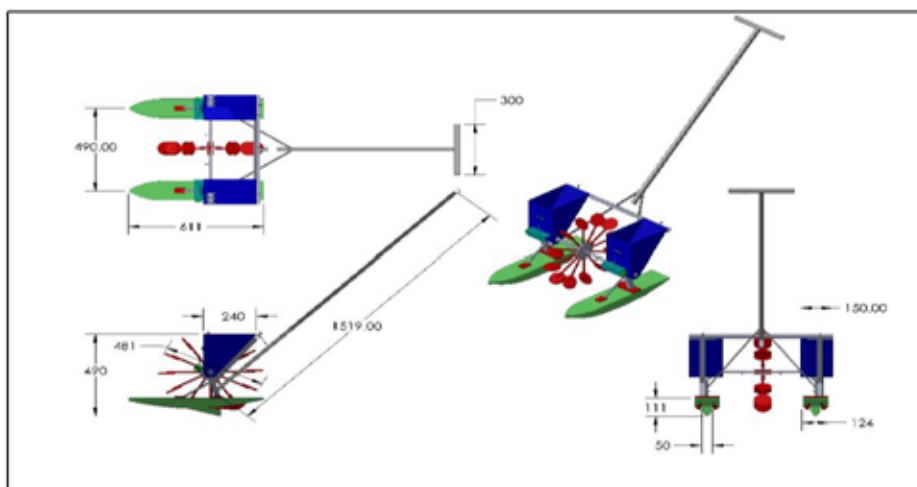


Fig 16. Modified BRRl Prilled Urea Applicator with auger metering.

Performance Outcomes

Field and laboratory evaluations of the modified applicator demonstrated substantial improvements in efficiency, accuracy, and durability compared to the original design (Table 11). The auger-based metering system achieved a more uniform fertilizer

flow, while the upgraded stainless steel and fiber-reinforced body enhanced field life and reduced maintenance requirements. Farmers also reported easier handling due to improved balance and smoother operation, despite the slightly reduced weight.

Table 11. Comparative performance of the BRRI prilled urea applicator before and after modifications.

Performance Metric	Original Prototype	Auger & Material Upgrade
Weight	~9 kg	~ 6.5 kg
Metering Accuracy (CV)	<10%	~ 3–4%
Flow Adjustability	Limited	Infinitely variable via auger control
Durability (field life)	Moderate	High (due to SS & fiber body)
Clogging Incidents	Minimal	Negligible

Fabrication of the modified version

Following the design changes, BRRI fabricates prototype units of the improved Prilled Urea Applicator to test its field performance (Fig. 17). The manufacturing focused on the precise engineering of the auger-based metering system and the integration of an upgraded stainless steel and fiber-reinforced composite body, ensuring ergonomic balance, ease of use, and durability in puddled rice fields. The adjustable auger lever allows farmers to control

fertilizer flow as needed, while the reinforced body and skids resist corrosion, abrasion, and long-term water exposure. Final assembly at BRRI’s workshop included quality checks for metering accuracy, flow consistency, and mechanical strength. These prototypes represent a significant improvement over earlier versions, offering enhanced precision, longer service life, and reduced maintenance, thereby supporting cost-efficient and effective fertilizer management in rice farming.



Fig. 17. Field evaluation of the modified applicator in puddled rice plots.

Operators reported significantly improved control over fertilizer application due to the manual adjustment lever for the auger (Fig. 17). Clogging was virtually eliminated, even under heavy silt conditions. Although the unit's weight increased slightly, enhanced material durability and ergonomic design facilitated easier handling and reduced maintenance requirements.

INDUSTRIAL AND FARM LEVEL EXTENSION

Training on operation, repair, and maintenance of BRRI-developed farm machinery

Proper operation and maintenance increase the self-life of a machine, and as a result, more income-generating activities (IGA) were observed, thus increasing the machine's productivity. To build up trained manpower on farm machinery in the rural areas, the SFMRA project of Farm Machinery and Postharvest Technology Division of Bangladesh Rice Research Institute conducted a two-day long residential training program at BRRI headquarter, Gazipur, Chuadanga, Bottoil of Kushtia, and Dinajpur district.

Two-Week Residential Hands-On Training for Mechanics and Machine Operators

Two 15-day residential training programs were successfully conducted under the financial and technical support of the PARTNER Project, implemented by the Farm Machinery and Postharvest Technology Division of BRRI (Fig. 18). Each batch enrolled twenty participants, selected in coordination with BRRI's regional stations, with priority given to individuals with prior experience in operating agricultural machinery. This ensured that the training directly benefited those actively engaged in mechanized farming while maintaining strong local representation from farming communities near BRRI regional stations.

The curriculum, designed and delivered by experienced BRRI scientists, combined theoretical instruction with predominantly hands-on practical sessions. Participants were trained in the operation, maintenance, and troubleshooting of the BRRI-

developed. They promoted machinery, including the self-propelled reaper, prilled urea applicator, power and manual weeders, winnower, and power tiller, with special emphasis on the mechanical rice transplanter and combine harvester. Practical sessions began with no-load operation at the FMPHT research field and nearby roads, followed by supervised field demonstrations where participants operated each machine step by step under expert guidance. A key live demonstration on raising rice seedlings in plastic trays further enhanced their understanding of integrated mechanization practices.

At the end of each program, a post-training evaluation was conducted to measure improvements in knowledge and skills, as well as to gather feedback on participant satisfaction and recommendations. To assist with field application, trainees received certificates, informational leaflets, and a set of essential tools. In total, 40 participants completed the two training programs, acquiring the technical skills and confidence needed to promote mechanized rice farming practices in their regions.

Major activities done by the participants

The training program provided participants with extensive hands-on experience in operating and maintaining a wide range of BRRI-developed machinery, technologies, and other agricultural equipment. A key demonstration was conducted on the seedling raising technique for the mechanical rice transplanter, which was followed by practical sessions on the operation and maintenance of the BRRI seed sower, mechanical rice transplanter, combine harvester, prilled urea applicator, chopper machine, winnower machine, reaper machine, and BRRI weeder. In addition, participants received training in the repair and maintenance of diesel and petrol engines, as well as the operation of electric motors, generators, and dynamos. To consolidate learning, practical field sessions were organized at the farm level, enabling participants to apply their skills directly in real-world conditions under expert guidance.



Fig. 18. Pictorial view of hands-on training

Workshop Machinery and Maintenance (WMM) Division

- 316 Summary**
- 317 Development of Solar Power Operated Sprayer**
- 320 Design and Development of a Recirculating type Dryer for Farm Holders**
- 324 Development of Mat type Seedling Using Hydroponic Technique**

SUMMARY

Solar power operated sprayers of three types: backpack, multi-nozzle, and trolley-mounted were designed in Solid Works and fabricated at the WMM Division, BRRI, Gazipur, to improve herbicide and pesticide application and demonstrate their performance to farmers. The sprayers were constructed using solar panels, DC motors and batteries, charge controllers, tanks and nozzles, with the trolley-mounted sprayer incorporating a stainless steel frame for durability. Performance evaluation was conducted under laboratory conditions and field trials at BRRI Farm, Gazipur.

The recirculating type dryer was designed using Fusion 360. An attempt was made to develop it at BRRI farm machinery research workshop, Gazipur. All components of the dryer have been successfully fabricated, and the assembling work has also been ongoing. However, some operational issues have been observed during the testing phase. Efforts are in progress to identify the root causes and implement appropriate solutions.

The experiment aimed to develop a mat-type seedling using the hydroponic technique and evaluate its performance with a rice transplanter. The experiment was conducted at BRRI farm, Gazipur during July-November/2024 in T. Aman season. The study was utilized BRRI dhan103 duration of 126 days. The hydroponic technique for mat-type seedling development demonstrated notable outcomes across key performance indicators. Missing hills accounted for 10.8%, while mechanically damaged hills and buried hills were recorded at 8.8% and 3.32% respectively, indicating effective hill establishment. Floating hills were minimal at 4%, and transplanting depth averaged

4.80 cm, ensuring consistent placement. Plant heights at 15, 30, 45, and 60 days averaged 22.16 cm, 73.66 cm, 117.5 cm, and 138.83 cm, respectively, with tiller counts progressively increasing to 18.66 by 60 days. An average of 15.66 effective tillers/hill and a panicle length of 26.66 cm, with 203.16 filled grains/ panicle and minimal unfilled grains/panicle 27.33. The 1000-grain weight averaged 23.33 g, contributing to an average grain yield of 5.93 t/ha, signifying the potential of hydroponic mat seedlings in enhancing crop productivity.

DEVELOPMENT OF SOLAR POWER OPERATED SPRAYER

Md Moudud Ahmmed, M A Hossain, B C Nath, G K Bhuiya, S Paul

Objectives

- to design and fabricate efficient solar-powered sprayers
- to assess their operational performance.

Methodology

Three types of solar-operated sprayers: backpack, multi-nozzle, and trolley-mounted were designed in SolidWorks (Fig. 1, 2 & 3) and fabricated at the WMM Division, BRRI, Gazipur, to improve herbicide and pesticide application and demonstrate their performance to farmers. The sprayers were constructed using solar panels, DC motors and batteries, charge controllers, tanks and nozzles, with the trolley-mounted sprayer incorporating a stainless steel frame for durability. Performance evaluation was conducted under laboratory conditions and field trials at BRRI Farm, Gazipur (Fig. 4, 5 & 6).

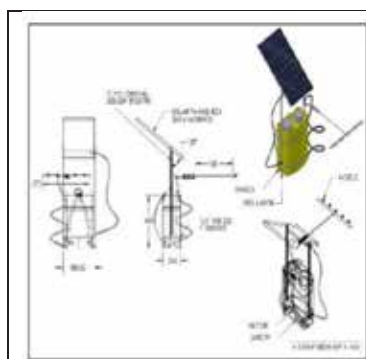


Fig. 1. Layout of back pack solar powered sprayer

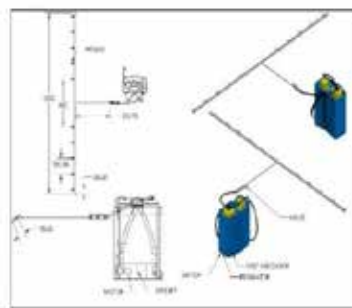


Fig. 2. Layout of multi nozzle sprayer

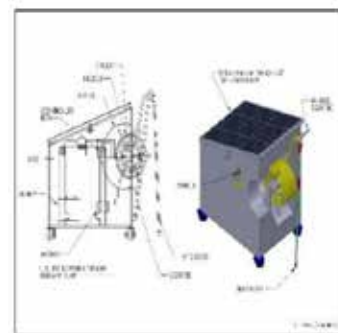


Fig. 3. Layout of trolley mounted solar powered sprayer



Fig. 4. Back pack solar operated sprayer



Fig. 5. Multi nozzle sprayer



Fig. 6. Trolley Mounted sprayer

Performance evaluation

The performance evaluation of the solar-operated sprayers was conducted in two phases: laboratory testing at the WMM Divisional Workshop and field trials at BRRI Farm, Gazipur. Table 1 shows that the trolley-mounted sprayer achieved the highest average effective field capacity (0.182 ha/hr),

followed by the multi-nozzle (0.159 ha/hr) and backpack sprayers (0.136 ha/hr). Table 2 indicates that the trolley-mounted sprayer also had the highest average field efficiency (78.61%), while the multi-nozzle and backpack sprayers achieved 74.67% and 71.39%, respectively. These results demonstrate that the trolley-mounted sprayer provides greater coverage and efficiency compared to the other types.

Table 1. Effective Field capacity of different sprayer.

Sprayer type	Obs. no.	Area coverage (ha)	Time taken (sec)	Effective field capacity (ha/hr.)	Average effective field capacity (ha/hr.)
Backpack sprayer	1	0.0025	64	0.141	0.136
	2		66	0.136	
	3		68	0.132	

Sprayer type	Obs. no.	Area coverage (ha)	Time taken (sec)	Effective field capacity (ha/hr.)	Average effective field capacity (ha/hr.)
Multi-nozzle sprayer	1	0.0025	55	0.164	0.159
	2		57	0.158	
	3		59	0.155	
Trolley-mounted sprayer	1	0.0025	48	0.188	0.182
	2		50	0.180	
	3		52	0.175	

Table 2. Field efficiency of different sprayer.

Sprayer type	Obs. no.	Spraying width (m)	Forward speed (km/hr)	Theoretical field capacity (ha/hr)	Effective field capacity(ha/hr)	Field efficiency (%)	Average field efficiency (%)
Backpack sprayer	1	0.60	2.00	0.199	0.141	70.83	71.39
	2	0.60	2.00	0.185	0.136	73.33	
	3	0.60	2.00	0.189	0.132	70.00	
Multi-nozzle sprayer	1	1.50	2.50	0.220	0.164	74.67	74.67
	2	1.50	2.50	0.208	0.158	76.00	
	3	1.50	2.50	0.211	0.155	73.33	
Trolley-mounted sprayer	1	2.00	3.00	0.240	0.188	78.33	78.61
	2	2.00	3.00	0.232	0.180	77.50	
	3	2.00	3.00	0.219	0.175	80.00	

Results and discussion

Battery voltage increases with daytime as solar charging progresses, while current follows a similar trend (Fig. 7). Solar irradiance peaks midday and decreases thereafter, causing a corresponding drop in

flow rate (Fig. 8). Trolley Mounted Sprayer: Battery voltage increases with time as solar irradiance rises, while the flow rate slightly decreases during peak hours (Fig. 9). Solar irradiance shows a typical diurnal pattern, peaking around midday and gradually declining toward evening (Fig. 10).

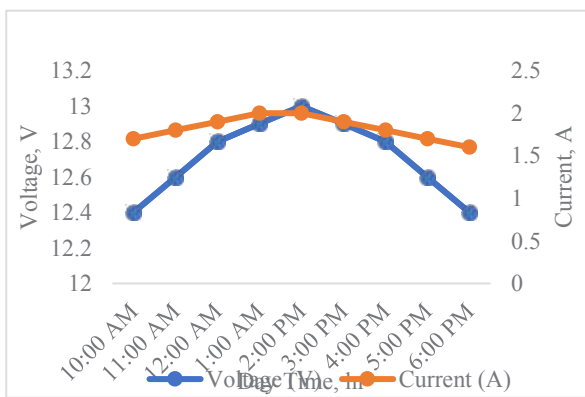


Fig. 7. Variation of battery voltage and current with daytime in trolley mounted sprayer.

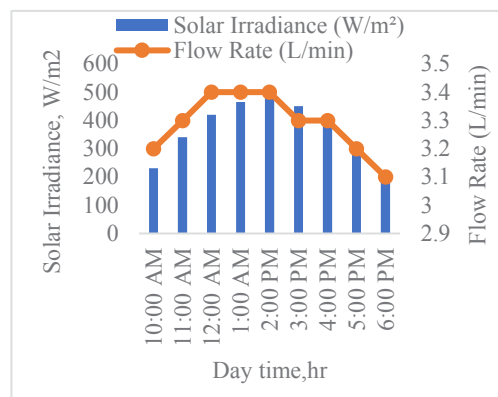


Fig. 8. Variation of solar irradiance and flow rate with daytime in trolley mounted sprayer.

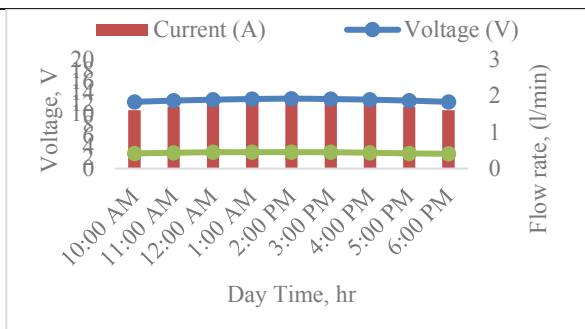


Fig. 9. Variation of voltage and flow rate with day time in backpack sprayer.

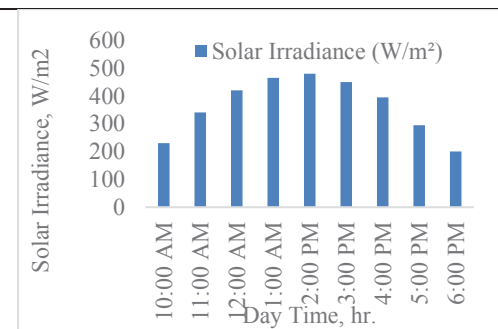


Fig. 10. Variation of solar irradiance rate with daytime in backpack sprayer.

Fig. 11 shows flow rate and pump speed increase until early afternoon, peaking around 2:00 PM, and then gradually decrease toward evening, reflecting the effect of solar energy availability on system performance.

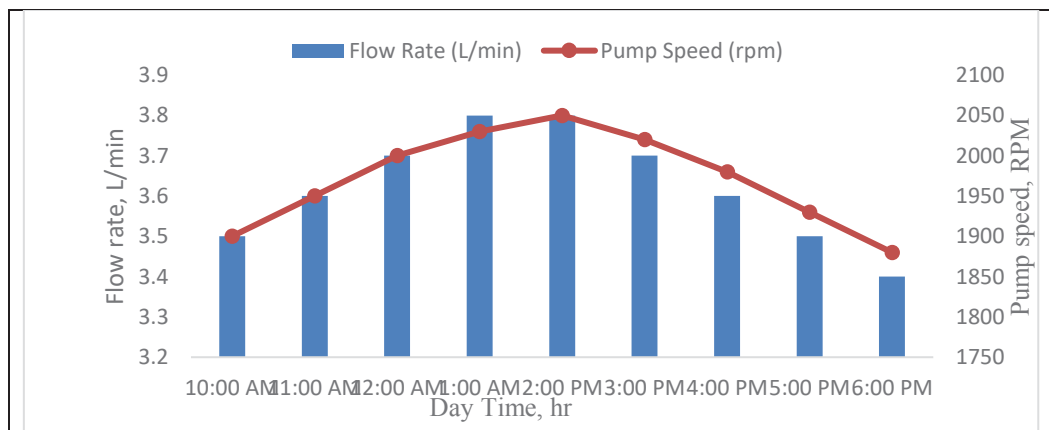


Fig. 11. Variation of flow rate and pump speed during daytime in multi nozzle sprayer.

Table 3. Detailed technical specifications of solar-operated sprayers.

Items	Back pack solar powered sprayer	Multi-nozzle sprayer	Trolley mounted solar powered sprayer
Type of sprayer	Solar operated	Multi nozzle boom sprayer	Solar-operated, Trolley mounted (SS frame)
Capacity of the tank	16 L	18L	20 L
Solar panel power	15 W	-	40 W
Solar panel size	675 mm x380 mm x25 mm	-	700 mm x510 x 25 mm
Battery current	1.7 A	2.5	30 A
Pump voltage	12 V (DC)	12 V (DC)	12 V (DC)
Charging time (hr)	4	5.5	6
Number of nozzle (nos.)	5	10	5
Max pressure (MPa)	0.45	0.50	0.60
Open flow (L/min)	2.8	3.7	3.4
Battery voltage (VDC)	12	12	12
Max current (A)	2.0	2.5	3.0
Net weight	6 kg	5.2 kg	20 kg

Limitations

- Solar-powered sprayers rely on sunlight; performance decreases on cloudy or rainy days.
- Trolley-mounted sprayer is heavy, making it difficult for a single person to transport; solar panels add significant weight.
- Battery charging time may limit continuous operation during extended fieldwork.

DESIGN AND DEVELOPMENT OF A RECIRCULATING TYPE DRYER FOR FARM HOLDERS

Mohammad Afzal Hossain; MA Hossen

Specific Objectives

- to design and develop a recirculating type mobile dryer for small farm holders
- to evaluate the performance of the developed dryer

Methodology

The recirculating type dryer was designed using Fusion 360 and developed at the BRRI Farm

Machinery Research Workshop, and it is planned to be tested during the Aus, Aman, and Boro seasons. The study required various materials and instruments, including moisture, temperature, and relative humidity sensors, a digital moisture meter (Model-RiceterL, accuracy $\pm 0.2\%$), and a digital anemometer (Model-Testo 416, accuracy ± 0.2 m/s). Additionally, a blower and a 12 hp diesel engine with an 8-foot-long auger were used, along with construction materials such as 16-gauge stainless steel sheets, 14-gauge mild steel sheets, and #18 galvanized wire mesh. Other components included a plastic box, two-inch square box bars, angle bars, flat bars, a helical spring, flywheel, V-belt, pulleys, chains, sprockets, and related mechanical parts.

Design consideration

- Locally available materials should be used to minimize the fabrication cost.
- It should be designed well that uniform drying of grain may occur.
- It should be easy to operate, repair and maintenance.
- The cost of dryer must be within the capacity of the farmers.

- It should be suitable for drying low quantity of grain i.e. 500 kg.
- Moisture, temperature and relative humidity of grain will be monitored through sensors.
- Grain temperature must be auto controlled. Automated control system will be incorporated.

Experimental design

Randomized complete block design with two factors was followed in the study.

Factors: a) dryer of different sizes and b) paddy of different moisture content (MC).

Replication	Amount/ Batch, kg
3	500
	550
	600

Results

Using Fusion 360 software, a recirculating type drier for agricultural holders was made. As seen in Figure 12, it can be transported to farm households for paddy drying.



Fig. 12. Recirculating type dryer.

Dryer components

The recirculating type dryer consists of various components. It includes a basement unit, a grain holding unit, heating elements, a power transmission unit, and so forth. The basement unit features a mainframe that houses all the aforementioned components together. The grain holding unit is made up of a hopper and two types of bins: an inner bin and an outer bin, along with lower and upper covers. The heating elements comprise a heating chamber and a blower. The power transmission unit consists of a diesel engine, a pulley, a chain, a sprocket, a handle, a ground wheel, and other related parts.

Basement unit

Mainframe

Dimension of the mainframe is 48 x 96 inches. A square box bar with a size of two inches was utilized

to construct the mainframe. The thickness of the square box bar is 3 mm. It accommodates the grain holding unit, diesel engine, heating elements, operation unit, driving seat, and other components.

Grain holding unit

Bin

Two types of bins were utilized: 1) the inner bin and 2) the outer bin.

Inner bin

The diameter of the inner bin measures 158 cm and its height is 340 cm (Fig. 13.a).

Outer bin

The diameter of the outer bin is 560 cm, and it also has a height of 915 cm (Fig. 13.b).

Lower cover of the grain chamber

The diameter of the lower cover of the grain chamber is 1160 cm, with a height of 470 cm. It is constructed from stainless steel in a conical shape with an opening of 200 cm (Fig. 13.c).

Upper cover of the grain chamber

The diameter of the upper cover of the grain chamber is 635 cm, and it is 292 cm high. It is also made from stainless steel in a conical shape with an opening of diameter 114 mm in the apex position (Figure 13.d).

Heating elements

Heating Chamber

The diameter of the heating chamber measures 560 cm. Its height is 910 cm. The thickness of the heating chamber is 10 mm (Fig. 13.e). It has an opening of 260X207 mm in the lower part of the heating chamber. It has a lid of diameter of 205 mm in the upper cover.

Blower

The axial flow blower is engineered to provide a continuous supply of hot air. Hot air is directed to the grain through the use of a blower (Fig. 13.f) and heating elements. The machine operates with a high-speed blower that delivers air, along with a heating element that warms the air.

Developed Parts	
 a. Inner bin of the grain chamber	 b. Outer bin of the grain chamber
 c. Lower cover of the grain chamber	 d. Upper cover of the grain chamber
 e. Heating chamber	 f. Blower

Fig. 13. Grain holding unit.

Grain circulation unit

Screw augur

A screw augur is used to transfer grain from lower side to the upper side. It will spread grain as an influence of turbulence. The screw augur (Fig. 14.a) is constructed from galvanized sheet which is unaffected by temperature.

Roller

The screw augur is run and supported by a roller (Fig. 14.b). CI material is used to make it. The roller has a cylindrical, hollow form. A roller is used to wind the screw conveyor.

Developed Parts	
 Screw augur	 b. Roller
 c. Reducing gear box of screw augur	 d. Augur housing

Fig. 14. Grain circulation unit.

Power transmission unit

Power transmission system of the recirculating dryer entails diesel engine, chain, sprocket, pulley, gear box, ground wheel etc. It is shown in Fig. 15.

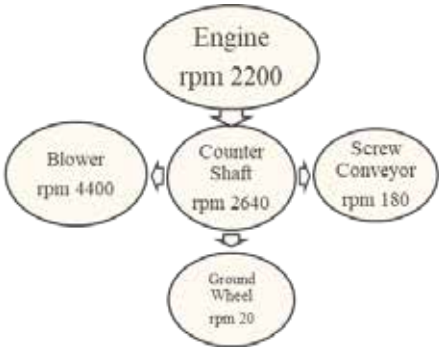


Fig. 15. Power transmission system of the recirculating dryer

Diesel engine

Diesel engine (12 hp) is used as prime mover of the recirculating type dryer.

Ground wheel

Three ground wheel was attached in the basement to make the dryer movable. Rim diameter of the wheel

was 34 cm. Pneumatic tire of 4 ply was used in the ground wheel. Two pair of ball bearings with pillow type casing are used to fit the wheel axle to the inclined trusses. A pair of 11.9 cm diameter sprocket is used in this axle to transmit power from the gearbox by a roller chain.

Driving handle was made of 20 mm diameter MS pipe are used. Two MS rods are used to connect the other ends of the engine base frame to driving handles by electric arc welding.

DEVELOPMENT OF MAT TYPE SEEDLING USING HYDROPONIC TECHNIQUE

Md Moudud Ahmmed, MA Hossain, BC Nath, GK Bhuiya

Specific Objectives:

- to develop mat-type rice seedlings using hydroponic techniques
- to evaluate their suitability for mechanical transplanting.

Methodology

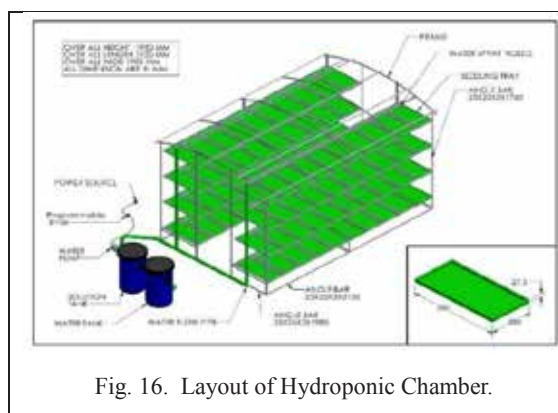


Fig. 16. Layout of Hydroponic Chamber.



Fig. 17. Mat type seedling using hydroponic technique.

General information of experiment:

- **Seed properties:** Germination 98%, Length 9.2 mm, Thickness 2.2 mm, L/B ratio 4.18, Slender type
- **Experiment duration:** 21 Jul – 21 Nov 2024 (126 days)
- **Soil properties:** Clay loam, pH 6.2, Organic matter 1.94%, Bulk density 1.22 gcm⁻³, Porosity 47.7%. (Soil properties were analyzed prior to transplanting at the experimental site).

Result and Discussion

The plant population increased progressively with higher seed rates, indicating better establishment of seedlings (Fig. 18). Similarly, plant height showed steady growth over time, with higher seed rates producing slightly taller seedlings (Fig. 19). The percentage of missing and damaged hills decreased as seed rate increased, demonstrating improved stand uniformity (Fig. 20), while buried and floating hills were also minimized at higher seed rates (Fig. 21). Consequently, the number of hills per square meter increased proportionally with seed rate (Fig.

22). Higher seed rates positively influenced grain yield and 1000-grain weight, reflecting the

beneficial effect of optimal seed density on crop yield (Fig. 23).

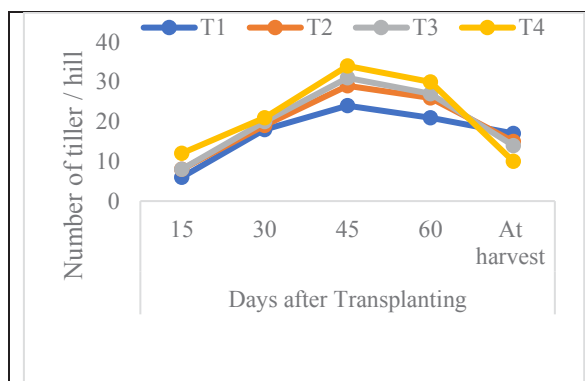


Fig. 18. Plant population with respect to days after transplanting as affected by rate.

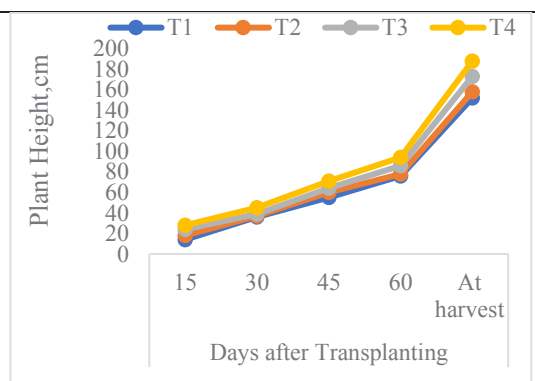


Fig. 19. Plant height with respect to days after transplanting as affected by rate.

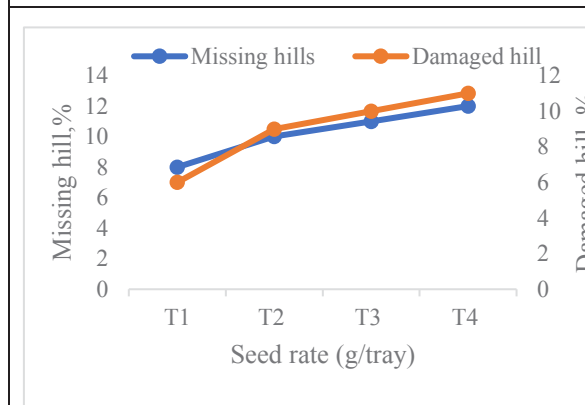


Fig. 20. Percent of missing hills and damage hill as affected by seed rate.

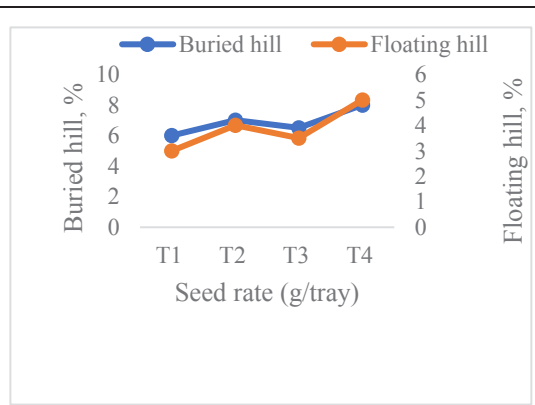


Fig. 21. Percent of buried hills and Floating hill as affected by seed rate.

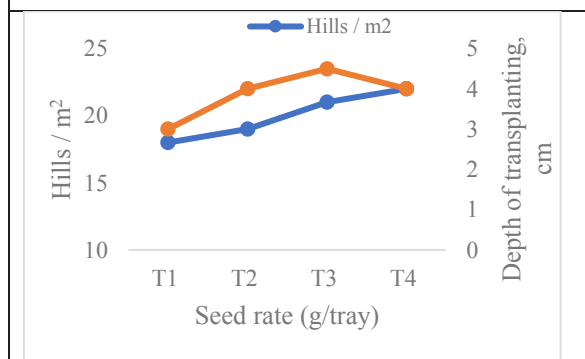


Fig. 22. Effect of seed rate on hills per m²

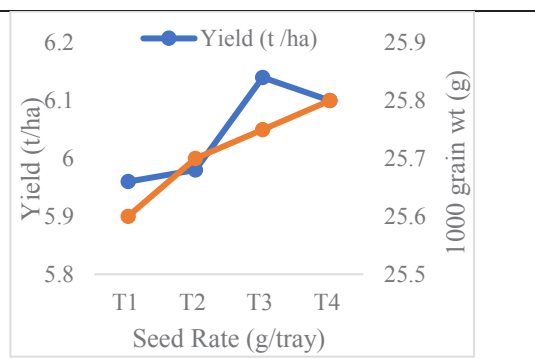


Fig. 23. Effect of seed rate on yield and 1000 grain weight..

Table 4. shows that increasing seed rates generally improved effective tillers, filled grains per panicle, and harvest index, contributing to higher yield. Table 5. compare the economics of seedlings raised with and without soil. Seedlings with soil incurred a lower total production cost (77,072 Tk./ha) compared to seedlings without soil (92,012 Tk./ha), mainly due to savings on nutrient solution costs. Consequently,

rice production was higher with seedlings grown in soil (4540 kg/ha vs. 4140 kg/ha), leading to greater gross returns (166,450 Tk./ha) and net returns (86,019 Tk./ha). Table 5 shows the benefit-cost ratio (BCR) was also higher for seedlings with soil (2.07) compared to seedlings without soil (1.84), indicating that using soil-based seedlings is more profitable and cost-efficient for rice production.

Table 4. Effect of treatments on yield and yield-contributing characters of rice.

Treatment	Effective tillers/hill	Ineffective tillers/hill	Panicle length (cm)	Filled grains/panicle	Unfilled grains/panicle	Straw yield (t/ha)	Biological yield (t/ha)	Harvest index (%)
T1	13	2	27	161	33	4.4	9.2	52.0
T2	15	1	26	213	49	3.2	6.6	51.0
T3	18	1	26	231	19	4.1	8.3	51.2
T4	21	2	26	193	26	4.6	7.6	51.1
Mean	15.66	1.33	26.66	203.16	27.33	3.9	8.0	51.4

Table 5 Economic analysis of mat type hydroponic seedling raising technique

Parameters		Seedling with soil	Seedling without soil
Seedling Cost	Cost of seed (Tk./kg)	65	65
	Tray cost (Tk./ha)	2475	2475
	labor cost Tk./ha)	14000	14000
	Solution (Tk./ha)	0	17901
	Fungicide (Tk./ha)	2200	2200
Transplanting	Land preparation (Tk./ha)	10980	10980
	Fertilizer	8140	8140
	Plowing	9355	9355
	Weeding	7192	7192
	Land Charge	10813	10813
	Pesticide	2145	2145
	Harvesting	18686	18686
	Irrigation (Tk./ha)	2222	2222
	Labor (Tk./ha)	14816	14816
Transplanter	Fixed Cost (Tk./ha)	5220	5220
	Variable cost (Tk./ha)	14877	14877
Total cost (Tk./ha)		77072	92012
Rice Production (kg/ha)		454032	414032

Parameters	Seedling with soil	Seedling without soil
Price of Rice (Tk./ha)	121374	110374
Price of Straw (Tk./ha)	21565	19565
Gross Returns (Tk./ha)	166450	122636
Net Returns (Tk./ha)	86019	65365
Production Cost (Tk./kg)	14.64	21.94
BCR	2.07	1.84

Recommendation

- Need comparative study with test with traditional and mat type seedling with rice transplanters.
- Local material may be used to reduce cost.

Repair and maintenance work of transport/vehicles and different farm machinery

WMM Division of BRRI repairs and maintains different transport/vehicles and farm machinery through following services:

- Spare parts change and repair
- Overhauling, Denting-painting
- CNG conversion, troubleshooting
- Tyre-tube change
- Battery Change
- CNG related and electrical works of vehicles
- Transport/vehicles/machinery cleaning and servicing

A total of 40 cars (4-wheelers) 434 times, 112 motorcycles 290 times, 05 tractors 63 times, 25 power tillers 285 times, 15 hydro tillers 51 times, and other farm machinery 27 times were repaired and changed spare parts under moderate/minor repair and maintenance work.

Adaptive Research Division

330	Summary
330	Technology validation
347	Technology dissemination
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SUMMARY

Advanced Line Adaptive Research Trials (ALART) were conducted at farmers' field under different agro-ecological conditions of the country to test the yield potential and adaptability of advanced breeding lines to generate the feedback about the advantages and disadvantages of the advanced lines from extension workers and farmers. A total of 46 advanced rice genotypes were tested along with 36 check varieties under 22 ALARTs during the reporting period 2024-2025, which included three rice seasons; Aus Aman and Boro. Considering the yield and yield contributing characters and farmers' choice, only eight advanced rice genotypes were recommended for Proposed Variety Trial (PVT). None of the genotypes recommended from ALART Aus 2024, only two advanced lines such as BR13113-4R-63 and BRH9-3-2B were recommended for PVT from ALART STR-SD and Kateri type grain, Aman 2024. A total of six advanced rice genotypes, BR13113-4R-63 and BR13113-4R-116 for ALART STR-SD, BR13113-4R-185 and BR13122-4R-136 for STR-MD, BR (Path) 13802-BC3-73-13 and BR (Path)13802-BC3-73-14 were recommended for PVT during Boro season.

A total of 16 Adaptive Trials (AT) were conducted during Aman 2024 under the LSTD project. The findings revealed that BRRI dhan103 and BRRI dhan87 yielded approximately 1 ton per hectare more than BRRI dhan93 and BRRI dhan95 at the selected locations, indicating their greater potential for higher productivity. Additionally, 1,585 Seed Production and Dissemination Programmes (SPDP) were carried out in 2024–25 under the Core Programme, PARTNER, and LSTD projects, using 20 recently released BRRI rice varieties. These programmes collectively produced 2,241.46 tons of rice seed, from which 196.741 tons were retained by farmers for future use. Through these initiatives, 75,516 farmers were engaged in knowledge-sharing activities, and 28,810 were motivated to adopt improved rice varieties and cultivation practices.

ARD conducted 35 batches of farmers' training at different locations of the country, in which 1,050 trainees participated on modern rice production technologies. A total of 23 field days were arranged at different locations of the country. A total of 4,820 kg quality seeds of modern rice varieties were produced by ARD at BRRI Gazipur in 2024-25 to execute adaptive research trials and demonstrations.

TECHNOLOGY VALIDATION

Advanced line adaptive research trial (ALART)

The ALART trials were conducted at farmers' field in different agro-ecological zones (AEZ) of Bangladesh. Common methodology was followed for all the ALART trials. The trial was set up following randomized complete block design (RCBD) with three replications at all the locations. Uniform fertilizers dose and management practices were followed for all the locations. Insects and diseases are controlled, but not controlled in case of ALART for Insect resistant rice (IRR) and disease resistant rice (DRR). Data taken in the trials were analyzed using statistical softwares like Statistix-10 and R.

1.1 ALART Bacterial blight resistant rice-1 (BBRR-1) Aus 2024. Three advanced rice genotypes BR11866-5R-147, BR11867-5R-103, BR11867-5R-442 were evaluated against BRRI dhan48 and BRRI dhan98 as checks at farmers' field in T. Aus 2024 at ten locations such as Cumilla, Habiganj, Kushtia, Rajshahi, Rangpur, Satkhira, Gazipur, Bhola, Sirajganj and Feni. Irrespective of genotypes and environments, BRRI dhan98 produced significantly the higher mean grain yield (4.53 t ha⁻¹) over the tested genotypes (Table 1). The crop of Feni site was damaged due to severe flood and crop of Sirajganj was discarded due to bird and rat damage. Considering overall performances, yield, disease score, phenotypic acceptability, farmers' opinion; none of the tested lines could be advanced for proposed variety trial (PVT).

Table 1. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART (BBRR-1) during Aus 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹)									duration (day)	plant ht. (cm)	1000-grain wt. (g)
	Cumilla	Habiganj	Kushtia	Rajshahi	Rangpur	Satkhira	Gazipur	Bhola	Mean			
BR11866-5R-147	4.78	3.45	5.45	4.13	3.70	3.36	3.46	3.63	4.00	110	97	22.8
BR11867-5R-103	5.73	3.95	5.64	5.14	3.64	3.23	3.47	3.31	4.26	110	100	20.6
BR11867-5R-442	4.61	4.11	5.75	5.25	3.54	4.06	3.54	3.45	4.29	112	102	22.7
BRRI dhan48(Std.ck)	4.51	4.28	6.01	4.27	4.17	3.40	3.47	3.31	4.18	109	107	23.6
BRRI dhan98 (Std.ck)	5.51	3.79	5.85	4.66	3.82	4.38	4.76	3.46	4.53	110	100	23.3
LSD _{0.05}	0.57								0.20	0.7	1.5	0.6

ALART bacterial blight resistant rice-2 (BBRR-2), Aus 2024

Three advanced lines i.e., BR (path)13784-BC3-34-9-10-HR9, BR (path)13784-BC3-5-3-4-HR15 and BR (path)13784-BC3-61-1-6-HR3 along with BRRI dhan82 and BRRI dhan98 as checks were tested at farmers' field in ten locations such as Bhola, Barguna, Cumilla, Habiganj, Feni, Kushtia, Rajshahi, Rangpur, Sirajganj and Gazipur. The trials at Sonagazi Feni and Barguna were

completely destroyed by severe flood. The crop of Sirajganj site severely damaged by bird led to the loss of 60–70% of the grain. Consequently, data from these three locations were excluded from the final analysis. Among the tested genotypes, significantly higher average grain yield (4.52 t ha⁻¹) was recorded in BRRI dhan98 over the tested genotypes (Table 2). Considering overall performances, yield, disease score, phenotypic acceptability, farmers' opinion; none of the tested lines could be advanced for PVT.

Table 2. Grain yield, growth duration, plant height and grain weight of the rice genotypes under ALART BBRR-2 during Aus 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹)							Mean			
	Bhola	Cumilla	Habiganj	Kushnia	Rajshahi	Rangpur	Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt (g)
BR(path)13784-BC3-34-9-10-HR9	3.54	5.38	3.43	4.95	4.55	3.13	4.36	4.19	111	102	23.9
BR(path)13784-BC3-5-3-4-HR15	3.45	4.75	3.48	5.58	4.59	3.57	4.30	4.24	109	104	23.4
BR(path)13784-BC3-61-1-6-HR3	3.53	4.68	2.66	4.89	3.72	4.30	2.92	3.81	112	106	22.2
BRRI dhan82 (ck)	3.37	4.48	2.33	4.92	4.29	3.95	2.73	3.72	106	107	22.5
BRRI dhan98 (ck)	3.74	5.61	2.73	5.26	4.53	3.95	5.79	4.52	111	103	23.7
LSD _{0.05}	0.66							0.29	0.4	2	0.4

ALART Antioxidant enriched rice-short duration (AER-SD), Aman 2024. Three anti-oxidant enriched rice (AER-SD) advanced lines BR12836-4R-312, BR12839-4R-124-2 and BR12839-4R-51 developed by Plant Breeding Division were evaluated against the check varieties BRRI dhan34 (ck) and BRRI dhan70 (ck) during Aman 2024. The entries were evaluated in ten different locations of the country but two experiments of two locations

were damaged by high inundation (Sonagazi and Cumilla), the rest of the eight locations such as Bhanga, Gazipur, Gopalganj, Barishal, Habiganj, Kushtia Rajshahi, Rangpur, and Sirajganj. Interaction of genotypes and environments had significant effect on grain yield, growth duration, plant height and grain weight (Table 3). Among the genotypes, the highest mean grain yield (3.58 tha⁻¹) was obtained in the genotype BR12839-4R-124-2,

which was at par with the check BRRI dhan70 (3.43 t ha⁻¹). Considering yield, yield components, disease

and insect score, and the all other parameters; none of the tested lines could be advanced for PVT.

Table 3. Grain yield, growth duration Plant height and grain weight of the rice genotypes under ALART AER in Aman 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations								Mean			
	Bhanga	Gazipur	Gopalganj	Habiganj	Kushtia	Rajshahi	Rangpur	Sirajganj	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR12836-4R-312	4.75	1.86	4.53	2.17	3.63	4.34	2.63	3.06	3.37	129	113	21.3
BR12839-4R-124-2	4.21	1.94	5.04	3.03	3.69	4.10	3.55	3.07	3.58	130	116	21.7
BR12839-4R-51	4.19	1.81	4.53	2.80	3.68	4.16	3.03	3.17	3.42	130	121	20.6
BRRI dhan34 (ck)	3.93	2.97	3.33	4.08	3.60	3.02	2.96	3.23	3.39	141	146	12.7
BRRI dhan70 (ck)	5.11	3.55	2.37	3.41	4.17	3.09	2.53	3.19	3.43	130	146	20.1
LSD _{0.05}	0.54								0.19	0.3	1.3	0.5

ALART Superior high yielding-zira grain type rice (SHY-Zira type), Aman 2024

Two advanced lines BRH17-23-8-2-7B and BR11-7-17-10B along with BRRI dhan75 (ck) and Zirashail (ck) as checks were tested at farmers' fields in ten locations such as Bogura (Sirajganj), Satkhira (Sadar), Kushtia (Sadar), Cumilla (Debidwar), Rajshahi (Godagari), Rangpur (Mithapukur), Dinajpur (Parbatipur), Habiganj

(Bahubal), and BRRI HQ Gazipur (West Byde) during Aman 2024. Among the genotypes, BR11-7-17-10B recorded the highest average grain yield (5.08 t ha⁻¹) which was at par with the check BRRI dhan75 (4.88 t ha⁻¹) (Table 4). Based on yield, yield components, growth duration, and all the other parameters, and farmers opinions; none of the tested lines were suitable for PVT.

Table 4. Grain yield, Growth duration Plant height and grain weight of the rice genotypes under ALART SHY-Zira type in Aman 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations								Mean			
	Bahubal, Habiganj	Bogura, Sirajganj	BRRI, Gazipur	Sadar, Kushtia	Paba Rajshahi	Godagari Rajshahi	Mithapukur, Rangpur	Parbatipur, Dinajpur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BRH17-23-8-2-7B	3.71	5.28	2.75	5.62	5.22	5.20	5.57	5.54	4.86	113	109	18.8
BR11-7-17-10B	4.45	5.74	2.85	5.63	5.48	6.00	5.22	5.30	5.08	114	113	19.5
BRRI dhan75 (Ck)	4.80	4.55	3.00	5.44	5.39	5.45	5.52	4.89	4.88	114	110	21.3
Zirashail (Ck)	2.30	2.19	1.85	3.98	4.75	4.75	4.16	4.31	3.54	110	114	18.1
LSD _{0.05}	0.80								0.28	0.4	0.8	0.5

ALART Superior high yielding-katari grain type rice (SHY-Kateri type), Aman 2024.

Three Katari type advanced rice genotypes BRH13-9-5-2B, BRH9-3-2B and IR12A177, (ck) and along with two check varieties BRRI dhan57(ck) and Katari (L. ck) were tested at farmers' field in ten

locations such as Rajshahi (Godagari and Paba), Rangpur (Mithapukur), Dinajpur (Parbatipur), Bogura (Sadar), Kushtia (Sadar) Habiganj (Bahubal), Feni (Sonagazi), Cumilla (Debidwar) and BRRI HQ Gazipur during T. Aman 2024. Interaction effect of genotype and environment

(locations) was highly significant (Table 5). Irrespective of genotypes and environments (locations), the genotype, BRH9-3-2B produced the highest mean grain yield (4.96 t ha⁻¹) which was at par and statistically similar with BRH13-9-5-2B (4.91 t ha⁻¹). The check variety BRRI dhan57

produced the lowest mean grain yield (3.81 t ha⁻¹) followed by local check variety Katari (4.32 t ha⁻¹). Considering yield, growth duration, and all other parameters, and opinions of farmers and extension personnel; the genotype BRH9-3-2B was recommended for PVT.

Table 5. Grain yield, growth duration Plant height and grain weight of the rice genotypes under ALART SHY-Kateri type in Aman 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations								Mean			
	Godagari Rajshahi	Paba Rajshahi	Sadar Bogura	Bahubal Habiganj	Sadar Kushtia	Mithapukur Rangpur	Parbatipur Dinajpur	BRRI Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BRH13-9-5-2B	5.55	5.29	5.18	3.51	5.72	5.69	5.62	2.72	4.91	116	111	18.3
BRH9-3-2B	5.59	6.11	5.37	3.81	5.25	5.96	4.77	2.81	4.96	117	109	18.9
IR12A177	5.14	4.65	5.09	4.29	5.17	4.63	5.34	2.92	4.65	121	116	24.6
BRRI dhan57 (ck)	4.02	3.91	3.90	3.29	4.58	4.36	4.22	2.23	3.81	113	111	17.1
Katari (L. ck)	4.09	3.79	4.56	4.56	5.12	4.58	5.27	2.62	4.32	128	121	15.3
LSD _{0.05}	0.52								0.18	0.7	1.3	0.4

ALART drought tolerant rice (DTR), Aman 2024.

One drought tolerant advanced lines BR1202-6R-111 along with BRRI dhan71 as check were evaluated in ten locations such as Kushtia Sadar, Kushtia Khoksa, Rajshahi (Paba), Rajshahi (Godagari), Bogura Sadar-1, Bogura Sadar-2, Lalmonirhat, Nilphamari, Satkhira and BRRI HQ Gazipur (West Byde) in Aman 2024. However, crop of Satkhira site was damaged due to flood and stagnant water. A significant interaction effect

between genotype and environment (locations) was observed. The check variety BRRI dhan71 demonstrated a statistically higher mean yield (5.33 t/ha) compared to the advanced line BR1202-6R-111 (5.30 t/ha). Among all locations, the highest grain yield (6.54 t/ha) was recorded for BRRI dhan71 at Edulpur, Rajshahi, followed by BR1202-6R-111 at Bogura Sadar with a yield of 5.97 t/ha (Table 6). Based on results, ALART monitoring team report and farmers' perspective, none of the entries was recommended for PVT.

Table 6. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART DTR in Aman 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations									Mean			
	Kushtia Sadar	Kushtia Khoksa	Paba Rajshahi	Godagari Rajshahi	Bogura Sadar-1	Bogura Sadar-2	Lalmonirhat	Nilphamari	BRRI Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR1202-6R-111	5.84	5.35	5.20	5.97	5.76	5.4	4.6	5.9	3.59	5.30	114	116	20.2
BRRI dhan71 (ck)	5.46	5.04	4.96	5.60	5.91	6.54	4.3	5.3	4.78	5.33	116	125	23.6
LSD _{0.05}	0.61									0.20	0.3	1	0.5

ALART false smut resistant rice, Aman 2024

Three advanced lines BR (Path)13804-BC3-4-5, BR (Path)13804-BC3-13, BR (Path)13804-BC3-16, were evaluated along with BRRI dhan49 as check in ten different locations such as, Rajshahi, Sirajganj (Sadar), Rangpur, Sonagazi, Cumilla (Debidwar), Habiganj (Sadar), Faridpur, (Bhanga), Kushtia (Sadar), Gopalganj (Sadar), Gazipur (WB) during T. Aman 2024. Trial of Cumilla and Sonagazi were completely damaged by severe flooding and Habiganj trial was damaged (60-100%) by rat and entry no. BR (Path)13804-BC3-4-5 was completely damaged in Kushtia due to high rain. Therefore, data from Cumilla, Sonagazi, Habiganj and Kushtia were not included in the analysis. Environment has significant impact on

genotypes yields, growth duration and plant height. In terms of grain yield (GY), the check variety BRRI dhan49 (V4) recorded the highest average yield (5.19 t/ha), followed closely by BR (Path)13804-BC3-4-5 (4.92 t/ha) and BR (Path)13804-BC3-13 (4.88 t/ha), while BR (Path)13804-BC3-16 produced the lowest yield (4.06 t/ha). The highest site-specific yield was achieved by BR (Path)13804-BC3-4-5 in Faridpur (6.24 t/ha), whereas the lowest yield was observed in BR (Path)13804-BC3-16 at Gazipur (2.33 t/ha) (Table 7). Based on yield performance, yield-contributing traits, and reports from farmers and the monitoring committee; none of the advanced lines were found suitable for PVT.

Table 7. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART false smut resistant rice in Aman 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations						Mean			
	Rajshahi	Sirajganj	Rangpur	Faridpur	Gopalganj	BRRI Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
V1=BR (path) 13804-BC3-4-5	5.49	4.68	5.53	6.24	5.18	2.42	4.92	115	112	20.4
V2=BR (path) 13804-BC3-13	5.15	5.39	4.88	6.05	5.31	2.53	4.88	117	116	17.6
V3=BR (path) 13804-BC3-16	4.62	3.60	3.32	5.98	4.47	2.33	4.06	117	124	18.0
V4=BRRI dhan49 (ck)	4.59	5.63	5.72	6.16	5.21	3.85	5.19	131	113	18.4
LSD _{0.05}	0.44						0.18	0.2	2.2	0.5

ALART photosensitive rice, Aman 2024

Two photosensitive advanced rice genotypes BR10212-17-3-2-2 and BR10212-5-5-3 were tested along with two check varieties BR22 and BR23 at farmers' field in ten locations such as Rajshahi (Godagari), Bogura (Sadar), Rangpur (Mithapukur), Feni (Sonagazi), Cumilla (Burichang), Habiganj (Bahubal), Kushtia (Sadar), Faridpur (Bhanga), Gopalganj (Sadar) and BRRI Gazipur during Aman 2024. Irrespective of genotype and location, the genotype, BR10212-5-5-3 produced the highest mean grain yield (4.86 t ha⁻¹) which was statistically similar with BR22 (4.80 t ha⁻¹) (Table 8). The check variety BR23 produced the lowest mean grain yield

(4.32 t ha⁻¹) followed by BR10212-17-3-2-2 (4.53 t ha⁻¹). Interaction effect of genotype and environment (location) was highly significant. Across the locations, the highest grain yield (5.81 t ha⁻¹) was found in BR22 followed by BR10212-5-5-3 (5.72 t ha⁻¹) at Sadar, Gopalganj and the lowest was in BR23 (2.68 t ha⁻¹) at Mithapukur Rangpur. In general, grain yield was lower at BRRI HQ Gazipur as the crops were lodged due to strong storm. The crop of Cumilla and Feni sites total damaged due to severe flood. Considering grain yield, growth duration and grain size; none of the advanced lines were recommended for PVT.

Table 8. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART Photosensitive rice in Aman 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations								Mean			
	Mithapukur Rangpur	BRRI Gazipur	Godagari Rajshahi	Bogura Sadar	Bhanga Faridpur	Sadar Kushtia	Gopalganj Sadar	Bahubal Habiganj	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR10212-17-3-2-2	3.98	4.29	5.55	4.03	3.62	4.95	4.98	4.84	4.53	133	124	24.2
BR10212-5-5-3	4.10	4.35	5.55	4.35	4.37	5.49	5.72	4.94	4.86	132	127	25.5
BR22 (Ck)	3.43	4.76	5.54	5.03	4.02	5.01	5.81	4.77	4.80	135	123	20.5
BR23 (Ck)	2.68	4.09	5.43	3.95	3.47	5.30	5.57	4.05	4.32	142	122	24.5
LSD _{0.05}	0.61								0.22	1.4	1.7	0.4

ALART Salt tolerant rice-short duration (STR-SD), Aman 2024

Two salt tolerant advanced lines: BR13113-4R-63 and BR13118-4R-76 along with BRRI dhan73 (Tolerant ck) and BRRI dhan75 (Susceptible ck) were evaluated in ten locations such as Patuakhali (Kalapara), Barguna (Taltoli), Satkhira (Sadar, Kaliganj and Shyamnagar), Bagerhat (Sadar and Rampal), Feni (Sonagazi), Noakhali (Companiganj) and BRRI HQ research farm (Gazipur) during Aman 2024. Trials in four locations (Satkhira Sadar, Bagerhat Sadar, Feni Sonagazi, and Noakhali Companiganj) were damaged due to heavy rain and inundation. Data from six remaining locations revealed significant variations in grain

yield and agronomic traits. The grain yield of the tested genotypes varied across the six locations (Table 9). The highest mean grain yield was recorded for BR13113-4R-63 (4.17 t/ha), followed closely by BR13118-4R-76 (4.10 t/ha). The tolerant check, BRRI dhan73, had a lower mean yield (3.92 t/ha), whereas the susceptible check, BRRI dhan75, had the lowest mean yield (3.69 t/ha). Salinity in Aman season was very low to medium at Satkhira, Bagerhat, Patuakhali and Barguna (Fig. 1 to 3). However, salinity of Satkhira sites were higher than other sites so that the crop was not affected by salinity. Based on overall performance and farmers opinion, the BR13113-4R-63 line is recommended for the proposed variety Trial (PVT).

Table 9. Grain yield, growth duration plant height and grain weight of the rice genotype under ALART STR-SD in Aman 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations							Mean			
	Kalapara, Patuakhali	Taltoli, Barguna	Kaliganj, Satkhira	Shyamnagar Satkhira	Rampal, Bagerhat	West Bye, Gazipur		Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR13113-4R-63	4.79	5.21	3.65	3.77	4.87	2.75		4.17	118	103	21.5
BR13118-4R-76	5.21	4.74	3.61	3.73	4.54	2.77		4.10	122	112	22.7
BRRI dhan73 (T. ck)	3.78	4.73	3.49	4.05	5.13	2.37		3.92	121	120	21.6
BRRI dhan75 (Std. ck)	-	3.41	4.10	3.90	4.41	2.60		3.69	115	102	20.7
LSD _{0.05}	0.48							0.21	0.4	1.4	

ALART Salt tolerant rice (STR LD), Aman 2024

Four salt-tolerant advanced rice lines V1=BR13103-4R-37, V2 =BR13103-4R-7, V3=BR13105-4R-37 and V4=BRR13115-4R-122 along with the check varieties V5 = tolerant check BRRI dhan30 and V6 = standard check BRRI dhan23, were evaluated in ten locations such as Patuakhali (Kalapara), Barguna (Taltoli), Satkhira (Satkhira Sadar, Kaliganj and Shyamnagar), Bagerhat (Bagerhat Sadar and Rampal), Feni (Sonagazi), Noakhali (Companiganj) and BRRI research farm (Gazipur) during Aman 2024. Among the genotypes the highest mean grain yield (4.67 t/ha) was obtained in standard check BR23 and followed by V1=BR13103-4R-37(4.24 t/ha),

V2=BR13103-4R-7(4.50 t/ha), V4=BRR13115-4R-122(4.21t/ha), tolerant check V5=BRRI dhan30(4.26 t/ha) and the lowest yield was found in V3=BR13105-4R-37 (4.19 t/ha) (Table 10). Salinity in Aman season was very low to medium at Satkhira, Bagerhat, Patuakhali and Barguna (Fig 1 to 3). Consequently, the crop affected very minimum due to lower salinity levels. Therefore, all the advanced lines failed to perform better over the standard check BR23. Considering yield and yield attributing traits; and phenotypic appearance compared to the check varieties, farmers preferred BR23 over the advanced lines. Therefore, none of the advanced line found suitable for PVT.

Table 10. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART STR-LD in Aman 2024 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations							Mean			
	Bagerhat Sadar	Kalapara, Patuakhali	Kaliganj Satkhira	Rampal Bagerhat	Shyamnagar Satkhira	Taltoli Barguna	BRRI Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR13103-4R-37	3.44	4.95	4.09	3.56	4.63	4.33	4.71	4.24	135	118	22.1
BR13103-4R-7	4.92	4.60	4.13	5.30	3.87	4.30	4.30	4.50	143	106	21.7
BR13105-4R-37	4.21	3.54	3.62	4.46	4.00	4.87	4.60	4.19	140	94	23.6
BRR13115-4R-122	4.29	4.56	3.78	4.55	3.42	4.40	4.43	4.21	142	104	22.3
BRRI dhan30 (T.ck)	4.82	4.51	3.11	4.91	3.89	4.45	4.15	4.26	142	124	24.1
BR23 (Std. ck)	5.33	4.81	4.21	5.47	4.40	4.90	3.58	4.67	145	123	24.6
LSD _{0.05}	0.54							0.20	3.7	3.2	0.5

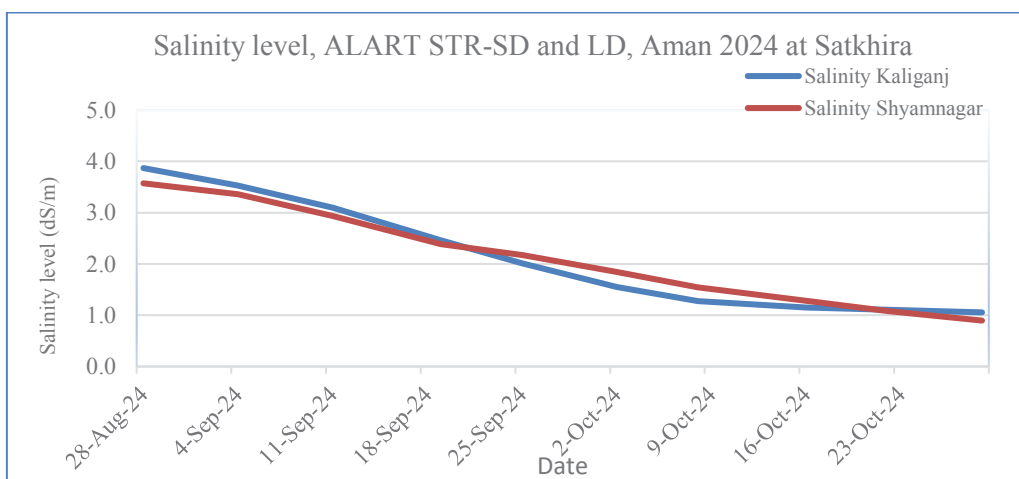


Fig. 1. Water salinity level in ALART STR-SD and LD, Aman 2024 at Kaliganj and Shyamnagar, Satkhira.

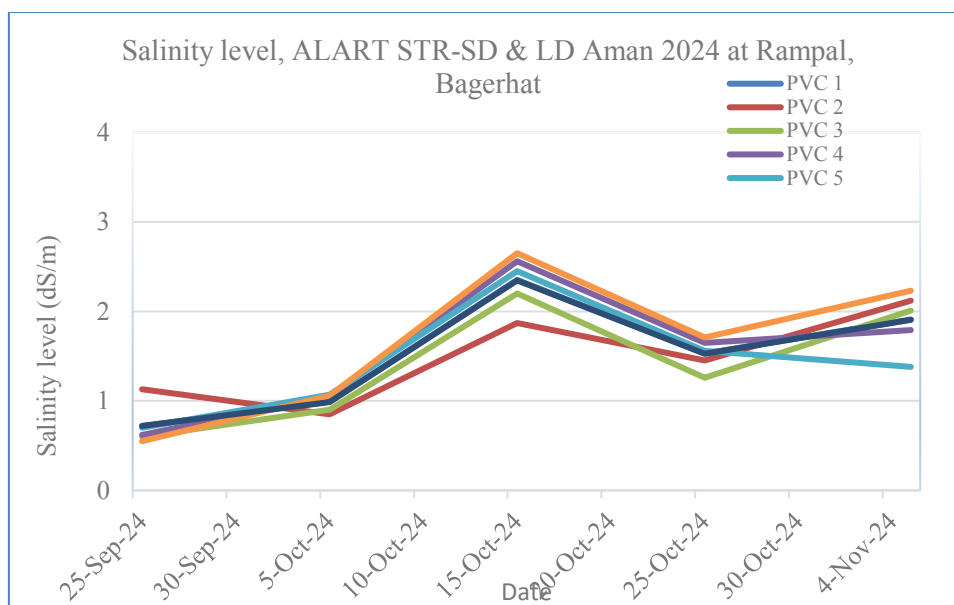


Fig. 2. Water salinity level in ALART STR-SD and LD, Aman 2024 at Rampal, Bagerhat.

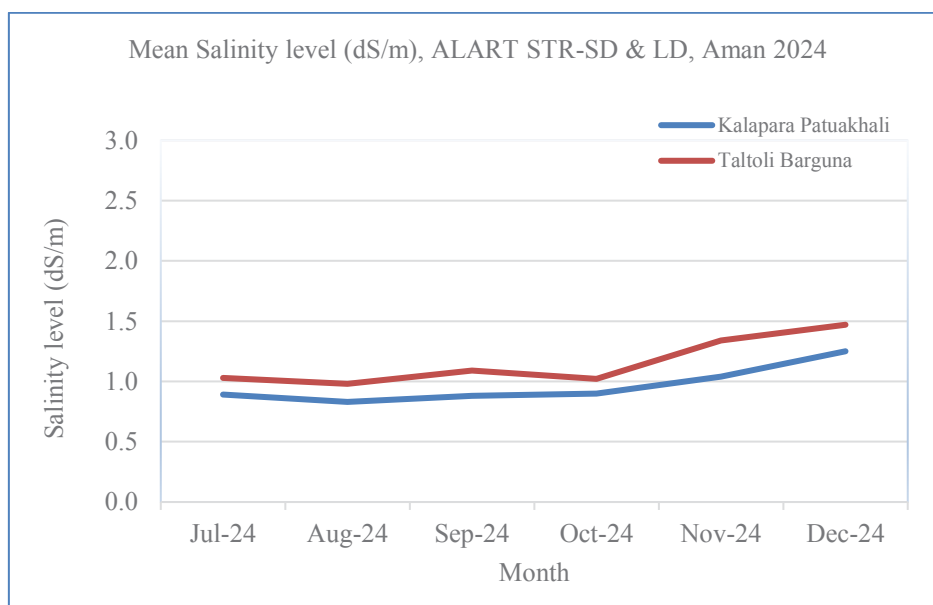


Fig. 3. Water salinity level in ALART STR-SD and LD, Aman 2024 at Rampal, Bagerhat.

ALART Favourable Boro rice-short duration (FBR-SD), Boro 2024-25

One advanced line, BR12574-5R-52 and BRRI dhan88 (Std. ck) in 10 different locations such as Satkhira, Kushtia, Cumilla, Sonagazi, Gopalganj,

Rajshahi, Sirajganj, Rangpur, Habiganj and Gazipur during Boro 2024-25. Interaction effect of genotype and environment (location) was highly significant (Table 11). The check variety BRRI dhan88 produced significantly higher grain yield (7.16 t/ha) than the advanced line BR12574-5R-52

(6.48 t/ha). The yield of BRRI dhan88 ranged from 5.78 t/ha at Sonagazi to 8.99 t/ha at Sirajganj, while BR12574-5R-52 ranged from 5.27 t/ha at Kushtia to 7.23 t/ha at Cumilla. Considering grain yield, yield-contributing components, disease resistance,

lodging tolerance, and all other parameters, the tested lines (BR12574-5R-52) did not fulfill the required selection criteria and, as a result, were not advanced to the PVT.

Table 11. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART FBR-SD in Boro 2024-25 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Sadar Satkhira	Sadar Kushtia	Cumilla	Sonagazi	Sadar Gopalganj	Rajshahi	Sirajganj	Rangpur	Habiganj	Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
V1= BR12574-5R-52	6.24	5.27	7.23	6.91	6.83	6.72	6.49	6.54	6.99	5.38	6.48	145	117	25.8
V2= BRRI dhan88 (Std. ck)	7.38	6.86	7.92	5.78	8.33	5.90	8.99	7.50	7.21	5.93	7.16	144	95	21.0
LSD _{0.05}	0.75										0.34	0.5	2	0.6

ALART Favorable Boro Rice-Medium duration (FBR-MD), Boro 2024-25

Three advanced lines BR11894-5R-260, BR12508-5R-5, BR12517-5R-57 were tested along with two check varieties BRRI dhan97 (ck) and BRRI dhan102 (ck) in 10 different locations such as Satkhira, Kushtia, Cumilla, Sonagazi, Gopalganj, Rajshahi, Sirajganj, Rangpur, Habiganj, Gazipur (BRRI HQ) during Boro 2024-25. Among the evaluated genotypes, V3 (BR12517-5R-57) demonstrated the highest mean grain yield of 8.17 t/ha, followed by V2 (7.99 t/ha) and V1 (7.65 t/ha). Among the check varieties, BRRI dhan102 (V5) yielded 7.84 t/ha, while BRRI dhan97 had the

lowest average yield of 7.57 t/ha (Table 12). The genotype BR12517-5R-57 maintained consistently strong performance across key locations such as Habiganj, Cumilla, and Rangpur, reflecting good yield stability and adaptability. However, none of the advanced lines exhibited statistically significant yield superiority over BRRI dhan102, and none met the National Seed Board (NSB) requirement of at least a 10% yield gain over both check varieties for variety release under the Boro season. Based on yield performance, yield-contributing traits, and reports from farmers and the monitoring committee, none of the advanced lines were found suitable for PVT.

Table 12. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART FBR-LD in Boro 2024-25 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Satkira	Kushia	Cumilla	Sonagazi	Gopalganj	Rajshahi	Sirajganj	Rangpur	Habiganj	Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR11894-5R-260	7.65	7.53	8.58	6.59	8.29	6.88	8.08	7.08	7.91	7.96	7.65	145	110	23.7
BR12508-5R-5	7.86	7.92	8.23	6.79	8.90	6.62	9.26	7.67	9.19	7.46	7.99	144	103	24.8
BR12517-5R-57	7.92	7.61	8.42	7.50	8.90	6.51	9.20	8.28	9.30	8.08	8.17	145	107	25.4

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Satkhira	Kushtia	Cumilla	Sonagazi	Gopalganj	Rajshahi	Sirajganj	Rangpur	Habiganj	Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BRRI dhan97 (Ck)	8.18	6.50	7.80	6.01	8.85	6.62	8.24	7.58	9.39	6.48	7.57	147	113	26.7
BRRI dhan102(Ck)	7.74	7.37	7.35	6.92	8.23	7.21	8.94	8.44	8.26	7.90	7.84	151	107	22.4
LSD _{0.05}	1.04										0.46	0.4	2.9	0.8

Report of ALART premium quality rice (PQR), Boro 2024-25.

Two premium quality advanced rice genotypes BR11359-4R-181 and BR11359-4R-279 along with two check varieties BRRI dhan104(ck) and BRRI dhan107(ck) were tested at farmers' field in ten locations such as Rangpur (Mithapukur), Cumilla (Burichang), Feni (Sonagazi), Gopalganj (Sadar), Kushtia (Kumarkhali), Gazipur (Sadar), Natore (Sadar), Satkhira (Sadar), Habiganj (Bahubal) and Sirajganj (Kamarkand) during Boro 2024-25. Grain yield was significantly affected by both the environments and genotypes (Table 13). Irrespective of environment and genotype, the highest mean grain yield (6.97 t ha⁻¹) was obtained

in BRRI dhan107 which was at par and statistically similar with BRRI dhan104 (6.93 t ha⁻¹) and BR11359-4R-279 (6.81 t ha⁻¹). The lowest mean grain yield (6.45 t ha⁻¹) was found in the advanced genotype BR11359-4R-181 (Table 13). Interaction effect of genotypes and environments (location) was highly significant. Across the locations, the highest grain yield (8.05 t ha⁻¹) was found in BR11359-4R-279 at Kamarkand, Sirajganj followed by BRRI dhan104 (7.84 t ha⁻¹) at Sadar, Gazipur and the lowest was in BR11359-4R-181 (5.32 t ha⁻¹) at Sadar, Gopalganj. Considering yield and yield components, growth duration, plant height and all other parameters, and opinions of farmers and extension personnel; None of the genotypes was recommended for PVT.

Table 13. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART PQR in Boro 2024-25 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Mithapukur Rangpur	Burichang Cumilla	Sonagazi Feni	Sadar Gopalganj	Kumarkhali Kushtia	BRRI Gazipur	Sadar Natore	Sadar Satkhira	Bahubal Habiganj	Kamarkand Sirajganj	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR11359-4R-181	6.34	6.39	5.70	5.32	6.41	6.45	7.40	6.86	7.26	7.04	6.45	148	117	23.2
BR11359-4R-279	8.04	6.97	5.67	6.90	6.07	7.00	6.26	7.07	6.83	8.05	6.81	145	114	23.0
BRRI dhan104 (ck)	7.56	5.91	6.38	7.61	6.46	7.84	7.41	6.21	7.25	7.16	6.93	145	101	23.6
BRRI dhan107 (ck)	7.44	6.39	5.91	7.83	6.44	7.11	6.53	6.73	8.22	7.79	6.97	145	106	25.6
LSD _{0.05}	0.87										0.27	0.32	1.6	0.6

Report of ALART premium quality rice for disease tolerance, Boro 2025.

One premium type advanced rice genotype BRRI(Path)-Premium1 along with two check

varieties BRRI dhan50 (ck) and BRRI dhan104 (ck) were tested at farmers' field in ten locations such as Natore (Sadar), Rangpur (Mithapukur), Kushtia (Sadar) Habiganj (Bahubal), Feni (Sonagazi),

Sirajganj (Kamarkhand), Kushtia (Kumarkhali), Gopalganj (Sadar), Satkhira (Sadar), Cumilla (Burichang), and Gazipur (Sadar) during Boro 2024-25. Irrespective of genotype and location, the genotype, BRRI dhan104 (ck) produced the highest mean grain yield (7.25 t ha⁻¹) which was at par and statistically similar with BRRI (Path)-Premium1 (7.14 t ha⁻¹) (Table 14). The check variety BRRI

dhan50 produced the lowest mean grain yield (6.79 t ha⁻¹). Interaction effect of genotype and environment was highly significant. Based on overall performances of the genotype BRRI (Path)-Premium1; Farmers and Extension personnel did not like the genotype. Therefore, the genotype BRRI (Path)-Premium1 was not recommended for PVT.

Table 14. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART PQR-Path in Boro 2025 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Bahubal Habiganj	Burichang Cumilla	Kamarkhand Sirajganj	Kumarkhali Kushtia	Mithapukur Rangpur	Sadar Gazipur	Sadar Gopalganj	Sadar Natore	Sadar Satkhira	Sonagazi Feni	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BRRI(Path)-Premium1	7.53	7.47	7.47	6.32	6.11	6.58	8.47	7.40	8.13	5.97	7.14	144	101	23.3
BRRI dhan50 (ck)	6.32	6.68	6.07	6.61	7.28	7.23	7.06	6.26	7.64	6.78	6.79	147	92	19.7
BRRI dhan104 (ck)	7.11	6.98	6.67	6.85	7.71	7.71	7.63	7.41	7.45	6.97	7.25	147	102	23.3
LSD _{0.05}	0.92										0.29	0.3	1.4	0.4

ALART Antioxidant enriched rice-dhort duration (AER-SD), Boro 2024-25.

Three anti-oxidant enriched rice-short duration (AER-SD) advanced lines BR12839-4R-137 developed by Plant Breeding Division were evaluated against the check variety BRRI dhan88 (Std. ck) at BRRI during Boro 2024-25. The entries were evaluated in ten different locations of the country such as Satkhira, Bhanga, Cumilla, Sonagazi, Gopalganj, Rajshahi, Sirajganj, Rangpur,

Habiganj, and BRRI HQ Gazipur. The interaction between genotype and environment significantly influenced grain yield, growth duration, plant height, and various yield components (Table 15). Among the genotypes, the highest mean grain yield was recorded by the standard check variety BRRI dhan88 (7.54 t/ha), closely followed by the advanced line BR12839-4R-137, which yielded 7.02 t/ha. Considering yield, yield components, disease and insect score and all other parameters the tested lines could not be advanced for PVT.

Table 15. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART AER-SD in Boro 2025 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Satkhira	Bhanga	Cumilla	Sonagazi	Gopalganj	Rajshahi	Sirajganj	Rangpur	Habiganj	Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR12839-4R-137	8.51	7.69	7.65	5.13	8.27	7.16	5.43	7.37	6.27	6.73	7.02	141	97	18.9
BRRI dhan88 (Std. ck)	8.84	8.11	8.27	5.88	8.83	6.68	8.23	7.97	7.45	5.13	7.54	142	98	21.3
LSD _{0.05}	0.81										0.36	3	2.8	0.4

ALART antioxidant enriched rice-medium duration (AER-MD), Boro 2024-25.

Two advanced lines, BR12839-4R-157-2 and BR12839-4R-5-2 were tested along with the check varieties BRRI dhan100 (ck) in 10 different locations such as Sonagazi, Gopalganj, Satkhira, Bhanga, Cumilla, Gopalganj, Rajshahi, Sirajganj, Rangpur, Habiganj and BRRI HQ Gazipur during Boro 2024-25. The genotypes BR12839-4R-157-2, BR12839-4R-5-2 and the check variety BRRI dhan100 were tested across ten locations: Satkhira, Bhanga, Cumilla, Gopalganj, Rajshahi, Sirajganj, Rangpur, Habiganj, Sonagazi and Gazipur. One

replication of BR12839-4R-157-2, BR12839-4R-5-2 were completely damaged by blast disease in Sonagazi. Consequently, the results from Sonagazi were excluded from the analysis. Grain yield varied across the locations, with V3 (check) showing the highest mean yield (7.65 t/ha), followed closely by V1 (7.27 t/ha) and V2 (7.20 t/ha) (Table 16). Although V3 performed best overall, V1 yielded more consistently across diverse environments, especially in Satkhira and Gopalganj. Based on yield performance, yield-contributing traits, and reports from farmers and the monitoring committee, none of the advanced lines were found suitable for PVT.

Table 16. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART AER-MD, Boro 2024-25 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations									Mean			
	Satkhira	Bhanga	Cumilla	Gopalganj	Rajshahi	Sirajganj	Rangpur	Habiganj	Gazipur	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR12839-4R-157-2	9.00	7.66	6.42	8.02	6.30	7.42	6.67	7.03	6.92	7.27	148	115	20.3
BR12839-4R-5-2	8.30	8.12	6.12	7.75	6.64	7.62	6.40	6.93	6.92	7.20	147	112	20.4
BRRI dhan100 (ck)	8.80	8.41	6.97	8.95	6.85	7.13	7.67	7.21	6.90	7.65	143	108	19.2
LSD 0.05	0.72									0.24	1.2	2.4	1.6

ALART Blast resistant rice-short duration (BRR-SD), Boro 2024-25.

Two blast resistant short-duration high-yielding rice advanced lines, BR (Path)15641-3HR-15 and BR (Path)15641-3HR-45, developed by the Plant Breeding Division, were evaluated against the check variety BRRI dhan88 during Boro 2025. The entries were tested across ten diverse locations: Debidwar (Cumilla), BRRI HQ (Gazipur), Gopalganj (Sadar), Habiganj (Sadar), Kushtia (Sadar), Natore (Rajshahi), Rangpur (Mithapukur),

Satkhira (Sadar), Sirajganj (Kamarkhand), and Sonagazi (Companiganj). Interaction between genotype and environment had significant effects on grain yield, growth duration, plant height, and yield components (Table 17). Among the entries, the highest average grain yield was obtained from BR (Path)15641-3HR-45 with 7.03 t/ha, followed by BRRI dhan88 (7.09 t/ha) and BR (Path)15641-3HR-15 with 6.64 t/ha. Considering yield, disease score, and all the other parameters, none of the tested lines were suitable for PVT.

Table 17. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART BRR-SD in Boro 2024-25 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Debidwar, Cumilla	BRRI, Gazipur	Sadar, Gopalganj	Sadar, Habiganj	Sadar, Kushtia	Natore, Rajshahi	Mithapukur, Rangpur	Sadar, Satkhira	Kamarkhand, Sirajganj	Companiganj, Noakhali	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR(Path)15641-3HR-15	6.18	5.91	8.76	6.29	6.06	6.38	7.16	7.69	6.07	5.89	6.64	141	105	23.2
BR(Path)15641-3HR-45	7.24	6.65	9.57	6.59	5.87	7.34	7.31	8.47	5.62	5.60	7.03	140	105	22.1
BRRI dhan88 (ck)	7.28	6.32	8.94	7.30	6.22	7.55	7.49	6.68	6.29	6.78	7.09	141	99	21.9
LSD _{0.05}	0.89										0.28	0.3	6.4	0.5

ALART for blast resistant rice-medium duration (BRR-MD), Boro 2024-25.

Two blast resistant medium duration high yielding rice advanced lines, BR (Path)15855-BC3-2HR-5 and BR (Path)15860-BC2-3HR-48, developed by the Plant Breeding Division, were evaluated against the check variety BRRI dhan58 during Boro 2024-25. The entries were evaluated in ten different locations of the country, namely Cumilla (Debidwar), Gazipur (BRRI HQ), Gopalganj (Sadar), Habiganj (Sadar), Kushtia (Sadar), Natore (Rajshahi), Rangpur (Mithapukur), Satkhira (Sadar), Sirajganj (Kamarkhand), and Noakhali

(Companiganj). Interaction of genotype and environment had significant effects on grain yield, plant height, and yield components (Table 18). Among the genotypes, the highest mean grain yield (7.27 t/ha) was obtained in BRRI dhan58 (7.22 t/ha), followed by BR (Path)15855-BC3-2HR-5 (7.13 t/ha) and BR (Path)15860-BC2-3HR-48 (6.63 t/ha). However, yield differences were statistically similar, and none of the tested lines exceeded the check variety by the required 10% margin for PVT recommendation. Considering yield, disease score, and all the other parameters, none of the tested lines were suitable for PVT.

Table 18. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART BRR-MD in Boro 2024-25 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Debidwar, Cumilla	BRRI, Gazipur	Sadar, Gopalganj	Sadar, Habiganj	Sadar, Kushtia	Natore, Sadar	Mithapukur, Rangpur	Sadar, Satkhira	Kamarkhand, Sirajganj	Companiganj, Noakhali	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR(Path)15855-BC3-2HR-5	8.60	5.61	8.18	8.37	6.67	7.68	8.18	6.58	6.09	5.3	7.13	147	110	21.1
BR(Path)15860-BC2-3HR-48	7.71	5.80	6.56	7.22	6.64	7.18	6.82	6.82	6.35	5.20	6.63	147	121	24.0
BRRI dhan58 (ck)	8.10	6.74	8.47	6.41	7.89	7.09	8.29	6.47	6.75	5.95	7.22	147	107	22.6
LSD _{0.05}	0.78										0.24	0.3	1.3	0.5

ALART Blast resistant rice-long duration (BRR-LD), Boro 2024-25.

Two blast resistant long-duration high-yielding rice advanced lines, BR (Path)15855-BC2-3HR-23 and BR (Path)15860-BC2-3HR-47 developed by the Plant Breeding Division, were evaluated against the check variety BRRI dhan29 during Boro 2024-25. The entries were tested across ten diverse locations Debidwar (Cumilla), BRRI HQ (Gazipur), Gopalganj (Sadar), Habiganj (Baniachang), Kushtia (Kumarkhali), Singra Natore, Rangpur

(Mithapukur), Satkhira (Sadar), Sirajganj (Kamarkhand), and Noakhali (Companiganj). Interaction between genotype and environment had significant effects on grain yield, growth duration, plant height, and yield components (Table 19). Among the entries, the highest average grain yield was obtained from check variety BRRI dhan29 with 7.67 t/ha, followed by BR (Path)15855-BC2-3HR-23 (7.37 t/ha) and BR (Path)15860-BC2-3HR-47 with 6.64 t/ha. Considering yield, disease score, and all the other parameters, Monitoring report, none of the tested lines were suitable for PVT.

Table 19. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART BRR-LD in Boro 2024-25 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Debidwar, Cumilla	BRRI Gazipur	Gopalganj Sadar	Baniachong Habiganj	Kumarkhali Kushtia	Mithapukur Rangpur	Satkhira Sadar	Singra Natore	Kamarkhand Sirajganj	Companiganj Noakhali	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR(Path)15855-BC2-3HR-23	7.96	7.10	6.60	8.22	6.67	9.55	7.12	7.40	7.24	5.89	7.37	147	114	22.5
BR(Path)15860-BC2-3HR-47	6.34	5.32	6.69	7.29	6.64	8.31	6.30	6.26	7.68	5.60	6.64	147	117	23.9
BRRI Dhan29 (ck)	7.69	7.27	8.42	7.06	7.89	9.22	6.96	7.41	7.96	6.78	7.67	148	111	21.7
LSD 0.05	2.20										0.44	0.4	1.6	0.7

ALART Bacterial blight and blast resistance rice (BB + Blast) Boro 2025.

Three bacterial blight and blast resistant (BB + Blast) high yielding rice advanced lines BR (Path)13802-BC3-54-12, BR (Path)13802-BC3-73-13 and BR (Path)13802-BC3-73-14 developed by Plant Breeding Division were evaluated against the check varieties BRRI dhan88 during Boro 2024-25. The entries were evaluated in ten different locations of the country such as Burichang, Cumilla, Gopalganj Sadar, Baniachong Habiganj, Kumarkhali Kushtia, Mithapukur, Rangpur, Satkhira Sadar, Singra, Natore, Kamarkhand, Sirajganj, Sonagazi, Feni and BRRI HQ Gazipur. Interaction of genotype and

environment had significant effect on grain yield, growth duration, plant height and yield components (Table 20). Among the genotypes, highest mean grain yield (7.75 tha⁻¹) was obtained in the advanced line V3= BR (path)13802-BC3-73-14 followed by the advanced line V2= BR (path)13802-BC3-73-13, it was 7.44 t/ha followed by the advanced line V1= BR (path)13802-BC3-54-12, it was 7.37 t/ha and the lowest grain yield was found in standard check V4= BRRI dhan88 (Ck) and it was 7.07 t/ha (Table 20). Considering yield, growth duration, and all other parameters, V2= BR (path)13802-BC3-73-13 and V3= BR (path)13802-BC3-73-14 lines could be advanced for PVT.

Table 20. Grain yield, growth duration plant height and grain weight of the rice genotypes under **ALART BB+Blast Boro 2024-25 at different locations of Bangladesh.**

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Burichang Cumilla	BRRi Gazipur	Gopalganj Sadar	Baniachong Habiganj	Kumarkhali Kushtia	Mithapukur Rangpur	Satkhirā Sadar	Singra Natore	Kamarkhand Sirajganj	Sonagazi Feni	Grain yield (t ha ⁻¹)	Growth duration (days)	Plant ht. (cm)	1000-grain wt. (g)
BR (path)13802-BC3-54-12	8.51	7.53	8.88	7.27	6.90	7.82	6.40	6.51	8.00	5.84	7.37	139	110	19.5
BR (path)13802-BC3-73-13	8.05	6.93	9.22	7.46	7.05	9.27	6.01	6.53	7.87	6.00	7.44	139	108	19.4
BR (path)13802-BC3-73-14	8.03	7.13	9.71	9.28	7.01	8.34	6.00	7.64	8.19	6.18	7.75	139	100	23.6
BRRi dhan88 (ck)	6.69	5.80	8.18	7.39	6.98	9.33	5.69	7.13	7.31	5.92	7.04	140	98	21.4
LSD _{0.05}	6.80										0.34	0.4	1.7	0.5

ALART Salinity tolerant rice-dhort duration (STR-SD), Boro 2024-25.

Two advanced salt-tolerant rice lines **BR13113-4R-63** and **BR13113-4R-116** were evaluated alongside two check varieties: **BRRi dhan28** (ck) and **BRRi dhan88** (ck), across ten locations in Bangladesh during the **Boro 2024-25** season. The test sites included a range of agroecological zones: Barguna, Bhanga, Cumilla, Gazipur, Gopalganj, Rajshahi, Rangpur, Satkhira, Sonagazi and Sirajganj. The mean grain yield across ten locations revealed promising results for the STR lines. The highest mean grain yield was recorded by BR13113-4R-116 (7.04 t ha⁻¹), followed by BR13113-4R-63

(6.70 t ha⁻¹) (Table 21). Both lines outperformed the tolerant check BRRi dhan28 (6.01 t/ha) and the susceptible check BRRi dhan88 (6.18 t ha⁻¹) (Table 21). Salinity in Boro season was low to high based on locations. It was the highest at Kaliganj, Satkhira followed by Gopalganj while it was lower at Mathbaria, Pirojpur followed by Taltali (Fig 4 to 6). Consequently, overall crop performance especially grain yield of Satkhira was significantly reduced at Kaliganj, Satkhira sites compared to the other locations. Particularly strong yields were observed in Gazipur, Cumilla, and Bhanga. The lines BR13113-4R-63 and BR13113-4R-116 were recommended for PVT.

Table 21. Grain yield, growth duration Plant height and grain weight of the rice genotypes under **ALART STR-SD in Boro 2024-25 at different locations of Bangladesh.**

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Taltali Barguna	Bhanga	Cumilla	Gazipur	Gopalganj	Rajshahi	Rangpur	Satkhira	Sirajganj	Sonagazi	Grain yield (t ha ⁻¹)	Growth duration	Plant ht. (cm)	1000-grain wt. (g)
BR13113-4R-63	6.69	8.28	7.87	9.72	5.06	7.47	8.05	3.28	6.89	3.64	6.70	140	100	18.9
BR13113-4R-116	7.04	8.76	8.49	10.49	5.46	6.82	8.71	1.99	8.32	4.33	7.04	140	101	21.1
BRRi dhan28 (ck)	6.07	6.61	6.24	6.66	6.00	7.41	8.02	1.68	7.84	3.53	6.01	140	102	21.7
BRRi dhan88 (ck)	6.26	7.55	7.22	5.86	4.29	6.53	7.48	0.00	7.10	3.34	6.18	141	97	20.5
LSD _{0.05}														

ALART, Salinity tolerant rice-medium duration (STR-MD), Boro 2024-25.

Three advanced salt-tolerant rice lines **BR13106-4R-184** (V1), **BR13113-4R-185** (V2) and

BR13122-4R-136 (V3) were evaluated alongside two check varieties: **BRRi dhan97** (tolerant check) (V4) and **BRRi dhan102** (susceptible check) (V5), across ten locations in Bangladesh during the **Boro**

2024–25 season. The test sites included a range of agroecological zones: Pirojpur, Bhanga, Cumilla, Gazipur, Gopalganj, Rajshahi, Rangpur, Satkhira, Sirajganj, and Sonagazi. Grain yield across ten locations showed notable variation among the genotypes (Table 22). The highest mean grain yield was recorded for BR13122-4R-136 (V3) (7.04 t/ha), followed by BR13113-4R-185 (V2) (6.82 t/ha) and BR13106-4R-184 (V1) (6.70 t/ha). Among the check varieties, BRRI dhan102 showed a lower mean yield (6.52 t/ha), while BRRI dhan99 recorded the lowest yield (6.29 t/ha), partially due to data loss from one location. The relatively superior performance of BR13122-4R-136 across locations such as Cumilla, Gazipur, Rajshahi, and

Rangpur highlights its yield stability under varied agro-climatic conditions, including salinity-prone areas like Satkhira and Sonagazi. Salinity in Boro season was low to high based on locations. It was the highest at Kaliganj, Satkhira followed by Gopalganj while it was lower at Mathbaria, Pirojpur followed by Taltali (Fig 4 to 6). Consequently, overall crop performance especially grain yield of Satkhira was significantly reduced at Kaliganj Satkhira sites compared to the other locations. Based on overall performance and farmers opinions, the genotypes BR13113-4R-185 and BR13122-4R-136 is recommended for the PVT.

Table 22. Grain yield, growth duration plant height and grain weight of the rice genotypes under ALART STR-SD in Boro 2024-25 at different locations of Bangladesh.

Genotype	Grain yield (t ha ⁻¹) at different locations										Mean			
	Mathbaria Pirojpur	Bhanga	Cumilla	Gazipur	Gopalganj	Rajshahi	Rangpur	Satkhira	Sirajganj	Sonagazi Feni	Grain yield (t ha ⁻¹)	Growth duration (day)	Plant ht. (cm)	1000-grain wt. (g)
BR13106-4R-184	7.49	8.79	8.51	6.89	6.64	7.52	7.44	2.84	7.22	3.63	6.70	144	91	19.2
BR13113-4R-185	7.79	9.21	8.05	8.71	5.48	7.09	6.98	4.04	7.98	2.91	6.82	143	91	19.7
BR13122-4R-136	8.10	8.74	8.03	8.98	5.12	7.79	8.18	3.65	7.88	3.98	7.04	146	108	21.4
BRRI dhan102 (ck)	6.81	8.49	6.69	7.61	6.18	7.51	8.19	2.70	8.19	2.84	6.52	146	99	21.5
BRRI dhan99 (Std. ck)	6.25	8.03	Damaged	7.91	5.61	7.68	7.12	3.67	6.97	3.36	6.29	148	99	22.1
LSD _{0.05}														

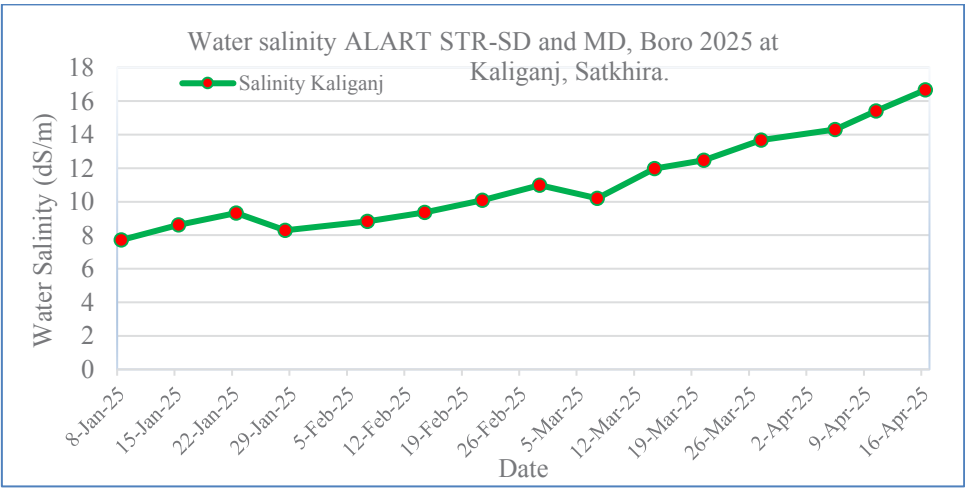


Fig 4. Water salinity level in ALART STR-SD and LD, Boro 2025 at Kaliganj, Satkhira.

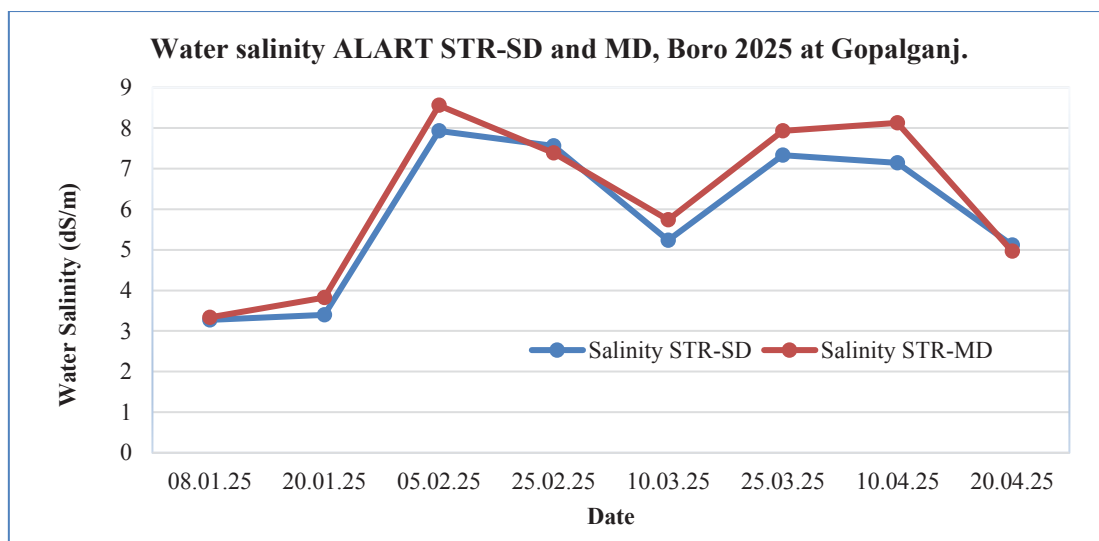


Fig 5. Water salinity level in ALART STR-SD and LD, Boro 2025 at Gopalganj.

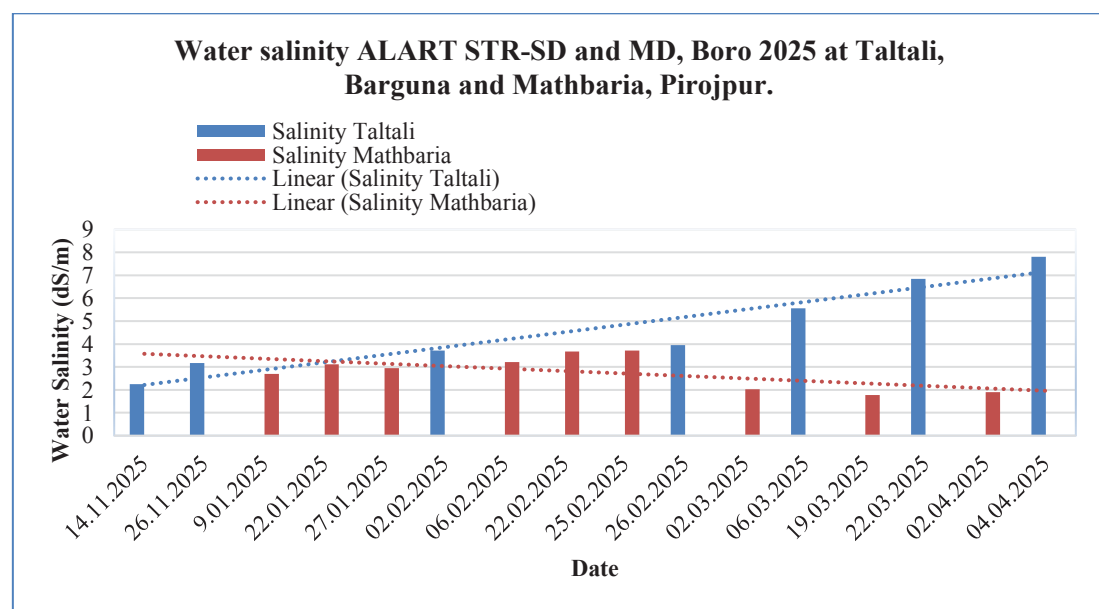


Fig 6. Water salinity level in ALART STR-SD and LD, Boro 2025 at Taltali, Barguna and Mathbaria, Pirojpur.

Adaptive trial during Aman, 2024 under LSTD project. A total of 16 demonstrations were established in eight upazilas of Bangladesh. The comparative evaluation of four rice varieties BRRI dhan87, BRRI dhan93, BRRI dhan95, and BRRI dhan103 in the adaptive trial (AT) during the Aman

2024 reveals notable differences in grain yield. In adaptive trial, BRRI dhan103 was found as the highest yielder (6.34 t ha^{-1}) having growth duration 131 days followed by BRRI dhan87 (6.17 t ha^{-1}). Conversely, BRRI dhan95 produced the lowest

yield (5.18 t ha⁻¹) in 127 days, followed by BRRI dhan93, which yielded 5.25 t ha⁻¹ in 135 days.

TECHNOLOGY DISSEMINATION

ARD conducted different demonstration trials and involved in different promotional activities for rapid dissemination of BRRI developed technologies in collaboration with DAE. A total of 1,585 demonstrations were executed by ARD during 2024-25 under GOB; PARTNER and LSDT project.

Seed production and dissemination programme (SPDP), Aus 2024 under GoB. Under the GoB-funded SPDP programme during Aus 2024, a total of 63 demonstrations of BRRI dhan98 were conducted. The variety, with a growth duration of 112 days, achieved an average grain yield of 4.97 t/ha, resulting in a total production of 41.911 ton of paddy. From this, 1,884 kg of seed were retained for future use. The demonstrations successfully engaged 1,156 farmers through knowledge sharing, with 500 farmers motivated to adopt the variety, demonstrating BRRI dhan98's strong potential for wider adoption during Aus season.

SPDP Jhum (B. Aus) rice in the hill districts. During B. Aus 2024, a total of 56 demonstrations were conducted using the broadcast rice variety BRRI dhan83 under Jhum cultivation in six upazilas across three hill districts of Bangladesh, with each plot covering one bigha. BRRI dhan83, with a growth duration of 106 days, recorded an average yield of 2.99 t/ha, resulting in a total production of 22.4 tons. From these demonstrations, 1,904 kg of seed were retained. The initiative successfully reached 2,128 farmers with knowledge dissemination and motivated 840 of them to adopt the variety, highlighting its potential for improving rice cultivation in hills regions through Jhum-based practices..

Special dissemination programme of BRRI hybrid dhan7 in Aus 2024. During Aus 2024, a total of 21 demonstrations of BRRI hybrid dhan7 were conducted across six upazilas in three hill districts of Bangladesh, with each plot covering one bigha. BRRI hybrid dhan7, with a growth duration of 131 days, achieved an average yield of 4.97 t/ha, resulting in a total production of 41.92 tons.

Although no seeds were retained due to the hybrid nature of the variety, the dissemination effort successfully reached 3,080 farmers with technical knowledge, and 1,344 of them were motivated to adopt the variety, highlighting its strong potential for increasing rice productivity in hills regions.

SPDP Aus 2024 in the valley of the hill districts under GOB. A total of six demonstrations were conducted in three hill districts named Khagrachari, Bandarban, and Rangamati covering six upazilas: Khagrachari Sadar, Dighinala, Lama, Alikadam, Kaptai, and Rajasthali to evaluate the performance of BRRI dhan98 during the valley Aus 2024 season under the GoB core programme. Each on a 2-bigha plot. The variety had a growth duration of 110 days and achieved an average yield of 4.84 t/ha, resulting in a total production of 14.22 tons. From these demonstrations, 720 kg of seed were retained. The initiative effectively reached and informed 428 farmers, with 222 of them being motivated to adopt the variety, indicating its potential for wider dissemination and impact in the Aus season.

SPDP Aman 2024 under GoB. A total of 464 SPDP was conducted in 19 upazilas of 11 districts and nine BRRI developed high yielding Aman varieties were used during T. Aman 2024. Each demonstration with an area of one bigha. Among the varieties, BRRI dhan103 recorded the highest grain yield (5.81 t/ha) and total production (156,185 kg), along with the highest numbers of knowledge sharing (8,342) and motivated farmers (3,380). In contrast, BRRI dhan90 had the lowest grain yield (4.32 t/ha), total production (15,881 kg), and the fewest knowledge sharing (302) and motivated farmers (161). The variety BRRI dhan76 had the longest growth duration (151 days) but showed relatively lower productivity and farmer motivation metrics. On average, the varieties had a growth duration of 127 days and a mean grain yield of 5.00 t/ha. The total production across all varieties was 439.96 ton, with 68,041 kg of seeds retained, 26,848 knowledge sharing farmers, and 10,939 motivated farmers involved in the demonstrations.

Dissemination of BRRI hybrid dhan6 during Aman 2024 under GoB. A total of 28 demonstrations were conducted across 24 locations in seven districts of Bangladesh to evaluate the

performance of BRRI hybrid dhan6. The average grain yield of BRRI hybrid dhan6 across all demonstrations was 5.53 t/ha, with a growth duration of about 125 days. The total production from these demonstrations amounted to 44.396 ton. In addition to production performance, the demonstrations served as an effective extension tool. Approximately 3,274 farmers gained knowledge about BRRI hybrid dhan6 through these activities. Among them, 1,372 farmers expressed interest and were motivated to cultivate BRRI hybrid dhan6 in the following season, provided that seeds are made available on time in the market.

SPDP in the valley of Hill in T. Aman 2024 under GoB. In the SPDP Valley programme during Aman 2024, a total of 28 demonstrations were carried out, each on a 1-bigha plot, using three high-yielding rice varieties: BRRI dhan87, BRRI dhan103, and BRRI hybrid dhan6. BRRI dhan87 showed the highest total production at 14.59 tons with a yield of 5.45 t/ha and retained the most seed (1040 kg), also engaging 2,038 knowledge-gained and 166 motivated farmers. BRRI dhan103, despite the lowest production (3.34 tons), achieved a high yield of 6.25 t/ha and retained 210 kg of seed. BRRI hybrid dhan6 produced 5.12 tons at the highest yield of 6.7 t/ha but did not contribute to seed retention. Altogether, the programme yielded 23.06 tons of rice, retained 1,250 kg of seed, and engaged 2,896 farmers, of whom 226 were motivated to adopt the demonstrated varieties.

New model SPDP Aman 2024 under GoB. During Aman 2024, under the GoB-funded new model SPDP programme, 18 demonstrations were conducted across three upazilas in three districts using four BRRI-developed high-yielding Aman rice varieties, with each plot covering six bighas. The varieties BRRI dhan75, dhan87, dhan93, and dhan103 had growth durations ranging from 116 to 132 days. Among them, BRRI dhan103 showed the highest yield (6.72 t/ha) and total production (2.70 tons), as well as the highest retained seed (540 kg) and farmers motivation (210). Overall, the programme produced 9.54 tons of paddy, retained 1,300 kg of seed, reached 1,505 knowledge-sharing farmers, and motivated 528 farmers, demonstrating effective dissemination as well as adoption potential improved.

SPDP Aman 2024 under PARTNER project. A total of 180 demonstrations were conducted across 36 locations in 13 districts of Bangladesh, each using one acre plots planted with the high-yielding variety BRRI dhan103 during Aman 2024. This variety, with a growth duration of 130 days, achieved an impressive average yield of 5.68 t/ha, resulting in a total production of 413.73 tons. From these demonstrations, 34,795.8 kgs of seed were retained for future use. The programme also had a strong outreach impact, with 11,117 farmers gaining knowledge and 4,507 farmers becoming motivated to adopt the variety, indicating the potential of BRRI dhan103 to contribute significantly to Aman rice productivity and farmers engagement.

SPDP Aman 2024 under LSTD Project. During Aman 2024, under the LSTD project, a total of 171 seed production and dissemination programme (SPDP) demonstrations were conducted across 15 upazilas in seven districts, using eight BRRI-developed high-yielding Aman rice varieties, with each plot covering one acre. The varieties had growth durations ranging from 120 to 130 days. BRRI dhan95 recorded the highest yield at 6.20 t/ha, while BRRI dhan103 achieved the highest total production of 2,114 tons. In total, the programme produced 15.591 tons of rice, retained 1,095 kg of seed, shared knowledge with 493 farmers, and motivated 189 farmers to adopt the demonstrated varieties. The initiative significantly contributed to both seed dissemination and farmer awareness in the target regions.

SPDP Boro 2024-25 under GoB. Nine BRRI-developed high-yielding Boro rice varieties evaluated under the SPDP during Boro 2024 across 300 plots in 28 upazilas of 14 districts. Growth duration ranged from 142 to 157 days, with an average of 149 days. Yields varied between 6.30 and 8.25 t/ha, averaging 7.18 t/ha, with BRRI hybrid dhan6 producing the highest yield. Total production across all plots reached 8.65 ton. The programme enabled the retention of 666 kg seed, benefited 448 knowledge-gained farmers, and motivated 181 additional farmers, demonstrating strong dissemination and farmer engagement.

SPDP Boro 2024-25 under PARTNER project. During the Boro 2024-25 season, a total of 415 seed production and dissemination program (SPDP) plots were implemented across 37 upazilas in 14 districts using six BRRI-developed high-yielding Boro rice varieties, each cultivated on a one-acre plot. The varieties demonstrated average range of growth durations from 145 to 151 days, with BRRI dhan102 having the longest duration. Grain yield ranged from 6.58t/ha (BRRI dhan104) to 7.58 t/ha (BRRI dhan8). Overall a total of 1,181.67 ton seeds were produced from those demos across all varieties. The programme facilitated retention of 8618 kg of seed, knowledge dissemination to 22,636 farmers, and motivation of 8,151 additional farmers, indicating successful adoption and impact of the SPDP initiative.

PROMOTIONAL ACTIVITIES

Farmers' training. ARD conducted 35 Farmers' Training on rice technology at different locations of the country during 2024-2025 from which 20

trainings were funded by GoB and 15 from PARTNER project. A total of 1050 trainees participated in the trainings where male farmers were 753, female 47 and SAAO 13.

Field day. Adaptive Research Division conducted a total of 23 field days at different locations of the country under PARTNER and LSTD projects. Around 2,300 participants including farmers, local leaders and DAE personnel participated in the field days. These programmes also generated much enthusiasm about modern rice production technologies and BRRI varieties, which helped rapid dissemination of technologies.

Seed production at BRRI farm. ARD produced 4,820 kg quality seeds of modern rice varieties at BRRI farm in 2024-25 to execute adaptive research trials and demonstrations. A total of 1,490 kg quality seeds of 10 varieties were produced in Aman 2024 while 3,330 kg seeds of 11 varieties were produced in Boro 2024-25 season.

Training Division

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SUMMARY

Training Division has conducted 57 training programmes in the reporting year with course duration from day long to two weeks. Need based course curriculum was developed for these courses. Total number of participants was 1,686. The participants were Officers and Sub-Assistant Agriculture officer (SAAO) of the Department of Agriculture Extension (DAE), Scientists, scientific assistant of BRRI, BADE Officers, Officers of different seed companies and Seed, fertilizer, pesticide dealers. The highest number of participants was from the DAE. All the training programmes were successfully completed. Most of the BRRI's speakers' performance was very good to excellent.

CAPACITY BUILDING AND TECHNOLOGY TRANSFER

Twenty-four training courses on modern rice production technologies were conducted during the reporting period. The main objective of the course was to train the grass root level extension workers (SAAOs) of DAE. The course curriculum was designed based on the priority of field problems related to rice production and rice based technologies. Duration of the course was three days. A total of 720 SAAOs were trained. Among the participants 605 and 115 were male and female respectively (Table 1). This training is a regular programme of BRRI under GOB.

Six training programmes on modern rice production technologies for SAAOs of DAE were conducted during the year 2024-25. Through this training program 180 SAAO were trained. Among the participants 137 were male and 43 were female. Duration of the course was five days and the program was funded by LSTD project of BRRI (Table 2).

Another five-day long training programme for BRRI scientists on modern rice production technologies were conducted by using the same fund. Total 26 participants were trained through this course. Among the participants 10 were male and 16 were female respectively. Table 3 presents the particulars of the course.

Eleven training courses on hybrid rice and seed production technology for SAAOs of DAE were conducted during the reporting period under hybrid rice project. Duration of the course was five days. A total of 308 SAAOs were trained. Among the participants 250 and 58 were male and female respectively (Table 4).

During the reporting period, another two training programmes on hybrid rice and seed production technology were conducted using the fund of hybrid rice project. The participants of this two courses were BRRI scientists, DAE and BADE officers and officers from different seed companies. A total of 50 participants were trained. Among the participants 38 and 12 were male and female respectively (Table 5). The course duration was five days.

Training programme on bioinformatics for future rice for BRRI scientists were conducted during the reporting period and the programme were funded by PARTNER Programme of BRRI. Thirty participants were trained through this course. Table 6 presents the particulars of the training.

In the year 2024-25, one six-day training on research data management using spread sheet for BRRI scientists were conducted. The course was funded by PARTNER Programme of BRRI. Twenty-eight participants were trained through this course. Table 7 presents the particulars of the trainings

Two training programme on modern rice production technology, data collection and entry for Scientific Assistant (SA) and Senior Scientific Assistant (SSA) of BRRI were led during the reporting period. This programme also funded by PARTNER programme. Duration of the course was 14 days. Fifty-seven participants were trained through this course. Among the participants 50 and 7 were male and female respectively (Table 8).

Ten training programmes on safe use of agrochemicals for seed, fertilizer and pesticides dealers under PARTNER project were conducted during the reporting period. Duration of the course was three days. A total of 299 dealers were trained.

Among the participants 295 and 4 were male and female respectively (Table 9).

One training programme on systemic reviews and meta-analysis for BRRI scientists were conducted during the reporting period. Fifteen participants in one batch were trained through this course. Duration of the course was three days. This programme was financed by BRRI Agromet Lab. Table 10 presents the particulars of the trainings.

A day long training programme for SAAO of DAE on database preparation for farmers was successfully completed at that time. A total of 29 participants were trained through this programme.

Among the participants 24 and 5 were male and female respectively (Table 11). This program also funded by BRRI Agromet Lab.

Another day long training programme on modern rice production for Imam under KGF funded was conducted during that period successfully. Sixty participants were trained through this training (Table 12).

During the reporting period, 57 training programmes have been conducted by the Training Division. Through this training a total of 1,686 participants were trained. Table 13 presents the summaries of the trainings.

Table1. Particulars of one week modern rice production training course for SAAO of DAE

Batch no.	Duration	Total	Male	Female
1.	12-14 Mar 2025	30	28	2
2.	15-17 Apr 2025	30	19	11
3.	18-20 Apr 2025	30	23	7
4.	21-23 Apr 2025	30	23	7
5.	24-26 Apr 2025	30	23	7
6.	28-30 Apr 2025	30	28	2
7.	5-7 May 2025	30	25	5
8.	6-8 May 2025	30	30	0
9.	6-8 May 2025	30	28	2
10.	6-8 May 2025	30	25	5
11.	17-19 May 2025	30	27	3
12.	17-19 May 2025	30	28	2
13.	17-19 May 2025	30	20	10
14.	20-22 May 2025	30	27	3
15.	20-22 May 2025	30	28	2
16.	20-22 May 2025	30	27	3
17.	27-29 May 2025	30	27	3
18.	02-04 Jun 2025	30	26	4
19.	15-17 Jun 2025	30	22	8
20.	18-20 Jun 2025	30	23	7
21.	18-20 Jun 2025	30	23	7
22.	18-20 Jun 2025	30	30	0
23.	23-25 Jun 2025	30	18	12
24.	23-25 Jun 2025	30	27	3
Total		720	605	115

Table 2. Particulars of one-week modern rice production training course for SAAO of DAE (LSTD Project).

Batch no.	Duration	Total	Male	Female
1.	17-21 Nov 2024	24	16	8
2.	24-28 Nov 2024	28	19	9
3.	12-16 Apr 2025	30	21	9
4.	18-22 May 2025	33	22	11
5.	18-22 Jun 2025	30	25	5
6.	26-30 Jun 2025	30	24	6
Total		180	97	43

Table 3. Particulars of modern rice production training course for BRRI scientists (LSTD project).

Batch no.	Duration	Total	Male	Female
1.	20-24 Apr 2025	26	10	16

Table 4. Training on hybrid rice cultivation and seed production technology for SAAO of DAE (Hybrid project).

Batch no.	Duration	Total	Male	Female
1.	5-9 January 2025	28	20	8
2.	15-19 Jun 2025	28	26	2
3.	15-19 Jun 2025	28	26	2
4.	16-20 Jun 2025	28	20	8
5.	18-22 Jun 2025	28	14	14
6.	22-26 Jun 2025	28	25	3
7.	23-27 Jun 2025	28	22	6
8.	25-29 Jun 2025	28	25	3
9.	25-29 Jun 2025	28	26	2
10.	25-29 Jun 2025	28	27	1
11.	25-29 Jun 2025	28	19	9
Total		308	250	58

Table 5. Particulars of five days' hybrid rice and seed production technology training course for BRRI scientists.

Batch no.	Duration	Total	Male	Female	Org
1.	16-20 Mar 2025	25	13	12	BRRI
2.		25	25	-	DAE, BADC, Seed Company
Total		50	38	12	

Table 6. Training on Bioinformatics for future rice of BRRI Scientists.

Batch no.	Duration	Fund	Total	Male	Female
1.	15-28 Feb 2025	PARTNER	30	14	16

Table 7. Particulars of six days training course on Research data management using spread sheet for BRRI scientists.

Batch no.	Duration	Fund	Total	Male	Female
1.	28 Dec 2024-2 Jan 2025	PARTNER	28	9	19

Table 8. Particulars of two weeks modern rice production , data collection and entry training course for SA/SSA of BRRI funded by PARTNER project

Batch no.	Duration	Fund	Total	Male	Female
1.	1-14 Feb 2025	PARTNER	28	23	5
2.	1-14 Mar 2025	PARTNER	29	27	2
Total			57	50	7

Table 9. Particulars of three days training programme on safe use of agrochemicals for seed/fertilizer/pesticide dealers funded by PARTNER Project.

Batch no.	Duration	Total	Male	Female
1.	26-28 Oct 2024	30	30	0
2.	29-31 Oct 2024	30	30	0
3.	01-03 Nov 2024	30	30	0
4.	9-11 Dec 2024	30	30	0
5.	12-14 May 2025	29	29	0
6.	20-22 May 2025	30	30	0
7.	25-27 May 2025	30	30	0
8.	28-30 May 2025	30	30	0
9.	29-31 May 2025	30	30	0
10.	02-04 Jun 2025	30	26	4
Total		299	295	4

Table 10. Training on systematic reviews and meta-analysis for BRRI scientists.

Batch no.	Duration	Total	Male	Female
1.	19-21 Apr 2025	15	8	7

Table 11. Day long training programme for SAAO on database preparation for farmers.

Batch no.	Duration	Total	Male	Female
1.	4 May 2025	29	24	5

Table 12. Day long training programme on modern rice production for Imams funded by KGF.

Batch no.	Duration	Total	Male	Female
1.	26 Dec,2024	60	60	0

Table 13. Total training conducted by Training Division.

Name of the training	No. of training	Duration	No. of participants			Designation	Fund
			Total	Male	Female		
Training on modern rice production	29	5 days	865	707	158	SAAO, DAE	GOB
Training on modern rice production	6	5 days	180			SAAO, DAE	LSTD
Training on modern rice production	1	5 days	26	10	16	BRRI Scientists	LSTD
Hybrid rice and seed production technology training course	11	5 days	308	250	58	SAAO, DAE	Hybrid rice Project

Name of the training	No. of training	Duration	No. of participants			Designation	Fund
			Total	Male	Female		
Hybrid rice and seed production technology training course	2	5 days	50	38	12	BRRIScientists & Others	Hybrid rice Project
Training on bioinformatics for future rice	1	2 weeks	30	14	16	BRRIScientists	PARTNER
Research data management using spread sheet	1	6 days	28	9	19	BRRIScientists	PARTNER
Modern rice production, data collection and entry training course	2	2 weeks	57	50	7	SA, SSA BRRIScientists	PARTNER
Training course on safe use of agrochemicals	10	3 days	299	295	4	Dealer (Agri input)	PARTNER
Training on Systematic review and meta-analysis	1	3 days	15	8	7	BRRIScientists	Agromate Lab
Training programme on database preparation for farmers	1	Day long	29	24	5	SAAO	Agromate Lab
Training on modern rice production	1	Day long	60	60	0	Imam	KGF
Total	57		1686	1394	292		

EFFECTIVENESS OF IMPARTED RICE PRODUCTION TRAINING

It is important to determine the impact of different aspects of imparted rice production training for its better planning and execution in future. This study was conducted at the end of each batch to collect

the relevant information. After the completion of data collection, information was compiled and analyzed. This study reveals that all the training programs on modern rice production were very much helpful for the trainees to build up their capacity for modern rice production activities.

BRRI RS, Barishal

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SUMMARY

The variety development programs aimed at improving rice varieties for Barishal, addressing tidal submergence challenges. These efforts include hybridization of 17 parent varieties, resulting in 1,208 F1 seeds for tidal tolerance and 4,051 F1 seeds for high-yielding Boro rice varieties. Trials like OYTs, RYTs, and AYT were conducted to assess yield, growth, and adaptability, with some genotypes outperforming checks. Local germplasm characterization identified promising varieties such as Shobrimaloti and Bhushiara for tidal-prone areas due to their high tillering and seedling height. A survey of rice diseases and pests revealed low disease occurrence, with minor damage from pests like yellow stem borer and brown planthopper, and a new instance of neck blast in BRRI dhan74. A study on insect pests showed that weather, including temperature, solar radiation, and tidal height, significantly affects pest populations. Multi-allelic resistance in rice lines, like pi21/Pish, was found to be more effective against blast diseases than single-allelic resistance. Additionally, crop soil water management experiments highlighted the benefits of nutrient and water management, algae control, and

remote sensing to optimize yields. The socio-economic analysis of rice varieties in 2024-2025 revealed differences in yield, emphasizing the importance of variety selection based on duration and environmental conditions. The program also demonstrated high-yielding varieties, organized farmer training, and field days to promote modern agricultural practices and improve rice production in the region.

Variety Development

Hybridization and pedigree nursery

Development of varieties for tidal submergence. A total of 25 crosses were made using seventeen parents, and 1208 F1 seeds were obtained during T. Aman 2024. F1 seeds were collected to develop tidal submergence-tolerant rice varieties (Table 1). Out of 29 crosses, 26 crosses were confirmed and registered in BRRI cross-list with station code BRBa307 to BRBa332.

In Field RGA Nursery, segregating progenies from F2 to F6 generations were rapidly advanced in the field condition. In total 8486 progenies were harvested from 88 crosses using FRGA technique during T. Aman 2024

Table 1. List of F1 seeds produced in T. Aman 2024

Cross combination	No. of seeds	Cross combination	No. of seeds
Dudhmona / BRRI dhan52	21	BRRI dhan52 / Garcha	112
Dudhmona / BRRI dhan76	9	Kalagora/ BRRI dhan52	5
Dudhmona / BRRI dhan109	5	BRRI dhan109/Lotor	175
Mothamota / BRRI dhan109	18	Babarababa / BRRI dhan109	28
Holdemota / BRRI dhan76	12	Babarababa / BR23	83
Holdemota / BRRI dhan109	18	Kalavog / BRRI dhan44	16
Holdemota / BRRI dhan77	28	BRRI dhan109 / Babarababa	54
Komlamota / BRRI dhan109	61	Nakuchimota / BR23	12
Bohorimota / BRRI dhan44	96	Lotor / BR23	10
Bohorimota / BRRI dhan52	106	Komlamota / BR23	40
Nakuchimota / BRRI dhan76	22		
BRRI dhan52 / BRRI dhan44	125		
BRRI dhan44 / BRRI dhan52	101		
Nakuchimota / BRRI dhan77	43		
Garcha / BRRI dhan52	8		
Total			1208

Breeding for favourable ecosystem

A total of 47 crosses were done using 10 parents and 4051 F₁ seeds were obtained to develop high yielding Boro rice varieties during Boro 2024-25 (Table 2). Besides, 16 crosses were confirmed and registered in BRRi RS, Barishal cross list with station code BRBa333 to BRBa348 in Boro 2024-25 In Field RGA Nursery, segregating progenies from F₂ and F₃ generation were rapidly advanced in the field condition in Boro 2024-25. In total 18991 progenies were harvested using FRGA technique during Boro 2024-25.

Observational yield trial (OYT) Boro 2024-25

Two OYTs were conducted in Charbadna farm, Barishal, during Boro 2024-25. The OYT (FBC Barishal)-1 consisted of 224 entries along with three checks, BRRi dhan74, BRRi hybrid dhan3, and BRRi hybrid dhan8. Based on phenotypic acceptability (4-5) and grain yield performance twenty-five genotypes were selected for further evaluation.

The OYT(FBR_RCGC)-2 consisted of 222 entries along with four checks, BRRi dhan29, BRRi dhan88, BRRi dhan92 and BRRi dhan102. The growth duration of the tested entries was found 118-137 days where whereas 120-136 days were found in the check varieties. The yield range was observed 3.35-5.0 t/ha among the tested entries and 4.31-4.45 t/ha was found in the checks. The entry BR14870-BC1-R-115 gave the highest yield (5.0 t/ha) with 122 days growth duration than four check varieties.

Observational yield trial (OYT) T. Aman 2024

The OYT(Bio) consisted of 30 entries along with three checks, BR23, BRRi dhan76, and Sadamota. The growth duration of the tested entries was found 130-131 days where whereas 147-152 days were found in the check varieties. The yield range was observed 2.55-3.75 t/ha among the tested entries and 3.05-5.06 t/ha was found in the checks. The entry BR(Bio)-8033-AC23-2 gave the highest yield (3.75 t/ha) with 130days growth duration than local check variety Sadamota (3.05 t/ha).

Table 2. List of F₁ seeds produced in Boro 2024-25

Cross combination	No. of seeds	Cross combination	No. of seeds
BRRi dhan74 /IRRI 154-Pi9 +Dd9(N22)	47	Japan50/Japan59	150
BRRi dhan97 /IRRI 154-Pi9 +Dd9(N22)	92	Japan50/IRRI 154-Pikh	65
BRRi dhan106 /IRRI 154-Pi9 +Dd9(N22)	22	Japan50/BRRi dhan81	147
BRRi dhan102 /IRRI 154-Pi9 +Dd9(N22)	45	Japan50/BRRi dhan104	225
BRRi dhan104 /IRRI 154-Pi9 +Dd9(N22)	53	Japan51/Japan62	42
BRRi dhan74 /IR64-Pi9(L)	71	Japan51/IRRI 154-Pikh	123
BRRi dhan97 /IR64-Pi9(L))	105	Japan51/BRRi dhan81	24
BRRi dhan106 /IR64-Pi9(L)	7	Japan51/BRRi dhan104	62
BRRi dhan102 /IR64-Pi9(L)	65	Japan63/IRRI 154-Pikh	79
BRRi dhan104 /IR64-Pi9(L)	52	Japan63/BRRi dhan81	97
BRRi dhan74 /IRRI 154-Pikh	141	Japan63/BRRi dhan104	108
BRRi dhan97 /IRRI 154-Pikh	178	Japan59/IRRI 154-Pikh	88
BRRi dhan106 /IRRI 154-Pikh	8	Japan59/BRRi dhan81	165
BRRi dhan102 /IRRI 154-Pikh	32	Japan59/BRRi dhan104	200
BRRi dhan104 /IRRI 154-Pikh	48	Japan62/IRRI 154-Pikh	170
BRRi dhan74 /BRRi dhan101	97	Japan62/BRRi dhan81	85
BRRi dhan97 /BRRi dhan101	79	Japan62/BRRi dhan104	125
BRRi dhan106 /BRRi dhan101	31	BRRi dhan74/IRRI 154-Pikh	73
BRRi dhan102 /BRRi dhan101	26	BRRi dhan74/IRRI 154-Pi9 +Dd9	20
BRRi dhan104 /BRRi dhan101	67	BRRi dhan81/IRRI 154-Pikh	58
Japan58/Japan63	160	BRRi dhan81/IRRI 154-Pi9 +Dd9	66
Japan58/IRRI 154-Pikh	148	BRRi dhan104/IRRI 154-Pikh	59
Japan58/BRRi dhan81	128	BRRi dhan104/IRRI 154-Pi9 +Dd9	55
Japan58/BRRi dhan104	63		
Total			4051

Preliminary yield trial (PYT)

One PYT was conducted during Boro 2024-2025. The experiment, consisting of seventy-four advanced breeding lines along with three checks, BRRI dhan74, BRRI dhan101, and BRRI dhan102 was evaluated at Charbadna farm of BRRI RS, Barishal. Among the tested materials, BRBa76-8-4-1-3 (7.990 t/ha), BRBa76-8-3-1-2 (7.74 t/ha) and BRBa76-16-2-1-1 (7.18 t/ha) gave highest yield than three checks BRRI dhan74 (5.43 t/ha), BRRI dhan101 (4.80 t/ha) and BRRI dhan102 (5.45 t/ha). The yield range was 3.41-7.99 t/ha found in the tested entries. The growth duration range of the tested entries was 130-145 days whereas it was found 134-141 days in checks. The plant height varied in the tested entries was 88-120 cm whereas it was 100 cm for BRRI dhan101.

Regional yield trial (RYT)-T Aman 2024

Zinc Enriched Rice: one RYT comprising of nine entries along with four checks BRRI dhan49, BRRI dhan72, BRRI dhan75 and BRRI dhan87 was grown at Charbadna farm of BRRI RS, Barishal. None of the tested entries was found to be out yielded over the checks. The yield range of the tested entries was 4.36-4.99/ha whereas the yield range of the checks was 4.37-5.12/ha. The growth duration range of the tested genotypes varied from 115-130 days, whereas it was found for check varieties from 113 to 130 days.

A RYT for Bio: It comprising three entries along with two checks BRRI dhan71 and BRRI dhan75 was grown at Charbadna farm of BRRI RS, Barishal. None of the tested entries found better comparing with check varieties. BRRI dhan71 (4.24 t/ha) and BRRI dhan75 (4.61 t/ha). The growth duration of the tested genotype varied from 122-123 days which is similar to the growth duration of the check variety BRRI dhan71.

A RYT for PQR Rang: It consisting of four entries along with two checks viz. BRRI dhan70 and BRRI dhan75 was conducted at Charbadna farm during T. Aman 2024. The yield range of the tested entries was varied from 3.37 t/ha to 4.29 t/ha. Only one genotype i.e., BRrang35-5-5-1-1-1 gave highest yield (4.29 t/ha) than check varieties BRRI dhan70

(4.06 t/ha) and BRRI dhan75 (4.23 t/ha). The growth duration range was found 117-120 days.

A RYT for Rainfed Lowland Rice (RLR#1): It consisted of seven genotypes along with three checks viz. BRRI dhan71, BRRI dhan75 and BRRI dhan87 was evaluated at Charbadna farm of BRRI RS, Barishal. The yield range among the tested entries was varied from 3.79 to 4.41 t/ha. The growth duration range was found 119-122 days. None of the tested entries was found to yield more than check BRRI dhan87 (5.01 t/ha).

A RYT for Rainfed Lowland Rice (RLR#2): It consisted of twelve genotypes along with three checks viz. BRRI dhan71, BRRI dhan75 and BRRI dhan87 was evaluated at Charbadna farm of BRRI RS, Barishal. The yield range among the tested entries was varied from 3.43 to 4.97 t/ha. The growth duration range was found 126-137 days. None of the tested entries was found to yield more than check BRRI dhan87 (5.28 t/ha).

A RYT for Rainfed Lowland Rice (RLR#3): It consisted of four genotypes along with three checks viz. BRRI dhan71, BRRI dhan75 and BRRI dhan87 was evaluated at Charbadna farm of BRRI RS, Barishal. The yield range among the tested entries was varied from 4.24 to 4.33 t/ha. The growth duration range was found 116-123 days. None of the tested entries was found to yield more than the check BRRI dhan87 (5.17 t/ha).

A RYT for Rainfed Lowland Rice (RLR#4): It consisted of twelve genotypes along with three checks viz. BRRI dhan49, BRRI dhan75 and BRRI dhan87 were evaluated at Charbadna farm of BRRI R/S, Barishal. The yield range among the tested entries was varied from 4.06 to 4.82 t/ha. The growth duration range was found 118-121 days. None of the tested entries was found to yield more than check BRRI dhan87 (5.17 t/ha).

Regional yield trial (RYT)-Boro 2024-25

In RYT for Zinc Enriched Rice: three entries along with three checks BRRI dhan28, BRRI dhan74, BRRI dhan89 and BRRI dhan100 was tested at BRRI Charbadna farm, Barishal, during Boro 2024-2025. The yield range of the tested entries was 4.86-

6.81 t/ha. The growth duration range of the tested entries was 127-133 days.

A RYT_Rang_Basmoti consisting of four lines along with check BRRI dhan104 was conducted at Charbadna farm, Barishal, during Boro 2024-25. The average yield range of the tested entries were 5.41-5.72 (t/ha). None of the tested entries found higher yielded than check variety BRRI dhan104 (6.06 t/ha). The growth duration range of the tested entries found 126-128 days.

A RYT for EMF consisting of three genotypes along with two check BRRI dhan28(T) and BRRI dhan28(S) was tested at BRRI Charbadna farm, Barishal, during Boro 2024-25. The average yield range of the tested entries was 2.04–3.94t/ha whereas BRRI dhan28(T) and BRRI dhan28(S) showed 3.80t/ha and BRRI dhan(S) 3.7t/ha, respectively.

A RYT for Pigmented Rice was conducted at BRRI Charbadna farm, Barishal. Seven lines along with two standard check BRRI dhan88 and BRRI dhan89 were tested under this trial during Boro 2024-25. The average yield range of the tested entries was found 4.71-6.5t/ha. The growth duration range was found 119-134 days. None of the tested entries was found to yield more than checks BRRI dhan88 (7.10t/ha) and BRRI dhan89 (7.13t/ha).

A RYT for Favorable Boro (Medium Duration) consisted of twelve genotypes along with three checks viz. BRRI dhan88, BRRI dhan89 and BRRI dhan102 was evaluated at Charbadna farm of BRRI RS, Barishal. The yield range of the tested entries was 5.03-6.03 t/ha with a growth duration range of 132-143 days. None of the tested entries was found to yield more than check BRRI dhan89 (6.37t/ha).

A RYT for Favorable Boro (Short Duration) consisted of ten genotypes along with three checks viz. BRRI dhan28, BRRI dhan88 and BRRI dhan102 was evaluated at Charbadna farm of BRRI RS, Barishal. One genotype viz., BR13027-BC1-3R-139 (6.69 t/ha) gave the highest yield among three checks. The growth duration range of the tested entries found 129-136 days.

A RYT for Favorable Boro (Medium Long Duration) consisted of thirteen genotypes along with two checks, viz. BRRI dhan92, BRRI dhan102, was evaluated at Charbadna farm of BRRI RS, Barishal. The yield range among the genotypes was varied from 5.03 to 6.48 t/ha with a growth duration range of 135-143 days. The five genotypes were found to yield more than the check varieties BRRI dhan92 (5.07 t/ha) and BRRI dhan102 (5.22 t/ha). The yield range of the tested entries was 4.8 to 5.6 t/ha.

RYT_FBR_Barishal: Five entries along with two checks BRRI dhan74 and BRRI dhan102 were evaluated in twelve locations of the BRRI RS and BRRI HQ during Boro, 2024-25. Among the tested materials, the plant height was ranged from 95.8cm of BRBaNGR324-1 to 100 cm of BRBaNGR736-1. The highest average grain yield (9.50 t/ha) was found in BRBaNGR324-1 at Sonagazi, and the lowest average grain yield (5.21/ha) was found in BRBaNGR324-1 at Sirajganj. The check yield of BRRI dhan74 ranged from 5.17 t/ha at Sirajganj to 8.27 t/ha at Gopalganj, whereas another check variety, BRRI dhan102, gave 5.02t/ha at Barishal to 8.44t/ha at Gopalganj. There was significant yield variation found among 12 test locations. On average, the test line BR BaNGR324-1 (7.38t/ha) performed the highest yield over the checks and another genotype, viz. BR BaNGR994-1 (7.16t/ha) showed better performance than two checks varieties (Table 3).

Table 3. Yield and ancillary characters of RYT_FBR (Barishal) genotypes, Boro 2024-2025

Designation	Average PH (cm)	Average GD (day)	Yield (t/ha)		
			Lowest (location)	Highest (location)	Avg.
BRBaNGR 324-1	95.8	141	5.21(Sirajganj)	9.50 (Sonagazi)	7.38
BRBaNGR 1256-1	98.3	141	5.09(Sirajganj)	8.17 (Gopalganj)	6.63
BRBaNGR350-2	99.1	141	4.72 (Gazipur)	8.18 (Rajshahi)	6.57
BRBaNGR736-1	100.8	145	4.68 (Siranjanj)	9.90(Rangpur)	6.71

Designation	Average PH (cm)	Average GD (day)	Yield (t/ha)		
			Lowest (location)	Highest (location)	Avg.
BRBaNGR994-1	100.0	145	5.23 (Sirajganj)	9.63 (Rangpur)	7.16
BRRI dhan74(Ck)	104.5	148	5.17 (Sirajganj)	8.27 (Gopalganj)	6.94
BRRI dhan102(Ck)	97.5	141	5.02 (Barishal)	8.44 (Gopalganj)	6.77
LSD at 0.05	2.5	2.3			0.60
CV (%)	2.7	1.11			8.45
Heritability(H²)	0.91	0.93			0.72

L1= BRRI Barishal; L2= BRRIBhanga; L3= BRRI Cumilla; L4= BRRI Gazipur; L5= BRRI Gopalganj; L6= BRRI Habigonj; L7= BRRI Kustia; L8= BRRI Rajshahi; L9 = BRRI Rangpur; L10= BRRI Satkhira; L11= BRRI Sirajganj; L12= Sonagazi

Advanced yield trial (AYT)

AYT-1, T. Aman 2024: Twenty entries along with five checks BR23, BRRI dhan52, BRRI dhan76, BRRI dhan87, and BRRI dhan109 were grown at Charbadna farm, BRRI, Barishal. Growth duration of the tested entries ranged from 131 days to 137 days. The yield range of the tested entries was 2.64-4.08 t/ha, and the yield range of 4.10-4.87 t/ha was found in the check varieties. A lower yield of the genotypes was found due to 90-100% lodging.

AYT_FBC, Boro 2024-25: one advanced yield trial of favourable Boro rice consisted of 96 entries along with four checks BRRI dhan88, BRRI dhan89, BRRI dhan92, and BRRI dhan102 was evaluated at Charbadna of BRRI, Barishal. The yield of tested genotypes ranged from 2.86t/ha to 8.03t/ha. The growth duration of the tested materials ranged from 111 to 144 days, whereas the growth duration of the check varieties ranged from 128 (BRRI dhan88) to 144days (BRRI dhan92). The plant height of the tested entries was varied from 83.4 to 118.0 cm. None of the tested entries was found to yield more than the check varieties.

AYT-1, Boro 2024_25 comprising of eight entries along with three checks BRRI dhan74 and BRRI hybrid dhan3 and BRRI hybrid dhan8 was grown at Charbadna farm, BRRI, Barishal. The growth duration of the tested materials was ranged from 143 to 152 days, whereas the growth duration of the check varieties ranged from 135 (BRRI dhan74) to 142 days (BRRI hybrid dhan8). The plant height of the tested entries was varied from 88 to 111cm. The effective tiller of the tested entries was varied from 6 to 8. The yield range was 4.10 to 6.26 t/ha. None of the tested entries performed better than the check varieties.

AYT-2, Boro 2024-25 comprising of seven entries along with three checks BRRI dhan74 and BRRI dhan101 and BRRI dhan102 was grown at Sagardi farm, BRRI, Barishal. Among the tested entries, BRBa21-13-2-2-1 (6.60t/ha), BrBa21-4-1-2-1-P4 (6.70 t/ha), and BRBa23-11-5-2-1-P2 (7.10 t/ha) gave the higher yield than the highest yielded check BRRI dhan101 (6.50/ha). Growth duration of tested entries ranged from 134 to 145 days. The effective tiller of the tested entries was varied from 7 to 12.

Characterization of Local Rice Germplasm from the Barisal Region: Focusing on Seedling Height and Anaerobic Tillering Ability for Tidal Non-saline Sub-ecosystem

The Barisal region faces challenges in rice production due to tidal submergence during the T. Aman season. This study focuses on identifying local rice varieties with optimal seedling height and high anaerobic tillering ability to improve resilience and yield in tidal-prone areas. A total of 371 local rice germplasm, including seven HYV checks, were evaluated for seedling height and anaerobic tillering ability (Fig. 1). The study found significant variation, with Bhushiara having the highest seedling height (136.33 cm) and Shobrimaloti showing the highest tillering ability (22.4 tillers/hill). Varieties like Bhushiara, Dudmona, and Shobrimaloti demonstrated better adaptability, making them suitable for tidal areas. The findings suggest that selecting germplasm with higher tillering ability can enhance rice yield in these challenging conditions. Further studies should explore other environmental factors like soil salinity and flood tolerance for optimizing rice variety selection.

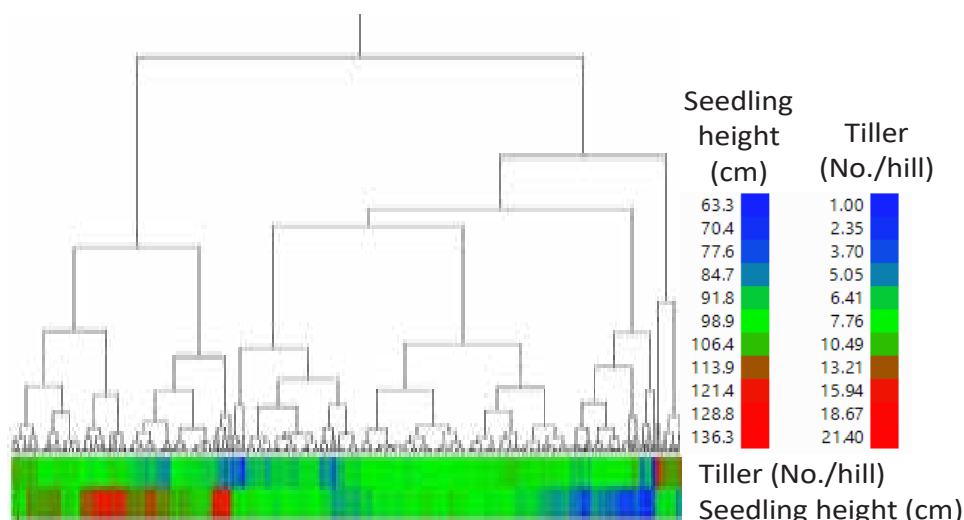


Fig. 1: Clustering local rice germplasm-based seedling height and anaerobic tillering ability

Pests Management

Survey and Monitoring of Rice Diseases and Insect Pests

A survey was conducted in the Barishal region during the Aus, T. Aman, and Boro seasons across six districts to monitor rice diseases and insect pests. The overall disease incidence was low, with minimal neck blast observed in Sakkorkhora rice during the T. Aman season. Bacterial leaf blight (BLB) was common in tidal water-submerged fields during Aus and T. Aman. During the Boro season, rice was largely disease-free, with only sporadic cases of BLB in hybrid rice and neck blast in BRRI dhan47. A new occurrence of neck blast in BRRI dhan74 was noted, suggesting potential evolution of new blast races. Insect pest pressure was generally low during the Aus and T. Aman seasons, with minor damage from pests like leaf folder and stem borer. However, pest pressure increased during the Boro season, especially from yellow stem borer and brown planthopper, with local varieties being less affected than high-yielding varieties. Pest infestations were influenced by tidal inundation and temperature, with pest buildup in T. Aman residues contributing to higher infestations in the Boro season.

Abundance of insect pests and their relationships with weather parameters at Barishal region

A study on insect pest abundance in the Barishal region in 2024-25 used light traps and the Random Forest Model to analyze insect population dynamics and their relationship with weather parameters. The analysis revealed significant pest population surges in October and November, particularly for species like Yellow Stem borer, Brown Plant Hopper, and White Backed Planthopper, while species like Green Leaf Hopper showed stable populations. Early months had lower populations, and some species displayed erratic patterns. The study found that mean temperature, solar radiation, and maximum tidal height were the most influential weather factors affecting insect populations. Tidal height was particularly important for coastal species, while rainfall and evaporation had lesser impacts (Fig. 2). These findings emphasize the need for ongoing monitoring to inform pest control strategies and improve understanding of environmental factors influencing insect dynamics.

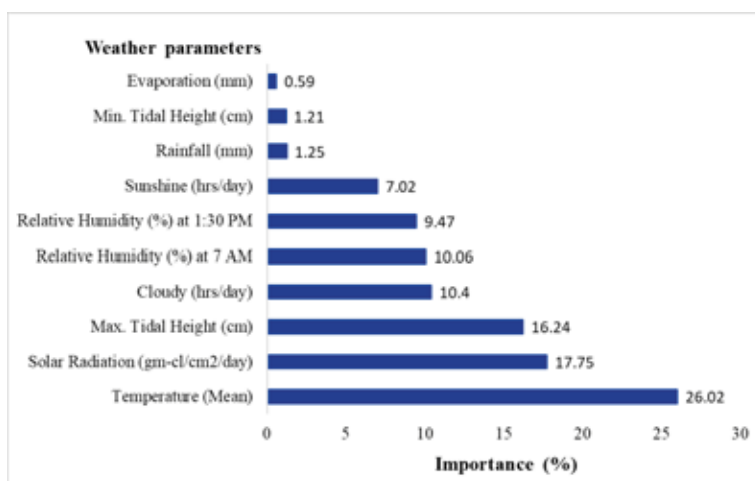


Fig. 2. Feature Importance for Weather Parameters on Insect Abundance in Barishal region

Development of Deployment of Multi-Allelic Blast Resistant Rice Lines for Durable Disease Resistance

This study compared the effectiveness of multi-allelic versus single-allelic resistance in rice lines against blast diseases. Multi-allelic resistance, such as pi21/Pish, showed significantly lower disease incidences for both neck and leaf blast compared to single-allelic lines like Pb1/Pish, which were highly resistant to neck blast but more susceptible to leaf blast. The multi-allelic lines demonstrated more durable and stable disease resistance, making them a more effective strategy for long-term disease management in rice (Fig. 3). The findings highlight the superiority of multi-allelic resistance for sustainable protection against diverse disease pressures, with recommendations for larger-scale field trials to further validate these results.

Crop Soil Water Management Program Area

Long-term Missing Element Trial in Rice-Rice Cropping Pattern

Nutrient deficiency problems are a major constraint on rice production in many soils of Bangladesh. Proper identification and management of these problems are a prerequisite for boosting production and sustaining higher yields over long period of time. The missing element trial is an effective field technique to identify the existence of limiting nutrient(s) in soil of that particular area.

The experiments were initiated on a permanent layout at the BRRI farm Barishal in Boro 2009, using 6 treatments in RCB design with 3 replications. The fertilizer rate of Barisal site was NPKSZn @ 150-15-50-10-1 kg/ha for Boro and 60-15-50-10-1 kg/ha for Aman. Urea-N was applied in three 3 equal splits i.e. 1/3 at final land preparation, 1/3 at active tillering stage and 1/3 at 5-7 days before PI stage. Rest of the fertilizers was applied at final land preparation. BRRI dhan74 was used as a tested crop in Boro season 2024-25. For grain yield the crop was harvested from 5 m² areas at the center part of each plot. The grain yield was recorded at 14% moisture content.

Exploring sediment deposition from tidal water in Barishal regional station

In the Southern tidal region, particularly in Barishal, large quantities of nutrient-rich sediment are deposited in rivers, canals, and agricultural fields through tidal water, benefiting farmers by reducing the need for fertilizers during the Aman season. A study conducted in Sagradi farm, Barishal, involved trapping sediment from tidal water for elemental analysis. The results showed that the sediment had a higher nutrient content than normal soil, with elevated levels of pH, nitrogen (N), phosphorus (P), potassium (K), sulfur (S), and zinc (Zn), while organic matter was slightly lower in the sediment than in soil (Table 4). These findings indicate that tidal sediment enhances soil fertility and provides significant benefits for crop production.

Table 4. Nutrient quality of sediments and soil of Sagardi Farm, Barishal in 2024-25

Sample category	pH	Organic matter (%)	Nitrogen (%)	Potassium (meq./100g soil)	Phosphorus (Olsen)	Sulphur ($\mu\text{g g}^{-1}$)	Zinc ($\mu\text{g g}^{-1}$)
Sediment	7.50	2.768	0.198	0.447	49.85	13.75	3.638
Soil	6.83	3.318	0.174	0.377	20.93	11.23	1.588

Management of Algae at Boro season in Barishal region

The experiment was conducted at Sagardi farm, BRRI Barishal, during Boro 2024-25. The treatments included the following Algae management methods: (1) Control (No chemical used), (2) CuSO_4 (2.5 kg/ha), (3) Dithan M45 (10g/L water), (4) Alternate wetting and drying (AWD), and (5) P-fertilizer management (1st 30DAT and 2nd 45DAT). The design of the experiment was RCBD with three replications. The variety BRRI dhan102 was used in this trail and 40days old seedlings were transplanted on 31 January 2025. Other management practices were followed according to the BRRI recommendation. Results showed that the application of Dithan M45 yielded the highest grain (7.82 t/ha) followed by P-fertilizer management, AWD and CuSO_4 (6.85, 6.44, 6.22 t/ha respectively) and the lowest yield was found at control (5.19 t/ha). Further experiment should conduct to confirm the findings (Fig. 4).

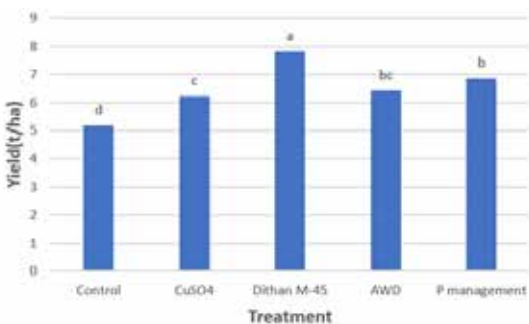


Fig. 4. Effect different algae management treatments on the grain yield of HYV rice in Sagardi farm, BRRI Barishal, Boro 2024-25 season

Management of nitrogen nutrition of HYV rice during Aman season under tidal flood situation

The experiment was conducted in Char Badna farm, BRRI Barishal, during T. Aman 2024. The treatments included the following five urea application methods: (1) prilled urea (PU): 2 splits ($\frac{1}{2}$ at 10 DAT + $\frac{1}{2}$ at 7d before PI), (2) PU: 3 splits ($\frac{1}{3}$ rd at 10 DAT + $\frac{1}{3}$ rd at active tillering + $\frac{1}{3}$ rd seven days before panicle initiation), (3) PU: full dose as basal, 4) PU: full dose after final recession of flood water, 5) No urea(control) and 6) urea deep placement (UDP) (@10 DAT). In treatments 1 and 2, the application of urea was carried out in between the flood water recession and new water entry periods during the high tides in full moon and new moon. The design of the experiment was factorial RCB with three replications, with the factors being i) variety and ii) urea application methods. The varieties were BRRI dhan52 (145 d) and BRRI dhan76 (165 d). The N application rate was 95 kg/ha. Other nutrients e.g., P-K-S-Zn were applied on soil test basis as a flat dose (10-65-11-2 kg/ha). Results showed that the application of PU @ 3 splits yielded the highest grain for both varieties. The control (No urea) plot, recorded the lowest grain yield indicating the significant effect of N fertilizer. A varietal difference was recorded in response to urea application, with BRRI dhan76 being more responsive to late urea applications than BRRI dhan52. Deep urea placement yielded higher grain in shorter duration variety BRRI dhan52, than in BRRI dhan76 with longer duration (Fig. 5). Further investigation will confirm the findings.

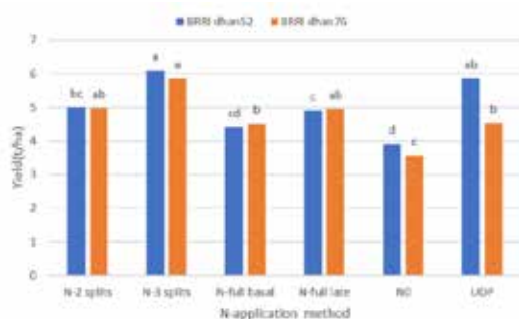


Fig 5. Effect of urea application method on the grain yield of HYV rice in Charbadna farm, BRRRI Barishal, T. Aman 2024

Effect of planting date on the growth and yield of newly developed BRRRI varieties in Barishal region

The experiment was conducted in Charbadna farm in T. Aman 2024 season and Sagardi farm in Boro 2024-25 season of BRRRI RS Barishal, aimed at identifying a suitable planting date for short and long-duration T. Aman and Boro rice cultivars to maximize grain yield. In case of T. Aman 2024 season, the selected cultivars were soaked from 10 June to 10 August and 25-30 days old seedlings were transplanted. On the other hand, in Boro 2024-25 season, the selected cultivars were soaked from 1 November to 16 January, and 40days old seedlings were transplanted. The design of experiment was RCBD with three replications. In both seasons, 3 short-duration varieties (T. Aman season: BRRRI dhan75, BRRRI dhan87, BRRRI dhan90, and Boro season: BRRRI dhan101, BRRRI dhan88, BRRRI dhan96) and 3 long duration varieties (T. Aman season: BRRRI dhan49, BRRRI dhan52, BRRRI dhan93, and Boro season: BRRRI dhan102, BRRRI dhan89, BRRRI dhan92) were tested. Fertilizer and other management practices were accomplished by following the BRRRI recommendation. Yield and yield components data were collected following the standard method. The data were analyzed using the STAR software.

The results of T. Aman 2024 showed that the short duration varieties BRRRI dhan75, BRRRI dhan87 and BRRRI dhan90 seeding at 25 July and transplanting 20 August produced higher grain yield (4.11 t/ha,

4.69 t/ha, 3.94 t/ha respectively) than the delayed transplanting. In case of long duration varieties; BRRRI dhan52, BRRRI dhan79 and BRRRI dhan93 seeding on 10 July and transplanting 5 August gave better yield (3.76 t/ha, 3.78 t/ha and 3.95 t/ha respectively).

The results of Boro 2024-25 showed that the short-duration varieties BRRRI dhan88, BRRRI dhan96 and BRRRI dhan101 gave the highest yield (7.27, 7.57 and 7.96 t/ha, respectively) on 10 January, 25 January and 10 December transplanting dates respectively (Table 8). In case of long duration varieties BRRRI dhan89, BRRRI dhan92 and BRRRI dhan102 performed better yield (6.98 t/ha, 7.47 t/ha and 7.33 t/ha, respectively) on 16 November seeding and 25 December transplanting (Table 8). In both cases, delay transplanting reduced the yield. Transplanting on 25 February, all long duration varieties damaged due to heat stress and high-tide which results no grain yield.

Applications of Remote Sensing for Increasing Boro Area in Barishal Region by Water Resource Assessment

The Boro Crop Area Mapping of Barishal Division from 2016 to 2024 provides crucial insights into the changing landscape of agricultural areas, particularly focusing on the Boro crop (Fig. 6). In 2016, Boro accounted for just 2% of the land area, with homesteads covering 47% and fallow land making up 38%. By 2020, the proportion of Boro crop area increased to 5%, while homesteads and fallow land slightly decreased to 46% and 36%, respectively. In 2024, Boro crop area further expanded to 7%, with a noticeable reduction in fallow land (23%) and a rise in Robi crop areas (9%).

This shift in land use, particularly the increase in Boro crop area, underscores the significance of water resource management and remote sensing applications in enhancing agricultural productivity. By utilizing remote sensing technologies, it is possible to assess and monitor water bodies and seasonal changes in the Barishal region, enabling better management of water resources. This

approach can help optimize the use of existing water bodies and identify new opportunities for expanding Boro crop cultivation. The assessment and sustainable management of water resources play a

vital role in increasing agricultural areas, particularly in regions like Barishal, where the irrigation system is closely linked to the agricultural seasons.

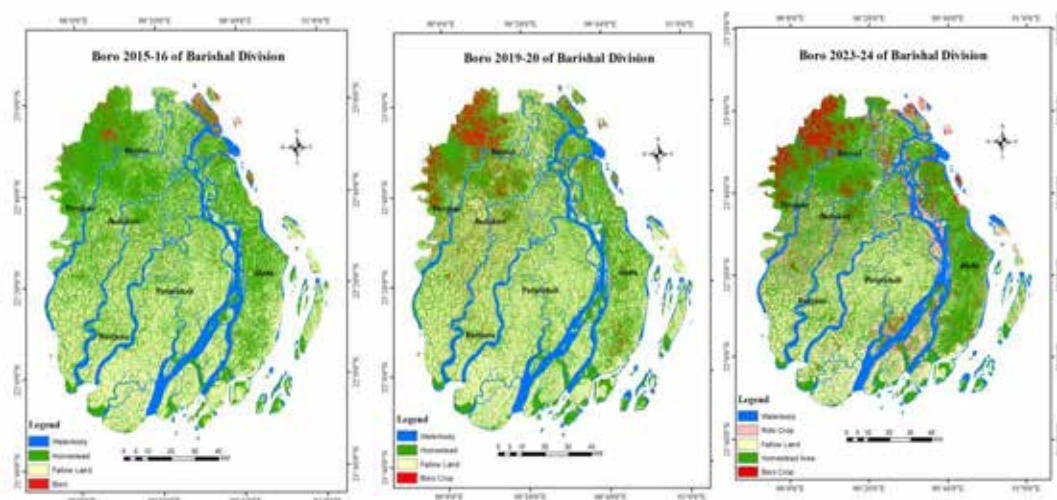


Fig 6. Boro Crop Area Mapping of Barishal Division from 2016 to 2024

Socio-Economic and Policy

Stability analysis of the BRRI released variety in 2024-25

Aus 2024

Study was accomplished at Charbadna farm, BRRI regional station, Barishal during Aus, 2024. Fourteen (14) BRRI released varieties were tested following RCB design with three replications. Size of unit plot was 3m x3 m, plot to plot distance was 40 cm, block to block distance was 60 cm and spacing was 20 × 20 cm. Twenty-six days old seedlings were transplanted. Crop management practices were done according to BRRI recommended practice. Among the tested 14 varieties BR24 gave highest yield (5.09 t/ha) followed by BRRI dhan85 (4.83 t/ha) and BRRI dhan98(4.75 t/ha). The lowest yield was observed in BRRI dhan43 (2.75 t/ha).

T. Aman 2024

During T. Aman 2024, forty-eight (48) BRRI released varieties were tested in three groups, namely, short duration (15 nos), medium duration

(22 nos) and long duration (11 nos). Among the tested short duration varieties, the highest yield was observed in BRRI hybrid dhan6 (5.04 t/ha) followed by BRRI dhan87 (4.79 t/ha), BRRI dhan95 (4.25 t/ha) and BRRI dhan53 (4.1t/ha). The lowest yield was found in BRRI dhan39 (2.58 t/ha). In medium duration varieties, the highest yield was found in BR4 (4.13 t/ha) followed by BRRI dhan80(3.73 t/ha) and BRRI dhan93 (3.73 t/ha). The lowest yield was observed in BR3 (1.96 t/ha). Finally, in the long duration varieties, the highest yield was in BRRI dhan46 (3.92 t/ha) followed by BR22 (3.66 t/ha) and the lowest yield was in BR5 (2.6 t/ha).

Boro 2024-25

Fifty-four (54) varieties were evaluated at Charbadna, Barishal during Boro 2024-25. The varieties were tested in two groups, namely short duration (27 nos.) and long duration (27 nos.). Among the tested short duration varieties, the highest yield was observed in BRRI hybrid dhan8 (6.76 t/ha) followed by BRRI hybrid dhan3 (6.28 t/ha) and BRRI hybrid dhan2 (5.73 t/ha). The lowest

yield was found in BRRI dhan107(4.11 t/ha). In case of the long duration varieties, the highest yielder was BR17 (4.86 t/ha) followed by BRRI dhan58 (4.74 t/ha) and BRRI dhan99 (4.55 t/ha). The lowest yield was observed in BRRI dhan50 (3.47 t/ha).

Technology Transfer

Activity 1: Demonstration, seed production and distribution of BRRI rice varieties

Demonstration

New HYVs of BRRI were demonstrated during T. Aman 2024 covering 35 upazilas across six districts of the Barishal Division. A total of 100 bigha of demonstrations were conducted with funding from GoB, 250 acres with the LSTD project, 150 acres with the PARTNER project, and 20 bighas with the Hybrid rice project by BRRI Barishal. Among the varieties demonstrated, BRRI-Barishal aimed to encourage farmers to replace their local varieties with the latest BRRI-released Aman varieties. The highest yield was achieved by BRRI dhan103 (6.5 t/ha), followed by BRRI dhan52 (5.12 t/ha) and BRRI dhan76 (4.25 t/ha). Since the Barishal region is prone to tidal submergence and it is challenging to grow BRRI dhan103, which has a growth period of about 125-130 days, its use is limited. However, in medium lowland areas (Phase-1), particularly Uzirpur, Gournadi, and Bhola Sadar, it yielded comparatively higher than in other locations. Nonetheless, it was chosen by farmers who plan to plant oil crops after the Aman season. Other farmers prefer BRRI dhan52 and BRRI dhan76, intending to cultivate these varieties next year along with neighbouring farmers.

During Boro 2024-25, a total of 166 acres of demonstrations were conducted with funding from GoB, 75 acres with the LSTD project, 600 acres with the PARTNER project, and 20 bighas with the Hybrid rice project by BRRI Barishal. The activities covered 35 Upazilas in Barishal Division. BRRI released HYV and hybrid varieties for distribution. Farmers participating in the demonstrations were advised on how to maximize yields. At maturity,

crop cut data were collected for each variety on every demonstration plot.

The hybrid variety BRRI hybrid dhan8 produced the highest average yield (10.12 t/ha) among the hybrid varieties. In HYV, BRRI dhan102 achieved the best yield at 8.12 t/ha. However, BRRI dhan74 attracted many farmers because of its coarseness, tastiness, and zinc enrichment. Overall, its lifespan is shorter than BRRI dhan89 and BRRI dhan92. Among saline-tolerant varieties, BRRI dhan97 performed well and was favored by farmers for its boldness. Farmers also preferred BRRI dhan67 because of its cold tolerance and high fertility rate.

Seed production and distribution

For breeder seed production, a single seedling was transplanted at 20 x 20 cm spacing. BRRI recommended practices for crop cultivation were followed. In Aus, a total of 2100 kg of seeds were produced at BRRI, Barishal. In T. Aman 2022, a total of 38700 kg of seeds were produced, with 31000 kg being breeder seed and 7700 kg being certified seed. In Boro, 20254-25, a total of 53200 kg was produced, with 31200 kg being breeder seed and 22000 kg being certified seed. A total of 30000 kg of seeds were distributed to farmers in this region during Boro 2022-23.

Activity 2: Farmers' training under different projects/GoB

Farmers' training programs were conducted in the Barishal region with DAE's collaboration, targeting farmers selected by local SAAOs from various villages. The training focused on modern rice production techniques, appropriate rice cultivars for tidal non-saline ecosystems, and effective pest, disease, irrigation, and fertilizer management. Sessions were delivered using multimedia presentations for better understanding. A total of 25 sessions were held under the GoB program, training 500 male farmers, 275 female farmers, and 30 SAAO/SA personnel. The programs helped raise awareness about BRRI rice production technologies and eco-friendly pest management. Ultimately, the training improved farmers' incomes and livelihoods

by promoting the adoption of modern rice production practices.

Activity 3: Farmers' field day under different projects/GOB:

Thirty-four field days were organized in the Barishal region with DAE's collaboration, involving farmers, researchers, extension workers, NGO staff, administrative personnel, and community leaders. Participants visited rice fields, harvested a 10 m² sample area, and engaged in discussions on the results. The event saw strong participation from female farmers, with approximately 3,400 attendees, including 2,400 men and 1,000 women. Farmers showed a preference for BRRI dhan52 and BRRI dhan76 due to their tolerance to tidal surges, and BRRI dhan103 for its higher yield.

Recommendations

1. Tidal submergence-tolerant, high-yielding rice varieties should be developed specifically for the Barishal region.
2. The characterization of local germplasm and the development of ecotype/target-based marker panels for creating tidal-non-saline submergence-tolerant rice varieties should be prioritized for the Barishal region.
3. Coordinated efforts among all agriculture-related departments are essential to expand the Boro rice area, particularly by enhancing irrigation facilities.
4. The current cropping pattern (Fallow-Fallow-T. Aman or Boro-Fallow-T. Aman) should be improved by introducing new varieties or crops in the fallow lands.
5. GIS and remote sensing-based studies should be conducted to facilitate better agricultural development planning for the Barishal region.
6. Farm mechanization should be prioritized in the Barishal region to improve agricultural efficiency.

BRRI RS, Bhanga, Faridpur

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SUMMARY

During the T. Aman 2024-25 season, a total of 13 crosses were carried out involving 19 different parents as part of various breeding programs. Specifically, six crosses using nine parents resulted in the production of 389 F₁ seeds for deepwater rice. For high-yielding Aman rice, seven crosses using ten parents produced 369 F₁ seeds. Out of 17 crosses, 15 were successfully confirmed. Overall, 10,467 segregating progenies from 52 F₂-F₄ generation crosses were advanced through the Field Rapid Generation Advance (FRGA) technique.

In the Boro 2024-25 season, 10 crosses were made, producing 1,639 F₁ seeds for developing high-input responsive Boro rice varieties tailored for a single Boro ecosystem. Out of 13 planned crosses, 06 were confirmed. In total, 13,528 segregating progenies from F₂-F₅ generations were advanced through FRGA technique.

During the Aman 2024-25 season, at the BRRI regional station, Bhanga, three sets of inbred trials were established and assessed as part of the Proposed Variety Trial (PVT) and Three ALART trials were also conducted.

During the Boro 2024-25 season at BRRI RS, Bhanga, several yield trials were performed. These included six sets of PVT, four ALARTs, twelve regional yield trials (RYTs), one advanced yield trial (AYT), and two observational yield trial (OYT). The ALARTs were established in farmer's field at Atadi, Bhanga under the supervision of BRRI RS, Bhanga. Effect of planting time on the phenological development and yield performance on the performance of modern rice varieties in Faridpur region was conducted in BRRI Bhanga. During Boro 2024-25 season, transplanting of BRRI dhan101 and BRRI dhan89 on January 10 resulted the highest grain yield for short and long-duration rice varieties, respectively.

An on farm field trial was conducted to evaluate BRRI released T. Aman rice varieties under Wheat-Jute-T. Aman cropping pattern. Among the tested cropping patterns, Wheat-Jute-T. Aman (BRRI dhan103) produced the highest REY (18.32 t/ha) and GM (2,61,000 Tk/ha) followed by CP₃: Wheat-

Jute-T. Aman (BRRI dhan87) (18.04 t/ha and 2,52,730 Tk/ha). An experiment was conducted to increase the cropping intensity and productivity of the existing Lentil-Jute-T. Aman cropping pattern in Faridpur region. Among the tested cropping patterns, the highest rice equivalent yield (25.77 t/ha) and MBCR (3.08) was found in CP₂ (Lentil+M. Melon (Relay)-Jute-T. Aman (BRRI dhan75).

Stability analysis of BRRI released rice varieties was conducted at BRRI RS, Bhanga during Aman 2024 and Boro 2024-25. Among the T. Aman varieties, BRRI dhan95, BRRI dhan72 and BR22 produced the highest grain yield for short, medium and long duration rice varieties, respectively. In Boro 2024-25, BRRI hybrid dhan8 produced the highest grain yield among the short duration Boro rice varieties while BRRI dhan92 yielded higher among the long duration rice varieties. Four hundred and fifty farmers and SAAO's of greater Faridpur region were trained on modern rice production technologies through 15 training programs under BRRI RS, Bhanga. A total of 335 GoB funded, 540 PARTNER funded, 110 LSTD and 60 Hybrid project funded demonstration trials using BRRI rice varieties were implemented through BRRI RS Bhanga and 20 field days were conducted during 2024-25.

VARIETY DEVELOPMENT

Hybridization

During Aman 2024-25, six crosses involving nine parents produced 389 F₁ seeds as part of a deepwater rice development program focusing on kneeing ability, nodal tillering, earliness, and good quality, awnless grain. Additionally, to develop high-yielding T. Aman rice varieties with water stagnation tolerance, anaerobic tillering, earliness, and good grain quality, seven crosses using ten parents generated 369 F₁ seeds (Table 1). A total of 15 crosses were confirmed out of 17 crosses. In Boro 2024-25, 10 crosses were made using 14 elite parents with the objective of developing high input responsive Boro varieties for single Boro ecosystem and 1,639 F₁ seeds were produced

(Table 2). The total of 06 out of 13 crosses were confirmed as true hybrid.

Progeny Advancement through FRGA

During Aman 2024-25, 10,467 segregating progenies from 52 crosses of F₂, F₃, F₄, F₅ generation were advanced following Field Rapid Generation Advanced (FRGA) technique. Around 14,000 F₂ seeds from fourteen crosses were sown and 4,894 F₃ seeds were harvested. Total 3781 progenies from eighteen crosses were advanced from F₃ to F₄ generation. Approximate 1,009 progenies from ten crosses of popular Boro hybrid were advanced from F₄ to F₅ generation. Also 145 F₅ seeds were harvested from 3 crosses of inbred rice. Around 638 F₆ seeds from seven crosses were harvested from F₅ generation (Table 3).

During Boro 2024-25, 13,528 segregating progenies from 59 crosses of F₂-F₆ generation were advanced following Field Rapid Generation Advance (FRGA) technique. Under the program of developing high yielding and high input responsive Boro rice varieties for single Boro ecosystem seeds of F₂ generation were sown and 5621 progenies were advanced as F₃. As for F₃ generation 4894 progenies were grown and 3632 progenies were harvested as F₄. Around 755 progenies from 9 popular hybrids were advanced F₄ to F₅. Another set of F₄ generation progenies were grown and 137 progenies were advanced as F₅. Total 638 F₆ progenies were grown and 482 progenies were harvested as F₇. Total 1,060 BC₁F₂ progenies were harvested from BC₁F₁ (Table 4).

Table 1. List of Crosses made during T. Aman 2024-25, BRRI RS, Bhanga

Crosses	F ₁ seeds	Objectives
BR13113-4R-116/BRRI dhan103	110	High yielding T. Aman
BR13106-4R-184/BRRI dhan75	50	High yielding short duration T. Aman
BR13122-4R-136/BRRI dhan103	66	High yielding T. Aman
BR10645-6-4-8-1-2/BRRI dhan75	80	High yielding short duration T. Aman
BR13111-4R-63/BRRI dhan49	61	High yielding T. Aman
BR11903-5R-56/BRRI dhan75	23	High yielding short duration T. Aman
BRRI dhan54/Hizal digha	100	High yield, kneeling ability, nodal tillering
BRRI dhan49/Hizal digha	15	High yield, kneeling ability, nodal tillering
BRRI dhan103/Laxmidigha	105	High yield, kneeling ability, nodal tillering
BRRI dhan103/Devmoni	50	High yield, kneeling ability, nodal tillering
BRRI dhan79/Shishumoti	84	High yield, anoxia tolerance,
Shishumoti/BRRI dhan75	30	High yield, anoxia tolerance
Lal Aman/BRRI dhan75	50	High yield, anoxia tolerance, short duration
Total	824	

Table 2. List of Crosses made during Boro 2024-25, BRRI RS, Bhanga

Crosses	F ₁ seeds	Objective
BR12274-4R-310/BRRI dhan89	270	High yielding Boro rice
IR18A1398/BRRI dhan102	100	High yielding Boro rice
BR13996-3R-156/BRRI dhan92	230	High yielding Boro rice
BR13180-4R-234/BRRI dhan89	145	High yielding Boro rice
BRBA NGR 994-1/BRRI dhan29	160	High yielding Boro rice
BR12570-5R-66-3/BRRI dhan102	140	High yielding Boro rice
BR13174-4R-67/BRRI dhan29	230	High yielding Boro rice
BR13180-4R-202/BRRI dhan89	110	High yielding Boro rice

Crosses	F ₁ seeds	Objective
IR18A1398/BRR1 dhan92	54	High yielding Boro rice
BR13201-4R-249/BRR1 dhan29	200	High yielding Boro rice
Total	1,639	

Table 3. Summary of Field Rapid Generation Advanced (FRGA), T. Aman 2024-25

Generation	No of crosses	No of plants harvested
F2	14	4,894
F3	18	3,781
F4 (Boro Hybrid)	10	1,009
F4	3	145
F5	7	638
Total	52	10,467

Table 4. Summary of Field Rapid Generation Advanced (FRGA), Boro 2024-25

Generation	No of crosses	No of plants harvested
F2	8	5,621
F3	14	3,632
F4	18	2,901
F5 (Popular Boro Hybrid)	9	755
F5	3	137
F6	7	482
Total	59	13,528
BC1F2	2	1,060

Proposed Variety Trial (PVT, T. Aman 2024-25)

Three sets of inbred trial were evaluated in PVT under the supervision of BRR1 Regional Station, Bhanga, Faridpur (Table 5).

In Set- I, test entry I-095 was tested against check entry I-096 and gave higher yield (6.17 t/ha) than the check entry (5.39 t/ha). The test entry performed 14.47% higher yield than the check entry.

In Set- II, test entry I-097 was tested against check entry I-098 and gave higher yield (6.38 t/ha) than the check entry (5.65 t/ha). The test entry performed 12.92% higher yield than the check entry.

In Set- III, test entry I-099 was tested against check entry I-100 and gave lower yield (3.60 t/ha) than

the check entry (5.15 t/ha). The yield performance of the test entry was poor.

Proposed Variety Trial (PVT, Boro 2024-25)

Six sets (Set-I, II, III, V, VI and VIII) of inbred trial were carried out at BRR1 Regional Station, Bhanga, Faridpur during Boro 2024-25 (Table 6).

Set-I: One advanced breeding line I-101 along with check I-102 were tested. The line I-101 produced 6.96 t/ha which was 10.47 % lower yield than the check variety coded as I-102 (7.74 t/ha). Both the entries had 137 days growth duration.

Set-II: One advanced breeding line I-103 along with check I-104 were tested. The line I-103 produced 9.9 t/ha which was 34.69 % higher yield than the check variety coded as I-104 (7.35 t/ha). Both the entries had 137 days growth duration.

Set-III: One advanced breeding line I-105 along with check I-106 were tested. The line I-105 (9.24 t/ha) gave 29.72 % higher yield than the check I-106 (7.26 t/ha). The growth duration of the advanced line was 160 days where as the check variety had 146 days growth duration.

Set-V: one test material and two check materials were evaluated in this set which were I-110, I-111 and I-112. The line I-110 gave 22.51% and 8.51% higher yield than the check variety coded as I-111 and I-112, respectively. The line had the growth duration of 152 days and both the checks had same growth duration of 153 days.

Set-VI: One test material and two check materials were evaluated in this set which were I-113

, I-114 and I-115. All entries had the similar growth duration of 150-152 days. I-113, I-114 and I-115 gave 10.18 t/ha, 9.53 t/ha and 9.11 t/ha yield respectively.

Set-VIII: One advanced breeding line I-119 along with check I-120 were tested. The line I-119 (9.40 t/ha) gave 3.63 % higher yield than the check I-120 (9.07 t/ha). Both the entries had the similar growth duration of 158 days.

Table 5. Performance of Proposed Variety Trial at BRRI RS, Bhanga during T. Aman 2024-25

PVT_Set	Location	Code No	Yield (t/ha)	Yield advantage (%)
Set-I	BRRI_Bhanga	I-095	6.17	14.47
		I-096	5.39	
Set-II	BRRI_Bhanga	I-097	6.38	12.92
		I-098	5.65	
Set-III	BRRI_Bhanga	I-099	3.6	-
		I-100	5.15	

Table 6. Performance of Proposed Variety Trial at BRRI RS, Bhanga during Boro 2024-25

PVT_Set	Location	Code No	GD (Days)	Avg. Yield (kg/ha)	Yield advantage (%)
Set-I	BRRI_Bhanga	I-101	137	6960	-10.47
		I-102	137	7774	
Set-II	BRRI_Bhanga	I-103	136	9900	34.69
		I-104	136	7350	
Set-III	BRRI_Bhanga	I-105	160	9241	29.72
		I-106	146	7124	
Set-V	BRRI_Bhanga	I-110	152	9958	22.51
		I-111	153	8128	
		I-112	153	9177	
Set-VI	BRRI_Bhanga	I-113	150	10183	6.78
		I-114	152	9536	
		I-115	151	9109	
Set-VIII	BRRI_Bhanga	I-119	158	9403	3.63
		I-120	158	9074	

ALART_False smut Aman: Three advanced breeding lines BR(Path)13804-BC3-4-5, BR(Path)13804-BC3-13 and BR(Path)13804-BC3-16 were evaluated against one check BRRI dhan49.

The entry BR(Path)13804-BC3-4-5 gave higher grain yield (6.27 t/ha) than the check variety BRRI dhan49 (6.13 t/ha) (Table 7).

Table 7. Grain yield and ancillary characters of ALART_False smut, Raynagar, Bhanga under the supervision of BRRI RS, Bhanga, Faridpur, Aman 2024

Designation	PH (cm)	Pan/m ²	GD (Days)	Yield (t/ha)
BR(Path)13804-BC3-4-5	107	292	148	6.27
BR(Path)13804-BC3-13	109	278	149	6.03
BR(Path)13804-BC3-16	113	272	148	5.97
BRRI dhan49 (ck)	114	262	160	6.13
Mean	110.82	275	NS	6.1
LSD _{0.05}	NS	NS	NS	NS
CV (%)	2.62	6.53	NS	3.8

ALART_Photosensitive rice Aman: Two advanced breeding lines BR10212-17-3-2-2 and BR10212-5-5-3 were evaluated against two checks BR22 and BR23. The entry BR10212-5-5-3 gave

higher grain yield (4.37 t/ha) than the check varieties BR22 (4.03 t/ha) and BR23 (3.47 t/ha) (Table 8).

Table 8. Grain yield and ancillary characters of ALART_Photosensitive rice Raynagar, Bhanga under the supervision of BRRI RS, Bhanga, Faridpur, Aman 2024

Designation	PH (cm)	Pan/m ²	GD (Days)	Yield (t/ha)
BR10212-17-3-2-2	98	277	129	3.63
BR10212-5-5-3	97	278	126	4.37
BR22 (Ck)	97	288	129	4.03
BR23 (Ck)	104	264	138	3.47
Mean	99	277	130.5	3.87
LSD _{0.05}	5.17	NS	NS	NS
CV (%)	2.61	5.25	-	11.76

ALART_Antioxidant rice Aman: Three advanced breeding lines BR12836-4R-312, BR12839-4R-124-2 and BR12839-4R-51 were evaluated against two checks BRRI dhan34 and BRRI dhan70. None of the tested entries performed better than the check

variety BRRI dhan70 (5.1 t/ha). The yield of the tested entries was ranged from 4.2-4.7 t/ha. The growth duration of the tested entries were 129-131 days (Table 9).

Table 9. Grain yield and ancillary characters of ALART_Antioxidant rice Raynagar, Bhanga under the supervision of BRRI RS, Bhanga, Faridpur, Aman 2024

Designation	PH (cm)	Pan/m ²	GD (Days)	Yield (t/ha)
BR12836-4R-312	110	208	131	4.7
BR12839-4R-124-2	115	189	129	4.2
BR12839-4R-51	119	187	129	4.2
BRRI dhan34 (check)	118	336	139	3.9
BRRI dhan70 (check)	129	223	129	5.1
Mean	118	228	131	4.4
LSD _{0.05}	3.3	55.5	NS	0.6
CV (%)	1.46	12.9	-	6.7

ALART_STR (SD) Boro: Two advanced breeding lines BR13113-4R-63 and BR13113-4R-116 were evaluated against two checks BRRI dhan28 and BRRI dhan88 at Atadi, Bhanga, Faridpur. Both the tested entries BR13113-4R-63 (8.28 t/ha) and BR13113-4R-116 (8.73 t/ha) gave higher grain yield than the check varieties BRRI dhan28 (7.04 t/ha) and BRRI dhan88 (8.06 t/ha) (Table 10).

Table 10. Grain yield and ancillary characters of ALART (STR_SD) at Atadi, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	Pan/m ²	GD (Days)	Yield (t/ha)
BR13113-4R-63	102.0	305	151	8.28
BR13113-4R-116	105.4	297	149	8.73
BRRI dhan28 (Ck)	103.9	248	145	7.04
BRRI dhan88 (Ck)	93.7	323	147	8.06
Mean	101.3	293.5	148	8.0
LSD _{0.05}	6.3	44.6	NS	0.6
CV (%)	3.1	7.6	0.5	3.5

ALART_STR (MD) Boro: Three advanced breeding lines BR13106-4R-184, BR13113-4R-185 and BR13122-4R-136 were evaluated against two checks BRRI dhan102 and BRRI dhan99 at Atadi, Bhanga, Faridpur. All the tested entries BR13113-4R-185 (9.21 t/ha), BR13106-4R-184 (8.79 t/ha) and BR13122-4R-136 (8.74 t/ha) gave higher grain yield than the check varieties BRRI dhan102 (8.49 t/ha) and BRRI dhan99 (8.03 t/ha) (Table 11).

Table 11. Grain yield and ancillary characters of ALART (STR_MD) at Atadi, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BR13106-4R-184	93	154	8.79
BR13113-4R-185	91	156	9.21
BR13122-4R-136	112	155	8.74
BRRI dhan102 (check)	104	155	8.49

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BRRi dhan99 (check)	99	154	8.03
Mean	100	155	8.70
LSD _{0.05}	1.70	NS	0.60
CV (%)	0.90	0.70	3.90

ALART_AOER (SD) Boro: One advance line BR12839-4R-137 was evaluated against standard check BRRi dhan88 at Atadi, Bhanga, Faridpur. The advance line BR11318-5R-84 gave lower grain

yield (7.69 t/ha) than the checks variety BRRi dhan88 (8.11 t/ha) (Table 12). Uniform flowering and maturity were observed in the line and grains were very attractive.

Table 12. Grain yield and ancillary characters of ALART (AOER_SD) at Atadi, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	Pan/m ²	GD (Days)	Yield (t/ha)
BR12839-4R-137	94.53	314	147	7.69
BRRi dhan88 (Std. ck)	91.40	382	146	8.11
Mean	93.00	348	147	7.90
LSD _{0.05}	NS	58.4	NS	NS
CV (%)	2.1	4.8	0.7	2.8

ALART_AOER (MD) Boro: Two advanced breeding lines BR12839-4R-157-2 and BR12839-4R-5-2 were evaluated against one check BRRi dhan100. None of the tested entries performed

better than the check variety BRRi dhan100 (8.41 t/ha). The yield of the tested entries was ranged from 7.66-8.12 t/ha. The growth duration of the tested entries were 148 & 153 days (Table 13).

Table 13. Grain yield and ancillary characters of ALART_AOER (MD) at Atadi, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	Pan/m ²	GD (Days)	Yield (t/ha)
BR12839-4R-157-2	117.1	249	148	7.66
BR12839-4R-5-2	111.6	259.3	153	8.12
BRRi dhan100 (ck)	106.8	320	152	8.41
Mean	111.8	276.1	150	8.06
LSD _{0.05}	5.1	36.5	2.9	NS
CV (%)	2.0	5.83	0.86	7.03

RYT (ZER) Boro: Three advanced breeding lines were evaluated against four checks, and among the test entries two entries i.e., BR11401-1-2-4-1 and BR12038-65-2-1 achieved higher yield 7.97 t/ha and 7.60 t/ha, respectively than the check entries BRRi dhan28 (6.43 t/ha), BRRi dhan74

(7.19 t/ha) and BRRi dhan100 (7.10 t/ha). Another check BRRi dhan89 out yielded all check entries and produced 8.45 t/ha. The growth duration of the test entries varied from 140-154 days (Table 14).

Table 14. Grain yield and ancillary characters of RYT_ZER at BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	GY_BLUE	GY_BLUP
BR11401-1-2-4-1	124	143	7.973	7.955
BR11401-8-3-1-1	103	141	6.358	6.479
BR12038-65-2-1	102	140	7.608	7.573
BRRI dhan28 (Ck)	108	141	6.402	6.434
BRRI dhan74 (Ck)	105	141	7.190	7.132
BRRI dhan89 (Ck)	119	154	8.450	8.437
BRRI dhan100(Ck)	119	143	7.103	7.072
h²b	.90	.99	0.97	
LSD (0.05)	1.29	0.56	0.341	

RYT (Basmati Rice Rangpur) Boro: Four test entries along with one check were evaluated in the RYT. The growth duration of the test entries varied from 142-144 days. Among the entries the check,

BRRI dhan104 gave lowest yield 7.53 t/ha than the four test entries. The test entries gave yield ranges 7.63 to 8.20 t/ha (Table 15).

Table 15. Grain yield and ancillary characters of RYT_ Basmati Rice Rangpur at BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	GY_BLUE	GY_BLUP
BRrang55-RGA-14-2-1-2	118	142	7.631	7.828
BRrang55-RGA-14-2-1-5	116	143	7.981	7.828
BRrang55-RGA-40-1-1-1	105	143	7.796	7.828
BRrang55-RGA-44-5-1-1	125	142	8.203	7.828
BRRI dhan104 (CK)	116	144	7.530	7.828
h²b	0.99	0.99	0.98	
LSD (0.05)	17.633	3.386	1.204	

RYT (Pigmented Rice) Boro: A total of six advanced breeding lines were evaluated against two standard check BRRI dhan88 and BRRI dhan89. The growth duration of the test entries varied from

134-154 days and yield varied from 5.80-7.62 t/ha whereas the check entries BRRI dhan88 and BRRI dhan89 gave a yield of 7.54 t/ha and 8.29t/ha, respectively (Table 16).

Table 16. Grain yield and ancillary characters of RYT_ Pigmented Rice Rangpur at BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	GY_BLUE	GY_BLUP
BR12839-4R-5-2	113	150	6.299	6.31
BR 12839-4R-93	111	134	6.826	6.826
BR12838-4R-89-1	111	146	5.803	5.825
BR12839-4R-106	120	154	6.414	6.423

Designation	PH (cm)	GD (Days)	GY_BLUE	GY_BLUP
BR12839-4R-137	103	143	6.006	6.023
BR12839-4R-138-4	110	149	7.624	7.608
BRRI dhan88 (Ck)	97	135	7.541	7.527
BRRI dhan89 (Ck)	108	152	8.288	8.258
h²b	0.89	0.92	0.979	
LSD (0.05)	22.14	15.18	2.103	

RYT (EMF) Boro: Two test entries along with three checks were evaluated in the RYT. The growth duration of the test entries varied from 141-158 days. Among the entries three check varieties

gave higher yield ranges from 5.79 to 6.39 t/ha than the two test entries. The test entries gave yield ranges 5.34 to 5.39 t/ha (Table 17).

Table 17. Grain yield and ancillary characters of RYT_EMF at BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	GY_BLUE	GY_BLUP
BR28(T)- qEMF3-6	109	155	5.390	5.402
BR28(T)-qEMF3-late DTH	102	158	5.335	5.348
BR28 (S) (Ck)	118	147	5.792	5.793
BR28(T) (Ck)	106	156	6.394	6.379
BRRI dhan98 (Ck)	110	141	6.277	6.265
h²b	0.99	0.94	0.974	
LSD (0.05)	18.689	10.160	1.583	

OYT (FBR): A total of 201 advanced breeding lines were evaluated against five checks. Among them 22 most promising lines were performed better than all the check varieties. The growth duration of the materials varied from 132 days to 166 days. From each entry 2 m² area was harvested. Many entries had excellent plant stature and good grain type.

OYT (Bhanga) Boro: A total of 131 advanced breeding lines were evaluated against three checks. Among them 53 most promising lines were selected for further evaluation. The growth duration of the materials varied from 132 days to 152 days. From each entry 2 m² area was harvested. Many entries had excellent plant stature and good grain type.

AYT (FBR): A total of 48 advanced breeding lines were evaluated against three checks. Among them

10 most promising lines were performed better than all the check varieties. The growth duration of the materials varied from 140 days to 145 days. From each entry 2 m² area was harvested. Many entries had excellent plant stature and good grain type.

RYT (FBR_Barishal): Five advanced breeding lines along with two check varieties viz. BRRI dhan74 and BRRI dhan102 were evaluated. Yield of all tested entries varied from 7.81-8.60 t/ha and growth duration varied from 147-153 days. Three test entries BRBaNGR994-1 (8.60 t/ha), BRBaNGR736-1 (8.35 t/ha) and BRBaNGR324-1 (8.33 t/ha) gave higher yield than both the checks BRRI dhan102 (8.14 t/ha) and BRRI dhan74 (8.05 t/ha) (Table 18).

Table 18. Grain yield and ancillary characters of RYT_FBR_Barishal at BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BRBaNGR324-1	99	148	8.33
BRBaNGR1256-1	106	147	7.81
BRBaNGR350-2	104	149	8.02
BRBaNGR736-1	107	154	8.35
BRBaNGR994-1	105	153	8.60
BRRI dhan74 (Ck)	102	148	8.05
BRRI dhan102 (Ck)	111	154	8.14
Mean	105	150	8.19
LSD _{0.05}	5.92	1.44	NS
CV (%)	1.98	0.63	4.35

RYT (FBR_SD): A total of ten advanced lines were evaluated against three check varieties BRRI dhan28, BRRI dhan88 and BRRI dhan102. Three advanced lines BR13027-BC1-3R-198 (8.60 t/ha), SVIN109 (8.46 t/ha) and BR13136-5R-165 (8.18 t/ha) produced higher yield than all the check varieties BRRI dhan102 (8.10 t/ha), BRRI dhan88 (7.61 t/ha) and BRRI dhan28 (6.43 t/ha) (Table 19).

Table 19. Grain yield and ancillary characters of RYT_FBR_SD at BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BR13141-5R-22	115.30	140	7.70
BR13418-5R-58	92.20	141	6.68
BR13418-5R-20	110.70	142	7.29
BR13136-5R-139	98.50	142	8.08
BR13136-5R-165	102.10	143	8.18
BR13418-5R-21	97.40	145	7.73
SVIN109	110.50	143	8.46
BR13027-BC1-3R-139	105.90	143	7.54
BR13027-BC1-3R-198	116.10	146	8.60
BR13153-5R-91	95.50	141	6.71
BRRI dhan28 (Ck)	102.40	140	6.43
BRRI dhan88 (Ck)	98.10	143	7.61
BRRI dhan102 (Ck)	111.10	153	8.10
Mean	104.30	143	7.62
LSD _{0.05}	9.42	1.09	0.93
CV (%)	3.02	0.54	4.07

RYT (FBR_MLD): A total of thirteen advanced lines were evaluated against two check varieties BRRI dhan92 and BRRI dhan102. Four advanced lines BR 12679-4R-6 (8.57 t/ha), BR 12672-4R-261 (8.47 t/ha), BR 12671-4R-138 (8.34 t/ha) and BR 12671-4R-312 (8.27 t/ha) produced higher yield than the check varieties BRRI dhan92 (8.18 t/ha), BRRI dhan102 (7.87 t/ha) (Table 20).

Table 20. Grain yield and ancillary characters of RYT_FBR_MLD at BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BR13418-5R-18	103.93	150	7.36
BR13137-5R-107	129.80	143	7.10
IR19A8188	114.60	152	7.41
IR19A8986	100.27	145	6.46
IR19A8263	137.60	150	7.34
IR12A173	108.13	146	6.14
BR 12679-4R-6	115.20	149	8.57
BR 12208-5R-403	96.73	145	8.10
BR 12671-4R-138	114.67	150	8.34
BR 12671-4R-312	111.80	150	8.27
BR 12672-4R-261	114.33	148	8.47
IR19A1473	103.07	158	7.90
BR11894-R-R-R-169	113.53	146	7.46
BRRI dhan102 (Ck)	110.27	153	7.87
BRRI dhan92 (Ck)	124.07	158	8.18
Mean	113.20	150	7.66
LSD _{0.05}	8.09	NS	0.81
CV (%)	2.36	0.68	3.5

RYT (FBR_MD): Regional yield trial consisting of eleven advanced lines were evaluated against three check varieties BRRI dhan88, BRRI dhan89 and BRRI dhan102. Two advanced lines BR13027-BC1-3R-76 (8.57 t/ha) and BR13027-BC1-3R-51 (8.46 t/ha) produced higher yield than all the check varieties BRRI dhan89 (8.20 t/ha), BRRI dhan102 (7.85 t/ha) and BRRI dhan88 (7.78 t/ha) (Table 21).

Table 21. Grain yield and ancillary characters of RYT_FBR_MD at BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BR13027-BC1-3R-51 (AYT-3)	109.07	145	8.13
BR13027-BC1-3R-21	118.87	146	7.72
BR13027-BC1-3R-76	103.47	146	8.57

Designation	PH (cm)	GD (Days)	Yield (t/ha)
IR18A1398	114.20	149	7.88
IR17A2922	110.67	147	7.75
BR11903-5R-56	108.60	143	7.07
BR13148-5R-12	109.67	145	7.59
BR12570-5R-66-3	116.40	153	7.55
BR13027-BC1-3R-24	113.27	148	7.94
BR13027-BC1-3R-51 (AYT-2)	110.60	145	8.46
IR19A9128	111.87	147	7.25
BRRi dhan88 (Ck)	96.73	142	7.78
BRRi dhan89 (Ck)	107.13	154	8.20
BRRi dhan102 (Ck)	108.93	151	7.85
Mean	109.96	147	7.84
LSD _{0.05}	6.77	NS	0.86
CV (%)	2.05	0.72	3.66

RYT (STR_1) Boro: Twenty advanced breeding lines along with four check varieties viz. BRRi dhan67, BRRi dhan89, BRRi dhan97 and BRRi dhan99 were evaluated. Yield of all test entries varied from 7.25-9.65 t/ha and growth duration varied from 154-158 days (Table 22). Fourteen advanced lines gave higher yield than all the

check varieties BRRi dhan67 (6.5 t/ha), BRRi dhan89 (8.3 t/ha), BRRi dhan97 (6.4 t/ha) and BRRi dhan99 (7.4 t/ha). The highest yield was found in BR13201-4R-15 (9.7 t/ha) followed by BR13201-4R-298 (9.2 t/ha) with 156 growth duration for both the entries.

Table 22. Grain yield and ancillary characters of RYT (STR_1), BRRi RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BR13205-4R-190	103	157	9.1
BR12274-4R-193	109	158	8.4
BR11276-4R-139	134	158	8.2
BR13201-4R-15	116	156	9.7
BR11276-4R-196	128	158	7.3
BR13201-4R-298	106	156	9.2
BR13201-4R-225	107	157	8.9
BR11276-6R-104	134	154	8.3
BR11720-6R-89	135	157	8.3
BR12650-6R-77	131	156	8.4
BR12645-4R-71	132	156	7.8
BR13207-4R-28	129	155	7.5
BR13201-4R-268	122	154	8.5

BR13201-4R-299	106	158	9.1
BR11718-4R-92	133	155	8.5
BR13201-4R-219	115	157	9.1
BR12640-4R-250	132	157	9.0
BR11276-4R-67	134	158	8.9
BR12661-4R-33	104	157	8.9
BR13201-4R-103	116	157	9.1
BRRi dhan67 (Std. Ck)	113	144	6.5
BRRi dhan89 (Std. Ck)	115	157	8.3
BRRi dhan99 (Std. Ck)	111	154	7.4
BRRi dhan97 (Res. Ck)	102	154	6.4
Mean	119	156	8.3
LSD _{0.05}	5.2	0.6	1.7
CV (%)	1.1	0.1	5.0

RYT (STR_2) Boro: Fifteen advanced breeding lines along with three check varieties viz. BRRi dhan67, BRRi dhan89 and BRRi dhan99 were evaluated. Yield of all test entries varied from 6.2-9.5 t/ha and growth duration varied from 153-157 days (Table 23). Five advanced lines BR13197-4R-

24 (9.3 t/ha), BR13201-4R-196 (9.5 t/ha), BR13206-4R-50 (8.8 t/ha), BR12274-6R-310 (9.0 t/ha), BR13106-4R-168 (8.5 t/ha) gave higher yield than all the check varieties BRRi dhan67 (6.7, t/ha), BRRi dhan89 (8.4 t/ha) and BRRi dhan99 (7.6 t/ha).

Table 23. Grain yield and ancillary characters of RYT (STR_2), BRRi RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BR13197-4R-24	115	156	9.3
BR13201-4R-30	100	153	8.1
BR13201-4R-249	118	157	8.1
BR12650-4R-55	121	156	8.0
BR13201-4R-196	98	159	9.5
BR12658-4R-255	110	155	7.0
BR13206-4R-50	120	155	8.8
BR12274-6R-310	112	157	9.0
BR11276-6R-150	107	157	6.6
BR11718-6R-110	104	156	6.2
BR11718-4R-125	128	154	8.0
BR12274-4R-255	102	155	6.6
BR13113-4R-121	114	153	7.6
BR13106-4R-168	102	157	8.5
BR11718-4R-230	119	157	8.4

BRRI dhan67	113	144	6.7
BRRI dhan89	115	157	8.4
BRRI dhan99	102	154	7.6
Mean	111	155	7.9
LSD _{0.05}	12.6	NS	1.4
CV (%)	2.8	-	4.4

RYT 1_SD-MD (BB and Blast) Boro: Twelve advanced lines were evaluated against one BB-resistant check variety BRRI dhan101 and one susceptible checks BRRI dhan88. Six advanced lines BR12904-4R-323, BR13174-4R-67, BR13178-4R-30, BR13178-4R-317, BR13180-4R-115 and BR13188-4R-170 gave higher yield (7.4, 8.1, 7.8, 7.8, 8.3 and 7.7 t/ha) than all the check varieties BRRI dhan88 and BRRI dhan101 (7.1 and 7.3 t/ha) (Table 24).

Table 24. Grain yield and ancillary characters of RYT 1_SD_MD (BB and Blast), BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BR12904-4R-323	120	146	7.4
BR13174-4R-67	110	146	8.1
BR13174-4R-131	107	147	7.3
BR13178-4R-30	116	146	7.8
BR13178-4R-61	107	144	7.0
BR13178-4R-177	132	145	5.3
BR13178-4R-317	132	145	7.8
BR13180-4R-234	115	151	6.8
BR13180-4R-115	120	149	8.3
BR13180-4R-117	121	151	6.4
BR13180-4R-259	117	153	6.6
BR13188-4R-170	121	146	7.7
BRRI dhan88 (Std. Ck)	100	141	7.1
BRRI dhan101 (Res. Ck)	117	142	7.3
Mean	117	147	7.2
LSD _{0.05}	30	NS	1.0
CV (%)	6.4	-	3.5

RYT 2_LD (BB) Boro: Fifteen advanced lines were evaluated against one BB-resistant check variety BRRI dhan101 and two susceptible checks BRRI dhan89 and BRRI dhan92. Three advanced lines BR1112904-4R-233 (9.16 t/ha), BR13174-4R-390 (8.94 t/ha), and BR13188-4R-170 (8.74 t/ha) gave higher yield than all the check varieties BRRI dhan89 (8.38 t/ha), BRRI dhan92 (8.64 t/ha) and BRRI dhan101 (7.7 t/ha) (Table 25).

Table 25. Grain yield and ancillary characters of RYT 2_LD (BB), BRRI RS, Bhanga, Faridpur, Boro 2024-25

Designation	PH (cm)	GD (Days)	Yield (t/ha)
BR11866-5R-277	114	150	7.28
BR1112904-4R-132	103	153	6.05
BR1112904-4R-219	107	152	5.66
BR1112904-4R-233	117	149	9.16
BR13174-4R-28	109	149	6.45
BR13174-4R-1	109	149	5.55
BR13174-4R-9	114	149	4.99
BR13174-4R-114	116	150	7.45
BR13174-4R-390	108	148	8.94
BR13178-4R-46	114	150	7.89
BR13180-4R-97	114	152	5.09
BR13180-4R-202	116	152	6.03
BR13188-4R-1	119	149	8.06
BR13188-4R-170	120	148	8.74
BR13188-4R-304	105	149	7.09
BRRI dhan89 (Std. Ck)	106	154	8.38
BRRI dhan92 (Std. Ck)	107	156	8.64
BRRI dhan101 (Res. Ck)	111	150	7.7
Mean	111	151	7.17
LSD _{0.05}	2.95	NS	1.25
CV (%)	0.65	-	4.28

CROP-SOIL-WATER MANAGEMENT

Experiment 1: Effect of planting time on the performance of modern Boro rice varieties in the Faridpur region

The experiment was conducted in Boro 2024-25 at the BRRI Regional Station, Bhanga. Newly released Boro varieties were evaluated along with the check in a time series of planting dates. During Boro Season, planting dates are 10 December, 25 December, 10 January, 25 January, 10 February, and 25 February with 15 days' interval. Forty days old seedlings were transplanted in the Boro season, and a 20 × 20 cm spacing was maintained. The unit plot size was 4m× 3m. These experiments were laid

down in a split-plot design with three replications, where planting date in the main plot and varieties were in subplots. The short-duration varieties were BRRI dhan88, BRRI dhan96, and BRRI dhan101, and the long-duration varieties were BRRI dhan89, BRRI dhan92, and BRRI dhan102. Standard management practices were followed for growing the crops.

Results: During Boro 2024-25 for short duration rice varieties, in 10 January transplanting, BRRI dhan101 produced higher grain yield with a growth duration of 150 days (Table 26). After 10 January transplanting grain yield decreases in rest of the planting dates. BRRI dhan88 gave a higher grain

yield from 25 January transplanting to 25 February. BRRI dhan96 obtained lower grain yield from 10 December to 25 January transplanting but in 10 February transplanting to 25 February, the lowest was found in BRRI dhan101 with a growth duration of 140 to 142 days (Table 26).

For long duration rice varieties in Boro season, in 10 January transplanting, BRRI dhan102 produced higher grain yield with growth duration of 158 days (Table 27). After 10 January transplanting grain yield decreasing in rest of the planting dates. BRRI dhan89 gave higher grain yield from 10 January transplanting to 10 February. BRRI dhan92 obtained lower grain yield in all planting dates (Table 27).

Experiment 2. Effect of planting time on the phenological development and yield performance of newly developed BRRI varieties in Faridpur region

Results: The weather data (temperature and rainfall) of Boro season 2024-2025 (1 November 2024 to 30 June 2025) at BRRI RS Bhanga is shown in the graph (Fig. 1). Maximum temperature was recorded in April while minimum was found in January. In case of rainfall, during Nov-March 2025 there was no rainfall while the highest was recorded in May 2025.

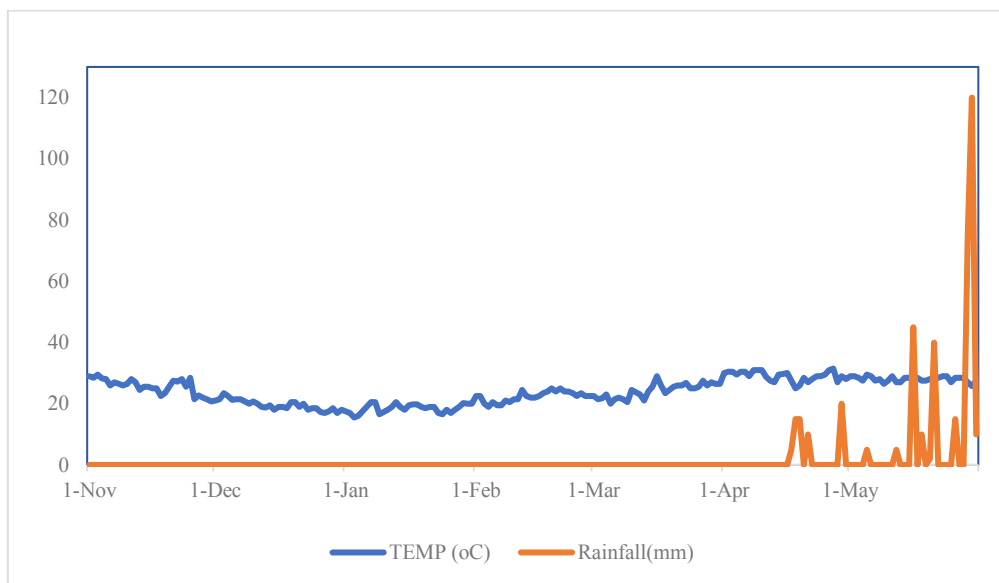


Figure 1. Weather data at BRRI RS Bhanga, Faridpur

For short-duration rice varieties in Boro season on 25th January transplanting of BRRI dhan88 produced higher grain yield (8.0 t/ha) with growth duration of 140 days (Table 28). After the 25th January transplanting grain yield decreased in the remaining planting dates (10th February and 25th February). BRRI dhan96 and BRRI dhan101 gave higher grain yield (7.63 and 8.13 t/ha) on 10th

January transplanting with 145 days and 150 days' growth duration, respectively (Table 28). Growth duration for all varieties decreased after 10th December transplanting (Table 28). Irrespective of variety, 10 to 25th January transplanting of short duration varieties performed better considering yield.

Table 26: Effect of planting time of short duration varieties on grain yield and growth duration, BRRI Bhanga, Boro 2024-25

Varieties	Date of transplanting											
	GY (t/ha)						Growth duration (Days)					
	10 th Dec	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb	10 th Dec	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb
BRRI dhan88	5.85	6.58	7.80	8.00	5.92	5.58	165	159	146	140	136	138
BRRI dhan96	5.32	5.62	7.63	7.42	5.11	3.94	167	160	145	142	137	140
BRRI dhan101	5.49	6.84	8.13	7.69	4.99	2.73	160	158	150	146	140	142
CV (plant. tim.) (%)				3.89						0.34		
CV (varieties) (%)				4.27						0.40		
HSD (0.05)				0.49						1.18		

For long-duration rice varieties in Boro season on 10th January transplanting of BRRI dhan102 produced higher grain yield with growth duration of 157 days (Table 2). After the 25th January transplanting grain yield decreased in remaining of

the planting dates. BRRI dhan89 and BRRI dhan92 gave higher grain yield from 10th January transplanting compared to 25th January (Table 2). Growth duration for all varieties decreased after 10th Dec transplanting (Table 2).

Table 27: Effect of planting time of long duration varieties on grain yield and growth duration, Boro 2024-25, BRRI Bhanga

Varieties	Date of transplanting											
	GY (t/ha)						Growth duration (Days)					
	10 th Dec	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb	10 th Dec	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb
BRRI dhan89	7.54	7.66	8.53	7.77	5.33	*	166	159	157	153	148	*
BRRI dhan92	7.78	7.64	8.43	7.29	5.84	*	165	163	160	157	153	*
BRRI dhan102	7.23	7.44	8.75	7.95	4.24	*	162	160	158	152	150	*
CV (plant. tim.) (%)				3.28						0.42		
CV (varieties) (%)				3.62						0.35		
HSD (0.05)				0.47						1.11		

*Due to heavy rainfall plants were inundated under water for that harvesting was not possible.

Conclusion: BRRI dhan101 and BRRI dhan102 transplanted on January 10 resulted in the highest grain yield for short and long-duration rice varieties, respectively.

RICE FARMING SYSTEMS RESEARCH

Experiment 1: Evaluation of different Aman rice varieties under Wheat-Jute-T. Aman cropping pattern in Faridpur region

The study was conducted in farmers' field at Pirerchar, Bhanga, Faridpur during 2024-25 to find

out the suitability of newly released Aman rice varieties under Wheat-Jute-T. Aman cropping pattern and increase system productivity. The tested cropping patterns were: CP₁: Wheat-Jute-T. Aman (BRRI dhan71), CP₂: Wheat-Jute-T. Aman (BRRI dhan75), CP₃: Wheat-Jute-T. Aman (BRRI dhan87), CP₄: Wheat-Jute-T. Aman (BRRI dhan103), CP₅: Wheat-Jute-T. Aman (BRRI hybrid dhan6) and CP₆: Wheat-Jute-T. Aman (BRRI dhan39) (Ck) in RCB design and dispersed farmers were considered as replication. Recommended

fertilizer doses and other recommended management practices for rice and non-rice crops were followed. To compare system productivity, yield of non-rice crops was converted to rice equivalent yield (REY).

Results: Individual crop yield and REY of respective cropping patterns are presented in Table 30. Considering the REY, there were significant difference ($P \leq 0.01$) among the cropping patterns. The highest REY (18.32 t/ha) was observed in CP₄: Wheat-Jute-T. Aman (BRRI dhan103) which is statistically similar with the CP₃: Wheat-Jute-T. Aman (BRRI dhan87) (18.04 t/ha). CP₂: Wheat-Jute-T. Aman (BRRI dhan75) and CP₁: Wheat-Jute-

T. Aman (BRRI dhan71) resulted statistically similar REY 17.49 and 17.22 t/ha, respectively. The lowest significant REY (16.65 t/ha) was found from CP₆: Wheat-Jute-T. Aman (BRRI dhan39) which is statistically similar to CP₅: Wheat-Jute-T. Aman (BRRI hybrid dhan6) (Table 30). From the economic analysis it was observed that the highest gross margin (GM) was obtained from CP₄ (2,61,000 Tk/ha) followed by CP₃ (2,52,730 Tk/ha) and CP₂ (2,36,400 Tk/ha) (Table 31). The lowest GM was observed in CP₆ (2,10,900 Tk/ha). The pattern CP₄, CP₃ and CP₂ gave 23.76%, 19.84% and 12.09% higher GM compared to the existing pattern CP₆ (Table 31).

Table 30. Individual crops yield and REY of respective cropping patterns under Wheat-Jute-T. Aman cropping pattern, Bhanga, Faridpur, 2024-25

Treatment	Yield (t/ha)			REY (t/ha)
	Wheat	Jute	T. Aman	
CP ₁	3.45	3.25	5.10	17.22bc
CP ₂	3.42	3.29	5.31	17.49abc
CP ₃	3.50	3.33	5.67	18.04ab
CP ₄	3.44	3.32	6.02	18.32a
CP ₅	3.45	3.29	5.90	17.14c
CP ₆ (ck)	3.44	3.27	4.49	16.65c
CV (%)	1.72			

Means with the same letter are not significantly different.

Table 31. Cost-return analysis of different crop combinations under Wheat-Jute-T. Aman cropping system, Bhanga, Faridpur, 2024-25

Treatment	GR ('000 Tk)	TVC ('000 Tk)	GM ('000 Tk)	% GM increase
CP ₁	516.50	288.50	228.00	8.11
CP ₂	524.90	288.50	236.40	12.09
CP ₃	541.23	288.50	252.73	19.84
CP ₄	549.50	288.50	261.00	23.76
CP ₅	514.12	288.50	225.62	6.98
CP ₆ (ck)	499.40	288.50	210.90	-

Market price: Wheat: 30 Tk/Kg, Jute: 80 Tk/Kg and Rice: 30 Tk/Kg.

Experiment 2: Fine tuning of the improved cropping pattern technology Lentil+Muskmelon-Jute-T. Aman in Faridpur region

The study was conducted in farmers' field at Pirerchar, Bhanga, Faridpur during 2024-25 to increase the system productivity and farmers' income under Lentil-Jute-T. Aman cropping pattern. The tested cropping patterns were: CP₁: Lentil+M. Melon-Jute-T. Aman (BRRI dhan71), CP₂: Lentil+M. Melon-Jute-T. Aman (BRRI dhan75), CP₃: Lentil+M. Melon-Jute-T. Aman (BRRI dhan90) and CP₄: Lentil-Jute-T. Aman (Ck) in RCB design and dispersed farmers were considered as replication. Recommended fertilizer doses and other recommended management practices for rice and non-rice crops were followed. To compare system productivity, yield of non-rice crops was converted to rice equivalent yield (REY).

Results: Individual crop yield and REY of the respective cropping patterns are shown in Table 32. Considering the REY, there were significant difference ($P \leq 0.01$) among the cropping patterns.

All the tested cropping patterns (CP₁: Lentil+M. Melon-Jute-T. Aman (BRRI dhan71), CP₂: Lentil+M. Melon-Jute-T. Aman (BRRI dhan75), CP₃: Lentil+M. Melon-Jute-T. Aman (BRRI dhan90) produced statistically similar REY 25.20, 25.77 and 24.80 t/ha, respectively (Table 32) which are statistically higher than the existing CP₄: Lentil-Jute-T. Aman (BRRI dhan39) cropping pattern. The lowest REY (17.74 t/ha) was obtained from CP₄: Lentil-Jute-T. Aman (Ck) and the highest REY (25.77 t/ha) was found in CP₂: Lentil+M. Melon-Jute-T. Aman (BRRI dhan75) cropping pattern. From the economic analysis it was observed that the highest gross margin (GM) was obtained from CP₂ (4,05,070 Tk/ha) followed by CP₃ (3,87,830 Tk/ha) and CP₁ (3,76,070 Tk/ha) (Table 33). The lowest GM was observed in CP₄ (2,42,210 Tk/ha). The pattern CP₂, CP₃ and CP₁ gave 67.24%, 60.12% and 55.26% higher GM compared to the existing pattern CP₄. The highest marginal benefit-cost ratio (MBCR) was found in CP₂ (3.08) followed by CP₃ (2.86) and CP₁ (2.71) (Table 33)

Table 32. Individual crops yield and REY of respective cropping patterns under Lentil+M. Melon-Jute-T. Aman cropping pattern, Bhanga, Faridpur, 2024-25

Treatment	Yield (t/ha)				REY (t/ha)
	Lentil	M. Melon	Jute	T. Aman	
CP ₁	2.02	10.00	3.24	5.11	24.80a
CP ₂	2.07	10.87	3.29	5.34	25.77a
CP ₃	1.98	11.50	3.31	4.67	25.20a
CP ₄ (ck)	1.38	-	3.42	4.47	17.74b
CV (%)	2.31				

Table 33. Cost-return analysis of different crops combinations under Lentil+M. Melon-Jute-T. Aman cropping system, Bhanga, Faridpur, 2024-25

Treatment	GR ('000 Tk)	TVC ('000 Tk)	GM ('000 Tk)	% GM increase	MBCR
CP ₁	744.10	368.03	376.07	55.26	2.71
CP ₂	773.10	368.03	405.07	67.24	3.08
CP ₃	755.87	368.03	387.83	60.12	2.86
CP ₄	532.07	289.86	242.21	-	-
Market price: Lentil: 90 Tk/Kg, M. Melon: 15 Tk/Kg, Jute: 80 Tk/Kg and Rice: 30 Tk/Kg					

SOCIO ECONOMICS AND POLICY

Experiment 1: Stability of yield of BRRI released Aman varieties, T. Aman 2024

Results: For short duration Aman varieties, the highest grain yield was found in BRRI dhan95 (5.44 t/ha) followed by BRRI dhan73 (5.07 t/ha), BRRI hybrid dhan6 (4.87 t/ha), and BRRI dhan75 (4.71 t/ha). BRRI dhan62 produced the lowest yield (3.12 t/ha) among the

short duration T. Aman rice varieties (Table 34). In medium duration Aman varieties, based on yield, BRRI dhan72 gave the highest grain yield 5.19 t/ha followed by BRRI dhan103 (5.02 t/ha), BRRI dhan70 (4.51 t/ha) and BRRI dhan78 (4.46 t/ha) (Table 35). In long duration T. Aman varieties, BR22 yielded higher (3.60 t/ha) followed by BR10 (3.59 t/ha), BRRI dhan46 (3.58 t/ha) and BRRI dhan41 (3.49 t/ha) whereas BRRI dhan91 produced the lowest grain yield (2.73 t/ha) (Table 36).

Table 34. Grain yield and growth duration of BRRI released short duration T. Aman varieties under stability analysis, BRRI RS, Bhanga, T. Aman 2024

Varieties	GD (Days)	Yield (t/ha)
BRRI dhan33	117	3.77
BRRI dhan39	122	4.49
BRRI dhan53	124	4.44
BRRI dhan56	113	3.57
BRRI dhan57	113	3.42
BRRI dhan62	113	3.12
BRRI dhan66	116	3.54
BRRI dhan71	115	4.41
BRRI dhan73	123	5.07
BRRI dhan75	114	4.71
BRRI dhan87	129	4.9
BRRI dhan90	124	4.1
BRRI dhan95	122	5.44
BRRI hybrid dhan4	120	4.17
BRRI hybrid dhan6	118	4.87
Mean	118	4.27
LSD (0.05)	4.37	0.71
CV (%)	1.22	5.46

Table 35. Grain yield and growth duration of BRRI released medium duration T. Aman varieties under stability analysis, BRRI RS, Bhanga, T. Aman 2024

Varieties	GD (Days)	Yield (t/ha)
BR3	139	3.72
BR4	139	3.61
BR11	139	3.88
BR25	136	3.88

Varieties	GD (Days)	Yield (t/ha)
BRRI dhan30	140	3.9
BRRI dhan31	137	3.41
BRRI dhan32	133	3.44
BRRI dhan40	145	4.05
BRRI dhan44	139	3.85
BRRI dhan49	132	4.38
BRRI dhan51	139	3.51
BRRI dhan52	137	3.42
BRRI dhan54	134	4.28
BRRI dhan70	126	4.51
BRRI dhan72	126	5.19
BRRI dhan77	155	3.56
BRRI dhan78	137	4.46
BRRI dhan79	132	4.14
BRRI dhan80	133	3.84
BRRI dhan93	137	3.81
BRRI dhan94	137	3.82
BRRI dhan103	130	5.02
Mean	136	3.99
LSD	5.36	1.06
CV (%)	1.26	8.54

Table 36. Grain yield and growth duration of BRRI released long duration T. Aman varieties under stability analysis, BRRI RS, Bhanga, T. Aman 2024

Varieties	GD (Days)	Yield (t/ha)
BR5	153	3.21
BR10	144	3.59
BR22	153	3.60
BR23	155	3.14
BRRI dhan34	139	2.97
BRRI dhan37	141	2.83
BRRI dhan38	142	3.29
BRRI dhan41	140	3.49
BRRI dhan46	152	3.58
BRRI dhan76	163	3.09
BRRI dhan91	154	2.73
Mean	149	3.23
LSD	4.26	0.75
CV (%)	0.98	7.9

Experiment 2: Stability analysis of BRRI released Boro varieties, Boro 2024-25

Results: In Boro season 2024-25, among the short duration varieties, the highest yield was found in BRRI hybrid dhan8 (9.33 t/ha) followed by BRRI hybrid dhan5 (9.03 t/ha), BRRI hybrid dhan3 (8.68

t/ha), BRRI hybrid dhan2 (7.72 t/ha) and BRRI dhan101 (7.28 t/ha) (Table 37). In long duration Boro varieties, BRRI dhan92 produced the highest (8.57 t/ha) yield followed by BRRI dhan99 (8.47 t/ha) and BRRI dhan89 (7.94 t/ha), respectively (Table 38).

Table 37. Grain yield and agronomic characters of BRRI released short duration Boro varieties under stability analysis in Boro, 2024-25 at BRRI RS, Bhanga, Faridpur

Varieties	GD (Days)	Yield (t/ha)
BR1	150	5.27
BR6	153	4.96
BR26	142	6.00
BRRI dhan27	157	5.16
BRRI dhan28	141	5.99
BRRI dhan36	142	5.25
BRRI dhan45	141	5.82
BRRI dhan55	149	5.93
BRRI dhan61	152	5.72
BRRI dhan63	146	6.66
BRRI dhan67	145	6.02
BRRI dhan68	150	6.26
BRRI dhan74	147	6.88
BRRI dhan81	142	6.48
BRRI dhan84	142	6.47
BRRI dhan86	142	5.67
BRRI dhan88	143	6.25
BRRI dhan96	144	6.32
Bangabandhu dhan100	147	7.23
BRRI dhan101	145	7.28
BRRI dhan104	148	7.16
BRRI dhan105	147	7.25
BRRI hybrid dhan2	147	7.72
BRRI hybrid dhan3	145	8.68
BRRI hybrid dhan5	146	9.03
BRRI hybrid dhan8	147	9.33
Mean	146.17	6.57
LSD (0.05)	3.83	0.92
CV (%)	0.82	4.38

Table 38. Grain yield and agronomic characters of BRRI released long duration Boro varieties under stability analysis in Boro, 2024-25 at BRRI RS, Bhanga, Faridpur

Varieties	GD (Days)	Yield (t/ha)
BR2	159	5.99
BR3	169	6.26
BR7	148	5.46
BR8	162	5.14
BR9	159	6.15
BR12	168	6.36
BR14	156	6.24
BR15	164	6.06
BR16	160	6.42
BR17	157	4.86
BR18	169	6.31
BR19	169	6.35
BRRI dhan29	161	7.92
BRRI dhan35	155	6.29
BRRI dhan47	148	6.35
BRRI dhan50	156	6.08
BRRI dhan58	151	7.32
BRRI dhan59	147	6.60
BRRI dhan60	146	6.42
BRRI dhan64	154	5.83
BRRI dhan69	153	6.84
BRRI dhan89	157	7.94
BRRI dhan92	163	8.57
BRRI dhan97	152	6.79
BRRI dhan99	155	8.47
BRRI dhan102	148	7.32
Mean	157.15	6.55
LSD	3.94	0.94
CV (%)	0.79	4.51

TECHNOLOGY TRANSFER

Demonstrations of modern rice varieties during Aus 2024, T. Aman 2024, and Boro 2024-25 were conducted at Faridpur, Madaripur, Shariatpur, and Rajbari districts with the financial assistance of GoB, PARTNER, LSTD, and the Hybrid project.

GoB demonstrations 2024-25:

In Aus 2024, total 50 demonstrations were established under the supervision of BRRI RS, Bhanga. Newly released high yielding varieties BRRI dhan83 and BRRI dhan98 were used. Yield of BRRI dhan83 varied from 4.10-4.65 t/ha with the average of 4.18 t/ha. Yield of BRRI dhan98

varied from 4.34-5.96 t/ha with the average of 5.15 t/ha (Table 39).

Similarly, in T. Aman 2024, total 60 demonstrations were carried out using BRRI dhan75 and BRRI dhan87. Yield of BRRI dhan75 varied from 4.07-5.72 t/ha with the average of 4.89 t/ha.

Yield of BRRI dhan87 varied from 4.78-5.94 t/ha with the average of 5.73 t/ha (Table 39).

In Boro 2024-25, a total of ten varieties such as BRRI dhan88, BRRI dhan89, BRRI dhan92, BRRI dhan96, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107, BRRI dhan108 and BRRI hybrid dhan5 were included in 225 demonstrations at seven upazilas of four districts namely Faridpur, Shariatpur, Madaripur and Rajbari under BRRI RS, Bhanga. Total 225 crop cuts were done in different upazilas. Among the demonstrated varieties the grain yield was found 7.71, 8.14, 8.22, 6.90, 8.13, 7.21, 7.05, 7.62, 8.18 and 8.80 t/ha in BRRI dhan88, BRRI dhan89, BRRI dhan92, BRRI dhan96, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107, BRRI dhan108 and BRRI hybrid dhan5, respectively (Table 39). The trial farmers stored their seeds according to their demands for growing in the next Boro season.

PARTNER demonstrations 2024-25: Under PARTNER project demonstration, during Aman 2024, 120 demonstrations were conducted using BRRI dhan103 at different upazilas of Faridpur, Madaripur and Shariatpur districts. The average yield and growth duration was 6.14 t/ha and 133 days, respectively (Table 40). During Boro 2024-25, a total of 420 demonstrations using six different Boro rice varieties viz., BRRI dhan101, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107 and BRRI dhan108 were conducted at eight different upazilas of Faridpur, Madaripur and Shariatpur districts. Among the trial varieties, BRRI dhan102 produced the highest average grain yield (8.21 t/ha) with 149 days' growth duration

followed by BRRI dhan108 (7.97 t/ha) and BRRI dhan101 (7.69 t/ha). The lowest average grain yield was found in BRRI dhan104 (7.35 t/ha) with 148 days' growth duration (Table 40).

LSTD demonstrations 2024-25: Under LSTD project demonstration trials, in Aman 2024, the highest average grain yield was found in BRRI dhan103 (6.04 t/ha) with the average growth duration of 133 days followed by BRRI dhan87 (5.64 t/ha) (Table 41). During Boro 2024-25, BRRI dhan92 produced the highest average grain yield (8.17 t/ha) with 158 days' growth duration followed by BRRI dhan102 (8.01 t/ha) and BRRI dhan89 (7.93 t/ha). BRRI dhan105 produced the lowest average grain yield (7.35 t/ha) with 149 days of growth duration (Table 41).

Hybrid demonstrations 2024-25: Under Hybrid project demonstration trials, in Aman 2024, a total of 20 demonstrations were conducted using BRRI hybrid dhan6. The average yield and growth duration was found 5.69 t/ha and 121 days', respectively (Table 42). In Boro 2024-25, BRRI hybrid dhan5 and BRRI hybrid dhan8 were demonstrated at 20 different farmers field. BRRI hybrid dhan8 yielded 9.20 t/ha with 147 days' growth duration whereas BRRI hybrid dhan5 produced average grain yield of 8.45 t/ha with 143 days' growth duration (Table 42).

Training and Field day's: Four hundred seventeen farmers along with thirty-three SAAO's of greater Faridpur region were trained on modern rice production technologies through 15 training programs in BRRI RS, Bhanga with the cooperation of DAE and the financial assistance of GOB and PARTNER project. A total of 20 field days were conducted of which 10, 03, 03 and 04 was funded by GoB, PARTNER, LSTD and Hybrid rice project, respectively (Table 43). Through field days' farmers were able to get information about newly released rice varieties and relevant modern technologies.

Table 39. Performance of BRRI released high yielding Aus, Aman and Boro rice varieties in Faridpur region under BRRI R/S, Bhanga, 2024-25

Season	Variety	No. of trials	Avg. GD (Days)	Avg. Yield (t/ha)
Aus 2024	BRRI dhan83	20	106	4.18
	BRRI dhan98	30	112	5.15
Aman 2024	BRRI dhan75	25	115	4.89
	BRRI dhan87	35	127	5.73
Boro 2024-25	BRRI dhan88	5	142	7.71
	BRRI dhan89	26	156	8.14
	BRRI dhan92	37	160	8.22
	BRRI dhan96	5	143	6.90
	BRRI dhan102	37	151	8.13
	BRRI dhan104	14	148	7.21
	BRRI dhan105	21	150	7.05
	BRRI dhan107	40	148	7.62
	BRRI dhan108	35	150	8.18
	BRRI hybrid dhan5	5	144	8.80

Table 40. Yield and growth duration of the demonstration trials of BRRI varieties during Aman and Boro season under PARTNER project, BRRI RS Bhanga, 2024-25

Season	Variety	No. of trials	Avg. GD (Days)	Avg. Yield (t/ha)
Aman 2024	BRRI dhan103	120	133	6.14
Boro 2024-25	BRRI dhan101	37	151	7.69
	BRRI dhan102	194	149	8.21
	BRRI dhan104	64	148	7.35
	BRRI dhan105	63	150	7.45
	BRRI dhan107	32	147	7.64
	BRRI dhan108	30	151	7.97

Table 41. Demonstrations of modern rice varieties during Aman and Boro season at Faridpur region (LSTD project) under BRRI RS, Bhanga, 2024-25

Season	Variety	No. of trials	Avg. GD (Days)	Avg. Yield (t/ha)
Aman 2024	BRRI dhan75	20	117	4.65
	BRRI dhan87	27	129	5.64
	BRRI dhan103	13	133	6.04
Boro 2024-25	BRRI dhan89	9	155	7.93
	BRRI dhan92	9	158	8.17
	BRRI dhan102	14	152	8.01
	BRRI dhan105	9	149	7.35
	BRRI dhan107	9	149	7.68

Table 42. Demonstrations of BRRI hybrid rice varieties during Aman and Boro season at Faridpur region (Hybrid project) under BRRI RS, Bhanga, 2024-25

Season	Variety	No. of trials	Avg. GD (Days)	Avg. Yield (t/ha)
Aman 2024	BRRI hybrid dhan6	20	121	5.69
Boro 2024-25	BRRI hybrid dhan5	10	143	8.45
	BRRI hybrid dhan8	10	147	9.20

Table 43. Farmers' training and field day's conducted by BRRI RS, Bhanga during 2024-25

Funding source	No. of Training	Participating farmers	Participating SAAO/SA	No. of Field days
GoB	11	297	33	10
PARTNER	4	120	-	3
LSTD	-	-	-	3
Hybrid Project	-	-	-	4
Total	15	417	33	20

BRRI RS, Cumilla

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SUMMARY

Varietal Development (Plant Breeding Division)

Varietal Development (Plant Breeding Division)

BRRI Regional Station, Cumilla is implementing a comprehensive breeding programme aimed to developing high-yielding, photosensitive, and disease and insect resistant rice varieties for the T. Aman season, as well as high-yielding favorable rice varieties suitable for the Boro season. To achieve the goal, in T. Aman 2024 season, 19 crosses were made. A total of 17 crosses were confirmed in T. Aman 2024 season. In total, 1500, 4000, 7000, 10000 and 19500 plants were advanced in F₂ F₃, F₄, F₅ and F₆ generations respectively through FRGA method. In LST, a total of 150 plants were selected from 18 crosses to conduct observational yield trial (OYT). Seventeen (17) and three genotypes were selected from OYT (Cum) and PYT (Cum) trial respectively. Eighteen crosses were made during Boro 2024-25 season and 16 crosses were confirmed. Total 1976, 3721, 2829, 896 and 236 plants were advanced from F₂ F₃, F₄, F₅ and F₆ generations respectively in Boro season through FRGA method. In LST, total 130 plants were selected from 13 crosses to carry out OYT. In total 24, 12, and two entries were performed better than check varieties in OYT (Cum), PYT (Cum), and AYT(Cum) trial respectively. During Aus 2024 season, in OYT#T. Aus 21 genotypes, in AYT#T. Aus, 11 genotypes, in RYT#1 (T. Aus) three genotypes and in RYT#3 (Tungro) four and in RYT# Upland Aus three entries were performed better and gave higher yield than check varieties.

Under PARTNER-BRRI project, four, five, two, two, two, two, three, and two performed better than check varieties in RYT#1 (RLR), RYT#2 (RLR), RYT#3 (RLR), RYT#4 (RLR), RYT#ZER, RYT#SD (Bio), RYT#PS (Bio), RYT# Rangpur trial respectively. On the other hand, none of the tested entries performed better in the RYT#ZER and RYT#AER in T. Aman 2024 season. In case of OYTs, 18 and 45 entries performed better than check varieties in OYT#1 (RLR) and OYT#ZER respectively. While in AYT# Eight, four and 10 entries showed better performance than the check

varieties in AYT#1(RLR), AYT#2 (RLR) and AYT#ZER trial respectively. Under IRRI_NARES Trial, 25 and 10 entries performed better than check varieties in Stage-1 and Stage-2 trial respectively during T. Aman 2024 season. The trial heritability obtained from yield was 53% in IRRI-NARES Trial (Stage-1) trial 71% in IRRI-NARES Trial (Stage-2).

During Boro 2024-25 season, a total of 30 genotypes showed better performance than standard check varieties in different RYTs such as RYT#1 (STR), RYT#2 (STR), RYT#PQR, RYT#FBR(SD), RYT#FBR(MD), RYT#FBR(MLD), RYT#ZER, and RYT#FBR(Barishal) trial respectively whereas none of the tested entries performed better than the check varieties in RYT#DRR(SD), RYT#DRR(LD), RYT#Rangpur, RYT#Pigmented rice and RYT#EMF. One RYT trial named RYT#Bio for blast resistant rice variety development was conducted in two locations: BRRI Cumilla Research farm and Debidwar, Cumilla. None of the entries performed better than the check varieties at research farm whereas one entry performed better than the check varieties at farmer's field in Debidwar, Cumilla. On the other hand, 79, 39, 114, 14, 12, 1 and 2 entries exhibited better performance than check varieties in OYT#1(ZER), OYT#2 (ZER), OYT#IRR, PYT (IRR), AYT#1 (ZER), AYT#2 (ZER), and AYT#IRR trial respectively during Boro 2024-25 season. Under IRRI-NARES Trial project, in IRRI-NARES Trial (Stage-1 and Stage-2), none of the tested entries performed better than check varieties in Boro 2024-25 season. The highest yield obtained from the check variety BRRI hybrid dhan8 (10.02 tha⁻¹ and 8.57 tha⁻¹) in both Stage-1 and Stage-2 trial respectively. Under RCGS_BRRI project, in OYT#FBC trial, 62 entries performed better than check varieties in Boro 2024-25 season.

Digital disease survey was conducted from 740 spots (T. Aman) of six Upazilla; and 440 spots (Boro) of 7 Upazilla in Cumilla district using ODK mobile Apps. The major rice diseases of Leaf blast, neck blast, sheath blight, bacterial blight, false smut, sheath rot and brown spot were observed in Aman and Boro seasons. One new viral disease rice

ragged stunt was also observed. Rice yield loss was saved 78-90 % (T. Aman) and 64-92 % (Boro) by following neck blast disease management technology. Disease was not found in the BRRI Technology-followed-rice fields. In Nangalkot, tungro disease was found during Aus, Aman and Boro 2024-25 seasons, respectively in the farmers practice plots. Spray fungicide at MT & Booting stage was found effective for controlling rice sheath blight disease. Twelve new fungicides were found effective to control rice sheath blight. Fifty-nine tungro resistance advanced lines were found resistant to rice tungro disease.

In, T. Aman 2024, due to heavy rainfall and flash flood all experiment were destroyed in seedling and tillering stage. In Boro 2024-25 season, grain yield and growth duration of short duration varieties showed less difference irrespective of sowing dates. On the other hand, long duration variety BRRI dhan102 produced significantly higher yield (8.68 t ha^{-1}) up to 25 December of transplantation. Basal application of potassium produced highest number of grains yield. Three split Urea produced maximum yield (7.5 t ha^{-1}) in BRRI dhan104. Two-third N splitting with additional 20 kg/ha MOP produced better in older seedling than three splitting. Omission of Nitrogen from complete treatment had a significant for getting grain and straw yield. In Boro 2024-25 season, 30 kg/ha rate of P produced highest grain yield (7.14 t ha^{-1}) of BRRI dhan88. Among the nitrogen doses, 175 kg/ha of N produced highest grain yield (7.57 t ha^{-1}) of BRRI dhan89 during boro 2024-25 season.

Stability Analysis of BRRI developed rice varieties was conducted at the research field at BRRI Cumilla. During Aus, BRRI Hybrid dhan7 (6.99 t ha^{-1}) and during Boro, BRRI BRRI hybrid dhan8 (10.07 t ha^{-1}) gave highest yield.

In Boro-Fallow-T. Aman, 2nd crop (Boro) BRRI dhan96 gave highest yield (7.07 t ha^{-1}) in CP₃. In Boro- Aus-T. Aman, 1st crop (Rabi season) BRRI dhan88 gave highest yield (7.61 t ha^{-1}) in CP₂. T. Aman field fully damaged by flood.

A total of 687 farmers and 63 SAAOs were trained up about rice cultivation and technologies. Twenty-

six field days were conducted and about 2600 farmers were benefited about new rice varieties. Total 32.804 tons TLS, 41.2 tons of certified and 24.725 tons breeder seeds were produced during 2024-25.

RESULTS

VARIETAL DEVELOPMENT PROGRAM AREA

During T. Aus 2024 season in OYT#1 for T. Aus, 21 entries were performed better and gave higher yield than check varieties. In AYT#T. Aus, 11 entries were performed better and given higher yield than check. In RYT#1, three entries were performed better and given higher yield than check varieties and in RYT#3 (Tungro), four entries were performed better and given higher yield than check varieties. In RYT#Upland Aus three entries were performed better and given higher yield than the check varieties. Expected yield was not obtained due to stagnant flooding conditions at maturity stage in T. Aus 2024 season.

During T. Aman 2024 season, 19 crosses were made (**Table 1**). A total of 17 crosses were confirmed in T. Aman 2024 season. A total of 1500, 4000, 7000, 10000 and 19500 individuals were advanced from F₂, F₃, F₄, F₅ and F₆ generation through FRGA method and in LST total 150 plants were selected from 18 crosses. In total 17 entries out of 140 entries were selected over the highest yielded check variety i.e.: BRRI Dhan49 (3.12 t/ha). The yield range of the tested entries was 0.45-3.84 t/ha and highest yield obtained from the genotype BRC633-4R-455 (3.84 (t/ha)) with a growth duration of 144 days. In PYT#Cumilla, three entries were selected over the highest yielded check variety i.e.: BRRI dhan49 (2.97 t/ha). BRC633-2-1-3-1 (3.39 t/ha), BRC641-3-3-2-1 (3.52 t/ha) and BRC642-5-3-2-3 (3.49 t/ha) genotypes were found to be outyielded with a growth duration of 149, 135 and 142 days respectively. Due to heavy rainfall and flash floods, the experimental fields were submerged from 19 to 28 August 2024, in T. Aman 2024 season and that's why satisfactory yield could not be found.

Table 1: List of F₁ seeds produced in T. Aman 2024

Cross combination	No. of seeds
BRC368-2-2-3-2-4/BR13111-4R-191	75
BRC575-9-3-2-1/BR13103-4R-37	113
BRC578-4-3-4-1/BR13111-4R-191	20
BRC636-2-3-1-2/BR13103-4R-37	18
BRC636-2-3-1-2/Utrimerah 16682	62
BRC3682-2-3-2-4/Utrimerah 16682	21
IR1-DQ125-L2-D2/BR12001-6R-205	65
BRC633-2-1-3-1/BR11227-6R-98	28
BRC575-9-3-2-1/BR22	23
BRC575-9-3-2-1/BR23	26
BRC578-4-3-4-1/BR12001-6R-205	10
IR1-DQ125-L2-D2/BR13111-4R-191	48
BRC368-2-2-3-2-4/BR10212-17-3-2-2	51
BRC575-9-3-2-1/BR10212-4-3-1	21
BRC575-9-3-2-1/BR11227-6R-98	26
BRC633-2-1-3-1/Utrimerah 16682	87
IR1-DQ125-L2-D2/ BR13103-4R-37	82
IR1-DQ125-L2-D2/BR11227-6R-98	104
BRC575-9-3-2-1/BR13111-4R-191	100
Total	981

Under PARTNER-BRRI project, Four, five, two, two, two, two, three, and two performed better than check varieties in RYT#1(RLR), RYT#2 (RLR), RYT#3 (RLR), RYT#4 (RLR), RYT#ZER, RYT#SD(Bio), RYT#PS(Bio), Rangpur trial respectively. On the other hand, none of the tested entries performed better in the RYT#ZER and RYT#AER. In case of OYTs 18 and 45 entries performed better than check varieties in OYT#1 (RLR) and OYT#ZER respectively. While in AYT# Eight, Four and 10 entries performed better than the check varieties in AYT#1(RLR), AYT#2 (RLR) and AYT#ZER trial respectively during T. Aman 2024 season.

Under IRRI-NARES Trial project, 25 and 10 entries performed better than check varieties in IRRI-NARES Trial (stage-1) and IRRI-NARES Trial (stage-2) trial respectively during T. Aman 2024 season. The heritability obtained from yield

was 53% in IRRI-NARES Trial (Stage-1) trial 71% in IRRI-NARES Trial (Stage-2). Due to heavy rainfall and flash flooding, the experimental fields remained submerged from August 19 to 28, 2024, during the T. Aman 2024 season. As a result, satisfactory yield could not be achieved.

Investigators: A. K. M. Shalahuddin, MR Islam and KM Iftekharuddaula

In Boro 2023-24 season, 18 crosses were made (Table 2). A total of 16 crosses were confirmed. Total 1976, 3721, 2829, 896 and 236 plants were advanced from F₂ F₃, F₄, F₅ and F₆ generation through FRGA method. In LST, total 130 plants were selected from 13 crosses. In OYT# Cumilla, 24 out of 214 entries were performed better than check varieties. The yield ranged from 2.58-9.41t/ha and the genotype BRC658-5R-66 gave the highest yield (9.41 t/ha) with a growth duration of 138 days. The highest yielded check variety was

BRRi dhan102 (7.11t/ha). In PYT# Cumilla, out of 23 genotypes, 12 genotypes were produced higher yield than check variety BRRi dhan102 (6.66 t/ha). The yield ranged from 4.44-9.28 t/ha and the highest yield obtained from the genotype BRC673-4-3-2-3 (9.28 t/ha) with a growth duration of 147 days. In AYT#Cumilla, two genotypes out of 15 genotypes gave better performance than the check

variety BRRi dhan102 (7.12 t/ha). The genotypes BRC602-9-4-4-1(8.17t/ha) produced the highest yield followed by BRC594-15-4-4-2(8.05t/ha) with a growth duration of 154 and 150 days respectively. The heritability obtained from yield in AYT (Cum) was 78% indicating high level of precision of this experiment.

Table 2: List of F₁ seeds produced through hybridization in Boro 2024-25

Cross combination	No. of Seeds
BRC472-19-1-1-B1/BR12682-4R-50	10
BRC491-5-2-1-B3/BR12682-4R-50	29
BRC546-5-1-5/BR12682-4R-50	70
BRC480-2-1-1-2/BR12520-5R-67	82
BRC626-4R-228/BR11318-5R-148	188
BRC602-9-4-4-1/BR11318-5R-148	45
BRC594-15-4-4-2/BR11318-5R-148	103
BRC472-19-1-1-B1/BR13027-BC1-3R-77	38
BRC480-2-1-1-2/BR13027-BC1-3R-77	70
BRC588-4R-71/BR7528-2R-19-16-RIL-59	47
BRC472-19-1-1-B1/BR11869-5R-148	8
BRC491-5-2-1-B3/BR11869-5R-148	6
BRC546-5-1-5/BR (Path)15641-3HR-15	11
BRC480-2-1-1-2/BR (Path)15641-3HR-15	19
BRC588-4R-71/BR (Path)15641-3HR-15	4
BRC626-4R-228/BR (Path)15641-3HR-15	31
BRC602-9-4-4-1/BR13113-4R-185	80
BRC594-15-4-4-2/BR13113-4R-185	84
Total	925

Under PARTNER-BRRi Project, total thirty genotypes (nine, three, one, two, four, five, three and three entries) showed better performance than standard check in RYT#1 (STR), RYT#2 (STR), RYT#PQR, RYT#FBR(SD), RYT#FBR(MD), RYT#FBR(MLD), RYT#ZER, and RYT#FBR(Barishal) trial respectively during Boro 2024-25 season. Whereas none of the tested entries

performed better than the check varieties in RYT#DRR(SD), RYT#DRR(LD), RYT#Rangpur, RYT#Pigmented rice and RYT#EMF. One RYT trial named RYT#Bio for blast resistant rice variety development was conducted in two locations such as BRRi Cumilla Research Farm and Debidwar, Cumilla. None of the entries performed better than the check varieties at research farm whereas one

entry performed better the check varieties at farmer's field in Debidwar, Cumilla.

On the other hand, 79, 39, 114, 14, 12, 1 and 2 entries performed better than check varieties in OYT#1(ZER), OYT#2 (ZER), OYT#IRR, PYT (IRR), AYT#1 (ZER), AYT#2 (ZER), and AYT#IRR trial respectively during Boro 2024-25 season. Under IRRI-NARES project, in IRRI-NARES Trial (Stage-1 and Stage-2), none of the tested entries performed better than check varieties in Boro 2024-25 season. The highest yield obtained from the check variety BRRI hybrid dhan8 (10.02t/ha and 8.57 t/ha) in both Stage-1 and Stage-2 trial respectively.

Under Rapid Cycle Genomic Selection (RCGS)-BRRI project, in OYT#FBC trial, 62 entries performed better than check varieties in Boro 2024-25 season.

Investigators: A. K. M. Shalahuddin, T Saha, MS Islam, M A Rahman and KM Iftekharuddaula

PEST MANAGEMENT PROGRAM AREA

Survey and monitoring of rice diseases in selected areas during 2024-25: Digital disease survey was conducted from 740 spots of eight Upazilla; Adarsha Sadar (96), Barura (149), Burichang (120), Chandina (67), Lalmai (28), Debidwar (83), Nangalkot (133). Sitakunda (64) Chattogram during T. Aman 2024 season and 440 spots of 7 Upazilla; Burichang (21), Chandina (51), Debidwar (61), Lalmai (20), Barura (169), Sadar Dakshin (32), Nangalkot (87) during Boro 2024-25 season in Cumilla district using ODK mobile Apps to know the present status of different rice diseases under various climatic environments. Disease incidence (DI) and disease severity (DS) data of major rice diseases were recorded following SES, IRRI 2013. During T. Aman 2024, neck blast disease was found predominant in the aromatic rice varieties such as BRRI dhan34 (Avg DI 20%, and DS 9), Khasa (%DI 58, DS 9) Kalijira (Avg. 1% DI, DS 5). The disease incidence of Tungro, sheath blight, bacterial blight, false smut, sheath rot and brown spot were 5-100 (DS 3-9), 10-80 (DS 3-9), 5-60 (DS 3-5), 1-15 (DS 1-3), 1-80 (DS 5-9) and 5-

60 (DS 1-3) respectively. During Boro 2024-25 season, major rice diseases like leaf blast, neck blast, tungro, bacterial blight, sheath blight, sheath rot and brown spot diseases were recorded as 5-80 % DI (DS 3-9), 5-80 % DI (DS 3-9), 5-90 % DI (DS 3-9), 3-50 % DI (DS 3-7), 5-80 % DI (DS 3-7), 5-70 % DI (DS 3-9) and 10-50 % DI (DS 1-3) respectively. One new viral disease rice ragged stunt was observed with 0.1 -1 % DI (DS 5-7).

□ Investigators: MM Rashid, MS Mia, M Hossain, MAI Khan, TH Ansari, MR Islam

Demonstration of rice neck blast disease management technology under farmer's field condition:

Rice blast disease management technology (5 kg MOP/bigha additionally apply during last top dress of urea, spray Fungicide Trooper or Tricyclazole group fungicides @ 0.8 g/L water for two times as preventive 1st at split booting stage and 2nd at flowering stage in the evening) was validated to build up farmers' awareness on rice blast disease management and minimize yield loss in BRRI Cumilla, Adarsha Sadar, Burichang and Nangalkot, Cumilla during T. Aman 2024 (BRRI dhan34) and Boro 2024-25 (BRRI dhan81). Disease incidence of neck blast was found 80-100 % (DS 9) in BRRI dhan34 at farmers practice and 1-7% DI (DS 3) in BRRI practice and rice yield loss was minimized significantly and saved 78-90% yield by managing neck blast disease following BRRI developed blast disease management technology in all the areas during T. Aman 2024 season. During Boro 2024-25 season, 27 field demonstrations were conducted in the farmers field condition and BRRI farm using highly susceptible BRRI dhan81 variety in Adarsha Sadar and Burichang Upazila of Cumilla. Farmers yield loss was saved 64-92 % by protecting neck blast disease using rice blast management technology.

□ Investigators: MM Rashid, MAI Khan, MA Monsur, MS Mia, MS Islam, TH Ansari

Validation of rice tungro disease management technology in Cumilla region (LSTD funded):

The Tungro management technology is seedbed along with surroundings should be free from GLH by 5 days interval hand sweeping along with light

trapping Or, Seedbed along with surroundings should be free from GLH by insecticide spray. First spray at 10, 10-15, 15-20 days after seeding during Aus, Aman and Boro season respectively, and 2nd spray at 3-5 days before transplanting for each season. To validate the technology 107 seedbeds of 195 farmers were selected in Nangalkot and Debidwar during Aus 2024, T. Aman 2024 and Boro 2024-25 seasons. Disease was not found in the BRRI Technology-followed-rice fields. In Nangalkot, tungro disease was found as 20-80 % DI with DS 7-9, 40-100 % DI with DS 7-9 and 60-80 % DI with DS 5-7 during Aus, Aman and Boro 2024-25 seasons, respectively in the farmers practice (no spray in the seedbed). In Debidwar, tungro disease was observed as 1 % DI with DS 5 during Boro 2024-25 season.

- Investigators: MM Rashid, MS Mia, MR Islam, MS Islam, TH Ansari

Upscaling of integrated rice sheath blight disease management at farmers field condition: A experiment was conducted to evaluate the efficacy of integrated sheath blight disease management techniques at farmers field condition during T. Aman 2024 season at Kabilpur, Debidwar, Cumilla with 5 treatments- T1 = Removal of floating debris (RFD), T2 = RFD + Apply MoP & Fungicides at MT stage, T3 = RFD + Apply MoP & Fungicides at Booting stage, T4 = RFD + Apply MoP & Fungicides at MT & Booting stage, T5 = Control. Disease reduction was obtained highest in the T4 (RFD + Apply MoP & Fungicides at MT & Booting stage) treatment.

Evaluation of new chemicals against Sheath blight diseases of rice: During T. Aman 2024, 12 out of 25 new fungicides for sheath blight were performed better and reduced rice diseases above 80%.

- Investigators: MM Rashid, MR Bhuiyan, M Hossain, TH Ansari, MS Islam, MR Islam

Observational Yield Trial of Tungro Resistant Lines in tungro hotspot area in Cumilla during T. Aman 2024 season: A total of 62 tungro resistance advanced lines derived from the crosses of TW-16, Matatag-1, IR69705-1-1-1-3-2 and

BRRI dhan48, BRRI dhan71 were evaluated in tungro hot-spot area along with 5 checks to find out the performance of tungro resistant lines in natural field condition at Kabilpur, Debidwar, Cumilla during T. Aman, 2024. Among the tested lines, all lines showed resistant to moderately resistant reaction on Tungro disease. Out of 62 lines, 59 lines showed Tungro resistant. Yield was reduced due to flood.

- Investigators: MM Rashid, MS Mia, SAI Nihad, TH Ansari, MS Islam, MR Islam

CROP-SOIL-WATER MANAGEMENT PROGRAM AREA

Effect of time of planting on the agronomic output of newly developed BRRI varieties in different eco-system: This study was undertaken to determine the effect of variable planting time on the growth and yield of newly released varieties and to identify the suitable time of planting and variety for Cumilla area. During T. Aman 2024, the treatments were A. Time of planting, eg. T1: 05 July, T2: 20 July, T3: 05 August, T4: 20 August, T5: 05 September and T6: 20 September; and B. Varieties: V1: BRRI dhan75, V2: BRRI dhan87, V3: BRRI dhan90, V4: BRRI dhan95 and V5: BRRI dhan49 (Ck). In Boro 2024-25, the tested six varieties were BRRI dhan88, BRRI dhan89, BRRI dhan92, BRRI dhan96, BRRI dhan101, BRRI dhan102. All the entries were transplanted on five transplanting times such as 10 December, 25 December, 10 January, 25 January, 10 February and 25 February 2024-25 in the BRRI RS, Cumilla research field. The experiment layout was done using the split plot design with three replications where planting dates were in the main plot and varieties were in the subplot. Fertilizer were applied N-P-K-S-Zn @ 145-31-77-13-1.5 kg/ha in Boro 2023-24.

In T. Aman 2024, all plots were damaged due to heavy rainfall and flashflood. In Boro 2024-25, BRRI dhan89, BRRI dhan92 and BRRI dhan102 produced higher grain yield within 155-158 days in first two planting time. BRRI dhan88, BRRI dhan96 and BRRI dhan101 showed expected higher yield with varying range of planting time. It was

observed that the best Planting time for long varieties (>140 days) was last week of December to first week of January.

- Investigators: T Ferdous, B Saha, S Pramanik and MS Islam

Effect of Seedling age and nutrient management

In T. Aman 2024 season, a field experiment was commenced at the research field at BRRI Rs Cumilla from July 2024 to find out the effect of seedlings age and different nitrogen (N) and potassium (K) levels on the yield performance of transplant Aman rice (BRRI dhan103). The experiment was completely collapsed by heavy downpour and flood in the month of August.

In Boro 2024-25 season this experiment comprised four ages of seedlings viz. 40, 50, 60 days old and six treatments T1=Full dose of urea at two equal splits, $\frac{1}{2}$ at 15 DAT + $\frac{1}{2}$ at 30 DAT, T2=Full dose of urea at two equal splits+20 kg/ha K, $\frac{1}{2}$ at 15 DAT + $\frac{1}{2}$ at 30 DAT, T3=Full dose of urea at two equal splits, $\frac{2}{3}$ at 15 DAT + $\frac{1}{3}$ at 45 DAT, T4=Full dose of urea at two equal splits +20 kg/ha K, $\frac{2}{3}$ at 15 DAT + $\frac{1}{3}$ at 45 DAT, T5=Full dose of urea at three equal splits, $\frac{1}{3}$ at 15 DAT + $\frac{1}{3}$ at 30 DAT+ $\frac{1}{3}$ at 45 DAT, T6=Full dose of urea at three equal splits +20 kg/ha K, $\frac{1}{3}$ at 15 DAT + $\frac{1}{3}$ at 30 DAT+ $\frac{1}{3}$ at 45 DAT, following randomized complete block design (RCBD) with three replications. The effect of age of seedling, treatments and their interactions were significant on growth, yield and yield contributing characters of BRRI dhan104. The treatment T6 gave higher yield (7.5 t/ha) from 40 days old seedling. Sixty days old seedling gave lower yield from all six treatments. T3, T4 performed better than other treatments in 40 days.

- Investigators: T Ferdous, B Saha, S Pramanik and MS Islam

Long-term missing element trial at BRRI Regional Station, Cumilla 2024-25: The experiment was conducted to assess long-term yield trend of rice under different nutrients managements. For this trial, seven fertilizer treatments viz. T₁= N-P-K-S-Zn (all), T₂ = N omission (-N), T₃ = P

omission (-P), T₄ = K omission (-K), T₅ = S omission (-S), T₆ = Zn omission (-Zn) and T₇ = N-P-K-S-Zn (all missing) were imposed following RCBD design with three replications both in T. Aman 24 and Boro 2024-25 season. Fertilizer doses were NPKSZn @ 110-15-42-9-1.5 kg/ha in T. Aman and NPKSZn @ 145-31-77-13-1.5 kg/ha in Boro season respectively. During T. Aman 2024, the experiment was fully damaged by flood at tillering stage. In Boro 2024-25, BRRI dhan88 produced the highest grain yield (7.12 t/ha) and straw yield (7.32 t/ha) with NPKZnS fertilizers and the lowest grain yield (3.18 t/ha) and straw yield (4.12 t/ha) with all missing element fertilizers. Omission of N from complete treatment had a significant effect on grain yield (3.50 t/ha) and straw yield (4.41 t/ha) among the treatments. The omission of P, K, S and Zn gave statistically similar grain and straw yield like complete fertilizer treatment.

- Investigators: B Saha, T. Ferdous, S Pramanik and MS Islam

Effects of P rates on the yield of BRRI released new variety in BRRI Farm Cumilla: The experiment was conducted to update the P rates of BRRI released new varieties in BRRI Farm Cumilla. Six doses of P (0, 10, 20, 30, 40 and 50 kg/ha) were tested with BRRI dhan87 in T. Aman 2024 and BRRI dhan88 in Boro 2024-25 season. The experiment was laid out in a RCBD design with three replications. In T. Aman season, the experiment was fully damaged by flood at tillering stage. In boro2024-25 season, 30 kg/ha rate of P produced highest grain yield (7.14 t ha⁻¹) during boro 2024-25 season. Grain yield was increased with the increasing rate of phosphorus up to a level and then produced the statistically similar grain yield.

- Investigators: B Saha T. Ferdous, S Pramanik, MS Islam

Effects of N rates on the yield of BRRI released new variety in BRRI Farm Cumilla: An experiment was conducted to determine the N response behaviour of BRRI released new varieties in BRRI Farm Cumilla. Nine doses of N (0, 25, 50,

75, 100, 125, 150, 175 and 200 kg/ha) were tested with BRRI dhan87 in T. Aman 2024 and BRRI dhan89 in Boro 2024-25 season. The experiment was laid out in a RCB design with three replications. In T. Aman season, the experiment was fully damaged by flood at tillering stage. Among the nitrogen doses, 175 kg/ha of N produced highest grain yield (7.57 t ha⁻¹) during boro 2024-25 season. Grain yield was increased with the increasing rate of nitrogen up to a level and yield of 125, 150, 175 and 200 kg ha⁻¹ doses were statistically similar.

- Investigators: B Saha T. Ferdous, S Pramanik, MS Islam

SOCIO-ECONOMIC PROGRAM AREA

Stability Analysis of BRRI developed rice varieties during 2024-25: Fourteen (Aus 2024), 48 (T. Aman 2024) and 54 (Boro 2024-25) varieties were evaluated to determine the stability index of BRRI developed rice varieties at BRRI, Cumilla. During Aus 2024 season, BRRI Hybrid dhan7 (6.99 t/ha) gave the highest yield followed by BRRI dhan98 (5.95 t/ha), BRRI dhan48 (5.57 t/ha), BRRI dhan82 (4.79 t/ha), dhan85 (4.69 t/ha) and BRRI dhan106 (4.62 t/ha). Growth duration of these varieties ranged from 109-114 days. During T. Aman 2024, T.Aman field fully damaged by flood. During Boro 2024-25, BRRI hybrid dhan8 (10.07 t/ha) gave the highest yield followed by BRRI hybrid dhan2 (9.87 t/ha), BRRI hybrid dhan3 (9.70 t/ha), BRRI dhan101 (9.48 t/ha), BRRI dhan36 (9.22 t/ha), BRRI dhan107 (9.19 t/ha) and BRRI dhan74 (9.10 t/ha), Growth duration of these varieties ranged from 135-159 days.

- Investigators: MT Husna, S Pramanik, MR Islam, MS Islam

RICE FARMING SYSTEM PROGRAM AREA

Inclusion of Mustard in Boro-Fallow-T. Aman cropping pattern in Cumilla region: Among the cropping patterns, the rice equivalent yield (REY) of 1st crop (Rabi season) Mustard CP₃ (0.98 t/ha), 2nd crop (Boro) obtained higher (7.07 t/ha) in CP₃ followed by CP₂ (6.79 t/ha) and CP₁ (6.06 t/ha), 3rd

crop (T.Aus) (5.78 t/ha) in CP₂ and T. Aman field fully damaged by flood.

- Investigators: MT Husna, S Pramanik, B Saha, MM Rashid, MS Islam, MR Islam

Varietal improvement of Boro- Aus-T. Aman cropping pattern in Cumilla region: Among the cropping patterns, the rice equivalent yield (REY) of 1st crop (Rabi season) remained higher (7.61 t/ha) in CP₂ followed by CP₁ (6.89 t/ha), 2nd crop (T. Aus) remained higher (5.58 t/ha) in CP₁ followed by CP₂ (4.72 t/ha) & T. Aman field fully damaged by flood.

- Investigators: MT Husna, S Pramanik, B Saha, MM Rashid, MS Islam, MR Islam

TECHNOLOGY TRANSFER PROGRAM AREA

Varietal dissemination through field demonstration (GoB): During Aus 2024 season, 50 field demonstration was conducted and BRRI dhan98 yield range was obtained 4.34-5.95 t/ha. In T. Aman 2024 season, 50 field demonstrations were conducted in different Upazilla of Cumilla region. The yield range of BRRI dhan93, BRRI dhan94, BRRI dhan95 and BRRI dhan103 were 4.4-5.8, 4.68-5.18, 4.7-6.11 and 4.2-6.15 t/ha respectively. Farmer's acceptance of BRRI dhan95 and BRRI dhan103 was found very high.

In Boro 2024-25 season, a total of 150 field demonstrations (1 bigha each) of newly released BRRI dhan96, BRRI dhan101, BRRI dhan102, BRRI dhan105, BRRI dhan107 and BRRI dhan108 were conducted in different Upazila of Cumilla, Bramanbaria and Chandpur district. The yield range of released BRRI dhan96, BRRI dhan101, BRRI dhan102, BRRI dhan105, BRRI dhan107 and BRRI dhan108 were 6.5-7.57, 6.45-7.75, 6.85-8.54, 6.11-6.65, 5.45-7.52, 7.88-8.67 t/ha respectively.

- Investigators: T Ferdous, B Saha, MT Husna, MM Rashid, S Pramanik, MA Rahman, MS Islam and MR Islam

Farmer's training and Field Day: Twenty one farmers' training was conducted in different locations of Cumilla region. A total of 567 farmers

and 63 SAAOs were trained up. Fifteen field days were conducted in the field demonstration areas at Cumilla region. About 1500 farmers as well as extension personnel were attended in the field days. Most of the farmers got interested to cultivate new rice varieties in their areas specially BRRI dhan93, BRRI dhan94, BRRI dhan95, BRRI dhan103 and BRRI dhan102, BRRI dhan108 varieties.

- Investigators: T Ferdous, B Saha, MT Husna, AKM Shalahuddin, MM Rashid, S Pramanik, MA Rahman, MS Islam and MR Islam

Seed Production: During Aus 2024 season, total 1.7 tons TLS seed of BRRI dhan48 and BRRI dhan98 was produced. During T. Aman 2024 season, 0.8 ton Breeder seed of BR22 and 7.160 tons TLS seeds (BR22, 23, BRRI dhan34, 46, 76, 87, 95 and 103) were produced. During Boro 2024-25, 23.925 ton Breeder seed (BRRI dhan58, 88, 89, 96, 102), 23.0 ton certified seed (BRRI dhan100, 104) and 9.0 ton TLS seeds (BRRI dhan29, 58, 88, 89, 92, 96, 102, 108) were produced at BRRI Cumilla farm.

- Investigators: T Ferdous, B Saha, MT Husna, AKM Shalahuddin, MM Rashid, S Pramanik, MA Rahman, MS Islam and MR Islam

PARTNER, BRRI Cumilla Part

Varietal dissemination through field demonstration: Total 140 Field demonstrations were conducted using BRRI dhan103 in Burichang, Debidwar, Nangalkot, Kasba, Nabinagar and Nasirnagar and yield ranged from 3.22-6.29 t/ha during T. Aman 2024 season. Yield was reduced due to devastating flood and 39 demonstration was fully damaged. During Boro 2024-25 season, total 525 field demonstrations with BRRI dhan100, 101, 102, 104, 105, 107 and 108 varieties were conducted in projected upazillas of Cumilla and Brahmanbaria. The yield ranges were 5.67-8.24, 6.05-7.98, 6.17-8.75, 5.1-8.35, 4.7-8.11, 5.45-8.0, 7.26-9.56 t/ha respectively.

Training and Field Days: Four farmers' trainings and three field days were conducted in projected locations of Cumilla and Brahmanbaria. A total of 120 farmers were trained up about modern rice

cultivation and technologies. About 300 farmers as well as extension personnel's were attended in the field days. Most of the farmers got interested to cultivate new rice varieties like BRRI dhan103 in Aman and BRRI dhan100, 101, 102, 104 and 108 in their areas.

Seed Production: During Aus 2024, 10.5 ton of BRRI dhan105, Aman 2024 season, total 7.7 ton of BRRI dhan103 and 23.0 ton of BRRI dhan100 (15.0 ton) and BRRI dhan104 (8.0 ton) certified seeds were produced.

- Investigators: S Pramanik, T Ferdous, B. Saha, MT Husna, AKM Shalahuddin, MM Rashid, MA Rahman, MS Islam and MR Islam

LSTD Project, BRRI Cumilla Part

Varietal dissemination through field demonstration: During T. Aman 2024 season, Total 120 field demonstrations were conducted using BRRI dhan87, 94, 95 and 103 in different upazila of Cumilla, Brahmanbaria and Chandpur and the yield varied from 4.8-5.8, 4.2-6.4, 3.2-6.02 and 4.95-6.4 t/ha, respectively. Yield was reduced due to flood devastation and 42 demonstration was fully damaged. During Boro 2024-25 season, total 50 field demonstrations with BRRI dhan96, 102, 107 and 108 varieties were conducted in different Upazila of Cumilla, Brahmanbaria and Chandpur and the yield ranged from 6.84-7.88, 7.32-8.86, 6.47-7.12 and 7.54-9.14 t/ha, respectively.

Field Days: Eight field days were conducted during 2024-25 in different locations of Cumilla region. About 800 farmers as well as extension personnel's were attended in the field days. Most of the farmers got interested to cultivate new rice varieties like BRRI dhan103 in Aman and BRRI dhan102 and 108 in their areas.

- Investigators: S Pramanik, T Ferdous, B. Saha, MT Husna, AKM Shalahuddin, MM Rashid, MA Rahman, MS Islam and MR Islam

BRRI RS, Habiganj

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SUMMARY

In Boro 2024-25 season, one OYT, 2 AYT, five RYT's trial were carried out focused on favorable Boro, and cold tolerant rice. Thirty genotypes from OYT, eleven genotypes from AYT, seven genotypes from RYT were selected which performed better compare to check varieties. One PVT was carried out and code I-0116 given the highest yield compare to code I-0117 and I-0118.

There were two, four and ten ALART during Aus 2024, Aman 2024 and Boro 2024-25 respectively. In Aus 2024 season, among the BB2 genotypes BR (path) 13784-BC3-34-9-10-HR9 and BR (path)13784-BC3-5-3-4-HR15 performed better compare to check varieties, namely BRRI dhan82 and BRRI dhan98. In Aman 2024 season, none of the advanced lines were performed better compare to check varieties. In Boro 2024-25 season, ALART for BRR-LD genotype BR (Path) 15855-BC2-3HR-23; for BRR-MD genotypes BR (Path) 15855-BC3-2HR-5 and BR (Path)15860-BC2-3HR-48; for BB+ Blast genotype BR(path)13802-BC3-62-14 were performed better than the check varieties. The cold stress was avoided through adjusting time of planting. In respect of grain yield, BR11894-R-R-R-R-169 and BRRI dhan102 was higher grain yield than TP16199, BRRI dhan28 and BRRI dhan88. BR11894-R-R-R-R-169 and BRRI dhan102 escaped cold stress at reproductive phase in early planting.

In the first crop of Boro season complete fertilizer (NPKSZn) treatment gave significantly higher yield than omission nutrient plots. The omission of N and P in Boro season from complete fertilizer significantly reduced the grain yield of rice. Among the major nutrient elements, the omission of N appeared as the most yield-limiting nutrient followed by P and K omission for rice. The S and Zn omission had a little effect on grain yield in Boro season.

Stability analysis during Aus 2024 season, among the varieties, BRRI Hybrid dhan7 yielded the highest, which were 5.93 t/ha and BRRI dhan43 yielded the lowest, which were 4.01 t/ha. On the

other hand, popular variety BRRI dhan98 yielded 5.68 t/ha. Stability analysis during Boro2024-25 season, among the varieties, BRRI hybrid dhan8 yielded the highest, which were 9.71 t/ha and BRRI dhan81 yielded the lowest, which were 4.53 t/ha. Some popular and new varieties like BRRI dhan28, BRRI dhan29, BRRI dhan58, BRRI dhan89, BRRI dhan92, BRRI dhan100, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107 and BRRI dhan108 were produced 6.64, 8.18, 6.8, 6.82, 7.70, 5.77, 7.53, 5.75, 6.74, 6.51 and 7.7 t/ha respectively.

A total 150 demonstrations during Aus 2024, 330 demonstrations during T. Aman 2025, 690 demonstrations during Boro 2024-25 were conducted under Gob and different projects. BRRI regional station, Habiganj conducted 12 farmer's training, 3 SAAO training and 2 dealer training during Boro season 2024-25. BRRI regional station, Habiganj also conducted 12 field days in different location of Sylhet region during the reporting period.

In Boro 2024-25 season, a total of 26350 kg breeder seed were produced. In Aus 2024 season, a total of 400 kg while in T. Aman 2024, a total 1500 kg TLS seed were produced. On the other hand, in Boro 2024-25 season, a total of 14,800 kg TLS seed were produced. In Boro 2024-25 season, a total of 16000 kg certified were produced. BRRI released varieties would be disseminated quickly to farmers by using these seeds

PROJECT 1: VARIETAL DEVELOPMENT PROGRAM (VDP) AREA

Evaluation of breeding lines in the Observation Yield Trial under Favorable Boro Rice (OYT_FBC)

Two hundred forty six genotypes were in Observation Yield Trial (OYT). Thirty genotypes out showing around 0.69-1.20 t/ha yield advantage and 3-5 days earlier growth duration over the check variety BRRI dhan88, BRRI dhan92 were selected (Table 1).

Table 1. Yield performances of the selected breeding lines from OYT_FBC conducted at Habiganj locations, Boro 2024-25

Designation	PH (cm)	GD (days)	Yld (t/ha)
BR14249-5R-103	104	132	7.03
BR14618-4R-38	104	128	6.93
BR14630-4R-10	121	138	6.93
BR14611-4R-7	104	139	6.87
BR14872-BC2-R-47	119	130	6.87
BR14621-4R-51	116	128	6.86
BR14229-5R-35	117	132	6.86
BR14609-4R-20	102	139	6.85
BR13995-R-R-R-61	112	130	6.83
BR14638-4R-8	116	132	6.8
BR14244-5R-32	111	129	6.79
BR14643-4R-85	119	138	6.79
BR14231-R-R-R-80	106	140	6.79
BR14225-R-R-R-39	116	131	6.79
BR14246-5R-34	116	128	6.78
BR14870-BC1-R-72	123	126	6.77
BR14226-R-R-R-160	119	131	6.77
BR14229-5R-178	114	133	6.75
BR14218-5R-42	121	131	6.75
BR14223-5R-35	133	137	6.73
BR14266-4R-331	93	132	6.73
BR14218-R-R-R-237	99	136	6.7
BR14870-BC1-R-76	115	134	6.68
BR14254-4R-201	120	136	6.67
BR14226-R-R-R-168	109	132	6.63
BR13986-R-R-R-22	119	129	6.61
BR14266-4R-24	116	138	6.53
BR14609-4R-100	118	131	6.52
BR14226-5R-236	118	130	6.51
BR14222-5R-35	107	128	6.5
BRRI dhan88	103	136	5.84
BRRI dhan92	109	142	5.7
h2B	0.29	0.27	0.34
LSD	11.9	6.73	0.69

Development of Favorable Boro and Cold Tolerant rice (AYT_1 and AYT_2)

From AYT_1, 48 genotypes were tested and five genotypes showing almost similar growth duration but 0.66-1.65 yield advantages compared to the check variety BRRI dhan88 (**Table 2**). Six

genotypes produced 0.75-1.61 t/ha yield advantage with 8-10 days shorter growth duration compared to the check variety BRRI dhan102 and the genotype BR13988-3R-150 showed the highest yield 7.56 t/ha were selected from 100 tested entries in AYT_2 (**Table 3**).

Table 2. Yield performances of the selected breeding lines from AYT-1 conducted at Habiganj locations, Boro 2024-25

Designation	PH (cm)	GD (days)	Yld (t/ha)
BR13983-3R-166	104	132	7.16
BR14007-3R-78	98	134	6.94
BR13998-3R-13	107	141	6.79
IR22MD3597	105	135	6.64
BR13983-3R-29	102	132	6.53
BRRI dhan102 (Ck)	107	141	5.87
BRRI dhan88 (Ck)	96	133	5.51
BRRI dhan92 (Ck)	105	141	5.17
h2B	0.88	0.98	0.69
LSD	5.0	1.46	1.04

Table 3. Yield performances of the selected breeding lines from AYT-2 conducted at Habiganj locations, Boro 2024-25

Designation	PH (cm)	GD (days)	Yld (t/ha)
BR13988-3R-150	136	135	7.56
BR13983-2R-107	124	133	7.23
BR13712-3R-24	96	134	6.87
BR13984-2R-59	123	136	6.83
BR13712-3R-119	113	133	6.82
BR14007-3R-100	108	139	6.70
BRRI dhan92 (Ck)	106	148	5.10
BRRI dhan102 (Ck)	107	143	5.95
BRRI dhan89 (Ck)	107	146	6.39
h2B	0.980	0.96	0.77
LSD	1.890	1.41	1.89

Evaluation of breeding lines in the Regional Yield Trial under Favorable Boro Rice (RYT#FBR)

Ten advanced breeding lines tested on RYT#1_SD at BRRI R/S Habiganj, two breeding lines showed

similar growth duration with check variety on BRRI dhan28 and BRRI dhan88 but 0.5-0.7 t/ha yield advantages with check varieties (**Table 4**); one breeding lines showing 6-8 days earlier than check varieties BRRI dhan89 and BRRI dhan102

but yield is similar at RYT#2_MD (**Table 5**). In RYT#3_MLD the advanced lines BR12671-4R-138- produced better yield (7.25 t/ha) to the check

variety BRRI dhan102 (6.33 t/ha) and nine days shorter growth duration than the check variety BRRI dhan102 (**Table 6**).

Table 4. Agronomic performances of the selected genotypes in RYT#1_SD, conducted at Habiganj locations, Boro 2024-25

Designation	PH (cm)	GD (days)	Yld (t/ha)
BR13418-5R-20	112	135	7.56
BR13418-5R-58	84	134	7.16
BRRI dhan28 (Ck)	107	136	6.43
BRRI dhan88 (Ck)	95	138	6.89
BRRI dhan102 (Ck)	112	143	6.58
h2B	0.95	0.920	0.74
LSD	1.21	1.380	0.22

Table 5. Agronomic performances of the selected genotypes in RYT#1_MD, conducted at Habiganj locations, Boro 2024-25

Designation	PH (cm)	GD (days)	Yld (t/ha)
BR13148-5R-12	121	136	6.78
BRRI dhan88 (Ck)	123	139	6.52
BRRI dhan102 (Ck)	124	144	6.49
BRRI dhan89 (Ck)	104	143	6.48
h2B	0.96	0.89	0.67
LSD	6.47	4.42	0.31

Table 6. Agronomic performances of the selected genotypes in RYT#1_MLD, conducted at Habiganj locations, Boro 2024-25

Designation	PH (cm)	GD (days)	Yld (t/ha)
BR 12671-4R-138	106	135	7.25
BRRI dhan92 (Ck)	108	144	6.91
BRRI dhan102 (Ck)	113	144	6.33
h2B	0.97	0.98	0.88
LSD	3.16	1.33	0.29

Regional Yield Trial (RYT_SD_MD Disease resistance)

Twelve advanced lines tested on RYT_SD_MD (Disease resistance rice), two lines were better performed out of 12 advanced lines. Growth

duration was similar with check variety BRRI dhan88 but yield is 0.63 ton advantages (**Table 7**). In RYT_LD (Disease resistance rice), eighteen advanced breeding lines were tested, but no lines better performance with check varieties BRRI dhan92 and BRRI dhan101.

Table 7. Agronomic performances of the selected genotypes in RYT#1_SD (DRR), conducted at Habiganj locations, Boro 2024-25

Designation	PH (cm)	GD (days)	Yld (t/ha)
BR13188-4R-170	122	136	7.15
BR13178-4R-61	113	139	7.04
BRRI dhan88 (Std. Ck)	116	138	6.53
BRRI dhan101 (Res. Ck)	115	137	6.88
h2B	0.87	0.93	0.69
LSD	4.5	3.91	0.47

Regional Yield Trial (RYT_Barishal)

Five advanced lines tested on RYT_Barisal, only one line showing 0.69 yield advantage with check variety BRRI dhan74 and four days earlier than check variety ((Table 8). In RYT_Basmati, four lines tested but no lines showing better performance

with check variety BRRI dhan104. RYT_EMF, three lines tested but no lines showing better performance with check variety BRRI dhan28. In RYT_Pigment, seven lines tested but no lines showing better performance with check variety BRRI dhan8 and BRRI dhan89.

Table 8. Agronomic performances of the selected genotypes in RYT_Barisal, conducted at Habiganj locations, Boro 2024-25

Designation	PH (cm)	GD (days)	Yield (t/h)
BRBaNGR 324-1	99	139	6.57
BRRI dhan74 (Ck)	96	143	5.88
BRRI dhan100 (Ck)	102	146	5.21
h2B	0.78	0.85	0.66
LSD	1.83	1.49	0.39

Proposed variety trial of inbred line for cold tolerant (Boro 2024-25)

The trial was conducted at the research field of BRRI Regional Station, Habiganj. Three genotypes namely code I-0116, I-0117, I-0118 were tested for the trial. The plant height of code I-0116, I-0117 and I-0118 were I-0116, I-0113 and I-0114 cm respectively, tiller/hill of code I-0116, I-0117 and I-0118 were 13, 14 and 15 respectively and yield of code I-0116, I-0117 and I-0118 were 7.02, 6.02 and 6.36 ton/ha respectively. From the results, code I-0116 given the highest yield compare to code I-0117 and I-0118.

PROJECT 2: TECHNOLOGY TRANSFER

Advanced Line Adaptive Research Trail (ALART)

Advanced Line Adaptive Research Trail (ALART) BB-1 Aus 2024

The experiment was conducted at the farmer's field at Komolganj upazila, in Moulovibazar. Three Bacterial Leaf Blight Rice lines, namely BR11866-54-147, BR1867-5R-103 and BR11867-5R-442 along with two standard check varieties, namely BRRI dhan48, and BRRI dhan98, were evaluated in this experiment. The yield ranges of advanced lines and two check varieties were 3.45-4.11 t/ha and 3.79-4.28 t/ha, respectively. So, none of the tested lines performed better than the check varieties. So, the advanced lines were not recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) BB-2 Aus 2024

The experiment was conducted at the farmer's field at komolganj upazila, in Moulovibazar. Three Bacterial Leaf Blight Rice lines, namely BR(path)13784-BC3-34-9-10-HR9, BR (path)13784-BC3-5-3-4-HR15 and BR(path)13784-BC3-61-1-6-HR3 along with two standard check varieties, namely BRRI dhan82 and BRRI dhan98, were evaluated in this experiment. The yield ranges of advanced lines and two check varieties were 2.66-3.48t/ha and 2.33-2.73t/ha, respectively. The tested genotypes BR (path) 13784-BC3-34-9-10-HR9 and BR(path)13784-BC3-5-3-4-HR15 performed better than the check varieties. So, the two advanced lines were recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) (Antioxidant Rice) Aman 2024

The experiment was conducted at the farmer's field at komolganj upazila, in Moulovibazar. Three Antioxidant Rice lines, namely BR12836-4R-312, BR12839-4R-124-2 and BR12839-4R-51, along with two standard check varieties, BRRI dhan34 and BRRI dhan70, were evaluated in this experiment. The yield ranges of three lines and two check varieties were 2.17-3.03 t/ha and 3.41-4.08 t/ha, respectively. None of the lines performed better than the check varieties. So, none of the advanced lines was recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) (Kataritype Rice) Aman 2024

The experiment was conducted at the farmer's field at Bahubol upazila, in Habiganj. Three Kataritype Rice lines, namely BRH13-9-5-2B, BRH9-3-2B and IR12A177, along with two standard check varieties, BRRI dhan57 and katari, were evaluated in this experiment. The yield ranges of three lines and two check varieties were 3.9-4.77 t/ha and 3.65-5.06 t/ha, respectively. None of the lines performed better than the check varieties. So, none of the advanced lines was recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) (False Smut) Aman 2024

The experiment was conducted at the farmer's field at komolganj upazila, in Moulovibazar. Three False Smut Rice lines, namely BR (Path) 13804-BC3-4-5, BR (Path)13804-BC3-13 and BR(Path)13804-BC3-16, along with one standard check variety, BRRI dhan70 were evaluated in this experiment. In this experiment, due to rat damage none of the plots harvested along with data collection. So, none of the advanced lines was recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) (Photosensitive) Aman 2024

The experiment was conducted at the farmer's field at Bahubol upazila, in Habiganj. Two Photosensitive Rice lines, namely BR10212-17-3-2-2 and BR10212-5-5-3, along with two standard check varieties, BR22 and BR23, were evaluated in this experiment. The yield ranges of two lines and two check varieties were 5.42-5.43 t/ha and 4.50-5.31 t/ha, respectively. None of the lines performed better than the check varieties. So, none of the advanced lines was recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) (Photosensitive) Aman 2024

The experiment was conducted at the farmer's field at Bahubol upazila, in Habiganj. Two Photosensitive Rice lines, namely BRH17-23-8-2-7B and BRH11-7-17-10B, along with two standard check varieties, BRRI dhan75 and zirasail, were evaluated in this experiment. The yield ranges of two lines and two check varieties were 3.71-4.45 t/ha and 2.29-4.80 t/ha, respectively. None of the lines performed better than the check varieties. So, none of the advanced lines was recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) BRR LD, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. Two Blast Resistant Rice Long Duration lines, namely BR(Path)15855-BC2-3HR-23 and BR(path)15860-BC2-3HR-47, along with one standard check variety, BRRI dhan29, were evaluated in this

experiment. The yield ranges of two lines and one check variety were 7.29–8.22 t/ha and 7.06 t/ha, respectively. The tested genotype BR(Path)15855-BC2-3HR-23 performed better than the check variety. So, this advanced line was recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) BRR MD, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. Two Blast Resistant Rice Medium Duration lines, namely BR(Path)15855-BC3-2HR-5 and BR(Path)15860-BC2-3HR-48, along with one standard check variety, BRRI dhan58, were evaluated in this experiment. The yield ranges of two lines and one check variety were 7.22–8.37 t/ha and 6.41 t/ha, respectively. The tested genotypes BR(Path)15855-BC3-2HR-5 and BR(Path)15860-BC2-3HR-48 performed better than the check variety. So, the advanced lines were recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) BRR SD, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. Two Blast Resistant Rice Short Duration lines, namely BR(Path)15641-3HR-15 and BR(Path)15641-3HR-45, along with one standard check variety, BRRI dhan88, were evaluated in this experiment. The yield ranges of two lines and one check variety were 6.28–6.59 t/ha and 7.29 t/ha, respectively. None of the tested genotypes performed better than the check variety. So, the advanced lines were not recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) BB + Blast, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. Three Bacterial Blight and Blast Resistant Rice lines, namely BR(path)13802-BC3-54-12, BR(path)13802-BC3-73-13 and BR(path)13802-BC3-62-14, along with one standard check variety, BRRI dhan88, were evaluated in this experiment. The yield ranges of three lines and one check variety were 7.27–9.28

t/ha and 7.39 t/ha, respectively. The tested genotypes BR(path)13802-BC3-62-14 performed better than the check variety. So, this advanced line was recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) FBR SD, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. One Favorable Boro Rice Short Duration line, namely BR12574-5R-52, along with one standard check variety, BRRI dhan88, were evaluated in this experiment. The yield of line and check variety were 6.99 t/ha and 7.21 t/ha, respectively. The tested genotype couldn't performed better than the check variety. So, the advanced line was not recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) FBR MD, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. Three Favorable Boro Rice Medium Duration lines, namely BR11894-5R-260, BR12508-5R-5 and BR12517-5R-57, along with two standard check varieties, BRRI dhan97 and BRRI dhan102, were evaluated in this experiment. The yield ranges of three lines and two check varieties were 7.91–9.30 t/ha and 8.26–9.40 t/ha, respectively. None of the tested genotypes performed better than the check varieties. So, the advanced lines were not recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) PQR, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. Two Premium Quality Rice lines, namely BR11359-4R-181 and BR11359-4R-279, along with two standard check varieties, BRRI dhan104 and BRRI dhan107, were evaluated in this experiment. The yield ranges of two lines and two check varieties were 6.83–7.26 t/ha and 7.25–8.22 t/ha, respectively. None of the tested genotypes performed better than the check varieties. So, the advanced lines were not recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) PQR, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. One Premium Quality Rice (PATH) lines, namely BRRI(Path)-Premium1, along with two standard check varieties, BRRI dhan50 and BRRI dhan104, were evaluated in this experiment. The yield ranges of one line and two check varieties were 7.53 t/ha and 6.32-7.11 t/ha, respectively. The tested genotype couldn't perform better than the check varieties. So, the advanced line was not recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) AOER MD, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. Two Antioxidant Enriched Rice Medium Duration lines, namely BR12839-4R-157-2 and BR12839-4R-5-2, along with one standard check variety, BRRI dhan100, were evaluated in this experiment. The yield ranges of two lines and one check variety were 6.93-7.03 t/ha and 7.21 t/ha, respectively. None of the tested genotypes performed better than the check variety. So, the advanced lines were not recommended for further testing.

Advanced Line Adaptive Research Trail (ALART) AOER SD, Boro 2024-25

The experiment was conducted at the farmer's field at Baniachong upazila, in Habiganj. One Antioxidant Enriched Rice Short Duration line, namely BR12839-4R-137, along with one standard check variety BRRI dhan88, were evaluated in this experiment. The yield of one line and one check variety were 6.27 t/ha and 7.45 t/ha, respectively. The tested genotype couldn't perform better than the check variety. So, the advanced line was not recommended for further testing.

Project 3: CROP SOIL WATER MANAGEMENT

Minimizing of Cold Stress of Rice genotypes and BRRI Varieties through Adjusting Planting Time

In respect of grain yield BR11894-R-R-R-R-169 and BRRI dhan102 was higher grain yield than TP16199, BRRI dhan28 and BRRI dhan88. BR11894-R-R-R-R-169 and BRRI dhan102 escaped cold stress at reproductive phase in early planting.

Table 9: Yield of tested genotypes under different time of planting during Boro season 2024-25

Genotype	Grain yield(t/ha)						
	7-Dec-24	14-Dec-24	21-Dec-24	28-Dec-24	4-Jan-25	11-Jan-25	18-Jan-25
TP16199	5.92	6.13	6.40	6.32	5.63	6.87	5.75
BR11894-R-R-R-R-169	6.88	4.90	7.94	7.30	7.35	7.64	6.85
BRRI dhan28	4.93	6.81	5.46	6.32	6.80	7.05	6.12
BRRI dhan88	5.98	5.27	6.67	6.94	6.63	7.37	6.73
BRRI dhan102	7.73	6.69	6.32	7.73	8.31	7.53	6.32
CV	6.94						
LSD	0.75						

Long-term missing element trial at BRRI Regional Stations Habiganj, Boro 2024-25

The field experiments were initiated in permanent layout at seven (7) BRRI RS farms during Boro, 2024-25 combining seven treatments: T₁= Control, T₂= NPKSZn, T₃= PKSZn (-N), T₄= NKSZn (-P),

T₅= NPSZn (-K), T₆= NPKZn (-S), T₇=NPKS (-Zn) in RCB design with three replications. Fertilizer was applied based on soil test (STB). Urea-N was applied into three equal splits at final land preparation, active tillering and 5-7 days before panicle initiation (PI) stage. Rest of the fertilizers

were applied at final land preparation as basal. In the first crop of Boro season complete fertilizer (NPKSZn) treatment gave significantly higher yield than omission nutrient plots. The omission of N and P in Boro season from complete fertilizer significantly reduced the grain yield of rice. Among the major nutrient elements, the omission of N appeared as the most yield-limiting nutrient followed by P and K omission for rice. The S and Zn omission had a little effect on grain yield in Boro season.

Project 4: SOCIOECONOMIC POLICY

Stability Analysis of BRRI released Aus Varieties

The experiment was conducted during Aus season at BRRI regional station Habiganj. The yield range for Aus varieties was 4.01 to 5.93 t/ha. Among the varieties, BRRI Hybrid dhan7 yielded the highest, which were 5.93 t/ha and BRRI dhan43 yielded the lowest, which were 4.01 t/ha. On the other hand, popular variety BRRI dhan98 yielded 5.78 t/ha.

Stability Analysis of BRRI released Boro Varieties

The experiment was conducted during Aus season at BRRI regional station Habiganj. The yield range for Boro varieties was 4.77 to 8.58 t/ha. Among the varieties, BRRI hybrid dhan8 yielded the highest, which were 8.57 t/ha and BR1 yielded the lowest, which were 4.77 t/ha. Some popular and new varieties like BRRI dhan28, BRRI dhan29, BRRI dhan58, BRRI dhan89, BRRI dhan92, BRRI dhan100, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107 and BRRI dhan108 were produced 6.64, 8.18, 6.90, 6.82, 7.70, 6.27, 7.53, 6.25, 6.74, 6.81 and 7.81 t/ha respectively.

PROJECT 5: DEMONSTRATION AND TRAINING PROGRAM

Activity 1: Demonstration

In Aus 2024, 150 demonstrations of BRRI dhan48, BRRI dhan98 and BRRI Hybrid dhan7 were conducted in Sylhet Region. Average yield of BRRI dhan48, BRRI dhan98 and BRRI Hybrid dhan7 were 4.4 t/ha, 5.1 t/ha and 5.5 t/ha, respectively. Farmers were motivated to cultivate all the three varieties. In T. Aman 2025, 330

demonstrations of BRRI dhan95, BRRI dhan103, BRRI BRRI Hybrid dhan6 were conducted at Sylhet Region. Average yield of BRRI dhan95, BRRI dhan103, BRRI Hybrid dhan6 were 5.6 t/ha, 5.8 t/ha and 6.7 t/ha, respectively. In Boro 2024-25, 690 demonstrations of BRRI dhan92, BRRI dhan96, BRRI dhan100, BRRI dhan101, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107, BRRI dhan108 and BRRI Hybrid dhan8. Average yield of BRRI dhan92, BRRI dhan96, BRRI dhan100, BRRI dhan101, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107, BRRI dhan108 and BRRI Hybrid dhan8 were 6.9 t/ha, 5.8 t/ha, 6.2 t/ha, 6.3 t/ha, 7.1 t/ha, 6.7 t/ha, 7.4 t/ha, 6.8 t/ha, 7.7 t/ha and 8.5 t/ha, respectively. Most of the farmers have chosen BRRI Hybrid dhan8, BRRI dhan92, BRRI dhan102, BRRI dhan105 and BRRI dhan108 for Boro season due to their higher yield and less blast disease. Some farmers preferred BRRI dhan96 for their short duration in Haor areas.

Activity 2: Farmers Training

BRRI regional station, Habiganj conducted 12 farmer's training at different location of Sylhet region during the reporting period. These training programs were conducted at Habiganj (Sadar, Baniachong, Madhobpur), Sylhet Sadar, Moulovibazar (Kamalganj, Rajnagar). In total 360 persons were trained. Three SAAO training (90 participants) and two dealer training (60 participants) were also conducted during Boro season 2024-25. Awareness for adopting improved rice cultivation technologies and enhancing the dissemination of BRRI Varieties was done through those trainings.

Activity 3: Farmer's Field Day

BRRI regional station, Habiganj conducted 12 field days in different location of Sylhet region during the reporting period. More than 1,000 farmers, extension personnel, administrative peoples, public leaders participated in these field days. Most of the farmers have preferred BRRI dhan98 over BRRI dhan48 due to its higher yield and slender grain in Aus season. In Aman season, farmers chosen BRRI dhan103 for its higher grain yield and BRRI

ghan95 for its non-lodging and higher yield. BRRI dhan92, BRRI dhan96, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107 and BRRI dhan108 have been chosen for Boro season due to their higher yield and less blast disease. Farmers showed their interest to cultivate the demonstrated varieties in the next season.

PROJECT 6: SEED PRODUCTION

Activity 1: Breeder seed production

In Boro 2024-25 season, a total of 26350 kg (4050 kg BRRI dhan28, 5500 kg BRRI dhan29, 7150 kg BRRI dhan89, 1650 kg BRRI dhan92, 5000 kg BRRI dhan100, 500 kg BRRI dhan101 and 2500 kg BRRI dhan102) breeder seed were produced.

Activity 2: TLS seed production

In Aus 2024 season, a total of 400 kg BRRI dhan98 were produced while in T. Aman 2024, a total 1500

kg (800 kg BRRI dhan93 and 700 kg BRRI dhan94) TLS seed were produced. On the other hand, in Boro 2024-25 season, a total of 14,800 kg (3500 kg BRRI dhan28, 1500 kg BRRI dhan88, 1200 kg BRRI dhan29, 2500 kg BRRI dhan92, 1400 kg BRRI dhan100, 500 kg BRRI dhan101, 3000 kg BRRI dhan102, 500 kg BRRI dhan108 and 700 kg BRRI dhan108) TLS seed were produced. BRRI released varieties would be disseminated quickly to farmers by using these seeds.

Activity 3: Certified seed production

In Boro 2024-25 season, a total of 16000 kg certified seed of BRRI dhan104 were produced. BRRI released variety BRRI dhan104 would be disseminated quickly to farmers by using these seeds.

BRRI RS, Rajshahi

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SUMMARY

Under the Heat Tolerant Breeding Program, 18 AYT#1 (HTR-SD), 6 AYT#2 (HTR-LD) and 3 RYT (HTR) entries gave significantly higher yield with 3-7 days higher growth duration compared to their corresponding checks during Late Boro 2024-25. In T. Aus 2024 only 2 entries under RYT#2 (T. Aus) were selected for further advancement.

During the Aman 2024, a hybridization program in BRRI Rajshahi, 172 F₁ seeds were produced from BC₁ with the objectives of developing Jira-type grain and lodging-tolerant lines. Nine crosses were confirmed in F₁. A total of 43652 individual progenies from the FRGA nursery were processed, purification of 5 local sampa katari were collected from different locations, and around 30 local germplasm were maintained for future crossing programs. Under the experimental trials, 65 entries in OYT (DRR), 2 entries in AYT#(DRR), 16 entries in AYT#2 (DTR-SD) and 2 entries in AYT#3 (DTR-LD) gave significantly higher grain yield compared to their corresponding checks. From 13 different RYT, 10 tested entries (BR11871-5R-127, BR11664-3R-2-3, BRH9-3-14-2B, BR(Bio)15086-AC119-16, BR12839-4R-106, BR12459-4R-26, BR12466-4R-167, BR12631-5R-35, BR11748-5R-16, IR19A7560) found promising for further advancement. Around 100 germplasm under the CRICIL project showed good performance under the drought environment.

Under hybridization program in Boro 2024-25, 16 crosses were made using 9 parents and 779 were produced with the objective of development of Jira type plant with lodging tolerant lines. Seventeen crosses out of 22 crosses were confirmed in F₁. A total of 17827 individual progenies from FRGA nursery and 23950 individual progenies from 18 crosses under LST (Line Stage Testing) program were preceded for trait development and around 14 local germplasm were maintained for future crossing programs.

Under the experimental trials, 114 genotypes showed significantly higher yield compared to the corresponding checks in OYT DRR, OYT FBC, OYT PQR-1 & OYT PQR-2. Total 11 genotypes

was found promising in four different AYT's (AYT#1 DRR-SD, AYT#2 DRR-LD, AYT#3 PQR-1 & AYT#2 PQR-2). In 13 Regional Yield Trials (RYT), 9 advance line (BR11276-4R-139, BR13201-4R-249, BR13136-5R-139, SVIN109, BR13027-BC1-3R-139, BR13027-BC1-3R-21, BR13178-4R-317, BR12839-4R-138-4, and BRBaNGR350-2) found promising for further advancement. 4 entries in (MD Satge-1) trail, under the IRRI-NARS Network, performed significantly higher over their checks.

Soil samples from nine upazilas in the Rajshahi district were collected to study hydraulic properties during the Aman season in 2024. The study found that soil organic matter content varied from 1.5% in the Godagari upazila to 2.8% in the Charghat upazila. Soil water storage was moderate to high, providing sufficient water for rice during early and mid-stages. The study also found a strong negative correlation between silt and clay content.

In validation of agricultural drought forecasting for mitigating drought in T. Aman rice trial it was observed that rainfall was overestimated compared to forecasted rainfall for two transplanting dates. However, when considering ET₀, the observed ET₀ was underestimated compared to the forecasted ET₀ for both transplanting dates. Furthermore, irrigation water savings of 26.32% and 21.43% achieved under early transplanting compared to delay transplanting.

The trial mango orchard agroforestry system in the Rajshahi regions showed higher rice equivalent yield, REY (13.15 t/ha) in the Field pea-Sesame-Aman (BRRI hybrid dhan6) cropping pattern, followed by Mustard-Blackgram-Aman (BRRI hybrid dhan6) and Field pea-Sesame-Aman. The zero-tillage mustard-based cropping pattern CP2 yielded higher REY (15.81 t/ha) and was found to be the most profitable for increasing total productivity. The Potato-Boro-T. Aman (improved) cropping pattern demonstrated the highest REY at 28.49 t/ha in CP2, followed closely by CP3 at 28.1 t/ha, achieved through the varietal replacement of the existing cropping pattern. The maize-T. Aus-T. Aman cropping pattern showed the highest system yield (22.97 t/ha) in the improved CP2 cropping

pattern. The improved mustard (BARI Sharisha-14)-Boro (BRRI dhan108)-T. Aman (BRRI dhan103) cropping pattern was found to be more profitable for increasing total productivity by increasing cropping intensity than Boro-Fallow-T. Aman.

USEFUL SCIENTIFIC INFORMATION

VARIETAL DEVELOPMENT PROGRAM

**TK Hore, MH Ali, S Haque, S Abedin,
MH Rashid and M Hossain**

Advanced Yield Trial (AYT), Late Boro 2024-25: In AYT#1 (HTR-SD), 16 entries gave significantly higher yield (6.19-6.91 t/ha; GD 103-119 days) compared to four checks (3.36-5.82 t/ha; GD 98-109 days). BR13157-4R-173 produced significantly higher grain yield (6.91 t/ha) with

almost similar GD (110 days) than the check BRRI dhan28 (5.82 t/ha, 108 days). In AYT#2 (HT-LD), 6 entries gave significantly higher yield (6.57-6.91 t/ha; GD 112-119 days) compared to three checks (Yield 5.47-6.12 t/ha; GD 110-125 days). BR12605-4R-182 produced significantly highest grain yield (6.91 t/ha) and 6 days shorter GD 119 days compared to BRRI dhan89 (6.12 t/ha; 125 days).

Regional Yield Trial (RYT), Late Boro 2024-25: Five genotypes were evaluated in one RYT (Table 1). Three genotypes gave significantly higher yield (5.76-5.96 t/ha; GD 110-117 days) compared to the checks (Yield 4.43-5.42 t/ha; GD 107-110 days). Higher grain yield producing advanced line was BR12605-4R-275 (5.96 t/ha) with 112 days GD which was 2 days longer GD than BRRI dhan98 (5.42 t/ha; 110 days).

Table 1: Yield and ancillary characters of breeding lines in RYT (HTR), Late Boro 2024

Designation	Plant height (cm)	Growth duration (Days)	Grain yield (t/ha)
BR12605-4R-275	116	112	5.96
BR12605-4R-298	121	110	5.78
BR11845-4R-50	129	117	5.76
BRRI dhan28 (ck)	115	109	4.43
BRRI dhan98 (ck)	107	110	5.42
Binadhan14 (ck)	96	107	5.23
LSD _(5%)	2.51	1.23	0.48

Observation Yield Trial (OYT), T. Aus 2024-25: Thirty entries gave significantly higher yield (5.70-6.59 t/ha; 110-143 days) compared to two checks BRRI dhan48 & BRRI dhan98 (Yield 4.44-5.30 t/ha; GD 110-112 days). BR13617-5R-120 produced higher grain yield (6.59 t/ha; 120 days) with 2 days earlier GD compared to higher grain yield producing check BRRI dhan98 (5.30 t/ha; 112 days).

Observation Yield Trial (OYT), DSR, IRRI-NARS Network Trial, T. Aus 2024-25: In IRRI-NARS Network Trial, one Observation Yield Trial (OYT) under Direct Seeded Rice (DSR) condition was conducted with 130 advanced breeding lines having 5 global checks and 5 local checks. The

selected experimental site was lowland and the crop faced hazardous environmental conditions. Despite of the adverse conditions faced by all genotypes, IR 147509-B-B-8-B and IR 147506-B-B-35-B performed exceptionally well, yielding 2.40-2.00 t/ha than the best performing check Binadhan-21 (0.73 t/ha).

Regional Yield Trial (RYT), T. Aus 2024-25: In RYT#2 (DSR), 2 entries-BR12862-5R-3 and BR10756-2B-8-72 produced highest grain yield (1.40-1.42 t/ha; 104-105 days) compared to BRRI dhan83 (1.13 t/ha; GD 100 days). All entries yielded very low because of hazardous environmental conditions during their lifespan (Table 2).

Table 2: Yield and ancillary characters of breeding lines in RYT#2 (DSR), Late Boro 2024

Designation	Plant height (cm)	Growth duration (Days)	Grain yield (t/ha)
BR10756-2B-8-72	94	104	1.42
BR12862-5R-3	96	105	1.40
BRRi dhan83 (ck)	105	100	1.13

Hybridization and F1 confirmation, T. Aman 2024-25: A total of 172 F1 seeds were produced from two back cross combination (BC₁) using four parents. Out of 12 crosses, 9 crosses were selected and confirmed as true F₁s comparing with their parents and registered in the BRRaj cross register. Seeds of these selected F₁ plants were selfed to produce F₂ seeds. At maturity, F₂ seeds of all selected plants were harvested, dried, cleaned and preserved.

Rapid Generation Advance of Segregating Nurseries, T. Aman 2024-25: A total of 43652 individual progenies from 42 crosses were harvested from F₂-F₆ generations through FRGA method.

Purifications of Sampa Katari, T. Aman 2024-25: A total of five local sampakatari germplasm were collected from different locations of Rajshahi, Natore and Naogaon region, grown single seedling/hill at BRRi Rajshahi though head to row method.

Germplasm screening of CRCIL project: BRRi Rajshahi conducted a field trial with 452 germplasm under the CRICIL at Godagari, Rajshahi and result was given to the PBD of BRRi Gazipur.

Germplasm collection & Maintenance Breeding, T. Aman 2024-25: Thirty local germplasm were collected from different Upazilla of Rajshahi to maintain the local germplasm for using in crossing program.

Observation Yield Trial (OYT), T. Aman 2024-25: One OYT (DRR) was evaluated along with 260 entries and three checks BRRi dhan49 BRRi dhan75, BRRi dhan87 & IRBB60. In OYT (DRR), a wide range of yield variation was observed between the entries, varied from 2.47-4.95 t/ha with the GD from 115-131 days. Among the entries 65

entries gave higher yield (3.60-4.95 t/ha; 115-131 days) compared to three checks BRRi dhan49 BRRi dhan75, BRRi dhan87 & IRBB60 (Yield 3.08-3.51 t/ha; GD 111-129 days). Among them, BR13962-4R-28-1 produced highest grain yield (4.95 t/ha; 124 days) with similar GD compared to highest yield producing check BRRi dhan87 (3.51 t/ha, 125 days).

Advanced Yield Trial (AYT) during T. Aman 2024-25: Fifty three genotypes were evaluated in three AYT's with standard checks. Out of 10 entries and four checks BRRi dhan49, BRRi dhan75, BRRi dhan87 & IRBB60 in AYT#1 (DRR-BB), 2 entries- BR12902-4R-127 and BR12896-4R-12 produced similar grain yield (5.73-5.77 t/ha and 116-120 days) compared to BRRi dhan87 (5.88 t/ha; 120 days). Checks yield ranges from 4.81-5.88 t/ha with the GD 111-125 days. In AYT#2 (DTR-SD), 26 lines were tested among them 16 entries gave significantly higher yield (5.34-6.24 t/ha; 103-122 days) compared to two checks BRRi dhan71 & BRRi dhan75 (Yield 4.86-5.01 t/ha; GD 108-110 days). BR13534-4R-13 produced higher grain yield (6.24 t/ha; 110 days) compared to BRRi dhan75 (5.01 t/ha; 110 days). In AYT#3 (DTR-LD), among the 17 lines, 2 entries gave significantly higher yield (6.02-6.24 t/ha; 125 days) compared to three checks BRRi dhan71, BRRi dhan75 & BRRi dhan87 (Yield 5.02-5.59 t/ha; GD 110-126 days). BR13051-4R-24 produced higher grain yield (6.24 t/ha; 125 days) with 2 days longer GD compared to BRRi dhan49 (5.59 t/ha; 122 days).

Regional Yield Trial (RYT), T. Aman 2023-24: In RYT#1 (DRR-BB), 2 lines gave significantly higher yield (6.59-6.89 t/ha; 110-111 days) compared to three checks (5.33-6.01 t/ha; 112-127 days). BR11871-5R-127 produced higher grain yield (6.89 t/ha; 110 days) among all the entries and checks, in which produced 12 days shorter GD

compared to BRRI dhan87 (6.01 t/ha; 122 days). In RYT#2 (ZER), BR11664-3R-2-3 produced almost similar grain yield (5.46 t/ha; 111 days) but 10 days shorter GD compared to check BRRI dhan72 (5.47 t/ha, 121 days). In RYT#3 (Jira), one tested entry gave significantly higher yield compared to two checks (4.08-5.23 t/ha; GD 110-114 days). Tested BRH9-3-14-2B (6.19 t/ha; 110 days) gave higher grain with 11 days shorter GD compared to highest grain producing check BRRI dhan87 (6.01 t/ha; 122 days). In RYT#4 (BIO), BR(Bio)15086-AC119-16 produced higher yield (4.28 t/ha; 115 days) compared to check BRRI dhan75 (4.08 t/ha, 110 days). In RYT#5 (AER), BR12839-4R-106 produced similar yield with 14 days shorter GD (6.43 t/ha; 115 days) compared to BRRI dhan49 (6.44 t/ha; 129 days). In RYT#6 (Rangpur), In RYT#7 (STR-SD), one entry gave significantly higher yield compared to three checks (2.42-5.69 t/ha; 121-136 days). BR12459-4R-26 produced significantly higher grain yield with similar GD (6.94 t/ha; 127 days) compared to highest yield producing check- BRRI dhan87 (5.69 t/ha; 127 days). In RYT#8 (STR-LD), 5 entries gave significantly higher yield (6.20-7 t/ha; 115-117 days) compared to two checks (4.08-2.26-5.93 t/ha; GD 133-141 days). BR12466-4R-167 produced higher yield (7.00 t/ha; 115 days) with 18 days shorter GD compared to check BRRI dhan30 (5.93 t/ha, 133 days). Four RYT's in RLR program, out of 7 entries, 3 entries gave significantly higher yield (6.29-6.55 t/ha; 106-111 days) compared to three checks (5.10-6.01 t/ha; 108-122 days). BR12631-5R-35 produced significantly higher grain yield with similar GD (6.55 t/ha; 109 days) compared to BRRI dhan87 (6.01t/ha; 122 days). In RYT#10 (RLR-2), 2 entries gave significantly higher yield (6.76-5.88 t/ha; 120-129 days) compared to three checks (5.07-5.45 t/ha; 109-113 days). BR11748-5R-16 produced higher yield (5.88 t/ha; 129 days) compared to check BRRI dhan87 (5.45 t/ha, 122 days). In RYT#11 (RLR-3), In RYT#12 (RLR-4), one entry produced higher yield (6.63 t/ha; 117 days) compared to three checks (5.10-6.00 t/ha; 103-126 days). IR19A7560 produced higher grain (6.63 t/ha; 117 days) with 9 days shorter GD compared to the highest yield producing check

BRRI dhan87 (6.03 t/ha, 126 days). Under the RYT#13 (DTR) program, in location-1, five entries performed higher grain yield (5.21-5.73 t/ha; 110-119 days) against the two checks (4.33-4.95; 105-112). In location-2, nine entries showed higher grain yield (5.22-5.65 t/ha; 114-125 days) compared to the two checks (4.20-4.67; 113-111) and in location number three, 4 entries performed better (5.15-5.52 t/ha; 115-119 days) over the two checks (4.32-4.68; 106-112).

Hybridization and F₁ Confirmation, Boro 2024-5:

A total of 779 F₁ seeds were produced from 16 crosses using 9 parents in Boro 2024-25 season. Out of 22 crosses, 17 crosses were selected and confirmed as true F₁s comparing with their parents. Seeds of these selected F₁ plants were selfed to produce F₂ seeds.

Rapid generation advance of segregating nurseries, Boro 2024-25: In total 17827 individual progenies from 24 crosses were harvested from F₂-F₅ generations through FRGA method to develop trait (with high yield and grain quality like Jira).

Line Stage Testing (LST), Boro2024-25: In total 23950 individual progenies from 18 crosses were grown in Boro season at BRRI Rajshahi farm comprising LST (Line Stage Testing) for the development of drought, cold tolerant and premium quality rice following SSD method of breeding.

Maintenance breeding program, Boro2024-25: To maintain the local germplasm for using in crossing program, around 14 local germplasm were grown in BRRI Rajshahi farm in Boro season.

Observation Yield Trial (OYT), Boro 2024-25: In OYT#1 DRR, 49 line showed significantly higher yield (8.13-9.54 t/ha; 127-146 days) compared to the checks (6.20-7.50 t/ha; 135-144 days). The line BR14322-4R-152 showed 14 days shorter GD and higher grain yield (9.54 t/ha, 131 days) among the all lines and also highest yield producing check BRRI dhan89 (7.54 t/ha, 144 days). In OYT#2 FBC, 4 entries show significantly higher yield (8.32-8.84 t/ha, 127-144 days) over the four checks (6.66-7.94; 128-156 days). BR14223-5R-43 was the highest grain yield (8.32 t/ha; 140 days) producing line which showed 8 days shorter

GD compared to the highest yield producing check BRRI dhan102 (7.94 t/ha; 148 days). In OYT#3 (PQR-1), 52 entries showed higher yield (7.75-9.58 t/ha; 127-149 days) compared with five checks (6.62-7.06 t/ha; 132-149 days). BR13257-4R-88 shows higher grain (9.58 t/ha; 130 days) with 19 days shorter GD over the higher grain producing check BRRI dhan50 (7.06 t/ha; 149 days). In OYT#4 (PQR-2), 9 genotypes gave significantly higher yield 7.53-8.05 t/ha; 134-148 days) compared to five the checks (5.88-6.97 t/ha; 134-151 days). BR13257-4R-283 gave higher yield (8.05 t/ha; 134 days) with 10 days shorter GD over the higher yield producing check BRRI dhan104 (6.97 t/ha; 144 days).

Advanced Yield Trial (AYT) during Boro 2024-25: In AYT#1 (DRR-SD), 3 entries gave significantly higher yield (8.58-8.83 t/ha; 142-146 days) among all of the tested entries and over the three checks BRRI dhan58, BRRI dhan88 and BRRI dhan101 (6.81-7.85 t/ha; 140-148 days).

BR13618-4R-91 showed higher grain (8.53 t/ha; 146 days) but 4 days longer GD compared to the highest grain producing check BRRI dhan101 (7.85 t/ha; 142 days). In AYT#2 (DRR-LD), 2 entries-BR13618-4R-253 (8.84 t/ha; 141 days) and BR13618-4R-209 (8.92 t/ha; 151 days) produced significantly higher grain yield with more or less similar GD (Table 3) among all the tested entries and also compared with three checks BRRI dhan89, BRRI dhan92 and BRRI dhan101 (7.15-8.00 t/ha; 142-156 days). In AYT#3 (PQR-1), 2 genotypes BR12582-4R-253 (7.58 t/ha; 136 days) and IR146443-9-2-B (7.83 t/ha; 135 days) showed significantly higher grain compared to three checks BRRI dhan81, BRRI dhan104 and BRRI dhan107 (6.55-7.29 t/ha; 136-145 days). In AYT#4 (PQR-2), 4 genotypes showed higher yield (7.45-7.56 t/ha; 139-144days) compared the checks (3.34-6.98 t/ha; 137-149 days). BR12583-4R-197 produced highest grain (7.56 t/ha; 141 days) among all the tested entries and highest grain producing check BRRI dhan104 (6.93 t/ha; 143 days) with similar GD.

Table 3: Yield and ancillary characters of the selected breeding lines in In AYT#2 (DRR-LD)

Designation	Plant height (cm)	Growth duration (Days)	Grain yield (t/ha)
BR13618-4R-253	117	141	8.84
BR13618-4R-209	120	151	8.92
BRRI dhan89 (ck)	105	151	7.86
BRRI dhan92 (ck)	110	156	8.00
BRRI dhan101 (ck)	117	142	7.15
LSD(5%)	3.51	0.91	0.74

Regional Yield Trial (RYT), Boro 2023-24: In RYT#2 (PQR), 3 entries performed higher grain yield (8.03-8.21 t/ha; 140-151 days) over the three checks (6.32-7.65; 141-250 days). BR11973-4R-309 produced the highest yield (8.21 t/ha; 140 days) with similar GD compared to check BRRI dhan107 (7.64 t/ha; 141 days). In another location, 4 entries gave higher yield (7.50-7.74 t/ha; 136-143 days) compared to two checks BRRI dhan50 and BRRI dhan104 (6.44-6.74 t/ha; 146-150 days). In RYT#3 (STR-1), BR11276-4R-139 gave significantly higher yield (7.20 t/ha; 153 days) compared to the four checks (5.59-6.83 t/ha; 141-155 days). In RYT#4 (STR-2), BR13201-4R-249 gave

significantly higher grain (7.20 t/ha; 150 days) over the three checks (6.43-6.78 t/ha; 135-155 days). In RYT#5 (FBR-SD), 3 entries BR13136-5R-139, SVIN109 and BR13027-BC1-3R-139 performed better (8.20-8.34 t/ha; 131-140 days) over the check BRRI dhan88 (8.12 t/ha; 135 days) and also other two checks (7.31-7.74 t/ha; 133-152 days). In RYT#6 (FBR-MLD), 3 entries gave the similar grain yield (8.28-8.31 t/ha; 149-150 days) over the check BRRI dhan92 (8.28 t/ha; 157 days) and also higher over the check BRRI dhan102 (7.40 t/ha; 150 days). In RYT#7 (FBR-MD), BR13027-BC1-3R-21 gave similar yield (8.37 t/ha; 144 days) with 8 days shorter GD to check BRRI dhan89 (8.34

t/ha; 152 days). In RYT#8 (DRR-SD-MD) 3 entries gave significantly higher grain (8.05-8.36 t/ha; 131-145 days) compared to 2 checks (7.14-7.50 t/ha; 138-147 days). BR13178-4R-317 gave the highest result on yield (8.36 t/ha; 142 days) and 5 days shorter GD compared to BRRI dhan101 (7.50 t/ha; 147 days). In RYT#9 (DRR-LD), 2 entries (8.19-8.30 t/ha; 144-145) gave similar yield with similar GD over two checks but better to the check BRRI dhan101 (7.26; 145 day). In RYT#11 (Pigmented Rice), BR12839-4R-138-4 showed similar performance to BRRI dhan89 and showed higher yield (7.63 t/ha; 151 days) compared to the check BRRI dhan88 (6.92 t/ha; 143 days). In RYT#13 (Barishal), BRBaNGR350-2 gave almost similar yield (8.18 t/ha; 140 days) with 13 days shorter GD compared to the check BRRI dhan102 (8.08 t/ha; 153 days). Two entries also gave higher yield (7.64-7.97 t/ha; 140-149 days) compared with the other check BRRI dhan74 (7.06 t/ha; 142 days).

Establishment of IRRI-NARS network Trial, Boro2024-25: In MD-Satge-1 trail, 4 entries gave more than 8 t/ha yield (8.09-8.45 t/ha) and IR23MD3797 gave the highest yield (8.45 t/ha, 135 days) and 8 days shorter GD compared to the check BRRI hybrid dhan8 (8.28 t/ha; 143 days). In MD Stage-2, yield range of this trial varied from 2.83-8.03 t/ha. The local checks yield ranges from 2.88-7.79 t/ha. IR22MD2741 showed similar grain yield (7.79 t/ha) to BRRI dhan102 (7.79 t/ha).

2. CROP-SOIL-WATER MANAGEMENT

MH Ali, TK Hore, S Haque, S Abedin, MH Rashid and M Hossain

Assessing the spatial distribution of soil hydraulic properties and available soil water in irrigated cropland: Soil samples from nine upazilas in Rajshahi district were collected during T. Aman 2024. The soil organic matter content in the topsoil (up to 10 cm depth) varied from 1.45% in the Godagari upazila to 2.75% in the Charghat upazila of Rajshahi district. Hydraulic Conductivity (Ks) values found low in Barind region compared to optimal (0.005 and 0.05 mm/s) facilitating waterlogging conditions which led to delayed harvest and reduced grain quality. Soil water

storage was likely moderate to high, providing sufficient water for Aman rice in the early (0–30 DAT) and mid (30–60 DAT) stages. The water content value is nearly always around field capacity, suitable for the vegetative and reproductive stages of rice. During early development (0-30 DAT), cumulative root water uptake (CRWU) was adequate, while in mid-growth, it's partially sufficient, reaching 10-15 cm and 30-50 cm, respectively. The highest median yields were observed in Paba and Mohonpur, indicating favorable agro-environmental conditions or agro-management practices in these regions.

The study reveals a strong negative correlation ($r = -0.80$) between silt and clay content, highlighting the binary nature of these soil components in agricultural soils. Water content has weak correlations ($r < 0.26$) with other soil parameters, indicating that soil moisture levels are influenced by a complex interplay of soil phenomena rather than a single physical property. The PCA biplot reveals three distinct clusters of soil properties: organic matter-rich sandy, clay-rich fine, and silt-dominated compact, highlighting significant textural and structural variability.

The surface soils (0–10 cm) from the Bagha, Baghmara, and Tanore clusters are closely aligned, indicating that these locations have similar soil properties in the top layer. Deeper soils (20–30 cm), especially in Charghat, Tanore, and Mohonpur, demonstrate greater variability in their properties at depth. Infiltration rate varies significantly across depth intervals, with the surface layer showing the lowest and most variable rates. Infiltration behaviour is heterogeneous, influenced by soil and hydrological properties. Tanore and Puthia show high rates across depths.

3. RICE FARMING SYSTEMS

MH Rashid, S Haque, MH Ali, TK Hore, S Abedin and M Hossain

Maximize the resource use efficiency of agro-forestry system in Rajshahi regions: Among the four cropping pattern, considering cropping system yield & economics of mango based agroforestry system, the higher REY (13.15 t/ha) was found in

(Field pea-Sesame- Aman (BRRI hybrid dhan6) cropping pattern closely followed by Mustard-Blackgram – Aman (BRRI hybrid dhan6) cropping pattern with REY(12.98) and Field pea-Sesame-Aman(BRRI hybrid dhan6) gave the highest gross margin of 235.514 thousand taka which was followed by Mustard- Blackgram – Aman (BRRI hybrid dhan6) cropping pattern (215.433 thousand taka). The lower system yield (5.76 t/ha) was found in sweet gourd-Fallow-Aman (BRRI hybrid dhan6) cropping system because of crop failure due to not germination of seed.

Evaluation of Zero Tillage Mustard Based Cropping Patterns in Rajshahi region:

Considering cropping system yield, the higher REY (15.81 t/ha) was found in CP3 closely followed by CP1 (15.55 t/ha) and the highest gross margin of CP3 was 289379 Tk/ha. The lower system yield (11.69 t/ha) was found in rice-rice cropping system (CP4) and the gross margin was found 197002 Tk/Ha. Out of four, mustard-based cropping patterns like CP1, CP2 and CP3 gave higher rice equivalent yield (REY) than the existing one. On the other hand, rice equivalent yield (REY) of zero tillage mustard-based cropping pattern CP3 gave higher yield than the others and this was found most profitable to increase the total productivity of unit area per year by increasing cropping intensity.

Improvement of Productivity in Potato-Boro-T.Aman cropping pattern through varietal replacement:

In consideration of the system productivity, the highest REY (28.49 t/ha) was found in CP2 followed by CP3 (28.1 t/ha). The lower system yield was found in Potato (BARI Alu-8)-Boro (BRRI dhan28) -T.Aman (BRRI dhan93) cropping system (CP1). Out of three, about 2 rice equivalent yield (REY) advantage in two improved patterns over existing pattern of Potato (BARI Alu-8)-Boro (BRRI dhan28)- Aman (BRRI dhan93). Among the three cropping pattern the highest gross margin was 366785 Tk/Ha was found in CP2 followed by CP3 (356184 Tk/Ha) and the lowest gross margin was 292799 Tk/Ha found in CP1 and CP2 seems like most profitable than the others.

Improvement of Productivity of Boro-Fallow-T. Aman cropping pattern through inclusion of

Mustard and promising rice varieties in Barind region: The system productivity gave the highest REY (17.26 t/ha) in improved CP3 followed by improved CP1 (17.00 t/ha). The lower system yield was found in the existing CP Fallow-Boro (Jira) - T.Aman (BRRI dhan51). The highest gross margin was 297777 Tk/ha found in improved CP3 Closely followed by improved CP1 and the lowest gross margin was 188256 Tk/ha found in existing CP Out of four, the improved CP Mustard (BARI Shorisha-14)-Boro (BRRI dhan108)-T. Aman (BRRI dhan103) combination was found most profitable to increase the total productivity of unit area per year by increasing cropping intensity.

Farmers participatory evaluation crops establishment techniques under Maize-T. Aus-T. Aman cropping pattern:

The highest system yield (22.97 t/ha) was recorded from improved CP2 whereas Transplanting of Aus and Aman was Transplanted though rice transplanter and seeding of maize through bed planter and BRRI dhan103 and BRRI dhan98 was used as T. Aus and T. Aman variety, respectively. The gross margin of the improved cropping pattern was higher than the existing one. Due to using rice transplanter and maize bed planter in cultivation, total cost was found lower than the conventional method and this improved CP2 was found most profitable.

4. SOCIO-ECONOMICS AND POLICY

S Haque, MH Ali, TK Hore, S Abedin, MH Rashid and M Hossain

Stability analysis of BRRI developed varieties:

During the Aman 2024 season, BRRI Rajshahi assessed forty-eight varieties of Aman rice at the Rajshahi farm. The top-performing variety was BRRI dhan51, which yielded 6.67 t/ha. Other high-yielding varieties included BRRI dhan52, BRRI dhan49, hybrid dhan6, and BR11, while the remaining varieties exhibited lower yields. A total of fifty-four rice varieties were evaluated during the Boro season of 2024-25. Based on yield performance, the top four rice varieties were BRRI hybrid dhan8 (8.96 t/ha), BRRI dhan92 (8.70 t/ha), BRRI dhan108 (8.65 t/ha) and BRRI dhan102 (8.65 t/ha). Conversely, BR26 (4.70 t/ha) and BRRI

ghan27 (4.74 t/ha) were recorded with the lowest yields among the Boro varieties

5. TECHNOLOGY TRANSFER

MH Ali, MH Rashid, TK Hore, S Haque, S Abedin and M Hossain,

ALART findings during T. Aman 2024: During T. Aman 2024, the genotype of ALART- Drought Tolerant Rice (DTR) demonstrated a higher yield and two weeks shorter in GD to that of the check BRRI dhan71. In ALART-Antioxidant Enriched Rice (AOER), tested genotypes yielded insignificantly higher though growth durations were noticeably shorter compared to the controls. In ALART-False Smut (FS) two entries, BR (Path) 13804-BC3-4-5 and BR (Path) 13804-BC3-13, gave significantly higher yields with shorter growth duration than BRRI dhan49. In ALART-Photosensitive rice two entries, BR10212-17-3-2-2 and BR10212-5-5-3 gave higher yields with shorter growth duration than both the checks. Two entries, BRH13-9-5-2B, BRH9-3-2B, and IR12A177 gave significantly higher yields with shorter growth duration than Katari (Ck) in ALART-SHY-Katari type rice. In another ALART-SHY-Katari trial the highest grain yield (6.11 t/ha) was found in BRH9-3-2B, followed by (5.29 t/ha) BRH13-9-5-2B, and the lowest grain yield (4.65 t/ha) was found in IR12A177. In the trial of ALART-SHY-Zira type rice the evaluated lines (5.5 t/ha in BR11-7-17-10B, 6.05 t/ha in BRH17-23-8-2-7B) along with the control BRRI dhan75 (Ck) produced significantly higher yields compared to Zirashail (Ck).

ALART findings for the Boro season 2024-25: ALART-STR-SD: The tested genotype BR13113-4R-63 (7.47 t/ha) produced similar yield to the Checks (7.41-7.47 t/ha) with almost similar growth

duration. ALART-PQR: the yield of BR11359-4R-181 (7.40 t/ha) was comparable to the checks. ALART-STR-MD: The genotypes BR13122-4R-136 (7.79 t/ha) and the check BRRI dhan99 (Ck) (7.68 t/ha) produced more among the tested lines. ALART-BRR-MD: The results indicated that both entries yielded more than the standard check, BRRI dhan58, with yields of 7.68 t/ha and 7.18 t/ha, respectively, compared to 7.09 t/ha for the check. ALART-PQR-PATH: The results showed that the entry BR(Path)-Premium1 and check BRRI dhan104 (Ck) produced similar yields (7.40 t/ha and 7.41 t/ha, respectively), which were higher than the standard check BRRI dhan50 (Ck) (6.26 t/ha). The ALART-BRR-LD: standard check BRRI dhan29 and BR(Path)15855-BC2-3HR-23 produced similar yield (7.43 t/ha) though the line had two weeks shorter growth duration. ALART-BB+Blast-SD: BR(Path)13802-BC3-62-14 yielded 7.64 t/ha, which is higher than the yield of the tested check, BRRI dhan88, at 7.13 t/ha.

Demonstration, Farmers training, Seed production and distribution: A total of 50 and 150 acres of field demonstrations were conducted in T. Aman and Boro season, respectively under LSTD project. The PARTNER project financed for 150 and 470 acres, respectively. Furthermore, the GoB funded for 83 acres in Aus, 2 acres in Aman and 13 acres in Boro seasons. A total of 22 training (GoB-15 and PARTNER-7) were conducted in which 660 participants attended. Additionally, seeds of modern rice varieties were distributed to farmers for demonstration purposes. Over the three seasons (Aus, T. Aman, and Boro), production of breeder, certified and TLS seeds were 31.86, 28.9, and 8.2 tons, respectively.

BRRI RS, Rangpur

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SUMMARY

For developing region specific suitable modern rice varieties for Rangpur-Dinajpur region, 25 germplasms were collected from farmers' field for maintenance breeding; six single crosses were made during 2024-2025. In total, 375 individual plants and three fixed genotypes were selected from observational yield trial under the program of breeding for second generation rice. In OYT, BRrang30-8-2-1-1-1 produced 9.39 t/ha grain yield which was higher than BRRI dhan89 (8.05 t/ha) with 07 days shorted growth duration. Under Basmati rice breeding program, 85 individual plants and three fixed genotypes were selected from OYT. BRrang57-5-2-2-2 produced 0.35 t/ha more yield over BRRI dhan104 (6.75 t/ha) with similar growth duration (148 days). Moreover, from RYT two genotypes viz. BRrang55-RGA-40-1-1-1 and BRrang55-RGA-14-2-1-2 performed higher yield over BRRI dhan70 during T. Aman/2024. A total of 34 RYT's and 23 ALART's and 9 sets of PVT were conducted during this reporting period.

In planting time experiment, 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 dhan52, BRRI dhan79 and BRRI dhan93 on 20th July – 05th August. In Boro season, short duration variety had higher grain yield on 10 January to 25 January planting except BRRI dhan96 which gave higher yield on 25 December. For long duration variety, BRRI dhan89 and BRRI dhan92 gave higher yield on 25 January planting and BRRI dhan102 gave statistically similar yield on 10 January and 25 January planting. In long-term nutrient omission trial, it was observed that the omission of N appeared as the most yield limiting nutrient followed by P and K omission for rice in both seasons. Besides some yield penalties, the S and Zn omission have no significant effect on yield reduction at BRRI regional station Rangpur farm in T. Aman and Boro season.

The inclusion of mustard in the Boro-Fallow-T. Aman cropping pattern significantly enhanced the overall productivity compared to the existing system and BARI Sarisha-17-BRRI dhan107-BRRI dhan103 and BARI Sarisha-14-BRRI dhan74-BRRI dhan103 patterns having the marginal benefit-cost ratio (MBCR) 1.32 emerged as economically viable options, offering greater profitability among the tested systems.

A total of 3815 (3815 bighas) varietal demonstrations were conducted in Rangpur-Dinajpur region during this reporting period. Twenty nine field days were arranged and 20 farmers training were conducted on modern rice production technology. A total of 8,669 kg and 17260 kg TLS were produced in T. Aman and Boro season, respectively. A total of 11650 kg Breeder seed was produced and sent to the GRS Division, BRRI Gazipur. In this reporting period, 25,929 kg TLS was distributed for dissemination and popularization of latest BRRI varieties in Rangpur-Dinajpur region.

VARIETAL DEVELOPMENT PROGRAM (VDP)

Breeding for Second Generation Rice (SGR)

In total 25 germplasm were collected from farmers' field for maintenance breeding (**Table 1**) and fixed varieties were used as parent for breeding program. 375 individual plants were selected from 750 tested genotypes in Observational Yield Trail (OYT) based on the better performance with in flowering, phenotypic acceptability, insect and disease reaction, earliness and grain yield. Selected plants will be evaluated in next season. Three fixed genotypes, BRrang30-10-1-1-1-1, BRrang30-10-1-1-1-1 and BRrang37-3-2-1-1-1 were selected (**Table 2**) and BRrang30-8-2-1-1-1 produced 1.34 t/ha yields advantage over BRRI dhan89 (8.05 t/ha) with 07 days earlier.

Table 1. List of rice germplasms collected from different sources during reporting period 2024-2025.

Name of the germplasms	Season	Location/Division	Characteristics
Tongte dhan	Aman	Kaitonpara, Thanchi, Bandarban	Good grain type
Klingrow	Aman	Kaitonpara, Thanchi, Bandarban	Good grain type
Mongthong	Aman	Kaitonpara, Thanchi, Bandarban	Medium bold type
Shere dhan	Aman	Kaitonpara, Thanchi, Bandarban	Good grain type
Cha Maa	Aman	Kaitonpara, Thanchi, Bandarban	Tulsimala type
Tutnum	Aman	Kaitonpara, Thanchi, Bandarban	Good grain type
Kalo Binni (Chich stui)	Aman	Kaitonpara, Thanchi, Bandarban	Long bold grain
Kalijira short	Aman	Kawnia, Rangpur	Aromatic
Kalijira slender	Aman	Kawnia, Rangpur	Aromatic
Mashuri guti	Aman	Sadar Nilphamari	Medium bold grain
Swarna Paijam	Aman	Sadar Nilphamari	Premium Quality
Ranjit Swarna	Aman	Sadar Nilphamari	Medium bold grain
Zira sail	Aman	Sadar Nilphamari	Premium Quality
Guti Swarna	Aman	Mithapukur, Rangpur	Medium bold grain
Sumon Swarna	Aman	Mithapukur, Rangpur	Medium bold grain
Shailla	Aman	Nababganj, Dinajpur	Aromatic
Rosulbhog	Aman	Kawnia, Rangpur	Aromatic
Jamaibhog	Aman	Kawnia, Rangpur	Aromatic
Shompa katari	Aman	Birol, Dinajpur	Premium Quality
Kataribhog	Aman	Sadar, Dinajpur	Premium Quality
Kalizira	Aman	Sadar, Dinajpur	Premium Quality
Katari	Aman	Sadar, Gaibandha	Premium Quality
Zira Miniket	Aman	Sadar, Rangpur	Premium quality
BRrang55-RGA-40-1-1-1	Aman	BRRI Rangpur	Aromatic Basmati
BRrang55-RGA-14-2-12	Aman	BRRI Rangpur	Aromatic Basmati

Table 2. Agronomic parameters of the selected materials from Observational Yield Trial (OYT), Breeding for Second Generation Rice (SGR), Boro, 2024-25.

Designation	Pht. (cm)	Mat. (days)	Yield (t/ha)
BRrang30-8-2-1-1-1	103	152	9.39
BRrang30-10-1-1-1-1	101	151	8.00
BRrang37-3-2-1-1-1	105	153	7.93
BRRI dhan89 (Ck.)	107	159	8.05

D/S: 15 December, 2024; D/T: 28 January, 2025 & Spacing: 20 cm x 20 cm

Breeding for Basmati Rice (God of Grains)

Six single crosses were made using seven parents (**Table 3**). In total 85 individual plants were selected from 150 tested genotypes in observational yield trail based on the field performance regarding flowering pattern, phenotypic acceptability in vegetative and ripening stage, insect and disease reaction, lodging behavior, earliness, grain type and

yield. Selected plants will be evaluated in next season. Three fixed genotypes BRrang57-5-2-2-2, BRrang57-8-1-1-1 and BRrang57-11-1-2-1 were selected (**Table 4**) from observational yield trail. Promising genotype BRrang57-5-2-2-2 produced 0.35 t/ha more yields over BRRI dhan104 with similar growth duration (148 days). Moreover, two promising genotypes viz. BRrang55-RGA-40-1-1-1 and BRrang55-RGA-14-2-1-2 were selected based

on phenotype and good grain quality over BRRI dhan70 and BRRI dhan104 from Regional Yield Trial (RYT) in T. Aman and Boro season (**Table 5 & 6**). Both selected advanced breeding lines performed higher yield over BRRI dhan70. The

physico-chemical properties of both selected genotypes viz. BRrang55-RGA-40-1-1-1 and BRrang55-RGA-14-2-1-2 were analysed (**Table 6 & 8**).

Table 3. List of crosses made, Breeding for Basmati Rice, Boro, 2024-25.

Cross combination	F ₁ seeds	Characteristics
Extra long grain/BRRI dhan84	39	Premium quality
Extra long grain/BRRI dhan100	37	Premium quality
Extra long grain/BRRI dhan102	29	Premium quality
Extra long grain/BRRI dhan108	45	Premium quality
Extra long grain/BR12836-4R-63-Rang3-1-1	30	Premium quality
Extra long grain/BRrang30-8-2-1-1-1	42	Premium quality

Table 4. Agronomic parameters of the selected materials from Observational Yield Trial (OYT), Breeding for Basmati Rice, Boro, 2024-25.

Designation	PHt. (cm)	Mat. (days)	Yield (t/ha)
BRrang57-5-2-2-2	95	148	7.15
BRrang57-8-1-1-1	98	145	6.78
BRrang57-11-1-2-1	100	145	6.53
BRRI dhan104 (Ck.)	97	148	6.75

D/S: 15 December, 2024; D/T: 29 January, 2025 & Spacing: 20 cm x 20 cm

Table 5. Agronomic parameters of the selected materials from Regional Yield Trial (RYT), Breeding for Basmati Rice, T. Aman, 2024

Genotypes	PHt. (cm)	Mat. (Days)	Location					
			Raj	Rang	Kus	Siraj	Bari	Avg.
BRrang55-RGA-40-1-1-1	109	121	3.25	4.62	2.99	4.25	4.55	3.93
BRrang55-RGA-14-2-1-2	116	119	3.62	3.79	2.53	5.27	5.41	4.12
BRRI dhan70 (Ck)	129	126	2.03	2.79	3.16	5.36	5.37	3.74
BRRI dhan75 (Ck)	109	112	4.38	4.23	3.13	5.53	5.65	4.58
CV	5.9	2.85	12.09	20.36	5.94	7.94	12.35	14.38
LSD (0.05)	3.88	1.97	0.33	0.67	0.14	0.31	0.39	0.31

Table 6. Agronomic parameters of the selected materials from Regional Yield Trial (RYT), Breeding for Basmati Rice, Boro, 2024-25

Genotypes	PHt. (cm)	Mat. (Days)	Location											
			Gaz	Com	Bari	Siraj	Hobi	Gopal	Raj	Rang	Dinaj	Gopal	Sat	Avg.
BRrang55-RGA-40-1-1-1	96	145	6.11	6.26	5.41	7.11	2.56	8.91	6.42	6.67	7.73	7.80	5.95	6.45
BRrang55-RGA-14-2-1-2	104	146	6.28	5.79	5.43	7.95	2.77	6.89	6.36	6.69	7.83	7.63	5.15	6.25
BRrang55-RGA-14-2-1-2	104	146	6.36	6.19	5.72	6.81	2.67	7.15	6.59	6.68	7.89	7.98	4.92	6.27
BRrang55-RGA-14-2-1-2	107	146	5.84	5.46	5.42	7.57	3.29	6.94	6.30	6.46	7.35	8.20	5.09	6.17
BRRI dhan102 (Ck)	99	145	6.04	6.84	6.06	6.67	3.89	8.55	7.07	6.80	7.94	7.53	6.72	6.74

CV	4.6	1.85	11.19	15.16	6.85	8.74	11.78	12.01	6.87	6.91	7.85	11.85	12.2	14.2
LSD (0.05)	2.79	0.94	0.55	0.62	0.24	0.48	0.74	0.83	0.71	0.22	0.35	0.62	0.67	0.38

Table 7. Physical characteristics of selected basmati genotypes from Regional Yield Trial (RYT), Breeding for Basmati Rice, T. Aman, 2024.

AC#	Designation	MO (%)	Head Rice Recovery	Chaki. (%)	M GrL (mm)	MGrW (mm)	L/B ratio	Size & Shape	TWG (gm)	Aroma
21628	BRrang-RGA-40-1-1-1	71.4	50	Tr/Wc/i mmature	7.3	1.7	4.3	LS	21.7	+
21629	BRrang-RGA-14-2-1-2	70.9	55.6	Tr	8.1	1.8	4.5	ELS	24.0	++
18104	BRRI dhan70 (Ck)	69	57	-	6.6	2.0	3.4	LS	19.7	++
21632	BRRI dhan104 (Ck)	69.8	43.6	Tr/Wb/i mmature	7.5	1.7	4.4	LS	23.4	++

Table 8. Chemical properties of selected basmati genotypes from from Regional Yield Trial (RYT), Breeding for Basmati Rice, T. Aman, 2024.

AC#	Designation	Alakali spreading value	Amy (%)	Protein (%)	Cooked rice L (mm)	EL	IR	Ring formation
21628	BRrang-RGA-40-1-1-1	7.0	24.3	8.0	13.7	1.8	5.0	Slightly ring
21629	BRrang-RGA-14-2-1-2	7.0	24.1	8.2	12.6	1.7	4.3	Slightly ring
18104	BRRI dhan70 (Ck)	4.0	21.7	7.1	10.7	1.6	4.1	Slightly ring
21632	BRRI dhan104 (Ck)	7.0	29.0	8.9	11.8	1.6	3.7	Slightly ring

Regional Yield Trial (RYT), T. Aus, 2024

Three RYT was conducted under T. Aus season; one favourable, one tungro resistant and one direct seeding against standard check varieties.

RYT#1 (Favourable): Twelve genotypes along with two standard checks; BRRI dhan48 and BRRI dhan98 were evaluated. The highest grain yield was observed in BRRI dhan98 (4.47 t/ha with 107 days) followed by BR12616-4R-104 (4.40t/ha with 108 days).

RYT#2 (Tungro Resistant Rice): Nine genotypes along with three standard checks; BRRI dhan48, BRRI dhan85 and BRRI dhan98 were evaluated. The highest grain yield was found in BRRI dhan98

(4.38 t/ha and 106 days) followed by BR (Path) 16115-BC-5HR-21 (4.06 t/ha and 107 days).

RYT#3 (Direct seeding): Eleven genotypes along with three standard check; BRRI dhan83 were tested. BR10756-2B-8-72 (4.35 t/ha with 119 days) produced highest grain yield followed by BR12248-5R-37 (4.18 t/ha with 120 days) and BR12862-5R-3 (4.07 t/ha with 118).

Regional Yield Trial (RYT), T. Aman, 2024

A total of 16 RYTs were conducted under T. Aman, 2024; four Rainfed Lowland Rice (RLR), one Zinc Enriched Rice (ZER), three drought tolerant rice (DTR), one short duration high yielding rice, one for photosensitive rice, one premium quality

basmati rice, two salinity tolerant rice (STR), one Disease Resistant Rice (DDR-BB), one for antioxidant rice and one for fine grain (Zira type) rice against standard check varieties.

RYT#1 (RLR-1): Seven entries were tested against three check varieties; BRRI dhan71, BRRI dhan75 and BRRI dhan87. Growth duration of all entries varied from 108-122 days. BR12303-5R-49 produced highest yield (4.92 t/ha) followed by BR12293-5R-47 (4.85 t/ha). Both had similar growth duration (115 days).

RYT#2 (RLR-2): Twelve entries were tested against three check varieties; BRRI dhan71, BRRI dhan75 and BRRI dhan87. Growth duration of the test entries varied from 122-134 days. BR11732-5R-107 produced highest yield (5.19 t/ha and 128 days) followed by BRRI dhan87 (5.09 t/ha and 129 days).

RYT#3 (RLR-3): Six entries were evaluated against three check varieties; BRRI dhan71, BRRI dhan75 and BRRI dhan87. IR97184-84-1-2-3 produced highest yield (4.82 t/ha and 120 days) followed by BRRI dhan71 (4.77 t/ha and 114 days).

RYT#4 (RLR-4): Twelve entries were tested against three check varieties; BRRI dhan49, BRRI dhan75 and BRRI dhan87. IR19A7535 gave highest yield (4.94 t/ha and 120 days) followed by IR19A7534 (4.65 t/ha and 120days) and IR19A7635 (4.65 t/ha and 118 days).

RYT#5 (ZER): Nine entries were tested against five check varieties; BRRI dhan49, BRRI dhan62, BRRI dhan72, BRRI dhan75 and BRRI dhan87. BR11672-3R-3-2 produced highest yield (5.03 t/ha) followed by BR1665-3R-5-2 (4.89 t/ha) and BR11672-3R-6-3 (4.87 t/ha) respectively.

RYT#6 (DTR-BRRI RS Rangpur): This trial was carried out in BRRI RS Rangpur. Eight advance lines were evaluated against two standard checks; BRRI dhan71 and BRRI dhan75. BR11788-5R-27 produced highest yield (5.83 t/ha with 115 days)

followed by BR12306-5R-14 (5.13 t/ha with 119 days).

RYT#7 (DTR-Sadar Lalmonirhat): This trial was conducted in Sadar Lalmonirhat. Eight advance lines were evaluated against two standard checks; BRRI dhan71 and BRRI dhan75. BR13024-4R-24 produced highest yield (5.83 t/ha with 124 days) followed by BR12316-5R-133 (5.44 t/ha with 120 days).

RYT#8 (DTR-Kishoreganj, Nilphamari): This trial was conducted in Sadar Lalmonirhat. Eight advance lines were evaluated against two standard checks; BRRI dhan71 and BRRI dhan75. BRRI dhan71 produced highest yield (5.78 t/ha with 115 days) than all entries followed by BR12316-5R-133 (5.73 t/ha with 120 days).

RYT#9 (SD_Biotechnology): Three genotypes were tested against two varieties; BRRI dhan71 and BRRI dhan75. BR(Bio)15086-AC120-18 produced highest yield (4.64 t/ha) with 109 days of growth duration followed by BR(Bio)15086-AC114-8-1 (4.60 t/ha) with 108 days of growth duration.

RYT#10 (Photosensitive Rice): Four genotypes were tested against two varieties; BR22 and BRRI dhan46. BR(bio)8033-AC5-1-1-HR1 produced highest yield (3.79 t/ha) followed by BR(bio)8033-AC7-1-1-HR2 (3.78 t/ha).

RYT#11 (PQR_Basmati): Four advance breeding lines were tested against two standard checks; BRRI dhan70 and BRRI dhan75. BRrang55-RGA-40-1-1-1 gave highest yield (4.62 t/ha) with 118 days. BRRI dhan70 and BRRI dhan75 produced 2.59 t/ha and 4.23 t/ha respectively.

RYT#12 (STR#2): Twenty-four test entries were evaluated against three standard check varieties; BRRI dhan73, BRRI dhan87 and BRRI dhan103. BR12462-4R-147 produced highest yield (6.21 t/ha) followed by BRRI dhan87 (5.35 t/ha).

RYT#13 (STR#3): Fifteen advance lines were tested against two standard varieties; BR23 and

BRRI dhan30. BR12477-4R-371 produced highest yield (5.09 t/ha) followed by check BR12459-4R-277 (4.99 t/ha). Both the entries had similar growth duration.

RYT#14 (DRR): Three entries were tested against three check varieties; BRRI dhan49, BRRI dhan75 and BRRI dhan87. Among the tested entries BRRI dhan87 produced highest yield (5.15 t/ha and 125 days) followed by BRRI dhan49 (4.65 t/ha and 131days).

RYT#15 (Antioxidant Rice): Seven entries were tested against two standard check varieties; BRRI dhan49 and BRRI dhan87. BRRI dhan49 produced better yield (4.53 t/ha) than all other entries. BR12839-4R-106 gave the second highest yield (3.64 t/ha). Both BRRI dhan49 and BR12839-4R-106 had similar growth duration (130 days).

RYT#16 (Katari type rice): Four advance lines were tested against one standard check; BRRI dhan87. BR10247-14-18-4 produced highest yield (5.28 t/ha with 104 days) followed by IR12A177 (5.25 t/ha with 113).

Regional Yield Trial (RYT), Boro, 2024-2025

A total of 15 RYTs were conducted during Boro 2024-25 including four trials for Favorable Boro Rice (FBR) with different categories (FBR_SD, FBR_MD, FBR_MLD and FBR_Barisal), two trials for Disease Resistant Rice (DRR_SD-MD and DRR_LD), two trials for Salinity Tolerant Rice (STR#1 & STR#2), one trial for pigmented rice, one trial for Early morning flowering (EMF), one trial for Zinc Enriched Rice (ZER), two trials for Premium Quality Rice (PQR) and two trials for Basmati Rice_Rangpur.

RYT#1 (FBR-SD): Ten genotypes along with three checks; BRRI dhan28, BRRI dhan88 and BRRI dhan96 were evaluated. BR13418-5R-21 produced the highest grain yield (7.79 t/ha with 150 days) followed by BR13027-BC1-3R-198 (7.33t/ha with

149 days) and BR13136-5R-165 (6.89 t/ha with 150 days).

RYT#2 (FBR-MD): Eleven genotypes along with three checks; BRRI dhan88, BRRI dhan89 and BRRI dhan102 were evaluated. BR13027-BC1-3R-24 produced highest grain yield (8.46 t/ha with 149 days) followed by BR12570-5R-66-3 (8.43 t/ha with 155 days).

RYT#3 (FBR-MLD): Twelve genotypes along with two checks; BRRI dhan92 and BRRI dhan102 were evaluated. BR12679-4R-6 produced the highest grain yield (7.99 t/ha with 156 days) followed by BRRI dhan92 (7.85 t/ha with 161 days) and IR19A8188 (7.84 t/ha with 157 days).

RYT#4 (FBR_Barisal): Five genotypes along with two checks; BRRI dhan74 and BRRI dhan102 were evaluated. BRBaNGR 994-1 produced the highest grain yield (9.63t/ha with155 days) followed by BRBaNGR 736-1 (9.09 t/ha with 155 days) and BRRI dhan102 (7.6 t/ha with 160 days).

RYT#5 (DRR_SD-MD): Twelve genotypes along with two checks; BRRI dhan88 and BRRI dhan101 were evaluated. BR13180-4R-117 produced the highest grain yield (8.2 t/ha with 156 days) followed by BR13188-4R-170 (8.0 t/ha with 154 days) and BR12904-4R-323 7.86 t/ha with 153 days.

RYT#6 (DRR-LD): Fifteen genotypes were tested against three standard checks; BRRI dhan89, BRRI dhan92 and BRRI dhan101. None of the test entries performed better than the standard check BRRI dhan101 which gave a grain yield of 8.54 t/ha with 157 days.

RYT#7 (STR#1): Twenty test entries were evaluated against four standard check varieties- BRRI dhan67, BRRI dhan89, BRRI dhan97 and BRRI dhan99. BR11276-4R-139 performed better than all test and check entries and produced grain yield of 8.19 t/ha with166 days. BRRI dhan99

produced second highest grain yield 7.47 t/ha with 161 days.

RYT#8 (STR#2): Fifteen test entries were evaluated against three standard checks- BRRi dhan67, BRRi dhan97 and BRRi dhan99. BR13201-4R-30 produced highest yield (9.958 t/ha with 160 days) followed by BR12274-4R-255 (8.25 t/ha with 166 days) and BRRi dhan99 (8.13 t/ha with 163 days).

RYT#9 (Pigmented Rice): Seven test entries were evaluated against two test entries BRRi dhan88 and BRRi dhan89. None of the test entries performed better than the check variety BRRi dhan89. The highest yield (8.56 t/ha with 154 days) was observed in BRRi dhan89 followed by BR12838-4R-89-1 (6.89 t/ha with 140 days). Almost all test entries and check variety BRRi dhan88 were infected by neck blast disease.

RYT#10 (EMF): Four test entries were evaluated against one standard check BRRi dhan88. BR29NILqRL6.1-03 produced the highest yield (8.11 t/ha with 157 days) followed by BR28NILqRL6.1-01 (7.89 t/ha with 158 days).

RYT#11 (ZER): Three test entries were tested against four check varieties- BRRi dhan28, BRRi dhan74, BRRi dhan89 and BRRi dhan100. None of the test entries produced better yield than the check varieties BRRi dhan89 and BRRi dhan100. Highest yield was produced by BRRi dhan89 (9.39 t/ha with 163 days) followed by BRRi dhan100 (7.12 t/ha with 147 days).

RYT#12 (PQR, Rangpur): Fourteen test entries were evaluated against three check varieties; BRRi dhan50, BRRi dhan104 and BRRi dhan107. Among all, BR11965-4R-75 gave the highest yield (8.79 t/ha with 163 days) followed by BR11966-4R-468 (8.36 t/ha with 16 days) and BR11980-4R-139 (8.32 t/ha with 164 days).

RYT#13 (PQR, Dinajpur): Fourteen advance breeding lines were evaluated against three check

varieties; BRRi dhan50, BRRi dhan104 and BRRi dhan107. BR11966-4R-344 gave the highest yield among all test and check entries (7.75 t/ha with 162 days) and second highest grain yield (7.63 t/ha with 172 days) was produced by BR11978-4R-112.

RYT#14 (Basmati Rice_Rangpur): Four advance breeding lines from Breeding for Basmati Rice program were evaluated against one standard check variety; BRRi dhan104. None of the test entries gave higher yield than the check. BRRi dhan104 produced the highest yield (6.80 t/ha with 145 days) followed by BRrang55-RGA-14-2-1-2 (6.69 t/ha with 146 days) and BRrang55-RGA-40-1-1-1 (6.67 t/ha with 145 days).

RYT#15 (Basmati Rice_Dinajpur): Four advance breeding lines from Breeding for Basmati Rice program were evaluated against one standard check variety; BRRi dhan104. None of the test entries gave higher yield than the check. BRRi dhan104 produced the highest yield (7.94 t/ha with 148 days) followed by BRrang55-RGA-14-2-1-5 (7.89 t/ha with 148 days) and BRrang55-RGA-14-2-1-2 (7.83 t/ha with 148 days).

Advanced Line Adaptive Research Trial (ALART)

During the reporting period, a total of 23 ALARTs were established and conducted in Farmer's field under different programs with the objective of finding the best lines for varietal release. In T. Aus, 2024; two ALARTs were conducted in Mithapukur, Rangpur. BR(Path)13784BC3-61-1-6-HR3 was performed better over standard check BRRi dhan98. Nine ALARTs were conducted in different regions; Rangpur, Dinajpur and Lalmonirhat with the aim of developing False Smut Resistant Rice, drought tolerant rice, photosensitive rice and antioxidant enriched rice and fine grain rice In T. Aman, 2024. BRH9-3-2B and BR10212-5-5-3 were selected from Katari type and photosensitive rice program. During Boro, 2024-25; a total of 12 ALARTs were established in the farmer's field of Mithapukur and Baldipukur upazila, Rangpur.

BR13113-4R-116, BR (Path) 15855-BC2-3HR-23 and, BR11359-4R-279 were selected from STR-SD, BRR-LD and PQR trails, respectively.

Proposed Variety Trial (PVT)

During the reporting period, a total of 9 sets of inbred trial were evaluated in PVT under the supervision of BRRi Regional Station, Rangpur. Three sets were conducted in T. Aman/2024. I-095 and I-097 were performed better among the all sets. Moreover, 6 sets were evaluated in Boro/2024-25. I-0103 and I-0110 were performed better among the all sets.

CROP-SOIL-WATER MANAGEMENT

1. Effect of time of planting of newly developed brri varieties in different regional stations

The experiments were conducted at the BRRi Farm, Rangpur both in T. Aman and Boro seasons, 2024-2025 for newly released varieties to improve rice yield through find out the suitable transplanting time under specific agro-climatic conditions.

T. Aman, 2024

The experiment was conducted at BRRi regional station farm, Rangpur aimed to identify a suitable planting window of short duration (BRRi dhan75, BRRi dhan87, BRRi dhan90) and long duration (BRRi dhan52, BRRi dhan79 and BRRi dhan93) varieties. 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. The analysis of variance (ANOVA) for grain yield and growth duration revealed highly significant effects of the main plot factor planting time and subplot factor variety ($p < 0.001$), along with a significant interaction between planting and variety ($p < 0.001$). This indicates that both the timing of planting and the varietal differences influenced grain yield and the response of varieties varied across different planting time.

Results showed that there was a significant effect of date of transplanting on the yield potential of the tested varieties in T. aman season (Table 1 & 2). Early transplanting of BRRi dhan75 (05th July to 20th of August) gave higher grain yield than the delayed transplanting, but planted on July 05 had lodging and bird damage at maturity. BRRi dhan87 and BRRi dhan90 transplanted on 20th of August produced higher grain yield (Table 9). All the long duration varieties gave higher yield on 20th July to 05 august (Table 10). Early planting had lower yield due to lodging and rainfall at flowering. 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 dhan52, BRRi dhan79 and BRRi dhan93 on 20th July – 05th August.

Table 9. Effect of planting time on the growth duration and yield of short duration BRRi varieties in T. Aman, 2024 at BRRi Rangpur

Variety	Date of transplanting									
	GD (days)					GY (t/ha)				
	05 th July	20 th July	05 th Aug	20 th Aug	05 th Sep	05 th July	20 th July	05 th Aug	20 th Aug	05 th Sep
BRRi dhan75	112	108	107	109	111	3.30	4.44	4.85	4.75	4.63
BRRi dhan87	124	124	120	123	121	2.44	3.04	3.48	3.98	3.95
BRRi dhan90	124	124	126	111	109	1.59	3.12	3.92	4.50	3.37
BRRi dhan103	131	125	122	125	123	3.57	5.20	5.67	5.41	4.57
CV (%)	0.3					8.0				
LSD	0.512					0.509				

Table 10. Effect of planting time on the growth duration and yield of long duration BRRI varieties in T. Aman, 2024 at BRRI Rangpur

Variety	Date of transplanting									
	GD (days)					GY (t/ha)				
	05 th July	20 th July	05 th Aug	20 th Aug	05 th Sep	05 th July	20 th July	05 th Aug	20 th Aug	05 th Sep
BRRI dhan52	149	140	132	129	124	4.49	5.67	6.11	4.64	3.94
BRRI dhan79	140	134	127	131	118	4.17	5.44	5.67	5.04	3.76
BRRI dhan93	141	136	130	129	126	2.55	4.08	5.42	5.31	3.39
CV (%)	0.2					6.2				
LSD	0.359					0.329				

Boro, 2024-25

In Boro season, short duration varieties BRRI dhan74, BRRI dhan88, BRRI dhan96, BRRI dhan101, BRRI dhan104 and BRRI dhan105 and long duration varieties BRRI dhan89, BRRI dhan92 and BRRI dhan102 were tested to find out the optimum planting date. Forty days old seedling was transplanted during 10 December to 25 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. The interaction means showed that certain varieties performed better under specific planting times. Results indicated that short duration variety had higher grain yield on 10 January to 25 January planting except BRRI dhan96 which gave higher yield on 25 December (Table 11). For long duration variety, BRRI dhan89 and BRI dhan92 gave higher yield on 25 January planting and BRRI dhan102 gave statistically similar yield on 10 January and 25 January planting (Table 12).

Table 11. Effect of planting time on the growth duration and grain yield of short duration rice in Boro, 2024-25 at BRRI Rangpur

Variety	Date of transplanting											
	GD (days)						GY (t/ha)					
	10 th Dec	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb	10 th Dec	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb
BRRI dhan74	175	160	148	139	134	123	3.74	6.08	6.92	7.19	7.24	6.37
BRRI dhan88	166	161	150	139	131	120	6.21	6.09	6.05	6.72	6.27	6.09
BRRI dhan96	167	156	147	135	127	120	5.52	6.13	4.87	5.85	5.27	6.03
BRRI dhan101	177	165	156	146	140	134	5.45	5.54	6.41	7.13	6.98	5.64
BRRI dhan104	175	164	156	145	140	133	4.67	5.29	6.39	6.67	6.74	4.72
BRRI dhan105	175	165	156	148	139	133	5.97	5.65	6.43	7.56	6.68	5.94
CV (%)	0.80						6.98					
LSD	1.95						0.58					

Table 12. Effect of planting time on the growth duration and grain yield of long duration rice in Boro, 2024-25 at BRRI Rangpur

Variety	Date of transplanting											
	GD (days)						GY (t/ha)					
	10 th Dec	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb	10 th Dec	25 th Dec	10 th Jan	25 th Jan	10 th Feb	25 th Feb
BRRi dhan89	175	170	155	155	140	146	7.46	7.4	7.59	8.2	6.9	6.69
BRRi dhan92	177	172	158	157	140	146	7.45	7.46	7.29	8.04	6.49	5.03
BRRi dhan102	179	173	158	157	140	146	7.72	7.41	8.12	7.92	6.34	5.27
CV (%)			0.55						5.93			
LSD			3.13						0.51			

3. Long-term missing element trial at brri regional station rangpur

Long-term nutrient omission trial is an effective tool for identifying the contribution of nutrients in crop production. In order to find the role of major macro and micronutrients, a long-term field experiment has been running in the BRRI farm, Rangpur since 2014-15 in rice-fallow-rice cropping pattern. The experiment includes seven treatments [T₁=Fertilizer control, T₂= NPKSZn, T₃= PKSZn (-N), T₄= NKSZn (-P), T₅= NPSZn (-K), T₆= NPKZn (-S), T₇=NPKS (-Zn)] which were designed in RCB with three replications. 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. HYV rice has been growing in Boro-Fallow-T. Aman cropping pattern. Omission of major nutrients significantly reduced the grain yield. After tenth cropping year, it was observed 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. 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. Besides some yield penalties, the S and Zn omission have no significant effect on yield reduction at BRRI regional station Rangpur farm in T. Aman and Boro season (Table 13 & 14).

Table 13. Effect of long-term missing element on grain yield of BRRi dhan87 at BRRI farm, Rangpur in T. Aman, 2024

Treatments	Grain yield (t ha ⁻¹)	(%) Grain yield decreased due to nutrient omission
T ₁	3.41	-
T ₂	5.83	-
T ₃	3.85	33.96
T ₄	5.58	4.29
T ₅	5.67	2.74
T ₆	5.62	3.60
T ₇	5.54	4.97
LSD (0.05)	0.48	
CV (%)	3.28	

N.B. T₁= Control, T₂= NPKSZn, T₃= PKSZn (-N), T₄= NKSZn (-P), T₅= NPSZn (-K), T₆= NPKZn (-S), T₇=NPKS (-Zn)

Table 14. Effect of long-term missing element on grain yield at BRRI RS farm Rangpur, Boro, 2024-25

Treatment	Grain Yield (t/ha) (BRRI dhan89)
T ₁	2.82 d
T ₂	7.38 a
T ₃	3.05 d
T ₄	5.75 c
T ₅	6.94 b
T ₆	7.33 a
T ₇	7.23 ab
CV%	3.20

N.B. T₁= Control, T₂= NPKSZn, T₃= PKSZn (-N), T₄= NKSZn (-P), T₅= NPSZn (-K), T₆= NPKZn (-S), T₇=NPKS (-Zn)

RICE FARMING SYSTEMS DIVISION

Pilot model farms to showcase the successful implementation of tailored climate-smart innovative good agricultural production practices about Boro rice – Rapeseed – T. Aman rice cropping system.

The experiment was carried out at Boikunthopur, Sadar, Rangpur to compare the profitability of improved cropping pattern (ICP= Mustard-Boro-T. Aman) with the existing cropping pattern (ECP= Boro-Fallow-T. Aman) for irrigated medium-high land ecosystem.

The yield of the T. Aman crop is presented in **Table 15**. There was no significant difference in grain yield of different varieties among the treatments. Mustard could not be sown at the optimal time, despite the harvest of Aman rice in mid-October, as farmers typically dry the crop in the field after harvesting. According to the farmers, this practice reduces transportation costs, threshing time, and helps produce high-quality straw. Both varieties got a positive response from the farmer. They are willing to grow next year specially BRRI dhan75 because of early maturity.

During the Rabi season of 2024-25, BARI Sarisha-14 and BARI Sarisha-17 were sown under Mustard-Boro-T. Aman cropping pattern. There was no significant difference in grain yield or crop duration between the two varieties across the different cropping pattern treatments (**Table 16**). Farmers expressed a preference for BARI Sarisha-14 due to

its earlier maturity by 4–5 days compared to BARI Sarisha-17. Farmers are concerned that delayed harvesting of mustard may lead to late transplanting of Boro rice, which, if done after 15 February, could result in reduced Boro yields.

The inclusion of mustard in Boro-Fallow-T. Aman system resulted in a significant reduction in grain yield compared to the existing cropping system (**Table 17**). Both under ICP and ECP, BRRI dhan107 produced significantly higher yields than other varieties. The introduction of mustard into the cropping system was associated with a reduction in panicle density and the number of filled grains per panicle. In contrast, the number of unfilled grains per panicle increased across all varieties. These findings highlight the yield potential of BRRI dhan74 and BRRI dhan107 under mustard-based cropping systems. Despite the higher grain yield of BRRI dhan107, farmers expressed a preference for BRRI dhan74 for several reasons. Firstly, BRRI dhan74 showed greater resilience to delay transplanting, and a higher market price.

The inclusion of mustard in the Boro-Fallow-T. Aman cropping pattern significantly enhanced the overall productivity compared to the existing system and BARI Sarisha-17-BRRI dhan107-BRRI dhan103 and BARI Sarisha-14-BRRI dhan74-BRRI dhan103 patterns having the marginal benefit-cost ratio (MBCR) 1.32 emerged as economically viable options, offering greater profitability among the tested systems.

Table 15. Yield of T. Aman rice under different cropping pattern combinations, Boikanthopur, Sadar, Rangpur, 2024.

Treatments	Variety	Panicle/m ²	Filled grain/pan.	Unfilled grain/pan.	1000-GW (g)	Yield (t/ha)
ICP= Mustard-Boro-T. Aman	BRRI dhan75	254	126	39	21.25	5.34
	BRRI dhan103	286	112	54	23.70	5.63
ECP= Boro-Fallow-T. Aman	BRRI dhan103	303	119	56	23.57	5.90
NS						

ICP= Improved cropping pattern, ECP: Existing cropping pattern

Table 16. Grain yield and yield components of mustard under different cropping pattern combinations, Boikanthopur, Sadar, Rangpur, 2024-25.

Treatments	Variety	Plant/m ²	Pod/plant	Seed/pod	1000-SW (g)	Yield (t/ha)
ICP= Mustard-Boro-T. Aman	BARI Sarisha-14	45	37	22	3.40	1.22
	BARI Sarisha-17	51	31	24	3.26	1.31
ECP= Boro-Fallow-T. Aman						NS

ICP= Improved cropping pattern, ECP: Existing cropping pattern

Table 17. Yield of Boro rice under different cropping pattern combinations, Boikanthopur, Sadar, Rangpur, 2024-25

Treatments	Variety	Panicle/m ²	Filled grain/pan.	Unfilled grain/pan.	1000-GW (g)	Yield (t/ha)
ICP= Mustard-Boro-T. Aman	BRRI dhan74	322	98	46	24.16	7.20Bb
	BRRI dhan100	286	119	43	17.26	7.01Ab
	BRRI dhan107	280	94	64	26.31	7.86Ba
ECP= Boro-Fallow-T. Aman	BRRI dhan74	342	107	35	24.23	7.69Ab
	BRRI dhan100	296	121	37	17.80	7.13Ac
	BRRI dhan107	330	111	38	26.17	8.24Aa

ICP= Improved cropping pattern, ECP: Existing cropping pattern; Capital letters indicated the comparison among different cropping patterns of a given variety. Lower case letters indicated the comparison among different varieties within a given cropping pattern. Different letters indicate significant difference at P< 0.05.

SOCIO-ECONOMIC

Stability analysis of BRRI varieties at BRRI Rangpur in T. Aus, T. Aman and Boro season during 2024-2025

A total one hundred and twelve of BRRI-released varieties were evaluated during T. Aus, T. Aman, and Boro seasons following RCBD with three replications. In Aus, BRRI dhan48 recorded the highest yield (4.27 t/ha) followed by BRRI dhan98 (4.10 t/ha), BRRI dhan83 (4.06 t/ha), and BRRI dhan85 (4.02 t/ha). In short-duration Aman, BRRI dhan66 produced the highest yield (5.82 t/ha) followed by BRRI dhan73 (5.44 t/ha) and BRRI

dhan53 (5.32 t/ha). In medium-duration Aman, BRRI dhan93 recorded the highest yield (6.30 t/ha) followed by BRRI dhan31 (6.28 t/ha) and BRRI dhan44 (6.19 t/ha). In long-duration Aman, BR10 gave the highest yield (4.58 t/ha) followed by BR22 (4.53 t/ha) and BRRI dhan41 (3.93 t/ha). In long-duration Boro, BR12 gave the highest yield (8.37 t/ha) followed by BRRI dhan69 (8.29 t/ha), BR8 (8.26 t/ha), and BRRI dhan89 (8.20 t/ha). In short-duration Boro, BRRI Hybrid dhan5 produced the highest yield (10.18 t/ha) followed by BRRI dhan55 (9.92 t/ha), BRRI Hybrid dhan2 (9.62 t/ha), and BRRI Hybrid dhan3 (9.51 t/ha).

TECHNOLOGY TRANSFER DEMONSTRATION

A total of 3815 (3815 bighas) varietal demonstrations were conducted at different locations of Rangpur-Dinajpur region. In T. Aus, 70 Bighas varietal demonstration was conducted using BRRI dhan98 and BRRI hybrid dhan7 were used and maximum yield was observed 5.50 t/ha in BRRI dhan98 at Mithapukur, Rangpur. In T. Aman, (1600 bighas), BRRI dhan71, BRRI dhan75, BRRI dhan93, BRRI dhan103, BRRI hybrid dhan4 and BRRI hybrid dhan6 were used. Maximum yield was observed 6.89 t/ha in BRRI dhan93 at Chilmari, Kurigram. In Boro season (2145 bighas), BRRI dhan89, BRRI dhan92, BRRI dhan100, BRRI dhan101, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107, BRRI dhan108, BRRI hybrid dhan3, BRRI hybrid dhan8 were used. Yield range was 6.4 to 9.2 t/ha. Maximum yield was observed 9.2t/ha in BRRI dhan108 at Gobindoan, Gaibandha and minimum was 6.4 in BRRI dhan10 in Kaharol, Dinajpur.

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 under GoB (13) and PARTNER (07) program. A total of 610 farmers and 60 SAAOs were trained through 20 training program. A total of 100 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. Twenty nine field days were arranged at different varietal demonstration sites in collaboration with DAE during 2024-2025. A total of 2060 farmers, local leaders and DAE personnel attended those field day programs.

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, Nizarsail and Gainja were distributed among the flood affected farmers in Mithapukur-Rangpur, Sadar-Kurigram, Gangachora-Rangpur, Sadar-Lalmonirhat, Kawnia-Rangpur and Metro-Rangpur.

Promotional activities for the formers enclave's farmer

BRRI RS Rangpur conducted 30 varietal demonstration and 2 farmers training programs for the dissemination of BRRI developed latest varieties in Dashiarchora, Fulbari, Kurigram (Former enclave).

Seed production and dissemination in July 2024-June 2025

In total, 8669 kg Truthfully Label Seed for T. Aman/20224 and 17,260 kg of Truthfully Label Seed were produced in Boro/2024-25. Under GoB, 4,600 kg Breeder seed (BRRI dhan90 and BRRI dhan93) was produced in T. Aman and 5250 kg Breeder seed (BRRI dhan89 and BRRI dhan104) was also produced in Boro season. Moreover, 1800kg of Breeder seed of BRRI dhan103 (1000kg) and BRRI dhan104 (800kg) were also produced from PARTNER program. A total of 11,650 kg Breeder seed was sent to the GRS Division, BRRI Gazipur. Under PARTNER program, 23,700kg certified seed of BRRI dhan103 (7,700kg) and BRRI dhan108 (16,000kg) were produced dring this reporting period. In three seasons, 25,929 kg TLS was distributed among the farmers for dissemination in Rangpur-Dinajpur region.

BRRI RS, Satkhira

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SUMMARY

The BRRI Regional Station in Satkhira is dedicated to developing salt-tolerant rice varieties to combat salinity issues prevalent in Bangladesh's southern coastal rainfed lowland and irrigated ecosystems. The breeding program employs a structured evaluation process—starting from Line Stage Testing (LST) and progressing through multiple trial phases, including Observational Yield Trials (OYT), Preliminary Yield Trials (PYT), Advanced Yield Trials (AYT), Regional Yield Trials (RYT), Advanced Lines Adaptive Research Trials (ALART), and Multi-Location Trials (MLTs). Trials are conducted across sites with varying salinity levels, from low salinity at BRRI Satkhira Farms to very high salinity at Kaliganj. During the T. Aman 2024 season, LST faced crop loss due to flooding, but the Boro 2024–25 season successfully selected 619 promising lines. Progressive trial stages narrowed down lines for salt tolerance and yield under saline stress. Collaborative AGGRi-2 and AFACI trials further identified superior genotypes for variety release and breeding, though salt damage limited some selections during Boro 2024–25. Extensive RYT and ALART trials in both saline and favorable environments evaluated lines for traits such as salinity tolerance, disease resistance, premium quality, and nutritional enrichment. Several advanced lines, including BR12459-4R-16 and BR13207-4R-28, outperformed standard checks in yield, particularly in salinity-affected areas. Disease-resistant, high-yielding, and specialty rice trials showed variable but promising results. Complementary crop-soil-water management research highlighted the importance of nutrients (N, P, K, S, Zn) in yield improvement and explored nano urea and zeolite applications to enhance productivity and reduce greenhouse gas emissions. Stability trials of BRRI varieties identified top-performing cultivars for diverse Agro-ecologies. Seed production ensured quality seed availability, while extension programs—including 15 farmer trainings and over 1,000 demonstrations—promoted adoption of improved

varieties across Khulna, Satkhira, and Jashore districts, supporting Bangladesh's resilient rice production.

VARIETAL DEVELOPMENT

Development of Salt Tolerant Rice (STR): Salinity remains a major constraint in the rainfed lowland and irrigated rice ecosystems of Bangladesh's southern coastal regions. Therefore, the primary research focus of BRRI Regional Station, Satkhira, is the development of salt-tolerant rice varieties by supporting field-level multi-location trials of breeding lines developed under the Varietal Development Program Area. This research follows a systematic evaluation process, beginning with Line Stage Testing (LST), followed by Observational Yield Trials (OYT), Preliminary Yield Trials (PYT), Advanced Yield Trials (AYT), Regional Yield Trials (RYT), Advanced Lines Adaptive Research Trials (ALART), and other Multi-Location Trials (MLTs). These multi-location trials (MLTs) were conducted at BRRI Satkhira Farm-1 and Farm-2 under low salinity conditions (EC: 3–7 dS m⁻¹), at Debhata and Shyamnagar under moderate to high salinity conditions (EC: 7–14 dS m⁻¹), and at Kaliganj under very high salinity conditions (EC: 9–25 dS m⁻¹) (see figure 1 and 2).

Line Stage Testing (LST): In the T. Aman 2024 season, a total of 1,790 lines were planted in the LST trial for selection based on homogeneity, strong culm strength, desirable plant ideotype, and acceptable grain quality. However, none could be selected due to complete crop damage caused by prolonged water stagnation for about two months, with water depths reaching 80–100 cm. In contrast, during the Boro 2024–25 season, 5,886 lines were planted, and 619 were selected based on desirable traits and uniformity. All selected lines were sampled for trait-based SNP genotyping

Observational Yield Trials (OYT): Under the OYT, 83 lines were selected from 745 tested entries at Kaliganj during the T. Aman 2024 season. Similarly, during the Boro 2024–25 season, 127 lines were selected from 442 entries at BRRI Farm and 48 lines from Kaliganj.

Preliminary Yield Trials (PYT): Two PYTs were conducted at Kaliganj during the T. Aman 2024 season, from which 14 and 17 lines were selected out of 72 and 69 tested entries, respectively. In contrast, three PYTs were conducted during the Boro 2024–25 season, each evaluating 82 entries. From these, 13, 7, and 17 lines were selected at BRRI Farm; 11, 6, and 4 lines at Kaliganj; and 3, 5, and 4 lines at Debhata.

Advanced Yield Trials (AYT): Two AYT were conducted at Kaliganj during the T. Aman 2024 season, from which 16 and 20 lines were selected out of 34 entries in each trial. In the Boro 2024–25 season, three AYT were conducted, evaluating 44, 52, and 48 entries, respectively. From these, 14, 19, and 18 lines were selected at BRRI Farm; 7, 1, and 0 lines at Kaliganj; and 13, 6, and 12 lines at Debhata.

AGGRi-2 Network Evaluation Trials in Salt-Stress-Prone Areas of Bangladesh: During the T. Aman 2024 season, 188 and 27 breeding lines, and during the Boro 2024–25 season, 137 and 36 breeding lines from IRRI along with international and national check varieties were evaluated at two locations: Kaliganj and Shyamnagar in Satkhira. The objective was to identify superior genotypes for direct inclusion in the variety release system or for use as parents in breeding programs. In T. Aman 2024, 29 and 10 lines were selected at Kaliganj, while 56 and 11 lines were selected at Shyamnagar. However, during Boro 2024–25, no selections were made at Kaliganj due to salt damage, and all entries were retained at Shyamnagar for further evaluation.

Performance Evaluation of AFACI Breeding Lines in Stage-1 and Stage-2 Trials: The trials were conducted at three coastal saline locations: Kaliganj, Shyamnagar, and Debhata. The objective was the same as that of the AGGRi-2 trials—identifying superior genotypes for direct inclusion in the variety release system or use as parents in breeding programs. During the T. Aman 2024 season, 6 and 8 lines were selected from 33 tested entries at Kaliganj and Shyamnagar, respectively. In the Boro 2024–25 season, no selections were made at Kaliganj due to salt damage, while 3 and 1 line were selected from 109 and 33 tested entries at Debhata.

Regional Yield Trial during T. Aman 2024–25

Experiment 1. Regional Yield Trial-1 for Development of Salinity Tolerant Rice (STR-1)

Twenty-three advanced lines, along with two check varieties, were evaluated for yield performance in the salinity hotspot of Kaliganj, Satkhira during the T. Aman 2024 season. Among them, BR12459-4R-16 recorded the highest yield 5.22 t ha^{-1} , significantly outperforming the checks BRRI dhan73 (4.35 t ha^{-1}) and BRRI dhan87 (3.42 t ha^{-1}). Several other lines—BR12459-4R-172, BR12459-4R-286, BR12471-4R-98, BR12461-4R-51, BR12459-4R-113 and BR13122-4R-46 also produced significantly higher yields only compared to BRRI dhan87. Based on overall performance, seven promising lines were selected for further improvement (Table 1).

Experiment 2. Regional Yield Trial-2 for Development of Salinity Tolerant Rice (STR-1)

Twenty-four advanced lines, along with three check varieties, were evaluated for yield performance in the salinity hotspot of Kaliganj, Satkhira during the T. Aman 2024 season. Among them, BR12466-4R-14, BR12459-4R-118, BR12459-4R-26, BR12459-4R-103, BR12466-4R-106, and BR12462-4R-82 recorded higher yields than the check variety BRRI dhan103 (4.32 t ha^{-1}), although the differences

were not statistically significant. However, these lines produced significantly higher yields compared to the other two check varieties BRRI dhan73 (3.74 t ha⁻¹) and BRRI dhan87 (3.30 t ha⁻¹). Based on overall performance, six promising lines were selected for further advancement (Table 2).

Experiment 3. Regional Yield Trial-3 for Development of Salinity Tolerant Rice (STR-1)

Fifteen advanced lines, along with two check varieties, were evaluated for yield performance in the salinity hotspot of Kaliganj, Satkhira during the T. Aman 2024 season. Among them, BR12465-4R-61 recorded the highest yield at 4.43 t ha⁻¹, significantly outperforming the checks BR23 (2.33 t ha⁻¹) and BRRI dhan30 (3.27 t ha⁻¹). Several other lines-BR12459-4R-241, BR12466-4R-317, BR12465-4R-26, BR12477-4R-186, BR12459-4R-117, BR12465-4R-231, BR12459-4R-277, and BR12465-4R-100 also produced significantly higher yields only compared to BR23. Based on overall performance, eight promising lines were selected for further improvement (Table 3).

Regional Yield Trial during Boro 2024-25

Experiment 4. Regional Yield Trial for Development of Salinity Tolerant Rice (STR-1)

Twenty rice entries were evaluated for salinity tolerance alongside four check varieties: BRRI dhan67, BRRI dhan28, BRRI dhan97, and BRRI dhan99. Among the checks, BRRI dhan99 recorded the highest yield at 9.98 t ha⁻¹. However, three test entries-BR13207-4R-28 (10.65 t ha⁻¹), BR13201-4R-299 (10.10 t ha⁻¹), and BR13201-4R-103 (10.07 t ha⁻¹)-outperformed BRRI dhan99. Based on overall performance under saline conditions at Kaliganj, four promising lines-BR11276-4R-196, BR12645-4R-71, BR13207-4R-28, and BR11276-4R-67 were selected for further development.

Experiment 5. Regional Yield Trial for Development of Salinity Tolerant Rice (STR-2)

Fifteen entries were evaluated for development of salinity tolerant rice comparing with three check varieties BRRI dhan67, BRRI dhan89 and BRRI dhan99. Among the check varieties BRRI dhan67 produced highest yield (8.86 t ha⁻¹). But the entry BR13201-4R-30 (9.58 t ha⁻¹), BR13201-4R-249 (9.66 t ha⁻¹), BR12650-4R-55 (9.28 t ha⁻¹), BR13201-4R-196 (8.93 t ha⁻¹) and BR12274-4R-255 (10.18 t ha⁻¹) produced higher yield than BRRI dhan67. For development of salinity tolerant rice two lines were selected (BR11718-4R-230 and BR13206-4R-50) in Kaliganj.

Experiment 6. Regional Yield Trial (RYT-Barishal) for High Yielding Rice

Five entries were evaluated for development of high yielding rice comparing with two check varieties BRRI dhan74 and BRRI dhan102. None of the tested genotypes were found higher yielder than BRRI dhan102 (8.36 t ha⁻¹). The entry BRBaNGR 324-1 (7.99 t ha⁻¹) produced 2.57% higher yield than BRRI dhan74 (7.79 t ha⁻¹).

Experiment 7. Regional Yield Trial for Development of Disease Resistant Rice for BB and blast

Twelve entries were evaluated for development of disease resistant rice for BB and blast comparing with two check varieties BRRI dhan88 and BRRI dhan101. BR13178-4R-30 produced highest yield with 9.02 t ha⁻¹, followed by BR13188-4R-170 (8.01 t ha⁻¹) and BR13180-4R-117 (7.80 t ha⁻¹).

Experiment 8. Regional Yield Trial for Development of Disease Resistant Rice for BB

Fifteen entries were evaluated for development of disease resistant rice for BB comparing with three check varieties BRRI dhan89, BRRI dhan92 and BRRI dhan101. BR12904-4R-219 produced highest yield with 8.88 t ha⁻¹, followed by BR13188-4R-170 (8.80 t ha⁻¹) and BR13174-4R-9 (8.21 t ha⁻¹).

Experiment 9. Regional Yield Trial (RYT) of Early Morning Flowering Lines (EMF)

Two entries were evaluated for early morning flowering lines comparing with three check varieties. None of the tested genotypes gave better performance in terms of yield than check variety BR29Ref-01 and BRRI dhan88.

Experiment 10. Evaluation of breeding lines in the Regional Yield Trial under Favorable Boro Rice (MD)

Eleven entries were evaluated for medium duration favorable boro rice comparing with three check varieties BRRI dhan88, BRRI dhan89 and BRRI dhan102. No entry gave better performance in terms of yield than check varieties BRRI dhan88 and BRRI dhan89.

Experiment 11. Evaluation of breeding lines in the Regional Yield Trial under Favorable Boro Rice (MLD)

Thirteen entries were evaluated for medium long duration favorable boro rice comparing with two check varieties BRRI dhan102 and BRRI dhan92. Highest grain yield was found in IR19A8188 (9.05 t ha⁻¹) followed by BR13418-5R-18 (8.20 t ha⁻¹), BR12671-4R-312 (8.13 t ha⁻¹) and BR12679-4R-6 (8.11 t ha⁻¹).

Experiment 12. Evaluation of breeding lines in the Regional Yield Trial under Favorable Boro Rice (SD)

Ten entries were evaluated for short duration favorable boro rice comparing with three check varieties BRRI dhan28, BRRI dhan88 and BRRI dhan102. Only one entry named BR13141-5R-22 (8.01 t ha⁻¹) performed better in terms of yield than check variety BRRI dhan28 (7.72 t ha⁻¹).

Experiment 13. Regional Yield Trial of Pigmented Rice

Seven entries were evaluated for pigmented rice comparing with two check varieties BRRI dhan88 and BRRI dhan89. Only one entry named BR12837-5R-57 produced better yield (4.73 t ha⁻¹) than check varieties BRRI dhan88 (4.36 t ha⁻¹) and

BRRI dhan89 (4.41 t ha⁻¹). Yield of all the tested genotypes were poor due to late seeding and drought stress in reproductive stage.

Experiment 14. Regional Yield Trial for Development of Premium Quality Rice (PQR)

Fourteen entries were evaluated for development of premium quality rice comparing with three check varieties BRRI dhan50, BRRI dhan104 and BRRI dhan107. None of the tested genotypes gave higher yield than check variety BRRI dhan104 (7.85 t ha⁻¹).

Experiment 15. Regional Yield Trial, Breeding for Basmati Rice (Rangpur)

Four entries were evaluated for basmati rice comparing with check variety BRRI dhan104. None of the tested genotypes were found higher yielder than check variety BRRI dhan104 (6.72 t ha⁻¹).

Experiment 16. Regional Yield Trial for Development of Zinc Enriched Rice (ZER)

Three entries were evaluated for development of zinc enriched rice comparing with four check varieties BRRI dhan28, BRRI dhan74, BRRI dhan89 and BRRI dhan100. The entry BR11401-1-2-4-1 produced highest yield with 7.88 t ha⁻¹.

Advanced Line Adaptive Research Trial (ALART) during T. Aman 2024-25

Experiment 17. ALART for Salinity Tolerant Rice Short Duration (STR_SD), Aman 2024 at Shyamnagar site

Two short-duration rice genotypes were evaluated for yield under salinity and compared with the check varieties BRRI dhan73 and BRRI dhan75. The tested entries, BR13113-4R-63 and BR13118-4R-76, recorded yields of 3.06 and 3.01 t ha⁻¹, respectively. However, these yields were not significantly higher than those of the check varieties-BRRI dhan73 (2.69 t ha⁻¹) and BRRI dhan75 (3.80 t ha⁻¹).

Experiment 18. ALART for Salinity Tolerant Photosensitive Long Duration (STR_LD), Aman 2024 at Shyamnagar site

Four long-duration, photosensitive rice genotypes were evaluated for yield performance under saline conditions, with BRRI dhan30 and BR23 used as check varieties. Among the tested entries, only BR13103-4R-37 recorded a significantly higher yield of 4.63 t ha⁻¹ compared to BRRI dhan30 (3.89 t ha⁻¹). Although its yield was also higher than that of BR23 (4.41 t ha⁻¹), the difference was not statistically significant.

Experiment 19. ALART for Salinity Tolerant Rice Short Duration (STR_SD), Aman 2024 at Kaliganj site

Two short-duration rice genotypes were evaluated for yield performance under saline conditions, using BRRI dhan73 and BRRI dhan75 as check varieties. Among the tested entries, only BR13113-4R-63 recorded a significantly higher yield of 3.32 t ha⁻¹ compared to both BRRI dhan73 (2.49 t ha⁻¹) and BRRI dhan75 (2.65 t ha⁻¹).

Experiment 20. ALART for Salinity Tolerant Photosensitive Long Duration (STR_LD), Aman 2024 at Kaliganj site

Four long-duration, photosensitive rice genotypes were evaluated for yield performance under saline conditions, with BRRI dhan30 and BR23 used as check varieties. All tested entries recorded significantly higher yields than BRRI dhan30 (3.11 t ha⁻¹); however, none outperformed BR23 (4.20 t ha⁻¹).

Advanced Line Adaptive Research Trial (ALART) during Boro 2024-25

Experiment 21. ALART for Medium Duration Favorable Boro Rice (FBR-MD)

Three entries were evaluated for medium duration favorable Boro rice compared with BRRI dhan97 and BRRI dhan102. None of the tested entries

performed better yield than BRRI dhan97 (7.36 t ha⁻¹). BR12517-5R-57 (7.13) and BR12508-5R-5 (7.07 t ha⁻¹) produced higher yield than BRRI dhan102 (6.97 t ha⁻¹) but not statistically significant.

Experiment 22. ALART for Premium Quality Rice (PQR)

Two entries were evaluated with two check varieties BRRI dhan104 and BRRI dhan107. Tested entries BR11359-4R-279 (6.36 t ha⁻¹) and BR11359-4R-181 (6.17 t ha⁻¹) showed better yield over check varieties.

Experiment 23. ALART for Short Duration Bacterial Blight and Blast Resistant Rice (BB+Blast-SD)

Advanced line adaptive research trial for short duration bacterial blight and blast resistant rice was evaluated consisting of three entries comparing with the check variety BRRI dhan88. All entries performed better yield than BRRI dhan88. The entry BR (path)13802-BC3-54-12 produced highest yield (5.76 t ha⁻¹).

Experiment 24. ALART for Short Duration and Blast Resistant Rice (BRR-SD)

Two entries were evaluated for short duration and blast resistant rice with the check variety BRRI dhan88. Both BR (path)15641-3HR-15 and BR (path)15641-3HR-45 entries produced higher yield than BRRI dhan88. The entry BR (path)15641-3HR-45 gave highest yield (7.44 t ha⁻¹).

Experiment 25. ALART for Premium Quality Rice from Pathology (PQR-PATH)

Advanced line adaptive research trial for premium quality rice was evaluated consisting of one entry with two check variety BRRI dhan50 and BRRI dhan104. The entry BRRI(Path)-Premium1 performed better yield (8.13 t ha⁻¹) than check varieties.

Experiment 26. ALART for Medium Duration Antioxidant Enriched Rice (AOER-MD)

Advanced line adaptive research trial for medium duration antioxidant enriched rice was evaluated consisting of two entries comparing with the check variety BRRI dhan100. Highest yield was found in tested genotype BR12839-4R-157-2 (8.10 t ha⁻¹). But the entry BR12839-4R-5-2 (7.47 t ha⁻¹) gave lower yield than BRRI dhan100 (7.92 t ha⁻¹).

Experiment 27. ALART for Short Duration Antioxidant Enriched Rice (AOER-SD)

One entry was evaluated for short duration antioxidant enriched rice with check variety BRRI dhan88. The entry BR12839-4R-137 (7.66 t ha⁻¹) produced lower yield than check variety BRRI dhan88 (7.95 t ha⁻¹).

Experiment 28. ALART for Medium Duration Blast Resistant Rice (BRR-MD)

Advanced line adaptive research trial for medium duration blast resistant rice was evaluated consisting of two entries comparing with the check variety BRRI dhan58. The BR (Path)15860-BC2-3HR-48 (7.41 t ha⁻¹) was the best performing entry in this trial for grain yield.

Experiment 29. ALART for long Duration Blast Resistant Rice (BRR-LD)

Advanced line adaptive research trial for long duration blast resistant rice was evaluated consisting of two entries comparing with the check variety BRRI dhan29. The entry BR(path)15855-BC2-3HR-23 (7.12 t ha⁻¹) produced highest yield and the entry BR (Path)15860-BC2-3HR-47 produced lowest yield (6.30 t ha⁻¹).

Experiment 30. ALART for Short Duration Favorable Boro Rice (FBR-SD)

Advanced line adaptive research trial for short duration favorable boro rice was evaluated consisting of one entry comparing with the check variety BRRI dhan29. The entry BR12574-5R-52

(5.62 t ha⁻¹) could not perform better than check variety BRRI dhan29 (6.91 t ha⁻¹) in terms of yield.

Experiment 31. ALART for Short Duration Salinity Tolerant Rice (STR-SD)

Advanced line adaptive research trial for short duration salinity tolerant rice was evaluated consisting of two entries comparing with the check variety BRRI dhan28 and BRRI dhan88. BRRI dhan88 did not give any yield due to salt damage. The entry BR13113-4R-63 produced highest yield (3.07 t ha⁻¹).

Experiment 32. ALART for Medium Duration Salinity Tolerant Rice (STR-MD)

Advanced line adaptive research trial for medium duration salinity tolerant rice was evaluated consisting of three entries comparing with the check variety BRRI dhan102 and BRRI dhan99. Only the entry BR13113-4R-185 (3.88 t ha⁻¹) performed better yield than the check variety BRRI dhan99 (3.51 t ha⁻¹).

Experiment 33: Evaluation of breeding lines in the Observational Yield Trial (OYT-FBC) for Genomic Selection

One hundred ninety-six entries were evaluated under OYT-FBC for genomic selection in a partially replicated design against 4 check, BRRI dhan29, BRRI dhan88, BRRI dhan92 and BRRI dhan102 in BRRI farm Satkhira. Among them BR14226-R-R-R-198-P2 (8.79 t ha⁻¹), BR14227-5R-41 (8.70 t ha⁻¹), BR14229-5R-184 (8.63 t ha⁻¹), BR14612-4R-101 (8.35 t ha⁻¹) showed relatively better performance in Satkhira.

CROP-SOIL-WATER MANAGEMENT

Experiment 34. Effect of missing nutrient on rice production in southern coastal area during Boro 2024-25

Nutrient deficiency is a major constraint to rice production across the country. Proper identification and management of these

deficiencies are essential for enhancing productivity and sustaining high yields over time. Field evaluation of soil fertility plays a crucial role and complements both soil and plant testing. The missing element trial is an effective technique for assessing soil fertility status in the field and identifying limiting nutrients, thereby supporting efficient nutrient management for maximizing rice yields.

In the T. Aman 2024 season, the missing element trial was damaged due to flooding caused by heavy rainfall. However, in the Boro season, the application of nitrogen (N), phosphorus (P), potassium (K), sulfur (S), and zinc (Zn) significantly increased rice yield compared to the control and P-omitted plots. Yield reductions were observed in plots where N, P, K, S, or Zn were omitted, with the control plot (no fertilization) and the P-omitted plot reducing yield by 25% and 24%, respectively, compared to the complete fertilizer treatment. Other nutrient omission plots showed yield reductions ranging from 1.2% to 14.2%. Notably, there was no significant difference in yield between the P-omitted plot and the control treatment.

Experiment 35. Effect of Zinc on growth and Zinc nutrition of Zinc-enriched rice cultivar in unfavourable ecosystem of Bangladesh in Boro 2024-25

In this experiment, no significant yield differences were observed among the different Zinc treatments [Control (-Zn), 100% Recommended Dose of Zn (RDZn), 50% RDZn, and 50% RDZn + Nano Zn] in both the Zinc-enriched BRRI dhan84 and non-Zinc rice variety BRRI dhan104. These results suggest that Zinc deficiency was likely absent in the experimental plots, despite being inundated by floodwater for nearly two months during the T. Aman season. However, differences in grain Zinc content may still exist and are currently under investigation.

Experiment 36. Improving Rice yield and mitigating Greenhouse gas emission in Rice cultivation using Nano Urea and Zeolite in Boro 2024-25

To reduce greenhouse gas (GHG) emissions in rice cultivation, a field trial was conducted using different nitrogen management treatments: T1: Control (-N), T2: 66% of the recommended prilled urea (RPU) applied as 33% basal + 33% at 25 days after transplanting (DAT), T3: 66% RPU applied as 22% basal + 22% at 25 DAT + 22% before panicle initiation (BPI), T4: T3 + zeolite @ 4 t ha⁻¹, T5: T2 + liquid nano urea @ 1,235 ml ha⁻¹ and T6: 100% RPU applied as 33% basal + 33% at 25 DAT + 33% at BPI. The newly released Zn-enriched variety BRRI dhan102 was used in this trial. Among the treatments, T3 produced the highest yield (8.76 t ha⁻¹), followed by T2 (7.95 t ha⁻¹) and T6 (7.90 t ha⁻¹). Gas samples collected from the different treatment plots are currently being analyzed using gas chromatography to determine which treatment is most effective in reducing GHG emissions.

SOCIO-ECONOMIC AND POLICY

Experiment 37. Stability Analysis of BRRI Varieties at Satkhira

The stability of a rice variety across diverse environments is crucial for its widespread adoption and expansion in farmers' fields. To date, BRRI has developed 121 rice varieties tailored to different Agro-ecosystems for the Aus, Aman, and Boro seasons. This experiment was conducted to identify the most suitable and adaptable BRRI rice varieties for specific regions. During the Boro 2024–25 season, among the 27 long-duration varieties tested, the highest yield was recorded by BRRI dhan108 (7.91 t ha⁻¹), followed closely by BRRI dhan59 (7.89 t ha⁻¹), BRRI dhan89 (7.84 t ha⁻¹), and BRRI dhan58 (7.71 t ha⁻¹). Among the 27 short-duration varieties tested, particularly hybrid varieties, BRRI hybrid dhan8 produced the highest yield (10.34 t

ha⁻¹) followed by BRRI hybrid dhan5 (9.73 t ha⁻¹) and BRRI hybrid dhan3 (8.83 t ha⁻¹). And among the short duration inbred varieties, BRRI dhan96 (8.24 t ha⁻¹) gave the highest yield followed by BRRI dhan28 (8.15 t ha⁻¹) and BRRI dhan100 (7.92 t ha⁻¹).

OTHER ACTIVITIES

Breeder Seed Production

Breeder seed production is a mandatory activity to ensure a consistent supply of quality seeds of BRRI-released rice varieties to both public and private sector seed producers. This is a routine responsibility of the BRRI Regional Station Satkhira. During the Boro 2024–2025 season, a total of 16.25 tons of breeder seeds were produced from five varieties: BRRI dhan28 (4.5 tons), BRRI dhan50 (3.5 tons), BRRI dhan67 (2.75 tons), BRRI dhan88 (4.5 tons), and BRRI dhan105 (1.0 ton). All seeds were delivered to the GRS Division, BRRI, Gazipur.

Certified Seed Production

During Boro 2024-25 seasons, a total of 16 tons of certified seed was produced from two varieties (BRRI dhan100 – 8.0 ton and BRRI dhan101 – 8.0 ton)

Truthfully Labeled Seed (TLS) Production

During Boro 2024-25 seasons, a total of 13.9 tons of TLS was produced from seven varieties (BRRI dhan28 – 3.3 ton, BRRI dhan50 – 1.2 ton, BRRI dhan67 – 6.0 ton, BRRI dhan88 - 1.0 ton, BRRI dhan97 – 0.85 ton, BRRI dhan99 – 0.65 ton and

BRRI dhan105 – 0.90 ton) and stored.

Quality Seed Production

During Boro 2024-25 seasons, a total of 2.9 tons of quality seed was produced for a newly released Blast resistant rice variety BRRI dhan114.

Field Day, Farmer's Training and Agriculture Fair

Fifteen farmer's trainings (GoB- 11, Partner- 4) on rice production technology, quality seed production & preservation were conducted to train up 450 farmers of Satkhira, Khulna and Jashore districts. A total of 24 field days were arranged during the reporting period (GoB- 10, Partner- 4, LSTD- 6, Hybrid Rice- 4). BRRI, Satkhira attended as well as participated in various workshops, seminars, regional and district agricultural coordination committee meetings, district coordination committee meetings, discussion meetings, farmers' field visits with advisory activities in field level and on-line basis.

Demonstration of newly released rice varieties

BRRI Regional Station Satkhira conducted demonstrations of BRRI's newly released rice varieties to facilitate their rapid dissemination and promote the replacement of older varieties, enabling farmers to achieve greater benefits. This initiative is expected to accelerate the adoption of newly released varieties. During the reporting period, a total of 1,060 demonstration trials were conducted across three districts- Khulna, Satkhira, and Jashore- covering approximately 853 acres of land.

Table 1. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT-1 (STR-1) during T. Aman, 2024.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12459-4R-172	128.40	11.00	4.69	128
BR13711-4R -190	112.70	10.50	3.80	129
BR12459-4R-286	123.80	10.70	4.42	127
BR12460-4R-102	116.30	14.40	3.79	132

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12459-4R-39	98.90	11.00	4.06	135
BR12468-4R-231	100.10	10.50	3.55	132
BR12460-4R-44	107.90	12.10	3.47	135
BR12459-4R-33	86.40	11.40	3.14	137
BR12471-4R-98	117.80	10.10	4.30	122
BR12461-4R-51	131.80	11.50	4.91	128
BR12462-4R-227	107.10	13.50	5.02	137
BR12459-4R-80	119.20	10.40	3.20	132
BR12459-4R-40	97.80	10.50	3.46	135
BR12465-4R-321	103.50	10.60	4.06	132
BR12459-4R-113	138.20	10.70	4.76	136
BR12468-4R-337	116.10	10.30	4.13	123
BRR1 dhan73	120.80	11.00	4.35	121
BRR1 dhan87	106.00	12.70	3.42	132
BR13122-4R-46	124.90	10.60	4.90	121
BR12459-4R-265	130.00	11.20	5.03	128
BR12459-4R-54	104.20	10.90	4.09	131
BR12459-4R-140	117.70	13.10	3.74	132
BR12459-4R-16	118.40	12.50	5.22	129
BR12459-4R-283	93.40	11.40	3.30	136
BR12459-4R-37	108.30	12.00	3.45	132
CV (%)	0.85	6.20	8.99	0.42
LSD _{0.05}	1.99	1.46	0.76	1.14

Table 2. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT-2 (STR-1) during T. Aman, 2024.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12464-4R-298	103.40	10.80	2.93	129.00
BR12466-4R-98	108.10	9.90	3.30	131.50
BR12462-4R-283	109.80	11.40	3.63	134.00
BR12465-4R-91	103.00	11.40	3.72	131.00
BR12466-4R-275	106.80	10.00	2.93	136.00
BR12466-4R-14	101.60	11.90	4.85	130.00
BR12459-4R-114	112.20	11.00	3.47	133.50
BR12459-4R-118	123.10	10.50	4.61	132.00
BR12459-4R-120	114.10	10.80	3.29	131.50
BR12459-4R-26	112.10	10.40	4.60	131.00
BR12462-4R-147	104.80	9.40	3.66	132.00
BR12459-4R-103	98.80	10.90	4.68	132.00
BR12465-4R-59	96.50	12.00	3.18	135.00

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12466-4R-159	103.20	10.80	2.67	136.00
BR12465-4R-312	97.30	12.00	3.20	135.50
BR12466-4R-106	110.70	10.10	4.63	125.00
BR12469-4R-204	118.10	12.10	3.15	123.50
BRR1 dhan73	118.10	10.70	3.74	124.00
BRR1 dhan87	119.30	11.00	3.30	132.00
BRR1 dhan103	120.60	11.10	4.32	132.00
BR12460-4R-24	103.20	11.60	3.23	132.00
BR12465-4R-201	122.40	11.90	3.20	123.50
BR12465-4R-85	93.00	11.70	2.96	134.50
BR12466-4R-180	Damaged due to salinity			
BR12462-4R-82	134.30	11.30	4.70	130.00
BR12460-4R-145	96.00	11.60	3.42	132.00
BR12459-4R-106	126.40	11.60	3.92	132.50
CV (%)	0.98	4.71	8.44	0.48
LSD _{0.05}	2.22	1.07	0.64	1.30

Table 3. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT-3 (STR-1) during T. Aman, 2024.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12477-4R-371	106.30	10.90	2.41	132.00
BR12459-4R-241	107.90	12.10	3.36	129.00
BR12466-4R-317	99.00	11.30	3.69	127.00
BR12465-4R-26	98.70	11.20	3.19	133.50
BR12477-4R-186	118.20	11.50	3.18	132.50
BR12465-4R-130	88.70	12.30	1.48	151.00
BR12465-4R-132	90.70	12.20	2.86	142.00
BR23 (Ck.)	113.60	11.10	2.33	142.00
BRR1 dhan30 (Ck.)	104.70	10.80	3.27	142.00
BR12459-4R-117	113.00	12.40	3.41	141.50
BR12465-4R-223	95.20	10.90	2.48	137.00
BR12465-4R-231	101.80	11.00	3.45	134.00
BR12459-4R-277	104.40	11.60	3.44	140.00
BR12465-4R-100	100.60	11.70	3.40	136.00
BR12465-4R-113	99.70	11.00	2.78	139.00
BR12465-4R-61	101.30	10.90	4.43	136.00
BR12466-4R-167	116.00	10.60	2.41	134.50
CV (%)	1.25	6.08	10.35	0.25
LSD _{0.05}	2.74	1.47	0.73	0.67

Table 4. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (STR-1) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13205-4R-190	103	11	9.72	129
BR12274-4R-193	114	8	9.43	127
BR11276-4R-139	134	9	9.00	138
BR13201-4R-15	110	9	9.49	131
BR11276-4R-196	123	9	9.51	130
BR13201-4R-298	108	9	9.16	130
BR13201-4R-225	104	8	9.37	129
BR11276-4R-104	133	9	8.92	137
BR11720-4R-89	134	9	9.62	130
BR12650-4R-77	133	9	9.32	130
BR12645-4R-71	129	9	8.38	130
BR13207-4R-28	128	10	10.65	135
BR13201-4R-268	109	9	8.54	129
BR13201-4R-299	107	9	10.10	131
BR11718-4R-92	144	11	9.60	138
BR13201-4R-219	107	9	9.63	131
BR12640-4R-250	125	9	9.55	134
BR11276-4R-67	143	8	9.76	137
BR12661-4R-33	125	9	8.86	131
BR13201-4R-103	108	10	10.07	128
BRRI dhan67	118	10	8.53	128
BRRI dhan28	110	10	8.63	124
BRRI dhan97	124	11	9.58	132
BRRI dhan99	108	10	9.98	136
CV%	1.34	4.11	3.65	0.68
LSD _{0.05}	3.32	0.79	0.71	1.85

Table 5. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (STR-2) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13197-4R-24	115	9	8.72	128
BR13201-4R-30	105	9	9.58	130
BR13201-4R-249	116	9	9.66	133
BR12650-4R-55	117	10	9.28	126
BR13201-4R-196	103	10	8.93	127
BR12658-4R-255	121	9	8.72	127
BR13206-4R-50	123	9	8.81	128
BR12274-4R-310	124	8	7.87	138

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR11276-4R-150	113	10	8.69	139
BR11718-4R-110	100	9	4.24	129
BR11718-4R-125	133	9	7.64	136
BR12274-4R-255	104	12	10.18	131
BR13102-4R-91	113	11	8.22	130
BR11716-4R-176	103	9	8.70	129
BR11718-4R-230	121	9	8.28	136
BRR1 dhan67	119	10	8.86	126
BRR1 dhan89	120	11	8.37	135
BRR1 dhan99	109	11	8.41	135
CV%	1.32	4.69	20.07	0.53
LSD_{0.05}	3.18	0.95	3.60	1.47

Table 6. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (Barishal) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BRBaNGR 324-1	105	11	7.99	131
BRBaNGR 1256-1	103	12	7.47	131
BRBaNGR350-2	105	11	6.92	135
BRBaNGR736-1	103	9	7.75	137
BRBaNGR994-1	100	10	7.85	134
BRR1 dhan74 (Ck)	103	10	7.79	136
BRR1 dhan102 (Ck)	101	10	8.36	135
CV%	2.17	8.95	4.26	1.99
LSD_{0.05}	5.45	2.29	0.81	6.55

Table 7. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (BB + Blast) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12904-4R-323	116	10	7.12	135
BR13174-4R-67	110	9	7.59	135
BR13174-4R-131	114	9	5.26	127
BR13178-4R-30	117	11	9.02	134
BR13178-4R-61	100	9	6.53	125
BR13178-4R-177	127	9	6.80	131
BR13178-4R-317	132	8	6.43	131
BR13180-4R-234	112	10	6.92	139
BR13180-4R-115	106	9	6.32	133
BR13180-4R-117	111	9	7.80	134

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13180-4R-259	115	9	6.62	137
BR13188-4R-170	115	9	8.01	132
BRRI dhan88 (Std. Ck)	93	11	4.68	126
BRRI dhan101 (Res. Ck)	105	9	7.21	130
CV%	5.19	10.17	20.01	2.02
LSD_{0.05}	9.80	1.60	2.35	4.56

Table 8. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (BB) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR11866-5R-277	101	10	7.77	139
BR12904-4R-132	110	9	7.67	139
BR12904-4R-219	111	12	8.88	137
BR12904-4R-233	114	12	7.89	134
BR13174-4R-28	112	8	7.40	131
BR13174-4R-1	111	8	7.11	137
BR13174-4R-9	111	9	8.21	137
BR13174-4R-114	117	10	7.08	138
BR13174-4R-390	105	8	7.38	136
BR13178-4R-46	123	9	5.95	142
BR13180-4R-97	108	10	6.34	142
BR13180-4R-202	118	11	7.46	136
BR13188-4R-1	119	9	7.02	134
BR13188-4R-170	122	10	8.80	131
BR13188-4R-304	115	10	7.46	135
BRRI dhan89 (Std. Ck)	114	10	7.87	136
BRRI dhan92 (Std. Ck)	117	11	5.70	137
BRRI dhan101 (Res. Ck)	109	10	6.51	136
CV%	3.91	8.09	12.34	1.10
LSD_{0.05}	9.31	1.67	1.94	3.21

Table 9. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (EMF) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR28NILqRL6.1-01	100	10	6.62	126
BR29NILqRL6.1-03	102	10	7.27	123
BR28Ref-01 (Ck)	108	10	7.20	120
BR29Ref-01 (Ck)	113	10	8.09	113
BRRI dhan88 (Ck)	116	10	8.19	114
CV%	1.55	5.98	9.37	1.38
LSD_{0.05}	3.14	1.15	1.32	3.09

Table 10. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (FBR-MD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13027-BC1-3R-51 (AYT-3)	110	12	8.83	129
BR13027-BC1-3R-21	111	11	8.32	126
BR13027-BC1-3R-76	115	11	7.81	130
IR18A1398	112	9	7.75	130
IR17A2922	110	11	8.57	130
BR11903-5R-56	112	10	8.70	127
BR13148-5R-12	114	11	8.47	128
BR12570-5R-66-3	115	10	8.57	126
BR13027-BC1-3R-24	109	10	8.41	125
BR13027-BC1-3R-51 (AYT-2)	111	10	8.18	126
IR19A9128	114	10	8.04	128
BRR1 dhan88 (Ck)	111	11	8.90	126
BRR1 dhan89 (Ck)	119	11	8.87	126
BRR1 dhan102 (Ck)	107	11	8.48	126
CV%	6.15	6.82	6.96	4.11
LSD_{0.05}	11.57	1.21	0.98	8.78

Table 11. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (FBR-MLD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13418-5R-18	118	10	8.20	131
BR13137-5R-107	115	11	7.62	128
IR19A8188	114	9	9.05	128
IR19A8986	122	10	7.19	125
IR19A8263	116	10	7.90	128
IR12A173	109	10	7.36	135
BR12679-4R-6	123	10	8.11	133
BR12208-5R-403	112	10	7.56	136
BR12671-4R-138	116	10	7.59	132
BR12671-4R-312	112	10	8.13	129
BR12672-4R-261	135	10	6.94	137
IR19A1473	105	11	7.82	124
BR11894-R-R-R-169	116	10	7.72	125
BRR1 dhan102 (Ck)	111	11	7.86	129
BRR1 dhan92 (Ck)	116	11	7.30	139
CV%	7.27	6.47	11.57	2.09
LSD_{0.05}	14.09	1.09	1.51	4.56

Table 12. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (FBR-SD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13141-5R-22	110	12	8.01	126
BR13418-5R-58	111	11	7.72	124
BR13418-5R-20	115	11	6.89	126
BR13136-5R-139	112	9	7.36	127
BR13136-5R-165	110	11	7.23	126
BR13418-5R-21	112	10	7.58	124
SVIN109	114	11	7.33	125
BR13027-BC1-3R-139	115	10	7.38	125
BR13027-BC1-3R-198	109	10	7.35	125
BR13153-5R-91	111	10	7.51	123
BRRI dhan28 (Ck)	114	10	7.76	122
BRRI dhan88 (Ck)	111	11	7.72	122
BRRI dhan102 (Ck)	119	11	7.61	122
CV%	6.21	6.52	8.60	2.78
LSD _{0.05}	11.77	1.16	1.09	5.83

Table 13. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (Pigmented) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12837-5R-57	106	10	4.73	128
BR12839-4R-5-2	109	9	3.26	119
BR12839-4R-93	102	9	3.32	118
BR12839-4R-138-4	102	10	3.23	116
BR12839-4R-137	104	10	4.26	115
BR12839-4R-4R-106	108	10	3.24	117
BR12838-4R-89-1	103	9	4.32	116
BRRI dhan88 (Ck)	106	11	4.36	108
BRRI dhan89 (Ck)	110	10	4.41	115
CV%	4.09	6.36	35.87	1.17
LSD _{0.05}	7.46	1.04	2.37	2.42

Table 14. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (PQR) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR11965-4R-75	110	10	7.30	123
BR11966-4R-262	110	10	7.46	123
BR11966-4R-313	109	11	7.02	124

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR11966-4R-344	112	10	7.43	128
BR11973-4R-224	110	10	7.29	127
BR11973-4R-309	109	11	6.97	127
BR11966-4R-406	111	9	6.96	135
BR11966-4R-439	109	9	6.98	128
BR11966-4R-468	112	10	7.69	137
BR11971-4R-1	108	9	7.22	129
BR11971-4R-228	105	9	7.15	123
BR11973-4R-363	105	10	7.35	128
BR11978-4R-112	105	9	7.01	132
BR11980-4R-139	106	10	7.46	131
BRR1 dhan50 (Ck)	108	10	7.05	132
BRR1 dhan104 (Ck)	109	11	7.85	131
BRR1 dhan107 (Ck)	112	10	7.17	133
CV%	5.22	9.12	8.18	2.35
LSD_{0.05}	9.44	1.49	0.99	5.05

Table 15. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (Basmati, Rangpur) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BRrang55-RGA-40-1-1-1	110	9	5.95	126
BRrang55-RGA-14-2-1-2	119	8	5.15	127
BRrang55-RGA-14-2-1-5	119	9	4.93	127
BRrang55-RGA-44-5-1-1	120	9	5.08	126
BRR1 dhan104 (Ck)	108	9	6.72	125
CV%	2.48	6.58	8.77	0.48
LSD_{0.05}	5.39	1.10	0.92	1.14

Table 16. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under RYT (ZER) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR11401-1-2-4-1	113	8	7.88	140
BR11401-8-3-1-1	98	10	6.03	139
BR12038-65-2-1	96	9	6.97	144
BRR1 dhan28 (Ck)	106	10	7.87	142
BRR1 dhan74 (Ck)	102	10	7.49	139
BRR1 dhan89 (Ck)	107	10	6.72	141

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BRRI dhan100 (Ck)	108	10	7.31	142
CV%	2.72	6.10	9.49	0.83
LSD_{0.05}	5.05	1.03	1.21	2.09

Table 17. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (STR-SD) during T. Aman, 2024 at Shyamnagar site.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13113-4R-63	98.47	12	3.06	116
BR13118-4R-76	106.20	13	3.01	120
BRRI dhan73	117.53	13	2.69	118
BRRI dhan75	93.80	13	2.80	116
CV%	1.06	2.80	8.43	--
LSD_{0.05}	2.19	0.71	0.49	--

Table 18. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (STR-Photosensitive_LD) during T. Aman, 2024 at Shyamnagar site.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13103-4R-37	131.20	10	4.63	133
BR13103-4R-7	96.33	12	3.86	146
BR13105-4R-37	87.07	12	4.00	140
BR13115-4R-122	88.40	11	3.42	146
BRRI dhan30	123.97	11	3.89	145
BR23	115.97	10	4.41	144
CV%	0.75	4.87	5.31	0.34
LSD_{0.05}	1.46	0.98	0.39	0.88

Table 19. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (STR-SD) during T. Aman, 2024 at Kaliganj site.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13113-4R-63	100.23	12	3.32	118
BR13118-4R-76	110.80	10	2.95	121
BRRI dhan73	118.80	11	2.49	120
BRRI dhan75	102.77	11	2.65	116
CV%	0.63	2.99	8.04	0.42
LSD_{0.05}	1.36	0.66	0.46	0.99

Table 20. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (STR-Photosensitive_LD) during T. Aman, 2024 at Kaliganj site.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13103-4R-37	134.63	11	4.09	134
BR13103-4R-7	107.43	13	4.13	147
BR13105-4R-37	87.73	11	3.62	141
BR13115-4R-122	102.10	12	3.78	145
BRRI dhan30	117.53	11	3.11	152
BR23	120.07	12	4.20	145
CV%	0.77	3.54	5.43	0.24
LSD _{0.05}	1.57	0.75	0.38	0.64

Table 21. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (FBR-MD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR11894-5R-260	93	10	6.88	137
BR12508-5R-5	91	10	7.07	134
BR12517-5R-57	100	10	7.13	137
BRRI dhan97 (Std. Ck)	105	10	7.36	145
BRRI dhan102 (Std. Ck)	103	10	6.97	144
CV%	1.48	7.42	5.07	0.28
LSD _{0.05}	2.75	1.40	0.68	0.73

Table 22. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (PQR) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR11359-4R-181	121	10	6.17	145
BR11359-4R-279	103	11	6.36	144
BRRI dhan104 (Ck)	104	10	5.59	141
BRRI dhan107 (Ck)	97	10	6.05	139
CV%	1.57	4.87	4.71	0.48
LSD _{0.05}	3.34	1.01	0.57	1.37

Table 23. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (BB+Blast-SD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR (path)13802-BC3-54-12	91	11	5.76	134
BR (path)13802-BC3-73-13	79	10	5.41	134
BR (path)13802-BC3-62-14	97	10	5.40	133
BRRI dhan88 (Ck)	102	10	5.12	136

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
CV%	1.12	6.15	7.4	0.46
LSD_{0.05}	2.06	1.26	0.80	1.19

Table 24. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (BRR-SD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR (path)15641-3HR-15	112	10	6.76	138
BR (path)15641-3HR-45	105	11	7.44	137
BRRI dhan88 (Ck)	103	12	5.88	136
CV%	1.25	2.20	7.92	0.38
LSD_{0.05}	3.02	0.54	1.20	1.19

Table 25. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (PQR-PATH) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BRRI(Path)-PremiumI	104	10	8.13	144
BRRI dhan50 (Ck)	94	11	7.64	146
BRRI dhan104 (Ck)	103	10	7.45	144
CV%	0.78	2.67	3.01	0.44
LSD_{0.05}	1.77	0.63	0.53	1.33

Table 26. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (AOER-MD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12839-4R-157-2	118	9	8.10	147
BR12839-4R-5-2	104	11	7.47	137
BRRI dhan100 (Ck)	121	9	7.92	147
CV%	0.57	4.28	3.22	5.05
LSD_{0.05}	1.47	0.93	0.57	1.52

Table 27. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (AOER-SD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12839-4R-137	121	11	7.66	136
BRRI dhan88 (Ck)	96	10	7.95	136
CV%	0.26	9	5.36	0.30
LSD_{0.05}	0.99	3.26	1.47	1.43

Table 28. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (BRR-MD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR (path)15855-BC3-2HR-5	120	9	7.14	146
BR (path)15860-BC2-3HR-48	100	11	7.41	138
BRRI dhan58 (Ck)	111	10	7.03	138
CV%	1.06	2.71	5.16	0.41
LSD_{0.05}	2.65	0.60	0.84	1.31

Table 29. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (BRR-LD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR (Path)15855-BC2-3HR-23	112	10	7.12	146
BR (Path)15860-BC2-3HR-47	110	10	6.30	145
BRRI dhan29 (Ck)	111	10	6.96	147
CV%	1.33	6.73	7.49	0.46
LSD_{0.05}	3.35	1.51	1.15	1.51

Table 30. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (FBR-SD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR12574-5R-52	92	10	5.62	134
BRRI dhan88 (Std. Ck)	93	10	6.91	136
CV%	0.62	8.58	9.01	0.52
LSD_{0.05}	2.01	2.99	1.98	2.48

Table 31. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (STR-SD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13113-4R-63	87	9	3.07	136
BR13113-4R-116	60	9	1.84	140
BRRI dhan28 (Ck)	80	9	1.55	136
BRRI dhan88 (Ck)	Salt damage			
CV%	1.65	2.93	50.98	0.24
LSD_{0.05}	2.84	0.60	2.49	0.76

Table 32. Plant height, effective tiller, grain yield and growth duration of some rice genotypes under ALART (STR-MD) during Boro, 2024-25.

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13106-4R-184	78	9	2.84	136
BR13113-4R-185	75	9	3.88	138

Genotype	Plant height (cm)	Effective tiller hill ⁻¹	Grain yield (t ha ⁻¹)	Growth duration (days)
BR13122-4R-136	98	9	3.49	144
BRRI dhan102 (Ck.)	79	9	2.61	149
BRRI dhan99 (Std. Ck)	85	10	3.51	149
CV%	0.75	4.97	21.24	0.42
LSD _{0.05}	1.17	0.86	1.31	1.12

Table 33. Plant height, grain yield and growth duration of some rice genotypes under OYT-FBC during Boro, 2024-25.

Genotype	Plant height (cm)	Grain yield (t ha ⁻¹)	Growth duration (days)
BR14226-R-R-R-198-P2	124	8.79	124
BR14227-5R-41	107	8.70	117
BR14229-5R-184	110	8.63	120
BR14612-4R-101	108	8.35	130
BR14231-R-R-R-8-P1	126	7.79	122
BR14223-R-R-R-18	109	7.50	118
BR14226-R-R-R-160	119	7.45	126
BR14254-4R-160	100	7.17	115
BR14226-R-R-R-184-P1	123	7.02	122
BR14218-R-R-R-213	113	6.95	128
BR14229-5R-39	118	6.95	126
BR14266-4R-223	97	6.92	124
BR14229-5R-102	121	6.90	125
BR14233-R-R-R-52	107	6.89	123
BR14218-R-R-R-53	113	6.86	129
BR14231-R-R-R-106	112	6.81	124
BR14226-5R-243	107	6.80	127
BR14229-5R-219	114	6.76	125
BR14221-R-R-R-52	114	6.70	123
BR14252-R-R-R-14	106	6.66	123
BR14221-R-R-R-32	110	6.65	118
BR14229-5R-135	119	6.65	126
BR14236-5R-200	133	6.65	125
BR14266-4R-22	115	6.62	118
BR14231-R-R-R-57	101	6.61	122
BR14870-BC1-R-44	117	6.58	118
BR14652-4R-16	121	6.54	138
BR14247-5R-13	126	6.46	122

BRRi dhan114	103	6.48	124
BRRi dhan88 (Ck)	97	5.64	118
BRRi dhan92 (Ck)	113	5.10	136
BRRi dhan102 (Ck)	106	5.08	133
BRRi dhan29 (Ck)	103	4.47	133

Table 34. Effect of missing nutrient on rice production in southern coastal area during T. Aman 2024 and Boro 2024-25

Treatments	Grain yield (t ha ⁻¹)
-N	6.19
-P	5.52
-K	7.13
-S	6.76
-Zn	6.76
NPKSZn	7.22
- NPKSZn	5.42
CV%	12.17
LSD_{0.05}	1.39

Table 35. Effect of Zinc on growth and Zinc nutrition of Zinc-enriched rice cultivar in unfavourable ecosystem of Bangladesh T. Aman 2024 and Boro 2024-25

Treatment	Variety	Grain yield (t ha ⁻¹)
Control (-Zn)	BRRi dhan84	7.51
100% RDZn	BRRi dhan84	7.24
50% RDZn	BRRi dhan84	7.29
50% RDZn + Nano Zn	BRRi dhan84	7.44
Control (-Zn)	BRRi dhan104	7.53
100% RDZn	BRRi dhan104	7.43
50% RDZn	BRRi dhan104	7.52
50% RDZn + Nano Zn	BRRi dhan104	7.38
CV%		5.43
LSD_{0.05}		0.71

Table 36. Improving Rice yield and mitigating Greenhouse gas emission in Rice cultivation using Nano Urea and Zeolite T. Aman 2024 and Boro 2024-25

The treatment 66% RPU (22% basal+22% at 25 DAT+ 22% BPI)

Treatments	Grain yield (t ha ⁻¹)
T ₁ - Control (-N)	5.61
T ₂ - 66% RPU (33% basal+33% at 25 DAT)	7.95

T ₃ - 66% RPU (22% basal+22% at 25 DAT+ 22% BPI)	8.76
T ₄ - 66% (22% basal+22% at 25 DAT+ 22% BPI) + Zeolite 4 t ha ⁻¹	7.56
T ₅ - 66% RPU (33% basal+33% at 25 DAT) + Liquid nano urea 1235 ml ha ⁻¹	6.99
T ₆ - 100% RPU (33% basal+33% at 25 DAT+ 33% BPI)	7.90
CV%	14.03
LSD_{0.05}	1.90

Table 37. Stability Analysis of BRRI Varieties at Satkhira

(Long duration)

Varieties	Grain yield (t ha ⁻¹)
BRRI dhan60	7.71
BRRI dhan58	6.94
BRRI dhan64	6.60
BR7	3.85
BRRI dhan29	5.68
BR17	Damage
BRRI dhan59	7.89
BRRI dhan97	7.29
BRRI dhan89	7.84
BRRI dhan92	6.59
BRRI dhan35	5.66
BRRI dhan108	7.91
BR12	5.22
BRRI dhan47	7.67
BR8	4.53
BRRI dhan99	6.98
BRRI dhan69	7.40
BR14	6.14
BR9	5.68
BR2	6.53
BR15	6.64
BR18	5.98
BR3	4.42
BRRI dhan102	7.64
BR19	5.43
BRRI dhan50	6.28
BR16	5.93
CV%	6.06
LSD_{0.05}	0.64

Short duration)

Varieties	Grain yield (t ha ⁻¹)
BRRi dhan67	6.62
BRRi dhan55	7.29
BRRi hybrid dhan5	9.73
BRRi dhan84	7.67
BRRi dhan36	6.96
BRRi dhan63	7.45
BRRi dhan27	6.72
BRRi dhan68	7.79
BRRi hybrid dhan2	7.67
BRRi dhan81	7.76
BRRi dhan74	7.31
BRRi dhan61	6.97
BRRi dhan100	7.92
BRRi dhan28	8.15
BRRi dhan104	7.52
BRRi dhan88	7.86
BR26	6.50
BRRi hybrid dhan3	8.83
BRRi dhan45	7.21
BRRi dhan86	7.79
BRRi dhan96	8.24
BR6	7.20
BRRi dhan101	7.64
BR1	4.30
BRRi hybrid dhan8	10.34
BRRi dhan105	7.51
BRRi dhan107	6.49
CV%	4.13
LSD_{0.05}	0.51

Figures:

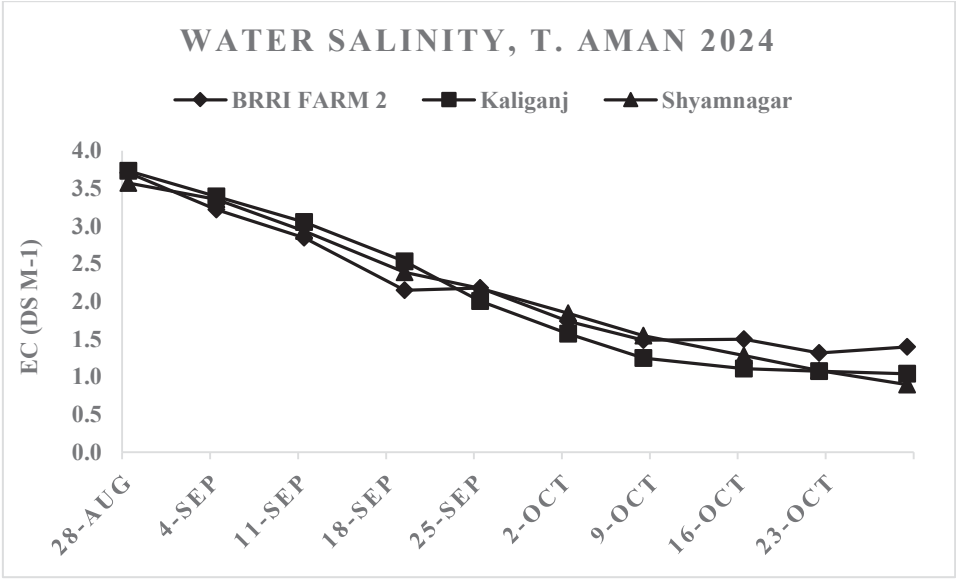


Fig. 1. Crop standing water salinity during T. Aman 2024 at 3 different trial sites of Satkhira

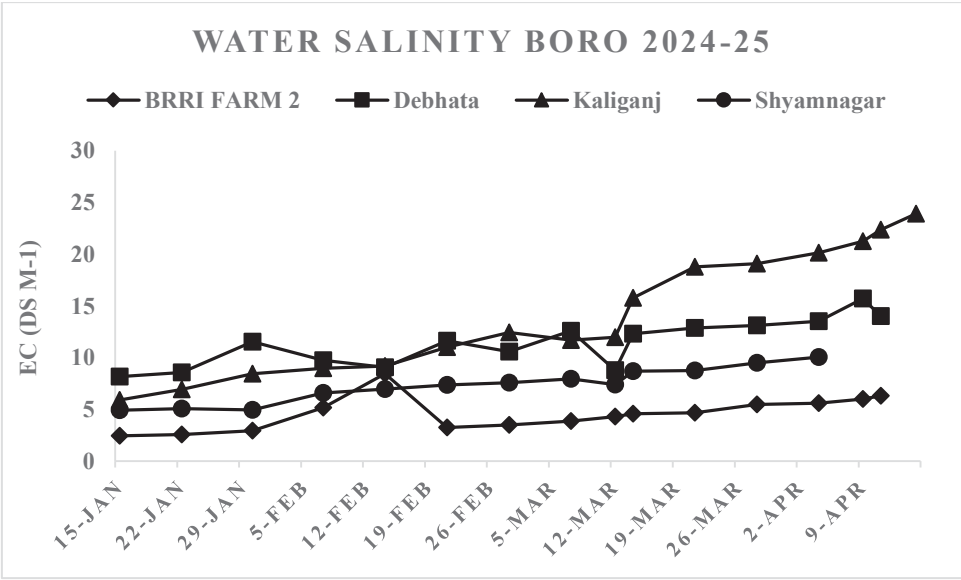


Fig. 2. Crop standing water salinity during Boro 2024-25 at 4 different trial sites of Satkhira

BRRI RS, Sonagazi

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SUMMARY

Altogether 27 crosses were made during T. Aman 2024 at BRRI Regional Station, Sonagazi. One F1 cross of BR22/BR23 was confirmed in Aman 2024 season. Twenty-two BC1F1 crosses of Rajashail & Kajalshail were made during T. Aman. For pure line selection of Ranguin (one of the best local Aus varieties in Hilly areas), 18 uniform lines were selected during T. Aus 2024. A total of 221 breeding lines were tested under RYT trials during the reporting period. Breeding lines were supplied from Plant breeding division, Biotechnology divisions, BRRI RS Rangpur and BRRI RS Barishal. 105 lines along with standard checks were tested under 12 RYTs during Aman 2024. 116 lines along with standard checks were tested under 12 RYTs during Boro 2024-25. 192 lines along with 4 standard checks were tested under 1 OYT (RCGS) during Boro 2024-25. 43 advanced lines along with standard checks were evaluated under 2 ALART's, 3 ALARTs and 11 ALARTs during Aus 2024, Aman 2024 and Boro 2024-25, respectively in different locations of BRRI, Sonagazi, Feni and Noakhali. 7 lines along with 5 standard checks were evaluated under MLT (BIO) during Boro 2024-25. Multi-Location Trials (MLT) of promising Hybrid, Aman 2024: Among the materials Ent#15 (IR58025A/BRRI56R) produced highest yield 9.4 t/ha followed by Ent#14 (IR79156A/BRRI20R) 9.1 t/ha yield. Multi-Location Trials (MLT) of promising Hybrid, Boro 2024-25: Among the materials Ent#10 (BRRI99A/BRRI32R) produced highest yield 6.4 t/ha followed by Ent#8 (IR102758A/BRRI42R) 5.5 t/ha. Stability analysis, Aus 2024: Total 14 varieties. Damaged by floods. Stability analysis, Aman 2024: Total 48 varieties. Among the varieties, BRRI hybrid dhan6 ranked the top in terms of yield followed by BRRI dhan103. Stability analysis, Boro 2024-25: Total 54 varieties. Among the varieties, BRRI hybrid dhan8 ranked the top in terms of yield followed by BRRI hybrid dhan5. A total 1075 demonstration of modern rice varieties were executed in 2745 bigha land during the reporting period under GOB and different projects.

A total of 200 demonstrations were executed in 200 bigha of land at farmer's field at Chattogram and Rangamati regions during 2024-2025 funded by GOB.. A total of 25 farmers training having 625 male and 125 female farmers were conducted in 2024-2025 financial year at Chattogram and Rangamati regions. A total of 28 field days were conducted in 2024-2025 financial year at Chattogram and Rangamati regions. Nearly 3000 progressive farmers, entrepreneurs, extension personnel (DAE and NGO personnel), local leaders, and public representatives were participated in those occasions. A total of 50 ton breeder seeds were produced under GOB fund during the reporting period. All the Breeder seeds of different varieties were sent to Genetic Resource and Seed Division, BRRI, Gazipur. A total of 28.92 ton TLS of modern rice varieties were produced by BRRI Sonagazi during the reporting period. BRRI Sonagazi produced 2300 kg F1 seed of BRRI hybrid dhan8 in Boro 2024-25 at BRRI Sonagazi farm and all the seeds were sent to Hybrid Rice Division, BRRI, Gazipur for proper storing. A total of 29 ton certified seeds were produced under PARTNER project.

VARIETAL DEVELOPMENT PROGRAM

Germplasm collection for Pure line selection:

Ranguin is a one of the best and popular local Aus variety in Hilly areas. 18 uniform lines were selected during T. Aus 2024.

Hybridization, T. Aman 2024

In this hybridization program, 5 crosses were made for forward breeding using BRRI varieties (Table 1) and 22 BC1F1 crosses of Rajashail & Kajalshail were made (Table 2), expected to introgress genes from diverse genetic background for the improvement of local popular photosensitive variety with higher yield (7.0 t/ha), slender grain, lodging tolerance. In, Backcross breeding, crossing was done between F₁ and respective donor parents and in forward breeding crossing was done between elite vs elite parents. Usual method of emasculation and pollination was followed for crossing.

Table 1. List of crosses made for forward breeding during T. Aman 2024, BRRI Sonagazi

Cross combinations	Traits	No. of F ₁ 's Seeds
BRRI dhan87/BRRI dhan75	Lodging tolerant, short duration	21
BRRI dhan103/BRRI dhan75	Lodging tolerant, short duration	19
BRRI dhan49/BRRI dhan75	Short duration, slender grain	63
BRRI dhan75/BRRI dhan34	Aroma, short grain	90
BRRI dhan52/BRRI dhan75	Lodging tolerant, short duration, slender grain	5

Table 2. List of crosses made for backcross breeding (BC₁F₁) during T. Aman 2024, BRRI Sonagazi

BR No.	Cross combinations	Traits	No. of F ₁ 's Seeds
BRSon1	Rajashail/BRRI dhan103// BRRI dhan103	Photosensitivity, high yield	111
BRSon2	Rajashail/BRRI dhan87// BRRI dhan87	Photosensitivity, high yield	158
BRSon3	Rajashail/BRRI dhan52// BRRI dhan52	Photosensitivity, high yield, submergence	152
BRSon4	Rajashail/BRRI dhan49// BRRI dhan49	Photosensitivity, high yield, lodging tolerant	75
BRSon5	Rajashail/BR11//BR11	Photosensitivity, high yield	82
BRSon6	Rajashail/BRRI dhan54// BRRI dhan54	Photosensitivity, high yield	104
BRSon7	Rajashail/BRRI dhan71// BRRI dhan71	Photosensitivity, high yield	16
BRSon8	Rajashail/BRRI dhan75// BRRI dhan75	Photosensitivity, high yield, slender grain, lodging tolerant	41
BRSon9	Rajashail/BR22// BR22	Photosensitivity, high yield	24
BRSon10	Rajashail/BRRI dhan72// BRRI dhan72	Photosensitivity, high yield	84
BRSon11	Rajashail/BRRI dhan79// BRRI dhan79	Photosensitivity, high yield	365
BRSon12	Rajashail/BRRI dhan80// BRRI dhan80	Photosensitivity, high yield, slender grain	96
BRSon13	Rajashail/BRRI dhan90// BRRI dhan90	Photosensitivity, high yield, short grain	25
BRSon14	Rajashail/BRRI dhan94//BRRI dhan94	Photosensitivity, high yield	144
BRSon16	Kajalshail /BRRI dhan46// BRRI dhan46	Photosensitivity, high yield	73
BRSon17	Kajalshail /BRRI dhan49// BRRI dhan49	Photosensitivity, high yield, lodging tolerant	135
BRSon18	Kajalshail /BRRI dhan51// BRRI dhan51	Photosensitivity, high yield, submergence	319
BRSon19	Kajalshail /BRRI dhan52// BRRI dhan52	Photosensitivity, high yield, submergence	241
BRSon20	Kajalshail /BRRI dhan54// BRRI dhan54	Photosensitivity, high yield	109
BRSon21	Kajalshail /BRRI dhan75// BRRI dhan75	Photosensitivity, high yield, slender grain, lodging tolerant	158
BRSon22	Kajalshail /BRRI dhan78// BRRI dhan78	Photosensitivity, high yield, submergence	40

F1 confirmation, T. Aman 2024: One F₁ cross of BR22/BR23 was confirmed (Table 3).

Table 3. List of cross confirmed for forward breeding during T. Aman 2024, BRRI Sonagazi

BR No.	Parentage	Traits
BRSon23	BR22/BR23	Photosensitivity, high yield

Regional Yield Trials (RYT)

A total of 221 breeding lines were tested under RYT trials during the reporting period. Breeding lines were supplied from Plant breeding division, Biotechnology divisions, BRRI RS Rangpur and BRRI RS Barishal.

RYT Aman 2024: 105 lines along with standard checks were tested under 12 RYT trials during Aman 2024.

RYT Boro 2024-25: 116 lines along with standard checks were tested under 12 RYT trials during Boro 2024-25.

OYT Boro 2024-25: 192 lines along with 4 standard checks were tested under 1 OYT (RCGS) during Boro 2024-25.

MLT (Multi-Locations Yield Trial) Boro 2024-25: 7 lines along with 5 standard checks were evaluated under MLT (BIO) during Boro 2024-25.

Advanced Line Adaptive Research Trial (ALART)

The objectives were to evaluate yield potential and adaptability of advanced rice genotypes at farmer's field, to get feedback information about the advantages and disadvantages of the breeding lines from farmers and DAE personnel and to select promising rice genotypes for proposed variety trial (PVT). Total 43 advanced lines along with standard checks were evaluated under 2, 7, 12 ALARTs during Aus 2024, Aman 2024 and Boro 2024-25, respectively in different locations of BRRI, Sonagazi, Feni and Comapanyganj, Noakhali to test the yield performance and to evaluate the yield potential and adaptability of superior breeding lines. All the data were sent to Adaptive Research Division, BRRI, Gazipur for combined reporting and further necessary action.

AGGRi Network Trials (ANT) in salt-stress prone environment of Bangladesh

To evaluate yield potential and adaptability of the advanced genotypes at farmer's field in coastal saline environments and to select rice genotypes tolerant to high salinity stress during the T. Aman 2024 season, 192 breeding lines with check

varieties were evaluated at Char Elahi, Comapanyganj, Noakhali. The design of the experiment was Alpha lattice with 2 replications and the spacing was 20 cm × 20 cm. All the data were sent to Plant Breeding Division, BRRI, Gazipur for combined reporting and further necessary action.

Confined Field Trial (CFT) of Pro-Vitamin-A Enriched GR2E BRRI dhan49 and GR2E BRRI dhan62 Golden Rice

To evaluate phenotypic characteristics and agronomic performance under field conditions of advanced breeding lines containing the GR2E event, confined field trial was conducted during Aman 2024 season, 12 rice genotypes with 3 standard check were evaluated at BRRI Sonagazi Farm. The trial was carried out in RCBD design with 3 replications at a spacing of 20 cm × 20 cm. All the data were sent to Plant Breeding Division, BRRI, Gazipur for combined reporting and further necessary action.

Multi-location Yield Trials (MLT) of promising Hybrid, T. Aman 2024

The experiments were conducted at BRRI R/S Sonagazi, during T. Aman 2024, pointed to assess the yield of promising rice hybrids at different locations for their adaptability. 15 hybrids with 4 checks were used as planting materials. 25 days old seedlings were transplanted with a spacing of 20 × 15 cm² using one seedling/hill. All the data were sent to Hybrid Rice Division, BRRI, Gazipur for combined reporting and further necessary action. Among the materials Ent#10 (BRRI99A/BRRI32R) produced highest yield 6.4 t/ha followed by Ent#8 (IR102758A/BRRI42R) 5.5 t/ha.

Multi-location Yield Trials (MLT) of promising hybrids, Boro 2024-25

The experiments were conducted at BRRI R/S Sonagazi, during Boro 2024-25, pointed to find out suitable promising hybrids for Boro season. 14 hybrids with 4 checks were used as planting materials. 32 days old seedlings were transplanted with a spacing of 20 × 15 cm² using one seedling/hill. All the data were sent to Hybrid Rice

Division, BRRI, Gazipur for combined reporting and further necessary action. Among the materials Ent#15 (IR58025A/BRRI56R) produced highest yield 9.4 t/ha followed by Ent#14 (IR79156A/BRRI20R) 9.1 t/ha.

PEST MANAGEMENT

Survey and monitoring of rice diseases

Survey was carried out at farmers' fields of Feni, Noakhali, and Laxmipur districts in Aman 2024 and Boro 2024-25. Sites were selected with the suggestion and collaboration of Upazila Agriculture Officer (UAO) of Department of Agricultural Extension (DAE). Sub Assistance Agricultural Officer (SAAO) of concern block helped in site selection who were the front-line workers and very much familiar to the farmers as well as their fields. Bacterial Leaf Blight (BLB), Bacterial Leaf Streak (BLS), Sheath rot, False smut and Sheath blight infestation were observed in different scores during Aman season. BRRI dhan49 in different locations and other breeding materials of BRRI Sonagazi research field were affected by false smut disease in different locations due to fluctuation of environmental conditions during Aman season. BRRI dhan28, BRRI dhan29, BRRI dhan67, BRRI dhan97, BRRI dhan89, BRRI 92 and BRRI dhan84 were affected moderately to high by neck blast during Boro season. The farmers were suggested for preventive measures using fungicide.

Monitoring of insect pests and natural enemies by using light trap

Rice insect pests and their natural enemies were monitored throughout the reporting period by Pennsylvanian light traps from July 2024 to June 2025 at the experimental field of BRRI regional station, Sonagazi, Feni. The abundance of Leaf roller, Stem borer, Rice bug, green leafhopper, grasshopper, Mole cricket, Field cricket, and stink bug were found in the light trap during the reporting period. Some beneficial insects like lady bird beetle, spider, damsel fly, carabid beetle, Staphylinid beetle were also found.

CROP SOIL AND WATER MANAGEMENT

Nitrogen Use Efficiency and Performance of BRRI dhan103 in Southeast Coastal Region of Bangladesh

The experiment was conducted to evaluate the response of BRRI dhan103 to varying nitrogen levels, investigate nitrogen use efficiency, and determine the optimum nitrogen requirement for maximum yield. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and a plant spacing of 25×15 cm. Eight treatments involving different nitrogen levels were applied: T1 – Researcher's Practice (RP) with N, P, K, S, and Zn at 83, 15, 56, 14, and 2.7 kg ha^{-1} , respectively (equivalent to 180, 75, 112, 75, and 7.5 kg ha^{-1} , or 24, 10, 15, 10, and 1 kg bigha^{-1}); T2 – RP without N; T3 – RP with 50 kg N ha^{-1} ; T4 – RP with 75 kg N ha^{-1} ; T5 – RP with 100 kg N ha^{-1} ; T6 – Soil test-based (STB) nutrients with N, P, K, S, and Zn at 88, 15, 54, 6, and 1.7 kg ha^{-1} (191, 75, 108, 33, and 4.7 kg ha^{-1}); and T7 – control with no fertilizers. Data were sent to respective division of BRRI.

Effect of Seedling age on the performance of short duration wet season rice

The experiment was conducted to investigate the effect of seedling age on yield and yield components of BRRI dhan75. The experiment was laid out in a RCBD design with 3 replications. Transplanting was done at a spacing of $20 \text{ cm} \times 20 \text{ cm}$ on plot having size of $3\text{m} \times 4\text{m}$. Seeds of all treatments were sown on the same date, but transplanted at different dates with 5-day intervals starting from 31 July, 2024 to 25 August, 2024. Fertilizers rate was N, P, K, S, Zn @ 76, 15, 56, 14, 2.7 kg/ha (Urea, DAP, MOP, Gypsum & Zinc Sulfate @ 164, 75, 112, 75 & 7.5 kg/ha). Except urea, full amount of all the fertilizers was applied as basal. Urea application was done in 3 equal splits at 7, 20 and 30 DAT. Data were sent to the respective division of BRRI.

Effect of Late Transplanting on the performance of short duration rice

The experiment was conducted to find out suitable seedling age at transplanting of high yielding short duration rice and to investigate the effect of seedling age on yield and yield components of BRRI dhan75. Seeds were sown at different dates @ 5 days interval starting from 20 July, 2024 to 15 August, 2024 but all seedlings were transplanted in the same date on 28 August, 2024. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and a plant spacing of 20 cm × 15 cm. Fertilizer rate was N, P, K, S, Zn @ 76, 15, 56, 14, 2.7 kg/ha (Urea, DAP, MOP, Gypsum & Zinc Sulfate @ 164, 75, 112, 75 & 7.5 kg/ha). Except urea, full amount of all the fertilizers was applied as basal. Urea application in equal 3 splits at 7, 22 and 35 DAT. Data were sent to respective division of BRRI.

Optimizing management options for aged seedlings of short duration wet season rice

The experiment was conducted to investigate the effect of management options on yield and yield components of BRRI dhan75 and to find out suitable management option(s) for better performance of aged seedling of short duration rice. This experiment was laid out in Randomized Complete Block Design with three replications. Unit plot size was 3 m x 4 m (12 m²) and seedling age was 40 days. Fertilizer rate was N, P, K, S, Zn @ 76, 15, 56, 14, 2.7 kg/ha (Urea, TSP, MOP, Gypsum & Zinc Sulfate @ 164, 75, 112, 75 & 7.5 kg/ha). Except urea, full amount of all the fertilizers was applied as basal. Urea application in equal 3 splits at 7, 22 and 35 DAT. Data were sent to respective division of BRRI.

Effect of planting date on the performance of modern rice varieties in southeast of Bangladesh, Boro 24-25

During Boro 2024-25 season this experiment was conducted at BRRI Sonagazi farm, aimed to identify a suitable planting window of Boro rice cultivars to maximize grain yield. The objectives of the experiment was to investigate the effect of transplanting date on yield and yield components, to find out the optimum transplanting date and yield loss assessment due to delayed transplanting. It was

two factors experiment where six transplanting dates and six varieties BRRI dhan88, BRRI dhan96, BRRI dhan101, BRRI dhan89, BRRI dhan92 and BRRI dhan102 were included in the experiment. The seeding started on 1 November 2024 and continued up to 16th January 2025 at 15 days interval and transplanting started on 10 December 2024 and completed on 25 February 2025 at 15 days interval. Forty days old seedlings were transplanted for all the plantings. The spacing was 20 cm x 20 cm. Unit plot size was 3.2 m x 3.8 m. This experiment was laid out in Randomized Complete Block Design with three replications. Fertilizer doses N, P, K, S and Zn @ 138, 22.4, 75, 20.4 and 4.0 kg ha⁻¹ (Urea, TSP, MOP, Gypsum & Zinc Sulfate (Monohydrate) @ 300, 112, 150, 112 & 11 kg ha⁻¹) were applied equally for all the sets. Urea top dressing was done at 20, 35 and 50 days after transplanting (DAT). Unified management practices were followed for all the plantings. Yield and yield components were significantly affected by both the planting dates and varieties. All the data were sent to Agronomy Division, BRRI, Gazipur for combined reporting and further necessary action.

Long-term Missing Element Trial in Rice -Rice Cropping Pattern

The experiment was conducted at BRRI Sonagazi farm to identify the limiting nutrients of soil, observe the yield trend under different nutrient management practices, and study soil fertility changes under long-term fertilizer application. The test crop was BRRI dhan102, grown in a Randomized Complete Block Design (RCBD) with four replications. Each plot measured 5 m × 4 m with a spacing of 20 cm × 20 cm. Seven treatments were imposed: T1—Control (no fertilizer), T2—NPKSZn (complete fertilizer), T3—PKSZn (–N), T4—NKSZn (–P), T5—NPSZn (–K), T6—NPKZn (–S), and T7—NPKS (–Zn). The fertilizer doses were applied at the rates of 160, 20, 80, 10, and 2 kg/ha of N, P, K, S, and Zn, respectively. All the data were submitted to the Soil Science Division, BRRI, Gazipur, for compilation, reporting, and further necessary action.

Effect of SILIFORCE-4 on Growth and Yield of Rice

The experiment was conducted to evaluate the efficacy of SILIFORCE-4 on rice growth and yield using BRRI dhan102 in a randomized complete block design with four replications. Each plot measured 5 m × 4 m at 20 cm × 20 cm spacing. Three treatments were tested: T1, recommended fertilizer with three foliar sprays of SILIFORCE-4 at early, mid, and late tillering; T2, recommended fertilizer with three sprays of DPN solution at the same stages; and T3, control with only recommended fertilizer. Fertilizers were applied at the rate of N-P-K-S-Zn @ 174-18-80-18-3 kg/ha. All the data were submitted to the Soil Science Division, BRRI, Gazipur for compilation, reporting, and further necessary action.

Effect of Calcium Silicate Fertilizer on Growth and Yield of Rice

A field experiment was conducted to evaluate the effect of Calcium Silicate Fertilizer (CSF) on the growth and yield parameters of rice using BRRI dhan102. The experiment was laid out in a Randomized Complete Block (RCB) design with three replications in 5 m × 4 m plots, maintaining a spacing of 20 cm × 20 cm. The treatments included T1 = 100% recommended fertilizer (control), T2 = 100% RF + CSF 247 kg/ha, T3 = 100% RF + CSF 494 kg/ha, and T4 = 100% RF + CSF 741 kg/ha. The recommended nutrient dose was N-P-K-S-Zn @ 174-18-80-18-3 kg/ha. The study aimed to determine the influence of CSF application on improving rice growth and yield performance. All the data were submitted to the Soil Science Division, BRRI, Gazipur for compilation, reporting, and further necessary action.

Role of ISABION* to improve rice yield over recommended fertilizer dose

(*ISABION: a PGR provided by BARC for field trial)

An experiment was conducted to evaluate the role of ISABION, a plant growth regulator (PGR), on rice yield in comparison to the recommended fertilizer dose. The study was carried out using

BRRI dhan102 with a plot size of 5 m × 4 m. The trial was laid out in a Randomized Complete Block (RCB) design with three replications and a spacing of 20 cm × 20 cm. Six treatments were tested: T1 = 100% STB PKSZn, T2 = 100% STB NPKSZn, T3 = 100% STB NPKSZn + 1 L ha⁻¹ ISABION (2 sprays), T4 = 100% STB NPKSZn + 2 L ha⁻¹ ISABION (2 sprays), T5 = 100% STB NPKSZn + 3 L ha⁻¹ ISABION (2 sprays), and T6 = 100% STB NPKSZn + 4 L ha⁻¹ ISABION (2 sprays). The 100% STB NPKSZn fertilizer dose corresponded to the application of N-P-K-S-Zn at 162-20-102-15-1 kg ha⁻¹, supplied from Urea, TSP, MoP, Gypsum, and ZnSO₄·H₂O, respectively. The experiment aimed to assess the effectiveness of ISABION in enhancing rice growth and yield under standard nutrient management. All the data were submitted to the Soil Science Division, BRRI, Gazipur for compilation, reporting, and further necessary action.

Management Options for Controlling Algae and Azolla in Rice Field

The experiment was conducted to evaluate Algae and Azolla's management options in rice fields and to find suitable management options (s) to control Algae and Azolla. The experiment was conducted using the rice variety **BRRI dhan102** in a **Randomized Complete Block Design (RCBD)** with three replications maintaining a spacing of **20 cm × 20 cm**. Each plot measured **3 m × 3 m**, ensuring proper layout for accurate observation and data collection.. The experiment consisted of ten treatments to evaluate the effects of nutrient management and weed-algae control on rice. **T1** represented the Researcher's Practice (RP), with N, P, K, S, and Zn applied at 124, 22, 75, 20, and 4.0 kg ha⁻¹, respectively, using Urea, TSP, MOP, Gypsum, and Zinc Sulfate Monohydrate at 270, 112, 150, 112, and 11 kg ha⁻¹. **T2** followed T1 but used DAP as the P source, with Azolla removed manually to deplete it from the plot. **T3** applied T1 fertilization along with the first top-dressing of urea at 15 days after transplanting (DAT), with algae and Azolla manually removed. **T4** combined T2 fertilization and the first urea top-dressing at 15 DAT, also with algae and Azolla removal. **T5**

applied T1 nutrients followed by hand weeding and dibbling algae and Azolla between every four hills. **T6** followed T2 nutrients with hand weeding and dibbling of algae and Azolla. **T7** applied T1 nutrients along with Copper Sulfate at 3.75 kg ha⁻¹ mixed with sand at 20 and 40 DAT. **T8** applied T1 nutrients but controlled algae and Azolla using 2,4-D Amine Salt herbicide at 20 DAT as a late post-emergence application. **T9** followed T1 nutrients without controlling algae and Azolla, and **T10** served as the control with no nutrient application, representing the native soil nutrient supply. Data sent to respective division of BRRI.

SOCIO-ECONOMIC AND POLICY

Stability analysis of BRRI developed rice varieties

The consistent performance of a rice variety across various environments is essential for its broad acceptance and cultivation by farmers. So far, BRRI has released 121 rice varieties designed to suit different agro-ecosystems during the Aus, Aman, and Boro seasons. This experiment was conducted to investigate the stability of BRRI developed rice varieties and to find out location specific suitable variety(s). The experiments were laid out in RCBD design with three replications with a spacing of 20 cm × 20 cm. Standard management practices were followed for all the experiments in all the seasons. All the data were sent to Agricultural Statistics Division, BRRI, Gazipur for combined reporting and further necessary action.

Stability analysis, Aus 2024: Total 14 varieties (All damaged by August 2024's flood).

Stability analysis, Aman 2024: Total 48 varieties (Short duration= 15, Medium duration= 22, Long duration=11). Age of seedling was 21 days.

Stability analysis, Boro 2024-25: Total 54 varieties (Short duration =27, Long duration=27). Age of seedling was 42 days.

TECHNOLOGY TRANSFER

Demonstration of modern rice varieties

Demonstration of Modern Rice Varieties:

A total 1075 demonstration of modern rice varieties were executed in 2745 bigha land during the reporting period under GOB and different projects.

GOB Fund: A total of 200 demonstrations were executed in 200 bigha of land at farmer's field at Chattogram and Rangamati regions during 2024-2025 funded by GOB.

PARTNER Fund: A total of 640 demonstrations were executed in 1920 bigha of land at farmer's field at Chattogram and Rangamati regions during 2024-2025 funded by PARTNER project (BRRI Part).

LSTD Fund: A total of 195 demonstrations were executed in 585 bigha of land at farmer's field at Chattogram and Rangamati regions during 2024-2025 funded by LSTD project .

Hybrid Project Fund: A total of 40 demonstrations were executed in 40 bigha land at farmer's field during 2024-2025 funded by BRRI Hybrid project.

Farmers Training on Rice Technology 2024-25

A total of 25 farmer training sessions were conducted in the 2024-2025 financial year at the Chattogram and Rangamati regions.

GOB Fund: A total of 18 farmer trainings on rice technologies were conducted, training 540 farmers, comprising 450 males and 90 females.

PARTNER Fund: A total of 7 farmer trainings on rice technologies were conducted and trained up 210 farmers having 175 male and 35 female farmers.

Field day 2024-2025

A total of 28 field days were conducted in 2024-2025 financial year at Chattogram and Rangamati regions. Nearly 3000 progressive farmers, entrepreneurs, extension personnel (DAE and NGO personnel), local leaders, and public representatives were participated in those occasions.

GOB Fund: 19 field days were conducted in selected demonstration sites during 2024-2025 financial year under GOB fund.

PARTNER Fund: 3 field days were conducted in 2024-25 at Chattogram and Rangamati regions under PARTNER project.

LSTD Fund: 3 field days were conducted in 2024-25 at Chattogram and Rangamati regions under LSTD project.

Hybrid project Fund: 3 field days were conducted in 2024-25 at Chattogram and Rangamati regions under Hybrid rice project.

ENRICHMENT OF SEED STOCK

Breeder Seed Production

GOB Fund: A total of 50.0 ton (27.546 ton in Aman 2024 and 22.454 ton in Boro 2024-25) breeder seeds were produced under GOB fund during the reporting period. All the Breeder seeds of different varieties were sent to Genetic Resource and Seed Division, BRRI, Gazipur.

Truthfully Labeled Seed (TLS) Production

GOB Fund: A total of 28.92 ton (4.72 ton in Aman 2024 and 24.20 ton in Boro 2024-25) TLS of modern rice varieties were produced by BRRI Sonagazi during the reporting period.

F1 seed production of BRRI hybrid dhan8: BRRI Sonagazi produced 2300 kg F1 seed of BRRI hybrid dhan8 in Boro 2024-25 at BRRI Sonagazi farm and all the seeds were sent to Hybrid Rice Division, BRRI, Gazipur for proper storing.

Certified Seed Production

A total of 29.0 ton (7.0 ton in Aman 2024 and 22.0 ton in Boro 2024-25) certified seeds were produced under PARTNER project.

BRRI RS, Kushtia

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SUMMARY

A total of 63 experiments or programs were conducted from Aus 2024 to Boro 2024-25 under the program area of Varietal Development, Rice Farming Systems, Crop-Soil-Water Management and Socio-Economics & Policy. Under the Varietal Development Program Area, a total of 50 trials (RYT, AYT, ALART, G×E interaction) were conducted, of which six trials were during Aus season, twenty-three (23) were in T. Aman and twenty-one (21) were in Boro season. In addition, five trials of farming systems, two experiments of crop-soil-water management, five stability analysis experiment under the socio-economic and policy and one trial under technology transfer program were executed.

During Aus 2024, four trials were conducted, including RYT#DSR, RYT under favourable conditions, and DSR#AGGRi trial. In the RYT#DSR, none of the entries outperformed the check varieties. However, RYT under favourable conditions, the entry BR13162-4R-177 showed the highest yield (6.69 t/ha), which was statistically greater than the check varieties.

During T Aman 2024, a total of sixteen trials were conducted, including fourteen for RYT and two for AGGRi Network trials. Due to heavy rainfall, no entries performed statistically better over checks. However, under the AGGRi Network trial, the top performer was IR 147497-B-B-148-B (Entry 79), which gave the highest yield of 6.68 t/ha over the check.

During Boro 2024-25, a total of thirteen trials were conducted for RYT. In case of regional yield trial for Zinc Enriched Rice (ZER) the advanced line, BR11401-1-1-2-4-1 (8.30 t/ha) gave highest yield over all other advanced lines and check varieties. In RYT DRR-LD, three genotypes BR12904-4R-233 (7.13 t/ha), BR12904-4R-219 (6.97 t/ha) and BR13180-4R-97 (6.97 t/ha) gave statistically higher yield over checks and other tested genotypes where BR12904-4R-233 was the highest yielder.

During the reporting period a total of seventeen trials were conducted under Advanced

Line Adaptive Research Trial (ALART). There were two trials in Aus 2024. The advanced line BR (path)13784-BC3-5-3-4-HR15 (5.58 t/ha) from the ALART BB-2 was found as the highest yielded genotype over the check varieties and other genotypes. In Aman 2024, seven trials were executed. Three advanced lines and two check varieties were tested under the ALART SHY-Katari type where all the three advanced lines gave higher yield than the check varieties BRRI dhan57 (4.58 t/ha) and Katari (5.12 t/ha). Among these three advanced lines BRH13-9-5-2B (5.72 t/ha) gave statistically highest yield.

During Boro 2024-25, a total of eight ALART were conducted. Among them under the ALART FBR-MD, the advanced line BR12508-5R-5 (7.92 t/ha) gave statistically higher yield over all genotypes and check varieties BRRI dhan97 (6.50 t/ha) and BRRI dhan102 (7.37 t/ha).

A total of five programs were conducted under Rice Farming System. In case of “Maximize the resource use efficiency of agro-forestry system in Kushtia regions” Sweet gourd-Fallow- DS Aman (BRRI dhan71) gave the highest gross margin of 216.84 thousand taka with rice equivalent yield of 14.09 t/ha. The highest rice equivalent yield (35.68 t/ha) with gross margin of 754460 Tk/ha was recorded from cropping pattern Maize+ Potato-T. Aus-T. Aman cropping pattern in “Potato intercropping with maize in Maize- T. Aus- T. Aman cropping pattern in char area”. The highest rice equivalent yield (25.45 t/ha) was recorded from cropping pattern Onion- T. Aus-T. Aman cropping pattern with gross margin of 581810 Tk/ha in “Inclusion of Aus rice in Onion-Fallow-T. Aman cropping system”. Survey of Rice-based Cropping Patterns and Its Improvement in Kushtia District showed that Boro- Aus- T. Aman cropping pattern covered 6652 ha area with 28.62% of Net Cropped Area (NCA) in Kushtia Sadar upazila followed by Wheat- Jute- T. Aman cropping pattern (4310 ha area) in Daulatpur upazila.

Under Crop-Soil-Water Management program area, two trials were conducted. Between them one trial

named Effect of Missing Nutrient Elements on Growth and Grain Yield of Rice in BRRI Farm, Kushtia was conducted in both T. Aman 2024 and Boro 2024-25 season. In T. Aman 2024, control plot (without fertilization) reduced the highest yield level of (25%) followed by N omitted plot (19%) and in case of Boro 2024-25, similar feedback was found where control plot (without fertilization) reduced the highest yield level of (64%) followed by N omitted plot (63%).

In the experiment of stability analysis during T.Aman 2024 BRRI dhan87 (5.74 t/ha) yielded highest among the short duration varieties where BRRI dhan72 (6.10 t/ha) gave highest grain yield among medium duration varieties. Among the long duration Aman varieties BR10 (5.45 t/ha) was the best performer. In case of Boro 2024-25, among the long duration varieties BRRI dhan89 (8.16 t/ha) provided highest yield. For short duration varieties BRRI hybrid dhan8 (8.31 t/ha) was observed with the highest grain yield.

One multi-location trial was executed under technology transfer namely “Evaluation of yield performance of BRRI varieties with local/Indian cultivar at Border Zone at Aus 2024 and Boro 2024-25”. In Aus, 2024 season two varieties were tested from which farmers preferred BRRI dhan98 (5.48 t/ha) over khatobabu (5.04 t/ha) due to its higher yield, uniformity of growth and maturity and better grain quality whether in Boro 2024-25 among the four tested varieties khatobabu (8.85 t/ha) and Rod Minikit (9.60 t/ha) were preferable to farmers for better yield and price, shorter growth duration, low production costs, resistance to pests

and diseases, and ability to withstand stresses over BRRI dhan102 (7.98 t/ha).

In total 1160 demonstration (Aus, Aman and Boro) were conducted during 2024-2025 under GoB, LSTD project, PARTNER project and hybrid division to disseminate different latest variety. A total of 15 batches farmers training consisting of 450 farmers were conducted in five different districts during the reporting period. A total of 25 field days with more than 2500 farmers participants were organised. During the reporting period, BRRI RS, Kushtia produced 960, 1035 and 3694 kg TLS during Aus, Aman and Boro season, respectively. Total production of breeder seed was 360kg, 3400kg and 3350 kg during Aus, Aman and Boro season, respectively.

A. VARIETAL DEVELOPMENT

Regional/Advanced Yield Trial (RYTs/AYTs)/ AGGRi Network trial, Aus 2024

The aim is to select the best-performing advanced breeding lines with higher grain yield over the existing checks in on-station conditions or on-farm trials.

RYT#Favourable Aus, T Aus 2024

In this experiment, twenty advanced breeding lines and four standard checks, BRRI dhan48, BRRI dhan82, BRRI dhan83 and BRRI dhan98 were tested. Among the tested lines, the yield of BR13162-4R-177 was the highest (6.69 t/ha) (Table 1), which was statistically higher yield over the check.

Table 1. Performances of AYT#AUS genotypes, Favourable Aus, Aus 2024

Designations	Plant height (cm)	Growth duration (days)	Yield (t/ha)
BR13160-4R-196	137	120	3.5
BR13160-4R-37	120	111	5.6
BR13162-4R-177	100	113	6.69
BR13165-4R-95	98	105	5.97
BR13169-4R-202	105	112	5.81
BR13169-4R-83	113	113	5.65
BR13170-4R-60	127	117	5.83
BRRI dhan48	94	111	5.3

Designations	Plant height (cm)	Growth duration (days)	Yield (t/ha)
BRRi dhan82	95	103	4.67
BRRi dhan83	94	111	4.6
BRRi dhan98	107	110	5.88
LSD	6	2.78	0.76
Heritability	0.97	0.98	0.89
D/S: 04/05/24		D/T: 27/5/24	

Regional/Advanced Yield Trial (RYTs/AYTs)/AGGRi Network trial, Aman 2024

The aim is to select the best-performing advanced breeding lines with higher grain yield over the existing checks in on-station conditions or on-farm trials.

Due to heavy rainfall, no entries performed statistically better over the check varieties in Regional/Advanced Yield Trial (RYTs/AYTs).

Stage#1 genotypes, AGGRi Network trial, BRRi R/S Kushtia, T. Aman 2024

This trial consists of 120 advanced breeding lines developed at IRRI-HQ, along with 4 global (IRRI 154, IRRI 163, IRRI 176 and IR13LT799/IRRI 264) and 7 local check varieties (BRRi Hybrid dhan6, BRRi Hybrid dhan8, BRRi dhan49, BRRi dhan71, BRRi dhan87, BRRi dhan94 and BINA DHAN-17). The top performer was IR 147497-B-B-148-B (Entry 79), which gave the highest yield of 6.68 t/ha over the check (Table 2). The best-performing entry in Stage 1 at Shailkupa was IR 147496-B-B-50-B (Entry 21), which had the highest yield of 6.24 t/ha. It was closely followed by BRRi dhan103 (Entry 127), which yielded 6.21 t/ha (Table 3)

Table 2. Performances of Stage#1 genotypes, AGGRi Network trial, BRRi R/S Kushtia, T. Aman 2024

Entry No	Designation	Plant Height (cm)	Growth Duration (days)	Yield (t/ha)
79	IR 147497-B-B-148-B	104	119	6.68
129	IR 145504 H	93	107	6.60
86	IR 147503-B-B-196-B	113	118	6.50
71	IR 147501-B-B-16-B	114	116	6.25
66	IR 147498-B-B-76-B	113	120	5.90
135	BRRi Hybrid dhan 6	108	117	4.98
136	BRRi Hybrid dhan 8	106	111	5.82
137	BRRi dhan49	104	131	4.87
138	BRRi dhan 71	117	110	4.64
139	BRRi dhan 87	125	126	5.27
140	BRRi dhan 94	124	126	5.28
141	BINA DHAN-17	100	111	4.61
	Range	91-128	106-135	2.38-6.68
	Average	110.36	114.25	4.99
	Heritability	0.84	0.83	0.54

D/S: 7/16/24

D/T:8/6/24

Table 3. Performances of Stage#1 genotypes, AGGRi Network trial, Shailkupa, T. Aman 2024

Entry No	Designation	Plant Height (cm)	Growth Duration(days)	Yield(t/ha)
21	IR 147496-B-B-50-B	110	122	6.24
127	BRRi dhan103	128	129	6.21
15	IR 147501-B-B-31-B	106	113	6.07
11	IR 147498-B-B-92-B	97	115	5.89
43	IR 147496-B-B-148-B	103	113	5.88
8	IR 147498-B-B-70-B	121	119	5.59
135	BRRi Hybrid Dhan 6	107	111	5.54
136	BRRi Hybrid Dhan 8	101	109	5.93
137	BRRi dhan49	97	134	4.58
138	BRRi Dhan 71	114	117	5.80
139	BRRi Dhan 87	122	122	5.56
140	BRRi Dhan 94	102	122	4.96
141	BINA DHAN-17	115	112	4.44
	Range	91-131	102-137	3.05-6.24
	Mean	109	116	4.90
	Heritability	0.7	0.75	0.56
D/S:7/17/24			D/T:13/8/24	

**Regional/Advanced Yield Trial (RYTs/AYTs)/
AGGRi Network trial, Boro 2024-25**

**Regional Yield Trial (RYT), Development of
Zinc Enriched Rice (ZER), Boro, 2024-2025**

Three genotypes along with BRRi dhan28, BRRi dhan74, BRRi dhan89 and BRRi dhan100 as

standard checks were evaluated under this experiment to evaluate specific and general adaptability of the advance breeding lines as compared with standard checks in on-station condition. The advanced line, BR11401-1-1-2-4-1 (8.30 t/ha) gave highest yield over all other advanced lines and check varieties (Table 4).

Table 4. Performance of RYT (ZER) lines in RYT, Boro, 2024-2025

Designation	Growth Duration (days)	Plant Height (cm)	Panicle/m ²	Yield (t/ha)
BR11401-1-1-2-4-1	260	113	260	8.30
BR11401-8-3-1-1	212	106	212	7.73
BR12038-65-2-1	211	99.67	211	6.37
BRRi dhan28 (CK)	267	103.33	267	6.91
BRRi dhan74 (CK)	260	92.33	260	7.39
BRRi dhan89 (CK)	242	103	242	7.95
BRRi dhan100 (CK)	256	106.33	256	6.91
CV (%)	0.52	1.63	5.84	3.75
LSD (0.05)	0.64	1.37	11.67	0.23

D/S: 28-11-2024

D/T: 12-01-2025

Regional Yield Trial of Development of Disease Resistant Rice for BB and blast (RYT# DRR-LD), Boro 2024-25

Fifteen genotypes along with three standard checks BRRI dhan89, BRRI dhan92 and BRRI dhan101 were evaluated under this trial in RCBD with three replications to evaluate specific and general adaptability of the advance breeding lines as

compared with standard checks in on-station condition. Three genotypes BR12904-4R-233 (7.13 t/ha), BR12904-4R-219 (6.97 t/ha) and BR13180-4R-97 (6.97 t/ha) gave statistically higher yield over checks and other tested genotypes where BR12904-4R-233 was the highest yielder (Table5).

Table 5. Performance of (RYT#LD) genotypes, Development of Disease Resistant Rice for BB, Boro 2024-25

Designation	Growth Duration (Days)	Plant Height (cm)	Panicle/m ²	Yield (t/ha)
V3= BR12904-4R-219	149	96	299	6.97
V4= BR12904-4R-233	147	96	331	7.13
V11= BR13180-4R-97	152	94	266	6.97
V16= BRRI dhan89 (Std.CK)	148	100	275	6.15
V17= BRRI dhan92 (std.CK)	153	104	277	5.77
V18= BRRI dhan101 (ResCK)	148	106	261	6.05
CV (%)	0.38	1.67	7.75	5.53
LSD (0.05)	0.57	1.7	21.3	0.36

D/S: 11-12-2024

D/T: 21-01-2025

Advanced Lines Adaptive Research Trials (ALART), Aus 2024

ALART for Bacterial blight (BB-2) resistant advanced lines, Aus 2024

Three advanced lines along with two standard checks BRRI dhan82 and BRRI dhan98 were

evaluated under this trial to evaluate the yield potential and adaptability of the advanced lines at farmers' field in different agro-ecological zones. The advanced line BR(path)13784-BC3-5-3-4-HR15 (5.58 t/ha) was found as the highest yielded genotype over the check varieties and other genotypes (Table 6)

Table 6. Performance of some advanced genotypes (BB-2) in ALART, Aus 2024

Designation	Growth Duration (Days)	Plant Height (cm)	Panicle/m ²	Yield (t/ha)
V1= BR(path)13784-BC3-34-9-10-HR9	105	115	258	4.95
V2= BR(path)13784-BC3-5-3-4-HR15	106	117	289	5.58
V3= BR(path)13784-BC3-61-1-6-HR3	105	116	276	4.89
V4= BRRI dhan82 (ck)	101	122	281	4.92
V5= BRRI dhan98 (ck)	107	117	286	5.26
CV (%)	8.56	1.22	4.87	8.56
LSD (0.05)	0.36	1.17	11.05	0.36

D/S-16/05/2024

D/T-07/06/2024

Advanced Lines Adaptive Research Trials (ALART), Aman 2024

ALART for Superior High Yielding –Katari grain type rice (SHY-Katari type), Aman 2024

Three advanced lines along with one standard check BRRI dhan57 and one local check Katari were evaluated under this trial to evaluate the yield

potential and adaptability of the advanced lines at farmers' field in different agro-ecological zones. All the three advanced lines gave higher yield than the check variety BRRI dhan57 (4.58 t/ha) and Katari (5.12 t/ha). Among the three advanced lines BRH13-9-5-2B (5.72 t/ha) gave highest yield (Table 7)

Table 7. Performance of some advanced genotypes (SHY-Katari type) in ALART, Aman 2024

Designation	Growth Duration (Days)	Plant Height (cm)	Panicle/m ²	Yield (t/ha)
V1=BRH13-9-5-2B	112	111	282	5.72
V2= BRH9-3-2B	111	109	241	5.25
V3=IR12A177	115	119	280	5.17
V4= BRRI dhan57 (Ck)	111	110	296	4.58
V5= Katari (Ck)	121	124	288	5.12
CV (%)	0.56	1.11	5.26	4.48
LSD (0.05)	0.52	1.04	11.92	0.19

D/S-16/07/2024

D/T-10/08/2024

Advanced Lines Adaptive Research Trials (ALART), Boro 2024-25

ALART for Medium Duration Favorable Boro Rice (FBR-MD), Boro 2024-25

Three advanced lines along with two standard checks BRRI dhan97 and BRRI dhan102 were evaluated under this trial for on-farm evaluation of

advanced breeding lines compared to standard checks for testing their specific and general adaptability in different agro-ecological zones. All the three advanced lines gave higher yield than the both check varieties BRRI dhan97 and BRRI dhan102. Among the three advanced lines BR12508-5R-5(7.92 t/ha) gave the highest yield (table 8)

Table 8. Performance of some advanced genotypes (FBR-MD) in ALART, Boro 2024-25

Designation	Growth Duration (Days)	Plant Height (cm)	Panicle/m ²	Yield (t/ha)
V1=BR11894-5R-260	141	116	327	7.53
V2= BR12508-5R-5	143	110	286	7.92
V3=BR12517-5R-57	148	114	295	7.61
V4= BRRI dhan97 (Ck)	151	118	249	6.50
V5= BRRI dhan102 (Ck)	149	110	318	7.37
CV (%)	0.55	2.88	7.30	6.27
LSD (0.05)	0.66	2.68	17.58	0.38

D/S-26/12/2024

D/T-04/02/2025

RICE FARMING SYSTEMS

Maximize the resource use efficiency of agro-forestry system in Kushtia regions

Four cropping patterns, composed of vegetables, field crops and rice, along with one control plot were used as treatments of the experiment To increase the system productivity and existing

resources Among the four cropping pattern Sweet gourd-Fallow- DS Aman (BRRI dhan71) gave the highest gross margin of 216.84 thousand taka (Table 9) which was followed by Grass pea- Fallow – DS Aman (BRRI dhan71) cropping pattern (44.38 thousand taka). The lowest gross margin was observed from Field pea- Fallow- DS Aman (BRRI dhan71) cropping pattern (3.88 thousand taka).

Table 9. Productivity and economics of agro-forestry system in Kushtia, 2024-25

**Price: Rice-32.5 tk/kg, Sweet gourd-20 tk/kg, Field pea-70 tk/kg, Grass pea-35 tk/kg, Mustard-75 tk/kg

Cropping pattern (Inter-cropping with Mango)	Yields of crop (t/ha)			REY (t/ha)	TVC (‘000Tk/ha)	Gross Return (‘000Tk/ha)	Gross Margin (‘000Tk/ha)	BCR
	1st	2nd	3rd					
T ₁ = Sweet gourd- Fallow-DS Aman (BRRI dhan71)	16.67	-	3.80	14.06	266.25	483.09	216.84	0.81
T ₂ = Field Pea- Fallow- DS Aman (BRRI dhan71)	0.8	-	4.48	6.2	223.77	227.65	3.88	0.01
T ₃ = Grass Pea- Fallow- DS Aman (BRRI dhan71)	1.1	-	4.15	5.33	154.99	199.37	44.38	0.29
T ₄ = Mustard- Til- DS Aman (BRRI dhan71)	0.7	Fail	4.32	5.93	188.45	218.87	30.42	0.16
T ₅ = Sole (no crop with mango tree)	-	-	-	-	-	-	-	-

Potato intercropping with maize in Maize- T. Aus- T. Aman cropping pattern in char area

Improved cropping pattern Maize+ Potato- T. Aus- T.Aman cropping pattern and Existing cropping pattern Maize- T. Aus- T. Aman were evaluated at kantinagar char area in Kushtia district to increase

system productivity and profitability of existing cropping pattern and maximize the land use efficiency. The heighest rice equivalent yield (35.68 t/ha) was recorded from cropping pattern Maize+ Potato-T. Aus-T. Aman cropping pattern with gross margin 754460 Tk/ha. (Table 10)

Table 10. Productivity and economics of Potato intercropping with maize in Maize- T. Aus- T. Aman cropping pattern in char area, 2024-25

Cropping Pattern	Grain Yield (t/ha)			REY (t/ha)	TVC (‘000Tk/ha)	Gross Return (‘000Tk/ha)	Gross Margin (‘000Tk/ha)	MBCR
	Rabi	T. Aus	T. Aman					
Existing Pattern Maize- T. Aus (BRRI dhan48)- T. Aman (BRRI dhan49)	12.07	5.05	5.86	18.67	342.53	705.74	363.21	-
Proposed Pattern Maize + Potato- T. Aus (BRRI dhan98)- T. Aman (BRRI dhan87)	10.54+32.8	5.56	5.77	35.68	546.63	1301.09	754.46	2.92

**Price: Rice-35 tk/kg, Maize- 22.5 tk/kg, Potato-18.75 tk/kg

Inclusion of short duration Rabi crops (Mustard) in Boro- Fallow-T. Aman cropping system

Improved cropping pattern Mustard (BARI sarisha-14)- Boro (BRRI dhan102)-T. Aman (BRRI dhan75) cropping pattern and Existing cropping pattern Boro- Fallow- T. Aman were evaluated to evaluate the performance of short duration Rabi

crops (Mustard) in Boro-Fallow-T. Aman cropping system and increase the productivity of the existing cropping system. The highest rice equivalent yield (15.79 t/ha) was recorded from cropping pattern Mustard (BARI sarisha-14)- Boro (BRRI dhan102)- T. Aman (BRRI dhan75) cropping pattern with gross margin of this 3,22,410 Tk/ha (Table 11)

Table 11. Productivity and Economics of Mustard Inclusion in Boro-Fallow-T. Aman Cropping Pattern, 2024-25

Cropping Pattern	Grain Yield (t/ha)			REY (t/ha)	TVC (‘000Tk/ha)	Gross Return (‘000Tk/ha)	Gross Margin (‘000Tk/ha)	MBCR
	Rabi	Boro	T. Aman					
Existing Pattern Boro(BRRI dhan63)-Fallow- T. Aman (BRRI dhan49)	-	6.5	5.27	11.77	258.91	545.96	287.05	-
Proposed Pattern Mustard (BARI sarisha-14)- Boro (BRRI dhan102)-T. Aman (BRRI dhan75)	1.53	7.34	5.17	15.79	334.82	657.23	322.41	1.47

**Price: Rice-35 tk/kg, Mustard- 75tk/kg

Inclusion of Aus rice in Onion-Fallow-T.Aman cropping system

Improved cropping pattern Onion- T. Aus-T. Aman cropping pattern and Existing cropping pattern Onion- Fallow- T. Aman were evaluated to evaluate the performance of Aus rice in Onion-T.

Aus- T. Amancropping system to increase the productivity of the existing cropping pattern. The highest rice equivalent yield (25.45 t/ha) was recorded from cropping pattern Onion- T. Aus-T. Aman cropping pattern with gross margin of 581810 Tk/ha. (Table 12)

Table 12. Productivity and economics of Onion- T. Aus- T. aman cropping pattern, 2024-25

Cropping Pattern	Grain Yield (t/ha)			REY (t/ha)	TVC (‘000Tk/ha)	Gross Return (‘000Tk/ha)	Gross Margin (‘000Tk/ha)	MBCR
	Onion	T. Aus	T. Aman					
Existing Pattern Onion-Fallow- T. Aman (BRRI dhan75)	14.57	-	4.86	19.43	248.69	732.34	483.65	-
Proposed Pattern Onion- T. Aus (BRRI dhan98)-T. Aman (BRRI hybrid dhan6)	14.95	5.6	4.90	25.45	361.23	943.04	581.81	1.84

**Price: Rice-35 tk/kg, Onion- 37.5tk/kg

Survey of Rice-based Cropping Patterns and Its Improvement in Kushtia District

Information about rice-based cropping pattern were collected from Kushtia Sadar, Khoksa, kumarkhali, Mirpur and Daulotpur upazilas of kushtia districts to assume the existing cropping pattern scenario in

Kushtia district. Boro- Aus- T. Aman cropping pattern covered 6652 ha area with 28.62% of Net Cropped Area (NCA) in Kushtia Sadar upazila in 2023-24 but ten years ago Boro-Fallow-T. Aman cropping pattern was the highest. During 2023-24 Onion-Jute-T. Aman cropping patterns had the highest area coverage in Khoksa upazila while ten

years ago Wheat-Jute-T. Aman cropping pattern was the highest. Boro- Jute- T. Aman cropping pattern covered 2315 ha area with 9.53% of Net Cropped Area (NCA) in Kumarkhali upazila in 2023-24 but ten years ago Boro-Fallow-T. Aman cropping pattern was the highest. In case of Bheramara during the both reporting period Wheat-Jute-T. Aman cropping patterns had the highest area coverage. During 2023-24 Wheat-Jute-T.

Aman cropping patterns had the highest area coverage in Daulotpur upazila while ten years ago Tobacco-Jute-T. Aman cropping pattern was the highest. Boro- Fallow- T. Aman cropping pattern covered 3952 ha area with 17.10% of Net Cropped Area (NCA) in Mirpur upazila in 2023-24 but ten years ago Tobacco-Jute-T. Aman cropping pattern was the highest.

Table 13. Comparision of cropping patterns area coverage of Kushtia Sadar Upazila between 2023-24 and 2014-15

2014-15			2023-24		
Cropping Pattern	Area (ha)	% of NCA	Cropping Pattern	Area (ha)	% of NCA
Boro-Fallow-T. Aman	8100	35.08	Boro- Aus- T. Aman	6652	28.62
Boro-Aus-T. Aman	3300	14.29	Boro- Fallow- T. Aman	6203	26.69
Maize-Fallow-T. Aman	1300	5.63	Wheat- Jute- T. Aman	1127	4.85

Table 14. Comparision of cropping patterns area coverage of Khoksa Upazila between 2023-24 and 2014-15

2014-15			2023-24		
Cropping Pattern	Area (ha)	% of NCA	Cropping Pattern	Area (ha)	% of NCA
Wheat-Jute-T. Aman	1300	16.84	Onion- Jute- T. Aman	2000	22.75
Boro-Fallow-T. Aman	1200	15.54	Onion- Aus- T. Aman	1000	11.37
Onion-Jute-T. Aman	800	10.36	Boro- Jute- T. Aman	604	6.87

Table 15. Comparision of cropping patterns area coverage of Kumarkhali Upazila between 2023-24 and 2014-15

2014-15			2023-24		
Cropping Pattern	Area (ha)	% of NCA	Cropping Pattern	Area (ha)	% of NCA
Boro-Fallow-T. Aman	3300	19.30	Boro-Jute- T. Aman	2315	9.53
Onion-Fallow-T. Aman	1500	8.77	Onion- Jute- T. Aman	2190	9.02
Wheat-Sesame-T. Aman	1100	6.43	Wheat-Jute-T. Aman	2001	8.24

Table 16. Comparision of cropping patterns area coverage of Bheramara Upazila between 2023-24 and 2014-15

2014-15			2023-24		
Cropping Pattern	Area (ha)	% of NCA	Cropping Pattern	Area (ha)	% of NCA
Wheat-Jute-T. Aman	1200	13.26	Wheat- Jute- T. Aman	1125	10.31
Lentil-Jute-T. Aman	600	6.63	Tobacco- Jute- T. Aman	765	7.01
Boro-Aus-Fallow	500	5.52	Lentil- Jute- T. Aman	579	5.31

Table 17. Comparison of cropping patterns area coverage of Daulotpur upazila between 2023-24 and 2014-15

2014-15			2023-24		
Cropping Pattern	Area (ha)	% of NCA	Cropping Pattern	Area (ha)	% of NCA
Tobacco-Jute-T. Aman	4000	11.69	Wheat- Jute- T. Aman	4310	12.05
Tobacco-Jute-Fallow	2400	7.01	Lentil- Aus- Vegetable	2220	6.21
Lentil-Aus-Fallow	2000	5.84	Boro- Aus- T. Aman	2166	6.06

Table 18. Comparison of cropping patterns area coverage of Mirpur upazila between 2023-24 and 2014-15

2014-15			2023-24		
Cropping Pattern	Area (ha)	% of NCA	Cropping Pattern	Area (ha)	% of NCA
Tobacco-Jute-T. Aman	4460	18.91	Boro- Fallow- T. Aman	3952	17.10
Boro-Fallow-T. Aman	3500	14.84	Tobacco- Chilli- T. Aman	3335	14.43
Boro-Aus-T. Aman	2600	11.02	Tobacco- Jute- T. Aman	2660	11.51

CROP-SOIL-WATER MANAGEMENT

Effect of Missing Nutrient Elements on Growth and Grain Yield of Rice in BRRI Farm, Kushtia

The experiment of missing nutrient element trial was conducted at BRRI RS farm, Kushtia to assess long-term yield trend of rice under different nutrient managements using BRRI dhan87 and BRRI dhan100 during T. Aman, 2024 and Boro, 2024- 25 respectively. This trial was carried out using seven treatments T₁=NPKSZn, T₂=PKSZn (-N), T₃= NKSZn (-P), T₄= NPSZn (-K), T₅= NPKZn (-S), T₆= NPKS (-Zn), T₇= No Fertilizer in RCB

design with three replications. NPKSZn was applied at the rate of 95-14-50-12-1 kg ha⁻¹ in T. Aman and 145-10-60-15-2 kg ha⁻¹ in Boro season. In T. Aman 2024, control plot (without fertilization) reduced the highest yield level of (25%) followed by N omitted plot (19%). In Boro season, control plot (without fertilization) reduced the highest yield level of (64%) followed by N omitted plot (63%). However, insignificant variation in rice yield was observed between the missing of N solely and control treatment (Table 19).

Table 19. Effects of missing nutrient elements on the panicle, straw yield and grain yield of BRRI dhan87 and BRRI dhan100 at T. Aman, 2024 and Boro 2024-25 respectively.

Treatments	T. Aman 2024				Boro 2024-25			
	Panicle /m2	Straw Yield	Grain Yield	Yield reduction (%) due to missing element	Panicle/ m2	Straw Yield	Grain Yield	Yield reduction (%) due to missing element
T1	235	5.91	5.16	-	285	4.18	6.20	-
T2	195	4.22	4.18	19	150	2.37	2.32	63
T3	222	5.03	4.47	13	272	4.36	6.10	2
T4	243	4.98	4.55	12	282	4.12	6.17	0.5
T5	222	4.68	4.99	3	278	3.98	6.02	3
T6	225	5.27	5.05	2	270	3.84	5.99	3
T7	183	3.86	3.85	25	155	2.21	2.26	64
CV	9.69	6.67	6.96		9.72	7.38	6.94	
LSD (0.05)	17.24	0.27	0.26		19.18	0.22	0.28	

SOCIO-ECONOMICS AND POLICY

Stability analysis of BRRI varieties

In T. Aman 2024, 48 varieties and in Boro 2024-25, 54 varieties were used in this trial to maintain season, year and location wise database on the yield performance of BRRI varieties. In T. Aman 2024 trial, among short duration varieties the highest yielder was BRRI dhan87 (5.74 t/ha) and the lowest was BRRI dhan33 (2.62 t/ha); among medium

duration varieties the highest yielder was BRRI dhan72 (6.10 t/ha) and the lowest was BR3 (2.85 t/ha); among long duration varieties the highest yielder was BR10 (5.45 t/ha) and the lowest was BR5 (2.52 t/ha). In Boro, 2024-25 trial, among long duration varieties the highest yielder was BRRI dhan89 (8.16 t/ha) and the lowest was BR17 (5.16 t/ha) and among short duration varieties the highest yielder was BRRI hybrid dhan8 (8.31 t/ha) and the lowest was BRRI dhan27 (4.82 t/ha).

Table 20. Short duration Stability Analysis of BRRI varieties, T. Aman 2024

Variety	GD (days)	Yield (t/ha)	Ranks
BRRI dhan33	119	2.62	15
BRRI dhan39	118	4.80	4
BRRI dhan73	117	4.94	3
BRRI dhan87	124	5.74	1
BRRI Hybrid dhan6	121	5.18	2
LSD _{0.05}	0.66	0.3	
CV (%)	0.69	8.75	

D/S-11/07/2024

D/T-06/08/2024

Table 21. Stability Analysis of BRRI varieties (MD), T. Aman 2024

Variety	G D (days)	Yield (t/ha)	Ranks
BR3	141	2.85	22
BRRI dhan72	130	6.10	1
BRRI dhan93	133	5.19	3
BRRI dhan94	135	5.45	2
BRRI dhan103	128	5.16	4
LSD _{0.05}	0.67	1.62	
CV (%)	0.61	7.94	

D/S-11/07/2024

D/T-06/08/2024

Table 22. Long duration Stability Analysis of BRRI varieties, T. Aman 2024

Variety	G D (days)	Yield (t/ha)	Ranks
BR5	147	2.52	11
BR10	142	5.45	1
BR22	148	4.11	4
BR23	151	4.50	2
BRRI dhan76	153	4.38	3
LSD _{0.05}	0.6	0.25	
CV (%)	0.5	8.11	

D/S-11/07/2024

D/T-06/08/2024

Table 23. Long duration Stability Analysis of BRRI varieties, Boro 2024-2025

Variety	GD (days)	Yield (t/ha)	Ranks
BR17	143	5.16	27
BRRI dhan29	153	7.25	3
BRRI dhan89	154	8.16	1
BRRI dhan92	154	7.23	4
BRRI dhan102	152	7.51	2
LSD _{0.05}	0.66	0.45	
CV (%)	0.49	7.67	

D/S-17/12/2024

D/T-26/01/2025

Table 24. Short duration Stability Analysis of BRRI varieties, Boro 2024-2025

Variety	GD (days)	Yield (t/ha)	Ranks
BRRI dhan27	144	4.82	27
BRRI dhan74	139	6.96	4
BRRI hybrid dhan2	142	7.07	2
BRRI hybrid dhan5	145	7.03	3
BRRI hybrid dhan8	143	8.31	1
LSD _{0.05}	0.58	0.39	
CV (%)	0.51	7.72	

D/S-17/12/2024

D/T-26/01/2025

TECHNOLOGY TRANSFER

Evaluation of yield performance of BRRI varieties with local/Indian cultivar at Border Zone

This trial was implemented in four upazilas of Chuadanga district where BRRI released varieties and farmer-grown varieties were planted together in adjacent plots to find out the best performing varieties that are more adaptive to specific environment of border zone and causes of farmers preference. Farmers feedback about these varieties was collected. In Aus, 2024 season two varieties were tested from which farmers preferred BRRI dhan98 (5.48 t/ha) over khatobabu (5.04 t/ha) due

to its higher yield, uniformity of growth and maturity and better grain quality. In Boro 2024-25, four varieties were tested while BRRI hybrid dhan8 (10.25 t/ha) was the highest yielder. Among the rest of the varieties Rod Minikit (9.60 t/ha) provided highest yield followed by Khatobabu (8.85 t/ha) with shortest growth duration and BRRI dhan102 (7.98 t/ha) found with longest growing period (Table 25). Farmers preferred exotic varieties khatobabu and Rod Minikit for better yield and price, shorter growth duration, low production costs, resistance to pests and diseases, and ability to withstand stresses.

Table 25. Yield performance of BRRI varieties and local/Indian cultivar at border zone at T. Aus, 2024 & Boro 2024-25 respectively

Aus/2024					Boro/2024-25								
Location	Variety				Location	Variety							
	Yield (t/ha)		GD (days)			Yield(t/ha)				GD (days)			
	BRRI dhan 98	Khatobabu	BRRI dhan98	Khatobabu		BRRI dhan102	Khatobabu	Rod Mimikit	BRRI hybrid dhan8	BRRI dhan102	Khatobabu	Rod Mimikit	BRRI hybrid dhan8
Damosh, Alamdanga	5.71	4.90	112	108	Boro Boalia, Alamdanga	7.94	8.67	-	11.0	152	139	-	149
Boro Gangni, Alamdanga	5.21	4.45	115	111	Boro Gangni, Alamdanga	8.00	8.29	9.27	10.4	153	140	149	146
Monohor-pur Jibonnogor	5.48	4.82	113	110	Rajapur, Jibonnogor	8.07	9.75	9.04	10.8	149	139	148	145
Joyrampur, Damurhuda	5.53	5.97	116	112	Joyrampur, Damur-huda	7.48	9.4	10.8	9.68	151	138	149	147
	-	-	-	-	Dinnathpur Chuadanga Sadar	8.4	8.14	9.3	9.4	148	136	145	144
Average	5.48	5.04	114	110		7.98	8.85	9.60	10.3	151	138	148	146

Varietal Demonstration

BRRI, Regional Station, Kushtia also worked for expansion of newly released BRRI high yielding and hybrid varieties in Aus, Aman and Boro season. In the last reporting year, 2024-25 in total 1160 demonstration (Aus, Aman and Boro) were conducted under GoB, LSTD project, PARTNER project and hybrid division to disseminate different latest variety.

Farmers' Training and Field Day

In the reporting year, a total of 15 batches of farmers' training were organized in which 450 farmers. Modern rice varieties and relevant technologies were disseminated through field demonstration and 23 field days in which more than 2300 farmers participated.

ENRICHMENT OF SEED STOCK

Production of Truthfully Labeled Seed (TLS)

Truthfully labeled seed (TLS) production activities were conducted at BRRI, Kushtia research field during Aus, Aman and Boro season 2024-25. Total production of TLS during Aus, Aman and Boro were 960, 1035 and 3694 kg, respectively.

Production of Breeder Seed

Nucleus seeds were supplied from Genetic Resources and Seed (GRS) division for breeder seed production during Aus, Aman and Boro Season. Total production of breeder seed during Aus, Aman and Boro season was 360kg, 3400kg and 3350 kg, respectively.

BRRI RS, Sirajganj

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SUMMARY

A total of 38 experiments were conducted during T Aman 2024 and Boro 2024-25 under different program areas eg. Varietal development program, Crop-soil water management, Disease Management programme areas. Among the experiments, 1 OYT, 16 RYT and 19 ALART were conducted under varietal development program areas. in T Aman 2024 and and Boro 2024-25 seasons.

A total of 196 advanced breeding lines including 4 checks were evaluated in BRRI farm Sirajganj during Boro 2024-25 to estimate genomic estimated breeding value for genomic prediction and high value lines for recycling in crosses and promote for product development in OYT_FBC. Average yield of the tested lines was recorded ranging from 4.00 to 10.39 t/ha.

None of the genotypes under RLR RYT#1 gave significantly higher yield compared with check varieties. Among the 15 test genotypes under RYT#2 BR11752-5R-22, BR11752-5R-105, BR12303-5R-341, BR11731-5R-183, BR11748-5R-16, BR11747-5R-67 gave the higher yield than check varieties BRRI dhan71 and BRRI dhan75 but lower than BRRI dhan87. Among 7 under RYT#3 IR17A2932 gave the highest yield (6.23 t/ha) which was followed by IR132084-B-1191-1-2-B-9 (6.07 t/ha). In RYT#4 the highest grain yield (6.31 t/ha) was recorded from genotype IR19A7560 which was comparable with check BRRI dhan87. Statistically similar grain yields ranging 4.25-5.53 t/ha were obtained from all the tested genotypes of PQR (Rangpur). Seven genotypes under RYT of were evaluated along with BRRI dhan71 and BRRI dhan75 as standard check. Among the test genotypes of antioxidant enriched rice, the test entries BR12839-4R-76 gave comparatively higher yield (4.97 t/ha) but not significantly different from the check varieties. All the genotypes under fine grain type rice gave statistically similar yield ranging from 4.23 to 5.47 t/ha with the growth duration of 123-126 days. Under short duration high yielding rice test genotype BR11871-5R-127 produced significantly lowest yield (3.85 t/ha) compared with check variety BRRI dhan49 (5.25

t/ha), BRRI dhan75 (5.02 t/ha) and BRRI dhan87 (5.54 t/ha). Test genotype under ZER, BR11401-8-3-1-1 gave the highest grain yield (6.74 t/ha) with 140 days growth duration which was followed by BR11401-1-2-4-1 (5.58 t/ha) and BR12038-65-2-1 (5.12 t/ha) with 148 and 140 days of growth duration, respectively.

Under RYT FBR Barishal in Boro 2024-25 BRBaNGR 350-2 gave the highest yield (6.39 t/ha) which was followed by the check variety BRRI dhan102 (6.14 t/ha), BRBaNGR 994-1 (5.23 t/ha), and BRBaNGR 324-1 (5.21 t/ha). Among the test entries of 14 under BB and Blast RYT#1, genotype BR13180-4R-115 gave the highest yield (6.93 t/ha). But none of the tested entry gave significantly higher yield over check varieties. All the test genotypes of RYT Basmati rice (Rangpur) gave higher yield (6.80 -7.94 t/ha) but statistically similar with check variety BRRI dhan104 (6.66 t/ha).

In ALART DTR1 (T Aman 2024) check variety BRRI dhan71 gave higher yield (5.88 t/ha) than the test entry BR12023-6R-111 (4.89 t/ha) with the growth duration of 118 and 116 days, respectively. In DTR2, similar yields from the genotypes have been recorded. In T Aman 2024, none of the entries under ALART False smut gave higher yield compared with check variety BRRI dhan49. Entry BR (path)13804-BC3-13 produced 5.38 t/ha grain yield which is comparable with BRRI dhan49 (5.63 t/ha) (Table 23). In Photosensitive ALART check variety BR22 gave the highest yield 5.03 t/ha which is insignificant with genotype BR10212-5-5-3 and BR10212-17-3-2-2 where grain yield was recorded 4.35 and 4.03 t/ha, respectively. In Antioxidant, ALART Aman 2024, all the entries gave statistically similar yield which is ranging from 3.09 to 3.25 t/ha with the growth duration of 134-152 days. In T Aman 2024 ALART, all the test genotypes of SHR1 Katari type gave statistically higher yields (5.08- 5.36 t/ha) which are significantly different from check variety BRRI dhan57 (3.90 t/ha). In SHR 1 Zira type, genotype BRH11-7-17-10B (5.74 t/ha) and BRH17-23-8-2-7B (5.28 t/ha) gave significantly higher yield than check Zirashail (2.18 t/ha).

In Boro 2024-25, none of the test genotypes of ALART BRR_LD gave significantly higher yield than check variety. In BRR_MD genotype BR (path)15860-BC2-3HR-48 gave higher yield (7.83 t/ha) but statistically similar with BR (path)15855-BC3-2HR-5 (7.52 t/ha) and check 8.34 (t/ha). None of the tested entries of BRR_SD gave significantly higher yield compared with the check variety (6.99 t/ha). In STR_MD check variety BRRI dhan102 gave higher yield (7.36 t/ha) which is followed by genotype BR13113-4R-185 (7.18 t/ha) and BR13122-4R-136 (7.09) with the similar growth duration (150 days). In STR_SD genotype BR13113-4R-116 gave the highest yield than the check entries BRRI dhan28 (7.84 t/ha) and BRRI dhan88 (7.09 t/ha) with similar growth duration (144 days). The genotype BR12839-4R-5-2 under AOER_MD gave the highest yield (7.61t/ha) which was followed by BR12839-4R-157-2 (7.41t/ha) with the similar growth duration and in AOER_SD the test genotype BR12839-4R-137 gave significantly the lowest yield (5.43 t/ha) than the standard check (8.23 t/ha). In BB+Blast_SD the test genotype BR(Path)13802-BC3-62-14 gave higher yield (8.19 t/ha) than the standard check BRRI dhan88 (7.08 t/ha) with same growth duration. None of the test genotypes under FBR_MD Boro 2024-25 gave statistically higher yield than checks. In FBR_SD Boro 2024-25 test genotype BR12574-5R-52 did not give highest yield (6.48 t/ha) than the standard check (8.99 t/ha). In PQR Boro 2024-25 the test genotype BR11359-4R-279 gave the highest yield (8.05 t/ha) which is followed by BRRI dhan107 (7.79 t/ha) and BRRI dhan104 (7.15 t/ha). In PQR (path) the test genotype BRRI (Path) Premium1 gave the highest yield (7.47 t/ha) which is followed by BRRI dhan107 (7.79 t/ha) and BRRI dhan104 (7.15 t/ha). But there is no significant difference among the genotypes in terms of yield. The highest yield (8.57 t/ha) was recorded in the plot where standard doses of fertilizer was applied and no significant difference was found in yield from P, K, S and Zn omitted plots. Among the major nutrient elements, the omission of N appeared as the most yield-limiting nutrient element. Among the major disease, brown spot was dominating disease affecting most of the varieties

in surveyed areas. A total of 21600 kg certified and 1150 kg TLS were produced during 2024-25.

VARIETAL DEVELOPMENT PROGRAMME

OYT-FBC Boro 2024-25

A total of 196 advanced breeding lines including 4 checks were evaluated in the BRRI farm Sirajganj during Boro 2024-25 to estimate genomic estimated breeding value for genomic prediction and high value lines for recycling in crosses and promote for product development. Row-Column with p-rep design was followed at 20cm×20cm spacing. Average yield was recorded ranging from 4.00-10.39 t/ha.

1. Regional Yield Trial (RYT) during T.Aman 2024 and Boro 2024-25

1.1. Development of Rainfed Low land rice (RYT#1), T Aman 2024

Ten (10) genotypes were evaluated including three standard checks BRRI dhan71, BRRI dhan75 and BRRI dhan87 at BRRI farm Sirajganj. Standard agronomic practices were done during crop production. None of the genotypes gave significantly higher yield compared with check varieties. Among the test genotypes BR12631-5R-146 gave the lowest yield compared with other genotypes.

1.2. Development of Rainfed Low land rice (RYT#2), T Aman 2024

Fifteen (15) genotypes including three check varieties BRRI dhan71, BRRI dhan75 and BRRI dhan87 were tested at BRRI farm Sirajganj. Yield obtained from all genotypes ranged 3.96-6.53t/ha. Among the test genotypes BR11752-5R-22, BR11752-5R-105, BR12303-5R-341, BR11731-5R-183, BR11748-5R-16, BR11747-5R-67 gave the higher yield than check varieties BRRI dhan71 and BRRI dhan75 but lower than BRRI dhan87.

1.3. Development of Rainfed Low land rice (RYT#3), T Aman 2024

Seven (7) entries were tested including with three check varieties BRRI dhan71, BRRI dhan75 and BRRI dhan87 at BRRI farm Sirajganj. Among the test genotypes IR17A2932 gave the highest yield (6.23 t/ha) which was followed by IR 132084-B-1191-1-2-B-9 (6.07 t/ha), and the lowest yield (2.91 t/ha) was obtained by IR132084-B-26-1-5-B-2.

1.4. Development of Rainfed Low land rice (RYT#4), T Aman 2024

Fifteen breeding lines including three check varieties BRRI dhan49, BRRI dhan75 and BRRI dhan75 were grown at BRRI farm Sirajganj. Normal agronomic practices were done whenever necessary. Yield obtained from all the genotypes ranging from 3.96-6.31 t/ha. The highest grain yield (6.31 t/ha) was recorded from genotype IR19A7560 which was comparable with check BRRI dhan87. Rest of the the genotypes gave statistically similar yield except genotype IR19A8062 (3.96 t/ha).

1.5. Development of Premium Quality Rice (Rangpur), T Aman 2024

Four (4) genotypes BRrang55-RGA-40-1-1-1, BRrang55-RGA-14-2-1-2, BRrang35-5-5-1-1-1, BRrang35-7-2-2-2-1 along with two check varieties BRRI dhan70 and BRRI dhan75 were tested. Statistically similar grain yields ranging 4.25-5.53 t/ha were obtained from all the test genotypes including check varieties.

1.6. Development of Antioxidant Enriched Rice, T Aman 2024

Seven (7) genotypes were evaluated along with BRRI dhan71 and BRRI dhan75 as standard check at BRRI farm Sirajganj following appropriate methodologies. Among the test entries BR12839-4R-76 gave comparatively higher yield (4.97 t/ha) but not significantly different from the check varieties BRRI dhan 87 (5.40 t/ha) and BRRI dhan 49 (4.39 t/ha).

1.7. Development of fine grain type rice, T Aman 2024

Four (4) genotypes along with standard check variety BRRI dhan87 were evaluated at BRRI farm Sirajganj. All the genotypes gave statistically similar yield ranging from 4.23 to 5.47 t/ha with the

growth duration of 123-126 days. The check variety BRRI dhan87 gave the highest yield (5.63 t/ha) with 134 days of growth duration which was followed by IR12A177 (5.47 t/ha) 9 days shorter than BRRI dhan87.

1.8. Development of Bacterial blight resistant rice, T Aman 2024

Three (3) genotypes were evaluated along with three check varieties BRRI dhan49 and BRRI dhan75 and BRRI dhan87 at BRRI farm Sirajganj. Among the test entries genotype BR11871-5R-127 produced significantly lowest yield (3.85 t/ha) compared with check variety BRRI dhan49 (5.25 t/ha), BRRI dhan75 (5.02 t/ha) and BRRI dhan87 (5.54 t/ha).

1.9. Development of short duration high yielding rice, T Aman 2024

Three (3) genotypes along with check varieties BRRI dhan71 and BRRI dhan75 were grown at BRRI farm Sirajganj. Among the test entries genotype BR(BIO)15086-AC119-16 produced the highest yield (6.01 t/ha) which was statistically similar with the yield of other entries.

1.10. Development of Zinc Enriched Rice, T Aman 2024

Seven (7) genotypes including four standard checks namely BRRI dhan28, BRRI dhan74, BRRI dhan89 and BRRI dhan100 were tested at BRRI farm Sirajganj. Among the entries, genotype BR11401-8-3-1-1 gave the highest grain yield (6.74 t/ha) with 140 days growth duration which was followed by BR11401-1-2-4-1 (5.58 t/ha) and BR12038-65-2-1 (5.12 t/ha) with 148 and 140 days of growth duration, respectively. But there was no statistical difference in grain yield among the genotypes including standard checks except BRRI dhan89.

1.11. Development of Favorable Boro rice (Barishal), Boro 2024-25

Five (5) genotypes were evaluated along with two standard checks BRRI dhan102 and BRRI dhan74 at BRRI farm Sirajganj. Among the genotypes BRBaNGR 350-2 gave the highest yield (6.39 t/ha) which was followed by the check variety BRRI

dhan102 (6.14 t/ha), BRBaNGR 994-1 (5.23 t/ha), and BRBaNGR 324-1 (5.21t/ha). Genotype BRBaNGR 736-1 gave the lowest yield 4.67 (t/ha).

1.12 Development of Disease Resistant Rice for BB and Blast (RYT#1) Boro 2024-25

Fouteen (14) genotypes including two checks BRRI dhan101 and BRRI dhan88 was evaluated. Among the test entry genotype BR13180-4R-115 gave the highest yield (6.93 t/ha). None of the tested entry gave significantly higher yield over check varieties.

1.13. Development of Basmati Rice (Rangpur), Boro 2024-25

Four (4) breeding lines Brang55-RGA-40-1-1-1, Brang55-RGA-14-2-1-2, Brang55-RGA-14-2-1-5 and Brang55-RGA-44-5-1-1 along with check

variety BRRI dhan104 were grown in BRRI farm Sirajganj following standard agronomic practices. All the test genotypes gave higher yield (6.80 -7.94 t/ha) but statistically similar with check variety BRRI dhan104 (6.66 t/ha).

2. Advanced line adaptive research trial (ALART)

2.1 Drought tolerant rice (DTR 1), T. Aman2024

One genotype BR12023-6R-111 with a check variety BRRI dhan71 was evaluated in the farmer's field of sadar in Bogura. The experiment was laid out in a RCB design with three replications. Check variety BRRI dhan71 gave higher yield (5.88 t/ha) than the test entry (4.89 t/ha) with the growth duration of 118 and 116 days, respectively (Table 1).

Table 1: Performance of Drought tolerant rice (DTR 1), T. Aman 2024 at sadar, Bogura during T. Aman2024

Designation	GD (Days)	Plant height (cm)	Panicle/m ²	Yield (t/ha)
BR12023-6R-111	116	120.06	228	4.89
BRRI dhan71 (CK)	118	127.67	247.66	5.88
LSD(0.05)		6.45	172.82	1.14
CV(%)		1.48	20.68	6.05

2.2. Drought tolerant rice (DTR 2), T. Aman 2024

The experiment was conducted at the farmer's field of Sadar upazila in Bogura. One genotype with one

check variety BRRI dhan71 was evaluated. Both entries showed similar performance in terms grain yield (Table 2).

Table 2 Performance of Drought tolerant rice (DTR 2), T. Aman 2024 at sadar, Bogura during T. Aman2024

Designation	GD (Days)	Plant height (cm)	Panicle/m ²	Yield (t/ha)
BR12023-6R-111	119	119.86	268.33	5.18
BRRI dhan71 (CK)	120	128.26	299	5.32
LSD(0.05)		12.91	37.28	1.74
CV(%)		2.96	3.74	9.56

2.3. False smut, T. Aman 2024

The experiment was conducted at the farmer's field of Kamarkhanda upazilla in Sirajganj. Three genotypes including one check BRRI dhan49 was evaluated. The experiment was laid out in a RCB

design with three replications. None of the entries gave higher yield compared with check variety BRRI dhan49. Entry BR(path)13804-BC3-13 produced 5.38 t/ha grain yield which is comparable with BRRI dhan49 (5.63 t/ha) (Table 3).

Table 3: Performance of False smut resistant lines at Kamarkhanda upazilla in Sirajganj during T. Aman2024

Designation	GD (Days)	Plant height (cm)	Panicle/m2	Yield (t/ha)
BR(path)13804-BC3-4-5	120	118.33	285	4.67
BR(path)13804-BC3-13	120	124.74	281	5.38
BR(path)13804-BC3-16	123	129.9	277	3.59
BRRI dhan49(CK)	132	107.25	284	5.63
LSD(0.05)		4.36	16.67	0.54
CV(%)		1.82	2.96	5.63

2.4. Photosensitive, T Aman 2024

Two genotypes including two checks BR22 and BR23 were evaluated at farmer's field of Kamarkhand upazila, Sirajganj. The experiment was carried out following RCB design with three

replications. Check variety BR22 gave the highest yield 5.03 t/ha which is insignificant with genotype BR10212-5-5-3 and BR10212-17-3-2-2 where grain yield was recorded 4.35 and 4.03 t/ha, respectively (Table 4).

Table 4: Performance of different entries of Photosensitive at Kamarkhand Sirajganj during T Aman 2024

Designation	GD (Days)	Plant height (cm)	Panicle/m2	Yield (t/ha)
BR10212-17-3-2-2	152	128.33	224.33	4.03
BR10212-5-5-3	148	132.26	202.33	4.35
BR22(CK)	152	133.46	238.33	5.03
BR23(CK)	158	129	230.66	3.95
LSD(0.05)		4.96	27.46	0.79
CV(%)		1.9	6.13	9.15

2.5 Antioxidant, T Aman 2024

The trial was conducted at the farmer's field of Kamarkhand upazila of Sirajganj. Three genotypes including two checks BRRI dhan34 and BRRI

dhan70 were evaluated following the RCB design with three replications. All the entries gave statistically similar yield which is ranging from 3.09 to 3.25 t/ha with growth duration 134- 152 days (Table 5).

Table 5: Performance of different entries under Antioxidant at Kamarkhand, Sirajganj during T Aman 2024

Designation	GD (Days)	Plant height (cm)	Panicle/m2	Yield (t/ha)
BR12836-4R-312	142	108.30	145.33	3.09
BR12839-4R-124-2	140	112.20	146.00	3.09
BR12839-4R-51	140	120.33	145.67	3.20
BRRI dhan34(CK)	152	156.53	337.33	3.25
BRRI dhan70(CK)	134	155.93	169.33	3.20
LSD(0.05)		5.69	33.28	0.33
CV(%)		2.31	9.34	5.58

2.6. SHR1 Katari type, T Aman 2024

Three genotypes including two checks BRRI dhan57 and Katari were evaluated at the farmer's

field of sadar upazila of Bogura. All the test genotypes gave statistically higher yields (5.08-5.36 t/ha) which are significantly different from check variety BRRI dhan57 (3.90 t/ha) (Table 6).

Table 6: Performance of different entries under SHR 1 Katari at sadar, Bogura during T Aman 2024

Designation	Growth duration (Days)	Plant height (cm)	Panicle/m ²	Yield (t/ha)
BRH13-9-5-2B	115	112.7	239.66	5.18
BRH9-3-2B	118	112.1	284.66	5.36
IR12A177	119	123.8	290	5.08
BRRI dhan57 (ck)	112	115.83	301.33	3.90
Katari (ck)	123	123.1	277.66	4.55
LSD(0.05)		6.14	87.37	0.74
CV(%)		2.77	16.65	8.26

2.7 SHR 1 Zira type, T Aman 2024

The experiment was conducted at the farmer's field of sadar upazila of Bogura. Two genotypes including two checks BRRI dhan75 and Zirashail

were evaluated in a RCB design with three replications. The tested genotype BRH11-7-17-10B (5.74 t/ha) and BRH17-23-8-2-7B (5.28 t/ha) gave significantly higher yield than check Zirashail (2.18 t/ha) (Table 7).

Table 7: Performance of different entries under Table SHR 2 Zira at sadar, Bogura during T Aman 2024

Designation	GD (Days)	Plant height (cm)	Panicle/m ²	Yield (t/ha)
BRH17-23-8-2-7B	116	114.56	353.66	5.28
BRH11-7-17-10B	115	118.73	295.66	5.74
BRRI dhan75	113	114.9	299.66	4.54
Zirashail	112	116.1	306	2.18
LSD(0.05)		2.74	53.33	1.17
CV(%)		1.18	8.54	13.24

Boro 2024-25

2.8. ALART BRR_LD Boro 2024-25

Three genotypes including check BRRI dhan29 were evaluated at the farmer's field of Kamarkhand

upazila of Sirajganj. None of the test genotypes gave significantly higher yield compared with check variety (Table 8).

Table 8: Performance of different entries under ALART BRR_LD Boro 2024-25 at Kamarkhand, Sirajganj

Designation	GD (Days)	Plant height (cm)	Yield (t/ha)
BR(path)15855-BC2-3HR-23	158	111.49	8.04
BR(path)15860-BC2-3HR-47	154	110.35	8.53
BRRI dhan29 (Ck)	158	108.75	8.85
LSD(0.05)	1.85	6.64	0.56
CV(%)	0.52	2.59	2.93

2.9. ALART BRR_MD Boro 2024-25

Three genotypes including one check BRRI dhan58 were evaluated at the farmer's field of Kamarkhand upazila of Sirajganj. Between the test genotypes

BR(path)15860-BC2-3HR-48 gave higher yield (7.83 t/ha) but statistically similar with BR(path)15855-BC3-2HR-5 (7.52 t/ha) and check 8.34 (t/ha) (Table 9).

Table 9: Performance of different entries of BRR_MD at Kamarkhand, Sirajganj during Boro 2024-25

Designation	Growth duration (Days)	Plant height (cm)	Yield (t/ha)
BR(path)15855-BC3-2HR-5	150	105.47	7.52
BR(path)15860-BC2-3HR-48	149	122.50	7.83
BRRI dhan58(Ck)	146	108.23	8.34
LSD(0.05)	3.29	5.12	0.78
CV(%)	0.98	2.01	4.34

2.10. ALART BRR_SD Boro 2024-25

Two genotypes along with check variety BRRI dhan88 were evaluated at the farmer's field of

Kamarkhand upazila of Sirajganj following RCB design with three replications. None of the tested entry gave significantly higher yield compared with the check variety (6.99 t/ha) (Table 10).

Table 10: Performance of different entries under ALART BRR_SD at Kamarkhand, Sirajganj during Boro 2024-25

Designation	Growth Duration (Days)	Plant height (cm)	Yield (t/ha)
BR(path)15641- 3HR-15	149	109.86	6.74
BR(path) 15641- 3HR-45	150	107.60	6.24
BRRI dhan88(Ck)	153	95.94	6.99
LSD(0.05)	5.67	4.06	2.09
CV(%)	1.60	1.71	12.88

2.11. ALART STR_MD Boro 2024-25

The experiment was conducted at the farmer's field of sadar upazila of Bogura. Three genotypes including two checks BRRI dhan102 and BRRI dhan99 were evaluated following standard

agronomic practices. The check variety BRRI dhan102 gave higher yield (7.36 t/ha) which is followed by genotype BR13113-4R-185 (7.18 t/ha) and BR13122-4R-136 (7.09) with the similar growth duration (150 days) (Table 11).

Table 11: Performance of different entries under STR_MD, at Kamarkhand, Sirajganj Boro 2024-25

Designation	GD (Days)	Plant height (cm)	Yield (t/ha)
BR13106-4R-184	150	92.67	6.49
BR13113-4R-185	150	94.15	7.18
BR13122-4R-136	150	112.12	7.09
BRRI dhan102(Ck)	150	106.27	7.36
BRRI dhan99(Ck)	150	111.62	6.27
LSD(0.05)	5.67	6.51	2.22
CV(%)	1.60	3.34	17.16

2.12. ALART STR_SD Boro 2024-25

The experiment was conducted at the farmer's field of sadar of Bogura district. Two genotypes including two check BRRI dhan28 and BRRI dhan88 were evaluated following standard

agronomic practices. Genotype BR13113-4R-116 gave the highest yield than the check entries BRRI dhan28 (7.84 t/ha) and BRRI dhan88 (7.09 t/ha) with similar growth duration (144 days). (Table 12).

Table 12. Performance of different entries of STR_SD at sadar of Bogura district during Boro 2024-25

Designation	Growth duration (Days)	Plant height (cm)	Yield (t/ha)
BR13113-4R-63	145	107.16	6.89
BR13113-4R-116	144	112.38	8.32
BRRI dhan28(Ck)	144	113.72	7.84
BRRI dhan88(Ck)	143	104.26	7.09
LSD(0.05)	1.99	5.38	2.58
CV(%)	0.69	2.46	17.14

2.13 ALART AOER_MD Boro 2024-25

The experiment was conducted at the farmer's field of sadar of Bogura district following appropriate methodologies. Two genotypes along with check variety BRRI dhan100 were evaluated. Test genotype BR12839-4R-5-2 gave the highest yield

(7.61t/ha) which was followed by BR12839-4R-157-2 (7.41t/ha) with the similar growth duration. But the yield difference is not statistically significant from ck variety BRRI dhan100 (7.12 t/ha) (Table 13).

Table 13: Performance of different entries of AOER_MD at sadar, Bogura during Boro 2024-25

Designation	Growth duration (Days)	Plant height (cm)	Yield (t/ha)
BR12839-4R-157-2	152	112.82	7.41
BR12839-4R-5-2	152	113.1	7.61
BRRI dhan100 (Ck)	147	116.87	7.12
LSD(0.05)		6.42	1.49
CV(%)		2.48	8.90

2.14 ALART AOER_SD Boro 2024-25

The experiment was conducted at the farmer's field of sadar of Bogura district following appropriate methodologies. One genotype along with one check

variety BRRI dhan88 were evaluated. The test genotype BR12839-4R-137 gave significantly the lowest yield (5.43 t/ha) than the standard check (8.23 t/ha) (Table 14).

Table 14: Performance of different entries of AOER MD at sadar, Bogura during Boro 2024-25

Designation	GD (Days)	Plant height (cm)	Yield (t/ha)
BR12839-4R-137	147	90	5.43
BRRI dhan88 (Ck)	147	93.4	8.23
LSD(0.05)		23.27	1.3
CV(%)		7.2	5.45

2.15 ALART BB+Blast _SD Boro 2024-25

The experiment was conducted at the farmer's field of Kamarkhanda upazilla of Sirajganj district following appropriate methodologies. Three

genotypes along with one check variety BRRI dhan88 were evaluated. The test genotype BR(Path)13802-BC3-62-14 gave higher yield (8.19 t/ha) than the standard check BRRI dhan88 (7.08 t/ha) with same growth duration (Table 15).

Table 15: Performance of different entries of BB+Blast _SD at Kamarkhanda, Sirajganj during Boro 2024-25

Designation	GD (Days)	Plant height (cm)	Yield (t/ha)
BR(Path)13802-BC3-54-12	149	108.1	8.00
BR(Path)13802-BC3-73-13	149	109.8	7.87
BR(Path)13802-BC3-62-14	149	94.11	8.19
BRRIdhan88(ck)	149	94.0	7.08
LSD(0.05)		2.98	6.93
CV(%)		1.47	

2.16. FBR_MD Boro 2024-25 Bogura

The experiment was conducted at the farmer's field of sadar of Bogura district following appropriate methodologies. Three genotypes along with two

check variety BRRIdhan97 and BRRIdhan102 were evaluated. None of the test genotypes give statistically higher yield compared with checks (Table 16).

Table 16: Performance of different entries under FBR_MD at sadar of Bogura during Boro 2024-25

Designation	GD (Days)	Plant height (cm)	Yield (t/ha)
BR11894-5R-60	148	109.86	8.07
BR12508-5R-5	145	108.75	9.26
BR12517-5R-57	144	110.68	9.20
BRRIdhan97(ck)	149	115	8.24
BRRIdhan102(ck)	151	117	8.93
LSD(0.05)		15	2.0
CV (%)		7.1	12.16

2.17 FBR_SD Boro 2024-25

The experiment was conducted at the farmer's field of sadar of Bogura district following appropriate methodologies. One genotype along with one check

variety BRRIdhan88 were evaluated. The test genotype BR12574-5R-52 did not give highest yield (6.48 t/ha) than the standard check (8.99 t/ha) (Table 17).

Table 18: Performance of different entries of FBR_SD at sadar of Sirajganj during Boro 2024-25

Designation	GD (Days)	Plant height (cm)	Yield (t/ha)
BR12574-5R-52	150	127.3	6.48
BRRIdhan88 (Ck)	148	95.8	8.99
LSD(0.05)		12	5.38
CV (%)		7.19	19.81

2.18 ALART PQR Boro 2024-25

The experiment was conducted at farmer's field of Kamarkhanda of Sirajganj district following appropriate methodologies. Two genotypes along with two check varieties BRRIdhan104 and BRRIdhan107

were evaluated. The test genotype BR11359-4R-279 gave the highest yield (8.05 t/ha) which is followed by BRRIdhan107 (7.79 t/ha) and BRRIdhan104 (7.15 t/ha). But no significant difference was found among the genotypes in terms of yield (Table 18).

Table 18: Performance of different entries of PQR at Kamarkhanda of Sirajganj during Boro 2024-25

Designation	Growth duration (Days)	Plant height (cm)	Yield (t/ha)
BR11359-4R-181	150	117.28	7.03
BR11359-4R-279	149	117.74	8.05
BRR1 dhan104 (Ck)	149	105	7.15
BRR1 dhan107 (Ck)	148	109.66	7.79
LSD(0.05)	0.66	8.95	1.33
CV(%)		3.98	8.87

2.19. PQR (Path) Boro 2024-25

The experiment was conducted at farmer's field of Kamarkhanda of Sirajganj district following appropriate methodologies. One genotype along with two check variety BRR1 dhan50 and BRR1

dhan104 were evaluated. The test genotype BRR1 (Path) Premium1 gave the highest yield (7.47 t/ha) which is followed by BRR1 dhan107 (7.79 t/ha) and BRR1 dhan104 (7.15 t/ha). But there is no significant difference among the genotypes interms of yield. (Table 19)

Table 19. Performance of different entries under PQR at Kamarkhanda of Sirajganj during Boro 2024-25

Designation	Growth duration (Days)	Plant height (cm)	Yield (t/ha)
BRR1(Path)Premium1	146	103.16	7.47
BRR1 dhan50 (Ck)	155	88.98	6.07
BRR1 dhan104 (Ck)	155	105.97	6.67
LSD(0.05)		6.79	2.46
CV(%)		3.02	16.11

3. CROP SOIL WATER MANAGEMENT**Long-term missing element trial at BRR1 R/S Sirajganj during Boro 2023-24**

The experiment was initiated in a permanent layout at BRR1 farm Sirajganj to study the changes in soil physico-chemical and biological properties and the effect of long-term nutrient omission on rice yield. The experiment was conducted following RCB

design combining 7 treatments in RCB design with 3 replications. The highest yield (8.57 t/ha) was recorded in the plot where standard doses of fertilizer was applied and no significant difference was found in yield from P, K, S and Zn omitted plots. Among the major nutrient elements, the omission of N appeared as the most yield-limiting nutrient element (Table 20).

Table 20. Effect of long-term missing element on grain yield of BRR1 dhan105 at BRR1 farm, Sirajganj during Boro 2024-25

Treatment	Grain yield (t/h)
T ₁ (Control)	4.35c
T ₂ (NPKSZn)	8.57a
T ₃ (PKSZn (-N)	4.94b
T ₄ (NKSZn (-P)	8.35a
T ₅ (NPSZn (-K)	8.14a
T ₆ (NPKZn (-S)	8.49a
T ₇ (NPKS (-Zn)	8.38a
CV(%)	2.20

4. PEST MANAGEMENT PROGRAMME

Survey and monitoring of rice disease in different locations of Sirajganj district

A survey was conducted in eight upazilla of Sirajganj district during Aman 2024 and Boro 2024-25 season. Rice disease data were recorded from 5 rice growing locations of each upazilla. Five spots of each location were selected for conducting

the survey and the disease data were recorded by following SES scale. In both the season, a total of 5 diseases such as, bacterial blight, sheath blight, brown spot, false smut and blast were found in different rice varieties in the surveyed areas. Among the major disease, brown spot was dominating disease affecting all most all the vaieties grown over the locations (Fig1 and 2).

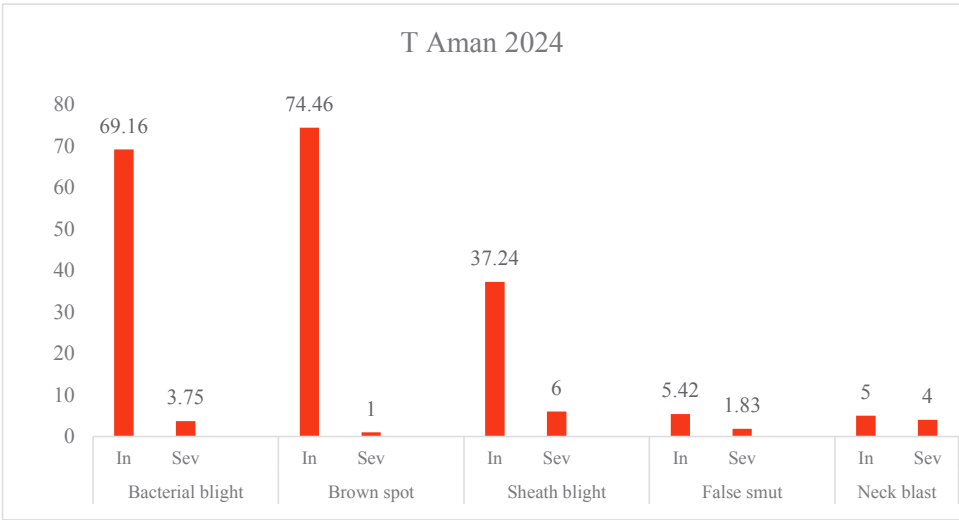


Fig: 1 Incidence and severity of major rice disease in T Aman 2024 season in Sirajganj district

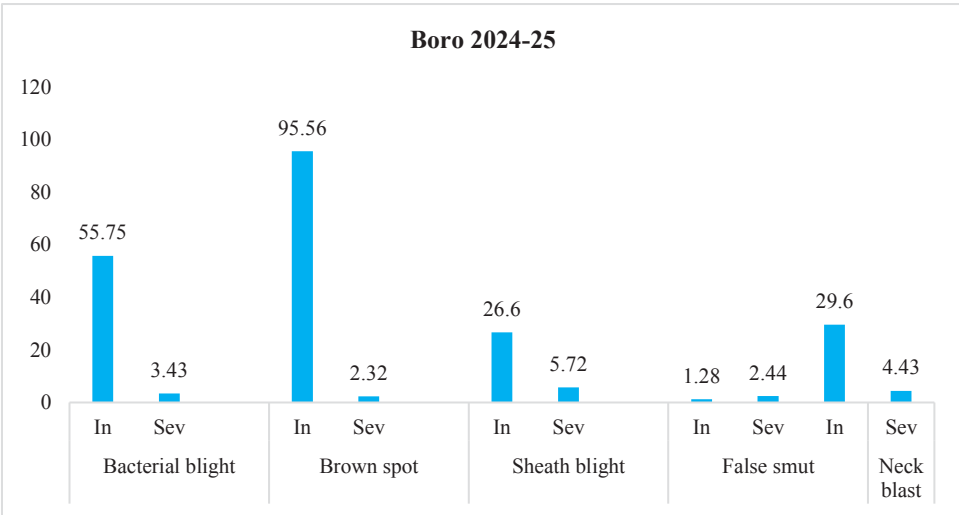


Fig: 2 Incidence and severity of major rice disease in Boro 2023-24 season in Sirajganj district

5. ENRICHMENT OF SEED STOCK

Certified seed and Truth fully leveled seed production

A total of 7600 kg certified seeds of BRRI dhan103 was produced in T Aman 2024 season and in Boro

2024-25 season 1400 kg certified seeds of BRRI dhan100 and BRRI dhan 102 were produced. In Boro 2024-25, a total of 1150kg TLS of BRRI dhan 101, 102, 105 107 108 and 114 of were produced (Table 21 and Table22).

Table 21. TLS production at BRRI R/S, Sirajganj during Boro 2024-25

Variety	TLS (kg)
BRRI dhan101	100
BRRI dhan102	350
BRRI dhan105	150
BRRI dhan107	50
BRRI dhan108	100
BRRI dhan114	400
Total	1150 kg

Table 22. Certified seed and TLS production at BRRI R/S, Sirajganj during Aman 2024 and Boro 2024-25 season

Variety	Season	Certified seed (kg)	TLS (kg)
BRRI dhan103	T Aman 2024	7600	-
BRRI dhan100	Boro 2024-25	4000	-
BRRI dhan101			100
BRRI dhan102		10000	350
BRRI dhan105			150
BRRI dhan107			50
BRRI dhan108			100
BRRI dhan114			400
Total		21600 kg	1150 kg

6. TECHNOLOGY TRANSFER

Demonstration, Training and field day

A good number of field demonstration of BRRI released varieties was conducted in different locations of Bogura region. A total of 280 demonstrations were conducted in T Aman 2024 with BRRI dhan103, 20 were in T Aus with BRRI hybrid dhan7 and 640 were in Boro 2024-25 with BRRI dhan 89, 92, 102, 104, 105 and 107 under GoB, PARTNER, LSTD and Hybrid projects (Table 23).

A total of 15 farmers training on modern rice production technology was conducted at different

upazilas of Bogura and Sirajganj districts in collaboration with DAE with the finance of GoB & PARTNER project (Table 24). A total of 450 farmers were trained through this programme. Among the participants, 100 and 350 were female and male, respectively. A total of 12 in-house training was arranged at BRRI regional station to improve the capability of office staffs for office management. BRRI regional station, Sirajganj also conducted 20 field day at different upazila of Bogura and Sirajganj districts for the dissemination of newly released BRRI varieties funded by GoB, PARTNER, LSTD and Hybrid project (Table 25).

Table 23. Demonstration conducted by BRRI R/S, Sirajganj during T Aman 2024 and Boro 2024-25

Funding source	Demonstration (#)		
	T Aman 2024	Aus 2025	Boro 2024-25
GoB	100	-	200
PARTNER	100		370
LSTD	60	-	50
Hybrid project	20	20	20
Total	280	20	640

Table 24. Farmers training conducted by BRRI R/S, Sirajganj during 2024-25

Funding source	Training (#)	Participating farmers (#)
GoB	11	330
PARTNER	04	120
Total	15	450

Table 25. Field day conducted by BRRI R/S, Sirajganj during 2024-25

Funding source	Field day (#)
GoB	15
PARTNER Project	03
Hybrid Rice Project	02
LSTD Project	01
Total	22

7. ADVISORY AND CLINICAL SERVICE

Any problem related to rice production at farmers' field was addressed duly in co-operation with the Department of Extension (DAE), Bangladesh Agricultural Development Corporation (BADC and Seed Certification Agency (SCA). Field visit to

address seed sterility at flowering, blast and rice plant hopper incidence after flowering during T. Aman, Boro season, different information, support in training etc. were the main aspects. Clinical services were also provided to the farmers and extension workers as well.

BRRI RS, Gopalganj

510	Summary
511	Varietal development
516	Technology transfer

SUMMARY

BRRI RS, Gopalganj conducted 17 Advanced Line Adaptive Research Trials (ALART) in Gopalganj and Bagerhat districts during the 2024-2025 reporting year.

In the ALART (False smut resistant) trials during the T. Aman 2024 season, among the three advanced lines, BR (Path)13804-BC3-13 produced a higher grain yield (5.31 t/ha) than the other two lines, BR (Path)13804-BC3-4-5 (5.19 t/ha) and BR (Path)13804-BC3-16 (4.47 t/ha), as well as the standard check BRRI dhan49 (5.21 t/ha).

In the ALART (Antioxidant Rice) trials during the T. Aman 2024 season, BR12836-4 R-312, BR12839-4 R-124-2, and BR12839-4 R-51 produced significantly higher grain yields of 4.53, 5.03, and 4.53 t/ha respectively, compared to the standard check varieties BRRI dhan34 (3.33 t/ha) and BRRI dhan70 (2.37 t/ha).

In the ALART (Photosensitive rice) trial during the T. Aman 2024 season, BR10212-17-3-2-2 and BR10212-5-5-3 produced similar yields of 4.98 and 5.72 t/ha respectively, compared to the check varieties BR22 (5.81 t/ha) and BR23 (5.57 t/ha).

In the ALART (Salinity Tolerant Rice) trial during the same season, BR13113-4 R-63 and BR13118-4 R-76 produced statistically similar yields of 4.87 and 4.54 t/ha respectively, compared to the check varieties BRRI dhan73 (5.13 t/ha) and BRRI dhan75 (4.40 t/ha).

During the ALART (Salinity-Tolerant Photosensitive Long-Duration) trial, the standard check variety BR23 produced significantly higher yield (5.47 t/ha) at Rampal upazila in Bagerhat district.

Seven RYT, namely RYT (Photosensitive High Yielding), RYT (Short Duration), RYT (PQR), RYT (Katari Type), RYT (Antioxidant Rice), RYT (STR-1, STR-3) RYT (Tall Breeding Materials), and RYT (Low Amylose), were conducted during the T. Aman 2024 season.

In the ALART (BRR-LD) during the Boro 2024 season, the check variety produced a statistically

higher grain yield of 8.4 t/ha compared to the advanced lines BR (Path)15855-BC2-3HR-23 (6.6 t/ha) and BR (Path)15860-BC2-3HR-47 (6.7 t/ha).

In the ALART (BRR-MD) during the Boro 2024 season, the check variety BRRI dhan58 yielded 8.5 t/ha, which was higher than the advanced lines BR (Path)15855-BC3-2HR-5 (8.2 t/ha) and BR (Path)15860-BC2-3HR-48 (6.6 t/ha).

In the ALART (BRR-SD) during the Boro 2024 season, one of the advanced lines, BR (Path)15641-3HR-45 produced a grain yield of 9.6 t/ha, surpassing other advanced lines, BR (Path)15641-3HR-15 (8.8 t/ha), and the check variety BRRI dhan88 (8.9 t/ha).

In the ALART (AOER-MD) during the Boro 2024 season, the check variety BRRI dhan100 yielded 9.0 t/ha, higher than two advanced lines.

In the ALART (FBR-MD) during the Boro 2024 season, the check varieties and advanced lines BRRI dhan97, BRRI dhan102, BR11894-5R-260, BR12508-5R-5, and BR12517-5R-57 yielded 8.8, 8.2, 8.3, 8.9, and 8.9 t/ha respectively, but the differences were not statistically significant.

In the ALART (AOER-SD) during the Boro 2024 season, the check variety BRRI dhan88 produced a grain yield of 8.8 t/ha compared to the advanced line BR12839-4R-137 (8.3 t/ha); however, this difference was not statistically significant.

In the ALART (PQR) during the Boro 2024 season, the two check varieties produced significantly higher grain yields of 7.6 t/ha and 7.8 t/ha respectively.

In the ALART (PQR-PATH) during the Boro 2024 season, the advanced line BRRI (Path)-Premium yielded significantly more grain at 8.5 t/ha compared to the two check varieties, BRRI dhan50 (7.1 t/ha) and BRRI dhan104 (7.6 t/ha).

In the ALART (BB+Blast-SD) during the Boro 2024 season, two advanced lines, BR (path)13802-BC3-73-13 and BR (path)13802-BC3-62-14, produced significantly higher grain yields of 9.2 t/ha and 9.7 t/ha respectively, compared to the other

advanced line BR (path)13802-BC3-54-12 (8.9 t/ha) and the check variety BRRi dhan88 (8.2 t/ha).

In the ALART (FBR-SD) during the Boro 2024 season, the check variety BRRi dhan88 produced significantly higher grain yield (8.3 t/ha).

In the ALART (STR-MD) during the Boro 2024 season, one advanced line, BR13106-4R-184, produced significantly higher grain yield at 6.6 t/ha compared to the other two advanced lines, BR13113-4R-185 (5.5 t/ha) and BR13122-4R-136 (5.1 t/ha), as well as the check varieties BRRi dhan102 (6.2 t/ha) and BRRi dhan99 (5.6 t/ha).

In the ALART (STR-SD) during the Boro 2024 season, one of the check varieties, BRRi dhan28, produced a significantly higher grain yield of 5.96 t/ha than the two advanced lines.

Four RYT, including RYT (FBR-Barishal), RYT (STR-1, STR-2), and RYT (Breeding for Basmati Rice), were conducted at BRRi RS, Gopalganj during the Boro 2024-25 season.

A total of 1,230 field demonstrations of newly released BRRi modern rice varieties were conducted in different farmers' fields in Gopalganj, Bagherhat, and Narail districts during the reporting year under the GoB, PARTNER project, Hybrid project, and LSTD project.

Additionally, during the reporting year, 6,935 kg of Truthfully Labelled Seed (TLS), 5,200 kg of breeder seed, and 925 kg of F1 BRRi Hybrid dhan8 seeds were produced.

Twenty-six field days showcasing different rice varieties were held in Gopalganj, Bagherhat, and Narail districts under the GoB, PARTNER, LSTD, and Hybrid projects. Approximately 1,680 farmers, extension workers, administrative staff, and public leaders participated in these field days.

During the same period, 20 farmers' training sessions were conducted in various locations across the Gopalganj region. Around 600 farmers, both men and women, attended these sessions and enhanced their knowledge of modern rice production technologies.

VARIETY DEVELOPMENT

ALART (False smut resistant) during T. Aman 2024. Among the three advanced lines, BR (Path)13804-BC3-13 produced a higher grain yield (5.31 t/ha) than the other two advanced lines BR (Path)13804-BC3-4-5 (5.19 t/ha), BR (Path)13804-BC3-16 (4.47 t/ha), and the standard check BRRi dhan49 (5.21 t/ha). The shortest growth duration was observed in the BR (Path)13804-BC3-4-5 advanced line (113 days), while the tallest plant was in the BR (Path)13804-BC3-16 advanced line (123.43 cm) (Table 1). For this reason, none of the advanced lines was selected for the proposed variety trial (PVT).

Shamsunnaher, M Z Islam, S C Das and M R Biswash.

ALART (Antioxidant rice) during T. Aman 2024. Among the three advanced lines, BR12836-4R-312, BR12839-4R-124-2, and BR12839-4R-51 produced significantly higher grain yields of 4.53, 5.03, and 4.53 (t/ha) respectively, compared to the two standard check varieties BRRi dhan34 (3.33 t/ha) and BRRi dhan70 (2.37 t/ha). The shorter growth duration was observed in BR12839-4R-124-2 (122 days), and the highest plant height was recorded in BR12839-4R-51 (124 cm) (Table 2). Therefore, the advanced lines BR12839-4R-124-2 and BR12839-4R-51 were proposed for the upcoming variety trial (PVT).

Shamsunnaher, M Z Islam, SC Das and M R Biswash.

ALART (Photosensitive rice) during T. Aman 2024. The Two advanced lines, BR10212-17-3-2-2 and BR10212-5-5-3 produced grain yields of 4.98 and 5.72 (t/ha) respectively, which are similar to the two standard check varieties BR 22 (5.81 t/ha) and BR 23 (5.57 t/ha). The longest growth period was observed in the standard check variety BR 23 (157 days). Plant height was statistically similar among the advanced lines BR10212-17-3-2-2 (135.8 cm), BR10212-5-5-3 (136.2 cm), and the two standard check varieties BR 22 (139.9 cm) and BR 23 (141.8 cm) (Table 3). None of the advanced lines were recommended for the proposed variety trial (PVT).

Shamsunnaher, M Z Islam, S C Das and M R Biswash.

ALART (STR-SD) during T. Aman 2024. Two advanced lines, BR13113-4 R-63 and BR13118-4 R-76 produced statistically similar grain yields of 4.87 and 4.54 tons per hectare respectively, compared to the check varieties BRRI dhan73 (5.13 t/ha) and BRRI dhan75 (4.40 t/ha). The growth durations of these two advanced lines were also statistically similar, each lasting 127 days, as was the check variety BRRI dhan73, which lasted 128 days. The highest plant height was observed in the standard check variety BRRI dhan73 at 126.7 cm (Table 4). None of the advanced lines were recommended for the proposed variety trial (PVT).

Shamsunnaher, M Z Islam, S C Das and M R Biswash.

ALART (STR-LD) during T. Aman 2024. The standard check variety BR23 yields a statistically higher grain production (5.47 t/ha) than all the other advanced lines. Among them, BR13103-4R-7 provides a higher grain yield (5.30 t/ha) than the other advanced lines BR13103-4R-37, BR13105-4R-37, and BR13115-4R-122, which produce 3.56 t/ha, 4.46 t/ha, and 4.55 t/ha respectively, as well as the tested check variety BRRI dhan30 (4.91 t/ha) at Rampal upazila (Table 5). Compared to the other lines and check varieties, the longest growth duration was observed in one of the advanced lines BR13115-4R-122, with 149 days at Rampal upazila. The tallest plant height was recorded for the two tested check varieties BR23 and BRRI dhan30, measuring 129.2 cm and 128.9 cm at Rampal upazila, and 126.4 cm for BRRI dhan30 at Sadar upazila, among all the advanced lines and check varieties (Table 5). None of the advanced lines was considered for the proposed variety trial (PVT).

Shamsunnaher, M Z Islam, S C Das and M R Biswash.

RYT (Photosensitive high-yielding rice) during T. Aman 2024. Four genotypes and three standard checks were cultivated at the regional station in Gopalganj during the T. Aman 2024 season. Among the four genotypes, the highest grain yield was observed in the line designated as BR (Bio)8033-AC5-1-1-HR1 (4.31 t/ha), with a shorter growth duration than the others. The shortest plant was found in the line BR (Bio)8033-AC5-1-2-HR1 (102

cm), which also had the lowest yield among these lines. (Table 6).

R K Roy; **Co-PI:** M Z Islam, S C Das and M R Biswash.

RYT (Short Duration high yielding rice) during the T. Aman 2024. Three genotypes and two standard checks were cultivated at the regional station in Gopalganj during the T. Aman 2024 season. Among the three genotypes, none outperformed the check varieties in terms of yield; however, all the three lines exhibited shorter growth durations. Additionally, all the lines and check varieties demonstrated similar plant height. (Table 7).

R K Roy; **Co-PI:** M Z Islam, S C Das and M R Biswash.

RYT (PQR-Rangpur) during T. Aman 2024. Four genotypes of premium quality rice (PQR) (Rangpur) and two standard checks were cultivated at the regional station in Gopalganj during the T. Aman 2024 season to assess their specific and general adaptability in on-station and farmers' field conditions. None of the lines produced higher yields. All of them have longer growth durations than the check varieties. The plant height of the three lines was nearly the same as that of the check variety BRRI dhan75 (Table 8).

M R Hasan and K M Iftekharuddaula, **Co-PI:** M Z Islam, S C Das and M R Biswash.

RYT (Katari Type) during the T. Aman 2024. Four genotypes of fine-grain type rice (Katari Type) and one standard check were tested at BRRI RS, Gopalganj during the T. Aman 2024 season to assess their specific and general adaptability in both on-station and farmers' field conditions. No line outperformed others in yield, but all lines had shorter growth durations compared to the check variety. The shortest plant was found in the line BRH9-3-14-2B, measuring 98.3 cm (Table 9).

S Maniruzzaman, **Co-PI:** S T Tuba, M M Yeasmin, A Rahman, K M Iftekharuddaula, M Z Islam, S C Das and M R Biswash.

RYT (Antioxidant Rice) during T. Aman 2024. Seven genotypes of antioxidant rice and two standard checks were grown at BRRI RS, Gopalganj during T. Aman 2024 season to evaluate their

specific and overall adaptability under on-station and farmers' field conditions. No genotype showed superior yield; however, shorter growth durations were observed in the lines R-76 (123 days) and R-137 (125 days). The smallest plant was found in the R-76 line, measuring 97.1 cm. (Table 10).

S Maniruzzaman, **Co-PI:** S T Tuba, M M Yeasmin, A Rahman, K M Iftekharuddaula, M Z Islam, S C Das and M R Biswash.

RYT (STR-1) during the T. Aman 2024. Twenty-three genotypes of salt-tolerant rice and two standard checks were grown at the regional station in Gopalganj during the T. Aman 2024 season to evaluate both specific and general adaptability in on-station and farmers' field conditions. Grain yield was the highest in the line designated as BR12460-4 R-44 (5.057 t/ha), and the growth duration was shortest in the line BR12471-4 R-98 (136 days). The shortest plant was found in the line BR12459-4 R-33 (89.8 cm), while the tallest was in BR12459-4 R-265 (134.4 cm) (Table 11).

M A Rahman, **Co-PI:** N Jahan, K M Iftekharuddaula, M Z Islam, S C Das and M R Biswash.

RYT (STR-3) during T. Aman 2024. Fifteen genotypes of salt-tolerant rice and two standard checks were grown in BRRI RS, Gopalganj during T. Aman 2024 season to evaluate their specific and overall adaptability under on-station and farmers' field conditions. Grain yield was the highest in the line designated as BR12459-4R-277 (6.24 t/ha), while the shortest growth duration was in the line BR12466-4R-317 (138 days). The shortest plant was observed in the line BR12466-4R-317, measuring 96 cm (Table 12).

M A Rahman, **Co-PI:** N Jahan, K M Iftekharuddaula, M Z Islam, S C Das and M R Biswash.

ALART (BRR-LD) during Boro 2024-25. Two advanced lines were cultivated alongside BRRI dhan29 as a check variety at North Gobra, Gopalganj Sadar. The check variety produced a statistically higher grain yield of 8.4 t/ha compared to the advanced lines BR (Path)15855-BC2-3HR-23 (6.6 t/ha) and BR (Path)15860-BC2-3HR-47 (6.7 t/ha). The growth duration for the advanced lines, BR

(Path)15855-BC2-3HR-23 and BR (Path)15860-BC2-3HR-47, was 146 days, while the check variety, BRRI dhan29, had a duration of 147 days, with no significant difference among them. Notably, BR (Path)15860-BC2-3HR-47 exhibited a significantly greater plant height of 117 cm than the other advanced lines and the control (Table 13). None of the advanced lines was considered for the proposed variety trial (PVT).

Shamsunnaher, M R Biswash, M H K Baktier and A Khatun

ALART (BRR-MD) during the Boro 2024-25. Two advanced lines were grown alongside BRRI dhan58 as a check variety at North Gobra, Gopalganj Sadar. The check variety BRRI dhan58 produced a higher grain yield of 8.5 t/ha compared to the advanced lines BR (Path)15855-BC3-2HR-5 (8.2 t/ha) and BR (Path)15860-BC2-3HR-48 (6.6 t/ha). The growth duration of the two advanced lines, BR (Path)15855-BC2-3HR-23 and BR (Path)15860-BC2-3HR-47, was 146 days each, while the check variety lasted 147 days. Notably, BR (Path)15860-BC2-3HR-48 had a significantly taller plant height of 125 cm compared to another advanced line (109 cm) and the check variety (101 cm) (Table 14). None of the advanced lines was recommended for the PVT.

Shamsunnaher, M R Biswash, M H K Baktier and A Khatun

ALART (BRR-SD) during the Boro 2024-25. Two advanced lines were tested alongside BRRI dhan88 as a check variety at North Gobra, Gopalganj Sadar. Among them, one of the advanced lines, BR (Path)15641-3HR-45, produced a higher grain yield of 9.6 t/ha than the other advanced line, BR (Path)15641-3HR-15 (8.8 t/ha), and the check variety BRRI dhan88 (8.9 t/ha). The growth duration of the two advanced lines, BR (Path)15641-3HR-15 and BR (Path)15641-3HR-45, was 137 days and 136 days respectively. In contrast, the check variety, BRRI dhan88, lasted 138 days. Notably, the two advanced lines, BR (Path)15641-3HR-15 and BR (Path)15641-3HR-45, exhibited significantly greater plant heights of 106 cm and 103 cm respectively, compared to the check variety, which was 99 cm

(Table 15). Due to these results, the advanced line BR(Path)15641-3HR-45 was proposed for PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (AOER-MD) during Boro 2024-25. Two advanced lines were tested alongside BRRI dhan100 as a check variety at North Gobra, Gopalganj Sadar. The check variety BRRI dhan100 yield a higher grain production of 9.0 t/ha than the two advanced lines, BR12839-4R-157-2 (8.0 t/ha) and BR12839-4R-5-2 (7.8 t/ha). The growth period of the two advanced lines, BR12839-4R-157-2 and BR12839-4R-5-2, was 147 days each, while the check variety, BRRI dhan100, had a duration of 144 days. Notably, the two advanced lines, BR12839-4R-157-2 and BR12839-4R-5-2, showed significantly taller plant heights of 119 cm and 120 cm respectively, compared to the check variety, BRRI dhan100 (111 cm) (Table 16). None of the advanced lines were selected for the PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (FBR-MD) during Boro 2024-25. Three advanced lines were tested alongside BRRI dhan97 and BRRI dhan102 as check varieties at North Gobra, Gopalganj Sadar. The grain yields of the three advanced lines BR11894-5R-260, BR12508-5R-5, and BR12517-5R-57 were 8.3, 8.9, and 8.9 (t/ha) respectively, while the check varieties BRRI dhan97 and BRRI dhan102 yielded 8.8 and 8.2 (t/ha) respectively. In terms of grain yield, neither the advanced lines nor the check varieties showed statistically significant differences. The longest growth period was observed in BRRI dhan102 with 144 days. Regarding plant height, there was no significant variation among them (Table 17). One advanced line BR12517-5R-57, was selected for PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (AOER-SD) during the Boro 2024-25. One advanced line was tested alongside BRRI dhan88 as a check variety at North Gobra, Gopalganj Sadar. The check variety BRRI dhan88 yields a

higher grain production of 8.8 t/ha than the advanced line, BR12839-4R-137 (8.3 t/ha); however, the difference was not statistically significant. The growth duration of the advanced line, BR12839-4R-137, was 135 days, while the check variety, BRRI dhan88, lasted 137 days. Notably, the advanced line, BR12839-4R-137, had a taller plant height of 99 cm compared to the check variety BRRI dhan88. (Table 18). None of the advanced lines were included in the proposed variety trials (PVT).

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (PQR) during the Boro 2024-25. Two advanced lines were grown alongside BRRI dhan104 and BRRI dhan107 as check varieties at North Gobra, Gopalganj Sadar. Both the check varieties produced significantly higher grain yields of 7.6 t/ha and 7.8 t/ha respectively, compared to the two advanced lines BR11359-4R-181 (5.3 t/ha) and BR11359-4R-279 (6.9 t/ha). The longest growth duration was observed in the check variety BRRI dhan104 (144 days), which was significantly longer than BRRI dhan107 (142 days), as well as the advanced lines BR11359-4R-181 (143 days) and BR11359-4R-279 (143 days). In terms of plant height, the tallest plant was observed in the advanced line BR11359-4R-279 at 130 cm, surpassing the other line BR11359-4R-181 (123 cm), and the check varieties BRRI dhan104 (101 cm) and BRRI dhan107 (118 cm) (Table 19). None of the advanced lines were selected for the PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (PQR-PATH) during the Boro 2024-25. One advanced line, BRRI (Path)-Premium, was tested alongside BRRI dhan50 and BRRI dhan104 as check varieties at North Gobra, Gopalganj Sadar. The advanced line BRRI (Path)-Premium produced significantly higher grain yields of 8.5 t/ha compared to the two check varieties BRRI dhan50 (7.1 t/ha) and BRRI dhan104 (7.6 t/ha). Regarding growth duration, there was no significant difference between the advanced line BRRI (Path)-Premium (144 days) and the two check varieties BRRI dhan50 (144 days) and BRRI dhan104 (144 days). In terms of plant

height, the tallest plant was the advanced line BRRI (Path)-Premium, at 108 cm, while the check varieties BRRI dhan50 and BRRI dhan104 were 99 cm and 105 cm respectively (Table 20). The advanced line BRRI (Path)-Premium was recommended for the PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (BB+Blast-SD) during the Boro 2024-25.

Three advanced lines, such as BR (path)13802-BC3-54-12, BR (path)13802-BC3-73-13, BR (path)13802-BC3-62-14 were grown with a check variety, BRRI dhan88, at North Gobra, Gopalganj Sadar. Among these, two advanced lines BR (path)13802-BC3-73-13 and BR (path)13802-BC3-62-14 produced significantly higher grain yields of 9.2 t/ha and 9.7 t/ha respectively, compared to the other advanced line BR (path)13802-BC3-54-12 (8.9 t/ha) and the check variety BRRI dhan88 (8.2 t/ha). The longest growth duration was observed in the check variety BRRI dhan88 (136 days), which was significantly longer than the three advanced lines BR (path)13802-BC3-54-12 (133 days), BR (path)13802-BC3-73-13 (131 days), and BR (path)13802-BC3-62-14 (135 days). The tallest plant was observed in one of the advanced lines, BR (path)13802-BC3-54-12 (115 cm), compared to the other two advanced lines BR (path)13802-BC3-73-13 (110 cm) and BR (path)13802-BC3-62-14 (106 cm) and the check variety BRRI dhan88 (98 cm) (Table 21). The line BR (path)13802-BC3-62-14 is recommended for PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (FBR-SD) during Boro 2024-25. One advanced line, BR12574-5R-52, was grown alongside BRRI dhan88 as check varieties at North Gobra, Gopalganj Sadar. BRRI dhan88 yielded significantly more grain (8.3 t/ha) than the advanced line BR12574-5R-52 (6.9 t/ha). There was no significant difference in growth duration between the advanced line BR12574-5R-52 (138 days) and the check varieties, BRRI dhan88 (137 days). Regarding plant height, the tallest plant was found in the advanced line BR12574-5R-52 at 116 cm, while

the check variety BRRI dhan50 measured 99 cm (Table 22). The advanced lines were not recommended for PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (STR-MD) during Boro 2024-25. Three advanced lines, such as BR13106-4R-184, BR13113-4R-185, and BR13122-4R-136 were grown alongside two check varieties, BRRI dhan102 and BRRI dhan99 at Kashimpur, Sadar, Bagerhat. Among them, one advanced line, BR13106-4R-184 yielded significantly higher grain production of 6.6 t/ha compared to the other two advanced lines BR13113-4R-185 (5.5 t/ha) and BR13122-4R-136 (5.1 t/ha), as well as the check varieties BRRI dhan102 (6.2 t/ha) and BRRI dhan99 (5.6 t/ha). The longest growth duration was observed in the check variety BRRI dhan102 (144 days). Regarding plant height, the tallest plant was observed in one of the advanced lines BR13122-4R-136 (111 cm) (Table 23). The advanced line BR13106-4R-184 is recommended for PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

ALART (STR-SD) during the Boro 2024-25. Two advanced lines, such as BR13113-4R-63 and BR13113-4R-116 were grown alongside two check varieties BRRI dhan28 and BRRI dhan88, at Kashimpur, Sadar, Bagerhat. One of the check varieties BRRI dhan28 produced significantly higher grain yield (5.96 t/ha) than the two advanced lines BR13113-4R-63 (5.06 t/ha), BR13113-4R-116 (5.43 t/ha) and the other check variety BRRI dhan88 (4.26 t/ha). The check variety BRRI dhan28 showed the longest growth duration at 138 days. In terms of plant height, the tallest plants were observed in the advanced lines BR13113-4R-116 (106 cm), followed by other advanced line BR13113-4R-63 (101 cm) and the check varieties BRRI dhan28 (103 cm), BRRI dhan88 (93 cm) (Table 24). None of the advanced lines are recommended for PVT.

Shamsunnaheer, M R Biswash, M H K Baktier and A Khatun

RYT (FBR-Barisal) during Boro 2024-25. Five genotypes of Boro rice and two standard checks were grown in BRRI RS, Gopalganj during the Boro 2024-25 season to evaluate specific and general adaptability under on-station and farmers' field conditions. The highest yield (9.14 t/ha) was observed in line no BRBaNGR994-1 (Table 25). No. line showed a higher number of tillers than the check varieties. The plant height of the five lines was similar to that of the check varieties BRRI dhan74 and BRRI dhan102. The shorter growth duration (137 days) was recorded in lines BRBaNGR324-1 and BRBaNGR1256-1 compared to the check variety.

PI: T Saha, **Co-PI:** K M Iftekharuddaula, M R Biswash, M H K Baktier and A Khatun

RYT (STR-1) during the Boro 2024-25. Twenty genotypes of Boro rice, two registrant checks, and one susceptible check, were grown at the regional station in Gopalganj during the Boro 2024-25 season to evaluate specific and general adaptability under on-station and farmers' field conditions. Among the 20 genotypes, the highest yield was recorded at 9.22 t/ha in the BR13201-4 R-298 followed by BR13207-4 R-28 (9.17 t/ha) (Table 26). BR11276-4 R-196 and BR12265-4 R-71 exhibited higher tiller numbers (14 and 14.5) compared to the check varieties. BR11720-4 R-89 produced the 4plant with 131 cm. The shortest growth duration was 131 days for the check variety BRRI dhan67, followed by 141 days for another check variety BRRI dhan67.

PI: M A Rahman, **Co-PI:** H Khatun, M R Biswash, M H K Baktier and A Khatun

RYT (STR-2) during the Boro 2024-25. Twenty rice genotypes, including two registrant checks, and one susceptible check, were grown in BRRI RS, Gopalganj during the Boro 2024-25 season to evaluate specific and general adaptability under on-station and farmers' field conditions. Among the 15 new rice genotypes, the highest grain yield (10.87 t/ha) was observed in the check variety BRRI dhan89 (Table 27). BR13197-4 R-24 showed the highest number of tillers (14.5). Plant height across all genotypes was similar to that of the check variety. The shortest growth duration (131 days) was recorded in BR12650-4 R-55.

PI: M A Rahman, **Co-PI:** H Khatun, M R Biswash, M H K Baktier and A Khatun

RYT (Breeding for Basmati Rice) during Boro 2024-25. Four genotypes of Boro rice (Rangpur) and one standard check were grown in BRRI RS, Gopalganj during the Boro 2024-25 season to evaluate specific and general adaptability under on-station and farmers' field conditions. Among the four genotypes, the highest yield was observed in BRrang55-RGA-40-1-1-1 (Table 28). No line showed a higher number of tillers than the check variety. The highest plant height (126 cm) was observed in the BRrang55-RGA-44-5-1-1. Growth duration was approximately the same in all four lines and the check variety.

PI: M R Hasan and K M Iftekharuddaula, **Co-PI:** M R Biswash, M H K Baktier and A Khatun

Hybridization. Under 'High yielding hybrid rice variety development through modernization of research' project, in T. Aman 2023 season, 32 crosses were made using 12 parents, and 1800 F₁ seeds were produced to develop high-yielding, deep-water, and stagnation-tolerant rice varieties. The focus was on kneeing ability, nodal tillering, earliness, and being awnless with good grain quality. During the following year, in 2024 T. Aman season, a total of 14 F₁S were confirmed as true hybrids through eye estimation. Back crosses were completed, and BC₁F₁ seeds were harvested for further development (Table 29).

PI: M Z Islam **Co-PI:** S C Das and M R Biswash

TECHNOLOGY TRANSFER

Activity 1. Field Demonstration

A total of 1,230 field demonstrations (110 in Aus, 380 in T. Aman, and 740 in Boro) were conducted across farmers' fields in Gopalganj, Bagherhat, and Narail districts to showcase newly released BRRI modern rice varieties. Out of these, 731 trials occurred in Gopalganj, 372 in Bagherhat, and 127 in Narail during the Aus 2024, T. Aman 2024 and Boro 2024-25 seasons, under the GoB, PARTNER, Hybrid, and LSTD projects (Table 30). Farmers' acceptance of BRRI dhan98 and BRRI Hybrid dhan7

was very high in the T. Aus season; BRRI dhan75, BRRI dhan87, BRRI dhan103, and BRRI Hybrid dhan6 were well received in the T. Aman season; BRRI dhan74, BRRI dhan92, BRRI dhan100, BRRI dhan101, BRRI dhan102, BRRI dhan104, BRRI dhan105, BRRI dhan107, BRRI dhan108, BRRI Hybrid dhan3, BRRI Hybrid dhan5, and BRRI Hybrid dhan8 were favoured in the Boro season, based on grain size, panicle length, and high yield.

Activity 2. Farmers Field Day

Twenty-six field days were held in conjunction with the block demonstrations in the Gopalganj, Bagerhat, and Narail districts throughout the T. Aus 2024 T. Aman 2024, and Boro 2024-25 seasons. The GoB, PARTNER Project, the LSTD Project, and the BRRI Hybrid Project funded these events. About 1,680 farmers, extension workers, administrative staff, and public leaders attended the field days. Most farmers expressed interest in growing new rice varieties in their areas, especially BRRI dhan76, BRRI dhan87, BRRI dhan98, dhan101, BRRI dhan102, BRRI dhan103, BRRI dhan105, BRRI dhan106, BRRI dhan107, BRRI dhan108, BRRI hybrid dhan3, BRRI hybrid dhan5, BRRI hybrid dhan6, BRRI hybrid dhan7, and BRRI hybrid dhan8. (Table 31).

Farmers Training

During the reporting year, 20 farmers' training sessions were conducted at various locations in Gopalganj, Bagerhat, and Narail districts (Table 32). A total of 600 farmers, both men and women, attended these sessions, where they enhanced their understanding of modern rice farming techniques.

Breeder seed and TLS Production

The production of breeder seeds for various rice varieties of BRRI is a key and routine activity at BRRI RS, Gopalganj. This regional station also produces seeds that quickly distribute BRRI-released varieties to farmers in the Gopalganj area.

During the reporting year, a total of 360 kg, 480 kg, and 6095 kg of Truthfully Labelled Seed (TLS) were produced in T. Aus, T. Aman, and Boro seasons respectively (Table 33, 34). Additionally, 2700 kg of breeder seed was produced in T. Aman, and 2,500 kg of breeder seed of various BRRI varieties was produced in the Boro season (Table 33, 34). Overall, 5200 kg of breeder seed was sent to the GRS Division, BRRI, Gazipur.

Activity 4. F₁ Seed production in BRRI Hybrid dhan8 during Boro 2023-24

A total of 925 kg (2.28 t/ha) of F₁ seeds were produced from BRRI hybrid dhan8 (BRRI99A / BRRI37R) at BRRI RS, Gopalganj during the Boro season (Table 34).

Activity 5. Seed distribution in the Gopalganj region

BRRI's regional station in Gopalganj distributed 2,200 kg, 1,300 kg, and 1,500 kg of TLS in Gopalganj, Bagerhat, and Narail districts during the Aus 2024, T. Aman 2024, and Boro 2024-25 seasons respectively. Additionally, BRRI RS Gopalganj distributed 4,600 kg, 200 kg, and 1,350 kg of certified seed in the same districts during the Boro 2024-25 season under the PARTNER project.

Table 1. Grain yield and related traits of ALART (False smut resistant) genotypes during T. Aman 2024.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
BR(Path)13804-BC3-4-5	104.83b	113c	5.19ab
BR(Path)13804-BC3-13	118.40ab	117b	5.31a
BR(Path)13804-BC3-16	123.43a	117b	4.47b
BRRI dhan49 (ck)	111.90ab	129a	5.21ab
CV	5.10	0.48	5.29
Lsd (0.05)	16.53	1.63	0.75

Table 2. Grain yield and associated traits of ALART (Antioxidant) genotypes during T. Aman 2024.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
BR12836-4R-312	118d	124c	4.53a
BR12839-4R-124-2	117d	122d	5.03a
BR12839-4R-51	124c	124c	4.53a
BRR1 dhan34 (ck)	169a	139a	3.33b
BRR1 dhan70 (ck)	161b	129b	2.37c
CV	1.08	0.48	8.39
Lsd (0.05)	4.20	1.70	0.93

Table 3. Grain yield and related traits of ALART (Photosensitive) genotypes during T. Aman 2024.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
BR10212-17-3-2-2	135.8a	137d	4.98a
BR10212-5-5-3	136.2a	138c	5.72a
BR 22 (ck)	139.9a	149b	5.81a
BR 23 (ck)	141.8a	157a	5.57a
CV	4.07	8.71	0.20
Lsd (0.05)	15.95	1.35	0.81

Table 4. Grain yield and related traits of ALART (STR-SD) genotypes during T. Aman 2024.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
BR13113-4R-63	119.2bc	127a	4.87a
BR13118-4R-76	124.8ab	127a	4.54a
BRR1 dhan73 (T. ck)	126.7a	128a	5.13a
BRR1 dhan75 (Std. ck)	111.9c	118b	4.40a
CV	2.15	0.64	6.12
Lsd (0.05)	7.34	2.26	0.82

Table 5. Grain yield and related traits of ALART (STR-LD) genotypes during T. Aman 2024.

Genotype	Sadar Bagerhat	Rampal Bagerhat	Sadar Bagerhat	Rampal Bagerhat	Sadar Bagerhat	Rampal Bagerhat
Plant height (cm)	Growth duration (day)		Grain yield (t/ha)		Grain yield (t/ha)	
BR13103-4R-37	100.7c	98.0c	129e	128e	3.44c	3.56c
BR13103-4R-7	109.6bc	108.7bc	143c	143c	4.92ab	5.30ab
BR13105-4R-37	93.7c	93.4c	139d	143c	4.21bc	4.46abc
BR13115-4R-122	104.0c	102.7c	146bc	149a	4.29abc	4.55abc
BRR1 dhan30 (T. ck)	126.4a	128.9a	147ab	148ab	4.82ab	4.91ab
BR23 (Std. ck)	123.7ab	129.2a	144c	146bc	5.33ab	5.47a
CV	5.01		0.64		8.38	
Lsd (0.05)	16.34		2.68		1.15	

Table 6. Grain yield and related traits of RYT - Development Photosensitive high yielding rice in T. Aman season at 2024.

Designation	Plant height (cm)	Growth duration (Day)	Grain yield (t/ha)
BR (Bio)8033-AC5-1-1-HR1	112.9	132	4.31
BR (Bio)8033-AC5-1-1-HR2	115.5	131	3.54
BR (Bio)8033-AC5-1-2-HR1	102.0	132	3.33
BR (Bio)8033-AC7-1-1-HR2	111.2	133	3.58
BR22(ck)	118.4	140	4.38
BR23(ck)	107.6	148	3.91
BRRi dhan46 (ck)	119.3	133	4.30
CV	6.2	3.93	7.75
LSD (0.05)	5.13	4.67	0.75

Table 7. Grain yield and related traits of RYT – Development of Short Duration (SD) high-yielding rice in T. Aman season at 2024

Designation	Plant height (cm)	Growth duration (Day)	Grain yield (t/ha)
BR (Bio)15086-AC114-8-1	107.7	118	3.03
BR (Bio)15086-AC119-16	107.9	120	2.96
BR (Bio)15086-AC120-18	110	121	2.71
BRRi dhan71(CK)	109.5	121	4.31
BRRi dhan75(CK)	103.9	123	4.49
CV	5.41	2.16	6.56
LSD (0.05)	7.84	5.99	0.54

Table 8. Grain yield and related traits of RYT - development of premium quality rice (PQR) (Rangpur) in T. Aman season 2024.

Designation	Plant height (cm)	Growth duration (Day)	Grain yield (t/ha)
BRrang55-RGA-40-1-1-1	98.6	118	2.90
BRrang55-RGA-14-2-1-2	0	0	0
BRrang35-5-5-1-1-1	99.8	116	3.30
BRrang35-7-2-2-2-1	102.7	123	3.55
BRRi dhan70(ck)	142.3	125	4.19
BRRi dhan75(ck)	100.6	115	3.80
CV	8.31	5.72	5.77
LSD (0.05)	4.91	4.90	0.42

Table 9. Grain yield and related traits of RYT - Fine grains type rice (Katari Type) in T. Aman season at 2024.

Designation	Plant height (cm)	Growth duration (Day)	Grain yield (t/ha)
BRH9-3-14-2B	98.3	116	3.42
BR10247-14-18-4	101.5	111	3.65
BR10247-4-7-4B	102.1	113	3.53
IR12A177	107.2	118	3.86
BRRi dhan87	119.6	132	5.09
CV	3.18	2.95	7.46
LSD (0.05)	7.72	8.02	0.47

Table 10. Grain yield and related traits of RYT - Development of antioxidant rice in T. Aman season in 2024.

Designation	Plant height (cm)	Growth duration (Day)	Grain yield (t/ha)
BR12839-4R-106	109.2	137	3.38
BR12839-4R-34-1	105.1	136	3.41
BR12839-4R-76	97.1	123	2.66
BR12839-4R-137	99.6	125	3.99
BR12839-4R-86-1	108	135	3.49
BR12839-4R-90-1	100.7	129	2.89
BR12839-4R-72	0	0	0.00
BRR1 dhan87	113.5	130	4.37
BRR1 dhan49	100.9	134	4.83
CV	6.7	4.99	6.91
LSD (0.05)	2.11	4.44	0.54

Table 11. Grain yield and related traits of RYT- Salt-tolerant rice (STR-1) in the T. Aman season in 2024.

Designation	Plant height (cm)	Growth duration (Day)	Grain yield (t/ha)
BR12462-4R-227	118.8	146	4.725
BR12459-4R-283	93	154	3.243
BR12459-4R-40	103.2	144	3.947
BR12459-4R-113	123.4	142	3.083
BR12459-4R-37	105.6	144	4.226
BR12459-4R-39	105.6	140	4.107
BR12468-4R-231	93.8	139	4.412
BR12460-4R-44	123	143	5.057
BR12471-4R-98	117.2	136	3.363
BR137711-4R-190	119.8	143	3.167
BR12468-4R-337	109.6	143	2.891
BR12459-4R-33	89.8	155	3.496
BR12459-4R-16	107.8	143	3.586
BR12461-4R-51	124.2	142	4.873
BR12459-4R-286	120.6	137	2.977
BR12459-4R-80	106.2	151	3.681
BR12459-4R-172	134	140	3.113
BR12459-4R-265	134.4	140	3.117
BR12459-4R-54	103	144	4.07
BR12465-4R-321	110.8	143	4.714
BR12460-4R-102	125.8	144	3.75
BR13122-4R-46	116	137	3.263
BR12459-4R-140	124	144	4.709
BRR1 dhan73	118.8	138	3.444
BRR1 dhan87	125	144	5.193
CV	13.3	2.46	11.94
LSD (0.05)	5.4	2.01	5.48

Table 12. Grain yield and related traits of RYT- salt tolerant rice (STR-3) in T. Aman season in 2024.

Designation	Plant height (cm)	Growth duration (Day)	Grain yield (t/ha)
BR12465-4R-61	114.6	149	5.70
BR12465-4R-132	111.8	147	4.94
BR12465-4R-26	103	144	4.41
BR12465-4R-100	120	140	5.06
BR12465-4R-130	105.8	159	4.12
BR12465-4R-231	110.2	144	5.98
BR12477-4R-186	131	144	4.96
BR12466-4R-167	116.4	146	5.48
BR12466-4R-317	96	138	3.58
BR12459-4R-277	116	148	6.24
BR12459-4R-113	117	144	5.17
BR12459-4R-241	Due to seed dormancy seed did not germinate		
BR12459-4R-117	132.6	151	5.03
BR12465-4R-223	102.6	149	5.05
BR12477-4R-371	113.2	140	3.39
BR23	130.8	157	4.12
BRR1 dhan30	124.6	144	5.66
CV	2.38	1.92	6.55
LSD (0.05)	7.36	7.40	0.85

Note: During the T. Aman season of 2024 in the RYT experiment, heavy, continuous rainfall occurred in the Gopalganj region. The research plot of BRR1 RS, Gopalganj is situated in a low-lying area, which caused the experimental land to be submerged in water for 3-4 days multiple times, leading to waterlogging. This also significantly

disrupted the application of fertilizers, pesticides, and insecticides. We regularly notify our authorities about this issue. On 25 October, 2024, Cyclone Dana hit the region, causing lodging of the rice plants and worsening the waterlogging. This might explain the research plot's low yield and common disease outbreaks.

Table 13. Grain yield and related traits of ALART for long duration blast-resistant rice (BRR-LD) genotypes during the Boro 2024-25 season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1=BR(Path)15855-BC2-3HR-23	113b	146a	6.6b
V2=BR(Path)15860-BC2-3HR-47	117a	146a	6.7b
V3= BRR1 dhan29 (ck)	109c	147a	8.4a
CV	0.60	0.42	7.05
Lsd (0.05)	2.21	1.18	1.28

Table 14. Grain yield and related traits of ALART for medium-duration blast-resistant rice (BRR-MD) genotypes during the Boro 2024-25 season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1=BR(Path)15855-BC3-2HR-5	109b	146a	8.2a
V2=BR(Path)15860-BC2-3HR-48	125a	147a	6.6a
V3= BRR1 dhan58 (Ck)	101c	146a	8.5a
CV	0.67	0.60	10.52
Lsd (0.05)	1.87	2.21	2.04

Table 15. Grain yield and related traits of ALART for short duration blast-resistant rice (BRR-SD) genotypes during the Boro 2024-25 season.

Genotypes	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1= BR (Path) 15641-3HR-15	106a	137a	8.8a
V2= BR (Path) 15641-3HR-45	103a	136a	9.6a
V3= BRRRI dhan88 (ck)	99b	138a	8.9a
CV	1.45	0.73	6.17
Lsd (0.05)	3.73	2.5	1.40

Table 16. Grain yield and related traits of ALART for medium duration antioxidant enriched Rice (AOER-MD) genotypes during the Boro 2024-25 season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1= BR12839-4R-157-2	119ab	147a	8.0a
V2= BR12839-4R-5-2	120a	144a	7.8a
V3= BRRRI dhan100 (ck)	111b	144a	9.0a
CV	2.52	0.89	6.73
Lsd(0.05)	7.38	3.23	1.39

Table 17. Grain yield and related traits of ALART for medium-duration favourable Boro rice (FBR-MD) genotypes during the Boro 2024-25 season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1=BR11894-5R-260	113a	142ab	8.3a
V2=BR12508-5R-5	105a	139c	8.9a
V3=BR12517-5R-57	107a	140bc	8.9a
V4= BRRRI dhan97 (Std. ck)	113a	142ab	8.8a
V5= BRRRI dhan102 (Std. ck)	108a	144a	8.2a
CV	3.52	0.75	5.03
Lsd(0.05)	10.33	2.86	1.16

Table 18. Grain yield and related traits of ALART for Short Duration Antioxidant Enriched Rice (AOER-SD) genotypes during the Boro 2024-25 season

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1=BR12839-4R-137	99a	135a	8.3a
V2= BRRRI dhan88 (Std ck)	99a	137a	8.8a
CV	2.61	0.95	7.87
Lsd(0.05)	5.85	2.92	1.52

Table 19. Grain yield and related traits of ALART for premium quality rice (PQR) genotypes during the Boro 2024-25 season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1=BR11359-4R-181	123b	143ab	5.3b
V2=BR11359-4R-279	130a	143ab	6.9ab
V3= BRRRI dhan104 (ck)	101c	144a	7.6a
V4= BRRRI dhan107 (ck)	118b	142b	7.8a
CV	1.75	0.50	9.64
Lsd(0.05)	5.38	1.84	1.74

Table 20. Grain yield and related traits of ALART for premium quality rice from pathology (PQR-PATH) genotypes during the Boro 2024-25 season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1= BRRI(Path)- Premium	108a	144a	8.5a
V2= BRRI dhan50 (ck)	99b	144a	7.1b
V3= BRRI dhan104 (ck)	105ab	143a	7.6ab
CV	2.98	0.52	7.42
Lsd _(0.05)	7.79	1.87	1.41

Table 21. Grain yield and associated traits of ALART for short duration bacterial blight and blast resistant rice (BB+Blast-SD) genotypes during the Boro 2024-25 season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1=BR(path)13802-BC3-54-12	115a	133bc	8.9ab
V2=BR(path)13802-BC3-73-13	110ab	131c	9.2a
V3=BR(path)13802-BC3-62-14	106b	135ab	9.7a
V4= BRRI dhan88 (ck)	98c	136a	8.2b
CV	2.08	0.53	4.21
Lsd _(0.05)	5.84	1.84	0.99

Table 22. Grain yield and related traits of ALART for favorable boro rice (FBR-SD) genotypes during the 2024-25 Boro season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1= BR12574-5R-52	116a	138a	6.9a
V2= BRRI dhan88 (Std. ck)	97b	137a	8.3b
CV	3.28	0.42	4.03
Lsd _(0.05)	7.91	1.31	0.69

Table 23. Grain yield and related traits of ALART for medium-duration salinity-tolerant Boro rice (STR-MD) genotypes during the Boro 2024-25 season.

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1=BR13106-4R-184	99b	135d	6.6a
V2= BR13113-4R-185	89d	135d	5.5ab
V3= BR13122-4R-136	111a	139c	5.1b
V4= BRRI dhan102 (ck)	94c	144a	6.2ab
V5= BRRI dhan99 (Std. ck)	94c	141b	5.6ab
CV	1.57	0.32	7.93
Lsd _(0.05)	4.10	1.20	1.23

Table 24. Grain yield and ancillary characters of ALART for Short Duration Salinity Tolerant Boro Rice (STR-SD) genotypes during the Boro 2024-25 season

Genotype	Plant height (cm)	Growth duration (day)	Grain yield (t/ha)
V1= BR13113-4R-63	101a	137b	5.06ab
V2=BR13113-4R-116	106a	135c	5.43ab
V3= BRRI dhan28 (ck)	103a	138a	5.96a
V4= BRRI dhan88 (ck)	93b	136b	4.26b
CV	2.11	0.21	10.54
Lsd _(0.05)	5.54	0.75	1.42

Table 25. Phenotypic yield and yield contributing characters of favorable Boro rice (FBR-Barishal) of Regional Yield Trail (RYT), Boro 2024-25.

Designation	PH	ET	GD	Yield
BRBaNGR324-1	95	11.33	137	8.84
BRBaNGR1256-1	97	11.67	137	8.17
BRBaNGR350-2	97	9.5	138	7.39
BRBaNGR736-1	102	10.5	144	8.53
BRBaNGR994-1	101	11	142	9.14
BRRi dhan74 (ck)	94	13	139	8.42
BRRi dhan102 (ck)	109	12.5	144	8.45
CV	1.67	7.23	0.54	10.40
LSD _(0.05)	6.90	-	3.15	-

Table 26. Phenotypic yield and yield-contributing traits in the development of salt-tolerant rice (STR-1) during the regional yield trial (RYT) for Boro 2024-25.

Designation	PH	ET	GD	Y
BR13205-4R-190	92.5	9.0	140	8.12
BR12274-4R-193	104	9.5	136	7.69
BRI11276-4R-139	125	10.5	146	7.46
BRI13201-4R-15	101.5	10.5	140	8.70
BR11276-4R-196	114.5	14	141	8.02
BR13201-4R-298	99.5	8.5	138	9.22
BR13201-4R-225	97.5	10.5	139	8.61
BR11276-4R-104	125.5	9.5	147	7.24
BRI11720-4R-89	131.5	8.5	142	8.46
BR12650-4R-77	117.5	10.5	139	8.11
BR12265-4R-71	115	14.5	139	7.54
BR13207-4R-28	112.5	9	142	9.17
BR13201-4R-268	100	10	140	8.99
BR13201-4R-299	97	11.5	136	7.74
BR11718-4R-92	127	10.5	146	7.70
BR13201-4R-219	103	10.5	139	8.03
BR12640-4R-250	116	9.5	145	7.33
BR11276-4R-67	118	8.5	147	6.82
BR12661-4R-33	104.5	10.5	139	7.27
BR13201-4R-103	101.5	9	140	7.87
BRRi dhan67 (Rck)	106	11.5	131	8.00
BRRi dhan89 (Sck)	96.5	10	140	7.25
BRRi dhan99 (Rck)	101	13	147	8.11
CV	4.38	11.84	0.73	10.33
LSD _(0.05)	8.78	5.78	4.2	-

Table 27. Phenotypic yield and yield-contributing traits of regional yield trial (RYT) for developing salt-tolerant rice (STR-2) during Boro 2024-25.

Designation	PH	ET	GD	GY
BR13197-4R-24	107	14.5	138	10.12
BR13201-4R-30	102	11.0	136	9.62
BR13201-4R-249	108.5	12.0	141	9.97
BR12650-4R-55	110.5	12.0	131	9.99
BR13201-4R-196	102	10.0	134	9.99
BR12658-4R-255	114	12.5	134	10.15
BR13206-4R-50	104	9.5	135	9.08
BR12274-4R-310	108	11.5	143	8.92
BR11276-4R-150	98.5	10.5	145	8.85
BR11718-4R-110	100.5	12.0	137	8.00
BR11718-4R-125	129	12.5	143	9.96
BR12274-4R-255	101.5	10.5	139	9.96
BR13113-4R-121	99.5	12.0	137	10.32
BR13106-4R-168	90	13.0	137	9.73
BR11718-4R-230	110	11.0	143	10.06
BRR1 dhan67 (Rck)	107	14.5	134	10.47
BRR1 dhan89 (Sck)	109	12.5	141	10.87
BRR1 dhan99 (Rck)	101.5	14.0	142	10.65
CV	4.18	10.94	0.46	7.31
LSD _(0.05)	5.73	5.73	2.56	-

Table 28. Phenotypic yield and yield-contributing traits of the regional yield trail (RYT) for Basmati Rice (Rangpur), Boro 2024-25.

Designation	PH	ET	GD	GY
BRrang55-RGA-40-1-1-1	112.33	15.67	143	8.91
BRrang55-RGA-14-2-1-2	122.00	15.67	144	6.89
BRrang55-RGA-14-2-1-5	122.67	16.33	142	7.15
BRrang55-RGA-44-5-1-1	126.00	14.67	142	6.94
BRR1 dhan104 (ck)	102.33	17.00	143	8.55
CV	3.36	10.48	0.60	6.98
LSD _(0.05)	2.30	-	-	2.30

Table 29. List of the back crosses made during Aman 2024

Genotype	No. of BC ₁ F ₁ Seed
BRR1 dhan103/Laksmi digha// BRR1 dhan103	23
BRR1 dhan103/Sada Jabra// BRR1 dhan103	14
BRR1 dhan52/ Laksmi digha/ BRR1 dhan52	17
BRR1 dhan79/ Laksmi digha/ BRR1 dhan79	09
BRR1 dhan79/ Bashiraj/ BRR1 dhan79	11

Genotype	No. of BC ₁ F ₁ Seed
BRRi dhan79/ Sada Jabra/ BRRi dhan79	10
BRRi dhan79/ Bashiraj/ BRRi dhan79	09
BRRi dhan52/ Hejoldigha/ BRRi dhan52	15
BRRi dhan76/ Bashiraj/ BRRi Dhan76	18
BRRi dhan87/ Chamara/ BRRi Dhan87	21
BRRi dhan79/ Kartiksail/ BRRi Dhan79	10
BR10/ Devmoni/ BR10	22
BRRi dhan30/ Debmoni/ BRRi dhan30	18
BRRi dhan79/Jabra/ BRRi dhan79	23
Total	220

Table 30. Number of demonstrations in different districts during Aus 2024, T. Aman 2024, and Boro 2024-25 in the Gopalganj region.

Districts	GOB	PARTNER project	Hybrid project	LSTD project	Total
Gopalganj	180	411	39	101	731
Bagerhat	144	159	21	48	372
Narial	106	-	-	21	127
Total	1236				

Table 31. Source of harvest and number of field days in different rice varieties for the 2024-25 reporting year in Gopalganj region.

Found	Number of field Day	Number of Participants
GoB	10	650
PARTNER	3	250
LSTD	7	420
Hybrid	6	360
Total	26	1680

Table 32. Farmers Training on Modern Rice Cultivation and Blast Disease Management in Various Regions During 2024-25.

Upazila	No. of trainees				Total Trainees	
	SAAOs		Farmer			
	M	F	M	F		
GoB fund and PARTNER project, BRRi RS Gopalganj						
Gopalganj		-	-	240	150	390
Bagerhat		-	-	90	30	120
Narail		-	-	65	25	90
Total				395	205	600

Table 33. Breeder seed and TLS seed production in T. Aus 2024 and T. Aman 2024 seasons at BRRI RS, Gopalganj.

Variety	Breeder seed (kg)	TLS (kg)	Variety	Breeder seed (kg)	TLS (kg)
T. Aus, 2023			T. Aman, 2023		
BRRI dhan98	-	150	BRRI dhan76	-	30
			BRRI dhan87	1700	200
			BRRI dhan103	1000	250
Total		360	Total	2700	480

Table 34: Breeder seed and TLS seed production at BRRI RS, Gopalganj during the 2024-25 reporting year.

Variety	Breeder seed (kg)	TLS (kg)
Boro 2023-24		
BRRI dhan67	-	120
BRRI dhan74	1250	300
BRRI dhan92	-	425
BRRI dhan97	-	60
BRRI dhan99	-	225
BRRI dhan100	-	90
BRRI dhan101	-	715
BRRI dhan102	1250	1330
BRRI dhan104	-	445
BRRI dhan105	-	325
BRRI dhan107	-	470
BRRI dhan108	-	1590
Total	2500	6095

Table 35. F1 seed production of BRRI hybrid dhan8 in the Boro 2024-25 season.

Hybrid	Plant height (cm)		50% flowering (Day)		Plot area (Acre)	Seed yield (kg)	Seed yield (t ha ⁻¹)
	A line	R line	A line	R line			
BRRI99A / BRRI37R	115	125	120	125	1.0	925	2.28

