



WORKSHOP REPORT

National Level Result Sharing and Planning of Head-to-head Adaptive Trials in Bangladesh

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Lead Partners: International Rice Research Institute and Bangladesh Rice Research Institute

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This Workshop Report has been prepared the first step towards disseminating the findings from the HHATs conducted from 2019 to 2021 and discussing the potential gains with the stakeholders and has not been peer reviewed. Any opinions stated herein are those of the author(s) and do not necessarily reflect the policies or opinions of IRRI, donor agencies, or partners.

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EXECUTIVE SUMMARY



Climatic aberrations are a threat to many ecologies and crops across the globe. Bangladesh is one of the many countries facing extreme weather threats. Among the prominent crops in the country, rice is considered the most important crop because of its contribution to the country's food security. International Rice Research Institute (IRRI), Bangladesh Rice Research Institute (BRRI), and National Agricultural Research and Extension System (NARES) collaborators have developed and released several promising rice varieties to address the challenge of climate-induced stresses. However, such potential varieties have not been able to replace the prevailing old and popular mega varieties to the desired extent. Some of the key factors responsible for the poor varietal replacement rates are poor awareness of farmers, improper positioning of the varieties, i.e., failure to target the right varieties in the right geographies, and lack of supportive policies. Thus, emphasis on varietal introduction, positioning, and lifecycle management can address the issue to a large extent.

Head-to-Head Adaptive Trial (HHAT) is a form of on-farm trial (OFT) and is a scientific and proven means to evaluate and compare the new and old or check varieties in farmers' fields. In an HHAT both the varieties are cultivated adjacent to each other in the same plot. Since the crop management practices remain the same, HHAT demonstrates the genetic yield gain potential of the new varieties over the popular old varieties. Such quick comparative assessments not only help in the scaling of the promising varieties but also provide feedback to the breeders on varietal performances and choices.

The evaluation of varieties through HHAT is a scientific process and requires constant support and handholding as well as monitoring. It involves arduous data collection on a large scale through trained professionals. Thus, such trials are implemented through inspired Non-Governmental Organizations (NGOs), Agriculture Universities, and the Department of Agricultural Extension (DAE). The selection of varieties for HHAT, both new and old, is a strategic process and includes steps like market segmentation, product nomination, segmentation of the nominations, finalization of the market segments, and selection of benchmark and farmers' check varieties.

During the period 2019 to 2021, several HHATs were conducted in different locations in the diverse agro-ecological zones (AEZs) by BRRI and IRRI. The trials generated adequate quantitative evidence for the comparison of newly developed varieties, benchmark varieties, and popular varieties. Farmers' feedback on the varieties, as well as that of the stakeholders, was an important part of the trials. Demonstration of visible impacts created knowledge and demand for better performing varieties.

A workshop was jointly planned by BRRI and IRRI to present and discuss the findings from the HHATs. The workshop was organized in Gazipur, Bangladesh on 21 April 2022. The results of the trials were presented by Dr. Md. Humayun Kabir of BRRI and Dr. Swati Nayak of IRRI. They discussed the performance of the varieties during the transplanted Aman or T. Aman (wet) and Boro (dry) season HHATs between 2019 to 2021. While Dr. Humayun shared the findings gathered by BRRI, Dr. Swati discussed the learnings from the trials by IRRI.

The trials helped identify the rice varieties with the best yield potential in the selected segments. Three rice varieties, i.e., BRRI dhan88, BRRI dhan92, and BRRI dhan96, were found to be the best yield performers for the Boro season. For the transplanted Aman season and flash floods-prone regions of Bangladesh, the IR13F441 line and BRRI dhan79 were identified as the best performers. Varieties like BRRI dhan93, BRRI dhan94 and BRRI dhan95 were promising varieties for northern Bangladesh. Overall, considering country-wide performance, BRRI dhan87 was the best. The trials also exposed the need to replace the variety BRRI dhan28 which not only had very low yields but also was susceptible to pests. Also, BRRI dhan29, though comparable to BRRI dhan 89 in terms of yield, was susceptible to neck blast disease.

The workshop was crucial for the dissemination of information on the promising varieties identified for different target segments or environments. Several suggestions emerged on the possible use of such trials in increasing rice production. Some of the key recommendations were to strengthen linkages between the stakeholders, especially those in the public sector, e.g., revisiting the roles of Bangladesh Agricultural Development Corporation (BADC) and DAE; use the information generated through the HHATs to aid adoption decisions, and map national rice production targets; adopt management practices to control rice blast disease until resistant varieties are made available; include the Aus season as well for HHATs, and recommend varieties for 2022-23 trials.

A 'panel test' was suggested to gather data on factors that influence the adoption of specific varieties in different locations or environments. The development of 'product profiles' for the varieties was recommended to boost the adoption of varieties with superior profiles. It was also advised to plan 'location-specific mapping' to find out suitable 'domains' for all varieties. The propositions were appreciated and considered for planning the next phase of HHATs, i.e., transplanted Aman rice in 2022-23.

ABBREVIATIONS AND ACRONYMS

AEZ	Agro-Ecological Zones
AGGRi	Accelerated Genetic Gain in Rice (Alliance)
ARD	Adaptive Research Division
BADC	Bangladesh Agricultural Development Corporation
BAU	Bangladesh Agricultural University
BINA	Bangladesh Institute of Nuclear Agriculture
BMGF	Bill and Melinda Gates Foundation
BRRI	Bangladesh Rice Research Institute
CBO	Community Based Organization
CE	Coastal Ecosystem
CSO	Chief Scientific Officer
DAE	Department of Agricultural Extension
FFS	Flash Flood Submergence
HHAT	Head-to-Head Adaptive Trial
IBO	IRRI Bangladesh Office
IRRI	International Rice Research Institute
KVK	Krishi Vigyan Kendra
LC	Local check
LD	Long duration
MoA	Ministry of Agriculture
NARES	National Agricultural Research and Extension System
NARS	National Agricultural Research System
NGO	Non-Governmental Organization
OFT	On-Farm Trials
PSO	Principal Scientific Officer
RDA	Rural Development Academy
RLR	Rainfed Lowland Rice
SCA	Seed Certification Agency
SD	Short duration
UNSDGs	United Nations Sustainable Development Goals
STRASA	Stress Tolerant Rice for Africa and South Asia
T. Aman	Transplanted Aman
TRB	Transforming Rice Breeding
USDA	United States Department of Agriculture

BANGLA WORDS

Aman	Wet season for rice
Aus/Aush	Pre-monsoon season for rice
Bigha	Local unit of land measurement (1 bigha = 0.33 acre approximately)
Boro	Dry season for rice
Chinigura	Local rice variety
Dhan	Rice
Dudkalam	Local rice variety
Haor	Wetland ecosystem in north-eastern Bangladesh
Kataribhog	Local rice variety
Sadamota	Local rice variety
Swarna	Indian rice variety

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INTRODUCTION

A large proportion of the population in developing countries is dependent on farming, both for food security and livelihood. Therefore, an increase in agricultural productivity is a key to attaining the United Nations Sustainable Development Goals (UNSDGs) of “No Poverty” (SDG 1) and “Zero Hunger” (SDG 2). Rice is the staple food in most of the developing countries in South Asia, and Bangladesh in particular. Rice constitutes the principal food component for around 135 million people in the country. It is cultivated on nearly 75% of the total cultivated area, and 80% of the total irrigated area¹. Around 13 million farm households in the country cultivate rice¹ to meet their nutritional and financial requirements. In Bangladesh, rice also has economic significance because of the many industries that are directly or indirectly dependent on it. Nearly half of the jobs in rural Bangladesh are derived from activities related to rice production, processing, trading, and associated activities¹.

Ironically, rice production is extremely susceptible to vagaries of climate, which Bangladesh witnesses every year. The rice growing environments in Bangladesh are very dissimilar, e.g., while the north-west highlands are drought-prone, the central part is flood affected and the southern areas are saline coastal belts. Bangladesh is divided into thirty major AEZs based on the differences in topography, hydrology, and climate. Hence, increased availability and adoption of improved and stress-tolerant varieties of rice are imperative for countries like Bangladesh.

BIRRI is the apex organization dealing with research and development work in rice production in Bangladesh. It was founded in 1970 to develop modern rice varieties that can adapt to the diverse environments in the country and augment national rice production. BIRRI is also an integral part of the National Agricultural Research System (NARS) of Bangladesh. The impact of the long collaboration between IRRI and Bangladesh is visible in terms of the giant leap in rice production from 10.6 million tonnes in 1970-71 to 34.6 million tonnes in 2020-21. Today, Bangladesh is the fourth largest rice producer in the world.

IRRI has been instrumental in the development and delivery of improved rice varieties in South Asia and Africa, including zinc bio-fortified rice for the “Good Health and Well-Being” of the population (SDG 3). Through the Accelerated Genetic Gain in Rice (AGGRi) alliance, IRRI continues to address the issues of climate change in partnership with the NARES institutions. It focuses on increasing rice yields and improving livelihoods in stress-prone areas through active collaboration with government and non-government bodies. In doing so, it also addresses SDG 13 (“Climate Action”) and SDG 17 (“Partnerships for the Goals”). The AGGRi alliance links the “Transforming Rice Breeding (TRB)” project, which aims to

modernize IRRI's rice breeding programme, to the "Stress Tolerant Rice for Africa and South Asia (STRASA)" project through collaboration in areas of germplasm development, seed systems activities and varietal trials. Both the projects are supported by the Bill and Melinda Gates Foundation (BMGF) and are intended to expand IRRI's varietal testing network into a streamlined, structured, and globally aligned "community of practice" in the area of rice breeding. It also aims to empower women by ensuring their participation in the trials and the rice value chain, thereby contributing towards "Gender Equality" (SDG 5). Under the TRB project, HHATs were conducted across Bangladesh targeting specific ecologies. The trials tested and compared varieties nominated by NARES partner institutions. The trials generated robust data that could facilitate product advancement and positioning in targeted rice belts.

Building on the achievements of the TRB and STRASA projects, the IRRI Bangladesh office (IBO) launched HHATs on a large scale in 2018. HHATs are conducted in close collaboration with BRRI. The AGGRi team in Bangladesh provides technical support for conducting the trials as per IRRI-BRRI protocols, including coordination, field supervision, and need-based field assistance.

ABOUT HEAD-TO-HEAD ADAPTIVE TRIALS (HHAT)

HHAT is a form of on-farm trial in which the test variety and farmer's variety are grown side by side, i.e., in adjacent plots. The ideal plot size is 0.25 to 0.50 acres. The plots are similar in land and soil type and similar crop management practices are followed in both plots. The sources and types of seeds are also the same. Therefore, any difference in yield is attributed to the varieties.

IRRI and BRRI together conducted several HHATs in different locations of Bangladesh during the period 2019-2021. In the HHATs several newly developed varieties, benchmark varieties, and farmer-grown varieties were planted in adjacent plots to closely compare their performance. The objective was to generate reliable quantitative data that could aid region-specific varietal selection. As part of the HHAT process, feedback was also gathered from multiple stakeholders which included farmers, extension personnel, and all those involved in the trials. Thus, the information generated was also expected to help relate breeding decisions to the demands of farmers, consumers and processors which are often location specific. Thus, HHATs are supposed to help in the scaling of location-appropriate varieties for the benefit of the farmers. Rice cultivation in Bangladesh is divided into three seasons, viz. Aus, Aman and Boro. Through the HHATs in Bangladesh, the best-performing rice varieties were identified for the Aman (wet) and Boro (dry) seasons. Adoption of such varieties on a large scale can help increase the yield and consequentially profit.



WORKSHOP OBJECTIVE AND PARTICIPATION

Dissemination of findings is a critical component of the research process. It is important that stakeholders learn from the findings of the HHATs and that future extension activities are efficient enough to support the scaling of promising genotypes. So, a day-long workshop was jointly planned by IBO and the TRB-BRRI Project. The workshop on 'Result Sharing and Planning of Head-to-Head Adaptive Trial' was organized on 21 April 2022 at the BRRI Training Complex in Gazipur, Bangladesh.

The workshop was attended by a total of 114 participants who belonged to unique backgrounds, viz. public sector institutions, private organizations, NGOs, Community-based Organizations (CBOs), farmers' representatives, seed breeders, seed dealers, agriculture extension officers, scientists, researchers, and IRRI and BRRI officials. The details of the core organizing team members and the participants are specified in appendix 1 and appendix 2, respectively.

The workshop was chaired by Dr. Mohammad Khalequzzaman, Director (Research), BRRI, while Dr. Md. Shahjahan Kabir, Director General of BRRI presided over as the Chief Guest. Dr. Md. Abu Bakr Siddique, Director (Administration & Common Service), BRRI, and Dr.

Mohammad Rafiqul Islam, Project Lead and Country Breeding Lead, were present as Special Guests. Dr. KM Iftekharuddaula, Chief Scientific Officer (CSO) and Head-Plant Breeding Division, BRRI, welcomed all participants to the programme and briefly mentioned the background of the workshop. Mr. Bulbul Ahmed, Scientific Officer (TRB), BRRI, introduced all the participants to the audience.

Two papers were presented during the workshop and the findings of the trials were discussed. Dr. Md. Humayun Kabir, CSO, and Head-Adaptive Research Division (ARD), BRRI, presented the paper on 'Head-to-Head Adaptive Trial of T. Aman and Boro Seasons, 2019 to 2021' sharing the experience of BRRI. Dr. Swati Nayak, Scientist, and South Asia Lead - Seed Systems and Product Management, IRRI-India, presented the paper on 'Head-to-Head Adaptive Trial of T. Aman and Boro Seasons, 2019 to 2021' sharing IRRI's experience. The program agenda of the workshop is provided in appendix 3.

Summary of the Presentations

The session comprised of the following two presentations:

- Presentation on 'Result sharing of Head-to-Head Adaptive Trials (HHATs) of T. Aman and Boro Seasons, 2019 to 2021' (BRRI Part) by Dr. Md. Humayun Kabir, CSO, and Head-ARD, BRRI.
- Presentation on 'Result sharing and Planning of Head-to-Head Adaptive Trials (HHATs) of T. Aman and Boro Seasons, 2019 to 2021' (IRRI Part) by Dr. Swati Nayak, Scientist, and South Asia Lead - Seed System and Product Management, IRRI-India.

Result Sharing of HHATs by Dr. Md. Humayun Kabir (BRRI)

Dr. Kabir, in his presentation, mentioned that the HHATs are conducted with the aim to:

- Investigate the performance of newly released varieties compared to popular old mega varieties through generating sufficient quantitative data
- Identify promising varieties in the target environment(s) based on their specific and general adaptability
- Collect feedback about the varieties from farmers and extension personnel
- Generate demand for the newly released varieties in the target environment(s)

Dr. Humayun presented the findings for both Boro and Aman seasons' HHATs. A total of 200 HHATs were conducted and included 160 short-duration and 40 long-duration varieties. The HHATs were conducted across different AEZs, including those conducted by ARD-BRRI at seven regional stations of BRRI, 15 NGOs, and two seed companies. Dr. Kabir's complete presentation is provided in appendix 4.

Following are the findings from the HHATs as shared with the stakeholders by Dr. Humayun:

a) HHATs of Boro rice:

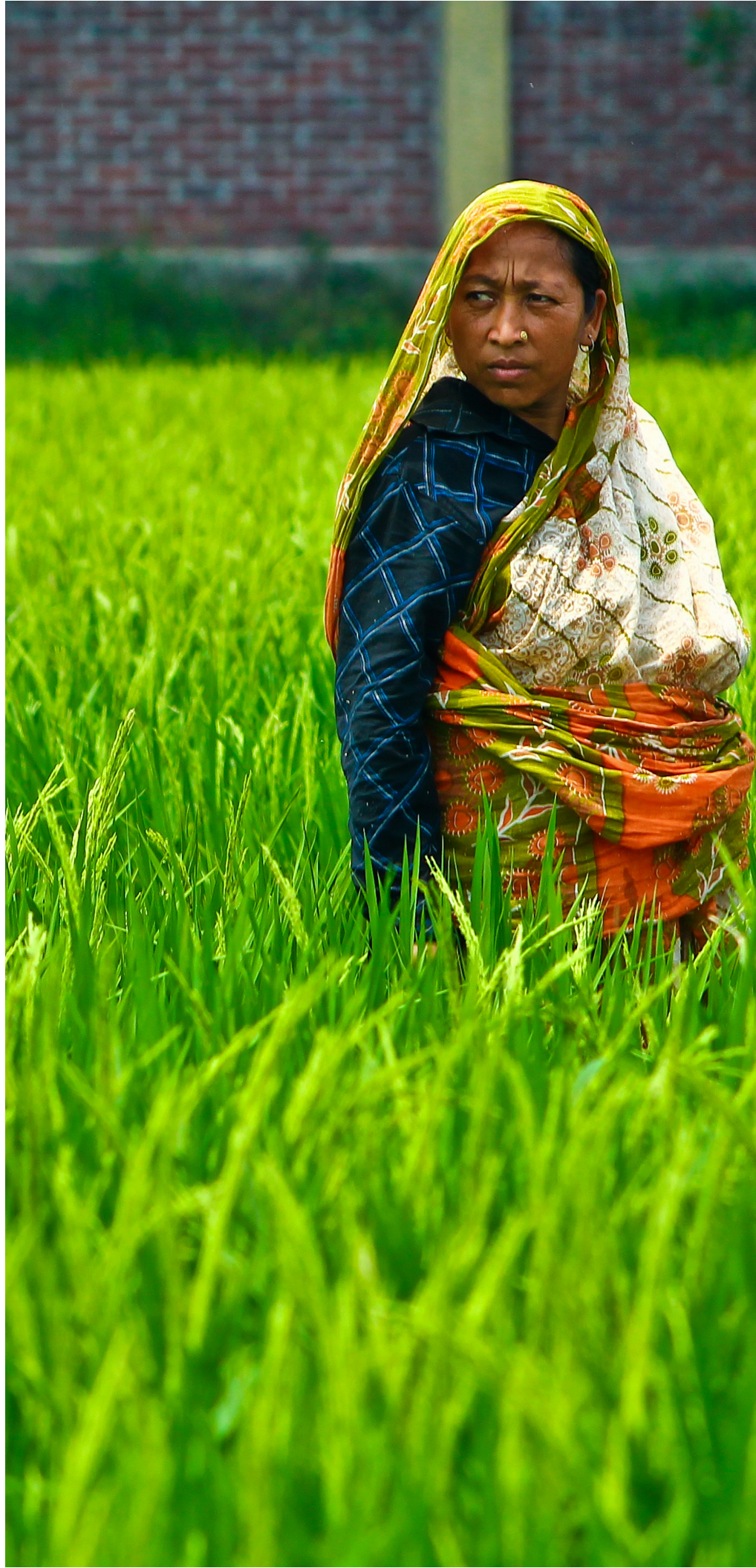
- BRRI dhan28 has the lowest yield (mean yield of 5.49 tha⁻¹ in 2019, 5.60 tha⁻¹ in 2020, and 6.00 tha⁻¹ in 2021) and the highest incidence of pests. It was therefore proposed for immediate replacement.
- BRRI dhan29 (mean yield of 6.91 tha⁻¹ in 2021) and BRRI dhan89 (mean yield of 7.01 tha⁻¹ in 2021) have competitive yields, but in some cases, BRRI dhan89 had a better yield as BRRI dhan29 was infested with neck blast.
- BRRI dhan58 (mean yield of 6.78 tha⁻¹ in 2021) can be cultivated across Bangladesh, except in the eastern parts.
- BRRI dhan67 (mean yield of 6.05 tha⁻¹ in 2021) performed remarkably well across the country.
- BRRI dhan74 (mean yield of 7.18 tha⁻¹ in 2021) is recommended only in those areas where farmers prefer bold grains.

- BRRRI dhan81 (mean yield of 6.32 tha⁻¹ in 2021) was susceptible to blast disease in most of the locations except southwest and northern regions where it can be cultivated.
- BRRRI dhan84 (mean yield of 6.78 tha⁻¹ in 2021) is a shorter duration variety suitable for medium to high land (with no water logging) and matures 2-3 days earlier than BRRRI dhan28.
- BRRRI dhan86 was extremely infested with diseases (Sheath blight, Bacterial blight, and Neck blast) and insects (Stem borer and Leaf folder).
- BRRRI dhan88 (mean yield of 6.50 tha⁻¹ in 2020) has the highest yield among all varieties.
- BRRRI dhan92 (mean yield of 7.26 tha⁻¹ in 2021) has a yield advantage over BRRRI dhan89 (mean yield of 7.01 tha⁻¹ in 2021) and all other tested varieties, but farmers dislike it due to its long duration.

b) HHATs of T. Aman Rice:

Four ecosystems were chosen for HHATs of T. Aman – Rainfed Lowland Rice (RLR) ecosystem with Short Duration (SD) rice variety, RLR ecosystem with Long Duration (LD) rice variety, Coastal ecosystem (CE), and Flash Flood Submergence (FFS) rice ecosystem. Following findings from the HHATs were shared in the workshop.

- BRRRI dhan49 has a good yield across the country but was infested with False smut disease.
- BRRRI dhan51 (mean yield of 4.37 tha⁻¹ in 2020) has a lower yield than BRRRI dhan52 (mean yield of 4.77 tha⁻¹ in 2020) and was highly infested with diseases (Sheath blight, Bacterial blight, and Neck blast) and insect (Stem borer).
- BRRRI dhan52 (mean yield of 4.77 tha⁻¹ in 2020) has a yield advantage with flash flood tolerance.
- BRRRI dhan66 showed drought tolerance but has low yields.
- BRRRI dhan70 has a lower yield because of higher sterility but its tasty aromatic slender rice is preferred by elites.
- BRRRI dhan71 (mean yield of 5.19 tha⁻¹ in 2020) performed exceptionally in both drought and favorable environments.
- BRRRI dhan72 (mean yield of 5.43 t ha⁻¹ in 2019) has bold grains with good yield and could be promoted for Barisal, Barguna, and Rangpur regions.
- BRRRI dhan73 (mean yield of 4.55 t ha⁻¹ in 2019) is saline tolerant with good yield but lodged during the cyclone.
- BRRRI dhan75 (mean yield of 4.91 t ha⁻¹ in 2019) is a short-duration variety with slightly aromatic long slender grain and high yield, suitable for rainfed lowlands in the country.
- BRRRI dhan76 has a yield advantage over BRRRI dhan77 and both have a yield advantage over local varieties e.g., Dudkalam and Sadamota.



- BRRRI dhan79 (mean yield of 5.16 tha⁻¹ in 2019) has a better yield with flash flood tolerance but was infested with False smut disease in some areas.
- BRRRI dhan80 (mean yield of 4.70 tha⁻¹ in 2019) has a yield advantage and is suitable for high and medium-high lands.
- BRRRI dhan87 (mean yield of 6.02 tha⁻¹ in 2019) is preferred by farmers due to its higher yield, straw yield, and long slender grains.
- BRRRI dhan93 (mean yield of 5.17 tha⁻¹ in 2020), BRRRI dhan94 (mean yield of 5.17 tha⁻¹ in 2020), and BRRRI dhan95 (mean yield of 5.11 tha⁻¹ in 2020) are alternatives to Indian Swarna and suitable for northern parts of Bangladesh.
- IR13F441 (mean yield of 4.40 tha⁻¹ in 2021) is suitable for flash flood-prone areas, but the number of trials so far is not adequate. So, it is recommended for trials in the next season (T. Aman).

Result Sharing of HHATs by Dr. Swati Nayak (IRRI)

Dr. Swati Nayak shared IRRI's experiences of the Head-to-Head Adaptive Trials (HHATs) conducted with the collaboration between IRRI and BRRRI. She mentioned that the trials were planned with the broad objectives of accelerating the genetic gain in rice in the farmers' field, and ensuring that old varieties are replaced by new varieties systematically. She outlined the need for research in varietal development and an organized approach to achieving varietal replacement. Several potential varieties with value-added traits emerge from the trials. The farmers must be aware of such traits and manage them to realize visible gains. So, the aim is to create opportunities for farmers to see for themselves and decide on the adoption of appropriate varieties.

Dr. Nayak mentioned that there are many stakeholders and organizations in Bangladesh who work closely with farmers in collaborative programmes, like NGOs, CBOs, women-based organizations, credit-based institutions/cooperatives, etc. and thus, it is important to take an integrated and systematic approach to position a new variety in the right geographic locations. Among the systematic approaches, one of the most important activities is on-farm validation, and therefore, HHATs are important. Many countries have taken up similar activities while the underlying objective remains the same, which is to validate the potential of new varieties in farmer-managed conditions and assess

their actual performance and compare them with the prevalent or benchmark varieties. Several innovative demonstrations are being designed and conducted in this direction. Another significant effort is to engage with multiple stakeholders to ensure that the new products that would replace the old ones are available in the seed chain to complete a full cycle from supplier to producer.

Dr. Swati Nayak stated that the workshop is the first step towards disseminating the findings from the HHATs conducted from 2019 to 2021 and discussing the potential gains with the stakeholders. During the presentation she briefly explained why varietal and seed replacement rates are low, the key interventions to tackle such challenges, and an explanation of the trials. While presenting the findings, Dr. Nayak explained that adoption is a complex process and yield is not the only factor behind adoption decisions. Other factors like aroma, grain quality, and cooking quality also influence farmers' decisions in varietal selection. Among the shorter-duration varieties, BRRRI dhan71 topped the charts. In Aman 2021, BRRRI dhan93, BRRRI dhan94 and BRRRI dhan95 showed superior performance compared to farmers' local check varieties. Dr. Nayak's presentation is provided in appendix 5.

Dr. Swati Nayak presented the following findings from the HHATs conducted in four agro-ecosystems in T. Aman and Boro Seasons from 2019 to 2022.

a) Aman 2019-21

- Rainfed Lowland Rice-Short duration (RLR-SD ecosystem): BRRRI dhan71, Binadhan-17 and Binadhan-22 are the short duration varieties with the highest yield potential and can replace old varieties like Binadhan-7, BRRRI dhan39, BRRRI dhan33.
- Rainfed Lowland Rice-Long duration (RLR-LD ecosystem): BRRRI dhan94, BRRRI dhan79 and BRRRI dhan87 are the long-duration varieties with the highest yield potential and can replace old varieties like Swarna, BR 11
- FFS ecosystem: BRRRI dhan51 and BRRRI dhan79 are found to be superior to farmers' varieties like BR11 in the FFS ecosystems (Kurigram, Gaibandha, Rangpur, Sirajgonj, Sylhet, Netrokona, Jamalpur)
- Coastal Ecosystem (CE): No recommendations yet and confirmatory trials will be continued.

b) Boro 2019-2022

- BRRRI dhan88, BRRRI dhan81 and BRRRI dhan96 are the short-duration varieties with the highest yield potential and can replace the mega old mega variety BRRRI dhan28.
- Though BAU dhan3 showed the highest yield potential the trials started only during Boro 2020-21. Therefore, confirmatory trials will be continued.
- In hill ecosystems, farmers prefer BRRRI dhan88 and BRRRI dhan96.
- Among long-duration varieties, BRRRI dhan92 and BRRRI dhan89 showed the highest yield advantage over the mega variety BRRRI dhan29 across all the divisions.

DELIBERATION FROM THE GROUP

After the presentations, the open discussion session was anchored by Dr. Md. Rafiqul Islam, IRRI-Bangladesh. He thanked the paper presenters and opened the floor to questions and discussion.

Dr. Biswajit Karmakar, PSO & Head, BRRRI Regional Station, Sonagazi: Dr. Biswajit enquired about the reason for the non-consideration of BRRRI dhan75 for the Aman season trials even though it performed well like BRRRI dhan71. He also requested to consider BRRRI dhan74 for the upcoming trials as it performed well too. He wished to learn more about BAU dhan3 which was new to that area. He also wanted to know the reason for the selection of particular ecosystems for the trials instead of specific locations as specific location-based trials could be more significant and relevant. In response to Mr. Karmakar's queries, Dr. Swati Nayak stated that the yield results of BRRRI dhan75 were not encouraging enough for its nomination to the selection pool. However, it would be considered in the next batch of trials. She mentioned the lack of enough information on BAU dhan3 and its traits, i.e., aroma, cooking qualities, etc. The yield performance of BAU dhan3 was good so far, and it would be considered for further study. Dr. Nayak requested other information about BAU dhan3, if any, from the field staff. She reiterated that yield performance is not always the ultimate deciding factor, other traits or performances are also considered when adopting new varieties. Concerning the selection of locations for HHATs, Dr. Nayak revealed that there are location and site-specific data as well, from the trials, which would be shared later and that would help in field-level decision-making. Dr. Md. Humayun Kabir also responded to the query on BRRRI dhan75 and cited that farmers prefer it as a short-duration promising variety and the same should be promoted.

Dr. Umme Shirajum Monira, Supreme Seed Company Ltd.: Dr. Monira emphasized that farmers' responses, after they adopt new varieties, are quite critical for seed companies. Sharing such information could be of great help to the companies. She also wanted to know about the pest susceptibility of the recommended varieties. Dr. Md. Humayun Kabir responded to the queries and suggestions and underlined that farmers' opinions were considered in the trials. BRRRI dhan28 is highly susceptible to blast disease, BRRRI dhan88 is moderately susceptible, whereas BRRRI dhan67 & BRRRI dhan74 are less affected by the disease. Also, a questionnaire was designed for farmers, to be used during the trials to collect their feedback on specific varieties. Information was also gathered during seed production from the 200 HHATs. The data are available and can be shared at a later stage.

Md. Rubel Mia, OFT Farmer, Sadar, Sunamganj: Mr. Mia shared his learnings and observations from the trials. He cultivates BRRRI dhan28 and 27 as early Boro rice because the early harvests help them avoid the damages from the severe flash floods in haor areas which completely inundate the fields. At the same time, he and other farmers in the region cultivate varieties like BRRRI dhan67, BRRRI dhan88, BRRRI dhan84 and BRRRI dhan96. However, BRRRI dhan96 has been the best performer, even better than BRRRI dhan88, as early harvest is possible.

Srimoti Gouri Rani, President, Khaddo Komorpur Nari Unnayan Sangatha, Sadullapur, Gaibandha: Srimoti Gouri Rani shared that out of the eight varieties cultivated in her area, a good yield was obtained from BRRI dhan74, and it was not infested by insects. Also, Binadhan-17 and BRRI dhan52 produced good crops.

Alama Begum, Community-Based Seed Production Groups: Alama Begum stressed the yield potential of BRRI dhan74 which gave the best yields as compared to BRRI dhan72, BRRI dhan78, and BRRI dhan84 that were cultivated along with it.

Rubel Mia, OFT Farmer, Sylhet: Mr. Mia recommended BRRI dhan88 for the Aman season because of its good yield. He also mentioned that both BRRI dhan80 and BRRI dhan87 didn't show any incidence of any pest.

Md. Haris Uddin, Seed Producer and Dealer: Mr. Uddin produced 8 MT seeds of BRRI dhan74 and 10 MT of BRRI dhan88 in 2021. He sold those in the Greater Barisal division including 30 Zillas and 48 Upazillas in Bangladesh. He recommended BRRI dhan74 as it produced a good yield in every location. He wants to produce seeds of BRRI dhan100 but has not been able to procure its seeds. He is keen to produce new varieties according to the market demand.

Md. Mamunur Rashid, Senior Coordinator, RDRS Bangladesh: According to Mr. Rashid, BRRI dhan71 and BRRI dhan74 performed well as short-duration varieties in northern parts of Bangladesh. BRRI dhan74 is well suited for the cropping pattern of Potato-Mustard-Rice. BRRI dhan51 and BRRI dhan52 can withstand one flash flood but not three to four, especially at the chars of Kurigram and Gaibandha. He also requested to conduct trials of Aus varieties.

Diponkar Roy, SHARP, Nilphamari: Mr. Roy shared that BRRI dhan81 is a good replacement for BRRI dhan28. It has less pest infestation and the grain is slender compared to BRRI dhan28. BRRI dhan93, BRRI dhan94 and BRRI dhan95 are also suitable substitutes for Swarna.

Dr. Md. Alamgir Hossain, CSO, and Head, BRRI Regional Station, Barishal: According to Dr. Hossain, BRRI dhan74 performed well in the first year of trials (2019), but the results of second-year trials were not promising, except for hilly locations. He also inquired about the non-inclusion of the variety in the HHATs. Dr. Hossain emphasized the need for informal discussions with farmers on different varieties. According to him, BRRI dhan29 is still a good variety but BRRI dhan89 and BRRI dhan92 are good alternatives to BRRI dhan29. However, accurate conclusions cannot be made based on trials in only one bigha of land. Therefore, trials should be conducted in larger plots for further validation. There is also a need to understand how BRRI dhan28 has prevailed for 30 years despite being susceptible to the blast disease.

Dr. Md. Rafiqul Islam, CSO & Head, BRRI Regional Station, Cumilla: Dr. Islam stated the need to validate the data of BRRI dhan74 which was one of the best yielders in 2019, but performed poorly in 2020, and moderately well in 2021. BRRI dhan72 is good for the coastal

regions but at the same time, it performs well in drought regions too. It also has an added advantage of less requirement of urea as the third top dressing is not required, leading to reduced costs.

Dr. M. Imtiaz Uddin, CSO, Bangladesh Institute of Nuclear Agriculture (BINA): Dr. Imtiaz expressed the need to understand the salinity patterns and the yield trends in salinity-prone areas, and suggested the need for sharing the trial data. Also, data on crop management needs to be included, as it is an influencing factor. He queried if the selection of Binadhan-24, a Boro season long-duration variety, was appropriate. He proposed to include Binadhan-11 in the trials in the flash flood regions.

Dr. Mahbubur Rahman, Deputy Manager (Seed Distribution), BADC: Dr. Rahman shared the statistics on seed production. BADC produced 10,000 tons of BRRI dhan58 as a replacement for BRRI dhan28 in 2019, but the millers didn't accept the produce and farmers faced losses. In 2021, BADC produced 65,000 tons of seeds of which 55,000 tons were of BRRI dhan28 and BRRI dhan29 and the remaining 10,000 tons were of other varieties. 65% of seeds of other varieties were unsold. So, should farmers be asked to replace BRRI dhan28? BR22, BR23, and BR11 are still the preferred varieties for Aman season and BADC can supply 25% of the total seed requirement. BR10 and BR11 perform well in the Khulna and Rangpur regions, respectively. The seed delivery system has failed to provide an alternative for the popular varieties, and joint research is required to explore suitable alternatives for the mega varieties. As BRRI dhan28 and BRRI dhan29 were affected by the blast diseases in the haor region, BRRI dhan67, BRRI dhan88 and BRRI dhan89 were suggested as replacements. In such cases, DAE should put in an advance request for the supply of the desired seeds as BADC produces seeds with the prior approval of the Seed Promotion Committee (SPC) of the Ministry of Agriculture (MoA). Dr. Md. Rafiqul Islam, Rice Breeder, IRRI-Bangladesh, responded to the comments and mentioned that the HHATs are conducted to address such issues such as validating the best varieties for a location or area. Several new potential varieties have been developed, but have not reached the farmers, either because of insufficient production or inefficient distribution. All such issues and gaps that are being identified through the HHATs can be addressed through planned efforts. BADC may consider such field-level issues while planning seed production.

Md. Saiful Islam, Deputy Director, DAE, Gazipur: Dr. Saiful pointed out that BRRI dhan74 is an emerging mega variety for the Boro season, and BRRI dhan88 is a promising variety as well. Both varieties need to be promoted as Zinc fortified rice. Also, the grain quality of BRRI dhan74 is better than BRRI dhan84. BRRI dhan28 is a short-duration mega variety, worryingly affected by the blast. Whether affected or not, the blast control method involves two sprays of the blast control chemicals – the first at the flowering stage and the second after one week. However, farmers do not spray the pesticide until the crop is affected by the disease. The growth duration of BRRI dhan28 and BRRI dhan88 are almost similar, so they can be alternated. A cropping pattern like the following should be promoted: SD Aman variety BRRI dhan75 – Potato – Binadhan-11/BR 17/BR 7 in Boro, or, SD Aman Variety – Mustard – Binadhan-7 in Boro otherwise known as the Kaliganj cropping pattern in Gazipur. At Kaliakoir, farmers follow the BRRI dhan75 – Mustard – BRRI dhan75 cropping pattern. He stated the need to promote a four-crops cropping pattern to increase food production.

Dr. Md. Fazlul Islam, PSO, and Head, BRRRI Regional Station, Rajshahi: Dr. Fazlul stated the need to replace the popular Indian variety Swarna with BRRRI dhan51 with the help of Aman HHAT trials. He also proposed HHATs of Jirashail and BRRRI dhan81 as Jirashail is popular for both Boro and Aus season crops.

Dr. Nazmul Islam, Joint Director, Research Cell, BADC: Dr. Nazmul specified that new varieties are usually not well promoted, and need a dissemination plan at the farmers' level, such as introduction through field days, farmers' fares, etc. BADC can also demonstrate seed plots of the new varieties as a promotional strategy. At the same time, DAE can reach out to farmers to show the trial results. BRRRI and IRRI can collaborate on this too.

Noor Mohammad, Assistant Director, Rural Development Academy (RDA), Bogura: Dr. Noor mentioned that RDA is a contract seed grower of BADC and currently grows BRRRI dhan92 and BRRRI dhan75 on 25 acres plots, each. If there is a scope for a similar collaboration with BRRRI in seed production, then RDA can provide new varieties for timely supply.

Dr. Md. Tahmid Hossain Ansary, PSO & Head, BRRRI Regional Station, Satkhira: Dr. Ansary explained that almost 50% of the area cultivated with rice in Satkhira is sown with BRRRI dhan28. It is also sown in most areas of Jessore. The variety is very productive and many farmers manage to irrigate it with pond water. There are incidences of blast disease in the region but the severity is avoided by following the 'BRRRI Blast Management Package'. So, losses are insignificant, especially in Satkhira. Certain areas in and around Jessore (Jessore-Rajaganj-Keshabpur-Satkhira highway) and Satkhira (Benapol-Navaron-Satkhira highway) are almost blast-free. Concerning BADC's role, it is important to resolve if BADC should produce the seeds that the farmers need, or if farmers should purchase the varieties that BADC produces. As production doesn't always match the farmers' demands, and BADC is responsible for selling what it produces, it opts for push selling in such scenarios. Therefore, BADC must rethink its approach to seed production.

Dr. Abdul Latif, CSO, and Head, Plant Pathology Division, BRRRI: Dr. Latif discussed the prevalence and possible management of rice blast disease. The variability of blast pathogens is widespread due to climatic variations in the country and favorable environments as well. The wider the variety of pathogens, the more difficult it is to withstand pest attacks. None of the short-duration varieties is blast resistant, including BRRRI dhan29 which gets affected around the month of April. BRRRI dhan88 performs well only at a few locations. Moreover, vulnerability increases with the increase of cropping areas. So, it is important to rethink widespread replications. As a temporary solution, it is essential to include blast management packages with seed distribution.

Mohammad Enayet-e-Rabbi, Dy. Director (Quality Control), Seed Certification Agency, MoA: Dr. Mohammad discussed the possibility of incorporating blast-resistant genes into the mega varieties as none of the existing varieties are resistant to blast. He also proposed to include Aus varieties in the HHATs as Aus is a major cropping season for the country. To popularize new and better rice varieties, strong collaboration is needed between BRRRI, BADC, and DAE. In response, Dr. Md. Rafiqul Islam mentioned that blast-resistant genes are available and can be incorporated into other varieties by molecular breeding technology and plant pathologists have been working on it. Following the seed production trend by the private sector seed producers, prevalent rice varieties should be replaced every four to five years with new varieties. This is necessary because varieties gradually become susceptible to diseases in a given environment.

After an elaborate open discussion, Dr. Md. Rafiqul Islam concluded the session and assured that the important and valuable suggestions and recommendations that surfaced from the forum would be properly documented and followed up on. He mentioned that adaptive research can guide towards demand creation for newer varieties that are more suitable to local needs. He emphasized the inclusion of newly developed improved varieties in the trials to assess their adaptability. It is through such trials that BRRRI dhan67 and BRRRI dhan74 were adopted. He thanked all those who participated in the discussion and urged them to continue with such discussions in the future.



PLANNING OF HHAT FOR T. AMAN SEASON OF 2022-23

Dr. Kabir presented the draft plan for the Head-to-Head Adaptive Trials (HHATs) of T. Aman 2022-23 Season. He requested the participating stakeholders to provide their suggestions on the plan, based on which the plan would be revised, finalized, and adopted by BRRRI.

He mentioned that HHATs for T. Aman would be conducted under four groups as per the draft plan. As suggested during the open discussion, more varieties might be included in the upcoming Aman trials as per the suggestions of the stakeholders. The draft plan includes long-duration varieties (including BRRRI dhan80, BRRRI dhan93, BRRRI dhan94 and BRRRI dhan95) and three short-duration varieties - BRRRI dhan75, Binadhan-17 and Binadhan-22. BRRRI dhan71 would be the benchmark variety and varieties like Binadhan-7, BRRRI dhan33 or BRRRI dhan39, and/or other location-specific prevalent varieties would be a part of the trials as local checks.

r. Shamsunnahar Begum, CSO, BINA suggested the inclusion of Binadhan-16 in short-duration trials. The required quantities of seeds could be facilitated by BINA in that case. She also suggested the selection of Binadhan-11 in the HHATs for submersible areas.

The specific modification and inclusion requests by the participants, for incorporation into the upcoming T. Aman HHAT, are as follows:

- BRRRI dhan51 and BRRRI dhan58 should be included in the trials as BRRRI dhan51 performs well in Rajshahi, Naogaon and Dinajpur, and BRRRI dhan58 in Rangpur. Both are location-specific varieties and qualify for location-based trials.
- In the Dinajpur area, the demand for premium quality rice varieties is increasing. RLR short-duration trial may include BRRRI dhan90 which has a good yield and can be harvested in 115 days.
- BRRRI dhan70 is a good variety in the Dinajpur area and should be used in long-duration trials.
- Since the number of trials is limited for technical reasons, the varieties to be included should be carefully selected, looking closely at the local varieties.
- BR11 should be used as a benchmark variety in the Rangpur trials.
- The number of trials with Swarna should be reduced in the Rajshahi/Rangpur area and it should be replaced with other local representative varieties.
- BRRRI dhan49 and BR11 should be included in the Mymensingh area trials, as they both are prevalent local varieties and can be considered as a benchmark.
- Rangpur, Dinajpur, Mymensingh, and Rajshahi should have four separate sets of trials

including the suggested varieties. The researchers have confirmed that, from a statistical point of view, the minimum number of ecologies should be 20. So, BRRRI can further explore and finalize the groups.

- Dr. Swati Nayak suggested splitting the trials into clusters according to market segmentation and then doing cluster-wise varietal distribution. In the process, varieties that are most appropriate for the groups should be considered.
- Dr. Swati Nayak suggested splitting the trials into clusters according to market segmentation and then doing cluster-wise varietal distribution. In the process, varieties that are most appropriate for the groups should be considered.
- Varietal adaptation should be increasingly researched in the coastal ecosystem for Aman, as local varieties still account for 50 percent of production. Most appropriate new varieties should be considered for the same.
- The coastal ecosystem (CE) has two areas – coastal saline (Satkhira) and coastal non-saline (Barishal). Also, tidal submergible and tidal non-submergible can be considered as two new categories.
- For RLR-long duration, targeted varieties should be BRRRI dhan23, BRRRI dhan52, BRRRI dhan76 and BRRRI dhan77, while the benchmark should be BRRRI dhan44 or BRRRI dhan83.
- For the Coastal ecosystem, in Satkhira & Khulna, BRRRI dhan73 and BRRRI dhan10 can also be included along with the already targeted varieties BRRRI dhan22 and BRRRI dhan23
- RLR-Short duration should have Binadhan-16 and BRRRI dhan90 varieties.
- For FFS trials, BRRRI dhan79 and Binadhan-11 should be the targeted varieties, BRRRI dhan51 or BRRRI dhan52 should be the benchmark, and Swarna and BR 11 should be the local checks.

Regarding the trial structure, Dr. Swati Nayak mentioned that 20 replications are ideal for one geographical cluster and two to three clusters could cover an agro-ecological zone. Dr. Md. Humayun Kabir, while summing up the presentation and discussion, mentioned that the HHATs plan would be finalized with the formation of new categories based on the discussion and further consultation, and trials would be conducted through public-private partnerships. He thanked everyone for their participation and contribution.

BRRRI and IRRRI jointly decided on the following plan for the T. Aman HHATs of 2022-23. It was finalized post discussion between the two research bodies and considering the feedback from the stakeholders.



HHATs Planned for T. Aman 2022-23 Season by IRRI-BRRI

	Rice Ecosystem	Targeted Rice Varieties	Benchmark Variety	Local Check (LC)*	Number of trials	Regions
1	RLR-LD (4:1:1)	BRRI dhan87 (2018), BRRI dhan93 (2019), BRRI dhan94 (2019), BRRI dhan95 (2019)	BRRI dhan51 (2010)	Swarna	30	Areas sown with Swarna
2	RLR-LD (3:1:1)	BRRI dhan70 (2015), BRRI dhan80 (2017), BRRI dhan90 (2019)	BRRI dhan34 (1997)	Kataribhog/ Chinigura	30	Fine rice dominant areas
3	RLR-LD (2:1:1)	BRRI dhan72 (2015), BRRI dhan87 (2018)	BRRI dhan52 (2010)	BR11	20	Areas sown with BR11
4	RLR-LD (3:1:1)	BRRI dhan87 (2018), BRRI dhan93 (2019), BRRI dhan94 (2019)	BRRI dhan49 (2008)	BRRI dhan32	20	Medium duration areas
5	RLR-SD (4:1:1)	BRRI dhan75 (2016), Binadhan-17 (2016), Binadhan-22 (2019)	BRRI dhan71 (2015)	Binadhan-7/ BRRI dhan33/ BRRI dhan39	30	Areas sown with Short duration varieties
6	CE (3:1:1)	BRRI dhan78 (2016), BRRI dhan79 (2017), Binadhan-23(2020)	BRRI dhan73 (2015)	BR 10/BR 23/ BRRI dhan30	20	Coastal areas
7	FFS (2:2:1)	BRRI dhan79 (2017), Binadhan-11 (2012)	BRRI dhan51 (2010) BRRI dhan52 (2010)	Swarna/ BR11	30	Flash flood areas
8.	Tidal Submergence (3:1:1)	BRRI dhan76 (2016), BRRI dhan77 (2016), BRRI dhan52 (2010)	BR23 (1988)	Sadamota/ Lalmota	20	Tidal Areas

Concluding Session and Inferences

Special guest of the session, **Dr. Md. Rafiqul Islam**, IRRI-Bangladesh, expressed his gratitude for the support received from Dr. Md. Shahjahan Kabir, Director General, BRRI. Dr. Kabir lent all possible support to the initiative during the preliminary stages which was much necessary to carry the programme ahead. He also conveyed his appreciation for Dr. Kabir's confidence in the HHATs and for making them possible. Dr. Rafiqul Islam also thanked Dr. Biswajit Karmakar, PSO & Head BRS, Sonagazi, for his immense support in conducting the trials during the initial stages. He also expressed gratefulness to the private sector stakeholders like seed companies, and NGOs who responded very positively to the initiative.

Dr. Rafiqul also mentioned that the stakeholders long awaited the results of the HHATs. However, the result sharing was delayed because of the hurdles posed by the COVID-19 pandemic. He was glad that IBO could finally organize the workshop which was much necessary for the dissemination of the findings among the stakeholders. Dr. Rafiqul also made the following suggestions regarding the trials:

- The HHATs established that yield performance is not the sole factor in the adoption of a variety by farmers, rather it's a combination of yield, grain quality, and taste. Yield performance of a variety, especially compared to the previously cultivated variety, overall financial viability including the cost of inputs and prices fetched, and interventions are all factored in by the farmers. Consumers are not concerned if the rice is an Aman or Aus crop, but what matters to them is the taste and the cost. In this context, Dr. Rafiqul proposed to incorporate a 'Panel Test' for each variety among some local farmers/ consumers from the trial areas to assess cooking properties and taste. The outcome would help understand factors that determine the adoption decision-making process.
- If rice varieties can be engineered to have stronger resistance to infestation by diseases and insects, their overall quality will improve. This will lead to a higher adoption rate at the farmers' level and increased preference by millers, thereby resulting in increased demand.
- If a 'product profile' can be developed for varieties, adoption would be higher for superior profiles. It is not required to adopt every variety as some can be used as local check variety.

Dr. Rafiqul Islam expressed hope that the HHATs would continue to benefit all the stakeholders and that the country would benefit if there is a higher adoption of good varieties.

Dr. Md. Abu Bakar Siddique, Director (Administration & Common Service), BRRI, a special guest at the event, reiterated that the food security of Bangladesh depends on rice security and the achievement of the SDGs is also linked to it, and BRRI is actively focused on it. The TRB program is a strong step in this regard. The partnership between BMGF, IRRI, and BRRI, since 2016, has been very successful. Dr. Siddique mentioned that popular mega varieties like BRRI dhan11, BRRI dhan28, and BRRI dhan29 have 25 years of history of progressive cultivation in Bangladesh and hopefully can improve through the HHATs. He thanked IBO for organizing the much-needed workshop.

He acknowledged the contributions of all those involved in the HHATs including partner organizations and the concerned scientists and the officials of the ARD, and BRRI in particular. He acknowledged everyone present with the hope that the collaborative effort in the implementation of HHATs would be more successful in the future.

Chief Guest, Dr. Md. Shahjahan Kabir, Director General of BRRI, stated that maximum participation by all stakeholder groups in the HHAT program was the highest point of the workshop. He was enthused to learn about the accomplishments of the program. He emphasized that increasing rice production is one of the highest concerns for BRRI, given the current post-COVID-19 situation. He realized the predicament that BADC needed to popularize the varieties it produces to avoid piling stocks and DAE wanted newer and better varieties at the farmers' level. In a way, HHATs are a way to demonstrate the problems at the field level and possible solutions can be deliberated.

BRRI has been producing region-specific varieties whose performance varied widely across the regions. The HHATs trials have demonstrated the performances of specific varieties at specific locations within the regional framework and beyond and the results have proven to be valuable lessons for all stakeholders. For better utilization of such valuable knowledge, Dr. Kabir emphasized creating location-specific mapping to find out suitable 'domains' for all varieties. The time factor also needs to be considered in this mapping process as varieties become susceptible over time. He stressed more research to ascertain why certain varieties do excellent in some locations while not in others. With this information, the maximum yield of each variety could also be assessed and used to advantage, which would greatly help in increasing rice production. All such information can help construct a 'profile' for each variety and combined with the mapping, an effective dissemination plan for all varieties could be discussed. For example, BADC can be advised on which variety is to be planted at which location, even at block levels or union levels within the Upazillas, and the quantities that would be needed. Similarly, DAE can use the information to disseminate field-level production decisions. Moreover, with detailed mapping and information, the government can adopt a defined rice production plan indicating which area can and should produce which varieties.

He also stressed the importance of using proper statistical methodology and tools in analyzing and interpreting data from the trials.

Dr. Kabir cited the examples of BRRI dhan28's outstanding performance and BRRI dhan10's lack of alternates in Satkhira. He suggested that instead of directly advising the farmers to replace a variety, step-by-step trials could be conducted to popularize a better variety in that location. The key is to keenly observe varietal appropriateness for a specific location. He recapped Dr. Swati Nayak's statement that adoption is a complex process. It varies between locations, and environments even between farmers, millers, and consumers. Thus, it is difficult to introduce a variety while addressing issues from all stakeholders. Dr. Kabir expressed confidence that the scientists and researchers can tackle the core issues to solve this complex problem and increase grain yield and overall production.

Dr. Kabir mentioned that due to the increased frequency of natural calamities, the government urges the production and adoption of more short-duration varieties. BRRI has some short-duration varieties, but trials need to be done to find out the location-specific appropriate varieties. Since BRRI has rich experience in doing trials and experiments on targeted rice breeding, the trials of short-duration varieties would not be a challenge. Dr. Kabir invited the representatives of the National Seed Certification Agency (SCA) to be more involved in the rice production network and contribute towards its strengthening. He added that until blast-resistant varieties are available, the only way to tackle blast problems would be to follow rigorous management practices.

Dr. Kabir also brought to light the false perception that slender variety rice is preferred by all consumers. He stated that a large percentage of consumers prefer thicker grains as well. Millers tend to over-polish the rice to get a price advantage while creating nutritional issues for the population in the process. Consumers need to be informed that thicker varieties are rich in micro-nutrients, are tastier, and have more health benefits. Also, most millers use machines of high capacities and therefore, do not want to process small quantities to reduce the machine operating costs. As a result, smallholders with less production face issues in processing their produce. Such issues should be considered while planning production targets in specific domains and discussions with local millers can be useful. A proper 'mapping plan' based on the HHATs' findings can help resolve such issues. The establishment of a network or linkage with the stakeholders can also solve the problems faced by BADC and DAE.

Dr. Kabir mentioned that the government of Bangladesh has adopted Rice Vision 2050, which has decade-wise and year-wise targets to increase rice production. For meeting the annual national targets, the stakeholders can consult among themselves and suggest the measures required to achieve the target set in the identified sectors. HHAT is a unique model which can provide effective guidance in building national plans and achieving targeted production as well as popularizing better and newer varieties.

Dr. Kabir thanked all the stakeholders for attending the workshop and providing valuable inputs for upcoming HHATs. He especially thanked the farmers' representatives for voicing their opinions. He expressed gratitude towards the presenters and hoped that such workshops should be organized annually, and preferably across the country. On behalf of BRRI, Dr. Kabir expressed sincere appreciation for everyone involved in the implementation of the HHATs.

Dr. Mohammad Khalequzzaman, Director of Research, BRRI, and the chairperson of the workshop, thanked everyone for attending the workshop on the result sharing of HHATs. He mentioned that though the adoption of newer rice varieties has already been happening, it is crucial to determine the process and swiftness of the transition. Through HHATs farmers and stakeholders can compare the yield advantage, susceptibility, profit and loss factors, etc. HHATs have been used in other countries as well and have become an important extension method in assisting with varietal adoption decisions. Before concluding the program, Dr. Khalequzzaman gave a brief vote of thanks to the Chief Guest and Special Guests, Dr. Swati Nayak, Division Heads of BRRI, IRRI, BINA, BADC, SCA, DAE, Regional Offices of BRRI, NGOs, CBOs, farmers, seed dealers, seed growers, and media partners.



Recommendations

Developing better rice varieties that are more adaptive to specific environments is important in ensuring increased productivity of rice. The next step is to create awareness of the advantages of these varieties and generate demand for them. Making these varieties accessible to farmers across the country is a subsequent step that will ultimately help to improve their incomes and livelihood.

Research and analysis of the trials reveal how promising varieties adapt to the target environments. The Head-to-Head Adaptive Trials provide firsthand knowledge on new varieties' performance compared to old popular varieties at the field level. It helps farmers in making informed decisions while adopting a variety. During the trials, researchers also collect feedback about the varieties from farmers and extension personnel. These trials also generate curiosity, knowledge, and demand for new and better-performing varieties through the demonstrated results in the field. With knowledge of the demand for location-specific varieties, producers can use the information to produce and supply the right quantity of seeds at the right place. As the adopted seed varieties are often the best yielders having better quality, there is an overall positive impact on rice production in the trial locations.

The result-sharing workshop for the HHATs established that the stakeholders are enthusiastic enough to participate in discussions on varietal performance and use the results to their benefit. It also showed there is a strong need for effective coordination between the multiple stakeholders in the rice production system. The recommendations from the workshop are derived from the open discussion between all the stakeholders including the researchers and scientists involved in the planning and implementation of the trials. They are categorized into general recommendations and grain or variety-specific recommendations as mentioned below.

General recommendations

- ▶ There is a need to rethink and reassess the role of BADC in seed distribution across the country. As observed, different varieties yield differently in different seasons and locations. So, the varieties and quantities required by farmers vary. But farmers tend to purchase

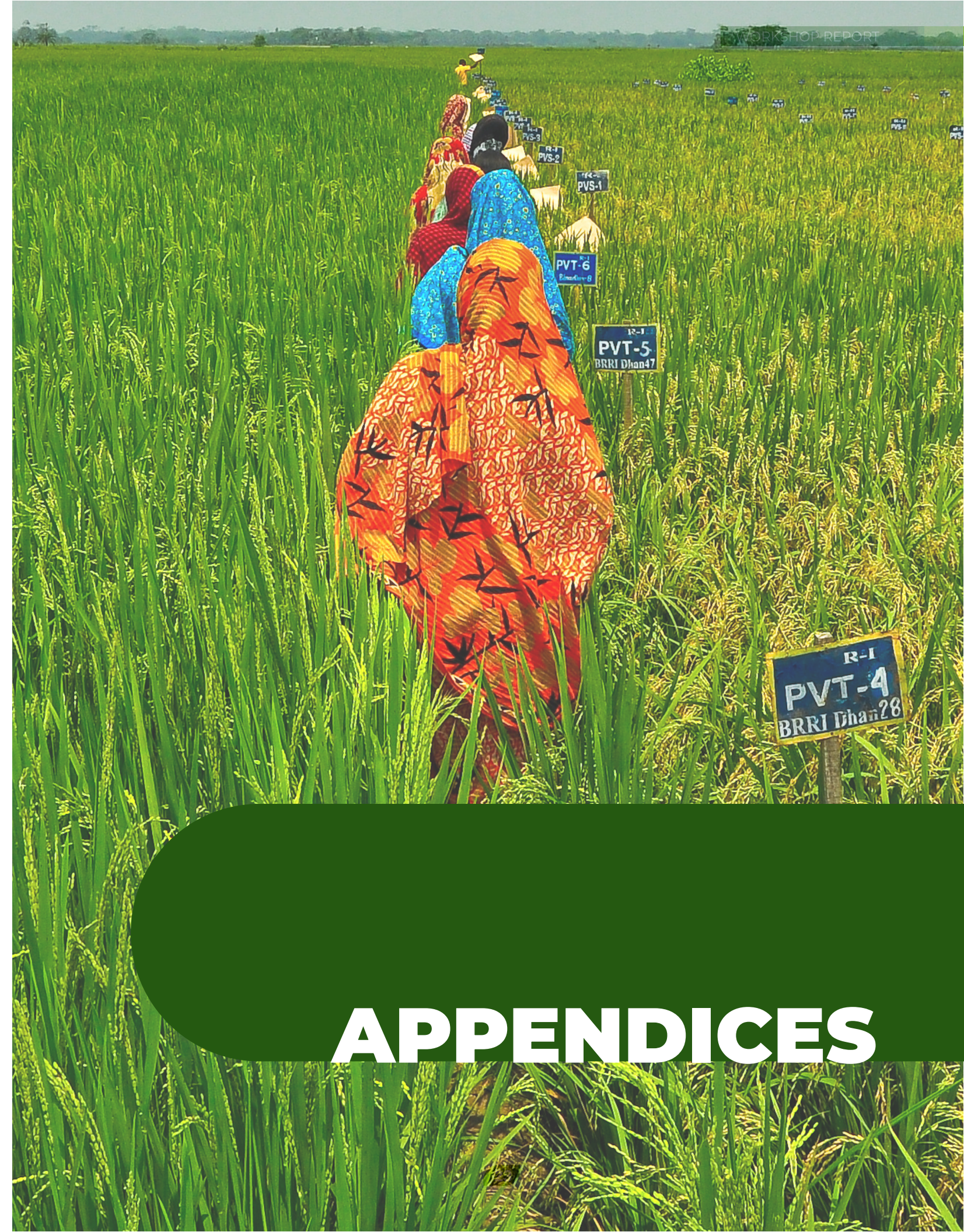
whatever is available through BADC. In this context, it is important to understand if BADC can produce and distribute seeds according to farmers' requirements.

- ▶ In different rice-producing areas of the country, farmers need to be briefed on the varieties suitable for their locations. All concerned agencies and stakeholders in the areas need to understand their roles.
- ▶ Many sites have reported the incidence of rice blast disease. More emphasis should be on blast control-related research. And as the pathogen has found a favourable environment, it is essential to include blast management packages while distributing seeds to farmers. Until blast-resistant varieties are made available, the only way to tackle blast problems is to adopt rigorous management practices.
- ▶ Molecular breeding technology may be used to incorporate blast-resistant genes into the new mega varieties for the development of blast-resistant varieties.
- ▶ Conclusions cannot be made on new rice varieties from trials in small areas like one bigha of land. For a more accurate conclusion, trials need to be replicated on larger plots.
- ▶ More data from the HHATs need to be shared with researchers and scientists. For example, i) Level & trends of salinity and rice yield trends in the salinity-prone areas ii) The level of management interventions during the trials as an influencing factor.
- ▶ Farmers usually avoid using pesticide sprays until crops are affected by blasts. Whether affected or not, the blast control method should be administered through two sprays – the first one at the flowering stage and the second after one week.
- ▶ For better utilization of limited land resources HHATs need to be conducted for multi-cropping patterns with newer and better rice varieties and other seasonal crops. In Kaliakoir, and Kaliganj areas three to four cropping patterns are successful with BRRI dhan75.
- ▶ New varieties are usually not promoted in the best possible ways. There is a need for a dissemination plan at the farmers' level to introduce new varieties, viz. field days, farmers' fairs, etc. BADC can also demonstrate seed plots of new varieties as a promotional strategy, and DAE can mobilize farmers to witness the trial results. To popularize new and better rice varieties across the country, a strong collaboration is needed between BRRI, BADC, and DAE.
- ▶ BRRI can collaborate with contract seed growers like RDA, Bogura which can ensure a timely supply of new varieties as per demand. Currently, RDA grows BRRI dhan92 and BRRI dhan75 for BADC.

- ▶ As Aus is a major cropping season in Bangladesh, it is proposed to include Aus rice varieties in the HHATs.
- ▶ While conducting HHATs, a 'Panel Test' for each rice variety can be undertaken to assess the cooking properties and taste factors which strongly influence the adoption decisions. Data can be collected from local farmers/consumers from the trial areas.
- ▶ A 'product profile' should be developed for each variety which would help in the adoption of varieties with improved profiles. It should be noted that all varieties might not be adopted and some could be as local check varieties.
- ▶ Traits like stronger resistance to diseases and insects can improve grain quality. This will lead to both higher adoption at the farmers' level and higher preference by millers, thus, resulting in increased demand.
- ▶ A mapping based on variety and location-specific data from the HHATs can help find out suitable 'domains' for all varieties. Incorporation of the time factor in such mapping exercise can help build 'profiles' of each variety including susceptibilities. This can be instrumental in the design of a detailed national rice production plan indicating which areas should produce which varieties during a given period. It will benefit all the stakeholders in the long run.
- ▶ Utmost importance should be given to the use of the right statistical methodology and tools in analyzing and interpreting the data from the HHATs. If the analysis of the contributing factors is wrong, replication of varieties will not be possible.
- ▶ If a strong communication network or linkage can be established within BRRI, BADC, and DAE, many operational problems can be resolved in terms of meeting production targets.

Grain Specific recommendations

- ▶ BRRI dhan28 was found to have the lowest yield in the Boro seasons of 2020 and 2021. It also had the highest frequency of pest infestation and was therefore proposed to be replaced soon.
- ▶ BRRI dhan88 (mean yield value of 6.50 tha⁻¹ in 2020) had the highest yield among all the varieties in the Boro season of 2020.
- ▶ BRRI dhan75 of the T. Aman season, a short duration high yielding variety with long slender, and slightly aromatic grain, is suitable for rainfed lowlands across the country.
- ▶ BRRI dhan74 is well suited to the cropping pattern of Potato-Mustard-BRRI dhan74 in some northern areas. It is recommended to be included in the Aus trials.
- ▶ Both BRRI dhan74 and BRRI dhan84 are Zinc enriched rice varieties and should be promoted as such to consumers.
- ▶ Binadhan-11 is proposed to be included for trials in the flash flood regions.
- ▶ BRRI dhan51 should be considered for the Aman season HHATs in Rajshahi with a plan to replace Swarna (Indian variety) which is popular in the area.
- ▶ BRRI dhan81 should be considered for the Boro season HHATs with Jirashail, a popular variety in Rajshahi, as the check variety.



APPENDICES

Appendix 1: Core Organizing Team Members

IRRI



Dr. Swati Nayak
 Scientist & South Asia Lead
 Seed Systems & Product Management
 Platform: Rice Breeding
 IRRI



Dr. Muhammad Ashraf Habib
 Senior Specialist
 Seed System & Product Management
 Platform: Rice Breeding
 IRRI



Dr. Saidul Islam
 Senior Specialist
 Seed System & Product Management
 Platform: Rice Breeding
 IRRI



Dr. Md. Rafiqul Islam
 PhD Scientist (Plant Breeder)
 Country Breeding Lead
 IRRI Bangladesh
 Project Lead - IRRI-PPP,
 Haor-KGF, BRRI-TRB

BRRI



Dr. Md. Shahjahan Kabir
 Director General, BRRI



Dr. Md. Humayun Kabir
 CSO and Head
 Adaptive Research Division
 BRRI



Dr. KM Iftekharuddaula
 CSO and Head
 Plant Breeding Division
 BRRI



Md. Yeakub Khan
 Scientific Officer
 Plant Breeding Division
 BRRI



Bulbul Ahmed
 Scientific Officer
 Adaptive Research Division BRRI

Appendix 2: List of Participants

Workshop on Result Sharing and Planning of Head-to-Head Adaptive Trial

List of Participants

Date: 21 April 2022

Venue: Training Complex Conference Room, BRRRI, Gazipur

#	Name	Designation
BRRRI		
1	Dr. Md. Shahjahan Kabir	Director General, BRRRI
2	Dr. Mohammad Khalequzzaman	Director (Research), BRRRI
3	Dr. Md. Abu Bakr Siddique	Director (Administration and Common Service), BRRRI
Divisional Heads, BRRRI		
4	Dr. Khandakar Md. Iftakharuddaula	CSO & Head, Plant Breeding Division, BRRRI
5	Dr. Md. Ismail Hossain	CSO and Head, Agricultural Statistics Division, BRRRI
6	Dr. Md. Humayun Kabir	CSO and Head, Adaptive Research Division, BRRRI
7	Mr. Md. Saiful Islam	PSO and Head, Agricultural Economics Division, BRRRI
8	Dr. Md. Abdul Latif	CSO and Head, Plant Pathology Division, BRRRI
9	Dr. Sheikh Shamiul Haque	CSO and Head, Entomology Division, BRRRI
10	Dr. Muhammad Ali Siddiquee	CSO and Head, Grain Quality & Nutrition Division, BRRRI
11	Dr. Md. Sirajul Islam	CSO and Head, Farm Management Division, BRRRI
12	Mr. Md. Monirul Islam	Principal Planning Officer, BRRRI
13	Dr. Md. Shahadat Hossain	CSO (CC) and Head, Training Division, BRRRI
14	Dr. Mst. Salma Pervin	PSO and Head, Plant Physiology Division, BRRRI
15	Dr. Mir. Sharf Uddin Ahmed	PSO and Head, GRS Division, BRRRI
16	Dr. Aminul Islam	CSO and Head, Soil Science Division, BRRRI

#	Name	Designation
Plant Breeding Division, BRRRI		
17	Dr. ASM Masuduzzaman	CSO, Director Research Office, BRRRI
18	Dr. Partha Sarathi Biswas	PSO, Plant Breeding Division, BRRRI
19	Dr. Mohammad Amir Hossain	PSO, Plant Breeding Division, BRRRI
20	Dr. Mahmuda Khatun	PSO, Plant Breeding Division, BRRRI
21	Dr. Md. Abdul Kader	PSO, Plant Breeding Division, BRRRI
22	Dr. Md. Ruhul Amin Sarker	SSO, Plant Breeding Division, BRRRI
23	Dr. Sharmistha Ghosal	SSO, Plant Breeding Division, BRRRI
24	Dr. Hasina Khatun	SSO, Plant Breeding Division, BRRRI
25	Sheikh Maniruzzaman	SO, Plant Breeding Division, BRRRI
26	Ms. Ratna Rani Majumder	SSO, Plant Breeding Division, BRRRI
27	Mr. M M Emam Ahmed	SO, Plant Breeding Division, BRRRI
28	Mr. Sanjoy Kumer Debsharma	SO, Plant Breeding Division, BRRRI
29	Nusrat Jahan	SO, Plant Breeding Division, BRRRI
30	Ms. Urmi Rani Shaha	SO, Plant Breeding Division, BRRRI
31	Mr. Md. Yeakub Khan	SO, TRB-BRRRI Project, Plant Breeding Division, BRRRI
32	Mr. Zabid-Al-Riyadh	SO, TRB-BRRRI Project, Plant Breeding Division, BRRRI
33	Ms. Ribed Farzana Disha	SO, TRB-BRRRI Project, Plant Breeding Division, BRRRI
34	Ms. Mahmuda Maliha Yeasmin	SO, TRB-BRRRI Project, Plant Breeding Division, BRRRI
35	Ms. Jannatul Ferdousy	SO, TRB-BRRRI Project, Plant Breeding Division, BRRRI

#	Name	Designation
Adaptive Research Division, BRRRI		
36	Dr. Md. Atiqul Islam	CSO (CC), Adaptive Research Division, BRRRI
37	Mr. Bulbul Ahmed	SO, TRB-BRRRI Project, Adaptive Research Division, BRRRI
IRRI Bangladesh Office (IBO)		
38	Dr. Rafiqul Islam	Rice Breeder, IRRI, Bangladesh
39	Dr. Swati Nayak	Scientist & South Asia Lead - Seed Systems & Product Management, IRRI, India
40	Dr. Sirajul Islam	CoP, IRRI, Bangladesh
41	Dr. Md. Kamal Hossain	Senior Associate Scientist, IBO
42	Md. Abdur Rahim	Senior Specialist, IBO
43	Dr. Saidul Islam	Senior Specialist, IBO
44	Muhammad Ashraful Habib	Senior Specialist, IBO
45	Mr. Md. Azizur Anik	Specialist-Communication, IBO
46	Mr. Md. Mizan UI Islam	Assistant Scientist, IBO
47	Md. Ahadat Hossain	Research Technician-III, IBO
48	Zeenat Ahmed	Consultant
BRRRI Regional Stations		
49	Dr. Md. Alamgir Hossain	CSO and Head, BRRRI Regional Station, Barishal
50	Mr. Md. Tahrat Al Touhid	SO, TRB-BRRRI Project, BRRRI Regional Station, Barishal
51	Dr. Md. Akhlasur Rahman	PSO and Head, BRRRI Regional Station, Bhanga
52	Mr. Tusher Chakrobarty	SO, BRRRI Regional Station, Bhanga
53	Mr. Md. Asadulla Al Galib	SO, BRRRI Regional Station, Bhanga

#	Name	Designation
54	Ms. Rowmika Jahan Promee	SO, BRRRI Regional Station, Bhanga
55	Dr. Md. Rafiqul Islam	CSO & Head, BRRRI Regional Station, Cumilla
56	Mr. AKM Shalahuddin	SO, BRRRI Regional Station, Cumilla
57	Dr. Md. Mahbubur Rahman Dewan	SSO and Head, BRRRI Regional Station, Kushtia
58	Mr. Md. Eftekhur Uddin	SO, BRRRI Regional Station, Kushtia
59	Dr. Md. Fazlul Islam	PSO and Head, BRRRI Regional Station, Rajshahi
60	Dr. Md. Harun-Ar-Rashid	SSO, BRRRI Regional Station, Rajshahi
61	Dr. Md. Rokebul Hasan	SSO and Head, BRRRI Regional Station, Rangpur
62	Mr. Tapon Kumar Roy	SO, BRRRI Regional Station, Rangpur
63	Dr. Biswajit Karmakar	PSO & Head, BRRRI Regional Station, Sonagazi
64	Dr. Md. Tahmid Hossain Ansary	PSO & Head, BRRRI Regional Station, Satkhira
65	Mr. Md. Amanatullah Raju	SO, BRRRI Regional Station, Satkhira
66	Dr. Md. Zahidul Islam	SSO & Head, BRRRI Regional Station, Gopalganj
67	Mr. Faruk Hossain Khan	SO, BRRRI Regional Station, Gopalganj
68	Mr. Md. Saidee Rahman	SO and Head, BRRRI Regional Station, Sirajganj
69	Mr. S.M.M. Shahriar Tonmoy	BRRRI Regional Station, Sirajganj
70	Dr. Ebne Syod Mohammad Harunur Rashid	GRS Division, BRRRI
Private Seed Companies		
71	Mr. Md. Shafiqul Islam	Senior Officer, ACI, Dhaka
72	Dr. Umme Shirajum Monira	Supreme Seed Ltd

#	Name	Designation
73	Md. Asifuddin, Chief Breeder	Supreme Seed Ltd
74	Dr. Md. Assaduzzaman	Chief Breeder , Lal Teer
75	Dr. Md. Anamul Haque	Breeder & Seed Development, Lal Teer
Research Institute & Government Organizations		
76	Dr. Shamsunnahar Begum	CSO & Head, BINA
77	Dr. M. Imtiaz Uddin	CSO, BINA
78	Dr. Nazmul Islam	Joint Director, Research Cell, BADC
79	Dr. Mahbubur Rahman	Deputy Manager (Seed Distribution), BADC
80	Dr. Md. Hasanul Kabir Kamali	Chief Seed Technologist, SCA
81	Mr. Mohammad Enayet-e-Rabbi	DD (Quality Control), SCA
82	Md. Rafiqul Islam	DTO, Khamarbari, DAE
83	Md. Hasibul Hassan	DAE
84	Md. Saiful Islam	Deputy Director, DAE, Gazipur
85	Mr. Noor Mohammad	Assistant Director, RDA
Partner NGOs and Others		
86	Mr. Md. Rafiqul Islam	Director, ISWA, Barguna
87	Mr. Md. Harunur Or Rashid	ED, PDI, Barishal
88	Mr. ASMAH Taimur	ED, PGUK, Chattogram
89	Mr. Md. Rabiul Karim	ED, SHARP, Nilphamari
90	Mr. Md. Kois Ahmad	ED, SRAC, Sylhet
91	Md. Shawkat Hossain	ED, WAVE, Chuadanga

#	Name	Designation
91	Md. Shawkat Hossain	ED, WAVE, Chuadanga
92	Mr. Md. Meshbaul Haque	Sr. Coordinator, AVA, Chapai Nawabganj
93	Mr. Md. Mamunur Rashid	Sr. Coordinator, RDRS, Rangpur
94	Mr. Liakot Ali	PM, SDC, Faridpur
95	Mr. Md. Moniruzzaman	Program Coordinator, SUK, Pirojpur
96	Mr. Md. Abu Bakkor	Sr. Coordinator, GJUS, Bhola
97	Mr. Md. Rafiqul Islam Milon	ED, AIHD, Pabna
98	Mr. Md. Masudul Hasan	AERI, Dhaka
99	Mr. Naznin Islam	ED, BMSMS, Bandarban
100	Mr. Md. Zillur Rahman	Senior Officer, CARITAS, Rajshahi
101	Ms. Rowshon Jamal Chowdhury	ESDO, Thakurgaon
102	Md. Saiful Islam	Program Officer, FIVDB, Sylhet
103	Mr. Md. Nazrul Islam	ED, IDEAL, Satkhira
Seed Net Partners		
104	Mr. Islam Jowerder	Bhai Bhai Seed, Meherpur
105	Mr. Md. Shahnawas Ali	Ali Seed, Jessore
Community Based Seed Production Groups		
106	Srimoti Gouri Rani	President, Khaddo Komorpur Nari Unnayan Sangatha
107	Mrs. Arifa Begum	Secretary, Khaddo Komorpur Nari Unnayan Sangatha
108	Alama Begum	

#	Name	Designation
109	Noorjahan Begum	
	OFT Farmers	
110	Md. Rubel Mia	OFT farmer, Sadar, Sunamganj
111	Md. Haris Uddin	OFT farmer, Companiganj, Sylhet
	Seed Dealers	
112	SM Zillur Rahman, Himalay Agro	
113	S. M. Shajahan Sarker	Hira Seed Company, Gazipur
114	Md. Saiful Islam	Bengal Seed Limited

Appendix 3: Programme Agenda of the Workshop

Workshop on Result Sharing and Planning of Head-to-Head Adaptive Trial Program Agenda

Date: 21 April 2022

Venue: Training Complex Conference Room, BRRI, Gazipur

Time	Topics	Speaker/Presenter/ Facilitator (Not according to seniority)	Participants
Opening Session			
09:00-09:30	Registration	Dr. Saidul Islam, Senior Specialist, IBO, Dhaka Mr. Md. Yeakub Khan, Scientific Officer (TRB), BRRI	All participants
09:30-09:45	Welcome Remarks	Dr. KM Iftekharuddaula, CSO and Head, Plant Breeding Division, BRRI	All participants
09:45-10:00	Participants Introduction	Mr. Bulbul Ahmed, Scientific Officer (TRB), BRRI	All participants
Technical Session			
10:00-10:30	Presentation on result sharing of Head-to-Head Adaptive Trial (HHAT) of T. Aman & Boro seasons 2019 to 2021 (BRRI-Part)	Dr. Md. Humayun Kabir, CSO & Head, Adaptive Research Division, BRRI	All participants
10:30-11:00	Presentation on result sharing of Head-to-Head Adaptive Trial (HHAT) of T. Aman & Boro seasons 2019 to 2021 (IRRI-Part)	Dr. Swati Nayak, Scientist & South Asia Lead - Seed System and Product Management, IRRI, India	All participants
11:00-12:00	Open discussion on result sharing	Dr. Md. Rafiqul Islam, Scientist, Plant Breeder, Rice Breeding & Innovation Platform, IRRI, Bangladesh	All participants
12:00-12:10	Planning of T. Aman 2022-23 Season (BRRI part)	Dr. Md. Humayun Kabir, CSO & Head, Adaptive Research Division, BRRI	All participants
12:10-12:20	Planning of T. Aman 2022-23 Season (IRRI part)	Dr. Swati Nayak, Scientist & South Asia Lead - Seed System and Product Management, IRRI, India	All participants

Time	Topics	Speaker/Presenter/ Facilitator (Not according to seniority)	Participants
12:20-13:00	Open discussion on T. Aman 2022-23 planning	Dr. KM Iftekharuddaula, CSO and Head, Plant Breeding Division, BRRRI	All participants
13:00-14:00	Prayer time		
	Closing Session		
14:00-14:10	Address by Special Guest	Dr. Md. Rafiqul Islam, Scientist, Plant Breeder, Rice Breeding & Innovation Platform, IRRI, Bangladesh	All participants
14:10-14:20	Address by Special Guest	Dr. Md. Abu Bakr Siddique, Director (Administration & Common Service), BRRRI	All participants
14:20-14:40	Address by Chief Guest	Dr. Md. Shahjahan Kabir, Director General, BRRRI	All participants
14:40-14:50	Address by Chairperson	Dr. Mohammad Khalequzzaman, Director (Research), BRRRI	All participants

Appendix 4: Presentation by Dr. Humayun Kabir (BRRRI)

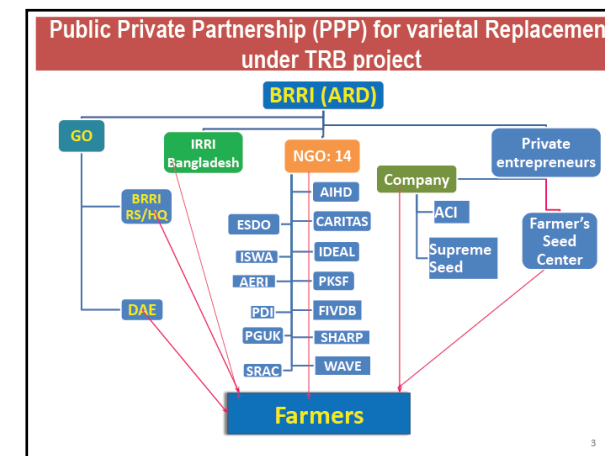
Welcome To

TRB-ARD Component

Dr. Md. Humayun Kabir CSO & Head Adaptive Research Division (ARD) Bangladesh Rice Research Institute

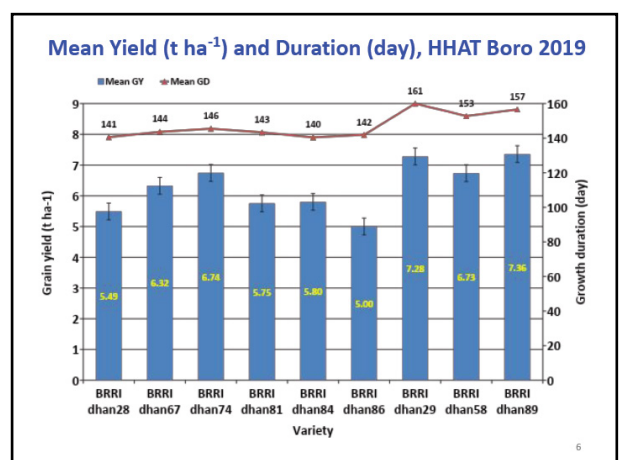
Objectives of Head to Head Adaptive Trial (HHAT)

1. Investigate the performance of newly released varieties compared to popular old mega varieties through generating sufficient quantitative data
2. Identification of promising varieties in the target environment/s for their specific and general adaptability
3. Collect feedback about the varieties from farmers and Extension personnel.
4. Generating demand of the newly released varieties in the target environment/s.



Head to Head Adaptive Trial (HHAT) Boro 2019

- ### HHAT during Boro, 2019
- On-farm multi location trials were conducted comprising two major rice.
 - Short growth variety (GD<150 days): BRRRI dhan28, BRRRI dhan67, BRRRI dhan81, BRRRI dhan84 and BRRRI dhan88.
 - Long duration variety (GD>150 days): BRRRI dhan29, BRRRI dhan58 and BRRRI dhan89.
 - A total 200 HHAT were conducted of which 160 were SD and remaining 40 were LD.
 - ARD-BRRRI, seven R/S of BRRRI, fifteen NGO and two seed company jointly implemented these trials.



Summary Statistics of grain yield and Growth duration of the varieties in HHAT (Short Duration)

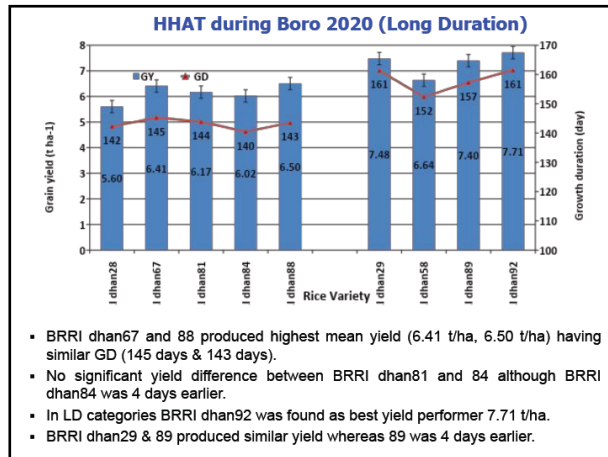
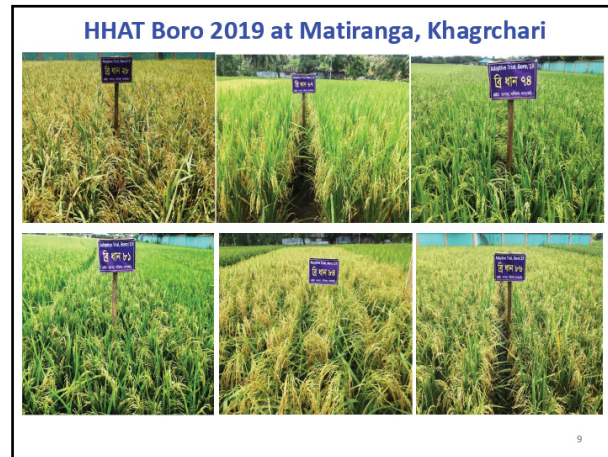
Variety	No. of Observation (n)	Grain yield (t ha ⁻¹)			Standard Deviation (SD)	Standard Error (SE)
		Mean	Maximum	Minimum		
Grain yield (t/ha)						
BRRi dhan28	140	5.49	7.37	3.34	0.77	0.07
BRRi dhan67	140	6.32	7.70	4.23	0.62	0.05
BRRi dhan74	140	6.74	8.14	4.78	0.61	0.05
BRRi dhan81	140	5.75	8.07	3.26	0.90	0.08
BRRi dhan84	140	5.80	7.50	3.99	0.73	0.06
BRRi dhan86	140	5.00	8.06	3.12	0.95	0.08
Growth duration (days)						
BRRi dhan28	140	141	147	130	2.5	0.21
BRRi dhan67	140	144	149	133	3.2	0.27
BRRi dhan74	140	146	152	134	3.8	0.32
BRRi dhan81	140	143	150	133	2.4	0.21
BRRi dhan84	140	140	145	134	2.0	0.17
BRRi dhan86	140	142	147	135	2.0	0.16

Summary Statistics of grain yield and Growth duration of the varieties in HHAT (Long duration)

Variety	No. of Observation (n)	Grain yield (t ha ⁻¹)			Standard Deviation (SD)	Standard Error (SE)
		Mean	Maximum	Minimum		
Grain yield (t/ha)						
BRRi dhan29	58	7.30	9.10	5.82	3.29	0.57
BRRi dhan58	58	6.75	8.43	4.68	3.75	0.65
BRRi dhan89	58	7.36	9.19	5.08	4.10	0.75
Growth duration (day)						
BRRi dhan29	58	161	165	153	12	2.66
BRRi dhan58	58	152	159	145	14	2.74
BRRi dhan89	58	157	163	150	13	2.80

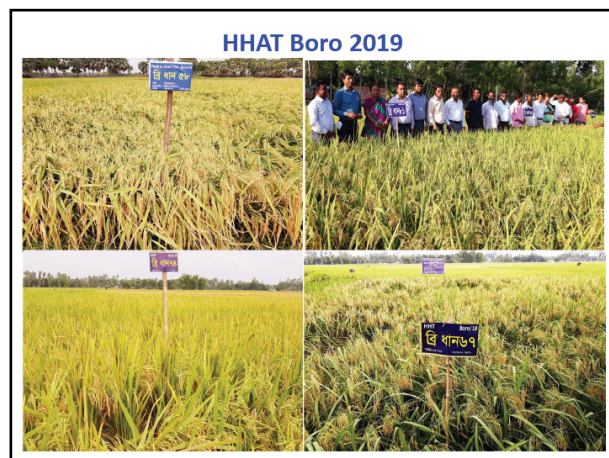
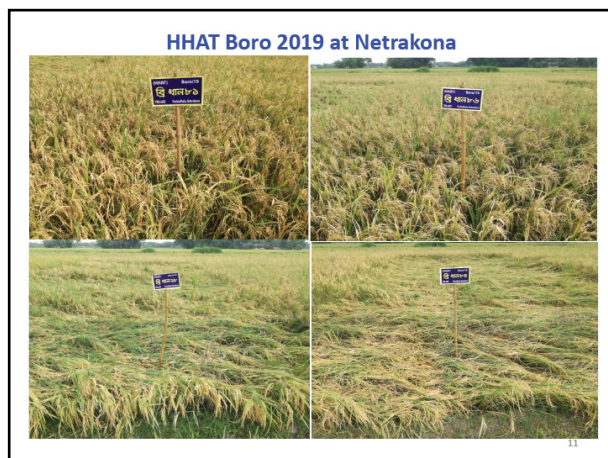
Head to Head Adaptive Trial (HHAT) Boro 2020

- HHAT during Boro 2020**
- On-farm multi location trials were conducted through two major rice var. groups
 - Short growth variety (GD<150 days): BRRi dhan28, BRRi dhan67, BRRi dhan81, BRRi dhan84 and BRRi dhan88.
 - Long duration variety (GD>150 days): BRRi dhan29, BRRi dhan58, BRRi dhan89 and BRRi dhan92.
 - A total 200 HHAT were conducted of which 160 were SD and remaining 40 were LD.
 - ARD-BRRi, seven R/S of BRRi, fifteen NGO and two seed company jointly implemented these trials.
 - Necessary data were collected and reports were made through statistical analysis.



Summary Statistics of Grain yield (t/ha) of tested rice varieties in HHAT during Boro, 2020 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Grain yield (t/ha)			Standard deviation	Standard error
		Mean	Maximum	Minimum		
Short duration						
BRRi dhan28	157	5.60	7.70	4.12	0.58	0.05
BRRi dhan67	157	6.41	8.13	4.70	0.61	0.05
BRRi dhan81	157	6.17	7.95	3.72	0.76	0.06
BRRi dhan84	157	6.02	7.94	3.87	0.71	0.06
BRRi dhan88	157	6.50	8.24	4.72	0.61	0.05
Long duration						
BRRi dhan29	40	7.48	9.63	5.60	0.74	0.12
BRRi dhan58	40	6.64	8.98	4.85	0.81	0.13
BRRi dhan89	40	7.40	9.79	6.05	0.81	0.13
BRRi dhan92	40	7.71	9.85	6.22	0.77	0.12



Summary Statistics of growth duration (days) of tested rice varieties in HHAT during Boro, 2020 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	growth duration (day)			Standard deviation	Standard error
		Mean	Maximum	Minimum		
Short duration (GD<150 days)						
BRRi dhan28	157	142	150	135	3.15	0.25
BRRi dhan67	157	145	152	139	3.03	0.24
BRRi dhan81	157	144	151	139	3.18	0.25
BRRi dhan84	157	140	148	135	2.85	0.23
BRRi dhan88	157	143	150	138	3.25	0.26
Long duration (GD>150 days)						
BRRi dhan29	40	161	166	157	1.83	0.29
BRRi dhan58	40	152	160	147	2.60	0.41
BRRi dhan89	40	157	162	154	2.01	0.32
BRRi dhan92	40	161	167	156	2.29	0.36

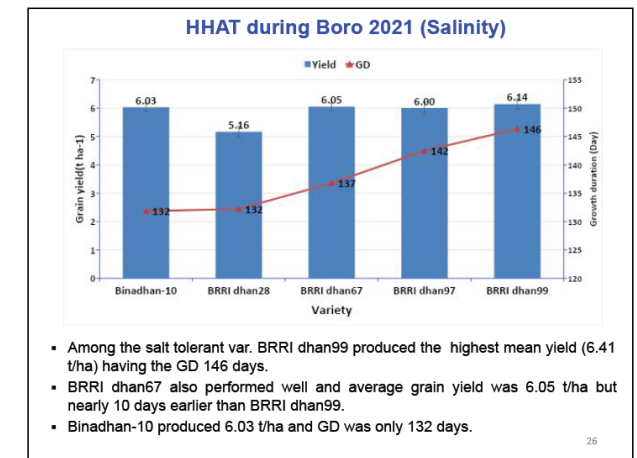




Head to Head Adaptive Trial (HHAT) Boro 2021

Summary Statistics of tested rice varieties in HHAT Long duration (LD) during Boro, 2021 under heterogeneous agro-ecological conditions of Bangladesh.

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain Yield (t/ha)						
BRRi dhan29	52	6.91	8.98	1.7	1.55	0.22
BRRi dhan58	52	6.78	10.07	1.7	1.48	0.21
BRRi dhan89	52	7.01	10.17	1.9	1.71	0.21
BRRi dhan92	52	7.26	10.5	1.6	1.66	0.24
Growth Duration (Day)						
BRRi dhan29	52	156	166	143	5.08	0.70
BRRi dhan58	52	151	160	141	3.90	0.54
BRRi dhan89	52	154	161	138	4.81	0.67
BRRi dhan92	52	155	163	142	4.76	0.66

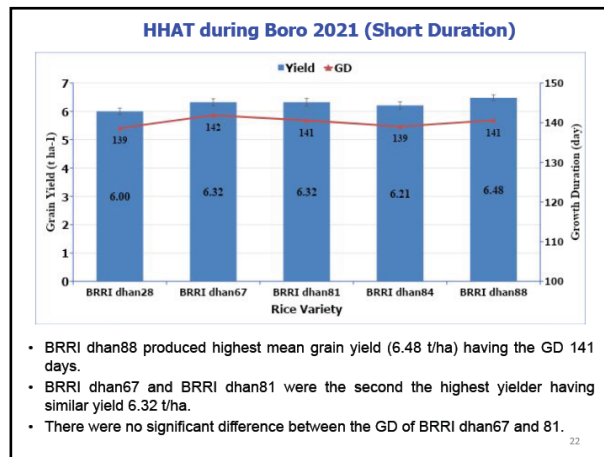


HHAT Boro 2021

Trials were conducted considering the five major groups:

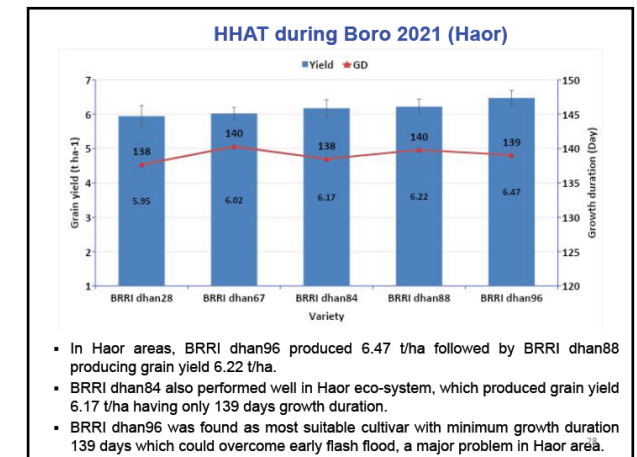
- Short duration variety (GD<150 days):** Tested var. BRRi dhan28, BRRi dhan67, BRRi dhan81, BRRi dhan84 and BRRi dhan88.
- Long duration variety (GD>150 days):** Tested var. BRRi dhan29, BRRi dhan58, BRRi dhan89 and BRRi dhan92.
- Saline Ecosystem (SE):** Tested var. BRRi dhan28, BRRi dhan67, BRRi dhan97, Binadhan-10 and BRRi dhan99.
- Haor Ecosystem (HE):** Tested var. BRRi dhan28, BRRi dhan67, BRRi dhan84, BRRi dhan88 and BRRi dhan96.
- Hill Eco-system (HI):** Tested var. BRRi dhan28, BRRi dhan67 and BRRi dhan74.

A total 200 HHAT were conducted following Public Private Partnership (PPP)



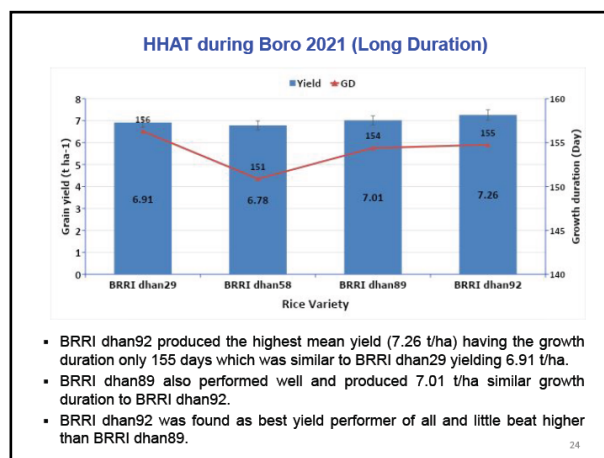
Summary Statistics of tested rice varieties in HHAT (Salinity) during Boro, 2021 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
Binadhan-10	50	6.03	9.52	3.32	1.03	0.15
BRRi dhan28	50	5.16	7.90	1.03	5.33	0.19
BRRi dhan67	52	6.05	8.40	3.95	0.95	0.13
BRRi dhan97	48	6.00	8.24	2.94	1.45	0.21
BRRi dhan99	48	6.14	8.89	3.66	1.26	0.18
Growth Duration (Day)						
Binadhan-10	50	132	140	120	5.08	0.72
BRRi dhan28	50	132	145	114	8.45	1.19
BRRi dhan67	52	137	145	118	7.01	0.97
BRRi dhan97	48	142	155	127	7.63	1.10
BRRi dhan99	48	146	155	136	5.20	0.75



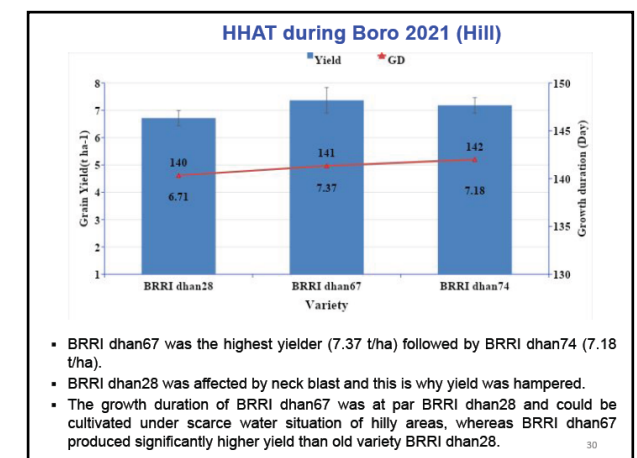
Summary Statistics of tested rice varieties in HHAT Short duration (SD) during Boro, 2021 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain Yield (t/ha)						
BRRi dhan28	63	6.00	8.23	3.71	0.89	0.11
BRRi dhan67	62	6.32	8.96	4.00	0.98	0.12
BRRi dhan81	62	6.32	9.86	3.70	1.05	0.13
BRRi dhan84	63	6.21	8.36	3.30	1.02	0.13
BRRi dhan88	63	6.48	8.34	4.90	0.80	0.10
Growth Duration (Day)						
BRRi dhan28	63	139	147	127	4.41	0.56
BRRi dhan67	62	142	150	129	4.20	0.53
BRRi dhan81	62	141	148	125	4.15	0.52
BRRi dhan84	63	139	147	128	4.42	0.56
BRRi dhan88	63	141	150	127	4.19	0.53



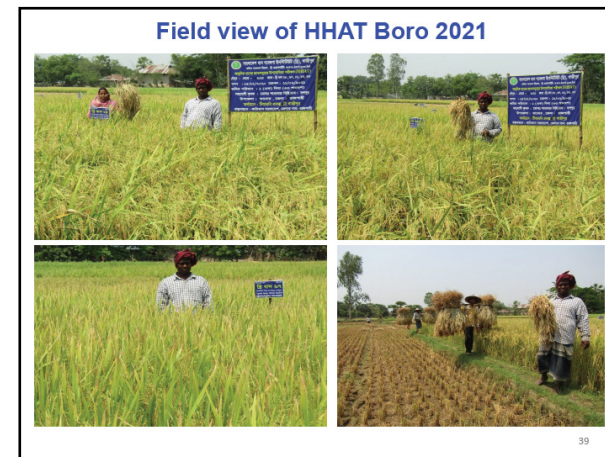
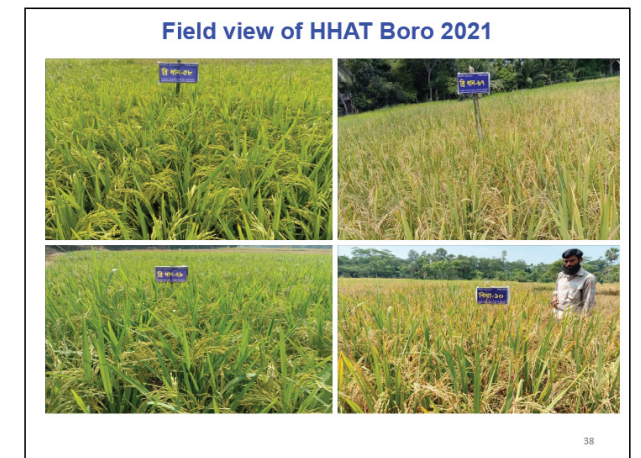
Summary Statistics of tested rice varieties in HHAT (Haor) during Boro, 2021 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain Yield (t/ha)						
BRRi dhan28	21	5.95	8.36	2.13	1.38	0.30
BRRi dhan67	21	6.02	8.59	5.28	0.80	0.17
BRRi dhan84	21	6.17	8.24	4.30	1.13	0.25
BRRi dhan88	21	6.22	8.24	3.33	1.00	0.22
BRRi dhan96	21	6.47	9.40	4.45	1.00	0.22
Growth Duration (Day)						
BRRi dhan28	21	138	143	125	4.78	1.04
BRRi dhan67	21	140	145	127	4.78	1.04
BRRi dhan84	21	138	144	131	3.92	0.86
BRRi dhan88	21	140	145	130	4.19	0.91
BRRi dhan96	21	139	145	132	3.81	0.83



Summary Statistics of tested rice varieties in HHAT (Hill) during Boro, 2021 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain Yield (t/ha)						
BRRi dhan28	6	6.71	7.4	6.0	0.7	0.3
BRRi dhan67	6	7.37	8.4	5.7	1.1	0.5
BRRi dhan74	6	7.18	7.7	5.9	0.7	0.3
Growth Duration (Day)						
BRRi dhan28	6	140	144	135	3.20	1.31
BRRi dhan67	6	141	144	139	1.86	0.76
BRRi dhan74	6	142	145	139	2.37	0.97



Conclusion on HHAT Boro (cont'd)

- BRRi dhan28 gave the lowest yield having highest pest incidence that should be replaced immediately.
- BRRi dhan29 produced competitive yield along with BRRi dhan89, however it was infected by neck blast disease in some locations
- BRRi dhan58 have good potentiality throughout the country except eastern parts of Bangladesh.
- BRRi dhan67 performed excellent throughout the country.
- BRRi dhan74 would be disseminated only those areas where farmers like bold grain.

Conclusion on HHAT Boro (Cont'd)

- BRRi dhan81 showed susceptibility to blast disease in most of the locations except southwest to northern regions where it would be cultivated.
- BRRi dhan84 produced good yield with shorter duration even 2-3 days earlier than BRRi dhan28. However it was lodged in some sites. This will be suitable in high and medium high land where water will not be logged.
- Performance of BRRi dhan86 was not at par level as it was highly infested by disease (sheath blight, bacterial blight and neck blast) and insect (stem borer, leaf folder).

Conclusion on HHAT Boro

- BRRi dhan88 was found as best yield performer of all tested varieties.
- BRRi dhan89 produced better yield than BRRi dhan29
- BRRi dhan92 was found as best yield performer among all and higher than BRRi dhan89.
- Most of the farmers liked for its competitive yield
- However some farmers disliked for its longer growth duration.

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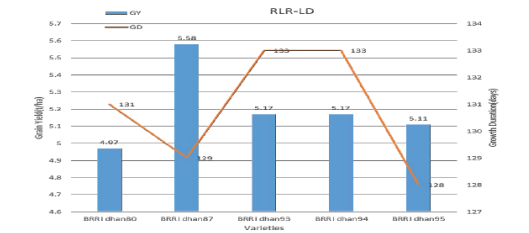
Head to Head Adaptive Trial (HHAT) T. Aman 2019

T. Aman, 2020 (HHAT)

Farmers' participatory on farm adaptive research trials were conducted under different/diverse four rice growing eco-systems

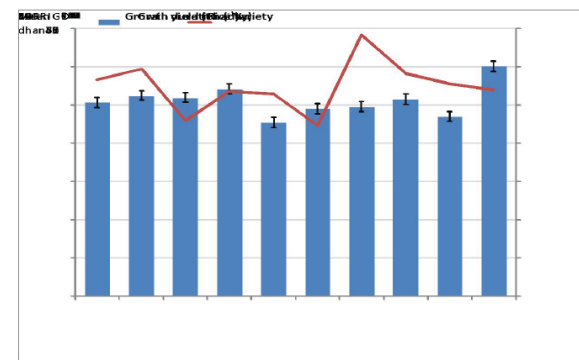
- Rainfed Low Land Rice ecosystem having short growth duration rice variety (GD<120 days): Tested var. BRRi dhan57, 71, 75, Binadhan-16, 17, 22
- Rainfed Low Land Rice ecosystem having long growth duration rice variety (GD>120 days): BRRi dhan80, 87, 93, 94, 95
- Coastal Ecosystem (CE): BRRi dhan72, 73, 78, 79
- Flash Flood Submergence (FFS) rice ecosystem: BRRi dhan51, 52, 79, IR13F441, Binadhan-11

HHAT during T. Aman 2020 (RLR-Long duration)



- BRRi dhan87 reliably performed as the best among the tested varieties average grain yield 5.58 t/ha in all over the Bangladesh. The mean maturity is 129 days .
- As well as BRRi dhan93, BRRi dhan94 and BRRi dhan95 which is released in 2019 are performed well in all over the Bangladesh and mean grain yields are 5.17, 5.17 and 5.11 t/ha respectively.
- Among them BRRi dhan95 has a week earlier than BRRi dhan93, BRRi dhan94.

Grain yield (t/ha) and growth duration (day) of modern rice varieties in HHAT Aman 2019



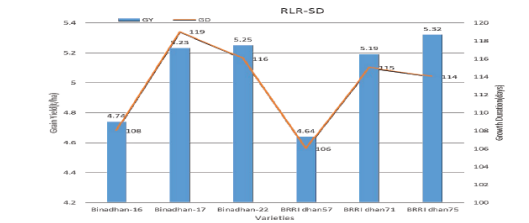
Summary Statistics Grain yield (t/ha) of tested rice varieties in HHAT during Aman, 2019 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean Grain yield	Maximum Grain yield	Minimum Grain yield	Standard deviation (SD)	Standard error (SE)
BRRi dhan49	101	5.07	6.22	3.67	0.56	0.06
BRRi dhan52	19	5.25	7.02	4.56	0.55	0.13
BRRi dhan71	87	5.20	6.60	4.00	0.58	0.06
BRRi dhan72	13	5.43	6.57	4.50	0.52	0.15
BRRi dhan73	13	4.55	5.02	4.23	0.26	0.07
BRRi dhan75	140	4.91	6.60	3.27	0.61	0.05
BRRi dhan76	13	4.96	6.25	3.88	0.54	0.15
BRRi dhan79	19	5.16	6.52	3.95	0.64	0.15
BRRi dhan80	88	4.70	6.72	3.35	0.57	0.06
BRRi dhan87	141	6.02	7.30	4.54	0.61	0.05

Summary Statistics of tested rice varieties in HHAT (RLR-LD) during T. Aman, 2020 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
BRRi dhan80	89	4.97	6.32	2.99	0.59	0.06
BRRi dhan87	89	5.58	6.80	3.33	0.72	0.07
BRRi dhan93	89	5.17	6.39	2.56	0.65	0.06
BRRi dhan94	89	5.17	6.6	2.81	0.68	0.07
BRRi dhan95	89	5.11	6.5	2.89	0.72	0.07
Growth duration (Day)						
BRRi dhan80	89	131	142	120	3.98	0.42
BRRi dhan87	89	131	140	124	3.68	0.39
BRRi dhan93	89	131	141	121	3.76	0.39
BRRi dhan94	89	131	140	119	3.46	0.36
BRRi dhan95	89	131	141	119	4.42	0.46

HHAT during T. Aman 2020 (RLR-Short duration)



- BRRi dhan75, Binadhan-22, Binadhan-17 and BRRi dhan71 varieties average grain yield 5.32, 5.25, 5.23 & 5.19 t/ha respectively and as well as similar mean maturity like 114, 116, 119 and 115.
- BRRi dhan57 and Binadhan-16 have very early mean maturity 106 & 108 days respectively comparatively more than 10 days earlier than other promising varieties and mean grain yield 4.64 and 4.74 t/ha respectively.

Summary Statistics of Growth duration (days) of tested rice varieties in HHAT Aman, 2019 under heterogeneous agro-ecological conditions of Bangladesh

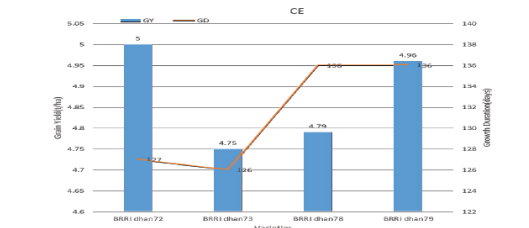
Variety	No. of Observation (n)	Mean Growth duration	Maximum Growth duration	Minimum Growth duration	Standard deviation (SD)	Standard error (SE)
BRRi dhan49	101	133	140	128	2.75	0.27
BRRi dhan52	19	139	142	135	2.21	0.51
BRRi dhan71	87	112	120	107	2.89	0.31
BRRi dhan72	13	127	131	124	3.25	0.90
BRRi dhan73	13	126	128	122	1.74	0.48
BRRi dhan75	140	109	115	105	2.13	0.18
BRRi dhan76	13	157	162	153	2.80	0.78
BRRi dhan79	19	137	140	134	1.89	0.43
BRRi dhan80	88	131	136	127	1.89	0.20
BRRi dhan87	141	128	134	125	1.87	0.16

Head to Head Adaptive Trial (HHAT) T. Aman 2020

Summary Statistics of tested rice varieties in HHAT (RLR-SD) during T. Aman, 2020 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
BRRi dhan57	55	4.64	6.30	3.60	0.67	0.09
BRRi dhan71	55	5.19	6.30	3.20	0.59	0.08
BRRi dhan75	55	5.32	6.40	3.54	0.57	0.07
Binadhan-16	55	4.74	6.10	2.50	0.73	0.09
Binadhan-17	55	5.23	6.70	3.87	0.83	0.11
Binadhan-22	55	5.25	6.90	3.87	0.69	0.09
Growth duration (Day)						
BRRi dhan57	55	106	119	103	2.94	0.39
BRRi dhan71	55	115	121	105	3.27	0.44
BRRi dhan75	55	114	130	108	4.49	0.60
Binadhan-16	55	108	123	103	4.29	0.58
Binadhan-17	55	119	128	107	4.30	0.58
Binadhan-22	55	116	123	109	3.35	0.45

HHAT during T. Aman 2020 (Costal Ecosystem)

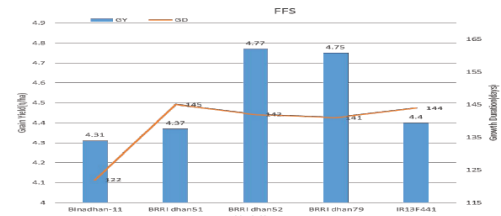


- BRRi dhan72 has 5 t/ha average grain yield and mean maturity is 127 days which shows significant better performance in all over the costal region of Bangladesh.
- BRRi dhan79 which is multi stress variety have also average grain yield that is 5.96 t/ha and its mean maturity is 136 days.
- BRRi dhan73 and BRRi dhan78 has better performance over the check or farmers variety in that region.

Summary Statistics of tested rice varieties in HHAT (CE) during T. Aman, 2020 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
BRRi dhan72	29	5.0	6.30	3.20	0.77	0.14
BRRi dhan73	29	4.75	6.67	2.86	0.85	0.15
BRRi dhan78	29	4.79	6.05	2.76	0.82	0.15
BRRi dhan79	29	4.96	6.15	2.99	0.86	0.16
Growth duration (Day)						
BRRi dhan72	29	127	139	123	4.25	0.79
BRRi dhan73	29	126	139	120	4.49	0.83
BRRi dhan78	29	136	142	129	3.36	0.62
BRRi dhan79	29	136	143	129	3.55	0.30

HHAT during T. Aman 2020 (Flash Flood Submergence)



- BRRi dhan52 has highest average grain yield 4.77 t/ha. As well as BRRi dhan79 has also very good average yield which is 4.75 t/ha in that FFS region.
- Binadhan-11, BRRi dhan51 and IR13F441 has potential yield advantages over the farmers varieties.
- Among them mean maturity of Binadhan-11 is 122 days which is three weeks earlier than among all the tested varieties.

Field view of HHAT Aman 2020



Head to Head Adaptive Trial (HHAT) T. Aman 2021

Summary Statistics of tested rice varieties in HHAT (FFS) during T. Aman, 2020 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
BRRi dhan51	19	4.37	5.32	3.43	0.52	0.11
BRRi dhan52	19	4.77	5.78	3.56	0.55	0.12
BRRi dhan79	19	4.75	5.69	3.80	0.50	0.11
IR13F441	19	4.40	5.01	4.01	0.26	0.06
Binadhan-11	19	4.31	5.5	3.32	0.64	0.14
Growth duration (Day)						
BRRi dhan51	19	145	155	138	5.34	1.22
BRRi dhan52	19	142	145	132	2.92	0.67
BRRi dhan79	19	141	146	126	4.36	1.00
IR13F441	19	144	148	139	2.74	0.64
Binadhan-11	19	122	125	116	3.02	0.69

Field view of HHAT Aman 2020

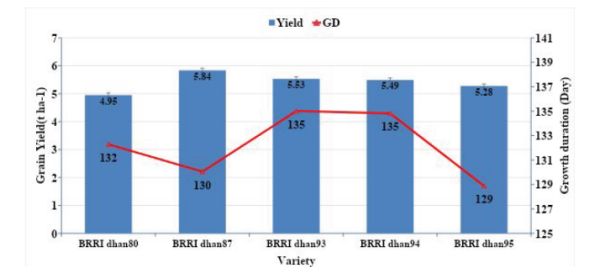


HHAT during Aman, 2021

On-farm farmer's participatory multi location trials were conducted under different rice growing eco-systems through out the country using the following four major groups

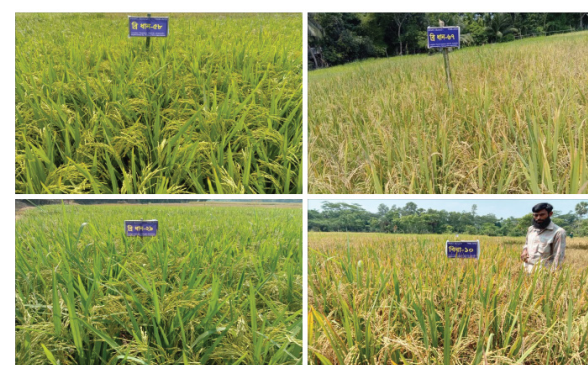
Rice Environment	Targeted Rice Varieties	Benchmark variety	Local Check (LC)
RLR-LD (4:1:1)	BRRi dhan80 (2017) BRRi dhan93 (2019) BRRi dhan94 (2019) BRRi dhan95 (2019)	BRRi dhan87 (2018)	Swarna/ BR 11/ BRRi dhan49 *Depends on popular variety in that community or farmers choice
RLR-SD (3:1:1)	BRRi dhan75 (2016) Binadhan-17 (2016) Binadhan-22 (2019)	BRRi dhan71 (2015)	Binadhan-7/ BRRi dhan33/ BRRi dhan39 /other local varieties *Depends on popular variety in that community or farmers choice
CE (3:1:1)	BRRi dhan78 (2016) BRRi dhan79 (2017) Binadhan-23 (2020)	BRRi dhan73 (2015)	BR 10/BR 22/BR 23/ BRRi dhan34 *Depends on popular variety in that community or farmers choice
FFS (2:2:1)	BRRi dhan79 (2017) IR13F441	BRRi dhan51 & BRRi dhan52 *Depends on region	Swarna/ BR 11/ BRRi dhan49 *Depends on popular variety in that community or farmers choice

HHAT during T. Aman, 2021 (Long Duration)



- BRRi dhan87 was found as highest yielder (5.84 t/ha) having growth duration 130 days.
- BRRi dhan80 produced the lowest yield (4.95 t/ha). BRRi dhan93, BRRi dhan94 and BRRi dhan95 produced the statistically similar yield and the growth duration were 135 days and 129 days respectively.

Field view of HHAT Aman 2020



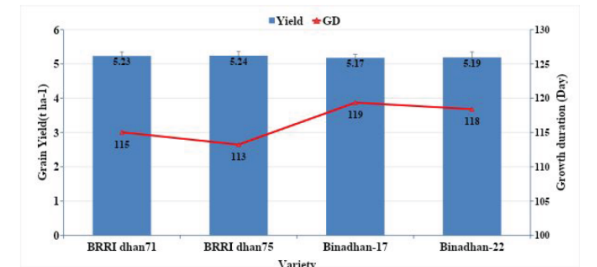
Field view of HHAT Aman 2020



Summary Statistics of tested rice varieties in HHAT (LD) during T. Aman, 2021 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
BRRi dhan80	98	4.95	7.05	3.00	0.82	0.08
BRRi dhan87	98	5.84	7.66	3.80	0.77	0.08
BRRi dhan93	99	5.53	7.31	3.50	0.76	0.08
BRRi dhan94	99	5.49	7.08	2.92	0.76	0.08
BRRi dhan95	100	5.28	7.13	3.61	0.73	0.07
Growth duration (Day)						
BRRi dhan80	98	132	154	120	5.79	0.58
BRRi dhan87	98	130	154	118	6.59	0.67
BRRi dhan93	99	135	154	125	4.90	0.49
BRRi dhan94	99	135	145	125	4.28	0.43
BRRi dhan95	100	129	142	119	5.79	0.58

HHAT during T. Aman 2021 (Short Duration)

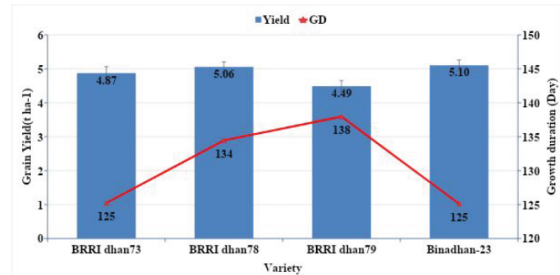


- BRRi dhan75 produced the highest grain yield (5.24 t/ha) having the lowest growth duration 113 days followed by BRRi dhan71 which produced 5.23 t/ha.
- Binadhan-17 produced the lowest yield (5.17 t/ha) which was statistically similar to Binadhan-22. The growth duration was 119 days and 118 days respectively.

Summary Statistics of tested rice varieties in HHAT (SD) during T. Aman, 2021 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
BRRi dhan71	44	5.23	7.05	2.97	0.74	0.11
BRRi dhan75	44	5.24	7.08	3.00	0.86	0.13
Binadhan-17	45	5.17	6.80	3.01	1.05	0.16
Binadhan-22	43	5.19	7.13	2.53	1.05	0.16
Growth duration (Day)						
BRRi dhan71	44	115	122	109	2.93	0.44
BRRi dhan75	44	113	120	104	3.66	0.55
Binadhan-17	45	119	126	114	2.90	0.43
Binadhan-22	43	118	122	113	2.49	0.38

HHAT during T. Aman 2021 (Coastal Ecosystem)



- Average highest yield of Binadhan-23 was recorded 5.10 t/ha followed by BRRi dhan78 producing grain yield 5.06 t/ha with 125 days growth duration.
- BRRi dhan73 also performed well in Coastal ecosystem, which produced grain yield 4.87 t/ha having only 125 days growth duration .

Conclusion on HHAT Aman (Cont'd)

- BRRi dhan72 produced higher yield but most of the farmers did not like for its bold grain.
- It could be suitable for Barishal region and some places of Bagura and Rangpur region
- BRRi dhan73 produced good yield in saline environment but it lodged in some locations especially after depression of October.
- BRRi dhan75 performed excellent in the Rainfed lowland environment in all over the country.
- Farmers preferred this variety for its higher yield with shorter growth duration, long slender grain having bit aroma,
- Rabi crop easily can be grown in time after harvesting.

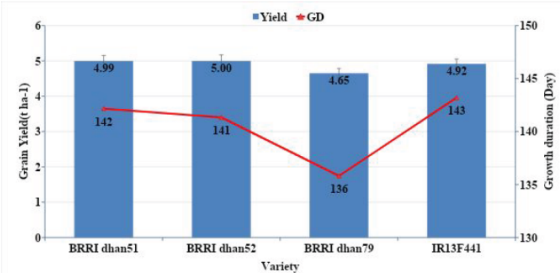
Conclusion on HHAT Aman (Cont'd)

- BRRi dhan76 & 77 gave higher yield than local varieties like DudKalam, Sadamota etc.
- But farmers preferred BRRi dhan76 than BRRi dhan77 for its higher yield.
- BRRi dhan79 has better yield with flash flood tolerance, but it was infected by False smut disease in some locations.
- BRRi dhan80 produced higher yield, it could be popularize in high and medium high land.
- BRRi dhan87 performed excellent throughout the country. Farmer preferred this variety for its higher grain , straw yield and for quality long slender grain.

Summary Statistics of tested rice varieties in HHAT (CE) during T. Aman, 2021 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
BRRi dhan73	26	4.87	7.31	3.34	0.97	0.19
BRRi dhan78	26	5.06	6.85	3.66	0.76	0.15
BRRi dhan79	24	4.49	6.51	2.87	0.81	0.17
Binadhan-23	24	5.10	6.82	3.26	0.78	0.16
Growth duration (Day)						
BRRi dhan73	26	125	130	117	4.74	0.93
BRRi dhan78	26	134	138	128	2.96	0.58
BRRi dhan79	24	138	142	125	4.48	0.91
Binadhan-23	24	125	130	116	4.85	0.99

HHAT during T. Aman 2021 (Flash Flood Submergence)



- BRRi dhan52 produced the highest mean yield (5.00 t/ha) having the GD 141 days followed by BRRi dhan51 producing grain yield 4.99 t/ha with 142 days growth duration.
- Line IR13F441 gave statistically similar yield Which can overcome early flash flood, a major problem in flash flood prone areas.

Conclusion on HHAT Aman

- IR13F441 line has the capacity to perform well in Flash Flood prone environment.
- BRRi dhan93, BRRi dhan94 and BRRi dhan95 highly preferable in Northern part of Bangladesh as a alternate of Indian Sorna.

Field visit of HHAT Aman 21



Summary Statistics of tested rice varieties in HHAT (FFS) during T. Aman, 2021 under heterogeneous agro-ecological conditions of Bangladesh

Variety	No. of Observation (n)	Mean	Maximum	Minimum	Standard deviation	Standard error
Grain yield (t/ha)						
BRRi dhan51	30	4.99	6.50	3.32	0.88	0.16
BRRi dhan52	30	5.00	6.52	3.46	0.95	0.17
BRRi dhan79	29	5.05	6.27	3.38	0.71	0.14
IR13F441	30	4.92	6.29	3.50	0.75	0.14
Growth duration (Day)						
BRRi dhan51	30	142	147	128	3.38	0.62
BRRi dhan52	30	141	151	121	6.38	1.16
BRRi dhan79	29	135	143	128	4.27	0.82
IR13F441	30	143	168	136	6.61	1.21

Conclusion on HHAT Aman (Cont'd)

- BRRi dhan49 produced good yield throughout the country, however it was infested by False smut disease.
- BRRi dhan51 gave lower compared to BRRi dhan52 and highly infested by disease (ShB, BB) and Insect (SB).
- BRRi dhan52 produced better yield with tolerance to flash flood.
- BRRi dhan66 showed drought tolerance but yield was lower. So, farmers are disappointed.
- BRRi dhan70 gave lower yield due its higher sterility. However, some elite farmers like for its long slender grain, good taste of cooked rice with aroma.
- BRRi dhan71 performed excellent in both the drought prone and favorable environment.

Field visit of HHAT Aman 21



Field visit of HHAT Aman 21



Field visit of HHAT Aman 21



Field visit of HHAT Aman 21



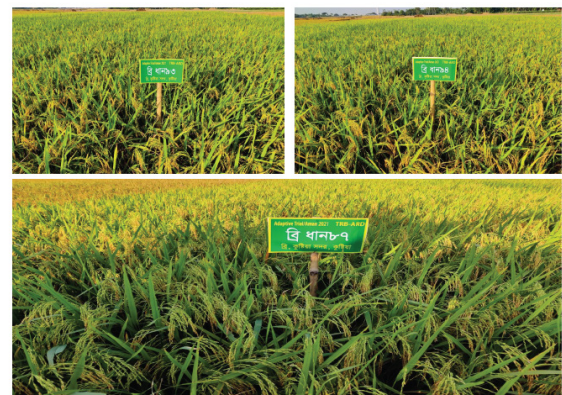
Field visit of HHAT Aman 21



Field visit of HHAT Aman 21



Field view of HHAT Aman 2021



Field view of HHAT Aman 2021



Acknowledgement

1. BIRRI Authority
2. Bill & Melinda Gates Foundation (BMGF)
3. IRRI Bangladesh Office (IBO), Dhaka
4. Plant Breeding Division, BIRRI
5. Scientists of BIRRI RS & HQ
6. Collaborators from GO, NGO & Company
7. DAE personnel
8. Farmers for their whole hearted cooperation

Thanks to all



Appendix 5: Presentation by Dr. Swati Nayak (IRRI)



Workshop on Result Sharing and Planning of Head to Head Adaptive Trial

Dr. Swati Nayak
Scientist & South Asia Lead - Seed Systems & Product Management
Platform: Rice Breeding
International Rice Research Institute

Date: 21 April 2022
Venue: Training Complex Conference Room, BRRI, Gazipur

IRRI CGIAR

Vision: Accelerating genetic gain , varietal turnover and seed replacement in farmer field



Why Varietal Replacement and Seed Replacement rates are low ?

- Not that new varieties are not competitive or not relevant to the farmers/consumers needs but more so due to lack of:
 - Product knowledge creation and documentation – Product profiles
 - System to transfer and communicate the product knowledge of new products to the farmers and other seed chain/market stakeholders in a timely manner
 - Lack of infrastructure and incentives to produce early generations seed (breeder seed, foundation seed etc.)
- New products stay listed in the workshop proceedings and in papers published – they never make to the farmers fields



Our key interventions to tackle the existing challenge

<p>Robust data driven product validation systems established</p> <ul style="list-style-type: none"> H2H trials Triadic Trials Measured data Genetic gain/ yield advantage assessments 	<p>Client oriented demand and linkage creating models scaled</p> <ul style="list-style-type: none"> Client oriented crop cafeteria Demonstrations Participation of men and women farmers, extension officer, seed production officers, seed firms, dealers, Millers, 	<p>Market stakeholder Assessment/ demand creation in place</p> <ul style="list-style-type: none"> Miller Assessment mechanisms Dealer Assessment Mechanisms Private led testings and demos 	<p>Enhance Quality Seed Access / Supply systems</p> <ul style="list-style-type: none"> Community led enterprise models Women led seed productions Quality seed production trainings EGS (Early generation seed) linkages
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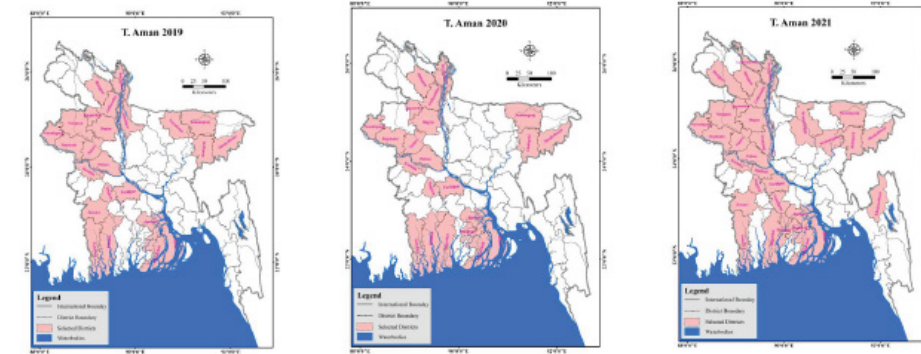


A Brief Trial Background

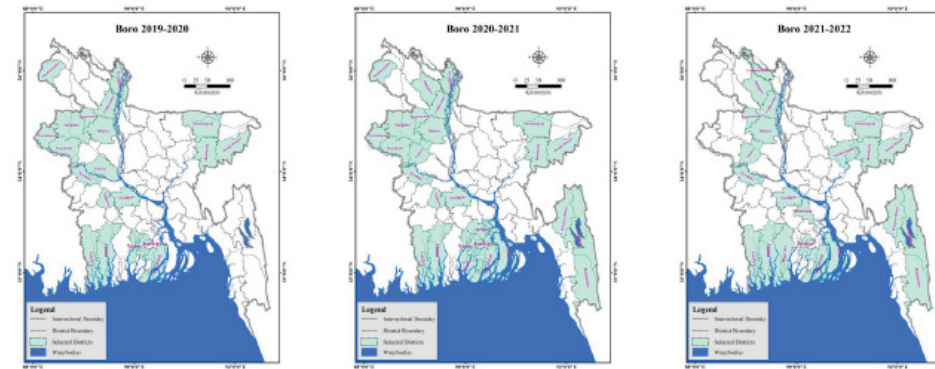
Item	Aman 2019	Boro 2019-20	Aman 2020	Boro 2020-21	Aman 2021	Boro 2021-22
Protocol	Tricot	Head to Head adaptive trials (IRRI-BRRI protocol)	H2H	Head to Head adaptive trials (IRRI-BRRI protocol)	Head to Head adaptive trials (IRRI-BRRI protocol)	Head to Head adaptive trials (IRRI-BRRI protocol)
Number Trial	1000	400	600	300	236	150
Seed chain stakeholders	Public: 05, NGO: 06	Public: 06, NGO: 07	Public: 06, NGO: 07	Public: 05, NGO: 07	Public: 04, NGO: 05	Public: 03, NGO: 02
Number of product use	Test variety 20, Farmer's check 09	Test variety 10, Farmer's check 02	Test variety 23, Farmer's check 08	Test variety 14, Farmer's check 02	Test variety 11, Line 01, Benchmark variety 05, Farmer's check 12	Test variety 10, Benchmark variety 04, Farmer's check 03



Bangladesh -Trial / Intervention locations- Kharif/Aman



Bangladesh -Trial / Intervention locations- Boro



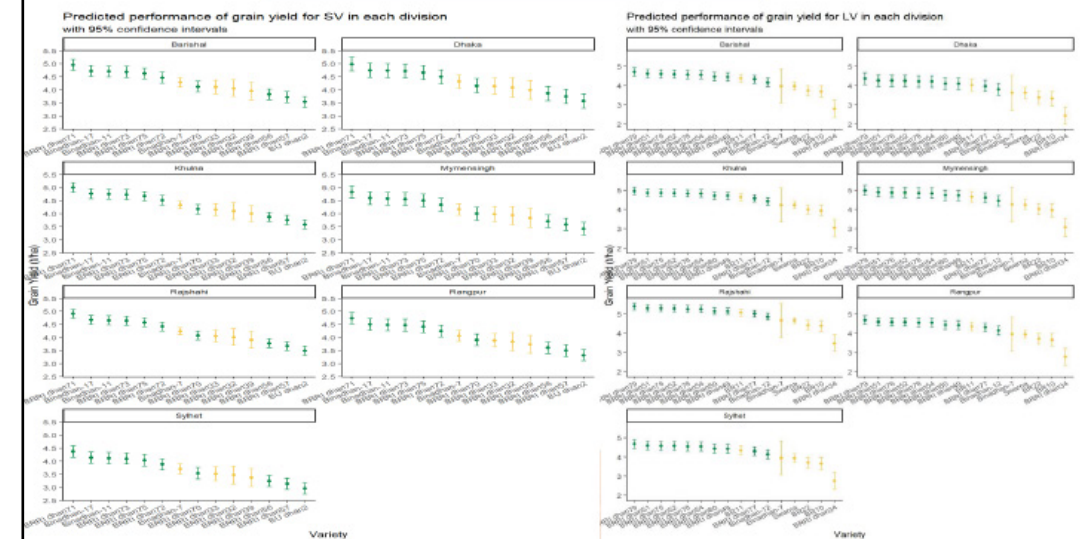
H2H

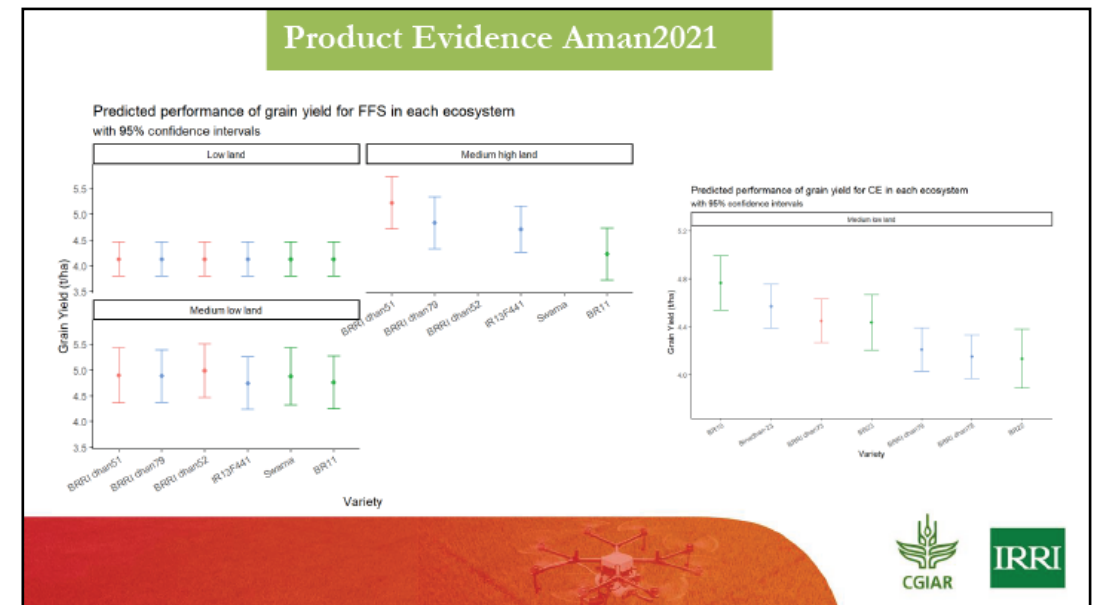
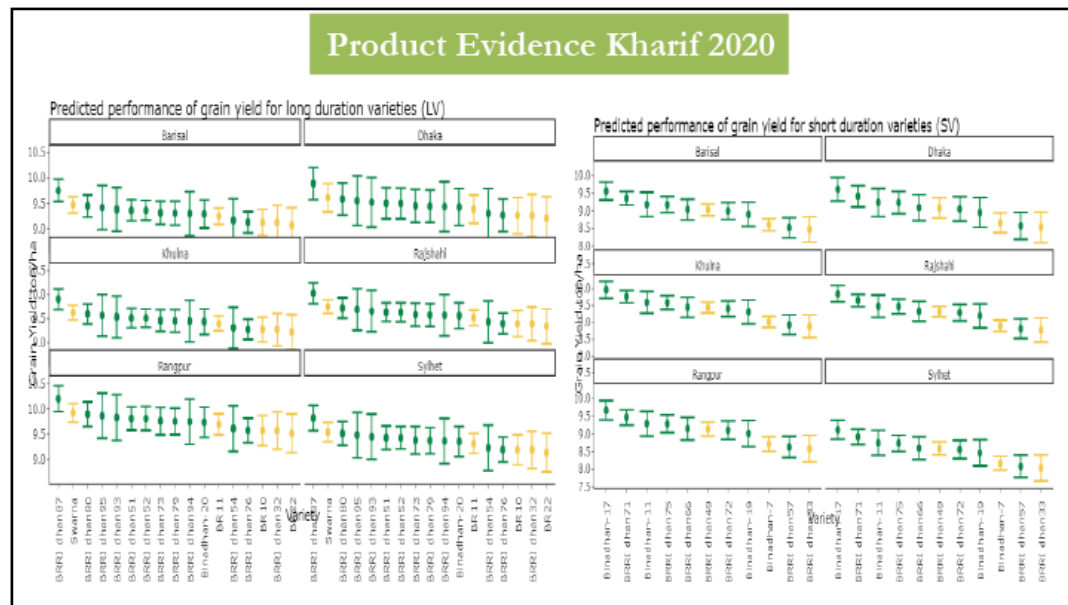
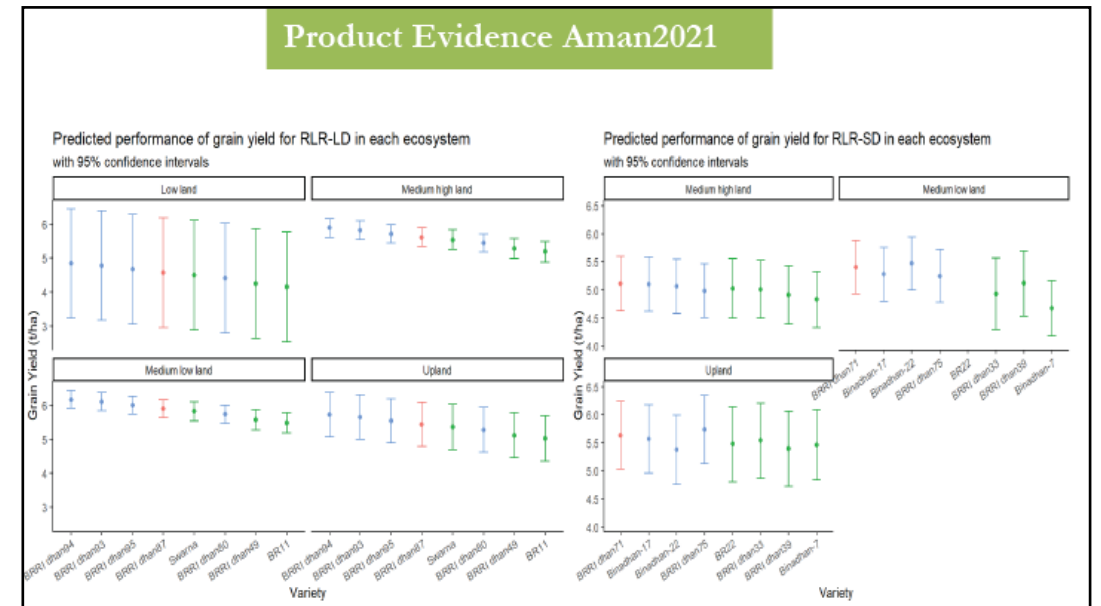
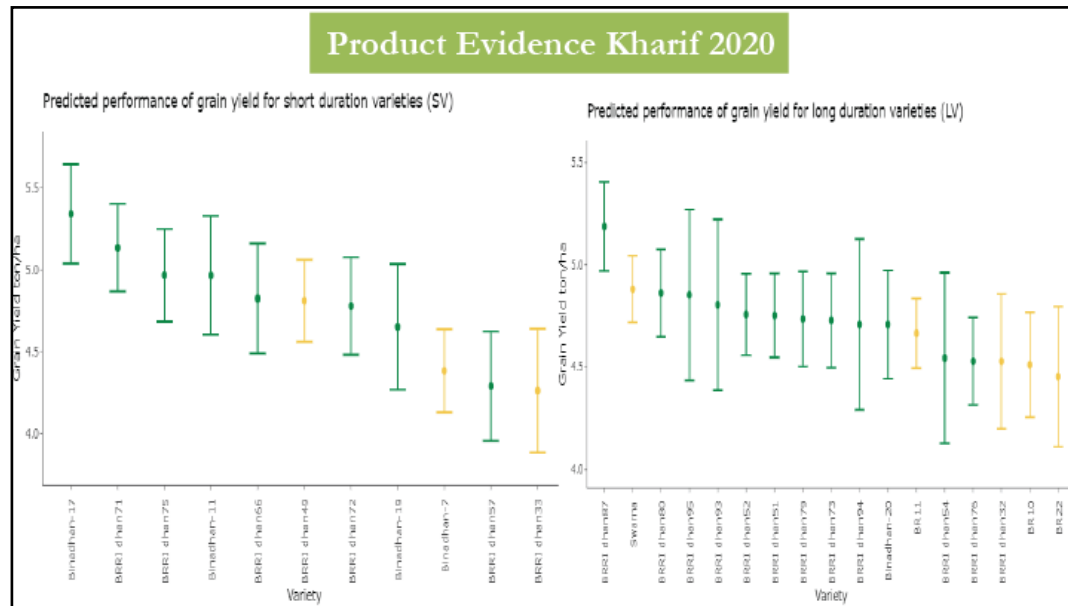
Different On-firm Trials



HHAT

Product Evidence Aman2019



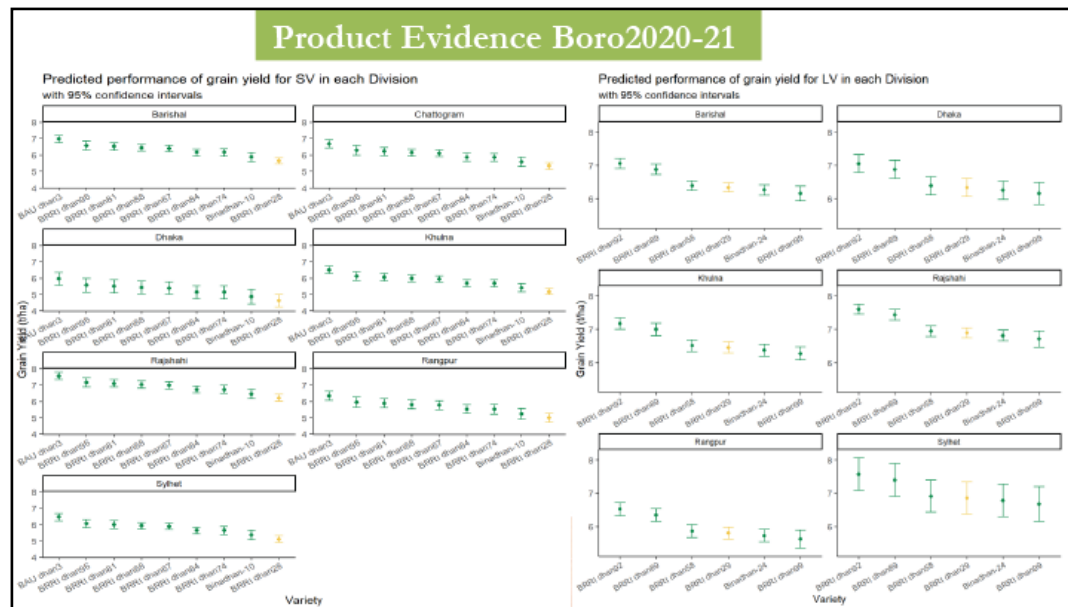
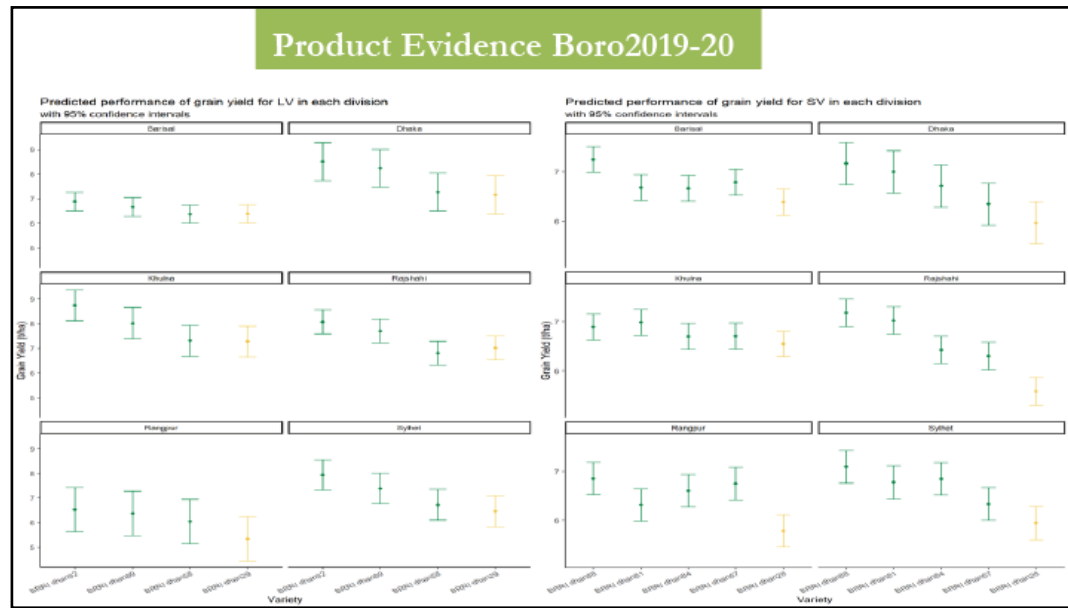


Rice Ecosystem wise Areas Aman2021 (Protocol)

Rice Environment	Clusters	Number of Trial (Each cluster we will conduct 12 trials)	Upzilla * avoiding duplication and expansion of area
Rainfed Lowland Rice-Long duration (RLR-LD)	Cluster 02, Cluster 04, Cluster 05, Cluster 06, Cluster 08, Cluster 09, Independent cluster, Expansion Area	96	Cluster-02 (Barisal Sadar, Pirjpur Sadar, Bakerganj) Cluster -04 (Daulatkhan, Babuganj, Monirumpur) Cluster-05 (Nabiganj, Kurigram Sadar, Aditmari) Cluster-06 (Kulaura, Sirajganj Sadar, Sreemangal) Cluster 08 (Godagari, Ishurdi, Chapainawabganj Sadar) Cluster-09 (Madhukhali, Kumarkhali, Lalpur) Independent cluster (Nokla, Phulpur, Kishoreganj Sadar) Expansion Cluster (Dimla, Fulbari, Baliadangi)
Coastal Ecosystem (CE)	Cluster 01, Cluster 02, Cluster 04,	36	Cluster-01 (Bhola Sadar, Tajmuddin, Indurkani,) Cluster-02 (Kolapara, Kaliganj, Kalaroa) Cluster-04 (Kachua, Morelgong, Bhola Sadar)
Flash Flood Submergence (FFS)	Cluster 02, Cluster 03, Cluster 05, Cluster 06, Cluster 08	60	Cluster-02 (Kaunia, Pirgachha, Sundorganj) Cluster 03 (Bishwambarpur Tahirpur, Sunamganj Sadar) Cluster-05 (Sadullahpur, Sundorganj, Kulaura) Cluster-06 (Sreemangal, Chhatak, Sirajganj Sadar) Cluster 08 (Sariakandi, Sherpur, Pangsha)
Rainfed Lowland Rice-Short duration (RLR-SD)	Cluster 02, Cluster 05, Cluster 08, Cluster 09	48	Cluster-02 (Nolcity, Jalkhathi Sadar, Satkhira Sadar) Cluster 05 (Lalmoinihat Sadar, Rangpur Sadar, Sadullahpur) Cluster 08 (Mohanpur, Akkelpur, Boalmari) Cluster-09 (Shalikka, Bogura Sadar, Badalgachhi)

Summary Recommendation from Aman 2019-21

- For short duration best yield potential for RLR-SD ecosystem is BRR1 dhan71, Binadhan-17 and Binadhan-22 which can replace the old varieties like Binadhan-7, BRR1 dhan39, BRR1 dhan33
- For RLR-LD ecosystem, BRR1 dhan94, BRR1 dhan79 and BRR1 dhan87 which can replace the old varieties like Swarna, BR 11
- In FFS ecosystem (like Kurigram, Gaibandha, Rangpur, Sirajgonj, Sylhet, Netrokona, Jamalpur) BRR1 dhan51 and BRR1 dhan79 do the best performance over the famers varieties like BR11.
- CE ??? (No recommendation yet- Confirmatory trials to be continued)

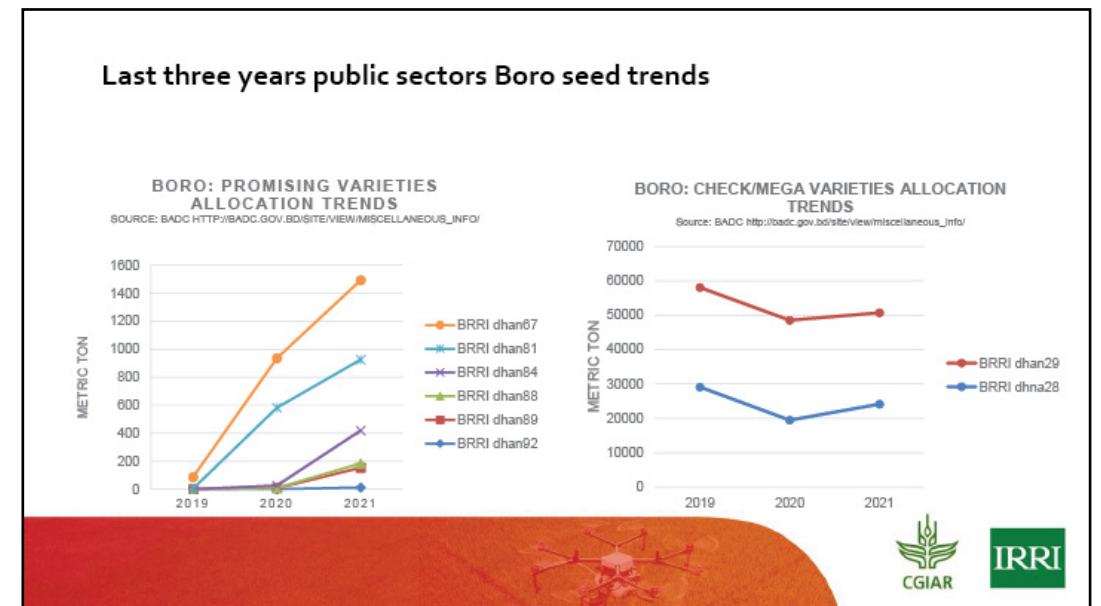


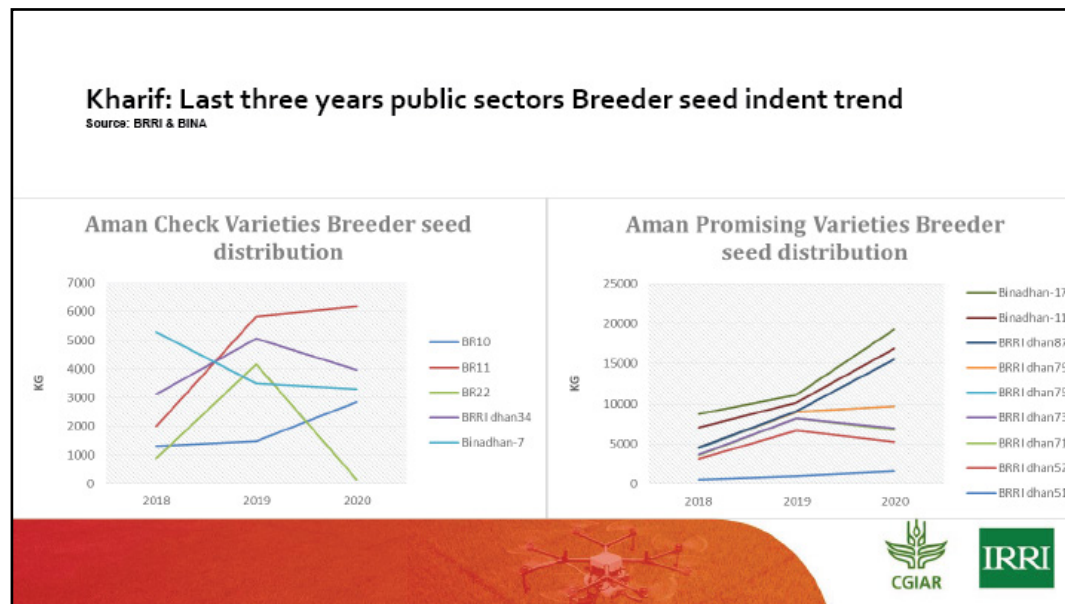
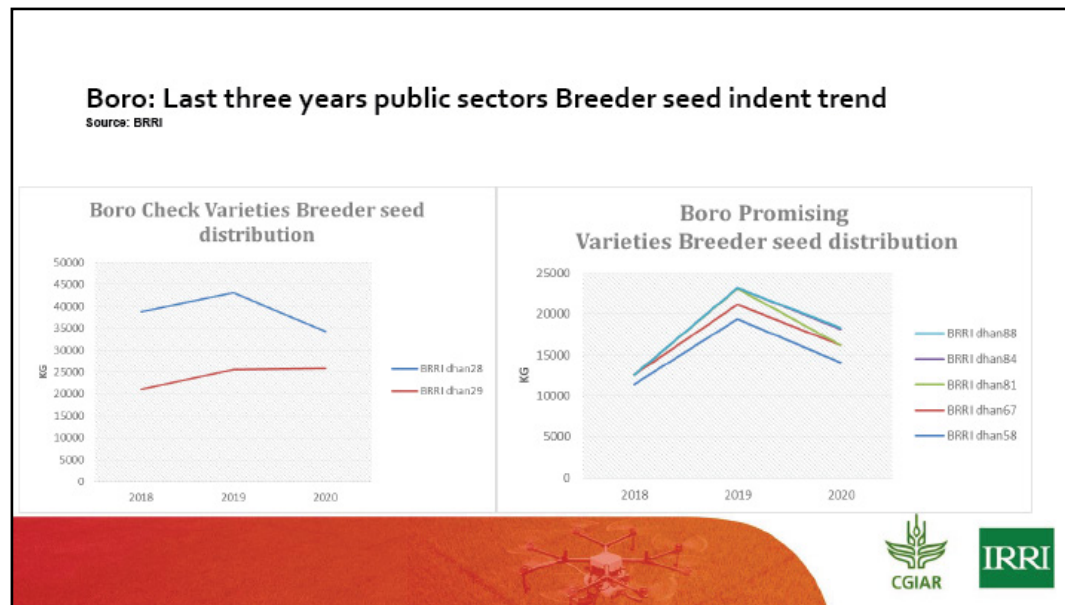
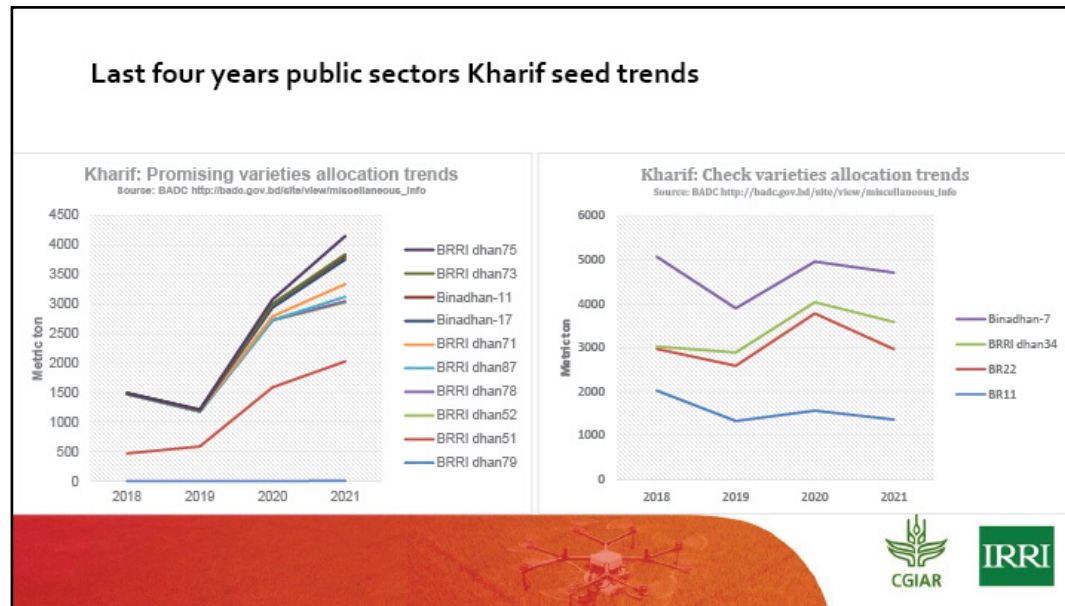
Summary Recommendation from Boro 2019-2022

- For short duration best yield potential is BARI dhan88, BARI dhan81 and BARI dhan96 which can replace the mega old variety BARI dhan28.
- As well one year BAU dhan3 showed highest yield potential. We need to do confirmatory trials continued.
- In hill ecosystem farmers like BARI dhan88 & BARI dhan96.
- For long duration BARI dhan92, BARI dhan89 showed highest yield advantages over the mega variety BARI dhan29 across all the divisions.

Product Evidence

Field photos





Major Outcomes so far

- ✓ Through large scale OFTs, identified potential varieties for promoting across seed chain (nearly 40+ products evaluated)
- ✓ Have positioned best performing/ potential varieties through strategic demand creations.
- ✓ A massive awareness creation of new promising varieties through cafeterias, crop cut and trial evaluations.
- ✓ Piloted and established market linkage for women / community led seed enterprises
- ✓ Designed and implemented gender inclusive and community centric trainings and materials
- ✓ Enhanced varietal awareness amongst market stakeholders like input dealers, millers
- ✓ Worked closely with Breeding network and Privates for EGS provisioning

Logos: CGIAR, IRRI

Thank you

Logos: CGIAR, IRRI



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GATES *foundation*