

Technology Transfer Program Committee (TTPC)

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EXECUTIVE SUMMARY

1. TECHNOLOGY VALIDATION

1.0 Advanced Line Adaptive Research Trial (ALART)

1.1 ALART: BRRI dhan49 type Short slender grain Superior High Yielding Rice-1 (SHR-1) during T. Aman 2023. Two advanced lines i.e., V1= BRH13-2-14-2-1B and V2= BR13-7-9-3-2B were evaluated along with BRRI dhan49 as check in ten different locations such as, Kushtia (Sadar), Gazipur (WB), Patuakhali (Sadar), Bogura (Sadar), Rangpur (Mithapukur), Satkhira (Sadar), Sonagazi (Feni), Cumilla (Burichang), Gopalganj (Sadar) and Rajshahi (Godagari) during T. Aman 2023. Across the locations, BRRI dhan49 produced higher mean grain yield (4.08 t/ha) than both the advanced lines V1= BRH-13-2-14-2-1B and V2= BR-13-7-9-3-2B produced 3.99 and 3.88 t/ha, respectively. Mean growth duration of the advanced lines was similar with BRRI dhan49, but 1000-grain weight of the advanced lines were significantly higher than BRRI dhan49. Plant growth, flowering and maturity of both the advanced lines were irregular. Therefore, considering the above characteristics of the tested genotypes could not be considered for further advancement.

1.2 ALART: Superior High Yielding Rice-2 (SHR-2) during T. Aman 2023. Two superior high yielding rice (SHR) advanced lines i.e., V1=BRH9392-6-2-1-3-4 and V2= BR9396-6-2-2B were evaluated against the check variety BRRI dhan94 in ten locations during Aman 2023. Interaction of genotypes and environments had significant effect on grain yield, growth duration, plant height and yield components. Among the genotypes highest mean grain yield (4.91 t ha⁻¹) was obtained in V1=BRH9392-6-2-1-3-4 followed by V2= BR9396-6-2-2B (4.74) and V3= BRRI dhan94(ck) (4.71) Mean growth duration of lines were 2 days longer than BRRI dhan94 (Ck) (136). Regarding other phenotypic and yield components parameter, there are no significant advantages observed in lines compared to check varieties and not recommended for PVT.

1.3 ALART: Aman 2024, ALART for Anti-Oxidant enriched rice. Two advanced lines, V1=BR12836-4R-63 and V2=BR12836-4R-312 along with check varieties BRRI dhan34 (Ck) and BRRI dhan70 (ck) were tested at farmers' field in ten locations. Mean grain yield of tested lines V1=BR12836-4R-63 (3.1 t/ha) and V2=BR12836-4R-312 (3.4 t/ha) were lower than BRRI dhan70 (3.6 t/ha) but slightly higher than BRRI dhan34 (2.9 t/ha). Average growth duration of tested lines were 1 to 4 days lower than BRRI dhan70 but 5-8 days lower than BRRI dhan34. The tested entries were found irregular in flowering and maturity in several locations. All tested lines including check varieties were highly infected by disease and insects in most of the locations. Regarding phenotypic and yield components parameter, there are no significant advantages observed in lines compared to check varieties and not recommended for PVT.

1.4 Re-ALART: Deep water Rice (DWR) B. Aman 2023. Two advanced lines bred for deep flooded (1 to 2 meter water depth) condition i.e., V1= BR10230-7-19-2B, V2= BR9392-6-2-1B were re- tested along with V3= Fulkori (ck.) and V4=Local popular variety(local check) as checks in nine different locations such as Faridpur (Sadar), Gopalganj (Moksedpur), Munshiganj (Louhajang), Habiganj (Baniachang), Manikganj (Harirampur), Rajshahi (Tanore), Sirajganj (Tarash 2 trial), BRRI Gazipur (Shibbari Deep water tank) during B. Aman 2023. Locally popular local check varieties used in this trials were Boirol, Hijal digha. The analysis focused on only data of Faridpur, Gopalganj, Sirajganj, and Munshiganj sites because data of other sites were not included due to rat damage, seedling mortality, lodging, etc. Highest water depth reached 110 cm (128 DAS) at Sirajganj. The genotypes V2=BR9390-6-2-1B produced the highest yield (1.50 t/ha), followed by V4=Local check (1.48 t/ha). Growth duration ranged from 163 to 171 days and Plant height ranged from 208 to 234 cm. The key trait kneeing for deep water rice was absent in the tested genotypes. Despite these insights, both advanced lines failed to adapt to increasing water depth, and irregularities at Sirajganj, Munshiganj, and Gazipur led to a lack of farmer interest. Consequently, none of the advanced lines were recommended for PVT.

1.5 ALART: Superior High Yielding Rice, Zira type (SHR-1) Boro 2023-24. Three advanced lines: V1=BRH15-24-7B, V2=BR9392-1-7-5B and V3=BR17-23-8-2-7B along with BRRi dhan88 (Ck) were tested at farmers' field in ten locations. The mean growth duration of tested lines were 4-5 days higher than standard check BRRi dhan88. Among the genotypes the highest mean grain yield (7.43 t ha^{-1}) was obtained in V3= BR17-23-8-2-7B followed by V1= BRH15-24-7B (7.02 t ha^{-1}), BRRi dhan88 (ck) (7.00 t/ha), and V2= BR9392-1-7-5B (6.96 t/ha). The tested entries were found irregular in flowering and maturity in all locations. Leaf Blast and Neck blast were not found severely in any location. Irregular maturity of grains in a single panicle was observed. Considering yield, growth duration, disease reactions and phenotypic acceptance, none of the tested line was recommended for advanced trial, Proposed variety trial (PVT).

1.6 ALART: Superior High Yielding Rice, Katari type (SHR-2), Boro 2024. Three advanced lines V1= BRH11-7-17-10B; V2= BRH9-3-2B and V3= BRH13-9-5-2B along with BRRi dhan81 (Ck) were tested at farmers' field in ten locations. The mean growth duration of tested lines were 5-6 days higher than standard check BRRi dhan81. Among the genotypes highest mean grain yield (7.33 t ha^{-1}) was obtained in V3= BRH13-9-5-2B followed by V2= BRH9-3-2B (7.27 t ha^{-1}), V1= BRH11-7-17-10B (7.24 t/ha), and BRRi dhan81 (ck) (6.57 t ha^{-1}). The tested entries were found irregular in flowering and maturity in all locations. Leaf Blast and Neck blast were not found severely in any location. Considering yield, growth duration, disease reactions and phenotypic acceptance, V3= BRH13-9-5-2B line is recommended for advanced trial, Proposed variety trial (PVT).

1.7 ALART: Favorable Boro Rice Long duration (FBR-LD) during Boro 2023-24. One advanced line V1= BR11318-5R-84 was evaluated against one check variety BRRi dhan92 in ten locations during Boro 2023-23 at farmers' field. Considering grain yield, growth duration and insect disease reactions, the advanced line V1= BR11318-5R-84 was not recommended for Proposed variety trial (PVT).

1.8 ALART: Favorable Boro Rice short duration (FBR-SD) during Boro 2023-24. Two advanced lines i.e., BR11903-5R-56 and IR18A2119 were evaluated along with two check varieties BRRi dhan88 and BRRi dhan96 in ten different locations during Boro 2023-24. Both the advanced lines i.e., BR11903-5R-56 and IR18A2119 produced significantly higher mean grain yield (7.02 and 7.04 t/ha) than both the check varieties i.e., BRRi dhan88 (6.73 t/ha) and BRRi dhan96 (6.63 t/ha). Most of the farmers didn't show their interest on both the advanced lines due to its lower grain yield, higher growth duration and phenotypic acceptance. Considering growth duration, grain yield, disease and insects reactions, phenotypic acceptance and farmers' preference none of the advanced lines were found suitable for PVT.

1.9 ALART: Favorable Boro Rice, Biotechnology (FBR-Bio), Boro 2023-24. Three advanced lines BR(Bio) 13028-AC24-1-2, BR(Bio) 13028-AC24-2-3 and BR(Bio) 13028-AC24-2-4 along with BRRi dhan86 (Ck) and BRRi dhan96 (Ck) were tested at farmers' field in ten locations. Growth duration of all the tested genotypes and checks was almost similar. All the tested entries gave almost similar yield compared to the check varieties The tested entries were not uniform in flowering and maturity in some locations. Considering all the characteristics, none of the tested entries were recommended for PVT.

1.10 ALART, FBR-Late Boro, Boro 2024: One advanced rice line, V1 = BR11845-4R-62, was tested alongside three check varieties: V2 = Binadhan-25 (Ck), V3 = BRRi dhan28 (Ck), and V4 = BRRi dhan98 (Ck) across 10 different locations during Boro 2024. Among the four tested rice genotypes, the check variety V4 = BRRi dhan98 produced a mean yield of 6.95 t/ha , which was significantly higher than the advanced line V1 = BR11845-4R-62 (6.55 t/ha) followed by V2 (Binadhan-14) recorded a mean yield of 6.11 t/ha , while V3 = BRRi dhan28 had an average yield of 6.34 t/ha . Flowering and maturity of V1 = BR11845-4R-62 was not uniform. Growth duration, plant height, and 1000-grain weight (g), did not show any advantage.

Moreover, farmers preferred the check variety BRRI dhan98 among the lines for its higher grain yield. Based on the ALART monitoring committee report, farmers' preferences, and data analysis, the advanced line V1 = BR11845-4R-62 was not recommended for PVT.

1.11 ALART: Cold Tolerant breeding lines suitable for haor areas [ALART-CTR (Haor)], Boro 2023-24. Two advanced lines; TP16199 and BR11894-R-R-R-R-169 along with BRRI dhan28 (Ck) and BRRI dhan67 (Ck) were tested at farmers' field in ten locations. The tested entry BR11894-R-R-R-R-169 gave higher yield compared to the check varieties having uniformity in flowering and maturity. Considering all the characteristics, BR11894-R-R-R-R-169 entry was recommended for PVT.

1.12 ALART: Bacterial Blight Resistance Rice, Boro, 2023-24. Three advanced lines BR(path)13800-BC3-8-1, BR(path)13800-BC3-8-9 and BR(path)13800-BC3-224-28 along with BRRI dhan89 (Ck) and BRRI dhan92 (Ck) were tested at farmers' field in ten locations. Growth duration was almost similar. All the tested entries gave almost similar yield compared to the check variety BRRI dhan92. The tested entries were found uniform in flowering and maturity in all locations. Both the entries gave almost similar yield compared to the check varieties and found susceptible to bacterial leaf blight and blast disease. Considering all the characteristics, none of the tested entries were recommended for PVT.

1.13 ALART: Bacterial Blight (BB) and Blast Resistance Rice, Boro 2024. Three advanced lines: R(path)13800-BC3-134-8, R(path)13800-BC3-134-25 and R(path)13800-BC3-224-44 along with BRRI dhan89 (Ck) and BRRI dhan92 (Ck) were tested at farmers' field in ten locations. Growth duration was almost similar. Both the R(path)13800-BC3-134-8 and R(path)13800-BC3-134-25 entries gave statistically higher yield compared to the check varieties. The tested entries were found uniform in flowering and maturity in all locations. Both the entries found less susceptible to bacterial leaf blight and blast disease. Considering all the characteristics, R(path)13800-BC3-134-25 line was recommended for PVT.

1.14 ALART: Premium Quality Rice (PQR), Boro 2024. Five advanced premium quality rice breeding lines such as V1= BR10645-6-4-8-1-2, V2= BR10646-3-2-2-4-3, V3= BR10648-12-1-3-4-1, V4=Zira, Nachole and V5=Katari were tested along with the three check varieties, BRRI dhan104, BRRI dhan107 and BINA dhan25r were evaluated in Boro 2024 at ten different locations. The check variety BRRI dhan107 BRRI dhan103 produced significantly higher yield (6.98 t/ha and 6.93 t/ha, respectively) than the tested entries V2= BR10646-3-2-2-4-3, V3= BR10648-12-1-3-4-1, V4=Zira, Nachol and V5=Katari, Shibganj. Droopy and curled leaves were observed in the tested entries. Sheath blight infestation were observed in all entries at 3 locations. Thousand-grain weight of all the entries were statistically similar as checks and grain quality was not preferable. Considering yield, disease and insect reactions, phenotypic acceptance, uniformity of flowering and maturity and farmers' preference none of the advance lines found suitable for PVT.

1.15 ALART: Salt tolerant rice (STR), Boro 2023-24. Four advanced lines i.e., BR11712-4R-44, BR11712-4R-93, BR11712-4R-12, BR11712-4R-6 along with BRRI dhan67 (ck) and BRRI dhan89 (ck) as checks were tested at farmers' field in ten locations under saline environment. These locations experienced low crop yields due to elevated salinity. The highest salinity level recorded was 18.18 dS/m in Satkhira (Kaliganj), while the lowest was 0.82 ds/m in Noakhali (Sadar). In the saline -prone areas, all tested lines produced higher yields in Noakhali (Sadar) (3.94 t/ha), compared to the lower yields in Satkhira (Shamnagar) (0.9 t/ha). In the non-saline prone areas, all tested lines produced higher yields in BRRI (H/Q) (8.26 t/ha) compared to the lower yields in Noakhali (Companiganj) (7.39 t/ha). V1= BR11712-4R-44 gave the similar grain yield with all tested entries including standard check BRRI dhan67 except susceptible check BRRI dhan89. Considering grain yield, growth duration, salinity status, phenotypic acceptance, insect and disease incidence all the advanced lines BR11712-4R-44 was recommended for PVT.

1.16 Head to Head Adaptive Trial (HHAT) during T. Aman 2023. A total of 200 Head to Head Adaptive Trials (HHAT) with eight categories according to rice eco-system were conducted in 8 agro-ecological zones throughout the country during T. Aman 2023 under TRB project through public and private partnership (PPP).. The major groups were; 1. Long growth duration rice variety (Swarna-Growing areas), 2. Long growth duration rice variety (Dinajpur areas), 3. Long growth duration rice variety (Rangpur areas), 4. Long growth duration rice variety (Mymensingh areas), 5. Short growth duration rice variety, 6. Coastal Ecosystem (CE), 7. Flash Flood Submergence (FFS), 8. Tidal Submergence (TS). In Swarna rice growing areas, BRRi dhan87 and BRRi dhan94 were found as better performer than others. BRRi dhan87 produced the highest grain yield 5.70 t/ha followed by BRRi dhan94 (5.67 t/ha). In Dinajpur areas, BRRi dhan80 was found as the highest yielder (4.80 t/ha) having growth duration 132 days followed by BRRi dhan90 (4.43 t/ha) Whereas, Kataribhog produced the lowest yield (3.49 t/ha). In Rangpur areas, BRRi dhan87 produced the highest grain yield (5.77 t/ha) having also the shortest growth duration 126 days only followed by BR11 which produced (5.29 t/ha). In Mymensingh regions, BRRi dhan87 produced the highest grain yield (5.93 t/ha) having also the shortest growth duration 132 days only. BRRi dhan49 and BRRi dhan94 produced the statistically similar yield and the similar growth duration respectively.

In Coastal Ecosystem (CE), the highest mean grain yield was recorded 5.50 t/ha in BRRi dhan79 followed by BR23 (4.91 t/ha) with the longest 146 days growth duration. BRRi dhan73 performed poor in Coastal ecosystem, having grain yield 4.29 t/ha with 126 days duration. Among the Flash flood submergence tolerant entry IR16F1148 produced the highest mean yield (5.66 t/ha) having the growth duration 140 days followed by BRRi dhan52 producing grain yield 5.22 t/ha with 147 days growth duration and other tested varieties BRRi dhan51, BRRi dhan79 gave statistically similar yield, which can overcome early flash flood. Tidal Submergence tolerant BRRi dhan52 produced the highest mean yield 5.04 t/ha having the growth duration 143 days followed by BR11 (5.01 t/ha) with 144 days.

2. TECHNOLOGY DISSEMINATION

ARD conducted different demonstration trials and involved in different promotional activities for rapid dissemination of BRRi developed technologies in collaboration with DAE. A total of 1618 demonstrations were executed by ARD during 2023-2024 under GOB; PARTNER and LSDT project.

2.1 Seed production and dissemination program (SPDP) during T. Aus 2023: A total of 58 SPDP of BRRi dhan98 executed in 29 upazilas of 11 districts during T. Aus 2023 GoB. The mean grain yield of BRRi dhan98 was 5.20 t/ha ranging from 3.40 to 6.20 t/ha A total of 39698 kg grains were produced from which 4530 kg quality seeds were retained by the farmers as seed for the next year cultivation.

2.2 Special SPDP at Bhola during T. Aus 2023: A special SPDP of BRRi dhan83 in B. Aus 2023 was conducted in 6 upazilas of Bhola district under GoB. was used in the program. Mean grain yield of BRRi dhan83 was 3.30 t/ha with a range from 2.60 to 4.10 t/ha A total of 5327 kg grains were produced from all demonstrated plots and 495 kg quality seeds were retained by the farmers as seed for the next year cultivation.

2.3 SPDP of B. Aus rice in the hill districts (Jhum) in 2023: A total of 57 demonstrations were conducted under Jhum system in the 6 upazilas in B. Aus 2023 in three hilly districts under GoB. BRRi dhan83 was used in the program. A total of 28087 kg grains were produced from all demonstrated plots and 3956 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 2689 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 1051 farmers were motivated and showed their interest to cultivate these varieties.

2.4 SPDP in the Valley of the Hill districts during T. Aus 2023. Seed Production and dissemination Program (SPDP) in T. Aus 2023 were conducted in the Valley of 6 upazilas of 3 districts. BRRIdhan98 was used in the program. The yield of BRRIdhan98 ranged from 3.9 to 6.20 t/ha with an average of 5.10 t/ha. A total of 9539 kg grains were produced from all demonstrated plots and 880 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 658 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing.

2.5 Special dissemination program of BRRIdhan7 during T. Aus 2023: A total of 56 Special dissemination program of BRRIdhan7 in T. Aus 2023 were conducted in 28 upazilas of 12 districts under GOB. The minimum yield of BRRIdhan7 was 4.7 t/ha, the maximum yield was 7.1 t/ha and the average yield was 5.8 t/ha. A total of 1044 farmers were motivated and showed their interest to cultivate these varieties in the next year.

2.6 SPDP T. Aman 2023: Trials were conducted in 25 upazilas of 12 districts on SPDP. Thirteen modern rice varieties were used in the program. Among the varieties, BRRIdhan103 produced the highest mean grain yield 5.7 t/ha followed by BRRIdhan78, BRRIdhan94 and BRRIdhan95 (4.9 t ha⁻¹). The lowest mean rice grain yield was 3.5 t/ha in BRRIdhan76 followed by 4.5 t/ha in BRRIdhan79, BRRIdhan75 (4.8 t/ha), BRRIdhan71 (4.7 t/ha) and BRRIdhan90 respectively. A total of 4,02,695 kg grains were produced from all demonstrated plots and 55,166 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 26760 farmers attained awareness and knowledge about the varieties from which 9192 farmers were motivated.

2.7 Demonstration of BRRIdhan4 and BRRIdhan6 during T. Aman 2023: Special dissemination program on BRRIdhan4 and BRRIdhan6 in T. Aman 2023 were conducted in 28 upazilas under 12 districts. Average yield of BRRIdhan4 and BRRIdhan6 was 5.0 and 5.8 t/ha, respectively.. About 1135 farmers acquired awareness and gained knowledge about the varieties and 436 farmers were motivated.

2.8 SPDP T. Aman 2023 in the Hilly districts: SPDP in T. Aman 2023 were conducted in the Valley of 6 upazilas of 3 districts under GoB. Three modern rice varieties such as BRRIdhan80, BRRIdhan87 and BRRIdhan103 were used in the program. Mean grain yield of the varieties were similar and it was around 5.0 t/ha.. A total of 37571 kg grains were produced from all demonstrated plots and 2977 kg quality seeds were retained by the farmers. About 1424 farmers gained knowledge about the varieties through field visits and discussion from which 725 farmers were motivated.

2.9 SPDP through cropping pattern during T. Aman 2023: SPDP through cropping pattern T Aman-Patoto-Boro in T. Aman 2023 were conducted in the 8 upazilas of 4 districts under GoB. Two modern rice varieties; BRRIdhan75 and BRRIdhan103 were used in the program. Mean grain yield of BRRIdhan75 and BRRIdhan103 were 5.0 and 5.5 t/ha, respectively. A total of 98691 kg grains were produced from all demonstrated plots and 3451 kg quality seeds were retained by the farmers as seed. About 665 farmers acquired awareness and knowledge about the varieties and 232 farmers were motivated and showed their interest to cultivate these varieties in the next year.

2.10 SPDP T. Aman 2023 under TRB: A total of 30 SPDPs were conducted in 20 Upazila of 8 districts under TRB project during T. Aman 2023. BRRIdhan71, BRRIdhan75, BRRIdhan87, BRRIdhan94 and BRRIdhan95 were demonstrated in the SPDPs. Among the varieties, BRRIdhan95 produced the highest mean grain yield 6.0 t/ha followed by BRRIdhan87 (5.7 t/ha). A total of 31190 kg grains were produced from all demonstrated plots and 6133 kg quality seeds were retained by the farmers as seed for the next year cultivation.

2.11 SPDP under PARTNER project during Boro 2023-24: A total of 400 demonstrations were established in Boro 2024 were conducted in 36 upazilas of 13 districts under PARTNER

project. Six modern rice varieties such as BRRi dhan99, Bangabandhu dhan100, BRRi dhan101, BRRi dhan102, BRRi dhan104 and BRRi dhan105 were used in the program. Plot size of each variety was 3 bighas area in a cluster in each block of each upazila. Among the varieties, BRRi dhan102 produced the highest mean grain yield 7.5 t/ha followed by Bangabandhu dhan100 and BRRi dhan105 (6.8 t ha⁻¹) and the lowest mean rice grain yield was 6.5 t/ha found in BRRi dhan104. Total grain produced was 471636 kg from all demonstrated plots and 61142 kg quality seeds were retained by the farmers as seed for the next year cultivation. A total of 4976 farmers were motivated and showed their interest to cultivate these varieties.

1.12 Special dissemination program on BRRi hybrid dhan8: A total of 37 demonstrations of BRRi hybrid dhan8 were executed in 36 upazilas of 13 districts in Boro 2024 under PARTNER project. Plot size of each variety was 3 bigha for one demonstration, this 3 bigha area in each upazila in a cluster. Average grain yield of BRRi hybrid dhan4 was 7.90 t/ha with a range from 5.0 to 9.90 t/ha. A total of 693 farmers were motivated and showed their interest to cultivate BRRi hybrid dhan8 in the next year.

2.13 SPDP under LSTD project in Boro 2024: SPDPs in Boro 2023-24 were conducted in 8 upazilas of 4 districts. Seven modern rice varieties; BRRi dhan67, BRRi dhan74, BRRi dhan84, BRRi dhan88, BRRi dhan89, BRRi dhan92 and Bangabandhu dhan100 were used in the program. Among the varieties, BRRi dhan92 produced the highest mean grain yield 7.3 t/ha followed by BRRi dhan89 (7.2 t/ha) and the lowest mean rice grain yield was 5.6 t/ha in BRRi dhan74 followed by BRRi dhan67 (5.7 t/ha). A total of 1093431 kg grains were produced from all demonstrated plots and 110800 kg quality seeds were retained by the farmers as seed. About 42739 farmers acquired awareness and knowledge about the varieties from which 18650 farmers were motivated and showed their interest to cultivate these varieties in the next year.

3. PROMOTIONAL ACTIVITIES

3.1 Farmers' training: A total of 44 Farmers' trainings were executed throughout the country by Adaptive Research Division (ARD) under GoB; and PARTNER and LSTD projects. A total of 1340 farmers and 69 SAAOs participated and updated their knowledge regarding modern rice production technology.

3.2 Field Day: Adaptive Research Division conducted a total of 23 Field days at different locations of the country under PARTNER and LSTD projects. Around 2,300 participants including farmers, local leaders and DAE personnel participated in the field days. These programs also generated much enthusiasm about modern rice production technologies and BRRi varieties, which helped rapid dissemination of technologies.

3.3 Farmer seed center (FSC): A total of 3 seed centers for farmers were established at different project implementing areas of the country. Six plastic drums were supplied by project cost in each center. Around 80 kg seeds were preserved in each drum, as a result a total of nearly 1500 kg seeds were preserved properly by the farmers themselves.

4.0 Sees production at BRRi farm: A total of 5270 kg quality seeds of different BRRi varieties were produced at BRRi farms during the reporting period for the enrichment of own seed stock during T. Aman and Boro seasons.

Detail Report

1. Technology Validation

1.0. Advanced Line Adaptive Research Trial (ALART)

Introduction: The Advanced Line Adaptive Research Trial (ALART) was conducted to test the yield potential and adaptability of advanced breeding lines at farmers' field under different agro-ecological conditions of the country and to generate the feedback about the advantages and disadvantages of the advanced lines from extension workers and farmers. This is an important step towards variety development. The trials were conducted in collaboration with the scientists of BRRRI Regional Stations and DAE personnel. Tested materials were supplied by Plant Breeding and Plant Pathology Divisions.

1.1 ALART-BRRRI dhan49 type Short slender grain Superior High Yielding Rice-1 (SHR-1) during T. Aman 2023.

Rationale: Superior High Yielding Rice (SHR) means its superiority having fine grain type and lower growth duration. Those lines must have higher grain yield than existing local and modern rice varieties along with fine grain shape and medium growth duration. Now-a-days, fine grain type varieties have higher demand in the market throughout the country. BRRRI released BRRRI dhan49 is a very popular rice variety with a slender type grain. Farmers are interested to cultivate rice varieties having higher grain yield, fine grain type and higher market price. The development of new elite rice varieties with high yield and superior quality is challenging for traditional breeding approaches, and new strategies need to be developed. With this view, two advanced lines were evaluated in different agro-ecological conditions of Bangladesh.

Hypothesis: There is possibility to identify and select BRRRI dhan49 type Short slender grain superior high yielding rice genotypes which is suitable for T. Aman season.

Materials and method: Two advanced lines i.e., V1= BRH13-2-14-2-1B and V2= BR13-7-9-3-2B were evaluated along with BRRRI dhan49 as check in ten different locations such as, Kushtia (Sadar), Gazipur (WB), Patuakhali (Sadar), Bogura (Sadar), Rangpur (Mithapukur), Satkhira (Sadar), Sonagazi (Feni), Cumilla (Burichang), Gopalganj (Sadar) and Rajshahi (Godagari) during T. Aman 2023. The trials were replicated thrice in each location. The unit plot size for each entry was 25 m² (5m x 5 m). The time of seed sowing at different locations was not same and the dates were within 15-30 June and transplanting date was 10-25 July 2023. Seedling age was 25-30 days. Fertilizers were applied @ 24-15-15-10-1 kg Urea, TSP, MoP, Gypsum, ZnSO₄ per Bigha. All amounts of TSP, MoP, Gypsum, Zinc sulfate and one-third (1/3) of urea were applied at the time of final land preparation. Rest of urea was top dressed in two equal splits at 20 and 40 days after transplanting (DAT) or synchronizing with rainfall and water depth. Seedling were transplanted at 25 cm x 15 cm spacing. Other standard management practices were followed as and when necessary. Appropriate measures were taken to control insect and other pests. Date of seeding, flowering and maturity, phenotypic acceptance at vegetative and ripening stage, yield and yield components, flood water depth, disease and insect incidence were recorded. Feedback from farmers and DAE personnel were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and Discussion:

Two trial sites out of ten locations were damaged. The trial site of Gopalganj (Sadar) was fully damaged by BPH and Rat and was abandon by ALART monitoring team. V2= BR-13-7-9-3-2B was fully damaged by rat in Rajshahi (Godagari) trial site. Therefore, results of eight locations were analyzed and discussed here. On an average of eight locations, both the advanced lines V1= BRH-13-2-14-2-1B and V2= BR-13-7-9-3-2B produced 3.99 and 3.88 t/ha respectively (Table 1) which is statistically similar with the check variety BRRRI dhan49 (4.08 t/ha) (Table 1), but numerical lower than the check variety, therefore both the advanced lines failed to perform better over the check variety BRRRI dhan49. The mean growth duration of both the

advanced lines V1= BRH-13-2-14-2-1B and V2= BR-13-7-9-3-2B were 133 days which was 2 days lower than the check variety (135 days) (Table 1). The tallest plant was V1= BRH-13-2-14-2-1B (116 cm) followed by V2= BR-13-7-9-3-2B (114 cm) which was 11 cm and 9 cm taller than the check variety BRRi dhan49 (Table 1). 1000-grain weight (TGW) of V1= BRH-13-2-14-2-1B (22.65 gm) was the highest followed by V2= BR-13-7-9-3-2B (20.5 gm) and the lowest was found in the check variety (19.97 gm) (Table 2). 1000-grain weight (TGW) of both the advanced lines was significantly higher than the check variety BRRi dhan49. Therefore, the grains of both the advanced lines are not as fine as the check variety. The panicles/square meter range varied from 129 to 327 and highest mean panicles/square meter was found in the check variety BRRi dhan49 followed by V1= BRH-13-2-14-2-1B (208) and V2= BR-13-7-9-3-2B (205) (Table 2). On an average of eight locations, the highest filled grains/panicle were found in V2= BR-13-7-9-3-2B (133) followed by check variety BRRi dhan49 (125) and it was the lowest (114) in V1= BRH-13-2-14-2-1B (Table 2). The mean sterility% of all the two advanced lines including check ranged from 15-25 (Table 2). The sterility% was significantly higher than the check variety. The sterility% of V1= BRH-13-2-14-2-1B and V2= BR-13-7-9-3-2B were 25 and 23 respectively. This may be one reason that both the advanced lines didn't produce higher grain yield than the check variety.

From the above results, it is observing that the highest yielder BRRi dhan49 (Ck. variety) gave similar yield to the both advanced lines. But, the mean grain yield of both the advanced lines was not higher over the check variety. Although the mean growth duration of the two advanced lines was two days lower than BRRi dhan49, its plant height was shorter than both the advanced lines. Grain size, shape and 1000-grain weight of the entry no. 1 & 2 were significantly higher than BRRi dhan49 i.e., grain of the both advanced lines are not similar to BRRi dhan49 type (Short slender grain). Plant growth, flowering and maturity of both the advanced lines were irregular. So, considering the above characteristics of the tested genotypes could not be considered for further advancement.

Table 1. Grain yield, Growth duration and Plant height of some rice genotypes under ALART (SHR-1) during T. Aman 2023.

Genotypes	Sadar Kushiya	WB, Gazipur	Sadar Patuakhali	Sadar, Bogura	Mithapukur, Rangpur	Sadar, Satkhira	Sonagazi	Burichang, Cumilla	Grand Average
Grain Yield (t/ha)									
V1= BRH-13-2-14-2-1B	3.99	3.58	3.36	5.1	3.32	3.21	5.34	4.08	3.99
V2= BR-13-7-9-3-2B	3.83	3.49	3.87	3.88	4.39	2.93	4.87	3.79	3.88
V3= BRRi dhan49 (ck)	5.26	4.05	3.44	3.71	4.09	2.75	5.41	3.95	4.08
LSD _{0.05}	0.66								0.23
CV%	10.03								
Growth duration (day)									
V1= BRH-13-2-14-2-1B	132	133	144	128	132	130	135	133	133
V2= BR-13-7-9-3-2B	126	131	136	135	132	132	134	135	133
V3= BRRi dhan49 (ck)	136	138	140	126	139	135	135	134	135
LSD _{0.05}	0.93								0.33
CV%	0.42								
Plant height (cm)									
V1= BRH-13-2-14-2-1B	131	116	107	121	131	108	112	98	116
V2= BR-13-7-9-3-2B	132	116	105	111	134	103	111	99	114
V3= BRRi dhan49 (ck)	114	107	95	93	129	106	106	93	105
LSD _{0.05}	4.71								1.67
CV%	2.57								

Table 2. Yield contributing characters of some rice genotypes under ALART (SHR-1) during T. Aman 2023

Genotype	Sadar Kushtia	WB, Gazipur	Sadar Patuakhali	Sadar, Bogura	Mithapukur, Rangpur	Sadar, Satkhira	Sonagazi	Burichang, Cumilla	Grand Average
1000-Grain Weight (g)									
V1= BRH-13-2-14-2-1B	21.4	24.04	21.87	26.8	21	22.4	20.09	23.6	22.65
V2= BR-13-7-9-3-2B	18.75	19.23	20.66	24.5	20	20.91	20.21	19.7	20.5
V3= BRRI dhan49 (ck)	19.5	19.55	20.02	20.57	20	19.9	20.43	19.8	19.97
LSD _{0.05}	1.45								0.51
CV%	4.20								
Panicles/Square meter (no.)									
V1= BRH-13-2-14-2-1B	262	235	207	217	192	212	214	128	208
V2= BR-13-7-9-3-2B	199	260	211	232	184	208	208	135	205
V3= BRRI dhan49 (ck)	327	281	211	243	247	223	210	129	234
LSD _{0.05}	25.92								9.16
CV%	7.31								
Filled Grains per Panicle (no.)									
V1= BRH-13-2-14-2-1B	80	99	143	85	84	143	150	128	114
V2= BR-13-7-9-3-2B	129	102	183	75	120	183	137	135	133
V3= BRRI dhan49 (ck)	84	106	172	85	104	172	150	129	125
LSD _{0.05}	30.39								10.75
CV%	14.90								
Sterility (%)									
V1= BRH-13-2-14-2-1B	32	35	20	18	40	24	18	14	25
V2= BR-13-7-9-3-2B	25	35	13	22	39	15	20	14	23
V3= BRRI dhan49 (ck)	18	22	11	7	18	12	17	13	15
LSD _{0.05}	6.94								2.45
CV%	20.04								

Disease infection

Sheath blight infection was found in two locations (Cumilla, and Bogura) with 3% occurrence in all the tested entries. About 1% Bacterial Blight infection was found only in one location (Bogura). Brown Spot disease was found about 3% only in one location (Bogura). Besides, 1-5% false smut disease was observed in Kushtia in different entries (Table 3). No control measures were taken to see the disease susceptibility of the rice genotypes.

Table 3. Disease score (%) of the rice genotypes under ALART (SHR-1) in Aman 2023.

Genotype	Disease Infection (%)			
	Sheath Blight	Bacterial Blight	Brown Spot	False smut
V1= BRH-13-2-14-2-1B	3% found in 2 locations (Cumilla & Bogura)	1% found in 1 location (Bogura)	3% found in 1 location (Bogura)	1% found in 1 location (Kushtia)
V2= BR-13-7-9-3-2B	3% found in 2 locations (Cumilla & Bogura)	1% found in 1 location (Bogura)	3% found in 1 location (Bogura)	5% found in 1 location (Kushtia)
V3= BRRI dhan49 (ck)	3% found in 2 locations (Cumilla & Bogura)	1% found in 1 location (Bogura)	3% found in 1 location (Bogura)	3% found in 1 location (Kushtia)

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Insect infestation

Stem borer infestation was found in three trial sites with lower level of infestation (3-5 %) in two locations and higher level of infestation (40-70%) in one location. BPH infestation was found in three locations. 20% BPH infestation was found in Gopalganj trial site in all the tested entries. However, 30-40% BPH infestation was observed in Bogura & Satkhira trial site in all the tested entries (Table 4). Though, proper controlled measures were taken to control insects as and when necessary in all the trial sites.

Rat Damage: About 70 % rat damaged was found in Gopalganj in all the tested entries. However, about 100 % rat damaged was found only in V2= BR-13-7-9-3-2B in Rajshahi trial site (Table 4).

Lodging incidence: 80-100% lodging was observed in both the advanced lines i.e., V1= BRH-13-2-14-2-1B, V2= BR-13-7-9-3-2B in Gazipur trial site. However, check variety BRRI dhan49 found lower lodging tendency (60-70%) in Gazipur trial site (Table 4).

Table 4. Insect attacked (%) score and Lodging susceptibility score (%) of the rice genotypes under ALART (SHR-1) during Aman 2023.

SN.	Genotype	Insect infestation (%)			Lodging susceptibility
		Yellow Steam Borer	BPH	Rat damage	
01	V1= BRH-13-2-14-2-1B	3-5% found in 2 locations and about 70% found in 1 location.	20% found in Gopalganj & 30% found in Bogura & Satkhira	70 % found in Gopalganj	80-100% found in 1 location Gazipur (WB).
02	V2= BR-13-7-9-3-2B	3-5% found in 2 locations and about 50 % found in 1 location.	20% found in Gopalganj & 30% found in Bogura & Satkhira	70 % found in Gopalganj & 100% found in Rajshahi	80-100% found in 1 location Gazipur (WB).
03	V3= BRRI dhan49 (ck)	3% found in 2 locations and about 40 % found in 1 location.	20% found in Gopalganj & 30% found in Bogura & 40% in Satkhira	70 % found in Gopalganj	60-70% found in 1 location Gazipur (WB).

Plant growth and other attributes

Plant growth, flowering and maturity of the two advanced lines were irregular (Table 5). However, plant growth, flowering and maturity of the check variety were uniform. Over all phenotypic acceptances of the two advanced lines during vegetative and maturity stages was not as good as the check variety. Grain size was Medium Slender in case of the advanced lines whereas it was slender in the check variety i.e., grains of the advanced lines were not as fine as the check variety (Table 5).

Table 5. Phenotypic Acceptance of the rice genotypes under ALART (SHR-1) in Aman 2023.

Genotype	Plant growth	Uniformity		Wrapping quality of culm	Grain type	Flag Leaf	PAcp		Farmer's Preference
		Flowering	Maturity				Veg.	Mat.	
V1= BRH-13-2-14-2-1B	Irregular	Irregular	Irregular	Semi wrapped	Medium Slender	Erect	5	5	2
V2= BR-13-7-9-3-2B	Irregular	Irregular	Irregular	Semi wrapped	Medium Slender	Erect	5	5	3
V3= BRRI dhan49 (ck)	Uniform	Uniform	Uniform	Well, wrapped	Slender	Erect	3	3	1

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

Farmer's opinions: Most of the farmers didn't show their interest on both the advanced lines due to its lower grain yield, irregularities in flowering and maturity and phenotypic acceptance. However, most of the Farmers preferred BRR dhan49 (check variety).

Recommendation: Considering yield, disease and insects reactions, phenotypic acceptance, uniformity of flowering and maturity and farmers' preference none of the advanced lines found suitable for PVT.

Rationale

1. Grain yield of both the advanced lines were not higher than the check variety BRR dhan49.
2. Irregular flowering and Irregular maturity was found in several locations.
3. BPH (20-30%) was found in 3 locations and rat attack was found in 2 locations.
4. Lodging was 8-100% in all the tested entries at West Byde, Gazipur.
5. Grains of both advanced lines are not similar to BRR dhan49 type (Short slender grain).

1.2 ALART: Superior High Yielding Rice-2 (SHR-2) during T. Aman 2023.

Rationale

Rice (*Oryza sativa* L.) is a staple food for more than half of the world's population. To meet the ever-increasing demand for food, because of population growth and improved living standards, world rice production needs to double by 2030. Superior High Yielding Rice (SHR) means its superiority having grain shape and lower growth duration (105-120 days). The development of new elite rice varieties with high yield and superior quality is challenging for traditional breeding approaches, and new strategies need to be developed. Here, we evaluated two advanced lines along with standard check BRR dhan94. The new genotypes exhibit higher yield potential and minimum growth duration. With this view, we evaluated these superior high yielding breeding lines under integrated improved management practices in different agro-climatic conditions of Bangladesh.

Hypothesis: There is possibility to identify and select suitable superior high yielding rice genotypes for favorable environment in Aman season.

Materials and Methods

Two superior high yielding rice (SHR) advanced lines i.e., V2= BR9396-6-2-2B and V1=BRH9392-6-2-1-3-4 developed by Plant Breeding Division were evaluated against the check varieties BRR dhan94 during Aman 2023. The entries were evaluated in eleven different locations of the country such as Rajshahi (Godagari), Cumilla (Burichang), Barishal (Bakerganj), Sonagazi (Feni), Bogura (Sadar) Gopalganj (Sadar), Rangpur (Mithapukur), Kushtia (Sadar), BRR Gazipur (HQ) and Satkhira (Sadar). The trials were replicated thrice in each location. The unit plot size for each entry was 25 m² (5m x 5m). Seeding was done at the date of 15-20 June 2023 for all the locations. Seedling ages for different locations were varied from 22-25 days due to some unavoidable situations during transplanting time at respective location. Seedlings were transplanted at 25 cm x 15 cm spacing. Fertilizers Urea, TSP, MoP, Gypsum and Zinc Sulfate were applied @ 24, 15, 15, 10 and 1 kg Bigha⁻¹. All fertilizers were applied as basal and in addition urea was applied in 4 equal splits at 15, 30 and 45 DAT. Standard and uniform management practices were followed as and when necessary for all the locations. Appropriate measures were taken to control insect pests but diseases were not controlled to identify susceptibility and tolerance level of lines. Date of seeding, transplanting, flowering and maturity, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers and DAE personnel were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion

Interaction of genotypes and environments had significant effect on grain yield, growth duration, plant height and yield components (Table 6 and 7). Among the genotypes highest mean grain yield (4.91tha^{-1}) was obtained in V1=BRH9392-6-2-1-3-4 followed by V2= BR9396-6-2-2B (4.74) and V3= BRRIdhan94(ck) (4.71) Compared to standard checks the mean growth duration of lines BRH9392-6-2-1-3-4, BR9396-6-2-2B (4.74) were 2 days longer than BRRIdhan94 (Ck) (136). Highest growth duration was observed in V1=BRH9392-6-2-1-3-4(138) and BR9396-6-2-2B (138). The tallest plant height was 128 cm found in the V2= BR9396-6-2-2B followed by the advanced line V1= BRH9392-6-2-1-3-4 (124 cm) and V3= BRRIdhan94 (ck) (119). The lowest 1000-grain weight (TGW) of tested lines was found in BRRIdhan94 (21.10 gm), V2= BR9396-6-2-2B (23.81 gm) and the highest TGW was found in V1=BRH9392-6-2-1-3-4(25.41 gm). The average panicle m^{-2} range varied from 220 to 225 and the highest mean panicle m^{-2} was found in BRRIdhan94 (225) followed by V2= BR9396-6-2-2B (224) whereas the lowest panicle m^{-2} was found in V1=BRH9392-6-2-1-3-4 (220) (Table). On an average, the highest filled grains panicle⁻¹ (131) was found in V1=BRH9392-6-2-1-3-4 followed by BRRIdhan94(ck) (130) and V2= BR9396-6-2-2B (125). The highest sterility % was found in in V3= BRRIdhan94 (22%) and lowest was observed in V1=BRH9392-6-2-1-3-4(20) and V2= BR9396-6-2-2B.

Table 6. Grain yield, Growth duration and Plant height of some rice genotypes under ALART (SHR-2) during T. Aman 2023.

Genotypes	Rajshahi (Godagari)	Cumilla (Burichang)	Barishal (Bakerganj)	Sonagazi	Bogura (Sadar)	Gopalganj (Sadar)	Rangpur (Mithapukur)	Kushtia (Sadar)	BRRIdhan94	Satkhira (Sadar)	Mean
Grain Yield (t/ha)											
V1=BRH9392-6-2-1-3-4	6.59	4.13	3.28	5.11	4.31	6.63	5.29	5.35	2.93	5.51	4.91
V2=BR9396-6-2-2B	7.49	4.27	4.10	5.01	2.97	5.67	5.22	5.21	2.78	4.69	4.74
V3= BRRIdhan94(ck)	7.40	3.93	3.55	5.19	4.45	5.89	4.95	5.00	3.56	3.17	4.71
LSD _{0.05}	0.69										0.22
CV%	8.81										
Growth duration (Days)											
V1=BRH9392-6-2-1-3-4	135	130	133	134	136	143	138	146	145	137	138
V2=BR9396-6-2-2B	139	134	137	133	125	136	144	149	148	132	138
V3= BRRIdhan94(ck)	136	130	141	135	135	134	138	139	141	136	136
LSD _{0.05}	0.83										0.26
CV%	0.37										
Plant Height (cm)											
V1=BRH9392-6-2-1-3-4	133	100	115	115	119	121	144	140	142	114	124
V2=BR9396-6-2-2B	138	97	109	114	132	127	224	131	109	98	128
V3= BRRIdhan94(ck)	130	101	109	117	106	118	138	134	137	99	119
LSD _{0.05}	4.99										1.58
CV%	2.47										

Table 7. Yield contributing characters of some rice genotypes under ALART (SHR-2) during T. Aman 2023.

Genotype	Rajshahi (Godagari)	Cumilla (Burichang)	Barishal (Bakerganj)	Sonagazi (Feni)	Bogura (Sadar)	Gopalganj (Sadar)	Rangpur (Mithapukur)	Kushitia (Sadar)	BRRJ Gazipur (HQ)	Satkhira (Sadar)	Mean
1000-Grain Weight (g)											
V1=BRH9392-6-2-1-3-4	27.42	22.97	25.59	22.61	26.40	27.23	26.67	26.65	23.02	25.55	25.41
V2= BR9396-6-2-2B	26.65	20.40	27.88	22.44	20.53	26.36	20.33	25.87	25.73	21.88	23.81
V3= BRRJ dhan94(ck)	20.72	20.83	22.19	20.19	23.47	20.85	20.00	22.23	19.38	21.10	21.10
LSD _{0.05}	1.20										0.38
CV%	3.13										
Panicles/Square meter (no.)											
V1=BRH9392-6-2-1-3-4	264	146	178	204	229	287	213	224	232	223	220
V2= BR9396-6-2-2B	278	148	180	203	237	263	267	219	241	207	224
V3= BRRJ dhan94(ck)	262	146	203	208	246	274	225	253	206	227	225
LSD _{0.05}	22.32										7.06
CV%	6.12										
Filled Grains per Panicle (no.)											
V1=BRH9392-6-2-1-3-4	138	136	155	137	123	147	139	113	92	129	131
V2= BR9396-6-2-2B	133	156	166	137	83	144	121	94	100	118	125
V3= BRRJ dhan94(ck)	154	148	187	149	115	160	129	115	107	41	130
LSD _{0.05}	29.84										9.44
CV%	14.18										
Sterility (%)											
V1=BRH9392-6-2-1-3-4	9	14	31	29	19	13	12	8	38	24	20
V2= BR9396-6-2-2B	13	12	21	27	24	22	14	13	32	19	20
V3= BRRJ dhan94(ck)	9	13	24	30	13	16	10	5	20	78	22
LSD _{0.05}	9.11										2.88
CV%	27.17										

Table 8. Disease incidence of the rice genotypes under ALART Swarna type grain (SHR-2), T. Aman 2023.

Genotype	Sheath Blight	BLB	Brown spot	Sheath rot
V1=BRH9392-6-2-1-3-4	3-5% in 3 locations (Cumilla, Bogura & Satkhira)	1-3% in 3 locations (Barishal, Satkhira & Bogura).	3% in 2 locations (Bogura & Satkhira).	5% in 1 location (Satkhira).
V2= BR9396-6-2-2B	3-5% in 3 locations (Cumilla, Bogura & Satkhira)	3-5% in 3 locations (Barishal, Satkhira & Bogura).	3% in 2 locations (Bogura & Satkhira).	3% in 1 location (Satkhira).
V3= BRRJ dhan94(ck)	3-5% in 3 locations (Cumilla, Bogura & Satkhira)	2-3% in 3 locations (Barishal, Satkhira & Bogura).	3% in 2 locations (Bogura & Satkhira).	3% in 1 location (Satkhira).

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Disease incidence: Disease did not control to identify susceptibility and tolerance level of the genotypes. Sheath Blight (3-5%), BLB (1-5%), Brown spot 3% and Sheath rot (3-5%) were observed in the tested entries in Kushtia, Bogura & Satkhira, Barishal and Cumilla (Table 8)

Insect infestation: Proper measures were taken to control insects as and when necessary. However, the crop was infested by BPH (3-5%) and stem borer (3-30%) in some locations (Table 9). Insect infestations were almost similar in all the entries including check variety.

Table 9. Insect infestation score of the rice genotypes under ALART Swarna type grain (SHR-2), T. Aman 2023.

SN	Genotypes	Stem Borer	BPH
1	V1=BRH9392-6-2-1-3-4	30% in Barishal & 3% in Bogura	3% in Satkhira
2	V2= BR9396-6-2-2B	30% in Barishal& 3% in Bogura	5% in Satkhira
3	V3= BRRI dhan94(ck)	20% in Barishal & 3% in Bogura	5% in Satkhira

Table 10. Phenotypic Acceptance of the rice genotypes under ALART Swarna type grain (SHR-2), T. Aman 2023

Genotype	Characteristics							
	Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality of culm	Grain type	Flag leaf	PAcp	
							Ve g	Ma t
V1=BRH9392-6-2-1-3-4	Good	Regular	Uniform	Well wrapped	Medium bold	Erect	3	5
V2= BR9396-6-2-2B	Good	Regular	Uniform	Well wrapped	Medium bold	Erect	3	5
V3= BRRI dhan94(ck)	Good	Regular	Uniform	Well wrapped	Medium slender	Erect	3	3

Phenotypic Acceptability;1=Excellent,3=Good,5=Fair,7=Poor,9=Unacceptable

Lodging incidence: The advance lines and checks were found to be lodged (10-20%) and varied at west bide, BRRI Gazipur (all entries) & Rajshahi (v1)

Feedback from Farmers and Scientists: Farmers and Scientists dislike the tested genotypes because grain yield of tested lines is statistically similar with the check variety BRRI dhan94. Thousand grain weight of the two advanced lines were significantly higher than check variety BRRI dhan94

Recommendation: Considering Grain yield, Growth duration and Grain size none of the advanced lines were recommended for PVT.

Rational of Recommendation;

1. Grain yield of tested lines V1=BRH9392-6-2-1-3-4 and V2= BR9396-6-2-2B is statistically similar with the check variety BRRI dhan94.
2. Average growth duration of tested lines were 2 days higher than standard check BRRI dhan94.
3. Thousand grain weight of the two advanced lines were significantly higher than check variety BRRI dhan94.
4. Lodging incidence was observed in advanced at West Bide, BRRI Gazipur (10-20%) (all entries) & Rajshahi (v1).
5. Rat damage was found in Barishal only.

1.3 ALART: Anti-Oxidant Enriched Rice, Aman 2023

Rationale

Agriculture is the mainstay of the Bangladesh economy, while rice is considered the most important food crop (Rahman et al., 2015; Siddique et al., 2018; Islam et al., 2020; Rahman et al., 2020; Rahman et al., 2020; Kabir et al., 2021). More than three-fourths of the country's total cropped land is devoted to rice production, contributing more than 83 percent of the total cereal food supply (FPMU, 2020). Rice (*Oryza sativa* L.) is one of the most important staple crops in

many countries. It is the main food source of over half of the world population accounting for about 50–80% of their daily calorie intake (International Rice Genome Sequencing Project, 2005; Food and Agriculture Organization, 2019). With an increasing world population, there is a need to increase rice production by 87% by 2050 (Kromdijk and Long, 2016). This is a challenging task, as the amount of arable land available to meet this demand for the increase in rice production is simply insufficient using current practices. Moreover, a large proportion of the global food production will have to deal with erratic environmental conditions and abiotic stresses due to climate change (Food and Agriculture Organization, 2019).

Rice is the staple food for nearly 50% of the world population [1] and Asia represents about 90% of global rice production and consumption. Bangladesh is the world's 6th largest rice-producer where people get more than 70% of their total calorie from staple food rice, providing carbohydrate and some other proteins, vitamins and minerals. Rice has the potential to promote human health, due to its content of phenolic compounds that are able to inhibit the formation or reduction of the concentrations of reactive cell-damaging free radicals, thereby reducing the risk of coronary heart disease and cancer [2,3] and preventing oxidative damage of lipid and low-density lipoproteins [4]. It has been well accepted that natural antioxidants may inhibit lipid peroxidation in food products and improve food quality and safety [5] as well as improve the redox status in biological systems and reduce the risk of aging associated health problems [6-9]. In order to cope with the increasing population, food security, nutrition, urbanization, climate change and changing in food preferences, Bangladesh Rice Research Institute (BRRI) has introduced many high yielding rice varieties and till today they have released 57 new varieties which are growing in three different seasons namely Aush, Aman and Boro. Aman is the main monsoon season in Bangladesh (July to November) and Aush is a short season (April-May) that follows the dry season or Boro (November- December to April-May). The selected high yielding rice varieties BR5, BR22, BRRI dhan34, BRRI dhan37, and BRRI dhan38 grows in Aman season and BR7, BR16, BRRI dhan28, BRRI dhan29, and BRRI dhan50 grows in Boro season. In the present study, we examined antioxidant properties of ten high yielding rice varieties of Bangladesh, growing in two different seasons and determined the potential correlation between total phenolic content and the antioxidant properties among those rice varieties. This information is needed for production of value-added rice grain high in natural antioxidants.

Hypothesis: There is possibility to identify and select suitable Anti-Oxidant Enriched high yielding rice genotypes for favorable environment in Aman season.

Materials and Methods

Three Anti-Oxidant Enriched Rice high yielding rice (Anti-Oxidant Enriched Rice) advanced lines i.e., V1=BR12836-4R-63 and V2=BR12836-4R-312 developed by Plant Breeding Division were evaluated against the check varieties BRRI dhan34 and BRRI dhan70 during Aman 2023. The entries were evaluated in ten different locations of the country such as Satkhira, Bogura, Cumilla, Sonagazi, Gopalganj, Barisal, Rajshahi, Rangpur, Kushtia and BRRI H/Q Gazipur. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding was done around at the date of 3rd week of July 2023 for all the locations. Seedling ages for different locations were varied from 30-35 days due to some unavoidable situations during transplanting time at respective location. Seedlings were transplanted at 25 cm x 15 cm spacing. Fertilizers Urea, TSP, MoP, Gypsum and Zinc Sulfate were applied @ 27-9-13-9-1.0 kg Bigha⁻¹. All fertilizers were applied as basal and in addition urea was applied in 3 equal splits at 15, 30 and 40 DAT. Standard and uniform management practices were followed as and when necessary for all the locations. Appropriate measures were taken to control insect pests but diseases were not controlled to identify susceptibility and tolerance level of lines. Date of seeding, transplanting, flowering and maturity, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers and DAE personnel

were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion

Interaction of genotypes and environments had significant effect on grain yield, growth duration, plant height and yield components (Table 11 and 12). Among the genotypes highest mean grain yield (3.6 t ha⁻¹) was obtained in standard check BRRi dhan70 and followed by V2=BR12836-4R-312 (3.4 t/ha) followed by V1=BR12836-4R-63 (3.1 t/ha) and the lowest yield was found in standard check BRRi dhan34 (2.9 t/ha). Two standard check BRRi dhan34 and BRRi dhan70 gave 2.9 t/ha, 3.6 t/ha respectively. Here, one standard check BRRi dhan70 gave the highest yield and the other BRRi dhan34 gave the lowest grain yield. Grain yield of tested lines V1=BR12836-4R-63 and V2=BR12836-4R-312 were lower than standard check BRRi dhan70 but slightly higher than standard check BRRi dhan34. Average growth duration of tested lines were 1-4 days lower than standard check BRRi dhan70 but 5-8 days lower than the standard check BRRi dhan34. Highest growth duration was observed in in standard check BRRi dhan34 (138 days) and lowest was observed in V2=BR12836-4R-312 (130 days) (Table 11). The highest plant height was 139 cm found in standard check BRRi dhan70 followed by standard check BRRi dhan34, it was 1130 cm and the lowest plant height was 113 cm found in the V2=BR12836-4R-312 followed by V1=BR12836-4R-63, it was 115 cm (Table 11). The lowest 1000-grain weight (TGW) of tested lines was found in standard check V₃= BRRi dhan34 (ck), it was 13.4 gm followed by V1=BR12836-4R-63 (19.3 gm.) followed by standard check V4= BRRi dhan70 (20.3 gm) and the highest 1000-grain weight (TGW) was found in breeding line V2=BR12836-4R-312 (23.4 gm) (Table 11).

The average panicle m⁻² range varied from 194 to 218 and the highest mean panicle m⁻² was found in standard check V₃= BRRi dhan34 (ck), (218) followed by standard check V4= BRRi dhan70 (ck), (215) and the lowest mean panicle m⁻² found in V2=BR12836-4R-312 (194) followed by V1=BR12836-4R-63, it was 199 (Table 12). On an average, the highest filled grains panicle⁻¹ (150) was found in standard check V₃= BRRi dhan34 (ck) followed by breeding line V2=BR12836-4R-312, it was 147 and the lowest filled grains panicle⁻¹ (122) was found in standard check V4= BRRi dhan70 (ck), it was 122 followed by breeding line V1=BR12836-4R-63, it was 125 (Table 12). On the contrary, on an average, the highest unfilled grains panicle⁻¹ (36%) was found in breeding line V2=BR12836-4R-312 and standard check V₃= BRRi dhan34 (ck), it was 36 and the lowest unfilled grains panicle⁻¹ (29) found in standard check V4= BRRi dhan70 (ck) followed by breeding line V1=BR12836-4R-63, it was 34 (Table 12). On the contrary, on an average, the highest sterility percent (28%) was found in breeding line V1=BR12836-4R-63 followed by standard check V₃= BRRi dhan34 (ck), it was 26% and the lowest sterility percent (24%) found in standard check V4= BRRi dhan70 (ck) followed by breeding line V2=BR12836-4R-312, it was 25% (Table 12). Phenotypic acceptance score of V1=BR12836-4R-63, V2=BR12836-4R-312, V₃= BRRi dhan34 (ck) and V4= BRRi dhan70 (ck) were good in respect of growth but irregular in flowering and maturity (Table 5). Ununiform flowering and maturity, semi well wrapped culm, medium bold grain, droopy type flag leaf was found in all entries. L₁= Satkhira, L₂= Bogura, L₃= Cumilla, L₄= Sonagazi, L₅= Gopalganj, L₆= Barisal, L₇= Rajshahi, L₈= Rangpur, L₉= Kushtia, L₁₀= BRRi H/Q, Gazipur

Table 11. Grain yield, Growth duration and Plant height of the rice genotypes under ALART (Anti-Oxidant) during Aman 2023.

Genotype	Locations										Mean
	Satkhira	Bogura	Cumilla	Sonagazi	Gopalganj	Barisal	Rajshahi	Rangpur	Kushtia	BRRi H/Q	
	Grain yield (t ha ⁻¹)										
V1=BR12836-4R-63	3.2	3	3.9	3.1	3.8	1.6	3.7	3	3.7	1.9	3.1
V2=BR12836-4R-312	3.5	2.9	4.1	4	5	1.9	5.1	2.3	3.2	2.2	3.4
V3=BRRi dhan34 (Ck)	2.5	2.3	3.2	3.4	3.7	2.2	3.3	2.2	3.1	2.9	2.9

V4=BRI dhan70 (Ck)	4.2	3.7	3.7	3.8	5	3	3.5	2.7	3.7	2.9	3.6
LSD (0.05)	0.69										0.70
CV	13.24										
Growth duration (days)											
V1=BR12836-4R-63	134	127	140	140	126	134	139	134	135	123	133
V2=BR12836-4R-312	135	127	143	138	116	131	129	127	127	122	130
V3=BRI dhan34 (Ck)	132	147	137	136	137	132	130	148	147	129	138
V4=BRI dhan70 (Ck)	134	120	132	139	130	134	133	129	132	155	134
LSD (0.05)	2.4										2.27
CV	1.11										
Plant height (cm)											
V1=BR12836-4R-63	133	106	93	116	109	94	134	130	108	122	115
V2=BR12836-4R-312	109	110	92	117	121	96	126	123	109	125	113
V3=BRI dhan34 (Ck)	134	126	121	118	130	133	144	131	138	129	130
V4=BRI dhan70 (Ck)	146	144	117	128	134	122	151	161	135	153	139
LSD (0.05)	4.69										4.72
CV	2.33										

Table 12. Yield components of the rice genotypes under ALART (Anti-Oxidant) during Aman 2023.

Genotype	Locations										Mean
	Satkhira	Bogura	Cumilla	Sonagazi	Gopalganj	Barisal	Rajshahi	Rangpur	Kushtia	BRI H/O	
1000-grain weight (g)											
V1=BR12836-4R-63	20	20	20	18	21	17	19	19	20	19	19.3
V2=BR12836-4R-312	23	25	23	20	25	22	24	25	23	24	23.4
V3=BRI dhan34 (Ck)	16	19	15	11	9	12	13	13	12	14	13.4
V4=BRI dhan70 (Ck)	21	23	18	19	20	20	21	20	20	21	20.3
LSD (0.05)	2.35										2.36
CV	7.58										
Panicles m ⁻² (no.)											
V1=BR12836-4R-63	190	209	175	221	253	98	201	190	218	234	199
V2=BR12836-4R-312	252	185	157	217	300	143	202	130	171	187	194
V3=BRI dhan34 (Ck)	248	231	191	223	178	161	228	221	231	272	218
V4=BRI dhan70 (Ck)	231	244	165	217	272	172	218	209	182	236	215
LSD (0.05)	22.72										22.77
CV	6.77										
Filled grains panicle ⁻¹ (no.)											
V1=BR12836-4R-63	169	108	122	98	147	126	152	120	109	94	125
V2=BR12836-4R-312	197	125	135	105	161	171	178	117	135	141	147
V3=BRI dhan34 (Ck)	212	156	127	156	122	175	181	120	143	108	150
V4=BRI dhan70 (Ck)	164	91	130	106	139	145	129	108	112	93	122
LSD (0.05)	29.41										29.66
CV	13.35										
Unfilled grains panicle ⁻¹ (no.)											
V1=BR12836-4R-63	44	32	29	23	41	37	30	37	34	32	34
V2=BR12836-4R-312	49	29	21	17	38	43	39	52	28	41	36
V3=BRI dhan34 (Ck)	28	39	27	28	43	41	33	57	27	41	36
V4=BRI dhan70 (Ck)	29	21	22	25	51	28	32	38	23	20	29
LSD (0.05)	11.30										11.39
CV	20.60										
Sterility (%)											
V1=BR12836-4R-63	26	31	24	23	29	30	20	31	31	34	28
V2=BR12836-4R-312	26	23	16	17	24	26	22	45	21	29	25
V3=BRI dhan34 (Ck)	13	27	22	18	36	24	18	47	19	38	26
V4=BRI dhan70 (Ck)	18	24	17	24	37	19	25	36	21	21	24
LSD (0.05)	9.91										10.04
CV	23.75										

Table 13. Disease incidence (%) of the rice genotypes under ALART (Anti-Oxidant) during Aman 2023

SN	Genotype	Disease incidence Score				
		Neck Blast	Leaf Blast	Brown spot	BLB	ShB
1	V1=BR12836-4R-63	Rangpur Sadar (1%), Cumilla (1%)	Rangpur Sadar (5%)	Rangpur Sadar (20%) Bogura Sadar (5%)	Cumilla (10%), Rangpur (15%)	Rangpur-3 Bogura-3 H/Q-3 Rajshahi-3
2	V2=BR12836-4R-312	Rangpur Sadar (1%), Cumilla (1%)	-	Bogura Sadar (5%) Rangpur Sadar (15%)	Cumilla (10%), Rangpur (15%)	Rangpur-3 Bogura-5 H/Q-3 Rajshahi-3
3	V3=BRRIdhan34 (Ck)	1% in Rangpur Sadar, Cumilla (70%)	-	Rangpur Sadar (35%), Bogura Sadar (5%)	Rangpur (20%), Gazipur (5%)	Rangpur-3 Bogura-3 H/Q-3 Rajshahi-3
4	V4=BRRIdhan70 (Ck)			Rangpur Sadar (20%), Bogura Sadar (25%)	Satkhira (10%), Rangpur (10%), Gazipur (5%)	Rangpur-5 Bogura-3 H/Q-3 Rajshahi-3

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Table 14. Insect infestation score of the rice genotypes under ALART (Anti-Oxidant) during Aman 2023.

SN	Genotype	Stem borer	Rice bug
1	V1=BR12836-4R-63	1-5% in all locations	1-5% in all location
2	V2=BR12836-4R-312	1-7% in all locations	1-5% in all location
3	V3=BRRIdhan34 (Ck)	1-5% in all locations	1-5 % in all location
4	V4=BRRIdhan70 (Ck)	1-5% in all locations	1-5 % in all location

Disease infection: Disease infections were found in all most all entries including checks in some locations. In breeding line V1=BR12836-4R-63, neck blast, leaf blast, brown spot and BLB infection was observed in Rangpur Sadar (1%, 5%, 20%, 15%), sheath blight (ShB) infection was observed in Rangpur Sadar (score-3), BLB infection was also observed in Cumilla 15%. In breeding line V2=BR12836-4R-312, neck blast observed in Rangpur Sadar and Cumilla (1%); leaf blast observed in Bogura Sadar (5%), Rangpur Sadar (15%), brown spot Bogura Sadar (5%) Rangpur Sadar (15%); BLB in Cumilla (10%), Rangpur (15%) and Sheath Blight disease observed in Rangpur-3, Bogura-5, H/Q-3. In standard check V3=BRRIdhan34 (Ck), neck blast observed in Rangpur Sadar and Cumilla (1% and 70%); brown spot Bogura Sadar (5%), Rangpur Sadar (35%), ; BLB in Rangpur Sadar (20%), Gazipur West Byde (5%) and Sheath Blight disease observed in Rangpur-3, Bogura-3, BRRIdhan34 (Ck) and Rajshahi-3. In standard check V4=BRRIdhan70 (Ck), brown spot Bogura Sadar (25%), Rangpur Sadar (20%); BLB in Rangpur Sadar (10%), Gazipur West Byde (5%), Satkhira Sadar (10%) and Sheath Blight disease observed in Rangpur-5, Bogura-3, BRRIdhan34 (Ck) and Rajshahi-3.

Insect infestation: Insect infestation was low in most of the locations. But, in some locations Stem borer (01-7%), Rice bug (01-5%) were reported with no mentionable difference among the entries. Proper control measures were taken for insect control as and when necessary. The insect infestations were similar in all the entries. (Table 14)

Table 15. Phenotypic Acceptance of all genotypes under ALART(BRR, (Anti-Oxidant) during Aman 2023.

SN	Genotype	Characteristics							
		Plant growth	Uniformity of		Wrapping quality	Grain type	Flag leaf	PAcp	
			flowering	maturity				Veg	Mat.
1	V1=BR12836-4R-63	Good	Irregular	Irregular	Semi wrapped	Medium bold	Droopy	7	5

2	V2=BR12836-4R-312	Good	Irregular	Irregular	Semi wrapped	Medium bold	Droopy	5	3
3	V3=BRRIdhan34 (Ck)	Good	Uniform	Uniform	Well wrapped	Short	Semi Droopy	5	3
4	V4=BRRIdhan70 (Ck)	Excellent	Uniform	Uniform	Well wrapped	Medium bold	Droopy	7	3

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

Recommendation: Considering yield, growth duration, disease reactions and phenotypic acceptance, none of the elite breeding lines were proposed for PVT.

Rationale of Recommendation:

1. Grain yield of tested lines V1=BR12836-4R-63 and V2=BR12836-4R-312 were lower than standard check BRRIdhan70 but slightly higher than standard check BRRIdhan34.
2. Average growth duration of tested lines were 1-4 days lower than standard check BRRIdhan70 but 5-8 days lower than the standard check BRRIdhan34.
3. Lodging incidence was found in two locations.
4. Plant growth were uniform, irregular flowering and maturity were recorded.
5. Sheath blight, neck blast, leaf blast, brown spot, false smut and BLB were recorded in all tested lines including standard check in all most all of the locations.
6. Stem borer, Brown Plant Hopper (BPH), rice bug infestations were recorded in all tested lines including standard check in all most all of the locations.

1.4 Re-ALART: Deep water Rice (DWR) B. Aman 2023.

Rationale: The Deep Water (DW) Aman rice crop faces significant challenges, primarily due to flooding, resulting in low yields. Despite a decrease in the area dedicated to this crop, there remains a considerable portion of land unsuitable for any crop other than DW Aman rice. This issue must be addressed to ensure sustainable food self-sufficiency, given our limited land resources. Traditional DW Aman rice exhibits low productivity (1.0 to 2.2 t ha⁻¹) due to the complex environmental conditions of its ecosystem. Moreover, modern rice varieties are not yet available for this ecosystem. Farmers often hesitate to cultivate DW Aman rice due to its poor yield and environmental complexities. Therefore, there is a need for potential modern DW Aman rice varieties, specifically adapted to deep-flooded conditions (1 to 2 meters), with higher yields and shorter growth durations to incentivize rice cultivation in these challenging areas.

Six advanced lines (BR10230-7-19-2B, BR9892-6-2-2B, BR9376-6-6-2B, BR9392-6-2-1B, BR-KM (Mun)-PL-5-7-3-B, BR-DL (Hbj)-PL-12-4-7-B) were evaluated along with Fulkori (ck) across seven locations during the B Aman 2022 season under deep-flooded conditions (1 to 2 meters water depth). Although all tested lines performed relatively well in Faridpur and Gopalganj, where the water depth ranged from 20-53 cm, which was below the expected level of 100-150 cm, their performance was unsatisfactory in Sirajganj and Munshiganj, where water depths ranged from 26-84 cm. Sites in Manikganj were completely water-free, while experiments in Cumilla and Habiganj were severely damaged by floods, raising concerns about their elongation capacity. The planting method for this trial was intended to be either line sowing or broadcasting, but transplanting was conducted in some locations such as Bhanga and Gazipur. Phenotypic data obtained from different locations showed inconsistency, particularly in the flowering and maturity of the advanced lines. While uniform in Faridpur and Gopalganj, these traits were irregular in Sirajganj and Gazipur. Considering the objective of identifying suitable varieties for deep water/flooded conditions, these lines are recommended for further evaluation through Re-ALART in more representative areas to assess their performance comprehensively.

Hypothesis: Suitable DWR variety for B. Aman season in deep flooded (1-to-1.5-meter water depth) condition may be identified to recommend for PVT.

Materials and method: Two advanced lines bred for deep flooded (1 to 2 meter water depth) condition i.e., V1= BR10230-7-19-2B, V2= BR9392-6-2-1B with V3= Fulkori (ck.) and V4=Local popular variety(local check) as checks were tested in nine different locations such as Faridpur (Sadar), Gopalganj (Moksedpur), Munshiganj (Louhajang), Habiganj (Baniachang), Manikganj (Harirampur), Rajshahi (Tanore), Sirajganj (Tarash 2 trial), BRRI Gazipur (Shibbari Deep water tank) during B. Aman 2023. Local check varieties were location specific. The Local check varieties used in this trial were Boirol, Hijol digha, The plots were selected in representative deep water rice area where flood water depth was expected to be around 1 to 2 meter. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (4 m x 5 m). The time of seed sowing in main field at different locations was not same and the dates were within 14 May to 06 June 2023. Direct seeding in line was done with 25 cm row spacing except Gazipur and Faridpur where transplanting was done. Fertilizers were applied @ 180, 75, 112, 75, 7.5 kg/ha Urea, TSP, MoP, Gypsum and ZnSO₄. All amounts of TSP, MoP, Gypsum, Zinc sulfate and one-third (1/3) of urea were applied at the time of final land preparation. Rest of urea will be top dressed in 2 equal splits at 20 and 40 days after sowing (DAS) or synchronizing with rainfall and water depth. It is wise to top-dress urea up to 30 cm depth (before flood water inundation). Other standard management practices were followed as and when necessary. Appropriate measures were taken to control insect and other pests. Date of seeding, flowering and maturity, phenotypic acceptance at vegetative and ripening stage, yield and yield components, flood water depth, disease and insect incidence were recorded. Feedback from farmers and DAE personnel were also recorded. For yield estimation, 10 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion: All the advanced lines and check varieties were damaged and not suitable for data collection in three locations i.e., Rajshahi and Manikganj, Gazipur. So, results obtained from Manikganj were discarded from the analysis. The data from Cumilla and Habiganj were omitted from the analysis due to the absence of floods in those areas. Nevertheless, rainwater depth was monitored in the experimental plot at the Habiganj site. Additionally, severe rat damage was observed in the check varieties at the Habiganj site. The result obtained from Four location i.e., Faridpur, Gopalganj, Sirajganj and Munshiganj. The water depth condition was shown in Fig 1. The maximum water depth was 110 cm (at 128 DAS) at Sirajganj, followed by Manikganj and Faridpur. Grain yield (GY) data reveal variations among the rice genotypes across different locations, with mean values ranging from 1.28 t/ha to 1.50 t/ha. Grain yield was statically similar to the local check in all locations. Highest grain yield was observed in V2=BR9390-6-2-1B (1.50 t/ha) followed by V4= Local check (1.48 t/ha) (Table 16)Growth duration (GD) data provide insights into the time taken by each genotype to reach maturity, with mean durations ranging from 163 days to 171 days. Although, GD is not important in case of deep water rice material as all the lines are strongly photosensitive. Plant height (PHT) data exhibit the vertical stature of the rice plants, with mean heights varying from 208 cm to 234 cm (Table 16). It is an important feature of DWR materials. Any Deep water lines should have the ability to grow longer with the increasing water depth along with kneeing ability. Both the advanced lines failed to grow with increasing water. In terms of Thousand-Grain Weight (TGW), V1=BR10230-7-19-2B displayed a mean TGW of 25.25 g across locations, whereas V2=BR9390-6-2-1B, V3=Fulkori (ck.), and V4=Loc ck had TGW values of 25.21 g, 24.65 g, and 25.36 g, respectively. Moving on to Panicles per Square Meter (PPM), V1=BR10230-7-19-2B 3 exhibited a mean PPM of 132, followed by V2=BR9390-6-2-1B, V3=Fulkori (ck.), and V4=Loc ck with PPM values of 131, 118, and 129, respectively. Similarly, for Grains per Panicle (GPP), V1=BR10230-7-19-2B 3 showed a mean GPP of 103, while V2=BR9390-6-2-1B, V3=Fulkori (ck.), and V4=Local check displayed GPP values of 108, 97, and 97, respectively. In both GPP and UFG, there was a significant differences in case of advanced lines with check Fulkori but similarly with the local check variety. (Table 17).

Regarding Unfilled Grains per Panicle (UFG), V1=BR10230-7-19-2B recorded a mean UFG of 16, while V2=BR9390-6-2-1B, V3=Fulkori (ck.), and V4=Loc ck had UFG values of 24, 15,

and 21, respectively. Moreover, V1=BR10230-7-19-2B exhibited a mean sterility percentage of 13%, followed by V2=BR9390-6-2-1B at 16%, statistically similar to V3=Fulkori (ck.). V4=Loc ck displayed the highest sterility percentage at 17% (Table 17).

Overall, the dataset provides valuable insights into the performance of different rice genotypes under ALART, DWR conditions, aiding in the selection of high-yielding, resilient varieties suitable for Aman season cultivation, while also highlighting the importance of considering growth duration and plant height characteristics for comprehensive variety assessment and breeding programs. However, irregularity was reported in all lines at Sirajganj, Munshiganj and Gazipur trials. Therefore, farmers were not showed interest on those advanced lines over the local check varieties.

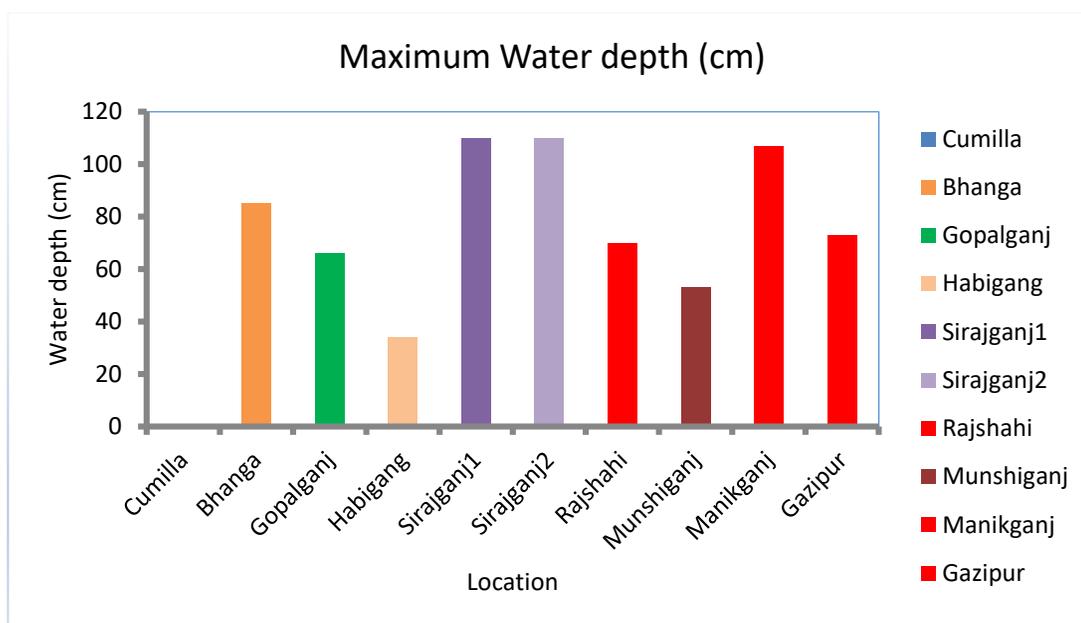


Fig.1 Maximum Water depth measurement of all trials ALART (DWR) during B. Aman, 2023.

Table 16. Grain yield (GY), growth duration (GD) and plant height (PHT) of the rice genotypes under ALART, Deep Water Rice (DWR), during B. Aman 2023.

Genotype	Location					Mean
	Bhanga	Gopalganj	Sirajgonj1	Sirajgonj2	Munshiganj	
GY (t/ha)						
V1=BR10230-7-19-2B	1.20	1.79	1.48	1.20	1.51	1.44
V2=BR9390-6-2-1B	1.36	1.94	1.47	1.06	1.69	1.50
V3=Fulkori (ck.)	1.27	1.62	1.43	1.03	1.04	1.28
V4=Loc ck	1.88	1.45	1.54	1.40	1.15	1.48
LSD _{0.05}	0.24					0.11
CV%	10.12					
DTM						
V1=BR10230-7-19-2B	151	166	169	169	160	163
V2=BR9390-6-2-1B	152	174	169	169	168	166
V3=Fulkori (ck.)	153	168	170	170	166	165
V4=Loc ck	168	170	174	174	167	171
LSD _{0.05}	0.61					0.27
CV%	0.22					
PHT						
V1=BR10230-7-19-2B	179	137	272	286	167	208
V2=BR9390-6-2-1B	180	141	293	285	179	216
V3=Fulkori (ck.)	196	209	285	277	190	231
V4=Loc ck	190	201	286	296	198	234
LSD _{0.05}	12.88					5.76
CV%	3.50					

The data from Cumilla and Habiganj were omitted from the analysis due to the absence of floods in those areas. Nevertheless, rainwater depth was monitored in the experimental plot at the Habiganj site. Additionally, severe rat damage was observed in the check varieties at the Habiganj site.

Table 17. Yield components of the rice genotypes under ALART (DWR) during B. Aman 2023.

Genotype	Location					Mean
	Bhanga	Gopalganj	Sirajgonj-1	Sirajgonj-2	Munshiganj	
	TGW					
V1=BR10230-7-19-2B	26.27	25.27	25.20	25.00	24.54	25.25
V2=BR9390-6-2-1B	26.37	23.60	24.87	25.93	25.31	25.21
V3=Fulkori (ck.)	24.93	22.30	26.23	25.97	23.84	24.65
V4=Loc ck	25.87	27.00	23.83	26.10	23.98	25.36
LSD _{0.05}	1.30					0.58
CV%	3.12					
	PPM					
V1=BR10230-7-19-2B	265	96	118	113	65	132
V2=BR9390-6-2-1B	262	102	108	109	76	131
V3=Fulkori (ck.)	238	85	102	111	53	118
V4=Loc ck	283	76	117	117	51	129
LSD _{0.05}	9.74					4.36
CV%	4.63					
	GPP					
V1=BR10230-7-19-2B	67	119	99	104	124	103
V2=BR9390-6-2-1B	70	153	100	94	122	108
V3=Fulkori (ck.)	81	111	97	83	112	97
V4=Loc ck	99	108	98	98	84	97
LSD _{0.05}	26.32					11.77
CV%	15.74					
	UFG					
V1=BR10230-7-19-2B	14	23	11	11	20	16
V2=BR9390-6-2-1B	14	63	9	12	22	24
V3=Fulkori (ck.)	17	19	13	12	14	15
V4=Loc ck	32	26	14	11	21	21
LSD _{0.05}	9.73					4.35
CV%	30.97					
	Sterility %					
V1=BR10230-7-19-2B	17	16	10	10	14	13
V2=BR9390-6-2-1B	16	29	8	12	15	16
V3=Fulkori (ck.)	18	15	11	13	11	14
V4=Loc ck	24	20	9	10	20	17
LSD _{0.05}	5.49					2.46
CV%	22.25					

Disease incidence and insect infestation

BLB and Brown spot disease was found in different levels ranged from (30-40%) in Gopalganj in all advanced lines and check variety. 5% Sheath blight disease was observed only at V1=BR10230-7-19-2B in Gopalganj trial site. Rice bug insect was most prominent in Gopalganj and Faridpur trial sites. Insect infestation was very few in all locations as proper controlling measure was taken timely. However, rat became the prominent pest for the trial sites in Faridpur and Gopalganj (5-20%). Disease incidence and insect infestation status is shown in the following (Table 18).

Table 18. Disease and insect reaction of different locations under ALART (DWR) B. Aman, 2023.

Genotype	Disease infection (%)				Insect infestation (%)	
	Leaf Folder	Brown Spot	BLB	Sheath Blight	Rice Bug	Rat damage
V1=BR10230-7-19-2B	30% in Habiganj	40% in G.ganj	30% in G.ganj	5% in G.ganj	5-10% in Faridpur and G.ganj	5-20% in Faridpur and G.ganj

V2=BR9390-6-2-1B	40% in Habiganj	30% in G.ganj	20% in G.ganj	-	5% in G.ganj	5-20% in Faridpur and G.ganj
V3=Fulkori (ck.)	30% in Habiganj	25% in G.ganj	25% in G.ganj	-	20% in G.ganj	5-20% in Faridpur and G.ganj
V4=Local ck.	40% in Habiganj	25% in G.ganj	30 in G.ganj	-	10% in G.ganj	5-20% in Faridpur and G.ganj

Table 19. Lodging incidence of different locations under ALART (DWR), Aman 2023.

Genotype	Lodging incidence (100%)			
	Faridpur	Gopalganj	Sirajganj	Gazipur
V1= BR10230-7-19-2B	100%	100%	100%	100%
V2= BR9392-6-2-1B	100%	100%	100%	100%
V3= Fulkori (ck.)	100%	100%	100%	100%
V4=local check	100%	100%	100%	100%

Phenotypic Acceptance: Plant growth was uniform and good at vegetative stage and poor in maturity stage. Irregularity of lowering and maturity was observed in all advanced lines. In most locations, farmers did not show any interest to the advanced lines. However, in Gopalganj, they preferred V1= BR10230-7-19-2B and V4= BR9392-6-2-1B for higher yield (Table 20).

Table 20. Phenotypic Acceptance of the rice genotypes, ALART (DWR) B. Aman 2023.

Genotypes	Plant growth	Uniformity		Wrapping quality of culm	Grain type	Flag Leaf	PAcp Score		Farmer's Preference
		flowering	maturity				Veg.	Mat.	
V1= BR10230-7-19-2B	Uniform	Uniform/irregular	Uniform/irregular	Node exposed	Medium bold	Erect	3	7	2
V2= BR9392-6-2-1B	Uniform	Uniform/irregular	Uniform/irregular	Node exposed	Medium bold	Erect	3	7	3
V3= Fulkori (ck.)	Uniform	Uniform/irregular	Uniform/irregular	Node exposed	Medium bold	Erect	3	7	4
V4=local check	Uniform	Uniform/irregular	Uniform/irregular	Node exposed	Slender to Medium bold	Erect	3	7	1

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

*Flowering and maturity were found both uniform and irregular in different locations which were confusing.

Lodging: 100% lodging was found in all entries in Gopalganj, Sirajganj, Gazipur and all other locations except Cumilla (Table 19).

Recommendation: Considering yield potentiality of the advanced lines, none of the advanced line found suitable for PVT.

Rationale of Recommendation:

1. Advanced lines in three locations (Natore, Manikganj, Gazipur) were completely damaged as failed to elongate with increasing water.
2. No yield advantages over the local checks.
3. Irregular flowering and maturity observed in most of the location
4. Phenotype at flowering and maturity was not good.
5. Farmers did not prefer the advanced lines over the local check varieties.

1.5 ALART Superior High Yielding Rice, Zira type (SHR-1), Boro 2024

Rationale

Rice (*Oryza sativa* L.) is a staple food for more than half of the world's population. To meet the ever-increasing demand for food, because of population growth and improved living standards, world rice production needs to double by 2030. Superior High Yielding Rice (SHR) means its superiority having grain shape and lower growth duration. The development of new elite rice varieties with high yield and superior quality is challenging for traditional breeding approaches, and new strategies need to be developed. Here, we evaluated three advanced lines along with standard check BRRi dhan88. The new genotypes exhibit higher yield potential and minimum growth duration. With this view, we evaluated these superior high yielding breeding lines under integrated improved management practices in different agro-climatic conditions of Bangladesh.

Hypothesis: There is possibility to identify and select suitable superior high yielding rice genotypes for favorable environment in Boro season.

Materials and Methods

Three superior high yielding rice Zira type (SHR-1) advanced lines i.e., V1= BRH15-24-7B; V2= BR9392-1-7-5B and V3= BR17-23-8-2-7B developed by Plant Breeding Division were evaluated against the check varieties BRRi dhan88 during Boro 2024. The entries were evaluated in ten different locations of the country such as BRRi Gazipur, Rajshahi, Kushtia, Bhanga, Sirajganj, Habiganj, Cumilla, Rangpur, Sonagazi and Gopalganj. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding was done around at the date of 4th week of November 2023 for all the locations. Seedling ages for different locations were varied from 30-35 days due to some unavoidable situations during transplanting time at respective location. Seedlings were transplanted at 25 cm x 15 cm spacing. Fertilizers Urea, TSP, MoP, Gypsum and Zinc Sulfate were applied @ 40-17-20-15-1.5 kg Bigha⁻¹. All fertilizers were applied as basal and in addition urea was applied in 3 equal splits at 15, 30 and 45 DAT. Standard and uniform management practices were followed as and when necessary for all the locations. Appropriate measures were taken to control insect pests but diseases were not controlled to identify susceptibility and tolerance level of lines. Date of seeding, transplanting, flowering and maturity, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers and DAE personnel were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion

Interaction of genotypes and environments had significant effect on grain yield, growth duration, plant height and yield components (Table 1 and 2). Among the genotypes highest mean grain yield (7.43 t/ha) was obtained in V3= BR17-23-8-2-7B followed by V1= BRH15-24-7B (7.02 t/ha), BRRi dhan88 (ck) (7.00 t/ha), and V2= BR9392-1-7-5B (6.96 t/ha). Compared to standard check BRRi dhan88 (Ck) the mean growth duration of lines V1= BRH15-24-7B; V2= BR9392-1-7-5B and V3= BR17-23-8-2-7B were 4-5 days higher. Highest and same growth duration was observed in V1= BRH15-24-7B; V2= BR9392-1-7-5B line (149 days) and lowest was observed in standard check BRRi dhan88 (144 days) (Table 21). The highest plant height was 97 cm found in the V3= BR17-23-8-2-7B line followed by the standard check BRRi dhan88 (95 cm) and advanced line V1= BRH15-24-7B (93 cm). However, the mean shortest plant height was found in the advanced line V2= BR9392-1-7-5B (92 cm) (Table 22). The lowest 1000-grain weight (TGW) of tested lines was found in V3= BR17-23-8-2-7B (17.9 gm), & V1= BRH15-24-7B (18.8 gm) and the highest TGW was found in BRRi dhan88 (21.3 gm) (Table 22).

The average panicle m⁻² range varied from 281 to 329 and the highest mean panicle m⁻² was found in V1= BRH15-24-7B (329) followed by V2= BR9392-1-7-5B (322) whereas the lowest panicle m⁻² was found in V4= BRRi dhan88 (ck) (281) (Table 22). On an average, the highest filled grains panicle⁻¹ (129) was found in V3= BR17-23-8-2-7B followed by V2= BR9392-1-7-

5B (115), (Table 22). The highest sterility % was found in in V3= BR17-23-8-2-7B (29%) and lowest was observed in V4=BRRRI dhan88 (20%) (Table 22). Phenotypic acceptance score of V1= BRH15-24-7B; V2= BR9392-1-7-5B and V3= BR17-23-8-2-7B and V4= BRRRI dhan88 (Ck) were good in respect of growth and grain size (Table 25). Uniform flowering and maturity were found in V3= BR17-23-8-2-7B and V4= BRRRI dhan88 (Ck) but irregular flowering and maturity were observed in V1= BRH15-24-7B and V2= BR9392-1-7-5B entries. Well wrapped culm, medium slender grain, erect type flag leaf was found in all entries.

Table 21. Grain yield, Growth duration and Plant height of the rice genotypes under ALART Zira type (SHR-1) during Boro 2024

Genotypes	Location										Mean
	BRRRI Gazipur	Paba, Rajshahi	Sadar, Kushtia	Bhanga, Faridpur	Kamarkhanda, Sirajganj	Sadar, Satkhira	Adorsha Sadar, Cumilla	Mithapukur, Rangpur	Sonagazi, Feni	Sadar, Gopalganj	
	Grain yield (t ha ⁻¹)										
V1= BRH15-24-7B	6.97	7.68	6.84	8.22	6.28	5.73	6.46	7.13	7.05	7.82	7.02
V2= BR9392-1-7-5B	7.61	7.77	5.84	7.69	5.93	6.26	6.00	7.83	6.71	7.99	6.96
V3= BR17-23-8-2-7B	8.34	7.96	6.71	8.06	7.18	6.40	6.44	7.98	7.01	8.26	7.43
V4= BRRRI dhan88 (ck)	7.61	7.68	5.46	8.65	6.23	6.45	6.31	8.28	6.31	6.99	7.00
LSD (0.05)	0.72										0.22
CV	6.24										
	Growth duration (days)										
V1= BRH15-24-7B	154	152	143	149	157	136	147	159	144	147	149
V2= BR9392-1-7-5B	154	147	147	150	157	136	146	158	143	148	149
V3= BR17-23-8-2-7B	157	146	144	149	152	136	146	159	145	146	148
V4= BRRRI dhan88 (ck)	150	142	138	149	152	136	143	147	142	142	144
LSD (0.05)	0.83										0.26
CV	0.35										
	Plant height (cm)										
V1= BRH15-24-7B	85	108	90	96	94	85	80	97	103	88	93
V2= BR9392-1-7-5B	88	103	95	94	93	85	83	94	102	82	92
V3= BR17-23-8-2-7B	94	109	102	98	91	91	88	101	105	87	97
V4= BRRRI dhan88 (ck)	92	104	95	97	89	85	87	102	103	91	95
LSD (0.05)	3.72										1.17
CV	2.44										

Table 22. Yield components of the rice genotypes under ALART Zira type (SHR-1) during Boro 2024

Genotypes	Locations										Mean
	BRRRI Gazipur	Paba, Rajshahi	Sadar, Kushtia	Bhanga, Faridpur	Kamarkhanda, Sirajganj	Sadar, Satkhira	Adorsha Sadar,	Mithapukur, Rangpur	Sonagazi, Feni	Sadar, Gopalganj	
	1000-grain weight (g)										
V1= BRH15-24-7B	17.3	17.3	20.4	16.5	21.0	20.0	16.9	20.0	20.5	18.6	18.8
V2= BR9392-1-7-5B	18.2	18.2	19.0	17.3	20.4	20.1	18.4	25.0	20.5	18.6	19.6
V3= BR17-23-8-2-7B	18.4	18.4	18.9	15.6	18.9	17.5	15.3	17.0	20.1	19.0	17.9
V4= BRRRI dhan88 (ck)	21.5	21.5	21.9	19.9	21.3	20.9	21.7	21.0	22.1	21.1	21.3
LSD (0.05)	1.97										0.62
CV	6.21										
	Panicles m ⁻² (no.)										

V1= BRH15-24-7B	353	342	258	384	283	348	378	150	362	433	329
V2= BR9392-1-7-5B	299	384	272	373	255	357	343	133	343	460	322
V3= BR17-23-8-2-7B	289	372	225	350	282	276	305	171	364	445	308
V4= BRRI dhan88 (ck)	274	264	284	324	273	282	310	100	301	402	281
LSD (0.05)	26.67										8.44
CV	5.02										
Filled grains panicle ⁻¹ (no.)											
V1= BRH15-24-7B	117	133	116	151	92	132	111	50	112	133	115
V2= BR9392-1-7-5B	115	120	109	147	82	134	100	30	107	154	110
V3= BR17-23-8-2-7B	142	178	153	177	89	126	140	47	111	128	129
V4= BRRI dhan88 (ck)	117	157	95	155	83	116	120	35	110	118	111
LSD (0.05)	28.80										9.10
CV	14.36										
Sterility (%)											
V1= BRH15-24-7B	28	39	21	32	26	22	22	25	21	31	26
V2= BR9392-1-7-5B	27	48	24	28	31	21	20	19	23	23	26
V3= BR17-23-8-2-7B	35	31	32	41	29	44	17	22	21	22	29
V4= BRRI dhan88 (ck)	20	11	25	20	31	15	13	26	22	13	20
LSD (0.05)	9.62										3.04
CV	23.29										

Table 23. Disease incidence (%) of the rice genotypes under ALART (SHR-1) during Boro 2024

SN	Genotype	Disease incidence Score			
		Neck Blast	Leaf Blast	ShB	BLB
1	V1= BRH15-24-7B	-	-	Sirajganj- (Incidence 20%; Severity-1) Bhanga 20%	Sirajganj- (Severity-1); Bhanga 60%; Cumilla 20%; Gopalganj 40%
2	V2= BR9392-1-7-5B	-	-	Bhanga 25%	Sirajganj- (Severity-1); Bhanga 50%; Cumilla 30%; Gopalganj 30%
3	V3= BR17-23-8-2-7B	-	-	Sirajganj- (Incidence 20%; Severity-1) Bhanga 20%; Cumilla 20%	Sirajganj- (Severity-1); Bhanga 60%; Gopalganj 30%
4	V4= BRRI dhan88 (ck)	-	-	Sirajganj- (Incidence 70%; Severity-1) Bhanga 30%; Cumilla 20%	Sirajganj- (Severity-1); Bhanga 60%; Gopalganj 40%

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Table 24. Insect infestation score of the rice genotypes under ALART (SHR-1) during Boro 2024

SN	Genotype	Stem borer	Rice bug	Rat Damage
1	V1= BRH15-24-7B	1-15% in all locations	5-10% in all location	5-10% in Satkhira
2	V2= BR9392-1-7-5B	1-20% in all locations	5-10% in all location	5-10% in Satkhira
3	V3= BR17-23-8-2-7B	1-10% in all locations	5-10% in all location	5-10% in Satkhira
4	V4= BRRI dhan88 (ck)	1-15% in all locations	5-10% in all location	5-10% in Satkhira

Disease infection: Notable Disease infections were found in all entries including checks in some locations. Sheath blight (20-70% in 3 locations), and BLB (20-30% in 4 locations) were reported in some

entries at several locations are given in Table 23. Leaf Blast and Neck blast were not found severely in any location.

Insect infestation: Insect infestation was low in most of the locations. But, in some locations Stem borer (01-15%), Rice bug (05-10%) and Rat damage (05-10%) were reported with no mentionable difference among the entries. Proper control measures were taken for insect control as and when necessary. The insect infestations were similar in all the entries. (Table 24)

Table 25. Phenotypic Acceptance of all genotypes under ALART (SHR-1) during Boro, 2024

SN	Genotype	Characteristics							
		Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality	Grain type	Flag leaf	PAcp	
								Veg	Mat.
1	V1= BRH15-24-7B	Good	Irregular	Irregular	Well wrapped	Medium slender	Erect	3	1
2	V2= BR9392-1-7-5B	Good	Irregular	Irregular	Well wrapped	Medium slender	Erect	3	3
3	V3= BR17-23-8-2-7B	Good	Uniform	Uniform	Well wrapped	Medium slender	Erect	1	1
4	V4= BRRI dhan88 (ck)	Good	Uniform	Uniform	Well wrapped	Medium slender	Erect	1	1

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

Recommendation: Considering yield, growth duration, disease reactions and phenotypic acceptance, none of the tested line was recommended for advanced trial, Proposed variety trial (PVT). Irregular maturity of grains in a single panicle was observed.

Rationale of Recommendation:

1. Grain yield of tested line V3= BR17-23-8-2-7B was higher than standard check BRRI dhan88
2. Average growth duration of tested line was 4-5 days higher than standard check BRRI dhan88 but it has about 0.43 t/ha yield advance than standard check BRRI dhan88 over the 10 locations.
3. Thousand grain weight of the tested line was lowest comparing to other entries and standard check.
4. Asynchronized maturity was found in several locations like according to ALART monitoring team report.
5. Sheath blight and BLB was recorded in all tested lines including standard check in several locations but no severe blast infection was observed among the all tested lines and standard check BRRI dhan88.

1.6 ALART Superior High Yielding Rice, Katari type (SHR-2), Boro 2024

Rationale

Rice (*Oryza sativa* L.) is a staple food for more than half of the world's population. To meet the ever-increasing demand for food, because of population growth and improved living standards, world rice production needs to double by 2030. Superior High Yielding Rice (SHR) means its superiority having grain shape and lower growth duration. The development of new elite rice varieties with high yield and superior quality is challenging for traditional breeding approaches, and new strategies need to be developed. Here, we evaluated three advanced lines along with standard check BRRI dhan81. The new genotypes exhibit higher yield potential and minimum growth duration. With this view, we evaluated these superior high yielding breeding lines under integrated improved management practices in different agro-climatic conditions of Bangladesh.

Hypothesis: There is possibility to identify and select suitable superior high yielding rice genotypes for favorable environment in Boro season.

Materials and Methods

Three superior high yielding rice Katari type (SHR-2) advanced lines i.e., V1= BRH11-7-17-10B; V2= BRH9-3-2B and V3= BRH13-9-5-2B developed by Plant Breeding Division were evaluated against the check varieties BRRI dhan81 during Boro 2024. The entries were evaluated in ten different locations of the country such as BRRI Gazipur, Rajshahi, Kushtia,

Bhanga, Sirajganj, Habiganj, Cumilla, Rangpur, Sonagazi and Gopalganj. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding was done around at the date of 4th week of November 2023 for all the locations. Seedling ages for different locations were varied from 30-35 days due to some unavoidable situations during transplanting time at respective location. Seedlings were transplanted at 25 cm x 15 cm spacing. Fertilizers Urea, TSP, MoP, Gypsum and Zinc Sulfate were applied @ 40-17-20-15-1.5 kg Bigha⁻¹. All fertilizers were applied as basal and in addition urea was applied in 3 equal splits at 15, 30 and 45 DAT. Standard and uniform management practices were followed as and when necessary for all the locations. Appropriate measures were taken to control insect pests but diseases were not controlled to identify susceptibility and tolerance level of lines. Date of seeding, transplanting, flowering and maturity, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers and DAE personnel were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion

Interaction of genotypes and environments had significant effect on grain yield, growth duration, plant height and yield components (Table 26 and 27). Among the genotypes highest mean grain yield (7.33 t/ha) was obtained in V3= BRH13-9-5-2B followed by V2= BRH9-3-2B (7.27 t/ha), V1= BRH11-7-17-10B (7.24 t/ha), and BRRRI dhan81 (ck) (6.57 t/ha). Compared to standard check BRRRI dhan81 (Ck) the mean growth duration of lines V1= BRH11-7-17-10B; V2= BRH9-3-2B and V3= BRH13-9-5-2B were 5-6 days higher. Highest growth duration was observed in V2= BRH9-3-2B (150 days); whereas same growth duration was observed in V1= BRH11-7-17-10B and V3= BRH13-9-5-2B line (149 days) and lowest was observed in standard check BRRRI dhan81 (144 days) (Table 1). The highest and on an average same plant height was 99 cm found in the ., V1= BRH11-7-17-10B; V2= BRH9-3-2B and V3= BRH13-9-5-2B lines followed by the standard check BRRRI dhan81 (98 cm) (Table 27). The lowest 1000-grain weight (TGW) of tested lines was found in V3= BRH13-9-5-2B (18.4 gm), & V2= BRH9-3-2B (18.6 gm) and the highest TGW was found in BRRRI dhan81 (21.6 gm) (Table 27). The average panicle m⁻² range varied from 278 to 323 and the highest mean panicle m⁻² was found in V1= BRH11-7-17-10B (323) followed by V2= BRH9-3-2B (322) whereas the lowest panicle m⁻² was found in V4= BRRRI dhan81 (ck) (278) (Table 27). On an average, the highest filled grains panicle⁻¹ (164) was found in V2= BRH9-3-2B followed by V3=BRH13-9-5-2B (149), (Table 27). The highest sterility % was found in in V2= BRH9-3-2B (33%) and lowest was observed in V4=BRRRI dhan81 (21%) (Table 2).

Phenotypic acceptance score of V1= BRH11-7-17-10B; V2= BRH9-3-2B and V3= BRH13-9-5-2B and V4= BRRRI dhan81 (Ck) were good in respect of growth and grain size (Table 5). Uniform flowering and maturity were found in V3= BRH13-9-5-2B and V4= BRRRI dhan81 (Ck) but irregular flowering and maturity were observed in V1= BRH11-7-17-10B; V2= BRH9-3-2B entries. Well wrapped culm, medium slender grain, erect type flag leaf was found in all entries.

Table 26. Grain yield, Growth duration and Plant height of the rice genotypes under ALART Katari type (SHR-2) during Boro 2024

Genotypes	Locations										Mean
	BRRRI Gazipur	Paba, Rajshahi	Sadar, Kushtia	Bhanga, Faridpur	Kamarkhanda, Sirajganj	Sadar, Satkhira	Adorsha Sadar, Cumilla	Mithapukur, Rangpur	Sonagazi, Feni	Sadar, Gopalganj	
	Grain yield (t ha ⁻¹)										
V1=BRH11-7-17-10B	8.15	7.63	7.04	7.98	6.76	5.51	6.52	8.71	6.66	7.42	7.24
V2= BRH9-3-2B	8.59	7.89	6.76	7.87	7.10	6.08	6.08	8.29	6.19	7.83	7.27
V3=BRH13-9-5-2B	8.39	7.83	6.83	7.94	7.05	5.72	6.33	8.54	6.53	8.13	7.33
V4= BRRRI dhan81 (Ck)	8.20	7.23	5.30	8.05	5.80	4.46	6.21	7.85	6.08	6.54	6.57
LSD (0.05)	0.69										0.22

CV	6.05										
Growth duration (days)											
V1=BRH11-7-17-10B	155	150	143	151	159	136	146	157	144	146	149
V2= BRH9-3-2B	156	151	147	151	157	136	145	159	146	147	150
V3=BRH13-9-5-2B	158	151	146	151	155	136	143	159	146	146	149
V4= BRR1 dhan81 (Ck)	150	144	139	149	149	136	143	147	140	143	144
LSD (0.05)	1.18										0.37
CV	0.49										
Plant height (cm)											
V1=BRH11-7-17-10B	98	110	105	100	102	90	90	105	101	90	99
V2= BRH9-3-2B	94	110	104	101	99	96	93	104	103	90	99
V3=BRH13-9-5-2B	93	112	102	101	100	90	94	105	98	91	99
V4= BRR1 dhan81 (Ck)	99	108	104	101	100	83	86	104	101	97	98
LSD (0.05)	3.97										1.25
CV	2.48										

Table 27. Yield components of the rice genotypes under ALART Katari type (SHR-2) during Boro 2024

Genotype	Locations										Mean
	BRR1 Gazipur	Paba, Rajshahi	Sadar, Kushtia	Bhanga, Faridpur	Kamarkhanda, Sirajganj	Sadar, Satkhira	Adorsha Sadar,	Mithapukur, Rangpur	Sonagazi, Feni	Sadar, Gopalganj	
1000-grain weight (g)											
V1=BRH11-7-17-10B	18.4	16.2	19.1	17.6	22.3	18.5	19.5	18.6	21.4	18.4	19.0
V2= BRH9-3-2B	17.1	16.4	18.1	18.2	21.7	17.7	18.4	18.5	21.2	18.4	18.6
V3=BRH13-9-5-2B	17.3	15.3	18.5	18.9	22.7	16.9	16.9	17.4	20.9	19.2	18.4
V4= BRR1 dhan81 (Ck)	23.1	22.6	20.6	20.0	21.3	22.0	20.9	23.5	21.4	20.9	21.6
LSD (0.05)	1.66										0.52
CV	5.61										
Panicles m ⁻² (no.)											
V1=BRH11-7-17-10B	302	330	300	399	312	277	307	318	319	361	323
V2= BRH9-3-2B	312	314	296	353	344	265	313	268	306	453	322
V3=BRH13-9-5-2B	318	233	303	340	336	260	297	291	322	407	311
V4= BRR1 dhan81 (Ck)	277	310	295	331	276	231	241	235	299	281	278
LSD (0.05)	28.12										8.89
CV	5.02										
Filled grains panicle ⁻¹ (no.)											
V1=BRH11-7-17-10B	156	160	129	150	119	193	110	170	113	177	148
V2= BRH9-3-2B	149	198	144	164	162	211	120	198	110	179	164
V3=BRH13-9-5-2B	138	149	135	160	148	163	115	190	111	185	149
V4= BRR1 dhan81 (Ck)	128	153	94	148	111	132	115	157	108	144	129
LSD (0.05)	29.44										9.31
CV	12.29										
Sterility (%)											
V1=BRH11-7-17-10B	28	47	33	39	18	14	21	36	21	27	28
V2= BRH9-3-2B	38	46	25	41	20	37	23	38	23	36	33
V3=BRH13-9-5-2B	33	50	25	40	12	39	26	41	22	32	32
V4= BRR1 dhan81 (Ck)	15	20	24	28	17	19	15	29	23	23	21
LSD (0.05)	9.18										2.98
CV	18.68										

Table 28. Disease incidence (%) of the rice genotypes under ALART Katari type (SHR-2) during Boro 2024

SN	Genotype	Disease incidence Score			
		Neck Blast	Leaf Blast	ShB	BLB
1	V1=BRH11-7-17-10B	-	-	Sirajganj- (Incidence 20%; Severity-1) Bhanga 20%	Sirajganj- (Severity-1); Bhanga 60%; Cumilla 20%; Gopalganj 40%
2	V2= BRH9-3-2B	-	-	Bhanga 25%	Sirajganj- (Severity-1); Bhanga 50%; Cumilla 30%; Gopalganj 30%
3	V3=BRH13-9-5-2B	-	-	Sirajganj- (Incidence 20%; Severity-1) Bhanga 20%; Cumilla 20%	Sirajganj- (Severity-1); Bhanga 60%; Gopalganj 30%
4	V4= BRR1 dhan81 (Ck)	-	-	Sirajganj- (Incidence 70%; Severity-1) Bhanga 30%; Cumilla 20%	Sirajganj- (Severity-1); Bhanga 60%; Gopalganj 40%

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Table 29. Insect infestation score of the rice genotypes under ALART Katari type (SHR-2) during Boro 2024

SN	Genotype	Stem borer	Rice bug	Rat Damage
1	V1=BRH11-7-17-10B	1-20% in all locations	5-10% in all location	1-2% in Satkhira
2	V2= BRH9-3-2B	1-25% in all locations	5-10% in all location	1-2% in Satkhira
3	V3=BRH13-9-5-2B	1-1% in all locations	5-10% in all location	1-2% in Satkhira
4	V4= BRR1 dhan81 (Ck)	1-15% in all locations	5-10% in all location	1-2% in Satkhira

Disease infection: Notable Disease infections were found in all entries including checks in some locations. Sheath blight (20-70% in 3 locations), and BLB (20-30% in 4 locations) were reported in some entries at several locations are given in Table 28. Leaf Blast and Neck blast were not found severely in any location.

Insect infestation: Insect infestation was low in most of the locations. But, in some locations Stem borer (01-20%), Rice bug (05-10%) and Rat damage (1-2%) were reported with no mentionable difference among the entries. Proper control measures were taken for insect control as and when necessary. The insect infestations were almost similar in all the entries (Table 29).

Table 30. Phenotypic Acceptance of all genotypes under ALART Katari type (SHR-2) during Boro 2024

SN	Genotype	Characteristics							
		Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality	Grain type	Flag leaf	PAcp	
								Veg	Mat.
1	V1=BRH11-7-17-10B	Good	Irregular	Irregular	Well wrapped	Medium slender	Erect	3	3
2	V2= BRH9-3-2B	Good	Irregular	Irregular	Well wrapped	Medium slender	Erect	1	3
3	V3=BRH13-9-5-2B	Good	Uniform	Uniform	Well wrapped	Medium slender	Erect	1	1
4	V4= BRR1 dhan81 (Ck)	Good	Uniform	Uniform	Well wrapped	Medium slender	Erect	1	1

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

Recommendation: Considering yield, growth duration, disease reactions and phenotypic acceptance, none of the tested line was recommended for advanced trial, Proposed variety trial (PVT). Irregular maturity of grains in a single panicle was observed.

Rationale of Recommendation:

1. Grain yield of tested line V3= BRH13-9-5-2B was higher than standard check BRR1 dhan81
2. Average growth duration of tested line was 5-6 days higher than standard check BRR1 dhan81 but it has about 0.76 t/ha yield advance than standard check BRR1 dhan81 over the 10 locations.

3. Thousand grain weight of the tested line was lowest comparing to other entries and standard check.
4. Asynchronized maturity were found in several locations like according to ALART monitoring team report.
5. Sheath blight and BLB was recorded in all tested lines including standard check in several locations but no severe blast infection was observed among the all tested lines and standard check BRRi dhan81.

1.7 ALART, Favorable Boro Rice Long duration (FBR-LD) during Boro 2023-24.

Rationale: Population of Bangladesh is increasing day by day. For sustainable food security, we have to put more emphasis on rice production in favorable condition in long duration Boro season. We have couple of varieties for long duration favorable condition in Boro season. Yield of these varieties has been increased in a certain level and stagnant. Some varieties became susceptible to pest and disease incidence. So, we need more FBR-LD varieties to break down the yield ceiling. With this view, one advanced line, developed by BRRi Breeding division, was evaluated in different agro-ecological conditions of Bangladesh.

Hypothesis: Long duration rice genotype suitable for favorable Boro rice may come out from evaluation at farmers' field.

Materials and method: One advanced line developed by Breeding Division of BRRi V1= BR11318-5R-84 was evaluated against one check variety BRRi dhan92 in different locations of the country during Boro 2023-23 at Farmers' field. The entries were evaluated in ten locations such as Faridpur (Bhanga), Cumilla (Debidwar), Gopalganj (Sadar), Habiganj (Baniachang), Kushtia (Khoksa), Rangpur (Mithapukur), Feni (Sonagazi), Sirajganj (Kamarkhanda), Rajshahi (Paba), and BRRi research farm Gazipur. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding was done from 14th November to 30th November 2023. Seedling ages for different locations were varied from 35-40 days. Seedlings were transplanted at 20 cm x 20 cm spacing. Fertilizers were applied @ 260: 100: 120: 110:11 kg/ha of Urea, TSP, MoP, Gypsum and Zinc sulphate. All fertilizers except urea were applied as basal and urea was applied in 3 equal splits at 15, 30 and 45 DAT. Other standard management practices were followed as and when necessary. Appropriate measures were taken to control insect pests but diseases were not controlled (to identify susceptibility and tolerance level of lines). Date of seeding, transplanting, flowering and maturity, plant height, lodging, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers, SA/SAAO, scientists and DAE personnel were scheduled to be recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion: Yield components, Growth duration and Plant height, varied significantly by the interaction of rice genotypes and different locations under ALART-LD in Boro 2023-24. There were no significant difference between the advanced line and check variety. Irrespective of locations, the advanced line V1= BR11318-5R-84 produced the mean grain yield 8.08 t/ha which was statistically similar with the grain yield (7.85 t/ha) (Table 31) of check variety BRRi dhan92. However, the mean grain yield of the advanced line V1= BR11318-5R-84 is numerically higher than the check variety BRRi dhan92. Mean growth duration over 10 locations of the advanced line V1= BR11318-5R-84 (entry no. 1) was 161 days which was significantly higher (two days) than the check variety BRRi dhan92 (159 days) (Table 31). Mean plant height was same for both the advanced line and check variety BRRi dhan92 which was 113 cm. Plant height range from 100 to 130 cm for the advanced line V1= BR11318-5R-84, whereas Plant height range from 95 to 122 cm for the check variety BRRi dhan92.

Although grains of the two tested entries are medium slender, on an average thousand grain weight of the advanced line was 21.33 gram which was significantly lower than the check variety BRRi dhan92 thousand grain weight (23.25 g; Lsd value 0.85). However, thousand grain weight

of the advanced line range from 18.22 to 24.17 gram whereas, it range from 21.36 to 25 gram in case of the check variety BRRI dhan92 (Table 2). The tested advanced line V1=BR11318-5R-84 produced significantly higher panicles per square meter (323) than the check variety BRRI dhan92 (312; Lsd value 8.33) (Table 2). Mean Filled grains/panicle of advanced line V1=BR11318-5R-84 was numerically higher (136) than the check variety BRRI dhan92 (128; Lsd value 10.6) (Table 2). However, Filled grains/panicle didn't differ significantly between advanced line V1=BR11318-5R-84 and BRRI dhan92. Sterility percentages of the advanced line varied from 9 to 26% and it was 10 to 25% for the check varieties (Table 32).

Disease infestation: Disease infections were found in both the tested entries including check in some locations. Sheath blight (10-15% in 3 loc.), BLB (10%, score 3 in 2 loc), Leaf Blast (10% score 3 in 2 loc), Brown spot (5-10%, score-3 in 3 loc) were reported in 3 locations (Table 33)

Insect attacked: Proper control measures were taken for insect control as and when necessary. Therefore, Insect infestation was low in most of the locations. But, in three locations (Gopalganj, Kushtia and Sirajganj) yellow stem borer was found 1-3% in the advanced line and 3-5% in the check variety BRRI dhan92 (Table 34)

Rat Damage: No rat damage was observed in the 10 trial sites in both the advanced lines and check variety BRRI dhan92 (Table 34).

Bird Damage: No rat damage was observed in the 10 trial sites in both the advanced lines and check variety BRRI dhan92 (Table 34).

Table 31. Grain yield, Growth duration and Plant height of the rice genotypes under ALART FBR-LD during Boro 2023-24

Genotypes	Locations										
	Bhanga, Faridpur	Debidwar, Cumilla	Sadar, Gopalganj	Baniachang, Habiganj	Khoksa, Kushtia	Paba, Rajshahi	Mithapukur, Rangpur	Kamarkhanda, Sirajganj	Sonagazi, Feni	West Byde Gazipur	Mean
Grain Yield (t/ha)											
V1= BR11318-5R-84	8.52	7.79	8.82	7.97	6.95	8.56	9.4	6.97	7.15	8.62	8.08
V2= BRRI dhan92 (Ck)	8.44	7.43	8.01	7.61	7.05	7.74	9.51	6.56	8.10	8.08	7.85
LSD _{0.05}	0.94										0.24
CV%	5.78										
Growth duration (day)											
V1= BR11318-5R-84	167	161	159	163	153	153	165	172	158	161	161
V2= BRRI dhan92 (Ck)	162	157	156	162	159	149	163	167	160	158	159
LSD _{0.05}	5.13										1.32
CV%	1.56										
Plant Height (cm)											
V1= BR11318-5R-84	117	104	100	116	118	130	108	116	106	112	113
V2= BRRI dhan92 (Ck)	122	104	95	112	119	121	114	117	109	114	113
LSD _{0.05}	7.2										1.86
CV%	3.12										

Table 32. Yield components of the rice genotypes under ALART under ALART FBR-LD during Boro 2023-24.

Genotypes	Locations										
	Bhanga, Faridpur	Debidwar, Cumilla	Sadar, Gopalganj	Baniachong Habiganj	Khoksa, Kushtia	Paba, Rajshahi	Mithapukur Rangpur	Kamarkhan da Sirajganj	Sonagazi Feni	West Byde Gazipur	Mean
Thousand Grains Weight (gm)											

V1=BR11318-5R-84	18.22	22.85	21.6	24.17	20.83	21.06	20	21.2	23.03	20.38	21.33
V2= BRRIdhan92 (Ck)	23.54	22.41	23.55	24.3	21.36	23.72	25	21.67	23.20	23.77	23.25
LSD _{0.05}	3.29										0.85
CV%	7.23										
Panicles per square meter (No.)											
V1=BR11318-5R-84	327	407	331	331	293	319	331	298	276	318	323
V2= BRRIdhan92 (Ck)	300	359	323	326	302	296	320	297	293	306	312
LSD _{0.05}	32.27										8.33
CV%	4.97										
Field Grains per Panicle (no.)											
V1=BR11318-5R-84	143	117	168	151	121	194	112	106	90	153	136
V2= BRRIdhan92 (Ck)	120	115	142	183	102	151	118	111	95	147	128
LSD _{0.05}	41.07										10.6
CV%	15.20										
Sterility %											
V1=BR11318-5R-84	23	14	9	20	18	18	19	26	20	17	18
V2= BRRIdhan92 (Ck)	25	19	10	17	19	22	17	19	19	19	19
LSD _{0.05}	7.58										1.96
CV%	19.99										

Table 33. Disease incidence of the rice genotypes under ALART FBR-LD during Boro 2023-24.

SN	Genotype	Sheath Blight	BLB	Brown Spot	Leaf Blast
1	V1= BR11318-5R-84	10% (3) in Cumilla S-1 in Sirajganj	10% in Bhanga S-3 in Sirajganj	5% in Bhanga S-3 in Kushtia S-3 in Sirajganj	10% (3) in Cumilla S-1 in Sirajganj
2	V2= BRRIdhan92 (Ck)	15% in Bhanga 10% (3) in Cumilla S-1 in Sirajganj	S-3 in Sirajganj	10% in Bhanga S-3 in Kushtia S-3 in Sirajganj	10% (3) in Cumilla S-1 in Sirajganj

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Table 34. Insect infestation score of the rice genotypes under ALART FBR-LD Boro 2023-24

SN	Genotype	Yellow Steam Borer	Bird Damage	Rat Damage
1	V1=BR11318-5R-84	2% in Gopalganj 3% in Kushtia 1% in Sirajganj	No	No
2	V2= BRRIdhan92 (Ck)	5% in Gopalganj 3% in Kushtia 3% in Sirajganj	No	No

Table 35. Phenotypic Acceptance of the rice genotypes under ALART FBR-LD Boro 2024

Genotype	Characteristics							
	Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality of culm	Grain type	Flag leaf	PAcp	
							Veg.	Mat.
V1= BR11318-5R-84	Good	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	3
V2= BRRIdhan92 (Ck)	Good	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	3

Phenotypic Acceptability; 1=Excellent, 3=Good, 5=Fair, 7=Poor, 9=Unacceptable

Recommendation: Considering grain yield, growth duration and insect disease reactions, the advanced line V1= BR11318-5R-84 was not recommended for Proposed variety trial (PVT).

Rationale of Recommendation:

1. Grain yield of the tested line V1= BR11318-5R-84 was numerically higher than the check variety BRRIdhan92, but statistically similar with the check variety BRRIdhan92.

2. Average growth duration of the tested line was 2 days higher than the check variety BRRIdhan92 which was significantly higher than the check variety BRRIdhan92.
3. No lodging incident was found in case of advanced line BR11318-5R-84.
4. Thousand grain weight of the tested line was significantly lower than the check variety BRRIdhan92.

1.8 ALART: Favorable Boro Rice short duration (FBR-SD) during Boro 2023-24.

Rationale: Population of Bangladesh is increasing day by day. For sustainable food security, we have to put more emphasis on rice production in favorable condition of short duration Boro season. We have couple of varieties for short duration in case of favorable condition in Boro season. Yield of these varieties has been increased in a certain level and stagnant. Some varieties became susceptible to pest and disease incidence. So, we need more FBR-SD varieties to break down the yield ceiling. With this view, one advanced line, developed by BRRIBreeding division, was evaluated in different agro-ecological conditions of Bangladesh.

Hypothesis: Short duration rice genotypes suitable for favorable Boro rice may come out from evaluation at farmers' field.

Materials and method: Two advanced lines developed by Breeding Division of BRRI i.e., V1= BR11903-5R-56 and V2= IR18A2119 were evaluated against two check varieties V3= BRRIdhan88 (ck) and V4= BRRIdhan96 (ck) in different locations of the country during Boro 2023-24 at Farmers' field. The entries were evaluated in ten locations such as Faridpur (Bhanga), Cumilla (Debidwar), Gopalganj (Sadar), Habiganj (Baniachong), Kushtia (Khoksa), Rangpur (Mithapukur), Feni (Sonagazi), Sirajganj (Kamarkhanda), Rajshahi (Paba), and BRRI research farm Gazipur. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding was done from 14th November to 30th November 2023. Seedling ages for different locations were varied from 35-40 days. Seedlings were transplanted at 20 cm x 20 cm spacing. Fertilizers were applied @ 260: 100: 120: 110: 11 kg/ha of Urea, TSP, MoP, Gypsum and Zinc sulphate. All fertilizers except urea were applied as basal and urea was applied in 3 equal splits at 15, 30 and 45 DAT. Other standard management practices were followed as and when necessary. Appropriate measures were taken to control insect pests but diseases were not controlled (to identify susceptibility and tolerance level of lines). Date of seeding, transplanting, flowering and maturity, plant height, lodging, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers, SA/SAAO, scientists and DAE personnel were scheduled to be recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion: Yield and yield components, growth duration and plant height, varied significantly by the interaction of rice genotypes and different locations under ALART-SD during Boro 2023-24. Both the advanced lines BRRI i.e., V1= BR11903-5R-56 and V2= IR18A2119 produced significantly higher grain yield (7.02 and 7.04 t/ha) than both the check varieties i.e., V3= BRRIdhan88 (6.73 t/ha) and V4= BRRIdhan96 (6.63 t/ha). However, there is no significant difference between the two advanced lines in case of grain yield. And both the advanced lines gave almost similar grain yield (Table 36). Mean growth duration over 10 locations of the two advanced lines was same and this was 147 days. Growth duration of both the advanced lines was significantly higher than both the check varieties. On an average growth duration of both the advanced lines was 3 to 4 days higher than both the check varieties. (Table 36). Highest plant height was found in V1= BR11903-5R-56 (104 cm) followed by V2= IR18A2119 (98 cm). Plant height of both the advanced was significantly higher than both the check varieties (93 and 91 cm) (Table 36). The lowest plant height was found in the check variety BRRIdhan96 (91 cm). On an average thousand grain weight of the advanced line V1= BR11903-5R-56 and V2= IR18A2119 was 22.83 23.77 gram respectively. Whereas, mean thousand grains weight of the two check varieties i.e., BRRIdhan88 and BRRIdhan96 was

21.58 and 20.96 gram respectively which was significantly lower (Lsd value 0.98) than both the check varieties (Table 37). The advanced line V1= BR11903-5R-56 produced the highest panicles per square meter (311) followed by the advanced line V2= IR18A2119 (307). Both the advanced lines produced statistically similar panicles per square meter (Lsd value 12.99) with the check variety V3= BRR1 dhan88 (305). But the advanced line V1= BR11903-5R-56 produced significantly higher panicles per square meter than only the check variety BRR1 dhan96 (Table 37). Mean filled grains/panicle of both the advanced lines advanced line i.e., V1= BR11903-5R-56 (115) and V2= IR18A2119 (110) was numerically lower than both the check varieties. However, there is no significant difference among the tested entries for filled grains/panicle (Lsd value 11.14). Comparatively higher sterility% was found in both the advanced lines than both the check varieties. The highest sterility% was found in the advanced line V2= IR18A2119 (27%) followed by V1= BR11903-5R-56 (26%). Sterility% in both the advanced lines was significantly higher than the check variety BRR1 dhan96 (Table 37).

Disease infestation: Different disease infections were found in all the tested entries including checks in some locations. Sheath blight (1-5% in 1-3 loc.), BLB (40% & 50% in both the check varieties in Bhanga; 1-3% in all tested entries in Sirajganj), Leaf Blast (1-5 in Sirajganj and Cumilla), Brown spot (1-3%, in Sirajganj and Cumilla) were reported (Table 38).

Insect attacked: Proper control measures were taken for insect control as and when necessary. Therefore, Insect infestation was low in most of the locations. But, in three locations (Gopalganj, Kushtia and Rangpur) yellow stem borer was found 1-5% in all the advanced line in the check varieties (Table 39).

Rat Damage: No rat damage was observed in all the 10 trial sites in the advanced lines and in check varieties (Table 39).

Bird Damage: No Bird damage was observed in all the 10 trial sites in the advanced lines and in check varieties (Table 39).

Plant growth and other attributes

Plant growth, flowering and maturity of the two advanced lines were uniform (Table 40). Over all phenotypic acceptances of the two advanced lines during vegetative and maturity stages was as good as the check varieties. Grain size was Medium Slender of all the tested entries except V2= IR18A2119 (Table 40). Erect flag leaves were found in all the tested entries. No lodging incident was found in all the tested entries including check varieties.

Table 36. Grain yield, Growth duration and Plant height of some rice genotypes under ALART FBR-SD during Boro 2023-24.

Genotypes	Locations										
	Bhanga, Faridpur	Debidwar, Cumilla	Sadar, Gopalganj	Baniachong, Habiganj	Khoksa, Kushtia	Paba, Rajshahi	Mithapukur, Rangpur	Kamarkhanda Sirajganj	Sonagazi, Feni	West Byde Gazipur	Mean
Grain Yield (t/ha)											
V1 = BR11903-5R-56	9.15	7.3	7.86	6.65	6.06	7.68	6.75	6.03	6.25	6.44	7.02
V2 = IR18A2119	8.52	6.97	7.67	8.08	5.77	7.77	6.88	5.99	6.4	6.32	7.04
V3= BRR1 dhan88 (ck)	8.43	7.18	7.23	6.7	5.65	7.96	6.5	5.36	6.32	5.95	6.73
V4= BRR1 dhan96 (ck)	8.54	6.46	6.7	6.28	6.21	7.68	6.6	5.66	6.2	5.98	6.63
LSD _{0.05}	0.69										0.25
CV%	7.13										
Growth duration (Days)											
V1 = BR11903-5R-56	151	143	146	144	156	141	149	155	137	150	147

V2 = IR18A21 19	151	142	146	147	157	139	145	155	141	150	147
V3= BRRI dhan88 (ck)	149	141	141	146	154	137	145	145	135	144	144
V4= BRRI dhan96 (ck)	153	141	145	143	142	139	146	145	134	145	143
LSD _{0.05}	3.91										1.43
CV%	1.91										
Plant Height (cm)											
V1 = BR11903- 5R-56	104	104	99	116	104	118	102	101	99	93	104
V2 = IR18A21 19	98	86	95	99	101	110	102	99	93	93	98
V3= BRRI dhan88 (ck)	95	92	87	98	95	99	98	89	84	89	93
V4= BRRI dhan96 (ck)	90	84	78	95	100	98	104	89	87	88	91
LSD _{0.05}	6.97										2.54
CV%	5.14										

Table 37. Yield components of the rice genotypes under ALART under ALART FBR-LD during Boro, 2023-24.

Genotype	Location											Mean
	Bhanga, Faridpur	Debidwar, Cumilla	Sadar, Gopalganj	Baniachong , Habiganj	Khoksa, Kushia	Paba, Rajshahi	Mithapukur , Rangpur	Kamarkhan da, Sirajganj	Sonagazi, Feni	West Byde Gazipur		
Thousand Grains Weight (g)												
V1 = BR11903- 5R-56	26.4	17.47	24.04	23.41	21.34	22.12	24.17	22.33	22.72	24.27	22.83	
V2 = IR18A21 19	22.7	19.57	26.5	23.06	23.26	25.8	27.67	22.23	23.26	23.68	23.77	
V3= BRRI dhan88 (ck)	23.03	19.01	22.02	22.78	20.06	19.17	21.33	23.27	23.39	21.73	21.58	
V4= BRRI dhan96 (ck)	26.1	19.35	21.51	20.61	19.2	18.94	20.33	21.33	22.93	19.26	20.96	
LSD _{0.05}	2.69										0.98	
CV%	8.60											
Panicles m ⁻² (no.)												
V1 = BR11903- 5R-56	360	320	368	388	301	276	245	297	264	294	311	
V2 = IR18A21 19	350	332	337	385	296	270	255	302	275	263	307	
V3= BRRI dhan88 (ck)	353	329	306	402	293	283	264	239	303	279	305	
V4= BRRI dhan96 (ck)	354	317	294	381	292	298	240	271	267	252	297	
LSD _{0.05}	35.57										12.99	
CV%	8.31											
Field Grains per Panicle (No.)												
V1 = BR11903- 5R-56	121	132	116	165	106	139	93	91	65	119	115	
V2 = IR18A21 19	98	127	104	173	104	118	97	99	60	118	110	
V3= BRRI dhan88 (ck)	122	130	123	180	108	154	139	66	69	116	121	
V4= BRRI dhan96 (ck)	148	122	139	91	107	149	143	65	75	126	117	
LSD _{0.05}	30.52										11.14	
CV%	18.81											
Sterility %												
V1 = BR11903- 5R-56	11	16	20	48	12	30	35	26	47	13	26	
V2 = IR18A21 19	24	16	25	39	13	31	31	20	51	24	27	
V3= BRRI dhan88 (ck)	21	19	7	38	17	25	22	20	46	17	23	
V4= BRRI dhan96 (ck)	8	17	8	24	12	27	27	28	41	15	21	
LSD _{0.05}	9.06										3.31	
CV%	28.73											

Table 38 Disease incidence of the rice genotypes under ALART FBR-SD during Boro 2024.

SN	Genotype	Sheath Blight	BLB	Brown Spot	Leaf Blast
1.	V1 = BR11903-5R-56	1% in Sirajganj	1% in Sirajganj	3% in Sirajganj	1% in Sirajganj
2.	V2 = IR18A21 19	5% (S-3) in Cumilla 1% in Kushtia 1% in Sirajganj	1% in Sirajganj	3% in Sirajganj	3% in Sirajganj
3.	V3= BRRI dhan88 (ck)	3 in Kushtia 5% in Sirajganj	40% in Bhanga 1% in Sirajganj	1 in Kushtia 3% in Sirajganj	5% (S-3) in Cumilla 3% in Sirajganj
4.	V4= BRRI dhan96 (ck)	3 in Kushtia 5% in Sirajganj	50% in Bhanga 3% in Sirajganj	3% in Sirajganj	3% in Sirajganj

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Table 39. Insect infestation score of the rice genotypes under ALART FBR-SD Boro 2024

SN	Genotype	Yellow Steam Borer	Bird Damage	Rat Damage
1	V1 = BR11903-5R-56	2% in Gopalganj, 3% in Kushtia, 1% in Rangpur	No	No
2	V2 = IR18A21 19	3% in Gopalganj, 3% in Kushtia, 3% in Rangpur	No	No
3	V3= BRRI dhan88 (ck)	3% in Gopalganj, 1% in Kushtia, 3% in Rangpur	No	No
4	V4= BRRI dhan96 (ck)	5% in Gopalganj, 1% in Kushtia, 3% in Rangpur	No	No

Table 40. Phenotypic Acceptance of the rice genotypes under ALART FBR-SD Boro 2024.

	Genotype	Characteristics								
		Plant growth	Uniformity		Wrapping quality of culm	Grain type	Flag leaf	PAcp		Lodging
			Flowering	Maturity				Veg.	Mat.	
1.	V1 = BR11903-5R-56	Good	Uniform	Uniform	Semi wrapped	Medium Slender	Erect	3	3	No
2.	V2 = IR18A21 19	Good	Uniform	Uniform	Well wrapped	Medium Bold	Erect	3	3	No
3.	V3= BRRI dhan88 (ck)	Good	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	3	No
4.	V4= BRRI dhan96 (ck)	Good	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	3	No

Phenotypic Acceptability: 1=Excellent, 3=Good, 5=Fair, 7=Poor, 9=Unacceptable

Recommendation: Considering grain yield performance, Growth duration, phenotypic acceptance, lodging tolerance, uniformity of flowering and maturity, disease reactions, none of the advanced lines were recommended for Proposed Variety Trial (PVT).

Rationale of Recommendation:

1. Growth duration of both the advanced lines i.e., V1 = BR11903-5R-56 and V2 = IR18A21 19 were significantly higher (3-4 days higher) than both the check varieties i.e., BRRI dhan88 and BRRI dhan96.
2. Thousand grain weight of both the tested lines were significantly higher than both the check varieties i.e., BRRI dhan88 and BRRI dhan96.
3. Grain yield of both the advanced lines i.e., BR11903-5R-56 and IR18A2119 (7.02 and 7.04 t/ha) were significantly higher than both the check varieties i.e., BRRI dhan88 (6.73 t/ha) and BRRI dhan96 (6.63 t/ha).
4. No lodging incident was found in case of both the advanced lines.

5. Uniformity of flowering and maturity were observed in the advanced line BR11318-5R-84.

1.9 ALART for Favorable Boro Rice, Biotechnology (FBR-Bio), Boro 2023-24

Rationale: Population of Bangladesh is increasing day by day. For sustainable food security, we have to put more emphasis on rice production in favorable condition in Boro season. We have couple of varieties for favorable condition in Boro season. Yield of these varieties has been increased in a certain level and stagnant. Some varieties became susceptible to pest and disease incidence. So, we need more FBR varieties to break down the yield ceiling. With this view, three advanced lines, developed by BIRRI Biotechnology division, were evaluated in different agro-ecological conditions of Bangladesh.

Hypothesis: Rice genotype suitable for favorable Boro rice may come out from evaluation at farmers' field.

Materials and method: Three advanced lines developed by BIRRI Biotechnology division: BR(Bio) 13028-AC24-1-2, BR(Bio) 13028-AC24-2-3 and BR(Bio) 13028-AC24-2-4 were evaluated against two check varieties BIRRI dhan86 and BIRRI dhan96 in ten different locations of the country during Boro 2023-24. The entries were evaluated in ten locations such as Kushtia (Gangni), Faridpur (Bhanga), Cumilla (Debidwar), Feni (Sonagazi), Gopalganj (Sadar), Rajshahi (Paba), Sirajganj (Kamarkhanda), Rangpur (Mithapukur), Satkhira (Sadar) and Gazipur (WB). The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding was done from 14th November to 20th November 2023. Seedling ages for different locations were varied from 35-40 days. Seedlings were transplanted at 20 cm x 20 cm spacing. Fertilizers were applied at 124: 22: 75: 20: 4 kg NPKSZn /ha. All fertilizers except urea were applied as basal and urea was applied in 3 equal splits at 15, 30 and 45 DAT. Other standard management practices were followed as and when necessary. Appropriate measures were taken to control insect pests but diseases were not controlled (to identify susceptibility and tolerance level of lines). Date of seeding, transplanting, flowering and maturity, plant height, lodging, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers, SA/SAAO, scientists and DAE personnel were scheduled to be recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion: On an average, the tested entry no. V1=BR(Bio) 13028-AC24-1-2 gave statistically similar yield (6.54 t/ha) to that of check variety BIRRI dhan96 (6.4 t/ha) but higher than the other check variety BIRRI dhan86 (6.05 t/ha) (Table 41). The tested entry no. V3=BR(Bio) 13028-AC24-2-4 gave the lowest mean yield (5.52 t/ha) among all the advanced lines and check varieties. Mean growth duration of all the tested entries ranged from 142-145 days, which were very close to each other and almost similar (Table 41). Among all the entries including checks, the longest mean plant height (116cm) was observed in V1=BR(Bio) 13028-AC24-1-2 which is statistically higher than the both check varieties (Table 41). Plant height of V2-V5 and check variety BIRRI dhan58 ranged from 93-103 cm. The tested entry V1=BR(Bio) 13028-AC24-1-2 produced comparatively higher panicles (300) in one square meter area, followed by V2= BR(Bio) 13028-AC24-2-3 (297), V5= BIRRI dhan96 (Ck) (283), V4= BIRRI dhan86 (Ck) (271), and V3= BR(Bio) 13028-AC24-2-4 (259) respectively (Table 42). Filled grains/panicle of check variety V5= BIRRI dhan96 (Ck) was higher (140) than the tested entries V1-V3 (114-124) (Table 42). Sterility percentages of the tested entries varied from 29-37 and it was 25% for the check variety V5= BIRRI dhan96 (Ck) (Table 42).

Table 41. Grain yield, growth duration and plant height of the rice genotypes under ALART for Favorable Boro Rice, Biotechnology (FBR-Bio), Boro 2023-24.

Genotype	Location										Mean
	Kushia (Gangni)	Faridpur (Bhanga)	Cumilla (Debidwar)	Feni (Sonagazi)	Gopalganj (Sadar)	Rajshahi (Paba)	Sirajganj (Kamarkhand)	Rangpur (Mithapukur)	Saikhira (Sadar)	BRRi Gazipur	
Grain yield (t ha ⁻¹)											
V1=BR(Bio) 13028-AC24-1-2	5.77	7.20	6.31	6.97	7.42	6.85	5.66	6.35	5.40	7.51	6.54
V2= BR(Bio) 13028-AC24-2-3	5.03	6.60	5.65	6.82	6.30	6.37	5.23	5.85	4.96	7.23	6.00
V3= BR(Bio) 13028-AC24-2-4	6.14	4.95	-	6.29	5.87	5.58	5.68	6.11	4.10	4.93	5.52
V4= BRRi dhan86 (Ck)	5.21	5.26	-	6.32	6.26	6.79	5.78	5.99	5.90	6.93	6.05
V5= BRRi dhan96 (Ck)	5.89	7.67	6.15	6.48	7.03	6.81	5.85	6.34	6.13	5.67	6.40
LSD _{0.05}	0.63										0.21
CV	6.4										
Growth duration (day)											
V1=BR(Bio) 13028-AC24-1-2	143	149	147	142	149	129	150	149	145	149	145
V2= BR(Bio) 13028-AC24-2-3	138	151	142	143	151	129	149	148	146	149	145
V3= BR(Bio) 13028-AC24-2-4	142	147	-	142	145	129	150	144	143	145	143
V4= BRRi dhan86 (Ck)	138	146	-	142	141	129	146	145	144	150	142
V5= BRRi dhan96 (Ck)	142	151	142	141	145	129	149	148	145	151	144
LSD _{0.05}	0.67										0.22
CV	0.29										
Plant height (cm)											
V1=BR(Bio) 13028-AC24-1-2	110	124	110	100	107	134	118	127	109	119	116
V2= BR(Bio) 13028-AC24-2-3	105	101	92	99	95	114	106	110	96	95	101
V3= BR(Bio) 13028-AC24-2-4	105	104	-	101	94	111	105	111	99	96	103
V4= BRRi dhan86 (Ck)	101	95	-	94	86	102	96	103	84	91	95
V5= BRRi dhan96 (Ck)	100	99	91	91	84	97	89	104	87	90	93
LSD _{0.05}	4.39										1.46
CV	2.66										

Table 42. Yield components of the rice genotypes under ALART for Favorable Boro Rice, Biotechnology (FBR-Bio), Boro 2023-24

Genotypes	Location										Mean
	Kushia (Gangni)	Faridpur (Bhanga)	Cumilla (Debidwar)	Feni (Sonagazi)	Gopalganj (Sadar)	Rajshahi (Paba)	Sirajganj (Kamarkh)	Rangpur (Mithapuk)	Saikhira (Sadar)	Gazipur (WB)	
Panicles m ⁻² (no.)											
V1=BR(Bio) 13028-AC24-1-2	273	355	371	322	283	298	362	273	211	258	300
V2= BR(Bio) 13028-AC24-2-3	287	330	347	313	261	298	354	220	302	253	297
V3= BR(Bio) 13028-AC24-2-4	238	296	-	304	233	242	340	252	191	232	259
V4= BRRi dhan86 (Ck)	253	258	-	284	272	254	377	248	229	259	271
V5= BRRi dhan96 (Ck)	289	287	360	297	270	223	341	244	234	288	283
LSD _{0.05}	37.36										12.4
CV	8.30										
1000-grain weight (g)											
V1=BR(Bio) 13028-AC24-1-2	19.3	19.5	17.3	21.5	22.2	21.3	23.2	24.9	21.8	22.7	21.4
V2= BR(Bio) 13028-AC24-2-3	19.8	16.3	12.9	21.7	19.1	18.0	21.6	22.9	20.2	20.0	19.2
V3= BR(Bio) 13028-AC24-2-4	22.7	20.0	-	21.6	22.2	21.2	22.8	21.1	22.2	21.7	21.7
V4= BRRi dhan86 (Ck)	20.5	22.2	-	23.0	22.9	22.4	21.3	18.2	24.9	22.8	22.0
V5= BRRi dhan96 (Ck)	19.7	18.2	17.2	20.5	19.3	18.6	21.1	19.5	20.9	19.0	19.4
LSD _{0.05}	1.02										0.34

CV	3.00										
Grains panicle ⁻¹ (no.)											
V1=BR(Bio) 13028-AC24-1-2	113	120	117	115	139	129	64	83	124	133	114
V2= BR(Bio) 13028-AC24-2-3	121	110	111	113	124	164	54	119	120	106	114
V3= BR(Bio) 13028-AC24-2-4	114	113	-	111	142	165	108	149	111	108	124
V4= BRRI dhan86 (Ck)	99	119	-	108	124	139	94	155	118	105	118
V5= BRRI dhan96 (Ck)	119	155	114	112	150	185	110	144	164	146	140
LSD _{0.05}	21.02										
CV	10.57										
Unfilled Grains panicle ⁻¹ (no.)											
V1=BR(Bio) 13028-AC24-1-2	15	35	52	14	23	70	42	63	26	28	37
V2= BR(Bio) 13028-AC24-2-3	24	16	49	21	22	63	39	51	40	23	35
V3= BR(Bio) 13028-AC24-2-4	23	43	-	22	27	45	31	17	30	22	29
V4= BRRI dhan86 (Ck)	32	48	-	19	28	70	37	82	27	74	46
V5= BRRI dhan96 (Ck)	25	12	36	19	14	49	29	15	22	29	25
LSD _{0.05}	24.05										
CV	44.34										
Sterility (%)											
V1=BR(Bio) 13028-AC24-1-2	11.9	22.7	30.8	12.0	14.1	35.1	39.4	43.2	21.6	17.0	24.8
V2= BR(Bio) 13028-AC24-2-3	16.5	12.6	30.5	18.9	15.3	27.8	42.0	29.7	33.3	17.5	24.4
V3= BR(Bio) 13028-AC24-2-4	16.5	27.6	-	20.2	15.8	21.2	22.7	10.2	28.8	16.8	20.0
V4= BRRI dhan86 (Ck)	24.5	28.9	-	17.8	18.3	33.5	28.5	34.5	22.3	32.4	26.7
V5= BRRI dhan96 (Ck)	14.0	7.05	23.7	17.0	8.42	20.9	20.8	9.33	13.2	17.2	15.1
LSD _{0.05}	10.01										
CV	28.22										

Insect infestation: Stem borer was reported in all locations for all the entries Scoring 1. Insect infestation was very low (negligible) in some locations and most of the location was not infested by insect at all (Table 43).

Disease incidence: Disease attack was very negligible in the ALART plots (Table 43). No mentionable differences were found among the entries. Among the diseases Sheath blight was prominent scoring 1-3 in Cumilla, Sirajganj, Feni and Rangpur.

Table 43. Disease infection and insect infestation of the rice genotypes under ALART for Favorable Boro Rice, Biotechnology (FBR-Bio), Boro 2023-24

Genotypes	Disease score (scale)*		Insect infestation (Score)		
	BLB	Sheath blight	YSB	RB	LF
V1=BR(Bio) 13028-AC24-1-2	3 (Cumilla)	3 (Cumilla & Feni), 1(Sirajganj)	1 in all locations	1 in Feni region	-
V2= BR(Bio) 13028-AC24-2-3	-	1 (Sirajganj)	1 in all locations	1 in Feni region	1 in Rajshahi
V3= BR(Bio) 13028-AC24-2-4	3 (Cumilla)	1 (Sirajganj) 3 (Cumilla & Feni)	1 in all locations	1 in Feni and Cumilla	-
V4= BRRI dhan86 (Ck)	3 (Cumilla)	3 (Sirajganj, Cumilla & Feni)	1 in all locations	1-3 in Feni and Cumilla	-
V5= BRRI dhan96 (Ck)	-	1 Mithapukur and Sirajganj)			3 in Cumilla

Abbreviations: BLB= Bacterial leaf blight, ShB=Sheath blight, RB= Rice Bug, LF= Leaf folder, YSB= Yellow Stem Borer.

*Eye estimation of the number of hills showing the sign and symptom of disease occurrence. The percentage indicates the variations in disease incidence level of the tested genotypes.

Table 44. Phenotypic Acceptance (PAcp) of the rice genotypes under ALART for Favorable Boro Rice, Biotechnology (FBR-Bio), Boro 2023-24

Genotypes	Characteristics						PAcp Score	
	Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality with culm	Grain type	Flag leaf	Veg.	Mat.
V1=BR(Bio) 13028-AC24-1-2	Attractive	Uniform	Uniform	Well wrapped	Slender	Erect	3	3

V2= BR(Bio) 13028-AC24-2-3	Attractive	Uniform	Uniform	Well wrapped	Medium Bold	Erect	3	3
V3= BR(Bio) 13028-AC24-2-4	Attractive	Uniform	Uniform	Well wrapped	Slender	Erect	3	3
V4= BRRI dhan86 (Ck)	Uniform	Uniform	Uniform	Well wrapped	slender	Erect	3	5
V5= BRRI dhan96 (Ck)	Attractive	Uniform	Uniform	Well wrapped	Bold	Erect	3	3

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

Lodging incidence, plant growth and other characters: The advance lines and checks were found to be lodging tolerant in all the locations Plant growth, flowering and maturity were not uniform for all the tested entries but it was uniform for all the check varieties. Flag leaf was erect for all the entries (Table 44). Phenotypic acceptance score was good for the tested entries.

Preference of Farmer and DAE personnel: Farmers preferred V5= BRRI dhan96 (Ck) check variety compared to the tested lines and other check variety.

Recommendation: Considering yield, growth duration, and all other parameters, none of the tested lines were suitable for PVT.

Rationale of Recommendation:

1. Although yield of the V1=BR(Bio) 13028-AC24-1-2 line is statistically higher than the check variety BRRI dhan96 but 10% higher yield is recommended to be selected for PVT.
2. Average growth duration of all tested lines was almost similar with the check varieties.
3. Regarding other phenotypic and yield components parameter, there are no significant advantages observed in lines compared to check varieties.

1.10 ALART: FBR-Late Boro, Boro 2024

Rationale: Bangladesh experiences distinct wet and dry seasons, with the dry season, known as the Boro season, presenting challenges for rice cultivation due to water scarcity. In this context, short-duration Boro rice varieties have proven advantageous as they require less water and can complete their life cycle within the limited dry season. Alongside rice, the cultivation of other crops is essential to address nutritional needs. Late Boro rice cultivation allows for the possibility of growing additional crops on the same land. However, high temperatures and the long growing duration of some Boro varieties can pose problems in the later part of the Boro season.

With climate change leading to unpredictable rainfall patterns and prolonged dry spells, the resilience of short-duration Boro rice varieties becomes increasingly valuable. These varieties are better suited to withstand variable climate conditions and reduce reliance on continuous water availability. Furthermore, crops such as potatoes or mustard can be grown after Aman rice and before the late Boro season. To ensure sustainable food security, it is crucial to develop Boro rice varieties that offer higher yields within a shorter growing period, ideally from February to June. These shorter-duration varieties are essential for meeting food needs and supporting long-term agricultural stability. To address these needs, an advanced rice line, V1 = BR11845-4R-62, has been tested in ten locations across the country against three check varieties: V2 = BINA dhan25 (Ck), V3 = BRRI dhan28 (Ck), and V4 = BRRI dhan98.

Hypothesis: Short duration favorable Late Boro rice genotype may be identified suitable for Boro season.

Materials and method: One advanced line, V1= BR11845-4R-62, were tested along with three check varieties V2= BINA dhan25 (Ck), V3= BRRI dhan28 (Ck), V4= BRRI dhan98 (Ck) in 10 different locations such as Rangpur (Sadar), Dinajpur (Parbotipur), Nilphamari (Sadar), Lalmonirhat (Sadar), Natore (Singra), Sirajganj (Tarash), Joypurhat (Sadar), Kushtia (Sadar), Manikganj (Saturia) and Gazipur (BRRI H/Q) during Boro 2023. The trials were replicated thrice in each location. The unit plot size was 20 m² (4.0m x 5.0m). Seeding time for twelve

locations varied from last week of November to first week of February 2024. Seedling age varied from 20-28 days among the locations. Seedlings were transplanted at 20 cm x 20 cm spacing. Fertilizers were applied at 260: 100: 120: 110: 10 kg of Urea: DAP: MoP: Gypsum: ZnSO₄ /ha respectively. All fertilizers except urea were applied as basal and urea was applied in 3 equal splits at 10 days, 30 days after transplanting, and 5 days before PI stage. BRRRI recommended management practices were followed as and when necessary. Appropriate measures were taken to control insect pests but diseases were not controlled (to identify susceptibility and tolerance level of lines). Date of seeding, transplanting, flowering and maturity, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers and extension personnel were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yield was adjusted to 14% moisture content.

Results: Among the four tested rice genotypes, V4 (BRRRI dhan98) produced significantly higher yields compared to the advanced line V1 (BR11845-4R-62) and the two check varieties, V2 (BINA dhan14) and V3 (BRRRI dhan28). V4 achieved its highest yield of 8.78 tons/ha in Manikganj and its lowest of 5.82 tons/ha in Natore, with an overall mean yield of 6.95 tons/ha. V1 (BR11845-4R-62) yielded between 3.55 tons/ha in Gazipur and 7.52 tons/ha in Lalmonirhat, averaging 6.55 tons/ha. V2 (BINA dhan14) recorded yields ranging from 4.24 tons/ha in Gazipur to 7.10 tons/ha in Lalmonirhat, with a mean yield of 6.11 tons/ha. V3 (BRRRI dhan28) showed yields ranging from 4.02 tons/ha in Gazipur to 7.45 tons/ha in Bogura, with an average yield of 6.34 tons/ha.

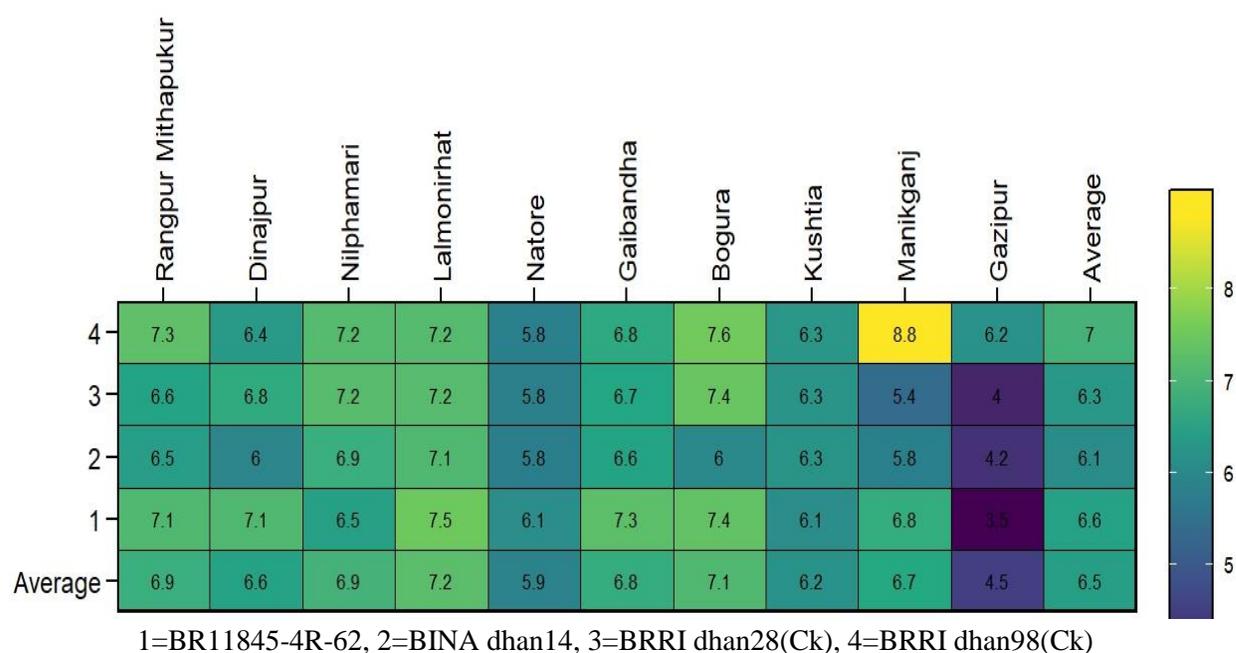


Fig 2. Heat map of mean grain yield in 10 locations of ALART FBR-Late Boro, Boro 2024

The average time from planting to maturity for these four rice genotypes ranged between 111 and 115 days. Both V1 (BR11845-4R-62) and V4 (BRRRI dhan98) had a mean maturity duration of 115 days, while V2 (BINA dhan14) and V3 (BRRRI dhan28) averaged 111 and 112 days, respectively. Maturity duration varied significantly by location. For V1 (BR11845-4R-62), maturity ranged from 100 days in Natore to 121 days in Rangpur. V2 (BINA dhan14) took as few as 95 days to mature in Natore and up to 119 days in Kushtia. V3 (BRRRI dhan28) had a maturity range of 100 days in Natore to 116 days in Rangpur. V4 (BRRRI dhan98) showed a maturity duration between 103 days in Natore and 122 days in Rangpur (Table 45). Environmental conditions influenced the plant height of the tested genotypes. V3 (BRRRI dhan28) exhibited the tallest average plant height at 114 cm, followed by V4 (BRRRI dhan98) at 107 cm, V1 (BR11845-4R-62) at 103 cm, and V2 (BINA dhan14) at 99 cm (Table 45).

Among the lines, the advanced line V1 (BR11845-4R-62) exhibited the heaviest grain weight, ranging from 21.05 g in Kushtia to 27.83 g in Dinajpur, with an average of 25.47 g. V2 (BINA

dhan14) had grain weights ranging from 16.73 g in Rangpur to 24.33 g in Nilphamari, with a mean of 22.55 g. V3 (BRRI dhan28) showed a range from 19.13 g in Rangpur to 23.47 g in Bogura, averaging 22.29 g. The check variety V4 (BRRI dhan98) recorded grain weights between 20.83 g in Rangpur and 26.07 g in Lalmonirhat, with an overall mean of 24.00 g (Table 46). Regarding tiller production, the check variety V4 (BRRI dhan98) produced the highest number of tillers, averaging 293, followed closely by V3 (BRRI dhan28). The panicle count for V1 (BR11845-4R-62) ranged from 252 in Lalmonirhat to 329 in Natore, with an average of 285. V2 (BINA dhan14) produced the lowest number of panicles, ranging from 244 in Rangpur to 305 in Gazipur, with a mean of 279. In terms of grain production, V3 (BRRI dhan28) led, followed by V1 (BR11845-4R-62). V1 produced grains ranging from 68 in Gazipur to 182 in Nilphamari, with an average of 115 grains per panicle. V2 (BINA dhan14) showed a range from 75 grains per panicle in Lalmonirhat to 120 in Natore, with a mean of 98. V4 (BRRI dhan98) produced grains per panicle ranging from 68 in Lalmonirhat to 164 in Rangpur, with an overall mean of 105 (Table 46). Sterility rates were lowest in V3 (BRRI dhan28) and highest in V4 (BRRI dhan98). For V1 (BR11845-4R-62), sterility ranged from 9% in Rangpur to 42% in Gazipur, with an average of 24%. V2 (BINA dhan14) exhibited sterility ranging from 15% in Nilphamari to 34% in Lalmonirhat and Kushtia, with a mean of 24%. V3 (BRRI dhan28) had sterility percentages between 7% in Rangpur and 39% in Gazipur, averaging 21%. V4 (BRRI dhan98) showed sterility rates from 14% in Kushtia to 59% in Lalmonirhat, with an overall mean of 29% (Table 46).

Table 45. Grain yield, Growth duration and Plant height of the rice genotypes under ALART (FBR-LB) during Boro 2024.

Genotypes	Rangpur	Dinajpur	Nilphamari	Lalmonirhat	Natore	Gaibandha	Bogura	Kushtia	Manikganj	Gazipur	Mean
GY (ton/ha)											
V1=BR11845-4R-62	7.10	7.10	6.55	7.52	6.14	7.27	7.35	6.12	6.81	3.55	6.55
V2=BINA dhan14(Ck)	6.46	5.96	6.87	7.10	5.80	6.59	6.03	6.26	5.82	4.24	6.11
V3=BRRI dhan28(Ck)	6.61	6.78	7.21	7.19	5.83	6.67	7.45	6.27	5.41	4.02	6.34
V4=BRRI dhan98(Ck)	7.30	6.40	7.17	7.17	5.82	6.76	7.57	6.32	8.78	6.22	6.95
LSD _{0.05}	0.61										0.19
CV%	5.74										
DTM (days)											
V1=BR11845-4R-62	121	114	118	118	100	112	116	113	120	115	115
V2=BINA dhan14(Ck)	114	109	112	112	95	105	109	119	113	116	111
V3=BRRI dhan28(Ck)	116	115	114	114	100	108	112	115	113	112	112
V4=BRRI dhan98(Ck)	122	115	118	120	103	111	114	118	113	117	115
LSD _{0.05}	0.82										0.26
CV%	0.45										
Plant height (cm)											
V1=BR11845-4R-62	96	105	95	112	103	102	100	106	105	102	103
V2=BINA dhan14(Ck)	99	101	100	107	95	101	96	103	94	96	99
V3=BRRI dhan28(Ck)	118	111	108	123	123	112	115	100	117	113	114
V4=BRRI dhan98(Ck)	106	106	102	114	112	103	107	93	119	105	107
LSD _{0.05}	2.41										0.77
CV%	1.41										

Table 46. Yield components of the tested the rice genotypes under ALART (FBR-LB) during Boro 2024.

Genotypes	Rangpur	Dinajpur	Nilphamari	Lalmonirhat	Natore	Gaibandha	Bogura	Kushtia	Manikganj	Gazipur	Mean
1000-grain weight (g)											
V1=BR11845-4R-62	24.40	27.83	27.00	27.60	23.81	26.67	25.20	21.05	26.07	25.07	25.47
V2=BINA dhan14(Ck)	16.73	23.83	24.33	23.40	21.50	23.83	23.17	22.56	23.45	22.66	22.55
V3=BRRI dhan28(Ck)	19.13	23.07	22.67	23.33	21.61	23.07	23.47	22.94	22.29	21.29	22.29
V4=BRRI dhan98(Ck)	20.83	25.33	25.67	26.07	22.62	25.33	22.90	22.53	25.08	23.65	24.00

LSD _{0.05}	0.80										0.25
CV%	2.09										
Panicles m-2 (no.)											
V1=BR11845-4R-62	275	271	273	252	329	285	277	299	292	299	285
V2=BINA dhan14(Ck)	244	275	267	267	274	282	286	300	292	305	279
V3=BRRRI dhan28(Ck)	266	265	284	294	281	280	323	297	284	288	286
V4=BRRRI dhan98(Ck)	283	286	276	281	286	313	305	306	300	295	293
LSD _{0.05}	21										7
CV%	4.62										
Grains panicle-1 (no.)											
V1=BR11845-4R-62	153	144	182	92	89	102	120	99	97	68	115
V2=BINA dhan14(Ck)	119	86	97	75	120	106	91	92	112	78	98
V3=BRRRI dhan28(Ck)	174	123	162	114	113	105	130	95	118	73	121
V4=BRRRI dhan98(Ck)	164	101	116	68	94	81	116	103	113	90	105
LSD _{0.05}	19.04										6.12
CV%	10.92										
Sterility (%)											
V1=BR11845-4R-62	9	22	16	33	34	19	17	17	31	42	24
V2=BINA dhan14	19	23	15	34	18	18	23	34	21	30	24
V3=BRRRI dhan28(Ck)	7	16	7	27	28	23	17	23	22	39	21
V4=BRRRI dhan98(Ck)	19	33	21	59	44	22	19	14	31	27	29
LSD _{0.05}	7.5										2.37
CV%	18.93										

Lodging incidence and other characters: Lodging was not found in any locations which is a good sign. Plant growth was excellent for all entries. However, flowering and maturity was not uniform in the advanced line V1=BR11845-4R-62 (Table 3). Phenotypic appearance was good for all the tested lines in vegetative stage.

Table 47. Phenotypic Acceptance of the rice genotypes under ALART (FBR-LB) during Boro 2024.

Genotype	Characteristics						PAcp Sc	
	Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality with culm	Grain type	Flag leaf	Veg.	Mat.
V1=BR11845-4R-62	Good	Uneven	Uneven	Well wrapped	Medium bold	Erect	1	5
V2=BINA dhan14(Ck)	Good	Uniform	Uniform	Well wrapped	Medium bold	Erect	1	5
V3=BRRRI dhan28(Ck)	Good	Uniform	Uniform	Well wrapped	Medium bold	Erect	1	5
V4=BRRRI dhan98(Ck)	Good	Uniform	Uniform	Well wrapped	Medium bold	Erect	1	1

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

Insect infestation: 1-2% Stem borer, rice bug infestation was reported in all location but was not a major concern as insecticide was applied properly.

Disease incidence: Minor Diseases and insect infestation was observed as proper management practices were followed in all locations.

Rat damage: No rat damage was reported in any of the locations.

Monitoring team and Farmer's opinions: In most of the cases, scientist, extension personnel and farmer choose the V4=BRRRI dhan98 for its phenotype and higher yield higher tillering ability.

Recommendation: Based on phenotype, yield, farmers and monitoring team's comments, the advanced line BR11845-4R-62 was not recommended for PVT.

Rationale of recommendation:

- The advanced line BR11845-4R-62 failed to produce higher yield than the check variety BRRRI dhan98.

- Phenotype was not good during ripening stage and sterility percentage was higher in compare to check varieties.
- Farmers preferred BRRI dhan98 over the advanced line
- Monitoring team also did not recommend this advanced line for PVT.

1.11 ALART for Cold Tolerant breeding lines suitable for haor areas, ALART-CTR (Haor), Boro 2023-24

Rationale: Very often at different areas of Bangladesh, Boro rice at different growth stage is seriously affected by severe cold. Rice seedling is stunted with yellowish leaf color at seedbed and transplanting is delayed due to cold spell. Sometimes it is difficult to maintain the actual seedling age due to lower growth of seedling affected by cold. After transplanting, tillering is also stunted for some time which ultimately increase the growth duration and affect the grain yield. Due to very early seeding and transplanting of Boro rice, especially short duration varieties fall under severe cold at their reproductive phase (PI to flowering) and resulted to high sterility or spikelet degeneration. Even long duration varieties are also affected if seeded very early and unusual cold spell is occurred at the reproductive phase. It is very difficult to overcome unusual natural cold spell. Cold tolerant rice variety may be the best solution to address the above-mentioned problems.

Hypothesis: Cold tolerant rice variety for Boro season may be identified to recommend for PVT.

Materials and method: Three cold tolerant advanced lines TP16199 and BR11894-R-R-R-R-169 along with BRRI dhan28 and BRRI dhan67 as checks were evaluated in ten locations such as BRRI research farm (Gazipur West byde); Kishoreganj (Mithamoin, Itna); Netrokona (Madan and khaliajuri); Habiganj (Baniachang, Ajmeriganj and Nabiganj) and Sunamganj (Taherpur and Santiganj) during Boro 2023-24. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding time was varied from 3rd week of November, 2021 in different locations and seedling age for different locations were also varied from 35-40 days. Seedlings were transplanted at 20 cm x 20 cm spacing. Fertilizers were applied at 124: 22: 75: 20: 4 kg NPKSZn /ha. All fertilizers except urea were applied as basal and urea was applied in 3 equal splits at 15, 30 and 45 DAT. Other standard management practices were followed as and when necessary. Appropriate measures were taken to control insect pests but diseases were not controlled (to identify susceptibility and tolerance level of lines). Date of seeding, transplanting, flowering and maturity, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers and DAE personnel were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion

Among all the entries including checks, the advanced line BR11894-R-R-R-R-169 gave slightly higher mean yield (7.66 t/ha) than the other tested entry (6.91 t/ha) and check variety BRRI dhan67 (7.03 t/ha). The other tested entry TP16199 gave the statistically similar mean yield (6.91 t/ha) with check variety BRRI dhan67 (7.03 t/ha) (Table 48). But all the tested entries and check variety BRRI dhan67 gave higher yield than another check variety BRRI dhan28 (6.00 t/ha) (Table 1). Interaction effect of genotypes and environments (location) was highly significant. Across the locations, the highest grain yield (9.39 t ha⁻¹) was found in BR11894-R-R-R-R-169 entry at Habiganj (Nabiganj) followed by 9.03 t/ha at Habiganj (Ajmeriganj) (Table 48). The lowest grain yield was found in the check variety BRRI dhan28 (5.17 t ha⁻¹) at Habiganj (Baniachong). In general, out of ten locations almost all the locations gave Average to higher grain yield. Growth durations were significantly varied among the entries due to environmental effect (Table 48). Mean growth duration of the highest mean yielder rice entry TP16199 was 151 days. On the other hand, mean growth duration of the other entry BR11894-R-R-R-R-169

was 148 days. which was 2 days higher than the two check varieties BRRi dhan28 and BRRi dhan67 (146 days). Out of two tested entries, BR11894-R-R-R-R-169 was found to be the lowest growth duration (145 days) at Sunamganj (Santiganj) district (Table 48). Plant height was significantly varied due to both the entries and environmental effect (Table 48). From mean value, TP16199 entry was found to be the tallest (120 cm) followed by the other BR11894-R-R-R-R-169 (115 cm). The mean plant height of the check varieties BRRi dhan28 and BRRi dhan67 was found at 98 and 113 cm. On the other hand, the mean shortest plant height among the entries and checks was found 78 cm of BRRi dhan28 at Gazipur (WB) district (Table 48). Interaction of entries and environments had significant effect on 1000-grain weight (Table 49). Among all the entries, the lowest mean 1000-grain weight was found in BRRi dhan67 (21.8 g) followed by BRRi dhan28 (22.33 g) and the two entries (BR11894-R-R-R-R-169 and TP16199) was 22.72 and 22.88 gm. Panicles produced by the genotypes varied significantly across the locations (Table 49). Among the genotypes, check variety BRRi dhan67 produced the mean highest panicles per unit area (318) that was followed by TP16199 (313). The lowest number of panicles produced by BR11894-R-R-R-R-169 was 303. Filled grains produced by the genotypes significantly varied from location to locations (Table 49). On an average, the highest number of mean filled grains (127) produced in a panicle by BR11894-R-R-R-R-169. Other tested entry produced almost similar filled grains/ panicle which is 126 grains/panicle. The lowest number of grains per panicle was obtained in BRRi dhan28 (113). The lowest sterility (%) was found in check variety BRRi dhan67 (19.05), whereas it was 26.75 for tested entry TP16199.

The main purpose of this ALART (CTR) is to recommend cold tolerant rice genotype which would be more suitable for hoar areas. In this trial, the genotype (BR11894-R-R-R-R-169) produced higher grain yield than the other genotype (TP16199) and check variety BRRi dhan28 and BRRi dhan67. The grain shape and size of the genotypes and check varieties were almost similar, that was medium slender.

Disease infection: A total of 4 diseases namely Bacterial blight (BB), Brown Streak (BLS), Leaf scald (LS) and Neck blast (NB) were found to infect all the cold tolerant rice (CTR) genotypes. Among them, both the check varieties were found susceptible to BLB scoring 1-9 in 4 locations. BRRi dhan67 was the only variety found susceptible to BLS in 2 locations scoring 3. All the tested entries and both the check varieties found susceptible to Neck Blast (NB) disease scoring 1-5 in different locations but BRRi dhan28 found more susceptible to NB disease in 4 locations. (Table 50).

Insect infestation: Proper controlled measures were taken as and when necessary. However, Yellow Stem borer and Rice bug were found in all locations scoring 1 (Table 51).

Lodging incidence: Lodging incidence was found only in 2 locations during late maturity stage which was 40-60 percent in case of all entries and check varieties. Among them BR11894-R-R-R-R-169 was less susceptible to lodging.

Phenotypic acceptance: The best phenotypic acceptance was found in BR11894-R-R-R-R-169. Attractive plant growth, uniform flowering and maturity, well wrapped with culm, erect flag leaf and medium slender grain was found in BR11894-R-R-R-R-169. Phenotypic acceptance of all the tested genotypes ranged from 3 in vegetative and at reproductive stage (Table 52).

Preference of the Farmer: Farmers preferred V4 = BRRi dhan67 (Ck) line compared to other tested lines and check varieties due to lower growth duration.

Recommendation: Considering yield, growth duration and other parameters, none of the tested lines found suitable for PVT.

Rationale of Recommendation:

1. Although the yield of the V2 = BR11894-R-R-R-R-169 line is statistically higher than the check variety BRRi dhan28 and BRRi dhan67 but some cold injury has found in the tested lines as stated by the monitoring team.

2. Average growth duration of tested lines were 2-5 days higher than both of the check variety BRRi dhan28 and BRRi dhan67.
3. Compared to the check variety BRRi dhan67 (Ck) both the lines were found more susceptible to diseases and insect infestation.
4. All the tested line along with check variety found susceptible to Lodging.

Table 48. Grain yield, growth duration and plant height of the rice genotypes under ALART for Cold Tolerant breeding lines suitable for haor areas [ALART-CTR (Haor)] Boro 2024

Genotype	Location										Mean
	Habiganj (Baniachon)	Habiganj (Ajmeriganj)	Habiganj (Nabiganj)	Sunamganj (Taherpur)	Sunamganj (Santiganj)	Kishoreganj (Itna)	Kishoreganj (Mithamoin)	Netrokona (Madan)	Netrokona (Khliazuri)	Gazipur (WB)	
Grain yield (t ha ⁻¹)											
V1= TP16199	7.30	6.76	8.71	6.18	7.27	6.28	5.95	6.80	7.15	6.74	6.91
V2= BR11894-R-R-R-R-169	8.09	9.03	9.39	8.29	7.98	6.91	5.59	6.59	7.78	7.00	7.66
V3= BRRi dhan28 (Ck)	5.17	6.13	5.71	7.83	6.17	5.96	5.86	5.79	5.81	5.56	6.00
V4= BRRi dhan67 (Ck)	8.19	7.34	7.80	7.39	7.29	6.80	6.22	6.83	6.26	6.15	7.03
LSD _{0.05}	0.72										0.23
CV	6.44										
Growth duration (day)											
V1= TP16199	153	152	150	152	148	154	153	149	150	151	151
V2= BR11894-R-R-R-R-169	152	148	148	150	145	149	150	145	145	147	148
V3= BRRi dhan28 (Ck)	149	144	147	148	144	149	147	142	141	144	146
V4= BRRi dhan67 (Ck)	148	144	144	148	145	150	152	141	143	146	146
LSD _{0.05}	0.67										0.21
CV	0.28										
Plant height (cm)											
V1= TP16199	126	127	123	115	122	111	113	122	123	113	120
V2= BR11894-R-R-R-R-169	119	118	119	112	120	113	114	107	118	106	115
V3= BRRi dhan28 (Ck)	100	101	104	100	104	96	96	100	101	78	98
V4= BRRi dhan67 (Ck)	116	120	119	112	118	106	110	110	116	103	113
LSD _{0.05}	10.16										3.21
CV	5.62										

Table 49. Yield components of the rice genotypes under ALART for Cold Tolerant breeding lines suitable for haor areas, ALART-CTR (Haor), Boro 2023-24

Genotype	Location										Mean
	Habiganj (Baniachong)	Habiganj (Ajmeriganj)	Habiganj (Nabiganj)	Sunamganj (Taherpur)	Sunamganj (Santiganj)	Kishoreganj (Itna)	Kishoreganj (Mithamoin)	Netrokona (Madan)	Netrokona (Khliazuri)	Gazipur (WB)	
Panicles m ⁻² (no.)											
V1= TP16199	391	312	333	342	297	283	275	308	311	275	313
V2= BR11894-R-R-R-R-169	378	311	356	335	295	260	249	289	298	257	303
V3= BRRi dhan28 (Ck)	376	329	349	343	263	274	264	296	309	254	306
V4= BRRi dhan67 (Ck)	367	367	365	351	307	296	295	286	295	248	318
LSD _{0.05}	37.42										11.83
CV	7.43										
1000-grain weight (g)											
V1= TP16199	23.77	13.54	23.77	24.59	23.77	23.60	24.25	23.38	24.32	23.79	22.88
V2= BR11894-R-R-R-R-169	24.11	16.89	24.11	24.33	23.11	24.27	23.01	22.60	21.87	22.94	22.72
V3= BRRi dhan28 (Ck)	24.15	16.16	24.15	24.07	23.98	23.16	22.90	20.41	22.22	22.13	22.33
V4= BRRi dhan67 (Ck)	24.55	16.61	24.55	24.40	24.14	20.60	21.00	19.10	21.79	21.22	21.80
LSD _{0.05}	1.67										0.53
CV	4.60										
Filled Grains panicle ⁻¹ (no.)											
V1= TP16199	165	63	196	114	186	110	104	111	109	105	126
V2= BR11894-R-R-R-R-169	176	77	169	161	190	106	77	104	110	105	127
V3= BRRi dhan28 (Ck)	160	78	130	125	122	108	100	93	107	109	113
V4= BRRi dhan67 (Ck)	166	87	119	135	76	115	111	102	119	119	115
LSD _{0.05}	34.54										10.92
CV	17.65										
Unfilled Grains panicle ⁻¹ (no.)											
V1= TP16199	59	59	33	34	43	23	26	57	55	51	44
V2= BR11894-R-R-R-R-169	36	40	30	42	40	24	22	59	49	45	39
V3= BRRi dhan28 (Ck)	38	38	32	21	38	21	27	51	43	39	35
V4= BRRi dhan67 (Ck)	25	31	20	20	26	18	23	29	29	36	26

LSD _{0.05}	14.33											4.53
CV	24.63											
Sterility (%)												
V1= TP16199	26.26	47.52	14.36	22.71	18.78	17.48	20.05	34.00	33.59	32.75	26.75	
V2= BR11894-R-R-R-R-169	16.76	33.40	15.32	20.89	17.39	18.44	22.37	36.11	30.69	29.83	24.12	
V3= BRR1 dhan28 (Ck)	18.95	33.14	20.55	14.21	25.04	16.41	20.13	35.22	28.26	26.54	23.85	
V4= BRR1 dhan67 (Ck)	13.00	26.05	14.80	13.19	27.43	13.32	17.58	22.32	19.81	23.03	19.05	
LSD _{0.05}	7.78											2.46
CV	20.42											

Table 50. Disease incidence (%) of the rice genotypes under ALART for Cold Tolerant breeding lines suitable for haor areas, ALART-CTR (Haor), Boro 2023-24

Genotype	Locations	Disease incidence Score							
		Bacterial Blight (BLB)		Bacterial Streak (BLS)		Leaf Scald (LS)		Neck Blast (NB)	
		%In	Sev	%In	Sev	%In	Sev	%In	Sev
V1= TP16199	Itna	100	3	-	-	90	5	20	3
	Mithamoin	100	5	-	-	80	1		
V2= BR11894-R-R-R-R-169	Itna	100	3	-	-	60	3	20	5
	Mithamoin	50	1	-	-	-	-	-	-
V3= BRR1 dhan28 (Ck)	Itna	40	1	-	-	50	3	70	5
	Mithamoin	100	9	-	-	100	3	-	-
	Madan	-	-	5	-	-	-	-	-
	Khaliajuri	-	-	5	-	-	-	-	-
V4= BRR1 dhan67 (Ck)	Itna	100	9	-	-	80	3	10	3
	Mithamoin	100	5	-	-	90	1		
	Madan	-	-	5	-	-	-	-	-
	Khaliajuri	-	-	70	-	-	-	-	-

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Table 51. Insect infestation score of the rice genotypes under ALART for Cold Tolerant breeding lines suitable for haor areas, ALART-CTR (Haor), Boro 2023-24

SN	Genotype	Insect Infestation Score	
		Stem Borer	Rice Bug
1	V1= TP16199	1 in all locations	1 in 4 locations
2	V2= BR11894-R-R-R-R-169	1 in all locations	1 in 4 locations
3	V3= BRR1 dhan28 (Ck)	1 in all locations	1 in 4 locations
4	V4= BRR1 dhan67 (Ck)	1 in all locations	1 in 4 locations

Table 52. Phenotypic Acceptance of the rice genotypes under ALART for Cold Tolerant breeding lines suitable for haor areas [ALART-CTR (Haor)], Boro 2023-24

SN	Genotype	Characteristics							
		Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality	Grain type	Flag leaf	PAcp	
								Veg.	Mat.
1	V1= TP16199	Good	Uniform	Uniform	Well wrapped	Medium slender	Erect	3	3
2	V2= BR11894-R-R-R-R-169	Good	Uniform	Uniform	Well wrapped	Medium slender	Erect	3	3
3	V3= BRR1 dhan28 (Ck)	Good	Uniform	Uniform	Well wrapped	Medium slender	Erect	3	3
4	V4= BRR1 dhan67 (Ck)	Good	Uniform	Uniform	Well wrapped	Medium slender	Erect	3	3

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

1.12 ALART for Bacterial Blight Resistance Rice, Boro 2023-24

Rationale: Rice bacterial blight is one of the deadly bacterial diseases, which is the most destructive affliction of cultivated rice (*Oryza sativa* and *O. glaberrima*). It is also known as the bacterial blight of rice. Bacterial leaf blight of rice is caused by a species of *Xanthomonas*. Almost, 75 percent of the crops would be destroyed in severe epidemics and millions of hectares of rice are infected annually. This disease was first found in Kyushu, Japan (1884 -1885), and the causal agent like bacterium *Xanthomonas oryzae* was first identified in 1911 at that time, this was named *Bacillus oryzae*. Bacterial leaf blight of rice is most commonly observed in rice-

growing regions of Asia, the western coast of Africa, Australia, Latin America, and the Caribbean regions. In places like the United States, bacterial blight is not found but a bacterial strain related to Xoo has been listed as a select agent by the US Department of Agriculture. It is a designation that places it under strict regulations. The common name of the rice bacterial leaf blight is also known as rice leaf blight.

Hypothesis: There is possibility to identify and select suitable Bacterial Blight Resistance high yielding rice genotypes for favorable environment in Boro season.

Materials and Methods: Three Bacterial Blight Resistance high yielding rice advanced lines (BBR) advanced lines i.e., V₁=BR (path)13800-BC3-8-1, V₂=BR (path)13800-BC3-8-9 and V₃=BR (path)13800-BC3-224-28 developed by Plant Breeding Division were evaluated against the check varieties BRRI dhan89 and BRRI dhan92 during Boro 2024. The entries were evaluated in ten different locations of the country such as Satkhira, Sirajganj, Cumilla, Sonagazi, Habiganj, Barisal, Rangpur, Netrakona, Kishoreganj and BRRI H/Q Gazipur. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding was done around at the date of 4th week of November 2023 to 1st week of December 2023 for all the locations. Seedling ages for different locations were varied from 30-40 days at respective location. Seedlings were transplanted at 25 cm x 15 cm spacing. Fertilizers Urea, TSP, MoP, Gypsum and Zinc Sulfate were applied @ 40-17-20-15-1.5 kg Bigha⁻¹. All fertilizers were applied as basal and in addition urea was applied in 3 equal splits at 15, 30 and 45 DAT. Standard and uniform management practices were followed as and when necessary for all the locations. Appropriate measures were taken to control insect pests but diseases were not controlled to identify susceptibility and tolerance level of lines. Date of seeding, transplanting, flowering and maturity, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers and DAE personnel were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion

Interaction of genotypes and environments had significant effect on grain yield, growth duration, plant height and yield components (Table 53 and 54). Among the genotypes highest or similar mean grain yield (7.0 tha⁻¹) was obtained in all the genotypes like V₁=BR(path)13800-BC3-8-1, V₂=BR(path)13800-BC3-8-9 and V₃=BR(path)13800-BC3-224-28. Two standard check BRRI dhan89 and BRRI dhan92 gave 6.4 t/ha, 6.8 t/ha respectively. Compared to standard check BRRI dhan89 the mean growth duration of lines like V₃=BR(path)13800-BC3-224-28 were 1 days longer and V₁=BR(path)13800-BC3-8-1, was 2 days shorter and V₂=BR(path)13800-BC3-8-9 was 1 day shorter. Compared to standard check BRRI dhan92 the mean growth duration of lines like V₁=BR(path)13800-BC3-8-1, was 2 days shorter, V₂=BR(path)13800-BC3-8-9 was 1 day shorter and V₃=BR(path)13800-BC3-224-28 was found similar growth duration. Highest growth duration was observed in V₃=BR(path)13800-BC3-224-28 line and standard check BRRI dhan92 (159 days) and lowest was observed in elite line like V₁=BR(path)13800-BC3-8-1 (157 days) and the standard check BRRI dhan89 was intermediate (158 days) (Table 53). The highest plant height was 112 cm found in the standard check BRRI dhan92 followed by also in the standard check BRRI dhan89, it was 109 cm. The lowest plant height was found in V₁=BR(path)13800-BC3-8-1, it was 103 cm followed by V₂=BR(path)13800-BC3-8-9 (106 cm) followed by the advanced line V₃=BR(path)13800-BC3-224-28 (107 cm). (Table 53). The lowest 1000-grain weight (TGW) of tested lines was found in V₂=BR (path)13800-BC3-8-9 (22.4 gm) followed by V₁=BR(path)13800-BC3-8-1 (22.9 gm) and the highest TGW was found in breeding line V₃=BR(path)13800-BC3-224-28 (23.4 gm) followed by standard check BRRI dhan92 (23.2 gm) followed by also standard check BRRI dhan89 (23.1 gm) (Table 54).

The average panicle m⁻² range varied from 283 to 303 and the highest mean panicle m⁻² was found in V₁=BR(path)13800-BC3-8-1 (303) followed by standard check BRRI dhan92 (296)

followed by standard check BRR I dhan89 (286) followed by V₂=BR(path)13800-BC3-8-9 (285) and the lowest mean panicle m-2 was found in V₃=BR(path)13800-BC3-224-28, it was 283 (Table 54). On an average, the highest filled grains panicle-1 (137) was found in V₂=BR(path)13800-BC3-8-9 followed by V₃=BR(path)13800-BC3-224-28, it was 124 followed by standard check BRR I dhan89 (123) followed by the standard check V₅= BRR I dhan92 (ck), it was 113 and the lowest filled grains panicle-1 was found in V₁=BR(path)13800-BC3-8-1, it was 110 (Table 54). On the contrary, on an average, the highest unfilled grains panicle-1 (39) was found in standard check V₄= BRR I dhan89 (ck) followed by V₂=BR (path)13800-BC3-8-9, it was 38 followed by V₃=BR(path)13800-BC3-224-28 and standard check V₅= BRR I dhan92 (ck), it was 36 and the lowest unfilled grains panicle-1 (28) was found in, it was 30 (Table 54). The highest sterility % was found in standard check V₅= BRR I dhan92 (ck) (36%) followed by standard check V₄ = BRR I dhan89, it was 34 followed by V₃=BR(path)13800-BC3-224-28, it was 30 and the sterility % was observed in V₁=BR(path)13800-BC3-8-1 and V₂=BR(path)13800-BC3-8-9, it was 29 (Table 54).

Disease infection: Disease infections were found in all entries including checks in some locations. BLB was found in all tested lines in Madan scoring 1 where check varieties scored 3 in Madan. Among the other diseases sheath blight was the major one scoring 1-3 in 2 locations. Leaf blast, Brown spot and bacterial leaf streak was also found in negligible amount. (Table 55)

Insect infestation: Stem borer was reported in all locations for all the entries Scoring 1. Insect infestation was very low (negligible) in some locations and most of the location was not infested by insect at all (Table 56).

Preference of Farmer and DAE personnel: Farmers preferred V₅=BRR I dhan92 (Ck) check variety compared to the tested lines and other check variety.

Recommendation: Considering yield, growth duration, and all other parameters, none of the tested lines were suitable for PVT.

Rationale of Recommendation:

1. Yield of the all the tested line is statistically similar with the check variety BRR I dhan92 but 10% higher yield is recommended to be selected for PVT.
2. Average growth duration of all tested lines was almost similar with the check varieties.
3. Regarding other phenotypic and yield components parameter, there are no significant advantages observed in lines compared to check varieties.

Table 53. Grain yield, Growth duration and Plant height of the rice genotypes under ALART (BBR) during Boro 2024

Genotypes	Locations										Mean
	Satkira (Sadar)	Siraganj (Kamarkhand)	Cumilla (Debidwar)	Feni (Sonacazi)	Habiganj (Baniachang)	Barisal (Sadar)	Netrakona (Madan)	Rangpur (Mithapukur)	Kishoreganj (Mithamoin)	Gazipur (Sadar)	
Grain yield (t ha ⁻¹)											
V ₁ =BR(path)13800-BC3-8-1	4.8	6.1	9.0	6.6	7.2	7.6	7.2	7.3	7.4	7.3	7.0
V ₂ =BR(path)13800-BC3-8-9	4.8	6.2	9.4	6.2	8.5	4.1	8.4	6.9	6.7	9.0	7.0
V ₃ =BR(path)13800-BC3-224-28	5.4	5.6	9.1	6.6	8.0	5.1	6.0	8.3	6.7	8.9	7.0
V ₄ =BRR I dhan89 (check)	5.7	5.1	9.1	4.8	6.7	4.6	6.0	6.8	7.0	8.5	6.4
V ₅ =BRR I dhan92 (check)	4.9	4.7	8.9	5.3	7.8	4.6	6.9	7.8	7.6	9.4	6.8
LSD (0.05)	1.70										
CV	7.68										
Growth duration (days)											
V ₁ =BR(path)13800-BC3-8-1	142	165	158	155	159	157	157	158	158	158	157
V ₂ =BR(path)13800-BC3-8-9	142	166	158	145	160	163	157	163	161	166	158
V ₃ =BR(path)13800-BC3-224-28	142	166	157	154	164	163	154	164	158	166	159
V ₄ =BRR I dhan89 (check)	142	165	158	154	159	162	151	162	157	165	158

V ₅ =BRRI dhan92 (check)											
LSD (0.05)	1.61										
CV	0.41										
Plant height (cm)											
V ₁ =BR(path)13800-BC3-8-1	100	107	101	103	104	103	103	103	103	103	103
V ₂ =BR(path)13800-BC3-8-9	102	110	99	101	108	112	104	106	107	107	106
V ₃ =BR(path)13800-BC3-224-28	107	112	102	103	109	111	109	107	108	107	107
V ₄ =BRRI dhan89 (check)	108	113	104	99	114	116	112	113	107	101	109
V ₅ =BRRI dhan92 (check)	112	113	104	103	116	124	118	112	108	113	112
LSD (0.05)	10.21										
CV	2.82										

Table 54. Yield components of the rice genotypes under ALART (BBR) during Boro 2024

Genotypes	Locations										Mean
	Satkhira (Sadar)	Sirajganj (Kamarkhan)	Cumilla (Debiddar)	Feni (Sonagazi)	Habiganj (Baniachang)	Barisal (Sadar)	Netrakona (Madan)	Rangpur (Mithapukur)	Kishoreganj (Mithamoin)	Gazipur (Sadar)	
1000-grain weight (g)											
V ₁ =BR(path)13800-BC3-8-1	21.7	24.7	22.2	22.9	23.3	22.8	23.0	23.0	22.9	23.0	22.9
V ₂ =BR(path)13800-BC3-8-9	21.8	21.7	22.8	20.7	23.7	21.2	19.9	24.4	22.5	24.8	22.4
V ₃ =BR(path)13800-BC3-224-28	21.2	23.3	23.1	21.0	22.9	22.8	21.8	25.0	24.5	28.6	23.4
V ₄ =BRRI dhan89 (check)	22.0	24.0	21.6	23.5	24.1	21.0	20.7	24.3	24.3	25.5	23.1
V ₅ =BRRI dhan92 (check)	23.7	25.7	20.8	22.5	22.7	22.8	20.6	25.4	24.3	23.9	23.2
LSD (0.05)	5.26										
CV	6.89										
Panicles m ⁻² (no.)											
V ₁ =BR(path)13800-BC3-8-1	269	282	338	296	305	313	305	308	309	307	303
V ₂ =BR(path)13800-BC3-8-9	253	264	331	247	357	280	303	254	244	313	285
V ₃ =BR(path)13800-BC3-224-28	232	289	335	218	350	305	300	253	234	311	283
V ₄ =BRRI dhan89 (check)	267	271	317	229	314	308	308	269	268	311	286
V ₅ =BRRI dhan92 (check)	272	289	341	238	359	313	280	304	265	303	296
LSD (0.05)	65.27										
CV	7.26										
Filled grains panicle ⁻¹ (no.)											
V ₁ =BR(path)13800-BC3-8-1	131	80	123	111	104	113	109	109	110	110	110
V ₂ =BR(path)13800-BC3-8-9	152	105	128	164	184	116	117	138	133	137	137
V ₃ =BR(path)13800-BC3-224-28	147	101	118	89	179	117	97	132	128	128	124
V ₄ =BRRI dhan89 (check)	164	87	137	71	179	101	96	139	132	124	123
V ₅ =BRRI dhan92 (check)	102	70	116	85	160	104	107	130	135	116	113
LSD (0.05)	63.56										
CV	14.90										
Unfilled grains panicle ⁻¹ (no.)											
V ₁ =BR(path)13800-BC3-8-1	43	30	24	32	29	28	30	29	29	29	30
V ₂ =BR(path)13800-BC3-8-9	56	38	27	28	40	52	33	30	23	57	38
V ₃ =BR(path)13800-BC3-224-28	43	26	24	20	31	56	49	14	40	59	36
V ₄ =BRRI dhan89 (check)	40	23	23	20	42	67	67	21	37	47	39
V ₅ =BRRI dhan92 (check)	42	38	23	19	44	52	55	22	22	45	36
LSD (0.05)	29.40										
CV	23.30										
Sterility (%)											
V ₁ =BR(path)13800-BC3-8-1	34	38	19	30	29	26	29	28	28	28	29
V ₂ =BR(path)13800-BC3-8-9	37	36	22	18	22	44	28	22	17	41	29
V ₃ =BR(path)13800-BC3-224-28	30	26	22	23	17	48	50	11	31	46	30
V ₄ =BRRI dhan89 (check)	24	34	17	28	23	67	70	15	28	38	34
V ₅ =BRRI dhan92 (check)	50	54	20	27	27	50	51	17	17	43	36
LSD (0.05)	34.75										
CV	32.06										

Table 55. Disease incidence (%) of the rice genotypes under ALART (BBR) during Boro 2024

Genotypes	Locations	Disease score (scale)*									
		BLB		ShB		LS		BS		BLS	
		%In	Sev	%In	Sev	%In	Sev	%In	Sev	%In	Sev
V1=BR(path)13800-BC3-8-1	Madan	100	1	-	-	-	-	100	1	90	1
	Mithamoin	-	-	-	-	30	1	80	1	-	-
	Sonagazi	-	-	10	3	-	-	-	-	-	-
V2=BR(path)13800-BC3-8-9	Madan	100	1	-	-	-	-	100	1	90	1
	Mithamoin	-	-	-	-	-	-	70	1	-	-
	Sonagazi	-	-	10	3	-	-	-	-	-	-
V3=BR(path)13800-BC3-224-28	Madan	100	1	-	-	-	-	100	1	90	1
	Mithamoin	-	-	-	-	100	1	80	1	-	-
	Sonagazi	-	-	20	3	-	-	-	-	-	-
V4=BIRRI dhan89 (check)	Madan	100	3	-	-	-	-	100	1	90	1
	Mithamoin	-	-	-	-	5	1	80	1	-	-
	Sonagazi	-	-	20	3	-	-	-	-	-	-
V5=BIRRI dhan92 (check)	Madan	100	1	-	-	-	-	100	1	90	1
	Mithamoin	-	-	-	-	-	-	90	1	-	-
	Sonagazi	-	-	40	5	-	-	-	-	-	-

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Abbreviations: BLB= Bacterial leaf blight, ShB=Sheath blight, LB= Leaf Blast, BS= Brown Spot, BLS= Bacterial Leaf Streak.

Table 56. Insect infestation score of the rice genotypes under ALART ((BBR) during Boro 2024.

Genotypes	Insect infestation (Score)	
	YSB	LF
V1=BR(path)13800-BC3-8-1	1 in all locations	-
V2=BR(path)13800-BC3-8-9	1 in all locations	-
V3=BR(path)13800-BC3-224-28	1 in all locations	1 in Barishal
V4=BIRRI dhan89 (check)	1 in all locations	1 in Barishal
V5=BIRRI dhan92 (check)	1 in all locations	-

Table 57. Phenotypic Acceptance of all genotypes under ALART (BBR) during Boro 2024.

SN	Genotype	Characteristics							
		Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality	Grain type	Flag leaf	PAcp	
								Veg	Mat
1	V ₁ =BR(path)13800-BC3-8-1	Uniform	Uniform	Uniform	Well wrapped	Medium Bold	Erect	3	1
2	V ₂ =BR(path)13800-BC3-8-9	Uniform	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	1
3	V ₃ =BR(path)13800-BC3-224-28	Uniform	Uniform	Uniform	Well wrapped	Medium Bold	Erect	3	1
4	V ₄ =BIRRI dhan89 (check)	Uniform	Uniform	Uniform	Well wrapped	Medium Bold	Erect	3	1
5	V ₅ =BIRRI dhan92 (check)	Uniform	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	1

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

1.13 ALART for Bacterial Blight (BB) and Blast Resistance Rice, Boro 2024

Rationale: Nearly half of India's population and one-third of the world's population rely on rice for calorie and carbohydrate intake. Despite enormous production and resolving global hunger, a 30% increase in rice production is required by 2030 from the present level, and rice production needs to be boosted by 160 million tones and should increase by 70% in 2050 to ensure global food security and nutritional security. Due to several biotic and abiotic stresses, rice production can be affected by unfavorable climate changes. The productivity of rice continues to be under threat by biotic stresses, viz., blast and bacterial leaf blight (BB), which cause significant losses in rice production. Among fungal diseases affecting rice crops, blast disease ranked first among the top 10 diseases. Bacterial blight (BB) disease, caused by *Xanthomonas oryzae* pv. *oryzae*, is

another important biotic stress factors, which reduces rice production by 20%–50%. The deployment of host plant resistance is the most preferred strategy for management of BB disease, and breeding disease resistant varieties remains a very economical and effective option. Bacterial blight (BB) and fungal blast diseases are the major biotic constraints that limit rice productivity. To sustain yield improvement in rice, it is necessary to developed yield potential of the rice varieties by incorporation of biotic stress resistance genes.

Hypothesis: There is possibility to identify and select suitable BBR and Blast Resistance high yielding rice genotypes for favorable environment in Boro season.

Materials and Methods: Three Bacterial Blight and Blast Resistance high yielding rice advance lines (BBR+Blast) advanced lines i.e., V1= R(path)13800-BC3-134-8, V2= R(path)13800-BC3-134-25 and V3= R(path)13800-BC3-224-44 developed by Plant Breeding Division were evaluated against the check varieties V4=BRRI dhan89 and V5=BRRI dhan92 during Boro 2024. The entries were evaluated in ten different locations of the country such as Satkhira, Sirajganj, Cumilla, Sonagazi, Habiganj, Barisal, Rangpur, Netrakona, Kishoreganj and BRRI H/Q Gazipur. The trials were replicated thrice in each location. The unit plot size for each entry was 20 m² (5m x 4m). Seeding was done around at the date of 4th week of November 2023 to 1st week of December 2023 for all the locations. Seedling ages for different locations were varied from 30-35 days at respective location. Seedlings were transplanted at 25 cm x 15 cm spacing. Fertilizers Urea, TSP, MoP, Gypsum and Zinc Sulfate were applied @ 40-17-20-15-1.5 kg Bigha⁻¹. All fertilizers were applied as basal and in addition urea was applied in 3 equal splits at 15, 30 and 45 DAT. Standard and uniform management practices were followed as and when necessary for all the locations. Appropriate measures were taken to control insect pests but diseases were not controlled to identify susceptibility and tolerance level of lines. Date of seeding, transplanting, flowering and maturity, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stage, yield and yield components were recorded. Feedback from farmers and DAE personnel were also recorded. For yield estimation, 9 m² sample area from each plot was harvested at maturity and grain yields were adjusted to 14% moisture content.

Results and discussion

Interaction of genotypes and environments had significant effect on grain yield, growth duration, plant height and yield components (Table 57 and 58). Among the genotypes highest mean grain yield (7.7 tha⁻¹) was obtained in V2= R(path)13800-BC3-134-25 followed by V1= R(path)13800-BC3-134-8, it was 7.5 t/ha followed by V3= R(path)13800-BC3-224-44, it was 7.1 t/ha and the lowest grain yield was found in standard check V4=BRRI dhan89, it was 6.7 followed by standard check V5=BRRI dhan92 and it was 6.9 t/ha (Table 57). Compared to standard check V5=BRRI dhan92 (Ck) the mean growth duration of lines 3 days shorter found in advance lines V1= R(path)13800-BC3-134-8 and V2= R(path)13800-BC3-134-25 and 1 day shorter found in advance line V3= R(path)13800-BC3-224-44 (Table 57). Compared to standard check V4=BRRI dhan89 (Ck), the mean growth duration of lines 1 day shorter found in V1= R(path)13800-BC3-134-8 and V2= R(path)13800-BC3-134-25 and the mean growth duration of lines 1 day longer found in advance line V3= R(path)13800-BC3-224-44. The highest growth duration was observed in standard check V5=BRRI dhan92 (Ck) (160 days) and lowest was observed in advance lines V1= R(path)13800-BC3-134-8 and V2= R(path)13800-BC3-134-25 (157 days) (Table 57). The highest plant height was 111 cm found in standard check V5=BRRI dhan92 (Ck) followed by standard check V4=BRRI dhan89 (Ck), standard check V4=BRRI dhan89 (Ck), it was 110 cm followed by the advanced line V3= R(path)13800-BC3-224-44 (109 cm) followed by the advanced line V1= R(path)13800-BC3-134-8, it was 107 days followed by the advanced line V2= R(path)13800-BC3-134-25, it was 105 days (Table 57). The highest plant height was 111 cm found in standard check V5=BRRI dhan92 (Ck) and the lowest plant height was found in advanced line V2= R(path)13800-BC3-134-25, it was 105 days) (Table 57).

The lowest 1000-grain weight (TGW) of tested lines was found in V2= R(path)13800-BC3-134-25, it was 22.7 gm followed by standard check V5=BRRRI dhan92 (Ck), it was 22.9 gm. The highest 1000-grain weight (TGW) of tested lines was found in advanced line V3= R(path)13800-BC3-224-44 and standard check V4=BRRRI dhan89 (Ck), it was 23.7 followed by tested line V1= R(path)13800-BC3-134-8, it was 23.0 gm. The highest 1000-grain weight (TGW) was found in advanced line V3= R(path)13800-BC3-224-44 and standard check V4=BRRRI dhan89 (Ck), it was 23.7 and the lowest 1000-grain weight (TGW) was found in advanced line V2= R(path)13800-BC3-134-25, it was 22.7 gm (Table 2). The average panicle m⁻² range varied from 278 to 298 and the highest mean panicle m⁻² was found in standard check V5=BRRRI dhan92 (Ck) (298) followed by advance line V1= R(path)13800-BC3-134-8 (290) followed by advance line V3= R(path)13800-BC3-224-44, V2= R(path)13800-BC3-134-25, it was 285, 284 respectively and the lowest panicle m⁻² standard check V4=BRRRI dhan89 (278) (Table 58). On an average, the highest filled grains panicle⁻¹ (143) was found in V1= R(path)13800-BC3-134-8 followed by V2= R(path)13800-BC3-134-25 (132) followed by advance line V3= R(path)13800-BC3-224-44 and standard check V4=BRRRI dhan89 (120) and the lowest filled grains panicle⁻¹ (112) was found in standard check V4=BRRRI dhan89 (Table 58).

The highest filled grains panicle⁻¹ (143) was found in V1= R(path)13800-BC3-134-8 and the lowest filled grains panicle⁻¹ (112) was found in standard check V4=BRRRI dhan89. The lowest filled grains panicle⁻¹ (112) was found in standard check V4=BRRRI dhan89 (Table 58). On the contrary, on an average, the highest unfilled grains panicle⁻¹ (41) was found in advance line V2= R(path)13800-BC3-134-25 followed by V1= R(path)13800-BC3-134-8 (38) followed by advance line V3= R(path)13800-BC3-224-44 (37) and the lowest unfilled grains panicle⁻¹ (31) was found in standard check V4=BRRRI dhan89 (31) followed by standard check standard check V5=BRRRI dhan92, it was 33 (Table 58). The highest sterility % was found in advance line V2= R(path)13800-BC3-134-25 (37%) followed by advance line V3= R(path)13800-BC3-224-44, it was 32 and lowest sterility % was observed in advance line V1= R(path)13800-BC3-134-8 (28) followed by standard check V4=BRRRI dhan89 (29%) followed by standard check V5=BRRRI dhan92, it was 30% (Table58).

Table 57. Grain yield, Growth duration and Plant height of the rice genotypes under ALART (BBR and Blast) during Boro 2024

Genotypes	Locations										Mean
	Sadar, Satkhira	Kamarkhand, Sirajganj	Debidar, Cumilla	Sonagazi, Feni	Baniachang, Habiganj	Sadar, Barisal	Madan, Netrakona	Mithapukur, Rangpur	Mithamoin, Kishoreganj	Sadar, Gazipur	
Grain yield (t ha ⁻¹)											
V1= R(path)13800-BC3-134-8	5.8	5.1	9.1	6.4	9.0	7.6	7.9	6.9	6.6	10.8	7.5
V2= R(path)13800-BC3-134-25	5.6	4.8	8.9	6.2	9.3	7.7	8.7	7.8	7.6	10.3	7.7
V3= R(path)13800-BC3-224-44	5.9	5.0	8.8	6.6	7.5	7.3	6.8	7.2	6.4	9.5	7.1
V4= BRRRI dhan89 (check)	5.5	3.9	8.6	4.8	6.8	7.1	6.2	7.6	7.2	9.1	6.7
V5= BRRRI dhan92 (check)	5.4	4.3	8.3	5.3	7.9	6.8	6.8	7.9	7.9	8.4	6.9
LSD (0.05)	1.66										
CV	6.80										
Growth duration (days)											
V1= R(path)13800-BC3-134-8	155	165	156	143	161	159	153	159	160	161	157
V2= R(path)13800-BC3-134-25	155	166	157	145	162	156	155	161	158	158	157
V3= R(path)13800-BC3-224-44	155	166	158	154	163	155	159	161	158	158	159
V4= BRRRI dhan89 (check)	155	165	157	154	163	160	159	160	155	156	158
V5= BRRRI dhan92 (check)	155	165	158	157	162	162	159	161	159	160	160
LSD (0.05)	1.15										
CV	0.22										
Plant height (cm)											
V1= R(path)13800-BC3-134-8	116	105	103	101	104	113	106	106	109	102	107
V2= R(path)13800-BC3-134-25	109	103	103	101	103	115	102	116	99	102	105
V3= R(path)13800-BC3-224-44	113	112	103	103	116	121	110	105	107	106	109
V4= BRRRI dhan89 (check)	114	115	104	99	117	122	113	106	104	105	110

V5= BRR1 dhan92 (check)	117	120	106	103	119	111	110	106	109	111	111
LSD (0.05)	8.98										
CV	2.47										

Table 58. Yield components of the rice genotypes under ALART (BBR and Blast) during Boro 2024

Genotypes	Locations											Mean
	Sadar, Satkhira	Kamarkhanda	Debidwar, Cumilla	Sonagazi, Feni	Baniachang, Habiganj	Sadar, Barisal	Madan, Netrakona	Mithapukur, Rangpur	Mithamoin, Kishoreganj	Sadar, Gazipur		
1000-grain weight (g)												
V1= R(path)13800-BC3-134-8	22.0	22.5	21.5	23.3	22.4	22.8	22.1	22.5	23.8	27.2	23.0	
V2= R(path)13800-BC3-134-25	23.0	22.3	22.9	20.7	22.4	21.4	21.8	24.2	23.2	24.7	22.7	
V3= R(path)13800-BC3-224-44	23.1	22.7	23.1	21.0	23.1	21.2	24.1	25.7	24.3	28.4	23.7	
V4= BRR1 dhan89 (check)	24.6	23.2	22.3	23.5	23.7	22.5	23.3	25.1	23.2	25.5	23.7	
V5= BRR1 dhan92 (check)	20.6	24.1	19.5	22.5	23.3	21.4	24.1	26.2	23.3	23.9	22.9	
LSD (0.05)	2.93											
CV	3.85											
Panicles m ⁻² (no.)												
V1= R(path)13800-BC3-134-8	261	277	264	250	368	302	321	305	258	294	290	
V2= R(path)13800-BC3-134-25	279	269	260	247	365	259	298	308	244	315	284	
V3= R(path)13800-BC3-224-44	297	279	270	218	341	296	311	301	234	304	285	
V4= BRR1 dhan89 (check)	280	223	346	245	360	270	292	210	272	282	278	
V5= BRR1 dhan92 (check)	261	296	309	238	383	347	311	282	281	276	298	
LSD (0.05)	181.78											
CV	18.80											
Filled grains panicle ⁻¹ (no.)												
V1= R(path)13800-BC3-134-8	148	106	123	154	185	187	158	120	119	127	143	
V2= R(path)13800-BC3-134-25	167	101	120	164	151	198	130	58	94	135	132	
V3= R(path)13800-BC3-224-44	147	91	115	89	176	163	103	74	113	130	120	
V4= BRR1 dhan89 (check)	140	94	100	71	152	151	125	54	119	115	112	
V5= BRR1 dhan92 (check)	143	66	99	85	158	155	103	109	142	137	120	
LSD (0.05)	70.27											
CV	16.92											
Unfilled grains panicle ⁻¹ (no.)												
V1= R(path)13800-BC3-134-8	20	21	27	23	45	44	43	73	32	53	38	
V2= R(path)13800-BC3-134-25	23	25	47	28	43	41	50	59	37	54	41	
V3= R(path)13800-BC3-224-44	28	34	31	20	50	44	73	29	28	30	37	
V4= BRR1 dhan89 (check)	23	14	27	20	54	43	39	20	25	45	31	
V5= BRR1 dhan92 (check)	31	21	23	19	48	37	73	14	23	43	33	
LSD (0.05)	29.24											
CV	25.11											
Sterility (%)												
V1= R(path)13800-BC3-134-8	22	16	22	17	24	24	27	61	26	43	28	
V2= R(path)13800-BC3-134-25	26	20	39	18	28	22	38	101	41	40	37	
V3= R(path)13800-BC3-224-44	31	27	27	23	28	27	71	39	26	23	32	
V4= BRR1 dhan89 (check)	26	13	27	28	35	29	31	38	21	42	29	
V5= BRR1 dhan92 (check)	34	25	24	27	31	24	71	13	16	32	30	
LSD (0.05)	29.38											
CV	28.55											

Table 59. Disease incidence (%) of the rice genotypes under ALART (BBR and Blast) during Boro 2024

Genotypes	Locations	Disease score (scale)*									
		BLB		ShB		LB		BS		LS	
		%In	Sev	%In	Sev	%In	Sev	%In	Sev	%In	Sev
V1=BR(path)13800-BC3-8-1	Madan	90	1	-	-	-	-	100	1	50	1
	Mithamoin	-	-	-	-	10	1	70	1	100	1
	Sonagazi	-	-	10	3	-	-	-	-	-	-
V2=BR(path)13800-BC3-8-9	Madan	100	1	-	-	-	-	100	1	-	-
	Mithamoin	50	1	-	-	-	-	90	1	100	1
	Sonagazi	-	-	20	3	-	-	-	-	-	-
V3=BR(path)13800-BC3-224-28	Madan	50	1	-	-	50	1	100	1	-	-
	Mithamoin	-	-	-	-	10	1	50	1	-	-
	Sonagazi	-	-	10	3	-	-	-	-	-	-

V4=BRRRI dhan89 (check)	Madan	100	1	-	-	90	1	100	1	-	-
	Mithamoin	-	-	-	-	30	1	30	1	-	-
	Sonagazi	-	-	20	3	-	-	-	-	-	-
V5=BRRRI dhan92 (check)	Madan	100	3	-	-	80	1	100	1	-	-
	Mithamoin	-	-	-	-	50	1	80	1	30	1
	Sonagazi	-	-	10	3	-	-	-	-	-	-

*Eye estimation of the number of hills showing the sign and symptom of disease infection. The percentage indicates the variations in disease incidence level of the tested genotypes.

Table 60. Insect infestation score of the rice genotypes under ALART (BBR and Blast) during Boro 2024

Genotype	Insect infestation (Score)	
	YSB	LF
V ₁ =BR(path)13800-BC3-134-8	1 in all locations	-
V ₂ =BR(path)13800-BC3-134-25	1 in all locations	-
V ₃ =BR(path)13800-BC3-224-44	1 in all locations	1 in Barishal
V ₄ =BRRRI dhan89 (check)	1 in all locations	1 in Barishal
V ₅ =BRRRI dhan92 (check)	1 in all locations	-

Table 61. Phenotypic Acceptance of all genotypes under ALART BBR and Blast during Boro 2024

SN	Genotype	Characteristics							
		Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality	Grain type	Flag leaf	PAcp	
								Veg.	Mat.
1	V ₁ =BR(path)13800-BC3-134-8	Uniform	Uniform	Uniform	Well wrapped	Medium Bold	Erect	3	1
2	V ₂ =BR(path)13800-BC3-134-25	Uniform	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	1
3	V ₃ =BR(path)13800-BC3-224-44	Uniform	Uniform	Uniform	Well wrapped	Medium Bold	Erect	3	1
4	V ₄ =BRRRI dhan89 (check)	Uniform	Uniform	Uniform	Well wrapped	Medium Bold	Erect	3	1
5	V ₅ =BRRRI dhan92 (check)	Uniform	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	1

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

Preference of Farmer and DAE personnel: Farmers preferred V₂=BR (path)13800-BC3-134-25 compared to the other tested lines and check varieties due to less disease incidence, higher yield and less growth duration.

Recommendation: Considering yield, growth duration, and all other parameters, V₂= BR(path) 13800-BC3-134-25 line could be advanced for PVT.

Rationale of Recommendation:

1. Yield of the tested line is statistically higher than both of the check varieties but V₂=BR (path)13800-BC3-134-25 line gives higher yield in 5 locations and more stable than the other lines and check varieties.
2. Average growth duration V₂=BR (path)13800-BC3-134-25 line was 1-3 days less than both of the check varieties.
3. V₂=BR (path)13800-BC3-134-25 line was less susceptible to disease than the others.
4. Regarding other phenotypic and yield components parameter, there are no significant advantages observed in lines compared to check varieties.

1.14 ALART: Premium Quality Rice (PQR), Boro 2024.

Rationale: Bangladesh has a considerable position regarding rice production in the world and achieved self-sufficiency. Now the people of the country prefer to consume rice with premium quality, since per capita income has increased. BRRRI already released some premium quality rice (PQR) varieties such as BRRRI dhan50 and BRRRI dhan63 for Boro season. Performance and quality of these varieties are good but not enough. So, BRRRI is trying to develop PQR varieties

having higher yield performance and better qualities than the previous ones. Therefore, Advanced Lines Adaptive Research Trial (ALART) of PQR was conducted at suitable locations of the country for releasing better quality of Premium Quality Rice variety during Boro season.

Hypothesis: Rice genotypes having the characteristics of premium quality may be identified through the on-farm evaluation advanced breeding lines.

Materials and Methods

Five advanced breeding lines such as V1= BR10645-6-4-8-1-2, V2= BR10646-3-2-2-4-3, V3= BR10648-12-1-3-4-1, V4=Zira, Nachol and V5=Katari, Shibganj having premium quality rice developed by Plant Breeding Division for Boro season were evaluated in different locations of the country along with the three check varieties, BRRi dhan104, BRRi dhan107 and BINA dhan25. The trials were conducted at ten locations such as Kushtia (Sadar), Cumilla (Sadar), Rajshahi (Paba), Rangpur (Mithapukur), Sirajganj (Kamarkhanda), Gopalganj (Sadar), Habiganj (Baniachang), Feni (Sonagazi), Faridpur (Bhanga) and Gazipur (BRRi research farm) during Boro, 2023-2024. The trials were conducted following the Randomized Completely Block Design (RCBD) with three replications at all locations. The unit plot size for each entry was 20 m² (5m x 4m). Fertilizers at the rate of 138 (300 Kg Urea): 20 (100 Kg TSP): 83 (165 Kg MP): 20 (112 Kg Gypsum): 4 (11 Kg Zn SO₄) Kg/ha NPKSZn were applied in the trial. All amount of P, K, S and Zn were applied at the time of final land preparation and nitrogen was applied at three equal splits at 10, 30 and 40-50 days after transplanting (DAT). Crop management such as weeding, irrigation etc. were done in time. Insects, diseases and other pests will be controlled properly. Standard and uniform management practices suggested by the breeders were followed as and when necessary for all the locations. Appropriate measures were taken to control the insect pests but not diseases to identify susceptibility and tolerance level of lines. Date of seeding, transplanting, flowering and maturity, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and maturity stage, yield and yield components were recorded following the standard methods. Feedback information about the tested entries from farmers and DAE personnel were also recorded.

Results and discussion

The highest mean grain yield was found in check variety BRRi dhan107 which was 6.98 t/ha and the check variety BRRi dhan103 produced 6.93 t/ha. Both these varieties produced significantly higher yield than the tested entries; V2= BR10646-3-2-2-4-3, V3= BR10648-12-1-3-4-1, V4=Zira, Nachol and V5=Katari, Shibganj. Only the tested entry V1= BR10645-6-4-8-1-2; produced mean grain yield 6.87 t/ha which was statistically similar with check varieties BRRi dhan104 and also with BRRi dhan107. The lowest mean grain yield (6.02 t/ha) was found in the tested entry; V3= BR10648-12-1-3-4-1 and statistically lower than all check varieties BRRi dhan104, BRRi dhan107 and BINA dhan25 produced 6.93 t/ha, 6.94 t/ha and 6.61 t/ha respectively. The highest mean growth duration (155 days) was found in check variety BRRi dhan107 whereas similar growth duration (154 days) were found in V5=Katari, Shibganj, V6=BRRi dhan104 and V8= BINA dhan25. The tested entry, V1= BR10645-6-4-8-1-2 was only one day earlier than the check varieties BRRi dhan104 and BINA dhan25 having mean growth duration of both 154 days but two days earlier than check variety BRRi dhan107 having growth duration 155 days. The tested entry, V3= BR10648-12-1-3-4-1 having growth duration 149 days was about one week earlier than the check variety BRRi dhan107 whereas four days earlier than both of the check varieties BRRi dhan104 and BINA dhan25. The highest plant height was observed in case of BINA dhan25 (128 cm) which was statistically higher than all of the tested entries such as V1= BR10645-6-4-8-1-2, V2= BR10646-3-2-2-4-3, V3= BR10648-12-1-3-4-1, V4=Zira, Nachol and V5=Katari, Shibganj having the mean plant height 106 cm, 112 cm, 106 cm, 102 cm and 108 cm respectively. The lowest plant height (99 cm) was found in case of check variety BRRi dhan104 (Table 62). The highest mean 1000-grain weight (24.79 g) was found in check variety BRRi dhan107 and the lowest was (20.67 g) in the tested entry V5=Katari, Shibganj. Thousand grain weight (21.94 g) of the tested entry V2= BR10646-3-2-2-4-3 was significantly higher than the check variety BINA dhan25 (21.02 g) but similar with

BRRI dhan104 (21.70 g). The thousand grain weight of V1= BR10645-6-4-8-1-2 (21.46 g), V2= BR10646-3-2-2-4-3 (21.94 g) and V3= BR10648-12-1-3-4-1 (21.06 g) were statistically similar with check varieties BRRI dhan104 (21.70 g). Only the check variety BRRI dhan107 produced significantly higher thousand grain weight (24.79 g) than all of the tested entries V1= BR10645-6-4-8-1-2 (21.46 g), V2=BR10646-3-2-2-4-3 (21.94 g), V3= BR10648-12-1-3-4-1 (21.06 g), V4=Zira, Nachol (21.08 g) and V5=Katari, Shibganj (20.67 g) (Table 63). Grain size and shape of the tested genotypes were not superior to the check varieties BRRI dhan104 and BINA dhan25 which is very important characteristic of the premium quality rice.

Table 62. Grain yield, Growth duration and Plant height of the rice genotypes under ALART (PQR) in Boro 2024

Genotype	Locations										
	Sadar, Kushiā	Sadar, Cumilla	Paba, Rajshahi	Mithapukur, Rangpur	Kamarkhand, Sirajganj	Sadar, Gopalganj	Baniachang, Habiganj	Sonagazi, Feni	Bhanga, Faridpur	BRRI, HQ	Mean
Grain Yield (tha ⁻¹)											
V1= BR10645-6-4-8-1-2	6.16	7.14	6.59	7.58	6.58	7.21	6.10	4.91	9.68	6.74	6.87
V2= BR10646-3-2-2-4-3	5.39	6.88	5.53	7.47	6.83	6.52	6.39	5.93	7.83	6.18	6.50
V3= BR10648-12-1-3-4-1	5.30	5.80	5.29	6.36	6.45	6.12	5.80	5.14	8.04	5.94	6.02
V4=Zira, Nachol	5.96	6.31	6.41	6.58	7.96	6.46	3.87	5.31	8.57	7.35	6.48
V5=Katari, Shibganj	5.47	6.73	6.53	5.44	6.45	6.63	5.78	5.92	7.98	6.86	6.38
V6=BRRI dhan104 (Ck)	6.79	6.90	6.52	6.67	7.05	6.83	6.29	6.50	8.24	7.54	6.93
V7=BRRI dhan107 (Ck)	5.47	7.07	5.91	7.33	7.67	7.42	7.56	6.35	7.72	7.28	6.98
V8=BINA dhan25 Ck)	6.52	6.75	5.87	7.76	8.07	6.91	4.53	5.68	6.73	7.28	6.61
LSD _{0.05}	0.49										0.15
CV	6.28										
Growth duration (Days)											
V1= BR10645-6-4-8-1-2	140	144	153	162	170	146	162	144	156	158	153
V2= BR10646-3-2-2-4-3	144	147	153	160	169	145	163	145	156	155	145
V3= BR10648-12-1-3-4-1	135	141	146	150	168	143	159	142	153	157	149
V4=Zira, Nachol	138	144	145	150	170	146	164	143	153	156	151
V5=Katari, Shibganj	145	146	151	162	172	147	162	144	157	156	154
V6=BRRI dhan104 (Ck)	144	149	153	160	169	148	163	145	157	157	154
V7=BRRI dhan107 (Ck)	145	146	153	162	174	148	165	146	157	158	155
V8=BINA dhan25 Ck)	149	146	147	160	169	148	159	142	158	160	154
LSD _{0.05}	0.95										0.33
CV	0.58										
Plant height (cm)											
V1= BR10645-6-4-8-1-2	104	100	117	105	119	92	104	101	109	110	106
V2= BR10646-3-2-2-4-3	113	104	121	109	122	100	108	100	117	121	112
V3= BR10648-12-1-3-4-1	101	100	117	106	116	87	105	99	115	118	106
V4=Zira, Nachol	102	92	111	104	109	86	98	98	106	110	102
V5=Katari, Shibganj	108	99	120	105	114	97	107	100	111	117	108
V6=BRRI dhan104 (Ck)	96	95	101	99	103	90	94	96	104	111	99
V7=BRRI dhan107 (Ck)	108	104	105	104	108	93	100	104	112	116	105
V8=BINA dhan25 Ck)	123	119	133	129	133	115	129	124	147	124	128
LSD _{0.05}	4.53										1.67
CV	4.26										

Table 63. Yield components of the rice genotypes under ALART (PQR) in Boro 2024

Genotype	Locations										
	Sadar, Kushiā	Sadar, Cumilla	Paba, Rajshahi	Mithapukur, Rangpur	Kamarkhand, Sirajganj	Sadar, Gopalganj	Baniachang, Habiganj	Sonagazi, Feni	Bhanga, Faridpur	BRRI, HQ	Mean
1000-grain weight (g)											
V1= BR10645-6-4-8-1-2	21.59	23.35	19.60	22.97	22.50	22.64	23.55	20.46	18.53	19.40	21.46
V2= BR10646-3-2-2-4-3	19.23	25.70	20.90	223.67	21.67	23.28	23.44	21.70	20.80	20.00	21.94
V3= BR10648-12-1-3-4-1	20.04	21.70	20.29	19.67	22.17	22.23	23.42	21.67	19.29	20.11	21.06
V4=Zira, Nachol	21.33	21.53	21.27	22.00	21.17	22.57	21.71	21.47	18.39	19.34	21.08
V5=Katari, Shibganj	20.89	20.33	19.56	20.00	21.83	21.13	21.45	21.57	19.51	19.67	20.67

V6=BRRRI dhan104 (Ck)	20.35	20.47	19.88	22.67	22.43	23.00	21.97	22.00	21.78	22.40	21.70
V7=BRRRI dhan107 (Ck)	20.89	24.70	25.37	28.00	23.10	26.85	25.61	21.86	25.95	25.60	24.79
V8=BINA dhan25 Ck)	20.11	22.31	20.12	21.00	22.27	20.04	24.06	21.69	18.90	19.59	21.02
LSD _{0.05}	1.65										0.55
CV	5.15										
Panicles m ²											
V1= BR10645-6-4-8-1-2	234	125	206	196	311	326	311	294	419	293	272
V2= BR10646-3-2-2-4-3	237	124	253	278	304	284	349	310	391	323	285
V3= BR10648-12-1-3-4-1	244	118	275	214	336	327	305	301	375	269	276
V4=Zira, Nachol	268	121	310	329	419	314	324	336	404	277	310
V5=Katari, Shibganj	251	122	216	297	348	354	342	304	413	334	298
V6=BRRRI dhan104 (Ck)	279	125	265	332	331	412	397	308	410	310	317
V7=BRRRI dhan107 (Ck)	251	125	238	235	320	368	353	303	416	310	292
V8=BINA dhan25 Ck)	223	125	221	193	302	311	336	280	406	285	268
LSD _{0.05}	34.21										8.94
CV	8.19										
Filled grains Panicle ⁻¹											
V1= BR10645-6-4-8-1-2	114	125	167	150	92	135	94	91	167	101	124
V2= BR10646-3-2-2-4-3	104	124	110	145	97	106	64	93	91	121	105
V3= BR10648-12-1-3-4-1	105	118	133	100	129	108	82	88	135	138	114
V4=Zira, Nachol	95	121	141	117	98	116	80	88	133	131	112
V5=Katari, Shibganj	113	122	146	174	72	145	92	103	161	153	128
V6=BRRRI dhan104 (Ck)	97	125	112	125	57	92	146	101	93	112	106
V7=BRRRI dhan107 (Ck)	113	125	103	151	70	88	173	101	89	98	111
V8=BINA dhan25 Ck)	128	125	168	224	110	189	110	97	137	132	142
LSD _{0.05}	20.11										6.43
CV	8.69										
Sterility %											
V1= BR10645-6-4-8-1-2	14	22	17	10	14	11	22	21	18	22	17
V2= BR10646-3-2-2-4-3	26	24	27	8	18	11	23	35	27	21	22
V3= BR10648-12-1-3-4-1	20	17	23	14	14	9	22	23	13	18	17
V4=Zira, Nachol	12	22	26	37	11	12	18	22	17	14	19
V5=Katari, Shibganj	14	22	19	8	16	11	20	26	16	17	17
V6=BRRRI dhan104 (Ck)	20	24	22	22	18	20	19	27	27	17	22
V7=BRRRI dhan107 (Ck)	14	22	31	11	18	17	17	26	27	22	20
V8=BINA dhan25 Ck)	26	23	36	13	13	18	22	47	39	19	26
LSD _{0.05}	8.43										2.69
CV	9.78										

Insect infestation: Proper measures were taken to control insects as and when necessary. However, the crop was infested by stem borer (5-10%) and Rice bug (2-10%) in some locations. Insect infestations were almost similar in all the entries including check variety.

Disease incidence: Disease did not control to identify susceptibility and tolerance level of the genotypes. Bacterial blight (2-10%), Sheath blight (10-25%) and Neck Blast (2-5%) were observed in the tested entries as well as all check varieties in Kushtia, Meherpur and Satkhira. Disease incidences were similar in the tested entries as like as check varieties.

Table 64. Phenotypic Acceptance of all genotypes under ALART PQR during Boro 2024

SN	Genotype	Characteristics								
		Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality	Grain type	Flag leaf	PAcp		
								Veg.	Mat.	

1	V1= BR10645-6-4-8-1-2	Uniform	Uniform	Uniform	Well wrapped	Slender	Erect	3	5
2	V2= BR10646-3-2-2-4-3	Uniform	Uniform	Uniform	Well wrapped	Slender	Erect	3	5
3	V3= BR10648-12-1-3-4-1	Uniform	Uniform	Uniform	Well wrapped	Slender	Erect	3	5
4	V4=Zira, Nachol	Uniform	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	5
5	V5=Katari, Shibganj	Uniform	Uniform	Uniform	Well wrapped	Medium Slender	Erect	3	5
6	V6=BRRI dhan104 (Ck)	Uniform	Uniform	Uniform	Well wrapped	Long slender	Erect	3	3
7	V7=BRRI dhan107 (Ck)	Uniform	Uniform	Uniform	Well wrapped	Long slender	Erect	3	3
8	V8=BINA dhan25 Ck)	Uniform	Uniform	Uniform	Well wrapped	Long slender	Erect	3	3

Phenotypic Acceptability: 1= Excellent, 3= Good, 5= Fair, 7= Poor, 9= Unacceptable

Feedback from Farmers, extension personnel and Scientists: Farmers and extension personnel dislike the tested genotypes as both the check varieties BRRI dhan104 and BRRI dhan107 produced significantly higher yield than the tested entries; V2= BR10646-3-2-2-4-3, V3= BR10648-12-1-3-4-1, V4=Zira, Nachol and V5=Katari, Shibganj. The grain quality of the tested entries was not better than the checks.

Recommendation: Considering Grain yield, growth duration, phenotypic acceptance, insect and disease incidence all the advanced lines recommended for PVT.

Rationale:

1. Yield of advanced lines were either similar or lower than the all check varieties.
2. Phenotype of lines was not good enough to convinced the farmers.

1.15 ALART, Salt tolerant rice (STR), Boro 2023-24

Rationale: Salinity has now become a major threat in Bangladesh. The problem of salinity in the southern part of the country is long standing. This problem has become more evident due to climate change. The salinity levels of soil, groundwater and surface water in coastal Bangladesh have been increasing over the past few decades. The development and adaptation of salt tolerant rice varieties seems to be a necessary step to address the salinity problem of coastal Bangladesh before sea level rises. Already we have some prominent salt tolerant varieties in Boro season. Considering the future threat, we need potential modern STR varieties for saline areas in Boro season characterized by higher grain yield.

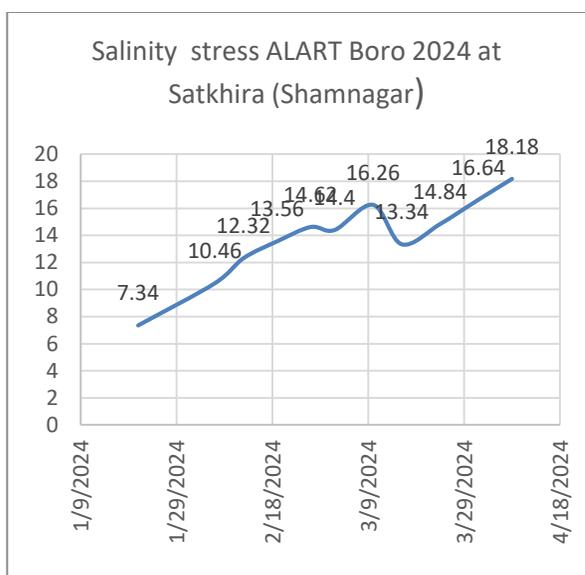
Hypothesis: Suitable STR variety for Boro season in saline condition may be identified to recommend for PVT.

Materials and method: Three salt-tolerant advanced rice lines V1 (BR11712-4R-44), V2 (BR11712-4R-93), V3 (BR11712-4R-12), and V4 (BR11712-4R-6) along with the check varieties V5 (BRRI dhan67) and V6 (BRRI dhan89), were evaluated across ten locations during the Boro season of 2023-2024. The trial sites included the BRRI research farm in Gazipur, as well as locations in Satkhira (Sadar, Shamnagar, and Kaliganj), Patuakhali (Kalapara), Feni (Sonagazi), Noakhali (Sadar and Companiganj), and Bagerhat (Sadar). Each trial was replicated three times at each location. The unit plot size for each entry was 20 m² (5 m x 4 m). Seeding times varied from 27 November to 18 December 2023-24, depending on the local conditions, and seedling ages ranged from 25 to 30 days due to unavoidable delays in transplanting. The seedlings were transplanted at a spacing of 20 cm x 20 cm. Fertilizers were applied at rates of 270 kg/ha urea, 100 kg/ha TSP, 83 kg/ha Mop, 20 kg/ha gypsum, and 4 kg/ha zinc sulfate. All fertilizers, except for urea, were applied as a basal dose, while urea was applied in three equal splits: 10-15 days, 15-30 days after transplanting, and 5-7 days before the PI (panicle initiation) stage. Additionally, 45 kg/ha (6.0 kg/bigha) of Mop was top-dressed during the final urea application. Standard management practices were followed, and appropriate measures were

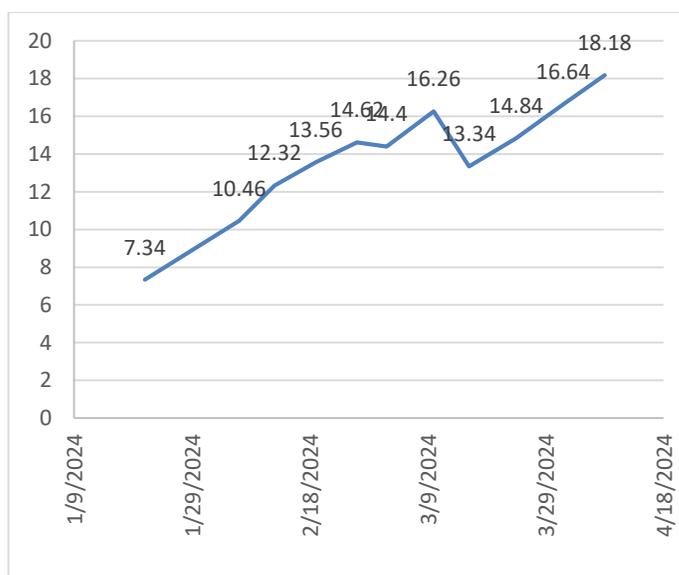
taken to control insect pests, although diseases were not controlled to assess the susceptibility and tolerance of the lines. Data were recorded on various parameters, including seeding, transplanting, flowering and maturity dates, plant height, lodging tolerance, pest and disease incidence, phenotypic acceptance at vegetative and ripening stages, yield, and yield components. Water salinity at the experimental plots was also monitored at different intervals. Feedback from farmers and scientific personnel was collected. For yield estimation, a 9 m² sample area from each plot was harvested at maturity, and grain yields were adjusted to 14% moisture content.

Results and discussion:

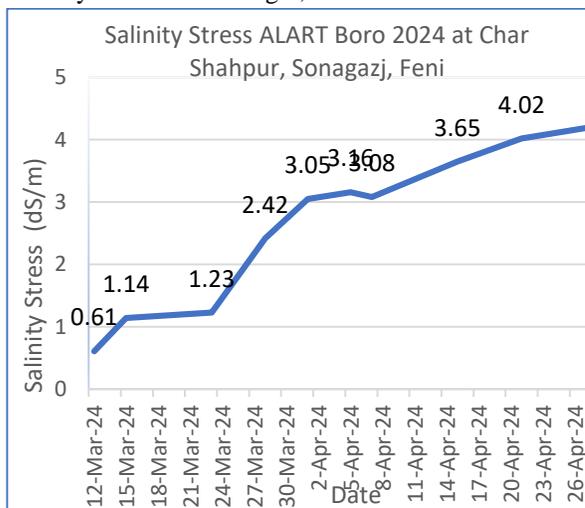
Among the 10 locations studied, high salinity levels were observed in 4 areas: Bagerhat (Sadar), Noakhali (Sadar), Satkhira (Kaliganj), and Satkhira (Shamnagar). These locations experienced low crop yields due to elevated salinity. The highest salinity level recorded was 18.18 dS/m in Satkhira (Kaliganj), while the lowest was 0.82 ds/m in Noakhali (Sadar). Table 4 illustrates salinity levels at different days after transplanting (DAT). In contrast, the remaining 6 locations, including Barishal (Sadar), BRRI (H/Q), Noakhali (Companiganj), Patuakhali (Kolapara), Satkhira (Sadar), and Sonagazi (Feni), exhibited low salinity levels, resulting in higher yields. In Feni Upazila of Sonagazi district, the lines BR11712-4R-6 and BRRI dhan67 (ck) were completely destroyed by leaf blast, while BRRI dhan89 (ck) in Bagerhat (Sadar) and Satkhira (Kaliganj) was entirely damaged due to salinity (7 ds/m & 18.18 ds/m). In Satkhira (Kaliganj), BRRI dhan67 (ck) grains failed to fill completely due to high salinity. Among the four high-salinity locations, Noakhali (Sadar) recorded the highest yield, while Satkhira (Shamnagar) had the lowest. Environmental factors likely contributed to these outcomes. In the salinity-prone areas, all tested lines produced higher yields in Noakhali (Sadar) (3.94 t/ha), compared to the lower yields in Satkhira (Shamnagar) (0.9 t/ha). The mean yield of all advanced lines ranged from 1.36 to 2.32 t/ha (Table 65). BRRI dhan89 (ck) was completely destroyed in Bagerhat (Sadar) and Satkhira (Kaliganj) due to salinity. Among the advanced lines, entry no. 1 produced the highest mean grain yield of 2.32 t/ha, similar to entry no. 5, at 2.29 t/ha. Another check variety, entry no. 6 produced a mean grain yield of 1.36 t/ha. For entry no. 1, the highest grain yield was observed in Noakhali (Sadar) at 3.4 t/ha, and the lowest in Satkhira (Shamnagar) at 1.02 t/ha. The grain yield of other advanced lines, including entry no. 2, entry no.3, entry no. 4, entry no. 5, and entry no. 6 ranged from 0.9-3.94 t/ha, 1.06-3.13 t/ha, 1.22-3.71 t/ha, 1.55-3.23 t/ha, and 0.2-2.52 t/ha, respectively. These results indicate a clear influence of environmental factors and salinity levels on production. Lower salinity levels were associated with shorter growth durations, with the mean growth duration of the four tested advanced lines ranging from 140-144 days (Table 65). Plant growth and height were also affected by salinity in areas such as Bagerhat (Sadar), Noakhali (Sadar), Satkhira (Kaliganj), and Satkhira (Shamnagar) where plant height was lower. The height of the tested entries ranged from 86-97 cm (entry no. 1), 93-110 cm (entry no. 2), 93-102 cm (entry no. 3), 77-89 cm (entry no. 4), 88-97 cm (entry no. 5), and 84-93 cm (entry no. 6). The 1000-grain weight of the advanced lines, except for entry no. 1 and 3, was significantly lower than that of entry no. 3. The average 1000-grain weight of the tested lines ranged from 20.14-22.73 g, with an overall average of 21.20 g (Table 66). Across six locations, the mean yield of all advanced rice lines ranged from 6.20 to 7.13 t/ha (Table 67), while the check varieties BRRI dhan67 (ck) and BRRI dhan89 (ck) showed mean yields of 5.88 to 5.95 t/ha (Table 67). In Sonagazi (Feni), entry no. 4, and entry no. 5, were completely damaged due to leaf blast, highlighting the environmental influence on yield. The yields of the tested lines varied significantly: entry no. 1, ranged from 5.65 to 9.18 t/ha, entry no. 2, from 5.47 to 8.97 t/ha, entry no. 3, from 4.57 to 8.16 t/ha, entry no. 4, from 4.48 to 8.99 t/ha, entry no. 5, from 4.53 to 7.48 t/ha, and entry no. 6, from 4.95 to 6.27 t/ha. The mean growth duration of the four tested advanced lines ranged from 142 to 148 days (Table 67). Salinity had no effect on plant height in areas where it was absent. In non-saline locations such as Barishal (Sadar), BRRI (Headquarters), Noakhali (Companiganj), Patuakhali (Kolapara), Satkhira (Sadar), and Sonagazi (Feni), plant height was normal. The plant height for entries 1 through 6 ranged from 102 to 116 cm, 119 to 135 cm, 114 to 129 cm, 93 to 104 cm, 111 to 119 cm, and 108 to 113 cm, respectively. The average 1000-grain weight of the tested lines ranged between 20.14 and 22.73 grams for the check varieties (Table 67).



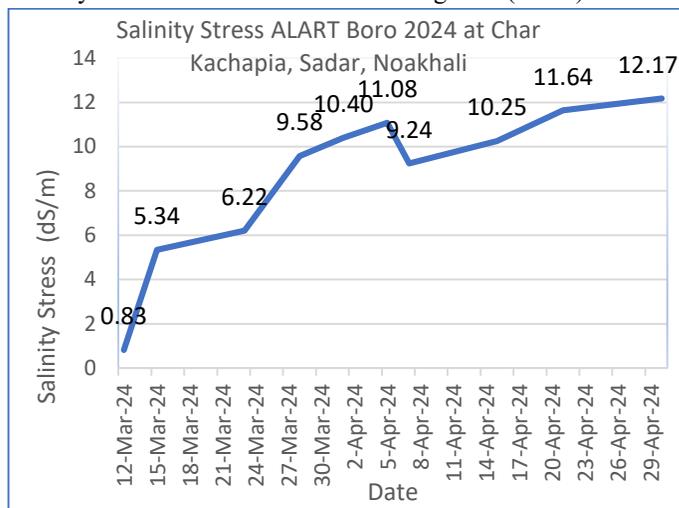
Salinity level at Shamnagar, Satkhira



Salinity Stress ALART Boro 2024 at Bagerhat (Sadar)



Salinity level at Sonagazi, Feni



Salinity level at Sadar, Noakhali

Fig 3: Salinity stress of ALART (STR) trial sites during Boro 2023-24.

Table 65. Grain yield, Growth duration and Plant height of some rice genotypes under ALART (STR) during Boro 2023-24 (Saline area).

Genotype	Bagerhat (Sadar)	Noakhali (Sadar)	Satkhira (Kaliganj)	Satkhira (Shamnagar)	Mean
Grain yield (t ha ⁻¹)					
V1= BR11712-4R-44	2.81	3.4	2.03	1.02	2.32
V2=BR11712-4R-93	2.01	3.94	2.05	0.9	2.23
V3=BR11712-4R-12	2.88	3.13	2.04	1.06	2.28
V4=BR11712-4R-6	2.55	3.71	1.64	1.22	2.28
V5= BRRI dhan67 (ck)	2.48	3.23	1.9	1.55	2.29
V6= BRRI dhan89 (ck)		2.52		0.2	1.36
LSD _{0.05}	0.43				0.21
CV%	11.51				
Growth duration (Days)					
V1= BR11712-4R-44	138	140	141	141	140
V2=BR11712-4R-93	141	142	143	143	142
V3=BR11712-4R-12	141	149	142	143	144
V4=BR11712-4R-6	146	142	137	138	141
V5= BRRI dhan67 (ck)	144	140	141	142	142
V6= BRRI dhan89 (ck)		150		149	150
LSD _{0.05}	1.12				0.56
CV%	0.48				
Plant Height (cm)					
V1= BR11712-4R-44	86	97	89	94	91.5
V2=BR11712-4R-93	93	110	94	97	98.5
V3=BR11712-4R-12	93	102	95	95	96.25
V4=BR11712-4R-6	82	89	77	80	82

V5= BRRI dhan67 (ck)	88	97	88	89	90.5
V6= BRRI dhan89 (ck)		93		84	88.5
LSD _{0.05}	5.46				2.73
CV%	3.60				

Table 66: Yield contributing characters of some rice genotypes under ALART (STR) during Boro 2023-24 (Saline area).

Genotypes	Bagerhat (Sadar)	Noakhali (Sadar)	Satkhira (Kaliganj)	Satkhira (Shamnagar)	Mean
1000-Grain Weight (Gram)					
V1= BR11712-4R-44	16.41	21.53	15.86	15.88	17.42
V2=BR11712-4R-93	18.00	24.11	16.98	16.33	18.86
V3=BR11712-4R-12	16.10	22.65	15.89	16.78	17.86
V4=BR11712-4R-6	20.83	23.04	19.29	19.33	20.62
V5= BRRI dhan67 (ck)	19.53	22.45	16.46	16.81	18.81
V6= BRRI dhan89 (ck)		23.30		16.37	19.84
LSD _{0.05}	1.10				0.55
CV%	3.56				
Panicles/Square meter (No.)					
V1= BR11712-4R-44	242	232	257	252	246
V2=BR11712-4R-93	215	221	252	240	232
V3=BR11712-4R-12	251	234	252	233	243
V4=BR11712-4R-6	258	229	237	248	243
V5= BRRI dhan67 (ck)	245	213	238	243	235
V6= BRRI dhan89 (ck)		208		253	231
LSD _{0.05}	34.93				17.46
CV%	8.82				
Filled Grains per Panicle (No.)					
V1= BR11712-4R-44	122	86	104	92	101
V2=BR11712-4R-93	143	86	93	84	102
V3=BR11712-4R-12	114	75	92	77	90
V4=BR11712-4R-6	84	70	68	54	69
V5= BRRI dhan67 (ck)	95	80	87	89	88
V6= BRRI dhan89 (ck)		82		64	73
LSD _{0.05}	17.63				8.81
CV%	11.87				
Sterility%					
V1= BR11712-4R-44	37	37	30	46	38
V2=BR11712-4R-93	22	40	33	41	34
V3=BR11712-4R-12	28	36	33	34	33
V4=BR11712-4R-6	24	35	27	34	30
V5= BRRI dhan67 (ck)	18	27	24	28	24
V6= BRRI dhan89 (ck)		46		43	45
LSD _{0.05}	10.43				5.21
CV%	19.92				

Table 67: Grain yield of the rice genotypes under ALART, Salt tolerant rice (STR), Boro 2023-24 (without salinity)

Genotypes	Locations						Mean
	Barishal (Sadar)	BRRI (H/Q)	Noakhali (C.ganj)	Patuakhali (Kolapara)	Satkhira (Sadar)	Sonagazi (Feni)	
Grain yield (t ha⁻¹)							
V1= BR11712-4R-44	6.96	8.26	7.39	5.65	7.23	6.39	6.98
V2=BR11712-4R-93	7.41	8.07	6.64	5.47	6.18	5.88	6.61
V3=BR11712-4R-12	6.28	7.34	6.24	4.57	5.56	6.40	6.06
V4=BR11712-4R-6	7.10	8.09	5.89	4.48	7.52		6.62
V5= BRRI dhan67 (ck)	4.53	5.96	5.72	5.03	7.48		5.74
V6= BRRI dhan89 (ck)	6.27	6.79	6.13	4.95	5.14	5.64	5.82
LSD _{0.05}	0.94						0.42
CV%	8.89						
Growth duration (Days)							
V1= BR11712-4R-44	138	149	145	132	155	144	144
V2=BR11712-4R-93	139	149	148	132	155	146	145
V3=BR11712-4R-12	138	150	153	135	155	152	147
V4=BR11712-4R-6	133	150	146	131	155		143
V5= BRRI dhan67 (ck)	131	147	146	130	155		142
V6= BRRI dhan89 (ck)	141	149	153	139	155	154	149

LSD _{0.05}	0.99						0.44
CV%	0.42						
Plant Height (cm)							
V1= BR11712-4R-44	113	112	116	116	102	108	111
V2=BR11712-4R-93	134	125	135	134	119	119	128
V3=BR11712-4R-12	121	129	123	119	114	115	120
V4=BR11712-4R-6	97	93	104	99	95		98
V5= BRR1 dhan67 (ck)	112	113	119	113	111		114
V6= BRR1 dhan89 (ck)	109	113	112	108	110	106	110
LSD _{0.05}	5.62						2.51
CV%	3.02						

Table 68: Yield contributing characters of some rice genotypes under ALART (STR) during Boro 2023-24 (without salinity).

Genotypes	Barishal (Sadar)	BRR1 (H/Q)	Noakhali (C.ganj)	Patuakhali (Kolapara)	Satkira (Sadar)	Sonagazi (Feni)	Mean
1000-Grain Weight (Gram)							
V1= BR11712-4R-44	20.39	22.88	21.80	20.57	24.10	21.96	21.95
V2=BR11712-4R-93	23.86	24.58	24.11	24.28	24.17	23.73	24.12
V3=BR11712-4R-12	22.54	22.65	22.18	20.62	21.50	22.53	22.00
V4=BR11712-4R-6	25.27	23.86	23.75	24.72	24.47		24.41
V5= BRR1 dhan67 (ck)	23.57	24.07	22.59	24.39	20.97		23.12
V6= BRR1 dhan89 (ck)	20.67	22.42	22.76	20.67	20.83	22.72	21.68
LSD _{0.05}	1.52						0.68
CV%	4.08						
Panicles/Square meter (No.)							
V1= BR11712-4R-44	245	287	292	262	239	284	268
V2=BR11712-4R-93	223	303	297	228	236	265	259
V3=BR11712-4R-12	257	287	292	250	255	293	272
V4=BR11712-4R-6	307	289	286	265	256		281
V5= BRR1 dhan67 (ck)	258	305	290	257	228		268
V6= BRR1 dhan89 (ck)	222	289	293	237	235	293	262
LSD _{0.05}	29.97						13.40
CV%	6.91						
Filled Grains per Panicle (No.)							
V1= BR11712-4R-44	128	114	118	132	146	78	119
V2=BR11712-4R-93	137	150	131	134	163	66	130
V3=BR11712-4R-12	119	110	113	126	157	57	114
V4=BR11712-4R-6	114	127	85	116	137		116
V5= BRR1 dhan67 (ck)	123	108	121	125	149		125
V6= BRR1 dhan89 (ck)	100	154	94	110	146	89	116
LSD _{0.05}	29.02						12.97
CV%	14.06						
Sterility%							
V1= BR11712-4R-44	30	39	30	18	36	25	30
V2=BR11712-4R-93	15	15	16	17	14	33	18
V3=BR11712-4R-12	33	27	21	28	32	28	28
V4=BR11712-4R-6	10	14	21	13	30		18
V5= BRR1 dhan67 (ck)	9	10	14	10	10		11
V6= BRR1 dhan89 (ck)	37	16	27	21	28	33	27
LSD _{0.05}	9.7886						4.37
CV%	28.03						

Table 69. Disease incidence of the rice genotypes under ALART, Salt tolerant rice (STR), Boro 2024

	ShB	Leaf blast	NB
V1= BR11712-4R-44	3% in Bagerhat, Sadar & 5% in Sonagazi, Feni	-	-
V2=BR11712-4R-93	5% in Bagerhat, Sadar & (5-7%) in Sonagazi, Feni	-	-
V3=BR11712-4R-12	2% in Bagerhat, Sadar & 1-3% in Sonagazi, Feni	-	-
V4=BR11712-4R-6	3% in Bagerhat, Sadar	Sonagazi	
V5= BRR1 dhan67 (ck)	2% in Bagerhat, Sadar	Sonagazi	1-3% Noakhali, Sadar, Sonagazi, Feni
V6= BRR1 dhan89 (ck)		5-7% Sonagazi	1-5% Noakhali, Sadar, Sonagazi, Feni

Disease incidence: Sheath blight disease incidence ranged from 1% to 7% in Bagerhat Sadar and Feni Sonagazi for entries 1, 2, and 3. In Bagerhat Sadar, leaf blast affected entries 4 and 5 with an incidence of 2% to 3%, while in Sonagazi, Feni, entries 4 and 5 were completely destroyed by leaf blast. In Sonagazi, Feni, and Noakhali Sadar, entries 5 and 6 were completely destroyed due to neck blast.

Table 70. Insect infestation score of the rice genotypes under ALART for Short Duration Favorable Boro Rice (STR), Boro 2023-24

	YSB
V1= BR11712-4R-44	5% in Barishal sadar & Patuakhali, Kolapara
V2=BR11712-4R-93	1-2% Patuakhali,Kolapara&Barishal,sadar
V3=BR11712-4R-12	5-10% in Barishal,sadar&Patuakhali,Kolapara
V4=BR11712-4R-6	-
V5= BRRI dhan67 (ck)	-
V6= BRRI dhan89 (ck)	2% in Barishal,sadar&Patuakhali,Kolapara

Insects Infestation: Yellow stem borer infestation was recorded in two locations Barishal (sadar) & Patuakhali (Kolapara) (1-10%).

Table 71. Phenotypic Acceptance of the rice genotypes under ALART, Salt tolerant rice (STR), Boro 2023-24

Genotype	Characteristics							
	Plant growth	Uniformity of flowering	Uniformity of maturity	Wrapping quality of culm	Grain type	Flag leaf	PAcp	
							Veg.	Mat.
V1= BR11712-4R-44	Uniform	Uniform	Uniform	Well wrapped	Medium bold	Erect	3	3
V2=BR11712-4R-93	Attractive	Uniform	Uniform	Well wrapped	Medium bold	Erect	3	3
V3=BR11712-4R-12	Attractive	Uniform	Uniform	Semi Droopy	Medium Slender	Erect	3	3
V4=BR11712-4R-6	Excellent	Uniform	Uniform	Well wrapped	Medium bold	Erect	5	5
V5= BRRI dhan67 (ck)	Excellent	Uniform	Uniform	Well wrapped	Medium Slender	Erect	5	3
V6= BRRI dhan89 (ck)	Excellent	Uniform	Uniform	Well wrapped	Medium bold	Erect	5	9

Phenotypic Acceptability;1=Excellent,3=Good,5=Fair,7=Poor,9=Unacceptable

Recommendation: Considering Grain yield, growth duration, salinity status, phenotypic acceptance, insect and disease incidence all the advanced lines recommended for Re-ALART.

Rationale:

1. Out of 10 trial site, higher salinity was found in 04 trial sites and comparatively lower salinity was found in 06 locations.
2. All the advanced lines in lower salinity trial sites gave higher grain yield than the higher salinity trial sites. In the lower salinity trial sites V1= BR11712-4R-44 gave the highest grain yield among all the tested entries. But in higher salinity trial sites V1= BR11712-4R-44 gave the similar grain yield with all tested entries including standard check BRRI dhan67 except susceptible check BRRI dhan89.
3. The minimum yield (0.9 t/ha to 3.94 t/ha) was observed in the four locations (Bagerhat (Sadar), Noakhali (Sadar), Satkhira (Kaliganj) and Satkhira (Shamnagar) where salinity range was about 4.3-18.18 ds/m. But in the lower salinity trial sites the yield was comparatively higher.
4. Growth duration of all the advanced lines was significantly lower than the check variety BRRI dhan89.

1.16 Head to Head Adaptive Trial (HHAT) during T. Aman 2023

Materials and Methods

A total of 200 Head to Head Adaptive Trials (HHAT) with eight categories according to rice ecosystem were conducted in throughout the country during T. Aman 2023 under TRB project through public and private partnership (PPP).

The trials were categorized in 8 different groups considering the agro-ecology and used rice variety. The followings were the major groups

- ✓ Long growth duration rice variety (Swarna-Growing areas): Tested var. BRRi dhan51, BRRi dhan87, BRRi dhan93 BRRi dhan94, BRRi dhan95 and Swarna.
- ✓ Long growth duration rice variety (Dinajpur areas): Tested var. BRRi dhan34, BRRi dhan70, BRRi dhan80, BRRi dhan90 and Kataribhog.
- ✓ Long growth duration rice variety (Rangpur areas): Tested var. BR11, BRRi dhan52, BRRi dhan72 and BRRi dhan87.
- ✓ Long growth duration rice variety (Mymensingh areas): Tested var. BRRi dhan32, BRRi dhan49, BRRi dhan87, BRRi dhan93 and BRRi dhan94.
- ✓ Short growth duration rice variety: Tested var. BRRi dhan33, BRRi dhan39, BRRi dhan71, BRRi dhan75, Binadhan-7, Binadhan-16, Binadhan-17 and Binadhan-22.
- ✓ Coastal Ecosystem (CE): Tested var. BR23, BRRi dhan30, BRRi dhan73, BRRi dhan78, BRRi dhan79 and Binadhan-23.
- ✓ Flash Flood Submergence (FFS): Tested var. BR11, BRRi dhan51, BRRi dhan52, BRRi dhan79, Binadhan-11 and IR16F1148.
- ✓ Tidal Submergence (TS): Tested var. BR11, BR23, BRRi dhan52, BRRi dhan76 and BRRi dhan77.

Area of each HHAT was 1 bigha (0.13 ha) and total area of HHAT was 200 bigha (26.8 ha). TRB-BRRi provided inputs like quality seeds, fertilizer, signboard, pesticide, Mobile bill, Honorarium; and partial labors. The program was executed through public and private partnership (PPP). The trial set up following RCB design where 1 farmer (1 trial) was considered as 1 replication. Uniform management practices were followed for each environment while upazila was considered environment. Appropriate measures were taken to control pest incidence. Date of seeding, transplanting, flowering and maturity, lodging tolerance, pest and disease incidence, grain yield were recorded. Feedback from farmers and extension personnel were also recorded. For yield estimation, 10 m² sample area from each plot was harvested at maturity and grain yield was adjusted to 14% moisture content. Uniform crop management practices were followed for all the varieties in each trial. Good collaboration of Government Organization, Non-Government Organization, Seed Company and Farmers expedited to complete such a high number field trials successfully. Data of all the trials were collected from the partners; then compiled and analyzed by Adaptive Research Division.

Results and Discussion

Grain yield, growth durations and the overall performance of tested rice varieties under different categories of HHAT varied significantly at different locations. In HHAT (LD-Swarna), BRRi dhan87 and BRRi dhan94 were found as better performer than others. BRRi dhan87 produced highest grain yield 5.70 t/ha followed by BRRi dhan94 (5.67 t/ha). Although BRRi dhan95 produced better yield than BRRi dhan93 but BRRi dhan95 was nearly one week earlier than BRRi dhan94 (Table 72, fig-4).

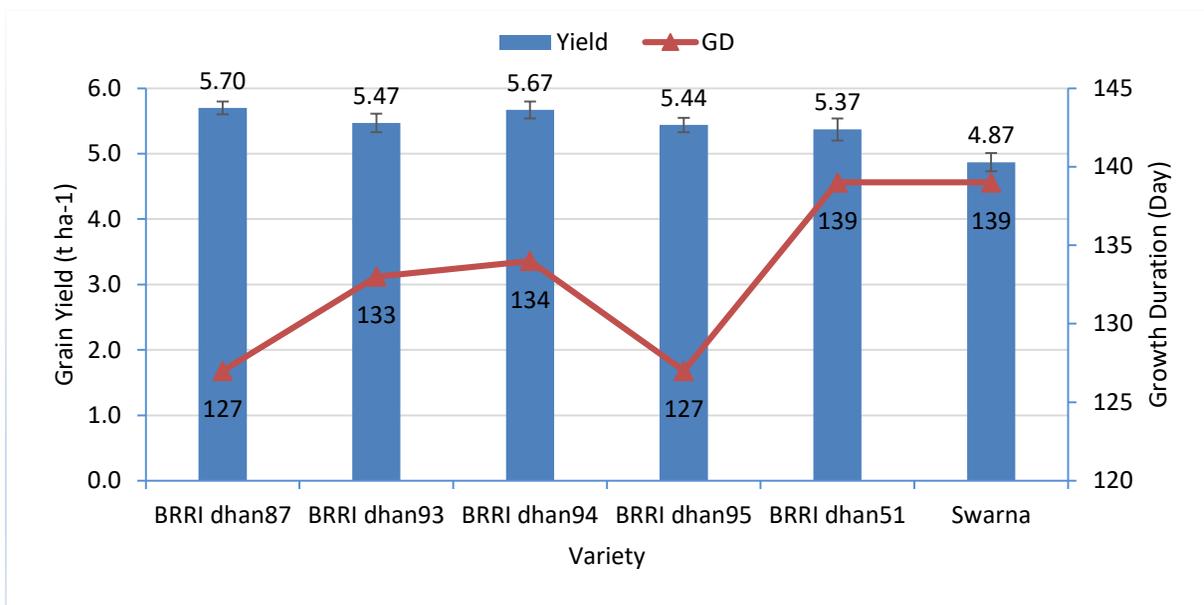


Fig 4. Average grain yield and growth duration of tested rice varieties in HHAT (LD-Swarna)

Table72. Summary Statistics of grain yield (t ha⁻¹) and growth duration of tested varieties in HHAT Aman 2023 (LD-Swarna)

Variety	Observation (n)	Mean	Maximum	Minimum	Standard deviation (SD)	Standard error (SE)
Grain yield (t/ha)						
BRRRI dhan87	29	5.70	6.96	4.59	0.50	0.10
BRRRI dhan93	29	5.47	7.20	4.56	0.77	0.14
BRRRI dhan94	29	5.67	6.79	4.23	0.67	0.13
BRRRI dhan95	29	5.44	6.72	4.57	0.52	0.11
BRRRI dhan51	29	5.37	7.11	3.80	0.83	0.17
Swarna	29	4.87	5.35	3.67	0.58	0.14
Growth duration (Day)						
BRRRI dhan87	29	127	138	124	3.62	0.67
BRRRI dhan93	29	133	139	126	2.64	0.49
BRRRI dhan94	29	134	142	127	3.27	0.65
BRRRI dhan95	29	127	138	120	3.54	0.72
BRRRI dhan51	29	139	148	129	5.41	1.13
Swarna	29	139	148	131	7.11	1.68

In HHAT (LD-Dinajpur), BRRRI dhan80 was found as highest yielder (4.80 t/ha) having growth duration 132 days followed by BRRRI dhan90 (4.43 t/ha) (Table 73, fig-5). Whereas, Kataribhog produced the lowest yield (3.49 t/ha) and BRRRI dhan34 (3.87 t/ha) respectively.

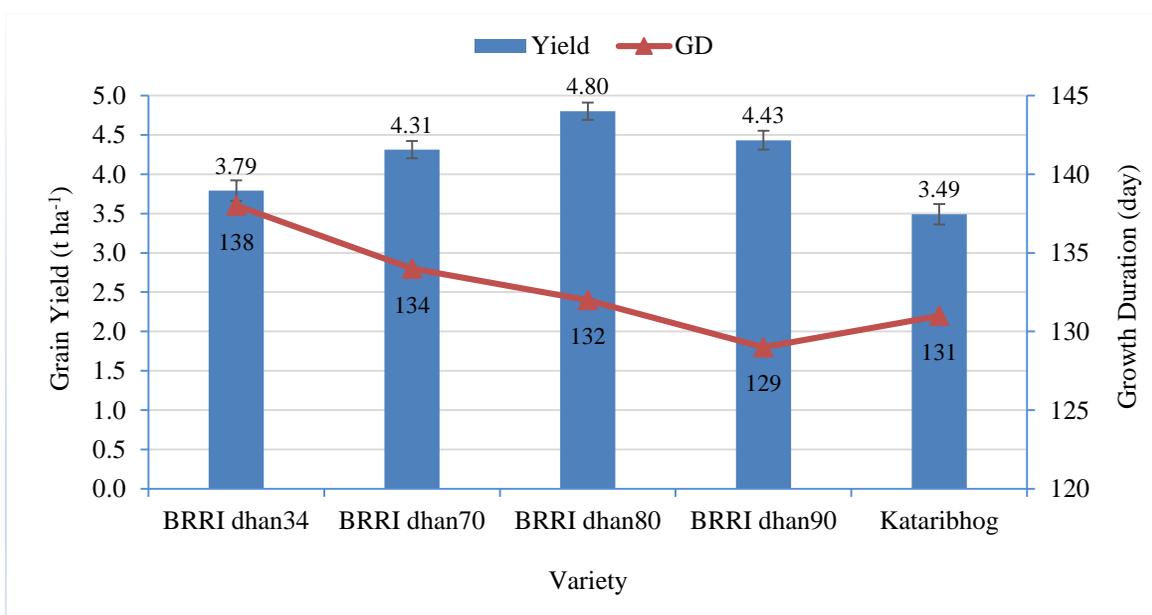


Fig 5. Average grain yield and growth duration of tested rice varieties in HHAT (LD-Dinajpur) Aman 2023.

Table 72. Summary Statistics of grain yield ($t\ ha^{-1}$) and growth duration of tested varieties in HHAT Aman 2023 (LD-Dinajpur)

Variety	Observation (n)	Mean	Maximum	Minimum	Standard deviation (SD)	Standard error (SE)
Grain yield (t/ha)						
BRRi dhan34	30	3.79	5.40	2.90	0.65	0.13
BRRi dhan70	30	4.31	4.77	3.45	0.43	0.11
BRRi dhan80	30	4.80	5.93	3.20	0.60	0.11
BRRi dhan90	30	4.43	5.83	3.10	0.64	0.12
Kataribhog	30	3.49	4.90	2.56	0.67	0.13
Growth duration (day)						
BRRi dhan34	30	138	146	123	9.25	1.81
BRRi dhan70	30	134	142	130	3.49	0.43
BRRi dhan80	30	132	142	118	4.73	0.86
BRRi dhan90	30	129	145	118	8.24	1.50
Kataribhog	30	131	140	122	5.12	1.02

In the category HHAT (LD-Rangpur), BRRi dhan87 produced the highest grain yield ($5.77\ t/ha$) having also the shortest growth duration 146 days only (Table 73, fig-6) followed by BR11 which produced ($5.29\ t/ha$). BRRi dhan52 produced the lowest yield ($5.01\ t/ha$) with longest growth duration 146 days only among of all tested varieties.

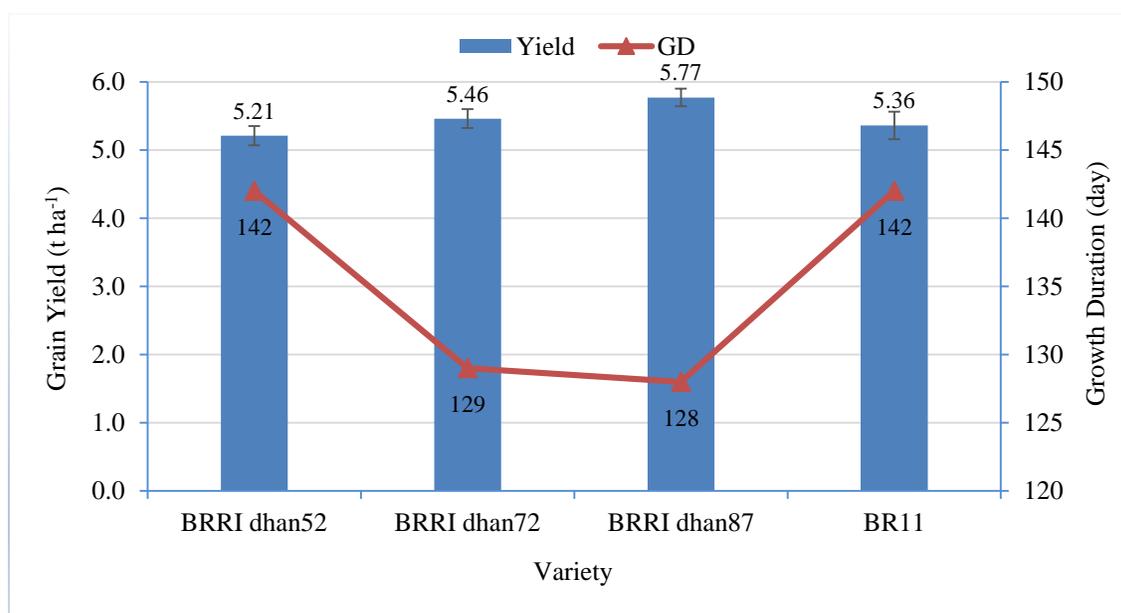


Fig 6. Average grain yield and growth duration of tested rice varieties in HHAT (LD-Rangpur) Aman 2023.

Table 73. Summary Statistics of grain yield ($t\ ha^{-1}$) and growth duration of tested varieties in HHAT Aman 2023 (LD-Rangpur)

Variety	Observation (n)	Mean	Maximum	Minimum	Standard deviation (SD)	Standard error (SE)
Grain yield (t/ha)						
BRRi dhan52	19	5.21	5.92	3.80	0.59	0.14
BRRi dhan72	19	5.46	6.30	4.10	0.60	0.14
BRRi dhan87	19	5.77	6.85	4.98	0.54	0.13
BR11	19	5.36	6.64	4.42	0.84	0.20
Growth duration (Day)						
BRRi dhan52	19	141	147	130	5.62	1.29
BRRi dhan72	19	129	133	124	3.07	0.70
BRRi dhan87	19	128	132	125	2.29	0.53
BR11	19	140	146	131	4.05	0.93

In the category HHAT (LD-Mymensingh), BRRi dhan87 produced the highest grain yield ($5.93\ t/ha$) having also the shortest growth duration 132 days only (Table 74, fig7). BRRi dhan49 and

BRRI dhan94 produced the statistically similar yield and growth duration respectively. BRRI dhan32 produced the lowest yield (5.28 t/ha) having growth duration 131 days.

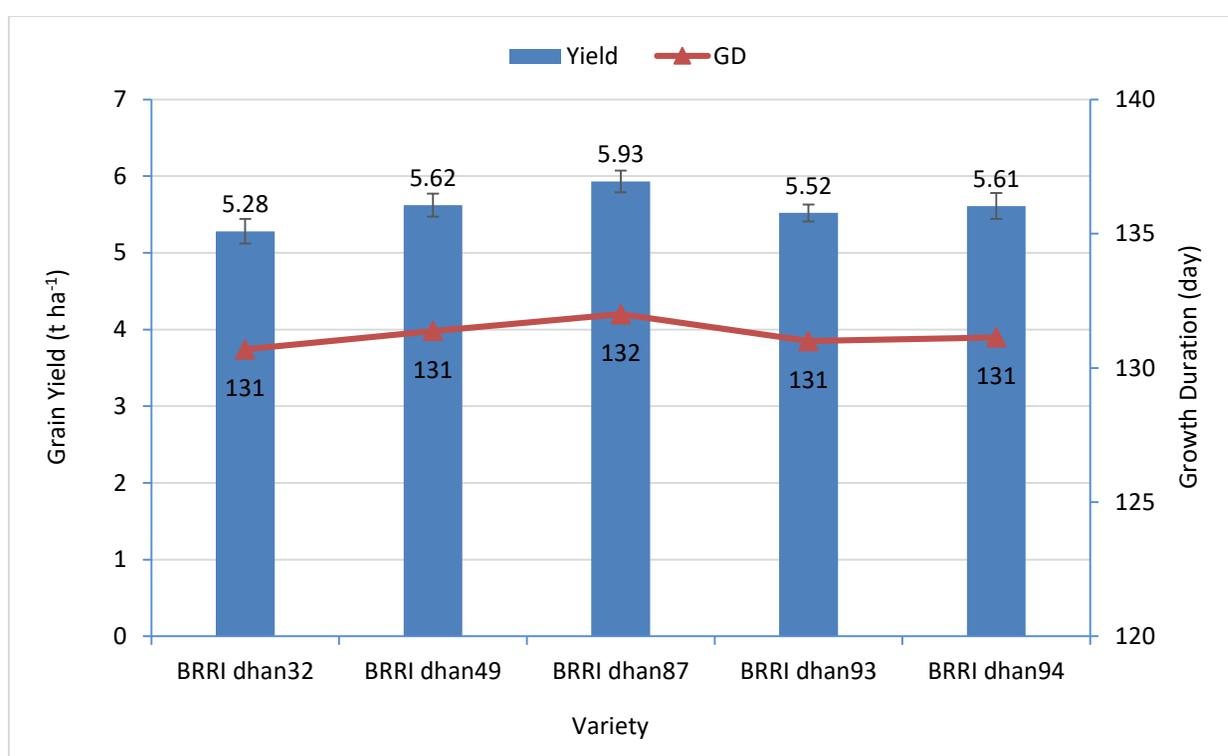


Fig 7. Average grain yield and growth duration of tested rice varieties in HHAT (LD-Mymensingh) Aman 2023.

Table 74. Summary Statistics of grain yield (t ha⁻¹) and growth duration of tested varieties in HHAT Aman 2023 (LD-Mymensingh)

Variety	Observation (n)	Mean	Maximum	Minimum	Standard deviation (SD)	Standard error (SE)
Grain yield (t/ha)						
BRRI dhan32	16	5.28	5.92	4.00	0.61	0.16
BRRI dhan49	16	5.62	6.57	4.32	0.61	0.15
BRRI dhan87	16	5.93	6.65	5.00	0.53	0.14
BRRI dhan93	16	5.52	6.00	4.43	0.43	0.11
BRRI dhan94	16	5.61	6.57	4.13	0.67	0.17
Growth duration (Day)						
BRRI dhan32	16	131	134	130	1.25	0.31
BRRI dhan49	16	131	134	130	1.71	0.43
BRRI dhan87	16	132	132	130	1.03	0.27
BRRI dhan93	16	131	134	130	1.25	0.32
BRRI dhan94	16	131	133	130	1.06	0.27

In the category HHAT (SD), average highest yield of BRRI dhan71 was recorded 5.32 t/ha followed Binadhan-17 by producing grain yield 5.30 t/ha. Binadhan-22 also performed well, which produced grain yield 5.15 t/ha having only 119 days growth duration (Table 75, fig-8). Binadhan-7 produced the lowest yield 4.47 t/ha, which was statistically similar to BRRI dhan39. The growth duration was 107 days and 121 days respectively.

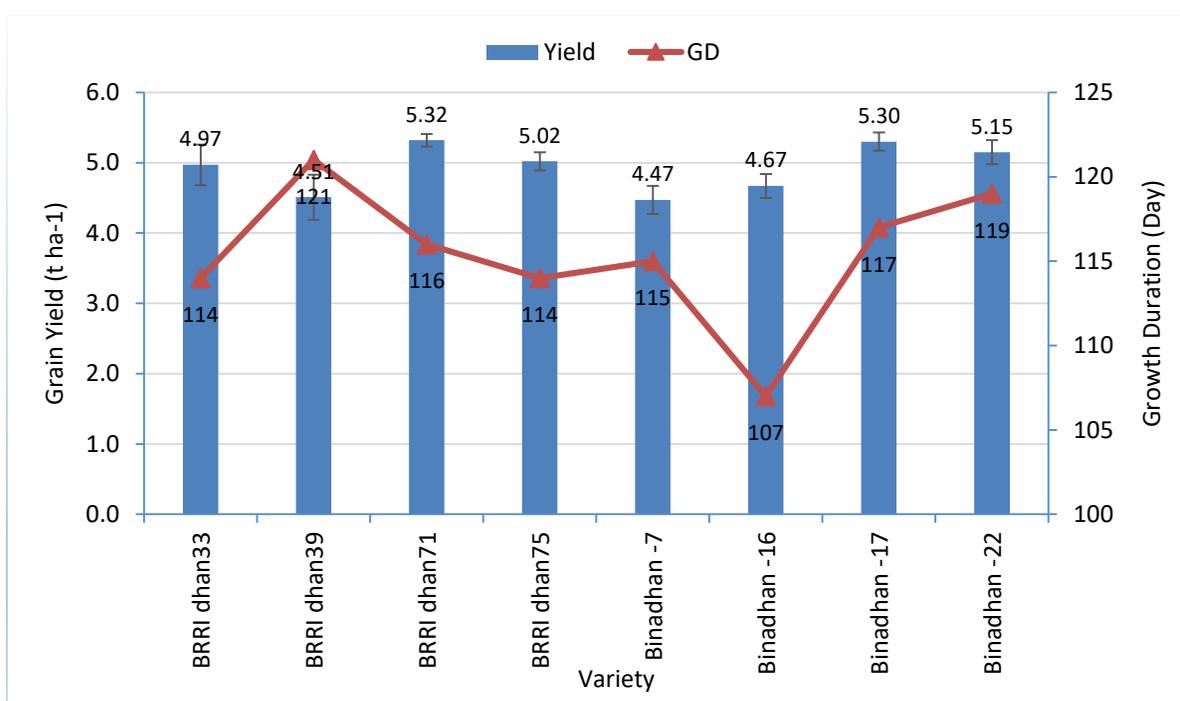


Fig 8. Average grain yield and growth duration of tested rice varieties in HHAT (SD)

Table 75. Summary Statistics of grain yield ($t\ ha^{-1}$) and growth duration of tested varieties in HHAT Aman 2023 (SD)

Variety	Observation (n)	Mean	Maximum	Minimum	Standard deviation (SD)	Standard error (SE)
Grain yield (t/ha)						
BRRi dhan33	8	4.97	5.62	4.00	0.66	0.29
BRRi dhan39	7	4.51	5.87	3.71	0.77	0.32
BRRi dhan71	30	5.32	7.10	4.68	0.50	0.09
BRRi dhan75	30	5.02	6.60	3.69	0.69	0.13
Binadhan-7	15	4.47	5.96	3.00	0.87	0.20
Binadhan-16	30	4.67	6.48	2.83	0.91	0.17
Binadhan-17	30	5.30	6.89	4.09	0.71	0.13
Binadhan-22	30	5.15	7.10	3.32	0.85	0.17
Growth duration (Day)						
BRRi dhan33	8	114	118	109	3.9	1.7
BRRi dhan39	7	121	124	116	3.0	1.2
BRRi dhan71	30	116	131	104	4.4	0.8
BRRi dhan75	30	114	131	103	4.5	0.8
Binadhan-7	15	115	120	101	4.3	1.0
Binadhan-16	30	107	125	103	5.0	0.9
Binadhan-17	30	117	125	113	3.0	0.6
Binadhan-22	30	119	139	114	7.9	1.6

In Coastal Ecosystem (CE) areas, the average highest yield was BRRi dhan79 was recorded 5.50 t/ha followed by BR23 producing grain yield 4.91 t/ha with longest 146 days growth duration. BRRi dhan73 performed less in Coastal ecosystem, which produced grain yield 4.29 t/ha having only 126 days growth duration (Table 76, fig-9).

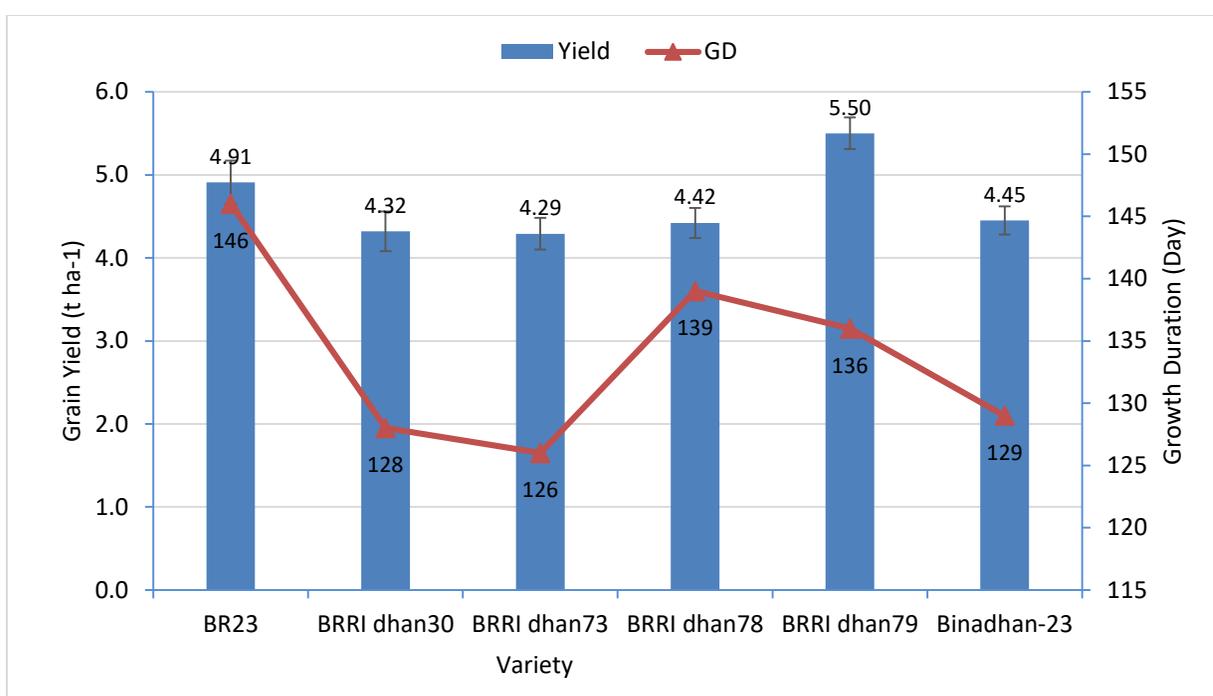


Fig 9. Average grain yield and growth duration of tested rice varieties in HHAT (CE)

Table 76. Summary Statistics of grain yield (t ha⁻¹) and growth duration of tested varieties in HHAT Aman 2023 (CE)

Variety	Observation (n)	Mean	Maximum	Minimum	Standard deviation (SD)	Standard error (SE)
Grain yield (t/ha)						
BR23	7	4.91	5.98	4.32	0.64	0.24
BRRi dhan30	7	4.32	5.82	3.21	0.77	0.26
BRRi dhan73	18	4.29	6.00	2.94	0.81	0.19
BRRi dhan78	18	4.42	6.10	3.27	0.77	0.18
BRRi dhan79	18	5.50	6.53	4.74	0.63	0.19
Binadhan-23	18	4.45	5.73	3.12	0.69	0.17
Growth duration (Day)						
BR23	7	146	148	145	1.30	0.58
BRRi dhan30	7	128	140	121	6.85	2.59
BRRi dhan73	18	126	136	114	5.63	1.33
BRRi dhan78	18	139	161	130	9.35	2.20
BRRi dhan79	18	136	142	130	3.67	1.11
Binadhan-23	18	129	137	125	3.79	0.92

Among the Flash flood submergence tolerant var. IR16F1148 produced the highest mean yield (5.66 t/ha) having the GD 140 days followed by BRRi dhan52 producing grain yield 5.22 t/ha with 147 days growth duration (Table 16, fig-12) and other tested varieties BRRi dhan51, BRRi dhan79 gave statistically similar yield, which can overcome early flash flood, a major problem in flash flood prone areas. Binadhan-11 produced lowest yield 4.68 t/ha among all the tested varieties.

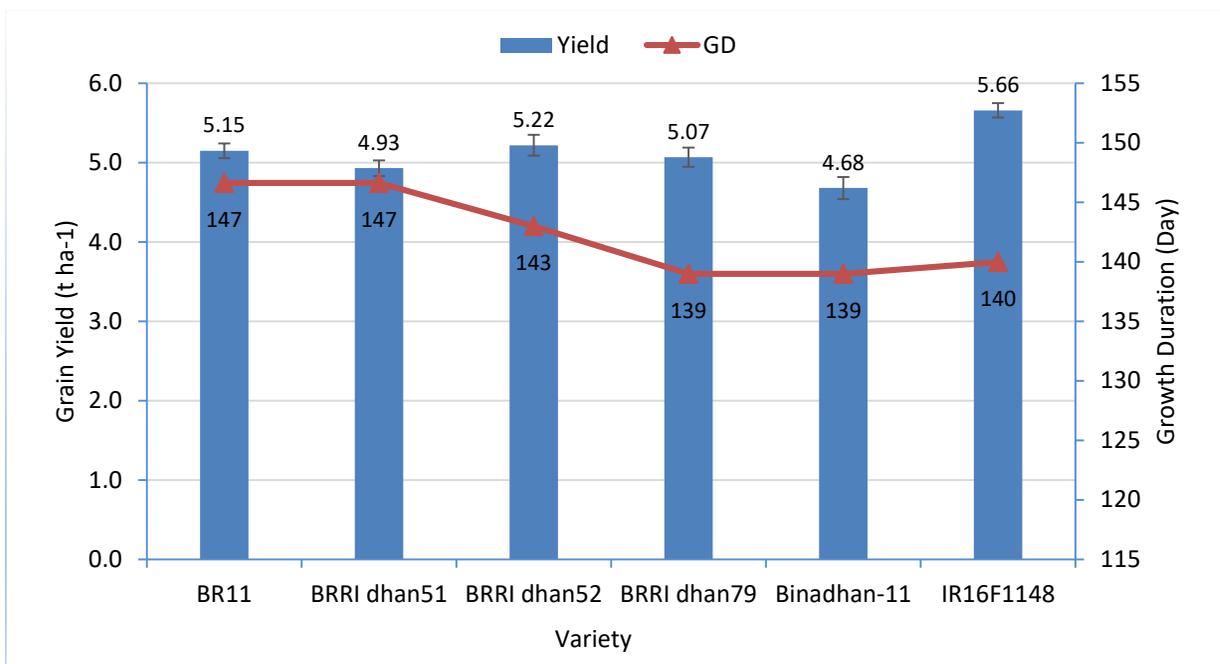


Fig 10. Average grain yield and growth duration of tested rice varieties in HHAT (FFS)

Table 77. Summary Statistics of grain yield (t ha⁻¹) and growth duration of tested varieties in HHAT Aman 2023 (FFS)

Variety	Observation (n)	Mean	Maximum	Minimum	Standard deviation (SD)	Standard error (SE)
Grain yield (t/ha)						
BR11	15	5.15	5.83	4.33	0.39	0.09
BRR1 dhan51	30	4.93	5.93	3.52	0.58	0.10
BRR1 dhan52	30	5.22	6.42	3.26	0.77	0.13
BRR1 dhan79	30	5.07	5.93	3.50	0.70	0.12
Binadhan-11	30	4.68	5.97	3.00	0.70	0.14
IR16F1148	15	5.66	6.03	5.02	0.33	0.09
Growth duration (Day)						
BR11	15	147	158	140	5.89	1.28
BRR1 dhan51	30	147	157	137	5.70	0.98
BRR1 dhan52	30	143	152	118	6.13	1.05
BRR1 dhan79	30	139	155	125	6.32	1.08
Binadhan-11	30	139	155	120	11.32	2.18
IR16F1148	15	140	143	135	2.14	0.57

Among the Tidal Submergence tolerant var. BRR1 dhan52 produced the highest mean yield 5.04 t/ha having the GD 143 days followed by BR11 producing grain yield 5.01 t/ha with 144 days growth duration (Table78, fig-11) and other tested varieties BRR1 dhan77, BR23 gave statistically similar yield, which can overcome Tidal Submergence, a major problem southwest part in Bangladesh.

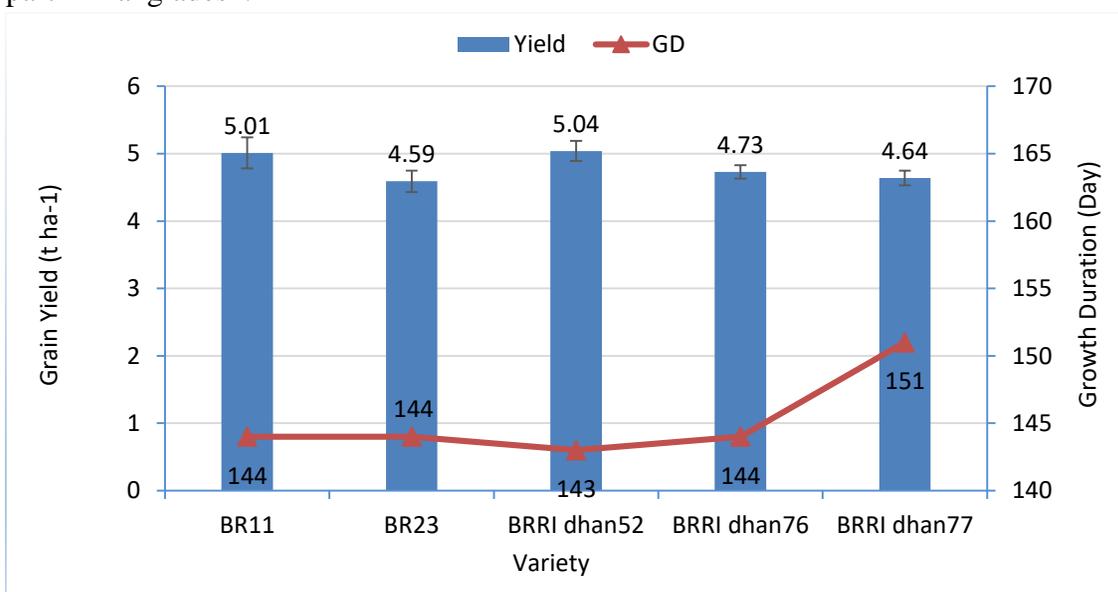


Fig 11. Average grain yield and growth duration of tested rice varieties in HHAT (TS)

Table 78. Summary Statistics of grain yield (t ha⁻¹) and growth duration of tested varieties in HHAT Aman 2023 (TS)

Variety	Observation (n)	Mean	Maximum	Minimum	Standard deviation (SD)	Standard error (SE)
Grain yield (t/ha)						
BR11	10	5.01	5.61	4.60	0.46	0.23
BR23	10	4.59	5.76	3.43	0.67	0.16
BRR1 dhan52	20	5.04	5.82	4.10	0.58	0.15
BRR1 dhan76	20	4.73	5.40	4.13	0.38	0.10
BRR1 dhan77	20	4.64	5.21	4.14	0.34	0.11
Growth duration (Day)						
BR11	16	144	146	143	1.41	0.71
BR23	20	144	153	130	8.71	2.11
BRR1 dhan52	20	143	151	138	3.87	0.97
BRR1 dhan76	20	144	164	109	18.61	4.97
BRR1 dhan77	20	151	157	147	3.05	0.96

Conclusion

In Swarna rice growing areas, BRR1 dhan87 and BRR1 dhan94 were found as better performer than others. BRR1 dhan87 produced highest grain yield 5.70 t/ha followed by BRR1 dhan94 (5.67 t/ha). In Dinajpur areas, BRR1 dhan80 was found as highest yielder (4.80 t/ha) having growth duration 132 days followed by BRR1 dhan90 (4.43 t/ha) Whereas, Kataribhog produced the lowest yield (3.49 t/ha). In Rangpur areas, BRR1 dhan87 produced the highest grain yield (5.77 t/ha) having also the shortest growth duration 146 days only followed by BR11 which produced (5.29 t/ha). In Mymensingh areas), BRR1 dhan87 produced the highest grain yield (5.93 t/ha) having also the shortest growth duration 132 days only (Table 13, fig-9). BRR1 dhan49 and BRR1 dhan94 produced the statistically similar yield and the similar growth duration respectively. In Coastal Ecosystem (CE) areas, the average highest yield was BRR1 dhan79 was recorded 5.50 t/ha followed by BR23 producing grain yield 4.91 t/ha with longest 146 days growth duration. BRR1 dhan73 performed less in Coastal ecosystem, which produced grain yield 4.29 t/ha having only 126 days growth duration.

Among the Flash flood submergence tolerant var. IR16F1148 produced the highest mean yield (5.66 t/ha) having the GD 140 days followed by BRR1 dhan52 producing grain yield 5.22 t/ha with 147 days growth duration and other tested varieties BRR1 dhan51, BRR1 dhan79 gave statistically similar yield, which can overcome early flash flood, a major problem in flash flood prone areas. Tidal Submergence tolerant var. BRR1 dhan52 produced the highest mean yield 5.04 t/ha having the GD 143 days followed by BR11 producing grain yield 5.01 t/ha with 144 days growth duration which can overcome Tidal Submergence, a major problem southwest part in Bangladesh.

2. TECHNOLOGY DISSEMINATION

2. Seed Production and Dissemination Program

Scientists of ARD conducted different demonstration trials and involved in different promotional activities for rapid dissemination of BRR1 developed technologies. Among them Seed Production and Dissemination Program (SPDP) was very important activity where BRR1 developed different promising rice varieties were demonstrated at farmers' field for rapid dissemination. SPDPs were conducted in collaboration of DAE using different sources of funds such as GoB, TRB and other sources. It was an effective program to generate feedback about the advantages and disadvantages about the varieties and other technologies from extension personnel and farmers.

Major objectives Motivate farmers to cultivate the recently released varieties, produce and preserve good quality seeds of those varieties.

- Rapid dissemination of newly released rice varieties among the farmers
- Increase availability of quality seeds at farm level

- Exchange seeds from farmers to farmers

2.1. Seed production and dissemination program (SPDP) during T. Aus, 2023

Materials and locations

Seed Production and dissemination Program (SPDP) in Aus 2023 were conducted in 29 upazilas of 11 districts (Narsingdi, Netrakona, Mymensingh, Sherpur, Gazipur, Manikganj, Bhola, Cumilla, B. Baria, Gaibandha and Patuakhali) under GOB core program. Only one modern rice variety (BRRI dhan98) was used in the program. Plot size of each variety was 1 bigha and 1 variety was demonstrated in 2 bighas area in a cluster in each upazila. BRRI provided quality seeds, fertilizer and signboard while the rest of the managements were done by the farmers. A total of 58 demonstrations were established in eleven districts of Bangladesh.

Table 79. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRI dhan98

Character	Yield Category (t/ha)		Frequency		Percent (%)	
Grain Yield (t/ha)	3.5-4.5		8		13.8	
	4.6-5.5		32		55.2	
	5.6-6.50		18		31.0	
	Total		58		100	
Descriptive Statistics						
Parameter	No. of Demo.	Minimum	Maximum	Mean	Std. Deviation	Total (Kg/No.)
Yield (t/ha)	58	3.4	6.2	5.2	0.67	-
Growth Duration (day)	58	102	115	111	2.79	-
Total Production (Kg)	58	307	835	684	113.19	39698
Retained Seed (Kg)	58	30	200	78	41.78	4530
K. gained Farmer (No.)	58	18	115	56	25.93	3235
Motivated Farmer No.)	58	7	95	25	19.86	1437

Results of BRRI dhan98

A total of 58 demonstrations were conducted in the different 29 upazila under 11 districts of Bangladesh. The minimum yield of BRRI dhan98 was 3.4 t/ha, the maximum yield was 6.2 t/ha and the average yield was 5.2 t/ha with 0.67 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (3.5-4.5, 4.6-5.5 and 5.6-6.5 t/ha). The highest yield category was (4.6-5.5 t/ha), it was 55.2% locations followed by yield category 5.6-6.50 t/ha, it was 31.0% locations and the lowest category was 3.5-4.5 t/ha, it was 13.8%. The minimum and maximum growth duration of BRRI dhan98 was 102 and 115 days respectively and the average growth duration was 111 days with 2.79 standard deviation. Minimum seed production 307 Kg, maximum 835 Kg seed were produced and the average 684 Kg seed was produced per location with 113.19 standard deviation. Farmers retained seed after harvesting, minimum and maximum 30 Kg and 200 Kg seed retained by the farmers respectively, the average retained seed was 78 Kg with 41.78 standard deviation. From this demonstration many of the farmers gained knowledge about BRRI dhan98, minimum 18 and maximum 115 farmers and average 56 farmers were gained knowledge about the variety with the standard deviation 25.93. The farmers who gained knowledge about BRRI dhan98, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in the proper time. Minimum 7 farmers and maximum 95 farmers and average 25 farmers were motivated with 19.86 standard deviation (Table 79). A total of 39698 kg grains were produced from all demonstrated plots and 4530 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 3235 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 1437 farmers were motivated and showed their interest to cultivate these varieties in the next year.

2.2. Special program of BRRI dhan83 rapid dissemination in Bhola district in B. Aus 2023

Materials and locations

A special Seed Production and dissemination Program (SPDP) in B. Aus 2023 were conducted in 6 upazilas of Bhola district under GOB core program. One modern rice variety like BRRI dhan83 was used in the program. Plot size of each variety was 1 bigha and 1 variety were demonstrated in 2 bigha area in each upazila. BRRI provided quality seeds, fertilizer and

signboard while the rest of the managements were done by the farmers. A total of 12 demonstrations were established in six upazilas in Bhola district of Bangladesh.

Table 80. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan83

Character	Yield Category (t/ha)		Frequency		Percent (%)	
Grain Yield (t/ha)	2.5-3.0		4		33.3	
	3.1-3.5		3		25.0	
	3.6-4.5		5		41.7	
	Total		12		100.0	
Descriptive Statistics						
Parameter	No. of Demo.	Minimum	Maximum	Mean	Std. Deviation	Total (Kg/No.)
Yield (t/ha)	12	2.6	4.1	3.3	0.52	-
Growth Duration (day)	12	102	105	103	1.31	-
Total Production (Kg)	12	342	550	444	70.74	5327
Retained Seed (Kg)	12	20	55	41	10.25	495
K. gained Farmer (No.)	12	15	28	19.5	2.31	262
Motivated Farmer No.)	12	8	14	10.5	3.25	131

Results of BRRi dhan83

A total of 12 demonstrations were conducted in the different 6 upazila under Bhola district of Bangladesh. The farmers of Bhola district generally cultivate B. Aus rice, so the program has been taken to justify the suitability of broadcast Aus. All the demonstrations were well established and got result successfully, 12 results were analysed. The minimum yield of BRRi dhan83 was 2.6 t/ha, the maximum yield was 4.1 t/ha and the average yield was 3.3 t/ha with 0.55 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (2.5-3.0 t/ha, 3.1-3.5 t/ha and 3.6-4.5 t/ha). Yield category (3.6-4.5 t/ha) was found the highest 41.7% locations followed by 2.5-3.0 t/ha, it was 33.3% locations and the lowest category was 3.1-3.5 t/ha, it was 25.0%. The minimum and maximum growth duration of BRRi dhan83 was 102 and 105 days respectively and the average growth duration was 103 days with 0.52 standard deviation. Minimum total production 342 Kg, maximum 550 Kg seed were produced and the average 444 Kg seed was produced per location with 70.74 standard deviation. Farmers retained seed after harvesting, minimum and maximum 20 Kg and 55.0 Kg seed retained by the farmers respectively, the average retained seed was 41 Kg with 10.25 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan83, minimum 15 and maximum 28 farmers and the average 19.5 farmers gained were gained knowledge about the variety with the standard deviation 2.31. The farmers who gained knowledge about BRRi dhan83, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 8 and maximum 14 farmers and the average 10.5 farmers were motivated with 3.25 standard deviation (Table 80). A total of 5327 kg grains were produced from all demonstrated plots and 495 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 262 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 131 farmers were motivated and showed their interest to cultivate these varieties in the next year (Table 80).

2.3. Dissemination of broadcast Aus rice variety (BRRi dhan83) in the hill districts as *Jhum* cultivation during B. Aus, 2023.

Materials and locations

Seed Production and dissemination Program (SPDP) in B. Aus 2023 were conducted in 6 upazilas of three Hill Tract districts like Bandarban, khagrachari and Rangamati under GOB. One modern rice variety BRRi dhan83 was used in the program. Plot size of each variety was 1 bigha and 1 variety was demonstrated in all most all the blocks in each upazila. BRRi provided quality seeds, fertilizer and signboard while the rest of the managements were done by the farmers. A total of 57 demonstrations were established in six upazilas of three hill districts of Bangladesh. Generally, the hilly or tribal people cultivate rice in the shifting cultivation system,

generally known as Jhum cultivation. The Jhumia farmers usually cultivate the indigenous or local variety, but its yield is very poor in most of the cases below one ton per hectare. If the HYV rice like BRRI varieties may be replaced by the local varieties, the yield may be increased into double or triple. On this context, we had taken to established 57 demonstrations in the hill tract region of Bangladesh for ensuring the food security of the hilly people.

Table 81. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRI dhan83.

Character	Yield Category (t/ha)	Frequency	Percent (%)			
Grain Yield (t/ha)	1.5-2.5	6	10.5			
	2.6-3.5	10	17.5			
	3.6-5.0	41	71.9			
	Total	57	100.0			
Descriptive Statistics						
Parameter	No. of Demo.	Minimum	Maximum	Mean	Std. Deviation	Total (Kg/No.)
Yield (t/ha)	57	1.7	4.7	3.7	0.74	-
Growth Duration (day)	57	100	115	105	2.73	-
Total Production (Kg)	57	233	629	493	99.06	28087
Retained Seed (Kg)	57	10	200	69	36.50	3956
K. gained Farmer (No.)	57	6	80	47	21.40	2689
Motivated Farmer No.)	57	2	40	18	10.95	1051

Results of BRRI dhan83

A total of 57 demonstrations were conducted in the 6 upazilas under three hill districts of Bangladesh. 57 demonstrations were conducted and got 57 results were analysed. The minimum yield of BRRI dhan83 was 1.7 t/ha, the maximum yield was 4.7 t/ha and the average yield was 3.7 t/ha with 0.74 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (1.5-2.5 t/ha, 2.6-3.5 t/ha and 3.6–5.0 t/ha). The highest yield category (3.6–5.0 t/ha) was found 71.9% locations followed by 2.6-3.5 t/ha, it was 17.5% locations and the lowest yield category (1.5-2.5 t/ha) was found 10.5%. The minimum and maximum growth duration of BRRI dhan83 was 100 and 115 days respectively and the average growth duration was 105 days with 2.73 standard deviation. Minimum total production 233 Kg, maximum 629 Kg seed were produced and the average 493 Kg seed was produced per location with 99.06 standard deviation. Farmers retained seed after harvesting, minimum and maximum 10 Kg and 200.0 Kg seed retained by the farmers respectively, the average retained seed was 69 Kg with 36.50 standard deviation. From this demonstration many of the farmers gained knowledge about BRRI dhan83, minimum 6 and maximum 80 farmers and the average 47 farmers gained were gained knowledge about the variety with the standard deviation 21.40. The farmers who gained knowledge about BRRI dhan83, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 2 farmers and maximum 40 and the average 18 farmers were motivated with 10.95 standard deviation (Table 81). A total of 28087 kg grains were produced from all demonstrated plots and 3956 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 2689 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 1051 farmers were motivated and showed their interest to cultivate these varieties. (Table 81).

2.4. Seed production and dissemination program (SPDP) during T. Aus 2023 in the Valley of the Hill districts

Materials and locations

Seed Production and dissemination Program (SPDP) in T. Aus 2023 were conducted in the Valley of 6 upazilas of 3 districts (Khagrachari, Bandarban and Rangamati) under GOB core program. One modern rice variety such as BRRI dhan98 was used in the program. Plot size of each variety was 1 bigha and 3 demonstrations were demonstrated in 3 bighas area in a cluster in each upazila. BRRI provided quality seeds, fertilizer and signboard while the rest of the

managements were done by the farmers. A total of 18 demonstrations were established in three hill districts of Bangladesh.

Table 82. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan98

Character	Yield Category (t/ha)	Frequency	Percent (%)			
Grain Yield (t/ha)	3.5-4.5	2	14.3			
	4.6-5.5	10	71.4			
	5.5-6.5	2	14.3			
	Total	14	100.0			
Descriptive Statistics						
Parameter	No. of Demo.	Minimum	Maximum	Mean	Std. Deviation	Total (Kg/No.)
Yield (t/ha)	14	3.9	6.2	5.1	0.60	-
Growth Duration (day)	14	102	115	110	4.26	-
Total Production (Kg)	14	520	830	681	79.32	9539
Retained Seed (Kg)	14	30	100	63	25.02	880
K. gained Farmer (No.)	14	20	80	47	24.62	658
Motivated Farmer No.)	14	7	40	20	11.82	283

Results of BRRi dhan98

A total of 18 demonstrations were conducted in the different 6 upazila under 3 hill districts of Bangladesh. But results of 14 demonstrations were received. The minimum yield of BRRi dhan98 was 3.9 t/ha, the maximum yield was 6.2 t/ha and the average yield was 5.1 t/ha with 0.60 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (3.5-4.5, 4.6-5.5 and 5.6-6.5 t/ha). From all of the yield category, the highest yield category was 4.6-5.5 t/ha, it was 71.4% locations. The minimum and maximum growth duration of BRRi dhan98 was 102 and 115 days respectively and the average growth duration was 110 days with 4.26 standard deviation. Minimum seed production 520 Kg, maximum 830 Kg seed were produced and the average 681 Kg seed was produced per location with 79.32 standard deviation. Farmers retained seed after harvesting, minimum and maximum 30 Kg and 100 Kg seed retained by the farmers respectively, the average retained seed was 63 Kg with 25.02 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan98, minimum 20 and maximum 80 farmers and average 47 farmers were gained knowledge about the variety with the standard deviation 24.62. The farmers who gained knowledge about BRRi dhan98, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in the proper time. Minimum 7 farmers and maximum 40 farmers and average 20 farmers were motivated with 11.82 standard deviation (Table 82). A total of 9539 kg grains were produced from all demonstrated plots and 880 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 658 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 283 farmers were motivated and showed their interest to cultivate these varieties in the next year. (Table 4).

2.5. Special program of BRRi hybrid dhan7 rapid dissemination in the different locations of Bangladesh in T. Aus, 2023.

Materials and locations

Special dissemination Program of BRRi hybrid dhan7 in T. Aus 2023 were conducted in 28 upazilas of 12 districts (Chattogram, Khagrachari, Bandarban, Rangamati, Barguna, Manikganj, Gazipur, Pirojpur, Jhalokathi, Patuakhali, Bhola and Gaibandha) under GOB core program. One BRRi hybrid rice variety (BRRi hybrid dhan7) was used in the program. Plot size of each variety was 1 bigha was demonstrated in 1 bigha area in each upazila. BRRi provided quality seeds, fertilizer and signboard while the rest of the managements were done by the farmers. A total of 35 demonstrations were established in three hill districts of Bangladesh.

Table 83. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi hybrid dhan7 in Aus 2023.

Character	Yield Category (t/ha)	Frequency	Percent (%)			
Grain Yield (t/ha)	4.0-5.0	11	19.6			
	5.1-6.0	21	37.5			
	6.1-7.2	24	42.9			
	Total	56	100.0			
Descriptive Statistics						
Parameter	No. of Demo.	Minimum	Maximum	Mean	Std. Deviation	Total (Kg/No.)
Yield (t/ha)	56	4.3	7.1	5.8	0.84	-
Growth Duration (day)	56	106	115	111	2.12	-
Total Production (Kg)	56	576	949	773	112.33	43266
Retained Seed (Kg)	56	0	0	0	0.00	0
K. gained Farmer (No.)	56	15	105	40	18.45	2214
Motivated Farmer No.)	56	4	52	21	13.02	1044

Results of BRRi hybrid dhan7

A total of 35 demonstrations were conducted in the different 28 upazila under 12 districts of Bangladesh. The minimum yield of BRRi hybrid dhan7 was 4.7 t/ha, the maximum yield was 7.1 t/ha and the average yield was 5.8 t/ha with 0.84 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-5.0 t/ha, 5.1-6.0 t/ha and 6.1-7.2 t/ha). Yield category (6.1-7.2 t/ha) was found the highest 42.9% locations followed by 5.1-6.0 t/ha, it was 37.5% locations and the lowest yield category (4.0-5.0 t/ha), it was 19.6% locations. The minimum and maximum growth duration of BRRi hybrid dhan7 was 106 and 115 days respectively and the average growth duration was 111 days with 2.12 standard deviation. Minimum total production 576 Kg, maximum 949 Kg seed were produced and the average 773 Kg seed was produced per location with 112.33 standard deviation. Farmers did not retain any seed after harvesting, as because hybrid seed cannot be used in the next season. From this demonstration many of the farmers gained knowledge about BRRi hybrid dhan7, minimum 15 and maximum 105 farmers and the average 40 farmers gained were gained knowledge about the variety with the standard deviation 18.45. The farmers who gained knowledge about BRRi hybrid dhan7, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 52 and the average 21 farmers were motivated with 13.02 standard deviation (Table 83). A total of 43266 kg grains were produced from all demonstrated plots. Farmers did not retain quality seeds by the farmers as seed for the next year cultivation. About 2214 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 1044 farmers were motivated and showed their interest to cultivate these varieties (Table 83).

2.6. Seed production and dissemination program (SPDP) during Aman 2023

Materials and locations

SPDPs in Aman 2023 were conducted in 25 upazilas of 12 districts (Tangail, Gazipur, Narsingdi, Manikganj, Kishoreganj, Netrokona, Mymensingh, Sherpur, Gaibandha, Bagerhat Cox's Bazar and Satkhira) under GOB core program. Thirteen modern rice varieties (BRRi dhan52, BRRi dhan71, BRRi dhan75, BRRi dhan76, BRRi dhan78, BRRi dhan79, BRRi dhan80, BRRi dhan87, BRRi dhan90, BRRi dhan93, BRRi dhan94, BRRi dhan95 and BRRi dhan103) were used in the program. Plot size of each variety was 1 bigha and 3-5 varieties were demonstrated in 5-55 bighas area in a cluster in each upazila. BRRi provided quality seeds, fertilizer and signboard while the rest of the managements were done by the farmers. A total of 735 demonstrations were established in fifteen districts of Bangladesh.

Table 84. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan52 in Aman 2023.

Character	Yield Category (t/ha)	Frequency	Percent (%)
	3.5-4.5	22	59.5

Grain Yield (t/ha)	4.6-5.5	11	29.7	
	5.6-6.5	4	10.8	
	Total	37	100.0	
Descriptive Statistics				
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	3.8	6.2	4.6	0.56
Growth Duration (day)	116	147	141	6.30
Total Production (Kg)	372	827	596	99.63
Retained Seed (Kg)	20	150	79	26.32
K. gained Farmer (No.)	8	100	36	22.30
Motivated Farmer No.)	3	30	13	7.81

A total of 37 demonstrations were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRR1 dhan52 was 3.8 t/ha, the maximum yield was 6.2 t/ha and the average yield was 4.6 t/ha with 0.56 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (3.5-4.5-5.0 t/ha, 4.6-5.5 and 5.6-6.5 t/ha). The highest yield category was (3.5-4.5-5.0 t/ha), it was 59.5% locations followed by yield category 4.6-5.5 t/ha, it was 29.7% locations and the lowest category was 5.6-6.5 t/ha and it was 10.8 % locations. The minimum and maximum growth duration of BRR1 dhan52 was 116 and 148 days respectively and the average growth duration was 141.0 days with 6.30 standard deviation. Minimum seed production 372 Kg, maximum 827 Kg seed were produced and the average 596 Kg seed was produced per location with 99.63 standard deviation. Farmers retained seed after harvesting, minimum and maximum 20 Kg and 150 Kg seed retained by the farmers respectively, the average retained seed was 79.0 Kg with 26.32 standard deviation. From this demonstration many of the farmers gained knowledge about BRR1 dhan52, minimum 8 and maximum 100 farmers were gained knowledge about the variety with the standard deviation 36.0. The farmers who gained knowledge about BRR1 dhan52, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 3 farmers and maximum 30 farmers were motivated with 7.81 standard deviation (Table 84).

Table 85. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan71

Character	Yield Category (t/ha)	Frequency	Percent (%)	
Grain Yield (t/ha)	3.5-4.5	49	38.9	
	4.6-5.5	69	54.8	
	5.6-6.5	8	6.3	
	Total	126	100.0	
Descriptive Statistics				
	Minimum Yield	Maximum Yield	Mean	Std. Deviation
Yield (t/ha)	3.7	6.1	4.8	0.52
Growth Duration (day)	107	145	117	5.51
Total Production (Kg)	371	814	629	93.92
Retained Seed (Kg)	20	250	110	52.83
K. gained Farmer (No.)	6	180	38	35.89
Motivated Farmer No.)	0	44	12	8.43

A total of 126 demonstrations were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRR1 dhan71 was 3.7 t/ha, the maximum yield was 6.1 t/ha and the average yield was 4.8 t/ha with 0.52 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (3.5-4.5-5.0 t/ha, 4.6-5.5 and 5.6-6.5 t/ha). The highest yield category (4.6–5.5 t/ha) was found 54.8% locations followed by yield category (3.5-4.5-5.0 t/ha) was found 38.9% and the lowest yield category (5.6–6.5 t/ha) and it was 6.3% locations. The minimum and maximum growth duration of BRR1 dhan71 was 107 and 145 days respectively and the average growth duration was 117 days with 5.51 standard deviation. Minimum total production 371.0 Kg, maximum 814.0 Kg seed were produced and the average 629.0 Kg seed was produced per location with 93.92 standard deviation. Farmers retained seed after harvesting, minimum and maximum 20.0 Kg and 250 Kg seed retained by

the farmers respectively, the average retained seed was 110 Kg with 52.83 standard deviation. From these demonstrations many of the farmers gained knowledge about BRR1 dhan71, minimum 6 and maximum 180 farmers and the average 38 farmers gained were gained knowledge about the variety with the standard deviation 35.89. The farmers who gained knowledge about BRR1 dhan71, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 0 farmers and maximum 40 and the average 12 farmers were motivated with 8.43 standard deviation (Table 85).

Table 86. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan75 Aman 2023.

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	2.0-3.5		1	1.6
	3.6-4.5		15	24.2
	4.6-5.8		46	74.2
	Total		62	100
	Descriptive Statistics			
		Minimum	Maximum	Mean
Yield (t/ha)	2.0	5.7	4.7	0.59
Growth Duration (day)	106	133	116	4.39
Total Production (Kg)	329	750	630	86.79
Retained Seed (Kg)	0	280	108	62.06
K. gained Farmer (No.)	5	140	47	36.38
Motivated Farmer No.)	2	42	17	9.97

Results of BRR1 dhan75

A total of 62 demonstrations were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRR1 dhan75 was 2.0 t/ha, the maximum yield was 5.7 t/ha and the average yield was 4.7 t/ha with 0.59 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (2.0-3.5 t/ha, 3.6-4.5 t/ha and 4.6-5.8 t/ha). The highest yield category (4.6-5.8 t/ha) was found 74.2% locations followed by yield category (3.6-4.5 t/ha), it was 24.2% locations and the lowest yield category was (2.0-3.5 t/ha) and it was 1.6% locations. The minimum and maximum growth duration of BRR1 dhan75 was 106 and 133 days respectively and the average growth duration was 116 days with 4.39 standard deviation. Minimum total production 329.0 Kg, maximum 750.0 Kg seed were produced and the average 630 Kg seed was produced per location with 86.79 standard deviation. Farmers retained seed after harvesting, minimum and maximum 0 Kg and 280 Kg seed retained by the farmers respectively, the average retained seed was 108 Kg with 62.06 standard deviation. From these demonstrations many of the farmers gained knowledge about BRR1 dhan75, minimum 5 and maximum 140 farmers and the average 47 farmers gained were gained knowledge about the variety with the standard deviation 36.38. The farmers who gained knowledge about BRR1 dhan75, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 2 farmers and maximum 42 and the average 17 farmers were motivated with 9.97 standard deviation (Table 86).

Table 87. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan76

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	2.5-3.5		20	39.2
	3.6-4.5		20	39.2
	4.6-5.5		11	21.6
	Total		51	100.0
	Descriptive Statistics			
		Minimum	Maximum	Mean
Yield (t/ha)	2.5	5.4	3.8	0.98
Growth Duration (day)	135	166	158	7.98

Total Production (Kg)	334	723	505	130.96
Retained Seed (Kg)	12	65	34	14.14
K. gained Farmer (No.)	20	54	40	7.72
Motivated Farmer No.)	5	23	14	3.65

Results of BRR I dhan76

A total of 51 demonstrations were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRR I dhan76 was 2.5 t/ha, the maximum yield was 5.4 t/ha and the average yield was 3.8 t/ha with 0.98 standard deviation. From the minimum and maximum yield, the yield was categorized into two category (2.5-3.5 t/ha, 3.6-4.5 t/ha and 4.6-5.5 t/ha). The highest yield category (2.5-3.5 t/ha and 3.6-4.5 t/ha) was found 39.2% locations followed by yield category (4.6-5.5 t/ha) was found 21.6% locations. The minimum and maximum growth duration of BRR I dhan76 was 135 and 166 days respectively and the average growth duration was 158 days with 7.98 standard deviation. Minimum total production 334 Kg, maximum 723 Kg seed were produced and the average 505 Kg seed was produced per location with 130.96 standard deviation. Farmers retained seed after harvesting, minimum and maximum 12 Kg and 65 Kg seed retained by the farmers respectively, the average retained seed was 34 Kg with 14.14 standard deviation. From this demonstration many of the farmers gained knowledge about BRR I dhan76, minimum 20 and maximum 54 farmers and the average 40 farmers gained were gained knowledge about the variety with the standard deviation 7.72. The farmers who gained knowledge about BRR I dhan76, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 5 farmers and maximum 23 and the average 14 farmers were motivated with 3.65 standard deviation (Table 87).

Table 88. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR I dhan78

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-4.5		10	29.4
	4.6-5.5		20	58.8
	5.6-6.0		4	11.8
	Total		34	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.1	5.9	4.9	0.51
Growth Duration (day)	133	140	136	1.55
Total Production (Kg)	549	790	662	68.59
Retained Seed (Kg)	35	120	61	23.47
K. gained Farmer (No.)	20	60	46	9.08
Motivated Farmer No.)	5	23	14	5.28

Results of BRR I dhan78

A total of 34 demonstrations were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRR I dhan78 was 4.1 t/ha, the maximum yield was 5.9 t/ha and the average yield was 4.9 t/ha with 0.51 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 and 5.6-6.0 t/ha). The highest yield category (4.6-5.5 t/ha t/ha) was found 58.8% locations followed by yield category (4.0-4.5 t/ha) was found 29.4% locations and the lowest yield category was 5.6-6.0 t/ha, it was only 11.8% locations. The minimum and maximum growth duration of BRR I dhan78 was 133 and 140 days respectively and the average growth duration was 136 days with 1.55 standard deviation. Minimum total production 549 Kg, maximum 790 Kg seed were produced and the average 662 Kg seed was produced per location with 68.59 standard deviation. Farmers retained seed after harvesting, minimum and maximum 35 Kg and 120 Kg seed retained by the farmers respectively, the average retained seed was 61 Kg with 23.47 standard deviation. From these demonstrations many of the farmers gained knowledge about BRR I dhan78, minimum 20 and maximum 60 farmers and the average 46 farmers gained were gained knowledge about the variety with the standard deviation 9.08. The farmers who gained knowledge about BRR I dhan78, among the farmers some of them were motivated to cultivate this variety in the next

year if the seeds are available in the market in proper time. Minimum 5 farmers and maximum 23 and the average 14 farmers were motivated with 5.28 standard deviation (Table 88).

Table 89. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan79

Character	Yield Category (t/ha)	Frequency	Percent (%)	
Grain Yield (t/ha)	4.0-4.5	26	32.5	
	4.6-5.5	47	58.8	
	5.6-6.5	7	8.8	
	Total	80	100.0	
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.0	6.1	4.8	0.49
Growth Duration (day)	114	152	135	8.74
Total Production (Kg)	531	817	645	64.30
Retained Seed (Kg)	20	250	86	46.34
K. gained Farmer (No.)	6	80	29	16.14
Motivated Farmer No.)	2	50	12	8.50

Results of BRR1 dhan79

A total of 80 demonstrations were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRR1 dhan79 was 4.0 t/ha, the maximum yield was 6.1 t/ha and the average yield was 4.8 t/ha with 0.49 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 and 5.6-6.5 t/ha). The highest yield category (4.6-5.5 t/ha) was found 58.8% locations followed by yield category (4.0-4.5 t/ha) was found 32.5% locations and the lowest yield category (5.6-6.5 t/ha) and it was 8.8% locations. The minimum and maximum growth duration of BRR1 dhan79 was 114 and 152 days respectively and the average growth duration was 135 days with 8.74 standard deviation. Minimum total production 531 Kg, maximum 817 Kg seed were produced and the average 645 Kg seed was produced per location with 64.30 standard deviation. Farmers retained seed after harvesting, minimum and maximum 20 Kg and 250 Kg seed retained by the farmers respectively, the average retained seed was 86 Kg with 46.34 standard deviation. From those demonstrations many of the farmers gained knowledge about BRR1 dhan79, minimum 6 and maximum 80 farmers and the average 29 farmers gained were gained knowledge about the variety with the standard deviation 16.14. The farmers who gained knowledge about BRR1 dhan80, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 2 farmers and maximum 50 and the average 12 farmers were motivated with 8.50 standard deviation (Table 89).

Table 90. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan80

Character	Yield Category (t/ha)	Frequency	Percent (%)	
Grain Yield (t/ha)	4.0-4.5	1	8.3	
	4.6-5.5	9	75.0	
	5.6-6.5	2	16.7	
	Total	12	100.0	
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.5	6.2	5.0	0.53
Growth Duration (day)	126	138	132	3.31
Total Production (Kg)	601	822	666	72.43
Retained Seed (Kg)	50	200	110	57.08
K. gained Farmer (No.)	11	63	30	17.25
Motivated Farmer No.)	2	27	13	8.35

Results of BRR1 dhan80

A total of 12 demonstrations were conducted in the different 12 locations under 12 districts of Bangladesh. The minimum yield of BRR1 dhan80 was 4.5 t/ha, the maximum yield was 6.2 t/ha and the average yield was 5.0 t/ha with 0.53 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 and 5.6-6.5

t/ha). The highest yield category (4.6-5.5 t/ha) was found 75.0% locations followed by yield category (5.6-6.5 t/ha) was found 16.7% locations and the lowest yield category (4.0-4.5 t/ha) and it was only 8.3% locations. The minimum and maximum growth duration of BRRi dhan80 was 126 and 138 days respectively and the average growth duration was 132 days with 3.31 standard deviation. Minimum total production 601 Kg, maximum 822 Kg seed were produced and the average 666 Kg seed was produced per location with 72.43 standard deviation. Farmers retained seed after harvesting, minimum and maximum 50 Kg and 200 Kg seed retained by the farmers respectively, the average retained seed was 110 Kg with 57.08 standard deviation. From those demonstrations many of the farmers gained knowledge about BRRi dhan80, minimum 11 and maximum 63 farmers and the average 30 farmers gained were gained knowledge about the variety with the standard deviation 17.25. The farmers who gained knowledge about BRRi dhan80, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 2 farmers and maximum 27 and the average 13 farmers were motivated with 8.35 standard deviation (Table 90).

Table 91. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan87

Character	Yield Category (t/ha)	Frequency	Percent (%)	
Grain Yield (t/ha)	2.0-3.5	4	3.8	
	3.6-5.0	34	32.4	
	5.1-6.5	67	63.8	
	Total	105	100.0	
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	2.0	6.4	5.2	.71
Growth Duration (day)	110	147	128	4.87
Total Production (Kg)	267	857	688	116.06
Retained Seed (Kg)	10	300	115	58.19
K. gained Farmer (No.)	5	170	41	36.05
Motivated Farmer No.)	2	80	16	13.20

Results of BRRi dhan87

A total of 105 demonstrations were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRRi dhan87 was 2.0 t/ha, the maximum yield was 6.4 t/ha and the average yield was 5.2 t/ha with 0.71 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (2.0-3.5 t/ha, 3.6-5.0 t/ha and 5.1-6.5 t/ha). The highest yield category (5.1-6.5 t/ha) was found 63.8% locations followed by yield category (3.6-5.0 t/ha) was found 32.4% locations and the lowest yield category (2.0-3.5 t/ha) and it was only 3.8% locations. The minimum and maximum growth duration of BRRi dhan87 was 110 and 147 days respectively and the average growth duration was 128.0 days with 4.87 standard deviation. Minimum total production 267 Kg, maximum 857 Kg seed were produced and the average 688 Kg seed was produced per location with 116.06 standard deviation. Farmers retained seed after harvesting, minimum and maximum 10 Kg and 300 Kg seed retained by the farmers respectively, the average retained seed was 115 Kg with 58.19 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan87, minimum 5 and maximum 170 farmers and the average 41 farmers gained were gained knowledge about the variety with the standard deviation 36.05. The farmers who gained knowledge about BRRi dhan87, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 2 farmers and maximum 80 and the average 16 farmers were motivated with 13.20 standard deviation (Table 91).

Table 92. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan90.

Character	Yield Category (t/ha)	Frequency	Percent (%)
Grain Yield (t/ha)	3.0-4.0	12	25.5
	4.1-5.0	23	48.9
	5.1-6.5	12	25.5
	Total	47	100.0

	Descriptive Statistics			Std. Deviation
	Minimum	Maximum	Mean	
Yield (t/ha)	3.0	6.2	4.6	0.71
Growth Duration (day)	105	135	122	5.21
Total Production (Kg)	400	830	614	94.98
Retained Seed (Kg)	20	220	101	52.22
K. gained Farmer (No.)	15	72	33	11.64
Motivated Farmer No.)	5	40	15	9.92

Results of BRRI dhan90

A total of 47 demonstrations of BRRI dhan90 were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRRI dhan90 was 3.0 t/ha, the maximum yield was 6.2 t/ha and the average yield was 4.6 t/ha with 0.71 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (3.0-4.0 t/ha, 4.1-5.0 t/ha and 5.1-6.5 t/ha). The highest yield category (4.1-5.0 t/ha) was found 48.9% locations followed by yield category (3.6-5.0 t/ha and 5.1-6.5 t/ha) was found 25.5% locations. The minimum and maximum growth duration of BRRI dhan90 was 105 and 135 days respectively and the average growth duration was 122.0 days with 5.21 standard deviation. Minimum total production 400 Kg, maximum 830 Kg seed were produced and the average 614 Kg seed was produced per location with 94.98 standard deviation. Farmers retained seed after harvesting, minimum and maximum 20 Kg and 220 Kg seed retained by the farmers respectively, the average retained seed was 101 Kg with 52.22 standard deviation. From this demonstration many of the farmers gained knowledge about BRRI dhan90, minimum 15 and maximum 72 farmers and the average 33 farmers gained were gained knowledge about the variety with the standard deviation 11.64. The farmers who gained knowledge about BRRI dhan90, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 5 farmers and maximum 40 and the average 15 farmers were motivated with 9.92 standard deviation (Table 90).

Table 91. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRI dhan93.

Character	Yield Category (t/ha)	Frequency	Percent (%)	
Grain Yield (t/ha)	4.0-4.5	6	28.6	
	4.6-5.0	10	47.6	
	5.1-5.5	5	23.8	
	Total	21	100.0	
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.2	5.3	4.7	0.34
Growth Duration (day)	124	138	133	4.26
Total Production (Kg)	376	710	588	123.70
Retained Seed (Kg)	70	250	152	59.13
K. gained Farmer (No.)	8	180	77	67.50
Motivated Farmer No.)	4	20	11	6.02

Results of BRRI dhan93

Around 21 demonstrations of BRRI dhan93 were conducted in the different 21 locations under 12 districts of Bangladesh. The minimum yield of BRRI dhan93 was 4.2 t/ha, the maximum yield was 5.3 t/ha and the average yield was 4.7 t/ha with 0.34 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.0 t/ha and 5.1-5.5 t/ha). The highest yield category (4.6-5.0t/ha) was found 47.6% locations followed by yield category (4.0-4.5 t/ha) was found 28.6% locations and the lowest yield category was 5.1-5.5 t/ha, it was 23.8% locations. The minimum and maximum growth duration of BRRI dhan93 was 124 and 138 days respectively and the average growth duration was 133 days with 4.26 standard deviation. Minimum total production 376 Kg, maximum 710 Kg seed were produced and the average 588 Kg seed was produced per location with 123.70 standard deviation. Farmers retained seed after harvesting, minimum and maximum 70 Kg and 250 Kg seed retained by the farmers respectively, the average retained seed was 152 Kg with 59.13

standard deviation. From this demonstration many of the farmers gained knowledge about BRR1 dhan93, minimum 8 and maximum 180 farmers and the average 77 farmers gained were gained knowledge about the variety with the standard deviation 67.50. The farmers who gained knowledge about BRR1 dhan93, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 20 and the average 11 farmers were motivated with 6.02 standard deviation (Table 91).

Table 92. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan94 in Aman 2023.

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-4.5		12	46.2
	4.6-5.5		6	23.1
	5.6-6.5		8	30.8
	Total		26	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.0	6.1	4.9	0.74
Growth Duration (day)	115	140	132	6.95
Total Production (Kg)	370	817	647	110.71
Retained Seed (Kg)	35	250	107	50.32
K. gained Farmer (No.)	8	82	36	20.36
Motivated Farmer No.)	3	42	14	10.05

Results of BRR1 dhan94

Around 26 demonstrations of BRR1 dhan94 were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRR1 dhan94 was 4.0 t/ha, the maximum yield was 6.10 t/ha and the average yield was 4.9 t/ha with 0.74 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 t/ha and 5.6-6.5 t/ha). The highest yield category (4.0-4.5 t/ha) was found 46.2% locations followed by yield category (5.6-6.5 t/ha) was found 30.8% locations and the lowest yield category was 4.6-5.5 t/ha, it was 23.1% locations. The minimum and maximum growth duration of BRR1 dhan94 was 115 and 140 days respectively and the average growth duration was 132 days with 6.95 standard deviation. Minimum total production 370 Kg, maximum 817 Kg seed were produced and the average 647 Kg seed was produced per location with 110.71 standard deviation. Farmers retained seed after harvesting, minimum and maximum 35 Kg and 250 Kg seed retained by the farmers respectively, the average retained seed was 107 Kg with 50.32 standard deviation. From this demonstration many of the farmers gained knowledge about BRR1 dhan94, minimum 8 and maximum 82 farmers and the average 36 farmers gained were gained knowledge about the variety with the standard deviation 20.36. The farmers who gained knowledge about BRR1 dhan94, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 3 farmers and maximum 42 and the average 14 farmers were motivated with 10.05 standard deviation (Table 92).

Table 93. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan95

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-4.5		20	40.8
	4.6-5.5		18	36.7
	5.6-6.5		11	22.4
	Total		49	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.0	6.3	4.9	0.70
Growth Duration (day)	112	137	125	5.54
Total Production (Kg)	372	837	641	113.89
Retained Seed (Kg)	40	250	91	38.57
K. gained Farmer (No.)	8	70	35	19.16
Motivated Farmer No.)	4.0	6.0	5	0.70

Results of BRR I dhan95

Around 49 demonstrations of BRR I dhan95 were conducted in 25 locations under 12 districts of Bangladesh. The minimum yield of BRR I dhan95 was 4.0 t/ha, the maximum yield was 6.3 t/ha and the average yield was 4.9 t/ha with 0.70 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 t/ha and 5.6-6.5 t/ha). The highest yield category (4.0-4.5 t/ha) was found 40.8% locations followed by yield category (4.6-5.5 t/ha) was found 36.7% locations and the lowest yield category (5.6-6.5 t/ha) and it was only 22.4% locations. The minimum and maximum growth duration of BRR I dhan95 was 112 and 137 days respectively and the average growth duration was 125 days with 5.54 standard deviation. Minimum total production 372 Kg, maximum 837 Kg seed were produced and the average 641 Kg seed was produced per location with 113.89 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 250 Kg seed retained by the farmers respectively, the average retained seed was 91 Kg with 38.57 standard deviation. From this demonstration many of the farmers gained knowledge about BRR I dhan95, minimum 8 and maximum 70 farmers and the average 35 farmers gained were gained knowledge about the variety with the standard deviation 19.16. The farmers who gained knowledge about BRR I dhan95, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 6 and the average 5 farmers were motivated with 0.70 standard deviation (Table 95).

Table 96. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR I dhan103

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	2.5-5.5		15	36.6
	5.6-6.5		21	51.2
	6.6-8.7		5	12.2
	Total		41	100
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	2.5	8.7	5.7	1.28
Growth Duration (day)	114	140	130	5.47
Total Production (Kg)	333	1165	746	177.63
Retained Seed (Kg)	40	500	156	107.31
K. gained Farmer (No.)	8	190	46	43.81
Motivated Farmer No.)	3	50	18	12.12

Results of BRR I dhan103

Around 41 demonstrations of BRR I dhan103 were conducted in the different 25 locations under 12 districts of Bangladesh. The minimum yield of BRR I dhan103 was 2.5 t/ha, the maximum yield was 8.7 t/ha and the average yield was 5.7 t/ha with 1.28 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (2.5-5.5 t/ha, 5.6-6.5 t/ha and 6.6-8.7 t/ha). The highest yield category (5.6-6.5 t/ha) was found 51.2% locations followed by yield category (2.5-5.5 t/ha) was found 36.6% locations and the lowest yield category (6.6-8.7 t/ha) and it was only 12.2% locations. The minimum and maximum growth duration of BRR I dhan103 was 114 and 140 days respectively and the average growth duration was 130 days with 5.47 standard deviation. Minimum total production 333 Kg, maximum 1165 Kg seed were produced and the average 746 Kg seed was produced per location with 177.63 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 500 Kg seed retained by the farmers respectively, the average retained seed was 156 Kg with 107.31 standard deviation. From this demonstration many of the farmers gained knowledge about BRR I dhan103, minimum 8 and maximum 190 farmers and the average 46 farmers gained were gained knowledge about the variety with the standard deviation 43.81. The farmers who gained knowledge about BRR I dhan103, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time.

Minimum 3 farmers and maximum 50 and the average 18 farmers were motivated with 12.12 standard deviation (Table 96).

Table 97. Results of SPDP during Aman 2023 under GOB.

Variety	Mean Growth duration (day)	Mean Grain yield (t/ha)	Total production (kg)	Seeds retained (kg)	Knowledge sharing farmers (no.)	Motivated farmers (no.)
BRRi dhan52	141	4.6	22065	2917	1345	474
BRRi dhan71	115	4.7	23353	3285	1067	416
BRRi dhan75	117	4.8	23612	2874	1490	633
BRRi dhan76	155	3.5	17574	1145	1437	513
BRRi dhan78	137	4.9	40084	3236	2996	983
BRRi dhan79	139	4.5	22292	2240	1274	496
BRRi dhan80	140	4.6	42695	4627	2262	889
BRRi dhan87	129	5.4	26556	2955	1522	587
BRRi dhan90	123	4.5	22342	3297	1267	540
BRRi dhan93	129	4.6	42512	7488	3360	952
BRRi dhan94	133	4.9	64588	11635	5363	1436
BRRi dhan95	125	4.9	24456	3065	1474	550
BRRi dhan103	130	5.7	30566	6402	1903	723
Average/Total	-	-	402695	55166	26760	9192

Results and discussion

Among the varieties, BRRi dhan103 produced the highest mean grain yield 5.7 t/ha followed by BRRi dhan78, 94 and 95 (4.9 t ha⁻¹) followed by BRRi dhan75 (4.8 t ha⁻¹). The lowest mean rice grain yield was 3.5 t/ha in BRRi dhan76 followed by 4.5 t/ha in BRRi dhan79 and BRRi dhan90 respectively (Table 97). However mean rice grain yield of BRRi dhan71 was 4.7 t/ha which was intermediate among the demonstrated rice varieties. The highest grain yield of BRRi dhan103 varied from 2.5-8.7 t/ha in different locations depending on soil fertility, salinity, cropping pattern and management practices (Table 97). Total grain production of BRRi dhan52, BRRi dhan71, BRRi dhan75, BRRi dhan76, BRRi dhan78, BRRi dhan79, BRRi dhan80, BRRi dhan87, BRRi dhan90, BRRi dhan93, BRRi dhan94, BRRi dhan95 and BRRi dhan103 were 22065 kg, 23353 kg, 23612 kg, 17574 kg, 40084 kg, 22292 kg, 42695 kg, 26556 kg, 22342 kg, 42512 kg, 64588 kg, 24456 kg and 30566 kg respectively. The retained seeds by the participant and associated farmers of BRRi dhan52, BRRi dhan71, BRRi dhan75, BRRi dhan76, BRRi dhan78, BRRi dhan79, BRRi dhan80, BRRi dhan87, BRRi dhan90, BRRi dhan93, BRRi dhan94, BRRi dhan95 and BRRi dhan103 were 2917 kg, 3285 kg, 2874 kg, 1145 kg, 3236 kg, 2240 kg, 4627 kg, 2955 kg, 3297 kg, 7488 kg and 11635 kg, 3065 kg and 6402 kg respectively. A total of 402695 kg grains were produced from all demonstrated plots and 55166 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 26760 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 9192 farmers were motivated and showed their interest to cultivate these varieties in the next year. BRRi dhan103, BRRi dhan78, BRRi dhan94 and BRRi dhan95 were highly preferred by the farmers for its higher yield. BRRi dhan95 was also specially preferred by the farmers for its higher paddy production, good taste, quality grain and shorter life cycle that create opportunity to timely establishment of Rabi crops. Therefore, they were motivated to cultivate this variety (Table 97).

Table 98. Minimum, maximum, mean grain yield and standard deviation of different rice varieties cultivated during Aman 2023 in the country.

Variety	Minimum Yield	Maximum Yield	Mean	Std. Deviation
BRRi dhan52	3.8	6.2	4.6	0.56
BRRi dhan71	3.7	6.1	4.8	0.52
BRRi dhan75	2.0	5.7	4.7	0.59
BRRi dhan76	2.5	5.4	3.8	0.98
BRRi dhan78	4.1	5.9	4.9	0.51
BRRi dhan79	4.0	6.1	4.8	0.49
BRRi dhan80	4.5	6.2	5.0	0.53
BRRi dhan87	2.0	6.4	5.2	0.71
BRRi dhan90	3.0	6.2	4.6	0.71

BRRi dhan93	4.2	5.3	4.7	0.34
BRRi dhan94	4.0	6.1	4.9	0.74
BRRi dhan95	4.0	6.3	4.9	0.70
BRRi dhan103	2.5	8.7	5.7	1.28

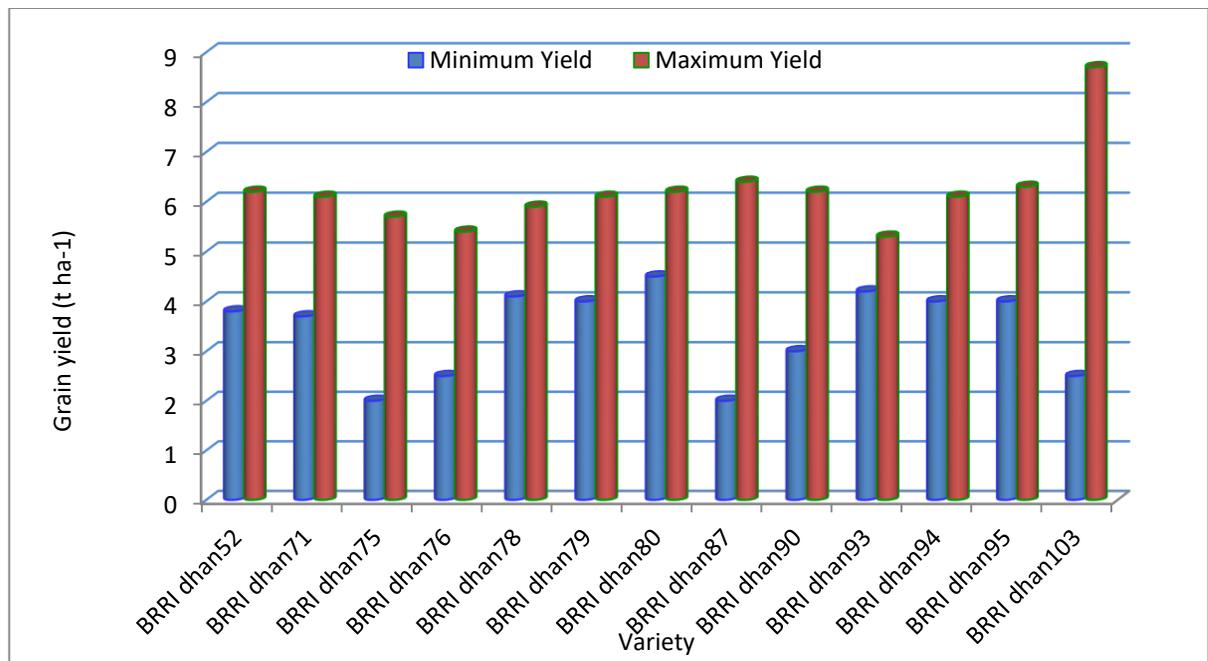


Figure 12. Showing Minimum, maximum mean grain yield of different rice varieties cultivated during Aman 2023.

Among the thirteen rice varieties (BRRi dhan52, BRRi dhan71, BRRi dhan75, BRRi dhan76, BRRi dhan78, BRRi dhan79, BRRi dhan80, BRRi dhan87, BRRi dhan90, BRRi dhan93, BRRi dhan94, BRRi dhan95 and BRRi dhan103) for maximum yield, BRRi dhan103 gave the highest yield 8.7 t/ha followed by BRRi dhan87 and the yield was 6.4 t/ha and the lowest yield was also found in BRRi dhan93 and it was 5.3 t/ha followed by BRRi dhan76 and it was 5.4 t/ha. On the contrary, in case of minimum yield BRRi dhan80 gave the highest yield 4.5 t/ha followed by BRRi dhan93 and the yield was 4.2 t/ha and the lowest yield was found in BRRi dhan75 & 87, it was 2.0 t/ha followed by BRRi dhan76 & 103 and it was 2.5 t/ha (Table 98 & Fig. 12).

2.7. Special dissemination program on BRRi hybrid dhan4 and BRRi hybrid dhan6 in the different locations of Bangladesh in Aman, 2023

Materials and locations

Special dissemination program on BRRi hybrid dhan4 and BRRi hybrid dhan6 in Aman 2023 were conducted in 28 upazilas under 12 districts (Tangail, Gazipur, Narsingdi, Manikganj, Kishoreganj, Netrokona, Mymensingh, Sherpur, Gaibandha, Bagerhat, Cox's Bazar and Satkhira) under GOB core program. Two BRRi hybrid dhan (BRRi hybrid dhan4 and BRRi hybrid dhan6) were used in the program. Plot size of each variety was 1 bigha and 2 varieties were demonstrated in 2 bighas area in each upazila. BRRi provided quality seeds, fertilizer and signboard while the rest of the managements were done by the farmers. A total of 56 demonstrations were established in fourteen districts of Bangladesh.

Table 99. Results of BRRi hybrid dhan4, Aman 2024

Character	Yield Category (t/ha)		Frequency	Percent (%)		
Grain Yield (t/ha)	4.0-4.5		2	7.1		
	4.6-5.5		10	35.7		
	5.6-6.5		16	57.1		
	Total		28	100		
Descriptive Statistics						
Parameter	No. of Demo.	Minimum	Maximum	Mean	Std. Deviation	Total (Kg/No.)
Yield (t/ha)	28	4.0	6.5	5.5	0.55	-
Growth Duration (day)	28	116	131	121	3.51	-
Total Production (Kg)	28	535	870	738	74.13	20653

Retained Seed (Kg)	28	0	0	0	00	0
K. gained Farmer (No.)	28	3	170	41	29.79	1135
Motivated Farmer No.)	28	4	38	16	8.02	436

Results of BRRI hybrid dhan4

Around 28 demonstrations were conducted in the different 25 locations (Upazilas) of 12 districts. The minimum yield of BRRI hybrid dhan4 was 4.0 t/ha, the maximum yield was 6.5 t/ha and the average yield was 5.5 t/ha with 0.55 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 t/ha and 5.6-6.5 t/ha). Yield category (5.6-6.5 t/ha) was found the highest, it was 57.1% locations followed by yield category (4.6-5.5 t/ha) was found 35.7% locations and the lowest yield category (4.0-4.5 t/ha), it was 7.1% locations. The minimum and maximum growth duration of BRRI hybrid dhan4 was 116 and 131 days respectively and the average growth duration was 121 days with 3.51 standard deviation. Minimum total grain production 535 Kg, maximum 870 Kg grains were produced and the average 738 Kg grain was produced per location with 74.13 standard deviation. A total of 20653 kg grains were produced from all demonstrated plots. Farmers did not retained seed after harvesting, as because hybrid seed cannot grow for the next time for crop cultivation. From these demonstrations many of the farmers gained knowledge about BRRI hybrid dhan4, minimum 3 and maximum 170 and the average 41 farmers were gained knowledge about the variety with the standard deviation 29.79. The farmers who gained knowledge about BRRI hybrid dhan4, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 38 and the average 16 farmers were motivated with 8.02 standard deviation. A total of 20653 kg grains were produced from all demonstrated plots. About 1135 farmers acquired awareness and gained knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 436 farmers were motivated and showed their interest to cultivate BRRI hybrid dhan4 in the next year (Table 99). BRRI hybrid dhan4 were highly preferred by the farmers for its higher grain yield.

Table 100. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRI hybrid dhan6 in Aman 2023.

Character	Yield Category (t/ha)		Frequency		Percent (%)	
Grain Yield (t/ha)	4.0-4.5		4		14.2	
	4.6-5.5		3		10.8	
	5.6-6.6		21		75.0	
	Total		28		100.0	
Descriptive Statistics						
Parameter	No. of Demo.	Minimum	Maximum	Mean	Std. Deviation	Total (Kg/No.)
Yield (t/ha)	28	4.1	6.6	5.8	0.61	-
Growth Duration (day)	28	110	130	121	6.30	-
Total Production (kg)	28	549	884	770	81.52	21556
Retained Seed (kg)	28	0	0	0	00	0
K. gained Farmer (No.)	28	5	150	37	27.68	1022
Motivated Farmer No.)	28	4	7	6	0.61	408

Results of BRRI hybrid dhan6

Around 28 demonstrations were conducted in the different 25 locations (Upazilas) under 12 districts of Bangladesh. The minimum yield of BRRI hybrid dhan6 was 4.1 t/ha, the maximum yield was 6.6 t/ha and the average yield was 5.8 t/ha with 0.61 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 t/ha and 5.6-6.6 t/ha). Yield category (5.6-6.6 t/ha) was found 75.0% locations followed by yield category (4.0-4.5 t/ha) was found 14.2% locations. The minimum and maximum growth duration of BRRI hybrid dhan6 was 110 and 130 days respectively and the average growth duration was 121 days with 6.30 standard deviation. Minimum total grain production 549 Kg, maximum 884 Kg seed were produced and the average 770 Kg grains were produced per

location with 81.52 standard deviation. A total of 21556 kg grains were produced from all demonstrated plots. Farmers did not retained seed after harvesting, as because hybrid seed cannot grow for the next time for crop cultivation. From these demonstrations many of the farmers gained knowledge about BRRi hybrid dhan6, minimum 5 and maximum 150 and the average 37 farmers were gained knowledge about the variety with the standard deviation 27.68. The farmers who gained knowledge about BRRi hybrid dhan6, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 7 and the average 6 farmers were motivated with 0.61 standard deviation. A total of 21556 kg grains were produced from all demonstrated plots. About 1022 farmers acquired awareness and gained knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 408 farmers were motivated and showed their interest to cultivate BRRi hybrid dhan6 in the next year (Table 100). BRRi hybrid dhan6 were highly preferred by the farmers for its higher grain yield.

Results and discussion

From two BRRi developed hybrid rice varieties, BRRi hybrid dhan6 produced the highest mean grain yield 5.7 t/ha followed by BRRi hybrid dhan4 (5.5 t ha⁻¹) (Table 23). The highest grain yield of BRRi dhan80 varied from 4.1-6.6 t/hain different locations depending on soil fertility, salinity, cropping pattern and management practices.

Table 101. Results of Demonstration of BRRi hybrid dhan in Aman 2023.

Variety	Growth Duration (day)	Grain yield (t/ha)	Total production (kg)	Knowledge sharing farmers (no.)	Motivated farmers (no.)
BRRi hybrid dhan4	122	5.5	47490	2759	1020
BRRi hybrid dhan6	121	5.7	74156	3983	1523
Average/Total	122	5.6	121646	6742	2543

2.8. Seed production and dissemination program (SPDP) during T. Aman 2023 in the Valley of the Hill districts

Materials and locations

Seed Production and dissemination Program (SPDP) in T. Aman 2023 were conducted in the Valley of 6 upazilas of 3 districts (Khagrachari, Bandarban and Rangamati) under GOB core program. Three modern rice varieties (BRRi dhan80, BRRi dhan87 and BRRi dhan103 were used in the program. Plot size of each variety was 1 bigha and 3 varieties were demonstrated in 3 bighas area in a cluster in each upazila. BRRi provided quality seeds, fertilizer and signboard while the rest of the managements were done by the farmers. A total of 42 demonstrations were established in 6 upazilas under 3 hill districts of Bangladesh.

Table 102. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan80

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-5.1		0	0
	5.2-5.5		3	75.0
	5.6-6.0		1	25.0
	Total		4	100
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	5.1	5.6	5.3	0.22
Growth Duration (day)	130	133	132	1.29
Total Production (Kg)	683	750	706	29.80
Retained Seed (Kg)	40	60	49	8.54
K. gained Farmer (No.)	25	40	33	6.45
Motivated Farmer No.)	17	22	20	2.22

Results of BRRi dhan80

A total of 4 demonstrations were conducted in the different 4 locations under 3 hill districts of Bangladesh. The minimum yield of BRRi dhan80 was 5.1 t/ha, the maximum yield was 5.6 t/ha and the average yield was 5.3 t/ha with 0.22 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-5.1 t/ha, 5.2-5.5 and 5.6-6.0 t/ha). The highest yield category (5.2-5.5 t/ha) was found 75.0% locations followed by yield category (5.6-6.0 t/ha) was found 25% locations and the lowest yield category (4.0-5.1 t/ha) and it was only 0% locations. The minimum and maximum growth duration of BRRi dhan80 was 130 and 133 days respectively and the average growth duration was 132 days with 1.29 standard deviation. Minimum total production 683 Kg, maximum 750 Kg seed were produced and the average 706 Kg seed was produced per location with 29.80 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 60 Kg seed retained by the farmers respectively, the average retained seed was 49 Kg with 8.54 standard deviation. From those demonstrations many of the farmers gained knowledge about BRRi dhan80, minimum 25 and maximum 40 farmers and the average 33 farmers gained were gained knowledge about the variety with the standard deviation 6.45. The farmers who gained knowledge about BRRi dhan80, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 17 farmers and maximum 22 and the average 20 farmers were motivated with 2.22 standard deviation (Table 102).

Table 103. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan87 in Aman 2023.

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	3.0-4.0		7	20.6
	4.1-5.0		8	23.5
	5.1-6.5		19	55.9
	Total		34	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	3.0	6.4	5.0	1.14
Growth Duration (day)	124	135	129	3.05
Total Production (Kg)	195	857	651	170.58
Retained Seed (Kg)	20	111	49	27.31
K. gained Farmer (No.)	6	65	23	16.59
Motivated Farmer No.)	4	25	11	5.19

Results of BRRi dhan87

A total of 34 demonstrations were conducted in the different 6 locations under 3 hill districts of Bangladesh. The minimum yield of BRRi dhan87 was 3.0 t/ha, the maximum yield was 6.4 t/ha and the average yield was 5.0 t/ha with 1.14 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (3.0-4.0 t/ha, 4.1-5.0 t/ha and 5.1-6.5 t/ha). The highest yield category (5.1-6.5 t/ha) was found 55.9% locations followed by yield category (4.1-5.0 t/ha) was found 23.5% locations and the lowest yield category (3.0-4.0 t/ha) and it was only 20.6% locations. The minimum and maximum growth duration of BRRi dhan87 was 124 and 135 days respectively and the average growth duration was 129.0 days with 3.05 standard deviation. Minimum total production 195 Kg, maximum 857 Kg seed were produced and the average 651 Kg seed was produced per location with 170.58 standard deviation. Farmers retained seed after harvesting, minimum and maximum 20 Kg and 111 Kg seed retained by the farmers respectively, the average retained seed was 49 Kg with 27.31 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan87, minimum 6 and maximum 65 farmers and the average 23 farmers gained were gained knowledge about the variety with the standard deviation 16.59. The farmers who gained knowledge about BRRi dhan87, among the farmers some of them were motivated to cultivate this variety in the next

year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 25 and the average 11 farmers were motivated with 5.19 standard deviation (Table 103).

Table 104. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan103 Aman 2023.

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	3.0-4.0		1	5.9
	4.1-5.5		7	41.2
	5.6-6.5		9	52.9
	Total		17	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	3.2	6.3	5.5	0.71
Growth Duration (day)	118	136	131	4.30
Total Production (Kg)	428	843	742	95.66
Retained Seed (Kg)	20	110	65	33.03
K. gained Farmer (No.)	5	65	30	23.81
Motivated Farmer No.)	5	27	15	7.11

Results of BRRi dhan103

Around 17 demonstrations of BRRi dhan103 were conducted in the different 6 locations under 3 hill districts of Bangladesh. The minimum yield of BRRi dhan103 was 3.2 t/ha, the maximum yield was 6.3 t/ha and the average yield was 5.5 t/ha with 0.71 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (3.0-4.0 t/ha, 4.1-5.0 t/ha and 5.1-6.5 t/ha). The highest yield category (5.6-6.5 t/ha) was found 52.9% locations followed by yield category (4.1-5.0 t/ha) was found 41.2% locations and the lowest yield category (3.0-4.0 t/ha) and it was only 5.9% locations. The minimum and maximum growth duration of BRRi dhan103 was 118 and 136 days respectively and the average growth duration was 131 days with 4.30 standard deviation. Minimum total production 428 Kg, maximum 843 Kg seed were produced and the average 742 Kg seed was produced per location with 95.66 standard deviation. Farmers retained seed after harvesting, minimum and maximum 20 Kg and 110 Kg seed retained by the farmers respectively, the average retained seed was 65 Kg with 33.03 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan103, minimum 5 and maximum 65 farmers and the average 30 farmers gained were gained knowledge about the variety with the standard deviation 23.81. The farmers who gained knowledge about BRRi dhan103, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 5 farmers and maximum 27 and the average 15 farmers were motivated with 7.11 standard deviation (Table 104).

Results and discussion

Among the varieties, BRRi dhan80 produced the highest mean grain yield 5.3 t/ha followed by BRRi dhan103 (5.1 t ha⁻¹) and the lowest mean rice grain yield was 5.0 t/ha in BRRi dhan87 (Table 105). However mean rice grain yield of BRRi dhan87 was 5.0 t/ha which was intermediate yield among the demonstrated rice varieties. The highest grain yield of BRRi dhan80 varied from 5.1-5.6 t/ha in different locations depending on soil fertility, salinity, cropping pattern and management practices.

Table 105. Results of SPDP Aman 2023 in the hill districts

Variety	Growth Duration (day)	Grain yield (t/ha)	Total production (kg)	Seeds retained (kg)	Knowledge sharing farmers (no.)	Motivated farmers (no.)
BRRi dhan80	132	5.3	2825	195	130	81
BRRi dhan87	129	5.0	22136	1681	784	387
BRRi dhan103	131	5.1	12610	1101	510	247
Average/Total	-	-	37571	2977	1424	715

Total grain production of BRRi dhan80, BRRi dhan87 and BRRi dhan103 were 2825 kg, 22136 kg and 12610 kg respectively. The retained seeds by the participant and associated farmers of BRRi dhan80, BRRi dhan87 and BRRi dhan103 were 195 kg, 1681 kg and 1101 kg respectively. A total of 37571 kg grains were produced from all demonstrated plots and 2977 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 1424 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 725 farmers were motivated and showed their interest to cultivate these varieties in the next year. All the varieties like BRRi dhan80, BRRi dhan87 and BRRi dhan103 were highly preferred by the farmers for its higher yield. Therefore, they were motivated to cultivate those varieties (Table 105).

Table 106. Minimum, maximum, mean grain yield and standard deviation of different rice varieties cultivated during T. Aman 2023 in the Valley of the hill.

Variety	Minimum Yield	Maximum Yield	Mean	Std. Deviation
BRRi dhan80	5.1	5.6	5.3	0.22
BRRi dhan87	3.0	6.4	5.0	1.14
BRRi dhan103	3.2	6.3	5.5	0.71

Among the three rice varieties (BRRi dhan80, BRRi dhan87 and BRRi dhan103) for maximum yield, BRRi dhan87 gave the highest yield 6.4 t/ha followed by BRRi dhan103 and the yield was 6.3 t/ha and the lowest yield was found in BRRi dhan80, it was 5.6 t/ha. On the contrary, in case of minimum yield BRRi dhan80 gave the highest yield 5.1 t/ha followed by BRRi dhan103, it was 3.2 t/ha and the lowest yield was found in BRRi dhan87, 3.0 t/ha (Table 106).

2.9. Seed Production and Dissemination Program (SPDP) during T. Aman, 2023 through cropping pattern

Materials and locations

Seed Production and dissemination Program (SPDP) in T. Aman 2023 were conducted in the 8 upazilas of 4 districts (Bogura, Joypurhat, Nilfamari and Thakurgaon) under GOB core program. Two modern rice varieties (BRRi dhan75 and BRRi dhan103) were used in the program. Plot size of each variety was 1 bigha and 2 varieties were demonstrated in 2 bighas area in a cluster in each upazila. BRRi provided quality seeds, fertilizer and signboard while the rest of the managements were done by the farmers. A total of 16 demonstrations were established in 8 upazilas under 4 northern districts of Bangladesh. But two demonstrations of two varieties did not established due to some natural hazards in one upazila of Bogura. We get the fourteen results and analyzed.

Table 107. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan75

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-4.5		2	28.6
	4.6-5.5		0	00
	5.6-6.0		5	71.4
	Total		7	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.1	5.6	5.0	0.55
Growth Duration (day)	113	129	117	5.56
Total Production (Kg)	549	747	669	73.17
Retained Seed (Kg)	40	147	64	101.29
K. gained Farmer (No.)	30	55	44	8.86
Motivated Farmer No.)	8	25	15	7.04

Results of BRRi dhan75

A total of 7 demonstrations were conducted in the different 7 locations under 42 northern districts of Bangladesh. The minimum yield of BRRi dhan75 was 4.1 t/ha, the maximum yield

was 5.6 t/ha and the average yield was 5.0 t/ha with 0.55 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 t/ha and 5.6-6.0 t/ha). The highest yield category (5.6-6.0 t/ha) was found 71.4% locations followed by yield category (4.0-4.5 t/ha); it was 28.6% locations. The minimum and maximum growth duration of BRR1 dhan75 was 113 and 129 days respectively and the average growth duration was 117 days with 5.56 standard deviation. Minimum total production 549 Kg, maximum 747 Kg seed were produced and the average 669 Kg seed was produced per location with 73.17 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 147 Kg seed retained by the farmers respectively, the average retained seed was 64 Kg with 101.29 standard deviation. From these demonstrations many of the farmers gained knowledge about BRR1 dhan75, minimum 30 and maximum 55 farmers and the average 44 farmers gained were gained knowledge about the variety with the standard deviation 8.86. The farmers who gained knowledge about BRR1 dhan75, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 8 farmers and maximum 25 and the average 157 farmers were motivated with 7.04 standard deviation (Table 107).

Table 108. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan103

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	5.0-5.5		3	42.9
	5.6-6.0		4	57.1
	Total		7	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	5.2	5.8	5.6	.21
Growth Duration (day)	123	131	128	2.57
Total Production (Kg)	696	776	740	27.25
Retained Seed (Kg)	60	144	266	39.33
K. gained Farmer (No.)	30	65	51	15.12
Motivated Farmer No.)	10	30	18	7.54

Results of BRR1 dhan103

A total of 7 demonstrations were conducted in the different 7 locations under 42 northern districts of Bangladesh. The minimum yield of BRR1 dhan103 was 5.2 t/ha, the maximum yield was 5.8 t/ha and the average yield was 5.6 t/ha with 0.21 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (5.0-5.5 t/ha and 5.6-6.0 t/ha). The highest yield category (5.6-6.0 t/ha) was found 57.1% locations followed by yield category (5.0-5.5 t/ha) was found 42.9% locations. The minimum and maximum growth duration of BRR1 dhan103 was 123 and 131 days respectively and the average growth duration was 128 days with 2.57 standard deviation. Minimum total production 696 Kg, maximum 776 Kg seed were produced and the average 740 Kg seed was produced per location with 27.25 standard deviation. Farmers retained seed after harvesting, minimum and maximum 60 Kg and 144 Kg seed retained by the farmers respectively, the average retained seed was 67 Kg with 39.33 standard deviation. From this demonstration many of the farmers gained knowledge about BRR1 dhan103, minimum 30 and maximum 65 farmers and the average 51 farmers gained were gained knowledge about the variety with the standard deviation 15.12. The farmers who gained knowledge about BRR1 dhan103, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 10 farmers and maximum 30 and the average 18 farmers were motivated with 7.54 standard deviation (Table 108).

Results and discussion

Among the varieties, BRR1 dhan103 produced the highest mean grain yield 5.5 t/ha followed by BRR1 dhan75 (5.0 t ha⁻¹) (Table 108). The highest grain yield of BRR1 dhan80 varied from 5.2-5.8 t/ha in different locations depending on soil fertility, salinity, cropping pattern and management practices.

Table 109. Results of SPDP during Aman 2023 in the northern districts of Bangladesh

Variety	Growth Duration (day)	Grain yield (t/ha)	Total production (kg)	Seeds retained (kg)	Knowledge sharing farmers (no.)	Motivated farmers (no.)
BRRi dhan75	117	5.0	4685	1592	310	108
BRRi dhan103	128	5.5	5184	1859	355	124
Average/Total	123	5.3	9869	3451	665	232

Total grain production of BRRi dhan75 and BRRi dhan103 were 4685 kg and 5184 kg respectively. The retained seeds by the participant and associated farmers of BRRi dhan75 and BRRi dhan103 were 1592 kg and 1859 kg respectively. A total of 9869 kg grains were produced from all demonstrated plots and 3451 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 665 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 232 farmers were motivated and showed their interest to cultivate these varieties in the next year. All the varieties like BRRi dhan75 and BRRi dhan103 were highly preferred by the farmers for its higher yield. Therefore, they were motivated to cultivate those varieties (Table 109).

2.10. Seed Production and Dissemination Program (SPDP) during Aman2023 under TRB Materials and Locations

A total of 30 SPDPs were conducted in 20 Upazila of 8 districts (Gazipur, Netrakona, Mymensingh, Tangail, Kishoreganj, Chuadanga, Jhenidah, Khulna, Bogura, Gaibandha, Narsingdi and Bandarban) under TRB project during T. Aman 2023. BRRi dhan71, BRRi dhan75, BRRi dhan87, BRRi dhan94 and BRRi dhan95 were demonstrated in the SPDPs. Area of each SPDP was 3 bigha and total area of SPDP was 90 bigha. The program was executed in collaboration of DAE. TRB-BRRi provided quality seeds, fertilizer and signboard while rests of the managements were done by the farmers.

Table 110. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRi dhan71

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-4.5		4	33.3
	4.6-5.5		6	50.0
	5.6-6.0		2	16.7
	Total		12	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.1	5.9	5.0	0.62
Growth Duration (day)	115	125	121	3.45
Total Production (Kg)	548	788	670	83.22
Retained Seed (Kg)	50	210	154	42.49
K. gained Farmer (No.)	13	34	22	7.29
Motivated Farmer No.)	1	12	6	2.87

A total of 12 demonstrations were conducted in the different 9 locations under 8 districts of Bangladesh. The minimum yield of BRRi dhan71 was 4.1 t/ha, the maximum yield was 5.9 t/ha and the average yield was 5.0 t/ha with 0.62 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 and 5.6-6.5 t/ha). The highest yield category (4.6–5.5 t/ha) was found 50.0% locations followed by yield category (4.0-4.5 t/ha) was found 33.3% and the lowest yield category (5.6–6.5 t/ha) and it was 16.7% locations. The minimum and maximum growth duration of BRRi dhan71 was 115 and 125 days respectively and the average growth duration was 121 days with 3.45 standard deviation. Minimum total production 548 Kg, maximum 788 Kg seed were produced and the average 670 Kg seed was produced per location with 83.22 standard deviation. Farmers retained seed after harvesting, minimum and maximum 50 Kg and 210 Kg seed retained by the farmers respectively, the average retained seed was 154 Kg with 42.49 standard deviation. From these

demonstrations many of the farmers gained knowledge about BRR1 dhan71, minimum 13 and maximum 34 farmers and the average 22 farmers gained were gained knowledge about the variety with the standard deviation 7.29. The farmers who gained knowledge about BRR1 dhan71, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 1 farmer and maximum 12 and the average 6 farmers were motivated with 2.87 standard deviation (Table 110).

Table 111. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan75

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-4.5		4	40.0
	4.6-5.5		5	50.0
	5.6-6.0		1	10.0
	Total		10	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.0	5.6	4.8	0.54
Growth Duration (day)	106	120	113	4.65
Total Production (Kg)	378	747	606	133.11
Retained Seed (Kg)	75	220	160	56.22
K. gained Farmer (No.)	5	50	25	14.87
Motivated Farmer No.)	3	42	19	15.67

Results of BRR1 dhan75

A total of 10 demonstrations were conducted in the different 9 locations under 8 districts of Bangladesh. The minimum yield of BRR1 dhan75 was 4.0 t/ha, the maximum yield was 5.6 t/ha and the average yield was 4.8 t/ha with 0.54 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 and 5.6-6.5 t/ha). The highest yield category (4.6-5.5 t/ha) was found 50.0% locations followed by yield category (4.0-4.5 t/ha), it was 40% locations and the lowest yield category was (5.6-6.0 t/ha) and it was 10% locations. The minimum and maximum growth duration of BRR1 dhan75 was 106 and 120 days respectively and the average growth duration was 113 days with 4.56 standard deviation. Minimum total production 378 Kg, maximum 747 Kg seed were produced and the average 606 Kg seed was produced per location with 133.11 standard deviation. Farmers retained seed after harvesting, minimum and maximum 75 Kg and 220 Kg seed retained by the farmers respectively, the average retained seed was 160 Kg with 56.22 standard deviation. From these demonstrations many of the farmers gained knowledge about BRR1 dhan75, minimum 5 and maximum 50 farmers and the average 25 farmers gained were gained knowledge about the variety with the standard deviation 14.87. The farmers who gained knowledge about BRR1 dhan75, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 3 farmers and maximum 42 and the average 19 farmers were motivated with 15.56 standard deviation (Table 111).

Table 112. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR1 dhan87

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.5-5.5		7	38.9
	5.6-6.0		8	44.4
	6.1-6.5		3	16.7
	Total		18	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.5	6.4	5.6	0.61
Growth Duration (day)	127	140	131	3.82
Total Production (Kg)	601	857	750	81.47
Retained Seed (Kg)	100	300	153	51.20
K. gained Farmer (No.)	10	75	28	16.94
Motivated Farmer No.)	4	60	18	16.41

Results of BRR I dhan87

A total of 18 demonstrations were conducted in the different 9 locations under 8 districts of Bangladesh. The minimum yield of BRR I dhan87 was 4.5 t/ha, the maximum yield was 6.4 t/ha and the average yield was 5.6 t/ha with 0.61 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.5-5.5 t/ha, 5.6-6.0 t/ha and 6.1-6.5 t/ha). The highest yield category (5.6-6.0 t/ha) was found 44.4% locations followed by yield category (4.5-5.5 t/ha) was found 38.9% locations and the lowest yield category (6.1-6.5 t/ha) and it was only 16.7% locations. The minimum and maximum growth duration of BRR I dhan87 was 127 and 140 days respectively and the average growth duration was 131 days with 3.82 standard deviation. Minimum total production 601 Kg, maximum 857 Kg seed were produced and the average 750 Kg seed was produced per location with 81.47 standard deviation. Farmers retained seed after harvesting, minimum and maximum 100 Kg and 300 Kg seed retained by the farmers respectively, the average retained seed was 153 Kg with 51.20 standard deviation. From this demonstration many of the farmers gained knowledge about BRR I dhan87, minimum 10 and maximum 75 farmers and the average 28 farmers gained were gained knowledge about the variety with the standard deviation 16.94. The farmers who gained knowledge about BRR I dhan87, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 60 and the average 18 farmers were motivated with 16.41 standard deviation (Table 112).

Table 113. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRR I dhan94, Aman 2023.

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-4.5		4	50.0
	4.6-5.5		2	25.0
	5.6-6.5		2	25.0
	Total		8	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.0	6.1	4.8	0.80
Growth Duration (day)	124	139	134	5.42
Total Production (Kg)	533	817	638	107.55
Retained Seed (Kg)	40	150	81	39.07
K. gained Farmer (No.)	20	73	42	22.44
Motivated Farmer No.)	5	33	14	9.34

Results of BRR I dhan94

Around 8 demonstrations of BRR I dhan94 were conducted in the different 8 locations under 8 districts of Bangladesh. The minimum yield of BRR I dhan94 was 4.0 t/ha, the maximum yield was 6.1 t/ha and the average yield was 4.8 t/ha with 0.80 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-4.5 t/ha, 4.6-5.5 t/ha and 5.6-6.5 t/ha). The highest yield category (4.0-4.5 t/ha) was found 50% locations followed by yield category (4.6-5.5 t/ha) was found 25% locations followed by yield category was 5.6-6.5 t/ha, it was 25% locations. The minimum and maximum growth duration of BRR I dhan94 was 124 and 139 days respectively and the average growth duration was 134 days with 5.42 standard deviation. Minimum total production 533 Kg, maximum 817 Kg seed were produced and the average 638 Kg seed was produced per location with 107.55 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 150 Kg seed retained by the farmers respectively, the average retained seed was 81 Kg with 39.07 standard deviation. From this demonstration many of the farmers gained knowledge about BRR I dhan94, minimum 20 and maximum 73 farmers and the average 42 farmers gained were gained knowledge about the variety with the standard deviation 22.44. The farmers who gained knowledge about BRR I dhan94, among the farmers some of them were motivated to cultivate this variety in the next

year if the seeds are available in the market in proper time. Minimum 5 farmers and maximum 42 and the average 33 farmers were motivated with 9.34 standard deviation (Table 113).

Table 114. Yield with category, growth duration, total production, retained seed, knowledge gained and motivated farmers of BRRI dhan95 Aman 2023.

Character	Yield Category (t/ha)	Frequency	Percent (%)	
Grain Yield (t/ha)	5.5-6.0	4	57.1	
	6.1-6.5	3	42.9	
	Total	7	100.0	
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	5.8	6.3	6.0	0.17
Growth Duration (day)	129	137	132	2.82
Total Production (Kg)	776	843	806	22.37
Retained Seed (Kg)	40	100	64	22.49
K. gained Farmer (No.)	19	63	43	17.88
Motivated Farmer No.)	12	21	16	3.08

Results of BRRI dhan95

Around 7 demonstrations of BRRI dhan95 were conducted in the different 7 locations under 7 districts of Bangladesh. The minimum yield of BRRI dhan95 was 5.8 t/ha, the maximum yield was 6.3 t/ha and the average yield was 6.0 t/ha with 0.17 standard deviation. From the minimum and maximum yield, the yield was categorized into two category (5.5-6.0 t/ha and 6.1-6.5 t/ha). The highest yield category (5.5-6.0 t/ha) was found 57.1% locations followed by yield category (6.1-6.5 t/ha) was found 42.9% locations. The minimum and maximum growth duration of BRRI dhan95 was 129 and 137 days respectively and the average growth duration was 132 days with 2.82 standard deviation. Minimum total production 776 Kg, maximum 843 Kg seed were produced and the average 806 Kg seed was produced per location with 22.37 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 100 Kg seed retained by the farmers respectively, the average retained seed was 64 Kg with 22.49 standard deviation. From this demonstration many of the farmers gained knowledge about BRRI dhan95, minimum 19 and maximum 63 farmers and the average 43 farmers gained were gained knowledge about the variety with the standard deviation 17.88. The farmers who gained knowledge about BRRI dhan95, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 12 farmers and maximum 21 and the average 16 farmers were motivated with 3.08 standard deviation (Table 114).

Results and discussion

Among the varieties, BRRI dhan95 produced the highest mean grain yield 6.0 t/ha followed by BRRI dhan87 (5.7 t ha⁻¹) (Table 36). The highest grain yield of BRRI dhan95 varied from 5.8-6.3 t/ha in different locations depending on soil fertility, salinity, cropping pattern and management practices.

Table 115. Results of SPDP during Aman, 2023 in the northern districts of Bangladesh

Variety	Mean Growth duration (day)	Mean Grain yield (t/ha)	Total production (kg)	Seeds retained (kg)	Knowledge sharing farmers (no.)	Motivated farmers (no.)
BRRI dhan71	121	5.0	8046	1845	263	77
BRRI dhan75	113	4.8	6060	1603	252	190
BRRI dhan87	132	5.7	9207	1920	371	213
BRRI dhan94	134	4.8	2235	320	74	22
BRRI dhan95	132	6.0	5642	445	304	111
Average/Total	126	5.3	31190	6133	1264	613

Total grain production of BRRi dhan71, BRRi dhan75, BRRi dhan87, BRRi dhan94 and BRRi dhan95 were 8046 kg, 6060 kg, 9207 kg, 2235 kg and 5642 kg respectively. The retained seeds by the participant and associated farmers of BRRi dhan71, BRRi dhan75, BRRi dhan87, BRRi dhan94 and BRRi dhan95 were 1845 kg, 1603 kg, 1920 kg, 320 kg and 445 kg respectively. A total of 31190 kg grains were produced from all demonstrated plots and 6133 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 1264 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 613 farmers were motivated and showed their interest to cultivate these varieties in the next year. All the varieties like BRRi dhan95, BRRi dhan87 and BRRi dhan71 were highly preferred by the farmers for its higher yield. Therefore, they were motivated to cultivate those varieties (Table 115).

Table 116. Minimum, maximum, mean grain yield and standard deviation of different rice varieties cultivated during T. Aman 2023

Variety	Minimum Yield	Maximum Yield	Mean	Std. Deviation
BRRi dhan71	4.1	5.9	5.0	0.62
BRRi dhan75	4.0	5.6	4.8	0.54
BRRi dhan87	4.5	6.4	5.6	0.61
BRRi dhan94	4.0	6.1	4.8	0.80
BRRi dhan95	5.8	6.3	6.0	0.17

Among the three rice varieties (BRRi dhan71, BRRi dhan75, BRRi dhan87, BRRi dhan94 and BRRi dhan95) for maximum yield, BRRi dhan87 gave the highest yield 6.4 t/ha followed by BRRi dhan95 and the yield was 6.3 t/ha and the lowest yield was found in BRRi dhan75, it was 5.6 t/ha. On the contrary, in case of minimum yield BRRi dhan95 gave the highest yield 5.8 t/ha followed by BRRi dhan87, it was 4.5 t/ha and the lowest yield was found in BRRi dhan75 and BRRi dhan94, 4.0 t/ha (Table 116).

2.11 Seed production and dissemination program (SPDP) under PARTNER project during Boro 2023-24

Materials and locations

SPDPs in Boro 2023-24 were conducted in 36 upazilas of 13 districts (Tangail, Netrokona, Jamalpur, Khagrachari, Gaibandha, Sherpur, Satkhira, Gazipur, Manikganj, Munshiganj, Narsingdi, Kishoreganj and Mymensingh) under PARTNER project. Seven modern rice varieties (BRRi dhan99, Bangabandhu dhan100, BRRi dhan101, BRRi dhan102, BRRi dhan104, BRRi dhan105 and BRRi hybrid dhan8) were used in the program. Plot size of each variety was 3 bighas area in a cluster in each block of each upazila. BRRi provided quality seeds, fertilizer, pesticide (Fungicide and insecticide) and signboard while the rest of the managements practices were done by the farmers. A total of 400 demonstrations (Three bigha for one demonstration) were established in four districts of Bangladesh.

Table 117. Results of BRRi dhan99 under PARTNER project during Boro 2024

Character	Yield Category (t/ha)		Frequency	Percent (%)
		6.5-6.8		25
	Total			100
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	6.5	6.8	6.7	0.11
Growth Duration (day)	142	146	144	1.36
Total Production (Kg)	2632	2753	2693	45.35
Retained Seed (Kg)	115	928	458	244.74
K. gained Farmer (No.)	28	65	48	10.08
Motivated Farmer No.)	10	38	25	7.15

Results of BRRi dhan99

Around 25 demonstrations were conducted in the different locations of 25 upazila under 13 Districts of Bangladesh. The minimum yield of BRRi dhan99 was 6.5 t/ha, the maximum yield was 6.8 t/ha and the average yield was 6.5 t/ha with 0.11 standard deviation. From the minimum and maximum yield, the yield was categorized into one category (6.5-6.8 t/ha).

This yield category (6.5-6.8 t/ha) was found 100% locations. The minimum and maximum growth duration of BRRI dhan99 was 142 and 146 days respectively and the average growth duration was 144 days with 1.36 standard deviation. Minimum total production 2632 Kg, maximum 2753 Kg seed were produced and the average 2693 Kg seed was produced per location with 45.35 standard deviation. Farmers retained seed after harvesting, minimum and maximum 115 Kg and 928 Kg seed retained by the farmers respectively, the average retained seed was 458 Kg with 244.74 standard deviation. From this demonstration many of the farmers gained knowledge about BRRI dhan99, minimum 28 and maximum 65 farmers and the average 48 farmers gained were gained knowledge about the variety with the standard deviation 10.08. The farmers who gained knowledge about BRRI dhan99, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 10 farmers and maximum 38 and the average 25 farmers were motivated with 7.15 standard deviation (Table 117).

Table 118. Results of Bangabandhu dhan100 under PARTNER project during Boro 2024

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.5-5.5		21	13.3
	5.6-7.0		101	63.9
	7.1-8.5		36	22.8
	Total		158	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.9	8.2	6.6	0.77
Growth Duration (day)	125	160	147	4.07
Total Production (Kg)	825	5200	2702	399.37
Retained Seed (Kg)	25	1800	306	277.22
K. gained Farmer (No.)	10	204	47	35.05
Motivated Farmer No.)	2	100	20	17.67

Bangabandhu dhan100

Around 158 demonstrations were conducted in the different locations of 36 upazilas under 13 Districts of Bangladesh. The minimum yield of Bangabandhu dhan100 was 4.9 t/ha, the maximum yield was 8.2 t/ha and the average yield was 6.6 t/ha with 0.77 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.5-5.5 t/ha, 5.6-7.0 t/ha and 7.1-8.5 t/ha). The highest yield category (5.6-7.0 t/ha) was found 63.9% followed by the yield category (7.1-8.5 t/ha) was found 22.8% locations. The minimum and maximum growth duration of Bangabandhu dhan100 was 125 and 160 days respectively and the average growth duration was 147 days with 4.07 standard deviation. Minimum total production 825 Kg, maximum 5200 Kg seed were produced and the average 2702 Kg seed was produced per location with 399.37 standard deviation. Farmers retained seed after harvesting, minimum and maximum 25 Kg and 1800 Kg seed retained by the farmers respectively, the average retained seed was 306 Kg with 277.22 standard deviation. From this demonstration many of the farmers gained knowledge about Bangabandhu dhan100, minimum 10 and maximum 204 farmers and the average 47 farmers gained were gained knowledge about the variety with the standard deviation 35.05. Minimum 2 farmers and maximum 100 and the average 20 farmers were motivated with 17.67 standard deviation (Table 118).

Table 119. Results of BRRI dhan101 under PARTNER project during Boro 2023-24

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.5-5.5		2	5.4
	5.6-7.0		25	67.6
	7.1-8.0		10	27.0
	Total		37	100.0

	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.8	7.9	6.7	0.69
Growth Duration (day)	120	154	144	6.11
Total Production (Kg)	2080	3806	2776	306.25
Retained Seed (Kg)	50	1000	332	269.89
K. gained Farmer (No.)	5	183	50	36.61
Motivated Farmer No.)	0	81	21	18.15

BRR1 dhan101

Around 37 demonstrations were conducted in the different locations of 36 upazila under 13 Districts of Bangladesh. The minimum yield of BRR1 dhan101 was 4.8 t/ha, the maximum yield was 7.9 t/ha and the average yield was 6.7 t/ha with 0.69 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.5-5.5, 5.6-7.0 and 7.1-8.0 t/ha). This yield category (5.6-7.0 t/ha) was found 67.6% locations followed by the yield category 7.1-8.0 t/ha, it was 27.7% locations and the lowest yield category 4.5-5.5 t/ha, it was only 5.4% locations. The minimum and maximum growth duration of BRR1 dhan101 was 120 and 154 days respectively and the average growth duration was 144 days with 6.11 standard deviation. Minimum total production 2080 Kg, maximum 3806 Kg seed were produced and the average 2776 Kg seed was produced per location with 306.25 standard deviation. Farmers retained seed after harvesting, minimum and maximum 50 Kg and 1000 Kg seed retained by the farmers respectively, the average retained seed was 332 Kg with 269.89 standard deviation. From this demonstration many of the farmers gained knowledge about BRR1 dhan101, minimum 5 and maximum 183 farmers and the average 50 farmers gained were gained knowledge about the variety with the standard deviation 36.61. The farmers who gained knowledge about BRR1 dhan101, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 0 farmers and maximum 81 and the average 21 farmers were motivated with 18.15 standard deviation (Table 119).

Table 120. Results of BRR1 dhan102 under PARTNER project during Boro 2024

Character	Yield Category (t/ha)	Frequency	Percent (%)	
Grain Yield (t/ha)	4.5-6.0	11	11.5	
	6.1-7.5	42	43.8	
	7.6-9.0	43	44.8	
	Total	96	100.0	
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.7	9.0	7.3	0.90
Growth Duration (day)	125	163	150	4.69
Total Production (Kg)	1903	3644	2971	346.35
Retained Seed (Kg)	40	1325	373	263.18
K. gained Farmer (No.)	10	270	60	63.16
Motivated Farmer No.)	4	110	26	23.50

BRR1 dhan102

Around 96 demonstrations were conducted in the different locations of 36 upazila under 13 Districts of Bangladesh. The minimum yield of BRR1 dhan102 was 4.7 t/ha, the maximum yield was 9.0 t/ha and the average yield was 7.3 t/ha with 0.90 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.5-6.0, 6.1-7.5 and 7.6-9.0 t/ha). This yield category (7.6-9.0 t/ha) was found the highest 44.8% locations followed by the yield category 6.1-7.5 t/ha, it was 43.8% locations and the lowest yield category 4.5-6.0 t/ha, it was only 11.5% locations. The minimum and maximum growth duration of BRR1 dhan102 was

125 and 163 days respectively and the average growth duration was 150 days with 4.69 standard deviation. Minimum total production 1903 Kg, maximum 3644 Kg seed were produced and the average 2971 Kg seed was produced per location with 346.35 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 1325 Kg seed retained by the farmers respectively, the average retained seed was 373 Kg with 263.18 standard deviation. From this demonstration many of the farmers gained knowledge about BRR1 dhan102, minimum 10 and maximum 270 farmers and the average 60 farmers gained were gained knowledge about the variety with the standard deviation 63.16. The farmers who gained knowledge about BRR1 dhan102, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 110 and the average 26 farmers were motivated with 23.50 standard deviation (Table 120).

Table 121. Results of BRR1 dhan104 under PARTNER project during Boro 2024

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	5.0-6.0		8	33.3
	6.1-7.0		10	41.7
	7.1-8.5		6	25.0
	Total		24	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	5.2	8.2	6.5	0.74
Growth Duration (day)	132	154	148	4.07
Total Production (Kg)	2160	3319	2737	333.22
Retained Seed (Kg)	40	1200	253	276.19
K. gained Farmer (No.)	8	250	48	63.62
Motivated Farmer No.)	4	120	21	28.31

BRR1 dhan104

Around 24 demonstrations were conducted in the different locations of 24 upazila under 13 Districts of Bangladesh. The minimum yield of BRR1 dhan104 was 5.2 t/ha, the maximum yield was 8.2 t/ha and the average yield was 6.5 t/ha with 0.74 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (5.0-6.0, 6.1-7.0 and 7.1-8.5 t/ha). This yield category (6.1-7.0 t/ha) was found the highest 41.7% locations followed by the yield category 5.0-6.0 t/ha, it was 33.3% locations and the lowest yield category 7.1-8.5 t/ha, it was only 25.0% locations.

The minimum and maximum growth duration of BRR1 dhan104 was 132 and 154 days respectively and the average growth duration was 148 days with 4.07 standard deviation.

Minimum total production 2160 Kg, maximum 3319 Kg seed were produced and the average 2737 Kg seed was produced per location with 333.22 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 1200 Kg seed retained by the farmers respectively, the average retained seed was 253 Kg with 276.19 standard deviation. From this demonstration many of the farmers gained knowledge about BRR1 dhan104, minimum 8 and maximum 250 farmers and the average 48 farmers gained were gained knowledge about the variety with the standard deviation 63.62. The farmers who gained knowledge about BRR1 dhan104, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 120 and the average 21 farmers were motivated with 28.31 standard deviation (Table 121).

Table 122. Results of BRR1 dhan105 under PARTNER project during Boro 2024

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	5.0-6.5		7	41.2
	6.6-7.0		3	17.6
	7.1-8.0		7	41.2
	Total		17	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation

Yield (t/ha)	5.4	7.6	6.8	0.65
Growth Duration (day)	140	150	148	2.58
Total Production (Kg)	2186	3200	2777	278.52
Retained Seed (Kg)	10	700	240	194.22
K. gained Farmer (No.)	5	200	41	51.95
Motivated Farmer No.)	3	100	21	24.70

BRR1 dhan105

Around 17 demonstrations were conducted in the different locations of 17 upazila under 13 Districts of Bangladesh. The minimum yield of BRR1 dhan105 was 5.4 t/ha, the maximum yield was 7.6 t/ha and the average yield was 6.8 t/ha with 0.65 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (5.0-6.5, 6.6-7.0 and 7.1-8.0 t/ha). Two yield category (5.0-6.5 and 7.1-8.0 t/ha). was found similar and the highest 41.2% locations followed by the yield category 6.6-7.0 t/ha, it was 17.6% locations.

The minimum and maximum growth duration of BRR1 dhan105 was 140 and 150 days respectively and the average growth duration was 148 days with 2.58 standard deviation.

Minimum total production 2186 Kg, maximum 3200 Kg seed were produced and the average 2777 Kg seed was produced per location with 278.52 standard deviation. Farmers retained seed after harvesting, minimum and maximum 10 Kg and 700 Kg seed retained by the farmers respectively, the average retained seed was 240 Kg with 194.22 standard deviation. From this demonstration many of the farmers gained knowledge about BRR1 dhan105, minimum 5 and maximum 200 farmers and the average 41 farmers gained were gained knowledge about the variety with the standard deviation 51.95. The farmers who gained knowledge about BRR1 dhan105, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 3 farmers and maximum 100 and the average 21 farmers were motivated with 24.70 standard deviation (Table 122).

Results and discussion

Among the varieties, BRR1 dhan102 produced the highest mean grain yield 7.5 t/ha followed by Bangabandhu dhan100 and BRR1 dhan105 (6.8 t ha⁻¹) and the lowest mean rice grain yield was 6.5 t/ha found in BRR1 dhan104 followed by 6.6 t/hain BRR1 dhan101 (Table 123). The highest grain yielder, BRR1 dhan102 yield varied from 4.7-9.0 t/hain different locations depending on soil fertility, salinity, cropping pattern and management practices (Table 123). Total grain production of BRR1 dhan99, Bangabandhu dhan100, BRR1 dhan101, BRR1 dhan104 and BRR1 dhan105 were 67333 kg, 68109 kg, 68575 kg, 75469 kg, 65677kg and 126473 kg respectively. The retained seeds by the participant growers and associated farmers of BRR1 dhan99, Bangabandhu dhan100, BRR1 dhan101, BRR1 dhan104 and BRR1 dhan105 were 11462 kg, 11412 kg, 9451kg, 10027kg, 6060 kg and 12730 kg. A total of 471636 kg grains were produced from all demonstrated plots and 61142 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 11208 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 4976 farmers were motivated and showed their interest to cultivate these varieties in the next year. BRR1 dhan102 and BRR1 dhan105 were highly preferred by the farmers for its higher yield. Bangabandhu dhan100 was also preferred by the farmers for its higher paddy production, good taste, quality grain and shorter life cycle that create opportunity to timely establishment of Rabi crops. Therefore, they were motivated to cultivate this variety.

Table 123: Results of SPDP during Boro 2024.

Variety	GY (t ha ⁻¹)	GD (day)	TP (kg)	RS (kg)	KGF (no.)	MF (no.)
BRR1 dhan99	6.7	144	67333	11462	1194	620
Bangabandhu dhan100	6.8	149	68109	11412	2362	1158
BRR1 dhan101	6.6	143	68575	9451	1391	580
BRR1 dhan102	7.5	150	75469	10027	2622	961
BRR1 dhan104	6.5	148	65677	6060	1145	499
BRR1 dhan105	6.8	148	126473	12730	2494	1158
Mean/Total	6.8	147	471636	61142	11208	4976

Table 124. Minimum, maximum, mean grain yield and standard deviation of different rice varieties cultivated during Boro 2023-24 in the country

Variety	Minimum	Maximum	Mean	Std. Deviation
BRRi dhan99	6.5	6.8	6.7	0.11
Bangabandhu dhan100	4.9	8.2	6.6	0.77
BRRi dhan101	4.8	7.9	6.7	0.69
BRRi dhan102	4.7	9.0	7.3	0.90
BRRi dhan104	5.2	8.2	6.5	0.74
BRRi dhan105	5.4	7.6	6.8	0.65

Among the ten rice varieties (BRRi dhan99, Bangabandhu dhan100, BRRi dhan101, BRRi dhan104 and BRRi dhan105) for maximum yield, BRRi dhan102 gave the highest yield 9.0 t/ha followed by Bangabandhu dhan100 and BRRi dhan104 and the yield was 8.2 t/ha and the lowest yield was found in BRRi dhan99, it was 6.8 t/ha followed by BRRi dhan105 and it was 7.6 t/ha. On the contrary, in case of minimum yield of BRRi dhan99 gave the highest yield 6.5 t/ha followed by BRRi dhan105, the yield was 5.4 t/ha and the lowest yield was found in BRRi dhan102, it was 4.7 t/ha followed by BRRi dhan101 and it was 4.8 t/ha (Table 124).

2.12 Special dissemination program on BRRi hybrid in the different locations of Bangladesh

Materials and locations

Special dissemination program on BRRi hybrid dhan8 in Boro 2023-24 was conducted in 36 upazilas of 13 districts (Tangail Netrokona Jamalpur, Khagrachari, Gaibandha, Sherpur, Satkhira, Gazipur, Manikganj, Munshiganj, Narsingdi, Kishoreganj and Mymensingh) under PARTNER project. One BRRi hybrid dhan (BRRi hybrid dhan8) was used in the program. Plot size of each variety was 3 bigha for one demonstration, this 3 bigha area in each upazila in a cluster. BRRi provided quality seeds, fertilizer, pesticides and signboard while the rest of the managements were done by the farmers. A total of 37 demonstrations were established in thirteen districts of Bangladesh.

Table 125. Results of BRRi hybrid dhan8 demonstrated in Boro 2023-24

Character	Yield Category (t/ha)	Frequency		Percent (%)	Total (TP/RS/KGF/MF)
Grain Yield (t/ha)	5.0-6.5	7		18.9	
	6.6-8.0	11		29.7	
	8.1-10	19		51.4	
	Total	37		100.0	
	Descriptive Statistics				
	Minimum	Maximum	Mean	Std. Dev	
Yield (t/ha)	5.0	9.9	7.9	1.30	-
Growth Duration (day)	120	156	145	6.51	-
Total Production (Kg)	2210	5220	3289	542.53	81591
Retained Seed (Kg)	0	0	0	0.00	-
K. gained Farmer (No.)	12	240	62	51.24	1741
Motivated Farmer No.)	4	120	21	24.94	693

BRRi hybrid dhan8

Around 37 demonstrations were conducted in the different locations (36 Upazilas) of 13 districts of Bangladesh. The minimum yield of BRRi hybrid dhan4 was 5.0 t/ha, the maximum yield was 9.9 t/ha and the average yield was 7.9 t/ha with 1.30 standard deviation. From the minimum and maximum yield, the yield, the yield was categorized into three category (5.0-6.5, 6.6-8.0 and 8.1-10.0 t/ha). The yield category (8.1-10.0 t/ha). was found the highest 51.4% locations followed by the yield category 6.6-8.0 t/ha, it was 29.7% locations and the lowest yield category was 5.0-6.5 t/ha, it was 18.9% locations.

The minimum and maximum growth duration of BRRi hybrid dhan8 was 120 and 156 days respectively and the average growth duration was 145 days with 6.51 standard deviation. Minimum total grain production 2210 Kg, maximum 5220 Kg seed were produced and the average 3289 Kg seed was produced per location with 542.53 standard deviation. A total of 81591 kg grains were produced from all the demonstration plots. Farmers did not retained seed after harvesting, as because hybrid seed cannot grow for the next time for crop cultivation. From these demonstrations many of the farmers gained knowledge about BRRi hybrid dhan8, minimum 12 and maximum 240 and the average 62 farmers were gained knowledge about the variety with the standard deviation 51.24. The farmers who gained knowledge about BRRi hybrid dhan8, among the farmers some of them were motivated to cultivate this BRRi hybrid dhan8 in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 120 and the average 34.82 farmers were motivated with 24.94 standard deviation. A total of 51591 kg grains were produced from all the demonstrated plots. About 1741 farmers acquired awareness and gained knowledge about the variety through field visits, discussion and knowledge sharing. A total of 693 farmers were motivated and showed their interest to cultivate BRRi hybrid dhan8 in the next year (Table 125). BRRi hybrid dhan8 were highly preferred by the farmers for its higher grain yield.

2.13 Seed production and dissemination program (SPDP) during Boro 2023-24 under LSTD project

Materials and locations

SPDPs in Boro 2023-24 were conducted in 8 upazilas of 4 districts (Tangail, Mymensingh, Netrokona and Joypurhat) under LSTD project. Seven modern rice varieties (BRRi dhan67, BRRi dhan74, BRRi dhan84, BRRi dhan88, BRRi dhan89, BRRi dhan92 and Bangabandhu dhan100) were used in the program. Plot size of each variety was 3 bighas area in a cluster in each block of each upazila. BRRi provided quality seeds, fertilizer, pesticide (Fungicide and insecticide) and signboard while the rest of the management practices were done by the farmers. A total of 116 demonstrations (Three bigha for one demonstration) were established in four districts of Bangladesh.

Table 126. Results of BRRi dhan67 during Boro 2023-24 under LSTD project

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	3.5-6.5		21	87.5
	6.6-8.5		2	8.3
	8.6-10.0		1	4.2
	Total		24	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	3.8	9.9	5.7	1.21
Growth Duration (day)	137	152	144	3.7
Total Production (Kg)	1579	3960	2287	461.9
Retained Seed (Kg)	0	700	215	224.9
K. gained Farmer (No.)	12	320	87	73.0
Motivated Farmer No.)	10	120	41	29.38

BRRi dhan67

Around 24 demonstrations were conducted in the different locations of 8 upazila under 4 Districts of Bangladesh. The minimum yield of BRRi dhan67 was 3.8 t/ha, the maximum yield was 9.9 t/ha and the average yield was 5.7 t/ha with 1.21 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (3.5-6.5 t/ha, 6.6 – 8.5 t/ha and 8.6 – 10.0 t/ha). Yield category (3.5-6.5 t/ha) was found the highest 87.5% locations followed by yield category (6.6 – 8.5 t/ha), it was found 8.3 % and the lowest yield category (8.6 – 10.0 t/ha), it was found only 4.2% locations. The minimum and maximum growth duration of BRRi dhan67 was 137 and 152 days respectively and the average growth duration was 144

days with 3.71 standard deviation. Minimum seed production 1579 Kg, maximum 3960 Kg seed were produced and the average 2287 Kg seed was produced per location with 461.9 standard deviation. Farmers retained seed after harvesting, minimum and maximum 0 Kg and 700 Kg seed retained by the farmers respectively, the average retained seed was 215 Kg with 224.9 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan67, minimum 12 and maximum 320 farmers were gained knowledge about the variety and the average was 87 with the standard deviation 73.0. The farmers who gained knowledge about BRRi dhan67, among the farmers some were motivated to cultivate this variety in the next year if the seeds are available in the market in time. Minimum 10 farmers and maximum 120 farmers and the average were 841 were motivated with 29.38 standard deviation (Table 126).

Table 127. Results of BRRi dhan74 during Boro 2023-24 under LSTD project

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-5.0		5	50.0
	5.1-6.0		0.0	0.0
	6.1-7.0		5	50.0
	Total		10	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.5	6.5	5.5	1.03
Growth Duration (day)	144	148	147	1.49
Total Production (Kg)	1822	2632	2235	418.42
Retained Seed (Kg)	150	380	257	113.24
K. gained Farmer (No.)	40	71	60	9.22
Motivated Farmer No.)	23	35	27	5.02

BRRi dhan74

Around 10 demonstrations were conducted in the different locations of 8 upazilas under 4 Districts of Bangladesh. The minimum yield of BRRi dhan74 was 4.5 t/ha, the maximum yield was 6.5 t/ha and the average yield was 5.5 t/ha with 1.03 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-5.0 t/ha, 5.1 – 6.0 t/ha and 6.1-7.0 t/ha). Here two yield categories were found, both the category had the similar frequency percentage (4.0-5.0 t/ha and 6.1-7.0 t/ha) was found 50.0%. The minimum and maximum growth duration of BRRi dhan74 was 144 and 148 days respectively and the average growth duration was 147 days with 1.49 standard deviation. Minimum total production 1822 Kg, maximum 2632 Kg seed were produced and the average 2235 Kg seed was produced per location with 418.42 standard deviation. Farmers retained seed after harvesting, minimum and maximum 150 Kg and 380 Kg seed retained by the farmers respectively, the average retained seed was 257 Kg with 113.24 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan74, minimum 40 and maximum 71 farmers and the average 60 farmers gained were gained knowledge about the variety with the standard deviation 9.02. The farmers who gained knowledge about BRRi dhan74, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 23 farmers and maximum 35 and the average 27 farmers were motivated with 5.02 standard deviation (Table 127).

Table 128. Results of BRRi dhan84 during Boro 2023-24) under LSTD project

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.0-5.0		2	14.3
	5.1-6.0		9	64.3
	6.1-7.0		3	21.4
	Total		14	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.1	6.5	5.6	0.72
Growth Duration (day)	136	145	142	2.67
Total Production (Kg)	1648	2510	2242	274.55
Retained Seed (Kg)	40	650	262	227.09
K. gained Farmer (No.)	20	310	94	91.05
Motivated Farmer No.)	4	100	49	42.72

BRRi dhan84

Around 14 demonstrations were conducted in the different locations of 8 upazilas under 4 Districts of Bangladesh. The minimum yield of BRRi dhan84 was 4.1 t/ha, the maximum yield was 6.5 t/ha and the average yield was 5.6 t/ha with 0.72 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.0-5.0 t/ha, 5.1-6.0 t/ha and 6.1-7.0 t/ha). The highest yield category (5.1-6.0 t/ha) was found 64.3% locations followed by yield category (6.1-7.0 t/ha) was found 33.3% locations and the lowest yield category was (4.0-5.0 t/ha), it was 14.3% locations. The minimum and maximum growth duration of BRRi dhan84 was 136 and 145 days respectively and the average growth duration was 142.1 days with 2.67 standard deviation. Minimum total production 1648 Kg, maximum 2510 Kg seed were produced and the average 2242Kg seed was produced per location with 274.55 standard deviation. Farmers retained seed after harvesting, minimum and maximum 40 Kg and 650 Kg seed retained by the farmers respectively, the average retained seed was 262 Kg with 227.09 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan84, minimum 20 and maximum 310 farmers and the average 94 farmers gained were gained knowledge about the variety with the standard deviation 91.05. The farmers who gained knowledge about BRRi dhan84, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 100 and the average 49 farmers were motivated with 42.72 standard deviation (Table 128).

Table 129. Results of BRRi dhan88during Boro 2023-24) under LSTD project

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	4.5-5.5		2	18.2
	5.6-6.5		7	63.6
	6.6-7.5		2	18.2
	Total		11	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	4.5	7.0	5.9	0.81
Growth Duration (day)	137	146	141	2.77
Total Production (Kg)	1822	2820	2409	322.52
Retained Seed (Kg)	30	600	216	177.49
K. gained Farmer (No.)	10	320	65	90.73
Motivated Farmer No.)	4	100	35	40.42

BRRi dhan88

Around 11 demonstrations were conducted in the different locations of 8 upazilas under 4 Districts of Bangladesh. The minimum yield of BRRi dhan88 was 4.5 t/ha, the maximum yield was 7.0 t/ha and the average yield was 5.9 t/ha with 0.81 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (4.5-5.5 t/ha, 5.6-6.5 t/ha and 6.6-7.5 t/ha). The highest yield category (5.6-6.5 t/ha) was found 63.6% locations followed by yield category (4.5-5.5 t/ha and 6.6-7.5 t/ha); similar number of locations was found 18.2%. The minimum and maximum growth duration of BRRi dhan88 was 137 and 146 days respectively and the average growth duration was 141 days with 2.77 standard deviation. Minimum total production 1822 Kg, maximum 2820 Kg seed were produced and the average 2409 Kg seed was produced per location with 322.52 standard deviation. Farmers retained seed after harvesting, minimum and maximum 30 Kg and 600 Kg seed retained by the farmers respectively, the average retained seed was 216 Kg with 177.49 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan88, minimum 10 and maximum 320 farmers and the average 65 farmers gained were gained knowledge about the variety with the standard deviation 90.73. The farmers who gained knowledge about BRRi dhan88, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 4 farmers and maximum 100 and the average 35 farmers were motivated with 40.42 standard deviation (Table 129).

Table 130. Results of BRRi dhan89 during Boro 2023-24 under LSTD project

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	5.0-6.5		4	23.5
	6.6-7.5		8	47.1
	7.6-8.5		5	29.4
	Total		17	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	5.4	8.4	7.1	0.84
Growth Duration (day)	143	158	154	3.56
Total Production (Kg)	2170	3360	2859	346.79
Retained Seed (Kg)	50	600	284	203.42
K. gained Farmer (No.)	15	360	89	105.42
Motivated Farmer No.)	8	100	35	31.49

BRRi dhan89

Around 17 demonstrations were conducted in the different locations of 8 upazilas under 4 Districts of Bangladesh. The minimum yield of BRRi dhan89 was 5.4 t/ha, the maximum yield was 8.4 t/ha and the average yield was 7.1 t/ha with 0.84 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (5.0-6.5 t/ha, 6.6-7.5 t/ha and 7.6-8.5 t/ha). The highest yield category (6.6-7.5 t/ha) was found 47.1% followed by yield category (7.6-8.5 t/ha) was found 29.4% and the lowest yield category (5.0-6.5 t/ha) and it was 23.5% locations. The minimum and maximum growth duration of BRRi dhan89 was 143 and 158 days respectively and the average growth duration was 154 days with 3.56 standard deviation. Minimum total production 2170 Kg, maximum 3360 Kg seed were produced and the average 2859 Kg seed was produced per location with 346.79 standard deviation. Farmers retained seed after harvesting, minimum and maximum 50 Kg and 600 Kg seed retained by the farmers respectively, the average retained seed was 284 Kg with 203.42 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan89, minimum 15 and maximum 360 farmers and the average 89 farmers were gained knowledge about the variety with the standard deviation 105.42. The farmers who gained knowledge about BRRi dhan89, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 8 farmers and maximum 100 and the average 35 farmers were motivated with 31.49 standard deviation (Table 130).

Table 131. Results of BRRi dhan92 during Boro 2023-24 under LSTD project

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	5.0-6.5		6	37.5
	6.6-8.0		6	37.5
	8.1-9.5		4	25.0
	Total		16	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	5.4	9.3	7.2	1.11
Growth Duration (day)	145	162	156	4.13
Total Production (Kg)	2205	3753	2894	447.03
Retained Seed (Kg)	60	710	309	233.28
K. gained Farmer (No.)	15	410	115	128.74
Motivated Farmer No.)	5	130	49	40.90

BRRi dhan92

Around 16 demonstrations were conducted in different locations of 8 upazilas under 4 Districts of Bangladesh. The minimum yield of BRRi dhan92 was 5.5 t/ha, the maximum yield was 9.3 t/ha and the average yield was 7.2 t/ha with 1.11 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (5.0-6.5 t/ha, 6.6-8.0 t/ha and 8.1-9.5 t/ha). The highest yield category (5.0-6.5 t/ha, 6.6-8.0 t/ha) was found 37.5% followed by yield category (5.5-7.0 t/ha) was found 13.1% and the lowest yield category (8.1-9.5 t/ha t/ha)

and it was 25 % locations. The minimum and maximum growth duration of BRRi dhan92 was 145 and 162 days respectively and the average growth duration was 156 days with 4.13 standard deviation. Minimum total production 2205 Kg, maximum 3753 Kg seed were produced and the average 2894 Kg seed was produced per location with 447.03 standard deviation. Farmers retained seed after harvesting, minimum and maximum 60 Kg and 710 Kg seed retained by the farmers respectively, the average retained seed was 309 Kg with 233.28 standard deviation. From this demonstration many of the farmers gained knowledge about BRRi dhan92, minimum 15 and maximum 410 farmers and the average 115 farmers gained were gained knowledge about the variety with the standard deviation 128.74. The farmers who gained knowledge about BRRi dhan92, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 5 farmers and maximum 130 and the average 49 farmers were motivated with 40.90 standard deviation (Table 131).

Table 132. Results of BRRi dhan100 during Boro 2023-24 under LSTD project

Character	Yield Category (t/ha)		Frequency	Percent (%)
Grain Yield (t/ha)	5.5-6.0		6	27.3
	6.1-7.0		10	45.5
	7.1-8.0		6	27.3
	Total		22	100.0
	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Yield (t/ha)	5.8	7.6	6.6	0.61
Growth Duration (day)	136	159	146	5.58
Total Production (Kg)	2320	3069	2650	248.02
Retained Seed (Kg)	50	720	353	237.65
K. gained Farmer (No.)	15	450	138	155.47
Motivated Farmer No.)	6	140	50	45.87

Bangabandhu dhan100

Around 22 demonstrations were conducted in the different locations of 8 upazilas under 4 Districts of Bangladesh. The minimum yield of Bangabandhu dhan100 was 5.8 t/ha, the maximum yield was 7.6 t/ha and the average yield was 6.6 t/ha with 0.61 standard deviation. From the minimum and maximum yield, the yield was categorized into three category (5.5-6.0 t/ha, 6.1-7.0 t/ha and 7.1-8.0 t/ha). The highest yield category (6.1-7.0 t/ha) was found 45.5% followed by the rest two yield category (5.5-6.0 t/ha and 7.1-8.0 t/ha) was found similar 27.3% locations. The minimum and maximum growth duration of Bangabandhu dhan100 was 136 and 159 days respectively and the average growth duration was 146 days with 5.58 standard deviation. Minimum total production 2320 Kg, maximum 2069 Kg seed were produced and the average 2650 Kg seed was produced per location with 248.02 standard deviation. Farmers retained seed after harvesting, minimum and maximum 50 Kg and 720 Kg seed retained by the farmers respectively, the average retained seed was 353 Kg with 237.65 standard deviation. From this demonstration many of the farmers gained knowledge about Bangabandhu dhan100, minimum 15 and maximum 450 farmers and the average 138 farmers gained were gained knowledge about the variety with the standard deviation 155.47. The farmers who gained knowledge about Bangabandhu dhan100, among the farmers some of them were motivated to cultivate this variety in the next year if the seeds are available in the market in proper time. Minimum 6 farmers and maximum 140 and the average 50 farmers were motivated with 45.87 standard deviation (Table 132).

Results and discussion

Among the varieties, BRRi dhan92 produced the highest mean grain yield 7.3 t/ha followed by BRRi dhan89 (7.2 t ha⁻¹) and the lowest mean rice grain yield was 5.6 t/hain BRRi dhan74 followed by 5.7 t/hain BRRi dhan67 (Table 133). The highest grain yielder, BRRi dhan92 yield varied from 5.4-9.3 t/hain different locations depending on soil fertility, salinity, cropping pattern and management practices (Table 134). Total grain production of BRRi dhan67, BRRi dhan74, BRRi dhan84, BRRi dhan88, BRRi dhan89, BRRi dhan92 and Bangabandhu dhan100 were 51629 kg, 96984 kg, 143356 kg, 190832 kg, 247020 kg, 305318 kg and 58292 kg respectively.

The retained seeds by the participant growers and associated farmers of BRRi dhan67, BRRi dhan74, BRRi dhan84, BRRi dhan88, BRRi dhan89, BRRi dhan92 and Bangabandhu dhan100 were 4765 kg, 9570 kg, 14335 kg, 18875 kg, 24375 kg, 31115 kg and 7765 kg respectively. A total of 1093431 kg grains were produced from all demonstrated plots and 110800 kg quality seeds were retained by the farmers as seed for the next year cultivation. About 42739 farmers acquired awareness and knowledge about the varieties through field visits, discussion and knowledge sharing. A total of 18650 farmers were motivated and showed their interest to cultivate these varieties in the next year. BRRi dhan92 and BRRi dhan89 were highly preferred by the farmers for its higher yield. Bangabandhu dhan100 was also preferred by the farmers for its higher paddy production, good taste, quality grain and shorter life cycle that create opportunity to timely establishment of Rabi crops. Therefore, they were motivated to cultivate this variety.

Table 133. Results of SPDP during Boro 2024.

Variety	Mean GY (t ha ⁻¹)	Mean GD (day)	TP (kg)	RS (kg)	KGF (no.)	MF (no.)
BRRi dhan67	5.7	144	51629	4765	2033	929
BRRi dhan74	5.6	147	96984	9570	3901	1727
BRRi dhan84	5.8	142	143356	14335	5557	2576
BRRi dhan88	5.9	141	190832	18875	7238	3314
BRRi dhan89	7.2	154	247020	24375	9107	4009
BRRi dhan92	7.3	156	305318	31115	11868	5044
BRRi dhan100	6.7	147	58292	7765	3035	1096
Mean/Total	6.3	147	1093431	110800	42739	18695

Table 134. Minimum, maximum, mean grain yield and standard deviation of different rice varieties cultivated during Boro 2024.

Variety	Minimum	Maximum	Mean	Std. Deviation
BRRi dhan67	3.8	9.9	5.7	1.21
BRRi dhan74	4.5	6.5	5.5	1.03
BRRi dhan84	4.1	6.5	5.6	0.72
BRRi dhan88	4.5	7.0	5.9	0.81
BRRi dhan89	5.4	8.4	7.1	0.84
BRRi dhan92	5.4	9.3	7.2	1.11
BRRi dhan100	5.8	7.6	6.6	0.61

Among the ten rice varieties (BRRi dhan67, BRRi dhan74, BRRi dhan84, BRRi dhan88, BRRi dhan89, BRRi dhan92 and Bangabandhu dhan100) for maximum yield, BRRi dhan67 gave the highest yield 9.9 t/ha followed by BRRi dhan92 and the yield was 9.3 t/ha and the lowest yield was found in BRRi dhan74 and BRRi dhan84, it was 6.5 t/ha followed by BRRi dhan88 and it was 7.0 t/ha. On the contrary, in case of minimum yield of Bangabandhu dhan100 gave the highest yield 5.8 t/ha followed by BRRi dhan89 and BRRi dhan92, the yield was 5.4 t/ha and the lowest yield was found in BRRi dhan67, it was 3.8 t/ha followed by BRRi dhan84 and it was 4.1 t/ha (Table 134).

2.14 Feedback about BRRi varieties:

Some feedbacks about BRRi varieties provided by the famers from the demonstration sites are given below:

Table 135. feedbacks about BRRi varieties cultivated during 2023-24

SN	Variety	Advantage	Disadvantage
Season: Aus			
1	BRRi dhan83	Good yield, Suitable for both direct seeding and transplanting	bold grain type
2	BRRi dhan98	Higher yield as like as Boro rice, Slender grain, Shorter growth duration	-

3	BRRi hybrid dhan7	Higher yield, Slender grain, Lodging tolerant, Lower growth duration.	Seed can't be stored for next year cultivation.
Season: Aman			
4	BRRi dhan52	Higher yield, bold grain, lodging tolerant and submergence tolerant	Higher pest infestation especially Stem borer and Bacterial blight.
5	BRRi dhan71	Drought tolerant, higher yield, Good yield, short duration, Rabi crop can be grown easily after harvesting.	Bold grain, higher bird and Rice bug attack
6	BRRi dhan75	Fine grain having slight aroma, higher yield with shorter duration Rabi crop easily can be grown after harvesting.	Susceptible to False smut disease
7	BRRi dhan76	Higher yield than local varieties like DudKalam, Sadamota etc.	-
8	BRRi dhan78	Taller plant type, higher yield	-
9	BRRi dhan79	Submergence tolerance. Good yield.	Susceptible to False Smut disease
10	BRRi dhan80	Higher grain yield, long slender grain, looking good.	Insect attack is higher, no aroma
11	BRRi dhan87	Higher grain and straw yield, long slender grain, long panicle, farmers are highly interested, lower sterility.	Having lodging tendency. Susceptible to False smut, BLB, and Sheath blight disease
12	BRRi dhan93	Higher grain yield, attractive colorful grain, Swarna type.	Higher growth duration.
13	BRRi dhan94	Same as like as Indian Swarna.	Good yield
14	BRRi dhan95	Higher yield with shorter growth duration Similar to Indian Swarna.	Satisfactory yield
15	BRRi dhan103	Higher grain and straw yield, long slender grain	-
Season: Boro			
16	BRRi dhan67	Long and slender grain. Better yield. fine grain	salinity tolerate, Susceptible to blast disease
17	BRRi dhan74	Less pest and insect infestation. Higher yield. Lodging tolerant. Shorter growth duration	-
18	BRRi dhan84	Nutrient enriched, Better market price, Short duration	Suceptable to Blast disease
19	BRRi dhan88	Slender grain, Less growth duration	Highly susceptible to Blast
20	BRRi dhan89	Higher yield, Culm is strong and straight, no lodging tendency.	-
21	BRRi dhan92	Higher yield, Long slender grains, Lower pest and insect infestation, this variety grows well with less water.	Longer growth duration
22	BRRi dhan100	Nutrient enriched, less insect and disease attack, short duration	Having lodging tendency
23	BRRi dhan102	Higher grain yield, slender grain	-
24	BRRi dhan104	Long slender grain (Basmati type), having aroma	Higher sterility,
25	BRRi dhan105	Anti-diabetic rice, higher yield, fine grain	Having lodging tendency

3. PROMOTIONAL ACTIVITIES

3.1 Farmers Training

Introduction:

Farmers' trainings is an important tool to train up farmers on updated technologies of modern rice cultivation and encourage them to adopt modern rice varieties and associated technologies for increasing yield at reduced cost of production.

Objectives:

- To update knowledge and skills of farmers and field workers on modern rice varieties and rice production technologies.
- To enhance dissemination of new technologies among the farmers.

Methodology:

Farmers' training is a one-day program. In each training, a total of 30 trainees (about 25-30 farmers and about 0-5 SAAOs) were participated. Farmers' trainings were conducted through the financial support of GoB, TRB and PPNB. It was conducted in different Upazila of Bangladesh with collaboration of DAE. Modern rice varieties and associated rice cultivation technologies are discussed with the help of colorful slides, white board and videos using multimedia projector for easy understanding by the farmers.

Results and discussion

During the reporting period, ARD conducted a total of 44 Farmers' Training at different locations of the country under GoB (27) and projects (15 from PARTNER and 02 from LSTD) from which 1340 trainees (1033 male farmers, 238 female farmers and 69 SAAOs of DAE) participated on modern rice production technologies (Table 136).

Table 136. List of Farmer's training during the period Aus 2023, Aman 2023 and Boro 2024 under GoB, PARTNER and LSTD.

SN	Date	Location	Farmers		SAAO		Total	Funding Source
			Male	Female	Male	Female		
1	30/11/2023	Sadar, Gazipur	30	0	0	0	30	GOB
2	30/11/2023	Sadar, Gazipur	30	0	0	0	30	GOB
3	01/12/2023	Sadar, Gazipur	30	0	0	0	30	GOB
4	01/12/2023	Sadar, Gazipur	27	3	0	0	30	GOB
5	29/12/2023	Pakundia Kishoreganj	25	2	2	1	30	GOB
6	29/12/2023	Pakundia Kishoreganj	25	2	2	1	30	GOB
7	30/12/2023	Sadar, Manikganj	23	4	3	0	30	GOB
8	30/12/2023	Sadar, Manikganj	22	5	2	1	30	GOB
9	17/01/2024	Sirajdikhan Munsiganj	27	0	3	0	30	GOB
10	18/01/2024	Louhajong Munsiganj	24	3	1	2	30	GOB
11	05/03/2024	Kapasia, Gazipur	22	5	2	1	30	GOB
12	06/03/2024	Sreepur, Gazipur	20	7	3	0	30	GOB
13	07/03/2024	Palash, Narsingdi	27	0	2	1	30	GOB
14	08/03/2024	Belabo, Narsingdi	27	0	2	1	30	GOB
15	18/04/2024	Khaliajuri, Netrokona	18	9	3	0	30	GOB
16	19/04/2024	Khaliajuri Netrokona	16	11	3	0	30	GOB
17	22/04/2024	Sonargaon Narayanganj	25	2	0	3	30	GOB
18	24/04/2024	Sonargaon Narayanganj	21	6	2	1	30	GOB
19	05/05/2024	Barhatta, Netrokona	16	11	3	0	30	GOB
20	06/05/2024	Barhatta, Netrokona	21	6	2	1	30	GOB

21	06/05/2024	Barhatta, Netrokona	24	3	3	0	30	GOB
22	13/05/2024	Palashbari, Gaibandha	17	10	2	1	30	GOB
23	13/05/2024	Palashbari, Gaibandha	6	21	3	0	30	GOB
24	14/05/2024	Palashbari, Gaibandha	20	7	2	1	30	GOB
25	14/05/2024	Palashbari, Gaibandha	22	5	2	1	30	GOB
26	15/05/2024	Gobindaganj Gaibandha	21	6	3	0	30	GOB
27	15/05/2024	Gobindaganj Gaibandha	20	7	2	1	30	GOB
28	20/05/2024	Sadar, Joypurhat	28	12	0	0	40	LSTD
29	23/05/2024	Kalai, Joypurhat	22	18	0	0	40	LSTD
30	27/12/2023	Karimganj Kishoreganj	25	5	0	0	30	PARTNER
31	27/12/2023	Karimganj Kishoreganj	25	5	0	0	30	PARTNER
32	28/12/2023	Saturia, Manikganj	29	1	0	0	30	PARTNER
33	28/12/2023	Saturia, Manikganj	25	5	0	0	30	PARTNER
34	17/01/2024	Sirajdikhan Munsiganj	28	2	0	0	30	PARTNER
35	18/01/2024	Louhajong Munsiganj	30	0	0	0	30	PARTNER
36	05/03/2024	Kapasia, Gazipur	18	12	0	0	30	PARTNER
37	06/03/2024	Sreepur, Gazipur	28	2	0	0	30	PARTNER
38	07/03/2024	Palash, Narsingdi	23	7	0	0	30	PARTNER
39	08/03/2024	Belabo, Narsingdi	27	3	0	0	30	PARTNER
40	18/04/2024	Khaliajuri, Netrokona	23	7	0	0	30	PARTNER
41	19/04/2024	Khaliajuri, Netrokona	26	4	0	0	30	PARTNER
42	22/04/2024	Gojaria, Munsiganj	27	3	0	0	30	PARTNER
43	24/04/2024	Gojaria, Munsiganj	21	9	0	0	30	PARTNER
44	05/05/2024	Barhatta, Netrokona	22	8	0	0	30	PARTNER
Total			1033	238	52	17	1340	

3.2 Field day/Farmers' rally:

Objectives:

- 1) To create awareness and interest among farmers, SAAOs, local leaders, elite persons, NGO workers and DAE personnel about BRRI varieties and technologies.
- 2) To promote dissemination and get feedback about BRRI technologies from farmers.

These events are very useful tools for generating awareness and interests among the farmers and concerned extension agents about the modern rice production technologies.

ARD conducted a total of 23 Field days at different locations of the country under PARTNER and LSTD projects. Around 2,300 participants including farmers, local leaders and DAE personnel participated in the field days. These programs also generated much enthusiasm about modern rice production technologies and BRRI varieties, which helped rapid dissemination of technologies (Table 137).

Table 137. List of Field Day during the period Boro 2024 under PARTNER and LSTD.

SN	Date	Location	Funding	Participants
1	18/04/2024	Khaliajuri, Netrokona	PARTNER	100
2	19/04/2024	Khaliajuri, Netrokona	PARTNER	100
3	30/04/2024	Kapasia, Gazipur	PARTNER	100
4	04/05/2024	Sadar, Mymensingh	PARTNER	100
5	05/05/2024	Barhatta, Netrokona	PARTNER	100
6	05/05/2024	Sokhipur, Tangail	PARTNER	100
7	05/05/2024	Palash, Narsingdi	PARTNER	100
8	07/05/2024	Jhinaigati, Sherpur	PARTNER	100

9	08/05/2024	Nalitabari, Sherpur	PARTNER	100
10	12/05/2024	Palashbari, Gaibandha	PARTNER	100
11	13/05/2024	Palashbari, Gaibandha	PARTNER	100
12	15/05/2024	Gobindaganj, Gaibandha	PARTNER	100
13	16/05/2024	Gobindaganj, Gaibandha	PARTNER	100
14	16/05/2024	Madhapur, Tangail	PARTNER	100
15	04/06/2024	Harirampur, Manikganj	PARTNER	100
16	05/06/2024	Sirajdikhan, Munsiganj	PARTNER	100
17	06/06/2024	Saturia, Manikganj	PARTNER	100
18	07/06/2024	Sirajdikhan, Munsiganj	PARTNER	100
19	18/05/2024	Sadar, Joypurhat	LSTD	100
20	19/05/2024	Sadar, Joypurhat	LSTD	100
21	20/05/2024	Mirzapur, Tangail	LSTD	100
22	21/05/2024	Kalai, Joypurhat	LSTD	100
23	22/05/2024	Kalai, Joypurhat	LSTD	100
Total				2300

3.3. Farmer seed center (FSC)

Objectives

1. To increase availability of quality seeds at field level.
2. To build up storage facilities for seeds at farmers' level.
3. To encourage farmers to store quality seeds

A total of 3 farmer's seed centers were established at different project implementing areas of the country. Six plastic drums were supplied by project cost in each center. Around 80 kg seeds were preserved in each drum, as a result a total of nearly 1500 kg seeds were preserved properly by the farmers themselves. Involved and associated farmers used these good quality seeds of promising rice varieties for rapid dissemination through seed exchange or selling among the farmers.

4. QUALITY SEED PRODUCTION

Seed Production at BRRRI Farm

A total of 5270 kg quality seeds of different BRRRI varieties were produced at BRRRI farm during the reporting period for conducting adaptive research trials. Total 1990 kg quality seeds of 8 varieties were produced during T. Aman, 2023 whereas 3280 kg TLS of nine- BRRRI developed rice varieties were produced during Boro 2023-2024 season (Table 138). These seeds were used in different adaptive research trials and SPDPs for rapid dissemination of the varieties.

Table 138. Produced TLS during Aman 2023 and Boro 2023-24 under ARD, in research field of BRRRI, Gazipur

Season: T. Aman 2023		Season: Boro 2024	
Varieties	Seed produced (kg)	Variety	Seed produced (kg)
BRRRI dhan71	300	BRRRI dhan67	400
BRRRI dhan75	250	BRRRI dhan74	250
BRRRI dhan76	90	BRRRI dhan88	240
BRRRI dhan87	300	BRRRI dhan89	350
BRRRI dhan90	200	BRRRI dhan92	350
BRRRI dhan93	150	BRRRI dhan96	300
BRRRI dhan95	200	BRRRI dhan100	450
BRRRI dhan103	500	BRRRI dhan102	640
		BRRRI dhan104	300
Sub-total	1990	Sub-total	3280
Grand Total			5270