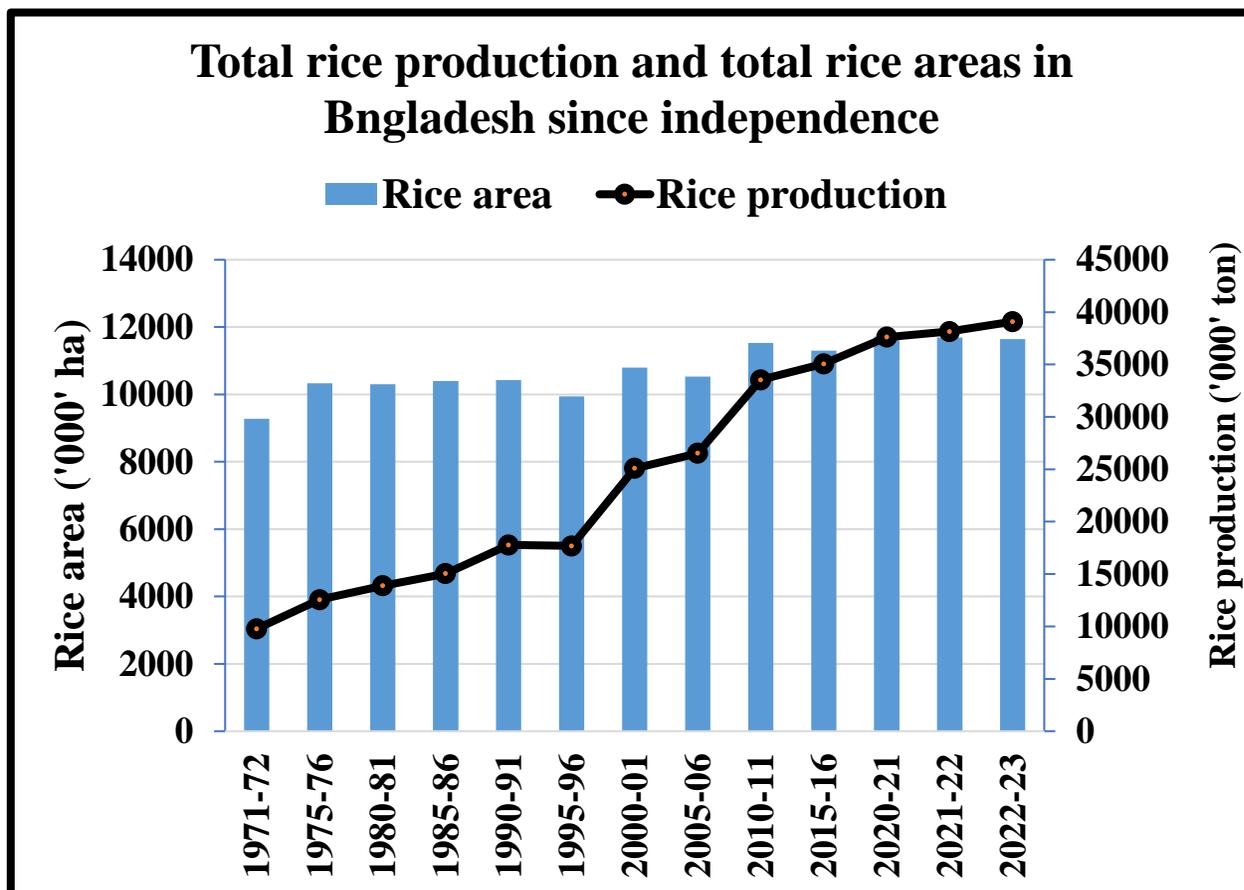


ANNUAL RESEARCH REVIEW WORKSHOP

2023-2024



XV. AGRICULTURAL ECONOMICS DIVISION



Bangladesh Rice Research Institute (BRRI)
Gazipur-1701

AGRICULTURAL ECONOMICS DIVISION

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SUMMARY

The first study covers adoption status of different rice varieties grown in Bangladesh. Data were collected from 14 agricultural regionals DAE office in 2023-24. This study also covered three seasons like, Aus, T. Aman, and Boro. Study found that, the adoption of modern varieties was 95.30, 89.64, and 99.71% in Aus, T. Aman, and Boro seasons, of which coverage of BRRI released varieties were about 74.63, 58.85, and 59.24%, respectively. BRRI dhan48 ranked the top position (46.28%) in the Aus season in terms of area coverage, followed by BRRI dhan85 (5.36%). The coverage of Indian varieties in the T. Aman season was about 16.24% which was 19.78% in 2022-23. On the other hand, BRRI dhan28 and BRRI dhan29 were still the most dominant varieties in the Boro season, covering 16.34% of areas. However, both the varieties accounted for 41.25% of areas in 2021-22. In addition, BRRI dhan89 in Boro season, is getting popularity in all the regions of Bangladesh and covered 13.07% Boro season area on average in Bangladesh. In terms of yield, BRRI dhan102 produced the highest yield (5.50 ton/ha) in the Aus season whereas, in T. Aman and Boro seasons, it was BRRI dhan53 (5.76 ton/ha) and BRRI dhan92 (6.64 ton/ha), respectively. BRRI hybrid dhan2 and BRRI hybrid dhan3 yielded the highest which was 7.70 ton/ha whereas the average hybrids' yield was 7.43 ton/ha in the Boro season.

According to DAE report, area under BRRI variety has been increased from 8.02% in 2014 to 50.44% in 2024 in T. Aman season at Tanore upazilla of Rajshahi district. In 2014, area coverage of Indian varieties was more than 60% which is declining over the time. The most popular variety was BRRI dhan51 (47.51%) due to higher yield. Indian variety covered more than 49% area in 2024. In Boro season area of coverage of BRRI variety was 27.50% in 2014 which reached at 3.31% in 2023. Other MVs like BRAC 576 covered almost 25% area in 2023. Most popular variety BRRI dhan28 lost demand over the time and in 2023 area coverage of this variety was nil. In Boro season, Zirashail become a most popular variety due to higher price higher yield and demand. BRAC 576 and 65 dhan also gained popularity due to higher yield, slender grain, short duration suitable for potato cultivation and also high market price and demand. Some BINA varieties were found covering very minimum areas. In our survey report, area coverage of T. Aman variety was closer to DAE report (46.67% & 50.44%, respectively).

During the Aman season, BRRI dhan80 and BRRI dhan93 exhibited the highest rates of change, reaching approximately 233% and 166%, respectively. BRRI dhan49 and BRRI dhan94 demonstrated an increasing trend. But the area coverage of BRRI dhan71 and BRRI dhan87 decreased over the time. It is also observed that, non-demonstrated old variety like BR10, BR11, BR22 and BR23 are still covering large areas because of good yield and good taste. In addition to this, BR22 has short plant, strong root system that prevent from lodging, the grain is small and slender, suitable for low land. In Boro season, farmers have significantly increased the cultivation of BRRI dhan74, BRRI dhan92 and BRRI dhan100 with an increase in the area by 436%, 209% and 220%, respectively in 2023. On the other hand, the area coverage under BRRI dhan67, BRRI dhan81 decreased over time. The area of BRRI hybrid dhan8 decreased due to unavailability of seed. The farmers in the study area got demonstration for the first time in 2023 for BRRI dhan102 and BRRI dhan105. Since from the very beginning, BRRI has been performing demonstration programs all over the country. To find out the effect of the demonstration program on rice variety adoption and food production, a study was conducted in Habiganj and Feni district. The most popular demonstrated varieties in Aus season are BRRI dhan48, BRRI dhan85, BRRI dhan96, BRRI dhan98 and BRRI hybrid dhan7. But the farmers changed their attitude regarding variety selection when they have alternative options. After certain period of time one popular variety was replaced by other better variety. Higher yield, fine and slender grain, and less pest attack are the major factors for selecting a variety.

Estimation of cost and return in crop production is essential for researchers and planners to develop technologies and policies that increase farmers' returns by reducing costs. This study has been undertaken to assess the level of inputs used, the cost of rice cultivation at the farm and profitability of MV Aus, MV T. Aman, and MV Boro rice cultivation at the farm level. Farmers used more seeds than recommend amount. They are dependent on hired labor due to shortage of family labor. Farmers did not use balanced and recommended fertilizer dose because of inappropriate knowledge. Most farmers used power threshers on a custom-hired basis for threshing paddy. Costs of production of T. Aman, Aus and Boro rice production was 135598, 135058 and 151633Tk/ha, respectively. Per kg production cost in T. Aman, Aus, and Boro season was Tk. 25, 24, and 26 respectively. The per hectare gross margin for Boro rice was Tk. 63,490, followed by T. Aman (Tk. 61,194) and Aus (Tk. 56,513). The benefit-cost ratio (BCR) based on full-cost calculation was highest for Boro (1.26) and T. Aman (1.26), followed by Aus (1.24), reflecting the profitability of rice cultivation in all three seasons.

Rice farmers in the country often face significant welfare losses due to market price fluctuations as well as declining farm gate prices. Understanding the dynamics behind the welfare losses is essential for developing sustainable agricultural policies and interventions aimed at improving farmers' economic resilience. Therefore, this research aimed to assess the paddy producers' welfare loss based on actual market price and government declared procurement price in the Boro season. The findings of this study ensuring paddy market price positively influence rice supply in Bangladesh. Other positively influential factors are rice area, yield, pesticide use, and agricultural credit. The government should ensure these factors for maintaining surplus rice production. Moreover, farmers had to sell paddy for less than the declared procurement price, which impacted their surplus. However, from the initiation of the COVID-19 pandemic, farmers are getting better price (more than the declared

procurement price) and gaining surplus. Therefore, ensuring better farm gate price is essential for the betterment of the farmers.

The last study used three-period panel data and data were collected from the International Food Policy Research Institute (IFPRI). IFPRI conducted three periods (2011-12, 2015 and 2018-19) surveys covering 6,500 rural households in each which were nationally representative sample in Bangladesh. Out of 6,500 rural households, we selected 4,093 rural households in each period to achieve the goal of the study. Poisson's fixed effect model was used to achieve the set objective. This study found that nutrition security Household Dietary Diversity Score (HDDS) was significantly increased due to the reduction of the poverty gap among households over the short and long-run periods. However, nutrition security in terms of HDDS decreases by 3.70% from one period (2011/12 to 2015) to another period (2015 to 2018-19). It might be due to less consumption of different food groups. And a higher inflation rate prevails in the 2015 to 2018-19 period compared to 2011-12 to 2015. The analysis shows that the production diversity score, male members and female members in the households, access to information, and asset index significantly increased nutrition security. In the following statement emphasizes the need for a comprehensive policy framework to combat poverty and enhance food and nutrition security in Bangladesh. Key components include: 1) Economic growth and employment generation. 2) Price stabilization for essential commodities. 3) Improved access to affordable credit. 4) Enhanced social and political accountability.

PROGRAM AREA I: RURAL INSTITUTION & ECONOMIC CONSEQUENCES

PROJECT 1: FARM LEVEL ADOPTION AND EVALUATION OF MODERN RICE CULTIVATION IN BANGLADESH

MS Islam, MA Islam, MC Rahman, MS Rahaman, L Deb, and SA Jui

Introduction

Rice is the staple food in Bangladesh, which provides about 55 and 75% of the total protein and calories of the daily human diet (Siddique et al., 2016). About 75% of the total cropped area is devoted to rice cultivation in the country (BBS 2022). Bangladesh Rice Research Institute has developed 115 high-yielding modern varieties (MVs) along with 8 hybrids for different production environments, which contributed to attaining rice self-sufficiency in Bangladesh. The adoption rate of the cultivated modern varieties (MVs) differs substantially in different regions and seasons in Bangladesh. The study has been designed to verify the adoption status and performance of different rice varieties with the following specific objectives;

- determine the region-wise adoption rate of different rice varieties in different seasons; and
- assess the yield of diverse rice varieties in different regions and seasons.

Methodology

Secondary data have been collected from 14 agricultural regions of Bangladesh. Data were collected in three seasons namely, Aus, T. Aman, and Boro. Rice varietal adoption data of 64 districts during 2023-24 were collected from the Additional Director's (AD) office of the Department of Agricultural Extension (DAE) (see **Figure 1** for details). Finally, data were compiled and analyzed using descriptive statistics.

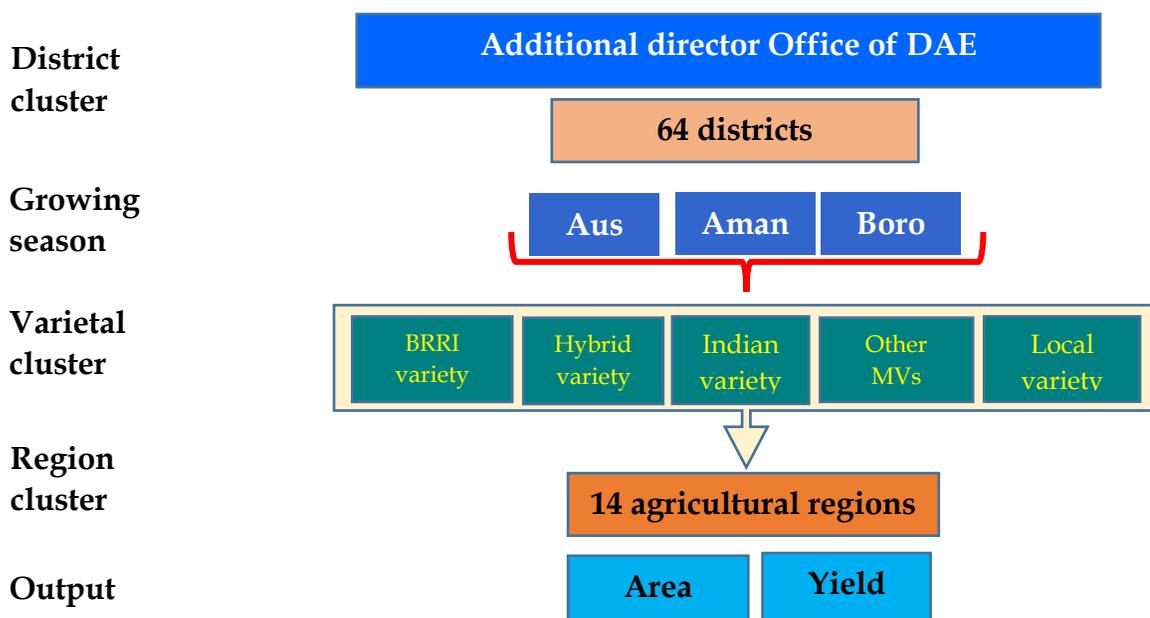


Figure 1: Flow diagram of methodology of the study

Results and discussion

Varietal adoption

Aus season

The adoption of modern varieties (MVs) in Aus season was about 95.30%, which was recorded as 94.23% in 2022-23. The adoption of BRRI varieties was approximately 74.63%, exceeding the previous year (2021-22) at 74.48%. This increase can be attributed to the expansion of Indian and All Other Modern Varieties (MVs) rice cultivation areas. The highest adoption (93.73%) of BRRI varieties was observed in the Mymensingh region (R10), while the lowest (21.66%) was recorded in the

Rangamati region (R12). Among all BRRi varieties, BRRi dhan48 ranked in the top position (46.28%) regarding area coverage, followed by BRRi dhan85 (5.36%), BRRi dhan98 (4.66%). The coverage of other MVs, Indian, and hybrids in the Aus season were about 8.93, 6.57, and 5.17%, respectively. Results also revealed that area coverage of traditional varieties was about 5.17% in Aus season (Table 1).

Table 1: Adoption (%) of different Aus rice varieties by agricultural regions of Bangladesh, 2023-24

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	BD
Inbred BRRi total	70.87	69.63	79.78	92.64	90.22	80.14	60.31	60.84	55.86	93.49	64.59	21.66	70.24	92.69	74.55
BR2	1.56	0.00	0.18	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49
BR3	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.03
BR9	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
BR11								0.03							0.002
BR12	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
BR14	0.07	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.00	0.08
BR16	0.00	0.00	0.09	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
BR20	0.00	0.00	0.10	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
BR21	0.08	1.75	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.55	0.23
BR24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.03
BR26	1.85	0.82	1.17	0.69	0.74	0.04	1.30	0.59	3.03	4.14	0.22	0.00	0.24	4.24	1.19
BRRi dhan27	5.80	0.93	3.48	0.10	0.00	0.00	1.37	0.06	1.10	0.00	0.00	0.00	0.00	0.76	1.31
BRRi dhan28	0.06	7.05	3.48	1.14	0.61	18.13	0.27	1.77	0.88	1.91	2.56	0.00	8.78	3.19	2.91
BRRi dhan29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.02
BRRi dhan30	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
BRRi dhan33	0.00	0.00	0.16	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
BRRi dhan42	0.74	0.00	2.83	0.17	0.00	0.02	2.30	0.00	0.00	0.00	0.11	0.00	0.78	1.12	0.56
BRRi dhan43	0.74	0.00	8.25	0.42	0.17	0.28	5.47	0.00	0.00	0.00	0.00	0.00	0.10	1.17	1.07
BRRi dhan47	0.00	0.00	11.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91
BRRi dhan48	53.75	40.18	30.20	52.61	63.64	45.38	34.27	47.12	38.47	73.38	34.81	16.54	46.44	55.22	46.28
BRRi dhan50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.04
BRRi dhan55	0.87	0.05	3.31	0.15	0.74	0.22	4.50	0.77	3.48	0.68	1.62	0.00	0.10	2.80	1.21
BRRi dhan56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.63	0.00	0.00	0.00	0.65
BRRi dhan58	0.00	0.00	0.00	1.09	0.74	1.74	0.00	0.02	0.00	0.00	0.00	0.00	0.55	0.00	0.31
BRRi dhan65	0.04	0.20	0.00	0.14	0.09	0.00	2.21	0.00	0.01	0.00	6.45	0.00	0.29	0.50	1.05
BRRi dhan74	0.00	0.00	0.00	0.84	0.00	3.36	0.00	1.64	0.00	0.00	0.01	0.00	1.51	0.00	0.59
BRRi dhan75	0.00	0.00	0.23	0.00	0.05	0.00	0.00	0.00	0.00	0.00	3.81	0.00	0.00	0.00	0.55
BRRi dhan82	2.73	2.42	3.19	5.87	4.78	5.11	3.27	2.26	2.15	3.69	3.51	1.51	4.00	6.57	3.85
BRRi dhan83	0.84	0.10	1.62	0.61	2.56	0.00	2.33	0.10	0.26	0.12	0.00	1.69	0.13	1.45	0.66
BRRi dhan85	0.90	7.23	7.67	13.00	10.35	0.96	1.88	2.16	0.67	5.30	4.07	1.64	3.60	7.48	5.36
BRRi Dhan90	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
BRRi dhan92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.005
BRRi dhan95	0.00	0.00	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
BRRi dhan96	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.02
BRRi dhan98	0.66	8.31	1.97	12.05	5.75	4.89	0.00	3.93	5.82	4.27	1.92	0.27	2.28	7.04	4.66
BRRi dhan100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.09	0.00	0.00	0.00	0.02
BRRi dhan102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRRi dhan106	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRRi Hybrid total	0.04	0.00	0.06	0.04	0.32	0.07	0.00	0.07	0.42	0.21	0.04	0.01	0.41	0.05	0.09
BRRi hybrid dhan2	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRRi hybrid dhan7	0.04	0.00	0.06	0.04	0.32	0.07	0.00	0.07	0.42	0.21	0.04	0.01	0.41	0.05	0.08
All BRRi varieties	70.91	69.63	79.84	92.68	90.55	80.20	60.31	60.91	56.28	93.70	64.63	21.66	70.65	92.74	74.63
All Hybrid varieties	0.07	2.68	5.87	4.88	3.05	17.53	0.07	6.96	7.40	0.84	2.65	6.09	24.58	0.06	5.17
All Indian varieties	0.00	3.29	0.00	0.01	0.00	0.36	0.00	26.83	7.03	0.00	17.47	0.00	0.00	0.00	6.57
All other MVs	24.31	13.89	6.47	2.39	3.50	1.85	3.49	4.87	2.14	5.23	14.22	0.75	4.77	6.65	8.93
BINA total	1.32	10.92	0.34	1.87	3.50	1.85	3.18	4.13	1.72	5.23	8.22	0.75	4.68	6.65	3.89
Bina dhan10	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
Bina dhan11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.005
Bina dhan14	0.04	0.62	0.00	0.00	0.03	0.00	0.00	0.16	0.00	0.00	0.17	0.00	0.48	0.00	0.10
Bina dhan17	0.00	0.00	0.02	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.16	0.00	0.00	0.00	0.03
Bina dhan19	1.14	6.89	0.28	1.23	3.20	1.27	3.08	3.05	1.59	4.48	6.97	0.47	3.47	4.44	2.97

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	BD
Bina dhan20	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
Bina dhan21	0.12	1.84	0.03	0.60	0.25	0.58	0.10	0.91	0.04	0.73	0.91	0.27	0.73	2.21	0.72
Bina dhan22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0007
Bina dhan24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.0007
Bina dhan7	0.00	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.06
Iratom24	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
Other MVs	22.99	2.96	6.13	0.51	0.00	0.00	0.31	0.73	0.42	0.00	5.99	0.00	0.09	0.00	5.04
All MVs total	95.29	89.48	92.17	99.95	97.10	99.94	63.86	99.56	72.85	99.77	98.96	28.50	100.00	99.45	95.30
All LVs total	4.71	10.52	7.83	0.05	2.90	0.06	36.14	0.44	27.15	0.23	1.04	71.50	0.00	0.55	4.70
Grand Total	100	100	100												

Note: R = Region, R1= Barishal, R2= Bogura, R3=Chattogram, R4= Cumilla, R5= Dhaka, R6= Dinajpur, R7= Faridpur, R8= Jashore, R9=Khulna, R10= Mymensingh, R11= Rajshahi, R12= Rangamati, R13= Rangpur, R14= Sylhet and BD=Bangladesh, Source: DAE 2023-24.

Districts covered by the regions

Region 1 (Barishal): Barishal, Barguna, Bhola, Jhalokhati, Patuakhali, and Pirojpur;

Region 2 (Bogura): Bogura, Joypurhat, Pabna and Sirajganj;

Region 3 (Chattogram): Chattogram, Cox's Bazar, Feni, Laxmipur and Noakhali;

Region 4 (Cumilla): Cumilla, B.Barua, and Chandpur;

Region 5 (Dhaka): Dhaka, Gazipur, Kishoreganj, Manikganj, Munshiganj, Narshingdi, Narayanganj, and Tangail;

Region 6 (Dinajpur): Dinajpur, Panchagarh and Thakurgaon;

Region 7 (Faridpur): Faridpur, Gopalganj, Madaripur Rajbari and Shariatpur;

Region 8 (Jashore): Kushtia, Chuadanga, Jashore, Jhenaidah, Meherpur, and Magura;

Region 9 (Khulna): Khulna, Bagerhat, Narail and Satkhira;

Region 10 (Mymensingh): Mymensingh, Jamalpur, Netrakona and Sherpur;

Region 11 (Rajshahi): Rajshahi, C.Nawabganj, Naogaon, and Natore;

Region 12 (Rangamati): Rangamati, Bandarban and Khagrachari;

Region 13 (Rangpur): Rangpur, Gaibandha Kurigram, Lalmonirhat, and Nilphamari;

Region 14 (Sylhet): Sylhet, Habiganj, Moulvibazar and Sunamganj.

T. Aman season

The adoption of modern varieties (MVs) in T. Aman season was about 89.64%. Adoption of BRRI varieties was 58.85%, which was higher than 2022-23 (57.24%). Although adoption of BRRI varieties seemed low, it was substantially higher in some regions like Cumilla (R4), Sylhet (R14), and Dhaka (R5), where BRRI varieties covered 85.44, 83.05, and 81.09%, respectively. BRRI dhan49 covered the highest area in T. Aman season covering 11.46% of the total T. Aman area. Area coverage of BRRI dhan49 in some regions like Dhaka (R5) (33.15%), Mymensingh (R10) (22.76%), and Sylhet (R14) (27.39%) were remarkable. However, the coverage of BR22 was about 3.38% of the total T. Aman areas. Adoption of this variety is decreasing but still popular in Cumilla and Sylhet regions covering 22.18 and 10.59% areas respectively. Adoption of BRRI dhan34 was only 3.93% of the total T. Aman areas. However, this variety occupied comparatively larger area in Dinajpur (R6) (19.78%), Rajshahi (R11) (4.82%), and Mymensingh (R10) (2.88%) regions. Coverage of BRRI dhan75 was only 5.81% of the total T. Aman areas. This variety occupied comparatively larger area in Faridpur (R7) (17.24%), Jashore (R8) (16.15%), Bagura (R2) (8.66%), and Khulna (R9) (8.62%) regions. Similarly, coverage of BRRI dhan87 was only 7.54% of the total T. Aman areas. This variety occupied relatively larger area in Faridpur (R7) (19.60%), Jashore (R8) (15.58%), Khulna (R9) (12.39%), and cumilla (R4) (11.96%) regions. On average, Indian varieties covered 16.24% of areas in T. Aman season. Notably, the adoption of Indian varieties in border regions like Jashore, Dinajpur, Bogura, and Rajshahi was relatively high (19.69 to 43.51% of total areas). In comparison, the area coverage of local rice varieties in the Aman season was 10.36% (**Table 2**).

Table 2: Adoption (%) of different T. Aman rice varieties by agricultural regions of Bangladesh, 2023-24

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	BD
Inbred BRRi total	56.02	48.64	68.62	85.40	80.65	42.45	66.68	56.43	65.87	55.58	49.76	71.69	40.18	82.98	58.66
BR2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BR10	0.00	0.00	0.17	0.44	0.00	0.00	0.00	0.07	10.90	0.00	0.00	0.36	0.00	0.61	0.66
BR11	8.66	0.72	3.48	0.89	1.16	0.23	0.21	0.10	2.37	0.88	0.00	7.34	6.99	6.36	3.11
BR22	4.79	0.90	6.42	22.18	4.58	0.00	0.01	0.00	0.52	2.35	0.00	1.33	0.00	10.59	3.38
BR23	10.87	0.10	5.65	3.73	0.58	0.00	0.01	0.04	11.13	0.65	0.01	0.59	0.00	3.65	3.02
BR25	0.00			0.21	5.96					0.15		5.10			0.37
BR26	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
BRRi dhan28	0.00	0.01	0.00	0.00	0.04	0.00	0.17	0.00	0.00	0.05	0.01	0.00	0.04	0.00	0.02
BRRi dhan29	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.02
BRRi dhan30	0.04	0.00	0.09	0.00	0.02	0.00	0.00	0.08	4.89	0.00	0.03	1.14	0.00	0.00	0.29
BRRi dhan31	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
BRRi dhan32	0.08	0.09	0.33	4.69	0.38	0.00	0.00	0.00	0.00	2.06	0.00	0.40	0.04	2.58	0.65
BRRi dhan33	0.02	0.37	0.98	0.00	0.04	0.00	5.09	1.02	0.07	0.04	0.11	2.24	0.21	0.11	0.44
BRRi dhan34	0.11	2.80	0.02	0.82	0.80	19.78	0.29	0.12	0.10	2.88	4.82	0.19	1.34	1.30	2.93
BRRi dhan36	0.00	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
BRRi dhan37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRRi dhan39	0.01	0.69	0.58	0.34	0.20	0.00	10.82	1.47	0.47	0.61	0.85	4.41	0.20	1.14	0.88
BRRi dhan40	1.91	0.00	2.15	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	1.13	0.00	0.06	0.47
BRRi dhan41	0.98	0.00	1.42	0.11	0.04	0.00	0.05	0.00	0.03	0.13	0.00	1.09	0.01	0.28	0.32
BRRi dhan44	1.22	0.00	0.22	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.26	0.20
BRRi dhan46	0.09	0.00	0.79	5.33	0.09	0.00	0.00	0.00	0.00	0.16	0.00	0.34	0.00	1.29	0.40
BRRi dhan47	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
BRRi dhan48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.01
BRRi dhan49	2.46	13.45	15.05	18.80	33.15	1.96	5.37	6.93	6.66	22.76	3.99	15.06	2.80	27.39	11.46
BRRi dhan51	0.74	2.55	3.11	0.99	4.30	6.53	1.86	10.07	0.51	4.59	17.08	2.27	2.46	4.99	4.67
BRRi dhan52	16.28	1.16	12.30	1.33	1.77	1.12	1.56	0.54	2.86	3.02	0.10	3.76	5.98	5.38	5.23
BRRi dhan53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.001
BRRi dhan54	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.00
BRRi dhan56	0.02	0.07	0.00	0.00	0.00	0.02	0.42	0.03	0.00	0.04	0.00	0.90	0.26	0.05	0.07
BRRi dhan57	0.00	0.00	0.01	0.00	0.00	0.02	0.32	0.12	0.00	0.00	0.03	0.15	0.18	0.01	0.05
BRRi dhan58	0.01	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
BRRi dhan62	0.04	0.07	0.01	0.00	0.03	0.01	0.14	0.16	0.08	0.12	0.00	0.00	0.04	0.24	0.07
BRRi dhan64	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
BRRi dhan65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.006
BRRi dhan66	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
BRRi dhan67	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.01
BRRi dhan70	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.05	0.00	0.00	0.26	0.07	0.00	0.02
BRRi dhan71	0.08	0.95	0.55	0.15	0.47	0.02	0.51	2.19	0.38	4.50	0.20	2.25	1.37	0.58	1.07
BRRi dhan72	0.46	0.10	1.18	0.06	0.27	0.03	1.25	0.24	0.33	0.66	0.01	0.37	0.44	0.70	0.45
BRRi dhan73	0.09	0.00	0.15	0.02	0.00	0.00	0.00	0.09	0.13	0.00	0.00	0.54	0.01	0.00	0.05
BRRi dhan74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.01
BRRi dhan75	0.52	8.66	3.07	5.34	7.44	2.14	17.24	16.15	8.62	3.73	6.93	6.61	5.01	4.03	5.81
BRRi dhan76	3.16	0.03	0.55	0.01	0.00	0.02	0.09	0.00	0.96	0.01	0.00	0.15	0.00	0.02	0.51
BRRi dhan77	0.92	0.00	0.16	0.00	0.00	0.00	0.03	0.00	0.02	0.01	0.00	0.00	0.04	0.00	0.14
BRRi dhan78	0.50	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.03	0.01	0.00	0.11
BRRi dhan79	0.00	0.01	0.07	0.00	0.00	0.00	0.01	0.00	0.06	0.01	0.00	0.12	0.08	0.11	0.03
BRRi dhan80	0.00	0.38	0.78	0.91	1.21	0.13	0.22	0.73	0.81	0.26	0.32	1.48	0.73	0.21	0.48
BRRi dhan82	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.05	0.00	0.14	0.01
BRRi dhan83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00
BRRi dhan85	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.08	0.00	0.00	0.01
BRRi dhan87	1.60	8.08	6.84	11.96	16.13	1.76	19.60	15.58	12.39	4.49	7.47	8.40	5.11	7.34	7.54
BRRi dhan89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRRi dhan90	0.00	4.67	0.05	0.07	0.20	3.52	0.14	0.39	0.13	0.21	5.42	0.03	0.26	0.61	1.17
BRRi dhan91	0.00	0.00	0.00	0.07	0.00	0.00	0.24	0.00	0.08	0.05	0.01	0.47	0.02	0.00	0.03
BRRi dhan92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
BRRi dhan93	0.10	0.28	0.76	1.66	0.51	4.03	0.29	0.03	0.30	0.15	0.62	1.60	3.01	0.61	1.02
BRRi dhan94	0.01	0.01	0.32	1.91	0.42	0.48	0.06	0.07	0.08	0.10	0.47	0.01	1.74	0.87	0.47
BRRi dhan95	0.20	0.99	1.03	3.30	0.65	0.63	0.18	0.05	0.39	0.27	0.95	0.91	1.69	1.46	0.83
BRRi dhan98	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRRi dhan100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.07
BRRi dhan103	0.00	0.01	0.00	0.01	0.05	0.00	0.00	0.00	0.10	0.00	0.00	0.02	0.03	0.00	0.01
BRRi dhan105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0001	0.00	0.00	0.00	0.00	0.00007
BRRi Hybrid total	0.01	0.29	0.02	0.03	0.44	0.02	0.51	0.23	0.54	0.43	0.01	0.07	0.16	0.07	0.18
BRRi hybrid dhan4	0.00	0.07	0.01	0.03	0.16	0.00	0.00	0.09	0.15	0.05	0.00	0.03	0.08	0.03	0.05
BRRi hybrid dhan6	0.01	0.23	0.01	0.00	0.28	0.02	0.51	0.15	0.39	0.38	0.01	0.04	0.09	0.05	0.14

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	BD
<i>All BRRI varieties</i>	<i>56.04</i>	<i>48.93</i>	<i>68.64</i>	<i>85.44</i>	<i>81.09</i>	<i>42.47</i>	<i>67.19</i>	<i>56.66</i>	<i>66.40</i>	<i>56.01</i>	<i>49.77</i>	<i>71.76</i>	<i>40.35</i>	<i>83.05</i>	<i>58.85</i>
<i>All Hybrid varieties</i>	<i>0.12</i>	<i>7.15</i>	<i>2.41</i>	<i>2.32</i>	<i>6.02</i>	<i>10.31</i>	<i>10.41</i>	<i>11.68</i>	<i>8.53</i>	<i>16.91</i>	<i>1.82</i>	<i>2.63</i>	<i>12.22</i>	<i>0.15</i>	<i>7.03</i>
<i>All Indian varieties</i>	<i>2.31</i>	<i>25.17</i>	<i>7.84</i>	<i>0.00</i>	<i>2.04</i>	<i>43.51</i>	<i>0.26</i>	<i>19.69</i>	<i>3.16</i>	<i>6.41</i>	<i>34.70</i>	<i>12.52</i>	<i>39.97</i>	<i>1.98</i>	<i>16.24</i>
Guti swarna	2.31	10.80	0.00	0.00	0.81	17.93	0.26	15.53	2.11	2.37	31.68	0.00	28.71	0.75	9.71
Swarna5	0.00	5.21	0.00	0.00	0.00	22.19	0.00	0.00	0.00	0.00	0.00	0.00	3.06	0.00	2.63
<i>All other MVs</i>	<i>1.71</i>	<i>17.19</i>	<i>10.47</i>	<i>6.30</i>	<i>3.19</i>	<i>3.37</i>	<i>13.34</i>	<i>11.63</i>	<i>4.95</i>	<i>10.22</i>	<i>7.90</i>	<i>9.64</i>	<i>5.30</i>	<i>6.56</i>	<i>7.52</i>
BINA total	0.51	10.64	0.62	6.08	3.19	3.34	13.29	10.41	4.41	5.23	7.45	7.20	4.44	6.37	5.11
Bina dhan10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.01	0.01	0.00	0.001
Bina dhan11	0.07	0.03	0.02	0.08	0.14	0.01	0.29	0.09	0.18	0.50	0.02	0.87	0.23	0.64	0.18
Bina dhan12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.63	0.00	0.00	0.03
Bina dhan13	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
Bina dhan14	0.0001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00007
Bina dhan15	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.001
Bina dhan16	0.01	0.01	0.01	0.03	0.04	0.01	0.07	0.18	0.08	0.06	0.01	0.41	0.12	0.30	0.07
Bina dhan17	0.18	7.31	0.40	2.11	1.96	3.08	8.94	6.89	1.69	1.90	5.34	0.91	2.98	1.63	2.96
Bina dhan19	0.02	0.03	0.00	0.05	0.01	0.00	0.00	0.00	0.03	0.05	0.01	0.02	0.00	0.00	0.01
Bina dhan20	0.11	0.15	0.02	0.20	0.24	0.07	0.34	0.08	0.21	0.38	0.03	1.35	0.15	0.24	0.17
Bina dhan21	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.001
Bina dhan22	0.01	0.20	0.01	0.53	0.00	0.00	0.34	0.68	0.07	0.01	0.25	0.00	0.09	0.99	0.21
Bina dhan23	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.004
Bina dhan25	0.00	0.00	0.0001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00007
Bina dhan7	0.10	2.92	0.16	3.06	0.81	0.17	3.32	2.48	2.03	2.33	1.79	0.01	0.86	2.56	1.46
Other MVs	1.19	6.54	9.84	0.22	0.00	0.02	0.05	1.22	0.54	4.99	0.44	2.44	0.86	0.19	2.41
<i>All MVs total</i>	<i>60.17</i>	<i>98.44</i>	<i>89.35</i>	<i>94.06</i>	<i>92.34</i>	<i>99.66</i>	<i>91.19</i>	<i>99.66</i>	<i>83.04</i>	<i>89.55</i>	<i>94.19</i>	<i>96.55</i>	<i>97.83</i>	<i>91.74</i>	<i>89.64</i>
<i>All LVs total</i>	<i>39.83</i>	<i>1.56</i>	<i>10.65</i>	<i>5.94</i>	<i>7.66</i>	<i>0.34</i>	<i>8.81</i>	<i>0.34</i>	<i>16.96</i>	<i>10.45</i>	<i>5.81</i>	<i>3.45</i>	<i>2.17</i>	<i>8.26</i>	<i>10.36</i>
Grand Total	100														

Note: R = Region, R1= Barishal, R2= Bogura, R3=Chattogram, R4= Cumilla, R5= Dhaka, R6= Dinajpur, R7= Faridpur, R8= Jashore, R9=Khulna, R10= Mymensingh, R11= Rajshahi, R12= Rangamati, R13= Rangpur, R14= Sylhet and BD=Bangladesh, Source: DAE 2023-24.

Boro season

The adoption of modern rice varieties (MVs) in 2023-24 was 99.71% of total Boro areas, of which 59.24% of areas was covered by BRRI varieties. BRRI dhan28 and BRRI dhan29 were the mega varieties in this season. The area coverage of the two varieties was about 16.34% in 2023-24, whereas those two varieties' adoption was about 26.49% in the year 2022-23. The adoption of those two varieties has been decreasing gradually due to disease (Blast) susceptibility. Besides, overall adoption of recently released BRRI dhan89 was about 13.07% and was also notable in the regions of Dhaka (23.96%), Bogura (18.77%), Dinajpur (17.44%), Sylhet (16.17%) Mymensingh (14.78%), Cumilla (14.69%), and Faridpur (13.09% of total areas). On the other hand, the overall adoption of hybrid and Indian varieties were about 29.04 and 7.72%, respectively (Table 3). Again, significant adoption (28.83%) was recorded for BRRI dhan74 in the Barishal region, while the coverage of this variety was around 7% for other regions (Table 3).

Table 3: Adoption (%) of different Boro rice varieties by agricultural regions of Bangladesh, 2023-24

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	BD
Inbred BRRI total	54.01	60.41	48.80	77.67	81.09	63.09	52.22	53.28	33.23	61.01	32.19	43.27	53.61	69.44	59.09
BR2	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
BR3	0.09	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.02
BR11	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00007
BR12	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.001
BR14	0.00	0.00	0.25	0.00	0.16	0.00	0.00	0.00	0.00	0.04	0.00	0.00	2.48	0.17	0.30
BR15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.004
BR16	0.00	0.38	0.69	0.45	0.00	4.12	0.00	0.00	0.00	0.03	0.00	0.23	1.90	0.00	0.52
BR17	0.0001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00007
BR19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01
BR26	0.00	0.00	0.01	0.01	0.09	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.17	0.07
BRRI dhan28	4.38	8.32	3.95	6.33	6.20	7.75	2.77	3.97	7.37	7.41	3.79	4.19	6.10	5.63	5.95
BRRI dhan29	2.32	11.03	2.94	11.47	27.03	19.46	8.57	0.80	0.34	13.11	4.11	2.31	6.87	10.28	10.39
BRRI dhan33	0.00	0.41	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.02	0.00	0.06

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	BD
BRRi dhan36	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.03	0.00	0.00	0.13
BRRi dhan39	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.01
BRRi dhan45	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.04	0.01
BRRi dhan47	1.45	0.00	0.15	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
BRRi dhan48	0.00	0.00	0.61	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.02	0.00	0.15	0.11
BRRi dhan49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.003
BRRi dhan50	0.17	0.29	0.08	0.72	0.46	0.41	1.02	13.05	1.05	0.06	0.12	0.94	0.31	0.51	1.34
BRRi dhan55	0.13	0.00	0.48	0.01	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.15	0.02	0.16	0.05
BRRi dhan57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.001
BRRi dhan58	0.36	2.21	2.78	5.41	3.33	2.45	5.45	3.84	1.00	3.97	1.29	4.45	3.23	2.72	3.03
BRRi dhan59	0.11	0.01	0.01	0.03	0.00	0.00	0.07	0.00	0.00	0.06	0.00	0.04	0.00	0.00	0.02
BRRi dhan60	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.01	0.00	0.00	0.19	0.00	0.02
BRRi dhan61	0.09	0.01	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
BRRi dhan62	0.00	0.02	0.13	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
BRRi dhan63	0.00	0.09	0.04	0.40	0.16	0.04	0.51	6.30	1.75	0.10	0.44	0.24	0.13	0.17	0.72
BRRi dhan64	0.41	0.01	0.04	0.01	0.01	0.00	0.09	0.00	0.03	0.18	0.02	0.00	0.02	0.12	0.07
BRRi dhan65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.0007
BRRi dhan66	0.00	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00007
BRRi dhan67	7.31	0.03	4.49	0.57	0.06	0.00	1.02	0.13	5.97	0.59	0.00	0.80	0.03	0.36	1.08
BRRi dhan68	0.09	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.02	0.03
BRRi dhan69	0.20	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.59	0.20	0.06	0.05
BRRi dhan70	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
BRRi dhan72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.0007
BRRi dhan74	28.83	1.87	7.71	6.35	1.13	2.86	4.24	4.27	1.99	1.84	0.65	6.39	0.00	2.26	3.65
BRRi dhan75	0.00	0.00	2.60	0.12	0.00	0.00	0.00	0.00	0.00	0.00	3.30	0.32	0.00	0.00	0.40
BRRi dhan76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.004
BRRi dhan77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.00	0.80
BRRi dhan81	0.16	2.30	0.16	1.25	0.48	1.09	1.70	5.32	1.65	0.83	2.07	0.90	1.24	0.75	1.43
BRRi dhan84	0.64	0.51	0.43	0.40	0.71	0.14	1.09	0.48	1.02	1.12	0.70	0.87	0.82	1.89	0.81
BRRi dhan86	0.15	0.19	0.21	0.18	0.09	0.00	0.00	0.49	0.22	0.09	0.54	0.42	0.46	0.19	0.23
BRRi dhan87	0.00	0.00	0.05	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.005
BRRi dhan88	0.37	3.78	3.33	8.71	5.37	1.60	2.26	2.20	3.70	10.74	1.86	3.83	2.68	10.28	5.14
BRRi dhan89	4.95	18.77	6.99	14.69	23.96	17.44	13.09	5.76	2.77	14.78	6.43	7.14	9.25	16.17	13.07
BRRi dhan90	0.00	1.16	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	1.97	0.00	0.00	0.00	0.28
BRRi dhan92	0.46	5.76	6.96	10.53	8.15	4.63	8.03	3.33	1.33	3.49	2.66	4.14	6.18	12.44	5.97
BRRi dhan93	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00007
BRRi dhan94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.001	0.00	0.00	0.00	0.00	0.00007
BRRi dhan96	0.26	0.25	0.32	5.51	0.60	0.00	0.10	0.28	0.11	0.52	0.02	0.44	0.27	1.74	0.79
BRRi dhan97	0.09	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.01	0.12	0.00	0.00	0.04
BRRi dhan98	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0007
BRRi dhan99	0.03	0.00	0.17	0.03	0.00	0.00	0.00	0.00	0.54	0.00	0.01	0.21	0.00	0.00	0.04
BRRi dhan100	0.77	2.12	2.00	3.51	3.02	0.36	1.47	3.01	2.09	1.41	0.90	3.16	2.59	2.89	2.15
BRRi dhan101	0.00	0.05	0.01	0.02	0.01	0.00	0.03	0.01	0.01	0.00	0.00	0.04	0.13	0.01	0.02
BRRi dhan102	0.03	0.07	0.11	0.02	0.04	0.10	0.05	0.06	0.05	0.01	0.12	0.11	0.37	0.03	0.08
BRRi dhan104	0.02	0.02	0.01	0.01	0.00	0.03	0.05	0.00	0.00	0.00	0.05	0.00	0.02	0.02	0.02
BRRi dhan105	0.00	0.01	0.00	0.01	0.00	0.00	0.12	0.00	0.01	0.00	0.00	0.02	0.02	0.01	0.01
BRRi dhan107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.001	0.00	0.00	0.00	0.00	0.00007
BRRi dhan108	0.00	0.0001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0001	0.00	0.00	0.00	0.00	0.00001
BRRi Hybrid total	0.19	0.07	0.03	0.12	0.21	0.02	1.20	0.07	0.18	0.04	0.30	0.04	0.07	0.10	0.15
BRRi hybrid dhan1	0.00	0.00	0.00	0.00	0.05	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
BRRi hybrid dhan2	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.001
BRRi hybrid dhan3	0.10	0.01	0.00	0.09	0.10	0.01	0.86	0.01	0.05	0.02	0.00	0.00	0.00	0.02	0.06
BRRi hybrid dhan5	0.07	0.05	0.02	0.00	0.05	0.01	0.22	0.04	0.11	0.02	0.00	0.01	0.03	0.02	0.04
BRRi hybrid dhan7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.002
BRRi hybrid dhan8	0.00	0.01	0.01	0.02	0.00	0.01	0.10	0.01	0.03	0.00	0.30	0.00	0.02	0.06	0.04
All BRRi varieties	54.19	60.47	48.82	77.79	81.30	63.11	53.42	53.35	33.41	61.06	32.50	43.31	53.67	69.54	59.24
All Hybrid varieties	37.38	11.21	49.26	21.17	17.90	20.07	43.89	16.28	58.61	38.36	8.78	52.03	44.04	28.89	29.04
All Indian varieties	1.62	11.92	0.14	0.00	0.02	16.47	0.00	28.61	5.45	0.02	43.73	0.00	0.06	0.00	7.72
Zirasail	0.00	6.17	0.00	0.00	0.00	9.84	0.00	0.10	0.04	0.00	40.41	0.00	0.06	0.00	4.10
All other MVs	5.69	15.80	1.72	0.98	0.44	0.36	1.76	1.76	2.47	0.50	14.98	4.62	2.00	0.87	3.71
BINA total	4.45	0.76	0.92	0.98	0.28	0.16	1.48	1.76	2.47	0.34	1.13	4.52	0.38	0.86	1.00
Bina dhan10	3.45	0.01	0.68	0.33	0.02	0.00	0.53	0.40	1.61	0.03	0.00	0.18	0.04	0.36	0.38
Bina dhan12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.52	0.00	0.00	0.02
Bina dhan14	0.04	0.03	0.01	0.02	0.02	0.01	0.17	0.34	0.15	0.06	0.11	0.11	0.15	0.09	0.09
Bina dhan17	0.00	0.04	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.67	0.00	0.00	0.00	0.06
Bina dhan18	0.03	0.02	0.01	0.00	0.00	0.00	0.08	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.01

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	BD
Bina dhan24	0.03	0.01	0.01	0.03	0.05	0.01	0.01	0.05	0.24	0.09	0.00	0.00	0.00	0.17	0.06
Bina dhan25	0.11	0.62	0.04	0.57	0.18	0.14	0.59	0.95	0.39	0.14	0.35	0.63	0.19	0.24	0.33
Bina dhan5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.07	0.00	0.00	0.005
Bina dhan7	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.002
Bina dhan8	0.77	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.04
Iratom24	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Other MVs	1.24	15.04	0.79	0.00	0.16	0.20	0.28	0.00	0.00	0.17	13.85	0.09	1.62	0.01	2.71
All MVs total	98.87	99.40	99.94	99.93	99.65	100.00	99.06	100.00	99.94	99.94	99.98	99.96	99.78	99.30	99.71
All LVs total	1.13	0.60	0.06	0.07	0.35	0.00	0.94	0.00	0.06	0.06	0.02	0.04	0.22	0.70	0.29
Grand Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Note: R = Region, R1= Barishal, R2= Bogura, R3=Chattogram, R4= Cumilla, R5= Dhaka, R6= Dinajpur, R7= Faridpur, R8= Jashore, R9=Khulna, R10= Mymensingh, R11= Rajshahi, R12= Rangamati, R13= Rangpur, R14= Sylhet and BD=Bangladesh, Source: DAE 2023-24.

Yield of modern rice varieties

Aus season

In the Aus season, the average yield of inbred BRRi varieties was about 4.25 ton/ha; among them, BRRi dhan102 produced the highest yield (5.50 ton/ha) and BRRi dhan92 ranked the second position with an average yield of 5.45 ton/ha, respectively. Prominent BRRi variety like BRRi dhan48 did not perform well in terms of yield potentiality in all regions which reduced the average yield. The yield performance of the hybrid varieties was 5.49 ton/ha. Indian varieties yield was 4.56 ton/ha in this season. The average yield of all MVs in the Aus season was 4.67 ton/ha (Table 4).

Table 4: Average yield (t/ha) of different Aus rice varieties by agricultural regions of Bangladesh, 2023-24.

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	Av.
Inbred BRRi total	3.91	4.23	4.13	4.39	4.37	4.81	3.76	4.76	4.21	4.08	5.06	4.21	4.15	3.65	4.25
BR2	3.97		3.64	4.12											3.94
BR3	3.95													3.03	3.49
BR9				4.12											4.12
BR11								4.30							4.30
BR12	4.32														4.32
BR14	3.89		3.93										4.47		3.99
BR16			3.66	4.20			3.79								3.83
BR20			4.18	3.83											3.95
BR21	3.45	4.40	3.98								3.48			2.50	3.39
BR24														3.33	3.33
BR26	3.88	4.19	3.87	4.06	3.86	4.39	3.53	4.73	4.09	3.71	4.90		3.79	3.28	3.93
BRRi dhan27	3.72	4.16	3.93	3.41			3.70	4.39	4.17					3.03	3.82
BRRi dhan28	3.79	4.21	3.97	4.32	3.50	4.59	3.64	4.67	4.15	4.17	4.79		3.94	3.76	4.17
BRRi dhan29													4.56		4.56
BRRi dhan30							3.96								3.96
BRRi dhan33			4.31				3.88								4.09
BRRi dhan42	3.58		3.85	4.07		4.86	3.66				5.42		3.26	3.03	3.82
BRRi dhan43	3.86		3.72	4.41	3.85	4.52	3.94						3.26	3.31	3.86
BRRi dhan47			4.41												4.41
BRRi dhan48	4.14	4.29	4.47	4.70	4.52	4.86	3.86	4.80	4.28	4.24	5.13	3.80	4.22	4.15	4.42
BRRi dhan50								4.30							4.30
BRRi dhan55	3.86	4.39	4.15	4.39	4.52	4.71	3.59	4.93	4.16	3.64	5.00		4.06	3.83	4.20
BRRi dhan56											4.85				4.85
BRRi dhan58				4.47	5.17	5.00		4.85					3.89		4.72
BRRi dhan65	3.76	4.02		3.98	3.72		3.71		4.02		5.26		4.34	3.33	4.00
BRRi dhan74				4.48		5.59		4.68			4.55		5.15		4.81
BRRi dhan75			4.55		4.05						5.36				4.65
BRRi dhan82	4.10	4.24	4.21	4.51	4.50	4.90	3.83	4.79	4.12	4.11	5.08	4.11	3.93	4.27	4.35
BRRi dhan83	3.93	4.11	3.96	4.08	4.19		3.75	4.97	4.08	3.64		4.63	3.33	3.91	4.13
BRRi dhan85	4.00	4.27	4.30	4.53	4.58	4.86	3.83	4.77	4.44	4.18	5.13	4.52	4.08	3.60	4.37
BRRi Dhan90		4.05													4.05
BRRi dhan92													5.45		5.45
BRRi dhan95			4.55												4.55
BRRi dhan96				4.64				4.85							4.74
BRRi dhan98	4.27	4.43	4.51	4.94	4.69	4.79		4.84	4.28	4.36	5.35	3.97	4.42	4.34	4.60
BRRi dhan100								4.21			5.42				4.82

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	Av.
BRR1 dhan102											5.50				5.50
BRR1 dhan106					4.55										4.55
BRR1 Hybrid total	5.18		5.40	5.87	6.21	5.52		5.83	5.30	5.37	5.66	2.92	5.46	5.20	5.41
BRR1 hybrid dhan2	4.65														4.65
BRR1 hybrid dhan7	5.35		5.40	5.87	6.21	5.52		5.83	5.30	5.37	5.66	2.92	5.46	5.20	5.43
<i>All BRR1 varieties</i>	3.98	4.23	4.17	4.47	4.44	4.85	3.76	4.78	4.34	4.18	5.11	4.13	4.24	3.75	4.31
<i>All Hybrid varieties</i>	5.32	5.09	5.78	5.69	5.46	5.54	5.16	5.67	5.21	4.26	5.96	5.12	5.38	5.63	5.49
<i>All Indian varieties</i>		3.93		4.44		4.61		4.78	4.29		4.62				4.56
<i>All other MVs total</i>	3.82	4.01	4.11	4.39	4.04	4.93	3.88	4.64	4.12	4.02	5.03	3.26	4.01	3.87	4.18
BINA total	4.02	3.95	4.11	4.51	4.04	4.93	3.95	4.76	4.22	4.02	5.06	3.26	4.02	3.87	4.24
Bina dhan10	3.68														3.68
Bina dhan11									4.41						4.41
Bina dhan14	3.86	3.48			4.45			4.85			5.76		4.33		4.38
Bina dhan17			3.64	4.02				4.85			4.85				4.34
Bina dhan19	4.10	4.07	4.17	4.61	4.10	5.02	3.89	4.70	4.09	4.08	4.90	3.47	3.89	3.89	4.24
Bina dhan20					4.24										4.24
Bina dhan21	4.32	4.02	4.18	4.50	3.74	4.83	4.08	4.79	4.09	3.94	5.08	2.93	4.20	3.85	4.24
Bina dhan22									4.70						4.70
Bina dhan24										4.05					4.05
Bina dhan7		3.80									5.15				4.25
Iratom24	3.03														3.03
Other MVs	3.65	4.16	4.11	3.62			3.64	4.37	3.90		4.95		3.92		3.99
<i>All MVs total</i>	4.05	4.34	4.49	4.87	4.57	5.21	3.87	5.20	4.62	4.16	5.29	4.53	4.89	3.89	4.67
<i>All LVs total</i>	2.16	2.84	2.20	2.95	1.98	2.88	1.93	2.13	2.57	2.06	3.14	2.04		1.90	2.21
All average	3.59	4.10	4.14	4.77	4.38	5.16	3.08	5.02	4.18	3.98	5.06	3.03	4.89	3.45	4.26

Note: R = Region, R1= Barishal, R2= Bogura, R3=Chattogram, R4= Cumilla, R5= Dhaka, R6= Dinajpur, R7= Faridpur, R8= Jashore, R9=Khulna, R10= Mymensingh, R11= Rajshahi, R12= Rangamati, R13= Rangpur, R14= Sylhet and BD=Bangladesh, Source: DAE 2023-24.

T. Aman season

Among BRR1 varieties, BRR1 dhan53 was the top yielder (5.76 ton/ha), followed by BRR1 dhan64 (5.68 ton/ha), BR26 (5.40 ton/ha), and BRR1 dhan29 (5.26 ton/ha) in T. Aman season. On the other hand, the average yield of BINA varieties, hybrids, and Indian varieties were 4.61, 5.81, and 4.67 ton/ha, respectively. The average yield of BRR1 inbred varieties was 4.58 ton/ha. Widely adopted BRR1 varieties average yield was lower due to lower yield of some regions. This season's overall yield of modern varieties (MVs) was 4.95 ton/ha (Table 5).

Table 5: Average yield (t/ha) of different T. Aman rice varieties by agricultural regions of Bangladesh, 2023-24.

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	Av.
Inbred BRR1 total	4.22	4.86	4.58	4.42	4.56	4.95	4.55	5.00	4.55	4.40	5.02	4.62	4.51	4.41	4.58
BR2		4.85													4.85
BR10			4.62	4.20				4.74	4.42			4.14		4.09	4.43
BR11	4.32	4.13	4.50	3.61	4.27	5.06	4.35	5.45	4.35	4.34		4.47	4.42	4.55	4.44
BR22	4.18	4.80	4.44	4.39	4.52		4.78		4.38	4.25		4.28	4.47	4.47	4.42
BR23	4.18	4.51	4.41	4.38	4.17		4.39	4.33	4.57	3.82	5.00	4.24	4.39	4.47	4.32
BR25	3.83			4.30						4.22		4.39			4.23
BR26							5.40								5.40
BRR1 dhan28		4.55			5.41		3.79			4.14	4.65		4.47		4.50
BRR1 dhan29		5.42					4.92				5.42				5.26
BRR1 dhan30	3.86		4.41		4.37			4.55	4.35		4.92	4.45			4.36
BRR1 dhan31	3.94											4.20			4.03
BRR1 dhan32	4.12	5.21	4.46	4.08	4.05					4.41		4.26	4.62	4.22	4.33
BRR1 dhan33	3.76	4.62	4.66		4.29		4.47	4.85	4.31	4.08	4.70	4.23	4.30	4.55	4.44
BRR1 dhan34	3.70	4.36	3.91	3.89	3.74	4.14	3.90	4.24	4.42	3.97	3.85	4.39	3.88	4.23	4.00
BRR1 dhan36		5.03													5.03
BRR1 dhan37		5.18													5.18
BRR1 dhan39	3.44	4.88	4.44	4.34	4.30		4.62	4.75	4.21	4.45	4.77	4.19	4.36	4.43	4.47
BRR1 dhan40	4.10		4.42		4.24		4.85			4.85		4.47		4.55	4.36
BRR1 dhan41	4.15		4.40	4.13	4.65		4.36		4.57	4.42		4.71	4.39	4.14	4.36
BRR1 dhan44	4.06		4.60	4.36								4.67		4.34	4.28
BRR1 dhan46	3.99		4.39	4.17	4.48					4.62		4.70		4.35	4.41

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	Av.
BRRi dhan47			4.55												4.55
BRRi dhan48								4.55							4.55
BRRi dhan49	4.37	4.82	4.64	4.77	4.78	5.06	4.62	5.03	4.44	4.67	5.14	4.54	4.44	4.55	4.70
BRRi dhan51	4.12	4.92	4.47	4.36	4.50	5.15	4.58	5.08	4.43	4.54	5.74	4.68	4.59	4.17	4.64
BRRi dhan52	4.43	4.85	4.61	4.35	4.58	5.20	4.60	4.91	4.34	4.60	5.17	4.60	4.70	4.55	4.66
BRRi dhan53												5.76			5.76
BRRi dhan54	4.27								4.30			4.85			4.42
BRRi dhan56	4.44	4.81			4.29	4.55	4.67	4.85		4.09	4.70	4.67	4.42	4.55	4.57
BRRi dhan57	4.39	5.30	3.94	3.79	4.42	4.39	4.57	4.59			4.69	5.45	4.50	4.55	4.60
BRRi dhan58	4.33				5.48										4.90
BRRi dhan62	3.95	4.96	4.09	4.55	4.60	4.24	4.15	4.90	4.39	4.28			4.07	4.35	4.37
BRRi dhan64		5.68													5.68
BRRi dhan65												4.61			4.61
BRRi dhan66		4.55	4.21									4.36	4.05		4.24
BRRi dhan67							4.85		4.48						4.60
BRRi dhan70	4.85	5.08		4.17	4.02	4.70			4.36		4.85	4.67	4.60		4.59
BRRi dhan71	4.07	4.78	4.53	4.17	4.43	4.98	4.48	5.04	4.41	4.43	4.90	3.78	4.46	4.34	4.49
BRRi dhan72	4.30	4.13	4.72	4.27	4.44	4.77	4.63	5.26	4.39	4.42	4.82	4.85	4.58	4.39	4.56
BRRi dhan73	4.08		4.46	4.27					4.80	4.32			4.54	4.47	4.34
BRRi dhan74									4.85			4.85			4.85
BRRi dhan75	4.30	4.99	4.56	4.68	4.78	5.00	4.66	5.16	4.42	4.50	5.14	4.52	4.57	4.39	4.69
BRRi dhan76	4.29	4.89	4.39	4.42		5.15	4.77		4.48	3.94		4.44		4.55	4.52
BRRi dhan77	4.40		4.51			5.30	4.92		4.55	4.55			4.24		4.52
BRRi dhan78	4.17		4.54			4.91			4.40				4.21	4.18	4.37
BRRi dhan79	5.15	4.77	4.54		5.68		3.94		4.85	3.79		5.04	4.44	4.55	4.62
BRRi dhan80		4.89	4.49	4.55	4.76	4.96	4.67	5.01	4.41	4.30	5.00	4.96	4.51	4.45	4.70
BRRi dhan82	4.55		4.55					3.88		4.29			4.64		4.41
BRRi dhan83													4.32		4.32
BRRi dhan85	4.58	4.85			4.61						5.08	4.52			4.72
BRRi dhan87	4.62	5.06	4.91	4.94	5.07	5.19	4.76	5.40	4.58	4.70	5.40	5.15	4.68	4.48	4.93
BRRi dhan89	4.09														4.09
BRRi dhan90	4.76	4.92	4.91	4.77	4.45	4.60	4.44	4.94	4.52	4.31	4.84	4.52	4.75	4.34	4.63
BRRi dhan91				4.39				4.70	3.83	4.65	4.36	4.80	4.11	4.17	4.47
BRRi dhan92										4.47					4.47
BRRi dhan93	4.48	5.20	5.01	4.70	4.78	5.44	4.65	5.45	5.65	3.89	5.22	4.89	4.89	4.51	4.90
BRRi dhan94	5.00	4.55	4.84	4.73	4.63	4.75	4.47	5.48	4.38	4.27	5.26	5.05	4.90	4.42	4.76
BRRi dhan95	4.35	4.90	4.90	4.75	4.78	5.26	4.54	5.28	4.54	4.66	5.25	4.96	4.81	4.45	4.80
BRRi dhan98		5.00													5.00
BRRi dhan100										3.88		5.45			4.67
BRRi dhan103	4.55	5.30	6.06	4.88	5.92	6.02	5.15	4.55	6.06	5.30	5.45	5.34	4.75		5.37
BRRi dhan105											5.08				5.08
BRRi Hybrid total	5.48	6.41	5.82	5.80	6.47	6.15	5.74	6.39	5.51	5.93	6.41	6.83	5.80	5.62	6.00
BRRi hybrid dhan4	5.43	6.29	6.04	5.92	6.33	5.80		6.38	5.51	5.63		6.41	6.11	5.56	5.95
BRRi hybrid dhan6	5.52	6.50	5.59	5.56	6.67	6.38	5.74	6.40	5.51	6.17	6.41	7.26	5.50	5.69	6.04
<i>All BRRi varieties</i>	<i>4.27</i>	<i>4.97</i>	<i>4.65</i>	<i>4.48</i>	<i>4.66</i>	<i>5.06</i>	<i>4.60</i>	<i>5.08</i>	<i>4.60</i>	<i>4.54</i>	<i>5.08</i>	<i>4.71</i>	<i>4.61</i>	<i>4.48</i>	<i>4.66</i>
<i>All Hybrid varieties</i>	<i>5.32</i>	<i>6.04</i>	<i>5.98</i>	<i>5.61</i>	<i>5.94</i>	<i>5.85</i>	<i>5.94</i>	<i>6.10</i>	<i>5.98</i>	<i>5.76</i>	<i>6.25</i>	<i>6.19</i>	<i>5.38</i>	<i>5.22</i>	<i>5.81</i>
<i>All Indian varieties</i>	<i>4.41</i>	<i>4.98</i>	<i>4.40</i>		<i>4.29</i>	<i>5.10</i>	<i>4.37</i>	<i>4.85</i>	<i>4.14</i>	<i>4.27</i>	<i>5.02</i>	<i>4.33</i>	<i>4.48</i>	<i>3.74</i>	<i>4.67</i>
Guti swarna	4.41	5.01			4.44	5.37	4.37	4.82	4.40	4.26	5.57		4.61	4.09	4.76
Swarna5		5.15				5.24							4.41		4.94
<i>All other MVs total</i>	<i>4.29</i>	<i>4.77</i>	<i>4.50</i>	<i>4.42</i>	<i>4.67</i>	<i>4.84</i>	<i>4.58</i>	<i>5.07</i>	<i>4.42</i>	<i>4.28</i>	<i>4.84</i>	<i>4.17</i>	<i>4.47</i>	<i>4.52</i>	<i>4.56</i>
BINA total	4.38	4.85	4.52	4.45	4.67	4.88	4.61	5.12	4.46	4.31	4.99	4.18	4.46	4.58	4.61
Bina dhan10			4.39						4.78			4.39	4.62		4.55
Bina dhan11	4.17	4.90	4.35	4.41	4.45	4.85	4.55	5.08	4.44	4.33	4.95	3.07	4.18	4.55	4.38
Bina dhan12			4.39						5.43			4.35			4.73
Bina dhan13					4.55										4.55
Bina dhan14	3.45														3.45
Bina dhan15				4.50											4.50
Bina dhan16	4.09	4.55	4.94	3.82	5.00	4.85	4.56	5.31	4.24	4.25	4.87	4.42	4.48	4.55	4.64
Bina dhan17	4.59	5.05	4.49	4.70	4.92	5.05	4.69	5.23	4.18	4.56	5.08	4.72	4.70	4.58	4.77
Bina dhan19	5.86	4.92		4.39	4.44				4.58	4.23	5.33	4.20			4.73
Bina dhan20	4.39	4.63	4.43	4.29	4.48	4.69	4.57	4.95	4.09	4.17	4.80	4.53	4.50	5.05	4.52
Bina dhan21		5.08				5.30							4.09		4.82

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	Av.
Bina dhan22	4.44	4.90	4.77	4.81	5.20	4.85	4.64	5.14	4.20	4.24	5.18		4.77	4.58	4.78
Bina dhan23	4.35		4.62				4.85	5.76	5.42	4.14					4.79
Bina dhan25			4.24												4.24
Bina dhan7	4.30	4.82	4.51	4.56	4.50	4.82	4.56	4.88	4.25	4.30	4.84	4.21	4.27	4.31	4.52
Other MVs	3.97	4.59	4.42	4.21		4.52	3.77	4.84	4.00	4.23	4.09	4.15	4.51	3.83	4.31
All MVs total	4.35	5.26	4.84	4.75	4.92	5.42	4.99	5.35	4.96	4.86	5.28	4.80	4.94	4.52	4.95
All LVs total	2.61	2.53	2.57	2.91	2.65	2.92	2.56	2.51	2.69	2.64	3.04	2.61	2.73	2.39	2.63
All average	3.54	5.01	4.31	4.27	4.35	5.26	4.32	5.17	4.33	4.22	5.08	4.57	4.56	3.90	4.41

Note: R = Region, R1= Barishal, R2= Bogura, R3=Chattogram, R4= Cumilla, R5= Dhaka, R6= Dinajpur, R7= Faridpur, R8= Jashore, R9=Khulna, R10= Mymensingh, R11= Rajshahi, R12= Rangamati, R13= Rangpur, R14= Sylhet and BD=Bangladesh, Source: DAE 2023-24.

Boro season

In the Boro season, the average yield of BRRi inbred varieties in 2023-24 was about 6.19 ton/ha. Among BRRi varieties, BRRi dhan92 was the top yielder (6.64 ton/ha), followed by BRRi dhan89 (6.61 ton/ha), BRRi dhan102 (6.56 ton/ha), and BRRi dhan36 (6.54 ton/ha). The average yield of the hybrid was 7.51 ton/ha, whereas for Indian varieties was 6.26 ton/ha. The overall yield of modern varieties in Boro season was about 6.97 ton/ha (Table 6).

Table 6: Average yield (t/ha) of different Boro rice varieties by agricultural regions of Bangladesh, 2023-24.

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	Av.
Inbred BRRi total	6.23	6.29	5.62	6.14	6.34	6.58	6.45	6.49	5.94	6.15	6.83	5.68	6.24	5.78	6.19
BR2	5.92														5.92
BR3	6.43			5.38										5.15	5.75
BR11			5.56												5.56
BR12			4.76									5.15			4.96
BR14	7.12		5.40		6.15					5.30			5.83	5.77	5.79
BR15													4.62		4.62
BR16		5.68	5.19	5.98		6.79				5.27		5.10	5.89		5.56
BR17	6.06														6.06
BR19														5.08	5.08
BR26			5.45	5.30	5.35					5.60				5.40	5.47
BRRi dhan28	5.90	6.19	5.29	5.90	5.67	6.25	5.98	5.83	5.74	5.65	6.72	5.78	5.84	5.41	5.84
BRRi dhan29	6.24	6.71	5.61	6.30	6.60	6.92	6.62	6.68	6.02	6.36	7.12	5.78	6.50	5.72	6.40
BRRi dhan33		6.36	5.16									5.12	6.06		5.57
BRRi dhan36		6.36									6.93	5.91			6.54
BRRi dhan39			5.15									5.67			5.49
BRRi dhan45	5.89			5.45								4.70		5.13	5.26
BRRi dhan47	5.91		5.66				6.36								5.91
BRRi dhan48			5.38	5.61							6.16	5.30		5.00	5.49
BRRi dhan49												5.76			5.76
BRRi dhan50	5.76	5.89	5.27	5.71	6.09	6.19	5.86	6.32	5.79	5.19	6.36	5.58	5.78	5.33	5.85
BRRi dhan55	6.39	6.33	5.59	5.00			6.45					5.88	5.92	5.58	5.86
BRRi dhan57											6.21				6.21
BRRi dhan58	6.32	6.51	5.49	6.16	6.35	6.70	6.60	6.56	5.89	6.02	6.77	5.74	6.14	5.70	6.23
BRRi dhan59	6.47	6.21	5.86	6.24			6.06			5.64		5.61	6.44		6.02
BRRi dhan60							6.21			5.61			6.18		6.07
BRRi dhan61	5.91	6.06					6.22					5.45	6.29		6.03
BRRi dhan62		6.06	6.82				6.40			5.23			6.29		6.20
BRRi dhan63		5.91	5.75	5.80	6.20	6.67	6.33	6.45	5.92	6.16	6.48	5.65	5.86	5.51	6.06
BRRi dhan64	5.95	6.36	5.38	6.21	5.75		6.47		6.10	6.08	6.67		6.24	5.73	6.04
BRRi dhan65											6.52				6.52
BRRi dhan66		5.76													5.76
BRRi dhan67	5.83	6.12	5.45	6.02	5.86		5.91	6.17	5.93	6.24		5.61	5.53	5.69	5.83
BRRi dhan68	6.12		5.25							6.17				5.73	5.96
BRRi dhan69	5.78	6.06	5.76	5.94						6.11		5.83	5.94	5.77	5.89

Variety name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	Av.
BRRi dhan70		6.06													6.06
BRRi dhan72													5.83		5.83
BRRi dhan74	6.39	6.12	5.83	6.45	5.97	6.70	6.72	6.47	5.86	6.43	6.72	5.82		5.79	6.24
BRRi dhan75			6.03	5.61							6.86	5.91			6.31
BRRi dhan76											6.12				6.12
BRRi dhan77													6.36		6.36
BRRi dhan81	6.06	6.17	5.62	6.00	6.05	6.22	6.42	6.43	6.12	5.87	6.94	5.58	5.85	5.84	6.09
BRRi dhan84	6.15	6.25	5.61	6.14	6.22	6.10	6.22	6.28	5.80	5.97	6.63	5.62	6.06	5.87	6.08
BRRi dhan86	6.08	6.26	5.64	6.13	6.05			6.27	5.69	5.90	6.67	5.98	6.06	5.88	6.07
BRRi dhan87			4.64		5.68										5.16
BRRi dhan88	6.22	6.37	5.72	6.32	6.43	6.35	6.51	6.48	5.88	6.22	6.97	5.81	6.18	5.97	6.26
BRRi dhan89	6.41	6.72	6.01	6.48	7.16	6.87	6.77	6.82	5.77	7.00	7.65	5.72	6.55	6.02	6.61
BRRi dhan90	5.30	6.21				6.08					6.30				6.10
BRRi dhan92	6.65	6.69	6.25	6.59	7.08	6.87	6.71	6.82	6.07	6.69	7.45	5.81	6.48	6.17	6.64
BRRi dhan93	5.82														5.82
BRRi dhan94										5.27					5.27
BRRi dhan96	6.50	6.35	5.43	6.46	6.52		6.33	6.59	6.14	6.72	6.78	5.76	6.52	6.06	6.34
BRRi dhan97	5.42	7.20	5.57	6.06	6.67				5.82		6.92	5.92			5.92
BRRi dhan98		6.36													6.36
BRRi dhan99	6.00		5.63	6.31					5.84		6.82	5.83			6.03
BRRi dhan100	6.44	6.21	5.95	6.57	6.45	6.64	6.54	6.64	6.21	6.17	7.23	5.83	6.45	6.07	6.40
BRRi dhan101	6.82	6.23	5.73	6.36	6.76	6.73	6.58	6.69	5.83	6.30		5.59	6.53	6.01	6.39
BRRi dhan102	7.00	6.18	5.96	6.45	6.98	6.74	6.87	6.54	6.29	6.61	6.88	5.90	6.82	6.13	6.56
BRRi dhan104	6.83	6.23	5.76	6.57	6.06	6.55	6.74	6.44	6.06	6.56	6.39	5.23	6.63	6.14	6.45
BRRi dhan105	6.84	6.23	5.41	6.12	6.06	7.07	6.54	7.58	6.82	6.29	6.67	5.77	6.76	6.20	6.48
BRRi dhan107										6.06					6.06
BRRi dhan108		7.50								6.06					6.78
BRRi Hybrid total	7.77	6.79	5.20	7.14	7.74	7.35	8.23	7.73	6.64	7.58	8.47	6.88	7.59	7.50	7.43
BRRi hybrid dhan1				7.27	7.19		8.48	7.50							7.47
BRRi hybrid dhan2	8.05							7.42					7.67		7.70
BRRi hybrid dhan3	7.79	6.67		7.65	8.23	7.38	8.37	7.83	7.14	7.95		6.97	7.58	7.58	7.70
BRRi hybrid dhan5	7.79	6.63	6.58	7.39	7.92	7.33	8.36	7.88	7.09	7.80	8.51	7.00	7.77	7.58	7.54
BRRi hybrid dhan7												6.44			6.44
BRRi hybrid dhan8	7.65	7.01	1.04	6.67	7.58	7.34	8.02	7.80	5.22	6.55	8.43	7.12	7.46	7.35	7.05
All BRRi varieties	6.41	6.32	5.61	6.23	6.44	6.65	6.60	6.58	6.01	6.28	6.87	5.74	6.34	5.89	6.28
All Hybrid varieties	7.61	7.32	7.18	7.30	7.97	7.40	7.73	7.88	7.20	7.65	8.19	6.96	7.41	7.50	7.51
All Indian varieties	6.42	6.13	4.44		6.06	6.40		6.35	5.63	5.77	6.87		5.64		6.26
Zirasail		5.76				6.44		6.29	5.54		7.04		5.64		6.20
All other MVs total	6.15	6.27	5.39	5.98	6.32	6.67	6.53	6.42	5.77	5.98	6.48	5.66	6.18	5.95	6.14
BINA total	6.12	6.26	5.45	5.98	6.33	6.73	6.58	6.42	5.77	6.09	6.68	5.73	6.18	5.93	6.16
Bina dhan10	6.04	6.21	5.31	6.16	5.85		6.63	6.32	5.75	6.33		5.56	5.72	5.79	5.97
Bina dhan12												5.79			5.79
Bina dhan14	5.99	6.28	5.05	5.58	6.10	6.36	6.55	6.30	5.78	5.84	6.46	5.39	5.92	5.88	6.02
Bina dhan17	6.06	6.36		5.91						5.92	6.44				6.19
Bina dhan18	6.15	6.59	5.56				6.68	6.82					6.18		6.36
Bina dhan24	6.59	6.38	5.62	6.04	6.56	6.76	6.20	6.47	5.99	5.94	6.74		6.97	6.00	6.26
Bina dhan25	6.19	6.26	5.75	6.04	6.60	6.84	6.66	6.54	5.70	6.30	6.94	5.85	6.54	5.99	6.37
Bina dhan5										5.70		5.91			5.80
Bina dhan7		5.61													5.61
Bina dhan8	6.02						6.58		5.61						6.01
Iratom24			5.89												5.89
Other MVs	6.24	6.29	5.20		6.22	6.51	6.35			5.71	6.21	5.05	6.22	6.10	6.08
All MVs total	7.01	6.83	6.34	6.84	7.18	7.07	7.21	7.22	6.78	7.18	7.40	6.39	7.07	6.82	6.97
All LVs total	2.90	3.05	3.11	2.92	3.07		2.70		3.06	3.15	4.17	3.51	2.73	2.83	3.00
All average	6.89	6.71	6.33	6.74	6.80	7.07	6.94	7.22	6.75	6.96	7.32	6.36	7.02	6.39	6.83

Note: R = Region, R1= Barishal, R2= Bogura, R3=Chattogram, R4= Cumilla, R5= Dhaka, R6= Dinajpur, R7= Faridpur, R8= Jashore, R9=Khulna, R10= Mymensingh, R11= Rajshahi, R12= Rangamati, R13= Rangpur, R14= Sylhet and BD=Bangladesh, Source: DAE 2023-24.

Conclusion

Adoption of modern varieties were 95.30, 89.64, and 99.71% in Aus, T. Aman, and Boro seasons, respectively. Coverage of BRRI varieties were about 74.55, 58.66, and 59.09%, in Aus, T. Aman, and Boro seasons, respectively. There is debate on the depletion of water resources that are affected mainly by Boro cultivation using underground water. To address this issue, the government launched incentives and other subsidy programs for Aus cultivation that motivated the farmers to grow more Aus rice, which mainly shifted from the Boro area. With the broader disbursement of incentives, BRRI dhan48 ranked the top position (46.28%) in the Aus season in terms of area coverage, followed by BRRI dhan85 (5.36%). The coverage of Indian varieties in the T. Aman season was about 16.24%. The area coverage of BRRI dhan89 is growing faster in Boro season, which covered 13.07%. However, BRRI dhan28 and BRRI dhan29 were the dominant varieties in the Boro season, covering 16.34% of areas. However, both the varieties accounted for 41.25% of areas in 2021-22. BRRI dhan102 produced the highest yield (5.50 ton/ha) in the Aus season whereas, in T. Aman and Boro seasons, it was BRRI dhan53 (5.76 ton/ha) and BRRI dhan92 (6.64 ton/ha), respectively. BRRI hybrid dhan2 and BRRI hybrid dhan3 yielded the highest which was 7.70 ton/ha whereas the average hybrids' yield was 7.43 ton/ha in the Boro season.

**PROJECT 2: PROSPECT AND CONSTRAINTS TO ADOPTION OF BRRI RELEASED
MODERN RICE VARIETIES IN BANGLADESH: A CASE OF RAJSHAHI DISTRICT**
MA Islam, MC Rahman, MS Rahaman, L Deb and MS Islam,

In Bangladesh, rice is the most extensively grown and consumed crop, covering approximately 76% of the country's gross cultivated area (GCA) (BBS, 2024) and contributing 89.6% of food grain production (MoA, 2019). The overall production of rice in Bangladesh has increased more than threefold since the introduction of Green Revolution technologies in the late 1970s, with yield more than tripling during this period. The Bangladesh Rice Research Institute (BRRI) has made a significant contribution to Bangladesh's food security by developing 115 high-yielding rice varieties and eight hybrids. The ongoing release and effective dissemination of cultivars resistant to various biotic and abiotic challenges is essential for maintaining rice yield, which remains the primary diet of a vast portion of Bangladesh's population. Out of 115 varieties, all BRRI varieties are not widely adopted all over the country. The yield performance of all varieties is not as per the farmers' desire due to different biotic, abiotic, and socio-economic constraints.

Under such a situation, an in-depth study is needed to explore the adoption status as well as underlying reasons for the adoption and non-adoption of BRRI varieties at the farm level with the following objectives.

Specific objectives:

- to identify the drivers and constraints of the adoption of rice varieties in different seasons;
- to delineate the prospect for BRRI varieties for large-scale adoption at the farm level.

Methodology

The study was conducted in all nine unions of Tanore Upazila, located in the Rajshahi district. Both primary and secondary data were collected from various sources. Farmers' group discussions (FGDs) involving key informants, and a household survey, were conducted to obtain farm-level data. The respondents were selected using a multistage random sampling approach. A total of 27 FGDs were conducted to generate in-depth data about the adaptation dynamics of rice varieties in different seasons. Additionally, an expert panel interview involving Sub-assistant Agricultural Officers (SAAOs) and the Upazila Agriculture Officer (UAO) was conducted to validate the data collected through FGDs. The survey was carried out from June 20 to 29, 2024. The selected farmers were interviewed using a pretested semi-structured questionnaire. Descriptive statistics were applied to analyze the data.

Results and Discussions

Data in **Table 7** illustrate the adoption level of T. Aman rice varieties from 2014 to 2023 in Tanore Upazila, Rajshahi District. Key varieties include **BRRI dhan51** and **BRRI dhan49**, with notable increases in adoption rates, particularly for BRRI dhan51, reaching 47.31% by 2023. In contrast, traditional Indian varieties like **Swarna** maintained relatively high adoption rates (49.07% in 2023) but showed a decline over time, reflecting a gradual shift towards more recently developed BRRI varieties.

Table 7: Level of adoption (%) of different T. Aman rice varieties in different years in Tanore Upazila of Rajshahi district.

Variety name	% area devotion									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BRI	8.02	21.02	18.41	17.84	22.79	21.79	33.15	34.21	38.99	50.44
BR11	0.65									
BR23	0.44									
BRI dhan32	0.32									
BRI dhan34	0.32	1.45	0.38	1.50	0.96	0.22	0.25	0.22	0.23	
BRI dhan39	0.99	1.47	0.72	1.63	0.58	0.08	0.04	0.04	0.04	
BRI dhan49	2.21	5.76	6.81	7.29	8.57	3.75	3.33	3.42	3.50	0.66
BRI dhan51	1.99	6.77	9.61	5.46	11.82	17.08	28.39	29.44	34.11	47.31
BRI dhan52	1.10	3.38	0.18	0.69	0.25	0.13	0.77	0.63	0.65	
BRI dhan56		1.44	0.37	0.52	0.06					
BRI dhan57			0.05	0.08						
BRI dhan62		0.76	0.29	0.68	0.26	0.12	0.04	0.04	0.04	
BRI dhan66					0.31					
BRI dhan71						0.12	0.08	0.08	0.08	0.00
BRI dhan75						0.08	0.04	0.04	0.04	1.29
BRI dhan80						0.10	0.08	0.08	0.08	0.00
BRI dhan87						0.11	0.12	0.21	0.21	0.61
BRI dhan90										0.32
BRI dhan93										0.12
BRI dhan94										0.08
BRI dhan95										0.04
Hybrid							0.04	0.08	0.08	0.08
Arize 7006							0.04	0.08	0.08	0.04
Tezgold										0.04
Indian	60.35	65.02	65.13	67.05	68.86	70.47	61.81	61.27	57.90	49.07
Swarna	60.35	65.02	65.13	67.05	68.86	70.47	61.81	61.27	57.90	49.07
Local	15.88	9.22	9.58	5.93	3.55	3.31	4.23	3.58	2.14	0.20
Chenguin	0.65									
Chiniatob	15.23	7.88	9.15	5.01	3.11	3.31	4.23	3.58	2.14	0.20
Kalozira		1.33	0.44	0.92	0.44					
OMVs	15.75	4.74	6.88	9.18	4.81	4.43	0.77	0.87	0.89	0.20
BINA dhan17					0.58	0.05	0.12	0.24	0.25	0.20
BINA dhan7	15.63	4.74	6.88	9.18	4.23	4.38	0.65	0.63	0.65	
Nerica	0.12									
Average	100	100	100	100	100	100	100	100	100	100

Source: DAE, 2024

Table 8 presents the adoption rates of various Boro rice varieties from 2013 to 2023. While **BRI dhan28** and **BRI dhan29** were initially widely adopted, their adoption rates have declined in recent years. This decline coincides with the increasing prevalence of Indian varieties such as Zirasail, with adoption rates exceeding 70%. This shift suggests that farmers prioritize varieties perceived as resilient and marketable. Notably, BRI varieties continue to exhibit varying degrees of adoption across same upazila.

Table 8: Adoption (%) of different Boro rice varieties by different years in Tanore Upazila under Rajshahi district.

Variety name	% area devotion										
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BRI	27.50	30.50	26.07	24.72	9.71	10.61	9.43	4.79	3.80	4.11	3.31
BRI dhan28	27.50	30.50	22.14	18.48	8.04	8.28	7.07	2.91	1.86	1.85	
BRI dhan29			2.88	3.49	0.38	0.68	0.52	0.42	0.38	0.38	
BRI dhan50			1.05	2.41	0.47	0.45	0.34	0.13	0.12	0.12	
BRI dhan55					0.05	0.05	0.11	0.05			
BRI dhan58				0.28	0.29	0.36	0.27				

Variety name	% area devotion										
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BRRi dhan63				0.06	0.47	0.74	0.53	0.27	0.25	0.25	
BRRi dhan65									0.24	0.52	1.24
BRRi dhan74					0.01						
BRRi dhan81						0.05	0.59	0.69	0.63	0.63	0.09
BRRi dhan84								0.05	0.05	0.05	
BRRi dhan86								0.10	0.09	0.10	
BRRi dhan88								0.03	0.05	0.05	0.13
BRRi dhan89								0.09	0.09	0.09	1.31
BRRi dhan92								0.02	0.05	0.07	0.21
BRRi dhan100											0.34
HYBRID											0.55
S 1204											0.13
S 1208											0.21
SL8H											0.21
Indian	72.3	69.3	73.3	75.0	82.0	73.4	70.0	71.4	69.1	69.0	70.0
	4	6	5	3	5	0	4	6	7	4	3
Nayanmoni	21.7	19.8	5.72	1.10							
Pariza	22.5	20.6	1.81	1.14	0.10						
Zira Shail	28.1	28.8	65.8	72.7	81.9	73.4	70.0	71.4	69.1	69.0	70.0
	1	5	2	9	5	0	4	6	7	4	3
OMVs	0.16	0.15	0.58	0.25	8.24	15.9	20.5	23.7	27.0	26.8	26.1
						9	3	6	3	5	0
BINA dhan10						0.03					
BINA dhan14			0.11	0.12	0.16	0.80	0.71	2.56	2.30	2.29	1.21
BINA dhan19							0.01	0.05			0.09
BINA dhan21											0.04
BINA dhan25											0.21
BINA dhan7			0.27		8.08	7.49	5.02	3.63	2.00	1.82	0.04
BRAC 576						7.62	14.8	17.5	22.7	22.7	24.5
							0	1	3	4	0
IR 50	0.16	0.15									
Nerica			0.19	0.13		0.05					
Grand Total	100	100	100	100	100	100	100	100	100	100	100

Source: DAE, 2024

During the Boro season, BRRi dhan29 and Indian hybrid varieties demonstrated substantial yields, frequently exceeding 6.5 t/ha. Notably, hybrid varieties exhibited peak yields approaching 7 t/ha (Table 10). The Boro season consistently yielded higher harvests, attributed to adequate water availability and optimized cultivation practices. BRRi dhan29 and BRRi dhan89 consistently demonstrated high yields across the years, appealing to farmers seeking to enhance productivity.

Table 9 show the yield of T. Aman varieties in tons per hectare from 2014 to 2023. High-yielding varieties like BRRi dhan51 showed consistent yields above 5 t/ha, while the Indian variety Swarna had a stable yield above 5 t/ha. This suggests a competitive performance among BRRi varieties with targeted support. Though certain varieties, such as BRRi dhan49, also showed stable yield performance in last couple of years.

During the Boro season, BRRi dhan29 and Indian hybrid varieties demonstrated substantial yields, frequently exceeding 6.5 t/ha. Notably, hybrid varieties exhibited peak yields approaching 7 t/ha (Table 10). The Boro season consistently yielded higher harvests, attributed to adequate water availability and

optimized cultivation practices. BRRi dhan29 and BRRi dhan89 consistently demonstrated high yields across the years, appealing to farmers seeking to enhance productivity.

Table 9: Paddy yield (t/ha) of different T. Aman rice varieties by different years in Tanore Upazila under Rajshahi district.

Variety name	Yield (t/ha)									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BRRi	4.39	4.90	4.37	4.53	4.77	4.90	4.94	4.94	4.94	5.06
BR11	4.50									
BR23	4.20									
BRRi dhan32	4.50									
BRRi dhan34	3.60	4.20	3.30	3.31	3.31	3.54	3.54	3.53	3.54	
BRRi dhan39	4.65	4.59	4.63	4.62	4.61	4.64	4.65	4.67	4.69	
BRRi dhan49	4.60	5.25	4.93	3.55	5.25	5.37	5.39	5.38	5.37	5.20
BRRi dhan51	4.60	5.70	4.94	5.70	5.83	5.85	5.84	5.83	5.85	5.70
BRRi dhan52	4.50	5.25	4.46	4.80	5.68	5.68	5.69	5.67	5.68	
BRRi dhan56		4.80	4.23	5.55	4.20					
BRRi dhan57			4.46	4.50						
BRRi dhan62		4.50	4.02	4.20	4.48	4.47	4.47	4.48	4.48	
BRRi dhan66					4.80					
BRRi dhan71						4.77	4.77	4.77	4.78	
BRRi dhan75						4.20	4.49	4.48	4.49	5.10
BRRi dhan80						4.79	4.78	4.79	4.78	
BRRi dhan87						5.70	5.79	5.79	5.79	5.00
BRRi dhan90										4.00
BRRi dhan93										5.20
BRRi dhan94										5.20
BRRi dhan95										5.10
Hybrid							7.43	7.39	7.44	6.50
Arize 7006							7.43	7.39	7.44	6.50
Tezgold										6.50
Indian	4.80	5.70	5.16	5.67	5.87	5.88	5.85	5.91	5.86	5.40
Swarna	4.80	5.70	5.16	5.67	5.87	5.88	5.85	5.91	5.86	5.40
Local	2.40	1.95	2.27	1.95	2.18	2.49	2.48	2.49	2.48	2.85
Chenguin	2.70									
Chiniatob	2.10	2.10	2.39	2.10	2.25	2.49	2.48	2.49	2.48	2.85
Kalozira		1.80	2.16	1.80	2.10					
OMVs	4.05	4.50	4.25	4.50	4.75	5.01	4.96	4.97	4.99	5.10
BINA dhan17					4.80	5.29	5.25	5.26	5.27	5.10
BINA dhan7	4.50	4.50	4.25	4.50	4.71	4.73	4.67	4.68	4.70	
Nerica	3.60									
Average	4.07	4.40	4.08	4.19	4.45	4.82	5.01	5.01	5.01	5.14

Source: DAE, 2024

Table 10: Paddy yield (t/ha) of different Boro rice varieties by different years in Tanore Upazila under Rajshahi district.

Variety name	Yield (t/ha)										
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BRRi	4.80	4.80	5.53	5.63	5.74	5.72	5.61	5.67	5.78	5.79	5.97
BRRi dhan28	4.80	4.80	5.25	5.40	5.40	5.68	5.68	5.40	5.75	5.75	
BRRi dhan29			6.50	6.80	6.60	6.20	6.20	6.20	6.19	6.21	
BRRi dhan50			5.10	5.10	5.03	5.02	5.04	5.04	5.05	5.04	
BRRi dhan55					6.75	6.60	5.70	4.50			
BRRi dhan58				5.60	5.53	5.53	5.54				
BRRi dhan63				5.50	5.43	5.43	5.43	5.42	5.42	5.42	
BRRi dhan65									5.08	5.07	5.20
BRRi dhan74					5.80						
BRRi dhan81						5.60	5.57	5.56	5.60	5.59	5.57
BRRi dhan84								5.65	5.61	5.63	
BRRi dhan86								5.69	5.67	5.67	

Variety name	Yield (t/ha)										
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BRRi dhan88								5.56	5.58	5.59	5.51
BRRi dhan89								6.63	6.62	6.68	6.67
BRRi dhan92								7.00	6.99	7.01	7.00
BRRi dhan100											5.88
HYBRID											7.64
S 1204											7.50
S 1208											7.75
SL8H											7.66
Indian	4.37	4.37	4.47	4.73	5.30	5.76	5.76	5.77	5.85	5.85	6.10
Nayanmoni	4.08	4.07	4.07	4.08							
Pariza	4.24	4.24	4.28	4.04	4.50						
Zira Shail	4.80	4.80	5.06	5.40	5.70	5.76	5.76	5.77	5.85	5.85	6.10
OMVs	4.00	4.00	4.29	4.02	4.65	4.78	5.02	4.96	5.08	5.13	5.49
BINA dhan10						6.60					
BINA dhan14			5.06	5.04	5.09	5.27	5.25	5.25	5.26	5.27	5.52
BINA dhan19							4.20	4.50			5.40
BINA dhan21											5.40
BINA dhan25											6.50
BINA dhan7			4.20		4.20	4.37	4.37	4.38	4.50	4.50	4.65
BRAC 576						5.10	5.20	5.20	5.19	5.30	5.45
IR 50	4.00	4.00									
Nerica			3.60	3.00		3.15					
Grand Total	4.45	4.45	4.84	5.06	5.45	5.41	5.44	5.47	5.59	5.61	6.04

Source: DAE

Reasons of low adoption

In Tanore Upazila, farmers' adoption of T. Aman and Boro rice varieties is strongly influenced by a balance of yield potential, market demand, resilience, and pest management needs (**Table 11** and **Table 12**).

BRRi dhan51 is highly favored during the T. Aman season due to its substantial yield (6069 kg/ha), strong market demand, and resilience to drought. 100% of surveyed farmers acknowledged its profitability and the high-quality straw it provides for fodder. However, cultivation of BRRi dhan51 necessitates significant inputs. 100% of respondents reported high fertilizer and pesticide requirements, along with susceptibility to pests such as stem borers and sheath rot.

Swarna-5 is also popular for its high yield (5987 kg/ha) and lower input costs compared to BRRi dhan51, though farmers (100%) report frequent brown planthopper (BPH) and mealybug infestations.

Meanwhile, **Lal Swarna** is chosen for its slender grain and market stability, although it suffers from lodging and pest issues, with farmers concerned about its susceptibility to false smut and uneven flowering.

In the Boro season, varieties like **Zira Sail** (6267 kg/ha) and **65dhan/BRRi dhan65** (6312 kg/ha) are widely adopted for high yield and short growth cycles, which fit well in multi-cropping systems. Zira Sail's high market demand is offset by lodging and high irrigation requirements, reported by over 60% of farmers, while BRRi dhan65's resilience makes it popular despite needing more pesticide due to stem borer vulnerability.

BRAC-576 is another well-accepted variety, appreciated for high yield, short duration, and market demand, although 90% of farmers note its susceptibility to BPH and uneven flowering.

Varieties like **BINA dhan14** and **BINA dhan7** are valued for drought tolerance and short cycles, helping farmers in water-scarce regions despite challenges with pest resistance and heat-related yield losses. Overall, while high-yielding varieties like **BRI dhan51** and **BRAC-576** are popular, farmers manage trade-offs in pest resistance and input requirements to optimize productivity and market value.

In both T. Aman and Boro seasons, farmers balance factors like yield potential, pest and disease resistance, and market acceptance, prioritizing varieties that provide economic stability and meet local environmental challenges. The shift toward newer **BRI** varieties and hybrids is gradual but evident, indicating a steady adoption of modern rice varieties that align with both yield and market requirements.

Table 11: Positive and negative traits of different T. Aman rice varieties

Variety name	Positive traits	% opined	Negative traits	% opined
BRI dhan51	Gives higher yield (6069 kg/ha).	100	Medium bold grain.	100
	Market demand is high.	100	Required more chemical fertilizers and pesticides.	100
	Has drought and submergence-tolerant capacity.	100	Stem borer infestation is high.	100
	This variety exhibits a medium plant height. There is a high demand for its straw, which is well-suited for cattle feed.	100	Sheath rot problem is observed.	100
	Strong stem. No lodging problem.	100	Observed mealybug problem	90
	Milling outturn is 26-27 kg/40 kg paddy	100	False smut infestation.	90
	Good for double transplanting	100	Long duration. It requires 7 more days than Swarna-5 .	80
Swarna-5/Sumon Swarna	Yield is 5987 kg/ha.	100	Higher rate of sheath rot disease infestation.	100
	Market demand is high, so it is easy to sell.	100	More BPH infestation is observed.	100
	Medium bold grain.	100	Mealybug problem is high.	100
	Market price is 1100-1300 Tk./40 kgs.	100	Less taste than BRI dhan51	100
	Can fit into the Swarna-5 – Potato – BRAC 576/65dhan/Zirashal (short plant height) cropping pattern.	100	Not suitable for low lying and highland areas. Lodging problem during panicle initiation due to long plant height.	100
	Chemical fertilizers, pesticides, and insecticides are needed at a comparatively lower rate than BRI dhan51 .	100	20-25 days more time is needed for harvesting compared to BINA dhan17 .	55
	Straw demand is high.	100		
	Less disease and pest infestation compared to BRI dhan51 .	100		
	Harvest 10 days early compared to BRI dhan51 .	100		
	Have drought tolerant capacity.	100		
	Suitable for highlands.	90		

Variety name	Positive traits	% opined	Negative traits	% opined
	Milling outturn is 25-27 kgs/40 kgs paddy.	100		
Lal Swarna	Yield is lower (5378 kg/ha) than BRRI dhan51, Swarna-5)	100	Sheath rot infestation is observed	100
	Rice is slender and tasty.	100	Mealy bug infestation is detected	100
	Impressive market price (1000-1100 Tk./40 kgs).	100	Shorter plant height. Weak stem.	100
	Slendar grain and good taste.	100	False smut infestation is observed.	100
	Need less chemical fertilizers compare to BRRI dhan51.	80	Straw price is low.	100
			No drought tolerant capacity.	100
			Uneven flowering	100
BRRI dhan49	Medium, slender grain.	100	Severe false Smut problem. More unfilled grain.	100
	The rice plant is short and strong.	100	Yield is lower than Swarna-5 and BRRI dhan51	90
	Market demand is high.	100	Low panicle size	100
	The market price is high.	100	Less tiller (12-13/hill)	100
	Straw quality is good for fodder.	100		
	Milling outturn is 23-24 kgs/40 kgs paddy.	90		
BINA dhan17	Early variety/Short Duration.	100	Low amylose (Sticky Rice).	100
	Rice is medium slender.	100	Lower plant height (Less straw)	100
	The rice plant is strong.	100	Lower market price	100
	Yield is 5506 kg/ha	100	Mouse attacks more due to early variety.	90
Guti Swarna	Drought tolerant. Yield is 5698 kg/ha.	100	The market price is a bit lower than BRRI dhan51 and Swarna-5 due to bold grain.	100
	All types of land are suitable for cultivation	100	Yield is low compared to BRRI dhan51	90
	Market Demand is high.	100	Mealy bug infestation is observed.	80
	Milling outturn is 26-27 kg/40kgs paddy.	100	Stem borer infestation is detected.	80
	Less pest and disease infestation are observed.	100		
	7 days earlier than BRRI dhan51.	100		
	Need less chemical fertilizers.	100		

Table 12: Positive and negative traits of different Boro rice varieties

Variety name	Positive traits	% opined	Negative traits	% opined
Zirasail	Yield of Zirasail is 6267.11 Kg/ha. Yield is high than BRAC-576 (6218.89 kg/ha).	100	Lodging susceptible (Long plant height).	100
	Good taste and long slender grain.	100	Susceptible to stem borer.	100

Variety name	Positive traits	% opined	Negative traits	% opined
	Market price is 1200-1250 Tk./40 kgs	90	Susceptible to BPH.	100
	Lodging tolerant (medium plant height).	95	Need more irrigation.	60
	Need lower amount of insecticide and pesticide.	90	Long duration (>150 days).	40
	Non sticky rice.	100	Short duration (140-145 days).	80
	High market demand	100	Unfilled grain during heavy heat.	80
	Milling outturn is 24.28 kg from 40 kgs paddy.	80	Neck blast problem (But less than other varieties).	90
	High quality straw. High demand	100	Bacterial panicle blight problem	70
65 dhan/ BRRI dhan65	Short Duration (110-120 days)	100	Susceptible to stem borer.	80
	Yield is 6312.23 kg/ha. Yield is higher than Zira Sail (6267.11 kg/ha) and BRAC -576 (6218.89 kg/ha).	100	Need more insecticide and pesticide.	70
	Drought tolerant.	100	BPH infestation	80
	Requires less irrigation.	90		
	Slender grain. Long panicle. Taste is good.	100		
	Market demand is high.	100		
	Market price is 1000-1200 Tk/40 kgs	100		
	Strong stem. No lodging and shattering problems.	100		
BRAC-576	Yield is 6218.89 kg/ha.	100	Susceptance to BPH.	90
	Medium slender grain like BRRI dhan28.	100	Rice is hard.	80
	Less disease infestation.	95	Uneven flowering.	90
	No lodging problem.	100		
	Short duration (110-115 days)	100		
	High market demand. Market price is 1100-1200 Tk/40 kgs	100		
	Effective tillering 15-20.	90		
Bina-14 (Siattar dhan)	Yield is high (average yield is 5890 kg/ha)	100	Drought causes unfilled grain during panicle initiation.	100
	Short duration (110-115 days)	100	BPH infestation.	100
	Market demand is high.	100	Uneven plant type.	100
	Strong stem and drought tolerant.	100		
BINA dhan-7	Yield is near to BRAC-576.		unfilled grain due to heat.	100
	Short duration (130-135 days)		Blast susceptible (Neck blast)	100
	Medium plant height		BPH and stem borer infestation.	
	No lodging problem		Left over rice is not in good condition.	
BRRI dhan57	Short duration (105-110 days)		Yield is low (4978 kg/ha)	
	Slender grain. Short plant height		BPH susceptible.	
	Market price is 1000-1100 tk/40 kgs.			
	Market demand is medium.			

Data in **Table 13** focus on the level of adoption of T. Aman rice varieties. Data show that **BRRI varieties**, particularly BRRI dhan51, achieved remarkable adoption rates across unions, with an average adoption of 44.44%. The variety BRRI dhan51 is notably popular in Kalma, Mundumala Powrosova, and Chanduria, where over 70% of farmers adopted it. Another prominent variety, **Indian Swarna-5**, averaged around 31.89% adoption across the unions, with especially high uptake in Pachondor, Talakanda, and Tanore Powrosova. Other varieties like BRRI dhan34 and Gutu Swarna showed minimal adoption (under 2% on average), with very few unions adopting them.

Data in **Table 14** covers Boro season varieties, highlighting that **Indian varieties and Zirasail** observed extensive adoption, with an average adoption rate of 41.11% each. Zira Sail was particularly popular in Kalma, Mundumala Powrosova, and Badhair, where 50-80% of farmers adopted it. **Other Modern Varieties (OMVs)** were also widely adopted across unions, with an average adoption rate of 57.22%, indicating strong interest in alternative, high-performing varieties for Boro cultivation. In contrast, specific varieties like **BRAC-576** and **65 dhan** had moderate adoption, with BRAC-576 being more popular in areas like Pachondor, Talanda, and Tanore Powrosova (averaging 35%). BINA dhan7 and BINA dhan14 were adopted on a smaller scale, with average rates below 4%, showing limited use.

In both seasons, adoption trends reflect farmers’ preferences for varieties with high yield, market demand, and resilience. BRRI dhan51 and Swarna-5 in T. Aman and Indian hybrids in Boro indicate a mix of both local and foreign varieties as farmers optimize for regional growing conditions and market needs.

Table 13: Adoption (%) of different T. Aman rice varieties in different unions of Tanore Upazila under Rajshahi district, 2023-24.

Variety name	Different unions									
	Kalma	Mundumala powrosova	pachondor	Saranji	Talanda	kama rgaon	Tanore powrosova	Badhair	Chanduria	Av.
BRRI varieties	70	70	32	20	35	20	15	70	88	46.67
BRRI dhan34	0	0	0	0	0	10	0	0	0	1.11
BRRI dhan49	0	0	4	0	0	0	0	0	3	0.77
BRRI dhan51	70	70	25	20	35	10	15	70	85	44.44
BRRI dhan93	0	0	3	0	0	0	0	0	0	0.33
Hybrid:	0	0	0	0	0	60	0	0	0	6.67
Sonar Bangla	0	0	0	0	0	60	0	0	0	6.67
Indian:	30	30	65	80	65	20	80	30	12	45.78
Swarna-5	30	0	65	0	65	20	80	15	12	31.89
Sumon Swarna	0	20	0	70	0	0	0	0	0	10.00
Lal Swarna	0	10	0	10	0	0	0	5	0	2.78
Gutu Swarna	0	0	0	0	0	0	0	10	0	1.11
Other MVs:	0	0	3	0	0	0	5	0	0	0.89
BINA dhan17	0	0	3	0	0	0	0	0	0	0.33
Others	0	0	0	0	0	0	5	0	0	0.56
	100	100	100	100	100	100	100	100	100	100.00

Source: FGD survey, 2024.

Table 14: Adoption (%) of different Boro rice varieties in different unions of Tanore Upazila under Rajshahi district, 2023-24.

Variety Name	Different unions									
	Kalma	Mundum ala powroso va	Pachond or	Saranj ai	Taland a	kamargao n	Tanore powroso va	Badhai r	Chandu ria	Av.
BRRi dhan57	0	0	0	0	0	10	0	0	0	1.11
Indian:	65	50	60	30	5	40	10	80	30	41.11
Zira	65	50	60	30	5	40	10	80	30	41.11
Other Modern Varieties (OMVs):	35	50	40	65	95	50	90	20	70	57.22
65 dhan	35	0	10	5	45	20	30	5	0	16.67
BRAC 576	0	50	0	60	50	30	60	15	50	35.00
BINA dhan7	0	0	0	0	0	0	0	0	20	2.22
BINA dhan14	0	0	30	0	0	0	0	0	0	3.33
others	0	0	0	5	0	0	0	0	0	0.56
	100	100	100	100	100	100	100	100	100	100.00

Source: FGD survey, 2024.

Comparison of yield level among different rice varieties:

Boro season:

Figure 2 shows a comparison of the level of yield data for various Boro rice varieties based on survey results and the official data published by the Department of Agricultural Extension (DAE). For the rice varieties BRAC-576, BRRi dhan100, Zirasail, and BRRi dhan65, the survey-based yields are significantly higher than the yields officially reported by the DAE. However, for the BINA dhan25 variety, the survey-based yield is slightly lower than the DAE's official yield.

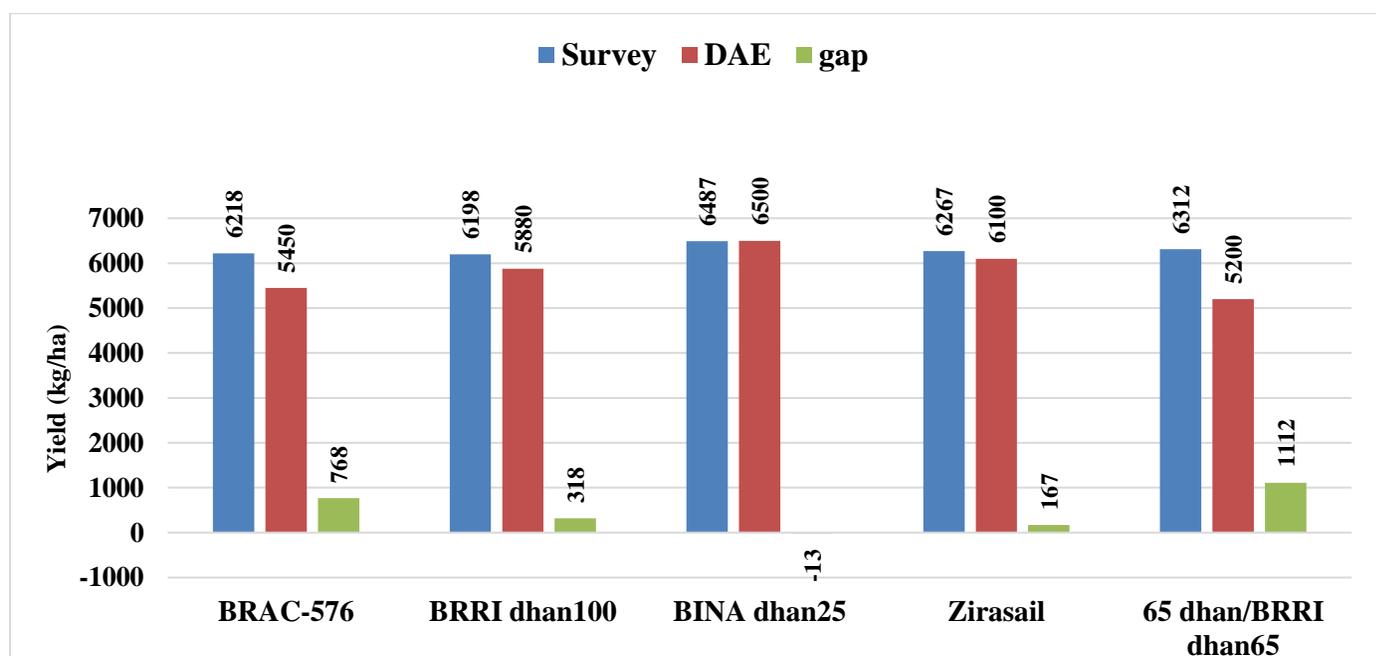


Figure 2: Yield comparison of Boro season rice varieties grown in Tanore Upazila

T. Aman season:

Figure 3 shows a comparison of yield data for various T. Aman rice varieties based on survey results and the official data published by the Department of Agricultural Extension (DAE). For the rice varieties BRRi dhan51, BRRi dhan93, BINA dhan17, Gutiswarna, and Sumonswarna (also known as Swarna5), the survey-based yields are significantly higher than the yields officially reported by the

DAE. However, for the Lal swarna variety, the survey-based yield is slightly lower than the DAE's official yield.

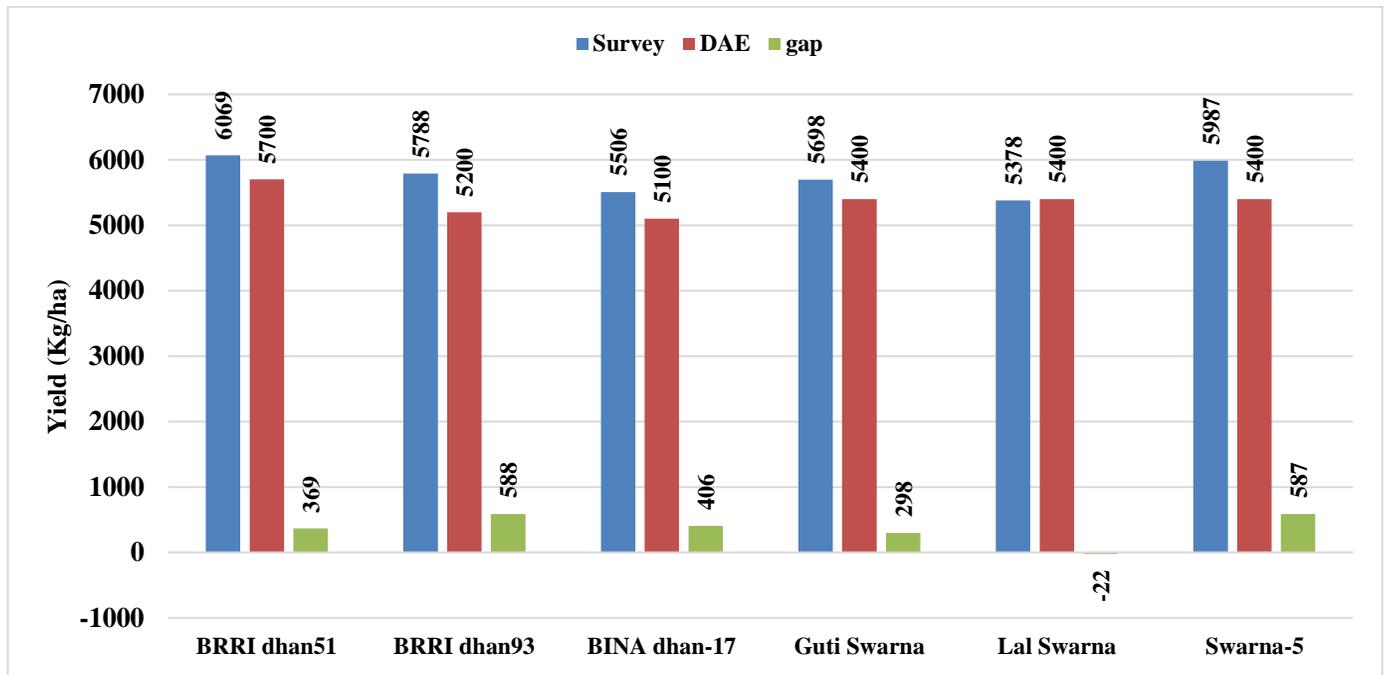


Figure 3: Yield comparison of T. Aman season rice varieties grown in Tanore Upazila

Profitability of different rice varieties in Boro and T. Aman seasons in Tanore upazila

In the Boro season, **Figure 4** shows the return on investment in different rice varieties.

BRAC-576: BCR of 1.12 on a full-cost basis indicates that for every unit of cost, the return is 1.12 units. On a cash cost basis, the BCR is significantly higher at 1.75, suggesting that the variable costs (cash expenses) are much lower, leading to better profitability when only cash costs are considered.

BRRI dhan100: BCR of 1.08 under full costs indicates modest profitability. However, the BCR increases to 1.62 on a cash cost basis, showing that cash expenses are relatively lower compared to the total costs, thereby improving economic returns.

65 dhan/BRRI dhan65: With a BCR of 1.07 on a full-cost basis, the variety is just above the break-even point. The BCR of 1.61 on a cash cost basis suggests that once non-cash costs are excluded, the variety is more profitable.

BINA dhan-25: This variety has the highest BCR of 1.17 on a full-cost basis, indicating good profitability even when all costs are considered. The BCR of 1.69 on a cash cost basis further enhances its economic appeal, showing that it performs well under both cost measures.

Zirasail: With a BCR of 1.14 under full costs and 1.67 under cash costs, Zirasail demonstrates solid economic returns. The higher BCR under cash costs highlights its efficiency in terms of variable expenses.

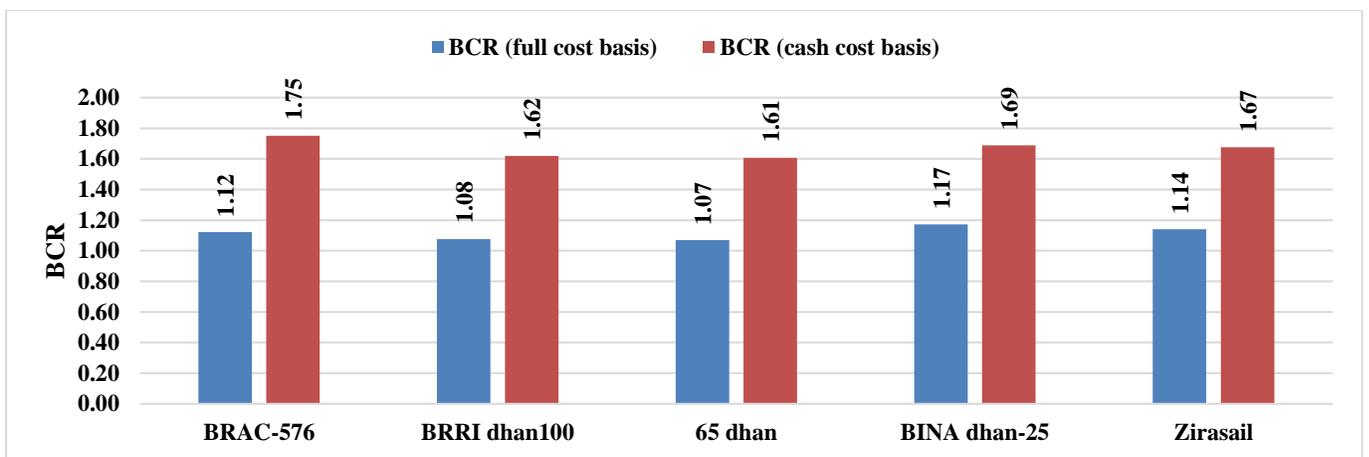


Figure 4: Return over investment for different rice varieties in Boro season in Tanore Upazila

T. Aman season:

Figure 5 shows the return on investment in different rice varieties in the T. Aman season.

BRRRI dhan51: BCR on a full-cost basis is 1.18, indicating a moderate profit margin when all costs (including fixed and variable) are considered. The significantly higher BCR of 1.86 on a cash cost basis suggests a much better return when only direct cash expenses are factored in, highlighting the variety's economic viability in terms of liquid expenses.

BRRRI dhan76: With a BCR of 1.10 on a full-cost basis, this variety offers a slim profit. However, on a cash cost basis, the BCR of 1.67 shows better profitability, indicating that the fixed costs are a significant part of the total cost structure.

BRRRI dhan93: BCR of 1.13 on a full cost basis reflects a decent profitability. The higher BCR of 1.73 on a cash cost basis demonstrates that excluding non-cash costs results in a more favorable return, emphasizing efficient cash expense management.

BINA dhan-17: This variety shows a BCR of 1.12 under full costs, indicating profitable cultivation. The BCR of 1.71 on a cash-cost basis further underscores its economic feasibility, especially when focusing on cash-flow expenditures.

Guti Swarna: With a BCR of 1.14 on a full-cost basis, Guti Swarna is profitable when all costs are considered. The BCR of 1.80 on a cash cost basis indicates a higher return when only cash expenses are accounted for, showing its strong economic performance under variable costs.

Lal Swarna: This variety has the lowest BCR on a full-cost basis (1.10), indicating marginal profitability. However, it has the highest BCR on a cash-cost basis (1.91), suggesting it is highly profitable when only direct cash costs are considered. This highlights significant fixed costs that impact overall profitability.

Swarna-5: The BCR of 1.15 on a full cost basis indicates good profitability. The BCR of 1.78 on a cash cost basis shows enhanced profitability when considering only cash costs, reflecting its economic efficiency with regard to liquid expenses.

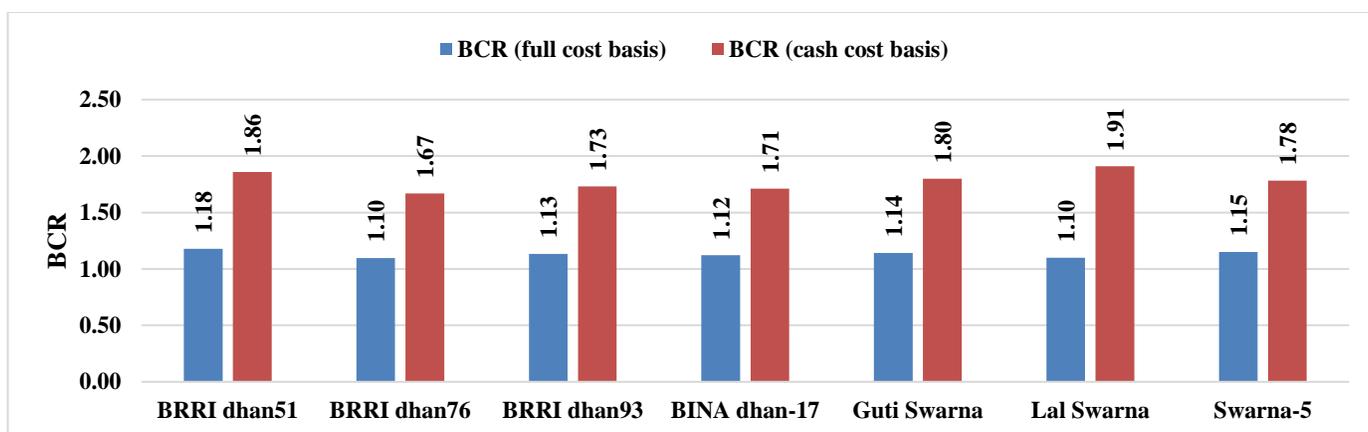


Figure 5: Return over investment in T. Aman season's different rice varieties of Tanore Upazila

Conclusion:

This study aimed to investigate the adoption status and constraints of modern rice varieties within Tanore Upazila, Rajshahi district. During the Aman season, BRRi-released rice varieties cultivated 50.44% of the area, with BRRi dhan51 contributing 47.31%. Indian varieties accounted for 49.07% of the cultivated area. In the Boro season, BRRi varieties were cultivated on 3.31% of the area, while Indian varieties covered 70.03%.

The factors considered for varietal adoption in the study area included yield advantage, profitability, market acceptance, grain quality, susceptibility to insects and pests, and adaptability to environmental shocks (drought and cold).

Furthermore, enhanced extension services and farmer training programs would be valuable in promoting the adoption of newly developed modern rice varieties within the study area.

Policy recommendations:

To increase the adoption of BRRi rice cultivars in Tanore Upazila, Rajshahi District, several targeted policy measures could be implemented to address farmers' preferences, regional challenges, and market conditions:

1. Provide Extension Services with an Emphasis on Pest and Disease Management;
2. Encourage Climate-Resilient BRRi varieties;
3. Strengthen Market Connections and Guarantee Price Stability;
4. Strengthen Seed Distribution Networks and Quality Assurance;
5. Arrange Farmer Training and Demonstration Trials; and
6. Take farmers incentive program.

PROJECT 3: IMPACT OF DEMONSTRATION ON SELECTED AREAS OF BANGLADESH

Limon Deb, Saida Akter Jui, Md. Saiful Islam

Introduction:

The demonstration program is considered as the major tool for extending BRRI released rice varieties and its impacts in the different parts of the country. Since from the very beginning, BRRI has been performing demonstration programs all over the country. Recently a program has been taken to find out the impact of the demonstration program in the northern and southern parts of the country.

A team comprised of scientists from Agricultural Economics Division (AED) have recently visited Habiganj and Feni district for primary data collection at the farm level. The key observations from this primary data collection on demonstration impact of BRRI released variety are presented in this report in detail. The objectives of the study are:

- to identify the impact of demonstration on the adoption (area coverage) of different BRRI released varieties;
- to identify the drivers and constraints of the adoption of rice varieties in different seasons.

Methodology:

The study was conducted in different Upazilas under Habiganj and Feni district. Both primary and secondary data were collected from different sources. Farmers' group discussions (FGD) involving key informants and a household survey were done to obtain farm-level data. The respondents were chosen using a random sampling approach. In total, 86 farmers were interviewed to generate in-depth data about the adoption of BRRI released rice varieties in different seasons. Besides, an expert panel interview consisting of Sub-assistant Agricultural Officers (SAAO) and Upazila Agriculture Officer (UAO) was conducted to validate the collected data. The selected farmers were interviewed using a pretested semi-structured questionnaire. Descriptive statistics were used to analyze the data.

Feni District

Aus Season

The most popular demonstrated varieties in Aus season are BRRI dhan48, BRRI dhan85, BRRI dhan96, BRRI dhan98 and BRRI hybrid dhan7 in Feni district. It is apparent from **Table 15** that in the base year of the Aus season in 2018, the farmers who got demonstration had planted BRRI dhan48 in 30 decimals of land on an average which increased by 300% in 2021 and reached at 120 decimals. But in 2022, the area again reached at 30 decimals and in 2023 the farmers shifted to other varieties. In 2019, the average area of BRRI dhan85 was 100 decimals, which showed highest increase in 2020 by 300%. But in 2022, the area decreased by 45% than in 2019. The area increased by 69% and reached at 169 decimals in 2023. The average area of BRRI dhan96 in 2022 was 15 decimals that increased by 47% in 2023. The average area of BRRI dhan98 in 2020 was about 300 decimals but decreased by 39% in 2023. BRRI hybrid dhan7 covered an area of 200 decimals in 2022 and remain unchanged (**Table 15**).

Table 15: Status (area coverage) of the demonstrated varieties among the farmers during different years (Aus season) in Feni District

Demonstrated Variety	Cultivated area in 2018	Cultivated area in 2019	Cultivated area in 2020	Cultivated area in 2021	Cultivated area in 2022	Cultivated area in 2023
	Area (decimal)	Area (decimal)	(decimal) Base Year	Area (decimal)	Area (decimal)	Area (decimal)
BRRi dhan48	30	60 (100%)	60 (100%)	120 (300%)	30 (0%)	-
BRRi dhan85	-	100	400 (300%)	171 (71%)	55 (-45%)	169 (69%)
BRRi dhan96	-	-	-	-	15	22 (47%)
BRRi dhan98	-	-	300	245 (-18%)	200 (-33%)	183 (-39%)
BRRi hybrid dhan7	-	-	-	-	200	200 (0%)

Source: Field survey 2024

In Aus season, the most cultivated variety is BRRi dhan48, BRRi dhan85, BRRi dhan98 and BRRi hybrid dhan7. BRRi dhan48 has very good acceptance among the farmers as they have mentioned that this variety has very good yield, no shattering problem, seed is available and good taste as well. On average, yield of BRRi dhan48 was found 5.6 t/ha in the study areas. Farmers have also mentioned that BRRi dhan48 has very good acceptance among the farmers in both districts as the duration of this variety is quite short which enables the farmers to grow three crops in a year. BRRi dhan85 has gained acceptance among farmers because of lower disease and insect infestation, has strong root system as well as higher yield (**Table 17**). The average yield of BRRi dhan85 was found to be 4.87 t/ha in the study areas. BRRi dhan98 is another popular variety of Aus season in the study areas. This variety has gained acceptance among the farmers because of its small and slender grain, higher yield, lower disease attack and good taste. Average yield of BRRi dhan98 in study areas was 7 t/ha. Another popular variety adopted by the farmers is BRRi hybrid dhan7 because of its higher yield which is about 8.4 t/ha. But due to unavailability of seeds this variety couldn't cover a large area. Farmers opined that the number of demonstrations should be increased so that the farmers of the respective areas get to know about the advantages of this variety. The yield of demonstrated varieties is much higher than non-demonstrated varieties (**Table 16**).

Table 16: Yield status of demonstrated and non-demonstrated varieties during Aus season in Feni district

Demonstrated variety	Yield (t/ha)	Other non-demonstrated variety	Yield (t/ha)
BRRi dhan48	5.59	Binadhan-19	4.19
BRRi dhan85	4.87	Rajashail	4.19
BRRi dhan98	7.00		
BRRi hybrid dhan7	8.38		

Source: Field survey 2024

Table 17: Popular varieties and reasons for varietal adoption in Feni district (Aus season)

Name of the Variety	Reasons for varietal adoption
BRRRI dhan48	1. Good yield, 2. Short duration, 3. Less shattering, 4. Good taste, 5. Long plant, 6. Seed is available
BRRRI dhan85	1.Low disease infestation, 2. Low insect infestation, 3. Strong root, 4. High yield
BRRRI dhan98	1.Small and slender grain, 2. High yield, 3. Low disease infestation, 4. Good taste
Binadhan-19	1.Low disease infestation, 2. Low insect infestation, 3. Good yield, 4. Strong root

Source: Field survey 2024

Aman Season

During the Aman season, BRRRI dhan80 and BRRRI dhan93 showed the highest rate of change, that is about 233% and 166%, respectively. BRRRI dhan49 also showed an increasing trend, from 50 decimals in 2020 to 127 decimals in 2023. The area of BRRRI dhan94 was 40 decimals in 2020 that increased to 75 decimals in 2023. But the area of BRRRI dhan71 and BRRRI dhan87 decreased over the time (**Table 18**).

Table 18: Status (area coverage) of the demonstrated varieties among the farmers in different years (Aman season) in Feni district

Demonstrated Variety	Cultivated area in 2020	Cultivated area in 2021	Cultivated area in 2022	Cultivated area in 2023
	(decimal) Base Year	Area (decimal)	Area (decimal)	Area (decimal)
BRRRI dhan49	50	107 (114%)	139 (178%)	127 (154%)
BRRRI dhan71	100	100 (0%)	100 (0%)	47 (-53%)
BRRRI dhan80	-	33	20 (-39%)	110 (233%)
BRRRI dhan87	-	40	27 (-33%)	33 (-18%)
BRRRI dhan93	-	32	78 (141%)	85 (166%)
BRRRI dhan94	40	50 (25%)	40 (0%)	75 (88%)
BRRRI dhan95	-	21	-	30(43%)

Source: Field survey 2024

In Aman season, BR22 and BR23 are still popular varieties having an average yield of 2.63 t/ha and 4.94 t/ha respectively, even though it is replacing by other varieties in recent years (**Table 19**). These varieties have got acceptance because of good yield and good taste. In addition to this, BR22 has short plant, strong root system that prevent from lodging, the grain is small and slender, suitable for low land because it is waterlogging tolerant (**Table 20**). BR23 has less pest and rat infestation and it can be cultivated and harvested later. BR10 and BR11 also covered a large area because of good yield, good taste, lodging and waterlogging tolerance, though these are oldest varieties. The average yield of BR10 and BR11 are 5.19 t/ha and 4.15 t/ha, respectively. Other popular varieties are BRRRI dhan49, BRRRI dhan51, BRRRI dhan52, BRRRI dhan87, BRRRI dhan93, BRRRI dhan94, BRRRI dhan95 and BRRRI dhan103. Among the demonstrated varieties, the yield of BRRRI dhan95 was the highest which is about 9 t/ha, followed by BRRRI dhan103 and BRRRI dhan94 with an average yield of 7.84 t/ha and 7.23 t/ha respectively. BRRRI dhan49 and BRRRI dhan52 had an average yield of 4.5 t/ha and 6.11 t/ha, respectively (**Table 19**). In Aman season, the majority of the rice areas are covered with BRRRI varieties. The comparative analysis among demonstrated and non-demonstrated varieties showed that most of the demonstrated varieties had showed higher yield than non-demonstrated varieties.

Table 19: Yield status of demonstrated and non-demonstrated varieties during Aman season in Feni district

Demonstrated variety	Yield (t/ha)	Other non-demonstrated variety	Yield (t/ha)
BRRi dhan49	4.50	Binadhan-17	3.62
BRRi dhan52	6.11	BR10	5.19
BRRi dhan80	3.95	BR11	4.15
BRRi dhan93	4.5	BR22	2.63
BRRi dhan94	7.23	BR23	4.94
BRRi dhan95	9.00	BRRi dhan44	6.89
BRRi dhan103	7.84	BRRi dhan46	5.6
		BRRi dhan51	4.62
		BRRi dhan71	7.36
		BRRi dhan72	6.21
		BRRi dhan76	7.90
		BRRi dhan80	7.00
		BRRi dhan87	5.37
		Shwarnobashuri	5.72
		Ranjit	3.29
		Rajashail	3.31
		Guti swarna	7.41

Source: Field survey, 2024

Table 20: Popular varieties and reasons for varietal adoption in the study area (Aman season) in Feni district

Name of the Variety	Reasons for varietal adoption
BR10	1. Good yield, 2. Good taste, 3. Strong root, 4. Waterlogging tolerant, 5. Medium slender, 6. Low insect infestation
BR11	1. Good yield, 2. More weight, 3. Low disease infestation, 4. Short duration, 5. No lodging
BR22	1. Good yield, 2. Good taste, 3. Short plant, 4. strong root, 5. Waterlogging tolerant, 6. Lodging tolerant, 7. Small and slender rice
BR23	1. Good yield, 2. Suitable for low land, 3. Easy to harvest as land becomes dry for its long and late life cycle, 4. Can cultivate even it is late, 5. Good taste, 6. Less pest and rat infestation
BRRi dhan49	1. High yield, 2. Good taste, 3. Medium slender grain, 4. Good price, 5. Less shattering, 6. Good straw quality
BRRi dhan51	1. Slender rice, 2. Short plant
BRRi dhan52	1. Waterlogging tolerant, 2. Good taste, 3. Small grain size
BRRi dhan87	1. Good yield, 2. Early variety, 3. Mustard can be grown after harvesting
BRRi dhan93	1. Good yield, 2. Good taste, 3. Strong plant, 4. Slender grain, 5. Waterlogging tolerant
BRRi dhan94	1. High yield, 2. Good taste, 3. Strong plant
BRRi dhan95	1. Good yield, 2. Good market price, 3. Slender grain
BRRi dhan103	1. Good yield, 2. Lodging tolerant

Source: Field survey, 2024

Boro Season

During the Boro season, farmers have significantly increased the cultivation of BRRi dhan74 and BRRi dhan92 with an increase in the area by 436% and 209%, respectively in 2023. Also, there is an increase in the area of BRRi dhan100. On the other hand, the area coverage under BRRi dhan67 and BRRi dhan81 decreased over time. The farmers in the study area got demonstration for the first time in 2023 for BRRi dhan102 and BRRi dhan105 (**Table 21**).

Table 21: Status (area coverage) of the demonstrated varieties among the farmers in different years (Boro season) in Feni district

Demonstrated Variety	Cultivated area in 2018	Cultivated area in 2019	Cultivated area in 2020	Cultivated area in 2021	Cultivated area in 2022	Cultivated area in 2023
	Area (decimal)	Area (decimal)	(decimal) Base Year	Area (decimal)	Area (decimal)	Area (decimal)
BRRi dhan67	96	30 (-69%)	-	-	80 (-17%)	-
BRRi dhan74	-	47	62 (32%)	149 (217%)	142 (202%)	252 (436%)
BRRi dhan81	-	40	40 (0%)	10 (-75%)	20 (-50%)	-
BRRi dhan89	-	-	-	30	36 (20%)	30 (0%)
BRRi dhan92	-	-	33	59 (79%)	123 (273%)	102 (209%)
BRRi dhan97	-	-	-	100	-	-
BRRi dhan100	-	-	-	30	48 (60%)	96 (220%)
BRRi dhan102	-	-	-	-	-	99
BRRi dhan105	-	-	-	-	-	100

Source: Field survey 2024

The most popular varieties in the study area were BRRi dhan100 and BRRi dhan92 which have received huge acceptance among the farmers with an average yield of 5.80 t/ha and 5.14 t/ha, respectively (**Table 23**). The reasons behind the popularity of these varieties are lower disease and insect infestation, high yield, good taste, slender grain and high market price (**Table 23**). Farmers are cultivating BRRi dhan92 as replacement of BRRi dhan28 and BRRi dhan29. BRRi dhan100 is a short duration variety that gives scope to the farmer to grow three crops. Other popular varieties include BRRi hybrid dhan8, BRRi dhan74 and BRRi dhan67 with an average yield of 8.98 t/ha, 7.06 t/ha and 7.66 t/ha, respectively. The common factors behind the popularity of these varieties are good yield, good taste, lower disease and insect attack. BRRi dhan74 is early and short duration variety with lodging tolerance. Though the yield of BRRi hybrid dhan8 is high, due to insufficient supply of seed area coverage is not so high. On the other hand, BRRi dhan105, BRRi dhan104, BRRi dhan102, BRRi dhan101 all these varieties have an average yield of greater than 6 t/ha (**Table 22**).

Table 22: Yield status of demonstrated and non-demonstrated varieties during Boro season in Feni district

Demonstrated variety	Yield (t/ha)	Other non-demonstrated variety	Yield (t/ha)
BRRi dhan100	5.80	BRRi dhan81	5.35
BRRi hybrid dhan8	8.98	Binadhan-10	2.00
BRRi dhan92	5.14	Binadhan-25	4.23
BRRi dhan89	4.64	BR16	3.29
BRRi dhan74	7.06	Hira	7.61
BRRi dhan67	7.66		
BRRi dhan105	6.84		
BRRi dhan104	7.50		
BRRi dhan102	6.27		
BRRi dhan101	9.00		

Source: Field survey 2024

Table 23: Popular varieties and reasons for varietal adoption in Feni district (Boro season)

Name of variety	Reasons for varietal popularization
BRRI dhan100	1.High yield, 2. Good taste, 3. Low disease infestation, 4. Low insect attack, 5. Short duration, 6. Slender grain and higher market price
BRRI dhan92	1. High yield, 2. Good taste, 3. Slender grain, 4. Low insect attack, 5. Low disease infestation, 6. High price and alternative to BRRI dhan29
BRRI dhan29	1.High yield, 2. Good taste, 3. No shattering, 4. Slender grain
BRRI dhan74	1.Good yield, 2. Low insect infestation, 3. Low disease attack, 4. Good taste, 5. Early and short duration variety, 6. No lodging
BRRI dhan89	1. Good taste, 2. Medium slender, 3. Good yield, 4. Low insect attack
BRRI hybrid dhan8	1.High yield, 2. Slender grain, 3. Low pest and disease
Hira	1.High yield, 2. High market demand and price, 3. No shattering, 4. Early variety, 5. Low insect attack, 6. Low disease infestation

Source: Field survey, 2024

Habiganj District

Aman Season

A very small portion of farmers cultivate rice in Aman season in Habiganj district. But the adoption and area coverage are very low. During the Aman season, the demonstrated area of BRRI dhan49 was 75 decimals but it decreased by 9.33% in 2023 and reached at 68 decimals (**Table 24**).

Table 24: Status (area coverage) of the demonstrated varieties among the farmers in different years (Aman season) in Habiganj district

Demonstrate d Variety	Cultivated area in 2020	Cultivated area in 2021	Cultivated area in 2022	Cultivated area in 2023
	(decimal) Base Year	Area (decimal)	Area (decimal)	Area (decimal)
BRRI dhan49	-	-	75	68 (-9.33%)

Source: Field survey 2024

In Aman season, BR11 and BR22 are the popular varieties, having an average yield of 5.02 t/ha and 2.53 t/ha respectively, even though these varieties are oldest variety (**Table 25**). These varieties have got acceptance because of good yield, good taste, short plant, strong root system that prevent from lodging, suitable for low land because it is waterlogging tolerant (**Table 26**). Other popular varieties are BRRI dhan46, BRRI dhan49 and BRRI dhan52. Among the demonstrated varieties, the yield of BRRI dhan52 is about 5.88 t/ha, followed by BRRI dhan49 with an average yield of 4.06 t/ha (**Table 25**). The comparative analysis among demonstrated and non-demonstrated varieties showed that demonstrated varieties had showed higher yield than non-demonstrated varieties.

Table 25: Yield status of demonstrated and non-demonstrated varieties during Aman season in Habiganj district

Demonstrated variety	Yield (t/ha)	Other non-demonstrated variety	Yield (t/ha)
BRRI dhan49	4.06	BR11	5.02
BRRI dhan52	5.88	BR22	2.53
		Ranjit	2.63

Source: Field survey 2024

Table 26: Popular varieties and reasons for varietal adoption in Habiganj district (Aman season)

Name of the Variety	Reasons for varietal adoption
BR11	1. Good yield, 2. More weight, 3. Low disease infestation, 4. Short duration, 5. No lodging
BR22	1. Good yield, 2. Good taste, 3. Short plant, 4. strong root, 5. Waterlogging tolerant, 6. Lodging tolerant, 7. Small and slender rice
BRRi dhan46	1. Late transplanting can be done, 2. Good taste, 3. Waterlogging tolerant
BRRi dhan49	1. High yield, 2. Good taste, 3. Medium slender grain, 4. Good price, 5. Less shattering, 6. Good straw quality
BRRi dhan52	1. Waterlogging tolerant, 2. Good taste, 3. Small grain size

Source: Field survey, 2024

Boro Season

During the Boro season, farmers have significantly increased the cultivation of BRRi dhan89 and BRRi dhan92 with an increase in the area by 105% and 138%, respectively in 2023. Also, there is an increase in the area of BRRi dhan67 and BRRi hybrid dhan5. On the other hand, the area coverage under BRRi dhan88 and BRRi hybrid dhan8 decreased over time. The area of BRRi hybrid dhan8 decreased due to unavailability of seed (**Table 27**).

Table 27: Status (area coverage) of the demonstrated varieties among the farmers in different years (Boro season) in Habiganj district

Demonstrated Variety	Cultivated area in 2020	Cultivated area in 2021	Cultivated area in 2022	Cultivated area in 2023
	(decimal) Base Year	Area (decimal)	Area (decimal)	Area (decimal)
BRRi dhan67	-	-	23	40 (74%)
BRRi dhan84	-	30	-	30 (0%)
BRRi dhan88	-	54	49 (-9%)	28 (-48%)
BRRi dhan89	-	43	59 (37%)	88 (105%)
BRRi dhan92	45	60 (33%)	69 (53%)	107 (138%)
BRRi dhan96	-	-	-	22
BRRi dhan102	-	-	-	56
BRRi hybrid dhan3	-	60	105 (75%)	60 (0%)
BRRi hybrid dhan5	-	88	165 (88%)	120 (36%)
BRRi hybrid dhan8	-	-	100	65 (-35%)

Source: Field survey, 2024

In Boro season, BRRi dhan29 and BRRi dhan28 still cover significant areas with an average yield of 5.93 t/ha and 7.57 t/ha, respectively (**Table 28**). Because of its grain quality, good taste as well as high yield, farmers in the study areas are still cultivating this variety. The most popular varieties in the study area were BRRi dhan92 which have received huge acceptance among the farmers with an average yield of 6.34 t/ha. The reasons behind the popularity of these varieties are lower disease and insect infestation, high yield, good taste, slender grain and high market price (**Table 29**). Farmers are cultivating BRRi dhan92 as replacement of BRRi dhan28 and BRRi dhan29. Other popular demonstrated varieties include BRRi dhan96, BRRi dhan84, BRRi dhan67 and BRRi dhan102 with average yield of 6.71 t/ha, 6.09 t/ha, 6.02 t/ha and 6.35 t/ha, respectively. Though BRRi hybrid dhan8, BRRi hybrid dhan5 and BRRi hybrid dhan3 have higher, due to insufficient supply of seed area coverage is not so high. BRRi hybrid dhan8, BRRi hybrid dhan5 and BRRi hybrid dhan3 have an average yield of 8.38 t/ha, 6.47 t/ha and 6.42 t/ha, respectively (**Table 28**).

Among the other varieties which are not being demonstrated, Janakraj yielded the highest 8.05 t/ha which is hybrid. Moreover, different hybrid varieties like Aftab, Agrani, Hira, Krishibid, Nafco, National-4 etc. have significant area coverage that could be a good opportunity for BIRRI to extend its potential hybrid varieties to those study areas.

Table 28: Yield status of demonstrated and non-demonstrated varieties during Boro season in Habiganj district

Demonstrated variety	Yield (t/ha)	Other non-demonstrated variety	Yield (t/ha)
BIRRI hybrid dhan8	8.38	Aftab	7.46
BIRRI hybrid dhan5	6.47	BIRRI dhan29	5.93
BIRRI hybrid dhan3	6.42	BIRRI dhan28	7.57
BIRRI dhan96	6.71	Agrani	6.81
BIRRI dhan92	6.34	Zira	3.29
BIRRI dhan89	5.55	Surovi	6.18
BIRRI dhan88	4.14	Sugandha	7.82
BIRRI dhan84	6.09	Poshusail	4.28
BIRRI dhan67	6.02	Partex	7.33
BIRRI dhan102	6.35	National4	7.58
		Nafco	7.32
		Krishibid	7.23
		Janakraj	8.05
		Hira	7.09
		Chamak	6.04

Source: Field survey, 2024

Table 29: Popular varieties and reasons for varietal adoption in Habiganj district (Boro season)

Name of variety	Reasons for varietal popularization
BIRRI dhan92	1. High yield, 2. Good taste, 3. Slender grain, 4. Low insect attack, 5. Low disease infestation, 6. High price and alternative to BIRRI dhan29
BIRRI dhan29	1.High yield, 2. Good taste, 3. No shattering, 4. Slender grain
BIRRI dhan89	1. Good taste, 2. Medium slender, 3. Good yield, 4. Low insect attack
Agrani	1.High yield, 2. High market demand, 3. High price, 4. Drought tolerant
Hira	1.High yield, 2. High market demand and price, 3. No shattering, 4. Early variety, 5. Low insect attack, 6. Low disease infestation
Janakraj	1.High yield, 2. No shattering, 3. Good weight
Nafco	1.High yield, 2. No shattering, 3. Lower disease, 4. Good weight
National 4	1.High yield, 2. Low shattering, 3. More weight
Shuravi	1.High yield, 2. Slender grain

Source: Field survey, 2024

Conclusion

In Aus season the most common varieties are BRR I dhan48, BRR I dhan85, BRR I dhan98 and BRR I hybrid dhan7 in Feni district. Among the demonstrated varieties, the highest average yield was found for BRR I hybrid dhan7 which is 8.38 t/ha followed by BRR I dhan98 with an average yield of 7 t/ha. In Feni district during Aman season a large number of areas are covered by various BRR I developed varieties of which the most popular varieties are BRR I dhan49, BRR I dhan52, BRR I dhan80, BRR I dhan93, BRR I dhan94, BRR I dhan95, BRR I dhan103. Among the demonstrated variety during Aman season, the highest yield was for BRR I dhan95, followed by BRR I dhan103 and BRR I dhan94. During Boro season, the most popular varieties are Bangabandhu dhan100, BRR I hybrid dhan8, BRR I dhan92, BRR I dhan29, BRR I dhan74, BRR I dhan89. Among the demonstrated variety, the highest yield was found for BRR I dhan101, followed by BRR I hybrid dhan8.

On the other hand, in Habiganj district farmers do not cultivate any Aus variety. Some farmers cultivate Aman varieties, but the area coverage is much lower. In Aman season popular varieties in Habiganj are BR11, BR22, BRR I dhan46, BRR I dhan49 and BRR I dhan52. But the yield is not up to the mark. In Boro season the popular varieties are BRR I dhan92, BRR I dhan89, BRR I hybrid dhan8, BRR I hybrid dhan5, BRR I hybrid dhan3 with yield greater than 6 t/ha. In Boro season a large amount of area is covered by various types of hybrids, such as Janakraj, Nafco, Krishibid, National-4 etc. Though the yield of BRR I developed hybrid varieties is higher than many other hybrid varieties, due to insufficient seed production and supply the area coverage is still very low. Farmers have opined that the number of demonstrations should be increased as well as a timely supply of seed should be ensured. Community approach should be introduced for demonstration program instead of individual farm level demonstration to ensure the massive inclusion of the farming community and fasten the extension process of BRR I released rice varieties.

PROGRAM AREA II: PRODUCTION ECONOMICS

PROJECT 1: ESTIMATION OF COSTS AND RETURN OF MV RICE CULTIVATION AT THE FARM LEVEL

MS Islam, MA Islam, MC Rahman, MS Rahaman, L Deb, and SA Jui

Economic decisions are primarily concerned with determining the most profitable level of input use in the production process. The viability of a technology is largely dependent on its cost and returns. Therefore, it is essential to understand the cost and return of rice cultivation where farmers use different types of technologies. Through cost and return analysis, researchers and planners can develop technologies that increase farmers' returns while reducing costs. This study has been undertaken to assess the profitability of rice cultivation in Bangladesh with the following specific objectives:

- To determine the level of inputs used in Modern rice production in different seasons.
- To estimate the cost of MV rice cultivation at the farm level across different seasons.
- To evaluate the profitability of MV Aus, MV T. Aman, and MV Boro rice cultivation at the farm level.

Methodology

A multistage random sampling technique was adopted to select farmers from all 14 agricultural regions of Bangladesh. Data on input use patterns, prices of inputs and outputs, and yields were collected from 70, 124, and 162 farmers for the Aus, T. Aman, and Boro seasons, respectively. This resulted in a total of 356 rice-growing farmers being surveyed. Data were collected through face-to-face interviews using structured questionnaire. Descriptive statistical techniques were primarily used for data analysis, and the results were presented using tabular formats.

Results and Discussion

Input Use Patterns

Farmers primarily hired contractual labor for three major labor-intensive intercultural operations: transplanting, harvesting, and carrying. They also hired labor on a daily wage basis for other operations such as land preparation, weeding, and post-harvest processing. Most farmers used power threshers on a custom-hired basis for threshing rice.

The analysis of input use patterns for MV rice cultivation across different seasons—Aus, T. Aman, and Boro—highlights significant variations in labor use, seed rates, and fertilizer application. The highest use of human labor was recorded in MV Aus rice cultivation, where 121 man-days per hectare were employed, followed by MV T. Aman (110 man-days/ha) and MV Boro (110 man-days/ha). Labor was divided into hired, family, and contractual labor, with MV Aus showing the highest reliance on hired contract labor for transplanting, weeding, and harvesting operations (67 man-days/ha) (**Table 30Table**).

Seed use across all seasons exceeded BRRI recommendations, with farmers using 42 kg/ha for Aus, 41 kg/ha for T. Aman, and 44 kg/ha for Boro, against the recommended rate of 25–30 kg/ha. Fertilizer usage was also generally higher than recommended levels. For instance, the use of Urea during Aus season was 151 kg/ha compared to the recommended 125 kg/ha. Similarly, the application of TSP,

MoP, and DAP fertilizers was notably higher in all seasons except Boro, reflecting the farmers' tendency to over-use of fertilizer (**Table 30**).

Table 30: Per hectare input used for MV rice cultivation in different seasons of Bangladesh, 2023-24

Input Items	Season		
	T. Aman	Aus	Boro
Human Labour (man-day/ha):	110	121	110
Hired	37	39	41
Family	15	16	14
Hired contract (transplanting, weeding and harvesting)	58	67	55
Seed (kg/ha):	41	42	44
Fertilizer (kg/ha):			
Urea	144 (150)	151 (125)	230 (250)
TSP	74 (56)	74 (44)	84 (94)
MoP	110 (75)	87 (67)	97 (123)
DAP	92 (56)	81 (44)	64 (94)
Gypsum	35 (50)	38 (33)	38 (62)
ZnSo4	5 (7)	6 (7)	6 (10)
MgSo4	5	5	5
Boron	4	4	4
Vitamin	2	1	3

Note: Data in parentheses indicate average BRRRI recommended fertilizer doses (Adhunik Dhaner Chas book, 2022). Source: Field Survey, 2023-24

Cultivation Costs

The per-hectare costs for human labor were highest for MV Aus cultivation at Tk. 54,389, followed by MV Boro at Tk. 49,332, and MV T. Aman at Tk. 49,296. Fertilizer costs were also highest for Boro cultivation at Tk. 11,065 /ha, followed by T. Aman (Tk. 9,729 /ha) and Aus (Tk. 9,304 /ha). The increase in fertilizer costs can be attributed to rising fertilizer prices (**Table 31**).

Irrigation costs were significantly higher for MV Boro cultivation at Tk. 16,955 /ha, primarily due to the heavy reliance on irrigation during the dry season. In contrast, MV Aman and MV Aus required much lower irrigation costs, at Tk. 6,309 /ha and Tk. 6,091 /ha, respectively. This increase in irrigation costs, especially during the Aus season, was due to a lack of rainfall and higher fuel prices. Total variable costs per hectare were highest for Boro at Tk. 1,14,114, followed by Aus (Tk. 1,01,651) and T. Aman (Tk. 97,729) (**Table 31**).

Table 31: Per hectare cost of MV rice cultivation in different seasons in Bangladesh, 2023-24

Input-wise cost	Season (Tk./ha)		
	T. Aman	Aus	Boro
Seed	3557	2348	5045
Seedling development	3157	3815	3930
Land preparation (ploughing and laddering)	11542	12315	12565
Human labour:	49296	54389	49332
Hired	16685	17348	18523
Family	6532	7018	6163
Hired contract (transplanting, weeding, and harvesting)	26078	30023	24646
Fertilizer cost	9304	9729	11065
Irrigation	6309	6091	16955
Pesticide:	5024	4437	4447
Herbicide	1353	1239	1192
Insecticide and fungicide	3671	3198	3254
Power thresher	5739	4656	4449
Total variable cost	97729	101651	114114

Input-wise cost	Season (Tk./ha)		
	T. Aman	Aus	Boro
Interest on operating capital	1501	1611	1823
Land rent	35466	30890	34890
Total fixed cost	37869	33407	37520
Total cost	135598	135058	151633

Source: Field Survey, 2023-24

Profitability

Per hectare yield of Boro paddy was the highest at 5,949 kg, followed by Aus at 5,614 kg and T. Aman at 5,407 kg. The favorable climate, low pest and disease infestation, and availability of irrigation contributed to the higher yields during the Boro season.

The gross margin per hectare for Boro season rice cultivation was Tk. 63,490, followed by T. Aman (Tk. 61,194) and Aus (Tk. 56,513). The benefit-cost ratio (BCR) based on full-cost calculation was highest for Boro and T. Aman (1.26), followed by Aus (1.24), reflecting the profitability of rice cultivation in all three seasons.

Moreover, gross profit ratios were 38%, 35%, and 35% for, T. Aman, Aus and Boro, respectively, indicating that farmers earned substantial profits, especially during the T. Aman season. The cost of production per kilogram of rice was similar across the seasons at Tk. 26/kg for Boro, Tk. 24/kg for Aus, and Tk. 25/kg for T. Aman, while the selling price of grain was Tk. 28/kg for Boro and T. Aman, and Tk. 27/kg for Aus (**Table 32**).

Table 32: Per hectare profitability of MV rice cultivation in different seasons in Bangladesh, 2023-24

Item	Season		
	T. Aman	Aus	Boro
1 Total costs (TK./ha) (2+3)	135598	135058	151633
2 Total variable costs (TK./ha)	97729	101651	114114
3 Total fixed cost (TK./ha)	37869	33407	37520
4 Yield (kg/ha)	5407	5614	5949
5 Market value of paddy (TK./ha) (4*11)	150104	148942	167452
6 Market value of straw (TK./ha)	8820	9222	10152
7 Gross benefit (GB) (TK./ha) (5+6)	158924	158164	177604
8 Gross margin (GM) (TK./ha (7-2)	61194	56513	63490
9 Gross profit ratio ((GM*100)/GB)	38	35	35
10 Net return (TK./ha) (7-1)	23325	23106	25971
11 Cost of production (TK./kg)	25	24	26
12 Selling price of grain (TK./kg)	28	27	28
13 BCR (full cost basis) (7/1)	1.26	1.24	1.26
14 BCR (cash cost basis) (7/2)	1.75	1.64	1.67

Source: Field Survey, 2023-24

Conclusion

Per hectare total variable costs for Boro and Aus rice cultivation were higher compared to T. Aman. Similarly, per hectare the gross margin for MV Boro rice cultivation was the highest at Tk. 63,490, followed closely by T. Aman at Tk. 61,119, and Aus at Tk. 56,513. The BCR on a full-cost basis was highest for MV Boro and T. Aman at 1.26, followed by Aus (1.24). The higher gross profit ratios during the T. Aman season (38%) suggest that farmers were able to sell their produce at favorable prices, making rice cultivation profitable across all three seasons.

PROGRAM AREA III: RICE MARKETING AND PRICE POLICY

PROJECT 1: PRODUCERS' WELFARE LOSS IN BANGLADESH: AN ASSESSMENT OF RICE MARKET DISTORTION

MC Rahman, MA Islam, MS Rahaman, SA Jui and MS Islam

Introduction

Rice, as the staple food of Bangladesh, plays a critical role in both the economy and the livelihood of millions of farmers. However, rice farmers in the country often face significant welfare losses due to market price fluctuations. Despite the importance of rice production, farmers frequently struggle with declining farmgate prices, which are often lower than the investment in paddy production. This market disparity, influenced by factors such as government policies, middlemen exploitation, and international price competition, puts immense pressure on smallholder farmers, reducing their income and overall well-being. The cyclical nature of rice prices, coupled with the limited access to modern farming inputs, leaves farmers vulnerable to economic instability. As a result, rice farmers in Bangladesh endure welfare losses that not only affect their livelihoods but also pose broader challenges to food security and rural development in the country. Understanding the dynamics behind these welfare losses is essential for developing sustainable agricultural policies and interventions aimed at improving farmers' economic resilience.

Therefore, this research aimed to assess the paddy producers' welfare loss based on actual market price and government declared procurement price in the Boro season.

Methodology

Data sources and description

Estimating rice supply function: The data used in this study has been gathered from different recognized sources. Annual data on rice supply, cultivated area, yield, chemical fertilizer, and pesticide use have been collected from the Bangladesh Bureau of Statistics. The agricultural credit disbursement data has been gathered from Bangladesh Economic Review. Data on the costs of paddy production have been collected from the Agricultural Economics Division of Bangladesh Rice Research Institute. The time series data on these variables covered the period 1982-2022.

Producers' welfare change estimation: The paddy farmgate price and procurement price data have been gathered from the Department of Agricultural Marketing and the Ministry of Food, Bangladesh, respectively. As the government procurement program had been running from 2000 onward only for the Boro season, we have estimated producers' surplus change in the Boro season based on the declared procurement price and actual farmgate price during 2000-2022.

Empirical estimation

Estimating rice supply function

The basic objective of this research is to estimate the rice supply function in Bangladesh and assess the change in producers' surplus due to the deviation of farmgate price from the declared procurement price. Due to the theoretical and empirical studies that have shown the endogenous status among the variables responsible for rice supply, it is evident that the paddy market price depends on the rice

cultivated area, average rice yield, pesticide used, chemical fertilizer used, and agricultural credit, where the instrumental variable is lag of paddy production cost. Hence, the impact of the paddy market price on rice supply will be estimated as the following equation:

$$\ln Y_t = \beta_0 + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \beta_4 \ln X_{4t} + \beta_5 \ln X_{5t} + \beta_6 \ln X_{6t} + u_t \quad (1)$$

In constraint with the equation as follows:

$$\ln X_{1it} = \alpha_0 + \alpha_1 \ln P_{t-1} + \alpha_2 \ln X_{2t} + \alpha_3 \ln X_{3t} + \alpha_4 \ln X_{4t} + \alpha_5 \ln X_{5t} + \alpha_6 \ln X_{6t} + v_t \quad (2)$$

Where, Y_t = supply of clean rice (million ton); X_{1t} = average real paddy price (BDT/kg) (endogenous variable); X_{2t} = total rice cultivated area (million hectare); X_{3t} = average clean rice yield (ton/hectare); X_{4t} = total pesticide used (million ton); X_{5t} = total chemical fertilizer used (million ton); X_{6t} = total agricultural loan distributed (million BDT); P_{t-1} = Lag of costs of paddy production (BDT/kg) (Instrumental variable); $t = 1, \dots, n$ (number of year)

According to many theoretical and empirical studies, the problem is that endogeneity may occur with variable X_{1t} . Variable X_{1t} might be correlated with the error term u_t , that is, $\text{corr}(X_{1t}, u_t) \neq 0$. If we use simple OLS in Equation (1), the estimated coefficient will be biased and inconsistent. This situation occurs when there are unobserved factors influencing both paddy market prices (X_{1t}) and the outcome (Y_t). Because of endogeneity in the model, we will use the method of GMM 2-Stage Least Squares to deal with this issue. This technique is the extension of the OLS method. It is used when the dependent variable's error terms are correlated with the independent variables.

In this case, we say that X_{1t} is endogenous. Then, the solution is applied as follows. Step 1: specify a model for X_{1t} . According to the previous theory and empirical studies, a model can be built as Equation (2). We run Equation (2) using OLS, obtain the estimated coefficients, and generate predicted program participation. Step 2: substitute estimated X_{1t} in the main Equation (1). Step 3: test for endogenous variable and instrumental variable.

Welfare change estimation

The welfare effects of market distortion scenario will be anticipated based on a simple welfare analysis. The change in producer surpluses (ΔPS) will be determined by employing a supply and price relationship equation. The related welfare impact will be captured using Equation 3 as follows:

$$\Delta PS = \int_{P_P}^{P_A} Q_s dP \quad (3)$$

where P_P is the procurement price and P_A is the actual farmgate price. This implies that, if the actual farmgate price (P_A) became less than that of procurement price (P_P), then producers are losing, and vice versa.

Using the supply elasticity of own farmgate price of paddy, we can write the simplified supply equation 4 as:

$$\ln Q_s = \alpha_0 + \beta \ln P \quad (4)$$

Given that above Equation is in log form, β represents the elasticity. Using the mean values of

rice supply (Q_s) and price (P) from the available data set, and estimated price elasticity of supply, we can determine α_0 . From Equation 4 we can write

$$Q_s = e^{(\alpha_0 + \beta \ln P)} \quad (5)$$

Therefore, the change in producer surplus can be derived as

$$\Delta PS = \int_{P_P}^{P_A} e^{(\alpha_0 + \beta \ln P)} \cdot dP = \left(\frac{e^{\alpha_0}}{1 + \beta} \right) [e^{(1+\beta) \ln P_A} - e^{(1+\beta) \ln P_P}] \quad (6)$$

Scenario 1: Farmgate price > Procurement price = Welfare gain

Scenario 2: Farmgate price < Procurement price = Welfare loss

Results

Estimating supply function

The two-step generalized method of moments (GMM) results showed that rice supply is positively influenced by factors like paddy market price, cultivated rice area, pesticide use, and agricultural credit (Table 33).

Table 33: Estimated regression results of OLS and Two-step GMM

Explanatory variables	OLS		Two-step GMM	
	Coeff.	SE	Coeff.	Robust SE
Total supply of rice (Dep. variable)				
Independent variables:				
Log average paddy market price	0.121***	0.042861	0.189***	0.048455
Log total rice area	0.632**	0.308705	0.609**	0.309155
Log average yield	0.691***	0.183546	0.806***	0.156252
Log total pesticide use	0.083***	0.020651	0.071***	0.019075
Log chemical fertilizer use	0.048 ^{NS}	0.037875	0.011 ^{NS}	0.055861
Log agricultural credit use	0.047*	0.024446	0.051*	0.027982
Constant	1.943 ^{NS}	2.99903	2.3352 ^{NS}	3.08449
Diagnostic statistic:				
F test (6,34)	903.89***		-	
Adj R2	0.993		-	
Period of observation (year)	41		40	

Producers' welfare change estimation:

The welfare change analysis reveals that over the estimated period, the rice producers lost an average 54.37 million BDT/season of their surplus based on the procurement price. However, after initiating the COVID-19 pandemic, the producers are getting a better surplus (on an average of 4.35 million BDT/season) (Figure 6)

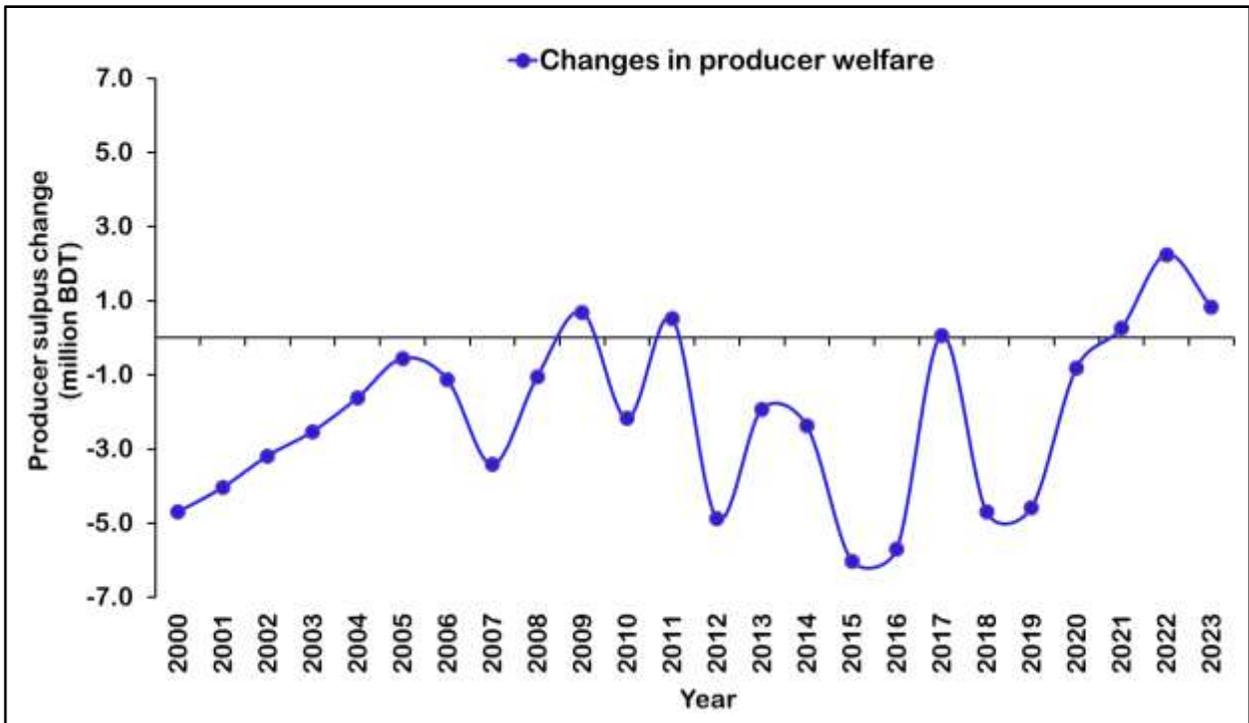


Figure 6: Welfare impact of rice producers due to market distortion in Bangladesh.

Conclusion

The findings of this study ensuring paddy price positively influence rice supply in Bangladesh. Other positively influential factors are rice area, yield, pesticide use, and agricultural credit. The government should ensure these factors for maintaining surplus rice production. Moreover, farmers had to sell paddy for less than the declared procurement price, which impacted their surplus. However, from the initiation of the COVID-19 pandemic, farmers are getting better price (more than the declared procurement price) and gaining surplus. Therefore, to be farmer-oriented, ensuring better farmgate price is essential.

PROGRAM AREA IV: AGRICULTURAL POLICY AND DEVELOPMENT

PROJECT 1: IMPACT OF POVERTY REDUCTION ON NUTRITION SECURITY IN RURAL HOUSEHOLDS OF BANGLADESH

M. A. Islam, M.C. Rahman, M. S. Rahaman, and M. S. Islam

Introduction

Bangladesh made significant progress in reducing poverty and malnutrition over the past two decades, yet many indicators of food insecurity and malnutrition remain high (HIES, 2022). The nature of malnutrition has significant long-term implications for the country's economic development. It is presumed that Bangladesh will face enormous challenges in achieving nutrition security and ensuring food security for all individuals and groups in the country if the country cannot implement a sustainable development goal (SDG) by 2030. Although Bangladesh has achieved remarkable progress in food security in terms of access, nutrition security is still a central problem for heterogeneous farm households. However, this study aims to investigate whether both in the short and long run the reduction of poverty can increase the nutrition security status of rural farmers in Bangladesh using panel data and to draw some policy recommendations from the findings.

Methodology

In this study, three-period balanced panel data were used and data were also collected from the International Food Policy Research Institute (IFPRI). IFPRI conducted three periods (2011-12, 2015 and 2018-19) surveys covering 6,500 rural households in each case which were nationally representative sample in Bangladesh. Out of 6,500 rural households, we selected 4,093 rural households in each period to achieve the goal of the study.

In this study, we used the Household Dietary Diversity Score (HDDS) as an indicator of nutrition security. The HDDS is constructed based on the number of food groups consumed by the household during a given reference period. Food items were categorized into 12 different food groups as proposed by the Food and Agriculture Organization of the United Nations (FAO, 2011). The 12 food groups are Cereals; White tubers and roots; Legumes, nuts and seeds; Vegetables; Meat; Eggs; Fish and other seafood; Fruits; Milk and milk products; Oils and fats; Sweets; and Spices, condiments and beverages. Each food group adds one score point toward the HDDS if any member of the household consumed a food item from that group in the given seven-day period. Thus, an HDDS ranges from 0 to 12. The use of dietary diversity scores is considered superior to calorie intake totals over Household Dietary Richness Score (HDRS) because the HDDS also reflects the quality of foods available to households (Ruel, 2003).

In the context of measuring poverty in a population, the indices in Foster *et al.* (1984) are commonly used which is expressed as:

$$P_{\alpha} = \frac{1}{N} \sum_{i=1}^N \left[\frac{Z-y_i}{Z} \right]^{\alpha} \quad (\alpha > 0) \text{ and } (y_i < Z) \dots \dots \dots (1)$$

where Z is the agreed-upon international monetary poverty line (US\$ 1.90/capita/day) converted to Bangladeshi Taka, N is the total household population, y_i is household expenditure per capita for the i^{th} person and α is a poverty aversion (sensitivity) parameter. When $\alpha = 1$, it is a measure of the poverty gap (Islam 2018). The study used the international poverty line of US\$ 1.90/capita/day for 2011-12, 2015, and 2018-19. Real per capita household expenditure was used for measuring poverty which was updated to March 2023 using the consumer price index.

The majority of the previous studies have employed household dietary diversity score (HDDS) as an indicator of nutrition security. In this study, we also used it to address nutrition security in developing countries like rural Bangladesh.

Poisson two-way fixed effect regression was used in this study:

$$HDDS_{it} = \beta X'_{it} + C_i + \gamma_t + u_{it}, t = 1 \dots T \dots \dots \dots (2)$$

Where HDDS is the respective outcome variable (household dietary diversity score). X_i is a vector of explanatory variables that influences the outcome variable, and it includes the poverty gap index (PGI), household socioeconomic, farm and contextual characteristics, and crop diversity score. β as the respective vectors of parameters to be estimated. C_i and γ_t represent unobserved individual and time-specific effects respectively, and u_{it} is the error term. For addressing unobserved heterogeneity problems, we used the Chamberlin-Mundlak approach. Our dependent variable is a count variable, so the Poisson two-way fixed effect model is a natural starting point. This Poisson quasi-maximum likelihood-based methodology is fully robust to any distributional misspecification (Wooldridge, 1999a). The log-linear model form of the Poisson regression model can be depicted as:

$$\ln \lambda_{it} = \beta X'_{it} + C_i + \gamma_t + u_{it} \dots \dots \dots (3)$$

Multicollinearity and heteroskedasticity issues

In this case, variance inflation factor (VIF) was used to test whether the multicollinearity problem existed or not. The study found that the value of VIF was about 6.42. The rule of thumb is if the VIF value is ≤ 10 , there is no multicollinearity problem in the model (Gujarati, 2004). That means there was no multicollinearity problem in the data. Since, we have included households with different levels of engagement in agriculture, there was a potential heteroskedasticity problem in the model. The study, therefore, employed bootstrapped standard error to address the heteroscedasticity issue in both individual period models and pool model (Chegere and Stage, 2020).

Wald Chi² test for detecting unobserved heterogeneity

In our study, we employ different short and long-run Poisson fixed effect models (See **Table 28**). We suspect that our model exists in time-varying unobserved heterogeneity. To address the time-varying unobserved heterogeneity problem, we used the Chamberlin-Mundlak approach. We also set a null hypothesis that time-varying unobserved heterogeneity does not exist in the model. **Table 28** shows that in all the short and long-run models we found, Wald Chi² values are statistically insignificant. That means the null hypothesis we set was accepted in all the models. We can say that time-varying unobserved heterogeneity does not exist in our models. So we can use the Poisson fixed effect model.

Results and discussion

Data in **Table 34** show that, in the short run, if the poverty gap decreases by 1%, then nutrition security (HDDS) increases by 27.9% from the period 2011-12 to the period 2015. Similarly, if the poverty gap decreases by 1%, then nutrition security (HDDS) increases by 23.8% from the period 2015 to the period 2018-19. Nutrition security in terms of HDDS decreases 4.10% from one short-run period (2011/12 to 2015) to another short-run period (2015 to 2018-19). It might be due to less consumption of different food groups, and a higher inflation rate prevails in the 2015 to 2018-19 period compared to 2011-12 to 2015. In addition, in the long run, if the poverty gap decreases by 1%, then nutrition security (HDDS) increases by 25.9% from

the period 2011-12 to the period 2018-19. The analysis further shows that the production diversity score, male members and female members in the households, access to information, and asset index significantly increased the nutrition security in rural households in Bangladesh.

Table 34: Short and long-run impact of poverty reduction on nutrition security (HDDS) in Bangladesh using the Poisson fixed effect model.

Particulars	2011-12 to 2015 (Short run)		2015 to 2018-19 (Short run)		2011-12 to 2018-19 (Long run)		2011-12, 2015 and 2018-19 (Pooled)	
	APE coeff.	Boot. SE	APE coeff.	Boot. SE	APE coeff.	Boot. SE	APE coeff.	Boot. SE
Poverty gap	-0.279***	0.03274	-0.238***	0.03893	-0.259***	0.02245	-0.261***	0.02421
Household head age (year)	0.001	0.00105	0.000	0.00109	-0.000	0.00072	0.000	0.00065
Household head age2 (year)	-0.000	0.00001	-0.000	0.00001	0.000	0.00001	-0.000	0.00001
Household head sex (Male=1)	0.006	0.00523	0.006	0.00383	-0.001	0.00373	0.003	0.00294
Household head occupation (Farming=1)	0.003	0.00254	0.002	0.00260	-0.001	0.00236	0.001	0.00177
Male member in the family (Number)	0.007***	0.00212	0.003*	0.00147	0.005***	0.00143	0.005***	0.00114
Female member in the family (Number)	0.009***	0.00168	0.006***	0.00117	0.007***	0.00120	0.007***	0.00095
Production diversity score	0.001***	0.00026	0.001***	0.00022	0.001***	0.00021	0.001***	0.00016
Access to information (Access=1)	0.012***	0.00374	0.010**	0.00455	0.008**	0.00346	0.010***	0.00283
Migration (Migrated=1)	0.002	0.00255	-0.003	0.00210	-0.002	0.00215	-0.002	0.00163
Farm size (decimal)	-0.000	0.00001	0.000	0.00001	0.000*	0.00001	0.000	0.00001
Asset index	0.000	0.00132	0.002**	0.00085	0.003***	0.00077	0.002***	0.00068
Market participation (Participated=1)	-0.000*	0.00005	-0.000	0.00005	0.000	0.00004	-0.000	0.00004
Year dummy 2015	0.032*	0.00186	-0.006***	0.00141	-	-	0.033***	0.00151
Year dummy 2018-19	-	-	-	-	0.037***	0.00150	0.038***	0.00150
Diagnostic statistic:								
Pseudo-log likelihood	-4226.7699		-4263.0818		-4233.9993		-9022.3789	
Wald chi2 (14)	967.14		205.39		1474.27		Wald chi2 (15) =1620.89	
Prob > chi2	0.0000		0.0000		0.0000		0.0000	
Wald Chi² test:								
H₀: Time-varying unobserved heterogeneity does not exist in the model.								
		Chi2 (14) = 14.72	Chi2 (14) = 17.42	Chi2 (14) = 09.50	Chi2 (15) = 19.08			
		Prob > Chi2 = 0.3976	Prob > Chi2 = 0.2345	Prob > Chi2 = 0.7975	Prob > Chi2 = 0.2100			
H₁: Time-varying unobserved heterogeneity exists in the model.								
Number of observations	8,186		8,186		8,186		12,279	

Source: BHHS panel data (2011-12, 2015 and 2018-19)

Note: 1) APE means average partial effect

2) ***p<0.01, **<0.05, *<0.10

3) Bootstrapping standard errors with 1000 iterations

Conclusion and recommendations

In summary, nutrition security was significantly increased due to the reduction of the poverty gap among households over the different short and long-run periods in Bangladesh. In the country, presently one of the top policy priorities is to improve food and nutrition security. Short and long-run policy actions are required to increase income-generating activities and reduce of inflation rate of food commodities that can help to purchase more nutritious foods and food groups at any time.

To effectively reduce poverty and enhance food and nutrition security in Bangladesh, a multifaceted approach encompassing both short- and long-term policy measures is crucial. Key interventions include:

- **Stimulating income-generating activities:** This involves implementing policies that foster economic growth and create sustainable employment opportunities for the impoverished population.
- **Stabilizing food and non-food prices:** Controlling inflation rates for essential commodities is paramount to ensure that the purchasing power of low-income households is not eroded.
- **Improving access to credit:** Reducing the cost of obtaining credit for both individuals and businesses is essential to facilitate investment, entrepreneurship, and economic empowerment.
- **Enhancing social and political accountability:** Promoting transparency, accountability, and participatory governance at all levels is crucial to ensure that policies and programs effectively address the needs of the most vulnerable populations.

Appendix:

Appendix A1: Short and long-run impact of poverty reduction on nutrition security (HDDS) in Bangladesh using Poisson fixed effect with Chamberlin-Mundlak approach.

Particulars	2011-12 to 2015 (Short run)		2015 to 2018-19 (Short run)		2011-12 to 2018-19 (Long run)		2011-12, 2015 and 2018-19 (Pooled)	
	APE coeff.	Boot. SE	APE coeff.	Boot. SE	APE coeff.	Boot. SE	APE coeff.	Boot. SE
Poverty gap	-0.277***	0.03506	-0.274***	0.03747	-0.303***	0.03609	-0.282***	0.02325
Household head age (year)	0.001	0.00145	0.000	0.00146	-0.000	0.00119	0.000	0.00083
Household head age2 (year)	-0.000	0.00001	-0.000	0.00002	-0.000	0.00001	-0.000	0.00001
Household head sex (Male=1)	0.014*	0.00733	0.008	0.00623	0.004	0.00652	0.009**	0.00425
Household head occupation (Farming=1)	0.007*	0.00396	0.006	0.00432	-0.002	0.00387	0.003	0.00247
Male member in the family (Number)	0.007**	0.00333	-0.001	0.00218	0.005**	0.00245	0.004**	0.00169
Female member in the family (Number)	0.009***	0.00258	0.005**	0.00225	0.007***	0.00211	0.007***	0.00145
Production diversity score	0.001**	0.00040	0.001	0.00042	0.000	0.00035	0.001***	0.00023
Access to information (Access=1)	0.007	0.00549	0.020**	0.00837	0.009	0.00593	0.010**	0.00394
Migration (Migrated=1)	0.006	0.00382	-0.000	0.00392	-0.006	0.00385	-0.001	0.00246
Farm size (decimal)	-0.000	0.00002	0.000	0.00005	0.000	0.00002	0.000	0.00002
Asset index	0.001	0.00236	0.002	0.00166	0.004***	0.00135	0.002**	0.00109
Market participation (Participated=1)	-0.000***	0.00010	-0.000	0.00012	-0.000	0.00008	-0.000**	0.00006
Year dummy 2015	0.033***	0.00307	-0.006**	0.00254	-	-	0.033***	0.00222
Year dummy 2018-19	-	-	-	-	0.039***	0.00263	0.039***	0.00225
Diagnostic statistic:								
Chamberlin-Mundlak approach used	Yes		Yes		Yes		Yes	
Pseudo-log likelihood	-4226.7184		-4263.0291		-4233.9632		-9020.3133	
Wald chi2 (28)	1018.48		257.13		1501.21		Wald chi2 (30) =1705.81	
Prob > chi2	0.0000		0.0000		0.0000		0.0000	
Number of observations	8,186		8,186		8,186		12,279	

Source: BIHS panel data (2011-12, 2015 and 2018-19)

Note: 1) APE means average partial effect

2) ***p<0.01, **<0.05, *<0.10

3) Bootstrapping standard errors with 1000 iterations