Research Achievement (2017-2018)

VARIETAL DEVELOPMENT PROGRAM PROGRAM AREA

PLANT BREEDING DIVISION

Table-1
Research Achievement 2017-2018
(Technology Developed)

Technology Developed	How Country/Farmer/User will be benefited
Program Area: Varietal Development program (VDP)	
BRRI dhan88: BRRI dhan88 was released as a short duration Boro variety for favorable irrigated ecosystem. It gave 0.2- 0.6 t/ha higher yield and 2-3 days earlier growth duration compared BRRI dhan28.  	BRRI dhan88 has long slender grain with 9.8% protein and 26.3% amylose. The variety has lodging tolerance and given flag leaf stay during maturity. This variety has the potentiality to replace BRRI dhan28 and could contribute to increase rice production of the country.

Hybrid Rice Division

Table-1

Research Achievement 2017-2018
(Technology Developed)

Sl. No	Technology Developed	How country/farmer/user will be benefited
01.	A total of 9767 kg of parental lines (A & R) and hybrid seeds of five released hybrid varieties distributed to 12 seed companies along with 80 farmers	Popularization of BRRI released hybrid varieties than imported hybrids
02.	One potential hybrid combination (IR79156A/BRRI20R) has released as BRRI hybrid dhan6 for T Aman season having slender grain with yield potentiality 6.5-7.0 t/ha and growth duration within 115-120 days. It is released in Dhaka, Chattogram and Jashore regions for cultivation. It is a high amylose (24%) content hybrid that is preferable for most of the consumers.	Newly released BRRI hybrid dhan6 has immense yield potentiality with desirable grain quality will fulfill farmers demand
03.	Leaflet of BRRI released hybrids cultivation and seed production technologies were published	It will helpful for farmer and small entrepreneurs to understand technology easily.
04.	Two promising restorer lines (BR7358-36-2-2-1R & BR7881-25-2-3-12R) were identified from local elite advance lines	These two restorer lines performed well in both Aman and Boro season. Hopefully it will able to produce good heterotic hybrid combinations with short duration and desired grain quality.
05.	F_1 seed production package development of the selected hybrids	Seed production of the newly selected hybrids have been fine tuning and farmers can easily make seed production with this combinations

Genetic Resources and Seed Division (GRSD)

Table - 1
Research Achievement 2017-2018
(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
Program Area 01: Varietal Development Program (VDP)		
3	**Sub-program area: Rice Germplasm and Seed**	

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
3.1	**Project: Rice germplasm conservation and management**	
3.1.1	**Germplasm Collection:** 161 rice germplasm including 32 Jhum, 31 Aus, 91 T. Aman, 7 Boro varieties were collected from different districts of Bangladesh.	These germplasm would be utilized in breeding program for varietal improvement.
3.1.2	**Morphological Characterization:** Characterization of 158 germplasm was performed against 53 morpho-agronomic characters. Rejuvenation of 2,040 accessions was performed and 36 new germplasm were registered (from accession 8201 to 8236) in BRRI Genebank. Besides, characterization of 203 local T. Aman germplasm was conducted and 20 superior genotypes were selected for boosting yield through trait discovery in changing climatic conditions.	Characterized and as well as conserved germplasm would be utilized in trait specific breeding program.
3.1.3	**Molecular characterization:** Molecular characterization of 48 T. Aman landraces was completed using 69 SSR markers and revealed that RM206 (0.87) was the best marker. Besides, the population structure analysis showed two population groups namely GI (green) and GII (red) representing 42 and 6 studied germplasm, respectively.	Characterized germplasm would be protected regarding varietal identification and intellectual property rights (IPR's).
3.2	**Project: Seed production and variety maintenance**	
	During the reporting year, 151.93 tons of breeder seed were produced and 125.37 tons of breeder seed were distributed among 873 (GO, NGO and PS) 'Rice Seed Network' partners.	Faster dissemination of produced quality seed, as well as its variety to the end users and increased production of rice accordingly.
3.3	**Project: Exploratory and genetic studies**	
3.3.1	Genetic diversity of 61 local Binni varieties in T. Aman season were studied with 12 agro-morphological characters and were grouped into five clusters through Mahalonobis (D^2) and Canonical Vector analyses.	The genetic variability and relationships i.e. genetic makeup of the studied germplasm could be well understood.
3.3.2	From observational trial (OT), 7 of which two from Balam (Acc. 1011, 516), three from Jesso-Balam (2473, 2464, 2472), one each from Sada Mota (7888) and Lal Mota (7889) out of 21 popular rice germplasm from southern regions were selected for Preliminary Yield Trial (PYT).	Characterized wild rice would be protected regarding intellectual property rights (IPR's).
3.4	**Documentation of technology:** During the reporting year, 2000 accessions were documented in computer through *Microsoft Office Excel* program with collected available information.	Characterized information of the germplasm could be utilized for selecting parent(s) in breeding program.

Biotechnology Division

Table 1
Research Achievement 2017-2018

Sl. No.	Technology Developed	How country/ Farmer/ User will be benefited
1	In total 12 doubled haploid green plants were regenerated from the hybrid anther of different crosses. Ten (10) doubled haploid green lines were grown for generation advancement.	This line will be used for developing high yielding, low glycemic index and premium quality rice variety that ultimately benefits the farmers.
2	During T. Aman/2017, one advanced line BR(Bio)9786- BC2-132-1-3 was evaluated as PVT and selected by SCA team and released as a variety named **BRRI dhan87.**  **Characteristics:** Mean Plant height is 122cm Culm very strong so lodging resistance Light green leaves. Flag leaf erect and, long and broader than BRRI dhan49 Long slender grain. 1000 grain weight 24.1 gm Amylose: 27% Growth Duration 126-128 days, 7 days earlier than BRRI dhan49 Mean Yield 6.5 ton/ha	This high yielding T Aman rice variety will be grown by the farmers that ultimately benefit the farmers as well as whole country. This variety will be replacement of mega variety BR11.

Sl. No.	Technology Developed	How country/ Farmer/ User will be benefited
3	During Boro/2017-18, one advanced line BR(Bio)9786- BC2-59-1-2 was evaluated as PVT and selected by SCA team and released as a variety named **BRRI dhan89**  **Characteristics:** Mean Plant height is 106 cm Culm very strong so lodging resistance Light green leaves. Flag leaf broader than BRRI dhan29 Plant retains greenish at the time of maturity 1000 grain weight 24.4 gm Amylose: 28.5% Growth Duration 154-158 days, Mean Yield 8.0 ton/ha	This high yielding Boro rice variety will be grown by the farmers that ultimately benefit the farmers as well as whole country. Hopefully this variety will be replacement of mega variety BRRI dhan29.
4	During Boro/2017-18, Five lines were evaluated in ALART with standard checks. One-line BR(Bio)9787-BC2-63-2-2 was selected for PVT.	These lines will be used to develop high yield Boro rice variety that ultimately benefits the farmers
5	During Boro/2017-18, nine Bacterial Blight (BB) gene pyramided BRRI dhan28 rice lines having three BB resistant genes (*Xa4, xa13* and *Xa21*) were evaluated as PYT and five lines were selected for RYT depending on the phenotypic acceptability, yield performance BB scoring and presence of BB resistance genes	These lines will be used to developed bacterial blight resistant variety that ultimately benefits the farmers.
6	For the gene cloning study, cDNA was synthesized from RNA of treated *P. coarctata* and amplified with *Vacuolar H+ ATPase (PVA1)* primer followed by sequence analysis. Then PCR product was clone into	Salt tolerant transgenic rice variety will be develop that ultimately benefits the farmers

Sl. No.	Technology Developed	How country/ Farmer/ User will be benefited
	TOPO TA cloning vector. Positive clone were confirmed by colony PCR and PCR. Plasmid DNA extracted from positive clone and sequencing was done for further confirmation.	

CROP SOIL WATER MANAGEMENT PROGRAM AREA

Agronomy Division

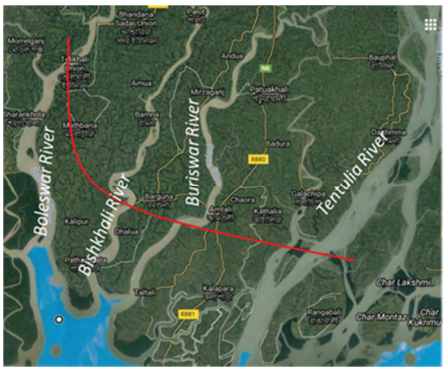
Table-1
Research Achievement, 2017-2018

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
1	None	

Irrigation and Water Management Division

Table 1
Research Achievement 2017-18

Sl. No.	Technology Developed/Information generated	How Country/Farmer/ User will be benefited
1	**Technology: Delineation of fresh water areas in tidal Barishal regions** Dry season water salinity was monitored in the major river systems (Tentulia, Buriswar, Biskhali and Boleswar) in Barishal during March-June 2018. Considering 1 dS/m as safe limit for continuous irrigation, a line for saline sweet water interface was drawn (Figure 1). Water salinity in the upstream part from Charkhali ferry ghat point in Boleswar River, Kakchira ferry ghat point in Biskhali River, Borobogi point in Buriswar River, and Panpatti point in Tentulia River were 1.08 dS/m, 0.55 dS/m, 0.48 dS/m and 0.76 dS/m, respectively in 2018. The results suggest that water from the selected rivers are suitable for irrigation when the water is applied from the upstream of the saline-sweet water interface of the river (above the red line shown in Figure 1). The saline-sweet water interface is located at 34 km for Boleswar river, 24 Km for Bishkhali river, 18 km for Buriswar river, and 17	Farmers will be able to include one or two more crops in their existing single cropped cropping pattern utilizing suitable water for irrigation from the rivers. Crop productivity of the farmers will be increased, and thus the livelihood of the farmers will be improved.

	km for Tentulia river from the respected estuaries.  Figure 1. Map showing saline-sweet water interface with the red line for selected four rivers in Barishal region. **Technological benefit** i. Delineation of suitable areas for Boro or dry land non-rice crops will be done using these salinity data. ii. Lands that are cultivated during Aman season and remains fallow during Boro or Dry season in Barishal region will be brought under cultivation. iii. Crop productivity and hence, the cropping intensity will be increased in Barishal region.	

PLANT PHYSIOLOGY DIVISION

Table-1
RESEARCH ACHEIVEMENT 2017-18
(Technology Developed/ Useful scientific information)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
Not applicable for Plant Physiology Division		

Soil Science Division

Research Achievement 2017-18

Table-1

Scientific Information/ Technology Developed	How country/Farmer/User will be benefited
Technology Vermicompost (VC) or Poultry manure (PM) at 0.5 t ha^{-1} with full doses of chemical fertilizer could be suitable for sustaining rice productivity and rice soil	The developed scientific information will be useful to the researchers and scientific personnel related to agriculture

health. **Scientific Information** ➢ The grain yield and nutrient uptake of BRRI dhan58 was significantly influenced by N rates. The calculated economically optimum N dose for BRRI dhan58 in Boro season was 144 kg/ha. ➢ In first crop cycle, AEZ based fertilizer seems to be enough for obtaining the potential yield of each crop. However, long-term evaluation needs to see the yield trend and soil fertility status. ➢ A combination of 100 kg K and 120 kg N for Boro rice (BRRI dhan74) cultivation seems to be suitable for desired yield. ➢ Soil P affected rice yield and plant nutrition more in dry season than wet season. ➢ In Rangpur region, N appeared as the most limiting nutrient for rice in both T. Aman and Boro seasons. ➢ Long-term omission of N, P, K, S adversely affected rice yield though S and Zn omission had no negative effect on rice yield in Grey Terrace soil of BRRI farm, Gazipur. Long-term application IPNS based fertilizers showed increasing trend of yield, while inorganic fertilizer alone showed yield plateau. So, IPNS based fertilizer management is necessary for sustainable rice production in Bangladesh. ➢ Intensive rice cropping without fertilizer showed decreasing trend and lower nutrient status of soil. However, complete fertilization can recuperate	in home and abroad. The farmers in our country will also be benefited.

soil productivity even after a long period of rice cultivation. ➢ In double rice cropping pattern, STB dose gave 9.17 t ha^{-1} yr^{-1} grain yields but 50% STB + MM resulted in 13.01 t ha^{-1} yr^{-1} under triple rice cropping. ➢ Deep placement of UB significantly increased rice yield and NUE compared to PU under AWD and CSW practices in Boro season. Deep placement of UB significantly reduced floodwater NH_4^+-N and NH_3 volatilization compared to broadcast PU. ➢ The INM practice was superior over balanced chemical fertilization to maintain soil carbon stock. Mean weight diameter of water stable (MWDw) aggregates and crop yields were positively correlated with SOC. ➢ On an average, AWD condition reduced GWP by 39% over conventional practices in Boro season. ➢ Short duration rice variety is one of the important key factor for reducing greenhouse gas emission. ➢ Application of bio-organic fertilizer (1-2 t ha^{-1}) can supplement 25-30% chemical N and 100% TSP fertilizer requirement for rice production. Bio-organic fertilizer improved rice yield in saline soil. ➢ Long-term study proved that application of cow dung or poultry manure as IPNS improves soil biology and maintained nutrient dynamics as well as soil health and crop productivity. .	

PEST MANAGEMNT PROGRAM AREA

Entomology Division

Table 1
Research Achievement 2017-18
(Technology Developed)

Sl. No.	Technology developed/Scientific information	How country/Farmer/User will be benefited
1	**Pest and natural enemy incidence in BRRI farm, Gazipur** Rice insect pests, natural enemies and crop damage intensities in six habitats were monitored weekly by 100 complete sweeps from each habitat at BRRI research farm. The overall insect pest incidence was low in all season. Higher incidences of insect pests were found in T. Aman than Aus season. Highest insect pest and natural enemies were found in rice bund during Aus season. Short-horned grasshopper (SHG), rice bug (RB), spider (SPD) and damselfly were dominant in all habitats of Aus season. In T. Aman season, highest insect population and natural enemies were found in seed bed and irrigated rice habitat respectively. Short horned grasshopper was dominant insect in all habitats of T. Aman season. Spider, damselfly and ladybird beetle were the dominant predators in all the habitats. Visual counting from 20 hills showed that the population and the damage of insect pests were below economic threshold level (ETL).	Long term data will be used to forecast insect pests outbreak in rice field and farmers can be informed for their effective control measures.
2	**Incidence of insect pests and natural enemies in light trap** Rice insect pests and natural enemies were monitored throughout the year by Pennsylvanian light trap from dusk to dawn throughout the year at BRRI headquarter, and BRRI regional stations. Cumilla, Sonagazi, Barishal, Rangpur, Habiganj and Rajshahi. The total number of insect pests was the highest at Habiganj and followed by Gazipur, Barishal, Rajshahi, Sonagazi, Rangpur and Cumilla. The abundance of GLH, RLF,	Long term data will be used to forecast insect pests outbreak in rice field and farmers can be informed for their effective control measures.

Sl. No.	Technology developed/Scientific information	How country/Farmer/User will be benefited
	BPH, WBPH and YSB was observed almost all the seven locations. The highest number of BPH was observed during the month of November at Habiganj and Gazipur. BPH had an additional peak in April 2018 at Gazipur. The highest peak of YSB was observed at Habiganj in September. In June at Habiganj and October-November in Barisal there was a peak of GLH. The highest number of natural enemies in light trap was recorded at Habiganj, followed by Gazipur, Barisal, Sonagazi, Rajshahi and Cumilla. No Natural Enemy was in Rangpur station during July 2017 to June 2018. Green mirid bug (GMB) population of Gazipur was noticeably higher than those of the 6 stations (Cumilla, Rajshahi, Barishal, Habiganj, Rangpur and Sonagazi). In the month of November & April two different peaks of GMB were observed in both Gazipur & Barishal. The highest peak of SPD was observed at Sonagazi in the month of November and April.	
3	**Use of solar light trap for insect pests management in crop field** Rice insect pests yellow stem borer (YSB), green leafhopper (GLH), white leafhopper (WLH), leaffolder (LF), caseworm (CW), brown planthopper, mole cricket, field cricket, grasshoppers, rice bug (RB) and vegetable insect pests brinjal shoot and fruit borer (BSFB), cabbage butterfly, cutworm catches were found in solar light trap in each location. Highest numbers of insect pests were trapped in May than that of April. Highest number of YSB was observed in May followed by GLH. More than 900 YSB were caught in each light trap per month. This result indicated that solar light trap would be a promising pest control tool in rice field as well vegetable crops. We also recorded damaged symptoms both from solar light trap installed plot and farmers plot (without solar light trap). Significantly lower damaged was found in solar light trap installed plot than control one (farmers plot). This result indicated that use of solar light traps both in rice and vegetable crops showed effective tool for controlling and monitoring insect pests and providing an effective for sustainable pest management. Using this solar light trap reduces chemical insecticide use and save environment from insecticidal pollution. The farmers showed high interest to use this solar light trap	Farmers can use this solar light trap in their crop field and avoid chemical insecticide application in crop protection programme.

Sl. No.	Technology developed/Scientific information	How country/Farmer/User will be benefited
	in crop field.	
4	**Impact of climate change on rice arthropods.** A hierarchical structure of 22 years 14 migratory insect species, with three orders of diversity (q = 0, 1, 2) accounted by temporal diversity decomposition framework based on hill numbers. Species diversity showed significant quadratic correlations with short period (month). Species richness increased with monthly average temperature and rainfall, but both the species and heterozygosity decreased with increased temperature showing a linear relationship. While correlations didn't exhibit annually at constant pattern due to climate variation and sensitivity of species to temperature, thus leading to a historical hierarchical structure. Only half of ten equivalent species appeared during 10 years increased, indicating that the composition of migratory pool kept relative constant within 22 years. However, based on historical data, model predicts that species diversity will be reduced by 2050. This study highlights the importance of temporal diversity decomposition to dissect the impact of climate change on the species-environment interactions and may provide guidelines for historical biodiversity research.	Distribution and abundance of insect pests and biocontrol agents in a changing condition can be predicted.
5	**Impact of salinity on insect population development** The population of brown planthopper (pest) and green mirid bug (pest control agent) developed at five levels of salinity i.e., 2.0 ds/m, 4.0 ds/m, 6.0 ds/m and 8.0 ds/m including control (0 ds/m) were determined. The salinity has significant impact on the development of both pest and pest control agent (P = 0.05). Total number of BPH increased from control (0.0 ds/m) to 4.0 dS/m) salinity and thereafter declined with increasing salinity level. The highest population of BPH (361.33) developed at 4.0 dS/m and the lowest population (144.33) was found at 8.0 dS/m salinity. The reason behind the highest population was found at 4.0 ds/m is unknown at this stage. Similarly, salinity has significant impact on pest control agent, green mirid bug (GMB) (P = 0.05). GMB is a potential predator for BPH pest in rice field. The number of GMB population developed at different level of salinity decreased with increased salinity level. The highest population of GMB (96.67) was found at 0.0 dS/m and lowest (35.33)	Impact of elevated salinity on insect pest in coastal area would be known and farmers can use this impact in their crop protection programme.

Sl. No.	Technology developed/Scientific information	How country/Farmer/User will be benefited
	at 8.0 dS/m. These results indicated that salinity influence the pest control service in coastal area. In control treatment showed that the population number of BPH and mirid bug were 298.33 and 96.67 respectively. BPH showed highest population at 4.0 ds/m salinity and thereafter decreased significantly. It indicated that BPH loves slight salty environment. However, GMB showed clear decline trend with increasing salinity level. The population of GMB is highly correlated to the population of planthopper in the field. In this study, GMB population did not follow the population of BPH at 4.0 ds/m. It can be explained that GMB does not like salty environment/host that developed in salty environment. This result indicated that mildly elevated salinity zone harbor higher BPH pest in crop field and GMB does not like salinity. The results of this study revealed that salinity has significant impact on rice growth (P = 0.05, N = 3). The plant height ranged from 105.11 to 116.78 cm. The highest plant height was observed in control treatment and lowest was in 8.0 dS/m. The plant height decreased with increasing salinity. Salinity has also significant impact on grain filling of rice crop (P = 0.05). Number of unfilled grain per panicle ranges from 20 to 35. The highest number of unfilled grain (35) per panicle was found at 8.0 dS/m and the lowest (20) found at 0.0 dS/m. The number of unfilled grains per panicle increased with increased salinity level. The weight of 1000 grains also varied with different salinity levels and it ranged from 23 to 28g. The weights of 1000 grains gradually decreased with increasing salinity. The highest 1000 grains weight (28g) obtained at 0.0 dS/m and the lowest 1000 grains weight (23g) observed at 8.0 dS/m. Further studies are required to get precise information from this experiment.	
6	**Conservation of natural enemies in rice ecosystem** Natural enemies of rice insect pests can be conserved in rice ecosystem through ecological engineering approach. Eco-engineering treated plot showed highest parasitism activity to the exposed BPH and rice hispa egg in rice field. Rice hispa and BPH egg were parasitized by *Trichogramma zahiri* and *Anagrusspp*respectively. Severe pest outbreak was not observed in the experimental plot. Moreover, eco-	Farmers can grow flowering or vegetables or other commercial crops with nectar rich flowers. These flower power regulates pest population in rice field and reduce pesticide use in field without any yield penalty.

Sl. No.	Technology developed/Scientific information	How country/Farmer/User will be benefited
	engineering plot reduced 50% key pest population and 75% chemical insecticides from rice field. In addition, no significant yield difference was observed among three times insecticide treated plot (6.58 t/ha) and eco-engineering (6.73 t/ha), control (6.48t/ha) plot in BRRI dhan58 during Boro season.Moreover, lowest damaged symptom (white head) was observed in eco-engineering plot. This result indicated that rice can be produced without insecticide using ecological engineering technique.	
7	**Test of different candidate insecticides against major insect pests of rice.** A total of 115 commercial formulations of insecticides were evaluated against brown planthopper (BPH) and 6 against rice hispa. One hundred seven out of 115 insecticides were found effective against BPH and all 6 were found effective against rice hispa.	Farmers can use these insecticides to control insect pests in field.
8	**Fumigation action of botanical oils against stored grain insect pests.** The experiment was conducted in the field lab of Entomology Division and found that first (24 hrs) and 2nd exposure (48 hrs) period of rice stored grain insects to mahogany oil fume caused significant mortality to rice weevil and Angoumois grain moth compared to the control. Mortality ranges from 51 to 95.67% and 87.14 to 96.82% in rice weevil and Angoumois grain moth respectively. The result of this study indicated that mahogany oil would be an effective product to control stored grain insect pests. After fumigation exposure of grains, panel test was conducted to determine that bitter taste residue remains in the grain or not. Randomly more than 10 people were selected and approached to eat the grain after 48 hrs exposure of fumigation and feel no bitter taste by mahogany oil exposure rice grain.	Farmers can use this technology to protect their food grains during storage period.
9	**Identify insect resistance rice genotypes/variety** A total of 68 INGER IRBPHN 2017 materials were screened against BPH at green house condition to identify resistance sources against major insect pests of rice. A total of nineteen breeding lines showed moderately resistant score (3-5) reaction.	Breeder can use resistance genotypes for developing insect resistance rice variety.

Plant Pathology Division

Table 1

Research Achievement 2017-2018
(Technology Developed)

Sl No.	Technology Developed	How Country/Farmer/User will be benefited
1	**Management of false smut disease.** To minimize the disease, planting time of T. Aman varieties should be adjusted so that the panicle emergence occurs before mid-October. Avoid seeds from last year's infected field. Follow recommended nitrogen dose.	To minimize the disease and increase yield and quality rice as well..
2	**Management of red eel worm in rice field.** Application of Fipronil 3GR (10 Kg/ha) group insecticides followed by alternate wetting and drying (AWD) effectively controlled (>80%) red eel worm infestation.	To minimize infestation and increased yield
3.	***Ankuri* Seed Germinator- A vapour induced healthy rice seed germination technique** ***Ankuri* protocol-** A plastic bucket having inside a steel frame, sensor and water heater controlled by an auto control box is used in *Ankuri* seed germinator. *Ankuri* is a vapor induced healthy seed germination technique in cold environment. Around 40-50 L water is taken in the bucket (60 L) first. Then loosely packed seeds in a sac is kept on the frame inside bucket water and covered with the lid. Temperature indicator is set at 30-32 ^{0}C for 20-24 hours in the auto-control box and connected with electricity. When water temperature is adjusted to the set temperature, the heater disconnected automatically. Further, the heater becomes	**In cold environment farmers can use to germinate their rice seeds.**

	started-on automatically for heating water immediate after the set temperature goes down. The green light becomes on when the heater started for heating and becomes off when the heater goes off. After 20-24 hours, the bucket water drained out at the level below the steel frame but must be considerably above the heater. Soaked seeds should be kept again as like previous on the steel frame in the bucket covered with its lid and connected with electricity. Vapor was generated from water and keeps inside the bucket environment with high humidity and expected set temperature. Under this environment seed can be germinated within 3 days.	
4.	**Preparation of Tricho-compost and its nutritional facts for improving soil health.** The compositions of tricho-compost are: 1) Water hyacinth 2) Cowdung 3) *Trichoderma harzianum* 4) Urea solution. The ratio of compositions of tricho-compost was (v/v): Water hyacinth: Cow dung: *Trichoderma inoculum* = 3.0: 1.0: 0.25. Urea solution (10%) was applied and mixed all the components nicely and homogenously. Culture of *Trichoderma harzianum* (2 x 10^8 spore/mL) was grown in broken corn seeds in laboratory condition. The culture was mixed with dry water hyacinth, cow dung, and urea solution. Water hyacinth and cow dung were dried under intense sunlight for 7 days (42 hours), moisture reduced to be 40%. The composting materials were placed in layers in a pit (1m x 1m x1m) in ratio of water hyacinth: Cow dung: *Trichoderma* inoculums (v/v): 3: 1: 0.25.	**For improvement of soil farmers can apply this compost in the field.**

FARM MACHINERY AND MECHNIZATION PROGRAM AREA

Farm Machinery and Postharvest Technology Division

Table - 1

Research Achievement 2017-2018

Sl. No.	***Technology developed***	**How country/farmers/user will be benefited**
1	***Validation and Adaptive Field Trial of BRRI Developed Solar Light Trap***	Solar light trap manufactured, distributed and adaptive field trials were done in farmers' field under special research budget allocation of the Ministry of Agriculture. Aiming to validate and adaptive field trial of BRRI solar light trap to the end users, manufacturer and resource poor farmers that reduces the need for application of insecticides. Use of solar light trap both in rice and vegetable crops was found effective in controlling insect pests. It also reduces chemical insecticide application and save environment.

Workshop Machinery and Maintenance Division

Table 1

Research achievement 2017-18

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
1	Solar energy use in threshing operation	Solar energy is one of the most promising, clean, and reliable energy in Bangladesh. It varied over clean environment. Electricity is often produced by burning fossil fuels such as oil, coal, and natural gas which cause variety of pollutants into the atmosphere. Using solar energy to replace conventional fossil fuels can prevent the release of pollutants into the atmosphere and mitigate global warming. Therefore, Pedal thresher was modified to use solar energy in paddy threshing at Bangladesh Rice Research Institution (BRRI). Its performance was evaluated in Boro season 2018. Revolution per minute (RPM) of it was found 300. Two operators can thresh paddy simultaneously. Capacity of the developed thresher was found 320 kg/hr. Farmers of remote areas of Bangladesh where electricity is unavailable, can thresh paddy. As a result, it reduces human drudgery, time, and labor cost.

RICE FARMING SYSTEMS PROGRAM AREA

Rice Farming Systems Division

Table-l

Research Achievement 2017-2018
(Technology Developed)

Sl. No.	Technology Developed	How Country/ Farmer/User will be benefited
01	Potato- Mukhikachu-T. Aman	Water is most scarce in the southwestern and northwestern regions of the country during the dry season due to low annual rainfall and presence of light soil. In the dry winter season, the principal crop, Boro rice, is entirely irrigated, mostly with groundwater. Groundwater based irrigation system has already reached to critical state in the most part of the area. In Boro cultivation on an average 18 irrigation (1270 mm water) required in Boro in the existing cropping pattern (Boro- Mukhikachu-Fallow), whereas only 3 irrigation (90 mm water) will be required for potato in this technology. This CP technology produce 42.48 t ha^{-1} of rice equivalent yield (REY). In this improved pattern, the inclusion of T. Aman in the fallow period and the replacement of Boro by potato will be responsible for higher productivity. This CP technology can contribute to doubling the productivity by 2030 and will expedite the farmers income.

SOCIO-ECONOMICS AND POLICY PROGRAM AREA

Agricultural Economics Division

Table – 1

Research Achievement 2017 – 2018

SL. No.	Title	Achievement/ Key findings	How Country/Farmer/User will be benefited
1.	Farm level Adoption and Evaluation of Modern Rice Cultivation in Bangladesh	➢ In Aus season, overall adoption of modern varieties was 91% of which BRRI varieties' coverage was about 66%. BRRI dhan48 ranked the top position (17%) in terms of area coverage followed by BRRI dhan28 (15%). ➢ In T. Aman season, overall adoption of BRRI varieties was apparently low (48%). BRRI dhan49 (11%) and BR11 (7%) were mostly adopted BRRI varieties in T. Aman season. Total adoption of Indian varieties in T. Aman season was 22% while it was 43-58% in some regions. ➢ Overall adoption of modern varieties in Boro season was about 99%, of which coverage of	➢ Breeders may use the information of the study for developing climate resilient region specific popular modern varieties. ➢ Researchers, extensionists' and policy makers may also use this information to formulate

SL. No.	Title	Achievement/ Key findings	How Country/Farmer/User will be benefited
		BRRI varieties was about 70%. BRRI dhan28 and BRRI dhan29 were the most dominant varieties; jointly covered 61% of total areas in Boro season. ➢ BRRI dhan48 produced the highest yield (4.01 ton/ha) in Aus season whereas BRRI dhan49 (4.62 ton/ha) and BRRI dhan29 (6.43 ton/ha) was the top yielder in T. Aman season and Boro season, respectively. ➢ Average yield of hybrids was 7.27 ton/ha whereas BRRI developed hybrids yielded 7.63 ton/ha in Boro season.	appropriate policy for enhancing food grain production.
2.	Constraints to Adoption of BRRI Released Modern Rice Varieties in Bangladesh: A Policy Option	➢ Socio demographic factors like, family size and income, easy access to extension services and better market demand along with higher yield potential, good appearance and also good taste to eat had significant and positive influence to adopt a variety. ➢ Surveyed farmers of Mymensingh district opined that, though; performance of newly released BRRI varieties could not satisfy their expectation. ➢ Seed of the varieties which performed a bit better in the local demonstrations was not also sufficient; thus, the growers losing their interest about the BRRI varieties.	➢ Breeders and Policy makers may use this information to formulate appropriate breeding strategies and dissemination policy, respectively for modern rice varieties.
3.	Evaluation of the Propensity of Indian Rice Varieties Adoption in Selected Areas of Bangladesh	➢ In T. Aman season, among all Indian rice varieties, *Gutiswarna* was leading cultivar covering 39% area in Rangpur region, and in Dinajpur, it was 31% followed by *Swarna5* (5%). ➢ Most of the farmers continued to cultivate *Gutiswarna* due to its suitability in all types of lands; higher yield performance, better taste and quality straw. ➢ Due to some extent earliness of *Gutiswarna*, which facilitated to cultivate the next crop (Robi crops) also popularized it in both Rangpur and Dinajpur regions. ➢ In Boro season, *Zira* (71%) was the most dominant variety in Naogaon district due to yield advantage, good grain quality, lucrative	➢ Rice breeders can use the information from this study to develop and disseminate suitable varieties to replace the Indian rice varieties in the concern areas.

SL. No.	Title	Achievement/ Key findings	How Country/Farmer/User will be benefited
		price, required low intensive care, less susceptible to insects and diseases, high demand to the millers.	
4.	Estimation of Costs and Return of MV Rice Cultivation at Farm Level	➢ In Boro season, yield was higher due to better cropping environment, good management practices and use of better genotypes, consequently secured higher gross return. ➢ In T. Aman season gross and net return was higher due to lower costs of production and better market price. ➢ Overall, rice cultivation was profitable at current years' yield and price in terms of gross income and only the T. Aman and Aus rice was profitable in terms of net income.	➢ The findings would help policy makers to fix the public procurement price, guarantee the support prices as well as provide the input subsidies to promote the rice production for farmers' wellbeing.
5.	Preference analysis of T. Aman rice varieties in the coastal areas in Bangladesh	➢ Based on the performance of T. Aman rice in the trial plots in 2017-18, BRRI dha76 was the most preferred variety in Dacope due to its potentiality of transplanting in the fields with over a feet depth of water as well as less or no infestation of disease and long panicle with large number of grain. ➢ On the other hand, BRRI dhan54 was the most preferred variety at Amtali because of higher yield, matured for harvesting about 25-40 days earlier than the check varieties so that matured for food scared period. ➢ BRRI dhan77 was the second most preferred variety in Amtali mainly because of suitability of planting in stagnant water, matured for harvesting after drainage out stagnant water and long panicle so that expected higher yield. ➢ BBRI dhan73 was least preferred variety both in Dacope and Amtali, while BRRI dhan76 was the second least preferred variety in Amtali.	➢ Researchers, extension personnel and policy makers may use this information to formulate appropriate policy for increasing food grain production in the coastal belt of Bangladesh
6.	Vertical price transmission of rice in Bangladesh	➢ Price transmission scenario was asymmetric from farm to retail level both in long and short run. An increase in the farm price led to rapid increase in the wholesale and retail prices. ➢ A decrease in farm price did not decrease in wholesale and retail price at the same rate. That means the processors	➢ Policymakers may use these information to formulate policy for the better competitive rice market for the

SL. No.	Title	Achievement/ Key findings	How Country/Farmer/User will be benefited
		(wholesalers/millers) enjoy a certain advantage over primary producers (farmers) and that retailers enjoy a certain advantage over processors. ➢ Final consumers are more likely to experience a decrease in their surplus from a price increase rather than to experience an increase in their surplus from a price decrease at the upstream.	welfare of producers and consumers
7.	Welfare effect of adaptation policy for rice price variation under climate change in Bangladesh	➢ The support price policy creates a positive change in producer surplus of US$ 1,981 million, which is substantially higher than the consumer surplus (US$–1,785 million) in the intervened years. ➢ If the subsidized price policy is implemented, the price variation by 1.38% can be reduced and the change in consumer surplus (US$ 1,501 million) obtained in the intervened years. ➢ To adapt the unavoidable climate change and eliminate the number of victims of food insecurity, public food policy is necessary even if result of food policy is costly and ineffective.	➢ Provide information to the policy makers to enhance price support for the welfare of low income groups of the country
8.	Value Chain Analysis of Aromatic Rice (BRRI dhan34) in Bangladesh	➢ In our domestic market about 75% aromatic rice was supplied by millers and different companies and remaining 25% was exported in aboard. ➢ There are some production, marketing and institutional constrains of aromatic rice in Bangladesh	➢ Finding of the study will help the researcher and policymaker to develop an export oriented supply chain of aromatic rice in Bangladesh

Agricultural Statistics Division

Table-1
Research Achievement 2017-2018
(Technology Developed)

Technology Developed	How Country/Farmer/ User will be benefited
Name/Title of the technology: Description with photograph:	
● **Stability Analysis of BRRI varieties** **Description:** In T. Aman season, BRRI dhan49 were found near to stable with stability index 1.97 while BR3, BR5, BRRI dhan33, BRRI dhan37, BRRI dhan38, BRRI dhan39, BRRI dhan56, BRRI dhan57, BRRI dhan70, and BRRI dhan77 appeared to be below average stable. BR4, BR10, BR11, BR22, BR23, BR25, BRRI dhan30, BRRI dhan31, BRRI dhan32, BRRI dhan40, BRRI dhan41, BRRI dhan44, BRRI dhan46, BRRI dhan51, BRRI dhan52, BRRI dhan53, BRRI dhan54, BRRI dhan66, BRRI dhan71, BRRI dhan72, BRRI dhan73, BRRI dhan75, BRRI dhan76, BRRI hybrid dhan4, BRRI hybrid dhan6 were found having average stability among T. Aman varieties. Due to lodging, onslaught of bird and rat damage in some location BRRI dhan62 and BRRI dhan34 were found unstable in T. Aman season.	From the results of the analysis, researcher comes to know which variety is still stable and which variety is losing its stability that's why needs to replacement for any particular variety and set up their research strategy eventually which strength the future food security.
● **Seasonal weather forecasting for rice production** **Description:** Weather forecast based rice crop management system were enable farmers/researchers/decision makers to make effective decisions on rice crop supervision for different weather conditions, well ahead of time.	From this activity, it is not only reducing the risk but also enables to maximize the benefit from favorable weather conditions. And also has potential for increasing the rice yield, avoiding insect and disease outbreaks, proficient use of pesticides, herbicides & fertilizer application and efficient agricultural water management, thus, reducing the overall production cost as well.

● **Suitability mapping of newly released BRRI rice varieties** **Description:** BRRI dhan50 is suitable in south and eastern side, BRRI dhan63 is western side and BRRI dhan66 is suitable in north-western side of Bangladesh in Boro season. In T. Aman season, BRRI dhan71 is suitable in north-western side and Western side of Bangladesh is suitable for BRRI dhan72.	Farmers and researchers come to know the suitable area for BRRI dhan50, BRRI dhan63, BRRI dhan66, BRRI dhan71 and BRRI dhan72 and adobe particular variety in suitable area i.e. best use of land and maximizing production.
● **Online Application System of BRRI** **Description:** The online application system for recruitment is an ideal portal for Government. BRRI wants to manage their recruitment related activities through online. So BRRI will introduce this online system to decrease hassles of applicants/students for Job Application. Online application system will be developed by Teletalk Mobile Company Ltd with the help of ICT Cell, Agricultural Statistics division and Administration of BRRI. Already completed agreement between BRRI and Teletalk Bangladesh Limited, a public limited company on 8 March' 2017 for Web and SMS based application.	This application system will be reduced time and labor of Job applications processing for employer. Applicants will get all kinds of information (applicant list, exam center name and date, recruitment result etc.) through this web and SMS based application.

Farm Management Division

Table 1:
Research achievement 2017-2018
(Technology Developed)

SL. No.	Technology Developed	How Country/ Farmers/User will be benefited
	Program Area: Socio-Economics and Policy	
03	Farm Management Division	
	3.1. Effect of spacing on different short duration rice varieties in T.Aman and Boro seasons. **In T.Aman season:** Among the varieties BRRI dhan75 gave the highest grain yield. Among the spacing, the highest grain yield was obtained from (15 cm X 15 cm) and (20 cm X 15 cm) spacing. **In Boro season:** Among the varieties BRRI dhan84 produced the highest grain yield. Among the spacing, the highest yield was obtained from (20cm X 20cm) spacing.	These finding may be useful for the rice growers and researchers.
	3.2. Effect of tillage operation on the productivity and profitability of rice cultivation. Land preparation in BRRI Gazipur farm, no need to four/five ploughing followed by laddering. **Land can be prepared as: Option 1:** One ploughing followed by removal of grass by hand and laddering or **Option 2:** Herbicide application followed by one ploughing and laddering is sufficient.	This finding may be useful for the rice growers and researchers/ production farm.
	3.3. Laborers' wage rate in rice production farm: **Laborers' wage rate at rice production farm was monitored throughout the year at different locations of Gazipur sadar. The wage rate varies from Tk. 410 to 540 day^{-1}.**	The laborers' wage rates will help to estimate rice production cost and thus determine the retailer price of rice for the market.

Technology Transfer Program Area

Adaptive Research Division

Table-1
Research Achievement 2017-2018
(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
	Adaptive Research Division (ARD) works in technology validation and dissemination, not in technology development. However, ARD conducts Advanced Lines Adaptive Research Trial (ALART) at farmers' field in different agro-ecological zones of Bangladesh in different seasons, which is an important step before releasing any new variety.	ARD has important contribution in releasing rice variety of BRRI through validating the advance breeding lines in farmers' field. Suitable genotypes are selected through the validation trials that would have significant role to increase rice production and maintain sustainable food security of Bangladesh.

Training Division

Table -1
Research Achievement 2017–2018

	Technology Developed	How country /Farmer/User will be benefited
	Program Area : Technology Transfer Program Performing Unit : Training Division	
	1. Capacity Building and Technology Transfer Through Training	Knowledge and skill of the trained personnel on the subject matters were increased.
	Total training conducted : 70 No. of participants : 2,072 Duration: 1 day to 1 week Participants: Extension personnel of DAE, NGO officers, Imam of mosques, BRRI Scientists and farmers	1. Knowledge and skill of the participants on rice production technologies were enriched. 2. Rice yield and production of the country will be increased.

REGIONAL STATION PROGRAM AREA

Regional Station, Bhanga, Faridpur.

Table-1
Research Achievement 2017-2018
(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
	Not applicable	-

Regional Station, Rangpur

Table-1

Research Achievement 2017-2018
(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
	Not applicable	

Regional Station, Satkhira-9400

Table-1

Research Achievement 2017-2018
(Technology Developed)

Sl. No.	Technology Developed	How country/Farmers/Users will be benefited
1.	Contribution of BRRI RS, Satkhira for the development of BRRI dhan89, BRRI dhan90 and BRRI dhan92.	BRRI dhan89 and 92 could be alternatives of BRRI dhan29. BRRI dhan90 is premium quality rice like BRRI dhan34. These

		varieties will be a breakthrough to sustain the rice yield in Aman & Boro season.
2.	BRRI dhan67 creates massive opportunity for farmers to produce rice in high saline area.	It will increase the cropping intensity as well as the net cropped area which will increase the total production.
3.	Farmers showed interest about BRRI dhan76 which can be a better substitute of local cultivars.	Farmers will be benefited by higher production.

BRRI Regional Station, Sonagazi, Feni

Table -1
Research Achievement 2017-18

Sl. No	(Technology Developed)	How Country/Farmer/User will be benefited
	A total of 14.11 tons of breeder seed were produced during 2017-18 under the supervision of BRRI, Sonagazi. The station also produced 10.34 tons of TLS. The breeder seed was sent to the Genetic Resources and Seed Division. The TLS were sold among the farmers and public organizations. Nearly 1.50 tons of seeds were given to DAE as seed support in free of cost. It further arranged 24 trainings and 15 field days during Aus, T. Aman and Boro seasons.	Quality seed will be available for the country as well as for the farmers.

Regional Station, Sagardi, Barishal

Table – 1
Research Achievement 2017-18
(Technology Developed)

Technology Developed	How country /Farmers/Users will be benefited

4. Provided major contribution in development of BRRI dhan87, BRRI dhan88, and BRRI dhan89	High yielding BRRI dhan87 would replace BRRI dhan49 during T. Aman season. BRRI dhan88 and BRRI dhan89 might replace BRRI dhan28 and BRRI dhan29 respectively during Boro season. By cultivating those varieties, farmers might get higher yield comparing with other traditional and HYV's and hence the national productivity will be increased.

BRRI Regional Station, Cumilla

Table-1

Research Achievement, 2017-18
(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
	N/A	