Research Achievement (2016-2017)

VARIETAL DEVELOPMENT PROGRAM PROGRAM AREA
PLANT BREEDING DIVISION

Table-1

Research Achievement 2016-2017

(Technology Developed)

Technology Developed	How Country/Farmer/User will be benefited
BRRI dhan79: BRRI dhan79 was released as submergence tolerant rice variety for T. Aman season. Its yield potential is 3.8 to 6.9 t/ha based on the level of submergence. The variety showed around 0.5 t/ha higher grain yield than BRRI dhan49 under rainfed condition and 1.0 t/ha higher grain yield than BRRI dhan52 under flash flood and controlled condition. 	BRRI dhan79 can tolerate three weeks complete submergence in clear to semi-turbid water and can also tolerate 15-20 days medium deep (50-60 cm) water stagnation after de-submergence.

BRRI dhan80: BRRI dhan80 has 4.0- 4.5 t/ha grain yield with 133 days growth duration in T. Aman season. It has long slender type grain with colored tip and small awn. Rice grain is premium quality type (Thailand Jesmine type with aroma). 	Export quality aromatic rice production will be increased in areas of the country in T. Aman season.
BRRI dhan81: BRRI dhan81was released as non-aromatic premium quality favorable Boro rice. It showed similar or 0.5 t/ha higher yield as BRRI dhan28. 	BRRI dhan81 is a long slender (local Jira type) export quality grain with 10.3% protein and 25.2% amylose. The proposed variety has lodging tolerance.

BRRI dhan82 (NERICA10-7-PL2-B): BRRI dhan82 was released as short duration and high yielding rice variety for T. Aus. It can produce 0.40-.50 t/ha more yield than BRRI dhan48.  	Its growth duration five days earlier than BRRI dhan48. It can produce 4.4-5.5 t/ha grain yield with uniform flowering. As a result, after harvesting BRRI dhan82 farmers can easily cultivate T. Aman variety.
BRRI dhan83: BRRI dhan83 was released as highly drought tolerant variety with high yield (4.0-5.3t/ha) for B. Aus. The variety produces 1.0 t/h higher yield than BRRI dhan43 ii similar growth duration. 	It is a short duration (105days) high yielding (4.5t/ha) variety. After harvesting BRRI dhan83, farmers can grow T. Aman, vegetables or other crops.

BRRI dhan84: BRRI dhan84 (BR7831-59-1-1-4-5-1-9-P1) was released as highly Zinc (27.6 mg/kg) and medium Iron enriched with red pericarp rice variety for Boro season. The variety produced similar yield with same growth duration of BRRI dhan28. 	It is a short duration (141 days) high yielding (6.0-6.5 t/ha) rice variety. Zinc deficiency problem can be overcome by cultivating this rice variety.
BRRI dhan85: BRRI dhan85 (BR7718-55-1-3) was released as high yielding (4.5–5.0 t/ha) long slender grain T. Aus variety for Cumilla region. It can give higher yield than BRRI dhan48 with same growth duration (105-110 days). 	BRRI dhan85 can tolerate stagnant water from tillering to harvesting with and can give satisfactory yield.

Hybrid Rice Division

Table-1

Research Achievement 2016-2017

(Technology Developed)

Sl. No	Technology Developed	How country/farmer/user will be benefited
01.	A total of 81350 kg F_1 seeds were produced during Boro 2016-17 with the technical assistance from BRRI under 13 seed companies and regional stations of BRRI. In the reporting year, hybrid rice division supplied 3395 kg of parental lines and F_1 seeds to 40 farmers, 13 seed companies, scientists and staffs of BRRI**.**	Popularization of BRRI released hybrid varieties.
02.	During the reporting year one new hybrid rice variety named as BRRI hybrid dhan5 has been released all over Bangladesh for Boro season cultivation. It is a high yielding (9-9.5 t/ha) having long bold grain with intermediate amylose (23.4) content.	This hybrid have lot of promise and hope able to fulfill farmers demand
03.	Two short duration promising combinations (BRRI7A/EL254R & BRRI13A/EL108R) was selected for Boro season having excellent grain quality and good seed production potentiality from Preliminary Yield Trials. This combination will be tested under MLT (Multi-location trials)	New hybrid combinations having desirable grain quality, high yield and duration will fulfill farmers demand
04.	Two promising restorer lines (EL254R & EL108R) were identified from R × R improvement program	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 2016-2017

(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
3	**Rice Germplasm and Seed**	

3.1	**Project: Rice germplasm conservation and management**	
3.1.1	**Germplasm Collection:** 344 rice germplasm in which 253 under GOB fund and 91 under AFACI project of BARC 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 218 germplasm including 55 new collections from hilly and coastal areas was performed against 53 morpho-agronomic characters. Rejuvenation of 2,004 accessions including 400 new collections was performed and 119 new germplasm were registered (from accession 8082 to 8200) in BRRI Genebank.	Characterized and as well as conserved germplasm would be utilized in trait specific breeding program.
3.1.3	**Molecular characterization:** Molecular characterization of 36 aromatic landraces were performed using 36 SSR markers and were grouped into four major clusters through UPGMA clustering.	Characterized germplasm would be protected regarding varietal identification and intellectual property rights (IPR's).
3.2	**Seed production and variety maintenance**	
	During the reporting year, 142.9 tons of breeder seed were produced and 130.7 tons of breeder seed were distributed among 858 (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	**Exploratory and genetic studies**	
3.3.1	In Pure line selection study, 21 popular local varieties (three Balam, seven Jesso Balam, four Sadamota, three Lalmota, two Bashful and one each from Khejur Chhori and Khejur Jhupi) were selected for Observational trial in the following T. Aman season.	The genetic variability and relationships i.e. genetic makeup of the studied germplasm could be well understood.
3.3.2	Molecular diversity and DNA fingerprinting regarding IPR's of 77 wild rice were performed using 42 SSR markers and the UPGMA clustering grouped the wild rice into six major clusters.	Characterized wild rice would be protected regarding intellectual property rights (IPR's).
3.4	**Documentation of technology:** During the reporting year, 150 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.

Grain Quality and Nutrition Division

Table-1

Research Achievement 2016-2017

(Technology Developed)

Sl. No.	Technology Developed	How Country/farmer/ user will be benefited
1.	On the basis of physicochemical and cooking properties, 13 lines from 368 breeding lines were suggested for further research.	Breeders
2.	A total of 934 Transforming Breeding lines were evaluated for physicochemical and cooking properties for superior quality. Based on the performance on grain quality, 18 lines for further advancement were recommended.	Breeders
3.	The highest milling outturn (73%) of BR3, BRRI dhan28 and BRRI dhan29 was found in Rangpur but the lowest (69%) in Sonagazi and the lowest amylose content was found in Barishal but the highest in Shatkhira. The lowest protein content of BR3, BRRI dhan28 and BRRI dhan29 was found in Kushtia but the highest protein content was found in Barishal.	Breeders
4.	Higher dose of urea application on BRRI dhan29 increases higher protein content and higher yield but decreases amylose content. The lowest milling outturn and head rice recovery were found in Aus season. The lowest paddy length and 1000-grain wt. were found in Aman season. The highest protein content (9.5%) was shown in Boro season.	Breeders
5.	Thirty five BRRI HYVs were selected to evaluate their vitamin profiling including thiamin and riboflavin, minerals such as zinc, iron, phytic acid and molar ratio of phytate to respective minerals (PA/Zn and PA/Fe). BRRI dhan36 has the highest thiamin content of 1.15 $mg100^{-1}g$ followed by BRRI dhan29 (1.14 $mg100^{-1}g$), BRRI dhan48 (1.12 $mg100^{-1}g$), BRRI dhan28 (1.09 $mg100^{-1}g$) and BRRI dhan43 (1.08 $mg100^{-1}g$). Both BRRI dhan43 (27.17 ppm) and BRRI dhan42 (27.12 ppm) have higher Zn content among the tested BRRI varieties. Both BRRI dhan43 and BRRI dhan42 can be used as micronutrient enriched HYV for Aus season.	Consumer
6.	Noodles prepared from BRRI varieties were acceptable by the panelists. The cooking qualities including cooking loss and water absorption of the rice noodles were acceptable. This study showed the potential for commercial production of noodles.	Consumer
7.	We have formulated energy dense nutraceutical enriched rice based food formulation specially cake and biscuits having energy density	Consumer

	ranging from 5.0-5.5 100^{-1}g serving respectively. It will open diversified uses of rice and rice based food products in Bangladesh.	
8.	Puffed, popped and flattened rice were produced from 11 BRRI varieties to evaluate the quality products. Comparing few parameters (fully puffed rice, length and breadth increase percentage) with BR16, it was found that BRRI dhan59, BRRI dhan60, BRRI dhan62 and BRRI dhan66 are more or less suitable for making puffed rice. Considering physical parameters, BRRI dhan60, BRRI dhan62, BRRI dhan65, BRRI dhan66 and BRRI dhan67 can be used commercially for popped rice production. Among the tested varieties, BRRI dhan62, BRRI dhan64, BRRI dhan65, BRRI dhan66 and BRRI dhan68 produce similar/better quality flattened rice comparing with BR16.	Consumer

CROP SOIL WATER MANAGEMENT PROGRAM AREA

Agronomy Division

Table-1

Research Achievement, 2016-2017

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

Irrigation and Water Management Division

Table 1

Research Achievement 2016-17

Sl. No.	Technology Developed/Information generated	How Country/Farmer/ User will be benefited
1	**Suitable irrigation water availability from rivers in Barishal region:** In Barishal region, water salinity was monitored in Tentulia, Buriswar, Biskhali and Boleswar rivers during dry season peak salinity period (April-June). The safe salinity limit for irrigation water is 1 dS/m. In Boleswar river, upstream part from Telikhali launchghat, Bhandaria was found safe for irrigation. In Bishkhali river, upstream part from Kalmegha	The river salinity information during peak saline period will encourage the farmers/users to cultivate their fallow lands during Boro/Rabi season. Farmers in the tidal areas of Barisal

	bazar, Patharghata was found safe for irrigation. In Buriswar river, upstream part from Chotobogi Moupara, Taltali was found safe for irrigation. In Tentulia river, upstream part from Panpatti, Galachipa was found safe for irrigation. Huge land adjacent to those rivers remains fallow during dry season. These lands can be brought under irrigated agriculture practice. Farmers can use Low Lift Pump (LLP) to get the suitable water from the rivers or connected canals. The pumped water will be distributed to the fields by locally available flexible plastic pipe on demand basis during dry season (Boro season). It is necessary to continue the salinity monitoring of the rivers during peak salinity period, in case river water salinity goes above safe limit. In that case, irrigation from rivers need to be stop immediately.	region, especially living close to the mentioned rivers, can intervene this water easily by using LLP and flexible plastic pipe.

PLANT PHYSIOLOGY DIVISION

Table-1

RESEARCH ACHEIVEMENT 2016-17

(Technology Developed/ Useful scientific information)

Sl. No.	Technology Developed/Useful scientific information	How country /Farmers/User will be benefited
1	Around 700 germplasm and breeding lines were characterized and of them 59 were found tolerant to salinity stress at seedling stage. Breeding line BR10238-5-1 was found tolerant to reproductive stage at 8 dS/m salinity stress.	Breeder may use these materials as a donor parents for salinity stress breeding
2	A total of 12 QTLs were identified from a Bangladeshi germplasm Ashfal Balam for seedling and reproductive stage tolerances.	This information will be helpful for the researcher.
3	Sixteen advance breeding lines were found tolerant to two-weeks of complete submergence. At deep flooding environment (>1.0 m) Habiganj Aman-1 performed better than other tested genotypes.	Breeder may use these materials as a donor parents for the development of submergence tolerant and deep water rice.
4	Out of 20 advance breeding lines, IR96977-B-B-7-B had 50% germination in anaerobic condition.	Breeder may use these materials as a donor parents anaerobic condition.
5	Out of 250 tested genotypes 26 germplasm and 3 advanced breeding lines (HHZ17-DT6-Y1-DT1, HHZ23-DT16-DT1-DT1 and BR10230-7-1) were identified and selected as drought tolerant.	Breeder may use these materials as a donor parents for drought stress breeding.
6	At high temperature environment, 7 advanced breeding lines were identified as heat tolerant.	This information will be helpful for the breeders.
7	Under Marker assisted breeding program 20 and 13	This information will be helpful for

	lines of 2nd and 3rd backcross generation were advanced and 40 and 20 fixed QTL lines selected based on genotypic and phenotypic similarity.	the researcher as well as farmers.
9	Nineteen advanced rice genotypes were evaluated for reproductive phase cold tolerance at natural condition of which two genotypes (BR8907-B-1-2-CS1-4-CS2-P3-4 and IR87322-65-2) were found as moderately cold tolerant.	This information will be helpful for the researcher as well as farmers.
10	BRRI dhan69 was evaluated for cold tolerance and it was found moderately cold tolerant both at seedling stage and reproductive phase.	Farmers could cultivate BRRI dhan69 at moderately cold prone area.
11	Under growth studies project, newly released Boro varieties were tested at 5 different sowing dates. BRRI dhan28 performed better at 3rd sowing (12/12/16) with shorter growth duration but BRRI dhan68 performed well at 2nd sowing (27/11/16). Long duration variety such as BRRI dhan29 did not perform well when sown late due to different natural hazards.	This information will be helpful for the farmers.
12	Breakdown of apical dominance had higher yield over control in 17 genotypes out of 44 Aus germplasm	This information will be helpful for the researcher as well as farmers.
13	Twenty selected Bangladeshi rice germplasm were tested for CO_2-responsiveness at field condition. Finaly-Wilkinson regression analyses showed photosensitive low-land varieties are more resilient than insensitive upland varieties in changing climatic condition. Tiller and Panicle number, Panicle dry weight and Harvest Index are strongly associated with CO_2 responsiveness in rice.	This information will be helpful for the researcher as well as farmers.
14	The dormancy period varied from 20-45 days and 5-36 days in Aman and Boro season, respectively. Seed viability period of Aman varieties (210 days) was longer than Boro varieties (110 days).	This information will be helpful for the researcher as well as farmers.

Soil Science Division

Research Achievement 2016-17

Table-1

Technology Developed	How country/Farmers/User will be benefited
1. **Nitrogen and potassium ratio for BRRI dhan49 and BRRI dhan29 cultivation:** A combination of 50 kg K ha^{-1} and 50 kg N ha^{-1} was enough for optimum yield of BRRI dhan49 at BRRI Gazipur farm. BRRI dhan29	The developed technology will be useful to the researchers and scientific personnel related to agriculture in home and abroad. The farmers in

required 50 kg K ha^{-1} and 120 kg N ha^{-1} for optimum yield. 2. **Bio-organic fertilizer to reduce urea and TSP Fertilizer use in rice production:** Application of bio-organic fertilizer (1-2 t ha^{-1}) can supplement 25% chemical N and 100% TSP fertilizer requirement rice production, which will reduce about 5.39 ton of N_2O and 934 million ton of CO_2 emission yearly due to rice cultivation in Bangladesh.	our country will also be benefited.

PEST MANAGEMNT PROGRAM AREA

Entomology Division

Table 1
Research Achievement 2016-17
(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
1.	Forty nine (49) advanced materials were screened against BPH, WBPH and GLH. Among them BR 7815-18-1-3-2-1, BR (Bio) 9787-BC2-173-1-3 and BR (Bio) 9785-BC2-6-2-2 advanced lines were found moderately resistant against WBPH and BR 8079-19-1-5-1 against GLH (Score 5)	This material has been given to Plant Breeding Division for developing resistant rice varieties.
2.	Highest natural enemies and parasitism of BPH and WBPH were observed in rice field near by nectar-rich flowering plants both in Gazipur and Rajshahi. But least natural enemies and parasitism were found in rice field where prophylactic insecticide applied at 15 days interval. Moreover, no significant yield reduction observed in rice field surrounding by flowering plants compared with insecticide treated field.	Conservation of natural enemies in rice field will reduce dependence on insecticidal control. Environmental pollution will also be reduce by avoidance of insecticide use.
3.	Prophylactic application of insecticides at 15 days intervals compared to perching and sweeping techniques at 15 days interval failed to show any	Farmers could harvest similar yield by using perching and sweeping techniques rather than insecticide

	significant yield advantages in Pirojpur, Gopalganj and Bagerhat districts.	application and able to increase substantial profit from reduce insecticide application.
4	A total of 37 commercial formulations of insecticides were evaluated against brown planthopper (BPH) and 13 against yellow stem borer (YSB). Of which 24 were found effective against BPH and 01 against YSB.	Farmers will be benefited by using these new effective insecticides.

Plant Pathology Division

Table 1
Research Achievement 2016-17

(Technology Development)

Sl No.	Technology Developed	How Country/Farmer/User will be benefited
01.	Comparative study on pathogenicity of 10 rice and 11 wheat blast isolates of *P.oryzae*	Comparative pathogenicity test indicates that 11 wheat blast isolates produced highly susceptible reaction on 22 BARI wheat varieties and showed non-pathogenic reaction on 23 blast resistant monogenic lines of rice. Conversely 10 rice isolates produced blast symptoms on monogenic rice lines and non-pathogenic to all wheat varieties. This information is very important for farmers those who cultivate rice and wheat.
02.	Eleven standard differential blast isolates (SDBIs) were finally selected for Bangladesh from the preselected 25 SDBIs	Pathologist can include these SDBIs for screening purposes to identify new blast resistant line/s.
03.	Evaluation of NERICA-L-19 against Bangladeshi blast isolates	NERICA-L-19 was found highly resistant against Bangladeshi blast isolates. QTL analysis suggested that NERICA-L-19 harbored blast resistant genes on chromosomes. 1, 4, 6, 8, 10, 11 and 12. These QTLs may use for developing blast resistant variety in Bangladesh
04.	Screening of germplasm for resistant to bacterial blight.	Among the 100 tested germplasm, 5 materials such as accession no. 523, 553, 578, 586 and 587 were found resistant to bacterial blight. Disease resistant line will be used as a donor for the development of variety.
05	Screening of germplasm for resistant to bakanae.	Out of 100 germplasm, two accessions such as no. 363 and 369 were found resistant against bakanae. Disease resistant line will be

		used as a donor for the development of variety.
06.	Evaluation of new chemicals against blast disease of rice	Among the 23 fungicides, only five such as Pazodi 32.5 SC, Navera, Bravo 75WG, Seltima and Azonil 56SC successfully controlled rice blast disease (above 80%) in Gazipur. Those fungicides could be used for the management of rice blast disease.
07.	Management of Sheath blight disease using Tricho- compost.	Tricho-copmpost treated plots showed lower relative lesion height (14.06%) and disease incidence (14.06 %) of sheath blight compared to control. Farmers can use trico-compost for the management of sheath blight disease.

FARM MACHINERY AND MECHNIZATION PROGRAM AREA

Farm Machinery and Postharvest Technology Division

Table - 1

Research Achievement 2016-2017

Sl. No.	Technology developed	How country/farmers/user will be benefited
1	***Design and development of manual rice transplanter***	Comparing with traditional hand transplanting, the machine can save about 60% labour and 45% transplanting cost and it is an intermediate technology for marginal farmer before fully introducing of power operated mechanical rice transplanter.

Workshop Machinery and Maintenance Division

Table 1

Research achievement 2016-17

Sl. No.	Name of the Experiment	How Country/Farmer/User will be benefited
1	Modification of reaper travelling wheel for wet land condition	In our soil condition wet land suited travelling wheel of reaper is necessary for harvesting crop. It minimizes the harvesting time, cost, human drudgery and yield loss.

RICE FARMING SYSTEMS PROGRAM AREA

Rice Farming Systems Division

Table-l

Research Achievement 2016-2017

(Technology Developed)

S1.No.	Technology Developed	How Country/Farmer/User will be benefited
01	**Four cropped cropping pattern: Potato+Maize – T. Aus – T.Aman**	Intercropping of companion crops including maize and potato in Potato – T. Aus – T. Aman cropping pattern. The total yield of intercropped crops were greater than sole cropping, i.e. from one hectre of land average yield of potato, maize, T. Aus and T. Aman is 10.82 t, 8.2 t, 4.17 t and 4.30 t respectively from where 1,61,020 tk can earn annually. Rice Equivalent Yeild (REY) is higher in proposed pattern comparing to existing pattern i.e. 18 t/ha in proposed pattern whereas 10 t/ha in farmer's pattern. In Kustia region where farmers usually practice Potato – T. Aus – T. Aman cropping pattern can adopt this new technology and may be extrapolated in potato and maize growing area with sandy loam soil.
02	**Four cropped cropping pattern: Muskmelon + Lentil – Jute – T. Aman** .	Intercropping of musk melon with lentil in lentil – Jute – T. Aman cropping pattern Net income ranges from 30,000-35,000 tk/bigha by investing 8000-10000 tk/bigha Cost benefit ratio is higher in in proposed pattern comparing to existing pattern. In Pirojpur region where farmers usually practice lentil

		– Jute – T. Aman cropping pattern can adopt with this new technology and may be extrapolated in other lentil and jute growing areas in medium low land.

SOCIO-ECONOMICS AND POLICY PROGRAM AREA

Agricultural Economics Division

Table 1

Research Achievement 2016-17

SL. No.	Title	Achievement/ Key findings	Remarks
1.	**Farm level Adoption and Evaluation of Modern Rice Cultivation in Bangladesh**	Adoption of modern varieties in Aus, T. Aman and Boro season were, 90%, 80% and 99%, respectively, of which representation of BRRI varieties were 67%, 48% and 71%, respectively. BRRI dhan28 and BRRI dhan29 were the most dominant varieties (e.g., 62% of total areas) in Boro season. Besides, BRRI dhan49 (11%) and BR11 (7%) were the major varieties in T. Aman season and BRRI dhan48 was the major one in Aus season (17%). Performance of BRRI dhan29 (6.41 ton/ha), BRRI dhan49 (4.60 ton/ha) and BRRI dhan48 (4.04 ton/ha) better than that of average yield of modern varieties in Boro (5.6 ton/ha), T. Aman (4.55 ton/ha) and Aus (4.2 ton/ha) season.	Researchers, extension personnel and policy makers may use this information to formulate appropriate policy for increasing food grain production. Breeders may use this information for developing stress tolerant varieties.
2.	**Tracking of Climate Resilient Rice Varieties and Its Economic Performance at the Farm Level in Bangladesh**	Although, the stress tolerant rice varieties are getting popularity, but slower dissemination hinders wider adoption in the stress prone areas. Therefore, still the farmers are cultivating non-stress tolerant varieties as a chance crop to secure their return. Development and dissemination of higher yield potential stress tolerant variety may enhance productivity and profitability of rice cultivation at the farm level in the stress ecosystem.	Policy makers may use this information to formulate appropriate dissemination policy for stress tolerant rice varieties
3.	**Insight of Seasonal Agricultural Credit on MV Boro Rice Cultivation at Farm Level in Chapainawabganj**	RAKUB provides about 75% of total credit requirement of farmers in the study villages during Boro, 2016/17. Small farmers used 48% of their credit for MV Boro rice cultivation, though they received lower amount of credit compared to medium (35%) and large (23%) farmers.	This information will be helpful to prioritize the agriculture credit disbursement.

	District		
4.	**Estimation of Costs and Return of MV Rice Cultivation at Farm Level**	Boro growers obtained higher yield and gross returns followed by MV T. Aman and Aus growers, but the Aman growers accumulated higher net return due to lower costs of production and better market prices. T. Aman rice is not only more profitable but also less risky, followed by Aus and Boro rice.	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.	**Comparative Economic Viability of Modern and Local Variety Transplanted Aman Rice in the Coastal Area in Bangladesh**	Economic viability (profitable and less risky) of T. Aman rice under research management is largely higher than farmer's practice. Adoption of modern technologies (variety and agronomic management) not only likely to increase food grain production and farm income but also to reduce risk of the rainfed crop cultivation largely.	Researchers, extension personnel and policy makers may use this information to formulate appropriate policy for increasing food grain production.
6.	**Value Chain Analysis of Rice Bran Oil in Bangladesh: An Economic Investigation**	The study revealed that only 67% of the total production capacity of rice bran oil mills was utilized; due to shortage supply of rice bran. The major constraint to get adequate supply of rice bran to the mills was unconscious use of bran as poultry and dairy feed. Because most of the poultry and dairy farms use bran directly as feed but this bran could be used after extraction of oil as fish or poultry feed from where the level of present bran oil production could be increased substantially.	The government may take initiatives to ensure the optimum use of rice bran which would significantly contribute in fulfilling the national demand as well as save foreign currencies for importing edible oil
7.	**Farmers' Perception of Climate and Environmental Change and Adaptation Practices in Southern Coastal Bangladesh**	Farmers' adaptation strategies to climate change were included adoption of modern rice variety, changes in transplanting time, providing the supplementary irrigation, adopting stress tolerant varieties, home-yard gardening, rearing livestock, receiving credit and undertaking off/non-farm wage work. Re-excavation of canal, repairing and/or establishing a new sluice gate between canal and rivers, increased access to extension supports, stress tolerant technologies (varieties and management) quality inputs may enhance cropping intensity and/or ensure agricultural sustainability in the coastal areas of Bangladesh.	Policy makers may use this information for formulation of policy regarding cropping system intensification
8.	**Preference analysis of T. Aman Rice Varieties in the Coastal Areas in**	In addition to grain and straw yield, grain quality and stem strength, other phenotypic traits like growth duration substantially influenced to select a variety for adoption. Environmental adaptability of a variet especially at maturity stage is more crucial consideration of	The breeders and extension workers should consider the farmers preference to developed and disseminate rice

	Bangladesh	farmers to select a new variety along with higher yield, plant height, strong stem, tiller per hills, panicle length, and grain size.	varieties.
9.	**Effectiveness of Boro Rice/Paddy Procurement Program in Some Selected Areas of Bangladesh**	Government procurement program has positive impacts on both farmers and millers. Farmers obtained higher returns through selling paddy at procurement center than selling paddy at local market. Inadequate quota, undue expectation of procurement staff, strict regulation about quality of paddy, husked rice, and payment system would be reported as major limitation of inefficient procurement systems.	Policy makers may use this information to modify present procurement system to be benefited majority farmers.
10.	**Rice Cultivation in Newly Independent Enclaves of Bangladesh: A Field Level Investigation**	The study found no significant difference in using input by enclave farmers in rice cultivation. The rice cultivation was severely constrained with higher irrigation cost, inputs price, disease catastrophe and natural disasters. The farmers also reported that the existing extension service was not sufficient. Good irrigation facility, smart extension service, and awareness regarding disease and climate hazards with adaptation technologies could be suitable remedies to sustain the desirable productivity of rice farms.	The findings of the study would help the extension agents and policy planners to make the priority settings toward the development of newly independent enclaves

Farm Management Division

Table 1:
Research achievement 2016-2017
(Technology Developed)

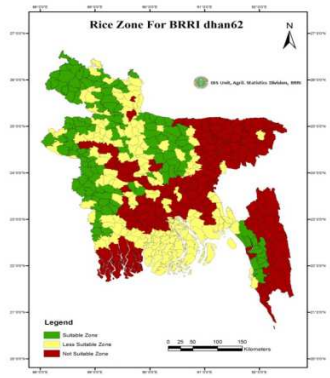
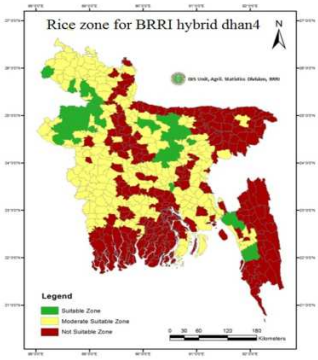
SL. No.	Technology Developed	How Country/ Farmers/User will be benefited
3.1.	**Seed quality of different T. Aman rice as affected by rainfed condition in ripening phase:** The seed quality such as germination percentage (GM %), seedling vigor index (SVI), high density grain (HDG %), shoot dry weight (SDW) and root dry weight (RDW) were significantly reduced due to rainfed / unavailable moisture during ripening phase.	This finding may be useful for the rice growers and researchers.

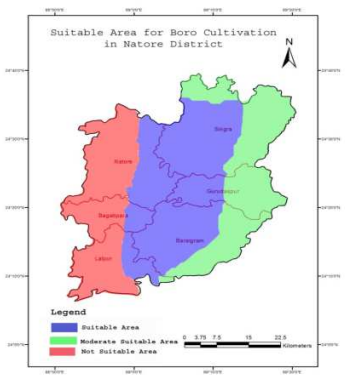
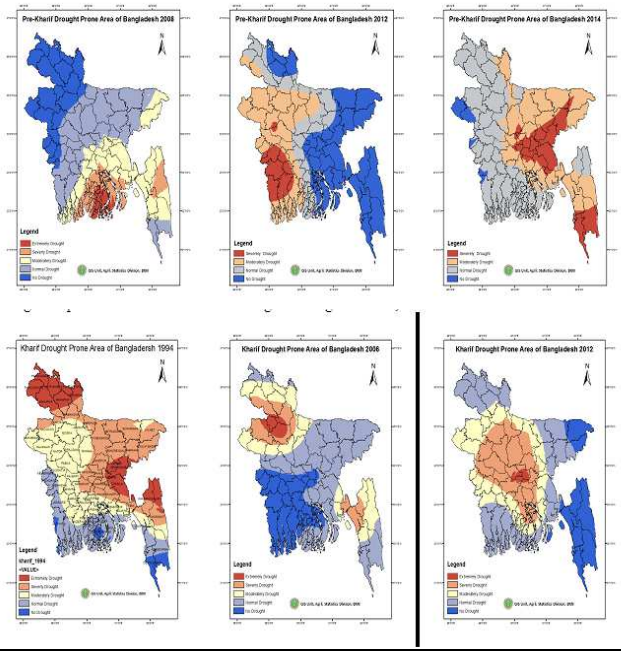
3.2.	**The influence of seedling age on tiller production, yield and yield components of rice:** Fifteen days old seedling produced the highest number of tiller per hill which was statistically identical with the tiller number produced from 20 and 25 days old seedling. The lowest number of tillers was recorded in 40 days old seedling. Yield and yield components was higher in younger seedling used plot that produced more tillers and panicles.	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. 400 to 530 day-1. The wage rate in peak periods of the year was Tk. 480 to 530 in May, Tk. 480 to 500 in July-August and Tk.450 to 500 in December - January. In Habiganj, Rangpur, Rajshahi, Barisal, Sonagazi, Comilla Satkhira and Khulna the wage was Tk. Tk. 390-415, 370-430, 420-480, 385-445, 425-455, 420-480, 380-420 and 430-475, respectively.	The Laborers' wage rates will help to estimate rice production cost and thus determine the retailer price of rice for the market.

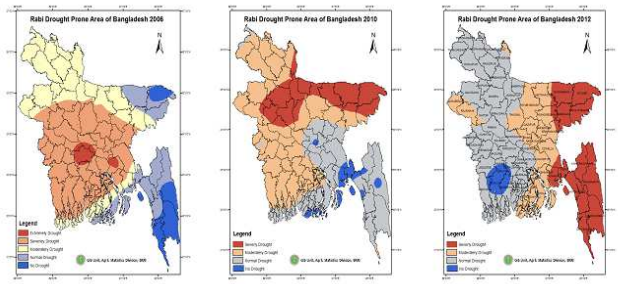
Agricultural Statistics Division

Table-1
Research Achievement 2016-2017
(Technology Developed)

Technology Developed	How Country/Farmer/ User will be benefited
Name/Title of the technology: Description with photograph:	
Stability Analysis of BRRI varieties: From the stability analysis of BRRI released rice varieties, it was found that in T. Aman season, BRRI dhan49 were found stable and in Boro season BRRI Hybrid dhan5 were the stable variety.	From the results of the analysis, researcher comes to know which variety is still stable and which variety is loosing 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.

Rice Zoning of BRRI Varieties: Mainly top north-west and central north-west areas are suitable for BRRI dhan62 but central part of Bangladesh i.e. Gangeas flood plain, southern and eastern parts of Bangladesh are not suitable for BRRI dhan62. Here total 464 upazilas are considered, among them 128 upazilas are found under suitable zone, 164 upazilas are found under less suitable zone and 172 upazilas are found under not suitable zone. Figure 10 shows the zoning map of BRRI dhan62. Few areas of north western side is suitable for BRRI hybrid dhan4. Middle part of Bangladesh is moderate suitable, eastern and southern sides are not suitable for BRRI hybrid dhan4.In this context 464 upazilas were considered, among them 52 upazilas were found under suitable zone, 221 upazilas were found under moderate suitable zone and 191 upazilas were found under not suitable zone. Figure 11 shows zoning map of BRRI hybrid dhan4. In a nut shell, it can be said that the northern side is suitable for cultivation of BRRI dhan62 and BRRI hybrid dhan4. But south and eastern sides are not suitable for both BRRI dhan62 and BRRI hybrid dhan4 cultivation.  	Farmers and researchers come to know the suitable zone for BRRI dhan62 and BRRI Hybrid dhan4 and adobe particular variety in suitable area i.e. best use of land and maximizing production.
Suitable area for Boro cultivation for Natore District: From the groundwater depth contour maps of minimum, maximum and fluctuation depths, it is found that groundwater condition in the western side was critical, eastern side and few areas of top most northern side were in moderate condition and central area was in good condition. Long term hydrographs of these three areas implies the same results as contour maps analysis. Thus we tried to the apparent condition for Boro suitability area of Natore district.	Farmers and researchers can safely plan to cultivate Boro rice in Natore District.

	
Drought Prone Areas of Bangladesh: In southern and western regions, Jessore, Satkhira, Khulna, Bhola, Barisal and its surroundings; central regions, Dhaka, Faridpur, Feni, Tangail and its surroundings; eastern regions, Chittagong, Rangamati hill tract areas and most of the northern region were more vulnerable to meteorological drought. Major finding of this study was that Kharif and Rabi seasons are the most vulnerable to meteorological drought that indicates high Rainfall anomaly seasons in most of the regions of Bangladesh. 	Farmers and researchers can safely plan to cultivate Agricultural Crops in Bangladesh.

	
Mobile Apps of "RKB" (Rice Knowledge Bank): Mobile Applications (apps) software is developed for use on mobile devices andmade available through app stores. Mobile appshave developed into a significant industry andappsstores have become highly competitive places.This movement has also been felt in Bangladesh, over the past five years, where millions of people have begun to use smart phones and mobile apps forthe first time. Our findings areuseful for mobile developers to understand the key aspects of the average Bengali consumer and what they expect from their mobile app experience.Mobile apps and mobile internet usage are heavily correlated. Analysis of the results has given us a deeper understanding of the mobile app user mind-setand beneficial for the developer.  **Figure:**Mobile Apps of "RKB" (Rice Knowledge Bank) of BRRI	Farmers can easily come to know about newly BRRI released rice variety,Modern Rice cultivation methods, Rice pest management, Rice insect & diseases management, Soil and fertilizer management, Irrigation and water management, Quality rice seed production management, Training and publications.

Adaptive Research Division

Table-1

Research Achievement 2016-2017

(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.	

Training Division

Table -1

Research Achievement 2016–2017

	Technology Developed	**How country /Farmer/User will be benefited**
	Program Area : Technology Transfer Program Performing Unit : Training Division	
I	1. Capacity Building and Technology Transfer Through Training	Knowledge and skill of the trained personnel on the subject matters were increased.
	Total training conducted : 58 No. of participants : 1,249 Duration: 1 day to 1 week Participants: Extension personnel of DAE, GO/NGO officers, Imam, 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, Sagardi, Barishal

Table – 1

Research Achievement 2016-17

(Technology Developed)

Technology Developed	How country /Farmers/Users will be benefited
1. Provided major contribution in development of BRRI dhan78, BRRI dhan81, BRRI dhan84 and BRRI dhan86	BRRI dhan78 would be cultivated in tidal-saline areas. BRRI dhan81 contains high protein and is an alternative for Jirashail. BRRI dhan84 is a Zn-enriched variety and BRRI dhan86 is suitable for harvesting by harvester. By cultivating those varieties, farmers might get higher yield comparing with other traditional and HYV's.

Regional Station, Bhanga, Faridpur.

Table-1

Research Achievement 2016-2017

(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
1.	**Contributed to develop BRRI dhan86 through conducting RYT and Proposed Variety Trial (PVT)**	By cultivating this variety, farmers of this region may get higher yield comparing with other traditional and HYV's. No lodging incidence is occurred. For that reason harvesting is possible through mechanical harvester. Export quality for its slender grain.
2.	Under PGB-IADP (BRRI Part) project **Weed control of rice through integrated weed management**	Weedicides + One hand weeding is best practice rather than farmers practice to increase yield and cost reduction of rice cultivation.

Regional Station, Cumilla

Table -1

Research Achievement 2016-17

Sl.	Seasons	Technology developed	How Country/Farmer/User Will be benefited

1. Varietal Development Achievement			
1.1	T. Aus	BRRI dhan85	This variety is suitable for both upland and water stagnant situation with higher yield and medium long slender grain and farmers can get more than 5.5 ton/ha grain yield.
2. **Crop-Soil-Water Management Achievement**			
2.1	T. Aman	Application of 80 kg N/ha for BRRI dhan75 to get the maximum grain and straw yield.	Farmers can mitigate the fertilizer loss.

Regional Station, Habiganj

Table-1

Research Achievement 2016-2017

(Technology Developed)

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

Regional Station, Kushtia

Table-1

Research Achievement 2016-2017

(Technology Developed)

Sl. No.	**Technology Developed**	**How country/Farmer/User will be benefited**
	None	-

Regional Station, Rajshahi

Table 1

Research Achievement: 2016-2017

(Technology Development)

Technology Developed	How country /Farmers/Users will be benefited
2.Provided major contribution in development of BRRI dhan83, BRRI dhan88 and BRRI dhan89	BRRI dhan83 may be cultivated in some selected areas of Barind region. BRRI dhan88 could be alternatives of BRRI dhan28 and BRRI dhan89 could be alternatives of BRRI dhan29. By cultivating these varieties,farmers of this region may get higher yield comparing with other traditional and HYV's.
3. **Jute+relay BRRI dhan71 + strip/bed planted wheat system is a profitable system in this area**	Cost of cultivation was reduced by 25% and famers may save at least Tk. 20000/ha by adopting of jute+relay BRRI dhan71-strip/bed planting wheat system.

Regional Station Rangpur

Research Achievement for 2016-17

Table 1

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
01	Major contribution has been provided for developing BRRI dhan72, BRRI dhan79, BRRI dhan81 and BRRI dhan84.	BRRI dhan72 and BRRI dhan84 could be cultivated as biofortified rice (Zinc rich). BRRI dhan79 may be cultivated in flash flood prone areas BRRI dhan81 would be more popular than presently cultivated Boro varieties. Using these newly released varieties, farmers will get higher yield than traditional varieties.

02	BRRI dhan66, BRRI dhan71, BRRI dhan75 have been identified as early yield potential T. Aman varieties for early potato and vegetable growing area	Many farmer of Nilphamary, Phanchaghar, Thakurgon, Rangpur district will cultivate these varieties and will be benefited.
03	BRRI dhan48 as Early Aus rice in Potato - Boro - T. Aman cropping system in medium highland irrigated ecosystem showed no yield reduction as BRRI dhan28	Farmers of Rangpur region will got more yield less disease hazard as suitable alternative of late boro variety BRRI dhan28.
04	Successfully workshops have been conducted with all AD, DD, UAO of Rangpur and Dinajpur regions, other extension people from GOs and NGOs organization, researcher from NARS and farmer's representatives for quickly dissemination rice production technology.	Sustainable rice production will be achieved by the farmers through dissemination and adoption in these regions.
05	210 farmers including ex-Enclave farmers were trained on modern rice production technology.	Knowledge on modern rice production technology has improved.
06	10 in-house 10 in-house training were provided for the improving skill and efficiency of office staff.	Efficiency of staff has improved.
07	For the purpose of quality seed production and dissemination at farmers' level, a total of 5274 kg TLS and 1880 kg Breeder seed was produced during T. Aus and T. Aman. 5123 kg TLS and 6000 kg Breeder seed was produced during Boro season.	National and regional seed demand of newly released and popular varieties will be meet up to some extend
	2350 kg TLS were distributed free in cost among the flood affected farmers in Rangpur Region	Flood affected helpless farmers have benefitted

Regional Station, Satkhira-9400

Table-1

Research Achievement 2016-2017

(Technology Developed)

Sl. No.	Technology Developed	How country/Farmers/Users will be benefited
4.	Provided major contribution in development of BRRI dhan81, BRRI dhan84.	BRRI dhan81 and BRRI dhan84 could be alternatives of BRRI dhan28. These varieties will be a breakthrough to sustain the rice yield in Boro season.
5.	Four cropped cropping pattern of Jute-T. Aman-Cauliflower-Boro produced about 196% higher rice equivalent yield (REY) than Boro-Fallow-T. Aman cropping	Four cropped cropping pattern of Jute-T. Aman-Cauliflower-Boro increased the cropping intensity and total productivity in favorable ecosystem.

	pattern.	

BRRI Regional Station, Sonagazi, Feni

Table -1
Research Achievement 2016-17

Sl. No	(Technology Developed)	How Country/Farmer/User will be benefited
	During reporting period, the station produced 20 tons of Breeder seed and 40 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 1.35 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.