Research Progress 2016-2017

Plant Breeding Division

Research Progress 2016-2017

Research Progress	Expected Output
Program Area/Project (Duration): Varietal Development program (VDP)	
1. Rice Breeding	
1.1 Development of Upland rice Fourteen entries were selected from 67entries in OYT based on overall phenotypic performance and yield potential. Thirteen advanced lines were selected from PYT#1 and PYT#2 out of 16 entries for further trials. Nine genotypes were selected out of 13 in SYT for further evaluation. In regional Yield Trial (RYT), three promising lines were selected from 5 entries. Selection criteria were the superiority in yield and grain quality with desired phenotype over the checks. One genotype, BR6848-3B-12 was selected from ALART and recommended for Proposed Variety Trial.	Proposed short duration Upland *Aus* rice variety with high grain yield will be able to increase the productivity of upland *Aus* ecosystem in Bangladesh.
1.2 Development of T Aus rice NERICA10 Pure Line (NERICA10-7-PL2-B) was proposed by both Advanced Line Adaptive Research Trial (ALART) and Proposed Variety Trial (PVT) for proceeding in variety release protocol.	Development of short duration rice varieties is promoted with acceptable yield performance suitable for T. Aus season.
1.3 Development of Shallow Flooded Rice varieties 22 crosses were made using 24 parents and 1026 F_1 seeds were produced. Six F_1s selected out of 13; were advanced through FRGA. From F_2 population 2270 individuals were obtained from five crosses. 300 individuals were obtained from F_5 population, 1300 individuals were obtained from F_7 population, 750 breeding lines were obtained from F_8 RILs. One genotype was selected from Preliminary Yield Trial (PYT) based on grain yield out of nine entries. One genotype was selected from Multi-location Yield Trial (MYT) based on grain yield.	Development of high yielding (4.0-5.0 t/ha) rice varieties for shallow flooded area (up to 1.0 m depth), shallow deep area (30 cm water) and medium deep area (50-60 cm water) along with submergence, facultative elongation and hypoxia tolerance.
1.4 Development of rainfed lowland rice (RLR): In T. Aman season, 14 crosses were made; 41 crosses were confirmed as true hybrid; 504 progenies were selected from 22 F_2 populations; 775 progenies and 37 fixed lines were selected from pedigree nurseries. Sixty three genotypes were selected from OT. Nine genotypes from	Development of high yielding rice varieties with short growth duration and acceptable grain quality like BRRI dhan39 and BRRI dhan49 in T. Aman.

IRLON, 6 from PYT, 20 from SYT, 9 from RYT were selected and 2 genotype performed better from ALART was recommended by Adaptive Research Division (ARD) to release as a variety.	
1.5 Development of Premium Quality Rice (PQR) for T. Aman Season: In total, 11 crosses were made using 15 parents; 15 crosses were confirmed as true hybrid; 111 progenies were selected from 15 F_2 populations; 350 progenies and 70 36 genetically fixed lines were selected from pedigree nurseries (F_3-F_6 generations). 36 advanced lines were selected from OT. Twenty one advanced lines were selected from PYT. Ten genotypes were selected from SYT#1 and SYT#2 for further evaluation. In regional Yield Trial (RYT), 8 promising lines were selected for on farm trials (ALART). All of the above mentioned Advanced rice lines are growing in current T. Aman season (T. Aman 2017-18). **Development of Photosensitive Rice (PSR)** 20 local Genotypes were selected from different location of Bangladesh for Observational Yield Trial (OYT), 15 advanced breeding were selected from Observational trial (OT) for PYT and during last T.Aman season.	Development of high yield potential aromatic and non-aromatic fine grain quality rice with national standards (Kalizira / Kataribhog / Chinigura / BRRI dhan34 type), earliness and good plant type. Development of high yield potential photosensitive rice varieties for low land, medium low land flood affected rice growing area of Bangladesh.
1.6 Development of Salt Tolerant Rice (STR) In *T. Aman* season, 2016-17, 7 entries were selected from 30 OYT (BR genotypes) and 19 entries were selected from 49 STBN material based on overall phenotypic performance and yield potential. All the twelve entries were selected from PYT for further experiments in SYT. Selection criteria were the superiority in yield and grain quality with desired phenotype over the checks. In PVS preference analysis IR78761-B-SATB1-68-6, IR78761-B-SATB1-52-1 and IR8768-2-AJY1-B was the most preferred genotype selected by the farmers. In *Boro* Season, 2016-17, 17 entries were selected from 56 OYT (BR genotypes) and 17 entries were selected from 49 STBN material.3 entries (out of 12 genotypes) were selected from PYT#1 and 4 entries (out of 12 genotypes) were selected PYT#2. Four entries (out of 13 genotypes) were selected from SYT. Another 4 entries (out of 12 genotypes) were selected from AYT. Selected	Salt affected barren unused lands of the coastal regions will come under modern rice variety cultivation and national yield will be increased.

lines were better in terms of yield and other relevant characters.In PVS preference analysis, IR86385-117-1-1-B wasthe most preferred genotype according to farmer's vote.	
1.7. Development of Zinc Enriched Rice (ZER) In total 43 crosses were made, 15 crosses were confirmed and 247 plants were selected from 9 F_2 populations. From pedigree nursery 335 segregating progenies and 35 fixed lines were isolated. From observational trial (OT), 18 genotypes were selected for PYT, 10 genotypes were selected from PYT, 10 genotypes were selected from SYT and 4 lines were selected from RYT trial. The BRRI developed varieties showed wide range of variation zinc content in both polished and brown rice. Zinc content in polished rice varied from 12.3 mg/kg to 32.5mg/kg with an average value of 18.7 mg/kg. It was found that rice varieties grown under upland condition had higher zinc content. This might be due to higher availability of zinc in upland soils rather than low land and/or irrigated land resulting higher accumulation in rice grains.	Development of high yielding rice varieties with improved nutritional quality in term of high iron and zinc content in polished grain.
1.8 Development of Insect Resistant Rice (IRR) In *T. Aman* season, 2016-17, 60 lines from 236 of OYT materials were selected for further trial, 9 lines were evaluated in PYT and 6 were selected. 4 lines from 7 genotypes of SYT#1 and 2 lines out of 6 were selected in SYT#2 for further trial in the next season. Entries selected for the next season trials were superior in PAcp score, duration of growth, yield potential and grain quality. In *Boro* Season, 2016-17, 52 genotypes were selected from 179 genotypes in OYT based on the yield performance and overall phenotypic acceptability. In SYT, 6 genotypes out of 11 entries were selected. All of the selected entries performed better than each of the checks and was resistance to BPH in *Boro* season.	Varieties resistant to brown plant hopper (BPH), gall midge (GM) and white brown plant hopper (WBPH) will be developed for modern rice cultivation.
1.9 Development of Disease Resistant Rice (DRR) One genotype for BB resistance was selected from AYT during T. Aman season and Two genotypes for BB resistance were selected from RYT during Boro season.	Development of BB, Blast & RTV resistant with high yielding rice varieties/lines.
1.10 Development of Favorable Boro Rice (FBR)	Development of improved genotypes

Eleven genotype were selected from AYT during Boro season and Two genotypes for were selected from RYT during Boro season.	with high yield potential, earliness and acceptable grain quality for irrigated areas of Bangladesh.
1.11 Development of Cold Tolerance Rice (CTR) Eighty five genotype were selected from OYT during Boro season and Five genotypes for were selected from PYT during Boro	The thrust is to develop short duration varieties accompanied with cold tolerance for Boro season.
1.12 Development Submergence and Water Stagnation Tolerant Rice varieties Totally 18 single crosses were made involving 14 parents and 1463 F_1 seeds were produced. Thirteen crosses were selected and confirmed as true F_1s. Totally 17176 individuals of F_3 population were advanced through FRGA. Pedigree generations were grown under controlled submergence and medium stagnant water condition of BRRI, Rangpur. A total of 870 tolerant progenies from F_2-F_8 generations were selected and preserved. Thirty seven homozygous and tolerant lines were selected for observational trial. In Marker Assisted Selection, introgression of SUB1 QTL into the genetic background of BR22 was advanced up to BC_5F_2 generation and 12 heterozygote plants were selected. Whereas Introgression of SUB1 QTL into BRRI dhan62 was advanced up to BC_1F_2 and >4000 seeds were produced for advancement of breeding population through RGA. From five OYT's, four PYT's and one AYT conducted under rainfed and flash flooding conditions, 91 genotypes were selected based on grain yield and growth duration. In PVS trial conducted under non-flooded condition, the highest preference score was obtained in favour of IR 85261-18-158-Gaz-3B-62 because of more effective tiller, acceptable grain quality, tall plant type, lodging resistance, long panicle, less disease attack, less sterility and prediction of good yield. Among the tested entries, IR 85261-18-158-Gaz-3B-62 produced the highest grain yield 5.0 t/ha. In PVT, the proposed line BR9159-8-5-40-14-57 produced 5.37 t/ha grain yield which was significantly higher than the grain yield of BRRI dhan49 (4.12 t/ha). The growth duration of the proposed line was around 5 days earlier than BRRI dhan52. Though under 16 days of controlled complete submergence pressure the line produced similar	Short duration and high yielding rice varieties with three weeks submergence, stagnant flood and anaerobic germination tolerances with yield target 6.0-6.5 t/ha in normal condition and 5.0 t/ha in stress condition. Development of multiple stress tolerant rice varieties like submergence+ stagnant flood, submergence+ drought with yield target 6.0-6.5 t/ha in normal condition and 5.0 t/ha in stress condition.

grain yield compared to BRRI dhan52 but under 25 days of submergence pressure at BRRI Gazipur, the line produced 2.3 t/ha more yield than BRRI dhan52 and 3.1 t/ha more grain yield than BRRI dhan49. The proposed line has already been released as BRRI dhan79 in the 92th NSB Meeting on 05.04.2017. In 'Head to Head' trial, Sub1-varieties were tested under non-flooded conditions of 4 locations and the highest average grain yield was obtained from BR11 being 5.1 t/ha with 144 days growth duration whereas the lowest average growth duration was exhibited by Binadhan-11 which was 125 days with 4.2 t/ha grain yield	
1.13 Development of Water Saving and Aerobic Rice varieties Totally 11225 individuals of F_3 population, 43175 individuals of F_4 population and 14100 individuals of F_5 population were advanced through FRGA. Two entries were selected out of 13 entries from AYT#1 and AYT#2 based on grain yield. In BRRI R/S Bhanga, one entry selected out out of eight entries based on grain yield.	Development of low water and aerobic rice which will give significantly higher grain yield (at least 10% more) than standard check (BRRI dhan28) but will save 20-30% water.
1.14 : Development of Drought Tolerant Rice (DTR): In T. Aman season, 17 crosses were made; 29 crosses were confirmed as true hybrid; 170 progenies were selected from 18 F_2 populations; 897 progenies and 101 fixed lines were selected from pedigree nurseries. Twenty six genotypes were selected from OT.	Development of high yielding rice varieties with tolerant to drought stress for the rainfed lowland rice ecosystem in Bangladesh.
1.15 Development of Green Super Rice (GSR) Three drought tolerance genotypes from AYT and two salinity tolerance genotypes were selected from Participatory Variety Selection (PVS) for T. Aman season. In Boro season, four genotypes were selected from RYT.	Development of less input but high yield potential genotypes with tolerance to different stresses (abiotic and biotic).

Biotechnology Division
Research Progress 2016-2017

Sl. No.	Research Progress	Expected Output
1	**Project I: Development of double haploid rice variety**	

	Expt.1.1 Development of low glycemic index (GI) rice variety through anther culture A total of 55686 hybrid anthers from nine F_1 populations were plated in N6 and M10 medium. The highest numbers (208) of calli were obtained from hybrid anthers of MR219/Kanaklata cross. A total of 125 green plantlets were obtained from 522 callus. A total of 176 F_1 seeds were harvested from three crosses for future anther culture program period.	Low glycemic index (GI) rice variety will be developed.
	Expt. 1.2 Development of salt tolerant rice variety through anther culture A total of 50922 hybrid anthers from seven crosses were plated in N6 and M10 media and eleven calli were obtained.A total of 1636 F_1 seeds were harvested from eight crosses for future anther culture program	Salt tolerant rice lines will be developed.
	Expt.1.3 Development of premium quality kalijira type rice variety through anther culture About 17051 hybrid anthers were plated in N6 and M10 medium and 30 green plants were regenerated from the cross of BRRI dhan50/Bashful. A total of 672 F_1 seeds were harvested from three crosses for future anther culture program	Kalijira type aromatic rice lines will be developed.
	Expt. 1.4 Development of Aus rice variety through anther culture A total of 21671 hybrid anthers from five crosses were plated in N6 and M10 medium. In total 102 calli were produced. Four green plants were regenerated from two crosses. A total of 672 F_1 seeds were harvested from six crosses for future anther culture program.	Short duration, high yielding Aus rice variety will be developed.
	Expt 1.5 Development of Swarna type rice variety through anther culture Ten crosses were made between BRRI released varieties and different Swarna rice genotypes. A total of 1304 F_1 seeds were harvested from 10 crosses for future anther culture program	Swarna type rice variety will be developed.
	Expt 1.6 Development of antioxidant enriched black rice variety A total of 717 F_1 seeds were harvested from 12 crosses for future anther culture program. A total of 10671 hybrid anthers from 12 crosses were plated in N6 and M10 media. In total 12 calli were produced.	Antioxidant enriched black rice variety will be developed.
2	**Project II: Development of rice variety through somaclonal variation**	
	Exp 2.1 Development of somaclone using EMS treated rice seed Hundred, 12 and 55 somaclones were selected from BR(Bio)8072-AC8-1-1-3-1-1, BRRI dhan28 and BRRI dhan29, respectively.	High yielding rice variety for Aus, Aman and Boro will be developed through somaclonal variation.
	Exp 2.2 Development of high yielding Aus variety through somaclonal variation In total 124 four plants were selected from 145	High yielding Aus variety will be

	somaclonal lines of BRRI dhan48	developed.
	Exp 2.3 Improvement of BRRI dhan47 through somclonal variation Forty plants were selected from 16 somaclonal lines of BRRI dhan47	Shattering resistant BRRI dhan47 will be developed.
	Exp 2.4 Development of antioxidant enriched rice variety through somaclonal variation Two hundred fifty seeds of each genotype (five) were plated in MS media. A total of 1090 calli were obtained. Seventy three green plants were regenerated. Seeds were harvested from five SC_0 Plants	Antioxidant enriched high yielding rice varieties will be developed.
3	**Project III: Field evaluation of tissue culture derived advanced breeding lines.**	
	Expt. 3 .1 Progeny selection During T. Aman/2016, 31 homozygous lines were bulked from 183 pedigree lines for further evaluation. During Boro/2016-17, 86 plants were selected and 24 lines were bulked from 112 pedigree lines for further evaluation **Expt. 3.2 Observational trails** During T. Aman/2016, five doubled haploid lines were evaluated as OT with standard checks. None was selected. **Expt. 3.3 Preliminary Yield Trial** During T. Aman/2016, six doubled haploids were evaluated with standard checks in a PYT Three lines were selected depending on the duration and comparable yield with checks **Expt. 3.4 Secondary Yield Trial** During T. Aman/2016, six doubled haploid lines were evaluated with standard checks in a SYT. None was selected. **Expt. 3.5 Regional Yield Trial** Six doubled haploids were evaluated at eight regional stations during Aus/2016. None was selected. Six doubled haploids were evaluated at eight regional stations during T Aman/2016. None was selected **Expt. 3.6 Propose Variety Trial (PVT)** Performances of two doubled haploid lines were evaluated at ten locations of the country.	New rice variety will be developed from these lines Short duration Boro rice variety will be developed from this study.
4	**Project IV: Development of rice variety through wide hybridization**	
	Expt 4.1 Development of rice variety through wide hybridization followed by embryo rescue One hundred seventy one seeds of BC_1F_1 were harvested from five cross combination between three wild rice	Different stress tolerant rice variety will be developed through

	varieties and two BRRI varieties.	wide hybridization
	Expt.4.2 Development of rice variety through wide hybridization followed by anther culture Four hundred ninety nine BC_1F_1 seeds were harvested from 8 crosses	Modern rice variety will be developed through wide hybridization
5	**Project V: Rice transformation studies**	
	Expt.5.1 Development of salt tolerant transgenic rice Agronomic performance of T_3 putative transforments having *GlyI and GlyII* genes were evaluated. All of these transforments had 60-70% sterility. So, all these materials were destroyed. More transformation works are advancing for new events. Putative transformed calli are on different selection media.	Salt tolerant transgenic rice lines will be developed.
	Expt. 5.2 Salinity screening of transgenic rice lines *PDH45* transgenic lines tested for salinity tolerance at seedling stage. Considering their salinity tolerance at seedling stage, the 5 transgenic lines *PDH_BR47-1*, *PDH_BR47-2*, *PDH_BR29-2*, *PDH_BR28-3* and *PDH_BR36-2* were selected for reproductive stage salinity screening.	Salt tolerant rice lines will be identified
6	**Project VI: Allele Mining**	
	Expt 6.1 Identification of yield enhancement QTLs During Aus 2016, three materials developed from QTL mapping population of BRRI dhan28*^{3}/*O. rufipogon* (acc. no. 105890) cross were evaluated as RYT. None of them were selected During T. Aman 2016, two lines developed from QTL mapping population of BRRI dhan29*^{3}/ *O. rufipogon* (acc. no 103404) cross were evaluated as ALART. One line was selected for PVT. During Boro, 2016-17, four materials developed from QTL mapping population of BRRI dhan28*^{3}/ *O. rufipogon* (acc. no 105890) cross were evaluated as RYT. Two lines were selected for ALART Four materials developed from QTL mapping population of BRRI dhan29*^{3}/*O. rufipogon* (acc. no 103404) cross were evaluated as ALART. One line was selected for PVT.	High yielding rice varieties will be developed.
	Expt 6.2 Identification of QTLs for salinity tolerance both at seedling and reproductive stage During Boro/2016-17 season fourteen lines were evaluated with standard checks in a PYT. Seven lines were selected for SYT. During Boro/2016-17 season seven lines developed from QTL mapping population of BRRI dhan29/IR4630-22-2-5-1-3) were evaluated with standard checks in a SYT. Four lines were selected for RYT.	QTLs for salt tolerance both at seedling and reproductive stage will be identified and high yielding rice varieties will be developed.

	Expt 6.3 Identification of QTLs for taller seedling height QTL mapping population was developed by crossing between BRRIdhan11/Shadamota (acc.no.1576). F_2 seeds were collected for genotyping and phenotyping. Parental polymorphism survey was carried out and a total of 115 SSR markers were identified as polymorphic.	QTLs for taller seedling height will be identified for developing tidal submergence tolerant rice variety.
7	**Project VII: Gene Pyramiding**	
	Expt 7.1 Gene pyramiding for resistance to bacterial blight (BB) Five Bacterial Blight (BB) gene pyramided BRRI dhan29 rice lines having two BB resistant genes (*Xa4* and *Xa21*) were evaluated as RYT during Boro 2016-17 with standard checks. These lines were also confirmed by PCR with gene specific primers. Three lines were selected for ALART depending on the phenotypic acceptability; yield performance, BB scoring and presence of BB resistance genes. Twenty one Bacterial Blight (BB) gene pyramided materials having three BB resistant genes (*Xa4*, *xa13* and *Xa21*) were evaluated during Boro 2016-17 in an observational trial with standard checks. These lines were also confirmed by PCR with gene specific primers. Nine lines were selected for PYT depending on the phenotypic acceptability, yield performance BB scoring and presence of BB resistance genes.	Breeding lines possessing multiple BB resistance genes will be developed through Marker Assisted Selection
8	**Project VIII: Gene Cloning**	
	Expt 8.1 Isolation and cloning of salt tolerant gene cDNA synthesised from RNA of *P. coarctata* and amplified with DREB1 gene. DREB1 gene was isolated.	Salt tolerant genes will be isolated and cloned

GRS Division

Research Progress 2016-2017

Sl. No.	Research Progress	Expected Output
Program Area 01: Varietal Development Program (VDP)		
3	**Sub-program area: Rice Germplasm and Seed**	
3.1	**Project: Rice germplasm conservation and management** • Collection of 253 germplasm. Moreover, 91 germplasm were also collected under Asian Food and Agriculture Cooperation Initiative (AFACI) project of BARC. • Rejuvenation of 2,004 germplasm. • Morphological characterization of 197 germplasm with 53 morpho-agronomic characters and molecular characterization of	Long term conservation of the rice germplasm and utilization for future research and breeding. Findings of the experiments according to objective could be utilized in further research. Data generated through molecular characterization would be helpful

	36 aromatic rice landraces using 42 SSR markers were conducted. • Supply of 1,781 accessions of germplasm and 534 samples of BRRI varieties for research and demonstration.	to establish IPR of Bangladeshi rice germplasm/variety.
3.2	**Project: Seed production and variety maintenance** • All BRRI developed (71) and recommended (14) rice varieties were maintained as nucleus stock. • In total, 142.90 tons of breeder seed of which 57.00 tons from 42 varieties in T. Aman and 85.90 tons from 22 varieties in Boro seasons were produced. • At the same time, 130.70 tons of breeder seed of which 79.06 tons from 19 varieties in Boro, 5.37 tons from 12 varieties in Aus and 46.23 tons from 34 varieties in T. Aman seasons were distributed.	Maintenance of pure seed stock and supply of Breeder seed to GO, NGO and private seed producing organizations according to their demand under rice seed network of BRRI.
3.3	**Project: Exploratory and genetic studies** • Molecular diversity of characterized 36 local aromatic germplasm was grouped into four major clusters through UPGMA cluster analysis. • DNA fingerprinting of 77 wild rice was performed using 42 SSR markers and the UPGMA clustering analysis group the germplasm into six major clusters.	Characterized germplasm and wild rice would be protected regarding varietal identification and intellectual property rights (IPR's).
3.4	**Project: Documentation of technology** During reporting year, 500 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.

Hybrid Rice Division

Research Progress 2016-2017

Research Division/ Regional Station: Hybrid Rice Division, BRRI

Sl. No	Research Progress	Expected Output
	Program Area: Varietal Development **Project: Material development,**	

	seed production and its distribution **Duration: 2016-2017**	
01.	Seven new CMS (A) lines (BRRI60A/EL110, BRRI7A/EL116, BRRI7A/EL145, BRRI7A/EL195, BRRI7A/EL196, BRRI56A/EL23& BRRI32A/EL36) as BRRI86A, BRRI87A, BRRI88A, BRRI89A, BRRI90A, BRRI91A & BRRI92A having diverse characters were developed.	This CMS lines will use for new hybrid rice variety development for T Aman & Boro seasons.
02.	CMS multiplication and seed production package development of promising CMS lines and hybrid combinations has been initiated	After study of commercial seed production feasibility, the selected combination will submit to Seed Certification Agency (SCA) for variety release purposes.
03.	A total of 2000 kg of F_1 seeds of BRRI hybrid dhan2, BRRI hybrid dhan3 and BRRI hybrid dhan4 were distributed under PGB and CSISA project at project commanding areas	Popularization of BRRI released hybrid varieties.
04.	Seed production program of BRRI hybrid dhan2, BRRI hybrid dhan3, BRRI hybrid dhan4 and BRRI hybrid dhan5 was initiated at farmers level under Mymensingh, Gopalganj, Kurigram and Lalmonirhat district	Farmers can able to produce own F_1 seeds of BRRI released hybrid rice varieties and in such a way small entrepreneurship will be developed at farmers level

GQN Division

Research Progress 2016-2017

Sl. No.	Research Progress	Expected output
	Programme area / Project with duration	
Varietal Development		
1.1	Determination of physicochemical and cooking properties of rice grain (Year round)	Newly developed breeding lines will be identified to help to develop data base on physicochemical cooking and eating qualities of grain.
1.2	Evaluation of Physicochemical properties of newly released BRRI varieties (Year round)	Physicochemical and cooking qualities of recently released BRRI developed rice varieties will be identified for updating the data base.

1.3	Determination of physicochemical and cooking properties of Kanakchul (Year round)	Physicochemical and eating qualities of Kanakchul rice grain will be identified for identifying superior popping qualities.
2.1	Nutritional quality and organoleptic properties of rice based food product (Year round)	The quality and nutritional value, acceptability and shelf-life of rice based biscuit will be evaluated.
3.1	Effect of different degree of milling on the retention of micro nutrient of BRRI released high Zinc varieties (Year round)	The optimum milling time and percent degree of milling thus retains most micronutrient will be find out.
3.2	Mineral and vitamin profiling of BRRI varieties (Year round)	The vitamin and mineral contents of HYV will be evaluated.
3.3	In vivo experiment on glycemic index of differently processed rice (Year round)	The effect of differently processed rice such as unparboiled, parboiled, pressure parboiled and double parboiled rice on glycemic response in rat model will be accounted.
3.4	Determine an appropriate processing method for increase the concentration of resistant starch (RS) of cooked rice (Year round)	The conversion of rice starch to resistant starch using different cooking and cooling method will be maximized.
3.5	Identification of rice genotypes having low heavy metal uptake ability at seeding stage (Year round)	The heavy metal uptake in rice plant by different rice cultivars will be assessed. The dose response uptake of heavy metals on different rice genotype will be assessed. Low heavy metal uptake rice genotype will be identified.
3.6	Evaluation of commercial rice bran oil and soybean oil available in the market (Year round)	The peroxide value, saponification value, iodine number and fatty acid composition present in the oil will be determined.
3.7	Evaluation of amino acid composition of high, intermediate and low brown rice protein(Year round)	Lysine and other amino acid content in rice cultivars will be determined because lysine is the first limiting essential amino acid in rice proteins.
4.1	Physicochemical, cooking and sensory properties related to quality of rice noodles (Year round)	A laboratory-scale method for making rice noodles will be standardized and physicochemical, cooking and sensory quality of rice noodles will be evaluated.
4.2	Determination of physicochemical	The physicochemical and

	properties and quality of puffed, popped and flattened rice from newly released BRRI varieties (Year round)	nutritional quality of puffed, popped and flattened rice will be determined.
4.3	Survey on indigenous rice products of BRRI modern varieties (Year round)	The popular BRRI varieties are used for producing puffed and flattened rice will be find out.

Agronomy Division

Research Progress 2016-2017

Sl. No.	Research Progam/Project	Progress/ Output
01	Seeds and Seedlings	
1.1	Role of salicylic acid (SA) on quality seedling production of Boro rice under natural cold stress condition (on going)	Salicylic acid@ 250 µM produced good quality seedling in respect of seedling height and dry weight when sprayed at 15 and 25 day after seeding (from November- January seeding)
1.2	Role of micronutrients on sterility reduction of CN6	1. BRRI recommended fertilizer dose (N-P-K-S: 93-12-42-10 kg ha^{-1}) + Boron (@ 5 ppm) reduced 20% sterility compared to BRRI recommended fertilizer dose in Aman season. 2. BRRI recommended fertilizer dose (N-P-K-S-Zn: 120-18-75-20-4 kg ha^{-1}) + Boron (@ 5 ppm) reduced 13% sterility compared to BRRI recommended fertilizer dose in Boro season.
1.3	Effect of different modified seed bed technique in mat nursery in Boro season (on going)	Conventional seed bed with 80 gm^{-2} seed produced taller seedling (11 cm), more number of leaves (5 leaves $seedling^{-1}$) and highest dry matter (50 mg $seedling^{-1}$) at 30 DAS but all the treatments produced statistically similar grain yield (5.91-6.59 t ha^{-1}).
02	Planting Practices	
2.1	Effect of time of planting on growth and yield of advanced lines in Aus, Aman and Boro seasons (on going)	In T. Aus, 2016 none of the promising line gave higher grain yield over check variety, BRRI dhan42 up to 26 April seeding but BI dhan5 and BR718-28-19 gave 1.94 and 1.70 t ha^{-1} higher grain yield over BRRI dhan42 at 4 May seeding. In T. Aman, 2016, BR7528-2R-HR16-12-23-P1 (MER line) gave higher grain yield than check varieties (BRRI dhan72 and BRRI dhan39) at different time of planting and BR7895-4-3-3-2-3 gave similar grain yield in 15 and 30 July transplanting with check variety, BRRI dhan72. In ALART-1, advanced lines IR70213-10-CPA4-2-2-2 and BR8214-23-1-3-1 gave higher yield than check BRRI dhan39 at all plantings and BR8214-23-1-3-1 may be considered for new variety in T. Aman season. In ALART-2, BR8210-10-3-1-2 gave lower yield than the check varieties, BRRI dhan49 and Lalswarna. In ALART-3, Sumonswarna, Ranjitswarna, Nepaliswarna, Swarna5, and Gutiswarna did not give

		higher yield than the check varieties BR11 and BRRI dhan49. In Boro, 2016-17 (LD), BR(Bio)9787-BC2-63-2-2 (6.74 t ha^{-1}) and BR7812-19-1-6-1-P2 (6.70 t ha^{-1}) gave higher yield on 04 and 19 January planting having growth duration of 160 and 156 days, respectively and gave 0.5 t ha^{-} higher yield over BRRI dhan58 with 152 days growth duration. None of the promising lines from FBR and PQR performed better than ck. varieties. Among the SD lines, BR(Bio)9787-BC2-173-1-3 gave statistically similar yield (6.11 and 5.61 t ha^{-1}) over check variety BRRI dhan28 on 06 and 22 January planting with growth duration of 142 and 133 days. None of the promising lines from MER and CTR performed better than check varieties.
03	Fertilizer Management	
3.1	Performance evaluation of Swarna cultivars under different fertilizer management options	Swarna5 and Gootyswarna produced more than 5.60 t ha^{-1}) grain yield with all fertilizer combinations except Gootyswarna with N_{56} P_7 K_{38}. Sumonswarna produced the lowest grain yield with all fertilizer combinations.
3.2	Performance evaluation of Monibandhobi under different fertilizer management options	Higher number of panicles was observed on 16 August planting than 31 July planting irrespective of fertilizer management options. At 31 July planting, treatments, N_{56} P_7 (-K) produced higher number of panicles over other treatments. P_7 K_{38} (-N) produced higher number of panicles than N_{56} P_7 K_{38} due to lodging. But in 16 August planting, N_{56} P_7 K_{38} produced higher number of panicles and consequently higher grain yield
3.3	Influence of integrated nutrients and spacing on growth and yield of BRRI dhan69	BRRI recommended dose with 20 × 15 cm spacing gave higher grain yield (> 6.20 t ha^{-1}) of BRRI dhan69 due to higher number of panicles and higher LAI which is statistically similar with < 25% of BRRI Rec. dose + 2.5 t ha^{-1} decomposed PL with 25 × 15 cm spacing.
04	Weed Management	
4.1	Effect of herbicides on soil microbial population (on going)	At 3DAHA (days after herbicide application), both bacterial and fungal population reduced but at 7DAHA, fungal population and 10DAHA, bacterial population found statistically similar to initial population.
4.2	Effect of weed control methods on the productivity of direct wet seeded rice	*Cyperus difformis* and *Scirpus maritimus* were effectively controlled by Pretilachlor + Pyrazosulfuran ethyl + 1HW whereas; Bispyribac sodium + 1HW effectively controlled *Cyperus difformis*, *Scirpus maritimus* and also *Echinochloa crus-galli* in direct wet seeded rice.
4.3	Mixed weed flora management by new	Sulfentrazone (pre-planting herbicide) was effectively controlled (more than 80%) *Cyperus difformis* and

	molecule herbicides in transplanted and direct wet seeded rice (on going)	*Echinochloa crus-galli*; Pretilachlor + Trisulfuron (early post emergence herbicide) control *Cyperus difformis* and *Scripus maritimus;* Bensulfuran methyl + Bispyribac sodium (post emergence herbicide) was effectively controlled *Cyperus difformis*, *Scripus maritimus* and *Echinochloa crus-galli*in both transplanting and direct wet seeded rice.
4.4	Effect of continuous application of herbicide on weed species shifting and resistance (on going)	Mixed herbicide like, Pretilachlor + pyrazosulfuran ethyl effectively controlled *Cyperus difformis* and *Monochoria vaginalis* compared to single molecule herbicide.
4.5	Screening of crop residues for weed control efficiency in rice (on going)	Higher weed control efficiency (75%) was obtained from pre emergence herbicide followed by rice straw (72.3%) and sorghum (69.6 %).
4.6	Relative study of BRRI multi row power weeder and BRRI weeder	Highest WCE (87%) was found in 2HW plot followed by BRRI weeder +1 HW plot (84%). Lowest weed control efficiency (WCE) was observed in BRRI multi-row weeder (60%) and BRRI multi row weeder + 1 HW (75%). Highest grain yield was found in weed free treatments (4.60tha^{-1}) followed by 2HW treatments (4.56 t ha^{-1}) and BRRI weeder + 1HW plots (4.45 t ha^{-1}). Some modification or improvement is needed for multi row power weeder in order to successful operation for achieving higher WCE.
05	Yield Maximization	
5.1	Effect of organic and inorganic fertilizer management on growth and yield of BRRI dhan58 (on going)	Interaction effect of additional organic matter and N scheduling was insignificant. The individual effect of N scheduling and OM management on grain yield was significant. The treatment N_1 (30% basal + 35% AT + 35% PI) + PKZnS) produced 7.23 t ha^{-1} grain yield which is higher compared to other N scheduling treatment. Average yield advantage of N_1 treatment compared to other N treatment was 0.74 t ha^{-1}.
5.2	Yield maximization of Boro rice through adjustment of N and K splitting (on going)	Basal application of urea (40 kg ha^{-1}) i.e. treatment YM_4 is effective (inbred Boro rice) for early recovery and faster tillering after first top dress of urea. Most of the tillers would be effective if produced within 20-45DAT and ultimately increased grain yield of Boro rice. Treatment YM_1 is effective for hybrid rice to achieve higher yield in Boro season. About 10% spikelet fertility could be increased with scheduling of N and K in CN6
5.3	Study on nutrient management for yield maximization of hybrid rice	Higher grain yield was found in BRRI recom. dose (N-P-K-S-Zn = 115-20-60-12-2.6 kg ha^{-1}) with USG and 20% higher of BRRI recom. dose. BRRI hybrid dhan3 gave 1.0 t ha^{-1} higher grain yield compare to BRRI hybrid dhan5 with the growth duration of 148 and 145 days respectively.
5.4	Study on nutrient	Higher grain yield (5.30 t ha^{-1}) was found in STB dose

	management for yield maximization of fine rice	followed by BRRI recom. Dose (N-P-K-S-Zn = 92-14-50-8-2.5 kg ha^{-1}) with USG. BRRI dhan50 and BRRI dhan63 gave statistically similar grain yield with the growth duration of 156 and 145 days respectively.
06	Project Activities of PGB- IADP (BRRI part) (2016-17)	
6.1	Crop productivity improvement by modern Aus, Aman and Boro at Gopalgonj, Pirojpor and Bagerhat district	In Aus season (2016) BRRI dhan42, BRRI dhan43 and BRRI dhan48 performed better compared to local variety and yield increase 8-20% following improved management. BRRI hybrid dhan4 and BRRI dhan71 performed better among the varieties yielded more than 6.0 t ha^{-1}. BRRI dhan71 yielded about 7.0 t ha^{-1} in Gopalgonj district among the tested varieties. Farmer choose the variety BRRI dhan58 for average 7.0 t ha^{-1} of yield and shorter growth duration compared to BRRI dhan29. Farmers also chose BRRI dhan63 for slender grain and average 6.5 t ha^{-1} of yield potential. BRRI hybrid dhan3 yield more than 8.0 t ha^{-1} in different locations of Gopalgonj, Pirojpur and Bagerhat district.
6.2	Evaluation of musk melon intercropping with lentil in tidal non saline ecosystem	REY of Profitable cropping pattern was 23.21 whereas, REY of existing cropping pattern is 12.85. 100% more income could be achieved in cultivated lentil + muskmelon-Jute-T. Aman instead of lentil-Jute-T. Aman pattern.
6.3	Development of year round vegetables production practices in *Sorjan* system in Gopalganj area	Farmers could earn 60000-70000/- from vegetable production in one bigha of land of a year round modified Sarjon method.
6.4	Fine tuning of fertilizer management and Guti urea application	Average yield improvement was 12% over variety, season and locations and 7% yield increase due to use of Guti urea compared to farmers practice (prilled urea).
6.5	Validation trial on weed management practice at project areas	Weed management cost could be reduced Tk. 8000-9000 ha^{-1}) by using BRRI developed technology (BRRI weeder and herbicide).
6.6	Effect of non-selective herbicide to control aquatic weeds in Gopalgonj district	For controlling emergent aquatic weeds in mono cropped fresh water wetland areas (Boro-Fellow-Fellow) of Gopalganj district, non-selective herbicide, Gramoxone 20SL (Paraquat) is a cost effective weed control method when sparyed @ 2.0 L ha^{-1}.
6.7	Shallow DWR+Fish mixed culture: A promising technology in Boro-Fellow – Fellow cropping pattern in Gopalgonj area	Existing Cropping Pattern: Boro – Fellow - Fellow Proposed Cropping Pattern: Boro (HYV)-Aman (Bashi raj) + Fish Where, net return is 58395 Tk ha^{-1} and BCR is 1.65.
6.8	Optimization of P fertilizer in peat soil in Gopalganj area	BRRI dhan58 produced highest yield at Kotalipara with P @ 22 kg ha^{-1}, where initial P content of soil was medium (13.98ppm) and BRRI hybrid dhan3

		produced highest grain yield at Tungipara of Gopalganj district. With P @ 30 kg ha^{-}, where initial P content of soil was low (10.39 ppm).
6.9	Site specific nutrient management in peat soil in Gopalganj area	The highest grain yield (9.49 t ha^{-1}) was obtained from NPKSZn treated plot at Tungipara but in Kotalipara farmers practice plots gave highest yield (8.01 t ha^{-1}). Omission of P significantly effect in all plots. But in Tungipara omission of N did not effect on grain yield. But omission of K, S, and Zn reduced grain yield, but not significantly.
6.10	Relay cropping with jute and Aman at Gopalganj : Agronomic management	Reduced production cost: because no need to land preparation, leveling, seed bed preparation and transplanting cost. Farmers got optimum grain yield from BRRI dhan66 (6.2 t ha^{-1}). Farmers are economically benefited with this system.
6.11	Management of Sheath blight disease utilizing *Trichoderma harzianum (Tricho-compost)*	Applying tricho-compost control sheath blight disease and supply additional nutrient to the soil. Yield increase over farmers practice was 11-12%.
6.12	Identification of red eel worm and management package for minimizing yield loss	Insecticide regent (Fipronil) + AWD significantly reduced red eel worm about 83%. The causal agent red eel worm was identified as an insect with the help of Zoology department, DU. The causal organism is *G. Chyronomessp* not identified.

Plant Physiology Division

Research Progress 2016-2017

Crop soil water management program area		
Sl. No	**Name of experiments**	**Output**
Project Area 1: Salinity tolerance		
1.1	Exploring new sources of salinity tolerance from BRRI Gene Bank collections at seedling stage (TRB-Project) (March to December, 2016)	Thirty six (36) tolerant germplasm have been identified from 500 BRRI Gene Bank accessions at seedling stage @ 12 dS/m salinity stress.
1.2	Screening for salinity tolerance of advance breeding lines (STBN, IRSSTN, GSR, OT) and anther cultured lines at seedling stage during T. Aman and Boro season (April' 2016 to February' 2017)	i) Among 115 STBN & IRSSTN materials Fourteen (14) genotypes were found tolerant and 28 genotypes were found moderately tolerant at 14 dS/m salinity stress ii) Among 44 GSR materials Only one genotypes were identified as MT iii) Among OT 33 materials Eight (8) genotypes were found tolerant to moderately tolerant
1.3	Characterization of advanced breeding lines at different salinity stress for whole growth period during T. Aman and Boro season (2016-2017).	BR10238-5-1 was found tolerant for whole growth salinity stress (8 dS/m) having better yield potentiality under stress could be used for further breeding program.

1.4	Evaluation of Boro varieties at different interval of salt application	**Data analysis is ongoing.**
1.5	Physiological characterization of tolerant germplasms for whole growth period salinity tolerance (TRB-Project). (July'2016 to March'2017)	Two germplasm and 3 HYVs found tolerant at seedling stage were included in this trial in soil salinity tank and found tolerant at 6 dS/m stress and can flower and produce yield for salinity stress from transplanting till maturity.
1.6	Mapping QTLs for salinity tolerance of Ashfal balam at seedling stage. (2016 to 2017)	5 major QTLs were identified for SES, shoot length, shoot and root dry weight for seedling stage salinity tolerance from Ashfal balam.
1.7	Mapping QTLs for salinity tolerance of Ashfal balam at reproductive stage. (2016 to 2017)	7 major QTLs were identified for panicle number, grain number, grain weight, straw weight for reproductive stage salinity tolerance from Ashfal balam.
Project Area 2: Submergence Tolerance		
2.1	Screening of rice germplasm & advance breeding lines for flash flood submergence tolerance (March to August, 2016)	Out of 140 germplasm none of the germplasm found submergence tolerance. Among 60 breeding lines 15 genotypes were found 100% survivability with non elongating characteristics
2.2	Evaluation of some submergence tolerant genotypes at different submergence period and normal environmental condition (July to December, 2016)	None of the genotypes survived under 21 days of submergence but more than 90% survivability showed by all varieties under 14 days of submergence except sus. ck. Phenological development was observed different in respect of variety. Lowest growth duration was observed in Acc. no 1838 and highest in FR13A.
2.3	Characterization of some advance material for under deep flooding environment (July to December, 2016)	None of the materials perform better than check Habiganj Aman-1.
2.4	Screening of some advance lines for anaerobic germination (July to August, 2016)	Out of 20 Advance breeding lines IR96977-B-B-7-B showed 50% germination in anaerobic condition.
2.5	Screening of some rice gremplasm & advance breeding lines for medium stagnation (July to December, 2016).	Data analysis is on-going.
Project Area 3: Drought Tolerance		
3.1	Screening germplasm for drought tolerance at reproductive phase (July'2017 to April'2017)	Out of 236 germplasm 26 materials were selected.
3.2	Selection of F_2 materials under drought stress at reproductive stage in the rain-out shelter (July'2017 to February'2017)	Tolerant plant of the all crosses was selected under drought condition.
3.3	Performance of GSR materials under drought stress at reproductive stage	Out of 11 genotypes HHZ17-DT6-Y1-DT1 and HHZ23-DT16-DT1-DT1 were selected

	(August to December, 2016)	as drought tolerant.
3.4	Performance of advance breeding lines under drought stress at reproductive stage. (August to December, 2016).	Out of 5 advance breeding lines BR10230-7-1 performed better under drought condition.
Project Area 4: Heat Tolerance		
4.1	Marker assisted introgression of spikelet fertility loci from N22 in to two Bangladeshi mega rice variety BRRI dhan28 and BRRI dhan29 (CSISA-project).	20 BC_2F_5 lines were advanced and 40 fixed lines selected both genotypically and phenotypically 13 BC_3F_3 lines from both cross combination advanced and 20 lines having fixed heat tolerant QTL was identified genotypically
4.2	Screening rice germplasm and breeding lines towards the development of heat tolerant variety (2015-2017)	Seven materials were identified as moderately heat tolerant.
Project Area 5: Cold Tolerance		
5.1	Exploring new sources of cold tolerance from BRRI Gene Bank collections at seedling stage (TRB-Project) (October 2016 to February 2017)	Out of 200 germplasm, thirty-one (31) accessions showed moderately tolerant at seedling stage compared to check varieties such as BRRI dhan28 and 36.
5.2	Screening for cold tolerance of advance breeding lines at seedling stage (October 2016 to February 2017)	Out of 38 breeding lines, nine (9) genotype showed moderately cold tolerant at seedling stage compared to check varieties such as BRRI dhan28 and 36.
5.3	Characterization and evaluation of BRRI dhan69 for cold tolerance (October 2016 to May 2017)	BRRI dhan69 was found moderately cold tolerant both at seedling and reproductive stage.
5.4	Evaluation of some selected rice genotypes for reproductive stage cold tolerance (October 2016 to May 2017)	Out of 19 genotypes one advance line (BR8907-B-1-2-CS1-4-CS2-P3-4 and IR87322-65-2 found moderately cold tolerant at reproductive stage
Project Area 6: Growth and Yield		
6.1	Photo-sensitivity test of BRRI released T. Aman varieties (2014-2016)	Photo-sensitivity of the tested variety would be known.
6.2	Determination of growth stages of some rice varieties at Boro season as affected by sowing time 9November 2016 to may 2017)	Among the 4 set sowing, BRRI dhan28 performed well at 3rd set (D/S-12/12/16) with less growth duration. BRRI dhan68 performed well at 2nd set sowing (D/S-27/11/16). Long duration variety BRRI dhan29 does not perform well late sowing due to different natural hazard.
6.3	Physiological Characterization of Aus germplasm (April to September 2016)	Out of 44 Aus germplasm six genotypes flowered 60 days or less and 17 produce better yield after breakdown of apical dominance
6.4	Physiological dissection of growth	High yielding trait identification for further

	behavior and allied high yielding traits of three best varieties in the Aman season (July 2016 to Nov 2016)	breeding program.
6.5	Physiological characterization of CO_2-responsiveness of Bangladeshi rice germplasms through planting geometry technique. (2015 to 2017)	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.
Project Area 7: Seed Physiology		
7.1	Dormancy and viability test of BRRI varieties grown in T. Aman and Boro season (2016 to 2017)	The dormancy period varied from 20-45 days and 5-36 days in Aman and Boro season, respectively. Seed viability of Aman varieties (210 days) longer than Boro varieties (110 days).
Project Area 8: Crop Weather Information		
8.1	Automatic weather station data collection, storage and supply. (2016 to 2017)	Data recording and storage are in progress but some troubled older stations could replace soon by new stations.
8.2	Manual weather station data recording, storage, provide and maintenance. (2016 to 2017)	Collection, storage and provide of manual weather station data is on-going

Soil Science Division

Research Progress 2016-17

Research Progress	Expected output
Program Area: Crop-Soil-Water Management	
1. Project: Soil Fertility and Plant Nutrition	
Expt. 1.1. Determination of N P K fertilizer doses through SSNM for ALART materials **T. Aman 2016** BR7895-4-3-3-2-3 produced the highest grain yield (5.15 t ha^{-1}), which was statistically similar with BRRI dhan72 (5.20 t ha^{-1}). Nutrient requirement of BR7895-4-3-3-2-3 is 54-11-26 kg ha^{-1} of N-P-K. IR70213-10-CPA4-2-2-2 produced the highest grain (5.86 t ha^{-1}) followed by BR8214-19-3-4-1 (5.25 t ha^{-1}). Nutrient requirement of IR70213-10-CPA4-2-2-2 is 98-21-53 kg ha^{-1} of N-P-K for satisfactory grain yield. Suman swarna (Rajshahi) produced highest grain yield (5.61 t ha^{-1}) with 78-12-38 kg ha^{-1} of N-P-K. BR(Bio)9786-BC2-132-1-3 produced the highest grain yield (5.01 t ha^{-1}) with 91-13-35 kg ha^{-1} of N-P-K. **Boro 2016-17** BR(BIO)9787-BC2-63-2-2 produced the highest grain yield (6.15 t ha^{-1}) with 105-18-92 kg ha^{-1} N-P-K and BR(BIO)9786-BC2-124-1-1gave 6.39 t ha^{-1} with 109-19-96 kg ha^{-1} N-P-K. BRRI dhan63 produced the highest	Optimum fertilizer doses

grain yield (7.02 t ha^{-1}) followed by BR7372-18-2-1-HR1-HR6(COM) (5.86 t ha^{-1}). BR8340-16-2-1 produced the highest grain yield (8.20 t ha^{-1}) with139-25-123kg ha^{-1} N-P-K and BR7812-19-1-6-1-P2 (cold tolerance) produced 6.80 t ha^{-1} with 116-20-102 kg ha^{-1} N-P-K.	
Expt.1.2.Effect of nitrogen and potassium rates on modern rice cultivation A combination of 50 kg K ha^{-1} and 50 kg N ha^{-1} was enough for 4.47-5.25 t ha^{-1} grains yield in BRRI dhan49. BRRI dhan29 gave 6.12 t ha^{-1} with 50 kg K ha^{-1} and 120 kg N ha^{-1}. At K deficient condition, straw K concentration was below critical limit except N deficient condition that was corrected when 50 kg K ha^{-1} was applied during T. Aman season. If soil is K deficient, application of N will significantly reduce grain yield of T. Aman rice.	A suitable ratio of N and K for rice cultivation
Expt. 1.3. Additional nitrogen and potassium doses for rice yield improvement In AWD condition, grain yield in BRRI dhan65 in T. Aman season could be increased with 25% more N and K rates than existing recommended dose; but the recommended dose is enough for satisfactory grain yields of BRRI dhan56, BRRI dhan57 and BRRI dhan66. In Boro, recommended dose was enough for different rice genotypes. IR83142-B-71-B-B and BRRI dhan29 produced similar grain yields irrespective of fertilizer dose.	Fertilizer doses under AWD conditions
Expt. 1.4. Nutrient management for growing four crops in a year (Open) An experiment has been initiated in T. Aus 2016 to grow four crops in a year with sustainable soil fertility status. Three fertilizer treatments, AEZ based fertilizer (T_1), crop residues (CR) + AEZ based fertilizer (T_2) and native nutrients (T_3) were tested with Mustard-Boro-T. Aus-T. Aman and Mustard-Green gram-T. Aus-T. Aman patterns. Experimental design was randomized complete block with three replications. First mungbean crop was incorporated in T_2 treatment. After one crop cycle, it is observed that T_1 and T_2 treatments gave similar yield in each crop. Long-term evaluation is needed for conclusive results regarding yield trend and soil fertility status.	Fertilizer recommendation for intensive cropping and sustainable soil health
Expt. 1.5. Agronomic and genetic bio-fortification of zinc in rice grain The experiments were conducted in BRRI regional stations Comilla and Rajshahi during Boro 2016-17. Available Zn content in initial soils of Comilla and Rashahi were 5.72 and 0.33 ppm, respectively. Influence of Wuxal Zinc and Antracol were tested with BRRI dhan58 and BRRI dhan74 and compared with no spraying conditions. The treatments were assigned in a factorial randomized complete block design with three replications. Outer husks of unparboiled dried paddy were removed by Satake Testing Husker with rubber rollers coated with polyvinyl chloride compound to avoid mineral contamination. The dehusked brown rice was milled using a Grainman tester mill. Three different degrees of milling were tested: 0%, 10%, and 12%, where 10% represents well-milled polished rice. Analyses for those samples were done using atomic	Increased Zn content in rice grains

absorption spectrophotometer. **Grain and straw yields.** Grain and straw yields varied largely because of locations might be because of soil fertility and weather conditions. Zinc spraying resulted in 0.87-1.31 t ha^{-1} grain yield increase in BRRI-Comilla; but it was 0.12-0.33 t ha^{-1} in BRRI-Rajshahi. Grain yield increase with Zn spraying was about 2-10% for BRRI dhan58 and about 6-18% for BRRI dhan74 compared to control. **Grain Zn content**. In both the locations, grain Zn content increased with Wuxal spraying that decreased greatly with polishing. Grain Zn content in brown rice of BRRI dhan58 under control condition was about 17 μg g^{-1} that increased to about 19 μg g^{-1} through Zn spraying treatment. Brown rice Zn content of BRRI dhan74 varied from 22.02-23.78 μg g^{-1} under control condition, which increased to 24.25-25.79 μg g^{-1} after Zn spraying. Grain polishing by 9-12% reduced Zn content by about 20-29%.	
Expt. 1.6. Effect of intensive rice cropping on rice yield under continuous wetland condition (Open) Wetland puddle rice culture influences soil properties and yield in the long run. An experiment on continuous wetland rice culture was initiated since 1971 at BRRI, Gazipur. Six treatments viz. control (native nutrient), reverse control (NPKSZnCu), NPK, NPKS, NPKSZn and NPKSZnCu were tested. Grain yield in control plot was 1.17-2.22 t ha^{-1} irrespective of season in 2016 and annual production was 5.09 t ha^{-1}. Its reversed management i.e. addition of NPKSZnCu fertilizer resulted in 13.31 t $ha^{-1}yr^{-1}$ grain production, which was higher than complete fertilizer treatment (12.59 t $ha^{-1}yr^{-1}$). It indicates that complete fertilization can recuperate soil productivity even after a long period of rice cultivation. Annual NPK nutrients removal was higher in reverse management treatment.	Yield trend and nutrient depletion pattern
Expt. 1.7. Performance of MV Rice under Phosphorus Deficit Conditions The performance of different rice varieties under P deficient condition was evaluated at BRRI farm, Gazipur during 2016-17. Experimental designs used were split-plot and split-split-plot for wet and dry seasons, respectively with three replications. In wet season, four soil available P (1.80-2.50, 2.51-3.20, 3.21-3.90 and 3.91-4.60 mg kg^{-1}) were considered as main plot treatments and BRRI dhan49, Kasalat and Gainja as sub-plot treatments. In dry season, soil available P (1.70-2.30, 2.31-2.90, 2.91-3.50 and 3.51-4.10 mg kg^{-1}) were in the main plots, fertilizer P (0 and 20 kg ha^{-1}) in the sub-plots and BRRI dhan58, BRRI dhan69 and BR(Bio)9786-BC2-161-1-2 were assigned in the sub-sub plots. Rice yield, P and K uptakes decreased with reduced level of soil available P. Rice yield increased sharply due to P fertilizer application. BRRI dhan49 gave the best yield in wet season and BR(Bio)9786-BC2-161-1-2 in dry season. Kasalat required less P to produce one ton grain among the tested genotypes.	Phosphorus efficient rice genotypes

Expt. 1.8. Integrated nutrient management (INM) for double and triple rice cropping pattern for maximizing yield and sustaining soil fertility (Open) Intense rice cropping deteriorates soil productivity that might be mitigated through efficient nutrient management. An experiment was established in Boro 2008-09 at BRRI farm, Gazipur in a clay loam soil to evaluate the effect of INM under continuous wetland culture on soil health and productivity. Inorganic fertilizers alone or in combination with organic manures were used and compared with farmers' practice, FP (NPKS @ 80-10-20-10 kg ha^{-1} for Boro, 70-10-15-0 kg ha^{-1} for T. Aus and 70-10-15-0 kg ha^{-1} for T. Aman). The experiment was laid out in a RCB design with three replications. In Boro 2015-16, the highest grain yields (5.69 and 5.15 t ha^{-1}) were obtained with 100% soil test based (STB) fertilization and 50% STB with mixed manure (Cow dung and Ash) for growing double and triple rice, respectively in a year. The highest grain yield (3.81 t ha^{-1}) of BRRI dhan43 was found in 50% STB + mixed manure (MM) treatment in T. Aus season. In T. Aman 2016, the highest grain yield (4.11 t ha^{-1}) of BRRI dhan49 was found with 50% STB + MM under double cropping pattern; whereas it was 3.61 t ha^{-1} of BRRI dhan46 with 100% STB under triple cropping pattern. In double cropping, the STB dose gave 9.66 t $ha^{-1}yr^{-1}$ while 50% STB + MM gave 12.51 t ha^{-1} yr^{-1} under triple rice cropping. Average of seven years study indicated that STB and 50% STB + MM treatments are suitable option for rice cultivation under double and triple rice cropping pattern. Nutrient removal was higher in double cropping than triple cropping pattern.	INM for sustainable rice yield and soil fertility
Expt. 1.9. Long-term effect of organic and inorganic nutrients on yield and yield trend of lowland rice (Open) Long-term omission of N, P an K adversely affected rice yield though S and Zn omission had no negative effect on rice production in Grey Terrace soil of BRRI farm, Gazipur. Long-term application IPNS based chemical fertilizer showed increasing trend of rice yield, while inorganic fertilizer alone showed yield plateau. Among the organic materials, PM performed better in both seasons. Therefore, IPNS based fertilizer management is necessary for sustainable rice production in Bangladesh.	Yield limiting nutrients, long-term yield trend as well as soil fertility status
Expt.1.10. Performance of vermicompost and poultry manure on rice yield and soil health Continuous rice cropping using inorganic and organic fertilizers might influences soil properties, which was investigated in 2015 at BRRI Farm, Gazipur (23^{o}85.9' N and 90^{o}82.4' E), Bangladesh. The influence of poultry manure and vermicompost with chemical fertilizers on rice yield and soil health during T. Aman- Boro rice cultivation was determined. Rice grain yield was higher when 0.5 t ha^{-1} vermicompost was used with full doses of chemical fertilizer during T. Aman and Boro season.	Fertilizer management option for sustainable yield and soil health

Expt. 1.11. Soil organic carbon dynamics as influenced by long-term nutrient management in rice-rice cropping system Soil carbon dynamics under changing climate and management practices after 10 years of crop rotations were investigated with DNDC and DSSAT models. The models were validated with actual soil organic carbon (SOC) data generated from field study. Carbon mineralization rate (*r*) was determined through laboratory incubation study and compared with model generated data. The *r* was higher in integrated nutrient management practice (INM) compared to balanced chemical fertilizer management practices. The SOC stock increased by 27.98% due to addition of poultry manure at 2 t/ha for 10 years. The SOC decreased by 46% in fertilizer control and 15% in balanced chemical fertilizer treatment. The DNDC model estimated carbon sequestration was 47 kg/ha/year in control and 151 kg/ha/year in chemically fertilized plot; whereas it was 539 kg/ha/year in INM practiced soil. Highly acceptable RMSE and *d* value obtained for both DNDC and DSSAT model.	Carbon balance as an indicator for soil health
2. Project: Soil physics and plant nutrition	
Expt.2.1.Carbon storage and aggregate stability of paddy soil under continuous organic amendment in Bangladesh A field experiment was carried out to evaluate the effect of continuous organic amendments on soil organic carbon (SOC) stock and aggregate stability. The experiment was established in 2009 and continued up to 2016 under rice-fallow-rice pattern with four treatments: control (no amendment), use of NPKSZn fertilizers, cow dung and poultry manure with IPNS based inorganic fertilizations. Soil bulk density reduced in organic amendment plots than control and NPKSZn treated plots after eight years. Aggregate carbon and N were greater with organic and inorganic fertilizer compared to non-treated control. Mean weight diameter of water stable (MWDw) aggregates and crop yields were positively correlated with SOC. Continuous cropping and integrated use of organic and inorganic fertilizers increased soil C sequestration and crop yields. Balanced application of cow dung and poultry litter (2 t ha^{-1}) with IPNS based inorganic fertilizer was best option for higher crop yields and sustainable soil health in rice-fallow-rice rotation in Bangladesh.	Yield trend and soil carbon balance status
3. Project: Soil and environmental problem	

Expt.3.1. Effects of fertilizer and water management on rice yield, nitrogen use efficiency and emissions of nitrous and nitric oxides Field experiments were conducted at BRRI farm Gazipur to determine the effects of N placement and its sources on rice yield, NUE and to quantify N losses as ammonia volatilization, ammonium-N in floodwater, and emissions of N_2O and NO under continuous standing water (CSW) and alternate wetting and drying (AWD) regimes. Fertilizer treatments included broadcast prilled urea (PU), deep placement of urea briquettes (UB), and deep placement of PU by applicator (PUA) and IPNS based organic amendments i.e., poultry litter (PL), vermicompost (VC). Treatments were arranged in a randomized complete block design with three replications for each water regime. Deep placement of UB and UB+IPNS with PL significantly increased rice yield and NUE irrespective of season and water management options. Deep placement of UB and IPNS based organic amendments significantly reduced floodwater NH_4^+-N and NH_3 volatilization. The magnitudes and pattern of seasonal cumulative N_2O fluxes from UB treatment were similar in both the seasons, while PU treatment showed seasonal variation of N_2O fluxes. The PU+IPNS with PL showed similar trend in both the seasons, which is consistent with control treatment. NO fluxes were small compared to N_2O fluxes. Deep placement of UB showed higher seasonal cumulative NO fluxes compared to control, PU and PU+IPNS with PL treatment in T. Aman season.	Option for mitigation of GHG emission
Expt.3.2. Greenhouse gas emissions from selected cropping patterns and adaptation strategies in Bangladesh Greenhouse gas (GHG) emission takes place from different crops fields, but data are not available in Bangladesh. In order to estimate GHG emission from selected cropping patterns, Cool Farm Tool Beta-3 was used. Non-rice based cropping patterns had lower global warming potential (GWP) than rice-rice based cropping patterns. Onion-Jute-Fallow, Jute-Rice-Fallow, Wheat-Mungbean-Rice and Maize-Fallow-Rice patterns are relatively more suitable for reducing GHG emission and subsequent GWP. There were spatial variations in CH_4 emissions and the higher amounts were found in Mymensingh and Dinajpur districts of Bangladesh. On an average, about 1.56 Tg $year^{-1}$ CH_4 emissions took place from paddy field in Bangladesh during 2012-2015. Potato-Boro-T. Aman and Mustard-Boro-T. Aman cropping pattern showed highest total rice equivalent yield (REY) and low GWP than Boro-T. Aman-Fallow cropping patterns. But intermittent drainage for growing dry season irrigated rice under Potato-Boro-T. Aman and Mustard-Boro-T. Aman patterns can be adopted to reduce about 24-26% of total GHG emissions than continuous flooding and also to maintain higher crop productivity and food security in Asian countries.	Adaptation strategies for mitigation of GHG emission
Expt. 3.3. Climate smart agricultural practices for crop production and greenhouse gas emission in Bangladesh Experiments were conducted at Pakundia and Kotiadia of Kishoreganj district located at 24°14'45.27" to 24°19'46.77" N latitude and 90°40'46.84" to 90°47'37.33" E longitude. In this study short duration T.	Fertilizer dose and mitigation of GHG emission

Aman varieties with RCM and farmers' practice based management were introduced. Cool Farm Tool Beta-3 was used to determine total GHG emission patterns. Introduction of short duration rice variety not only helped in mustard crop sowing at the right time but also to reduce about 15-20 GWP (CO_2eq kg ha^{-1}) and to increase rice yield by about 15-30% than long duration variety. There were no significant yield differences because of 50% reduction in fertilizer rate. In machine and hand transplanting after one pass by tractor gave higher grain yield than 3-4 pass conditions because of younger seedlings used in machine transplanting. About 50% of recommended fertilizer dose for Boro rice could be reduced if mustard crop is grown under standard fertilizer practices. GHG emission can also be reduced through the cultivation of mustard and short duration rice variety cultivation.	
Expt. 3.4. Compositions of wet and dry depositions in Bangladesh Composition of dry and wet atmospheric depositions varies depending on geographic locations. Fog and dust particles were collected from different regions of Bangladesh and its compositions were analyzed. The composition of fog water and dust varies greatly among locations. The NH_4^+-N content was the highest (36 ppm) in Gazipur district and the lowest in Sylhet district. Cadmium (0.16 ppm) and P (1.75 ppm) contents are also higher in Gazipur district along with electrical conductivity (1.01 dS/m). These indicate that industrialization is influencing wet and dry deposition in Bangladesh. This study needs to be done elaborately for assessing ecological consequences and soil fertility management.	Composition of dry and wet deposits
4. Project: Soil microbiology and biofertilizer	
Expt.4.1. Evaluation of bio-organic fertilizers in soil plant system Bio-organic fertilizer is the complex product of organic and inorganic nutrient sources along with consortia of plant growth promoting microbes. A study was conducted at BRRI Farm Gazipur to evaluate the effect of bio-organic fertilizers on rice plant growth and to standardize its dose with chemical N and K fertilizers for rice yield maximization. Biological agents utilized were free living N_2 fixing bacteria, phosphate solubilizing bacteria (PSB) and indoleacetic acid (IAA) producing bacteria. Carrier materials used were vegetables waste, biochar, rice straw and rock phosphate. The influence of different combinations of bio-fertilizer and chemical fertilizers were evaluated and compared with control. About 25% chemical NKS fertilizers can be saved by using bio-organic fertilizer compared to 100% chemical based fertilization for BRRI dhan29 cultivation. It was reveal that bio-organic fertilizer (2 t/ha) with 25% less chemical N and 100% omission of TSP fertilizer can produce statistically similar grain yield compared to standard chemical fertilizer dose and can improve soil health.	Bio-organic fertilizer
Expt.4.2. Effect of long term nutrient management on soil health The study was conducted at BRRI farm, Gazipur to find out the effect long-term nutrient management practices (10 years) on soil health. Soil samples (0-20 cm) were collected from balanced chemical fertilizer, –N, –P, –K, IPNS (cow dung), and IPNS (poultry manure) treated plots and compared with fertilizer control treatment. Ten soil health indicators	Biological indicator of soil health

related to soil chemical and biological properties such as soil organic matter (SOM) content, NH_4^+-N, available P, exchangeable K, total microbial population, free-living N_2 fixing bacteria, phosphate solubilizing bacteria (PSB), phosphatase, and urease activities were determined. These soil health indicators were co-related with different fertilizer management options using principal component analyses (PCA). Application of organic matter as IPNS treatment increased SOM, total microbial population, N_2 fixing and PSB population, urease and phosphatase activities in soil. Missing of N and K nutrients significantly reduced microbial population. Balanced fertilization affected soil biology by reducing total and beneficial microbial communities. The influence of fertilizer management practices followed the order of NH_4-N>N_2 fixing population>SOM> yield>urease>available P>exchangeable K>total microbial population>PSB population>phosphatase activity. Long-term study proved that IPNS improved soil health and sustained soil biology over balanced chemical fertilizer practices.	
Expt.4.3. Isolation and characterization of plant growth promoting bacteria from terrace and acidic soil Plant growth promoting bacteria (PGPB) consist of wide range of beneficial soil bacteria that enhance plant growth via production and secretion of various regulatory molecules. In the present study, 30 PGPB were isolated from acid and terrace soils. Strains were able to produce IAA, fixing N_2 and solubilizing phosphate. By considering these plant growth promoting properties, it is expected that isolated PGPB can enhance soil fertility and promote plant growth.	Beneficial microbes

Irrigation and Water management Division

Research Progress 2016-2017

Sl. No.	Research Progress	Expected Output
	Sub-Program: Irrigation and Water Management	
Sub-Sub-Program I: Water Use Efficiency Improvement in Irrigated Agriculture		
01	**Water Requirement** ***Experiments:***	
	1.1 Determination of physical and hydraulic properties in different soil types **Progress:** Soil samples were collected from Tanore (Rajshahi), Ishurdi (Pabna), Thakurgaon sadar (Thakurgaon), Kaharol (Dinajpur), Sherpur (Bogra) and Mithapukur (Rangpur). Undisturbed soil samples were collected from different layers (0-10cm, 10-25cm, 25-50cm and 50-100 cm). Hydraulic conductivity varies with sites and depth of the layer. Highest saturated hydraulic conductivity of the top layer soil was found in Thakurgaon (0.4567090 m/day) followed by Mithapukur (0.0882103 m/day), Tanore (0.0062800 m/day), Sherpur (0.0048241 m/day), Kaharol (0.0044759 m/day) and Ishurdi (0.0036729 m/day), respectively. Generally a decreasing trend with the depth of layers was observed.	Documentation of important soil physical and hydraulic properties for efficient water management and utilization in crop models

	1.2 Development of Soil moisture declination model for alternate wetting and drying irrigation for Rice cultivation **Progress:** Study indicates that among the 4 treatments, T_2 (15 cm AWD) gives similar yield to T_1 (continuous standing water) but saves 17.3 percent of irrigation water (3 irrigations). Therefore, AWD irrigation can be followed for Boro rice under similar condition for higher water productivity. More analysis is going on to establish relationship among irrigation amount, perched water table depth and associated hydraulic parameters.	Development of model for prediction of efficient irrigation schedule.
	1.3 Study on water stress tolerance for different advanced rice genotype of BRRI **Progress:** In total, twenty one materials were tested under 6 irrigation treatments (AWD- 5 and CSW-1). Standard AWD irrigation was depletion of perched water table at 15 cm. Additional 3, 5, 7 and 10 days water stress were allowed in 4 other AWD treatments. All the genotypes gave better performance with AWD treatment. This year rainfall occurred optimum in reproductive stage for long duration ALART, that why, yield was better in some more stresses AWD treatment but short duration ALART felt water stress and yield reduced significantly with more stresses AWD treatment. ALART material of BR8340-16-2-1 under FBR gave good performance than the check with AWD but, none of the ALART from PQR and CTR was found better than check. ALART BR(BE)6158-RWBC2-1-2-1-1 and BR(Bio)9786-BC2-49-1-2 gave better performance and may be excepted for the variety. However, more water stresses AWD should not be imposed during reproductive stage.	Scaling of water stress tolerance capacity (WSTC) and proper irrigation schedule of a particular variety;
	1.4 Optimization of irrigation water for maximum year round production **Progress:** Six cropping patterns were tested during 2016-17. These patterns include the most popular Boro-Fallow-T. Aman (P_1) with Mustard-Late Boro-T. Aman (P_2); Potato-Braus-T. Aman (P_3); Lentil-Braus-T. Aman (P_4); Wheat-Braus- T. Aman (P_5) and Maize- Aus-T. Aman (P_6). Both long duration Boro (BRRI dhan29) and Aman (BRRI dhan49) varieties were used in P_1. In all other patterns, short duration BRRI dhan62 was used as Aman variety. Both BRRI dhan28 and BRRI dhan48 were used in other patterns as late Boro/Braus/Aus rice. BARI Sarisha-14, BARI Masur-6, BARI Alu-41, BARI Gom-26 and hybrid Maize NK-40 were used as Rabi crop. BRRI dhan29 gave the highest yield (7.39 t/ha) in Boro season. Satisfactory yield was obtained from BRRI dhan28 (5.03 t/ha) as late Boro and BRRI dhan48 (4.17 t/ha) as Braus rice. In Aman season, highest yield was obtained from BRRI dhan49 (4.90 t/ha) followed by BRRI dhan62 (3.92-4.18 t/ha). Satisfactory yield was obtained from Potato (20.21 t/ha) in Rabi season. The highest rice	Selection of cropping patterns for higher productivity, higher economic benefit and lower irrigation requirement

	equivalent yield was obtained from Potato-BRRI dhan28-BRRI dhan62 (18.00 t/ha) and Potato-BRRI dhan48- BRRI dhan62 (17.90 t/ha) patterns that required 760 mm irrigation. The rice equivalent yield of Fallow- BRRI dhan29-BRRI dhan49 was 12.29 t/ha with 1125 mm irrigation. Therefore, Potato-Braus- T. Aman pattern can ensure higher productivity with less amount of irrigation.	
	1.5 Study on the operation status of Ganges-Kobadak (G-K) irrigation project after six decades of its initialization **Progress:** Some secondary and primary data collection have been collected from the GK project site. Data analysis shows that low adoption of HYV rice varieties, poor irrigation intensity and heavy sedimentation in the intake channel of the pumping plants, lack of specific, organized technology transfer, less or no participation of farmers in water management and ineffectiveness of water management groups or associations are the main constrains to operate the project.	Recommend measures necessary for improving the performance of the irrigation project
Sub- Sub Program II: Utilization of Water Resources in Rainfed Environment		
02	**Water Management for rice cultivation in climate change environment** ***Experiments:***	
	2.1 Terminal drought mitigation through integrated approaches in T. Aman cultivation **Progress:** BRRI dhan33 suffered comparatively less drought than BR11 due to its shorter growth duration. From the analysis it can be said that short duration variety would be suffered drought both reproductive and ripening stages if it is transplanted beyond 24 July. For long duration variety, drought amount increased with late transplanting. The analysis shows that long duration variety faces less drought during critical stages (reproductive & ripening stags) when it is transplanted not beyond 17 July. But it suffers from more drought during critical stages if it is transplanted beyond 24 July.	Recommendation on optimum transplanting period for low risk of drought occurrence during critical stages of T. Aman rice.
	2.2 Effect of drought on different T. Aman varieties **Progress:** Nine popular T. Aman varieties were grown. BRRI dhan56, BRRI dhan57 and BRRI dhan62 were under short duration; BRRI dhan33 BRRI dhan66 and BRRI dhan71 were under medium duration; BRRI dhan31, BRRI dhan70 and BRRI dhan72 were under long duration group. Three water management treatments were applied as-application of supplementary irrigation whenever necessary (T_1); rainwater conservation by placing polyethylene sheets in levee (T_2); and maintaining rainfed condition (T_3). Water stress was found from 2nd decade of October 2016. Stress induced was highest on the long duration varieties followed by medium and short duration varieties. Yield of the varieties were compared under supplementary irrigated and rainfed condition. BRRI dhan56 was more drought tolerant	To findout suitable T. Aman varieties for drought prone area

	compared to BRRI dhan57 and BRRI dhan62. Similar drought tolerance was found in the medium duration varieties. BRRI dhan31 was found more drought tolerant compared to BRRI dhan70 and BRRI dhan72.	
	2.3 Maximum Utilization of Rainwater in Potato- T. Aus- T. Aman Cropping Pattern **Progress:** The experiment was conducted at BRRI R/S, Rangpur in Potato- T. Aus- T. Aman cropping pattern. Two varieties in T. Aus and two in T. Aman and potato in Rabi was tested with five different treatments following RCBD design. BRRI and BARI recommended doses of fertilizer and other agronomic practices were followed. Daily rainfall data was recorded. BRRI dhan33 received comparatively more rain water than BRRI dhan62 due to its long growth duration. In Aman season among different transplanting dates BRRI dhan33 gave the highest yield on 20th July transplanting (3.93 t/ha) and there was no yield found for BRRI dhan62 on 1st July transplanting due to bird damaged. In Rabi season all transplanting date of potato received same amount of rainfall and highest yield obtained 37.66 t/ha in 5th transplanting date. The lowest yield obtained 29.6 t/ha in 1st transplanting date.	A suitable transplanting period of Aus which received more rainfall
	2.4 Determination of suitable time for application of supplemental irrigation in T. Aman **Progress:** Supplemental irrigation was applied based on the parched water table in the field. Three depths 15 cm, 20 cm and 25 cm below the ground surface were used for irrigation scheduling treatments. Since, no significant difference was found among the treatments therefore it is assumed that the yield may be hampered when perched water table remains below 25 cm. If it is happened than a recommendation may be drown than supplemental irrigation should be given when perched water table remains at 25 cm. Further study is needed.	Determination of appropriate time for applying supplemental irrigation in T. Aman
Sub- Sub Program IV: Land and Water Resources Use for Sustainable Crop Production		
03	**Land and Water Resources Use for Sustainable Crop Production** ***Experiments:***	
	3.1 Assessment of suitable water resources availability for irrigation to increase crop production in tidal areas of Barisal region **Progress:** Water salinity was measured in Barisal, Jhalokhati, Pirojpur, Patuakhali and Barguna districts from December to May. Three major river systems of the area: Buriswar, Biskhali and Boleswar were taken under the study. Water samples were collected from the rivers. A considerable part of the upstream Buriswar, Biskhali and Boleswar river was suitable for irrigation throughout the dry season. The agricultural productivity of adjacent area of the	Assessment availability of suitable surface water resources in the coastal area for agricultural productivity improvement through irrigation

	rivers might be improved by using the surface water for irrigation.	
Sub- Sub Program IV: Sustainable Management of Groundwater		
04	**Surface and Ground Water Assessment** ***Experiments:***	
	4.1 Monitoring of groundwater fluctuation and safe utilization in different geo-hydrological regions **Progress:** The study was conducted at BRRI farm, Gazipur, Comilla, Hobiganj, Bhanga, Barisal, Kustia, Rajshahi and Rangpur. Available water level recorder was used for measuring groundwater fluctuation. Measurements were taken weekly. Collected weekly records were used to calculate monthly average, annual maximum and minimum. The groundwater level data indicates that Rajshahi, Kustia, Comilla and Gazipur are not suitable for STW. Maximum groundwater level at BRRI farm Gazipur is declining continuously and it was not fully recharged during monsoon.	Determination of declination rate of groundwater level in different regions of Bangladesh
	4.2 Waste water irrigation for crop production **Progress:** A survey work has been conducted to find out the sources of waste water in the main drainage canal from west byed of BRRI research field, Gazipur. Water samples were collected in every mid-month to analyze its pH value, EC, Na, K and Ca. In future SAR, ESP, nutritional value and biological hazard will be determined. Normal range of pH value for irrigation water is 6.5-8.4. So, pH value of the drain water is suitable for irrigation throughout the year. The range of EC value is 0.247-0.946. So the degree of restriction on use of waste water for irrigation is none to slight to moderate. Na^+ value is less than 3 me/l. So drain water has no restriction on use for irrigation. Ca^+ value (2.7-8.1) is within the usual range of irrigation water.	Best use of waste water and reduction of pressure on groundwater for irrigation
Sub- Sub Program V: RENEWABLE ENERGY		
05	**RENEWABLE ENERGY** ***Experiments:***	
	5.1 Effectiveness of solar pump for irrigated rice **Progress:** The experiment was established at BRRI, Gazipur. The whole system of solar pumping consists of the panels, supporting structure with tracking mechanism, electronic parts for regulation, cables accessories, pipes and the pump itself. Solar panels or modules are the main forces for driving the solar pump which use the light to produce electricity. Eight solar panels (size: 1 × 1.5 m^2) have connected together in arrays which produced 1600 watt DC energy. A 1.1 KW AC 3 Phase submersible pump were connected with pump controller using cables. Two year research findings showed, 1.5 hp capacity solar pump can be irrigated maximum around 1 ha land for Boro rice. This experiment will be continued next season and finally	Selection of an effective pump and solar panel for rice irrigation

	economic analysis will be done.	
Sub-Sub Program VI: Water Management Technologies Demonstration and Dissemination at Farmers' Field		
06	**Water Management Technologies Demonstration and Dissemination at Farmers' Field**	
	6.1 Cropping system intensification in the salt-affected coastal zones of Bangladesh and West Bengal, India (LWR/2014/73) **6.1.1 Selection of suitable T. Aman rice varieties for facilitating Rabi crops intensification** **Progress:** The adoption of modern technologies (variety and agronomic management) in the saline areas not only likely to increase food grain production and farm income but also to reduce risk of the rainfed crop cultivation largely.	Selection of suitable T. Aman varieties for coastal zones
	6.1.2 Growing vegetables crops with rice under low land condition **Progress:** Traditional double storied vegetables- T. Aman cultivation was found economically non-viable in the wet season. However, trial of double storied vegetables- T. Aman cultivation using modern varieties was found profitable. This system will be a good source of fresh vegetables for family consumption & income generation. Local farmers are interested to grow vegetables-Aman in coming wet season.	Crop intensification in the coastal zone with better nutrition for people
	6.1.3 Study on soil properties and salinity dynamics of soil and water in coastal areas of Bangladesh **Progress:** The experiment was carried out at Dacope, Khulna and Amtali, Barguna during dry season 2016-17. Fresh water resources development is one of the crucial issues for sustainable crop and soil salinity management in coastal areas. In both of the study locations, river water became saline (> 4.0 dS/m) after December and as high as 20-25 dS/m in April. Therefore, surface fresh water was trapped in local canals within December. Groundwater salinity was monitored from observation well. In Dacope, groundwater level varied from 0.75-0.95 m and salinity from 2.3-3.52 dS/m. In Amtali, groundwater level varied from 1.02-1.40 m and its salinity from 3.25-11.7 dS/m, which is beyond the permissible limit of irrigation.	Selection of suitable salinity management options for agriculture
	6.1.4 Planting time for Boro rice cultivation in saline areas (APSIM model) **Progress:** The study was conducted at Dacope, Khulna and Amtali, Barisal with a mirror side in non-saline location of BRRI farm, Barisal during the dry season of 2016-17. The trapped canal water was used for irrigation. Three varieties- BRRI dhan28, BRRI dhan67 and BINA dhan10 were tested. Boro rice was successfully grown in both of the tested locations. The BINA dhan10 (salt tolerant) produced successfully in both of the saline prone Dacope and Amtali region. But in Barisal, the non-saline area, non-saline	Suitable planting time for sustainable Boro cultivation with available canal water

	tolerant BRRI dhan28 produced highest yield compare to other locations. The enterprise budget indicates that dry season rice cultivation under research management at current price is profitable based on gross margin and return.	
	6.2 Modelling Climate Change Impact on Agriculture and Developing Mitigation and Adaptation Strategies for Sustaining Agricultural Production in Bangladesh **6.2.1 Climatic Variability and Wet-season Rice Production in North-west Bangladesh** **Progress:** The trend line analyses were done based on annual and seasonal climatic variables following MAKESENS model. Historical weather data of north-west parts of Bangladesh showed inter-annual and inter-seasonal variability. This indicates that climate change occurred in terms of increased temperatures, rainfall and reduction in sunshine hours. Increase in minimum temperature and decrease in sunshine hours are likely to reduce T. Aman rice yields in north-west part of Bangladesh. The study clearly indicates the usefulness of the regression based approach for evaluating the impact of climatic variability on yield of T. Aman rice; however there is a need to include other biotic and abiotic stresses that are operative simultaneously along with climatic conditions for precise estimates. For this purpose, use of simulation tools and artificial intelligence systems need to be employed.	Prediction trend of climatic parameters and assessment of their impact on agriculture

Plant Pathology Division

Research Progress 2016-17

Sl. No.	Research Progress **Program Area/Project: Pest Management (Plant Pathology)**	**Expected Output**
1	**Survey and monitoring of rice diseases in selected areas**	Surveys were conducted in both T. Aman 2016 and Boro 2016-17 at different locations including Gazipur, Comilla, Rangpur, Rajshahi, Kustia, Satkhira, Barisal and Habigonj districts of Bangladesh. In the surveyed areas, bacterial blight, blast, sheath blight, brown spot, leaf scald and ufra were recorded. Among the diseases, blast disease was observed severe in different upazilla of Comilla and Rangpur districts in Boro season whereas, bacterial blight, brown spot and sheath blight diseases were found as predominant in T. Aman season in other regions.
2	**Biology of rice false smut pathogen**	Rice false smut disease symptom initiated as white-belly-spikelet about seven days after panicle emergence. The full size smut ball formation took about 12 days after initiation of

		the symptom. Two distinct types of smut balls were observed: orange and greenish-black. Different coloured balls are visualized in different times also. Orange balls appear in Boro, Aus and early T. Aman (during October and early November). On the other hand, greenish-black balls only appeared in late (mid-November onwards) T. Aman season. Chlamydospores and sclerotia, both types of fruiting bodies are able to produced conidia in culture. The identification of the fungus *U. virens* was confirmed through species specific primer, US1-5/US3-3.
3	**Identification of seedling blight pathogens**	Pure culture of seedling blight pathogen was isolated and investigated under microscope. Based on morphological characteristic two types of fungi are identified named as *Fusarium* sp. and *Curvularia* sp.
4	**Standard differential set of blast isolates (*Magnaporthe oryzae* (Hebert) Barr.)**	A total of 25 blast (*Magnaporthe grisea* (Hebert) Barr.) isolates were selected primarily as differential isolates from 331 isolates, collected from all over Bangladesh. Depending on the differentiating ability, virulence, rate of sporulation, colony stability and storage potentiality, 11 isolates were selected finally for further work. Several resistance alleles of *Pik* locus had the same reaction patterns and could not be differentiated by these selected blast isolates. No avirulent isolate for *Pi19* was found.
5	**Identification of races and development of differential system of *Xanthomonas oryzae* pv. *oryzae***	A total of 125 bacterial (BB) isolates were isolated, purified and preserved for short (PSA slant) and long term (NBY 40% glycerol) preservation from 230 BB diseased samples of T. Aman 2016. To identify the differential BB isolates, 12 NILs and 14 pyramid lines were transplanted to test 80 BB isolates during Boro 2016-17. The isolates of *Xoo* were different reactions for virulence on 12 NILs. A total of eight races of *Xoo* existed in Bangladesh. The result suggests that the resistant gene *xa5, xa13, Xa7, Xa8* and *Xa21* can be used to develop of bacterial blight resistant variety for Bangladesh.
6	**Molecular detection of rice tungro virus**	The presence of rice tungro bacilliform virus (RTBV) on the tungro infected plants was confirmed using primers such as ORF-I-F/ORF-I-R and ORF-IV-F/ ORF-IV-R. The virus was further detected in the freshly inoculated seedlings

		using the same primer.
7	**Screening of breeding lines and germplasm against BB, sheath blight and bakanae**	A total of 309 materials including 100 rice landraces, 209 breeding lines two resistant checks and 13 susceptible checks were screened against bacterial blight. Among the 100 landraces, five materials such as accession no. 523, 553, 578, 586 and 587 were found resistant. However, among the 209 breeding materials, 13 showed highly resistant and 15 showed resistant to BB. Among the tested materials, none showed resistant reaction. Hundred germplasm were screened against bakanae of rice. Two accessions (acc. No. 363 and 369) were found resistant.
8	**Evaluation of advanced breeding lines against blast disease**	In T. Aman, 113 advanced breeding lines along with check materials were screened to identify the resistance sources against blast disease (*Pyricularia oryzae*). Four entries: BR8515-28-1-1-3-HR3 (Com), IR08L181, IR92240-40-2-2-1 and IR64683-87-2-2-3-3 showed moderate resistance to blast. In Boro season, out of 117 materials six materials: BR8079-19-1-5-1, BR9011-46-2-2, HHZ15-DT4-DT1-Y1, BR9025-50-2-1, BR8776-12-2-2, and BR8784-4-1-2 showed moderate resistance to blast disease.
9	**Screening and diversity analysis of exotic upland rice germplasm against blast disease**	Fifty upland rice genotypes, including one resistant check (Pongsu Seribu-1 (PS-1)), and one susceptible check (MR219), were evaluated. Resistant reactions were observed with the genotypes Biaw Bood Pae, Blau Noc, Chirikata 2, IPPA, IR 5533-50-1-10, IR 5533-55-1-11, Ja Hau, Ja No Naq, BR26, BRRI dhan42, and BRRI dhan43.
10	**Pyramiding of major blast resistant gene(s) in susceptible rice variety/lines**	Blast resistant genes *Pish*, *Pita2*, *Pi9* and *Pi40* were introgressed separately in BRRI dhan28, BRRI dhan29, BRRI dhan63, IR64, Kalijira and Nayonmoni. BC3F1 population was developed till boro 2016-17 and the population has confirmed using molecular linked marker.
11	**Development of tungro resistant varieties**	Seven crosses were made using five parents and four sets of BC2F1 and three sets of F1 seeds were obtained.
12	**Characterization of globally diverse blast-resistant upland rice (*Oryza sativa* L.) germplasms**	An experiment was conducted to elucidate the performances of 27 globally diverse blast-resistant upland rice genotypes. The Chirikata

		2, Choke Tang, BRRI dhan43 and Padi Beleong were identified as best genotypes in terms of yield.
13	**Transcriptome analysis of blast resistant cultivar BRRI dhan43 through next generation sequencing**	More than 30,000 expressed genes shared in the control and treatment samples were identified; approximately 96 and 88 SNPs from the control and the treatment samples, correspondingly and around one thousand novel transcribed active regions in both samples of rice species. The transcriptomes sequence data including gene and isoform expressions, SNPs and indel identification, and novel transcripts were higher in the control sample than its counterpart treated sample, thus revealing the reduction of some metabolic and biological activities in fungus-infected plants attacked by *M. oryzae* pathogen.
14	**Differentially expressed genes in incompatible interaction between upland rice cultivar BRRI dhan43 and fungus race P7.2 pathosystem**	Differentially expressed genes (DEGs) involved in the disease developmental stages were identified in the upland rice cultivar BRRI dhan43 and fungus race P7.2 pathosystem. Overall, 2,733 of the 30,436 DEGs were identified as true DEGs during incompatible interactions. A pathway enrichment analysis revealed several blast disease resistant inducible proteins, such as MLA10, L6, disease resistance protein RPS1, probable WRKY transcription factor 52, and disease resistance protein RPS4; other stress-inducible factors, such as heat shock protein (HSP90).
15	**Genetic variation of resistance to blast (*Pyricularia oryzae* Cavara) in rice germplasm**	Genetic variations in blast resistance in 334 Bangladesh rice accessions from four major ecotypes (Aus, Aman, Boro, and Jhum) were clarified. These were classified into two cluster groups, I and II, based on polymorphism data of 74 SSR markers. The groups I and II corresponded to Japonica and Indica Groups, respectively. Cluster II accessions were included in all ecotypes with high frequencies and subdivided into clusters IIa and IIb. The accessions of cluster IIa showed high frequencies in only Aus and Jhum. The accessions of cluster I was grown particularly those in the Aman ecotype. Distinct variations in resistance were found; these were classified into groups A1, A2, B1, and B2, based on the reaction to standard differential blast isolates. The most susceptible group was A2 including susceptible variety Lijiangxintuanheigu and

		most differential varieties and some accessions in Bangladesh. These results demonstrated that the accessions of Japonica group were found mainly in Aman, and Indica group distributed in all ecotypes. Susceptible accessions were limited in Aus and Aman.
16	**Estimation of blast resistance gene(s) using differential system and Bulk Segregating Analyses (BSA)**	Clarification of the existing genetic mechanism of blast resistance in Basmati 370 was done using the standard differential system, QTL and bulk segregating analyses. BC_1F_2 family lines were derived from the crosses between Basmati 370 and US-2 as the recurrent parent. Based on the comparative reaction pattern of Basmati 370 and DVs of 23 known blast resistance genes with 18 Standard Differential Blast Isolates (native and exotic), suggested that *Pib* and one of *Pik* allele (*Pik-s, Pik-m, Pi1, Pik-h, Pik, Pik-p* or *Pi7*(t)) were present in the genetic background of Basmati 370. In addition, comparative reaction patterns of the isolates PHL16 and Ba77a-B revealed that at least one unknown gene was present in the genetic background of Basmati 370. QTL analysis suggested that Basmati 370 harbored blast resistant genes *Pib* on chromosome 2 and one of the *Pik* alleles on the distal end of chromosome 11. There were some unknown genes on chromosome 4. Basmati 370 mostly harbored major QTLs on the regions of *Pik* locus on the long arm of chromosome11, and *Pib* on chromosome 2. These studies established that differential systems for blast are a powerful tool for estimating known blast resistant gene(s) in rice genome.
17	**Identification of blast resistant QTLs in NERICA-L-19**	Clarification of the existing genetic mechanism of blast resistance in NERICA-L-19, a highly blast resistant variety in Africa and South-East Asia was done using the standard differential system, QTL and bulk segregating analyses of BC1F2 family lines (LTH as recurrent parent). Eleven standard differential blast isolates (SDBIs) from Japan (n=8), Africa (n=1) and Bangladesh (n=2), were used for the investigation accordingly. A total of 119 polymorphic markers were used for genotyping and linkage map construction. Resistance spectra of NERICA-L-19 to standard differential blast isolates (SDBIs) were compared with

		those of 25 differential varieties (DVs). None of the isolates were found virulent against NERICA-L-19. Due to this, the differential system was not applicable for resistance gene estimation in NERICA-L-19. QTL analysis suggested that NERICA-L-19 harbored blast resistant genes on chrs. 1, 4, 6, 8, 10, 11 and12. These studies suggested that there are some novel QTLs in NERICA-L-19 those were responsible for high resistance potentiality against differential blast isolates of Japan, Africa, and Bangladesh.
18	**Introgression of complete and partial blast resistance genes into popular BRRI varieties**	To develop durable blast resistance popular rice varieties, BRRI dhan28, BRRI dhan29, BRRI dhan34, BRRI dhan63, BRRI dhan64 and Pusabasmati were selected as recurrent parent. As donor, partial resistance gene *Pb-1* and complete resistance gene *Pi9* were selected. Selection of differentiating isolates and polymorphic markers have already done. BC1F1 population has already been confirmed using markers.
19	**Development of cold tolerant and short duration blast resistance rice lines for Bangladesh**	Popular rice varieties: BRRI dhan28, BRRI dhan34 and Pusabasmati were selected as recurrent parent. As donor, Japonica group cultivar 'Mineasahi' harboring partial resistance gene *Pb-1* and *Pi39* was selected. F_1 population has developed in Boro 2016-17.
20	**Evaluation of blast resistantmultilines harboring resistant QTLs in Bangladesh**	Blast resistant multilines of IR64 were collected from JIRCAS, Japan. Observational yield trial (OT) was conducted in boro (2016-17) and the seeds were multiplied. The reaction of these lines against differential isolates has been completed under laboratory condition. Multilines, IR64-*Pi9* and IR64-*Pish* were found suitable and effective in Bangladesh in terms of yield and blast reaction.
21	**Gene pyramiding for bacterial blight (BB) resistance**	BRRI dhan28 and BRRI dhan29 were used as recipient parents and IRBB57, IRBB58 and IRBB60 were used as donor parents. A number of progenies of BC_1F_1 developed from the crosses and showed resistant reaction to the most virulent BB isolate BXO9.
22	**Density of false smut balls on infected rice panicles and its seasonal variation**	Comparatively more balls formed in 2015 than 2014 or 2016 seasons. As many as 136 smut balls were identified on an infected panicle in 2015, whereas maximum of 67 and 45 balls were recorded in 2014 and 2016, respectively.

		There was two-third chance that the maximum of five smut balls would be found on infected rice panicles. When the smut ball number per infected panicle was five or below, 48.1±3.5% (± is 95% confidence interval) of them located at the base, 45.5±3.4% at the mid and only 6.4±1.7% at the apex section of the infected panicles. As the number increased (up to 55), the smut ball formation gradually increased at the mid and decreased at the base section. Compared to potential grain number with this three portions (base, mid and apex) smut balls in a panicle, the proportion accounted for the base ($Y = 1.82 + 0.64\ X$; $R^2 = 0.95$; $n = 15$) and mid ($Y = -0.48 + 0.74\ X$; $R^2 = 0.99$; $n = 15$) remained almost similar; on the other hand, the proportion in the apex portion was much lower ($Y = -6.42 + 0.41\ X$; $R^2 = 0.84$; $n = 15$) than base or mid-section. Under natural infection, absolute predominance of distribution of false smut balls on the base and mid portions of the infected panicles indicate that the false smut pathogen might not enter into panicles from air with water droplet through the junction of flag leaf and lodicule.
23	**Evaluation and optimization of neck blast inoculation technique of rice**	Three techniques: cotton wrapping, spray and injection of spore suspension were tested under greenhouse condition. In spray method, blast symptoms were found in primary and secondary branches and also around the base of the panicle. Among the three techniques, disease progress was slow in cotton wrapping technique followed by spray and injection. But disease severity scale was recorded at 7-9 scale (SES, IRRI) after 10 days of inoculation. Though cotton wrapping technique was slow, it was selected for evaluating a large number of segregating populations in neck blast disease screening programme.
24	**A simple but robust artificial inoculation technique of rice false smut disease (*Ustilaginoidea virens* (Cooke) Takah)**	Water agar and Potato Sucrose Agar were selected for isolation and growing fungi on media. Injection of conidial suspension during late booting stage was found the best for inoculation.
25	**Effect of soil and seedling treatment on false smut disease development**	Rice variety BRRI dhan49 was used in this study. Treatments were as follows- T_1: Root dipping of seedling (Carbendazim); T_2: Soil treatment (Carbendazim); T_3: Foliar spray

		(Propiconazole); T_4: T_1 + T_2; T_5: T_1 + T3; T_6: T_2 + T_3; T_7: Tilt two spray; T_8: Nativo two spray; and T_9: Control. Data on disease incidence and severity with different treatments were collected at maturity. Among the nine treatments, root dipping along with twice foliar spray (T_5) produced the lowest number of infected tiller (30) followed by T_8 (34) and T_7 (35). The highest number of infected tiller (125) was found in control. The lowest number of infected floret (50.67) was recorded in T_5 treatment, followed by T_8 and T_7. The highest number of infected floret (221.67) was found in control plot. In addition to this, the highest 75.80% disease reduction was detected in T_5 plot.
26	**Efficacy of higher doses of fungicides for controlling false smut disease**	Rice variety BRRI dhan49 was used as a test variety. Treatments were as follows- T_1: Propiconazole two spray @ 500 ml/ha; T_2: Nativo two spray @ 250 gm/ha; T_3: Azoxstrobin two spray @ 500 ml/ha; T_4: Propiconazole two spray @ 1000 ml/ha; T_5: Nativo two spray @ 500 gm/ha; T_6: Azoxstrobin two spray @ 1000 ml/ha; and T_7: Control. Among the different treatments, T_5 produced lowest number of infected tiller (35.67) followed by T_2 and T_6, and the highest number of infected tiller (159) was recorded in T_7 in case of BRRI HQ, Gazipur. While, in case of Rangpur, T_5 produced the lowest number of infected tiller (29.67) followed by T_6 and T_2, and the highest number of infected tiller (151.33) was recorded in control plot (T_7). In addition to this, the highest 80.40% disease reduction was observed at Rangpur while 77.57% disease reduction was recorded at BRRI HQ, Gazipur.
27	**Efficacy of biopesticides against sheath blight disease of rice**	*In vitro* and pot experiments were conducted to screen out the biopesticides for the control of sheath blight during T. Aman 2016. *In vitro* experiment was conducted three times with different biopesticides along with chemical control (Nativo) and negative control (water). The treatments were *Trichoderma harzianum* (BT1), Microtech1 (*Bacillus. subtilis*), *B. subtilis*, Agroplus, Recharge (*Glomus* spp, *Bacillus* spp. *Trichoderma* spp.), Chitin, Nativo (Tebuconazole+Trifloxystrobin) and control (water). None of the biopesticides was found

		effective to inhibit fungal and bacterial growth *in vitro.* In pot experiment, artificial inoculation of ShB and BB was conducted and the tested biopestidides were applied by spray method. The results showed that ShB and BB diseases were reduced about 30- 50% by spraying the biopesticides and showed no significant difference over chemical control.
28	**Development of novel bio-pesticides against sheath blight and bacterial blight diseases**	Twelve *Trichoderma* and eight *Bacillus* isolates were purified from soil and plant samples (rhizosphere/phylloplane) collected from different rice growing areas in Bangladesh following dilution plate technique. *In vitro* experiment was performed three times following dual culture method on PDA for ShB and PSA for BB media. All those isolates were tested to know the efficacy of these isolates against *Rhizoctonia solani* and *Xanthomonas oryzae*pv. *oryzae*. *R. solani* agar disk (6 mm) isolated from pure culture was disposed at the center of petridishes and incubated at 25°C for 2-3 days. In *in vitro* test, the radial growth of *R. solani* and bacterial growth was significantly inhibited by nine *Trichoderma* and four *Bacillus* strains including chemical control compared to water control treatment. Percent fungal reductions by these isolates and the chemical control were determined about 70 to 90 % over control. In pot experiment, sheath blight disease was significantly reduced (about 40-70%) compared to diseased control by one *Bacillus* and two *Trichoderma* isolates and BB disease was reduced about 30-40% over diseased control by two *Trichoderma* isolates.
29	**Evaluation of new chemicals against blast disease**	Among the 23 fungicides, only six such as Pazodi 32.5 SC, Navera, Seltima and Azonli 56 successfully controlled rice blast disease (above 80%) in Gazipur. In Barisal, eight chemicals viz. Metrobin, Royal, Aiker, Sunzoxy, Navera, Seltima, Mcvo and Alivo significantly reduced (84-92%) neck blast and were similar to standard check chemical Nativo (89%). Among the tested eight fungicides, three fungicides namely Gunzim (carbendazim),Bitavo (Midacloprid 25%+Thiram 25%+Carbendazim 25%) and Topzim-super reduced more than 80% disease.

30	**Demonstration on integrated rice disease management of sheath blight and blast**	A total of 20 demonstrations were conducted for blast and sheath blight disease management at farmers' field in four upazilas i.e., Gapalgonj sadar, Nazirpir, Mollahat and Fakirhat of Gapalgonj and Bagerhat districts under PGB in 2016-17. One farmer's field was selected for each demonstration where BRRI recommended practices in a plot and farmers practice in the adjacent plot were demonstrated. BRRI recommend practice showed less disease severity and incidence resulted in higher yield.

Entomology Division

Research Progress: 2016 –17

Sl. no.	Programme area/Project with duration	Expected output
1.	**Project: Survey & Monitoring of Rice Arthropods**	
	1.1 Arthropod monitoring in BRRI Farms The overall insect pest incidence was low in the reporting year. Higher incidences of insect pests were found in Aus and T. Aman seasons than the Boro season (Table 1-3). Grasshoppers (GH) and green leafhopper (GLH) were the most abundant pests and found in all the three seasons. The highest population of GH was found in the grass fallow at Aus and T. Aman seasons. Higher numbers of natural enemies were observed in the Aus season than Boro and T. Aman seasons. Spider, damsel fly, ladybird beetle (LBB) and carabid beetle (CDB) was the dominant predators (Table 1-3) in all the habitats irrespective of season except in few cases. Likewise, insect pests, the natural enemies also concentrated mostly in the rice fields in all the seasons except Boro. Insect population and damage intensity were also investigated using 20 hills counting method at every week. Insect pests were below the ETL in all the three rice seasons. Whorl maggot (WM), rice leaffolder (RLF) and grasshoppers were the most abundant pests. Damaged caused by stem borers (SB), grasshoppers, long horn cricket (LHC), rice leaffolder (RLF) and whorl maggot (WM) were observed throughout the year. The damage due to SB was comparatively higher in the T. Aman season than that of other seasons. However, damaged intensity did not cross ETL. Spiders were the dominant predators and found in all habitats throughout the year.	Insect pests and natural enemies will be monitored from different rice habitats in a long term and will be developed some models for forecasting.
	1.2 Insect pests and natural enemies in the light traps Rice insect pests and their natural enemies were monitored by using light trap during July 2016 to June 2017 at BRRI farms in Gazipur, Barisal, Rajshahi, Comilla, Habiganj, Sonagazi and Rangpur. Brown planthopper population (191395) were higher followed by green leafhopper (126509), yellow stemborer (83056) and white-backed planthopper (44997) in all seven locations. Brown planthopper	Number of insect pests and natural enemies will be monitored throughout the year and

	(124596), green leafhopper (77942), yellow stemborer (55655) and white-backed planthopper (25399) dominated in Habiganj. Among the natural enemies green miridbug, carabid beetle, staphylinid beetle and spider were most prevalent. Highest population of green mirid bug (240863) was also observed in Gazipur.	update the existent database. Also, incidence and peak abundance will be determined.
	1.3 Construction of epidemiology information interchange system for migratory disease and insect pests of rice Monitoring of planthoppers with light trap: Generally, winged adults of BPH and WBPH were trapped in light trap. Yearly incidence of planthoppers differed among the light trap locations. Highest number of winged adults of BPH and WBPH were trapped in Gazipur followed by the catches of Sagordi farm (Barisal), Dobila and Washin under Tarash, Sirajganj. Population build-up of BPH and WBPH was started from the 1st week of October; and the incidence of 1st and 2nd peak occurred during 2nd week of November and December respectively; again in 1st to 3rd week of May 2017. The number of WBPH was higher than BPH. Among the natural enemies, green mirid bug (GMB) population was almost double in BRRI-HQ, Gazipur than Sagordi farm Barisal, indicating their density dependence with rice planthopper (BPH & WBPH) population. Monitoring of planthoppers with yellow sticky trap (YST): The incidence of rice planthopper started from 2nd week of October at Kanchaneswar, Kasta and Vogolman in Tarash upazila in T. Aman 2016. Peak incidence was found at Vogolman on October 26 and that was from October 26 to November 2 at Kanchaneswar and Kasta, and again highest on November 9 at Kasta then decreased until harvest of the crop. Among the natural enemies, GMB population was higher in Kanchaneswar on November 2 catches. In Boro 2017, BPH and WBPH population tended to increase at Dobila, Hamkuria and Washin from the 1st week of March and the peak population was in the 1st week of May indicating late invasion of hoppers in the reporting period than the previous year. Lower number of spider population was also observed in Boro 2017 season. Monitoring of planthoppers with aerial YST: Rice planthopper (BPH, WBPH, SBPH) and natural enemies (GMB and spider) were more active in the Boro seedbed at Dobila followed by Washin and Hamkuria. Higher number of insect was caught at 2.44 m height traps than the other one. Aerial monitoring showed almost similar findings in 1st, 3rd and 4th year but that differ with the 2nd year findings. Planthoppers monitoring using white and yellow color cloths: Planthoppers were also monitored using white and yellow color cloths (size - 1m X 1.5m) on grasses and non-rice crop during off	Forecasting of rice planthoppers (RPH) and their monitoring system to farmers as well as to extension personnel. Accurate identification techniques of RPHs at field condition will be enhanced. Finally, the LAMP technology for RPHs and rice virus species established and applied in fields.

	season. The cloth acts as a reflector of the light, a resting site for the attracted planthoppers, and hence as a collecting site. The white cloth reflected more light than the yellow one but insect resting period was high in yellow cloth than the white one. RPH samples from light trap and field collection were prepared and sent to Korea for the genetic analysis and to trace the migratory rout of RPH in the Asian countries.	
	1.4. Development of bioclimatic models to forecast the dynamics of rice insect pests. Weather data was collected from Bangladesh Meteorological Department, Dhaka. The large-scale data of insect pests has been continued to collect to run the model. At this stage, the Lotka–Volterra model, also known as the predator–prey equations were developed. This model used to describe the dynamics of biological systems in which two species interact, one as a predator and the other as prey. The model demonstrated clearly that one population follows another one. Population of rice mirid bug highly dependent on BPH population in BRRI farm.	Forecasting model of insect pests will be constructed.
	1.5. Survey of rice insect pests in selected AEZ's of Bangladesh. Overall insect pest occurrence in surveyed area was low and did not cross the ETL in any place. During Aus season, highest number of grasshoppers was found in Barisal than that of other surveyed area. Highest number of damsel fly was observed in Pirojpur (18) followed by Barisal (7), Gopalganj (2) and Rajshahi (1). Likewise, Aus season insect pest infestation was low in all the surveyed area at T. Aman season 2016. However, among the natural enemies damsel fly was the dominant predator and found in all surveyed area. However, Pirojpur harvoured highest numbers (28) of damsel fly followed by Bagerhat (22), Rajshahi (10), Gopalganj (6.7), Barisal (6) and Jhalokati (6). Rice bug population was observed only in Rajshahi at T. Aman season.	The incidence patterns of major insect pests and their natural enemies in different Agro-ecological Zones (AEZs) will be determined. Relationship between biotic and abiotic factors on their abundance will be known.
2	*Project: Studies on rice insect pest and natural enemy ecology*	
	2.1 Conservation of natural enemies through ecological engineering approaches Eco-engineering treated plot showed highest parasitism activity to the exposed BPH, WBPH, YSB and rice hispa egg in rice field. Severe pest outbreak was not found in the experimental plot. Moreover, eco-engineering plot reduced 50% key pest population and 75% chemical insecticides from rice field. In addition, in insecticide treated plot	The use of insecticide will be reduced at the early crop stages by enhancing the buildup of

	where insecticide used three times but yield was similar to that of eco-engineering and control plot. This result indicated that rice can be produced without insecticide using ecological engineering technique.	different natural enemies in rice agro-ecosystem.
	2.2. Monitoring of larval parasitism of rice leaf folder. A total of 69 larvae of rice leaf folder were collected from rice field at seven dates (Table 5). The collected larvae with rice leaves were kept in test tube in the laboratory for parasitoid emergence. The parasitized and non-parasitized larvae were identified. The 27.54% larvae showed parasitized by *Elasmus sp.* However parasitism rate ranged from 9 to 75%.	Understanding of the efficiency of natural enemies to suppress rice leaf folder will be clear.
	2.3. Functional response of predator (frog, carabid beetle & lady bird beetle) against planthoppers. This study was conducted to evaluate the biological control potential of the predacious frog, carabid beetle and lady bird beetle against brown planthopper (BPH). The consumption rate of frog, carabid beetle and lady bird beetle were investigated in confined field and laboratory condition respectively. Experimental results showed that the frog consumed 21.78-41.67 BPH (4^{th} instar nymph) within 48 hours. Carabid beetle and lady bird beetle consumed 3.57 and 3.22 BPH within 24h respectively. More experiments are required for getting conclusive results.	The mechanisms underlying predator-prey behavior to improve the practical predictive potential of predator candidates for biological control The consumption rate and effectiveness of predators against target pest will be determined.
	2.4. Study on the biology of green mirid bug. Gravid BPH females were confined inside the mylar on 40-days-old BR3 plant for egg laying on three consecutive nights. Then adult green mirid bugs (GMB) (both male and female) collected from BPH infested rice field were allowed to lay eggs on the leaf sheath of previously deposited BPH eggs. It took around 10-14 days to hatch nymph from eggs depending on temperature (ranging from 25-30^0C). The emerged nymph completed five nymphal instars to become adult and it required around 15 to 18 days depending on the room temperature. GMB nymphs feed on 1^{st} and 2^{nd} instar BPH nymphs for their growth, development and survival. GMB adult longevity ranged from 10-25 days depending on the availability of natural honey. Adult	Life cycle and morphological features of green mirid bug will be known.

	GMB is used to find out the alternate host(s) to be multiplied in off-season.	
	2.5. Study on entomogenous fungi to control brown planthopper (BPH A study on entomogenous fungi (e.g., *Metarhizium anisopliae*) was conducted in greenhouse condition to explore suitable media for mass production. Potato dextrose ager and boiled rice media were tested to culture this fungi. Boiled rice is more suitable to culture it quickly. The culturing technique of *M. anisopliae* was newly developed at BRRI. It took around 4-5 days to develop conidia. Conidia were washed with distilled water and sprayed on infested rice plant. Fungal conidia or mycelia have capacity to infect live brown planthopper, white backed planthopper and small brown planthopper.	Fungi from naturally infected insects and use it in BPH management.
3.	Project : Integrated Pest Management	
	3.1 Validation of BRRI recommended practices for insect pest management in Pirojpur, Bagerhat and Gopalganj regions (PGB). Field trials were conducted in farmers' fields at Pirojpur, Gopalganj and Bagerhat districts during T. Aman 2016 and Boro 2016-17 seasons. Three treatments including prophylactic use of insecticide (T_1) - insecticide was applied in rice field at every 15 day intervals without judging the insect pest infestation levels; (T_2) - perching (establishing perching sites for insectivorous birds) and concurrently using sweeping and need-based insecticide applications; and (T_3) - farmers own chosen practices. One portion of each farmer's field remained under the respective farmers' supervision without any intervention, which meant that T_3 is the control treatment of each experimental layout. During the experimental period insect infestation was below the economic threshold level (ETL) in all the locations. Insignificant numbers of insect pests were observed in trial fields both in Nazirpur and Gopalganj. So application of need-based insecticide was not necessary for T_2. Treatments showed significant higher number of leaf damaged due to leaffolder infestation but total damage did not exceed the ETL at any plot (Fig. 1). White head number (4) was higher in farmers practices plots (T_3) (Fig. 2) followed by T_2 (Perching+ Sweeping+ Need base insecticide) plot and T_1 (Prophylactic insecticide used). Higher number of spiders and damsel fly were found in plots without insecticide application (Fig. 3). It indicates that insecticide affected the number of natural enemies in rice field. Lower yield was observed at T_3 (farmers practices) in all the demonstration plots of Pirojpur, Gopalganj and Bagerhat. No significant yield differences were observed among the treatment T_1 (5.24 t/ha) and T_2 (5.27 t/ha) at Nazirpur with variety BRRI dhan52. Similar results were also found in all the demonstrations of Gopalganj and Bagerhat with variety BRRI dhan39 and BRRI dhan49. Insecticide (Virtako 40WG @ 75 g/ha) was applied three/four times in T_1 plot but yield advantage was not significantly higher than other treatment. But the costs of insecticides and its application were higher than the yield	To demonstrate BRRI recommended practices for successful management of rice insect pest.

	advantage. Therefore, it is concluded that continuous use of insecticide had no significant effect on rice yield when insect infestation was below the ETL. So, farmers should avoid continuous or indiscriminate use of insecticide which ultimately save production cost and save the environment from insecticidal pollution.	
	3.2. Title of the Experiment: Management of brown planthopper by configuration and geometry of rice planting. The following treatments were applied in planting method and configuration with four replications- T_1 = Six-row planting then one row gap and using double nozzle sprayer (with infestation) T_2 = Eight-row planting then one row gap and using double nozzle sprayer (with infestation) T_3 = Ten-row planting then one row gap and using double nozzle sprayer (with infestation) T_4 = Normal planting and using double nozzle sprayer (with infestation) T_5 = Normal planting and using single nozzle sprayer (with infestation) T_6 = Normal planting (half un-infested control/half infested control) T_7 = Eight-row planting then one row gap and without spray but with infestation (Control) Infestations were done by releasing 2-3rd instar BPH nymph and the plots were enclosed by fence of fine mesh nylon net. After 2-3 days of insect release, insecticide (Mipcin 75WP @ 1.3 kg/ha or Plenum 50WG @ 0.5 kg/ha) were sprayed by using double and single nozzle sprayer as per treatment. The spray swath and the coverage effect were measured. Spray swath is the important factor to control field population of BPH. The per cent mortality of BPH increased at early crop stage spray compared to the subsequent later stage spray indicating that rice canopy with higher number of tiller decreased the effectiveness of spray swath. At maximum tillering stage, six rows planting then one row gap (6:1) planting system showed good spraying capacity with double nozzle sprayer than the 8:1 and 10:1 planting system. Generally, double nozzle sprayer sprayed well in both side of a gap but the spray swath decreased with increasing trend of plant canopy. The middle line of 8:1 and 10:1 planting geography received less volume of spray causing less mortalities of insects at this position. However, it required less time of spray to cover same area than that of single nozzle sprayer. The plots, infested with BPH at mid-tellering stage with 10 nymphs per hill (ETL) caused hopperbum at booting to flowering stage of BRRI dhan29. BPH infestations with same number of nymphs during subsequent latter crop stage (e.g., maximum, booting and flowering) could not create hopperburn indicating to failure to develop the required number of BPH generation to cause hoppeburn. However, it reduced the obtained yield significantly. Mipcin 75WP was applied at recommended dose when the insect populations were at ETL (i.e., 10	To manage brown planthopper (BPH) in the field by changing planting system using double nozzle sprayer.

	nymph /hill). The insecticide sprayed with the double nozzle showed higher mortality than that of the single nozzle and normal planting plot.	
4	**Project IV: Crop Loss Assessment**	
	4.1. Effect of rice leaf folder damage on rice grain yield of BRRI dhan49. The study was conducted in the natural infested field of BRRI dhan49. Fifty rice hills with high levels of natural rice leaf folder (RLF) damage and another 50 healthy hills were marked at the flowering stage in study field of T. Aman 2016 season. Panicles of infested and healthy hills were harvested and grain weight were measured and adjusted at 14% moisture content. Yield loss occurred in rice leaf folder infested hills compared to control hills in BRRI dhan49 variety. The yield loss was estimated at 37.5 %, by adjusting the grain weight between healthy and infested hills.	To determine the yield loss potential of rice leaf folder.
	4.2. Relationship between rice gall midge damage and yield loss. Five rice varieties (namely BRRI dhan52, BRRI dhan62, BRRI dhan73 and two checks) were tested against rice gall midge infestation at field condition during T. Aman season 2016 at BRRI farm, Gazipur. BRRI dhan49 and BRRI dhan33 were used as susceptible and resistant check. Artificial infestation of gall midge was done at 26 days after transplanting (DAT). Around 50 DAT, the emerged adults were allowed to lay eggs before panicle initiation (PI) stage. Therefore, two time infestations occurred at field condition. Results showed that highest infestation occurred on BRRI dhan49 followed BRRI dhan52, BRRI dhan73, BRRI dhan62 and BRRI dhan33 (no infestation). Results also showed that one per cent infestation of onion shoot could cause 0.96, 0.90 and 0.85 per cent yield loss of BRRI dhan52, BRRI dhan73 and BRRI dhan62 respectively.	To determine the yield loss potential of different rice varieties against rice gall midge damage.
5.	**Project : Evaluation of chemicals and botanicals against rice insect pests**	
	4.1 Test of different insecticides against major insect pests A total of 50 commercial formulations of insecticides were evaluated against brown planthopper (BPH) and yellow stemborer (YSB). Among those 27 were found effective against BPH and 01 against YSB. Effective commercial formulations were recommended to PTASC for registration and commercial use.	Effective insecticide (s) will be determined against major insect pests.

	5.2. Application of Recharge in rice field for crop protection. The application of Recharge vitalizes the soil and restores its ability to function properly by providing vital background protection to the crop from invasive pests and diseases. Recharge only puts back what the soil has already lost due to excessive pesticide applications. With this prospect we applied recharge in rice field to boost up the production and to evaluate the effectiveness of Recharge against insect pest in T. Aman 2016 and Boro seasons 2016-17. To test this material, two treatments including T_1 = Recharge application and T_2 = Control (without recharge) were used for this experiment. The experiment was repeated four times. The recharge was applied @ of 3 kg/ha. First application was done at rice transplanting period and 2^{nd} was done after 30 days of 1^{st} application. Recharge treated plot showed vigorous growth of crop and comparatively greener than that of control plot. Significant differences were not found in respect of pest's abundance when compared to control plot. But slightly lower population of two natural enemies including damselfly, spider and one pest, green leafhopper (GLH) was found in recharge treated plot. Disease was not observed in any experimental plot. Significant yield improvement was not found in Recharge treated plot when compared to control plot. Similar result was found both in T. Aman 2016 and Boro 2016-17 season. The incidence of YSB population was very low during the experimental period. Therefore, this experiment needs to be conducted in YSB outbreak area.	The efficacy of Recharge (biopesticide) against rice insect pests will be determined.
	5.3. Fumigation action of botanical oils against stored grain insect pests. The mortality (reported after watching recoveries for four days) caused by the fumigation action of mahogany oil was recorded. The results indicated that the first exposure period (24 hrs) of rice stored grain insects to mahogany oil fume caused significant mortality to rice weevil and angoumois grain moth compared to the control. The second exposure period (48 hrs) to mahogany oil caused significant death among test insects compared to the control. Mortality ranges from 51 to 100% and from 88.57 to 100% in the rice weevil and angoumois grain moth respectively. The result of this study indicates that mahogany oil would be an effective product for controlling stored grain insect pests. However, more experiments are required for delivering as a technology.	Effective botanical oils against stored grain insect pests will be identified.
6.	**Project: Host Plant Resistance**	
	6.1 Screening of rice germplasm, advance line and F_2 materials against major insect pests A total of 49 materials were screened against brown planthopper, white backed planthopper and green leafhopper at green house. All the materials were found susceptible to BPH. Out of 49 advanced materials, only two materials were found moderately resistant (score 5) to WBPH and one material was found moderately resistant (score 5) to GLH (Table 6).	Resistant sources against major insect pests could be found.
	6.2. Pest reaction of BRRI released rice varieties against major insect	The insect

	pests. Sixty-nine BRRI released rice varieties were tested against BPH, none of these varieties were found resistant (score 0-1). However, 11 varieties were found moderately susceptible (score 5-7) against brown planthopper (BPH). Out of 61 varieties, none of varieties were found resistant but 5 varieties (BRRI dhan27, BRRI dhan28, BRRI dhan55, BRRI dhan62, BRRI dhan74) showed moderately resistant (score 5) against white backed planthopper (WBPH).	reaction status of BRRI varieties and identify resistant sources against major insect pests will be determined.
	6.3 Screening of rice germplasm advance lines and F_2 materials against rice gall midge (GM) A total of 119 rice germplasm collected from Genetic Resources & Seed Division, BRRI and were screened against gallmidge during the reporting period. Among those, IR12N177 and BR8526-9-2-3-5 were recorded as moderately resistant (6-10% OS) and highly resistant (0-1% OS) respectively.	Resistant sources against rice gall midge would be identified.
	6.4. Reaction of provitamin A enriched GR2-E BRRI dhan29 golden rice. introgressed lines to different insect pests under confined field trial condition. To conduct this experiment, the crop was established by the scientists involved in golden rice project of Plant Breeding division as per approved experimental design and work plan. A total of 10 test entries including BRRI dhan29 were evaluated under natural infestation at the confined field trial (CFT) site of Bangladesh Agricultural Research Institute (BARI), Gazipur during Boro season 2016-17. Prophylactic measures were taken to control insect pests during crop growing season. Four different groups of insecticides including Virtako 40WG, Malathion 57EC, Chlorpyriphos 20EC and Mipcin 75WP were applied in the experimental plot. The major insects namely stem borer (SB), leaffolder (LF), grasshoppers and natural enemies namely; lady bird beetle, spider, dragon fly and damsel fly were found. However, insect infestation was very low at the crop establishment stage due to regular application of insecticide. Stem borer infestation was observed from vegetative stage to the reproductive stage. But their level was negligible. No significant differences were observed between the transgenic golden rice lines and non-transgenic BRRI dhan29. A few number of stem borer egg masses were observed in the tested lines. Leaf damaged by leaffolder insect was observed both in transgenic and non-transgenic lines. No unusual insect pest infestation was found in transgenic lines. From this study it is concluded that transgenic rice line does not show any abnormal pest or natural enemies abundance in crop field.	The effect of transgenic lines (rice) on the incidence of insect pests and natural enemies will be quantified.
7.	**Project: Vertebrate Pest Management**	
	7.1 Study on the barn owl (*Tyto alba)* and their biology for sustainable rat management A total of 21 owl watching towers were established in three heights, namely 8, 10 and 12 feet in BRRI farm during the reporting period.	Rice field rat will be managed naturally with

	Owls used the watching tower as their rostering sites and prey the rodent during night time. The new burrow prepared by rat, and stay inside it is called active burrow. The active burrow became inactive when the owl caught the rat from that burrow. Therefore, inactive burrow count indicated the owl prey success considering the other preying options (predators) remaining the same. Active and inactive burrow count data were taken in 50 diameter area of each tower. Table 7 showed that the active burrow (4228) was higher than the inactive burrow (3772) during July 2016 to June 2017 count. Data also showed that highest number (620) of inactive burrow was recorded at 12 feet height tower in west byed A block followed by B, C and D Block. C block was considered as control area. The overall owl preying success was 47.15%.	the barn owl as a biocontrol agent. Besides, pest and predator biodiversity will be conserved.

Rice Farming Systems Division

Research Progress 2016-2017

Sl. No.	Research Activities	Progress
	Programme area: Rice Farming Systems	
1	Study on cropping pattern of Bangladesh and harnessing opportunities for improvement	After completion of cropping pattern survey, data were processed in spread sheet and processed data were validated in workshops conducted separately in 64 districts of the country. Finally the verified data are being analyzed to develop a database regarding crops and cropping pattern.
2	Evaluation of minimum tillage and crop residue retention in Wheat-Mungbean-T. Aman cropping system	Establishment method by minimum tillage (EM) and Crop residue retention (CRR) had no significant effect on rice equivalent yield (REY) in Wheat-Mungbean-T. Aman cropping pattern.
3	Evaluation of establishment method of rice in Mustard-Boro-T.Aman cropping pattern in medium highland ecosystem	Mustard yields were 0.8, 0.9, 0.9 and 1.02 t/ha under T1 (Single pass unpuddled Boro rice-Conventional Aman rice-Conventional Mustard), T2 (Conventional Boro rice-Single pass unpuddled Aman rice-Conventional Mustard), T3 (Single pass unpuddled Boro rice-Single pass unpuddled Aman rice- Conventional Mustard) and T4 (Conventional Boro rice-

		Conventional Aman rice-Conventional Mustard) (check) treatments, respectively. After Mustard, Boro (BRRI dhan 28) yields were 6.31, 5.70, 5.50 and 5.78 t/ha under T1, T2, T3 and T4 treatments.
4	**Development of Vegetables, fish and fruit system in mini pond**	The gross margin of T_1 (Aroid+Fish (Stocking density: 02 piece/m^2) was 286%, 185% and 131% higher over T_4 (Only fish - Stocking density: 01 piece/m^2), T_3 (Only aroid in the pond), T_2 (Aroid+Fish (Stocking density: 01 piece/m^2) treatment, respectively. The lowest gross margin was found in T_4 treatment where only fish was cultivated.
5	Long-term effect of three cropped cropping patterns on the agro-economic productivity and soil health	Highest REY (19.84 t/ha) was obtained from Potato-Boro-T. Aman cropping pattern. Lowest REY obtained from Boro-Fallow-T. Aman (10.26 t/ha) cropping pattern that also statistically similar to Maize-Mungbean-T. Aman cropping pattern. Highest gross margin (72,531 tk/ha) was found from Potato-Boro-T. Aman cropping pattern. organic matter, N and K were depleted in all the tested patterns except in Maize-Mungbean-T. Aman. P level increased in T_1, decreased in T_2 and remain static in the other cropping patterns
6	Determination of fertilizer dose for Mustard-Boro-T. Aman cropping patterns	The grain yields of all the tested crops were significantly influenced by the treatments**.** The required doses of N, P, K for T. Aman, Mustard and Boro were 42.7, 3.47 and 25 kg/ha; 103, 26 and 39 kg/ha; and 107.9, 8.2 and 23.9 kg/ha, respectively which were recommended from one year completion data and will be executed in more years for valid conclusion

7	Development of high intensity cropping pattern for greater Kushtia region	There was significant REY difference among the four cropping patterns. Potato+Maize-T. Aus-T. Aman gave the highest REY (18.36 t/ha) followed by Maize+Spinach-T. Aus-T. Aman (15.07) in Kushtia and in Meherpur district Potato+Maize-T. Aus-T. Aman gave the highest REY (22.95 t/ha) followed by Mustard-Mungbean-T. Aus -T. Aman (19.95). On the contrary, lowest yield was found from Maize-Fallow-T. Aman (Check) cropping pattern which was 10.14 t/ha in Kushtia and 14.16 t/ha in Meherpur district
8	Improvement of relay cropping of Aman with jute in Rabi-Jute-Relay Aman cropping pattern in shallow flood prone area	Highest yield (3.29 t/ha) was produced by BRRI dhan39 as relay crop with jute which was similar to that of BRRI dhan49 (3.27 t/ha) and BRRI dhan72 (3.26 t/ha). Among the fertilizer doses 30-14-12-8-1: Urea-TSP-MOP-Gypsum-Zinc sulphate, kg/Bigha produced the highest grain yield of BRRI dhan39.
9	Validation of improved cropping patterns for greater Kushtia	Introduction of high yielding variety BARI moshur6 and BRRI dhan39 through Pulse-Jute-T. Aman cropping pattern increased gross margin 43.27% over farmers practice.
10	Performance of exotic date palm (*Phoenix dactylifera*) for homestead and agro-forestry systems	In 2017, 30 male and 14 female plants are identified. Out of 14 female plants successful harvest was done from six plants.

Agricultural Economics Division

Research Progress for 2016- 17

Sl. No.	Research Progress	Expected output
	Sub-sub Program: I. Rural Institution & Economic Consequences	

2.1	Farm Level Adoption and Evaluation of Modern Rice Cultivation in Bangladesh Duration: Routine work Progress: To be continued	Variety wise adoption rate and constraints of different MVs and LVs be evaluated.
2.2	Utilization Pattern of Agricultural Credit on MV Boro Rice Cultivation in Chapainawabganj District Duration: July, 2016 - June, 2017 Progress: Completed	Utilization, profitability and constraints of agricultural credit be evaluated

Sub-sub Program: II. Production Economics

2.3	Estimation of Costs and Returns of MV Rice Cultivation at the Farm Level Duration: Routine work Progress: To be continued	Profitability, factor and income share of MV rice cultivation be estimated
2.4	Tracking of Climate Resilient Rice Varieties and Its Economic Performance at the Farm Level in Bangladesh Duration: July, 2014- June, 2017 Progress: Completed	Performance of stress tolerant rice varieties be evaluated.
2.5	Preference Analysis of T. Aman Rice Varieties in the Coastal Areas in Bangladesh Duration: July 2016 to June 2018 Progress: Report of 2016/17 completed.	Farmers' preference about Aman rice varieties with their most and least preferred traits is identified.
2.6	Comparative Economic Viability of Modern and Local Variety Transplanted Aman rice in the Coastal Area in Bangladesh Duration: July, 2016 - June, 2018 Progress: Report of 2016/17 completed.	Relative profitability and risks of T. Aman rice cultivation under farmers' current and recommended practice be evaluated

Sub-sub Program: III. Rice Marketing & Price Policy

2.7	Value Chain Analysis of Rice Bran Oil in Bangladesh: An Economic Investigation Duration: July, 2016 - June, 2018 Progress: Report of 2016/17 completed.	Prospects and potential of rice bran oil in Bangladesh be evaluated

2.8	Effectiveness of Boro Rice/Paddy Procurement Program in Some Selected Areas of Bangladesh Duration: July, 2016 - June, 2018 Progress: Report of 2016/17 completed.	Effectiveness of the procurement program be evaluated

Sub-sub Program: IV. Agricultural Policy & Development

2.9	Farmers' Perception of Climate and Environment Change and their Adaptation Practices, Constraints and Suggestions of Cropping Systems Intensification in Coastal Bangladesh Duration: July, 2016 - June, 2018 Progress: Report of 2016/17 completed.	Farmers' responses to climate and environment be delineated, factors facilitated and impeded the adaptation strategies be identified and farmers suggestions for intensification of crops be delineated
2.10	Rice Cultivation in Newly Independent Enclaves of Bangladesh: A Field Level Investigation Duration: July, 2016 - June, 2017 Progress: Completed	Farmers' rice cultivation practice and level of adoption technologies in newly independent enclaves be evaluated

S. N.	Research Progress	Expected output
IV: Program Area: Socio-economics and Policy		
1.	Project: Stability Analysis of BRRI varieties *1.1 Experiment/Study:* Study on G X E interaction of BRRI varieties (In collaboration with Pl. Breeding Div., ARD Regional Stations) *Research Progress:* T. Aman: Data collection is going on from various R/S. Boro: Experiment is in the field.	1. To determine stability index of BRRI varieties 2. To maintain season, year and location-wise database on BRRI varieties
	1.2 Experiment/Study: Stability and Adaptability of BRRI Released Aus Varieties in Different Locations of Bangladesh (In collaboration with Agronomy Div. and BRRI R/S Satkhira, Rajshahi, Rangpur, Kustia & Barisal) *Research Progress:* Data collection, data entry is completed and ready for analysis.	1. To identify high yielding aus rice varieties having wide adaptation and/or specific adaptation to environment 2. To assess the environment and variety interaction and varietal adaptability across different the environments 3. To determine the stability index of the variety using the BRRI developed stability model.
2.	Project: Multivariate Analysis of BRRI Varieties *2.1 Experiment/Study:* Assessment of consumer's preference for BRRI released rice varieties in Bangladesh (In collaboration with Agril. Econ. Div. GQN and GRS) *Research Progress:* Questionnaire construction is completed and ready for data collection.	1. To find out the most important attributes that consumers consider when purchasing rice. 2. To identify consumers' perception towards BRRI released rice varieties. 3. To determine the attributes for which consumers are willingness to pay for BRRI released rice varieties
	2.2 Experiment/Study: Prospects of BRRI dhan62 and BRRI dhan72 cultivation in Bangladesh *Research Progress:*	1. To find out the acceptability of BRRI dhan62 and BRRI dhan72 in Bangladesh. 2. To assess the regional yield performance of BRRI dhan62

	Format of for Questionnaire survey is ready	and BRRI dhan72. 3. To identify the major problis ready ems of BRRI dhan62 and BRRI dhan72 with respect to farmers perspectives.
	2.3 Experiment/Study: Maintenance of rice database *Research Progress:* Data is updating continuously & introducing important related data.	1. To maintain up-to-date computerized information on rice
	Project: Crop Modeling *3.1 Experiment/Study:* Seasonal weather forecasting for rice production in Bangladesh *Research Progress:* Data collection, data entry is completed and ready for analysis.	1. To develop a suitable model for forecasting seasonal weather 2. To enrich the technical capacity for crop management using seasonal weather forecasting.
	3.2 Experiment/Study: Effects of edaphic and climatic factors on yield of BRRI released varieties in Bangladesh *Research Progress* Data collection of Aman varieties is going on and Boro variety in the field. Analysis program is under process	1. To identify the location specific BRRI released rice varieties in Bangladesh 2. To assess the possible change in yield of BRRI released rice varieties due to different edaphic and climatic factors
	3.3 Experiment/Study: Identification of drought prone area in Bangladesh through Standardized Precipitation Index and Markov Chain Model *Research Progress* Data collection and processing is complete.	1. To explore yearly and seasonal variability of drought based on different threshold level of rainfall. 2. To estimate Standardized Precipitation Index (SPI), drought index (DI) for different threshold values of rainfall for all meteorological stations in Bangladesh. 3. Construct different types of GIS Maps according to drought prone area in Bangladesh.

4.	Project: Geographical Information System (GIS) *4.1 Experiment/Study:* Rice zoning of BRRI varieties (In collaboration with Plant Breeding Div., Soil Science Div. and ARD) *Research Progress:* Suitability map of BRRI dhan62 and BRRI hybrid dhan4 has been completed and a model has been developed and validated to calculate upazila wise area of percentage for suitability class. Within very short time based on suitable percent area for each upazila, rice zoning map will be completed	1. To construct suitability map of newly released BRRI rice varieties. 2. To construct upazila wise zonal map of newly released BRRI rice varieties
	4.1 Experiment/Study: Identification of suitable area of irrigated rice (Boro) based on groundwater level (In collaboration with IWM Division) *Research Progress:* For this year Natore district is selected with the discussion of IWM division. Groundwater table data for Natore district 2002 – 2014 has been collected from Bangladesh Water Development Board (BWDB) and data has been sorted and prepared contour maps (maximum, minimum water table and fluctuation). For the analysis of socioeconomic impact of groundwater table to study area a questionnaire survey has been conducted.	1. To determine depth, variability and flow direction of ground water study area. 2. To identify impact of groundwater depth on Boro rice production 3. Identify vulnerable area of Boro rice with respect to groundwater fluctuation of the study area.
5.	Project: Capacity Building Through Training *5.1 Experiment/Study:* Training program on experimental data analysis *Research Progress:* Seventy (70) scientists/officers were trained up on "Programming R for Experimental Design and Data Analysis " by four (04) batch.	1. To train up BRRI scientists on experimental data analysis using different Statistical software. 2. To make BRRI scientists self-dependent on experimental data analysis. 3. To developed skills on research planning, program and report writing.
6.	Project: Information and Communication Technology (ICT) *Activity 6.:* Mobile Apps of RKB *Research Progress:* 1. The mobile Apps of RKB is developed by our ICT skill manpower with the help of MCC. 2. RKB is hosted to Google Play Store. 3. Manage and maintain RKB through regular	1. Linking poor farmers to urban, regional and global markets; 2. To help farmers managing a range of risks; 3. To help poor farmers participating in higher value agriculture 4. To Increase smallholder

	updating with the information and documents.	productivity and incomes through mobile apps
	6 .2 Activity: e-File (Nothi) Management System of BRRI *Research Progress:* 1. e-File (Nothi) Management System is already introduced at BRRI with help of A2i, Prime Minister's Office (PMO). 2. Started and issued various file and official letter through e-Filing (Nothi) system at BRRI HQ.	1. To setup "e-File (Nothi) Management System" for all division, R/S and section of BRRI for establishing e-Governance. 2. To setup "e-File (Nothi) Management System" for ensuring faster movement of files, hassle less and paperless office system. 3. To setup "e-File (Nothi) Management System" for increased transparency throughout the organization and increased accountability in governance.
	6*.3 Activity:* e-Tender System of BRRI *Research Progress:* 1. To introduces the online tendering system to facilitate the procurement process of BRRI. 2. To participate in the local and international tender/procurement of BRRI. 3. To increase transparency and competition and minimize the processing time and effort.	1. Hosting e-GP system software of BRRI is already completed and started all type of procurement under e-GP on July' 2016.
	6.4 Activity: Management Information System (MIS) of BRRI *Research Progress:* 1. The MIS Software was setup to BRRI server. All scientists & Class 1 officers was connected to MIS Software through BRRI network. 2. Data entry of the 7 (Seven) modules has been already started in MIS Software. 3. ICT manpower gets Backup of MIS database every day after 5 P.M.	1. To manage, maintain and update all types of data of 7 (Seven) modules out of 9 (Nine) modules; 2. To keep Backup all data (09 Module of MIS) every day.
	6.5 Activity: BRRI Web portal Management *Research Progress:* 1. The dynamic website (Web Portal) of BRRI is developed by our ICT skill manpower of ICT Cell, Agricultural Statistics Division helping by Access to Information (A2i) Program. 2. BRRI website is hosted to Bangladesh Computer Council (BCC) server. 3. We have included Rice database, Weather	1. To develop the blank pages and modify the design of BRRI Web Portal. 2. To manage and maintain BRRI Web Portal through regular updating with various information and documents.

	database etc in web portal.	
	6 .6 Activity: Management of BRRI Local Area Network and Internet Connectivity *Research Progress:* 1. We have already provided internet connection in 300 computers. 2. We have increased internet bandwidth speed from 35 Mbps to 40 Mbps.	1. To initiate e-Governance in BRRI 2. To manage and maintain ICT network and internet connectivity of BRRI.
	6 .7 Activity: Video Conference System of BRRI *Research Progress:* 3. ICT Cell of Agricultural Statistics division provided Video conference system setup related support services such as Skype software, installation webcam and headphone etc.	1. To develop "Video conference system of BRRI" for administration, all divisional head and regional station head of BRRI. 2. To develop "Video conference system of BRRI" for research, administration works and innovative interactions.
	6 .8 Activity: Digital Signature System of BRRI *Research Progress:* 1. BRRI has already implemented Digital Signature Certificate processing by CCA under Information & Communication technology (ICT) division of Govt. of Bangladesh. Also, ICT Cell of Agricultural Statistics division distributed *53 (Fifty Three)* in first phase & *63 (Sixty Three)* in second phase digital signature certificate of scientists and officers of BRRI. 2. It has arranged two times workshop by ICT Cell for distributing digital signature certificate for scientists and officers of BRRI, where officials of CCA have staged.	1. To develop unique system for the sender 2. To develop proper integrity, accountability and confidentiality.
	6 .9 Activity: Heritage of BRRI *Research Progress:* 1. We have created Heritage for all retired scientists, officers, staffs and all labours of BRRI as per requirement of the BRRI authority. 2. Heritage is updated regularly as per availability of information. It is a routine work.	1. To develop "Heritage" for all retired scientists, all officers, all staffs, and all labours of BRRI. 2. Create and stimulate awareness amongst the present employees of BRRI about ex. Scientists and officer's great activity so that they can follow their instruction and inform about

		their noble work.
	6 .10 Activity: Online Application System of BRRI *Research Progress:* **1** Already took necessary steps to introduce online recruitment system through Teletalk Mobile Company Ltd. **2** Preparing SLA (Service Level Agreement) for introducing online recruitment system at BRRI.	1. To develop "e-Application System Software (e-ASS)". 2. To host "e-ASS" under national data center server. 3. To manage and maintain "e-ASS" through regular updating of the information and documents.
	6 .11 Activity: BRKB Website Management *Research Progress:* 1. Updated regularly with latest information of Aman, Aus & Boro Rice varieties included latest variety of BRRI 78 & Hybrid Dhan5. 2. All types of information i.e soil and fertilizer management, insects and Rice diseases management etc also updated regularly. It is a routine work.	1. To develop the blank pages and modify the design of BRKB Website. 2. To manage and maintain BRKB Website through regular updating of the information and documents.
	6 .12 Activity: BRRI Networks Update, Maintenance & Extension *Research Progress:* **1** At present, ***2****50 (*Two hundred ***&*** Fifty) are joined this *BRRI Networks* group. It will be increased more gradually. **2** Updated regularly by skilled ICT Cell employee to protect from all types of unwanted post, photo and other's spam.	1. To increase and stimulate awareness to all visitors of facebook group through 'BRRI Networks'. 2. To extend, manage, update and maintain 'BRRI Networks' regularly. 3. To promote all activities, where only official interactions, various problems and theirs solutions can be post.
	6 .13 Activity: LAN and internet connectivity of BRRI regional station (R/S) *Research Progress:* **1** Established Local Area Network (LAN) connectivity at five regional stations i.e. Rangpur, Barisal, Sonagazi, Comilla and Habigonj. **2** Established WiFi connection at five regional stations i.e. Rangpur, Barisal, Sonagazi, Comilla and Habigonj.	1. To setup Local Area Network (LAN) for all regional station of BRRI. 2. To setup Internet connectivity for all regional station of BRRI. 3. To manage and maintain LAN & Internet connectivity of BRRI regional station.

	6 .14 Activity: BRRI Web mail and Group mail *Research Progress:* 1. Created individual e-mail id into BRRI domain for all scientists and all class one officers 2. Hosting of BRRI Web mail & Group mail into BCC (Bangladesh Computer Council) server.	1. To create Web mail and Group mail id with password for all scientists and officers of BRRI. 2. To manage, maintain and update regularly as routine work web mail and group mail of BRRI.
	6 .15 Activity: Personal Data Sheet (PDS) of BRRI *Research Progress:* **1** Created Personal Data Sheet (PDS) database including various information fields for all scientists, officers, stuffs as per requirement of the Ministry of Agriculture (MoA).	1. To develop "Personal Data Sheet (PDS)" database for all scientists, officers, clerks of BRRI. 2. To develop "Personal Data Sheet (PDS)" database using user name & password. 3. To get BACKUP of "Personal Data Sheet (PDS)" database regularly.

Farm Management Division
Research Progress 2016-2017

Sl. No.	Research Progress	Expected output
Program area: Socio-economic and Policy		
03.	Farm Management Division	
	3.1. Project: Rice Production Management	
	• Expt. 1. The influence of seedling age on tiller production, yield and yield components of rice. Progress: It has been reported in the last BRRI Annual report 2016-17.	Tiller number, yield and yield components may increase with decreasing seedling age.
	• Expt.2. Seed quality of different T. aman rice as affected by rainfed/drought in ripening phase. Progress: It has been reported in the last BRRI Annual report 2016-17.	Seed quality *i.e.* germination percentage, grain weight and seedling vigor may be affected due to rain fed or unavailable moisture during ripening stage.

	• Expt. 3. Effect of tillage operation on the productivity and profitability of rice cultivation. Treatments: ➢ T_1= Normal cultivation practice in farm ➢ T_2= Applying herbicide followed by one ploughing by PT/HT and laddering ➢ T_3= Removal of straw/grass by hand and one ploughing Progress: It has been reported in the last BRRI Annual report 2016-17.	There will be no significant yield difference but T2 treatment might be profitable.
	• Expt. 4. Effect of organic matter on soil properties and yield of rice Treatments: T_1= Control T_2= Chemical fertilizer as BRRI recom. T_3= Kitchen waste 3.0 t/ha T_4= Bio-slurry 3.0 t/ha T_5= Poultry litter 3.0 t/ha Progress: It has been reported in the last BRRI Annual report 2016-17.	Better source of organic matter may be identified to ensure rice yield maximization and soil health improvement.
	• Expt.5. Evaluation of Shamolbangla bio-fertilizer on the yield and pest incidence of rice. Treatments: T1 : 296 Kg/ha Mixed Fertilizer (237 Kg Shamol Bangla + 59 Kg Urea) before final land preparation T2: 296 Kg/ha Mixed Fertilizer at 20 DAT and Mulching T3 : BRRI Recommended Fertilizer (Control) Progress: It has been reported in the last BRRI Annual report 2016-17.	296 Kg/ha Mixed Fertilizer (237 Kg Shamol Bangla + 59 Kg Urea) before final land preparation might be produced better yield of rice.
	3.2. Project: Survey and development of data base for labor management	
	• Expt. 1. Monitoring the laborers' wages rate for rice cultivation around BRRI Farms. Progress: It has been reported in the last BRRI Annual report 2016-17.	The average wage rate through out the year may higher than last year

	3.3. Project: Management and utilization of land and other resources. • Ten activities were done on seed production, irrigation, drainage, beautification etc. These are the continuous routine activities Progress: It has been reported in the last BRRI Annual report 2016-17.	These are for the better outcome from farm land and researches.

Farm Machinery and Postharvest Technology Division

Research Progress 2016-2017

Programme Area 6: *Farm Mechanization and Postharvest Technology*
Research Division: *Farm Machinery and Postharvest Technology Division*

Sl. No.	*Research Progress*	**Expected output**
1.	Programme area /Project with duration**: Development of Agricultural Machineries**	
1.1	***Design and development of a head feed power thresher*** **Duration**: 2013-2017 **Progress:** • First two prototype was fabricated and evaluated their performance • Second version was developed, tested and fault identified • Third version (final) prototype was developed and lab-test going on • Field performance will be done during Boro, 2017	Head feed thresher will be available within 5 years.
1.2	***Design and development of single row conical and double row weeder*** **Duration**: 2014-2017 **Progress:** • A conical weeder was designed and fabricated in the FMPHT divisional research workshop to evaluate the performance and identify the constraints during operation for wet land rice cultivation. • The weight of the weeder is 5.4 kg • One prototype of double row weeder was completed in the FMPHT divisional workshop, BRRI. • Thoroughly test and evaluation of single row conical and double row weeder is going on. • For making easier and adjustable of the weeder, modification is continuing in the research workshop.	Conical weeder will be introduced to the farmer for smooth weeding.

Sl. No.	*Research Progress*	**Expected output**
1.3	***Design and development of whole feed mini combine harvester*** **Duration**: 2014-2017 **Progress:** • First two prototype (two model) was fabricated and evaluated their performance • For cleaning Cyclone separator development is under process • The preliminary performance of the 2nd version was tested in wheat and Aus 2016 season to find out the capacity, efficiency, operation fault etc. • The harvesting capacity and fuel consumption were found 0.23~0.27ha/h, 3.5~3.80 l/h respectively.	Prototype of whole feed mini combine harvester will be available for Bangladesh condition.
1.4	***Development of manual rice transplanter*** **Duration**: 2016-2017 **Progress:** • A 20 cm row to row spacing rice transplanter was fabricated in FMPHT research workshop and evacuated in BRRI field. • Result was found promising but machine weight was 29 kg • Molding for plastic version is under process to reduce weight • After complete of plastic version machine will be tested in BRRI farm	Appropriate manual rice transplanter for marginal farmer will be available.
1.5	***Development of seed sower machine for mat type seedling*** **Duration**: 2016-2017 **Progress:** A prototype of manually operated seed sower machine was designed and fabricated in FMPHT Divisional research workshop for uniform seed distribution in mat type seedling. The performance of the prototype was tested on the plastic tray and was compared with the manual sowing of same area. It revealed that the adjusting lever keeping on the middle of the 3 and 4 marked position of the machine gives the desired rated seed 120g/tray and uniformity of the seeds (2-4 seeds per square cm).	Manual seed sower machine for raising mat type seedling will be introduced

Sl. No.	*Research Progress*	**Expected output**
1.6	***Test and evaluation of reaper binder*** **Duration**: 2016-2018 **Progress:** A 5.0 hp single cylinder, 4 stroke engine operated reaper binder was evaluated to find out as an alternative harvesting machine for Bangladesh. BRRI has tried to popularized reaper in the farmers' field last fifteen years. However, it can't be popularized due to scatters of harvested paddy and lack of binding facilities. The capacity of reaper binder was 0.20 ha/h at an average operating speeds of 3.4 km/h. The average fuel consumption was found 875.30 ml/h. The cutting height was found 8-35 cm from ground level which is quite similar to traditional sickle cutting. As the reaper binder has binding facilities and overall field performance found quite good.	A suitable reaper binder will be introduced for Bangladesh condition
1.7	**Design and development of handle type manual rice transplanter for small scale farmers** **Duration**: 2016-2018 **Progress:** A manually operated four-row (fixed row to row 20 cm) handle-type rice transplanter was fabricated at research workshop of FMPHT division for mechanical transplanting of rice seedling in the field.Locally available materials were used to fabricate the machine.The capacity of the machine was about 0.05 ha/h. The number of plants per hill varies from 4 to 6. Comparing with traditional hand transplanting, the machine can save about 60% labour and 45% transplanting cost. One-person can operate this machine up to one hours and two persons need to operate the machine alternately for increasing machine efficiency and reducing human drudgery.	Appropriate handle type manual rice transplanter for marginal farmer will be available
2	***Project Title: Milling and Processing Technology***	
2.1	**Test, evaluation and modification of rubber roll de-husker** **Duration**: 2016-2017 **Progress:** A de-husking machine was developed to improve the husking efficiency of rice mill. BRRI dhan50 was processed in the modified husking machine and polished in friction type polisher. The capacity of the developed de-husker was more than 600 kg/h in one pass and about 800 kg/h in second pass operation. Husking efficiency was found more than 90% in one pass and 100% in second pass. Milling recovery of BRRI dhan50 was obtained 62%.	A suitable rubber roll de-husker will be introduced for Bangladesh condition

Sl. No.	*Research Progress*	**Expected output**
2.2	***Improvement of air-blow type engelberg huller*** **Duration**: 2014-2016 **Progress:** The milling performance was measured by changing the pulley diameter. Five different sizes of pulleys were used to compare the milling performance of milling machine. Among them, the pulley diameter of 254 mm with 730 rotor rpm produced 44% head rice (based on input paddy supply) which was appeared as promising level. In the commercially operated engelberg huller mill, rotor revolution maintained at 1200 rpm which was not suitable to process un-parboiled paddy due to increased broken rice. In this experiment, 1200 rpm for processing unparboiled paddy gives. The lowest head rice recovery (32%) and that highest broken rice (31%) were obtained when parboiled rice was milled at 1200 rpm.	Improved rice milling system will be developed within 3 years
2.3	***Study on milling recovery of BRRI dhan63 under different moisture content*** **Duration**: 2014-2016 **Progress:** The rice variety BRRI dhan63 as parboiled rice was milled in the air blow type engelberg huller at six different moisture contents (9.3%, 10.1%, 11.3%, 12.2%, 13.3% and 14.1%) to find out the optimum moisture content for milling. It revealed that, 10-11% moisture content (wb) was suitable for milling parboiled paddy in the air blow type engelberg huller and 10% moisture content (wb) was found best in terms of head rice recovery (59.4%).	Premium quality rice milling data base will be developed.
3	***Project Title:*** **Renewable Energy Technology**	
3.1	**Study the briquette production from rice byproduct** **Duration**: 2014-2016 **Progress:** • *Electric coil, screw, barrel has redesigned for this experiment* • *Experiment was conducted at different ratio of rice straw and husk (20% straw + 80% husk, 30% straw + 70% husk, 40% straw + 60% husk)* • *In the mean time main switch has become out of odder*	Good quality briquettes will be produced
4	***Project Title:*** **Popularization of BRRI developed farm machinery and Postharvest technology**	

Sl. No.	*Research Progress*	**Expected output**
4.1	**Selective mechanization in wet season rice cultivation for enhancing productivity** **Duration**: 2016-2017 **Progress:** Mechanization at four different selective levels in six consequent operations was evaluated in farmer's field at Pirgacha, Rangpur during wet season (June to November) 2015. The mechanization systems were S_1 = hand transplanting + hand weeding + harvesting by sickle; S_2 = mechanical transplanting+ BRRI weeder + reaper; S_3 = mechanical transplanting + BRRI power weeder + reaper and S_4 = mechanical transplanting + herbicide + reaper. The experiment was carried out in randomized complete block design (RCBD). Mechanical transplanting reduced 61% labor and 18% cost compared manual transplanting. BRRI weeder, BRRI power weeder and herbicide application reduced 74, 91 and 98% labor whereas 72, 63 and 82% cost compared hand weeding. Herbicide application reduced the substantial amount of labor and cost in weeding operation. Mechanical harvesting also saved 96% labor and 72% cost compared to traditional method of harvesting using sickle.	Selective mechanization will be saved cost compared to traditional method of rice cultivation.
4.2	***Business model development of reaper*** **Duration**: 2016-2017 **Progress:** A study was performed to develop a business model based on the pros and cons of using small self-propelled reaper in harvesting rice at Bamonkanda, Bhanga, Faridpur and Satashia, Muksudpur, Gopalganj during *Boro* season 2016. Two models of reaper were used in harvesting rice. Crops from 59 plots covering 2.84 ha of area were harvested by reaper without any major failure of machine. Data on the field performance of reaper were collected and socio-economic relationship between farm holders and laborers affecting different steps of harvesting and post harvesting operation was carefully observed.	Business model will be developed for reaper

Workshop Machinery and Maintenance

Research Progress 2016-17

Sl. No.	Research Progress	Expected output
1	Design and development of power transmission system of a self-propelled power unit for multiple use Progress: Design of power transmission system of a self-propelled power unit has been done with the help of AutoCAD. Its fabrication is going on at BRRI research workshop.	A self-propelled power unit for multiple use will be developed.

2	Design, development, and modification of self-propelled reaper Progress: The complete design of self-propelled reaper has been done with the help of AutoCAD. Fabrication of the reaper is going on at BRRI Research Workshop. Test and evaluation of self-propelled reaper will be done at field level.	Self-propelled reaper will be developed and tested. Harvesting time, cost, human drudgery and yield loss will be minimized.
3	Modification of reaper travelling wheel for wet-land condition Progress: Self-propelled reaper travelling wheel have been modified and tested in wet paddy field at BRRI farm, Gazipur and it performed well in semi-wet land condition due to the increased contact area between the reaper travelling wheel and soil but there is a problem in tail-wheel to operate it in wet land. Its tail wheel has also been modified to operate it in wet land. It will be tested to overcome this problem.	Semi-wet land suited travelling wheel has been developed and tail wheel of this reaper will be developed.
4	Determination of tilling efficiency of power tiller at selected areas of Bangladesh Progress: Experiments were conducted in Aman 2016 and Boro 2017 seasons to determine paddy yield as influenced by different tillage depths (4-5 inch, 5-6 inch and 6-7 inch). It will also be tested in different places.	Optimum tillage depth for maximum paddy yield will be determined in different areas.
5	Potentiality of engineering workshop for enhancing farm mechanization in selected areas of Bangladesh Progress: Data has been collected by pre–prepared questionnaire from the engineering/manufacturing workshops of Shailakupa, Jhenidah and Chuadanga Sadar Upazilla. It will be continued.	Present status of engineering workshop will be identified.
6	Survey on status and constraint of farm machinery used in farmer's field at selected areas Progress: Data has been collected by pre–prepared questionnaire from the Modhupur and Sripur villages of Sripur upazilla of Magura District. It will be continued.	Present status of agricultural mechanization will be identified.

Adaptive Research Division

Research Progress: 2016-2017

Sl. No.	Research Progress Expt. Title and locations	Expected output
1.1	ALART, T. Aus 2016: BRRI Gazipur (East byde), Noakhali (Sadar), Comilla (Chandina), B. Baria (Sadar), Chittagong (Mirsori), Feni	Two advanced lines: BR7718-55-1-3 and WKI along with BRRI dhan48 as a check were tested in seven locations. In terms of grain yield, growth duration, grain type and

	(Sadar), BRRI R/S Comilla	plant type, most of the farmers preferred both the advanced lines. Considering grain yield, growth duration, disease infections, farmers' opinion and other necessary aspects, the two advanced lines BR7718-55-1-3 and WKI were recommended for Proposed Variety Trial (PVT).
1.2	ALART, B. Aus 2016: BRRI Gazipur (East byde), Naogaon (Manda), Natore (Sadar), Rajshahi (Godagari), Rajshahi (Paba), Kushtia (Kumarkhali), Chuadanga (Damurhuda), Faridpur (Modhukhali), Habiganj (Sadar) and Sylhet (Golapganj)	Four advanced lines BI dhan5, BRH11-9-14-6-7B, IR92240-40-2-2-1 and BR7178-2B-19 along with BRRI dhan42 as check were tested in 10 locations. In terms of grain yield, growth duration and grain type, most of the farmers preferred BI dhan5. Considering grain yield, growth duration, disease tolerance, farmers' opinion and other necessary aspects, the advanced line BI dhan5 was recommended for Proposed Variety Trial (PVT).
1.3	ALART, Rainfed lowland rice-1 (RLR-1), T. Aman 2016: West byde (BRRI Gazipur), Natore (Sadar), Feni (Sadar), Khulna (Dumuria), Sherpur (Nakla), Chittagong (Hathazari), Jessore (Jhikorgacha), Sylhet (Golapganj), Rangpur (Sadar) and Barisal (Sadar)	Three advanced lines: IR70213-10-CPA 4-2-2-2, BR8214-19-3-4-1 and BR8214-23-1-3-1 along with BRRI dhan39 as check were tested at farmers' field in 10 locations. Farmers did not show so much interest about the entries compared to check variety BRRI dhan39. Considering grain yield, grain size, growth duration, lodging tendency, phenotypic acceptance and farmers' opinion, none of the advanced lines was found suitable for PVT.
1.4	ALART, Rainfed lowland rice-2 (RLR-2), T. Aman 2016: West byde (BRRI Gazipur), Rajshahi (Paba), Naogaon (Manda), Chapainawabgonj (Sadar), Nilphamari (Syedpur), Panchogor (Sadar), Thakurgaon (Sadar) and Rangpur (Sadar)	One swarna type advanced line BR8210-10-3-1-2 along with checks, BRRI dhan49, Lal Swarna and Local Swarna checks (Sumon swarna, Swarna-59, Guti Swarna, Swarna pari, Swarna-5) were tested at farmers' field in eight locations. In respect to grain yield, grain size, growth duration and disease incidence, farmers did not show interest about the tested advanced line over the check varieties. Considering grain yield, growth duration, grain size, disease incidence and farmers' opinion, BR8210-10-3-1-2 was not recommended for PVT.
1.5	ALART, Rainfed lowland rice-3 (RLR-3), T. Aman 2016: West byde (BRRI Gazipur), Rajshahi (Paba), Naogaon (Manda), Chapainawabgonj (Sadar), Nilphamari (Syedpur), Panchogor (Sadar), Thakurgaon (Sadar) and	Five breeding materials: BR-SS(Raj)-PL5-B, BR-RS(Raj)-PL4-B, BR-NS(Rang)-PL2-B, BR-SF(Rang)-PL1-B and BR-GS(Raj)-PL3-B along with BR11 and BRRI dhan49 as checks were tested at farmers' field in eight locations. Considering grain yield, grain size, growth

	Rangpur (Sadar)	duration, phenotypic acceptance and farmers' opinion, BR-RS(Raj)-PL4-B (entry no. 2) and BR-SF(Rang)-PL1-B (entry no.4) may be considered for PVT.
1.6	ALART, Zinc enriched rice (ZER), T. Aman 2016: West byde (BRRI Gazipur), Natore (Sadar), Feni (Sadar), Khulna (Dumuria), Sherpur (Nakla), Chittagong (Hathazari), Jessore (Jhikorgacha), Sylhet (Golapganj), Rangpur (Sadar) and Barisal (Sadar)	Five zinc enriched advanced lines: BR7528-2R-HR16-12-3-P1, BR7528-2R-HR16-12-23-P1, IR84750-213-2-2-3-1, BR7895-4-3-3-2-3 and BR8445-54-6-6 along with BRRI dhan39, BRRI dhan49 and BRRI dhan72 as checks were tested at farmers' field in 10 locations. Considering grain yield, grain size, growth duration, disease reaction, lodging tendency, phenotypic acceptance and farmers'opinion, none of the advance lines was recommended for PVT.
1.7	ALART (RLR), Biotechnology, T. Aman 2016: West byde (BRRI Gazipur), Natore (Sadar), Feni (Sadar), Khulna (Dumuria), Sherpur (Nakla), Chittagong (Hathazari), Jessore (Jhikorgacha), Sylhet (Golapganj), Rangpur (Sadar) and Barisal (Sadar)	Two advanced breeding lines developed by Biotechnoly division: BR (Bio)9786-BC2-119-1-1 and BR (Bio)9786-BC2-132-1-3 along with BRRI dhan49 as check were tested at farmers' field in 10 locations. Considering grain yield, grain size, growth duration, phenotypic acceptance, disease tolerance and farmers' opinion, BR(Bio)9786-BC2-132-1-3 (entry no.2) was recommended for PVT.
1.8	ALART (DWR), B. Aman 2016: Sylhet (Golapgonj), Habigonj (Baniachang), Gopalgonj (Moksedpur), Faridpur (Bhanga), Shirajgonj (Tarash), Tangail (Basail), Pabna (Bera), Comilla (Daudkandi) and Natore (Boraigram).	Three advanced lines bred for semi deep water rice: BR9390-6-2-2B, BR10260-2-19-2B and BR7730-5-1-2B along with Lal Mohon and Habigonj Aman-1 as checks including local check (Fulkuri, Dhaldigi, Sarsaria, Manik digha, Lal Digha) were tested in nine locations. Farmers did not prefer the advanced lines due to its lower yield and longer duration. So, none of the advanced lines was recommended for PVT.
1.9	ALART, Favorable Boro Rice (FBR), Boro 2017: BRRI research farm (Gazipur), Rangpur (Sadar), Barisal (Sadar), Chittagong (Raojan), Hobigonj (Sadar), Khulna (Dumuria), Jessore (Jhikorgacha), Feni (Dagonbhuyan), Cox'bazar (Ramu) and Mymensingh (Sadar).	Three advanced lines for favorable condition: BR8338-34-3-4, BR8340-16-2-1 and BRRI dhan29-SC3-8-HR1 (Com) along with BRRI dhan58 and BRRI dhan29 as checks were evaluated in 10 locations. Considering grain yield, growth duration, grain size, lodging tolerance, phenotypic acceptance, disease tolerance and farmers' opinion, BRRI dhan29-SC3-8-HR1 (Com) was recommended for PVT.
1.10	ALART, Premium Quality Rice (PQR), Boro 2017: BRRI research farm (Gazipur), Rangpur (Sadar), Barisal	Two advanced lines for premium quality rice: BR8076-1-2-2-3 and BR7372-18-2-1-HR1-HR6 (Com) along with BRRI dhan50

	(Sadar), Chittagong (Raojan), Hobigonj (Sadar), Khulna (Dumuria), Jessore (Jhikorgacha), Feni (Dagonbhuyan), Cox'bazar (Ramu) and Mymensingh (Sadar)	and BRRI dhan63 as checks were evaluated in 10 locations. Considering all required characteristics, none of the lines was found suitable for PVT.
1.11	ALART, Cold Tolerant Rice (CTR), Boro 2017: BRRI research farm (Gazipur), Rangpur (Sadar), Rajshahi (Tanore), Naogaon (Manda), Panchagar (Sadar), Hobigonj (Sadar), Dinajpur (Sadar) and Kushtia (Sadar).	Cold tolerant advanced line BR7812-19-1-6-1-P2 along with BRRI dhan28 and BRRI dhan36 as checks were evaluated in eight locations. Averaged grain yield of the only advanced line was lower (5.43 t/ha) than the check varieties. On the other hand, mean growth duration of the line (151 days) was about 10 days longer than the check varieties (140-142 days). Flowering and maturity of the line was highly irregular. Moreover, it has a record of lodging tendency and Neck blast susceptibility. So, the line was not recommended for PVT.
1.12	ALART, Short duration (SD), Biotechnology, Boro 2017: BRRI research farm (Gazipur), Rangpur (Sadar), Barisal (Sadar), Chittagong (Raojan), Hobigonj (Sadar), Khulna (Dumuria), Jessore (Jhikorgacha), Feni (Dagonbhuyan), Cox'bazar (Ramu) and Mymensingh (Sadar)	Three advanced lines developed by Biotechnology division, : BR(Bio)9787-BC2-63-2-2, BR(Bio)9787-BC2-63-2-4 and BR(Bio)9787-BC2-173-1-3 along with BRRI dhan28 as check were evaluated in 10 locations. All the tested advanced lines gave lower mean yield, ranged from 5.45 to 5.70 t/ha, than the check variety BRRI dhan28 (5.97 t/ha). But the mean growth duration of the lines was higher (145-146 days) than the check (143 days). All the lines were found to be susceptible to sheath blight and also have higher shattering tendency at maturity. Considering the above situation and farmers' opinion, none found suitable for PVT.
1.13	ALART, Long duration (LD), Biotechnology, Boro 2017: BRRI research farm (Gazipur), Rangpur (Sadar), Barisal (Sadar), Chittagong (Raojan), Hobigonj (Sadar), Khulna (Dumuria), Jessore (Jhikorgacha), Feni (Dagonbhuyan), Cox'bazar (Ramu) and Mymensingh (Sadar).	Four long duration advanced lines developed by Biotechnology division: BR(Bio)9786-BC2-122-1-3, BR(Bio)9786-BC2-49-1-2, BR(Bio)9786-BC2-59-1-2 and BR(Bio)9786-BC2-124-1-1 along with BRRI dhan29 as check were evaluated in 10 locations. Considering grain yield, growth duration, grain size, lodging tolerance, phenotypic acceptance, disease tolerance and farmers' opinion, BR(Bio)9786-BC2-59-1-2 was recommended for PVT.

1.14	ALART, Long duration (LD), Comilla region, Boro 2017: BRRI research farm (Gazipur), Comilla (Daudkandi and Burichong), Feni (Dagonbhuyan), Laxmipur (Sadar), Chandpur (Hazigonj), B. Baria (Sadar) and Noakhali (Sonaimuri)	Three advanced lines: BR8261-19-1-13, HHZ15-SAL13-Y1 and BR7781-10-3-2-2 along with BRRI dhan58 as check were evaluated in eight locations of Comilla region. Having slightly lower growth duration (146-149 days) than the check (150 days), the advanced lines gave lower yield (5.10-5.92 t/ha) than the check BRRI dhan58 (6.31 t/ha). Flowering and maturity of entry no 1 and 2 was highly irregular. Although, it was uniform for entry no.3 but it had higher shattering tendency. Considering the above condition and farmers' opinion, none of the lines was recommended for PVT.

SN	Research Progress		Expected Output			
	Expt. Title (Dissemination Program)	Locations	Total production through demo (kg)	Seeds retained by farmers (kg)	Farmers gained awareness through demo (no.)	Motivated Farmer (no.)
2.1 SPDP under BRRI core program (GOB)						
2.1.1	SPDP during B. Aus, 2016 using BRRI dhan43 & BRRI dhan65	12 bighas in 6 upazilas of 3 districts (Magura, Rajbari & Sylhet)	4542	940	900	365
2.1.2	SPDP in Jhum cultivation during Aus 2016 using BRRI dhan43 & BRRI dhan65	16 bighas in 8 upazilas of 3 hilly districts (Khagrachari, Rangamati & Bandarban)	5190	557	1155	213
2.1.3	SPDP in valley during T. Aus, 2016 using BRRI dhan55	16 bighas in 8 upazilas of 3 hilly districts (Khagrachari, Rangamati & Bandarban)	4481	495	710	167
2.1.4	SPDP with USG during T. Aman 2016	96 bighas in 32 upazilas of 16 districts (Sherpur,	26630	2708	4924	1375

	using BRRI dhan34, 41, 49, 54, 56, 57, 62, 66, 71, 72 and 73	Netrakana, Gazipur, Rajbari, Khulna, Jessore, Naogoan, C. Nawabganj, Gaibandha, Thakurgoan, Panchagarh, Jhalokathi, Pirojpur, Chittagong, Cox's Bazar & Sylhet)				
2.1.5	SPDP with USG during Boro 2017 using BRRI dhan47, 50, 55, 58, 60, 63, 64, 67, 69 & 74	99 bighas in 33 upazilas of 17 districts (Sherpur, Netrakana, Mymensingh, Khulna, Jessore, Chuadanga, Noagoan, Gaibandha, Dinajpur, Pirojpur, Bhola, Sunamganj, Feni, Chittagong, Cox's Bazar, Khagrachari & Bandarban)	70321	11443	9834	2112
SPDP under Strengthening Physical Infrastructure and Research Activities of BRRI (SPIRA)						
2.1.6	SPDP with USG during Boro 2017 using BRRI dhan58, 60 & 63	42 bighas in 7 upazilas of 7 districts (Panchagarh, Thakhurgoan, Nilphamari, Bagerhat, Narsindhi, Sylhet & Moulivibazar)	35199	5665	3485	1179
SPDP under Transforming Rice Breeding Project (TRB)						
2.1.7	SPDP during T. Aus 2016 using BRRI dhan48.	8 bighas in 2 upazilas of 2 districts (Chuadanga & Rajshahi)	6100	2050	290	70
2.1.8	SPDP during T. Aman 2016 using BRRI dhan49, 52, 54, 56, 57, 62, 66, 70, 71, 72 and 73	68 bighas in 16 upazilas of 14 districts (Netrakana, Mymensingh, Khulna, Satkhira, Rajbari, Rajshahi, Chapai-Nawabganj, Naogaon, Dinajpur, Comilla, Chittagong,	42300	2715	4360	503

		Cox'sbazar, Sylhet and Moulovibazar)				
2.1.9	SPDP during Boro 2017 using BRRI dhan58, 60,63, 69, & 74	48 bighas in 11 upazilas of 9 districts (Netrakana, Mymensingh, Khulna, Rajshahi, Noagoan, Dinajpur, Comilla, Chittagong, Cox'sbazar and Sylhet)	40320	8465	4106	1560
SPDP under Mujibnagar Integrated Agricultural Development Project (MIADP)						
2.1.10	SPDP during T. Aman 2016 using BRRI dhan49, 52 & 57	36 bighas in 12 upazilas of 4 districts (Kushtia, Meherpur, Chuadanga & Jhinaidah)	22039	2307	2341	888
Grand Total			2,57,122	37,345	32,105	8,432

2.2 Seed support to stakeholders under TRB project

	Research Progress		Expected Output				
SN	Expt. Title (Dissemination Program)	Locations	Seed distributed (kg)	Area coverage (bigha)	Farmers/ Stakeholder (no.)	Upazila coverage (no.)	District coverage (no.)
2.2.1	Seed support during Aman 2016 using 12 varieties such as BRRI dhan34, 49, 52, 54, 56, 57, 62, 66, 70, 71, 72 and 73	60 upazilas of 20 districts (Sherpur, Jamalpur, Netrakana, Mymensingh, Rajbari, Gazipur, Tangail, Dhaka, Manikganj, Chuadanga, Joypurhat, Chapai-Nawabganj, Bogra, Rangpur, Panchgarh, Chittagong, Bhola)	1710	322	266	60	17
2.2.2	Seed support during Boro 2017 using 11	75 upazilas of 30 districts (Gazipur,	2100	420	300	74	30

	varieties such as BRRI dhan29, 50, 55, 58, 59, 60, 63, 64, 67, 69, & 74	Tangail, Manikganj, Faridpur, Netrakana, Mymensingh, Chuadanga, Jessore, Khulna, Bagerhat, Naogaon, Bogra, Chapai Nawabganj, Joypurhat, Gaibandha, Lalmonirhat, Kurigram, Dinajpur, Chittagong, Cox'sbazar, Comilla, Feni, Laxmipur, Brahmanbaria, Noakhali, Khagrachari, Rangamati, Bandarban and Habiganj)					
Grand Total			**3810**	**742**	**566**	**134**	**47**

Sl. No.	Research Progress	Expected Output
3.1 Farmers training		
	Farmers' training on modern rice production technologies during 2016-17: A total of 48 farmers' trainings were conducted under GOB and different projects (SPIRA, TRB & MIADP).	About 1,735 farmers and DAE field staffs were trained about modern rice production technologies.
3.2	Field day: A total of 43 field days were conducted during 2016-2017 under GOB and different projects (SPIRA, TRB & MIADP).	About 6,450 farmers and DAE personnel and local elite people participated and gained knowledge about BRRI technologies.
3.3	Establishment of Farmers seed center under TRB. Two seed centers for farmers were established at Singherbangla, Sadar, Netrakana and Kushodanga, Koyra, Khulna, where eight plastic drums were	Around 80 kg seeds will be preserved in each drum. Farmers will preserve good quality seed of promising rice

	provided at each center.	varieties for rapid dissemination through seed exchange or selling among the farmers.

Training Division

Research Progress 2016-17

Sl. No.	Research Progress	Expected Output
I	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 mater will be increased.
	1.1 Modern rice production training. Participants: SAAO Duration: 1 week No. of participants: 272 Progress: Completed	Knowledge of the trained SAAO on modern rice production technologies will be enriched. They can also able to provide better service on identification and solution of rice cultivation problems in the field.
	1.2 Hands-on training on modern rice production training (SPIRA). Participants: SAAO and NGO officer Duration: 1 week No. of participants: 343 Progress: Completed	Trained personnel will be able to identify field problems of rice cultivation and solve the problem.
	1.3 Rice production management training (SPIRA). Participants: DAE and NGO officer Duration: 3-day No. of participants: 230 Progress: Completed	Knowledge of the participants on different management aspects of rice production will be increased.
	1.4 Integrated rice production training (PGB) Participants: SAAO Duration: 1 week No. of participants: 30 Progress: Completed	Trained personnel will be able to identify field problems of rice cultivation and solve the problem. Rice production in the project area will be increased.
	1.5 Rice production management training (PGB). Participants: SO,SSO and DAE officers Duration: 3-day No. of participants: 78 Progress: Completed	Knowledge of the participants on different management aspects of rice production will be increased. Rice production in the project area will be increased.
	1.6 Experimental design and data analysis training (PGB). Participants: SO,SSO Duration: 3-day No. of participants: 58 Progress: Completed	Knowledge of the participants on experimental design and data analysis procedure will be enriched.
	1.7 Modern rice production training	Knowledge of Imams on modern rice

	(GOB) Participants: Imam. Duration: 3-day No. of participants: 30 Progress: Completed	production technologies will be increased.
II	Evaluation of imparted training program	
	2.1 Performance of long and short term training programs Participants: 1-week trainees.	This will help improvement of training course and method of training
III	BRKB and its improvement	
	3.1 Bangladesh Rice Knowledge Bank Updated: On going	Updated information on rice production technologies will be available.

Regional Station

Regional Station, Barisal

Research Progress 2016-2017

Sl #	Research Progress	Expected output
Programme area/Project with duration: Regional Station, 2016-2017		
1	Development of Tidal Submergence Tolerant Rice • Hybridization for the development of Varieties under Tidal Submergence was done and eleven F1s were obtained involving parents BR23, BRRI dhan52, BRRI dhan62, BRRI dhan76, BRRI dhan77, BRH11-9-11-4-5B, BR7988-14-1-4-4-2, Balam, Dudhkalam, Local Mala and Borsha during T. Aman 2016. • Hybridization for the development of introgression of dense and erect panicle gene in Indica rice was done and fourteen F1s were obtained involving parents BRRI dhan28, BRRI dhan29, BRRI dhan62, BRRI dhan72, BRRI dhan67, MK1, MK2, MK3, MK4, MK5, MK6, MK7, MK8, AKT3 during Boro 2016-17.	Generate better genotypes
2	Regional Yield Trial (RYT) RYT during Aman 2016: Three trials were conducted under RYT during Aman 2016. In these trials- six lines in RYT (SD), five lines in RYT (RLR), four lines in RYT (MER) were evaluated against standard checks. Tested line BR (Bio) 8032-AC3-4-1-3 gave the highest yield (3.72 t/ha) compared to check variety BRRI dhan39 (3.12 t/ha) in RYT (SD). In other RYT tested lines were not satisfactory compared to check. RYT during Boro, 2016-17: During Boro, 2016-17 RYT, four lines in RYT (FB), two lines in RYT (DR), six lines in RYT (MER-1), four lines in RYT (SD) and five lines in RYT (LD-BB) were tested against standard check. The lines BR8626-19-5-1-2 (RYT-FB); BR8333-15-3-2-2 (RYT-DR); BR8631-12-3-5-P2 (RYT-MER-1); BR(Bio)9785-BC2-19-3-5 (RYT-SD); BR(Bio)8333-BC5-2-16, 8333-BC5-3-10 and BR(Bio)8333-BC5-2-22 were promising in this season.	Better genotypes could be used for further advancement.
3	Proposed Variety Trial (PVT) for T. Aman rice During Boro 2016-17 two lines viz. BR(Bio)8072-AC5-4-2-1-2-1 and BR(Bio)8072-AC8-1-1-3-1-1 were tested in PVT (SD) which produced similar yield to the check.	

Sl #	Research Progress	Expected output
4	Transforming Rice Breeding (TRB) program A total of 385 entries were grown during T.Aman 2016 of which 322 lines were selected for re-observational trial (OT). During Boro 2016-17 a total of 322 entries were grown of which 26 fixed lines were selected for further process and rest entries remained for re-observational trial (OT). One PYT was conducted during T. Aman 2016. In this trial fifteen advanced lines were evaluated against standard check. Based on yield performance BRBa4-1 and BRBa4-3 which gave 5.11 and 5.33 t/ha yield respectively may be recommended for further process. Six advanced lines along with three checks BRRI dhan28 (Sus. Ck), BRRI dhan29 (Sus.Ck) and IR BB 60 (Res. Ck) were tested in PYT for Boro 2016-17. The highest yield was obtained by BR9942-38-4 (7.55 t/ha) which was higher than other lines and standard checks.	Better genotypes could be used for further advancement.
5	Advanced Line Adaptive Research Trial (ALART) ALART (T. Aman 2016): Three ALART programs were conducted during T. Aman 2016. In ALART (RLR-1) advanced line BR8214-23-1-3-1 gave the highest yield (5.73 t/ha) followed by BR8214-19-3-4-1 (4.93 t/ha) which was significantly higher than check variety BRRIdhan39 (3.93 t/ha). The ALART (MER) and ALART (Biotechnology) were totally damaged due to heavy rain after transplanting. ALART (Boro 2016-17): Five ALART programs were conducted during Boro 2016-17. In ALART (BIO-LD), advanced line BR(Bio)9786-BC2-122-1-3 gave the highest yield (7.64 t/ha) which was non-significantly followed by BR(Bio)9786-BC2-59-1-2 (7.58 t/ha) and the check variety BRRI dhan29 (7.14 t/ha). In ALART (FBR), BRRI dhan29-SC3-8-HR1 (Com) (6.75 t/ha) gave little bit higher yield than check variety BRRI dhan58 (6.62 t/ha). In other ALARTs, advanched lines gave lower yield than their corresponding standard checks.	Better genotypes could be used for further advancement.
6	Integrated approach on rice false smut disease management False smut disease was increased with the increasing of N-level. No false smut disease was observed at 1st and 2nd seeding time but increased at late planting. Lower number of balls on panicle was observed when N2 (1/3rd less than optimum N) and C3 (Azoxystrobin+Propiconazole) was applied at 3rd seeding time.	False smut disease management technique could be established
7	Screening of chemicals against blast disease of rice during T. Aman 2016 Out of twenty test chemicals tested on BRRI dhan34 against rice blast disease eight viz. Metrobin, Royal, Aiker, Sunzoxy, Navera, Seltima, Mcvo and Alivo significantly reduced neck blast over negative control (plain water used) and were similar to standard check chemical Nativo. Further test of those effective chemicals was suggested for the next season.	Effective chemical (s) against blast disease could be identified
8	Demonstration of blast disease management practices at farmers' field Under blast management program during Boro 2016-17, Nativo performed better in reducing leaf and neck blast disease incidence by	Blast management practices could be used

Sl #	Research Progress	Expected output
	76.0% and 79.8% respectively over control.	by farmers
9	Survey & monitoring of rice diseases Survey was conducted at Barisal Region during 2016-17. Blast was recorded as major diseases. Sheath blight, brown spot and false smut (later cultivated crop) were also observed as a promising disease. High yielding variety BRRI dhan34 and local variety Kumragoir were highly infected by blast disease during the survey period.	Database could be created in order to develop forecasting models.
10	Insect pest and natural enemy incidence in light trap at BRRI Barisal Insect pests and natural enemies were monitored by using light traps. Total population of green leafhopper (GLH, 23820) were higher followed by yellow stem borer (YSB, 17877), brown plant hopper (BPH, 8530), long horned cricket (LHC, 3111), leaf folder (LF, 2005), rice bug (RB, 1351) and white backed plant hopper (WBPH, 896). Among the natural enemies total population of Staphylinid beetle (SPB, 9386), Green mirid bug (GMB, 8513) and Carabid beetle (CRB, 5986) were most prevalent. Other natural enemies such as Pygmy grass hopper (PGH, 628), Damsel fly (DSF, 217), Spider (SPD, 157) and Lady bird beetle (LBB, 81) were also present in a small amount.	Database could be created in order to develop forecasting models.
11	Long-term missing element trial It is observed from the yield data that all the nutrients (N, P, K, S and Zn) should be applied during T.Aman season to maintain soil nutrient levels as well as for optimum yield of BRRI dhan49. For Boro rice yield, N is the most limiting nutrient in tidal flooded soil.	Yield limiting factor (fertilizer) could be identified
12	Maximizing rice yield through the application of balanced fertilizer and organic amendment in Tidal flooded soil Large difference in the grain yields of the control and treated plots (2.6 – 3.9 t/ha) implies that the tidal flood prone char land soils must be fertilized properly with chemical and/or organic fertilizer in order to achieve desired yield of the HYV rice, particularly in Boro season. By the addition of organic manure, fertilizer application can be reduced up to 25% without sacrificing yield of Boro rice varieties.	Nutrient status of Tidal flooded soil could be understand
13	Screening of modern rice varieties for efficient zinc utilization in Tidal flooded soil Most of the HYVs perform well without Zn application in Char Badna soil conditions. In other words, the soil available Zn content (0.80 mg/kg) is sufficient to maintain optimum grain yield of Boro rice in this farm.	Zinc status of soil could be understand
14	Development of soil fertility maps of experimental farms, Sagordi and Char Badna The farm soil was neutral in reaction with low organic matter content and low to medium total nitrogen. The status of available P, K and Zn was quite high at Sagardi farm. However, the farm soil was highly deficient in available S indicating that S should be applied every season for optimum crop yield.	Nutrient status of soil could be understand
15	Planting time for Boro rice cultivation in saline areas (APSIM model) Among the six sowing dates, 30 November and 15 December were better in increasing plant height and yield irrespective of all tested	Planting time for Boro rice cultivation in

Sl #	Research Progress	Expected output
	varieties and locations. Irrespective of locations irrigation water productivity varied from 0.54 to 1.08 kg/m^3 and the total water productivity varied from 0.42 to 0.80 kg/m^3 for all the tested varieties.	saline areas could be identified
16	Exploration of Potential Irrigation Water Source for Boro Cultivation in Barisal Region Out of surveyed 14 unions, Durgapasha, Kobai, Rongosri, Padrishibpur, Niamoti, Vorpasha have the potential source of irrigation water and also there is available canal water and it is not dried in dry season.	Potential Irrigation Water Source for Boro Cultivation in Barisal Region could be identified
17	Assessment of suitable water resources availability for irrigation to increase crop production in tidal areas of Barisal region Through particular latitude, salinity level was highest in the Tetulia River followed by Boleshor and Biskhali River. The highest salinity (9.78dS/m) was found at Padma Bazar, Patharghata. There was low salinity throughout the Biskhali River. In the Paira Bondor the water salinity was 22.9dS/m which was unsuitable for irrigation. Salinity proceeds through time towards the upstream of the river. Therefore, there is potential for growing Rabi crops in the downstream where salinity remains below 1 dS/m before March.	Explore the source of suitable water for irrigation
18	Demonstration, seed production and scaling up of MV rice in Barisal region under PGB-IADP In Aus 2016, average yield of BRRI dhan26 was 3.4 tha^{-1} and BRRI dhan48 was 5.0 tha^{-1}. During T. Aman 2016, BRRI dhan52 produced an average of 5.59 tha^{-1}grain yield with growth duration of 139 days. On the other hand BRRI dhan62 gave 4.43 tha^{-1} grain yield with much shorter growth duration (99 days). Farmers chose BRRI dhan62 due to its shorter growth duration, zinc content and satisfactory grain yield. They also liked BRRI dhan52 as it survived after 2 weeks of tidal inundation. BRRI Hybrid dhan4 yielded 6.40 t/ha. In Boro 2016-17, irrespective of locations average grain yield of BRRI dhan28, BRRI dhan47, BRRI dhan58, BRRI dhan61, BRRI dhan64, BRRI dhan67 and BRRI Hybrid dhan3 were 6.56, 5.98, 7.11, 6.16, 7.12, 6.71 and 8.43tha^{-1}, respectively. Farmers of those localities were motivated to grow those varieties due to satisfactory grain yield. A total of 900 kg and 1200 kg seeds of BRRI released rice varieties were produced under PGB project during T. Aman 2016 and Boro 2016-17 seasons respectively.	Farmers were motivated with the varieties BRRI dhan48 in Aus, BRRI dhan52 and BRRI dhan62 in Aman and, BRRI dhan28, BRRI dhan47, BRRI dhan58, BRRI dhan61, BRRI dhan64, BRRI dhan67 and BRRI Hybrid dhan3 in Boro
19	Demonstration of Zn-rich Rice Under HarvestPlus Project Demonstration of BRRI dhan62 and BRRI dhan72 was conducted at Najirpur and Mollahat. Yield of BRRI dhan62 was ranged from 4.17-4.82 t/ha with average growth duration of 97 days. At Mollahat, Bagerhat yield of BRRI dhan72 was ranged from 5.15-5.95 t/ha with	Farmers were motivated to cultivate Zn-rich variety BRRI dhan62

Sl #	Research Progress	Expected output
	average growth duration of 129 days. In Boro 2016-17 yield of BRRI dhan64 was ranged from 5.65 to 6.99 t/ha having average growth duration of 150 days. Farmers were motivated to cultivate Zn-rich variety BRRI dhan62 and BRRI dhan64.	
20	Farmer's training under different projects BRRI Barisal Regional Station conducted 16 farmers' training in different locations of Barisal region during the reporting period. These training programs were conducted at Bamna, Barguna(02); Ujirpur, Barisal(02); Babuganj, Barisal(02), Barisal Sadar (02) and at Agoiljhara, Barisal(02) under GoB fumd; at Nazirpur, Pirojpur(02) and Mollahat, Bagerhat (02) under PGB project, one under SPIRA (25 farmers; 18 male and 07 female) at Mollahat, Bagerhat and one under Harvest plus project.	Awareness for adopting improved rice cultivation technologies and accelerate the dissemination of BRRI varieties was done.
21	Farmers' Field Day under different projects Six field days were conducted of which three under PGB-IADP (2 at Najirpur, Pirojpur and 1 at Fakirhat, Bagerhat), one under HarvestPlus Bangladesh (Mollahat, Bagerhat,) projects and two under SPIRA project (1 at Babuganj, Barisal and 1 at Bamna, Borguna). More than 900 (550 male and 350 female) farmers, extension personnel, administrative peoples, public leaders were participated on those programs. Most of the farmers were motivated with the varieties BRRI dhan48 (5.1 t/ha) for Aus, BRRI dhan62 (4.43 t/ha, Zn content and 99 days growth duration) and BRRI dhan52 (yield 5.12 t/ha and survives after 2 weeks of tidal inundation) for Aman and BRRI dhan64, BRRI dhan67 and BRRI Hybrid dhan3 in Boro due to satisfactory grain yield.	Farmers showed their interest to cultivate the demonstrated varieties in the next season.
22	Hybrid seed production A total of 300 kg (150 kg during T. Aman 2016 and 150 kg during Boro2016-17) of BRRI Hybrid dhan3 was produced and provided to the farmers of this region to cultivate and disseminate.	BRRI released Hybrid varieties would be disseminated
23	Breeder seed production In T. Aman 2016, a total of 12000 kg (BR23=1200 kg, BRRI dhan34=2000, BRRI dhan41=1000, BRRI dhan44=600 kg, BRRI dhan52=4500 kg, BRRI dhan73=1700, BRRI dhan76=500 kg and BRRI dhan77=500 kg) and in Boro 2016-17, a total of 14100 kg (BR26=5000 kg, BRRI dhan28=5000 kg, BRRI dhan29=2000 kg, BRRI dhan60=1100 kg and BRRI dhan61=1000 kg) breeder seed were produced.	BRRI released varieties would be disseminated quickly to farmers
24	TLS production In T. Aman 2016, a total of 11045 kg (BR22=353 kg, BR23=696 kg, BRRI dhan34=752 kg, BRRI dhan41=511 kg, BRRI dhan44=190 kg, BRRI dhan49=1417, BRRI dhan52=850 kg, BRRI dhan53=244 kg, BRRI dhan54=328 kg, BRRI dhan62=266 kg, BRRI dhan73=429 kg, BRRI dhan75=366 kg, BRRI dhan76=3023 kg and BRRI dhan77=1620 kg) and in Boro 2016-17, a total of 4250 kg (BRRI	BRRI released varieties would be disseminated quickly to farmers

Sl #	Research Progress	Expected output
	dhan28=450 kg, BRRI dhan47=600 kg, BRRI dhan50=400 kg, BRRI dhan58=700, BRRI dhan64=800 kg, BRRI dhan63=200 and BRRI dhan67=1100 g) TLS were produced.	

BRRI R/S, Bhanga, Faridpur

Research Progress 2016-2017

SI. No.	Research Progress	Expected output
	Programme area/ Project with duration	
1.	F_1 Confirmation and Growing of F_2 population (Improvement of rice for shallow flooded DWR environment) (T. Aman, 2016; Boro, 2016-17)	Five F_1s were confirmed, their 5 F_2 population were grown and single panicle of F_3 population was collected from each F_2 plant.
2.	F_1 Confirmation and Growing of F_2 population (Breeding for developing high yielding rice varieties for single Boro cropping pattern) (T. Aman, 2016; Boro, 2016-17)	Four F_1s were confirmed, their 4 F_2 population were grown and single panicle of F_3 population was collected from each F2 plant.
3.	Regional Yield Trial (RYT), Rainfed lowland rice (T. Aman, 2016)	The advance breeding line IR05N412 produced higher grain yield than the check varieties BRRI dhan49 with almost 20 days shorter growth duration.
4.	Regional Yield Trial (RYT), Micronutrient enriched rice, T. Aman, 2016	The line BR7528-2R-HR16-3-98-1 was found promising.
5.	Proposed Variety Trial (PVT), Short duration (Biotechnology) and Micronutrient enriched rice during Boro, 2016-17	BR(Bio)8072-AC8-1-1-3-1-1 produced 0.41 t/ha higher than the check variety BRRI dhan28 with almost similar growth duration of short duration (Biotechnology) trial. But in case of micronutrient enriched rice none of the tested entries produced higher grain yield than the check variety BRRI dhan28.
6.	Regional Yield Trial for favourable condition during Boro, 2016-17	The promising line was BR8109-29-2-2-3 for favourable boro.
7.	Regional Yield Trial for Premium quality rice during Boro, 2016-17	The promising lines were BR8590-5-3-3-4-2 and BRC266-5-1-1-1 for premium quality rice.
8.	Regional Yield Trial for Micro nutrient enriched rice during Boro, 2016-17	The promising lines were BR8253-18-1-3-2-1 and BR7671-37-2-2-3-7-3-P11 for micro nutrient enriched rice.
9.	Regional Yield Trial for Disease resistant during Boro, 2016-17	The promising line was BR8938-19-4-3-1-1 for disease resistant rice.
10.	Regional Yield Trial for Short duration (SD)-Biotech during Boro, 2016-17	The promising lines were BR(Bio)9785-BC2-6-2-2 and BR(Bio)9785-BC2-20-1-3 for short duration Boro.
11.	Regional Yield Trial for Long duration (LD)-Biotech during Boro, 2016-17	The promising lines were BR(Bio)8333-BC5-2-16 and BR(Bio)8333-BC5-3-10 for long duration Boro.

12.	Advance Yield Trial during Boro, 2016-17	The promising lines were GSR IR1-DQ136-Y8-Y1 and GSR IR1-17-D6-Y1-D1-11 for advance yield trial.
13.	Stability analysis of BRRI released Aman varieties (T. aman, 2016)	Based on yield of 25 hill for stability analysis of BRRI varieties, BRRI dhan46 gave the highest grain yield in long duration Aman varieties, BRRI dhan71 gave the highest yield (710.7 gm) in short duration Aman varieties and BRRI dhan49 gave the highest grain yield (486.3 gm) in medium duration Aman varieties.
14.	Stability analysis of BRRI released Boro varieties (Boro, 2016-17)	Based on yield of 25 hill for stability analysis of BRRI varieties, BR16 gave the highest grain yield (683.4gm) in long duration Boro varieties and BRRI hybrid dhan3 yielded the highest (783.3gm) in short duration Boro varieties.
15.	Evaluation of Aman establishment time as relay cropping with jute in Jute-Relay Aman-Onion cropping pattern in shallow deep water rice ecosystem (2016-17)	The highest REY (27.43 t/ha) was obtained from T_3 treatment, that was BRRI dhan49 relayed with jute before 2 weeks of harvesting followed.
16.	Identification of potential rice variety in Onion-Jute-Relay Aman cropping Pattern under shallow deep water rice ecosystem (2016-17)	The highest REY was obtained from BRRI dhan72 (28.43 t/ha).
17.	Demonstration of modern rice varieties in Aman and Boro seasons in greater Faridpur region (T. Aman, 2016; Boro, 2016-17)	In the farmers' field trials, yield of BRRI released T. Aman and Boro varieties were as follows: 5.5 t/ha with 119 days of BRRI dhan71 4.98 t/ha with 137 days for BRRI dhan73 and 5.41 t/ha with 116 days of BRRI hybrid dhan4 during T.Aman season, 2016; BRRI hybrid dhan2, BRRI hybrid dhan3 and BRRI hybrid dhan5 were 8.56 t/ha with 143 days, 8.83 t/ha with 143 days and 9.49 t/ha with 144 days respectively in Fakirhat and Mollarhat upazillas of Bagerhat district and different upazillas of Gopalganj district during Boro, 2016-17. In Gopalganj district, the mean grain yield was 7.23 t/ha with 150 days of BRRI dhan58, 6.95 t/ha with 148 days of BRRI dhan63.
18.	Demonstration trials and seed production of BRRI dhan72 and BRRI dhan74 in farmers' fields supported by HarvestPlus project (T. Aman, 2016; Boro, 2016-17)	Demonstration trials of BRRI dhan74 of five farmers and BRRI dhan72 of 25 farmers were set up in farmers' fields of greater Faridpur region during Boro, 2016-17. Highest grain yield of BRRI dhan74 was 8.13 t/ha while lowest was about 7.92 t/ha. Highest grain yield of BRRI dhan72 was 5.86 t/ha while lowest was about 4.0 t/ha. The trial farmers shared their experience to neighboring farmers during

		field day, which built interest among them to these varieties in their own plots and thereby a demand for quality seed was generated.
19.	Seed production and dissemination in BRRI Farm (Boro, 2016-17)	BRRI R/S, Bhanga farm produced about 30.37 tons of seeds of which about 15.02 tons of breeder seed of BRRI dhan28 and BRRI dhan29 and the rest were TLS during Boro season in 2016-17.

BRRI R/S, Comilla

Research Progress 2016-2017

Sl. No.	Research Progress	Expected Output
Programme Area: Varietal Development Program		
	Project: Breeding rice varieties for Comilla Region for T. Aus TRB project:	Improved genotypes with high yield potential along with earliness, resistance to lodging, major diseases and insect pests will be developed for Comilla region
1	Expt. 1: Observational trial (OT). 12 genotypes were selected among 73 genotypes.	
2	Expt. 2 : Preliminary Yield Trial (PYT). 3 genotypes were selected from PYT#1 4 genotypes were selected from PYT#2 HQ Program	
3	Expt. 3 : Regional yield trial (RYT) No genotypes were selected from RYT#HQ No genotypes were selected from RYT#Biotech BRRI Comilla Program	
4	Expt. 4 : Advanced Line Adaptive Research Trial (ALART) 2 genotypes were selected	
	Project: Breeding rice varieties for Comilla Region for T. Aman	Improved genotypes with high yield potential along with earliness, premium quality photoperiod sensitivity and resistance to lodging, major diseases and insect pests will be developed for
5	Expt. 1 : Hybridization 33 crosses were made using 21 parents	
6	Expt. 2 : F1 Confirmation 26 crosses were confirmed among 26 crosses.	
7	Expt. 3 : F2 Confirmation 233 progenies were selected among 37 crosses	
8	Expt. 4 : Pedigree nursery F3 – 58 progenies were selected among 212 progenies F4 - 101 progenies were selected and 01 homozygous breeding line progeny was bulked among 287 progenies	
9	F5 – 109 progenies were selected among 177 progenies F6 - 215 progenies were selected and 10 homozygous	

10 11 12 13 14 15 16 17 18	breeding lines progenies were bulked among 262 progenies Expt. 5: Observational Yield trial (OYT). 10 genotypes were selected among 65 genotypes from OT (Com) TRB project No genotypes were selected from OYT (BB) 4 genotypes were selected OYT (RLR) 12 genotypes were selected OYT (Drought) Expt. 6 : Preliminary Yield Trial (PYT). 2 genotypes were selected from PYT#1Com 4 genotypes were selected from PYT#2 Com (IRLON) TRB Project 1 genotype was selected from PYT#1 BB 2 genotypes were selected from PYT#2 BB 4 genotypes were selected from PYT#1 RLR 3 genotypes were selected from PYT#2 RLR 2 genotypes were selected from PYT#3 Drought Expt. 7 : Secondary Yield Trial (SYT) 1 genotype was selected from SYT# Com Expt. 8 : Regional yield trial (RYT) 2 genotypes were selected from RYT#2 (RLR) 2 genotypes were selected from RYT#2 (PQR) No genotypes were selected from rest of the RYTs Expt. 9 : Advanced yield trial (AYT) 2 genotypes were selected from AYT#2 (RLR) 1 genotype was selected from AYT#3 (PQR) No genotypes were selected from rest of the AYTs Expt. 10: Evaluation of Advanced water stagnation Lines for yield and other agronomic characters 4 genotypes were selected Expt. 13: Evaluation of IRLON(International Rainfed Lowland Rice Observational Nursery) materials 13 genotypes were selected from 36 genotypes	Comilla region

19	Expt. 14: Evaluation of MAGIC (Multi-Parent Advanced Generation Intercross) INDICA 2014 materials (First generation Module 1) 30 genotypes were selected from 34 genotypes	
20	Expt. 15: Evaluation of MAGIC (Multi-Parent Advanced Generation Intercross) INDICA 2014 materials (First generation Module 2) 10 genotypes were selected from 10 genotypes	
21	Expt. 16: Evaluation of MAGIC (Multi-Parent Advanced Generation Intercross) PLUS 2014 materials (First generation Module 1) 10 genotypes were selected from 23 genotypes	
22	Expt. 17: Evaluation of MAGIC (Multi-Parent Advanced Generation Intercross) PLUS 2014 materials (First generation Module 2) 10 genotypes were selected from 22 genotypes	
23	Expt. 18: Evaluation of MAGIC (Multi-Parent Advanced Generation Intercross) GLOBAL 2015 materials (Second generation Module 1) 15 genotypes were selected from 30 genotypes	
24	Expt. 19: Evaluation of MAGIC (Multi-Parent Advanced Generation Intercross) GLOBAL 2015 materials (Second generation Module 2)	
25	10 genotypes were selected from 22 genotypes	
26	Expt. 20: Evaluation of MAGIC (Multi-Parent Advanced Generation Intercross) INDICA 2015 materials (Second generation Module 1) 16 genotypes were selected from 33 genotypes	
	Expt. 21: Evaluation of MAGIC (Multi-Parent Advanced Generation Intercross) INDICA 2015 materials (Second generation Module 2) 11 genotypes were selected from 17 genotypes	

	Expt. 22 : Proposed Variety Trial (PVT) 1 genotypes was evaluated from PVT# RLR	
	Project: Breeding rice varieties for Comilla Region for Boro	Improved genotypes with high yield potential along with earliness, aroma and resistance to drought, major diseases and insect pests will be developed for Comilla region
27	Expt. 1 : Hybridization 26 crosses were made using 44 parents.	
28	Expt. 2 : F1 Confirmation 39 crosses were confirmed among 39 crosses.	
29	Expt. 3 : F2 Confirmation 1232 progenies were selected among 33 crosses.	
30	Expt. 4 : Pedigree nursery F3 – 647 progenies were selected from 618 progenies F4 – 234 progenies were selected from 199 progenies F5 – 81 progenies were selected from 37 homozygous breeding lines progenies were bulked from 136 F6 – 45 progenies were selected and 69 homozygous breeding lines progenies were bulked from 613 progenies F7 – 21 progenies were selected and 46 homozygous breeding lines progenies were bulked from 98 progenies	
31	Expt. 5: Observational trial (OT)TRB 22 genotypes were selected among 45 genotypes. Expt. 6: Preliminary yield trial (PYT) 2 genotypes were selected from PYT (Com)# IRLON All genotypes were selected from PYT#1 (Com) MST All genotypes were selected from PYT#2 Super Yielder No genotypes were selected from PYT#GSR ()HQ	
32	Expt. 7 : Secondary Yield Trial (SYT) 3 genotypes were selected from SYT# 1 Com IIRON 6 genotypes were selected from SYT# 2 Com No genotypes were selected from SYT# 1 GSR (HQ) No genotypes were selected from SYT#2 GSR (HQ)	
33	Expt. 7 : Regional yield trial (RYT) 1 genotype was selected from RYT#FB 1 genotype was selected from RYT#1 MER 1 genotype was selected from RYT# PQR No genotypes were selected from rest of RYTs	

	Expt. 9 : Advanced yield trial (AYT) 2 genotypes were selected from AYT# (Com) 2 genotypes were selected from AYT# (Farmers' field) No genotypes were selected from other AYTS	
34	Expt. 11: Evaluation of Spike Gene Lines (SGL) for yield and other agronomic characters 2 genotypes were evaluated from SGL	
35	Expt. 13: Evaluation of IIRON(International Irrigated Rice Observational Nursery) materials 20 genotypes were selected from 40 genotypes	
36	Expt. 14 : Proposed Variety Trial (PVT) 2 genotypes were evaluated from PVT# Com	
40	Expt. 1: Breeder seed production In T. Aman, 2325kg BR22, 525 kg BRRI dhan32, 975 kg BRRI dhan48, 5175 kg BRRI dhan49, 1650 kg BRRI dhan62 and 2625 kg BRRI dhan75. In Boro, 7950 kg BRRI dhan28, 4862 kg BRRI dhan29, 3215 kg BRRI dhan58 , 2550 kg BRRI dhan69 and 4493 kg BRRI dhan74 breeder seeds were produced and were sent to GRS division, BRRI Gazipur	increase of breeder seeds of T.Aman and Boro season with target amount
	Programme Area 02: Socio-Economics and Policy	
41	Expt.1: Stability Analysis of BRRI Varieties In Aman, among 37 varieties, considering yield performance, the top five varieties were BRRI dhan71, BRRI hybrid dhan4, BRRI dhan72, BRRI dhan44 and BRRI dhan32 In Boro, among 37 varieties considering yield performance, the top five varieties were BRRI hybrid dhan5, BRRI hybrid dhan3, BRRI dhan69, BRRI hybrid dhan2 and BR3.	Evaluation of BRRI developed T. aman and Boro varieties to determine the stability index
	Programme Area 03: Crop-Soil-Water Management	
42	Updating fertilizer doses through SSNM (Side Specific Nutrient Management) for BRRI released varieties In Aman, The newly released BRRI dhan75 produced	1.To quantify rice yieldresponsesto fertilizer application 2.To determine the optimum doses of N,P,K,S

	maximum grain yield & maximum straw yield at N levels of N_{200} kg urea/ha. In Boro, The newly released BRRI dhan75 produced maximum grain yield & maximum straw yield at N levels of N_{160} kg urea/ha.	and Zn for ALART materials/newly released varieties
43	Long-term effects of some macro and micronutrients on yield and nutrition of upland rice In Aman, BRRI dhan49, BRRI dhan62 and BRRI dhan62 produced respectively 4.55, 3.78 and 4.62 t/ha grain yield with added NPKZnS fertilizers, however, three varieties were not similar in lifecycle. Omission of N, P, K, Zn and S from complete treatment had a great effect on grain yield of tested varieties indicating that a maintenance dose of fertilizer is enough for these entries . Straw yield was significantly affected by the omission of N, P and K from complete treatment and the significantly lowest straw yield was obtained with N omission plot. The experimental results shown shat the applied fertilizer was higher than actual requirement. In Boro, BRRI dhan58, BRRI dhan69 and BRRI dhan75 produced respectively 8.02, 8.78 and 9.03 t/ha grain yield with added NPKZnS fertilizers (Table 1), however, three varieties were not similar in lifecycle. BRRI dhan58 (GD 149days), BRRI dhan69 (GD 151 days) and BRRI dhan75 (GD 157days). Omission of N, P, K, Zn and S from complete treatment had a great effect on grain yield of tested varieties indicating that a maintenance dose of fertilizer is enough for these entries. Straw yield was significantly affected by the omission of N, P and K from complete treatment and the lowest straw yield was obtained with N omission plot. The experimental results shown shat the applied fertilizer was higher than actual requirement.	1. Determine nutrient deficiency problems in soil through missing elements techniques. 2. To see long-term yield trend of rice under different nutrients managements 3. To evaluate the effect the changes in soil physical, chemical and biological properties under long-term fertilization
45	*Effectiveness of combining agronomic and genetic bio-fortification of rice with zinc in Bangladesh* Grain an In Comilla and Rajshahi location, grain Zn content increased with Wuxal spraying that decreased greatly with polishing . Grain Zn content in brown rice of BRRI dhan58 under control condition was about 17 μg^{-1} that increased to about 19 μg^{-1} through spraying treatment. Brown rice Zn	To find out the effectiveness of combining agronomic and genetic bio-fortification of Zn content in rice grains grown under two ecological conditions of Bangladesh.

	content with genetically modified BRRI dhan74 varied from 22.02-23.78 μg^{-1} under control condition, which increased to 24.25-25.79 μg^{-1} after Zn spraying. Grain polishing by 9-12% reduced Zn content by about 20-29% indicating that achievement of nutritional target is very much difficult in Bangladesh because in most cases over polishing is done in rice mill. Similar views were expressed by Bashir et al. (2013). Ramberg and McAnalley (2002) also reported that essential nutrients concentration decreases with the degree of milling. Nonetheless, 0.53-0.95 ppm more Zn in grains were found with spraying treatment even after 9-12% polishing compared control.	
	Programme Area 04: Pest Management	
52	Expt. 1: Effect of planting time on the incidence of false smut disease in BRRI dhan49 No false smut disease occurred in 1st (15 June) and 2nd (30 June) planting. The incidence of false smut disease (% panicle infection) was higher in 3rd planting time (15 July) than planting 1st and 2nd planting time (15 June and 30 June). The incidence of false smut disease was increased in late planting i.e. after month o June.	Control measures of false smut disease of rice
53	Expt. 2: Effect of fungicides on the incidence of false smut disease in BRRI dhan 49 Combination of Azoxystrobin and Dipekonazole resulted in lowest percent panicle infection and number of smut ball at 3rd (15 July) planting time compared to other chemicals.	Control measures of false smut disease of rice
54	Expt.3: Reaction and recoverability of T Aman varieties to tungro disease Comparatively late infection with medium severity did not affect the yield.But last Aman season, no disease occurred in the experimental plot.	Recover and tolerance ability to tungro disease
55	Expt. 4: Evaluation of advanced breeding lines against Tungro disease	Resistant line to tungro disease in Bangladesh condition

	Last Aman season, no Tungro disease occurred in the experimental plot.	
	Expt. 5: Survey and monitoring of rice diseases in selected areas Different rice diseases such as bacterial blight, sheath blight, brown spot and leaf scald were found in different rice varieties in the surveyed areas. On an average, disease incidence of bacterial blight, sheath blight, brown spot and leaf scald were 5-70, 10-80, 10-80 and 20-50 % respectively. Among the major diseases, sheath blight disease was found all the surveyed plots and it was observed as severe (7-9 scale) in some areas of Burichong and deviddar upazilla. Leaf scald disease (DI 20-50%, DS 1-3) was observed in different locations of Barura upazilla in BR22 rice variety. In Boro season, a survey was conducted at different Upzilla of Comilla district (Barura, Adarshaw sadar, Sadar Dhakkin, Laksham, Nangolkot, Deviddar and Muradnagar) to investigate disease status. In all area neck blast disease was prevalent (incidence: 10-30% with severity index 7-9) compared to bacterial blight and sheath blight disease. The highest incidence (30%) of neck blast disease was recorded in BRRIdhan28, BRRIdhan64, BRRIdhan58 and lowest (10%) in BRRIdhan29 with 5-7 severity index. The sever BLB disease (incidence : 70-80%) was found in hybrid rice/SL8 at Adarshaw sadar and Sadar Dhakkin.	To investigate the present status of different rice diseases in different climatic environment
	Programme Area 05: Technology Transfer	
56	Expt 2:Training /Agricultural Fair In this year, 380 farmers were trained and 30 Imam were also trained about rice cultivation procedure. BRRI Comilla also participated in three 'Krishi mela' held in Comilla region.	Farmers and other personnel are known to newly release varieties and modern rice production technologies

BRRI R/S, Habiganj

Research progress 2016-17

Sl. No.	Research progress Programme area/project with duration	Expected output
Varietal Development Program Area		
Project I: Improvement of Transplant Aman Rice		
01	Regional Yield Trial (RYT), High Yielding Rice (Biotechnology), T. Aman 2016	Out of six, four entries has given higher yield (4.2, 4.1, 4.3 and 5.0 t/ha) than BRRI dhan39 (4.0 t/ha). Among these four genotypes BR(Bio)8019-AC4-1-2-2 has given highest yield (5.0 t/ha) with 2 days longer growth duration than the check BRRI dhan39.
02	PVT of Submergence and water stagnation tolerant rice, T. Aman 2016	Two submergence cum stagnant flood tolerant entries along with two checks BRRI dhan49 and BRRI dhan52 were planted in the farmers field of Habiganj. Both the lines BR9159-8-5-40-14-57 (6.93 t ha^{-1}) and BR9159-8-5-40-13-52 (6.78 t ha^{-1}) yielded higher than BRRI dhan49 (6.73 t ha^{-1}) and BRRI dhan52 (5.51 t ha^{-1}) with 2-7 days shorter growth duration.
Project II: Irrigated Rice (Boro)		
01	Secondary Yield Trial (SYT) Short duration, Boro 2016-17	Out of three, IR12A255 yielded higher (4.7 t ha^{-1}) than BRRI dhan28 (4.1 t ha^{-1}) with 13 days longer growth duration. Yield was not satisfactory because unfavorable weather condition and inundation occurred at reproductive stage.
02	Secondary Yield Trial (SYT#3) deep water and other materials, Boro 2016-17	BR9390-6-2-2B (4.0 t ha^{-1}) and BRH11-9-11-4-5B (4.7 t ha^{-1}) yielded higher than the check variety BRRI dhan78 (3.2 t ha^{-1}) but lower than BRRI dhan28 (4.8 t ha^{-1}) with 11 days longer growth duration.
03	RYT of ddevelopment of Favorable Boro Rice (FBR), Boro 2016-17	Out of four, BR8109-29-2-2-3 yielded slightly higher (4.7 t ha^{-1}) than BRRI dhan28 (4.6 t ha^{-1}) with 5 days longer growth duration but lower than BRRI dhan58 (5.3 t ha^{-1}) and BRRI dhan29 (5.4 t ha^{-1}). Yield was not satisfactory because unfavorable weather condition and inundation occurred at reproductive stage.
04	RYT of development of Premium Quality Rice (PQR), Boro 2016-17	BR8079-19-1-5-1 (6.0 t ha^{-1}) yielded higher than BRRI dhan50 (4.3 t ha^{-1}) and BRRI dhan63 (5.0 t ha^{-1}) but similar to BRRI dhan63 (6.1 t ha^{-1}) with 1-10 days shorter growth duration followed by BR8590-5-2-5-2-2.
05	RYT of development of Disease Resistant Rice (DRR), Boro	BR8333-15-3-2-2 (5.0 t ha^{-1}) and BR8938-19-4-3-1-1 (4.3 t ha^{-1}) yielded higher than IRBB60 (R. ck) (3.6

	2016-17	t ha^{-1}) with 5 days longer growth duration and resistant to bacterial blight disease but lower than BRRI dhan28 (5.5 t ha^{-1}) and BRRI dhan29 (6.0 t ha^{-1}).
06	Regional Yield Trial (RYT) Short Duration (Biotechnology), Boro 2016-17	Out of four, BR(Bio)9785-BC2-19-3-1 (5.8 tha^{-1}) and BR(Bio)9785-BC2-19-3-5 (5.8 t ha^{-1}) yielded higher than BRRI dhan28 (5.3 t ha^{-1}) with 1-2 days shorter growth duration.
07	Proposed Variety Trial (PVT) of Favorable Boro Rice (FBR), Boro 2016-17	The genotype BR7358-5-3-2-1-HR2 (Com) (4.63 t ha^{-1}) yielded lower than BRRI dhan28 (5.13 t ha^{-1}) with four days higher growth duration.
08	PVT of Micronutrient Enriched Rice (MER), Boro 2016-17	The genotypes BR7831-59-1-1-4-5-1-9-P1(4.66 t ha^{-1}) and BR7831-59-1-1-4-9-1-2-P3 (3.53 t ha^{-1}) yielded lower than BRRI dhan28 (4.94 t ha^{-1}) with 2-3 days higher growth duration.
09	PVT of Favorable BoroRice (FBR# Short duration), Biotechnology, Boro 2016-17	The genotypes BR7831-59-1-1-4-5-1-9-P1 (3.06 t ha^{-1}) and BR7831-59-1-1-4-9-1-2-P3 (3.12 t ha^{-1}) yielded lower than BRRI dhan28 (4.69 t ha^{-1}) with 2 days higher growth duration.

Crop-Soil-Water Management Program Area		
01	Yield maximization through INM practices in T. Aman season	Highest grain yield was obtained with recommended chemical fertilizer but it was statistically similar with T_3 (PM 1.0 t/ha + 50% rec. che. fert.) and T_5 (CD 3.0 t/ha + 50% rec. che. fert.) treatment, where PM and CD were applied with 1 t/ha and 3 t/ha with 50% chemical fertilizer, respectively. Among the fertilizer treatment T_4 (CD 2 t/ha + 50% rec. che. fert.) yielded lower where CD was applied @ 2 t/ha with 50% chemical fertilizer and the lowest yield was observed in control treatment.
02	Long-term missing element trial for diagnosing the limiting nutrient in soil	The highest grain yield was obtained in T_1 = NPKS (Complete) (7.09 t ha^{-1}) where complete fertilizer was used than T_3=NKS(-P) (6.72 t/ha with P omission). The K omission treatment (T_4=NPS(-K) 5.80 t/ha) has given significantly lower yied than P omission treatment (T_3=6.72 t ha^{-1}). Omission of S from the complete treatment has also given significantly lower yield (T_5= NPK(-S), 6.25 t/ha) like K omission. The yield performance was very poor where N was omission (T_2= PKS(-N), 4.95 t/ha) from complete elements and the lowest yield was found in fertilizer control treatment (T_8= all missing (-NPKS), 4.26 t/ha). It was also observed that beside N is the most yield limiting nutrient for Boro rice followed by K and S in BRRI regional station Habiganj farm soil.
03	Suitability study of BRRI	Although sowing date and transplanting date were

	dhan62 in comparison with BRRI dhan28 in low-land haor areas	same for both the varieties but BRRI dhan28 matured 2-3 days earlier than BRRI dhan62. The grain yield ha^{-1} of BRRI dhan62 also lower than BRRI dhan28 in all transplanting date during Boro season. So, in terms of growth duration and yield BRRI dhan62 is not suitable for cultivation in Boro season in comparison with BRRI dhan28 in low land haor areas.
04	Effect of planting time on the yield of the advanced line BRH11-9-11-4-5B and BRRI dhan28 in low land haor areas	The grain yield per hectare of BRH11-9-11-4-5B was lower than BRRI dhan28 in all transplanting date.Regarding BRH11-9-11-4-5B; 2nd tranplanting date i.e. 2nd week of January was the best time for transplanting. In case of BRRI dhan28; 1^{st} transplanting date i.e. 4^{th} January performed best.
05	Nitrogen response of the advanced line BRH11-9-11-4-5B in single Boro rice in haor areas	The grain yield increased significantly (6.10 t/ha) with increasing the N doses up to 100 kg N/ha after that grain yield decreased. Significantly lower grain yield (4.74 t/ha) obtained with highest doses of nitrogen (160 kg N/ha) and the N control plot yielded the lowest.
Pest Management Program Area		
01	Monitoring of insect pest and natural enemy incidence by using light trap	Among the insect pests, BPH populations found highest followed by GLH and YSB. Peak of BPH, GLH, YSB and WBPH observed in the month of November. Another peak of GLH, WBPH and YSB in the month of April and BPH in May. Among the natural enemies carabid beetle (CBB) populations found highest followed by staphylinid beetle (STB) and lady bird beetle (LBB). Peak of CBB and STB observed in the month of December and another peak of CBB found in April. LBB had two peak one in November another in May.
02	Survey and Monitoring of Rice Arthropods in Sylhet region	The population of grass hopper was found highest in sweep net collection (22.11/20 sweep) during Aus season followed by green leafhopper (GLH) and rice leaf folder (RLF) 9.0 and 5.44/20 sweep respectively. Green leafhopper (GLH) population found highest 17.00 and 19.95/20 sweep respectively in T. Aman and Boro season followed by short horned grasshopper (SHG) 8.13 and 5.40/20 sweep, white backed planthopper (WBPH) 8.07 and 3.30/20 sweep and brown planthopper (BPH) 8.07 and 3.30/20 sweep in T. Aman and Boro season respectively. Among the natural enemies Spider population found highest 10.33 and 10.60/20 sweep in T. Aman and Boro season respectively. During Aus season Damsel fly population found highest

		13.89/20 sweep followed by Spider and CBB 3.67 and 2.33/20 sweep. A few number of LBB, CBB, Drag. fly, Dam. fly and GMB were also observed in T. Aman and Boro season. During visual counting it was observed that T. Aman seed bed in all the locations are highly infested with thrips. So, it needs to proper care in seedling raising during T. Aman season in greater Sylhet region.
03	Incidence of insect pests and their natural enemies in perching used field and non-perching field.	Among the insect pests GH population found highest in all the season (21 to 24/20 sweep) followed by YSB and LHC 2.5 to 6.25 and 2.5 to 4.5/20 sweep respectively. On an average highest number of white leafhopper (26.98%) reduced in perching used field followed by leaf roller (20.87%), long horned cricket (20.28%), Grasshopper (20.69%) and yellow stem borer (18.73%). Perching had no effect on rice hispa (RH) and rice bug (RB). Among the natural enemies on an average reduction of Dam.fly, Drag.fly and SPD observed 15.08, 12.04 and 9.46% respectively in perching used field. But no or little reduction observed in case of CBB and LBB.

Rice farming system		
01	Productivity increase through improved Mukhikachu–T. Aman cropping pattern.	Improved cropping pattern given higher rice equivalent yield (REY) compared to traditional pattern. REY was increased about 17% by inclusion improved variety in the improved pattern than traditional pattern. Highest total productivity (27.5 t/ha/yr) also recorded with the treatment having improved varieties for Mukhikachu and T. Aman rice.
02	Rice fish culture in low-land areas for increasing farm productivity.	The fingerlings stocked weight increased 100-150 g and size increase to 18-22 cm at harvesting time. Average growth increment was 50%. The results showed that rice yield increased up to 8.18 % in addition of 500 kg ha^{-1} fish from rice-fish integrated farming than cultivating rice alone.
Socio- Economic and Policy Program Area		
01	Stability analysis of BRRI released Boro varieties	The yield range of BRRI released boro varieties was 2.7-4.7 t ha^{-1}. Among the inbreed varieties, BRRI dhan45 (4.7 t ha^{-1}), BRRI dhan74 (4.3 t ha^{-1}), BRRI dhan28 (4.2 t ha^{-1}) and BR19 (4.0 t ha^{-1}) yielded higher with the growth duration 145, 147, 145 and 165 days respectively. BRRI Hybrid dhan5 (4.6 t ha^{-1}) yielded higher than BRRI Hybrid dhan2 (3.8 t ha^{-1}) and BRRI Hybrid dhan3 (3.5 t ha^{-1}) with similar growth duration (Table 34). Yield was not

		satisfactory in all the varieties because unfavourable weather condition and innundation prevailed at reproductive stage.
Technology Transfer Program Area		
01	Breeders Seed production	About 22 tons Breeders seeds were produced from two T. Aman and four Boro varieties during the reporting year and sent to the Genetic Resource and Seed Division, BRRI Gazipur.
02	Truthfully leveled seed (TLS) production	More than 18 tons TLS were produced of one Aus, five Broadcast Aman (B. Aman), six T. Aman and ten Boro varieties during the reporting year which will be distribute and sale to the local farmers according to their demand.
03	Training, Workshop and Demonstration	BRRI Regional station, Habiganj conducted 12 training courses on "Modern rice cultivation technology" for 380 farmers in which they were trained up with rice production technology in different ecosystem especially on haor ecosystem. A total of 31 demonstrations under Harvest Plus project were conducted in 31 farmer's fields of Habiganj and Sylhet district. BRRI dhan72 in T. Aman and BRRI dhan74 were used in Boro season during the reporting period. Farmer accepts both the varieties and motivated to grow in future.

BRRI R/S, Station, Kushtia

Research Progress 2016-2017

SL.No	Research Program/progress	Expected output
	Program area/ project with duration	
Varietal development Program area		
T. Aus, 2016-17		
1.	Regional yield trial (Upland Aus, RYT-1)	Superior HYV for Upland Aus rice will be developed.
2.	Regional yield trial (Biotech.,RYT-2)	HYV for T. Aus rice will be developed.
3.	Regional yield trial (T. Aus, RYT-3)	-do-
T. Aman, 2016-17		
3.	Regional yield trial (RLR, RYT-1)	HYV for Rainfed Lowland T. Aman rice will be developed.
4.	Regional yield trial (RLR, RYT-2)	
5.	Regional yield trial (RLR, RYT-3)	
6.	Regional yield trial (RLR, RYT-4)	
7.	Regional yield trial (RLR, RYT-5)	
8.	Regional yield trial (RLR, RYT-6)	
9.	Regional yield trial (RLR, RYT-7	
10.	Regional yield trial (PQR, RYT- 8)	HYV for Premium Quality T. Aman rice will be developed.
11.	Regional yield trial (PQR, RYT- 9)	

12.	Regional yield trial (PQR, RYT- 10)	
13.	Regional yield trial (MER, RYT- 11)	HYV for Micronutrient Enriched T. Aman rice will be developed.
14.	Regional yield trial (Biotech,RYT-12)	HYV for T. Aman rice will be developed.
15.	Proposed variety trial (RLR, PVT-1)	Proposed HYV for Rainfed Lowland Rice will be released.
Boro, 2016-17		
12.	Regional yield trial (PQR,RYT-1)	HYV for Premium Quality Boro rice will be developed.
13.	Regional yield trial (PQR,RYT-2)	
14.	Regional yield trial(DRR,RYT-3)	HYV for Disease Resistant Boro rice will be developed.
15.	Regional yield trial (FBR,RYT-4)	HYV for Favourable Boro rice will be developed.
16.	Regional yield trial (MER,RYT-5)	HYV for Micronutrient Enriched Boro rice will be developed.
17.	Regional yield trial (MER,RYT-6)	
18.	Regional yield trial(Biotech.RYT-7)	HYV for Boro rice will be developed.
19.	Regional yield trial (Biotech.RYT-8)	
20.	Proposed variety trial (FBR, PVT-1)	Proposed HYV for Favourable Boro Rice will be released.
21.	Proposed variety trial (MER, PVT-2)	Proposed HYV for Micronutrient Enriched Boro Rice will be released.
	Proposed variety trial (SD, Biotech, PVT-3)	Proposed HYV for Short Duration Boro Rice will be released.
Socio Economics and Policy		
22.	Stability analysis of BRRI varieties (T. Aus, T. Aman and Boro season)	Stability of the released BRRI HYV rice will be assessed under diverse environmental conditions.
Crop-soil-water management		
23.	Terminal Drought Mitigation through integrated water management approaches in T. Aman, 2016	Appropriate technology will be developed for efficient water management under terminal drought.
24.	Determination of suitable time for application of supplemental irrigation in T. Aman,2016	Suitable time for application of supplemental irrigation will be developed.
Technology transfer		
25.	Farmers' training, Field day and Agricultural Fair	- Farmers will be trained up with BRRI developed modern rice production technologies. - BRRI's technologies will be disseminated.

BRRI R/S, Rajshahi

Research Progress: 2016-2017

Research Progress	Expected output
1. Survey & monitoring of rice insects and diseases Survey was conducted at Rajshahi Region during 2016-2017. Blast, sheath blight and bacterial blight were recorded as major diseases.	To create database on the occurrence and distribution of different rice insects and diseases with respect to varieties, cropping patterns, seasons, locations and environment in order to develop forecasting models. Identifying emerging insects and diseases with changed environment.
2. Variety Development Program (VDP) None of proposed line has been selected for variety. In Aman, 16 entries including one GSR material appeared promising for further advancemnt. In RYT Boro, one genotype for fabourable Boro, one disease resistant and one short duration biotechnolgy material were selected for further advancemnt.	Better genotypes could be used for further advancement.
3. VDP/ STRASA project In T. Aman season, ten promising drought tolerant advanced lines were identified for PVS function.	Better genotypes could be used for further advancement.
4. Conservation of natural enemies through ecological engineering approaches Highest natural enemies and parasitism by *Trichogramma zahiri* were observed in rice field nearby nectar-rich flowering plants. However, the least natural enemies and parasitism were found in rice field where four times (continuous/ prophylactic) insecticides were applied. Moreover, there was no yield reduction in rice field surrounding by flowering plants compared with insecticide application.	It will help to avoid insecticide spraying in the early crop stages by enhancing the buildup of different natural enemies in rice eco-system.
5. Evaluatin of short duratin crop varieties under different cropping patterns BRRI dhan56- BARI motorshuti3-BRRI dhan58 pattern found better compared with BRRI dhan62- BARI Sarisa 14- BRRI dahn28 and some other cropping patterns	Productivity and profitability of the farmers will be increased.
6. Evaluation of crop establishment methods under different tillage and crop residue management options under Rice-Wheat-Mungbean system Bed planting technology found better compared with strip tillage and conventional tillage	Profitability of the farmers will be increased.
7. Nitrogen Management in drought tolerant T. Aman rice varieties at drought prone area USG performed better compared to prilled urea plots in drought tolerant T. Aman rice varieties at drought prone area	Productivity of the farmers will be increased.
8. Soil fertility scenario of BRRI, Rajshahi farm soil The soil fertility status of BRRI Rajshahi farm soil was done	Information will be used for fertility management. and also crop selection

BRRI R/S, Satkhira

Research Progress 2016-2017

Sl. No.	Research Program/Progress	Expected output
01	Proposed Variety Trial (PVT) in T. Aman season	The tested line WAS 161-B-4-B-1-TGR 51 (NERICA-L-32) yielded (5.40 t ha^{-1}) little higher than the check BRRI dhan39 (5.36 t ha^{-1}).
02	Regional Yield Trial (RYT) for Short Duration T. Aman Rice	BR(Bio)8019-AC5-1-2-1 and BR(Bio)8032-AC4-1-2-2 could be selected for further varietal development activities.
03	Regional Yield Trials (RYT 1-9) for Rainfed Lowland Rice (RLR)	BR7358-56-2-2-1-HR7 (COM)), IR11F190, IR08L181, BR8490-5-1-4-4, BR8189-10-2-3-1-5, BR8189-10-2-3-1-6, BR8208-5-3-16 and BR8208-5-3-19, BR8521-30-3-1, BR8492-9-5-3-2 and BR8492-9-5-2-3 could be selected from these trials.
04	Regional Yield Trials (RYT 1-3) for Premium Quality Rice (PQR)	BR8850-20-3-5-1, BR8493-16-5-1 (Com) , BR8297-1-1-2- HR1 (Com), BR8522-53-1-3, BR8522-16-5-3-1-HR2 (Com), BR8526- 2-1-1-4 (Com), BR8536-27-2-1-2, BR8536-6-2-1-1, BR8536-27-4-3-5 and BR8536-27-4-3-6, BR9051-33-1-2-5, BR8512-3-1-1, BR8514-17-1-5 and BR8512-9-1-6 could be selected for next varietal development activities.
05	Regional Yield Trial for Micronutrient Enriched Rice (MER)	No entry could be suggested for next step of varietal development activities since all the tested genotypes yielded lower than both the checks BRRI dhan32 and BRRI dhan39.
06	Proposed Variety Trial (PVT) in Boro season	Among MER entries, BR7831-59-1-1-4-5-1-9-P1 yielded (8.86 t ha^{-1}) higher than the check BRRI dhan28 (8.46 t ha^{-1}). In favorable Boro rice trial, the tested entry BR7358-5-3-2-1-HR2 yielded higher than the check BRRI dhan28 in both Jessore and Satkhira. In PVT of short duration, both the tested entries yielded higher than the check BRRI dhan28.
07	Regional Yield Trial1 (RYT-1) for Short Duration	BR(Bio)9785-BC2-20-1-3 and BR(Bio)9785-BC2-19-3-1 could be selected for next varietal development activities.
08	Regional Yield Trial 2 (RYT-2) for Bacterial Blight Resistant (Long Duration)	All the tested entries yielded very close ranging from 7.10 t ha^{-1} to 7.58 t ha^{-1} with no significant differences among them but all of them showed significantly higher yield compared to check BRRI dhan28. Their growth duration was 10 to 12 days longer than BRRI dhan28. The tested entries should be compared with the varieties having similar growth duration.
09	Regional Yield Trial for Favorable Boro Rice (RYT-FBR)	BR8109-29-2-2-3, BR8626-19-5-1-2 and BR8626-10-5-1 could be selected for next varietal development activities.
10	Regional Yield Trial for Micronutrient Enriched Rice (RYT-MER)	No entry could be selected for next varietal development activities.
11	Regional Yield Trial for	No entry could be selected for next varietal

	Premium Quality Rice (RYT-PQR)	development activities.
12	Regional Yield Trial for Disease Resistant Rice (DR)	The entries yielded very close (6.24 to 6.28 t ha^{-1}) except one check BRRI dhan28 (5.64 t ha^{-1}).
13	Effect of missing nutrient on Boro rice in saline and nonsaline gher system	The missing element trial including soil analysis is needed to continue over several years for a complete fertilizer recommendation for rice production in gher areas. Apparently, balanced fertilization is needed for high yield in both saline and nonsaline gher.
14	Validation of Boro Rice Varieties for Gher System	BRRI dhan67 would be a good choice for saline gher whereas in non-saline gher BRRI dhan58might be a better choice.
15	Stability Analysis of BRRI Varieties at BRRI Farm Satkhira	In Boro season, the highest yield was obtained from hybrid varieties. Among inbreed varieties BRRI dhan58, BRRI dhan59, BRRI dhan16, BRRI dhan69, BRRI dhan35, BRRI dhan29, BR8 and BRRI dhan47 yielded more than 7.0 tons per hectare. In T. Aman season, BR10, BR11, BRRI dhan52, BRRI dhan49 and BRRI dhan30 might be better choice for this area.
16	Premium Quality Rice Trial and Blast Management	Use of K application has very little effect on blast disease control. Fungicide application along with MoP and elemental S spray is much effective in this case.
17	Development and evaluation of four-crop cropping pattern and sustainability	Among different four-crop cropping patterns, Jute-T.Aman-Vegetable/Mustard-Boro pattern might be a better choice and could increase farm production and income.
18	Improvement the productivity of gher system	Growing of summer and winter vegetables in bunds of ghers in both saline and nonsaline ghers increase total productivity of the gher land and increase social activities and social interactions of the farmers.
19	Breeder Seed Production	A total of 24.34 tons breeder seed were produced during the reporting year. In T. Aman season, a total of 9.64 ton whereas in Boro season 14.70 ton breeder seed were produced and all the seeds were sent to GRS division, BRRI, Gazipur.
20	Truthfully Labeled Seed (TLS) Production Program	620 kg truthfully labeled seeds were produced during T. Aman season and 2.75 tons were produced during Boro season.
21	Seed production and dissemination program (SPDP)	Total 162 SPDPs were conducted in the farmer's field of different upazila in Satkhira, Bagerhat, Jessore and Khulna districts during 2016-17. In T. Aman season 111 demonstrations were conducted. Among them 25 was funded by HarvestPlus and the remaining 86 were funded by GoB. In Boro season, 51 SPDP were conducted where 2, 4, 5 and 40 were funded by CSISA, SPIRA, HarvestPlus and GoB, respectively.
22	Farmers Training and Field Days	Fifteen Farmer's training on rice production technology was conducted to train up 460 participants of Satkhira, Khulna, Bagerhat and Jessore districts. Eight field days were arranged to disseminate and popularize BRRI

		varieties and other technologies during the reporting year.

BRRI R/S, Sonagazi
Research Progress 2016-2017

Sl. No	Research Progress	Expected output
Program area/ Project with duration		
1.	**Regional yield trial:** Under Regional Yield Trial (RYT) a total of 100 breeding lines were tested during Aus, T. Aman and Boro seasons. Among the tested lines; two rain-fed lowland rice, 10 premium quality rice and five micronutrient enriched rice in Aman, four favorable Boro rice of Plant Breeding Division appeared promising. On the other hand, one Aman and two Boro genotypes of Biotechnology Division appeared promising. The promising genotypes were selected for ALART.	Selection of region based uitable advanced breeding lines with special characters.
2.	**Proposed variety trials:** In proposed variety trials (PVT), the genotypes; BR9377-9-21-3B, IR77092-B-2R-B-10 for tidal submergence and salinity, BR7611-31-5-3-2 for rain-fed lowland rice, BR7697-15-4-4-2-2 for premium quality rice, HUA 565 for green super rice and NERICA Mutant, produced better yield than their respective checks.	Selection of more promising lines for variety release.
3.	**Nutrient management:** For Boro rice, nitrogen was the most limiting element. Soil test based fertilizer dose along with 30% higher NPK was the most profitable fertilizer packages in saline charland ecosystem.	Increase sustainable rice production in Boro season with suitable nutrient combination in saline charland ecosystem .
4.	**Breeder seed production:** During 2016-17, the station produced seven tons Breeder seed of BR11, BRRI dhan33 and BRRI dhan34 in Aman season. It also produced five tons Breeder seed of BRRI dhan28 and BRRI dhan29 in Boro season.	Enrichment of breeder seed stock.
5.	**Truthfully labeled seeds production:** A total of 25 tons truthfully labeled seeds were produced of different Aus and T. Aman varieties for the distribution in different parts of the country.	Increasing the availability of seed for farmers use.
6.	**Farmers training:** During 2016-17 a total of 22 farmers' training were arranged and 770 farmers were trained about modern technology of rice production.	Capacity building of farmers about modern rice production technologies.
7.	**Field day:** A total of 15 field days were arranged during Aus, T.Aman & Boro seasons and a total of nearly 3000 progressive farmers, local leaders, DAE field stuff, public representatives & NGO workers gained knowledge about BRRI varieties and other technologies.	Rapid dissemination of newly released rice varieties and other technologies throughout the country.

Regional Station, Rangpur

Research Progress 2016-2017

SL#	Name of the experiment	Objectives	Progress
	Aus 2016		
1.	Regional Yield Trial (RYT) i)RYT-1 (Broadcast Aus-B. Aus) ii) RYT-2 (T. Aus) iii) RYT-3 (Biotech-T. Aus)	To evaluate specific and general adaptability of the advanced breeding lines in on- station condition	i) One genotype (BR7587-2B-3) performed better over the check variety BRRI dhan43. ii) BRRI dhan62 produced similar yield with similar growth duration of BR26 and BRRI dhan48. iii) Two genotypes (BR(Bio)9785-BC2-8-4-2 and BR(Bio)9785-BC2-120-2-1) performed better over the check variety BRRI dhan48.
	T. Aman 2016		
2.	**Breeding for submergence and water stagnation tolerance** i)Growing and Screening of pedigree population ii) a. Participatory Variety Selection (PVS) - Mother trial under rainfed condition ii) b. Participatory Variety Selection (PVS) - Mother trial under control submergence condition ii) c. Mother Trial under Participatory Variety Selection (PVS) in northern Bangladesh	i)Selection of submergence and medium stagnant water tolerant progenies with improved plant type under controlled stressed condition ii) a. Evaluation of genotypes in the rainfed environment with the participation of farmers under the management practices of researchers. ii) b. Evaluation of genotypes in the control submergence environment with the participation of farmers under the management practices of researchers. ii) c. Evaluation of genotypes in the real submergence and/or medium stagnation prone environments of the	i) In total 873 tolerant progenies with better plant type and 44 fixed lines were selected from pedigree population (F_2-F_8 generations). ii) a. The highest grain yield obtained from IR 85261-18-158-Gaz-3b-62 line (5.92 t ha^{-1}) among the entries. PVS-8 (BRRI dhan52 Ck.) and PVS-9 (BRRI dhan44 Ck.) were chosen by the farmers through PVS function. ii) b. The highest survival percentage (91.7) were found in PVS-1 (IR 10F571) and PVS-4 (IR 09F222). PVS-6 (IR 85261-18-158-Gaz-3b-62) gave the highest yield (5.15 t ha^{-1}). PVS-8 (BRRI dhan52 Ck.) and PVS-6 (IR 85261-18-158-Gaz-3b-62) were chosen by the farmers through PVS function. ii) c. At Lalmonirhat, the highest survival percentage (66.1) were found in PVS-2 (IR 10F109). PVS-6 (IR 85261-18-158-Gaz-3b-62) gave the highest yield (3.62 t ha^{-1}). On the other field at Aitynorail, Polashbari, Gaibandha, the highest survival

	iii) Head to Head trial of the *SUB1* varieties	farmers' field with the participation of farmers under the management practices of researchers. iii) Evaluation of *SUB1* varieties for their adaptability in the rainfed environments of the farmers' field under the management practices of researchers.	percentage (94.1) was found in PVS-7 (BRRI dhan51 Ck.). PVS-6 (IR 85261-18-158-Gaz-3b-62) gave the highest yield (3.30 t ha^{-1}). PVS function didn't possible to arrange due to water stagnation condition. iii) Three *SUB1* geneotypes with one check variety were evaluated in two locations of Rangpur district. The results showed that BRRI dhan52 gave the highest yield in two locations followed by BR11. Among the varieties BINA dhan-11 was early maturing and lowest sterility percent.
3.	**Development of rice varieties suitable for Aman season in Rangpur region** i)Hybridization ii) F_1 Confirmation	i) To introgress genes from diverse genetic background for earliness, tolerance to submergence, drought with acceptable grain quality and high yield ii) Confirmation of crosses as true F_1	i) 13 Crosses were made using 10 parents ii) 5 crosses were confirmed
4.	Observational Trial (OT) of BRRI dhan49 NILs under RLR ecosystem in Rangpur region	Selection of homogeneous breeding lines with uniform plant height, heading, acceptable grain quality having high yield potential with good plant type and free from false smut infestation.	Forty seven genotypes were selected based on growth duration, plant height, phenotypic acceptability at maturity (PAcp) and grain yield. The grain yield of the selected genotypes was varied from 3.6 to 6.1 t/ha. The growth duration of the selected genotypes was varied from 113 to 135 days. Also 30 individual plants were selected.
5.	Observational Trial (OT) of NPT	Selection of homogeneous breeding lines with uniform heading, acceptable grain quality having high yield potential with good plant type.	Four genotypes were selected based on growth duration, plant height, phenotypic acceptability at maturity (PAcp) and grain yield. Also six individual plants were selected.
6.	**Regional Yield Trial (RYT)** i)RYT-1 (RLR-Late) ii) RYT-2 (RLR)	To evaluate specific and general adaptability of the advanced breeding lines as compared with standard checks in on-	i)The tested entry didn't perform better than the checks varieties. ii) Two genotypes (BR8192-10-1-2-3-4 and IR11F190) found

	iii) RYT-3 (RLR) iv) RYT-4 (RLR) v) RYT-5 (RLR) vi) RYT-6 (RLR) vii) RYT-7 (RLR) viii) RYT-8 (PQR-1-Kalizira type) ix) RYT-9 (PQR-2-BRRI dhan34 type) x) RYT-10 (PQR-3-BRRI dhan37+Kataribhog type) xi) RYT-11 (MER) xii) RYT-12 (Biotech-short duration high yielding)	station condition	high yielder with longer growth duration over the check varieties. iii) None of the tested genotypes found high yielder over the check variety. iv) One of the tested entry (BR8521-30-3-1) produced similar yield with shorter growth duration over the check variety BRRI dhan49. v) One genotype (BR8492-9-5-3-2) produced similar yield with shorter growth duration over the check variety BRRI dhan49. vi) Two genotypes (Nepali Swarna-Rangpur and Swarna5-Rangpur) found high yielder over the check varieties. vii) One genotype (BR10238-5-1) produced higher yield with longer growth duration over the check variety BRRI dhan49. viii) Two genotypes (BR8493-16-5-1 (Com) and BR8850-10-8-3-3) found high yielder over the check varieties. ix) Two genotypes (BR8522-53-1-3 and BR8522-16-5-3-1-HR2 (Com)) found high yielder with shorter growth duration over the check variety BRRI dhan34. x) One genotype (BR8234-1-3-7-1-3-HR21 (Com)) produced higher yield over the check varieties. xi) None of the tested genotypes found high yielder over the check varieties. xii) One genotype (BR(Bio)8032-AC3-4-1-3) performed better over the check variety.
7.	**Proposed Variety Trial (PVT)** i)Rainfed Lowland Rice (RLR) ii) Re-evaluation of	On- farm evaluation of proposed line by the NSB team for the recommendation of release as a new variety.	i) Proposed line WAS161-B-4-B-1-TGR51 (NERICA-L-32) gave 1.0 t/ha higher yield compared to check variety BRRI dhan39. ii) Proposed line BRRI dhan72 gave 2.0 t/ha higher yield

	BRRI dhan72 in Rangpur Region iii) Submergence and Water stagnation		compared to check variety BRRI dhan39 iii) The proposed lines (BR9159-8-5-40-13-52 and BR9159-8-5-40-13-57) gave 0.35 t/ha higher yield compared to check variety BRRI dhan49 at four locations under rainfed condition but in control condition gave 5.44 and 7.1 t/ha respectively.
8.	**Advanced Lines Adaptive Research Trial (ALART), T. Aman 2016** i) Rainfed Lowland Rice-1 (RLR-1) ii) Rainfed Low land Rice-2 (RLR-2) iii) Rainfed Low land Rice-3 (RLR-3) iv) Micronutrient Enriched Rice (MER) v) ALART Biotechnology	1. To evaluate the yield potential and adaptability of advanced breeding lines at farmers' field in different agro-ecological conditions. 2. To get feedback information about the advantages and disadvantages of the advanced lines from farmers and DAE personnel.	i)) BR8214-23-1-3-1 genotype gave the highest yield (4.5 t ha-1) followed by BR8214-19-3-4-1(4.3 t ha-1). ii) The tested entry didn't perform better than the check varieties. iii) BR-RS(Raj)-PL4-B gave the highest yield (4.8 t ha-1) followed by check variety BR11 (4.7 t ha-1). iv) BR7895-4-3-3-2-3 gave the highest yield (4.8 t ha-1) followed by check variety BRRI dhan49 (4.6 t ha-1). v) BR7895-4-3-3-2-3 gave the highest yield (4.8 t ha-1) followed by check variety BRRI dhan49 (4.6 t ha-1).
9.	Long-term effect of three cropped cropping patterns on the agro-economic productivity and soil health	To determine the long term implications of Potato-Boro-T. Aman,Maize-Mungbean-T. Aman, Boro- T. Aus-T. Aman and Boro-Fallow-T. Aman cropping patterns on: i)System productivity ii) Economic return and iii)Soil health	Average grain yield of T. Aman rice was 4.22 t ha^{-1} under Boro-Fallow-T. Aman, Boro -T. Aus-T. Aman, Potato-Boro-T. Aman and Maize -Mungbean -T. Aman cropping patterns. And yield of Potato (Cardinal) was 20.33t ha^{-1} under Potato-Boro-T. Aman cropping pattern. * Mungbean will be transplanted **Maize and Boro in the field
10.	Evaluation of BRRI dhan48 as early Boro rice in Potato - Boro - T. Aman cropping system in medium highland irrigated ecosystem	i) To find out suitability of BRRI dhan48 in late Boro season ii) To find out appropriate seedling age of rice after potato	T.Aman (BRRI dhan57) and Potato (Cardinal) were harvested and yield were 3.52(t/ha) and 31.00(t/ha) respectively. Early aus rice will be transplanted according to treatment.
11.	Performance evaluation of Swarna	To find out the suitable Swarna cultivar that gave	Swarna varieties (Lal Gooty swarna, Gooty Swarna and

	under different fertilizer combinations	satisfactory grain yield with poor management	Swarna5) didn't give higher yield than the check varieties (BR11 and BRRI dhan52) in terms of fertilizer treatments.
12.	Effect of nutrient management and application pattern on newly developed *Sub1* genotypes	To find out the appropriate dose and application pattern after flood water recession To enhance the survival percent and grain yield	Under nutrient management after de-submergence trial, three treatments (T_1=Modified dose (100 kg ha^{-1} Urea + 23 kg ha^{-1} MoP), T_2 (Modified dose + (75 kg ha^{-1} Urea + 60 kg ha^{-1} MoP)) and T_3=Modified dose + 60 kg ha^{-1} MoP) with three *SUB1* line/variety were evaluated in the control condition for 16 days submergence. T_2 performed better than the other nutrient management options.
13.	Effect of time of submergence for transplanting rice on survival, recovery and yield of rice in T. Aman	To investigate the suitable time of submergence at different DAT for survival, recovery and yield under flash flood submergence condition.	The experiment was conducted with five treatments (T_1-0DAT, T_2-5DAT, T_3-10DAT, T_4-15DAT and T_5-20DAT) under control condition for 16 days of submergence. The highest survival percent (82.6) was in (T_5) at 20 days later submergence where the lowest (18.1) in (T_1-0 DAT). T_5 (20 DAT) also showed the highest yield (4.70 t ha^{-1}) among the treatments. **Note:** Submergence tolerant rice survive more if submergence is occur in few days later after transplanting.