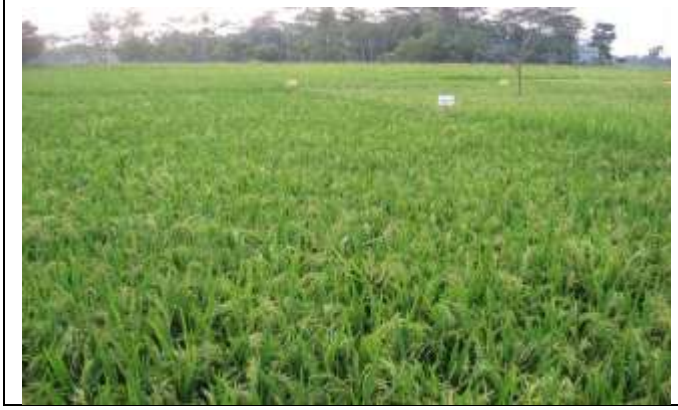
Name of the Institute: Bangladesh Rice Research Institute

Plant Breeding Division

Research Achievement 2012-2013

(Technology Developed)

Technology Developed	**How Country/Farmer/User will be benefited**
Program Area: Varietal Development program (VDP)	
1 Rice Breeding	
1.1.1. **BRRI dhan58**: National Seed Board (NSB) of Bangladesh approved somaclonal line (BRRI dhan29-SC3-28-16-4-HR2) as BRRI dhan58 for Boro season. This variety is a tissue culture induced somaclonal variation from BRRI dhan29 and can produce 7.5 t/ha average grain yield with growth duration 150-155 days.  	Rice production will be increased in the low lying areas of the country in Boro season

1.1.2. BRRI dhan59: National Seed Board (NSB) of Bangladesh approved BRRI dhan59 as a high yielding rice variety for Boro season. This variety has shorter plant height than BRRI dhan28 and medium bold grain type. This rice variety can produce 7.1 t/ha grain yield with growth duration 153 days. 	Rice production will be increased in the low lying areas of the country in Boro season.
1.1.3. BRRI dhan60: National Seed Board (NSB) of Bangladesh approved BRRI dhan60 as a high yielding rice variety for Boro season. The variety has extra long slender grain type. This rice variety can produce 7.3 t/ha grain yield with growth duration 151 days. 	Rice production will be increased in the low lying areas of the country in Boro season.

1.1.4. BRRI dhan61: National Seed Board (NSB) of Bangladesh approved BRRI dhan61 as high yielding variety for saline prone areas in Boro season. This salt tolerant rice variety can produce 3.8-7.4 t/ha grain yield with 145-150 days despite possesses 12-14 dS/m salinity tolerance at seedling and 8 dS/m at reproductive stage. 	Rice production will be increased in the saline prone areas of the country.
1.1.5. BRRI dhan62: National Seed Board (NSB) of Bangladesh approved BRRI dhan62 as Zinc (Zn) enriched high yielding rice variety for T. Aman season. This rice variety can produce 4.0-4.5 t/ha grain yield with 100 days growth duration. In addition, the variety has 20 ppm Zn content. 	This short duration variety can be fitted into Boro-T. Aman-Potato/Rabi cropping pattern which will increase cropping intensity of high to medium high lands. Moreover, the variety will solve the nutritional problem partly due to zinc deficiency.

Hybrid Rice Division

Research Achievement 2012-2013

SL. No.	Technology developed	How country/Farmer/User will be benefited
01.	Three new CMS lines were developed in the back ground of BRRI advanced lines and exotic sources	It will help developing new hybrid combinations with present farmers requirement
02.	Five new restorer lines were identified in the back ground of BRRI and IRRI	It will restorer fertility of hybrids for giving more heterosis and ultimately farmers will get high yield potential adaptable hybrids for Bangladesh conditions
03.	Three new hybrid combinations were selected as potential upcoming hybrids	Short duration coupled with high yield potential and good grain quality hybrids will fulfill farmers demand
04.	A total of 385.5 kg of parental lines (A & R) and hybrid seeds of four released hybrid varieties distributed to 4 seed companies along with BADC	Popularization of BRRI released hybrid varieties.

Biotechnology Division

Research Achievement 2012 – 2013
(Technology Developed)

Sl. No.	**Technology Developed**	**How Country/ Farmer/ User will be benefited**
1.	Four green plants were regenerated from the two crosses BRRI dhan29/FL478 and MR219/IRBB60 respectively.	This lines will be used to developed salt tolerant and bacterial blight resistant variety that ultimately benefit the farmers
2.	Four (4) putative transgenic plants from BRRI dhan29 were confirmed by GUS test, hygromycin screening and PCR.	These lines will be used to develop salt tolerant rice varieties that ultimately benefit the farmers in coastal areas.
3.	BRRI dhan29 and BRRI dhan28 were used for transformation with gene construct *AeMDHAR.* About 40 and 12 putative transgenic plants were regenerated from BRRI dhan29 and BRRI dhan28, respectively.	These lines will be used to develop salt tolerant rice varieties that ultimately benefit the farmers in coastal areas.
4.	TPSP gene construct was used to transform into BRRI dhan28 and BRRI dhan29 rice varieties. A total of twenty seven selected plants from the	These lines will be used to develop salt and drought tolerant rice varieties that ultimately benefit the farmers in coastal areas.

	hygromycin containing (50mg/l)) medium were transferred to earthen pot after acclimatiezation.	
5.	Back ground selection was carried out in BC_4F_1 generation with 31 SSR markers for Introgression of *sub1* gene into BRRI dhan44. 44 homozygous rice plants for *SUB1* gene were developed	These lines will be used to developed submergence tolerant variety that can be used in submerged areas.
6.	Two backcrosses were made to identify the QTLs for yield enhancement. Phenotypic data was recorded for 3 populations. Polymorphic markers were amplified to get molecular data.	Identified QTLs will be used for marker assisted molecular breeding
7.	Two backcrosses were made to identify the QTLs for salinity tolerance at both seedling and reproductive stage. Polymorphic markers were amplified for genotyping of F2 population of the cross.	Identified QTLs will be used for marker assisted molecular breeding
8.	3 resistant lines with pyramided gene for Bacterial Blight (BB) resistance (*xa13* and *Xa21)* were developed	This lines will be used to developed bacterial blight resistant variety that ultimately benefit the farmers
9.	Seventy six (76) polymorphic SSR markers were used to determine genetic diversity of 127 Aus genotypes (12 BRRI released and 115 landraces) which were grouped into 9 clusters. All BRRI released modern variety grouped in same cluster.	This information can be used to select parent for the development of new varieties.

Genetic Resources and Seed Division (GRSD)
Research Achievement 2012-2013
(Technology Development)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
Program Area 01: Varietal Development Program (VDP)		
3	**Sub-program area: Rice Germplasm and Seed**	
3.1.1	**Germplasm Collection:** A total of 40 rice germplasm were collected from different districts of Bangladesh including hilly areas.	These germplasm will be utilized in breeding program for varietal improvement.
3.1.2	**Characterization:** 270 germplasm including 20 GI varieties were characterized with 45 morpho-agronomic characters and 2149 accessions including 590 new collections were grown for rejuvenation.	Characterized germplasm will be utilized in specific breeding program
3.1.3	**Evaluation against biotic and abiotic Factors:** 1. Considering allelopathic effect, three germplasm *viz*: Rajasail, Biruin (Tola) and Balam dhan (acc. no. 841) have allelopathic potentialities.	The potential genotypes will be used as parent (s) for weed tolerant variety development.
	2. Among the tested 120 germplasm, 40 genotypes (Chiniguri, Kolomala, Luina, Baoibhog, Baoi jhaki, Tulsimaloti, Sugandhidhan, Hatishail, Khazar, KhasaMukpura, Begunbitchi, Chinairri, Dhanchikon, Badshabogh, Khutichikon (1), Basmati 370, Sadagura, Jirakatari, BR5, Tulsimoni, Chinigura, Deshikatari, Bawaibhog, Nunia, Premful, Elai, Chinikanai, Gandhakusturi, Awned-1, Duksail, Khaskani, BRRI dhan37, Khutichikon(3), Chinisail, Malshira, Madhumadab, , Kataribhog, Basmati 370, IRBB21, BR23) found tolerant against sheath blight.	Disease resistant landraces can be utilized as parents.
	3. 16 aromatic germplasm provided the lowest mean cluster disease score against blast and also confirmed using molecular marker.	The potential cultivars will be used as parent (s) for variety development.
	4. Acc. 4217, 4398 and 4399 found tolerant at seedling stage under complete submergence.	-do-
	5. Acc. no. 128 under net house and acc. no. 104 at field conditions found best tolerant to heat. Again, acc. no. 114, acc. no. 177, acc. no. 197 and acc. no. 202 found best tolerant to cold.	-do-
3.2	**Seed production and variety maintenance:** A total of 190.42 tons of Breeder seed were produced and 145.41 tons of Breeder seed were distributed. Again, 6.09 tons of truthfully labeled seeds (TLS) were available and around 6.02 tons of quality seed (TLS) were distributed.	Helping in quality seed dissemination for the increased production of rice.
3.3	**Exploratory and genetic studies:** Genetic divergence studies with forty rice genotypes of Boro season were done.	The genetic variability and relationships i.e. genetic make up of the studied germplasm can be clearly understood.

3.4	**Documentation of technology:** 100 accessions were entered into the database with collected available information within the reporting year.	Characterized information of the germplasm may be utilized for selecting parent(s) in breeding program.

Grain Quality and Nutrition Division

Research achievement 2012-13

(Technology Developed)

Sl. No.	Technology Developed	How country/farmer/User will be benefitted
1	Grain Quality Characteristics for Variety Development	Enhance releasing new variety
2	The quality of indigenous rice products of high yielding rice varieties	Farmer can choose right varieties for indigenous rice products
3	Effect of different degrees of milling on the retention of Iron and Zinc in 10 rice varieties	Ensure maximum nutrient contents in polished rice
4	Effect of different Soaking time on Fe and Zn content of BRRI dhan29	Ensure appropriate soaking method for milling to achieve maximum micronutrients after milling
5	Effect of open and pressure parboiling on Fe and Zn content of BRRI dhan29.	Standardized appropriate method of parboiling
6	Evaluation of rice cultivars through protein digestibility	Determination of protein digestibility of different rice varieties
7	Evaluation of cooked rice through protein loss	Determination of protein loss during cooking
8	Testing and Performance Evaluation of Small and Experimental Rice Mill	Ensure potential and commercial milling yield
9	Development and Modification of Engelberg Rice Huller	Save labor, electricity and produce quality rice with higher milling yield

Entomology Division
Research Achievement 2012-2013
(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/User will be benefited
1.	**1. Evaluation of Insecticide:** A total of two hundred three commercial formulations of insecticides were evaluated against BPH and yellow stemborer (YSB) of which 163 (149 against BPH and 14 for YSB) were found effective.	Farmers will be benefited by using these effective insecticides after approval from PATC.
2.	**2. Varietal Resistance:** One IRBPHN materials, IR10A110 showed resistant reaction to BPH.	This material has been given to Plant Breeding Division for resistance breeding programme.
3.	**3. Yield Loss:** Less yield loss by rice hispa rice varieties (BRRI dhan56 and BRRI dhan57) identified	Farmers of rice hispa prone areas will be benefited by cultivating these varieties.
4.	**4. Biological Control:** Rearing technique of *Trichogramma zahiri*, an egg parasitoid of rice hispa was developed.	Farmers will be control rice hispa by using this bio control agent.
5.	**5. Integrated Pest Management:** For controlling BPH, sprayer having double nozzle is effective and less time consuming.	Farmers will be benefited by using this type of sprayer.

PEST MANAGEMENT PROGRAMME AREA
Plant Pathology Component
Research Achievement: 2012-13

Survey and Monitoring:

- Least blast disease incidence and severity were observed in AEZ2 and AEZ20 irrespective of variety and season. While, highest disease incidence (50-70%) was recorded in AEZ1 and AEZ9.

- In Boro, hybrid Jhalak was worsely infested by neck blast while in Aman, aromatic rice particularly Bagunbichi and BRRI dhan34 were severely infected by neck blast disease. In Aman season, BR10, BR23 BRRI dhan30, Nayanmoni and Swarna were least infected by blast while in Boro hybrid rice Tia and Sonar bangla-6 was least infected.

Pathogen Population Biology and Molecular Studies

- 1200 samples collected from different AEZs of Bangladesh, single spore culture of 800 isolates have been preserved. Out of 536 blast isolates, 419 races were identified. Among the pathotypes, U, z and ta were more diversified in rainfed low land ecosystem (T.

Aman) while i, k, z pathotypes were in irrigated ecosystem (Boro). Pathotypes U63, z04 and ta403 were dominant in both the ecosystems and widely distributed in Bangladesh.

- Twenty five standard differential reference isolates have been developed for blast resistance studies.
- *Pi9, Pita-2, Pish* and *Pita* genes were found highest resistant frequency against the Bangladesh blast isolates.
- Cultural and molecular characterization of *Rhizoctonia oryzae sativae* isolates indicated the wide variation among this pathogen.

Resistance breeding and molecular studies

Resistance to blast

- *Pish* and *Pita*-2 genes were introgressed in the background of BRRI dhan29. The F1 plants were confirmed by molecular marker.
- DNA finger printing and reactions to MLs of 100 isolates have already completed.
- *Pi9* and *Pish* genes have been detected in landraces and BRRI released varieties.
- Out of surveyed 19 primers against blast *R*-gene *Pita*, *Pita2*, *Pish*, *Pi9* and *Pib*, primer pita440, OSM89, AOL45, RM195 and Sub3-5 were produce specific bands to corresponding *R*-gene.
- Out of 140 aromatic materials including MLs, 16 were found tolerant against blast. At least one of the genes either *Pish* or *Pita* or *Pi9* was detected using molecular marker of these materials.
- Among the 96 germplasms, 54 posses *Pita*, 54 having *Pita-2*, 33 having *Pish*, 1 having *Pi9* and 64 having *Pib* blast resistant gene.
- MR genes *Pita, Pita-2, Pish* and *Pib* against blast were found in the same background of H13, H35, H49 and H58 germplasms. The *Pi9* gene was detected only in one local rice variety (H100) in which *Pita-2* and *Pib* genes were also detected.
- Out of 50 BRRI varieties, *Pish* and *Pi9* genes were detected in 12 and 2 varieties, respectively. While, *Pib* gene were detected in all most all BRRI varieties.

Resistance to Bacterial Blight

- BC2F1 seeds harvested from the crosses of BRRI dhan28, BRRI dhan29, and IRBB60, IRBB65, and IRBB66.
- BC4F1 seed already developed in collaboration with Breeding Division.
- DNA extraction of 53 rice varieties has already been done. Next work will be done soon.

Screening advance breeding lines against blast, sheath blight and BB

- Out of 28 materials, seven materials such as BR7840-54-3-2, BR7831-10-3-1-6, BR7831-78-2-1-2-1, BR7830-16-1-5-3, BR7673-14-2-1-7-1HR1, BR7671-37-2-2-3-7 and BR7830-16-1-5-3 were moderately resistance to rice blast.

- ❖ Among the tested advanced breeding lines, two lines BR7830-16-1-5-3 and BR7840-54-1-2-5 were found tolerant to ShB, BR7830-16-1-5-3 was tolerant to BB and three lines BR7976-11-11-3-1, BR7840-54-3-1 and BR7840-54-1-2-5 showed tolerant to false smut disease under natural condition.

- ❖ Out of 120 aromatic materials, 40 materials found tolerant against ShB disease and 35 found moderately resistance to BB.

- ❖ Out of 79 INGER materials, 11 found resistance against BB.

Rice disease management

- ❖ Ten fungicides having Tricyclazole and Azoxystrobin were recommended for blast disease control.

- ❖ Five fungicides recommended for sheath blight (ShB) disease control.

- ❖ Sixteen demonstrations on ShB and blast management have been done successfully at farmer's field in Barisal and Rangpur region to upgrade knowledge and efficiency on disease control among the farmers.

Stored fungi and toxin production

- ❖ Seed borne pathogens viz. *Aspergillus*, *Penicillium*, *Fusarium* and *Rhizopus* have been isolated from the stored milled rice in CSD and LSDs. Percentage of seed infection level was low irrespective of fungi.
- ❖ Aflatoxin produced by *Aspergillus* has been detected below the lethal dose and all imported as well as locally procured milled rice found safe as human food.

Clinical Services

- ❖ Provided advisory and clinical services to around 200 farmers, DAE and NGO personnel.

Research Achievement 2012-13

Technology Developed (Soil Science Division)

Technology Developed	How country/Farmers/User will be benefited
Potassium fertilizer management in HYV rice: • Soil having exchangeable K with the range of 0.13-0.18 meq/100g soil need to apply 60 kg K/ha in T. Aman season to get a target yield of 4.5 t/ha, while in Boro season it requires 100 kg K /ha to achieve 6.0 t/ha grain yield. Application of 4.5 t/ha sundry rice straw can satisfy 60 kg K/ha. The rice straw should be	The technology will save inorganic K fertilizer producing optimum yield and may be suitable for Boro and T. Aman rice. Increasing rice production and saving fertilizer will benefit the farmer as well as the country.

applied 1 week before during the final land preparation. **Arsenic uptake reduction through aerobic rice cultivation:** • Aerobic or alternate wetting and drying (AWD) method is a sustainable technology for Boro rice cultivation in arsenic prone area with ground water irrigation. • AWD irrigation system with arsenic contaminated ground water had given similar yield benefit with reduced arsenic uptake by rice plant (78 % in straw and 39 % in grain) compared to rice grown in continuous standing water.	Arsenic is a poisonous element. People in As prone areas are at high risk of arsenic contamination. They can be benefited using the **Aerobic rice cultivation technology** to mitigate arsenic in soil-water-plant system.

Requirements of NPKS and Zn fertilizers for MV rice

Season	Rice varieties	N-P-K-S-Zn (kg/ha)	Management
T. Aman (145-155days)	BRRI dhan52 (Submerged condition)	120-10-40-10-0	1/3 N basal +1/3 N ATS+1/3 N DBPI, ½ K basal +½ K DBPI All PS and Zn at basal
T. Aman (105-110 days)	BRRI dhan56	60-10-30-10-0	Three equal splits, 1/3 N basal +1/3 ATS+1/3 DBPI All PKS and Zn at basal

Plant Physiology Division

Research Achievements 2012-13

(Technology Development)

Technology Developed	How Country/Farmer/User will be benefited
1. Two advanced breeding lines namely BR7100-R-6-6 and IR59418-7B-21-3 performed better than BRRI dhan47 for yield potential against salinity at reproductive stage and proposed for future salinity tolerant boro variety.	It can be used by the farmers for moderately saline prone areas
2.A total 36 genotypes were selected from 219genotypes as moderately tolerant at seedling stage for salinity tolerance.	Plant breeder can use for further breeding program
3.Three genotypes as NIL434, NIL657 and NIL683-R were selected from 20 genotypes for reproductive stage salinity tolerance.	Farmers can use these genotypes for slightly saline prone areas
4. A BRAC hybrid variety namely HB8 was identified having good yield potential at reproductive stage for salinity tolerance.	It can be used by the farmers
5. Three genotypes namely SONGA TEPI (Acc. No. 4217), ATSHOTTI (Acc. No. 4398) and ATSHOTTI (Acc.no. 4399) were selected from 97 genotypes for submergence tolerance.	Plant breeder can use for further breeding program
6. Among 5 ALART and 3PVS materials IR82589-B-B-84-3 performed in respect of drought tolerance	Farmers may use these material for drought prone areas
7. IR77496-31-2-1-3-1 and IR62266-42-6-2 found apparently cold tolerant both at the vegetative and reproductive phase.	These genotypes may be used by farmer for cold prone areas
8. For avoiding cold injury and establishing healthy seedling it is required to maintain 2-4 cm water layer in seedbed for 12-hour at night time.	It can be used by the farmers
9. Twenty-two genotypes were selected as heat tolerant genotypes having more than 85% spikelet fertility against heat stress.	Plant breeder can use for further research
10. Five automatic weather stations were established at the regional stations and data has been collected at every six months interval.	All research division can use these data

Agronomy Division

Research Achievement 2012-2013
(Technology Development)

Technology Development	How country/Farmer/User will be benefited
1. Evaluation of Herbicide A total of 22 herbicides were evaluated against different weed species of transplanted rice. Among them 20 herbicide showed higher weed control efficiency	Farmers will be benefitted by reducing weeding cost by using these herbicides after final approval from PTAC
2. NPK briquette deep placement for sustainable rice production	Farmers will get high yield with low amount of fertilizer
3. SRI principle for maximizing Boro yield in Bangladesh condition	Farmers will get higher yield

Irrigation and Water management Division

Research Achievement 2012-13
(Technology Developed)

Sl. No.	Technology Developed	How Country/Farmer/ User will be benefited
1	**Fresh groundwater investigation for sustainable crop production in coastal saline area** In Parulia village of Debhata Upazila under Sathkira district suitable water bearing aquifer has been found at a depth of 610-650 ft from the surface. The EC of the groundwater was found below 1.66 dS/m. Farmers are growing rice during dry season using the groundwater and getting excellent yield.  Fig. Installation observation well  Fig. Rice cultivated using GW	Salinity is the major problem for growing Boro rice in the saline area of Satkhira district due to lack of fresh water. Investigation was carried out for finding fresh groundwater and found that rice can be grown easily in this area in Boro season using non-saline groundwater.
2	**Refinement of Alternate Wetting and Drying (AWD)**	AWD (Irrigation when

	irrigation for rice cultivation Results showed that AWD method of irrigation (5-7 cm) when water level is 15 cm below the soil surface is more economically viable for Boro rice cultivation. It saved 20-25% irrigation water without hampering the rice yield. Even it increased yield 0.2-0.5 ton/ha. The additional benefit of AWD method was Tk.4931/ha over continuous standing water practices.	water level is 15 cm below the soil surface) is the best water management practice for irrigated Boro production. Farmers can save water and money using this technology.

Agricultural Economics Division

Research Achievement 2012-13

(Technology Developed)

Sl. No.	Technology Developed	How country/Farmer/User will be benefited
SUB-SUB-PROGRAM- I: PRODUCTION ECONOMICS & TECHNOLOGY ADOPTION		
1.1	Farm Level Evaluation of Modern Rice Cultivation in Bangladesh	Rate of adoption of MVs rice and its performance might assist extension agents in priority setting for varietal promotional programs. Higher adoption of potential variety indicated more area coverage and productivity of that variety, resulted in attaining food self-sufficiency.
1.2	Estimation of Costs and Return of MV Rice Cultivation at Farm Level	The findings would help planners and policy makers to formulate proper guideline for setting procurement and support price, input subsidy, etc of MVs rice production.
SUB-SUB- POGRAM- II: AGRICULTURAL POLICY AND DEVELOPMENT		
2.1	A Study on Resource Allocation in Rice Research in Bangladesh: Varietal Release Pattern and Adoption	The findings of the study provide comparative picture of resource allocation in varietal research development program in Bangladesh and its relative contribution to the economy as a whole.
2.2	A Simulation Study on Impact of Climate Factors on Production and Supply of Rice in Bangladesh	The findings of the study highlighted the harshness of climate change and its intervention to coup up with the condition.
2.3	Supply of and Demand for Agricultural labor in Gazipur District: Evidences from Farm Level Investigation	The findings of the study furnished the contemporary portrait of agricultural labor situation and urged the possible solution of the problem.

Agricultural Statistics Division

Research Achievement 2012-2013

(Technology Developed)

Technology Developed	How Country/Farmer/ User will be benefited
Development and validation of producer and consumer preference model to rice varieties **Description:** In T.Aman season, BR11, BR22 and BRRI dhan32, in Boro season, BR16, BRRI dhan28 and BRRI dhan29 and in Aus season, BR9, BR16 and BR20 were found to be more preferable and cultivable varieties due to higher yield among the producers and producer cum consumers. Pure consumers were found to prefer rice varieties on the basis of tastiness, fine rice and availability of the varieties. BRRI variety contributes about 90% of total production but it does not reflect in field label because of BRRI variety sale in different brand name, namely BRRI dhan28 sale as Nizersail and BRRI dhan29 as Jhingasail and Minikit etc	Three mathematical models have been developed for producer, consumer and producer cum consumer preference to rice varieties and these three models uses to determine factors affecting producer's decision on varieties for rice cultivation and can provide an indication of the factors affecting consumers' preference to rice varieties. Also, determine factors affecting producer cum consumer's preference to rice varieties. Therefore, farmer and researcher will take decision that which crop and what condition they will grow the rice.

An Application of Box-Jenkins Method for Forecasting of Aus Rice Production in Bangladesh **Description:** The objective of this study was to forecast the Aus rice production in Bangladesh by using the Box-Jenkins method. In this work we are interested to construct ARIMA model for yearly time series data of aus rice production in Bangladesh for the periods 1971-1972 to 2010-2011, which are taken from the reliable publication "Year Book of Agricultural Statistics" is published by Bangladesh Bureau of Statistics (BBS), Bangladesh. In this study the methodology first refers to use of ARIMA model as propounded by Box and Jenkins for forecasting of requirement and production of aus rice.	These projections will help the government to make policies with regard to relative price structure, production and consumption and also establish the relations with other countries of the world.

Farm Management Division

Research achievement 2012-2013
(Technology developed)

SL. No.	Technology Developed	How Country/ Farmers/User will be benefited
Program Area: Socio-Economics and Policy		
03	Farm Management Division	
	3.1. Different sources of N and weed control methods on rice Application of super clean instead of refit gave Tk. 4010 ha^{-1} more profit but Application of super clean instead of hand weeding gave Tk. 10210 ha^{-1} more profit. However, application of refit instead of hand weeding the more profit was Tk. 6200 ha^{-1} and application of USG instead of PU the more profit was Tk. 3875 ha^{-1}.	This finding may be useful for the rice growers and researcher .

	3.2. Cost of Production of rice: The cost of production (variable cost basis) of per kg of rice was Tk. 23.4 in aus, Tk. 16.9 in aman and Tk 16.5 in boro season. The BCR was 1.29, 1.71 and 1.72 in aus, aman and boro seasons, respectively.	This finding may be useful for the policy maker, planners, rice growers and rice research / production farm.
	3.3. Laborers' wage rate in rice production farm: Laborers' wage rate at rice production farm was monitored throughout the year at different locations of Gazipur sadar. The wage rate varies from Tk. 335 to 350 day^{-1}. The wage rate in peak periods of the year was Tk. 470 to 480 in May, Tk. 285 to 340 in July-August and Tk. 330 to 420 in December - January. In Habiganj, Rangpur, Rajshahi, Barisal, Sonagazi, Comilla Satkhira and Khulna the wage was Tk. 200-300, 200-300, 200-300, 250-300, 250-300, 300-400, 300-400 and 350-400, respectively.	The Laborers' wage rates will help to estimate rice production cost and thus determine the retailer price of rice for the market.
	3.4. Yield gap between breeder seed used plot and farmer's seed used plot In case of BRRI dhan 28, the yield gap between breeder seed and farmers' seed was 1.9 tha^{-1} and between TLS and farmers' seed about 1.0 tha^{-1}. In case of BRRI dhan 29, the yield gap between breeder seed and farmers' seed was 1.8 tha^{-1} and between TLS and farmers' seed about 1.2 tha^{-1}. In case of BRRI dhan 47, the yield gap between breeder seed and farmers' seed was 1.4 tha^{-1} and between TLS and farmers' seed about 0.6 tha^{-1}	This information will help to farmers to encourage use of quality seed to get higher yield

Research Achievement 2012-2013

Programme Area 6: ***Farm Mechanization and Postharvest Technology***

Research Division: **Farm Machinery and Postharvest Technology Division**

Sl. No.	*Technology developed*	**How country/farmers/user will be benefited**
1.1	Design and development of BRRI prilled urea applicator  BRRI prilled urea applicator  Field operation of BRRI prilled urea applicator	BRRI prilled applicator was designed considering line to line spacing of 20 x 20 cm and fabricated in the FMPHT divisional research workshop for double rows operation in rice field. After one revolution of drive wheel, amount of urea dispensed in both the hoppers was almost 14g which satisfied the amount of USG displacement in Aus cultivation. The applicator has to calibrate before field operation in each rice season. Prilled urea dispensing rate can be controlled by adjusting the metering device. The field capacity of the applicator was 32 decimal/h. BRRI prilled urea applicator can save 30 -35% of prilled urea without sacrificing yield.

Sl. No.	*Technology developed*	**How country/farmers/user will be benefited**
1.2	Development and evaluation of a power weeder for Bangladesh condition  BRRI Modified Power Weeder   Fig . Spike arrangement of the	Korean multi rows power weeder was modified for Bangladesh conditions considering the line to line spacing 18, 20 and 22 cm. Modified power weeder was 2-3 times faster than BRRI single row manual weeder.

Research Achievement 2012-13

Workshop Machinery and Maintenance Division (WMM)

Name/Title of the Technology:	Description:
1. A self-propelled reaper  	A self-propelled reaper for rice and wheat with a simple, light weight and low cost power transmission gearbox was designed and developed in the research workshop of BRRI. The gearbox was mounted to the chassis of the reaper and tested for 1.0 and 1.2-meter reapers. The effective field capacities of 1.0 and 1.2-meter reapers were 0.251 and 0.31 ha/hr, respectively for harvesting rice. The equivalent values for wheat were 0.246 and 0.32 ha/hr, respectively. Similarly, field efficiency of 1.0 and 1.2-meter reapers was 71.7 and 73.8%, respectively for rice. The equivalent values for wheat were 7.03 and 76.2%, respectively. In 1.2 m reaper, the effective field capacity is higher and on the other hand fuel consumption, harvesting time and cost are lower than those of 1.0 m reaper and manual harvesting. So harvesting with 1.2 m self-propelled reaper will be beneficial /profitable to the farmers.

Adaptive Research Division

Research Achievements: 2012-2013

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
01.	**Adaptive Research Division**	
	Project_1 **Validation of Technologies**	
	1.1. Advanced Lines Adaptive Research Trial (ALART): The Adaptive Research Division (ARD) evaluated the following 6 sets of ALART in different agro-ecological regions of Bangladesh in different seasons during 2012-2013.	It is an important step before releasing a new variety
	1.1.1 ALART (GSR), T. Aman, 2012. Five advanced lines along with BRRI dhan44 as check were tested in 9 locations of Bangladesh during T. Aman, 2012. Based on the growth duration, grain yield, grain quality and farmers' opinion, HUA 565 was found suitable for Proposed Variety Trial (PVT) in T. Aman season.	Farmers will be benefitted for its better yield (4.69 t/ha) and shorter growth duration (110 days) which will help the farmers to cultivate rabi crops after harvesting and before transplanting of boro crops.
	1.1.2 ALART (Drought), T. Aman, 2012. Five advanced lines along with BRRI dhan56 as check were tested in 8 locations of Bangladesh. In all locations, the trials escaped drought stress because of sufficient rainfall at the sensitive growth stages. The trial should be repeated to evaluate the lines under drought stress. However under favourable rainfed condition and based on the growth duration, grain yield, grain quality and farmers' opinion, IR83377-B-B-93-3 and IR82635-B-B-75-2 were found suitable for Proposed Variety Trial (PVT).	Under favorable rainfed condition, farmers will be benefitted for its better yield (around 5.00 t/ha) with shorter growth duration (110 days) which will help the farmers to increase cropping intensity of their land.
	1.1.3 ALART (RLR), T. Aman, 2012. Three advanced lines along with BRRI dhan44 and BR11 as checks were evaluated in 9 locations of Bangladesh. Based on grain yield and farmers' opinion, BR7611-31-5-3-2 was found	Farmers will be benefited for its higher yield (5.04 t/ha) having growth duration similar with BR11 (139 days).

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	suitable for Proposed Variety Trial (PVT) in T. Aman season. **1.1.4 ALART (Standard), Boro 2013.** Five advanced lines along with BRRI dhan28 were tested in 10 locations of Bangladesh during Boro, 2013. Based on grain yield, growth duration, shorter plant type, lodging tolerance and farmers' opinion, Weed tolerant rice and ZHONGZU 14 were considered for Proposed Variety Trial (PVT).	Farmers will be benefitted for its higher yield (6.00 t/ha) and reasonable growth duration (149 days).
	1.1.5 ALART (Micronutrient), Boro 2013. Three micronutrient dense advanced lines along with BRRI dhan28 were tested in 10 locations of Bangladesh during Boro 2013. Based on the growth duration, grain yield and farmers' opinion, micronutrient dense BR7830-16-1-5-3 and IR83294-9-1-3-2-3-Gaz1 were found suitable for Proposed Variety Trial (PVT).	Children and pregnant woman, especially in rural areas, will be benefitted by micronutrient dense genotype which is very much needed for their sound health.
	1.1.6 ALART (Salinity), Boro 2013. Four salt tolerant advanced lines along with BRRI dhan47 and BRRI dhan28 were evaluated in 7 salt affected areas of Bangladesh during Boro, 2013. Based on grain yield, growth duration, salt tolerance, non-shattering character, grain quality and farmers' opinion, IR59418-7B-21-3 and IR78794-B-Sat 29-1 were found suitable for Proposed Variety Trial (PVT).	Farmers in salt affected areas will be very much benefitted by using salt tolerant varieties having higher yield (more than 6.00 t/ha) and reasonable growth duration (145 days).

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
01	**Adaptive Research Division**	
	Project_2 **Dissemination of Technologies**	
	Seed Production and Dissemination Program (SPDP) were conducted under different funding sources during 2012-13.	Wide dissemination of BRRI varieties are expected throughout the country.
	2.1 BRRI Core Program **2.1.1 SPDP with USG, T. Aman, 2012.** SPDP with USG was conducted in 3 upazilas of 3 districts (Mymensingh, Sherpur and Khulna) by using BRRI dhan41, BRRI dhan49 and BRRI dhan57. Total production of BRRI dhan41, BRRI dhan49 and BRRI dhan57 were 470, 1860, and 520 kg respectively and retained a total of 770 kg quality seeds for next year use.	Wide dissemination of these aman varieties are expected in those areas. USG was found useful for efficient use and management of N fertilizer and it will help farmers in saving urea fertilizer.
	2.1.2 SPDP with USG, Boro, 2013. A total of 14 SPDPs with USG were conducted at 14 upzilas of 8 districts (Sherpur **,** Gazipur **,** Gaibandha **,** Gopalgonj **,** Khulna **,** Comilla **,** Chittagong and Sylhet) during Boro, 2013. BR16, BRRI dhan28, BRRI dhan47, BRRI dhan50, BRRI dhan55 were used as varieties in those demonstrations. About 10770, 560, 770, 9872 and 12805 kg grains were produced by those varieties. A total of 10,507 kg seeds were retained by the farmers for next year use.	Wide dissemination of these boro varieties are expected in those areas. USG was found useful for efficient use and management of N fertilizer and it will help farmers in saving urea fertilizer.
	2.1.3 SPDP using poultry manure, Boro, 2013. Eleven demonstrations using poultry manure in rice cultivation were conducted at 11 upazilas under 6 districts (Sherpur**,** Gazipur**,** Gaibandha**,** Comilla**,** Chittagong and Sylhet). BR16, BRRI dhan29, BRRI dhan50 and BRRI dhan58 were used for those trials. About 9703, 10870, 9007 & 10950 kg grains were produced and 2455, 1904, 2322, 2332 kg seeds of BR16, BRRI dhan29, BRRI dhan50 and BRRI dhan58	Poultry manure can be used as an alternative source of P fertilizer and it can save a lot of foreign exchange used for importing chemical P fertilizer.

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	were retained by the farmers for next season use.	
	2.2 AFACI Food Security Project in Bangladesh **2.2.1 Rice production using USG applicator in T. Aman, 2012.** Rice production using USG applicator was conducted in Chandina, Comilla and Sadar, Satkhira. In Chandina, Comilla the farmers were provided with seeds of BRRI dhan38, 39 and BRRI hybrid dhan4. In Sadar, Satkhira varieties were BRRI dhan49, 51, 52 and BRRI hybrid dhan4. Majority farmers at Comilla were interested to grow BRRI dhan49 for better yield along with fine grain and medium growth duration and high market price. Farmers at Satkhira preferred BRRI dhan49 and 52 compared to BRRI dhan51 and BRRI hybrid dhan4. **2.2.2 Rice production using USG applicator, Boro, 2013.** Rice production using USG applicator was conducted in Daudkandi, Comilla and Sadar, Satkhira. The farmers were provided with seeds of BRRI dhan50, 55, 58 and BRRI hybrid dhan3 in Daudkandi, Comilla and it was BRRI dhan47, BRRI dhan55, 58, BRRI hybrid dhan3 and BINA dhan8 in Sadar, Satkhira. About 40% of produced inbreed rice in demonstrated plots were retained as seeds by the farmers themselves for next year (season) cultivation. Number of motivated farmers to grow the new varieties is 1270 through these demonstration trials.	Wide dissemination of these Aman varieties and USG applicator are expected in those areas. USG applicator was found suitable to save time, labour and to reduce cost of application. Wide dissemination of these Boro varieties and USG applicator are expected in those areas. USG applicator was found suitable to save time, labour and to reduce cost of application.
	2.3 Integrated Agricultural Productivity Project (IAPP) **2.3.1 SPDP, Aus, 2012.** SPDP was conducted in 16 upazilas of 8 districts under IAPP. Out of these 16 upazilas, 8 upazilas	Wide dissemination of these Aus varieties are expected in those areas.

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	belonged to 4 districts (Barisal, Patuakhali, Jhalokathi & Borguna) of Barisal region & the rest 8 upazilas belonged to Rangpur & Kurigram districts under Rangpur region. Here, T. Aus varieties BRRI dhan27 and BRRI dhan48 were selected for Barisal region & B. Aus varieties BRRI dhan42 & BRRI dhan43 were selected for Rangpur region. Total produced grains of BRRI dhan27 and BRRI dhan48 were 7726 kg and 8647 kg and retained seeds by the farmers were 1390 kg and 1260 kg respectively for further use and for distribution to other interested farmers. Total produced grains of BRRI dhan42 and BRRI dhan43 were 3427 kg and 3293 kg and retained seeds by the farmers were 300 kg and 315 kg respectively for further use and for distribution to other interested farmers. **2.3.2 SPDP with USG, T. Aman, 2012.** SPDPs with USG were conducted in 32 upazilas of 4 southern and 4 northern districts under IAPP during T. Aman, 2012. BRRI dhan41 and BRRI dhan44 were selected as varieties in southern districts where as BRRI dhan49 and BRRI dhan57 were selected for northern districts. Total produced grains of BRRI dhan41 was 10.60 tons in 16 upazilas from which 2.20 tons were retained as seeds by the farmers for next season. BRRI dhan44 was a good variety for non saline tidal area and produced a total of 11.21 tons of grains and participated farmers retained 2.02 tons as seeds for the cultivation in next season. Total produced grains of BRRI dhan49 was about 10.81 tons and farmers retained 2.6 tons as seeds for next season. A total of nearly 8.45 tons grains of BRRI dhan57 were produced in 16 upazilas from which 3.62 tons were retained as seeds by the farmers for next season.	Wide dissemination of these aman varieties are expected in those areas. USG was found useful for efficient use and management of N fertilizer and it will help farmers in saving urea fertilizer.

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	2.3.3 Adaptive Trials under IAPP	
	2.3.3.1 Adaptive trials in southern districts, T. Aman, 2012. Eight Adaptive trials were conducted in 8 upazilas of 4 southern districts under IAPP during T. Aman, 2012. The southern districts were Barisal, Jhalokathi, Patuakhali and Borguna as the saline or non saline coastal tidal submergence rice ecosystem. BRRI dhan41, BRRI dhan44, BRRI dhan51, BRRI dhan52 and Shadamota as locak check were selected as varieties in southern districts. Among 8 upazilas under 4 districts BRRI dhan44 was the highest yielder among the varieties followed by BRRI dhan41, 51, 52 and the local check Sadamota. The highest average growth duration was found in standard local check Sadamota (162 days) followed by BRRI dhan41, BRRI dhan44, BRRI dhan52 (149, 146, 145 days respectively).	BRRI dhan44 and BRRI dhan52 were found suitable to cultivate in the southern region of Bangladesh.
	2.3.3.2 Adaptive trials in northern districts, T. Aman, 2012. Eight Adaptive Trials were conducted in 8 upazilas of 4 northern districts under IAPP during T. Aman, 2012. The northern districts were Rangpur, Nilphamari, Lalmolnirhat and Kurigram as the drought prone ecosystem. BRRI dhan49, BRRI dhan51, BRRI dhan52, BRRI dhan57 and Swarna as locak check were selected as varieties in northern districts with two replications. The highest average yield was found in BRRI dhan49 (5.40 t/ha) followed by BRRI dhan52, BRRI dhan51, BRRI dhan57 (5.0, 4.4, 4.4 t/ha respectively) and the lowest average yield was found in Swarna (3.4 t/ha). The highest average growth duration was found in Swarna, it was 147 days followed by BRRI dhan52, BRRI dhan51, BRRI dhan49 (145, 142, 135 days respectively).	BRRI dhan49 and BRRI dhan52 were found most suitable to cultivate for the northern region followed by BRRI dhan57.

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	2.3.4 SPDP with USG, Boro, 2013. SPDPs with USG were conducted in 16 upazilas of 4 southern and 4 northern districts under IAPP during Boro, 2013. BRRI dhan47 and BRRI dhan55 were selected as varieties in southern districts where as BRRI dhan50 and BRRI dhan55 were selected for northern districts. BRRI dhan55 performed as a very good variety in all demonstrated upazilas in the southern districts and it produced 7.2 tons of grains and participated farmers retained 1.09 tons as seeds for the cultivation in next season. Total produced grains of BRRI dhan47 was 6.9 tons in 8 upazilas from which 1.30 tons were retained as seeds by the farmers for next season. In northern districts BRRI dhan50 performed well and total produced grains of this variety was about 6.6 tons and farmers retained 1.3 tons as seeds for next season. A total of 7.23 tons grains of BRRI dhan55 were produced in 8 upazilas from which 1.2 tons were retained as seeds by the farmers for next season.	Wide dissemination of these Boro varieties are expected in those areas. USG was found useful for efficient use and management of N fertilizer and it will help farmers in saving urea fertilizer.
	2.3.5 Adaptive Trials under IAPP **2.3.5.1 Adaptive trials in southern districts, Boro 2013.** Eight Adaptive trials were conducted in 8 upazilas of 4 southern districts under IAPP during Boro 2013. The southern districts were Barisal, Jhalokathi, Patuakhali and Borguna as the saline or non saline coastal tidal submergence rice ecosystem. BR16, BRRI dhan28, BRRI dhan47, BRRI dhan55 and BRRI dhan47 (locak check) were selected as varieties in southern districts. The highest average yield was found in BRRI dhan55 (6.83 t/ha) followed by BRRI dhan28, BRRI dhan47. The highest average growth duration was found in BR16 (166 days) followed by BRRI dhan47, BRRI dhan55 and BRRI dhan28.	BRRI dhan55, BRRI dhan28 and BRRI dhan47 were found suitable for southern districts.

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	2.3.5.2 Adaptive trials in northern districts, Boro 2013. Eight Adaptive trials were conducted in 8 upazilas of 4 northern districts under IAPP during Boro 2013. The northern districts were Rangpur, Nilphamari, Lalmolnirhat and Kurigram as the drought prone ecosystem. BR16, BRRI dhan50, BRRI dhan55, BRRI dhan58 and BRRI dhan28 (locak check) were selected as varieties in northern districts. The highest average yield was found in BRRI dhan58 (6.90 t/ha) followed by BRRI dhan55, BRRI dhan28 and BRRI dhan50 and the lowest was found in BR16 (5.76 t/ha). The highest average growth duration was found in BR16 (168 days) followed by BRRI dhan50, BRRI dhan58, BRRI dhan55 and BRRI dhan28.	BRRI dhan58, BRRI dhan55 and BRRI dhan50 were found suitable for northern districts.
	2.4. Mujibnagar Integrated Agricultural Development Project (MIADP) **2.4.1. SPDP, T. Aus, 2012.** SPDPs were conducted in 16 upazilas of 4 districts (Kushtia, Meherpur, Chuadanga and Jinaidah) under MIADP by using BRRI dhan48. Total production was 17,751 kg and farmers retained 1881 kg seeds for next season cultivation.	Wide dissemination of BRRI dhan48 are expected in those areas.
	2.4.2. SPDP with USG, T. Aman 2012. SPDPs were conducted in 16 upazilas of 4 districts under MIADP. BRRI dhan49 and BRRI dhan57 were used in each upazila. Total production of BRRI dhan49 and BRRI dhan57 were 13,012 and 9,880 kg. Farmers retained 2,600 kg seeds of BRRI dhan49 and 2,808 kg of BRRI dhan57 for next season.	Wide dissemination of these Aman varieties are expected in those areas. USG was found useful for efficient use and management of N fertilizer and it will help farmers in saving urea fertilizer.
	2.4.3 SPDP with USG, Boro 2013. SPDPs were conducted in 17 upazilas of 4 districts under MIADP. BRRI dhan50 and BRRI dhan55 were used in each upazila. Total production of BRRI dhan50 and BRRI	Wide dissemination of these boro varieties are expected in those areas. USG was found useful for efficient use and management of N fertilizer and it will help farmers in saving urea fertilizer.

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	dhan55 were 25863 and 27952 kg. Farmers retained 6470 kg of BRRI dhan50 and 4061 kg of BRRI dhan55 as seeds for next season.	
	2.5. Minimizing Rice Yield Gap Project (BRRI Part) (MOA) **2.5.1 Identification of location specific rice cultivation problem and maximizing rice yield through BRRI technologies in Aman, 2012** Research activities were carried out in seventy five *upazilas* throughout the country. 25.98% yield gap was observed in T. Aman, 2011 which now reached at 15.59% in T. Aman, 2012 i.e. 10.41% yield gap was minimized within this period which results an additional production of around 28 lack tons and added to our national production **2.5.2. Identification of location specific rice cultivation problem and maximizing rice yield through BRRI technologies in Boro, 2013.** The experiments were conducted in 75 upazilas in farmer's participatory approach. Based on the present research findings it is come to light that improved practice i.e. BRRI Recommended Practice increased 15.23% yield over traditional farmers practice at farmer's field condition. A total of 45 lack tons extra rice production is possible to add to the national production if this program is possible to bring throughout the country.	Our national production will be increased and food security will be ensured. Our national production will be increased and food security will be ensured.

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	2.6. Yield gap minimization in rice using Integrated Crop and Resource Management (ICRM) Practices under KGF On-farm farmers' participatory adaptive research trials were conducted on Integrated Crop and Resource Management (ICRM) practices in 9 upazilas (Kapasia, Pakundia, Kotiadi, Monohordi, Polash, Madargonj, Sherpur Sadar, Nokhla and Nalitabari) of 5 districts (Gazipur, Jamalpur, Norshingdi, Kishoreganj and Sherpur) during Aman, 2012 and Boro, 2013. In ICRM practices, 0.8-1.2 t/ha increased grain yields over farmers practice were found during Aman season and 0.9-1.7 t/ha increased grain yields during Boro season.	Rice yield gap will be minimized to some extent and farmers will be benefitted.
	Project- 3	
	Farmers' training and promotional activities	
	3.1. Farmers training during 2012-13 A total of 72 farmers' training were conducted under different program in which 2520 trainees (2160 farmers and 360 DAE personnel) participated. **3.2. Field Day/ Farmer's Rally** ARD conducted 70 Field days at different locations of the country under different projects and GOB during the reporting period. A total of about 12,000 (aprox) persons participated in those occasions.	Farmer's knowledge and skill in modern rice cultivation technologies will be increased. Farmers motivated to adopt improved rice technologies
	Project_4	
	Enrichment of own seed stock	
	4.1. Production of quality seeds of BRRI released recent varieties during 2012-13 A total of 7900 kg quality seeds of the current rice varieties were produced at BRRI farm, Gazipur for adaptive trials in	Farmer will get the quality seeds of latest BRRI released varieties.

Sl. No.	Technology Developed	How Country / farmer / User will be benefited
Program Area: Technology Transfer		
	different locations of the country in Aus, Aman and Boro seasons.	

Training Division

Research Achievement 2012-2013

(Technology Developed)

	Technology Developed	How country /Farmer/User will be benefited
I	1. Technology Transfer through training	Knowledge and skill of the trained personnel of the subject matter will be increased.
	Total training conducted : 89 No. of participants : 1,922 Duration: 1 day to 1 week Participants: Extension personnel of DAE, GO/NGO officers and farmers.	1. Knowledge and skill of the participants on rice production technologies will be enriched. 2. Rice yield and production of the country will be increased.