PROJECT COMPLETION REPORT (PCR)

[Compiled]

Project Title:

Screening and testing of Improved Aus Rice Varieties/Genotypes Suitable for Rainfed Aerobic Soil Condition of Bangladesh

Project Code No:TF 04-C

Project Duration: 39 Months; From May 2013 to August 2016

CGP Project: KGF BKGET 1st Call

Submitted to:

Executive Director
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Submitted by:

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Date: 15-10-2016

Table of Contents

Full names of Abbreviations and Acronyms]

CGP = Competitive Grants Program
KGF = Krishi Gobeshona Foundation
MoU = Memorandum of Understanding
PVS = Participatory Varietal selection
PI = Principal Investigator
PIR = Project Inception Report
RP = Research Proposal
TMUF = Trinomul Manobik Unnayan Forum
BLB = Bacterial Leaf blight
BPH = Brown Plant Hopper
DAE = Department of agricultural Extension

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PROJECT COMPLETION REPORT ON

Screening and testing of Improved Aus Rice Varieties/Genotypes Suitable for Rainfed Aerobic Soil Condition of Bangladesh

CGP Projects: KGF BKGET 1st Call

Project Duration: 36 Months; From May 2013 to May 2016

A. Basic Project Information:

i. Project ID No. (FRP): TF 04-C

ii. Project Title- Screening and testing of Improved Aus Rice Varieties/Genotypes Suitable for Rainfed Aerobic Soil Condition of Bangladesh

iii. Name of Coordinator with designation: Dr. A S M Masuduzzaman
Chief Scientific Officer
Plant Breeding Division, BRRI, Gazipur-1701.

iv. Name of Principal Investigator with designation-- Meer Md. Muniruzzaman,
Consultant
Trinomul Manobik Unnayan Forum (TMUF)
Uttara, Shakhipur, Tangail-1900

v. Name of Co-investigator with designation -

1. A. B. M. Zahid Hossain
Senior Scientific Officer,
IWM Division, BRRI

2. Mohammad Anisuzzaman
Scientific Officer
Plant Breeding Division, BRRI, Gazipur-1701.

vi.Name of the applying organization with address- Bangladesh Rice Research Institute (BRRI), Gazipur-1701.

vii. Name of associate/collaborating organization(s)–
Trinomul Manobik Unnayan Forum (TMUF) Uttara, Shakhipur, Tangail-1900

viii.Project duration (months) - From May 2013 to May 2016

ix. Project commencement date (As per MoU) -- April 2016

x. Project locations/sites with name-- Gazipur (On Station), Rajshahi and Habiganj

xi. Project size (no. of participatory farmers/site; land area (ha)/farmer/site included in project activities with total number of farmers and total land area in hectare.

No. of participatory farmers/site: 25
Total land area (ha): 7 ha
Total no of farmer: 55

xii. Project cost (total) TK (Year-1: TK 29.95 lac, Year-2: TK24.68 lac Year-3: TK15.35 lac)

xiii. Fund received in TK. 64,27,000/- & Expenditure made in TK. 6368988/- during the reporting period.

B. Summary/Executive Summary:

In large portion of rainfed Aus areas of Bangladesh - rainfall is erratic and dry spells may occur during seedling stage (April to May) of Aus crop. Base line information indicated that there is scope to increase Aus areas through adapting short duration aerobic rice varieties under water saving direct seeding methods in Rajshahi and Sylhet regions. Under such situation, this coordinated project has been designed to develop aerobic rice varieties having short duration (100-105 days), high yielding and aerobic soil adaptability. BRRI worked with partner organization (TMUF) and a number of experiments were conducted during Aus 2013-16 and T. aman 2013-16. During 1st year, 19 lines were selected from 103 IRRI lines and further 12 lines were selected from 136 BRRI lines. During the 2nd year, 3 separate advanced yield trails were conducted under aerobic soil condition in farmer's field in replicated yield trials to find out the best aerobic rice lines. Under aerobic siol conditions, 4 lines were selected (IR91006-88-1-3-1, IR84788-40-3-3-1-1, IR90228-1-3-3-3-2 and IR92240-40-2-2-1) in respect to yield (3.60- 4.20 t/ha), comparatively shorter growth duration (105-109 days) - those have been selected under aerobic soil condition in two locations. Further, 4 top ranking lines (BR7178-2B-19-10, BR6855-3B-12, BR6848-3B-12 and BI dhan-5) in respect to yield (3.55- 4.50 t/ha), shorter duration (97-101 days) and better phenotypic acceptance were selected for PVS trial. Based on PVS results of 8 locations in Sylhet region and 8 locations in Noagoan - BR7178-2B-19, BI dhan-5, BR6855-3B-12 and IR92240-40-2-2-1 were finally selected for their comparatively higher yield and shorter growth duration (about 100 days) and as well choose as farmer's preferred. In the 3rd year, the RYT results of 6 locations showed that BR7178-2B-19 (4.28 t/ha), BI dhan-5 (4.15 t/ha), and IR92240-40-2-2-1 (3.97 t/ha) performed better and all the 3 lines were proceeded for release as variety.

Molecular data revealed that one of two markers- RM302 amplified a specific allele (112 bp) in all the aerobic rice genotypes, which showed different pattern from short rooted rice

genotypes. Thus, IR92240-40-2-2-1 was best aerobic rice genotypes possessed deeper root system. Phenotypic acceptance, root length and root / root-shoot ratio under water stress were used as criteria for selecting aerobic rice lines. IR90228-1-3-3-3-2 and IR91006-88-1-3-1 are the best aerobic rice genotypes with higher root length (55-58) and higher root / root-shoot (0.44-0.46) than others.

An experiment with 3 irrigation treatments revealed that irrigation after 3 days of disappearing of standing water was found the best water management option. About 27.64% water could be saved compared to continuous standing water. Experimental results indicated that herbicide application did not increase yield; however, herbicide application was found effective for saving time and cost for weeding. Thus, aerobic rice cultivation package have been standardized in respect with irrigation practices (irrigation after 3 days of disappearing of water) and standard weed control by herbicide. Farmers could harvest the crop 8-10 days earlier than normal transplanting method.

Further, one inception workshop cum farmer's training has been conducted at Rajshahi. Total 60 participants including DAE personnel, scientists from BRRI and farmers were participated. All the participants obtained a clear understating of aerobic rice and fed-back information from DAE and farmers were obtained. Six farmers training on aerobic rice cultivation method were conducted.

C. Introduction: During Aus season in Northern districts, rainfall is very low; water shortage seriously affecting our agriculture and supplementary irrigation cost is also high. At the same time, there is labour shortage during transplanting time and more labour costs are involved for transplanting of rice seedlings. In Sylhet region, about 1 million ha of land remain fallow due to shortage of irrigation facilities; there is scope to bring this fallow land under aus cultivation. Addressing these constraints- this coordinated project has been designed to develop aerobic rice varieties having shorter duration (100-105 days), high yielding and aerobic direct seeded adaptability. This project has mainly emphasized the direct seeding of rice in the main field instead of traditional transplanting of seedlings. The major advantages of direct seeding on the main field are: puddling and transplanting of seedlings are not required, direct seed sowing in dry field, less labour requirements and early crop harvest. Thus, crop is established by direct seeding– helps the poor farmers to reduce their cost of production, mainly for irrigation. Aerobic rice cultivation technique is a new water-saving technology that keeps the soil wet by using limited irrigation but not the soil saturated that helps to save 50-60% of irrigation water. Initiative have been taken to standardize the aerobic rice cultivation techniques for growing Aus rice under direct seeding and water saving aerobic conditions. After 3 year of project activities, we succeeded to develop three

high-yielding aerobic rice lines having deep rooting ability. In aerobic rice cultivation techniques soil is not puddled that helps to retain soil structure and reduce emission of methane gas. So this technique is important in the face of recent climate changing situation. The advantages of direct seeding will reduce the cost of rice production of poor farmers and farmers will also be benefited by cultivation of high yielding aerobic rice varieties.

D. Specific Project Objective(s): (As per FRP/PIR)

- To select improved Aus rice varieties/genotypes having high yield, shorter growth duration for growing under aerobic soil condition.
- To develop appropriate agronomic management practices for growing aerobic rice under direct seeding and water saving conditions.
- To evaluate the performance of promising aerobic rice varieties/genotypes and associate rice cultivation packages under aerobic soil condition.
- To improve the knowledge and skill of farmers as well public and private sectors personnel on aerobic rice production technologies.

E. Detailed Technical Report:

a. Statement of the Researchable Problem: Water shortage seriously affecting our agriculture and supplementary irrigation cost (about 5000 liter of water used for 1 kg paddy production) is also high in Northern districts. At the same time, there is labour shortage as well more labour costs are involved for transplanting. In Sylhet region, about 1 million ha of aus land remain fallow due to shortage of irrigation facilities; there is scope to bring this fallow land under cultivation. In about 1.23 m. ha of Aus areas, (BBS, 2010-11), supplementary irrigation is most limiting due to lack of surface as well ground water. It is clear that large expansion of Boro areas– reduced Aus areas during the last 4 decades. So, Aus areas could be increased through adaptation of short duration varieties, especially in northern districts. After discussion in inception workshop at Bagha, Rajshahi and Sadar upozilla of Habiganj – it was known that irrigation facilities are very few in these areas. Aus areas and production could be increased through adaptation of short duration aerobic rice varieties.

Addressing these above constraints- this project has been designed to develop improved Aus rice varieties having higher yield and shorter growth duration suitable for aerobic direct seeded conditions. Direct seeding of rice helps the farmers for reducing their cost of rice production, as seed bed preparation, soil puddling and transplanting of seedlings are not required and less water requirements as well 8-10 days early crop harvest is possible. Thus,

crop is established by direct seeding– helps the poor farmers to reduce their cost of production, mainly for irrigation (save 50-60% of irrigation water). The advantages of direct seeding will reduce the cost of rice production of poor farmers and farmers will also be benefited by cultivation of high yielding aerobic rice varieties. Initiative have been taken to standardize the aerobic rice cultivation techniques for growing Aus rice under direct seeding and water saving aerobic conditions. Aerobic rice cultivation techniques are important in the face of recent climate changing situation. After 3 year of project activities, we succeeded to develop three high-yielding aerobic rice lines having deep rooting ability. Thus, the project will help to increase rice yield and farmer's income with reduced cost of cultivation in Rainfed Aus areas.

b. Research Approaches and Methodologies:

i. Approaches:

The major purpose of this coordinated project is to increase productivity in rainfed Aus areas through developing aerobic rice varieties having short duration (100-105 days), high yielding and deep rooting ability. Efforts are being taken by the leading organization BRRI for planning breeding programme and for screening aerobic rice lines (deep rooting ability and modern rice genotypes). The coordinator of the project worked as principal investigator of BRRI part, as well coordinate with principal investigator of the component organization (TMUF) for implementing the project. Both on-station and on-farm trails were conducted for 3 years (2013-16) to select best aerobic rice lines with minimum time and finally 3 lines were selected in PVS trails. Breeding lines developed for direct seeding conditions, now in the process of variety release through BRRI. BRRI worked with partner organization (TMUF) and DAE for successful development of aerobic rice lines and associated production technologies. Aerobic rice crop establishment techniques were standardized under direct seeded and water saving condition.

BRRI Regional station Rajshahi and Habiganj was directly involved for implementation of trails and institutional support given by BRRI for proper implementation of the trails. One collaborating partner and DAE also worked to perform on-farm Participatory Varietal Selection (PVS) and demonstration trials.

ii. Methodologies:

1. Programme was developed to evaluate the improved Aus rice genotypes under aerobic conditions and experiments were set-up. All the data subject to statistical analysis, LSD values were calculated. The methodologies are as follows:

1A. Selection of short growth duration (97-101 days) aerobic lines: To evaluate the improved Aus rice genotypes under soil aerobic conditions -2 separate experiments (**Table 1A**-103 IRRI inbred lines under Advanced yield trial-1, **Table 1B**- 19 inbred lines under Advanced yield trial-2) were evaluated in Aus 2013-14 under direct dry seeded conditions. All the two experiments were laid out in RCB design with 3 replications at the project site BRRI, Gazipur and Rajshahi. Land was well prepared in dry conditions and direct seeding was done in lines. Unit plot size was 12 m^2. Direct seeding was done on well prepared dry land under line sowing with a spacing of 20 cm from line to line (20 cm x continuous seed sowing). Always the soil was kept wet but not saturated. The seed rate was 30 kg/ha. Direct seeding was done on well prepared non-puddle land under line sowing with a spacing of 20 cm from line to line (20 cm x continuous seed sowing). Fertilizer was applied @ 150, 100, 70, 60 and 10 kg/ ha Urea, TSP, MP, Gypsum and $ZnSO_4$ respectively. Full dose of TSP, Gypsum and ZnS04 was applied as basal; Urea top dressing: 1st at 15-20 DAS, 2nd at 35-40 DAS and 3rd before booting stage. Weeding was done by hand in three times. Data were collected and subjected to statistical analysis, LSD values were calculated**.**

1B. Marker assisted selection for deep rooting ability in rice: The experimental material was comprised of 24 rice lines (**Table 2**) selected under aerobic soil conditions in this project. The experiment was carried out to study the performance of rice genotypes grown under water-limited (aerobic) conditions during boro 2014. A small set of two microsatellite DNA markers (RM212, RM302), which have been shown earlier to be associated with drought resistance were used to amplify the SSR regions in rice genotypes. These two markers were located on chromosome 1 of rice between 135.8 and 143.7 cM (McCouch et al. 2002). Leaf samples were collected and DNA was extracted from each samples following standard protocol. DNA markers linked with deep rooting ability was used for PCR reactions. Gel pictures of DNA bands were taken in gel documentation system and DNA bands was analyzed to find the genotypes with deep rooting ability.

1C. Selection of aerobic lines with higher root length: Root and shoot growth studies of selected aerobic rice genotypes were done to identify lines with deep root system for survival under water stress aerobic conditions. 3.5 ft long polyvinyl chloride (PVC) pipe having 4

inches dia were cut into two parts in longitudinal direction. One part pipe was placed in the floor and filled with dry soil and than other part was placed up on filled pipes. The two parts of pipe were tighten by rope and placed straightly in net house. Nine selected materials were grown in each Polyvinyl chloride (PVC) pipe filled with soil. Seeds were shocked and direct seeding of 6 seeds/entry was done under aerobic soil condition in one PVC pipe. Care was taken for smooth growth of seedlings. Water was supplied when needed. Always the soil was kept wet but not saturated. The roots were thoroughly cleaned and straightened by repeated rinsing in clean water. Then the plants, roots and shoots were dried in sun light for measuring dry biomass. Root length and root weight: shoot and root weight under water stress condition were used as a criterion for selecting best aerobic rice lines

2. Programme was developed to standardize aerobic rice cultivation and the methodologies are as follows:

2A. Irrigation water saved in different irrigation treatments, Aus 2015, Gazipur: Experiment was conducted for developing appropriate technique for water-saving condition for aerobic rice and to find out the best water management in aerobic rice cultivation**.** Two lines were tested in the experiment. The experiment was laid out in split-plot design with three replications. Three irrigation treatments were allocated to the main plots and two varieties to the sub-plots.

Water treatments:

I_0 = Continuous standing water (Control)

I_1 = minimum irrigation, 3 days after disappearing of water

I_2 = minimum irrigation, 5 days after disappearing of water

Breeding lines:

V_1 = BR 6848-3B-12

V_2 = IR90228-1-3-3-3-2

To protect seepage losses polyethylene sheets were placed around the control plots and levees. Irrigation water was applied in each plot by using a plastic hose pipe and was measured by using a flow meter. Seeds were sown on 29 December, 2014. A spacing of 20 cm was maintained between lines to line. Two hand weeding were applied after 25 and 45 days of sowing and seedlings to seedling spacing were tried to maintain about 15 cm. Data on plant height, panicle number/m^2, sterility (%) and grain yield were recorded.

2B. Determination of effective weed management practice: Experiments were conducted for determination of effective weed management practice for aerobic rice cultivation. In direct seeding method, line to line distance was 20 cm. The treatments were; i) Post-emergence herbicide-1 + one hand weeding, ii) Post-emergence herbicide-2 + one hand weeding, iii) Hand weeding at 15 & 30 (DAS) days after sowing and compared with iv) control (No weeding). The post-emergence herbicide-1: Pretilachlor+ Pyrazosulfuran ethyl @ 750 g/ha, Fasal Super 35 WP applied at 6 days after seeding (DAS) in direct seeding method. The post-emergence herbicide-2: Bispyribac sodium @ 150 g/ha, Fasal Xtra 20 WP applied at 6 DAS in direct seeding. The treatments were distributed following RCB design with three replications.

2C. Standardizing appropriate tillage practices:

Materials and methods:

Experiment was done for standardizing appropriate tillage practices for maximum population density /m^2 under aerobic condition. Two selected varieties (BI5 and BR6848-3B-12) were tested under different tillage practices at Bagha, Rajshahi during Aus season of 2014 following split-plot design and 3 treatments. Three treatments were:

T_1 = Well prepared land using 3 plowing by power tiller

T2 = Medium prepared land using 2 plowing by power tiller

T3 = Conventional tillage (control). Land was prepared in dry conditions as like farmers' practices.

For direct seeding - seed rate was 30 kg/ha. The unit plot size was 4 × 4 m^2. Direct seeding was done under line sowing with a spacing of 20 cm from line to line (20 cm x continuous seed sowing). Experimental procedures were same as expt-1. Water was supplied by surface irrigation when needed. Always the soil was kept wet but not saturated. Weeding was done by hand for three times. The fertilizers were applied as recommended. Data on plant height, panicle number/m^2, sterility (%) and grain yield were recorded during harvesting.

4. **Determination of seed rate under direct seeding in lines, Aus 2013**

Materials and methods:

To determine the appropriate seed rate under direct seeding in lines, 4 varieties (BR6848-3B-12, BI5, BRRIdhan42 and BRRIdhan43) were tested under aerobic conditions at Bagha,

Rajshahi The experiment was set-up following split-plot design with 3 varieties and 3 treatments during Aus 2013. Land was well prepared in dry conditions. Direct seeding was done in lines under un-paddle aerobic soil condition. Direct seeding was done on well prepared day land under line sowing with a spacing of 20 cm from line to line (20 cm x continuous seed sowing).

The three treatments were:

T_1= Direct seeding @ 20 kg/ha

T_2= Direct seeding @ 30 kg/ha

T_3= Direct seeding @ 40 kg/ha

Fertilizer was applied @ 150, 100, 70, 60 and 10 kg/ ha Urea, TSP, MP, Gypsum and $ZnSO_4$ respectively. Full dose of TSP, Gypsum and ZnSO4 was applied as basal; Urea top dressing: 1st at 15-20 DAT, 2nd at 35-40 DAT and 3rd at booting stage. Water was supplied by surface irrigation when needed. Always the soil was kept wet but not flooded or saturated. Data on tillers/sqm**,** panicle length, spikelet sterility% and gain yield were recorded.

3. Selection of aerobic lines in PVS trials: PVS trials of aerobic lines in target field under direct seeding conditions were done to identify farmers preferred varieties/lines suitable for water saving direct seeding conditions. 9 selected entries with check were evaluated in Aus 2015 under direct dry seeded conditions. The experiment were laid out in RCB design with 3 replications during Aus 2015 in 30 locations in project - Sylhet, Habiganj, Gazipur and Rajshahi. Land was well prepared in semi-dry conditions and direct dry seeding was done in lines. Unit plot size was 20 m^2. The seed rate was 30 kg/ha. Direct seeding was done on well prepared non-puddle land under line sowing with a spacing of 20 cm from line to line (20 cm x continuous seed sowing). Fertilizer was applied @ 150, 100, 70, 60 and 10 kg/ ha Urea, TSP, MP, Gypsum and $ZnSO_4$ respectively. Full dose of TSP, Gypsum and ZnS04 was applied as basal; Urea top dressing: 1st at 15-20 DAS, 2nd at 35-40 DAS and 3rd before booting stage. Irrigation is being supplied by irrigation when needed. Always soil was kept wet but not saturated. Weeding was done by hand. Data were collected on plant height (cm), phenotyping scoring, panicle length, no. of effective tillers/m2, days to 50% flowering, duration and grain yield (t/ha) and subjected to statistical analysis, LSD values were calculated.

4**. Selection of aerobic lines in RYT trials:** RYT trials of aerobic lines in target field under direct seeding conditions were done to identify farmers preferred varieties/lines suitable for water saving direct seeding conditions. 3 selected entries with check were evaluated in Aus

2016 under direct dry seeded conditions. The experiment were laid out in RCB design with 3 replications during Aus 2016 in 6 locations in project – Noagoan, Habiganj and Rajshahi. Land was well prepared in semi-dry conditions and direct dry seeding was done in lines. Unit plot size was 20 m2. The seed rate was 30 kg/ha. Direct seeding was done on well prepared non-puddle land under line sowing with a spacing of 20 cm from line to line (20 cm x continuous seed sowing). Fertilizer was applied @ 150, 100, 70, 60 and 10 kg/ ha Urea, TSP, MP, Gypsum and ZnSO4 respectively. Full dose of TSP, Gypsum and ZnS04 was applied as basal; Urea top dressing: 1st at 15-20 DAS, 2nd at 35-40 DAS and 3rd before booting stage. Irrigation is being supplied by irrigation when needed. Always soil was kept wet but not saturated. Weeding was done by hand. Data were collected on plant height (cm), phenotyping scoring, panicle length, no. of effective tillers/m2, days to 50% flowering, duration and grain yield (t/ha) and subjected to statistical analysis, LSD values were calculated.

C. Results and Benefits:

The results of a set of experiments conducted during the project periods are cited below:

(i). List objective-wise activities clearly, resulting in specific output(s):

Specific Project Objective(s)	**Planned activities performed against each objective**	**State progress made clearly during the reporting period**	**Outputs/results achieved during this period**
1. To select improved Aus rice genotypes having high yield, shorter growth duration for growing under aerobic soil condition.	Documentation on baseline situation of the stated problem(s)	One inception workshop, survey and meeting with Agril Officer, Bagha, Rajshahi hold and it was confirmed that new aerobic lines are during Aus season	Survey and base line information from meeting and inception workshop indicated that - there is for adapting new aerobic rice lines
	1A. Selection of short growth duration (97-101 days) aerobic lines	During 1st year lines were selected. During 2nd year, 8 genotypes selected for PVS trial. The progress is up to the mark.	4 lines were selected (IR91006-88-1-3-1, IR84788-40-3-3-1-1, IR90228-1-3-3-3-2 and IR92240-40-2-2-1) (**Table1A**) in respect to yield (3.60- 4.20 t/ha), comparatively shorter growth duration (105-109 days) - those have been

			evaluated under aerobic soil condition in two locations. Further, 4 top ranking lines (BR7178-2B-19-10, BR6855-3B-12, BR6848-3B-12 and BI dhan-5) (**Table1B**) in respect to yield (3.55-4.50 t/ha), shorter duration (97-101 days) and better phenotypic acceptance were selected for PVS trial. Bouman et. al., (2016) found relatively higher grain yield of the aerobic varieties compensated for their relatively short growth duration.
	1B. Marker assisted selection for deep rooting ability in rice.	During 1st year 24 lines were selected. During 2nd & 3rd year, molecular analysis completed.	Molecular data revealed that one of two markers-RM302 amplified a specific allele (112 bp) in all the aerobic rice genotypes, which showed different pattern (**Table 2, Fig-1**) from short rooted rice genotypes. Thus, RM302 marker on chromosome 1 could be used to differentiate between long and short rooted genotypes. RM302 on chromosome 1 has shown linkage to the deep root length in rice (Kamoshita et al. 2002). IR92240-40-2-2-1 was best aerobic rice genotypes possessed deeper root system. Courtois B et. al. (2009) used breeding programs with markers allowing the combination of favorable alleles at key loci for root traits.

	1C. Root and shoot growth studies of selected aerobic rice genotypes	During 1st year- the procedure of root growth studies were standardized and during 2nd year- best aerobic rice genotypes selected based on root length. The progress is up to the mark.	During 1st year- the techniques of root growth studies were standardized and during 2nd year best aerobic rice genotypes selected based on phenotypic acceptance, root length and root / root-shoot ratio. Phenotypic acceptance, root length and root / root-shoot ratio under water stress were used as criteria for selecting aerobic rice lines. IR90228-1-3-3-3-2 and IR91006-88-1-3-1 are the best aerobic rice genotypes with better phenotypic acceptance (2-3), higher root length (55-58) and higher root / root-shoot (0.44-0.46) than others **(Table 3)**. Kato Y. et. al., (2006)., Samejima and Tsunematsu (2001), and Lafitte et. al., (2004) conducted experiment to assess the roles of deep roots and found genetic variation within the rice genome for root:shoot ratios.
2. To develop appropriate agronomic management practices for growing aerobic rice under direct seeding and water saving conditions.	**2A.** Developing appropriate technique for water-saving condition for aerobic rice	Water-saving experiment fully completed during 2nd and 3rd year	An experiment was conducted using 2 aerobic lines and 3 irrigation treatments to select best irrigation management practices for aerobic rice. Irrigation after 3 days of disappearing of standing water was found the best water management option. About 27.64% water could be saved compared to continuous standing water (**Table 2A**). Under 3 days after disappearing

			of standing water treatment - gave the higher yield for IR90228-1-3-3-3-2 (6.6 t/ha). Water productivity also originated higher for this line under irrigation after application of 3 days of disappearing of standing water. Chan CS et. al., (2012) and Nguyen et. al., (2015) conducted experiment to evaluate aerobic rice performances under different irrigation and their results showed that aerobic rice required least amount of water under stress and water uptake capacity was highly controlled by root traits. Results (**Table 2B**) indicated that weed control in direct seeding method either applied by herbicide or by hand weeding increased number of panicles per unit area over control plot. Among the treatments, three hand weeded crop showed the highest number of panicles per unit area and lowest percentage of spikelet sterility over herbicide treated plots. The performance of herbicide application is comparable with hand weeding to control weeds. Most of the grass and sedge were control by Pretilachlor +Pyrazosulfuran ethyl and Bispyribac. The results indicated that herbicide application did not increase yield; however,
	2B. Determination of effective weed management practice for aerobic rice cultivation	During 1st year-weed management expt was done and during 2nd year-Weed management experiment repeated.	

	1. Standardizing tillage practices	1. Well prepared land by 3 plowing was selected as best tillage practice for aerobic rice. The progress is up to the mark.	herbicide application was found effective for saving time and cost for weeding. Murthy and Reddy (2013) and Jabran K. and Chauhan BS. (2015) found wide increase in grain yield by implementing different weed control practices in aerobic rice and described scope of weed management supplemented with hand weeding. Maximum yield (3.55 t/ha) of BI5 was found from well prepared land by 3 plowing by power tiller(**Table 2C**) . Well prepared land by 3 plowing by power tiller gave maximum yield for all the two varieties and this tillage practice could be recommended for direct seeded rice. Sarvanan, T. (2014) conducted a field experiment to study the effect of land preparation techniques.
3. To evaluate the performance of promising aerobic rice varieties/genotypes and associate rice cultivation packages under aerobic soil condition.	3. PVS trials of aerobic lines in target field under direct seeding conditions	30 PVS trails have been set up in 24 locations during Aus 2015.	The results of 8 locations in Sylhet region showed that BR7178-2B-19 (5.3 t/ha), BI dhan-5 (4.1 t/ha), BR6855-3B-12(4.9 t/ha) and IR92240-40-2-2-1(3.9 t/ha) performed better in respect with yield. The results of 8 locations in Noagoan showed that BR7178-2B-19 (4.3 t/ha), BI dhan-5 (5.2 t/ha), BR6848-3B-12 and IR92240-40-2-2-1(4.8

			t/ha) performed better in respect with yield. However, BR7178-2B-19, BI dhan-5, BR6855-3B-12 and IR92240-40-2-2-1 were finally selected for their comparatively higher yield and shorter growth duration (about 100 days) and as well choose as farmer's preferred variety (Table 6A and 6B).
	4.Determination of seed rate under direct seeding	4. Expt. was set up at Bagha, Rajshahi during - 1st year	The seed rate @ 30 kg/ha gave maximum yield for all the varieties and 30 kg/ha seed rate could be recommended for direct seeded rice cultivation during Aus season
	5. RYT trials of aerobic lines under direct seeding conditions	5.Expt. was set up during - 3rd year	In the 3rd year, the RYT results of 6 locations showed that BR7178-2B-19 (4.28 t/ha), BI dhan-5 (4.15 t/ha), and IR92240-40-2-2-1 (3.97 t/ha) performed better and all the 3 lines were proceeded for release as variety.
4. To improve the knowledge and skill of farmers as well public and private sectors personnel on aerobic rice technologies.	4.1.Inception workshop and farmers training on "Direct seeding and water saving rice cultivation techniques" arranged.	4.1.One successful inception workshop and six farmers training completed during 1st and 2nd year	4.1.During 1st and 2nd year- six farmers training on aerobic rice cultivation method were conducted. One inception workshop has been conducted at Rajshahi. Total 60 participants including DAE personnel, scientists from BRRI and Farmers participated. All the participants obtained a clear understating of aerobic rice and fed-back information obtained.
	4.2. Two short documentary on aerobic rice for TV channels	4.2. Script was written and documentary was made	4.2. Documentary was broadcasting in TV channels

	4.3. One farmers training completed and 15 survey were conducted	4.3. During conducting PVS trials, farmers training and survey has been conducted.	4.3. All the PVS farmers and participants obtained a clear understating of aerobic rice and fed-back information from DAE and farmers were obtained.

(ii). Outputs/Results:

1. Under aerobic siol conditions, 4 lines were selected (IR91006-88-1-3-1, IR84788-40-3-3-1-1, IR90228-1-3-3-3-2 and IR92240-40-2-2-1) (**Table1A**) in respect to yield (3.60- 4.20 t/ha), comparatively shorter growth duration (105-109 days) - those have been evaluated under aerobic soil condition in two locations. Further, 4 top ranking lines (BR7178-2B-19-10, BR6855-3B-12, BR6848-3B-12 and BI dhan-5) (**Table1B**) in respect to yield (3.55- 4.50 t/ha), shorter duration (97-101 days) and better phenotypic acceptance were selected for PVS trial. Similar higher grain yield of the aerobic varieties were found by Bouman et. al., (2016) compensated for their relatively short growth duration.

2. Molecular data revealed that one of two markers- RM302 amplified a specific allele (112 bp) in all the aerobic rice genotypes, which showed different pattern (**Fig-1**) from short rooted rice genotypes. Thus, RM302 marker on chromosome 1 could be used to differentiate between long and short rooted genotypes. RM302 on chromosome 1 has shown linkage to the deep root length in rice (Kamoshita et al. 2002). IR92240-40-2-2-1 was best aerobic rice genotypes possessed deeper root system. Courtois B et. al. (2009) also used breeding programs with markers allowing the combination of alleles at key loci for root traits.

3. Phenotypic acceptance, root length and root / root-shoot ratio under water stress were used as criteria for selecting aerobic rice lines. IR90228-1-3-3-3-2 and IR91006-88-1-3-1 are the best aerobic rice genotypes with higher root length (55-58) and higher root / root-shoot (0.44-0.46) than others. Kato Y. et. al., (2006)., Samejima and Tsunematsu (2001), and Lafitte et. al., (2004 found genetic variation within the rice genome for root:shoot ratios.

4. An experiment with 3 irrigation treatments revealed that irrigation after 3 days of disappearing of standing water was found the best water management option. About 27.64% water could be saved compared to continuous standing water. Water productivity also originated higher for this line under irrigation after application of 3 days of disappearing of

standing water. Experiments of Chan CS et al. (2012) and Nguyen et. al., (2015) showed that aerobic rice required least amount of water under.

5. Results indicated that weed control in direct seeding method either applied by herbicide or by hand weeding increased number of panicles per unit area over control plot. Among the treatments, three hand weeded crop showed the highest number of panicles per unit area. The performance of herbicide application is comparable with hand weeding to control weeds.
The results indicated that herbicide application did not increase yield; however, herbicide application was found effective for saving time and cost for weeding. Murthy and Reddy (2013) and Jabran K. and Chauhan BS. (2015) also found wide increase in grain yield by implementing different weed control practices in aerobic rice.

6.Experiment was done for standardizing appropriate tillage practices for maximum population density /m^2 under aerobic condition using 3 treatments. Maximum yield (3.55 t/ha) of BI5 was found from well prepared land by 3 plowing by power tiller. Well prepared land by 3 plowing by power tiller gave maximum yield for all the two varieties and this tillage practice could be recommended for direct seeded rice. Sarvanan, T. (2014) conducted a field experiment to study the effect of land preparation techniques.

7. It was found that the tiller no/sqm increased with an increase of seed rate from 20 kg/ha to 40 kg/ha, but panicle length and yield/ha decreased with an increase of seed rate from 20 kg/ha /acre to 40 kg/ha. Spikelet sterility% was also increased with an increase of seed rate from 20 kg/ha to 40 kg/ha. Maximum yield (3.6 t/ha) of BI5 was found from seed rate @ 30 kg/ha. The seed rate @ 30 kg/ha gave maximum yield for all the varieties and 30 kg/ha seed rate could be recommended for direct seeded rice cultivation during Aus season

8. Based on PVS results of 8 locations in Sylhet region and 8 locations in Noagoan - BR7178-2B-19, BI dhan-5, BR6855-3B-12 and IR92240-40-2-2-1 were finally selected for their comparatively higher yield and shorter growth duration (about 100 days) and as well choose as farmer's preferred variety.

9. In the 3rd year, the RYT results of 6 locations showed that BR7178-2B-19 (4.28 t/ha), BI dhan-5 (4.15 t/ha), and IR92240-40-2-2-1 (3.97 t/ha) performed better and all the 3 lines were proceeded for release as variety.

10. One inception workshop cum farmer's training has been conducted at Rajshahi. Total 60 participants including DAE personnel, scientists from BRRI and farmers were participated. All the participants obtained a clear understating of aerobic rice and fed-back information from DAE and farmers were obtained. Six farmers training on aerobic rice cultivation method were conducted.

Table 1A. Evaluation rice IRRI lines/genotypes under water saving condition, Aus 2014

SL#	Genotype	Plant ht (cm)	Panicle length (cm)	Duration	Tler no /sq m	Yield (t/ha)		Phen accp (1-9)
						Gazi	Raj	
1	PSBRC-10	76.5	19.5	108	297	3.53	3.27	5
2	IR92240-40-2-2-1	99.0	21.2	109	190	3.60	3.70	4
3	IR91099-91-3-2-3	102.5	22.5	122	185	3.32	3.55	6
4	IR84788-40-3-3-1-1	104.1	24.2	105	330	4.10	4.20	2
5	IR90228-1-3-3-3-2	96.0	24.0	107	250	3.65	3.37	3
6	IR91006-88-1-3-1	103.0	24.5	109	270	4.00	3.86	3
7	IR91091-11-2-3-2	98.5	21.0	117	275	3.25	3.22	5
8	BRRI dhan 42	99.5	20.5	103	207	3.30	3.40	6
	SE (N=2)	0.353	0.3644	0.417	2.216	3.250	4.16	
	5% LSD 7DF	1.182	1.218	1.395	7.409	**0.324**	0.19	

D/S: 8-04-2014 both locations

Table 1B. Evaluation rice lines/genotypes under water saving condition, Aus 2014

SL #	Genotype	Plant ht(cm)	Panicle leng (cm)	Duration	Tler no /sq m	Yield (t/ha)		Phen accp (1-9)
						Gazi	Raj	
1	BR7182-2B-1-HR4	97.5	21.5	97	340	4.00	4.25	3
2	BR7178-2B-19-10	101.3	21.0	99	310	3.65	3.83	4
3	BR6855-3B-12	98.3	23.0	95	300	3.55	3.37	4
4	BR6848-3B-12	102.1	25.0	100	380	4.25	4.50	3
5	BI dhan-5	82.5	21.5	101	345	3.90	4.05	3
6	BR7566-4-4-2	97.5	21.5	123	265	3.14	3.25	5
7	IR91099-91-3-2-1-3	101.5	21.5	125	215	3.42	3.27	7
8	BRRI dhan 42	99.5	21.5	103	210	3.30	3.20	6
	5% LSD 8DF	0.4629	0.4629	0.467	3.472	0.324	1.51	
	CV	1.5477	1.5477	1.234	11.607	13.60	5.04	

D/S: 8-04-2014 both location

Table 2. Lines/genotypes for marker assisted selection for deep rooting ability

SL#	Genotype	SL#	Genotype
1	BR7182-2B-1-HR4	13	NSIC 2011Rc 238
2	BR7178-2B-19	14	NSIC RC 116
3	BR6855-3B-12	15	IR 85627-100-3-3-
4	BR6848-3B-12	16	IR92240-40-2-2-1
5	IR84788-40-3-3-1-1	17	IR91076-20-3-1-1
6	IR90228-1-3-3-3-2	18	IR92245-68-3-2-2
7	IR91006-88-1-3-1	19	IR91099-91-3-2-3
8	IR92240-40-2-2-1	20	IR85627-66-32-2
9	BIdhan5	21	BR7566-4-4-2
10	BRRI dhan42	22	BR7566-1-1-9
11	IR 85650-30-3-1-2	23	BR7577-9-1-2
12	BR7178-2B-19	24	CN4

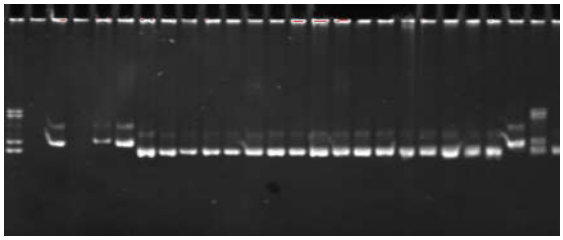

Fig-1. Screening against RM302 showing polymorphism

Table 3. Performance of selected aerobic rice genotypes root and shoot growth

Sl	Designation	Root length (cm)	Shoot length (cm)	Dry root-shoot wt /6 plants (gms)	Dry root wt /6 plants (gms)	Dry shoot wt /6 plants (gms)	Root / root-shoot ratio (score)
1	BR7182-2B-1-Hr4	54	60	15.96	4.04	11.92	0.25 (7)
2	BR7178-2B-19	47	73	17.82	4.10	13.92	0.23 (7)
3	BR6855-3B-12	47	55	8.08	3.00	5.08	0.37 (4)
4	BR6848-3B-12	43	68	15.04	4.96	10.08	0.33 (4)
5	IR84788-40-3-3-1-1	48	68	16.56	6.76	10.80	0.40 (4)
6	IR90228-1-3-3-3-2	58	65	18.73	8.70	10.03	0.46 (2)
7	IR91006-88-1-3-1	55	65	18.28	8.05	10.23	0.44 (3)
8	IR92240-40-2-2-1	46	66	13.08	3.30	9.78	0.25 (8)
9	BIdhan5	54	67	19.00	6.90	12.48	0.36 (3)
10	BRRI dhan42	42	62	8.08	3.79	11.70	0.46 (4)

Table 4A: Irrigation water saved in different irrigation treatments compared to control of Aus 2015, Gazipur

Irrigation treatment	Number of irrigation	Amount of irrigation (mm)	Irrigation saved over control(I_0)(%)
I_0	19	1044	-
I_1	14	750	28.80
I_2	11	676	35.24

Table 4B: Yield and water productivity two breeding lines under different treatments of Aus- 2015, BRRI, Gazipur

Treatment	Number of irrigation	Amount of irrig. (mm)	Grain yield t/ha)	
			V_1	V_2
I_0	19	1044	5.2	4.8
I_1	14	750	5.3	4.9
I_2	11	676	4.9	4.3

V_1 = BR 6848-3B-12, V_2 = BR6855-3B-12

Table 5. Effect of different weed control option in direct seeding method on yield components, Aus season, 2014

Treatments	Plant height (cm)	No of Panicle/m^2	% Sterility	Yield (t/ha)
T1=Pre emergence herbicide + one hand weeding	110.0	266	22.9	3.55
T2=Post emergence herbicide + one hand weeding	111.2	261	21.25	3.46
T3=3 times hand weeding at 15 , 30 & 45 DAT	110.6	248	19.30	3.35
T4=Control (No weeding)	101.0	very few	--	0.35

Table 6A: Mean data of 8 different locations in Sylhet region, Aus 2015

SN	Designation	L1	L2	L3	L4	L5	L6	L7	L8	Mean
1	BR7182-2B-1-HR4	6.1	5.0	4.3	3.6	5.0	5.4	5.3	4.8	4.9
2	BR7178-2B-19	6.4	5.5	4.6	3.8	5.9	5.6	5.6	5.1	5.3
3	BR6855-3B-12	6.1	5.9	4.2	3.1	4.9	4.4	4.3	4.5	4.8
4	BR6848-3B-12	5.8	5.3	5.6	3.9	5.3	5.9	5.6	5.2	5.3
5	IR84788-40-3-3-1-1	4.2	4.2	3.9	2.8	5.2	3.3	3.8	3.7	3.9
6	IR90228-1-3-3-3-2	4.1	4.2	3.5	3.7	4.4	4.4	4.5	4.3	4.1
7	IR91006-88-1-3-1	3.9	4.0	3.5	3.5	3.8	3.6	3.9	3.9	3.8
8	IR92240-40-2-2-1	4.0	4.1	3.7	3.0	4.3	3.9	4.2	3.7	3.9
9	BIdhan5	5.2	6.2	4.5	4.7	5.6	4.9	4.9	5.1	5.2
10	BRRI dhan42	6.6	6.3	4.3	3.1	6.7	4.4	4.6	5.0	5.2

Location 1: Jagatpur,Location 2: Balikhal,Location 3: Jagatpur,location 4: Habiganj Sadar,location 5: Habiganj Sadar,location 6: Habiganj Sadar,location 7: Maijgaon, Fenchuganj,location 8: Ghilachra, Fenchuganj

Table 6B: Mean plant height, growth duration and yield data of 8 locations, Aus 2015, Noagoan

SN	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha^{-1})
1	BR7182-2B-1-HR4	122	100	3.4
2	BR7178-2B-19	121	100	4.3
3	BR6855-3B-12	127	100	4.2
4	BR6848-3B-12	116	104	4.1
5	IR84788-40-3-3-1-1	127	115	3.1
6	IR90228-1-3-3-3-2	128	115	3.2
7	IR91006-88-1-3-1	128	114	3.3
8	IR92240-40-2-2-1	127	112	4.8
9	BIdhan5	99	100	3.5
10	BRRI dhan42 (CK)	114	102	3.4
	LSD (5%)	1.67	0.455	0.898
	CV(%)	2.0	0.6	3.8

Table 7: Mean Performance of advanced aerobic Aus rice lines, Rajshahi, Aus 2015

SL#	Entries	Plant height (cm)	Growth duration (days)	Grain yield (t/ha)
1	BR7182-2B-1-HR4	118	107	4.11
2	BR7178-2B-19	115	105	4.21
3	BR6855-3B-12	113	109	3.92
4	BR6848-3B-12	112	106	3.78
5	IR84788-40-3-3-1-1	102	110	3.92
6	IR90228-1-3-3-3-2	112	108	4.06
7	IR91006-88-1-3-1	120	105	4.12
8	IR92240-40-2-2-1	105	109	3.79
9	BI dhan5	99	103	3.89
10	BRRI dhan42 (ck)	103	104	3.82
	LSD (5%)	1.92	1.131	0.647
	CV(%)	2.7	1.3	17.2

Table 8. Multiplying the seeds of selected varieties during T. aman 2015

Sl	Designation	Seed production (kg)
1	BR7182-2B-1-HR4	10
2	BR7178-2B-19	9
3	BR6855-3B-12	8
4	BR6848-3B-12	6
5	IR84788-40-3-3-1-1	4
6	IR90228-1-3-3-3-2	8
7	IR91006-88-1-3-1	11
8	IR92240-40-2-2-1	12
9	BI dhan5	6
10	BRRI dhan42	7
	Total	**74**

Table 9. Selection of tillage practice for aerobic rice cultivation, Rajshahi, Aus 2014

Designation	Well prepared land by 3 plowing by power tiller			
	Tillers/sqm	Panicle len (cm)	Spikelet Sterility%	Yield t/ha
BR6848-3B-12	185	23.0	23.7	4.20
BI5	210	22.4	23.0	3.55
	Medium prepared land by 2 plowing by power tiller			
BR6848-3B-12	169	22.8	23.0	3.81
BI5	205	20.0	25.0	3.45
	Conventional tillage (control)			
BR6848-3B-12	162	22.4	24.2	3.42
BI5	195	20.1	26.1	3.20

Table 10. Determination of seed rate under direct seeding in lines, Aus 2013

Designation	Direct seeding @ 20 kg/acre			
	Tillers/sqm	Panicle len (cm)	Spikelet Sterility%	Yield t/ha
BR6848-3B-12	169	27.4	20	3.9
BI5	160	23.6	22	3.3
BRRIdhan42	175	24.8	23	3.4
BRRIdhan43	187	25.9	28	3.1
	Direct seeding @ 30 kg/acre			
BR6848-3B-12	265	26.3	22	4.8
BI5	250	22.0	24	3.6
BRRIdhan42	225	23.8	21	4.1
BRRIdhan43	250	24.3	26	3.9
	Direct seeding @ 40 kg/acre			
BR6848-3B-12	340	24.2	33	3.2
BI5	308	18.3	36	2.9
BRRIdhan42	323	19.6	41	2.8
BRRIdhan43	356	21.7	38	2.6

(iii) Benefits/Outcome:

1. Benefits of adapting associated direct seeded water saving technologies are as follows:

-Scope to reduce cost of rice production in transplanting of seedlings, seed bed preparation, as well as cost in irrigation of main field.

2. Benefits of adapting direct seeded rice lines are as follows:

- The new aerobic rice varieties could provide 0.5 to 0.8 t/h more yield than other aus varieties. Thus, aerobic rice varieties will help the poor farmers with higher yield and income. The new aerobic rice varieties could be harvested 8- 10 earlier than other varieties.

3. Environmental Impact for aerobic rice cultivation:

- Provide a safeguard for retention of soil structure
- Provide a safeguard in the face of occurrence of less rainfall.
- Over pumping of underground water will be reduced
- No environmental hazard for aerobic rice cultivation
- Methane elimination very low for aerobic rice cultivation

4. Dissemination of aerobic rice cultivation technologies: One inception workshop including participants including DAE personnel and farmers were conducted. PVS trials were conducted in 30 locations and farmers training on aerobic rice cultivation method were conducted. Two TV documentaries were prepared and broadcasted in different Channels.

d. Technology developed:

1. Three aerobic lines developed are being tested in variety release procedure under Advance Line Adaptive Research trail of BRRI: BR7178-2B-19, BI dhan-5 and IR92240-40-2-2-1 were selected for higher yield and shorter duration (about 100 days) and these lines are being evaluated for release as variety.

2. Developing agronomic management practices for aerobic rice: Aerobic rice cultivation package have been standardized in respect with tillage practices in non-puddle soil (well prepared land by 3 plowing), seed rate @ 30 kg/ha, irrigation practices (irrigation after 3 days of disappearing of water) and standard weed control by herbicide. Farmers could harvest the crop 8-10 days earlier than normal transplanting method.

e. Publication made/under process:

1. Popular article published on project achievement, The Reflector, Weakly Magazine, May 16-31, 2016
2. Article published on project achievement, The Reflector, Weakly Magazine, October16-31, 2015.
3. TV documentary (4 minutes) on project activities broadcasted in BTV.
4. TV documentary (3 minutes) on project activities broadcasted in BTV news.
5. Leaflet on Aerobic rice cultivation technique in Press

f. Training workshop organized:

Organizing project inception workshop:

Inception workshop was organized on 17 August, 2014. Inception workshop was held in presence of 8 BRRI scientists, 10 Agril Officers and 15 SAAOs and progressive 25 farmers at Bagha, Rajshahi .

Objectives:

To find out –

▲ Farmers opinion on suitability of new aerobic rice lines during Aus season

▲ The potential Aus areas in northern districts.
▲ Farmers opinion on water saving direct seeding technologies
▲ Irrigation facilities available/ cost of irrigation
▲ Land areas/rainfall pattern

Date and duration- One day Inception workshop on 17 August, 2014
Venue- Bagha, Rajshahi
No of participants- 8 BRRI scientists, 10 Agril Officers and 15 SAAOs and 25 farmers
Resource speakers- BRRI scientists

Organizing training:

Subject: Training on Aerobic rice cultivation technique was organized during the reporting period
Target group: Farmers and SAAOs.

Objective: to train farmers and SAAOs on aerobic rice cultivation methods
Duration- One day training
No of training-12
Venue- BRRI Habiganj and farmers field and project cite Rajshahi
No of Target participants- 300
Resource speakers- BRRI scientists and DAE personnel

g. Graduate Students: N/A

h. Linkage developed: One inception workshop, survey and meeting with Agril Officer, Bagha, Rajshahi anf Habiganj was hold. All the farmers and DAE participants obtained a clear understating of aerobic rice and fed-back information from DAE and farmers were obtained. During farmer selection for PVS trials- group discussion was done with DAE people and farmers. PVS farmer was trained on aerobic rice cultivation techniques in 4 districts. A linkage was developed with DAE personnel in Rajshahi, Noagoan and Habiganj region.

i. Equipment/Appliances Purchased:

Sl. No.	**Name of equipments**	Unit price	Total cost taka
A.	**Lab & field equipment**		
1	Tripal-5	4472/-	22360/-
2	Moisture meter -1	30160/-	30160/-
3	Weighing Balance (2 – 50 kg)	6160/-	12320/-
5	Tube well sets – 2 no	34800/-	69600/-
6	Irrigation pipe and accessories-	35/-	17465/-

	500 ft		
	Total		**151905/-**
B.	**Office equipment**		
1	Desktop computer with printer, Scanner & UPS – 1 set	54850/-	54850/-
2	Digital camera- 2 no	40225/-	40225/-
3	Hand mike – 2	4750/-	9500/-
4	File cabinet – 3	19190/-	57570/-
5	Bi-cycle	15000/-	15000/-
	Total		**= 177145/-**
	Grand total(A+B)		**= 32,90,50/-**

F. High Light of Research Findings:

1. Three aerobic lines were selected under this project: BR7178-2B-19, BI dhan-5 and IR92240-40-2-2-1 for higher yield and shorter duration (about 100 days) and these lines are being evaluated for release as variety. The shorter duration lines could be harvest by about 100 days and these lines are 7-10 earlier than other aus varieties.

2. The new aerobic rice varieties could provide 0.5 to 0.8 t/h more yield than other aus varieties. These aerobic rice lines will help the poor farmers with higher yield and income.

3. Aerobic rice cultivation package have been standardized in respect with irrigation practices (irrigation after 3 days of disappearing of water) and standard weed control by herbicide. These direct seeded aerobic rice technologies will save rice production cost in irrigation (about 50% irrigation cost will be saved) as well will save cost in seed bed preparation and seedling transplanting. Thus this technology will help the poor farmers with higher income by reducing cost of production.

G. Conclusion:

1. Three aerobic lines were selected under this project with higher yield and shorter duration (about 100 days) and these lines are being evaluated for release as variety. The shorter duration lines could be harvest by about 100 days and these lines are 7-10 earlier than other aus varieties. If prioritized at national level, the new aerobic rice varieties could provide 0.5 to 0.8 t/h more yield than other aus varieties. Thus, aerobic rice varieties by adapting in about 1.5 million ha of land (0.5 million ha in Rajshahi region and 1 million ha of fallow aus land in Sylhet) total additional rice production is expected 6 million tons and these lines also will help the poor farmers with higher yield and income.

2. Aerobic rice cultivation package in respect with irrigation and direct seeding with out transplanting will save rice production cost in irrigation (about 50% irrigation cost will be saved) as well will save cost in seed bed preparation and seedling transplanting. Thus, this technology will help the poor farmers with higher income by reducing cost of production. If prioritized at national level, this new cultivation package will save irrigation cost and seedling transplanting cost fewer than 1.5 million ha of Aus land.

3. Environmental Impact for aerobic rice cultivation:

- Provide a safeguard for retention of soil structure
- Provide a safeguard in the face of occurrence of less rainfall.
- Over pumping of underground water will be reduced
- No environmental hazard for aerobic rice cultivation
- Methane elimination very low for aerobic rice cultivation

H. Recommendation:

1. Aerobic lines of this project are being evaluated in field trial by BRRI for release as variety. At the same time, Distinctness, Uniformity and Stability (DUS) test by Seed Certification Agency and grain quality test by Grain quality division of BRRI have been done. For smooth running of variety release procedure- the project should be extended or supplementary project could be approved.

2. The government could take a plan to approve a big project for popularization the new water-saving aerobic technologies during aus season.

Financial Statement :

Particulars/Line Items									Actual Fig. in T
A. Fund Received in Installment									
1st install.	**2nd Install.**	**3rd install.**	**4th Install.**	**5th install.**	**6th install.**	**7th install.**	**8th install.**	**9th install.**	**Total**
5,99,000/-	8,98,500/-	11,98000/-	793100/-	9,87,200/-	7,40,400/-	2,46,800/-	6,14000/-	350,000/-	64,27,000/

Particulars/Line Items		Approved Total Budget	Exp. From June May 13 to November 15.	Current Exp. From December 2015 to 25 May 2016.	Cumulative Exp.	Rest of Budgeted Amount
Sl. No	**B. I. Expenditure: Recurring (Operational cost)**	1	2	3	4=(2+3)	5=(1-4)
1.	1.1 Remuneration for Contractual Staff (Expert Professionals;) 1.2 Remuneration of Accounting / Support Service, if any	990000/- 216000/-	675333/- 144000/-	210000/- 24000/-	885333/- 168000/-	104667/- 48000/-
2.	2.1 Research & Development (R&D) related cost i.e. all inputs, 2.2 Contractual Services	2800000/-	2312553/-	356350/-	2668903/-	193650/-
3.	Maintenance and repairing of lab. /field equipment, etc.	75000/-	59950/-	15000/-	74950/-	50/-
4.	Training	240000/-	179000/-	59250/-	238250/-	1750/-
5.	Workshop/Seminar/Meeting etc.	320000/-	169920/-	0-	169920/-	150080/-
6.	6.1 Travel expenses (TA/DA) as per own organizational rules (Public Sector) 6.2 Vehicle hiring/oil & fuel for organization vehicle for travel	426000/- 1038000/-	330674/- 802333/-	69000/- 155000/-	399674/- 957333/-	26326/- 80667/-
7.	Office supplies and contingency (not exceeding 15% of the total cost)	179000/-	148386/-	23579/-	171965/-	7035/-
8.	Any other items(specify with justification)	200000/-	183560/-	0/-	183560/-	16440/-
9.	Institutional Overhead Charge (if any, max 10% of total operating cost)	70000/-	27005/-	0/-	27005/-	42995/-
	B.I. Sub-total B.I (1-9)	6554000/-	5032714/-	912179/-	5944893/-	609107/-
B. II:	**Non-recurring (Capital cost)**					
10.	Equipment & Appliances (upon approval of KGF) 10.1. Lab. and Field Equipment 10.2. Office Equipment	279000/- 165000/-	258665/- 165430/-	0/- 0/-	258665/- 165430/-	20335/- -430/-
	B.II. Sub-total (10)	444000/-	***424095/-***	***0/-***	424095/-	19905/-
Grand Total Expenditure: GT(B.I+B.II)		6998000/-	5456809/-	912179/-	6368988	629012/

Balance (A-GT)= 58012/- as per Bank Statement = Bank in BBBR part = 53604/-, Bank in TMUF part = 4408/-

Financial Progress: (a) Fund Received in Tk: 64,27,000/- (b) Fund utilized as per SoE in Tk..63,68,988/-.; % achieved = 99.09 $\frac{b}{a}$ X100

Signature of PI with seal

J. Self Assessment of the Project:

1. Have you been able to achieve all specific objectives of your project? Yes/No; If no, please explain the reasons.

Yes, 3 aerobic rice lines have been developed and other 3 objectives were fulfilled.

2. Who is/are the target beneficiary group/s of your project output/result? Farmers/Policy makers/Agri. Business men/ Agro. Processors etc.

Mainly poor farmers. Agri. business men also are benefited by seed business with new varieties.

3. How the project outputs/results obtained would benefit the target beneficiary group/s? and how these could be transferred to the that/those target group/s?

Three aerobic lines were selected with higher yield and shorter duration (about 100 days). The shorter duration lines are 7-10 earlier than other aus varieties. The new aerobic rice varieties could provide 0.5 to 0.8 t/h more yield than other aus varieties. These lines will help the poor farmers with higher yield and income.

Now-a-days, demand of quality seeds is higher at farmer's level, quality seeds of new varieties could be reached to farmers by seed multiplication by the seed companies and by technology transfer effort of DAE as well as farmers to farmers seed exchange.

4. Do you think that you have successfully completed the project? Yes/No; If yes, please provide one page success story/communication brief of your project in simple language with relevant pictures where applicable.

Yes, I have successfully completed the project.

This coordinated project has been designed to develop aerobic rice varieties having short duration (100-105 days), high yielding and aerobic soil adaptability as well as to develop aerobic rice cultivation technologies. Based on PVS and RYT trial results - BR7178-2B-19, BI dhan-5 and IR92240-40-2-2-1 were finally selected for their comparatively higher yield and shorter growth duration (about 100 days) and as well choose as farmer's preferred variety and are in the way of being released as variety. These lines are being evaluated for release as variety, indicating the success of this project. We succeeded to develop three high-yielding aerobic rice lines having deep rooting ability. The shorter duration lines could be harvest by about 100 days and these lines are 7-10 earlier than other aus varieties. These aerobic rice lines will help the poor farmers with higher yield and income in the month of August, when there is shortage of food in farmers house.

Our successful experimental results indicated that herbicide application did not increase yield; however, herbicide application was found effective for saving time and cost for weeding. Standardization of aerobic rice cultivation package in respect with irrigation practices (irrigation after 3 days of disappearing of water) and standard weed control by herbicide have been successfully completed. Now-a-days, due to high cost of inputs, farmers neither could nor be benefited by rice cultivation. However, the direct seeded aerobic rice technologies will save rice production cost in irrigation (about 50% irrigation cost will be saved) as well will save cost in seed bed preparation and seedling transplanting. Thus, these direct seeded aerobic rice technologies will help the poor farmers with higher income by reducing cost of production for more irrigation and seedling transplanting. If this low cost technology is prioritized at national level, this new cultivation package will save irrigation cost and seedling transplanting cost in about 1.5 million ha of Aus land.

5. Please describe briefly the outcome/benefit and likely impact of your project on the productivity, policy, society, economy and environment.

The shorter duration aerobic lines have about 4 t/ha yield potentiality and could be harvest by about 100 days and these lines are 7-10 earlier than other aus varieties. These aerobic rice lines will help the poor farmers with higher yield and income. If these lines could be released soon - at national level, productivity will be increased in about 1.5 million ha of Aus land.

If this low cost technology is prioritized at national level- aerobic lines will provide a safeguard in the face of occurrence of less rainfall. Over pumping of underground water will be reduced. Under dry direct seeding- puddling of soil is not need, thus labor cost will be saved. Recently, shortage of agricultural labor is vital. Thus, this direct seeded technology will provide benefit to society in the face of labor shortage.

If this low cost technology is prioritized, this new cultivation package will save irrigation cost and seedling transplanting cost. The save of irrigation water must put a positive impact to the agricultural economy at national level.

In aerobic rice cultivation techniques soil is not puddled that helps to retain soil structure and reduce emission of methane gas. So this technique is important in the face of recent climate changing situation. Aerobic rice cultivation techniques are important in the face of recent climate changing situation.

K. Acknowledgement:

1. Krishi Gobashona Foundation
2. Bangladesh Rice Research Institute
3. Department of agriculture Extension
4. Bangladesh Agricultural Research Council

L. Endorsement:

Principal Investigator (PI)
Name:

Signature:
Seal:
Date:

Head of Organization/Authorized Person

Name:

Signature:
Seal:
Date:

Details results and data

Results and Discussion: A number of experiments were conducted during Aus 2013-16 and T. aman 2013-16. During 1st year, 19 lines were selected from 103 IRRI lines and further 12 lines were selected from 136 BRRI lines. During the 2nd year, 3 separate advanced yield trails were conducted under aerobic soil condition in farmer's field in replicated yield trials to find out the best aerobic rice lines and 8 top ranking lines were selected. The results of PVS at 8 locations in Sylhet region (Table 1R and 8R) showed that BR7178-2B-19 (5.3 t/ha), BI dhan-5 (4.1 t/ha), BR6855-3B-12(4.9 t/ha) and IR92240-40-2-2-1(3.9 t/ha) performed better in respect with yield. However, BR7178-2B-19, BI dhan-5, BR6855-3B-12 and IR92240-40-2-2-1 were finally selected for their comparatively higher yield and shorter growth duration (about 100 days) and as well choose as farmer's preferred variety.

BR7178-2B-19 (BLB score-4, BPH score-5) and BR6855-3B-12 (BLB score-5, BPH score-5) showed moderate level of tolerance against BLB (**Table 9R**) and BPH. DUS characters showed that BR6855-3B-12 distinct from BRRI dhan42 (**Table 10R**) in one character named leaf senescence at maturity stage.

Table 1R: Performance of lines at Location 1: Jagatpur, Habiganj, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-HR4	133	100	6.2
2	BR7178-2B-19	131	98	6.5
3	BR6855-3B-12	125	99	6.2
4	BR6848-3B-12	115	98	5.9
5	IR84788-40-3-3-1-1	131	109	4.3
6	IR90228-1-3-3-3-2	126	110	4.2
7	IR91006-88-1-3-1	125	108	3.9
8	IR92240-40-2-2-1	123	104	4.0
9	BIdhan5	96	98	5.3
10	BRRI dhan42 (CK)	115	98	6.6
	LSD(%)	2.72	1.115	0.132
	CV(%)	1.0	0.6	1.1

Table 2R: Performance of lines at Location 2: Balikhal, Habiganj, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-HR4	130	100	5.1
2	BR7178-2B-19	127	98	5.5
3	BR6855-3B-12	123	99	5.9
4	BR6848-3B-12	110	98	5.3
5	IR84788-40-3-3-1-1	125	109	5.3
6	IR90228-1-3-3-3-2	125	110	4.3
7	IR91006-88-1-3-1	128	108	4.1
8	IR92240-40-2-2-1	124	104	4.2
9	BIdhan5	101	98	6.1
10	BRRI dhan42 (CK)	115	98	6.3
	LSD(%)	3.912	1.131	0.184
	CV(%)	1.4	0.5	1.6

Table 3R: Performance of lines at Location 3: Jagatpur, Habiganj, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-HR4	129	101	4.3
2	BR7178-2B-19	130	100	4.7
3	BR6855-3B-12	131	101	4.3
4	BR6848-3B-12	114	102	5.7
5	IR84788-40-3-3-1-1	125	110	4.0
6	IR90228-1-3-3-3-2	124	112	3.6
7	IR91006-88-1-3-1	131	110	3.6
8	IR92240-40-2-2-1	124	106	3.8
9	BIdhan5	106	100	4.6
10	BRRI dhan42 (CK)	124	100	4.4
	LSD(%)	2.739	1.231	0.108
	CV(%)	1.0	0.6	1.2

Table 4R: Performance of lines at location 4: Habiganj Sadar, Habiganj, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-HR4	121	98	3.7
2	BR7178-2B-19	105	98	3.8
3	BR6855-3B-12	112	100	3.2
4	BR6848-3B-12	116	103	4.0
5	IR84788-40-3-3-1-1	119	112	3.0
6	IR90228-1-3-3-3-2	129	113	3.7
7	IR91006-88-1-3-1	124	112	3.6
8	IR92240-40-2-2-1	123	107	3.1
9	BIdhan5	107	98	4.7
10	BRRI dhan42 (CK)	128	98	3.1
	LSD(%)	2.590	1.21	0.146
	CV(%)	1.0	0.7	1.8

Table 5R: Performance of lines at location 5: Habiganj Sadar, Habiganj, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-HR4	129	100	5.1
2	BR7178-2B-19	130	99	6.0
3	BR6855-3B-12	127	100	4.9
4	BR6848-3B-12	114	101	5.4
5	IR84788-40-3-3-1-1	123	110	5.3
6	IR90228-1-3-3-3-2	123	112	4.6
7	IR91006-88-1-3-1	129	109	3.8
8	IR92240-40-2-2-1	134	106	4.4
9	BIdhan5	105	98	5.7
10	BRRI dhan42 (CK)	125	98	6.6
	LSD(%)	2.058	1.125	0.169
	CV(%)	0.7	0.8	1.5

Table 6R: Performance of lines at location 6: Habiganj Sadar, Habiganj, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-HR4	124	101	5.4
2	BR7178-2B-19	125	100	5.7
3	BR6855-3B-12	135	99	4.5
4	BR6848-3B-12	125	101	5.9
5	IR84788-40-3-3-1-1	120	113	3.4
6	IR90228-1-3-3-3-2	109	110	4.5
7	IR91006-88-1-3-1	130	112	3.7
8	IR92240-40-2-2-1	121	109	4.0
9	BIdhan5	96	99	5.0
10	BRRI dhan42 (CK)	103	100	4.5
	LSD(%)	2.011	1.118	0.174
	CV(%)	0.8	0.9	1.1

Table 7R: Performance of lines at location 7: Maijgaon, Fenchuganj, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-HR4	123	100	5.3
2	BR7178-2B-19	124	101	5.6
3	BR6855-3B-12	133	98	4.3
4	BR6848-3B-12	127	10	5.6
5	IR84788-40-3-3-1-1	121	111	3.8
6	IR90228-1-3-3-3-2	108	113	4.5
7	IR91006-88-1-3-1	128	111	3.9
8	IR92240-40-2-2-1	122	107	4.2
9	BIdhan5	98	97	4.9
10	BRRI dhan42 (CK)	101	102	4.6
	LSD(%)	2.02	1.115	0.173
	CV(%)	0.7	0.8	1.2

Table 8R: Performance of lines at location 8: Ghilachra, Fenchuganj, Habiganj, Aus 2015

SN	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha^{-1})
1	BR7182-2B-1-HR4	122	102	4.8
2	BR7178-2B-19	123	98	5.1
3	BR6855-3B-12	124	103	4.5
4	BR6848-3B-12	114	101	5.2
5	IR84788-40-3-3-1-1	123	112	3.7
6	IR90228-1-3-3-3-2	121	112	4.3
7	IR91006-88-1-3-1	125	111	3.9
8	IR92240-40-2-2-1	126	104	3.7
9	BIdhan5	102	98	5.1
10	BRRI dhan42	119	97	5.0
	LSD (5%)	4.72	1.131	0.63
	CV(%)	4.7	1.4	1.80

Table 1: Mean plant height, growth duration and yield data, Aus 2015, Noagoan

SN	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha^{-1})
1	BR7182-2B-1-HR4	122	100	3.4
2	BR7178-2B-19	121	100	4.3
3	BR6855-3B-12	127	100	4.2
4	BR6848-3B-12	116	104	4.1
5	IR84788-40-3-3-1-1	127	115	3.1
6	IR90228-1-3-3-3-2	128	115	3.2
7	IR91006-88-1-3-1	128	114	3.3
8	IR92240-40-2-2-1	127	112	3.8
9	BIdhan5	99	100	3.5
10	BRRI dhan42 (CK)	114	102	3.4
	LSD (5%)	1.67	0.455	0.898
	CV(%)	2.0	0.6	3.8

Table 1A: Performance of lines at location 1: Mandha,Noagoan, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-H	122	101	3.8
2	BR7178-2B-19	130	101	4.4
3	BR6855-3B-12	132	100	4.5
4	BR6848-3B-12	127	104	4.4
5	IR84788-40-3-3-1-1	129	115	3.6
6	IR90228-1-3-3-3-2	127	116	3.8
7	IR91006-88-1-3-1	129	115	3.9
8	IR92240-40-2-2-1	127	112	4.2
9	BIdhan5	99	101	3.7
10	BRRI dhan42 (CK)	114	103	3.8
	LSD(%)	1.878	1.348	0.169
	CV(%)	0.7	0.6	2.2

Table 1B: Performance of lines at location 2: Mandha,Noagoan, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-H	120	101	3.6
2	BR7178-2B-19	118	101	3.9
3	BR6855-3B-12	125	101	4.1
4	BR6848-3B-12	115	104	4.2
5	IR84788-40-3-3-1-1	126	115	3.2
6	IR90228-1-3-3-3-2	129	115	2.9
7	IR91006-88-1-3-1	127	115	3.4
8	IR92240-40-2-2-1	128	112	3.8
9	BIdhan5	99	101	3.1
10	BRRI dhan42 (CK)	115	103	3.2
	LSD(%)	1.590	1.131	0.110
	CV(%)	0.6	0.5	1.5

Table 1C: Performance of lines at location 3: Mandha,Noagoan, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-H	122	101	3.5
2	BR7178-2B-19	120	101	4.1
3	BR6855-3B-12	127	102	3.8
4	BR6848-3B-12	115	104	4.3
5	IR84788-40-3-3-1-1	125	116	3.4
6	IR90228-1-3-3-3-2	128	115	3.4
7	IR91006-88-1-3-1	130	114	3.3
8	IR92240-40-2-2-1	127	112	4.1
9	BIdhan5	99	101	3.7
10	BRRI dhan42 (CK)	115	104	3.4
	LSD(%)	1.305	1.079	0.130
	CV(%)	0.5	0.4	1.7

Table 1D: Performance of lines at location 4: Mandha,Noagoan, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-H	125	101	3.4
2	BR7178-2B-19	122	100	4.3
3	BR6855-3B-12	128	100	4.2
4	BR6848-3B-12	114	104	3.9
5	IR84788-40-3-3-1-1	129	115	2.9
6	IR90228-1-3-3-3-2	130	114	3.2
7	IR91006-88-1-3-1	128	114	3.4
8	IR92240-40-2-2-1	129	111	3.9
9	BIdhan5	99	100	3.5
10	BRRI dhan42 (CK)	114	102	3.1
	LSD(%)	3.131	1.545	0.113
	CV(%)	1.1	0.6	1.5

Table 1E: Performance of lines at location 5: Mandha,Noagoan, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-H	123	100	3.3
2	BR7178-2B-19	118	101	4.6
3	BR6855-3B-12	125	101	3.7
4	BR6848-3B-12	115	103	3.6
5	IR84788-40-3-3-1-1	129	115	3.3
6	IR90228-1-3-3-3-2	128	114	3.0
7	IR91006-88-1-3-1	130	115	2.8
8	IR92240-40-2-2-1	128	112	3.6
9	BIdhan5	100	99	3.4
10	BRRI dhan42 (CK)	114	102	3.4
	LSD(%)	1.761	1.261	0.908
	CV(%)	0.6	0.5	1.2

Table 1F: Performance of lines at location 6: Mandha,Noagoan, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-H	125	101	3.1
2	BR7178-2B-19	120	100	4.2
3	BR6855-3B-12	127	100	4.4
4	BR6848-3B-12	112	104	4.2
5	IR84788-40-3-3-1-1	126	116	3.2
6	IR90228-1-3-3-3-2	130	115	2.9
7	IR91006-88-1-3-1	128	115	3.0
8	IR92240-40-2-2-1	125	112	3.6
9	BIdhan5	99	101	3.7
10	BRRI dhan42 (CK)	115	103	3.3
	LSD(%)	1.011	0.505	0.126
	CV(%)	0.4	0.2	1.7

Table 1G: Performance of lines at location 7: Mandha,Noagoan, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-H	124	100	3.2
2	BR7178-2B-19	119	100	4.4
3	BR6855-3B-12	125	100	4.5
4	BR6848-3B-12	114	104	4.3
5	IR84788-40-3-3-1-1	126	116	2.7
6	IR90228-1-3-3-3-2	129	115	3.0
7	IR91006-88-1-3-1	130	114	3.2
8	IR92240-40-2-2-1	127	112	3.7
9	BIdhan5	98	101	3.2
10	BRRI dhan42 (CK)	114	103	3.4
	LSD(%)	3.355	1.011	0.508
	CV(%)	1.2	0.4	0.7

Table 1H: Performance of lines at location 8: Mandha,Noagoan, Aus 2015

SL#	Designation	Plant height (cm)	Growth duration (days)	Yield (t/ha)
1	BR7182-2B-1-H	120	101	3.5
2	BR7178-2B-19	121	101	4.7
3	BR6855-3B-12	128	100	4.6
4	BR6848-3B-12	115	105	4.5
5	IR84788-40-3-3-1-1	126	115	3.2
6	IR90228-1-3-3-3-2	128	115	3.1
7	IR91006-88-1-3-1	127	114	3.0
8	IR92240-40-2-2-1	128	112	3.6
9	BIdhan5	99	101	3.8
10	BRRI dhan42 (CK)	115	103	3.5
	LSD(%)	0.768	0.226	0.345
	CV(%)	0.6	0.2	1.0

Table 9R. Evaluation of selected lines against major pest-diseases

SN	Designation	BLB score	BPH score
1	BR7182-2B-1-HR4	7	5
2	BR7178-2B-19	4	5
3	BR6855-3B-12	5	5
4	BR6848-3B-12	3	4
5	IR84788-40-3-3-1-1	4	7
6	IR90228-1-3-3-3-2	5	7
7	IR91006-88-1-3-1	5	6
8	IR92240-40-2-2-1	4	5
9	BIdhan5	7	5
10	BRRI dhan42	5	3

score from 1-9

Table 10R: DUS characters of the BR6855-3B-12 **compared with BRRI dhan42**

SL #	Characteristics	BR6855-3B-12		BRRI dhan42	
		Code State	Character	Code State	Characters
1	Leaf color	3	Dark Green	2	Green
2	Flag leaf: attitude of the blade	1	Intermediate	5	Horizontal (46-90)
3	Time of heading (50% of plants with heads)	3	early	3	early
4	Stem length (Culm length):	7	Long (81-110 cm)	7	Long (81-110 cm)
5	Panicle length:	5	Medium (21-25 cm)	3	Short (20cm)
6	Time of maturity	1	very early	1	very early
7	Leaf senescence:	1	Late and slow	5	Intermediate
8	Decorticated grain: shape (Length-width ratio) of de-hulled grain	9	Slender (L:W>3.0	7	Medium Slender (L:W= 2.6-3.0

Annexure-2

Details results and data

Results and Discussion: PVS experiments were conducted in location in Rajshahi during Aus 2015 to find out the best aerobic rice lines. The results of PVS at 6 locations showed BR7178-2B-19, BI dhan-5, BR6855-3B-12 and IR92240-40-2-2-1 performed better in respect with yield and shorter growth duration (about 100 days) and as well choose as farmer's preferred variety.

Table 1: Performance of advanced aerobic Aus rice lines, Paba-2, Rajshahi

SL#	Entries	Flowering 50%	Growth duration (days)	Plant height (cm)	Panicle /m^2	Grain yield (t/ha)
1	BR7182-2B-1-HR4	85	107	125.17	311	4.01
2	BR7178-2B-19	81	106	120.33	295	4.30
3	BR6855-3B-12	87	108	118.00	282	4.02
4	BR6848-3B-12	89	109	113.83	291	3.65
5	IR84788-40-3-3-1-1	91	112	102.50	276	4.07
6	IR90228-1-3-3-3-2	91	112	114.33	285	4.02
7	IR91006-88-1-3-1	82	105	130.33	285	4.19
8	IR92240-40-2-2-1	91	112	110.50	306	4.09
9	BI dhan5	82	105	99.83	272	3.61
10	BRRI dhan42 (ck)	81	106	114.33	295	3.72

Direct seeding date: 22.05.15

Table 3: Performance of advanced aerobic Aus rice lines, Paba-3, Rajshahi

SL#	Entries	Flowering 50%	Growth duration (days)	Plant height (cm)	Panicle /m^2	Grain yield (t/ha)
1	BR7182-2B-1-HR4	84	109	124.50	284	4.07
2	BR7178-2B-19	81	106	120.67	264	4.22
3	BR6855-3B-12	86	109	118.83	259	3.89
4	BR6848-3B-12	87	109	115.50	271	3.68
5	IR84788-40-3-3-1-1	89	111	103.00	242	3.72
6	IR90228-1-3-3-3-2	90	112	116.67	258	3.79
7	IR91006-88-1-3-1	83	106	131.67	272	4.01
8	IR92240-40-2-2-1	90	112	113.67	283	3.77
9	BI dhan5	83	106	101.67	268	3.51
10	BRRI dhan42 (ck)	80	106	114.17	285	3.71

Table 4: Performance of advanced aerobic Aus rice lines, Godagari-1, Rajshahi

SL#	Entries	Flowering 50%	Growth duration (days)	Plant height (cm)	Panicle /m^2	Grain yield (t/ha)
1	BR7182-2B-1-HR4	82.50	104	121.98	303.00	3.84
2	BR7178-2B-19	79.00	103	115.00	289.00	3.90
3	BR6855-3B-12	86.50	108	116.50	263.50	3.75
4	BR6848-3B-12	78.50	102	113.00	291.00	3.68
5	IR84788-40-3-3-1-1	87.50	108	102.43	279.50	3.93
6	IR90228-1-3-3-3-2	79.50	103	112.00	288.50	4.26
7	IR91006-88-1-3-1	79.50	103	124.27	282.00	4.33
8	IR92240-40-2-2-1	86.50	106	112.10	279.50	3.73
9	BI dhan5	78.50	100	99.22	284.00	3.54
10	BRRI dhan42 (ck)	80.00	101	107.10	282.00	3.86

Direct seeding date: 27.05.15

Table 5: Performance of advanced aerobic Aus rice lines, Godagari-2, Rajshahi

SL#	Entries	Flowering 50%	Growth duration (days)	Plant height (cm)	Panicle /m^2	Grain yield (t/ha)
1	BR7182-2B-1-HR4	84	105	121.00	295	4.15
2	BR7178-2B-19	80	103	114.90	286	3.94
3	BR6855-3B-12	86.5	109	114.63	259	3.70
4	BR6848-3B-12	79.5	104	111.50	268	3.50
5	IR84788-40-3-3-1-1	86.5	109	99.17	280	3.69
6	IR90228-1-3-3-3-2	80.5	103	109.93	282	3.89
7	IR91006-88-1-3-1	79.5	103	122.25	289	4.07
8	IR92240-40-2-2-1	87.5	107	109.90	268	3.82
9	BI dhan5	78	100	98.77	272	3.62
10	BRRI dhan42 (ck)	79	102	105.20	277	3.87

Table 6: Performance of advanced aerobic Aus rice lines, Godagari-3, Rajshahi

SL#	Entries	Flowering 50%	Growth duration (days)	Plant height (cm)	Panicle /m^2	Grain yield (t/ha)
1	BR7182-2B-1-HR4	83	105	119.38	298	4.21
2	BR7178-2B-19	80	103	115.87	286	4.11
3	BR6855-3B-12	87	108	114.73	260	3.82
4	BR6848-3B-12	80	104	112.53	290	3.74
5	IR84788-40-3-3-1-1	88	109	100.80	273	3.86
6	IR90228-1-3-3-3-2	80	104	110.28	278	3.84
7	IR91006-88-1-3-1	82	104	121.03	301	4.00
8	IR92240-40-2-2-1	88	108	106.92	292	3.89
9	BI dhan5	79	99	99.85	282	3.82
10	BRRI dhan42 (ck)	80	102	103.13	283	4.03

Direct seeding date: 27.05.15

Table 7: Yield at 4 different locations RYT in Rajshahi and Habiganj region, Aus 2016

SN	Designation	L1	L2	L3	L4	L5	L6	Mean yield (t/ha)
2	BR7178-2B-19	4.1	4.2	4.3	4.5	4.4	4.2	4.28
8	IR92240-40-2-2-1	4.2	3.9	3.9	3.7	4.1	4.0	3.97
9	BIdhan5	4.4	4.2	4.1	3.9	4.3	4.0	4.15
10	BRRI dhan42	4.0	3.8	3.7	3.6	3.8	3.9	3.80

Location 1: Poba-1, Rajshahi, Location 2: Poba-2, Rajshahi, Location 3: Jagatpur, Habiganj Sadar, Location 4: Habiganj Sadar.

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