Welcome

Keynote Paper

Annual Research Review Workshop 2015-16

Bangladesh Rice Research Institute (BRRI)
Gazipur 1701, Bangladesh

BRRI

Presentation Outline

- Introduction
- Transferable technologies
- Upcoming technologies & scientific information
- Up scaling activities
- Research strategies
- Policy thoughts

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Transferable Technologies

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BRRI dhan70- A Premium Quality Aromatic rice variety for T. Aman season

- Plant height : 120 cm
- Gr. duration (days): 125-130
- Shape Size: LS
- Amylose: 21.7%
- Aroma: Strong
- Protein: 9.5%
- ER: 1.5
- Grain Yield: 5.0 t/ha

BRRI

BRRI dhan71 - A drought tolerant rice variety for T. Aman season

Plant height : 107-110 cm

Gr. duration (days): 115

Shape Size: MB

Dr. tolerance: 21 days

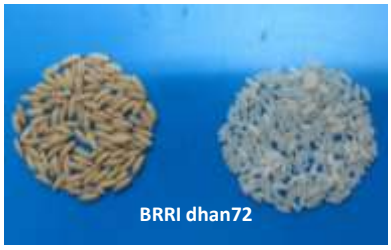
P. water depth: 50-70 cm

0.5-1.0 t/ha out yield than BRRI dhan56

Grain Yield: 4.0-4.5 t/ha
5.0-6.0 t/ha

BRRI

BRRI dhan72 - A zinc enriched rice variety for T. Aman season



Plant height : 117 cm

Gr. duration (days): 125-128

Shape Size: LB

Zn- content: 22.8 mg/kg

Amylose: 26%

Protein: 8.9%

ER: 1.4

Grain Yield: 6.0-6.5 t/ha

BRRI

BRRI dhan73 - A salinity tolerant rice variety for T. Aman season

Plant height : 120 cm

Gr. duration (days): 130

Shape Size: MS

Salt tolerance: 8 dS/m (WLC)

Amylose: 27.2 %

Grain Yield: 3.5-4.0 t/ha

5.0-6.0 t/ha

BRRI

BRRI dhan74- A Zn enriched rice variety for Boro season

Plant height : 110 cm

Growth duration (days): 147

Zinc content (mg/kg): 24.2

Shape Size: MB

Amylose: 28.0%

Protein: 8.3%

ER: 1.5

IR: 4.6

Grain Yield: 7.1 t/ha

BRRI

BRRI dhan75- A short duration variety for favorable T. Aman

- Plant height : 105 cm
- Gr. duration (days): 115-17
- Lodging tolerant
- Shape Size: MS
- Amylose: 24.0%
- Protein: 9.2%
- Aroma: mild
- ER: 1.6
- Grain Yield: 5.37 t/ha
- Yield potential : up to 6.5 t/ha

BRRI

BRRI dhan76- A T. Aman variety for Tidal non-saline ecosystem

- Seedling height : 60-70 cm
- Plant height : 121-140 cm
- Gr. duration (days):150-165
- Shape Size: Bold
- Amylose: 26.1%
- Protein: 8.2%
- ER: 1.6
- Grain Yield: 5.0 t/ha
- Pests: Tolerant to BB, Blast and Stem borer

BRRI

BRRI dhan77- Another T. Aman variety for Tidal non-saline wetland ecosystem

Rough rice and milled rice of BRRI dhan77

- Seedling height : 56-70 cm
- Plant height : 133-140 cm
- Gr. duration (days):145-154
- Shape Size: Bold
- Amylose: 26.3%
- Protein: 8.5%
- ER: 1.5
- Grain Yield: 4.5-5.0 t/ha
- Pests: Tolerant to BB, Blast and Stem borer

BRRI

BRRI hybrid dhan5 - A potential hybrid rice variety for boro season

- Plant height : 105-110 cm
- Gr. duration (days):143-145
- Shape Size: Long Bold
- Amylose: 23.4%
- Protein: 9.0%
- Seed yield :
- Boro: 2.2-2.5 t/ha
- T. Aman: 1.5-2.0 t/ha
- Grain Yield: 8.5-9.0 t/ha

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Soil Crop Water Mgt

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Rice Straw: A potential source of NPK fertilizer in IPNS for Barisal Region

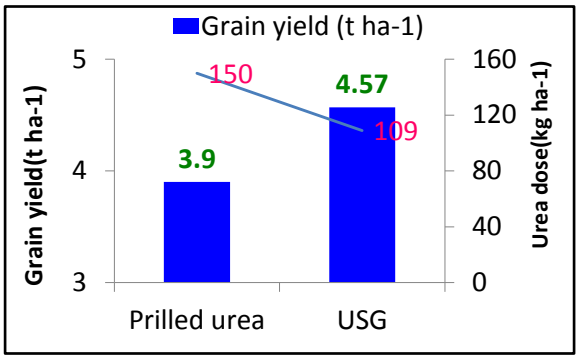
Seasons	Grain yield (t ha^{-1})		% yield increase over chemical fertilizer
	Chemical fertilizer	RS + IPNS	
Aus	3.99	4.38	9.77
T. Aman	3.66	4.01	9.56
Boro	6.90	7.52	8.98

- **RS @ 4.5 t ha^{-1} (sun dry basis) save 50 kg urea, 18 kg TSP, 144 kg MoP and 25 kg gypsum fertilizers**

- **RS @ 4.5 t ha^{-1} (sun dry basis) with IPNS based chemical fertilizer can increase rice yield up to 10%**

Application of USG: A potential technology for N-management of short duration variety in rainfed condition

BRRI



Urea save: 27%
Yield increase: 15%

Vegetables and Fish cultivation in modified *Sorjan* – A highly profitable farming system in Tidal fresh water inundated ecosystem

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Brinjal production on the ridge under modified *Sorjan*

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High value fish production in *Sorjan* ditch (after 6 months)

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Profitability of high value fish and vegetable cultivation in modified *Sorjan* system

Fish species	Gross margin (Lakh Tk/ha)		
	Fish	Vegetables	Total
Shing	2.11	5.98	**8.09**
Magur	3.25	6.03	**9.29**
Koi	1.09	4.00	5.08
Telapia (FP)	0.91	6.12	7.02
Carp (FP)	2.04	5.51	7.56

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Shallow DWR+Fish mixed culture: A promising technology for utilization of Fallow land in Aman season in Gopalgonj area

Existing Cropping Pattern: Boro - Fallow - Fallow

Proposed Cropping Pattern: Boro (HYV) – Aman (Bashi raj) + Fish

Fish: Ruhi, Mrigal, Telapia, Silver carp, Sorputi, Katla

Location: Tongipara, Gopalganj district and Mollarhat, Bagherhat district

Area: About 3 acres, Rice variety: Bashi Raj(Local)

Net return from Fish: Tk.159364, Net return from Rice:Tk. 19250






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RFS

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Musk melon intercropping with lentil: A profitable cropping pattern for tidal non-saline ecosystem



Varieties:

Lentil: BARI Masur-5

Jute: JRO540

Musk melon: Local

Rice: BRRI dhan33/62

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Profitability of musk melon intercropping grown at Nazirpur, Pirojpur during 2015-16

Cropping pattern (CP)	REY (t ha^{-1})	TVC (LakhTk ha^{-1})	GM (LakhTk ha^{-1})
CP1 (musk melon intercropping)	31.01	2.23	2.42
CP2 (No intercropping)	17.38	1.54	1.04

B

Four Crops Patterns: BRRI dhan62 – Mustard - Mungbean - BRRI dhan48


BRRI dhan62, 3 Aug - 20 OCT (80 Days)


BARI mustard14, 1 Nov - 20 Jan (80 days)


BARI Mung6, 25 Jan to 10 April (75 Days)


BRRI dhan48, 05 May to 31 July (85 days)

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Experiment on four-crops patterns at BRRI Rangpur

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Rice equivalent yield under different cropping patterns

Treat.	1st crop yield (t/ha)	2nd crop yield (t/ha)	3rd crop yield (t/ha)	4th crop yield (t/ha)	REY (t/ha)
T_1	BRRI dhan62 4.23	Potato 25.83	Mungbean 0.61	BRRI dhan48 3.63	35.93
T_2	BRRI dhan62 4.19	Mustard 0.93	Mungbean 0.71	BRRI dhan48 3.80	13.87
T_3	BR11 6.45	Potato 26.80	Maize 8.75	-	30.32
T_4	BR11 6.42	Boro 6.21	-	-	12.63

Price: Rice =14/kg (Bold grain), and 16.25/kg (Fine grain), Potato= 15/kg (early), Potato= 9.40/kg (late), Mustard= 50/kg, Mungben= 60/kg, Maize=12.5/kg

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Economic benefit of four crops pattern

Treatment	(000 Tk./ha)		GM (000Tk/ha)
	TVC	GR	
T_1	353.8	561.6	207.8
T_2	215.2	228.4	13.2
T_3	322.7	461.6	138.9
T_4	175.4	203.8	28.3

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Soil fertility status influenced by four crops pattern

Treat.	pH	OM	Total N	P	K	S	Zn
Initial soil	6.60	2.06	0.10	31.15	0.14	6.34	3.74
T_1	6.43	2.73	0.14	79.44	0.24	14.97	3.92
T_2	6.47	2.55	0.13	59.01	0.19	15.84	3.76
T_3	6.33	2.57	0.13	92.54	0.26	13.57	6.64
T_4	6.56	3.01	0.15	53.13	0.18	11.19	4.26
$LSD_{0.05}$	NS	0.29	NS	10.56	0.08	4.17	1.71

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Collection of Rice Germplasm

Sl. No.	Ecosystem	No. of germplasm collected
1	Jhum (hill rice)	108
2	Upland (Aus)	2
3	Rainfed lowland (T. Aman)	104
4	Deepwater (B. Aman)	13
5	Irrigated (Boro)	27
	Total	254

Potato-Mungbean-T. Aus-T. Aman: A potential Technology for Rangpur Region

Treatments

T_1= Potato –Mungbean -T. Aus -T.Aman

T_2= Mustard –Mungbean -T. Aus -T. Aman

T_3= Potato –Maize –T. Aman (Farmers' improved practice)

T_4= Boro- Fallow- T. Aman (Farmers' traditional practice)

Four Crops Patterns: T. Aman - Potato - Mungbean - T. Aus


BRRI dhan62, 3 Aug-20 OCT (80 Days)

Potato, 1 Nov to 25 Jan (80 Days)


BARI Mung6, 10 Feb- 25 April (75 Days)

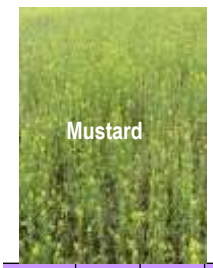

BRRI dhan48, 05 May -31 July (85 days)

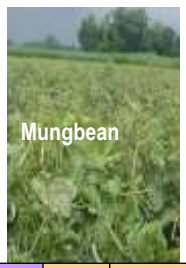
Potential Cropping Pattern for greater Kushtia

BRRI

Mustard-Mungbean-T.Aus-T. Aman

85 days | 65 days | 82 days | 78 days





Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	No
অগ্রহা	পৌষ	মাঘ	ফাল্গুন	চৈত্র	বৈশাখ	জৈষ্ঠ	আষাঢ়	শ্রাবণ	ভাদ্র	আশ্বিন	কার্তিক	

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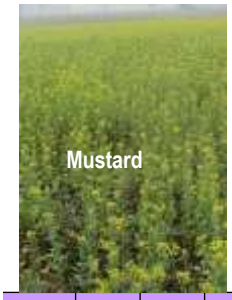
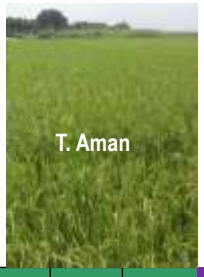
Mustard-Pumpkin-T.Aus-T. Aman

85 days | 90 days | 85 days | 78 days





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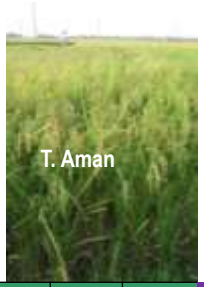
অগ্রহা	পৌষ	মাঘ	ফাল্গুন	চৈত্র	বৈশাখ	জৈষ্ঠ	আষাঢ়	শ্রাবণ	ভাদ্র	আশ্বিন	কার্তিক	

BRRI

Maize+Potato-T.Aus-T. Aman

158 days | 85 days | 78 days



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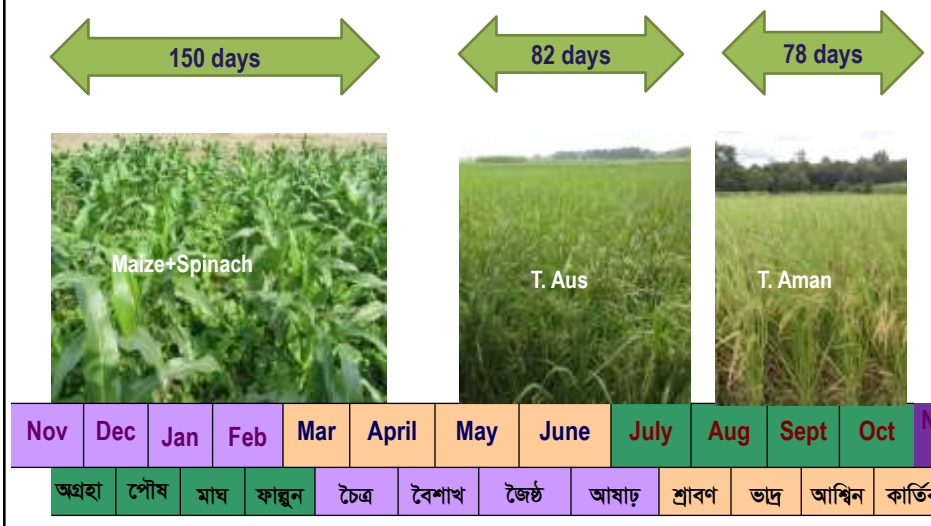
BRRI

Maize+Spinach-T.Aus-T. Aman



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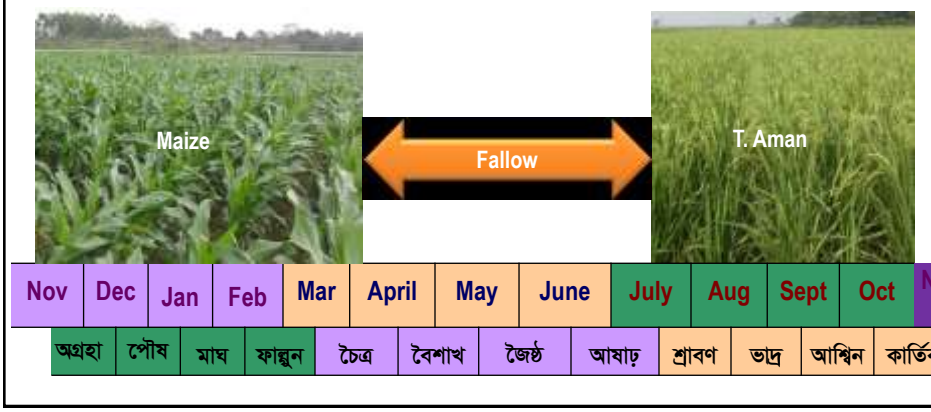
Maize-Fallow-T. Aman



Economic Analysis of Maize+Potato-T. Aus-T. Aman cropping pattern

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Cropping Pattern	Yield (t/ha)				REY (t/ha)	Field duration (days)
	Mustard/Maize	Mungbean/Spinach/Potato/S. gourd	T. Aus	T. Aman		
Mustard-Mungbean-T. Aus-T. Aman	1.77	0.75	3.85	4.24	14.50	310
Mustard-Pumpkin T. Aus-T. Aman	1.84	3.64	3.91	4.25	13.99	335
Maize+Potato-T. Aus-T. Aman	8.20	10.28	4.17	4.30	18.36	321
Maize+Spinach-T. Aus-T. Aman	8.44	5.00	4.14	4.20	15.07	318
Maize-Fallow-T. Aman	9.10	-	-	4.35	10.14	251
LSD $_{(0.05)}$	-	-	-	-	0.95	
F for treat.					**	
CV (%)	-	-	-	-	3.5	

Mustard = 50 tk/kg, Mungbean = 70 tk/kg, Rice = 22 tk/kg, Potato = 10 tk/kg, spinach = 6 tk/kg, Maize = 14 tk/kg, Sweer gourd=10tk/kg

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Economics of different cropping patterns

Cropping Pattern	TVC (Tk/ha)	Gross return (Tk/ha)	Gross margin (Tk/ha)
Mustard-Mungbean-T. Aus-T. Aman	1,82,000/-	3,19,000/-	1,37,000/-
Mustard-Pumpkin. Aus-T. Aman	1,85,000/-	3,07,780/-	1,22,780/-
Maize+Potato-T. Aus-T. Aman	2,42,900/-	4,03,920/-	1,61,020/-
Maize+Spinach-T. Aus-T. Aman	1,80,000/-	3,31,540/-	1,51,540/-
Maize-Fallow-T. Aman (ck)*	1,30,000/-	2,23,080/-	93,080/-

* covers 26% of cropped area

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Potato-Jute with relay B. Aman: Highly profitable technology for Mediun Highland Ecosystem



Potato-Jute relay B. Aman



Wheat-Jute relay B. Aman (BRRI dhan39)

Onion+Jute relay B. Aman

BRRI

Mustard-Jute relay B. Aman

BRRI

Economic Analyses of the patterns

Treatments	TVC (Tk/ha)	GR (Tk/ha)	GM (Tk/ha)
Potato-jute-BRRI dhan33	228115	348700	120585
Wheat-jute-BRRI dhan39	139682	157930	18248
Onion-jute-BRRI dhan39	213408	244470	31062
Mustard-jute-BRRI dhan34	133380	163250	29870
Mustard-jute-fallow	74,100	75,650	1550

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Pest Mgt.

Management of resurged Black beetle damage in rice

BRRI

Black beetle

Damage Symptom

- Dryland Insect
- First recorded in BD in 1980
- Resurge 2015 in Kolmakanda Netrokona
- Control by flood irrigation or insecticide

Heteronychus lioderes,
Order: Coleoptera, Family: Scarabaeidae

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Eco Engineering: A potential technique for sustainable insect pest management and natural enemy conservation

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- Increase natural enemies
- Reduce key rice insect pests (50%)
- Decrease pesticide use (70%)
- Enhance detrivores
- Increase yield (5%)

Fig. Nectar-rich flowering crops planted on rice bunds during Boro season in BRRI farm. Flowering plant provides nectar base sugar that fed by natural enemies and increases reproductive capacity

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Re-chargeable light: A low cost technique for trapping insect pests

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Collected insects

- Eco-friendly
- Cheap
- User friendly

Healthy Seedling Raising Technology for Mechanical Transplanter

BRRI

Seedling raising in tray appeared as serious problem during winter season due to seedling blight disease

Mechanical transplanting requires healthy seedling mat to avoid missing hill

This technology has been developed to facilitate mechanical transplanting for fulfilling the upcoming demand.

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Healthy Seedling Raising Technology for Mechanical Transplanter

Healthy Seedling

Use pulverized sandy loam/loam soil

Treat Seed with Azox.+Difen. in water solution @ 0.2-0.3% for 18-20 hrs

Allow seed for sprouting

Fill up tray with soil and level off

Seed uniformly and cover up with thin layer of the soil

Apply sprinkler irrigation and then cover tray with polythene for 72 hrs.

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Healthy Seedling Raising Technology for Mechanical Transplanter

If seed is not treated

Spray seedling with the same fungicide @ 0.2-0.3% 3 -DAS

Irrigate 2-3 times/day with sprinkler

Cover seedlings 17:00 – 09:00 hrs until ready for transplanting

Spray seedling by Urea, MoP, Thiovit & ZnSO4 @ 1-2, 0.6, 0.2 and 0.2%, respectively at 7 DAS

Healthy seedling will be ready within 25-30 days

BRRI

Sustainable Management of Bacterial Blight Disease

Fig.1. Initial symptom

Fig.2. Treated Plot

Fig.3. Untreated Plot

Application of Thiovit @ 60 g and MoP @ 60 g/10 L water for 5 decimal of land immediately after disease initiation in the field and apply 2nd spray 7 days after 1st spray

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Preventive management of Neck Blast in Aromatic Rice

Infected panicle

Neck blast infected aromatic rice field during T. Aman season

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Preventive management of Neck Blast in Aromatic Rice

Maintain standing water in the field if possible.

Consider: **Variety and heading-flowering stage**
Weather forecasting: Drizzle rain & windy environment

Apply fungicide: **Trooper (400 g/ha) or Nativo (250 g/ha) or Azoxystrobin twice 10-15 days interval**

Fungicides must be applied in the field at afternoon.

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FMPHT

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BRRI Manual Rice Transplanter

FEATURE

Line to line spacing: 20 cm
Hill to hill distance: 13-15 cm
No. of rows: 4
Machine weight: 19 kg
Missing hill (%): around 5%
Floating hill (%): 1%
Seedling Type: Mat type
Capacity: 1.5 acre/day
Cost Tk. 20,000/- (Approx.)

Limitation

Operation done in backward motion

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BRRI

BRRI Manual Rice Transplanter

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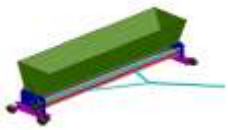
BRRI

BRRI seed sower machine- A new technology for mechanical rice transplanting

- Seeding raising in mat is pre-requisite for mechanical rice transplanting
- Uniformity is required for mechanical transplanter
- Convenient over manual seeding
- Save time and labour



AutoCAD drawing

BRRI seed sower machine

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BRRI seed sowing machine (Contd.)

- Seed rate could be adjusted according to seed size
- Optimum seed rate 100g, 120g and 135g per tray for small, medium and long-bold grain
- Uniformity of the seedling: 2-4 seedling/cm^2
- Capacity: 400-450/ tray
- Cost: 10000.00Tk

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Manually seed sowing in tray

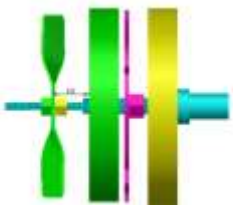
Mechanically seed sowing in tray

BRRI

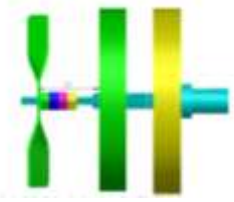
BRRI prilled urea applicator for deep placement of Urea

- Adjustable with dose of Urea for Aus, Aman and Boro
- The urea dispensed rate per wheel revolution in the laboratory condition of the machine for 13 mm, 19 mm and 37 mm distance of impeller was 17.0~17.50 gm (210 kg/ha), 13.50~14.00 gm (180kg/ha) and 09.00~10.00 gm (90 Kg/ha) respectively

Impeller adjustment for long duration Boro



Impeller adjustment for medium duration Boro



Impeller adjustment for Aus/Aman

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Patent for BRRI for developing Prilled Urea Applicator

Field operation of prilled urea applicator


GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
DEPARTMENT OF PATENTS, DESIGNS AND TRADEMARKS

Letters Patent

BRRI

Design and development of Combine harvester

Combine harvester was fabricated at Janata Engineering workshop, Chuadanga with the Technical support of FMPHT Division, BRRI under Public-Private Partnership

BRRI

Field performance of combine harvester

Crop	Rate of work				Fuel consumption l/h
	Area covered		Grain output (kg/h)	Straw output (kg/h)	
	(bigha/h)	(ha/h)			
Rice	2.00	0.27	1206.77	965.41	3.80
Wheat	1.73	0.23	693.00	485.10	3.65

- The field capacity was found 0.22~0.30 ha/h for rice and 0.21~0.31 ha/h for wheat
- Fuel consumption was 3.50~4.2 l/h
- Price: 6,50,000.00

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Combine harvester in field operation

BRRI

Upcoming technologies

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Promising T. Aus advanced lines

Genotype	Plant height (cm)	Growth duration (days)	Grain yield (t/ha)
BRRI dhan29-SC3-28-16-10-6-HR6 (com)	95	105	4.5-5.0
BR9011-34-3-2	110	110	5.0-5.5
BR9011-48-4-3	110	110	5.0-5.5
BR9039-28-3-2	95	110	5.5-5.8

BRRI

Development of NERICA10 Pure Line for T. Aus

NERICA 10-7-PL2-B

- Growth duration 102-105 days
- Grain yield 4.5-5.0 t/ha
- High amylose

BRRI

BRRI dhan49-Sub1 with 1 week more submergence tolerance than BRRI dhan52 with water stagnation tolerance

BRRI R/S Rangpur, T. Aman 2016

BRRI

Jasmine Type Variety for T. Aman

BR7697-15-4-4-2-2		BRRI dhan37 (Ck)	
GD (days)	GY (t/ha)	GD (days)	GY (t/ha)
132	4.6	149	3.6

- Amylose%: 23.6
- Elongation: 1.5
- Long Slender
- Aromatic rice

Jira Type Standard Boro Variety

Designation	PH (cm)	GD (days)	GY (t/ha)
BR7358-5-3-2-1-HR2 (Com)	97	142	5.76
BRRI dhan28 (Ck)	102	141	5.71

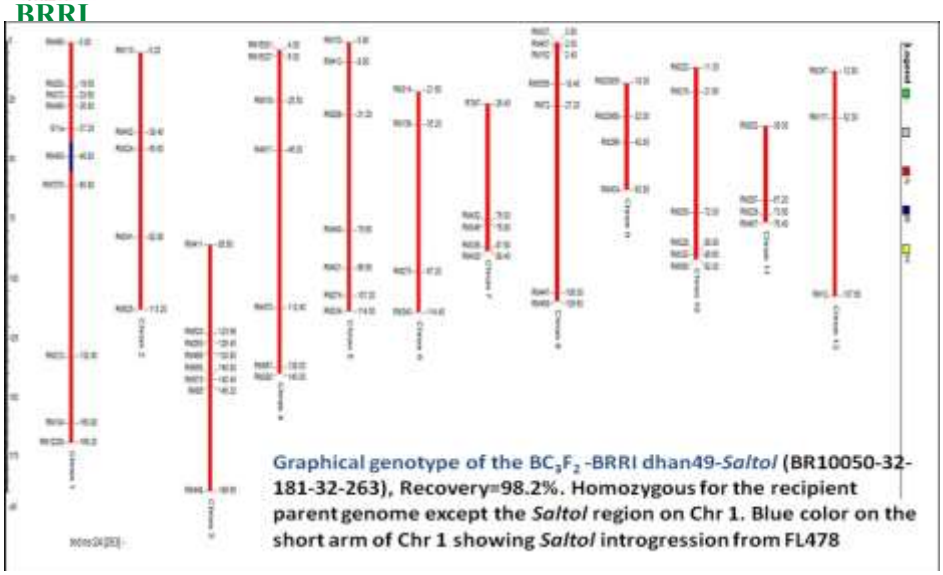
BRRI

High Zn & red pericarp rice

Zn 27 ppm; Amylose 26%; Grain yield 6.0-6.5 t/ha

BRRI

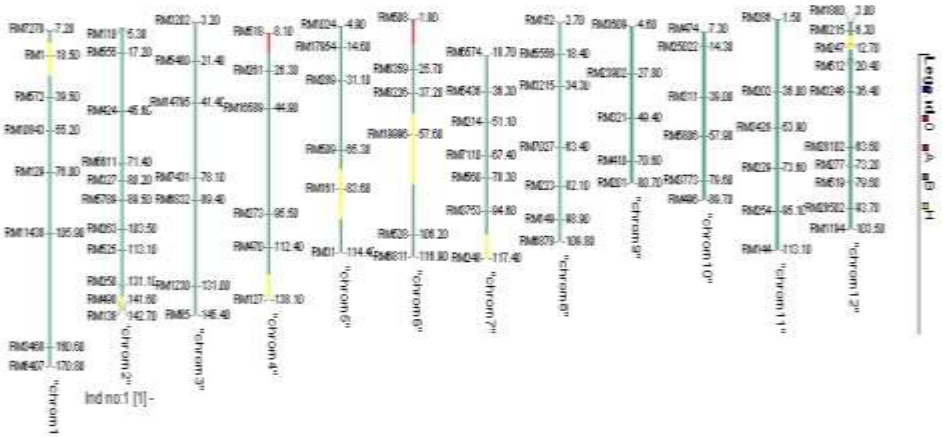
Marker Assisted introgression of *Saltol* QTL into BRRI dhan49



Graphical genotype of the BC_3F_2 -BRRI dhan49-*Saltol* (BR10050-32-181-32-263), Recovery=98.2%. Homozygous for the recipient parent genome except the *Saltol* region on Chr 1. Blue color on the short arm of Chr 1 showing *Saltol* introgression from FL478

BRRI

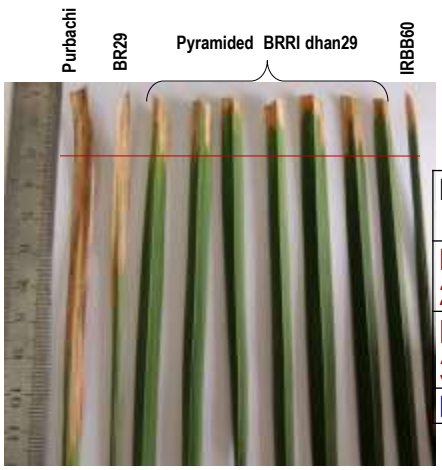
Marker Assisted introgression of QTL for seedling stage cold tolerance into BRRI dhan28



The plant 132A-3 of BC_2F_1 generation possessed 89.0% homozygous recipient genome (green colour)

BRRI

Five Bacterial Blight resistance genes (*Xa4 and Xa21*) pyramided lines selected for RYT



Designation	Yield (t/ha)	GD (days)	BB Score
BR(Bio)8333-BC5-2-22	7.12	156	3
BR(Bio)8333-BC5-3-10	6.96	154	3
BRRI dhan29 (CK)	6.96	158	7

21 days after bacterial inoculation with BxO9

BRRI

Doubled haploid lines generated from an Iranian variety Niamat and BR802-78-2-1-1 using Biotechnological technique are evaluating as Proposed Variety Trial in Boro 2016-17

Niamat ✕ BR802-78-2-1-1

F1

Premium Quality Rice
- Translucent and long slender
- Yield: 6.5 t/ha (similar to BRRI dhan28)
- GD : 142 days (similar to BRRI dhan28)
- Lodging resistance
- Suitable for mechanical harvest
- Amylose: 26%
- Protein: 9.5%

Anther Culture

Regenerated Plants

BR(Bio)8072-AC5-4-2-1-2-1

BRRI

BR(BE)6158RWBC2-1-2-1-1 developed form Rice-Wheat cross through anther culture followed by backcrossing are evaluating as Proposed Variety Trial in Boro 2016-17

- ✓Yield: Similar to BRRI dhan29
- ✓GD: 3-4 days earlier than BRRI dhan29
- ✓Imbibition ratio: It has 4.5 whereas BRRI dhan29 has 3.9
- ✓It has less yield reduction than BRRI dhan29 under different moisture levels (saturation and field capacity condition) in soil
- ✓Grain: Translucent and long slender
- ✓Elongation ratio: 1.4
- ✓Amylose: 26%

Black Rice Research Initiatives at BRRI

Fig 1. Rough rice / Paddy.
Fig 2. Brown rice.
Fig 3. Milled rice (10% polished).
Fig 4. Milled rice (over polished).
Fig 5. Rice bran.
Fig 6. Cooked rice.
Fig 7. Rice gruel.
Fig 8. Rice Bran oil.
Fig 9. DG, Director (Admin) and Director (Research) were presented in Crop cut session at GQN out house, BRRI.
Fig 10. All scientists of GQN Division.

Black rice research activities has been started in BRRI GQN Division, GQN Division.

Vutan-an exotic genotype for cold tolerance both at seedling and reproductive stage

Cold stress (13°C) at seedling stage

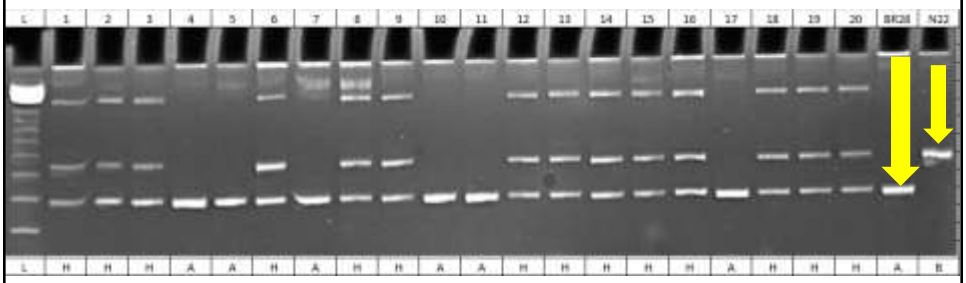
- Vutan had better vegetative vigor

Cold stress (18°C) at reproductive stage

- Well exerted panicle with less sterility
- Less reduction of plant height & last internode length

BRRI

Marker-assisted introgression of heat tolerant QTL (*qSF4.1*) into BRRI dhan28 and BRRI dhan29



PAGE of BC_3F_1 progenies of BRRI dhan28/N22///BRRI dhan28 genotyping through InDel marker R4M30

BRRI

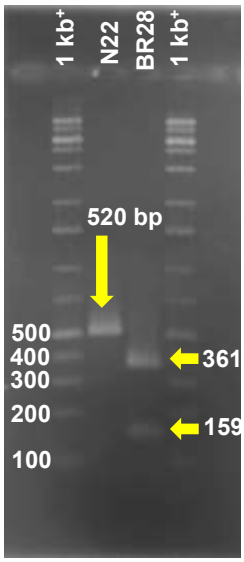
CAPS marker designed and validated to confirm the presence of SNP linked to the heat tolerance QTL (*qSF4.1*)

CTCCTAGGCCAATTGCAATACCTAGAAAAACATATACACATGTTAGTTTA
TTTATTTTTTCAATTAGATGTAACGACAAGTAAAAGTTTCATGAGGTAAT
TTAAATGAAACCATACATCTAAGATTAGTTTAATATTCAGTGAATATTAT
TTTGTCTACTTGTTTAATGCTGTGAAAGAGACCGGCATTACAAAACCCAA
GTTATTTTAATTTTTTTGAAATATTTGTAGAATGCAAAATACATTGTGCT
ACTTCCTTTTTAAATGATTTTAAGGGGCCCAAATGCATTTCATGTGAACT
TTAAAGCAAATATTGGCTATAAAAAATCTTGCAGTATTCTGAGGATATGT
GTTTACCGA[A/T]GCTAGTGGAAACTCTTTTCGGCATGGTCCAACAGAAG
CATCTCCTCGAGTACCCGCAGGGCAAAAACAATCGAATCCTCCAAGTTT
GTTGATGCACTTCCCATAGCAAGGGTACTTATTAGAATCCTCACACTCGT
TAATATCTACAATCATATTTCACA

Designed STS by tagging the SNP (id4005120) and the PCR product digested with *AluI* separated in 2% Agarose gel

5' .. A G C T .. 3'
3' .. T C G A .. 5'

Restriction site of *AluI*



BRRI

202 BRRI Gene Bank germplasm evaluated at field condition through planting geometry technique for CO_2 responsiveness

Accession Number	Accession Name	Relative Response	
		Panicle Number	Panicle dry weight (g/plant)
30	HASHIKALMI-DA-26	2.38	2.42
78	KARTIK JHUL	2.46	2.56
157	CHINI SAGAR	2.15	1.94
208	KOHA BINNI	2.09	2.15
224	DEPA DHAN	2.00	2.10
237	DUDKAT	2.06	2.02
263	SHADA DUMRA	2.03	2.05
406	BUTA	2.18	2.15
419	SUNA SAIL	1.88	2.50
463	RONJAY	2.03	1.99

Bangladeshi rice germplasm could be a good source of CO_2 responsiveness; useful for developing climate resilient varieties

BRRI

Promising Bio-organic fertilizer from BRRI

Parameters	Bio-organic fertilizer (BF)
Moisture (%)	60
Total organic C (%)	8.77
Total N (%)	0.78
C:N	11.2
pH	8.0
Total P (%)	2.33
Total K (%)	1.2
Humic acid (%)	96.34
Population of N_2 fixing bacteria	6 x10^8 Cfu g^{-1}
Population of PSB	8 x10^8 Cfu g^{-1}
Rock phosphate (%)	5





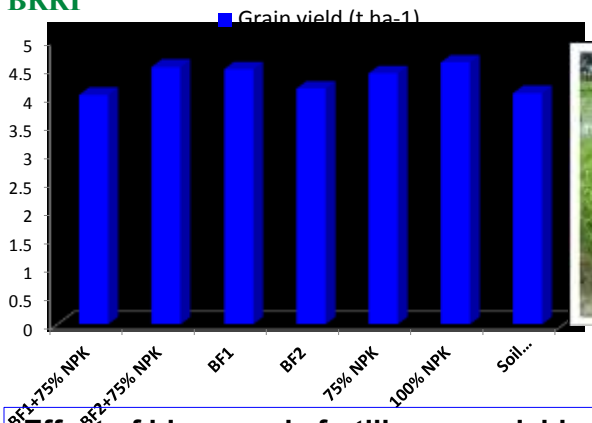
Rock Phosphate

Rice husk biochar

Beneficial Bacteria

BRRI

PERFORMANCE OF BRRI BIO-ORGANIC FERTILIZER



Effect of bio-organic fertilizers on yield of BRRI dhan48 in T. Aus 2016

BRRI

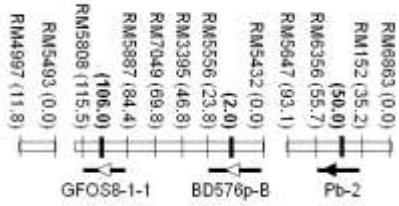
Identification of Candidate Genes/QTLs for Developing Durable Disease Resistance Varieties

1. **Bacterial Blight Disease**
   ***Xa21* and *xa13 genes* identified and effective**
   pyramiding of these genes may cover 89.0% BB races in Bangladesh

2. **Blast Disease**
   ***Pi9, Pita-2, Pish, Pib* and *Pi40* genes identified and effective**
   pyramiding of R-genes could effectively control Blast disease

3. **Tungro Disease**
   ***tsv1* gene identified and effective**
   ***M*ay be effective against RTV**

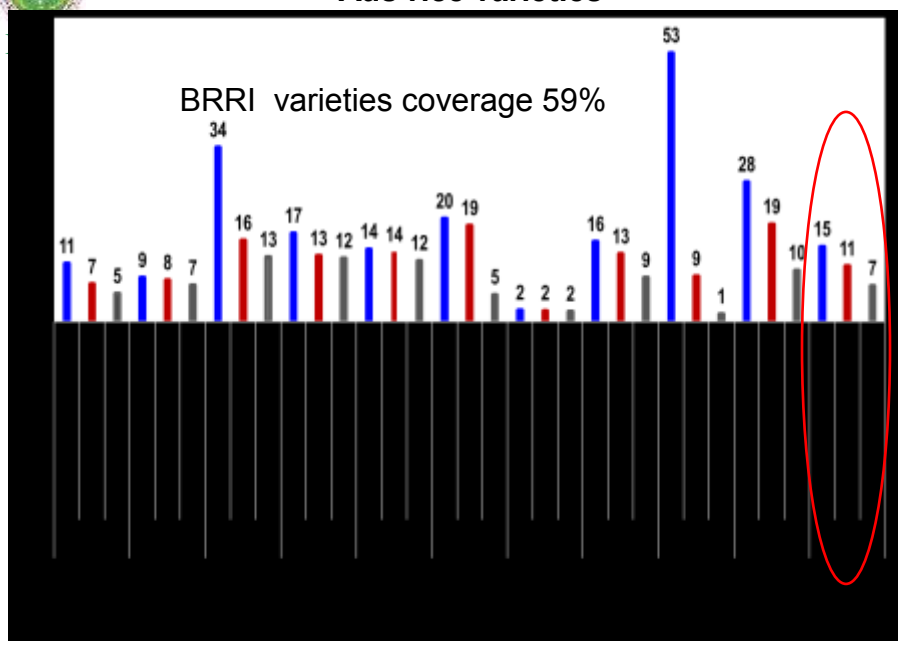
4. **Effective blast R-QTLs in NERICA-L-19 on chm. 8 (3 new QTLs identified)**



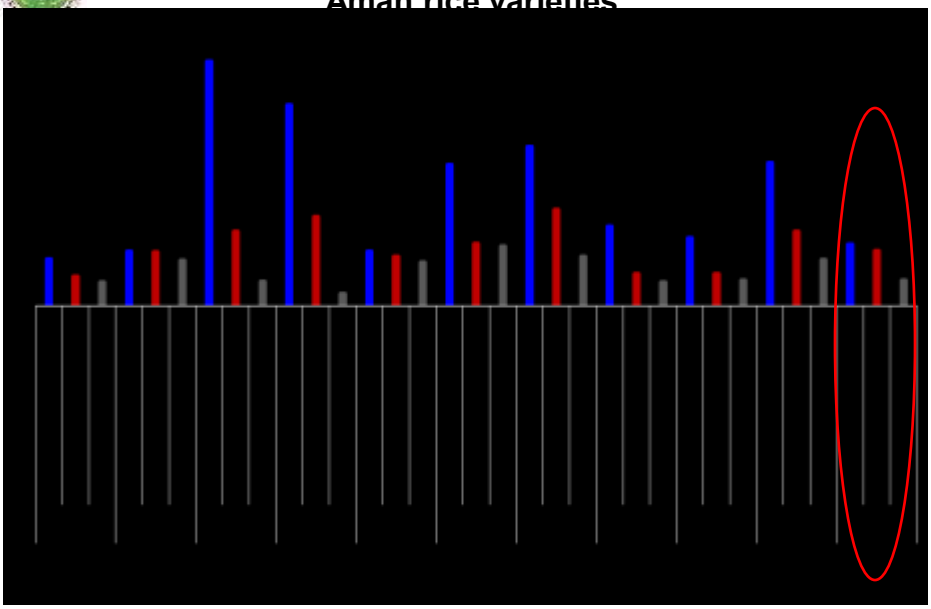
BRRI

Scientific information

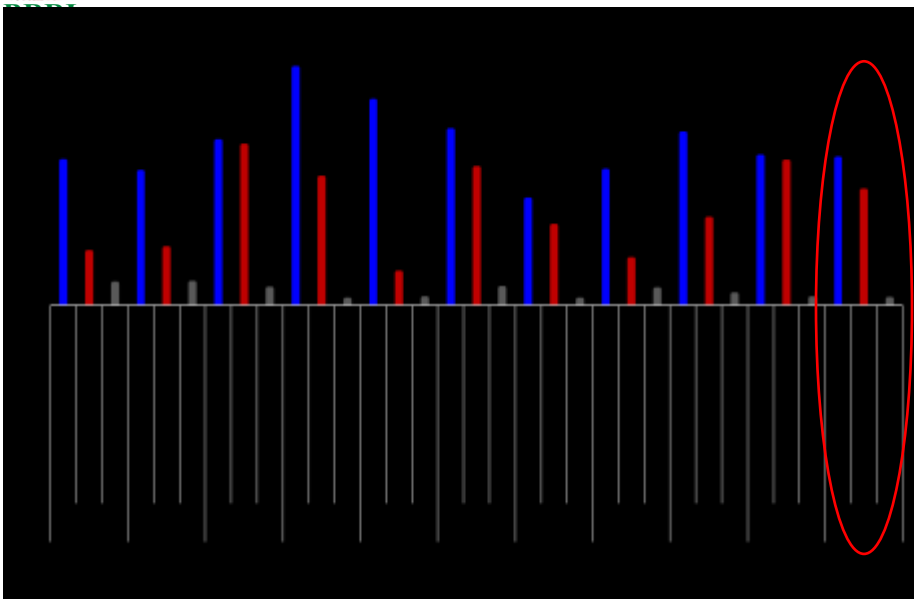
Region-wise area adoption of top ranked three Aus rice varieties



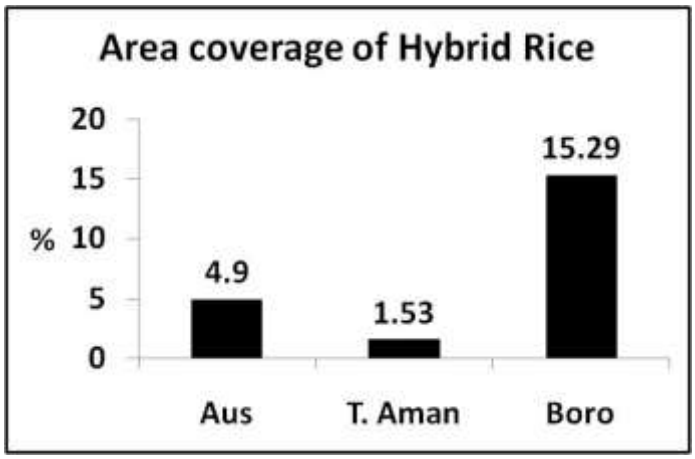
Region-wise area adoption of top ranked three Aman rice varieties



Region-wise adoption of top ranked three Boro rice varieties

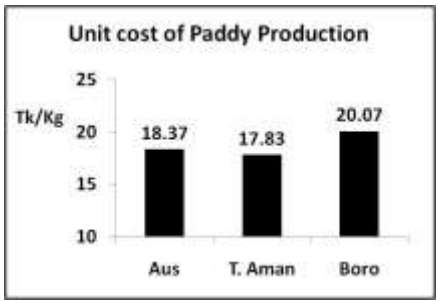


BRRI

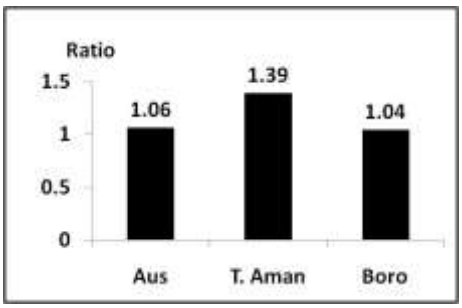


BRRI

Economics of rice production

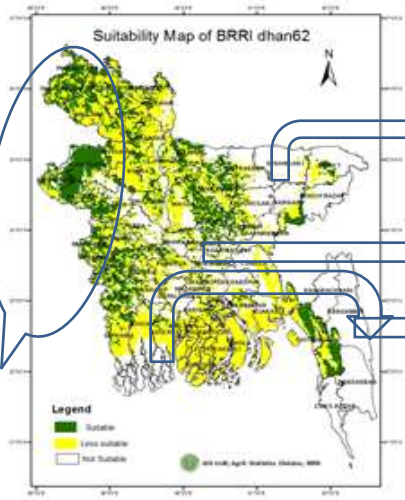


Rice cultivation marginally profitable based on variable cost



BRRI

Suitability map of BRRI dhan62



Top north-west and Central north-west areas are suitable for BRRI dhan62 cultivation

Central part and southern and eastern part of Bangladesh are not suitable for BRRI dhan62

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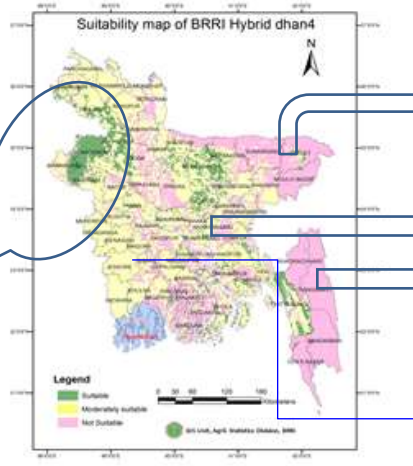
BRRI

Suitability map of BRRI Hybrid dhan4



North-west areas are suitable for BRRI hybrid dhan4 cultivation

Central and eastern part of Bangladesh are not suitable for BRRI hybrid dhan4

Wide areas are moderately suitable for BRRI hybrid dhan4 cultivation

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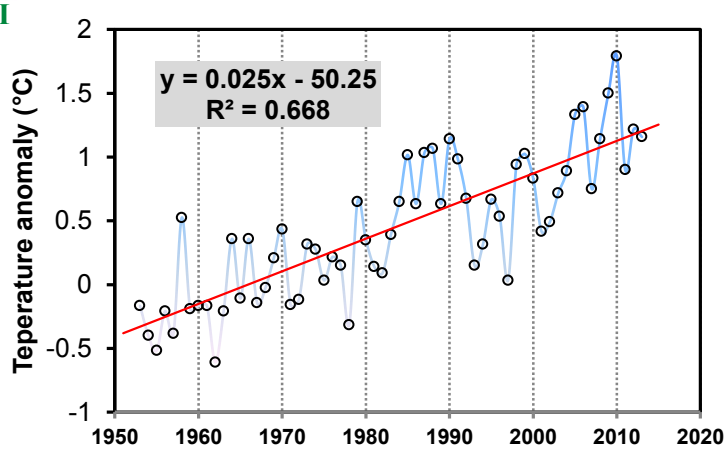
BRRI

Climate Change Effect



Temperature (minimum) anomaly at Dhaka with the mean temperature in the period of 1953-1980 as a reference. Data source: BARC

93

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Population trend of rice leaf folder

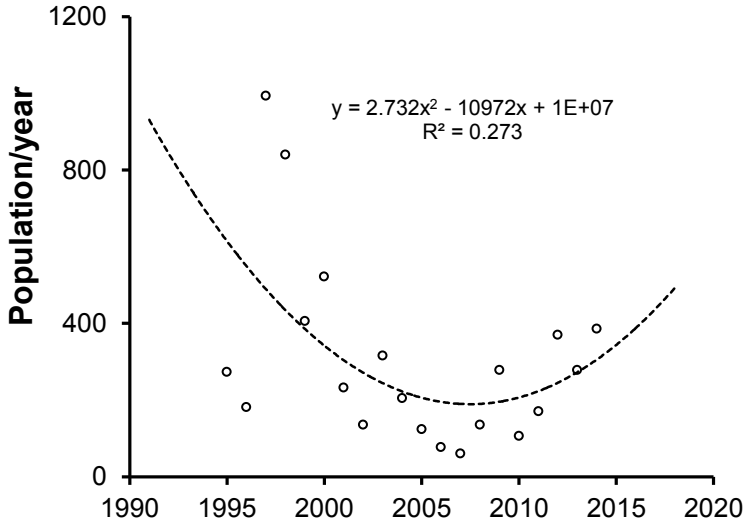


Fig. Population dynamic of leaffolder. Yearly total population caught by light trap in BRRI farm, Gazipur.

94

Emerging insect pest

BR

Rice water weevil
About 4 mm long

Location: Doulat Khan, Bhola

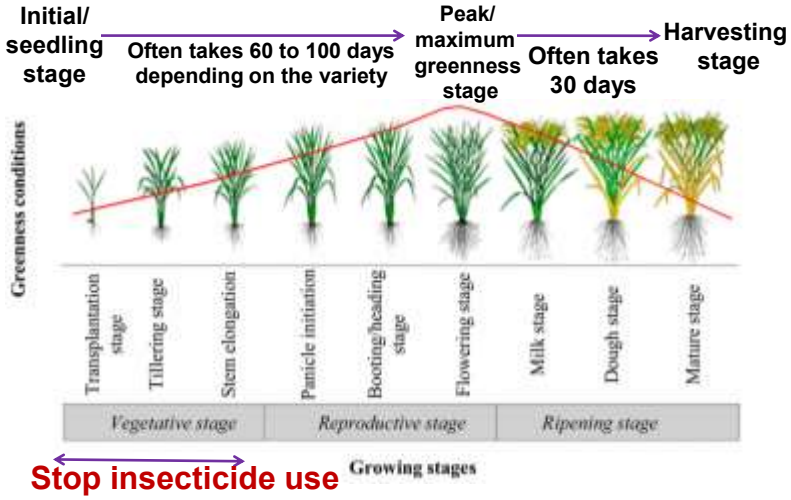
Scientific name: *Lissorhoptrus* sp

Order: Coleoptera, Family: Curculionidae

95

Avoid Pesticide up to 40 days after transplanting

BRRI



Stop insecticide use

Monitor rice field at 10-15 days interval

Identification of insect resistant rice genotypes

BRRI

IR 84839-RIL118-1-1-1-1 — **BPH**
BI dhan5

NERICA-L-36
BR 8626-20-9-1-3
BR 8626-19-5-1-2
BR 8626-19-4-1-1
IR 84839-RIL118-1-1-1-1 — **WBPH**
BR 7903-16-10
BI dhan5

BR8693-17-6-2-1
Koha binni
Muktahar
Safahar
F_2 (BR11/BRRI dhan33) — **GM**

Breeding → **Resistant Variety**

Prominent Insect Pests of Rice Leading to 2050

BRRI

SBPH

Most Damaging Insect Pests

BPH, WBPH, LF, GM, Mealy bug, Rats

Emerging New Pests

- SBPH and
- Rice black beetle

BRRI

BRRI dhan33: Resistant against Gall midge

Screened Germplasm	GM resistant / Tolerant Sources
Total Screened material: 1350	1. BR10 2. **BRRI dhan33** 3. BRRI dhan34 4. BR8526-8-2-3-5 (RYT-2) 4. BR7641-24-3-2-2 (RYT) 5. BR7642-62-1-2-3 (ALART) 6. BR8693-17-6-2-1-HR 7. BR11XBRRI dhan33 8. Safahar (10/368) 9. Muktahar (66/156) 10. Lalmughi (194/339) 11. Koha binni (93/208)

BRRI

Barn owl rearing technique has been developed

Barn owl from nest box

Picture after 15 days of feeding

Owl regurgitated pellets

Owl watching tower

Pellet with bone

Rat bone from pellet

BRRI

Cross inoculation of rice and wheat blast pathogen

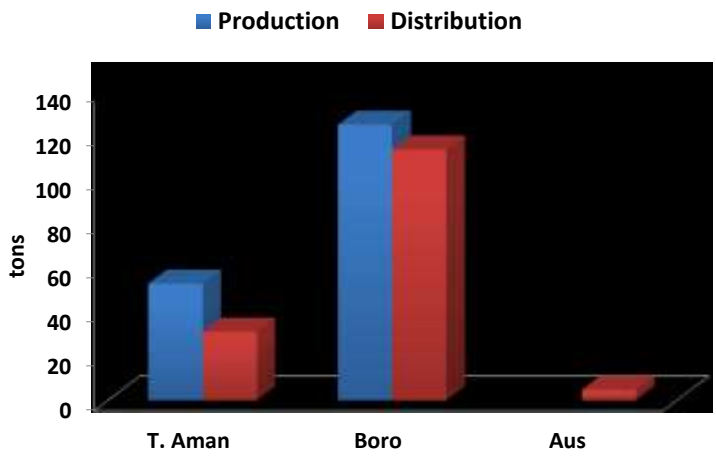
- Wheat blast pathogen do not infect rice plant and vice versa
- Wheat blast pathogen is different from rice blast pathogen *Magnaporthe oryzae*
- Wheat blast pathogen identified as *M. oryzae triticacle*
- Those information generated in the Plant Pathology Lab, BRRI in collaboration with WRC, BARI

BRRI

Up scaling of BRRI Technologies

BRRI

Production and Distribution of Breeder Seed



BRRI

Variety Popularization Program with Collaboration of DAE

Sl#	Varieties	Seed support	Region
1	BR24, BRRI dhan48, BRRI dhan55	5000 kg	T. Aus, B. Aus areas
2	BR24, BRRI dhan27, BRRI dhan55	700 kg	Jhum and Hill Valley

BRRI

Seed Production & Distribution Program T. Aman & Boro

Sl#	Varieties	Seed support (ton)
1	BRRI dhan49, 52, 54, 56, 57, 62, 71	14.0
2	BRRI dhan47, 58, 59, 60, 61, 63, 67, 69	25.0

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Farmers Training and Field day

Activities	Number	Participants
Farmers' Training	53	1,755
Field day	66	11,550

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Training on Modern Rice Production Technologies

During 2015-16

Total: 9,489
Farmer: 8,438
DAE officer: 863
Scientists: 176
NGO officer: 12

Last 5 years

Total: 42,842
Farmer: 34,976
DAE officer: 7,020
Scientists: 516
NGO officer: 330

BRRI

Bangladesh Rice Knowledge Bank (BRKB)

BRKB is updated with latest rice contents

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Home

BRRI

Research Strategies

BRRI

Research Issues

- Breaking yield ceiling
- Development of super hybrid rice
- Improvement of nutritional enriched healthier rice with pharmaceutical and export perspective
- Heat tolerant short duration T. Aman and T. Aus rice
- Development of multiple stress tolerant varieties to combat climate change
- Development of aerobic and water saving rice
- Location & ecosystem specific production packages

BRRI

Research Issues (Contd.)

- Development of environment friendly cost-effective package for controlling rice pests & diseases
- Crop intensification with sustainable soil health
- Development of precision agriculture
- Portable and low-cost farm machineries
- Crop modeling based carbon trading
- Development geographical segment-wise product profile
- Impact analysis of BRRI developed technologies

BRRI

Increasing genetic gain through Transforming Rice Breeding

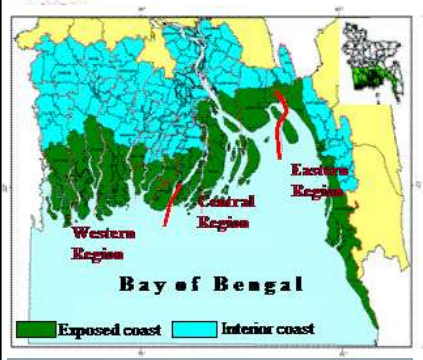
- Increasing size of the breeding program through RGA and automation of post-harvest operation in breeding program
- Application of diagnostic SNP markers for key traits and genomic selection
- Full genome sequencing of 40 foundational parents and GBS profiling of all parents
- Digitalization of breeding data management for increasing selection intensity
- Increasing selection pressure through promotion of early generation breeding lines in METs

BRRI

Policy thoughts

BRRI

1. Exploitation of resources from south coastal regions-require policy support



Brief Overview of Coastal Zones of Bangladesh

- Covers 19 districts of 50 m people
- 1.95 Mha of net cultivable area
- Includes 12 AEZ
- Dominant land type MHL (76%)
- Major cropping pattern Fallow-T. Aman-Fallow (39%)
- Includes both saline & non-saline areas
- Rich in bio-diversity
- CC adversely affects crop Pdn.

BRRI

Brief introduction of Coastal Zones of Bangladesh

Resources:

- Considered as EEZ, rich in natural and economic resources
- Some of them are: agricultural land, livestock, fisheries, forestry, waterways, salt production, seaport facilities, sites of archeological importance and tourism
- Contains many ecosystems, e.g. mangrove, marine, estuary, islands, coral and sandy beaches
- Treasure house of wetland resources and bio-diversity
- Presence of sweet water in rivers outside the polder
- Dead rivers, canals, ponds inside the polder as fresh water reservoir
- Scope of cultivation of high value shrimp, snails, crabs, eel, tortoise etc.
- Huge fallow land

BRRI

Strategies for increasing productivity of Coastal Zones

- Efficient utilization of existing surface water
- Enhancement of Rainwater harvesting
- Excavation and Re-excavation of silted & dead rivers and canals for water conservation
- Repair & rehabilitation of damaged polders
- Selection & up scaling of suitable crop varieties and management practices (soil & water) according to land elevation and hydrology for increasing cropping intensity (S1+S2 = 0.6 Mha)
- Replacement of local varieties by BRRI dhan76 and BRRI dhan77 in the non-saline tidal areas
- Cover crop during dry season
- Commercial farming

BRRI

Water salinity (dS/m) of Bishkhali River

Location	Distance from sea (km)	Date of sampling			
		28-Nov	2-Feb	19-Mar	21-Apr
Jhalakati Ghat	78	0.19	0.6	0.3	0.25
Bhabanipur Ghat	72	0.29	0.29	0.3	0.29
Tetulbaria Ghat	66	0.17	0.3	0.3	0.25
Niamati Ghat	62	0.17	0.3	0.29	0.26
Betagi Ghat	54	0.29	0.3	0.29	0.24
Amua Ghat	48	0.18	0.27	0.3	0.27
Bamna Ghat	42	0.29	0.29	0.3	0.31
Kalika Bari Ghat	36	0.17	0.3	0.31	0.28
Phuljhuri Ghat	30	0.14	0.37	0.36	0.32
Kakchira Ghat	24	0.17	0.87	0.78	0.48

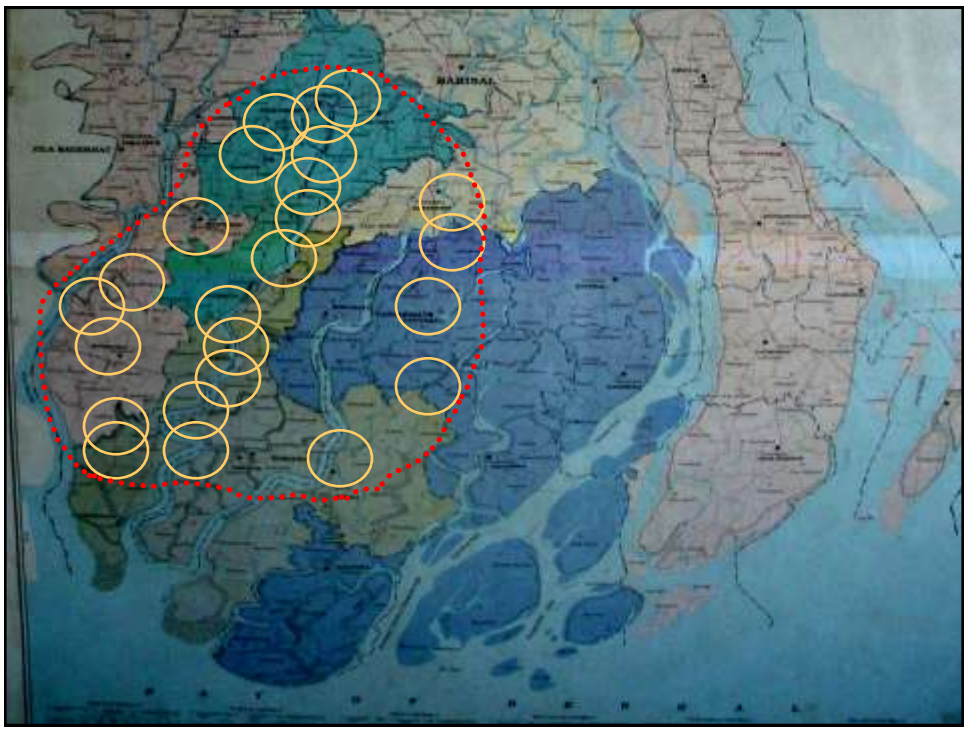
Monitoring river water salinity




Water salinity in the major rivers of Barisal division during dry season 2015-16

No.	Location	River name	EC(dS/m)				
			19-20 Dec 2015	29-30 Mar 2016	19-20 Apr 2016	23-24 Apr. 2016	18-19 May 2016
1	Dopdopia bridge, Barisal	Khoirabad	0.150	0.238	0.230	0.21	0.200
2	Lebukhali ferry ghat	Khoirabad		0.272	0.310	0.30	0.230
3	Mohiskata bazar, Amragacia	**Buriswar**		0.324	0.370	0.45	0.250
4	Subitkhali	**Buriswar**		0.376	0.430	0.45	0.200
5	Golbunia Bazar	**Buriswar**	0.210	0.930		0.41	0.240
6	Baliatoli	**Buriswar**	0.220	9.400	0.420	3.90	1.510
1	Fuljhuri Bazar	**Bishkhali**	0.180	0.350		0.41	0.350
2	Boroitola Ferryghat, Barguna	**Bishkhali**		0.645	0.310	0.42	0.250
3	Kakchira Ferryghat	**Bishkhali**		0.968	0.320	0.46	0.240
4	Rupdhonhat	**Bishkhali**		1.190		0.47	0.320
5	Kalmegha Bazar	**Bishkhali**		1.220	0.410	0.95	0.240
6	Pathorghata hat	**Bishkhali**	0.380	3.450	1.370	2.30	0.340
7	Nishanbaria kheyaghat	**Bishkhali**	0.380	6.530	0.740	1.95	0.850
1	Charkhali ferryghat, Vandaria	Kocha		0.560	0.310	0.31	0.290
2	Telikhali Launchghat	Kocha		0.981	0.621	0.687	0.529
3	Choto Machua	**Boleswar**		2.600	0.960	1.06	0.890
4	Boro Machua	**Boleswar**		2.820	1.610	1.23	1.350
5	Hogolpati hat	**Boleswar**		3.140	2.040	1.32	1.320
6	Khetachira	**Boleswar**		4.100	3.640	1.95	1.190
7	Charduanihat	**Boleswar**		4.780	3.840	3.42	1.860
8	Padma Bazar	**Boleswar**	0.420	15.930	9.630	10.19	3.620

Suitable surface water resources (river) for increasing productivity in coastal zone




After SIDR
BRRI dhan47 in 2013

Field day of BRRI dhan67 at Koyra, Khulna 2015-16

BRRI Re-excavation of small gherland

BRRI

Policy thoughts (contd.): rest important issues

2. Minimizing Yield Gap
3. Re-excavation of existing ponds in HBT for minor irrigation
4. Storage of river water commissioning more river dam eg: Atrai river
5. Expanding Aus crop by conjunctive use of underground and rain water in northern and Kushtia region.
6. Mixed planting of Aus + Aman in greater Sylhet and Chittagong
7. Utilization of shallow deep water ecosystem
8. Maintaining sustainable soil health through balance utilization of organic and inorganic amendments
9. Replacing angle-berg huller by rubber-rolled huller to increase milled rice

BRRI

To achieve the challenges of SDGs-

- **Holistic approaches**
- **Dignified delivery of all service providers and stakeholders**
- **Inter-institutional and international collaboration**
- **Policy support**
- **Commitment**

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Seedling Distribution in Flood affected Areas