



**Strategic Plan for Increasing Aus and Aman Rice Cultivation in Bangladesh**

**Bangladesh Rice Research Institute**

## Overview of Rice in Bangladesh

- **Fourth largest rice producing country in the world**
- **The total cultivable area is about 8.5 Mha and net cultivated area 7.45 Mha.**
- **Rice occupies about**
  - 76% (11.4 Mha) of total cropped area (14.9 Mha)
  - Aus area is 1.05 Mha ,
  - Aman area 5.6 Mha
  - Boro area 4.8 Mha
- **Modern varieties cover: 98% area in Boro, 70% in Aman and 75% in Aus.**
- **Boro are fully irrigated and only 5% and 7% area of Aus and Aman are under supplementation irrigation**

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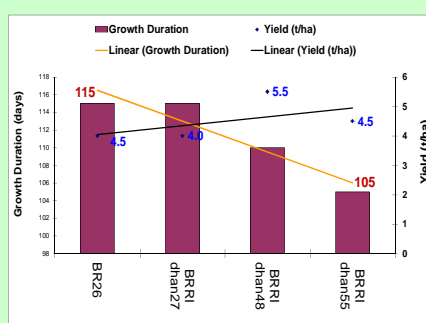
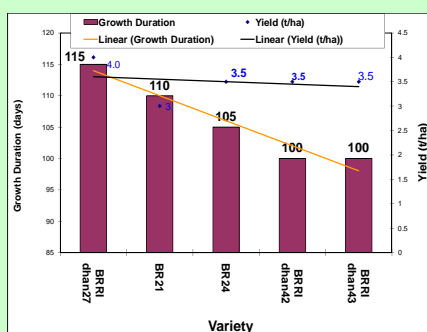
- Boro rice harvests more than half of annual production
- One kg of irrigated rice requires 3000-4000 liters water and consequently the level of ground water is receding day by day.
- The projected population will be 189.85 M by the year 2030 and it will require 28 million ton of clean rice (42.5 M ton of paddy) (considering the negative growth of rice consumption: -0.93%) (HEIS, 2010 and BBS, 2012).
- The country will be surplus of more than 15 lac ton of clean rice by 2030
- Special policy intervention should be undertaken in Aus and Aman production for sustaining food security in the country.

## Objectives

- To develop the strategic plan for increasing Aus and Aman rice production for sustainable food production in Bangladesh
- To reduce the use of groundwater irrigation by shifting some portion of Boro area to Aus.

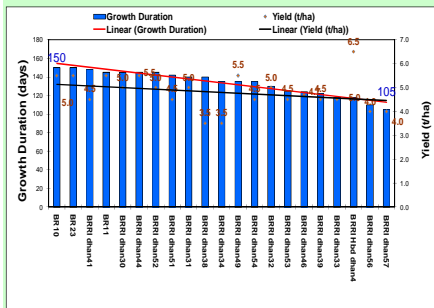
## Achievements of BRRI

Growth duration and Yield pattern of AUS varieties

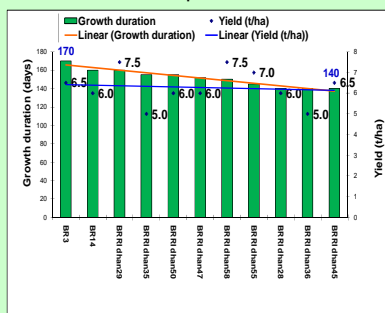


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Duration and Yield pattern of T. Aman varieties

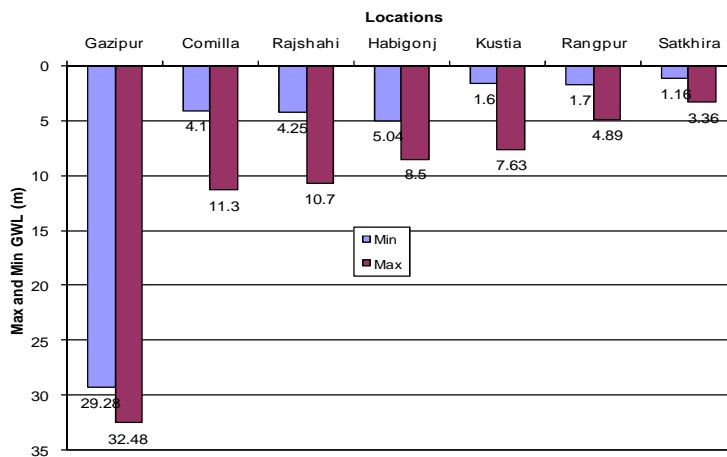


Growth duration and Yield pattern of Boro rice varieties



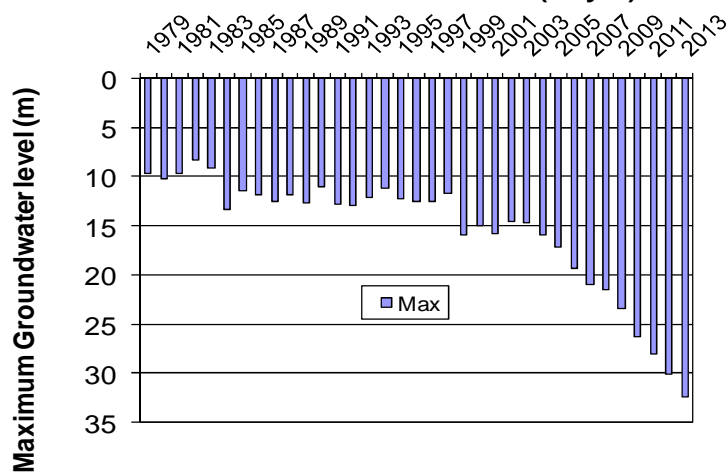
**? need expansion of Aus and Aman**

## Scenario of ground water level

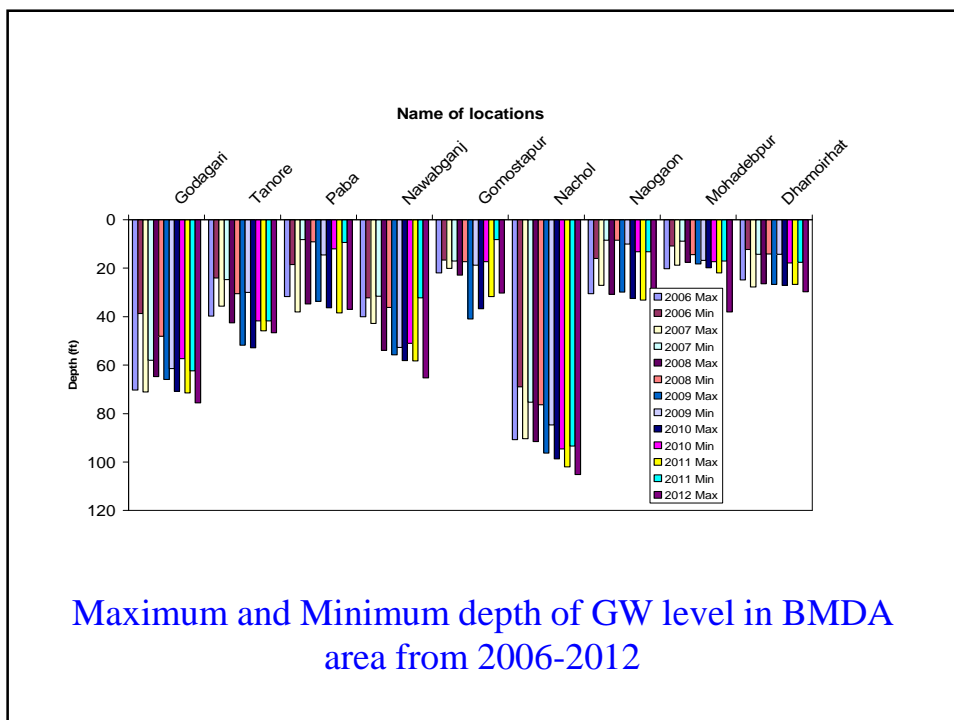
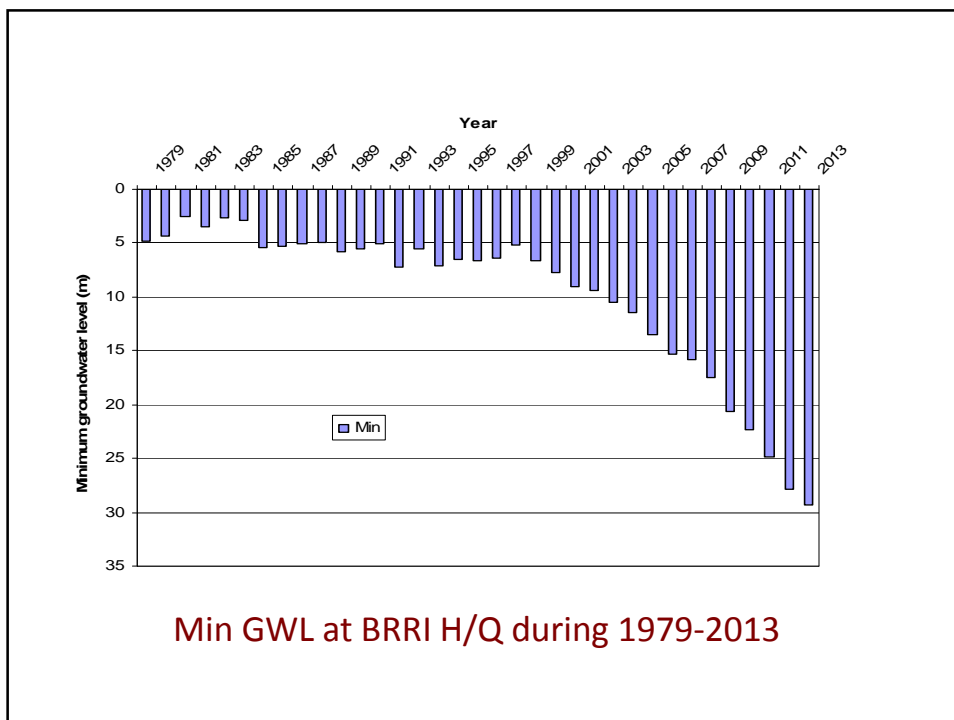


**Fluctuation of GWL at different BRRJ stations during 2012-13**

### Year 1979 - 2013 (35 yrs)



**Max GWL at BRRJ H/Q during 1979-2013**



### Present status of Aus and Aman

Season	Area (M ha)	Yield (t/ha)	Production (M t)
<b>Aus</b>			
Hybrid	0.031	2.94	0.091
HYV	0.76	2.28	1.73
local	0.264 (25)	1.27	0.336
<b>Total</b>	<b>1.05</b>	<b>2.05</b>	<b>2.16</b>
<b>Aman</b>			
HYV	3.98	2.63	10.44
Local	1.27 (23)	1.60	2.022
B. Aman	0.37	1.19	0.44
<b>Total</b>	<b>5.62</b>	<b>2.30</b>	<b>12.90</b>

Figure in the parenthesis indicates the percentage of area

### Proposed Aus and Boro area and production

Season	Area (Mha)	Yield (t/ha) Cleaned rice)	Total production (M ton)	% of total production	% of total area
Aus	1.05	2.05	2.16	6	9
Aman	5.62	2.30	12.90	38	49
Boro	4.76	3.95	18.78	56	42
<b>Total</b>	<b>11.42</b>	<b>2.96</b>	<b>33.83</b>	<b>100</b>	<b>100</b>
Proposed Aus from Boro	0.952 (20%)	2.83	5.66	-	-
Proposed Boro	3.80	-	-	-	-

## Simulation scenario of rice under climate change

### Yield of clean MV rice (t/ha)

Season	2009	2015	2020	2025	2030
Aus	2.32	2.57	2.72	2.89	3.19
Aman	2.41	2.55	2.69	2.66	2.79
Boro	3.69	3.77	3.98	4.35	4.42



### Area of MV rice (Mha)

<b>Season</b>	<b>2009</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
<b>Aus</b>	<b>0.82</b>	<b>0.36</b>	<b>0.38</b>	<b>0.44</b>	<b>0.42</b>
<b>Aman</b>	<b>3.76</b>	<b>4.15</b>	<b>4.16</b>	<b>4.24</b>	<b>4.39</b>
<b>Boro</b>	<b>4.41</b>	<b>6.03</b>	<b>5.79</b>	<b>5.77</b>	<b>5.88</b>

### Total production of rice in three different seasons

<b>Season</b>	<b>2009</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
<b>Aus</b>	<b>2.22</b>	<b>1.34</b>	<b>1.33</b>	<b>1.57</b>	<b>1.62</b>
<b>Aman</b>	<b>11.71</b>	<b>13.54</b>	<b>13.80</b>	<b>14.37</b>	<b>14.97</b>
<b>Boro</b>	<b>16.48</b>	<b>22.83</b>	<b>23.17</b>	<b>25.22</b>	<b>26.12</b>
<b>Total</b>	<b>30.42</b>	<b>37.70</b>	<b>38.30</b>	<b>41.17</b>	<b>42.71</b>

**10-15% area shift from Boro to Aus**

**Yield of clean rice of MV rice varieties (t/ha)**

<b>Season</b>	<b>2009</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
<b>Aus</b>	<b>2.41</b>	<b>2.57</b>	<b>2.72</b>	<b>2.89</b>	<b>3.20</b>
<b>Aman</b>	<b>2.55</b>	<b>2.55</b>	<b>2.73</b>	<b>2.70</b>	<b>2.83</b>
<b>Boro</b>	<b>3.64</b>	<b>3.76</b>	<b>3.97</b>	<b>4.35</b>	<b>4.41</b>

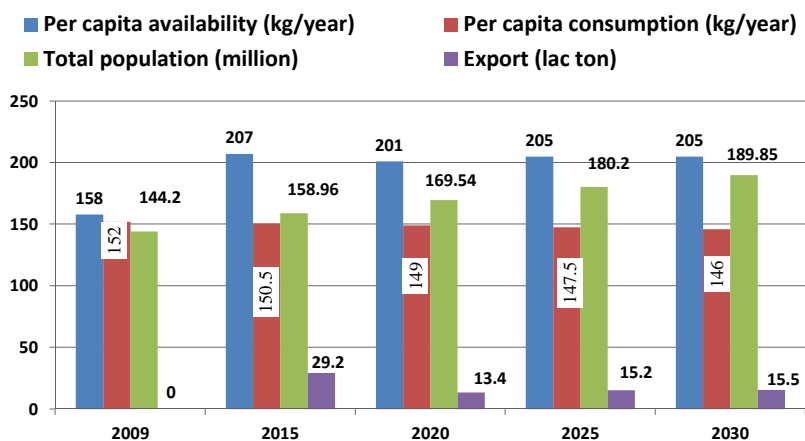
### Area of MV rice varieties (Mha)

Season	2009	2015	2020	2025	2030
Aus	0.69	1.71	1.81	1.46	1.45
Aman	3.70	3.95	3.86	3.89	4.03
Boro	3.97	5.26	4.92	4.89	5.02

### Total clean rice production (Mt)

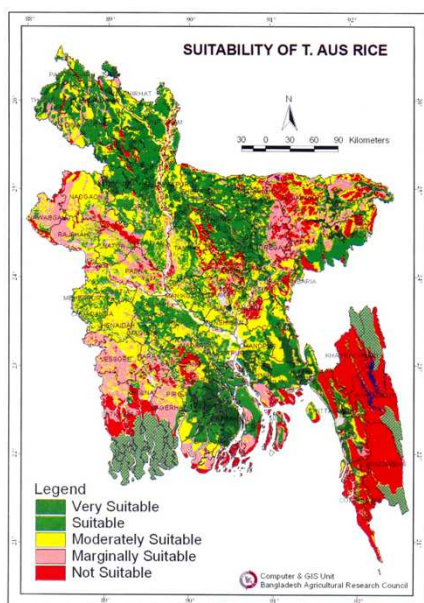
Season	2009	2015	2020	2025	2030
Aus	2.06	4.85	4.75	5.06	6.07
Aman	12.04	16.13	15.50	15.79	16.49
Boro	16.92	22.15	21.92	23.76	24.82
<b>Total</b>	<b>31.02</b>	<b>38.267</b>	<b>42.71</b>	<b>45.26</b>	<b>47.60</b>

### Projected per capita availability, consumption and population



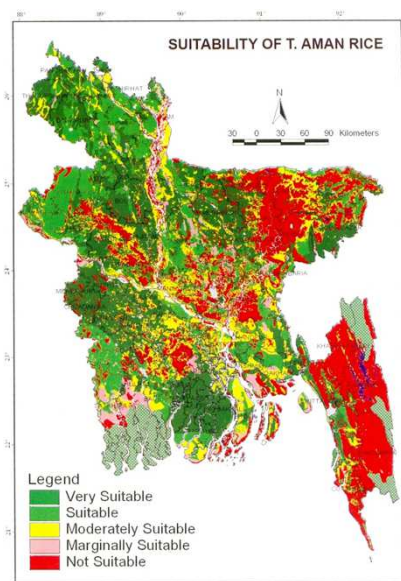
**Scope for Aus and Aman areas**

### Potential suitable area for Aus



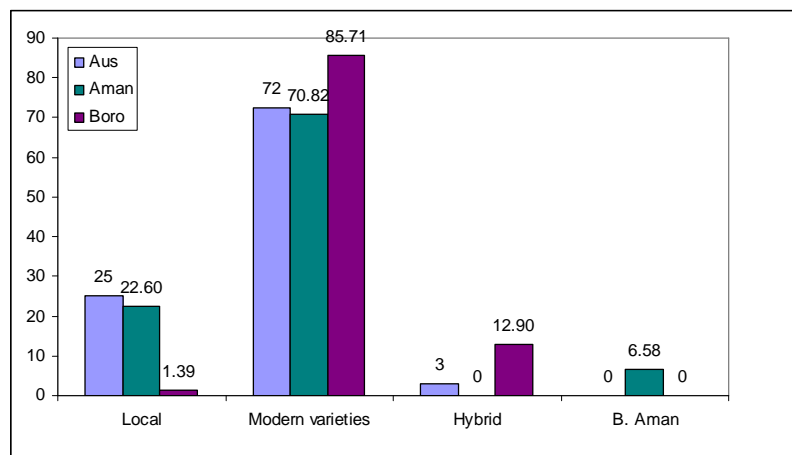
Crops	Suitability Class	Areas (ha)	Cultivable Area (%)
Aus Rice	Very Suitable (VS)	1351626	14%
	Suitable (S)	2671691	27%
	Moderately Suitable (MS)	2612170	27%
	Marginally Suitable (LS)	1743233	18%
	Not Suitable (NS)	1426639	15%
	VS+S	4023317	41%
	S+MS	5283861	54%
VS+S+MS	6635487	68%	

### Potential suitable area for T. Aman



Crops	Suitability Class	Areas (ha)	Cultivable Area (%)
Aman Rice	Very Suitable (VS)	3701517	38%
	Suitable (S)	1904287	19%
	Moderately Suitable (MS)	1511494	15%
	Marginally Suitable (LS)	502645	5%
	Not Suitable (NS)	2185417	22%
	VS+S	5605804	57%
	S+MS	3415781	35%
VS+S+MS	7117298	73%	

### Area under different rice varieties in three seasons



### Situation of cultivated and fallow land in Barisal region

Districts	Net cultivated land (ha)	Fallow land			
		Kharif-1		Kharif-2	
		Amount (ha)	%	Amount (ha)	%
<b>Barisal</b>	175689	124333	71	48868	28
<b>Patuakhali</b>	213600	149782	70	2020	1
<b>Borguna</b>	103235	59036	57	2407	3
<b>Bhola</b>	192375	118980	62	13320	7
<b>Pirojpur</b>	86056	50965	59	19556	23
<b>Jhalokathi</b>	54256	28796	53	6356	12
<b>Total</b>	<b>825211</b>	<b>5,31,892</b>	<b>65</b>	<b>92,527</b>	<b>11</b>

**Scenario of prospective area for Aus cultivation in south-western region**

<b>District</b>	<b>Cultivated area (ha)</b>	<b>Prospective area (ha)</b>	<b>Area increased (ha)</b>
Khulna	3986	6525	2539
Bagerhat	7449	8703	1254
Satkhira	9440	12190	2750
Jessore	31162	50400	19238
<b>Total</b>	<b>52037</b>	<b>77,818</b>	<b>25,781</b>

**Present and proposed area of Aus rice in Rajshahi region**

<b>Crop</b>	<b>Area (ha)</b>
Aus	23866
Aman	50780
Boro	55511
Cultivable waste land (fallow)	2429
<b>Proposed 20% area from Boro to Aus</b>	<b>11102</b>
<b>Total proposed Aus area</b>	<b>37,397</b>

### Present and proposed area of Aus rice in Sylhet region

Crop	Area (ha)
Aus	76037
Aman	370174
Boro	398866
Cultivable waste land (fallow)	54251
<b>Proposed area for Aus</b>	<b>1,30,288</b>

### Prospective areas for Aus cultivation

Locations	Cultivable Areas (ha)
Greater Faridpur	9312
Kushtia	405
Dhaka division excluding G. Faridpur	45344
Chittagong division	68016
<b>Total prospective area</b>	<b>1,23,077</b>



**BRRi moves with.....**

**Some high yielding with short to medium duration Aus rice varieties of BRRi**

<b>Name of variety</b>	<b>Growth duration (days)</b>	<b>Field duration (days)</b>	<b>Yield (t/ha)</b>	<b>Special characteristics</b>
BR9	120	95	5.0	Better yield
BR14	120	95	5.0	Better yield
BR26	115	90	4.0	Better yield, slender grain
BRRi dhan27	115	90	4.0	Tall plant height, suitable for tidal non-saline area
BRRi dhan48	110	85	5.5	High yield, short duration.
BRRi dhan55	105	80	5.0	Short duration, moderately tolerant to salt, drought and cold, high yield

### Some modern T. Aman rice varieties released by BIRRI

Name of variety	Growth duration (days)	Field duration (days)	Yield (t/ha)	Special characteristics
BR10	150	120	5.5	High yield
BR11	145	115	5.5	High yield
BR23	150	120	5.5	strongly photosensitive, high yield
BIRRI dhan32	130	100	5.0	Medium duration
BIRRI dhan33	118	98	4.5	Short duration, Monga mitigation
BIRRI dhan34	135	105	3.5	Aromatic
BIRRI dhan41	148	118	4.5	Salt tolerant
BIRRI dhan44	145	115	5.5	Bold grain, non-saline tidal area
BIRRI dhan49	135	105	5.5	Nizersail type grain, earlier than BR11
BIRRI dhan51	145	110	5.0	Submergence tolerant, slender grain
BIRRI dhan52	145	110	5.0	Submergence tolerant, bold grain
BIRRI dhan56	110	90	4.5	2-3 week drought tolerant at reproductive stage
BIRRI dhan57	105	85	4.5	drought escaping, short duration
BIRRI dhan62	100	80	3.5	Short duration, medium Zn content
BIRRI Hybrid dhan4	118	93	6.5	High yield, medium slender grain

### Productivity of some tested alternate cropping pattern

Cropping pattern	REY (t/ha)
Boro-Fallow-T. Aman	11.36
Potato-T. Aus-T. Aman	17.76
Mustard-T. Aus-T. Aman	12.49
Maize-Mungbean-T. Aman	12.20

**During the last five years, 9 varieties released for Aus and Aman season**

Variety	Growing season	Growth duration (days)	Yield (t/ha)	Special character
<b>BRRRI hybrid dhan 4</b>	T. Aman	115-120	<b>6.5</b>	High yielding, early maturing hybrid
<b>BRRRI dhan 51</b>	T. Aman	140-145	<b>4.0</b>	2 week flash flood submergence tolerant
<b>BRRRI dhan 52</b>	T. Aman	140-145	<b>4.5</b>	High yielding, 2 week flash flood submergence tolerant
<b>BRRRI dhan 53</b>	T. Aman	125	<b>4.5-5.0</b>	Salt olerant upto 8 ds/m
<b>BRRRI dhan 54</b>	T. Aman	135	<b>4.5-5.0</b>	Salt olerant upto 8 ds/m
<b>BRRRI dhan 55</b>	T. Aus	105	<b>5.0</b>	Slender grain, high yield, salt, cold and drought tolerant
<b>BRRRI dhan 56</b>	T. Aman	105-110	<b>4.0</b>	Drought tolerant, short duration
<b>BRRRI dhan 57</b>	T. Aman	105	<b>3.5</b>	Drought tolerant
<b>BRRRI dhan 62</b>	T. Aman	100	<b>4.0-4.5</b>	Short duration, high yielding, Zn enriched

## Pictorial view of rice varieties



## Rice varieties in the pipelines

Proposed line	Season	Growth duration (days)	Field duration (days)	Yield (t/ha)
OM 1490	B. Aus	95	95	3.5
BR 7611-31-5-3-2	T. Aman	138	108	5.0
HUA 565	T. Aman	116	86	4.3
IR 82635-B-B-75-2	T. Aman	113	83	4.0

## Promising Advanced Breeding Lines for B. Aus and T. Aus

Sl#	Designation	Plant height (cm)	Growth duration (days)	Grain Yield (t/ha)	Special characteristics
<b>B. Aus</b>					
01	BR7587-2B-3	114	98	3.0	Adaptation under upland Aus environment
02	BR7182-2B-1-2-HR4	115	100	3.0	„
03	BR7178-2B-19	107	97	3.5	„
04	BR6976-2B-11-1	92	98	3.5	„
05	BR7384-2B-5	112	100	3.0	„
<b>T. Aus</b>					
01	BR7566-4-4-2	107	98	4.2	Short duration, high yield potential
02	BR7566-39-6-1	104	100	4.2	„
03	BR7577-9-1-2	106	100	4.3	„

### Salt tolerant promising breeding lines, T. Aman

Sl#	Designation	Plant height (cm)	Growth duration (days)	Grain yield (t/ha)	Remarks
01	IR78761-B-SATB1-41-2	124	110	3.7	Salinity tolerance
02	IR78761-B-SATB1-52-1	135	108	3.5	„
03	IR78761-B-SATB1-68-6	124	112	3.8	„
04	IR78761-B-SATB2-17-1	120	110	4.0	„
05	IR73055-8-1-1-3-1	120	108	4.7	„
06	BR8371-73-194-1-71	117	138	4.9	„
07	BR8371-73-194-1-84	107	138	4.3	„
08	BR8371-18-20-52-124	115	136	4.6	„
09	BR8371-18-20-52-145	111	139	4.6	„
10	BR11-Saltol	113	138	4.2	„
11	IR78761-B-SATB1-28-3-24	-	125	4.3	„
12	IR78761-B-SATB1-28-3-26	-	126	4.2	„
13	IR78761-B-SATB2-4-25-3	-	130	3.8	„

### Favourable T. Aman promising breeding lines, T. Aman

Sl#	Designation	Plant height (cm)	Growth duration (days)	Grain yield (t/ha)	Remarks
01	BR8417-2-1-2	103	115	4.2	Short duration, high yield potential
02	BR7528-2R-19-HR10	117	135	5.3	„
03	BR7472-16-2-1-2-3	114	122	4.7	„
04	BR7622-5-1-1-1	118	121	5.0	„
05	BR7639-68-2-1-1	117	120	4.7	„
06	BR7468-12-1-1-1-1	114	126	3.9	„
07	BR7472-16-2-1-2-1	121	127	4.1	„
08	BR7966-16-2-2	116	131	4.5	„
09	BR7966-25-2-1	119	130	4.2	„
10	BR7638-7-2-5-2	113	136	4.4	„

**Premium Quality and drought tolerant promising breeding lines, T. Aman**

<b>PQR, T. Aman</b>					
<b>SI#</b>	<b>Designation</b>	<b>Plant height (cm)</b>	<b>Growth duration (days)</b>	<b>Grain yield (t/ha)</b>	<b>Remarks</b>
01	BR7357-11-2-4-1-1	122	132	3.5	Long slender grain
02	BR7369-16-5-2-3-1	132	132	3.5	''
03	BR6797-15-4-4-2-1	124	125	3.6	''
04	BR7697-15-4-4-2-2	127	126	3.5	''
05	BR7697-16-2-2-1-1	128	126	3.9	''
06	BR7369-52-3-2-1-1	120	123	3.5	''
<b>Drought, T. Aman</b>					
01	IR83383-B-B-129-4	105	112	3.7	Drought tolerance
02	IR82589-B-B-84-3	110	115	3.6	''

**Submergence tolerant promising breeding lines, T. Aman**

<b>SI#</b>	<b>Designation</b>	<b>Plant height (cm)</b>	<b>Growth duration (days)</b>	<b>Grain yield (t/ha)</b>	<b>Remarks</b>
01	BR9159-8-5-40-13-15	114	136	4.8	<b>BRR1 dhan49-Sub1 lines</b>
02	BR9159-8-5-40-13-21	113	135	4.8	''
03	BR9159-8-5-40-13-52	111	135	5.5	''
04	BR9159-8-5-40-13-63	110	135	5.3	''
05	BR9159-8-5-40-14-57	111	136	4.5	''
06	BR9159-8-5-40-14-75	111	137	5.2	''
07	BR9157-12-2-37-13-15	107	115	4.0	<b>BRR1 dhan33-Sub1 lines</b>
08	BR9157-12-2-37-13-17	108	115	3.9	''
09	BR9157-12-2-37-13-71	110	115	4.0	''
10	BR9158-19-9-6-7-94	129	139	4.6	<b>BRR1 dhan44-Sub1 lines</b>
11	BR9158-19-9-6-9-9	129	138	5.3	''
12	BR9158-19-9-6-9-17	136	138	4.7	''
13	BR9158-19-9-6-9-50	137	139	4.6	''
14	BR9158-19-9-6-9-60	137	141	4.5	''
15	BR9158-19-9-6-9-93	137	141	5.1	''
16	BR9158-19-9-6-9-101	139	138	4.8	''
17	BR9158-19-9-6-9-103	135	134	4.8	''
18	BR9158-19-9-7-8-3	140	142	5.2	''
19	BR9158-19-9-7-8-21	137	141	4.7	''
20	BR9158-19-9-7-8-38	141	136	5.7	''
21	BR9158-19-9-7-8-51	138	136	5.1	''

### Location specific suitabilities of Aus rice varieties

Sl#	Division	Ecosystem	Suitable varieties
1	Dhaka	Rainfed+ Partial irrigated	BR26, BRRi dhan28, BRRi dhan43, BRRi dhan48, BRRi dhan55
2	Chittagong	Rainfed	BR16, BR24, BR26, BRRi dhan27, BRRi dhan28, BRRi dhan42, BRRi dhan43, BRRi dhan48, BRRi dhan55
3	Chittagong	Rainfed+ Partial irrigated	BRRi dhan27, BRRi dhan28, BRRi dhan48, BRRi dhan55
4	Khulna	Rainfed+ Partial irrigated	BR24, BR26, BRRi dhan27, BRRi dhan28, BRRi dhan42, BRRi dhan43, BRRi dhan48
5	Khulna	Drought+Partial Irrigated	BR21, BR26, BRRi dhan28, BRRi dhan42, BRRi dhan48
6	Rajshahi	Drought+Rainfed+ Partial Irrigated	BR16, BR21, BR26, BRRi dhan27, BRRi dhan28, BRRi dhan42, BRRi dhan43, BRRi dhan48
7	Barisal	Rainfed + Tidal Submergence	BRRi dhan27, BRRi dhan48
8	Sylhet	Rainfed	BR1, BR3, BR24, BR26, BRRi dhan28, BRRi dhan48
9	Rangpur	Rainfed+Partial Irrigated	BR26, BR27, BRRi dhan28, BRRi dhan42, BRRi dhan43, BRRi dhan48, BRRi dhan55

### Location specific suitability of Aman rice varieties

Division	Ecosystem/Land type	Suitable varieties
Dhaka	High and medium highland	BR11, BRRi dhan30, 32, 33, 34, 37, 38, 39, 49, 52, 56, 57, 62 & BRRi Hybrid dhan4
Dhaka	Low land	BR11, BRRi dhan30, 52, BRRi Hybrid dhan4
Dhaka	Tidal Nonsaline submergence	BR11, BRRi dhan44, 52
Dhaka	Post flood situation	BR22, 23, BRRi dhan46
Chittagong	High and medium highland	BR11, BRRi dhan30, 32, 33, 34, 37, 38, 39, 49, 52, 56, 57, 62 & BRRi Hybrid dhan4
Chittagong	Low land	BR11, BRRi dhan30, 52, BRRi Hybrid dhan4
Chittagong	Submergence	BRRi dhan51, 52
Chittagong	Saline	BR23, BRRi dhan40, 41, 53 & 54
Khulna	High and Medium high land	BRRi dhan32, 33, 39, 49, 57, 62; BRRi Hybrid dhan4
Khulna	Low land	BR11, 23; BRRi dhan30, 52, 53, 54
Khulna	Saline	BR23; BRRi 53, 54
Khulna	Drought prone	BRRi dhan56, 57

### Location specific suitabilities of Aman rice varieties (Contd.)

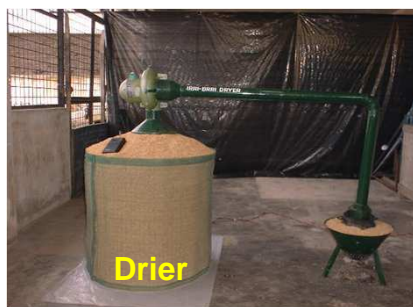
Division	Ecosystem	Suitable varieties
Rajshahi	High and Medium high land	BRR1 dhan32, 33, 39, 49, 56, 57, 62; BRR1 Hybrid dhan4
Rajshahi	Lowland	BR11, BRR1 dhan30, 52
Rajshahi	Drought prone	BRR1 dhan56, 57
Rangpur	High and medium high land	BR11, BRR1 dhan30, 32, 33,34,37,38,39,49,52,56, 57, 62 & BRR1 hybrid dhan4
Rangpur	Low land	BR11, BRR1 dhan30, 52 & BRR1 hybrid dhan4
Rangpur	Drought prone	BRR1 dhan33,56,57 & 62
Rangpur	Submergence	BRR1 dhan51, 52
Barisal	High and Medium high land	BR11, BRR1 dhan30, 32, 33, 34, 37, 38, 39, 49, 52, 56, 57, 62 & BRR1 Hybrid dhan4
Barisal	Low land	BR11, BRR1 dhan30, 52, BRR1 Hybrid dhan4
Barisal	Tidal Nonsaline Submergence	BR11, BRR1 dhan44, 52
Barisal	Saline	BR23, BRR1 dhan40, 41, 53 & 54
Sylhet	High and medium high land	BR11, BRR1 dhan30, 32, 33,34,37,38,39,49,52,56,57,62 & BRR1 hybrid dhan4
Sylhet	Low land	BR11, BRR1 dhan30, 52 & BRR1 hybrid dhan4
Sylhet	Submergence	BRR1 dhan51 & 52

### Farm mechanization

- Farm mechanization will be a crucial factor for increasing production of Aus and Aman
- Dry direct seeded aerobic culture will require mechanized land leveling and seeder machine
- Appropriate drier machine is required for drying the harvest of Aus season
- Timely establishment and harvesting of Aus and Aman crops also depend on farm mechanization
- BRR1 has so far developed 33 farm machinery and technologies.
- More interventions are required in this field to provide appropriate machinery with low cost to the farmers.



### Pictorial view of BRRRI machinery



### Limitations in Aus production

- As unit cost of production in Aus season (19.4 Tk/kg) is higher than T. Aman (16.5 Tk/kg) and Boro seasons (18.2 Tk/kg), farmers may be reluctant for Aus cultivation instead of Boro.
- Partial irrigation facilities are not available throughout the country at farm level to ensure timely sowing or transplanting of Aus rice.
- Incidence of weeds and pests are normally higher in Aus rice cultivation.
- Lack of potentially short duration (90 days) varieties having higher yield potential in Aus season.
- Flash flood submergence and unusual flood results to total crop failure.
- Lack of potential high yielding T. Aus varieties with tidal submergence tolerance.

### Recommendations

- Sacrificing Boro areas by aus areas should be scientifically analyzed.
- Shifting irrigated Boro culture to dry-direct seeded aerobic culture.
- Introducing conservation agriculture practice
- Popularizing AWD practice throughout the country through appropriate policy interventions.
- Promotion of integrated crop management
- Partial irrigation for T. Aus crop establishment and supplemental irrigation for T. Aman should be ensured.
- Development and adoption of higher yield potential varieties such as hybrid rice, new plant type.
- Location specific high yielding short duration (90 days) T. Aus rice varieties should be developed.

**Recommendations (Contd.)**

- Tidal submergence, shallow flooding, water stagnation, salinity, biotic stress tolerant varieties should be developed.
- Location specific cropping pattern by the inclusion of 1-2 non-rice crops between Aus and Aman should be developed.
- Heat tolerant T. Aus, B. Aus varieties with allelopathic quality should be developed.
- Location and ecosystem specific agronomic package should be developed.
- Assurance of adequate input and farm credit
- Mechanization to reduce the cost and postharvest losses
- Infra-structure and human resource capacity of BIRRI need to be upgraded.
- Number of regional stations along with manpower of BIRRI should be increased.

**Recommendations (Contd.)**

- Effective linkages with research, extension, farmers and other organizations
- Intensify technology transfer activities
- Support from government policy that needs to implement the strategic plan

