Rice bred in Nepal is a hit with farmers in the Bangladesh lowlands

RIU

Validated RNRRS Output.

Rice varieties bred in the Nepal lowlands and introduced to farmers in similar environments in the High Barind Tract of Bangladesh are spreading rapidly. Stagnant yields of rice in the Barind mean that incomes of resource-poor farmers are falling. But big increases in quantity and quality, and early ripening varieties that allow a follow-on cash crop, could improve lives. Farmers managed the trials of the Nepalese rice themselves. They found the new varieties both yielded more and matured earlier. In less than two years, two-thirds of the farmers were growing the new varieties. And nearly half share seed with other farmers. Development organisations are promoting them and villages are already organising community-based seed production.

Project Ref: **PSP12:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **CAZS-NR, UK**
Source: **Plant Sciences Programme**

Research into Use
NR International
Park House
Bradbourne Lane
Aylesford
Kent
ME20 6SN
UK

Geographical regions included:

Bangladesh, India, Nepal,

Target Audiences for this content:

Crop farmers,

Document Contents:

Description, Validation, Current Situation, Current Promotion, Impacts On Poverty, Environmental Impact, Annex,

Description

PSP12

A. Description of the research output(s)

1. Working title of output or cluster of outputs.
In addition, you are free to suggest a shorter more imaginative working title/acronym of 20 words or less.

Participatory varietal selection and client-oriented breeding in rice - improved varieties for the rainfed lowlands of Bangladesh.

Improved varieties with diverse maturity for the upper (Judi 582, Judi 572, Judi 567), medium (Sugandha 2002) and lower (Barkhe 3004 and Super 3004) ecosystems of the rice toposequence.

Other varieties include Pant Dhan 10, PNR 381, BG1442, Barkhe 2001, Sugandha 1 and Ekhattar

2. Name of relevant RNRRS Programme(s) commissioning supporting research and also indicate other funding sources, if applicable.

Plant Sciences Research Programme

3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities. As with the question above, this is primarily to allow for the legacy of the RNRRS to be acknowledged during the RiUP activities.

R8269, R7122, and R8071

CAZS-Natural Resources, UK (Dr. K.D. Joshi and Prof. J.R. Witcombe);
Peoples Resources Oriented Voluntary Association (PROVA), Rajshahi, Bangladesh (A Musa and Nur Nabi)
Department of Agricultural Extension (DAE), Bangladesh
Local Initiatives for Biodiversity, Research and Development (LI-BIRD), Nepal
(Mr K. Devkota)

4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? (max. 400 words). This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.

Rice varieties for the **transplanted rainfed lowland rice ecosystems** of **Bangladesh**. These include **Judi 582, Judi 572, Judi 567**, **Sugandha 2002, Barkhe 3004 and Super 3004** bred by **client-oriented breeding (COB)** in **Nepal**.

Other varieties are **Barkhe 2001 and Sugandha 1** (from the COB programme) **and Pant Dhan 10, PNR 381, BG1442, and Ekhattar** (identified by **participatory varietal selection (PVS)** in Nepal).

The varieties from COB (R7122 and R8071) were bred by LI-BIRD and CAZS-NR in collaboration with the National Rice Research Programme (NRRP) from 1997 to 2002 for the rainfed lowlands of the Nepal *terai*. The latitude and altitude of the Nepal terai and the **High Barind Tract** of **Bangladesh** (HBT) are similar, their ecosystems share some common characteristics, and early duration rice varieties fitted well with other research in the HBT on replacing the fallows that follow rice with a profitable crop (PSP dossier 35). Hence, starting from 2002, varieties from the Nepal **COB** and **PVS** programmes were introduced into the HBT for testing by PVS in the rainfed lowland ecosystem (see Figure 1).

Fig. 1. Schematic representation of the rice ecosystem in Bangladesh and the adaptation of some of the new varieties.

These varieties have proven to be much **higher yieldin**g and have other desirable traits such as **earlier maturit**y, **improved grain quality,** and **improved pest and disease resistance.** Three of the varieties, e.g. Judi 567, Judi 572 and Judi 582, are adapted to all of the rice growing seasons in Bangladesh

- transplanted, rainfed main season (T. *aman*) grown from June to October-November
- transplanted, irrigated winter season (*Boro*) grown from November to May, and
- broadcast, rainfed spring season (*Aus*) grown from March to September.

The other varieties vary in their adaptation (Table 1).

Table 1. Seasonal adaptation of the varieties in the High Barind Tract

Variety	Seasonal Adaptation (best first)
Judi 582	T. *aman, Boro, Aus*
Judi 572	T. *aman, Boro, Aus*

Judi 567	T. *aman*, *Boro, Aus*
Sugandha 2002	T. *aman,*
Barkhe 3004	T. *aman, Boro*
Super 3004	T. *aman*, *Boro*
Pant Dhan 10	*T. aman, Boro*
PNR 381	*T. aman, Boro*
Barkhe 2001	*T. Aman*
Sugandha 1	*T Aman*

Farmers in the HBT were growing largely varieties identified by farmers in their own innovation system that they had introduced from India and that had become popular such as Swarna, Parija, Noinmuni, Miniget or some old varieties e.g. BRRIdhan 28 particularly in *boro* season. Other recommended varieties from BRRI were not widely grown as they did not meet the demands of the farmers for one or more important criteria. Rice yields were lower than expected from the levels of inputs applied.

Rice is the staple food in the area and farmers are largely dependent on this crop. Only rice can be grown in much of the area so alternative crops are often not possible. Yields have been stagnant and incomes of farmers falling. Only substantial increases in rice grain yields or large improvements in rice grain quality that result in a considerably higher market price could significantly improve livelihoods. The urban poor, rural landless and those with less than 1 ha are also highly vulnerable to increases in the price of rice so greater production and stability of production helps them greatly.

5. What is the type of output(s) being described here?
Please tick one or more of the following options.

Product	***Technology***	***Service***	***Process or Methodology***	***Policy***	***Other Please specify***
x			*x*		

6. What is the main commodity (ies) upon which the output(s) focussed? Could this output be applied to other commodities, if so, please comment

The main commodity is the rice grown in all of the three rainfed lowland ecosystems as well as irrigated conditions. One of the original reasons of introducing them was to give farmers an earlier rice harvest to facilitate the sowing of a following crop such as chickpea, wheat or lentils.

The outputs focus on the provision of better rice varieties to farmers but also promotes the processes of PVS and COB by showing the value and wide adaptation of there varieties it can produce. These processes have important implications for policies on how farmers are integrated in the process of variety development, validation, promotion and marketing.

7. What production system(s) does/could the output(s) focus upon?
Please tick one or more of the following options. Leave blank if not applicable

Semi-Arid	High potential	Hillsides	Forest-Agriculture	Peri-urban	Land water	Tropical moist forest	Cross-cutting
x	x						

8. *What farming system(s) does the output(s) focus upon?*
Please tick one or more of the following options (see Annex B for definitions).
Leave blank if not applicable

Smallholder rainfed humid	Irrigated	Wetland rice based	Smallholder rainfed highland	Smallholder rainfed dry/cold	Dualistic	Coastal artisanal fishing
x	x	x				

9. *How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (**max. 300 words**). Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared.*

The introduction of new varieties of rice for the medium and lowland rainfed conditions can be linked with the rainfed *rabi* crops to replace fallows (dossier 35) where short-duration varieties of rice can facilitate the cultivation of pulses or other crops in the *rabi* season. In PVS, the new intervention is a crop variety which can combine with the testing of other interventions that are synergistic with new crop varieties, i.e., crop protection and improved crop agronomy interventions. Since farmers evaluate varieties for all traits including fodder quantity and quality then clustering with improved livestock nutrition would be synergistic.

It can be combined with outputs from other RNRRS themes:
CPP, Cost effective weed management packages for lowland rice in Bangladesh, R8412, R8234, R7471
CPP, Extension and promotion of rodent technologies in rice based systems, R8424, R8164
CPP, Good seed initiative, R8480
CPP, Linking demand with supply of agricultural information, R8429, R8281
CPP, Managing rice pests in Bangladesh by improving extension service information management for policy and planning, R8447
CPP, Rice sheath blight complex, R7778
CPP, Weed management in irrigated rice, R8409, R8233, R7377
NRSP, Participatory Technology Development, R7412

Validation

B. Validation of the research output(s)

***10. How** were the output(s) validated and **who** validated them?*

Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the "who" component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc... This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation ***(max. 500 words)****.*

The PVS process involves validation by the end users. These were resource-poor, farmers who cultivate smallholdings in the High Barind tract of Bangladesh (HBT). As a first step farmers were interviewed to find out their requirements in the varieties for the different parts of the rice continuum. We were then able to match the introduced variety to the upland, medium land and lowland ecosystems. However, farmers did not always get this right first time and over the years, knowledge of the varieties improved and they were better targeted to the parts of the ecosystem shown in Fig. 1.

Farmers' experiments used participatory varietal selection (PVS) techniques including mother trials, where farmers grew the complete set of varieties and baby trials where farmers compared just one variety with their local variety. All farmers' trials were conducted under farmers' own management without a package of practices. The on-farm trials were jointly evaluated for quantitative and qualitative traits using household level questionnaires and focus group discussions.

The target groups of farmers were mainly resource-poor farmers in the villages in which PROVA was working (Table 2). Seed was provided to all categories of farmers and social groups (resource-rich and resource-medium including women farmers). Three wealth categories were determined through local informants primarily on the basis of land holding size and off-farm sources of income. Evaluation of PVS trials included participating and non-participating farmers (including women) for the evaluation of the pre-harvest traits such as fodder yield, shattering and earliness. However, the evaluation of the post-harvest traits invariably involved women in the household level questionnaires for assessing the cooking quality and taste, and quality of fodder as well as storage properties.

Table 2. Number of farmers who validated the new varieties with on-farm trials conducted from 2003 to 2006 in three districts of Rajshahi Division of the High Barind Tract, Bangladesh

Year	Number of farmers who did PVS trials and IRD†		
	Rajshahi	Naogaon	Nawabganj
2002	1	-	1
2003	26	26	30
2004	98	25	27
2005	563	327	285

†The trials included mother and baby trials and informal research and development (IRD) where only a sample of farmers were interviewed in the evaluation process. In addition, 43 mother trials and 108 baby trials were conducted by partner NGOs and 64 baby trials by DAE.

Validation was primarily done by farmers who collaborated with researchers from PROVA, CAZS-NR and

extensionists from the DAE.

The new varieties yielded substantially more but were earlier to mature (Tables 3 and 4). They also yielded more straw and were preferred for their better grain quality. They had many other desirable traits such as improved cold tolerance for the winter season.

Feedback from various Upozilla of DAE and NGOs on the performance of the new varieties during the *Boro* season indicated that with few exceptions Judi 567 and Judi 582 yielded more than the existing *Boro* rice varieties. All farmers preferred these varieties to their existing ones.

Table 3. Yield advantages of some of the new varieties, 2002-2004 and 2005-2006

Variety	Season	n	Years	Yield advantage
Judi 582	T. *aman*	22	2002-2004	33% (additional 0.9 t ha^{-1}) over mean of Swarna and BRRRdhan 32
Judi 567	*T. aman*	8	2003	48% (additional 1.13 t ha^{-1}) over mean of local landrace Vadhai
Judi 582	*Aus*	4	2004	105% (additional 1.8 t ha^{-1}) over check local landrace Vadhai
Judi 572	*Aus*	4	2004	105% (additional 1.8 t ha^{-1}) over check local landrace Vadhai
Judi 582§	*Boro*	29	2005-2006	37% (additional 1.49 t ha^{-1}) yield over the mean of check varieties BRRIdhan 28 and Miniget
Judi 567§	*Boro*	29	2005-2006	20% (additional 0.81 t ha^{-1}) yield over the mean of check varieties BRRIdhan 28 and Miniget

§ Based on the results of 25 demonstrations from 25 Upozilla of DAE and 4 demonstrations each from NGOs, e.g. Ashrai, RDRS, GKF, ASSEDO and Mohiuddin Foundation (Judi 567 was not tested by Ashrai and Judi 582 by RDRS).

In addition to the mother-baby design of PVS trials we also monitored farmers' reactions when they grew the new varieties as the result of (a) wider dissemination of the best of the new varieties and (b) as a result of farmer-to-farmer dissemination or (c) farmers' innovation of trying a variety in a different season to the one initially targeted by researchers.

Table 4. The time to maturity of two of the new varieties, as an example, compared to the control varieties BRRIdhan 32 and Swarna. Mean of 23 trials over three years, 2002-2004.

Variety	Days to maturity	Advantage over Swarna
Judi 582	114	24 days earlier
Pant Dhan 10	102	36 days earlier

BRRIdhan 32	122	13 days earlier than Swarna
Swarna	147	-

The final stage of PVS has also been reached where community-based seed production has been done by local farmers. The success of such ventures is the 'gold standard' for validation. Varieties that have been validated in this way are Judi 582, Barkhe 3004, Super 3004, Judi 567, Judi 572 and Pant Dhan 10.

*11. **Where and when** have the output(s) been validated? Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above **(max 300 words)**.*

The outputs were tested in the semi-arid system. Most of the trials so far have been in the shallow and medium rainfed lowland ecosystem. More recently, Barkhe 3004 and Super 3004 have been introduced for the semi-deep lowland ecosystem.

The validation was done with farmer groups working with PROVA and an expanding network of partners (Table 5). The network of DAE and NGOs that validated the rice varieties used Baby trials and IRD and also produced and marketed seeds.

The farmers represent those of the districts. They are mainly resource-poor, smallholders as the average landholding size in Bangladesh is small. Efforts were made to involve all groups, wealth classes and both men and women.

Table 5. The location of activities of the expanding networks of partners for the validation and scaling up of the new rice varieties bred by COB, 2004-2006.

District, Upazilla	2004§	2005	2006
Rajshahi			
1. Paba	PROVA	PROVA	
2. Godagari	PROVA, DAE	PROVA, DAE,BARI OFRD	PROVA, DAE, BARI OFRD, CARB
3. Tanore	PROVA, DAE	PROVA, DAE,	PROVA, DAE, ASSEDO
4. Mohonpur		PROVA, DAE	PROVA, DAE
5. Bagmara		PROVA, DAE	PROVA, DAE
Nawabganj			
6. Nawabganj Sadar	PROVA	PROVA, DAE	PROVA, DAE
7. Nachole	PROVA	PROVA, DAE	PROVA, DAE
8. Gomostapur		PROVA, DAE	PROVA, DAE
9. Sibganj		PROVA, DAE	PROVA, DAE
Naogaon			
10. Naogaon Sadar		PROVA, DAE	PROVA, DAE
11. Sapahar	PROVA	PROVA, DAE	PROVA, DAE
12. Porsha	PROVA	PROVA, DAE	PROVA, DAE
13. Niamotpur		PROVA, DAE	PROVA, DAE
14. Patnitola		PROVA, DAE	PROVA, DAE

15.	Badalgachi		PROVA, DAE	PROVA, DAE
16.	Mohadebpur		PROVA, DAE	PROVA, DAE
17.	Atrai		PROVA, DAE	PROVA, DAE
18.	Raninagor		PROVA, DAE	PROVA, DAE
19.	Manda	PROVA	PROVA, DAE	PROVA, DAE, ASHRAI
Natore				
20.	Natore (s)	PROVA, DAE	PROVA, DAE	PROVA, DAE
21.	Singra	PROVA, DAE	PROVA, DAE	PROVA, DAE
22.	Gurudaspur		PROVA, DAE	PROVA, DAE
23.	Borigram	PROVA, DAE	PROVA, DAE	PROVA, DAE, AAS
Sirajganj				
24.	Sirajgonj (s)		PROVA, DAE	PROVA, DAE
25.	Ullapara	PROVA	PROVA, DAE	PROVA, DAE, AAS
26.	Shahzadpur		PROVA, DAE	PROVA, DAE
27.	Tarash	PROVA	PROVA, DAE	PROVA, AAS
28.	Belkuchi		PROVA, DAE	PROVA, Mohiuddin Foundation
Pabna				
29.	Pabna (s)		PROVA, DAE	PROVA, DAE, AAS
30.	Sujanagar		PROVA, DAE	PROVA, DAE
31.	Chatmohar		PROVA, DAE	PROVA, DAE
Joypurhat				
32.	Joypurhat (s)		PROVA, DAE	PROVA, DAE
33.	Khetlal		PROVA, DAE	PROVA, DAE
34.	Kalai		PROVA, DAE	PROVA, DAE
Bogra				
35.	Bogra (s)		PROVA, DAE	PROVA, DAE
36.	Kahalu		PROVA, DAE	PROVA, DAE
37.	Dupchachia		PROVA, DAE	PROVA, DAE
38.	Adamdighi		PROVA, DAE	PROVA, DAE
39.	Nandigram		PROVA, DAE	PROVA, DAE
Gazipur				
40.	Joydebpur		PROVA, DAE	PROVA, BRAC
41.	Faridpur (s)		PROVA, DAE	PROVA, Practical Action
42.	Jamalpur(s)		PROVA, DAE	PROVA, Practical Action
Sunamganj				
43.	Sunamgonj (s)		PROVA, DAE	PROVA, Interco operation
Kishoreganj				
44.	Nilgonj		PROVA, DAE	PROVA, CARE
Rangapur				
45.	Rangpur (s)		PROVA, DAE	PROVA, RDRS
46.	Mithapukur		PROVA, DAE	PROVA, GKF
47.	Kaunia		PROVA, DAE	PROVA, GKF
Comillah				
48.	Comillah (s)		PROVA, DAE	PROVA, AID Comillah
Dhaka			PROVA, DAE	PROVA, Winkrock Int.

§ Testing and validation of COB rice varieties was done by PROVA in 2002 and 2003**.** The network of partners was expanded only after 2004.

Abbreviations:
AAS = Agricultural Advisory Society.
AID = Association for Integrated Development, Comillah.
ASSEDO = Agriculture Sustainable & Socio-Economic Development Organization
ASHRAI = A Bengali word (not an abbreviation) meaning 'shelter'.
BARI OFRD = Bangladesh Agricultural Research Institute, On-farm Research Division
BRAC= BRAC
CARE = CARE
DAE = Department of Agricultural Extension
GKF = Grameen Krishi Foundation
RDRS = Rangpur Dinajpur Rural Service

Current Situation

C. Current situation

*12. **How and by whom** are the outputs currently being used? Please give a brief description **(max. 250 words**).*

Farmers are using the varieties in all of the rice ecosystems found in the HBT with the exception of the deeper water systems. They do so without changing their usual management practices as the new varieties do not require any special treatment.

The PVS on rice including rice varieties from COB started in 2003 and within two years period uptake and adoption of these varieties was 65%. And farmer-to-farmer seed spread was nearly 55% (Pandit, 2005) indicating that the magnitude of promotion of these outputs could be very high. Because most of these varieties were developed using a shuttle breeding system during spring and rainy season, as a result these have wide adaptation across seasons, e.g. most of these can be grown at least during two seasons - *Boro* and T. *aman* while many of them are even suitable even for Aus season greatly adding to the scope of wider promotion. Because of short duration, many of these are suitable for the promotion of winter crops, e.g. chickpea in the residual moisture and also in Haor area (flash flood areas) as these can be harvested before the flash floods come in late April or early May.

The varieties are also being used by development organisations. PROVA was the primary partner for the work in Rajshahi Division. Subsequently, these varieties spread more widely beyond HBT of Bangladesh.

*13. **Where** are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used **(max. 250 words).***

The main use of the outputs by farmers is currently in the Greater Rajshahi area (see Fig. 2) as this is where the varieties were first introduced in 2002. Of course, these varieties are also being used in Nepal (where they were bred). Some have been introduced into India and farmers there have adopted them.

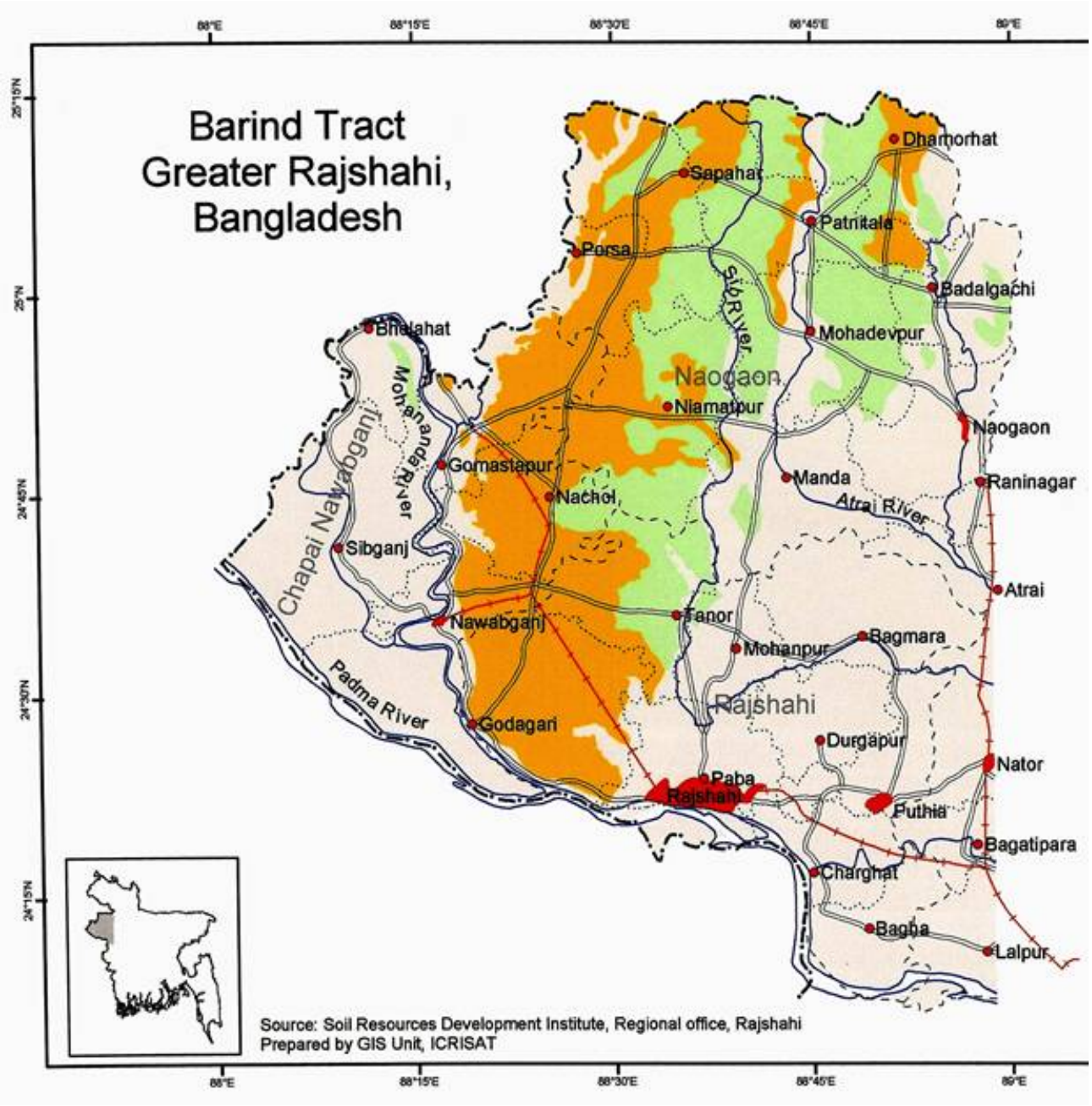

Figure 2. The High Barind Tract of Bangladesh where all of the initial testing took place.

The use is more extensive than this (see Table 5) but the scale of use in areas outside of Rajshahi will be smaller as the introductions were not until 2006.

14. What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading ***(max 250 words).***

The trials commenced on a small scale in 2002 and have increased in scale. The trials of the semi-deep lowland varieties are still continuing in 2006.

Currently the varieties are expanding rapidly from farmer-to-farmer in the districts where the research began and reaching to new districts through a network of both DAE and several NGOs (Table 5). An adoption study by Pandit (2005) showed that farmers, even at an early stage of adoption where seed was inevitably limited, were distributing farm-saved seed to others. On average, half of the farmers distributed seed to two other farmers (to produce an overall doubling of the number of farmers from season to season). Moreover, the quantity of seed received by each recipient household was quite large and averaged over 27 kg, sufficient to transplant over 0.5 ha of rice. This indicates that the scale of use is large but the high rates of increase add to the uncertainty of any estimate of adoption this early in the adoption process.

The major limiting factor in the scale of use of these varieties is the limited quantities of seeds. Currently large-scale seed production of these varieties is concentrated within the HBT of Bangladesh through individual farmers and farmers groups (Table 6). PROVA is facilitating seed production and marketing initiatives.

Table 6. Seed of the rice varieties produced and marketed by local communities, 2003-2006

	Year					
	2003-04		2004-05		2005-06	
Variety	Number of farmers & area (ha)‡	Production (t)	Number of farmers & area (ha)	Production (t)	Number of farmers & area (ha)	Production (t)
Judi 582	1 (0.1)	0.6	60 (14)	73.0	70 (23)	124
Judi 572	-	-	5 (0.4)	1.4	3 (0.7)	4
Judi 567	1 (0.1)	0.3	7 (2)	6.6	20 (7)	39
Sugandha 1	1 (0.1)	0.2	2 (0.3)	0.4	-	-
Barkhe 3004	-	-	-	-	4 (1.2)	7
Super 3004	-	-	1 (0.1)	0.29	15 (3.7)	21
Pant Dhan 10	8 (1.2)	2.9	45 (10)	56.3	7 (1.3)	7
PNR 381	-	-	24 (5)	35.2	18 (4.4)	23

‡ Figures in the parenthesis indicate area in ha.

15. In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you

see as the key facts of success? ***(max 350 words).***

The Department of Agriculture and Extension have programmes for promotion and popularisation of rice varieties through demonstrations that are typical of those used in the training and visit model of agricultural extension and are invariably run with the package of practices. They are helpful in disseminating new varieties widely across Upazillas but they can also carry a negative message as some (certainly not all) of the COB varieties may not give highest return under high input conditions.

The Bangladesh Rice Research Institute (BRRI) is responsible for the development and promotion of rice technologies in Bangladesh. They have evaluated some of the COB varieties in their on-station yield trials. For example, BRRI Regional Station Rajshahi evaluated at lest six varieties during the *Boro* season 2005-2006 and during the T. *aman* season as well.

The Bangladesh Institute of Nuclear Agriculture (BINA) are responsible mainly for the development of crop varieties through radiation. More recently, PROVA is collaborating with BINA for the exchange of rice germplasm and collaborative testing and promotion of rice varieties developed by both the organisations.

Large NGOs such as BRAC and CARE are involved in the evaluation of rice lines developed from COB (Table 5).

Several other innovation platforms are available for the scaling up of these outputs, e.g. Food security for sustainable household livelihoods (FoSHoL) project is aimed at identifying appropriate technologies, validate them for target farmer groups and effectively disseminate them. It is coordinated by IRRI and implemented by CARE, ActionAid and PracticalAction in various districts of Bangladesh.

Success has been due to networking researchers with the many stakeholders involved in development and extension. The field-based, participatory nature of the validation has proven to farmers that the varieties are of great value. Farmers have become some of the greatest advocates of the varieties in formal and informal meetings with research scientists.

Current Promotion

D. Current promotion/uptake pathways

16. ***Where*** *is promotion currently taking place? Please indicate for each country specified detail what promotion is taking place, by whom and indicate the scale of current promotion* ***(max 200 words).***

The current promotion is mainly concentrated with the Rajshahi Division involving thousands of farmers. The varieties have also been evaluated in other parts of Bangladesh through a network of both GOs and NGOs (see Fig. 3).

Figure 3. Areas where the where the varieties are being validated and promoted in 2006 (indicated by the nearest large town placed within a rectangle).

In 2004, a one-day workshop was organised to help the promotion of the new rice varieties bred using COB in Nepal. This included the Additional Director, Rajshahi Region; the Deputy Director, DAE, Dhaka; Deputy Directors from eight districts; staff of the Department of Agriculture Extension (DAE) within the Rajshahi Division and 32 Upazilla Agriculture Officers. Subsequently, this expanded to 48 Upazilla of 15 districts. As a result seeds of mostly Judi 582, Judi 567 and Judi 572 were distributed to Upazilla Agricultural Officers (UAOs) for field demonstration and promotion (Table 5). A typical demonstration run by the DAE involves growing the variety in a large plot using the entire package of practices and comparing the performance with the existing varieties under similar conditions.

In 2005, a similar workshop was organised in Dhaka to expand this collaboration with more NGOs (Table 5). Following the workshop, seeds of the new varieties were distributed by PROVA to 13 organisations, and five have shared their results so far.

17. What are the current barriers preventing or slowing the adoption of the output(s)? Cover here institutional

issues, those relating to policy, marketing, infrastructure, social exclusion etc. ***(max 200 words)****.*

Bangladesh has a very rigid system of varietal release. Regulations actually do not allow scientists to give non-released varieties for testing, and initially scientists demanded all of the seed back from the farmers to meet this requirement. Clearly, this was an unrealistic expectation and, if met, would have prevented one of the benefits of PVS, the simultaneous testing and promotion of new varieties.

BRRI has a very 'transfer-of-technology' way of working even though it has been exposed to participatory methods from various programmes including the RNRRS and the Poverty Elimination Through Rice Research in Asia (PETRRA). Individuals, but not the Institute, have accepted the value of farmer participation.

There is a poorly developed seed industry for rice that concentrates on hybrids. PROVA has produced seed but the uptake of seed production by other organisations is not so high mainly due to policy constraints. In Bangladesh, rice is a notified crop and only released varieties can be entered into any large scale seed production and distribution. Since all of the varieties bred by COB are yet to be officially released by the national system, this is the major barrier in the way of large-scale seed production and distribution.

18. What changes are needed to remove/reduce these barriers to adoption? This section could be used to identify perceived capacity related issues ***(max 200 words).***

Despite the legislative barriers, some of the Upazilla offices of DAE have initiated the production and marketing of seeds of these unreleased varieties, e.g. in 2005 the Boraigram Upazilla Agriculture office produced seeds of Judi 582 and Judi 567.

Experience with wheat scientists has shown that mindsets can quickly change as a result of experience. Initially, the scientists raised the legislative barriers as being very important but, once the benefits of working with farmers became apparent, the importance scientists gave to these barriers declined.

Not all organisations take notice of these legislative constraints. Many NGOs are perfectly content to supply seed of unreleased varieties. Farmers and farmer groups are also willing to take initiatives independent of the rules.

All that is needed to remove the barriers is to network likeminded organisations who are convinced of the approach while also involving more traditional partners in the network. Increased efforts are needed to make use of the huge network that can take place through NGOs, particularly BRAC.

19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people? ***(max 300 words).***

Using Rogers (2003) diffusion of information as a framework for the lessons learnt:

1. The relative advantage of a technology compared to what it is replacing;

This is extremely high given the already adequate yields in these rice ecosystems. Additional yield is substantial and can be as high as 1 t ha^{-1}. The growing of aromatic rice is very profitable. The yield advantages in the *Aus* season are spectacular.

2. The compatibility of the technology with existing systems and ways of doing things, which is closely related to culture;
The compatibility of these technologies is extremely high and allows people to continue with there traditional rice growing systems. The processes of PVS and COB require scientists and extensionists to learn new ways of working that are incompatible with existing mindsets.

3. *The complexity of the technology in terms of what people need to learn to make it work;*
The complexity is very low as there is no need to change the growing system. The processes of PVS and COB are relatively simple.

4. The observability of a technology in terms of how easy it is to demonstrate and observe performance;
The observability is high.

5. The trialability of a technology in terms of how easy it is to test it before deciding to adopt.
The trialability is very easy as long as seed is available.

Hence provision of a sustainable seed supply is the most important factor in getting this research into use. In relation to this, an intensification of the networking process of institutions willing to be involved in seed production and promotion is required.

Impacts On Poverty

E. Impacts on poverty to date

20. Where have impact studies on poverty in relation to this output or cluster of outputs taken place? This should include any formal poverty impact studies (and it is appreciated that these will not be commonplace) and any less formal studies including any poverty mapping-type or monitoring work which allow for some analysis on impact on poverty to be made. Details of any cost-benefit analyses may also be detailed at this point. Please list studies here.

1. Joshi, K.D., Musa, A., Johansen, C., Harris, D., Devkota, K.P., Gyawali, S. & Witcombe, J.R. (2004). Short duration rice varieties for the High Barind Tract of Bangladesh: the initial impact of varieties from client-oriented breeding and selection in Nepal. CAZS Discussion Paper. Pp 1-33. Available at www.dfid-psp.org
2. Pandit, D.B. (2005). Assessment of the Adoption and Spread of Short Duration Rice Varieties in High Barind Tract of Bangladesh. 2005. (Not yet publicly available. Not completed).

The adoption i.e. the uptake of new varieties was found to be high (Table 7) by a randomly selected sample of households in project villages. Over 50% of the adopting households were not those that had collaborated with PROVA. There were clear indications that adoption was higher in villages where two crops could be grown although the comparison was confounded by the amount of project intervention.

Table 7. Adoption of the new rice varieties in the HBT, 2005 (after first introduction in 2002)

Village category	Adoption by households (%)	Seed distributors (%)
High project intervention , two rice crops a year	93	64
Moderate project intervention, two rice crops a year	52	55
Low project intervention, one rice crop a year	40	25
No project activities	0	0

On average over half the farmers distributed seed to other farmers. More did so when they could grow both a T. *aman* and a *Boro* crop, presumably because the greater availability of seed was an important factor

Cost benefit studies have been made for new rice varieties in Nepal, India and Bangladesh (presentation made at the 'Pathways Out of Poverty, Cambridge' conference) of the three countries the cost-benefit is the most favourable for Bangladesh because:

- the potential area of adoption is the highest of the three situations
- the yield increase per hectare is the highest
- the potential rate of spread is highest as seed harvested in the T. *aman* can be sown for the *Boro* and the harvest from this season used for the T. *aman.*

Even with conservative assumptions - based on the adoption and seed spread data given above - the NPVs and the IRR were high. By 2011 with a 5% discount rate the NPV was anticipated to be £160 million and additional benefits per year post 2010 estimated at £182 million a year (non-discounted).

21. Based on the evidence in the studies listed above, for each country detail how the poor have benefited from the application and/or adoption of the output(s) ***(max. 500 words):***

- *What positive impacts on livelihoods have been recorded and over what time period have these impacts been observed? These impacts should be recorded against the capital assets (human, social, natural, physical and, financial) of the livelihoods framework;*
- *For whom i.e. which type of person (gender, poverty group (see glossary for definitions) has there been a positive impact;*
- *Indicate the number of people who have realised a positive impact on their livelihood;*
- *Using whatever appropriate indicator was used detail what was the average percentage increase recorded*

Pandit (2005) investigated the increase in income after the adoption of the COB varieties. He found from interviews of 44 sampled households that had adopted a COB variety that increased grain sales gave an additional income of £28. The overall benefits were higher because grain self sufficiency also increased and would increase as the area under adoption increases. These benefits are very early in the adoption process since the seed of these new varieties was first introduced only in 2002 and the first impact assessment was made in 2005.

Many interviews have been conducted with farmers on the impacts of these varieties. One example is given below from Joshi et al. (2004).

Rojab Ali, Chuabishanagar village owns 17 *bigha* (2.3 ha) of land.

- He grew Judi 582 in 5 *kattha (325 m^2)* of land. He got 1 kg seed from PROVA during last *T. aman* season and harvested 75 kg and the same seed was used for planting during the *Boro* season.

- His satisfaction was indicated by the name he gave it "*sundar Dhan*" meaning beautiful rice.
- There was no seedling mortality in the nursery as the variety was cold tolerant in the seedling stage. Under similar conditions, the seedling mortality for BRRIdhan 28 was quite high.
- It was drought tolerant.
- It had a high yield despite late seeding. Had other varieties been planted so late no reasonable harvest could be expected.
- It has more attractive grains and less chaff compared to other *Boro* varieties.
- Judi 582 is heavier in weight, an important criterion for the farmers.
- It is early maturing
- It did not lodge even under adverse conditions (survived stormy winds) while BRRIdhan 28 did.
- Planted Judi 582 in a relatively less fertile land compared to BRRIdhan 28 and applied same amount of fertilizer but his observation was that it did well even under moderate fertility.
- Required less cooking time compared with BRRIdhan 28
- Better quality of bhat (cooked rice) than BRRIdhan 28.
- Even *basi bhat* (cooked and kept rice) is reasonably good. Market price TK 300/maund (1$ = 67 Taka, 1 maund = 40 kg) high similar to high quality Parija
- His plan for the coming season was to reduce the area under BRRI varieties and increase the area under the new varieties.

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? ***(max 300 words)***

This could include direct benefits from the application of the technology or policy action with local governments or multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex.

Direct and indirect benefits:

- Increased productivity per unit area without the use of additional external inputs especially pesticides is environmentally beneficial. Rice cultivation in Bangladesh accounts for about 1% of total global greenhouse emissions. A large proportion of this is because of methane produced under anaerobic conditions and $C0_2$ used to produce inorganic nitrogen (IPPC, 2001). Research done by International Fertilizer Development Centre (IFDC) in Bangladesh indicated that nearly $80 million worth of urea applied on rice is wasted every year, through volatilization, leaching and run off losses causing major environmental implications (see www.ifdc.org). As the new varieties use both water and N more efficiently this can help mitigate the production of greenhouse gases per unit of production.
- Increased productivity will reduce the pressure to increase the area under cultivation (Evenson and Gollin, 2003).
- Varietal diversification will help reduce crop loss due to pests and diseases and thereby reduce the use of pesticides. Introduction of new varieties always increased on-farm diversity as farmers adopted many cultivars for different niches. Introduction of aromatic new variety (Sugandha 2002) will increase on-farm diversity tremendously as it is un-related to any cultivated variety in Bangladesh.
- The better disease and pest resistance of the new varieties can reduce the use of water and soil polluting agro-chemicals. Reduced use of pesticides and insecticides will also reduce the risk to human life will help in the creation of a balanced pest-predator cycle.
- Earlier maturing rice varieties will facilitate the cultivation of rainfed rabi crops such as chickpea that can improve soil fertility.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? ***(max 100 words)***

None are anticipated.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? ***(max 200 words)***

Earlier maturing varieties have increased the resilience of farmers by making available extra time for other operations, lower cost of production, reduced use of water and nutrients besides, in some cases, increasing cropping intensity (two crops a year in the place of one)

The new varieties do much better than existing varieties under limited irrigation or drought under rainfed conditions but they also respond well to better conditions thus increasing the resilience of farmers to cope with climatic variation.

Varietal diversification increases the resilience of the system. The staggered deployment of varieties that take different times to mature reduces the risks from drought, diseases and pests, and adverse weather (high winds, hail, and floods). Increased diversity reduces the risks from disease epidemics.

Annex

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